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The paper should be valuable and should not have been published or submitted for publication in any other Journals. The text should be complete with abstract, introduction, material and methods, results, discussion and reference. The text must not exceed 15 pages for sciences papers and 25 for the humanities

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Include page numbers. The page numbers should be placed in the lower right hand corner.

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The paper title must be capitalized, bold, centered, 11 pt., and spaced after 18 pt. Main titles and abstract title should be capitalized 9 pt., aligned left, bold, spaced before 12 pt., and after 6 pt., and numbered as (1., 2.,3.). Principle subtitles must be written in 10 pt, bold, aligned left.

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KEYWORDS: *Erosivity factor, Rainfall, Fournier index, Water Quality*

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Except the tables, all the graphs, maps and photographs must be named as figures. Tables and Figures should be numbered consecutively by Arabic numerals. The tables and figures must not exceed the page margins and must be on one page. All Table outline border should be (1 ½ pt.), inside border should be (½ pt.); table details should be Arial font and written with 7 pt. the figure and table names must be written with 8 pt. style. Names must be written in the middle on top for the tables with space 4 after and for the diagrams/figures, underneath on the bottom with space 4 before and 12 after. If the figure and table names have to be more than one line, the line spacing should be single spaced, and the terms of "Figures" and "Tables" must be bold. (See below)

Table (1): The effect of pepper shoot & root aqueous extract on the growth of different other plants:

	Shoot Extract					Root Extract				
Plant type	Conc. %	Root length (cm)	Shoot length (cm)	Intact plant length (cm)	Inhibition %	Conc. %	Root length (cm)	Shoot length (cm)	Intact plant length (cm)	Inhibition %
Okra	0	*25.7 a**	27.8 a	53.5a	-	0	25.7a	27.8a	53.5a	-
	5	25.00a	26.77a	51.77a	3.23	1	24.50a	27.00a	51.50a	3.73
	10	24.50a	25.95a	50.45a	5.70	2	23.87a	25.65a	49.52a	7.43
Sorghum	0	21.6a	27.2a	48.8a	-	0	21.7a	27.2a	48.9a	-
	5	13.00b	17.25b	30.25b	38.03	1	9.8b	25.5ab	35.3b	27.6
	10	6.00c	5.50c	11.50c	76.44	2	9.4b	22.6b	31.9 b	34.6

Figure (1): xxxxxxxxxxxxx

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CONTENTS

EFFECT OF GA3 AND DATE OF SPRAYING ON YIELD, QUALITY AND SOME CHEMICAL CHARACTERS OF GRAPE CV. RASH MEO, UNDER NON-IRRIGATED CONDITIONS.

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(Received: January 16, 2008; accepted for publication: June 5, 2008)

ABSTRACT

This study was carried out at a private vineyard located near Zawita /Dohuk city, during 2007 season. This experiment was studied the effect of spraying of Rash Meo cultivar with GA3 rates of (zero, 25 and 50 mg l^{-1}), at different dates (full bloom, fruit set and veraison) of grape cv. Rash Meo grown under rain fed condition. The results showed that the application of 50 mg l^{-1} GA3 caused an increase in total yield per vine, cluster weight, cluster length, cluster width, berry length, berry width, TSS and anthocyanin. Beside that this treatment was reduced total acidity.

The most effective application date was spraying with GA3 at fruit set stage, which significantly improved all qualitative parameters except anthocyanin content of berry, which was highly improved when vine sprayed at veraison stage. The interaction between 50 mg l^{-1} GA3 and fruit set date gave the best results of yield and its quality of this cultivar.

INTRODUCTION

The grapevine is considered as an important horticultural crop in the world and in Iraq. Its cultivation had been adopted in Iraq for along time (Alsaidi 2000). Its importance was attributed to its fruiting in different zones of the world. Rash Meo grape cultivar is widely distributed in Dohuk governorate. This cultivar is the early bunches ripening (beginning of July). It considered as juice cultivar (Alsaidi 2000). Improving the yield and its quality could be achieved through the foliar application of some nutrients or plant hormones such as gibberellic acid (GA3). Teszak et al. (2005) investigated the influence gibberellins foliar spray at flowering stage on polyphenol and anthocyanin content of berries. They found that gibberellins application profoundly increased anthocyanin in colored berries cultivars. Willams and Ayars (2005) sprayed Thompson seedless clones 2A at berries setting stage precisely 2 weeks after anther dehiscences. They found that this treatment substantially increased berry size. Renolds and Savigny (2004) sprayed soverign coronation grape cultivar by 15 mg.l^{-1}GA3 at blooming stage and GA3 rate 15+40 ppm after 14 days from the first spray. Finally plants were sprayed with 15+40 mg.l^{-1}GA3, two weeks after the second spray. They found that GA3 had no effects on total yield and cluster number per vine at the first spraying date. However, spraying after full bloom caused substantial increases in cluster weight highly reduced the berries number per cluster and acidity. Dokozlian et al. (2001) studied the effect of GA3 application at rates of 0, 5, 10, 15 and 20 g\ha^{-1} at full blooming on berries growth and other qualitative properties in Autumn Royal grape cultivar. They found that increasing GA3 applied rate resulted in significant increases in total soluble solids, total acidity and anthocyanin content of berries. They reported that g\ha GA3 was the most effective rate in which this rate tended to decrease berries number per cluster, therefore it lower the berries compaction in cluster, and in addition to that it reduced the cluster number per vine and increased berries length and width. Peacock (1998 a) studied the effects of gibberellins rate and time of application on Ruby seedless grape cultivar. He found that foliar spraying of GA3 at rate of 16 g/acre, 10 days after setting resulted in significant increase in term of yield per vine, berry weight and berry size. Whereas, GA3 application at rate of 20 g/acre after 20 days from setting showed increases in berry number per cluster. Peacock (1998 b) also found 5% increasing in berry size of Red Globle when 20 g/acre of GA3 was applied as compared to untreated check. He recommended that the spraying of grapevine at two weeks after berries setting or when berries diameter about 16 mm. Lee et al. (1996) submerged clusters in GA3 solution at rate of 25 mg.l^{-1} at the stage 10 days later full bloom. They found that cluster treatments resulted in significant increases in berries setting, length of cluster and berry weight, and significant increase in untreated check. Submerging clusters in GA3 at rate of 25mg.l^{-1} also increased skin anthocyanin content. However, it had no effect on total acidity. Byun and Kim (1995) studied the effects of GA3 on berries setting and berries quality in kyoho grape cultivar. They found that GA3 application significantly increased berry size and improved berry coloration through increasing anthocyanin of colored cultivars. Pommer et al. (1995) investigated that the rate and date of GA3 application on Maria seedless grape cultivar. They found that GA3 foliar spraying at rate of 200 g/acre 14 days after flowering showed significant increase in cluster weight, cluster length, cluster width, berries number per cluster, weight of berry, berry diameter and berry total soluble solids (TSS). Jindal (1973) studied that spraying cluster flower at fruit set with different concentration of GA3 (25, 50, 75ppm) in Thompson seedless led to an increase in the rate of berry length and diameter. Weaver and Pool (1971) found that GA3 application had slowly effect of total sugars percentage.

Therefore an attempt was made to determine the most potent rate and application date of gibberellic acid that influence the productivity and quality of Rash Meo grape cultivar grown under rain fed in Dohuk governorate.

Materials and Methods

This experiment was carried out at private vineyard located near Zawita / Dohuk city during 2007 season, to investigate the effect of spraying with different concentration of GA3 and the spraying dates on fertility, productivity and quality of grape cv. Rash Meo. The investigated vine was trained of head training system. These vines were planted at 2.5 x 2.5 m. spaces and had 15 years old. 27 vines were selected at about the same growth (diameter of Trunk at 20 cm above soil surface). The pruning time of the vines was in the second week of March. The buds left on each vines was four spurs, each with 5 eyes. This study included the spraying of vine with three concentrations of GA3 (zero, 25 and 50) mgl^{-1} and three different dates of spraying (full bloom, fruit set and veraison) stages, therefore factorial Randomize Block Design was used to include three applications of GA3 and three dates factors (9 treatments were included). Each treatment was replicated 3 times.

All cultural practices were made according to that had been recommended to the vineyard. (Tween-20 was added as surfactant). After the beginning of harvest stage, total yield and other investigated parameters (cluster weight, cluster length, cluster width, berry weight, berry length, berry width and chemical characters such as TSS, total sugar, total acidity, juice density and anthocyanin) were measured by taking samples from each vine as mentioned in Abdul-Qader (2006). All results were analyzed statistically by using SAS programs (1989). Duncns multiple tests (1955) at 5% level of portability was to compare the treatment according to (Al-Rawi and Kalafalla 1980).

RESULTS AND DISCUSSION

Total yield

Table (1) shows that spraying vines with GA3 resulted to a significant increase in total yield per vine in comparison to the untreated vines (control). But the different levels had no significant differences, the highest yield/vine was with spraying level (50 mgl^{-1}) compared with the lowest yield/vine on the untreated vines. All these results are in accordance of what had been concluded by Pommer (1995), Peacock (1998). Also table (1) indicates that date of spraying had a significant effect on total yield. The highest yield resulted when the vines spraying at fruit setting stage compared with the lowest yield when spraying at veraison stage. These results was in agreement to that was concluded by Jindal 1973, Pommer 1995, Peacock (1998 a, b). For the interaction, table (2) shows that spraying at level (50 mgl^{-1} GA3) and spraying at fruit setting stage gave the highest total yield per vine. The increase of the total yield of spraying with GA3 could be attributed to the increase in the cluster weight, cluster size, berry weight, berry size.

Quality characters:

Cluster weight

Table (1) indicated that spraying vine with different levels of GA3 led to an increase in the cluster weight when compared with the control vines. Various levels of GA3 were not differed significantly among each others. Spraying by 50 mgl^{-1} GA3 produced highest cluster weight, as compared with the control. These results agreed with what Pommer (1995) had attained that spraying with GA3 led to an increase in the berries weight. Also the date of spraying had a significant effect on cluster weight. The highest cluster weight was produced when the vines sprayed at fruit set stage. These results agreed with those of Pommer 1995, Peacock (1998 a, b), Williams 2005.

For the interaction, table (2) shows that the GA3 spraying with 50 mgl^{-1} and spraying in the fruit set stage gave the highest cluster weight when compared with the control vines. No significant differences showed between 25 and 50 $mg.l^{-1}$ GA3 at all dates of applying. Cluster weight increasing resulted from spraying GA3 levels could be due to the role of GA3 in increasing weight and volume of berries which leads to increasing cluster weight. For the date of spray effect, spraying with GA3 levels at full bloom stage had positive effect on cluster weight, the reason could be due to the influence of GA3 which increase flower thinning percentage and leads to decrease number of berries per cluster which will eventually decrease cluster weight. Also in the veraison stage, the berries were reached to the final size which causes that the effect of GA3 is very little in increasing weight and size of berries, this explain that spraying with GA3 at fruit set stage had more effect on increasing cluster weight.

Cluster length

It seems from the table (1) that spraying vines with GA3 caused a significant increase in the cluster length, in comparison with the untreated vines. But the 25 and 50 mgl^{-1} GA3 levels at fruit set and veraison dates had no significant differences among each other. The highest cluster length was with spraying 50 mgl^{-1} GA3. These results are the same of what had been concluded by Pommer et al. (1995) and Lee et al. (1996). Whereas the date of spraying had no effect on the cluster weight. For the interactions, table (2) shows that spraying with GA3 at full bloom or fruit setting stage gave the highest cluster length. The reason behind of the increase of cluster length could be due to the role of GA3 in increasing pedicel length that lead to a decrease of cluster compactness (Dokoozlian 2001) and this may be led to an increase in cluster length.

Table (1): Effect of GA3 and date of spray on yield and some physical characters of Grape.

Characters	GA3			Dates of spray		
	0	25	50	full bloom	fruit set	veraison
Total yield (kg/vine)	1.612 b	3.096 a	3.330 a	2.564 b	2.990 a	2.484 b
Cluster weight (g.)	133.46 b	174.87 a	188.23 a	167.18 b	184.22 a	160.16 b
Cluster length(cm.)	13.67 b	16.11 a	16.00 a	15.33 a	15.67 a	14.78 a
Cluster width(cm.)	8.33 c	12.11 a	10.78 b	10.00 b	11.78 a	9.44 b
Berry length(cm.)	1.838 b	2.294 a	2.263 a	2.101 a	2.217 a	2.078 a
Berry diameter(cm.)	1.463 b	1.613 a	1.670 a	1.573 a	1.606 a	1.568 a
Size of 100 berries (cm^3)	208.44 b	281.89 a	291.89 a	261.67 a	272.56 a	248.00 a
Weight of 100 berries (g.)	210.94 b	289.21 a	303.30 a	270.30 a	273.20 a	259.96 a

Means with same letters for each factor and interaction are not significantly different at 5% level of probability.

Cluster width

It can be noticed from the table (1) that the GA3 spraying caused a significant increase in cluster width when sprayed with 25 mgl^{-1} GA3. These results are similar to those of Pommer (1995) and Lee (1996). Also the spraying dates caused a significant effect and gave a high value of width when the vines sprayed at the fruit setting stage in comparison with low value of width in veraison stage. Concerning the interaction, the table (2) indicated that the high value of cluster width was obtained from the interaction between GA3 at 25 mgl^{-1} level and spraying at the fruit set stage. The increasing of cluster width by spraying of GA3 could be due to the increase of size and weight of berries. Also the increasing of the pedicels may be caused cluster loose and increase cluster width. Also spraying at fruit set date had the best effect when compare with spraying of other dates.

Berry length

Data in table (1) shows that the spraying of vines with GA3 led to a significant increase in the berry length in comparison to the control. Spraying with 25 mgl^{-1} GA3 led to produce the highest average of berry length compared with lowest average in untreated vines. But there were no effect shown between all concentrations of GA3. These results agree with those of Jindal (1973), Pommer (1995). The spraying date of GA3 had no effect on berry length. Table (2) shows that the interaction between GA3 concentrations and spraying dates had no significant effect on berry length. Increasing berry length when spraying with GA3 levels could be due to the role of GA3 in the process of cell division and elongation which tend to increase of berry length.

Berry diameter

Table (1) clear that the GA3 spraying led to a significant increase in berry diameter. Highest diameter was obtained at GA3 spraying at average (50 mgl^{-1}) in compare to the lowest average berry diameter at the untreated vines. The 25 and 50 $mg.l^{-1}$ levels of GA3 were not differed significantly among each others. These results agree with those of Jindal et al. (1973) and Pommer (1995). For the interaction, table (2) shows that there were no significant differences between the different treatments. Berry diameter increasing could be due to the role of GA3 in cell enlargement of the berry.

Size and weight of 100 berries

Table (1) shows that the size and weight of 100 berry of grape had a significant increase with increasing GA3 levels in comparison to the untreated vines. No significant differences between 25 and 50 mgl^{-1} GA3. The highest size and weight of 100 berry was by spraying GA3 (50 mgl^{-1}) compared with the lowest size and weight of 100 berry in the control vines. These results are agreed with those of Byun (1995), Peacock (1995) and Williams (2005). While the date of spraying had no significant effect on the size and weight of 100 berry.

The interaction effect data in table (2) shows that spraying with (50 $mg.l^{-1}$ GA3) at fruit set stage gave the highest size and weight of 100 berries which did not significantly differ than other treatments. Increasing size and weight of 100 berries may be due to the high accumulations of the nutritional substances in the berries which lead to increasing the size and weight of berries. Spraying at fruit set stage had more effect on increasing berry size and weight, this may be due to that the newly setted berries were in the active divisions so GA3 application may accelerate growth of berries and leads to an increase in size and weight of berries.

Table (2): Effect of interaction between GA3 and date of spray on yield and some physical characters of grape.

GA3 MG.L^{-1}								
0			25			50		
full bloom	fruit set	veraison	full bloom	fruit set	veraison	full bloom	fruit set	veraison
1.704 d	1.507 d	1.626 d	2.809 c	3.529 ab	2.950 bc	3.178 bc	3.935 a	2.877 bc
141.59 bc	130.58 c	128.20 c	165.42 abc	189.83 a	169.36 ab	187.24 a	194.53 a	182.92 a
13.67 de	14.00 cde	13.33 e	15.33 bc	17.00 a	16.00 ab	17.00 a	16.00 ab	15.00 bcd
8.00 b	9.00 b	8.00 b	13.00 a	13.33 a	10.00 b	9.00 b	13.00 a	10.33 b
1.717 a	1.987 a	1.810 a	2.253 a	2.330 a	2.300 a	2.333 a	2.333 a	2.123 a
1.429 a	1.48 a	1.476 a	1.635 a	1.624 a	1.581 a	1.656 a	1.709 a	1.645 a
211.67 cd	232.67 bc	181.00 d	308.33 a	273.33 ab	264.00 ab	265.00 ab	311.67 a	299.00 a

Means with same letters for each factor and interaction are not significantly different at 5% level of probability.

Chemical characters:

TSS

The table (3) indicated that spraying the vines with GA3 led to a significant increase in total soluble solids (TSS) when compared with control vines, the highest percentage of total soluble solid resulted from spraying 25 mgl^{-1} GA3 compared with the lowest percentage in untreated vines (control). No significant differences between 25 and 50 mg.l^{-1} of GA3. These results agree with those of Pommer (1995). The same table shows that the spraying date also had a significant effect in TSS percentage, the highest percentage of TSS produced from spraying vines at the fruit setting stage. Table (4) shows that the interactions between GA3 levels and dates of spraying indicate that the interactions had non significant effects on TSS percentage.

Total sugars

Table (3) indicates that spraying GA3 with different concentration at different dates had no significant effect on total sugars percentage. For the interaction, table (4) also shows that there are no significant differences between GA3 concentration and dates of spraying. These results are agreed with those of Weaver and Pool (1971).

Total acidity

It can be notice from table (3) that GA3 lowered the total acidity of the berry juice. The highest acidity was obtained in the control treatment. There are no significant differences between 25 and 50 mgl^{-1} GA3 concentrations which produce the lowest percentage of acidity compared with highest percentage of acidity at untreated vines. While the dates of spraying shows no significant effect on total acidity percentage. These results correspond with those of Reynold and Savigny (2004), Lee et al. (1996). Table (4) shows the interactions between the different GA3 levels and dates of spraying. The lowest percentage of total acidity produced from interaction between (25 mgl^{-1}) GA3 concentration and spraying at the fruit setting stage compared with the highest percentage of untreated vines. Decreasing total acidity percentage may be due to that spraying with GA3 concentration leads to earliest the berries ripening which leads to reducing the acidity content in the berries.

Table (3): Effect of GA3 and date of spray on some chemical characters of grape.

Characters	GA3 mg.l^{-1}			Dates of spray		
	0	25	50	full bloom	fruit set	veraison
T.S.S. %	16.31 b	19.04 a	18.66 a	17.81 ab	18.78 a	17.42 b
Total sugar %	9.51 a	10.15 a	10.57 a	9.97 a	10.64 a	9.62 a
Total acidity %	0.44 a	0.31 b	0.32 b	0.34 a	0.34 a	0.39 a
Juice density	1.09 a	1.12 a	1.11 a	1.11 ab	1.11 a	1.10 b
Anthocyanin (O.D)	1.02 b	1.20 a	1.28 a	1.06 b	1.10 b	1.33 a

Means with same letters for each factor and interaction are not significantly different at 5% level of probability.

Juice density

As shown in table (3) there were no significant effect result with spraying GA3 at different concentrations. Also the dates of spray had no effect on the juice density. These results agree with what Jindal et al. (1973), Pommer et al. (1995), Peacock (1998) had attained. For interaction table (4) also indicates that there are no differences resulted from interaction between GA3 levels and dates of spraying.

Anthocyanin

The table (1) indicates that spraying GA3 at different concentration and dates had a significant effect in anthocyanin content and led to produce highest content of anthocyanin when the vines sprayed with 50 mgl^{-1} GA3 compared with the lowest content in untreated vines. These results agree with those of Byun and Kim (1995), Lee et al. (1996), Teszlak et al. (2005). Also the same table shows that the highest content of anthocyanin produced when the vines sprayed with GA3 at veraison stage compared to the lowest content at full bloom stage spraying.

The correlation table (4) shows that there are a significant effect resulted from interaction between GA3 levels and dates of spraying, highest content of

Anthocyanin resulted from interaction between GA3 at (50 mgl^{-1}) level and spraying at veraison stage.

Table (4): Effect of the interaction between GA3 and date of spray on some chemical characters of Grape.

Characters	GA3 MG.L^{-1}								
	0			25			50		
	full bloom	fruit set	veraison	full bloom	fruit set	veraison	full bloom	fruit set	veraison
TSS %	16.27 cd	16.80 bcd	15.87 d	18.90 ab	19.93 a	18.30 abc	18.27 abc	19.60 a	18.10 abc
Total sugar %	8.52 a	10.32 a	9.68 a	10.12 a	10.40 a	9.94 a	11.28 a	11.21 a	9.23 a
Total acidity %	0.47 a	0.38 ab	0.48 a	0.27 b	0.32 b	0.34 ab	0.28 b	0.33 ab	0.35 ab
Juice density	1.09 a	1.09 a	1.09 a	1.13 a	1.12 a	1.11 a	1.10 a	1.11 a	1.11 a
Anthocyanin (O.D)	0.94 c	1.02 bc	1.09 bc	1.17 bc	1.18 bc	1.26 b	1.08 bc	1.11 bc	1.64 a

Means with same letters for each factor and interaction are not significantly different at 5% level of probability.

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تأثير تراكيز ومواعيد الرش بالجبريلين في كمية ونوعية الحاصل وبعض الصفات الكيميائية للعنب صنف ره ش ميو مزروع تحت ظروف الزراعة الديمية.

الخلاصة

أجريت هذه الدراسة في مزرعة أهلية قرب زاوينه / محافظة دهوك خلال الموسم الزراعي 2007 هدف دراسة تأثير الرش بالجبريلين بتركيز (صفر, 25 و50 ملغم . لتر$^{-1}$) ومواعيد مختلفة (الإزهار الكامل, عقد الثمار, مرحلة التحول) على الحاصل وبعض الصفات النوعية والكيميائية للعنب صنف ره ش ميو مزروع تحت ظروف الزراعة الديمية.

أظهرت النتائج بأن الرش بالجبريلين بتركيز 50 ملغم. لتر$^{-1}$ أدت إلى زيادة معنوية في الحاصل / كرمة, وزن العنقود, طول وعرض العنقود, طول وعرض الحبات, النسبة المئوية للمواد الصلبة الذائبة الكلية, صبغة الانثوسيانين. بينما أدى الرش بالجبريلين إلى نقصان معنوي في النسبة المئوية للحموضة الكلية. في حين لم تظهر فروقات معنوية في النسبة المئوية للسكريات الكلية وكثافة العصير عند الرش بالجبريلين بالتراكيز المختلفة. كذلك بينت النتائج أن الرش بالجبريلين في مرحلة عقد الحبات أدت إلى تحسين في جميع الصفات المدروسة بشكل معنوي ما عدا محتوى الانثوسيانين في الحبات والتي زادت بدرجة أفضل عند الرش في مرحلة التحول. أفضل تداخل كان عند الرش بتركيز 50 ملغم . لتر$^{-1}$ وفي مرحلة عقد الثمار حيث حسنت بصورة معنوية اغلب الصفات المدروسة.

كارتيكرنا تيراتيا وژڤانين رەشاندنی GA3 دچەندای وجوراتيا دەرامەكی وهندك ساخلەتين كيميائی بو ميوا تري ژ جوری رەش ميوی چاندی لبن كاودانين ديم.

كورتی

ڤەكولين ل رەزەكی خومالی ل رەخ زاويته / پاريزگەها دهوكی دوەرزين چاندنی يی 2007 هاتيە ئەنجامدان ب مەرەما ديازكرنا كارتيكرنا رەشاندنی ب جبرلينی بتراتيا (0–25–50)ملغم / لتر ب ژڤانين جوراجور (گولين تمام– گەهشتنا فيقی– قوناغا كوهورينی) لسەر بەرهەمی وهندەك ساخلەتين جواريەتی وكيمياوی ين ميوی ژجوری رەش ميوی چاندنی ل بن كاودانين چاندنی ين ديم. ئەنجاما ديازكر كو رەشاندنا ب جبريلينی ب تيرابيا 50 ملغم / لتر بو ئەگەری زيدەبونين بەرچاف د بەرهەمی/ ميوەكی, سەنگی ئيشييا ودريژی و پەهنيا ئيشيا ودريژی وپەهنييا تلييا وريژا سەدييا كەرەستين رەقين گشتی ورەنگی انپوسيانين. بەلی رەشاندنا جبرلينی بو ئەگەری كيمبونينا پيشجاڤ د ريژا سەدييا ترشاتيا گشتی. دهەمان دەمدا چو جوداهين پيشجاف دريژا سەدييا شەكرين گشتی وتيراتيا شيراڤی دەمی رەشاندنی ب جبرلينی ب تيراتين جوراجور ديار نەبون.

هەر وەسا ئەنجاما ديار بو كو رەشاندنا جبرلينی د قوناغا گەهشتنا تليا بو ئەگەری باش بونی دهەمی ساخلەتين ناڤبری ل سەری بشيوەيەكی پيشجاڤ ژبلی ريژا انپوسيانينی دتليدا كو بو ئەگەری زيده بونی باشتر ژدەمی رەشاندنی د قوناغا گوهورينی دا. باشترين تيكەلكرن دەمی رەشاندن ب تيراتيا 50 ملغم/ لتر دقوناغا گەهشتنا فيقی هاتبو تومارکرن كو پرانيا ساخلەتين لسەری هاتينە ديازكرن بشيوەيەكی پيش جاڤ باشتير لی هات

COMPARISON THE EFFECT OF THREE DRYING METHODS ON SOME PHYSICAL PROPERTIES OF TWO KINDS OF WOOD BOARDS

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ABSTRACT

Wood boards have been sawn (14x26 cm) from the stems of two tree kinds: *Pinus brutia* Ten. And *Eucalyptus camaldulensis* Dehn. from Ninava forest plantation and in two thickness (1.5 and 3 cm). The samples were dried by using three different drying methods: drying by electrical oven using three temperature (40, 60 and 80 °C), and drying by microwave oven using three levels of microwave intensity (low, medium and high), and drying by compound method using the three levels of microwave intensity (low, medium and high) for half hour then the drying was completed by the electrical oven using (80 °C). These drying methods were used to evaluate its effects on volume shrinkage percent, number of cracks and cupping intensity on the dried boards. The results indicated that drying by electrical oven was the best in reducing volume shrinkage percent, followed by microwave drying then compound method for both kinds of wood and for both thickness. While number of cracks was the lowest when using compound method for both kinds and thickness of wood boards compared with the other two drying methods which showed small differences between them. Microwave drying method showed the highest average in number of cracks and cupping intensity for boards with 1.5 cm thickness for both wood kinds compared with the other two kinds of drying which have very small differences between them. While 3 cm boards thickness gave the highest averages for crack number when using electrical oven drying followed by Microwave drying then compound method. Also, compound method drying gave the highest average in cupping intensity compared with the other two drying methods. Increasing temperature or Microwave intensity was significantly increased volume shrinkage percent for all drying methods, while its effect on cracks number and cupping intensity was varied among the drying methods.

INTRODUCTION

During drying wood by classical, electrical or microwave ovens methods, the wood may expose to different changes such as volume shrinkage, cracks or case hardening may occur. The occurrence of these defects depend on many factors such as methods of drying used, drying period, temperature and type of wood to be dried. Wang and Beall(1975) mentioned that red oak wood boards will form honey combing after drying, but it didn't t show any defects when applying pressure during drying. Peter (1980), Schimidt (1967) and Hittmeier and others (1968) didn't found defects when using pressure during drying four different hardwoods. Also, Almalah and Kasir (2001) didn't found defects after drying Eucalyptus boards when using hot pressure except in few (1) inch thick board samples. Few radial cracks was observed in boards exposed to high pressure and temperature. Although, they found that boards of 0.5 inch thickness didn't have any drying defects except slight cupping in boards exposed to high pressure and temperature. In study at internet site (Drying and stress relaxation, 2004) it was found that drying by microwave (which is an electro magnetic waves with 300 MH to 300 GH frequencies. The best frequencies used for drying is 2.45 GH with 122.4 ml wavelength, at this level it makes the organic matter particles vibrates producing high energy due to particle fractions. This energy force water molecules to be evaporated from the organic compounds (Internet communication 2004b. Microwave hybrid drying)) is the best in reducing defect percent after drying wood poles of yellow srtingbark trees in *Eucalyptus obliqua* compared to the control treatment which showed the present of cracks in dried wood. Almalah and Esmail (2005), explained that drying wood boards of pine and Eucalyptus trees by using microwave increase drying speed percentage 30 times compared to drying by electrical oven. Also, they found the presence of drying defects in samples exposed to higher levels of temperature or microwave frequencies such as cracks or cupping. A study at one of internet communication (fact sheet, 2003) mentioned about a project to establish four kinds of microwave ovens to be used for wood drying. The primary results indicated that using microwave as a pretreatment for drying moist hardwood will decrease drying period from one month to less than a week. Also, it will improve wood strength, permeability and it decrease wood defects.

This research was conducted to study the effects of three drying methods: (electrical oven, microwave oven and compound method) on volume shrinkage percentage, number of cracks and cupping intensity of two kinds of wood boards (hardwood and softwood).

MATERIAL AND METHODS

Two trees were full down, the first was *Pinus brutia* Ten., 25 years old with a 28 cm diameter at DBH, the other tree was *Eucalyptus camaldulensis* Dehn., 28 year old with 30 cm diameter at DBH from Nenava plantation in Nenava province, Iraq at the beginning of November 2003. the stem of these two trees were cut into 14x26 cm boards with two thickness: 1.5 and 3 cm, then they inserted into plastic bags until the time of drying. Mittler electrical balance was used to determine the weight of the samples before and after drying. Also, digital vernier were used to determine length, width and thickness of the studied boards before and after drying. Four wood samples were used to determine moisture content percentage for each tree after falling down. These samples were dried in electrical oven at 105 °C for

two days, moisture content percentage for pine tree was 111.48 % and for Eucalyptus was 57.74 %. The three methods of drying wood samples was as follow:

1- Microwave drying method: Each three wood samples (3 replicate) for each treatments were placed into microwave oven type (Hair) Model HR-7755 GT. The wood board samples were separated by wood sticker to increase moisture release out of wood samples during drying (Fig. 1).

Fig (1): Microwave oven showing wood samples before drying and the sticker separating board sample over the rotating glass saucer.

The microwave oven contain a regulator for choosing the frequencies suitable for drying the organic materials which is ranging between (low), (medium), (high) and (very high) frequencies. Also, the oven contain rotating glass saucer to increase the exposure uniformity of samples to microwave. The first three levels of frequencies were chosen (low, medium, high) for drying wood samples. The samples were weighted during drying periodically until loss of weight stopped. Wood board diameter was measured (length, width and thickness) to determine volume shrinkage percentage, as well as number of cracks and cupping intensity for each sample. Cupping intensity was calibrated in three value levels: zero, 1, 2, 3 by which zero: determine the absence of cupping, 1: presence of light cupping, 2: presence of medium cupping, 3: presence of severe cupping.

2- Electrical heater drying methods: Wood samples were placed in electrical oven (Type Memmert, Germany), and three drying temperature were used (40, 60, and 80 °C). Wood sample dimensions, number of cracks and cupping intensity were determined in the same way as in the previous drying method.

2- Compound drying method : in this method, the wood samples were placed in microwave oven for half hour using three levels of frequencies (low, medium, and high), then the samples were moved directly to the electrical oven to be dried at 80 ℃ (for about one day) until sample weight settled down. Wood sample dimensions, number of cracks and cupping intensity were calculated after drying.

Volume shrinkage percentage was determined according to American standard ASTM, D, 1037-78. SAS, 1997 analysis program was used to obtain ANOVA tables, Also, Duncan multiple range test (1955) was used to obtain the significant differences between treatment means of the studied properties. Complete Randomized Design (CRD) was used for statistical analysis (Senedecore and Cochran, 1967). Wood board thickness was not used as a factor due to the differences of their drying period.

RESULTS AND DISCUSSION

1) Effect of wood type and heat exposure intensity on the studied properties:

a- effect of wood type: Analysis of variance table (1) showed that there were significant differences in wood type when using electrical drying method under 0.01 probability level for each 1.5 and 3 cm board thickness for all studied properties. Table (2) showed that when using microwave drying method, there were significant differences under 0.01 probability level for wood type on volume shrinkage percentage and number of cracks properties. While there were no significant differences for wood type effect on cupping intensity of both board thickness. When using compound drying method (table 3), it was appeared that there were significant differences for wood type effect under 0.01 and 0.05 probability levels for both board thickness and all studied properties. Table (4, 5, 6) showed the means values of wood type effects on the studied properties for the three drying methods. Eucalyptus wood boards were higher than pine boards in increasing volume shrinkage percentage (table 4) and number of cracks

(table 5) and (fig 2) as much as twice for all drying methods and for both board thickness. These results were similar to Almallah and Esmail study (2005) when they found Eucalyptus boards were better in increasing thickness shrinkage percentage compared to pine boards for all studied drying methods (Electrical, microwave and compound drying methods). Also, Eucalyptus boards gave higher mean values compared to pine boards in cupping intensity (table 6) for both electrical and compound drying methods, while there were no significant differences between both wood kinds when using microwave drying method.

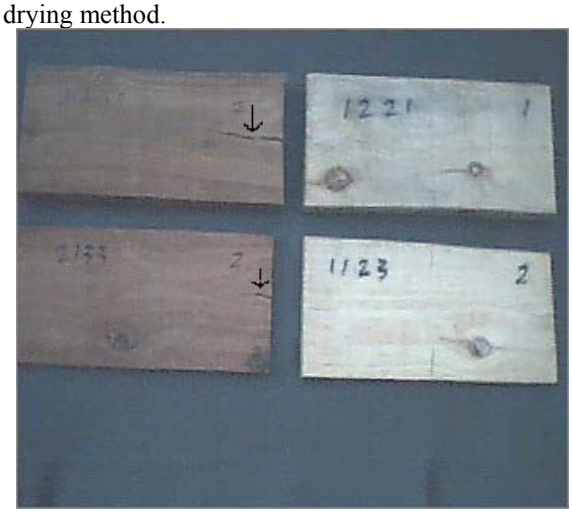

Fig (2): Eucalyptus wood boards gave higher cracks compared to pine boards (pine boards on the wright free of cracks in both 1.5 cm thickness (lower board) and 3cm thickness (upper boards), Eucalyptus boards on the left contain cracks (see arrow).

The reason of increasing volume shrinkage percentage in Eucalyptus boards compared to pine boards may referred to the structure of Eucalyptus tissues which contain different kinds of cells such as fiber, vessels, and parenchyma cells. These kinds of cells have different cell wall thickness and different sizes, while pine wood composed mostly of 90 % trachieds (Haygreen and Bowyer, 1982). While the reason for the absence of significant differences between the two type of wood in cupping intensity when using microwave drying method may be referred to the breakthrough of microwave energy inside wood tissue in a homogenous diffusion. This will result in a uniform loss of moisture content across the pores and the micro-void which formed by vapor pressure on cell wall and on tissues (Internet communication-2004 a), this cause reduction in cupping intensity for both wood types compared to the other drying methods.

b- Temperature effects: Analysis of variance (Table 1) showed that there were significant differences under 0.01 probability level for temperature factor effect on volume shrinkage percentage for both board thickness when using electrical drying method. But there were no significant differences for temperature factor effect on number of cracks and cupping intensity for both board thickness. While when using microwave drying method (table 2),there were no significant differences of temperature effect on all studied properties of 1.5 cm board thickness, but there were significant differences in 3 cm board thickness for volume shrinkage percentage(under 0.05 probability level) and cupping intensity (under 0.01 probability level). When using compound drying method (table 3), the temperature effect was significant under 0.05 probability level for number of cracks of both board thickness. However, there were no significant differences of temperature effect on the other two properties for both board thickness. Generally, Duncan 's multiple range test (Tables 4, 5, 6) showed that there were increasing in volume shrinkage percentage, number of cracks and cupping intensity by increasing temperature or exposure intensity of microwave, but these differences was not significant differences when using microwave drying methods for 1.5 cm thick boards. These results were similar to Almalah and Kasir (2001) study, since he found that there were significant differences in thickness and width shrinkage percentage by increasing temperature and pressure on Eucalyptus wood boards of 1 and 1.5 inch thickness. Also, these results were identical to Almalah and Esmail (2005) when they found that there were significant increase in thickness shrinkage percentage by increasing temperature (40,60,80 ̊C) when using electrical drying method for two type of wood boards (pine and eucalyptus). Also, they found that there were increasing in thickness shrinkage percentage when using microwave drying method but without significant differences. The reason for the absence of significant differences between microwave exposure intensity levels for the studied properties for 1.5 cm thickness may refer to the homogenously entrance of these waves to the deep of wood tissue across board thickness, this will lead approximately to the same loss of water vapor which causes to a closer volume shrinkage percentage across board thickness. Also, the above case may also have the same effect on number of cracks and cupping intensity.

Table (1) show that there was no significant effect of temperature and wood type interaction when using electrical drying method for all the studied properties and for both board thickness. But this interaction differs significantly when using microwave drying method for volume shrinkage percentage (table 2) and cupping intensity of 1.5 cm board thickness, and it was significantly difference in cupping intensity for 3 cm board thickness only. While by using compound drying method (table 3), there was significant differences for this interaction in volumetric shrinkage percentage and number of cracks for 1.5 cm board thickness only. This interaction can be considered of slight effect on the studied properties compared to main factors of wood type and temperature levels.

2) Effect of drying methods on the studied properties:

a- volume shrinkage percentage: Duncan multiple range test (table 4) showed that electrical drying method gave the lowest mean values for both (1.5

and 3 cm)thickness (10.93, 7.04 respectively), followed by microwave drying method (13.66, 12.06 respectively), then compound drying method (16.89, 17.76 respectively). This mean that electrical drying method gave the lowest values in reducing volume shrinkage percentage for 1.5 cm board thickness as much as 2.73 % compared to microwave drying method, and 5.96 % compared to compound drying method. In 3 cm board thickness, volume shrinkage percentage was also reduced as much as 5.02 % compared to microwave drying method and 10.72 % compared to compound drying method. The reason of increasing volume shrinkage percentage in compound drying method compared to the other drying methods may refer to the effect of half hour exposure of wood boards to microwave which induce water evaporation, producing pressure enough to breakdown some cell wall forming spaces and micro-pores which increase water evaporation out of wood tissue (Internet communication 2004, Freshscience). When these boards transferred to the electrical oven at 80 °C, volumetric shrinkage percentage increased. The lower mean values of volume shrinkage percentage when using electrical drying method may refer to the exposure of the outer layer surfaces of wood board to a higher temperature compared to the inner part of wood tissue which didn't receive enough energy as board surface tissues (wood is an insulator material) and hence moisture loss from these tissue was lower which reduce volume shrinkage percentage.

b- Number of cracks and cupping intensity: table (5) showed the means of crack, and number, and it appeared that the general mean of crack number for compound drying method for both board thickness and wood type (0.72) was the best in reducing this property compared to microwave wood drying (1.25) and electrical drying method (1.22) (fig. 3).

Fig (3): Board no. (3) from compound drying method free of cracks. While there were crack in board no. (1) from electrical drying method and board no. (2) from microwave drying method . (see arrows).

On the other hand, table (6) showed that compound drying method gave the highest mean value in cupping intensity (0.97) for both board thickness and wood type compared to microwave drying method (0.805) and electrical drying method (0.66) (fig. 4).

Fig (4): the effect of drying methods on cupping intensity : Boards no. (3) (1.5 and 3 cm thickness): compound drying method showed clear cupping.
Boards no. (1) electrical drying method and boards no. (2) microwave drying method : no cupping effect found.

microwave drying method (table 5) gives the highest mean of cracks number (1.05) for 1.5 cm board thickness compared to electrical drying method (0.55)and compound drying method (0.28).The increasing of crack number mean by using microwave drying method may refer to the rapid penetration of microwave throw 1.5 cm thick board which increase drying and accelerate moisture loss compared to the other drying methods, hence number of cracks was increased. While electrical drying method gave the highest mean value for 3 cm thick boards (1.89) for number of cracks compared to microwave drying method (1.45) and compound drying method (1.16). The reason may refer to the exposure of wood board surfaces (of 3 cm thick board) to a higher temperature compared to the inner wood tissue. This will increase number of cracks compared to other drying methods which used microwave capable of penetrating to inside wood tissue and increase homogenous water evaporation which decrease number of cracks (Internet communication, 2004b, Microwave hybrid drying). The same results was observed for drying methods effect on cupping intensity of 1.5 cm boards (Table 6). Microwave drying method showed the highest mean value (1.11) compared to electrical drying method (0.66) and compound drying method (1) for the same reason mentioned above. While in 3 cm board thickness compound drying method showed the highest mean value in cupping intensity (0.94) compared to electrical drying method (0.66) and microwave drying method (0.5). The reason may refer to the higher loss of moisture when using compound drying method which results in increasing cupping intensity compared to the other two drying methods. Also, it was the same reason resulted in

increasing volume shrinkage percentage when using compound drying method.

Conclusion: from this study results, it can be concluded that using electrical drying method gives the best results in reducing volume shrinkage percentage followed by microwave drying method then compound drying method. Concerning number of cracks, compound drying method showed the best results in reducing number of cracks, while the other two drying methods gives very small differences between them. Also, using electrical and microwave drying method gives the best mean values in reducing cupping intensity compared to compound drying method for both board thickness and both wood type. Pine wood is better than Eucalyptus wood in reducing volume shrinkage percentage, number of cracks and cupping intensity for both board thickness of all drying methods. Also, increasing of drying temperature or exposure to microwave will increase volume shrinkage percentage, number of cracks and cupping intensity of the dried wood boards.

Table (1): ANOVA table of sum of square mean showing the effect of treatments and their interaction on the studied properties by using electrical drying method.

Treatments	D. F.	Sum of Square mean		
		Volume shrinkage (%)	Number of cracks	Cupping intensity
1.5 cm board thickness				
Wood type (W)	1	344.014**	5.556 **	8.000 **
Temperature (T)	2	56.216**	0.777 n.s.	0.333 n.s.
W x T	2	11.932 n. s.	0.778 n.s.	0.333 n.s.
Error	12	39.577	5.333	9.334
3 cm board thickness				
Wood type (W)	1	245.732**	22.223**	8.000 **
Temperature (T)	2	65.9.6**	11.445 n.s.	1.000 n.s.
W x T	2	8.458 n.s.	1.445 n.s.	1.000 n.s.
Error	12	29.575	24.666	6.000

**** :** significantly difference at 0.01 probability level. n.s. : not significant

Table (2): ANOVA table of sum of square mean showing the effect of treatments and their interaction on the studied properties by using microwave drying method.

Treatments	D. F.	Sum of Square mean		
		Volume shrinkage (%)	Number of cracks	Cupping intensity
1.5 cm board thickness				
Wood type (W)	1	561.520 **	20.055 **	0.222 n.s.
Temperature (T)	2	19.586 n.s.	0.445 n.s.	0.445 n.s.
W x T	2	155.518 **	0.445 n.s.	8.445 *
Error	12	52.237	8.000	10.667
3 cm board thickness				
Wood type (W)	1	416.579 **	37.556 **	0.500 n.s.
Temperature (T)	2	21.053 *	6.778 n.s.	2.334 **
W x T	2	2.509 n.s.	6.778 n.s.	6.334 **
Error	12	208.603	19.333	1.333

****, * :** significantly difference at 0.01, 0.05 probability level respectively. n.s. : not significant

Table (3): ANOVA table of sum of square mean showing the effect of treatments and their interaction on the studied properties by using compound drying method.

Treatments	D. F.	Sum of Square mean		
		Volume shrinkage (%)	Number of cracks	Cupping intensity
1.5 cm board thickness				
Wood type (W)	1	787.288 **	1.388 **	8.000 *
Temperature (T)	2	5.316 n.s.	1.445 *	1.000 n.s.
W x T	2	38.796 *	1.445 *	2.334 n.s.
Error	12	43.577	1.333	10.667
3 cm board thickness				
Wood type (W)	1	927.144 **	6.722 *	4.500 *
Temperature (T)	2	2.352 n.s.	5.334 *	0.778 n.s.
W x T	2	7.942 n.s.	0.445 n.s.	2.334 n.s.
Error	12	42.084	10.000	7.334

****, * :** significantly difference at 0.01, 0.05 probability level respectively. n.s. : not significant

Table (4): Volume shrinkage percentage means of the used drying methods for board thickness and wood types.

Treatments			Drying Methods					
			Electrical drying method		Microwave drying method		Compound drying method	
			1.5 cm	3 cm	1.5 cm	3 cm	1.5 cm	3 cm
Wood type	Pine		6.56 b	3.35 b	8.07 b	7.25 b	10.28 b	10.58 b
	Eucalyptus		15.30 a	10.74 a	19.24 a	16.87 a	23.51 a	24.93 a
Means			10.93	7.04	13.66	12.06	16.89	17.76
Temperature - exposure intensity to microwave	40	low	8.65 b	9.61 a	12.49 a	7.24 b	17.01 a	17.65 a
	60	medium	12.95 a	6.51 b	13.46 a	13.74 a	16.18 a	17.38 a
	80	High	11.19 a	5.01 b	15.03 a	15.21 a	17.49 a	18.25 a
Means			10.93	7.04	13.66	12.06	16.89	17.76

Means with the same letter for each column are not significantly different at 0.05.

Table (5): Number of cracks means of the used drying methods for both board thickness and both wood types.

treatments			Drying Methods					
			Electrical drying method		Microwave drying method		Compound drying method	
			1.5 cm	3 cm	1.5 cm	3 cm	1.5 cm	3 cm
Wood type	Pine		0.00 b	0.78 b	0.00 b	0.00 b	0.00 b	0.55 b
	Eucalyptus		1.11 a	3.00 a	2.11 a	2.89 a	0.56 a	1.78 a
means			0.55	1.89	1.05	1.45	0.28	1.16
Temperature - exposure intensity to microwave	40	low	0.33 a	1.50 a	0.83 a	0.67 a	0.67 a	1.83 a
	60	medium	0.50 a	0.16 a	1.17 a	1.50 a	0.00 b	1.16 ab
	80	high	0.83 a	3.00 a	1.17 a	2.17 a	0.17 b	0.50 b
means			0.55	1.89	1.05	1.45	0.28	1.16

Means with the same letter for each column are not significantly different at 0.05.

Table (6): cupping intensity means of the used drying methods for both board thickness and both wood types.

treatments			Drying Methods					
			Electrical drying method		Microwave drying method		Compound drying method	
			1.5 cm	3 cm	1.5 cm	3 cm	1.5 cm	3 cm
Wood type	Pine		0.00 b	0.00 b	1.00 a	0.67 a	0.33 b	0.44 b
	Eucalyptus		1.33 a	1.33 a	1.22 a	0.33 a	1.67 a	1.44 a
means			0.66	0.66	1.11	0.50	1	0.94
Temperature - exposure intensity to microwave	40	low	0.67 a	1.00 a	1.00 a	0.33 b	0.83 a	1.00 a
	60	medium	0.50 a	0.50 a	1.00 a	0.17 b	0.83 a	1.17 a
	80	high	0.83 a	0.50 a	1.33 a	1.00 a	1.33 a	0.67 a
means			0.66	0.66	1.11	0.50	1	0.94

Means with the same letter for each column are not significantly different at 0.05.

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ECONOMIC ANALYSIS OF THE PRODUCTION FUNCTIONS OF WHEAT CROP IN SUMAIL DISTRICT IN DOHUK GOVERNORATE FOR PRODUCTION SEASON 2006-2007.

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ABSTRACT

This research analyses the production function of wheat crop. The production function has been estimated and the returns have been accounted. Statistical tests indicate that the independent variables i.e. labor and capital are significant and they predicted that the production elasticity of labor is low while it is relatively high for capital. The research revealed that both factors were not used in an economical way and that there is an opportunity to decrease total cost.

KEYWORDS production function wheat crop

INTRODUCTION

During centuries human beings were accustomed to use wheat as one of the basic components of nutrition; therefore, it considered one of the most important agricultural crops which is cultivated in various countries and continents of the world. Several resources indicate that wheat can be processed half of human body needs of plant protein[1]. Wheat is one of the most important strategic crops in Iraq as it occupies the largest allowance of cultivated area and occupies the first place in the agricultural sector in terms of the quantity and value of production. The large part of wheat planted area is focused in Kurdistan region. Some studies indicate that the original home of wheat production is located in Kurdistan region especially in the area of Tel Jarmo which lies (11) kilometers from Chamchamal District of Sulaymaniyah Governerate[2]. Wheat acreage in the region is estimated about (1.5) million donms* annually while production is about (300) thousand tone. Dohuk governorate comes in the second place in terms of total area planted and total production which the planted acreage is estimated about (335574) donms and the total production about (104477) tone in the year (1998), formed a rate of (29.4%) of total production of the region[3]. However, in Sumail district the planted acreage is estimated about (120388) donms with total production of (44544) tone in the year (1998)[4]. The objective of this research is to identify the production of wheat and productivity using convenient production function that reflects the relationship between input and output of sample categories. The economic use of productive resources is one of the main objectives of economic development strategy in the agricultural sector. To know the situation of wheat is of great benefit to amend the deficiencies in the routing productivity as an economic logic and studies indicate the resources are not used more efficiently, which requires consultation to production functions and work to modify the structure of resources combinations to ensure the rational use of those resources and thereby maximize the productivity returns through optimal combination of production elements.

* Donm = 2500 m^2

Methodology:

The data has collected by using questionnaire prepared for this purpose including all the information required. The research population includes almost all wheat producers in Sumail district of Dohuk governorate for the season (2006-2007). The randomized sample is about (70) farmers represented (44%) of the total[5] which ranged their cultivated areas between (10-350) donms. The sample has divided into three categories according to areas cropped. The first category included farmers who are ranging their farms between (10-90) donms and second (90-220) donms and the third (220-350) donms.

RESULTS AND DISCUSSION

The double logarithmic function has used as it is the most common function to estimate the relationships in the agricultural sector and compatible with the statistical tests. The output (Y) is the dependent variable while labor (X_1) and capital (X_2) are the independent variables. The function takes the following formula after converted to Cobb-Douglas function:

$y = a\, x_1^{b1}\, x_2^{b2}$

First: production function of wheat crop (first category)

The logarithmic model is selected from several models and the function is as follow:

$\ln y = \ln 1.334 + 0.418 \ln x_1 + 0.552 \ln x_2$

By converting previous function to Cobb-Douglas the model will be:

$y = 3.796\ \ x_1^{0.418}\ \ x_2^{0.552}$
S.E = (0.117) (0.166) (0.207)
t = 11.334 2.516 2.663 n = 23
R^2 = 96.34% R^{-2} adj. = 0.96
S.S.E = 0.1103 F = 276.39 $F_{tab.}$ = 3.47
D.W = 1.943 d_l = 1.19 d_u = 1.55 4- d_u = 2.45

The results have shown that the coefficient of labor is (0.418) with positive value. This means that increasing (1%) of labor leads output to increase for about (0.418%) assuming that capital is constant at its arithmetic mean which means the decreasing return to scale. The coefficient of capital is (0.552) which

means that increasing (1%) of capital leads output to increase by about (0.552 %) assuming that labor is constant. This means the decreasing return to scale as well. Also the production elasticity which represents the sum of labor and capital coefficients are (0.97) which reflects the supremacy of constant return to scale approximately where production is at the end of the first stage and the beginning of second stage.

Second: production function of wheat crop (second category)

The logarithmic model is selected also among several models and the function is as follows:

$\ln y = \ln 1.553 + 0.213 \ln x_1 + 0.669 \ln x_2$

By converting previous function to the Cobb-Douglas function, the results will be:

$y = 4.726 \; x_1^{0.213} \; x_2^{0.669}$
S.E = (0.090) (0.101) (0.092)
t = 17.238 2.107 7.259 n = 23
$R^2 = 95.838\%$ R^{-2} adj. = 0.954
S.S.E = 0.0591 F = 241.77 $F_{tab.} = 3.47$
D.W = 1.681 $d_l = 1.19$ $d_u = 1.55$ $4- d_u = 2.45$

From the results, the labor coefficient is (0.213) with positive value. This means that increasing (1%) of labor leads to increase output by about (0.213%) when the capital is constant. This means that the decreasing return to scale. But the capital coefficient is (0.669) which means that increasing (1%) of capital leads to increase output by about (0.669%) when labor is constant and this means decreasing return to scale too. Total production elasticity is (0.882) which reflects the decreasing return to scale and the function is at second stage (rational stage).

Third: production function of wheat crop (third category)

The logarithmic model is selected also among several models and the function is as follow:

$\ln y = \ln 2.193 + 0.483 \ln x_1 + 0.074 \ln x_2$

By converting previous function to the Cobb-Douglas function, the results will be:

$y = 2.609 \; x_1^{0.521} \; x_2^{0.644}$
S.E = (0.377) (0.124) (0.162)
t = 2.543 4.185 3.956 n = 23
$R^2 = 86.814\%$ R^{-2} adj. = 0.856
S.S.E = 0.0548 F = 69.13 $F_{tab.} = 3.47$
D.W = 1.551 $d_l = 1.17$ $d_u = 1.54$ $4- d_u = 2.46$

The labor coefficient is (0.521) which means that increasing (1%) of labor leads to increase the output by about (0.521%) but the capital coefficient is (0.644) which means that increasing (1%) of capital leads to increase output by about (0.644%). Total production coefficient is (1.165) which reflects increasing return to scale and production is at the first stage, therefore, we can increase the output level by using additional units of factors of production.

Partial derivatives of production function:

The third category is selected because its production coefficient is about (1.165); increasing return to scale and the crop is always planted in larger areas.

The labor and capital functions are derivate to show the relationship between output level and labor quantity (when capital is constant at its arithmetic means and labor quantities are arranged between its minimum and maximum uses in this category) and vice versa.

The marginal and average formulas of labor and capital factors are as follow:

$MP_L = 13.066 \; x_1^{-0.479}$
$AP_L = 25.079 \; x_1^{-0.479}$
$MP_K = 7.771 \; x_2^{-0.356}$
$AP_K = 12.067 \; x_2^{-0.356}$

The marginal production is calculated by taking the first derivative of production function for each factor when the second is constant; however the average production is calculated by dividing marginal production for each factor on its coefficient.

Table (1): Average and marginal production of labor (capital is constant).

Labor (Man/Day)	Output (Tons)	Mvp_l*	A.P
14	99.18	3.691	7.084
16	106.3	3.462	6.646
18	113.1	3.272	6.281
20	119.4	3.111	5.972
22	125.5	2.973	5.705
24	131.3	2.851	5.473
26	136.9	2.744	5.267

* MVP_L = marginal value product of labor.
Source: calculated by researcher.

Table (2): Average and marginal production of capital when labor is constant.

Capital (Millions Id)	Output (Tons)	Mvp_k*	A.P
28	103.2	2.373	3.685
30	107.9	2.315	3.595
32	112.4	2.263	3.514
34	116.9	2.214	3.439
36	121.3	2.170	3.369
38	125.6	2.129	3.305
40	129.8	2.090	3.245

* MVP_K = marginal value product of capital.
Source: calculated by researcher.

The tables (1) and (2) show that the average production values are greater than the marginal production values. Using these production factors are at the first stage (irrational stage) of diminishing return to scale.

To obtain the isoquant curves, four input levels are selected which lies between minimum and maximum levels of output in this category (90, 110, 130, 145) tons respectively. The isoquant curve function is concluded from the production function as it shown in table (3) and figure (1):

$X_1 = (y / 2.609\ x_2^{0.644})^{1/0.521}$ .....(1)

$X_2 = (y / 2.609\ x_1^{0.521})^{1/0.644}$ .....(2)

Table (3): Isoquant curves for labor combinations of four output levels.

Labor (Man/Day)	Output Levels (Tons)			
	90	110	130	145
14	28.88	39.44	51.12	60.57
16	25.92	35.40	45.89	54.37
18	23.57	32.18	41.72	49.42
20	21.64	29.55	38.31	45.39
22	20.04	27.36	35.46	42.02
24	18.67	25.50	33.05	39.16
26	17.50	23.90	30.98	36.71

Source: calculated by researcher.

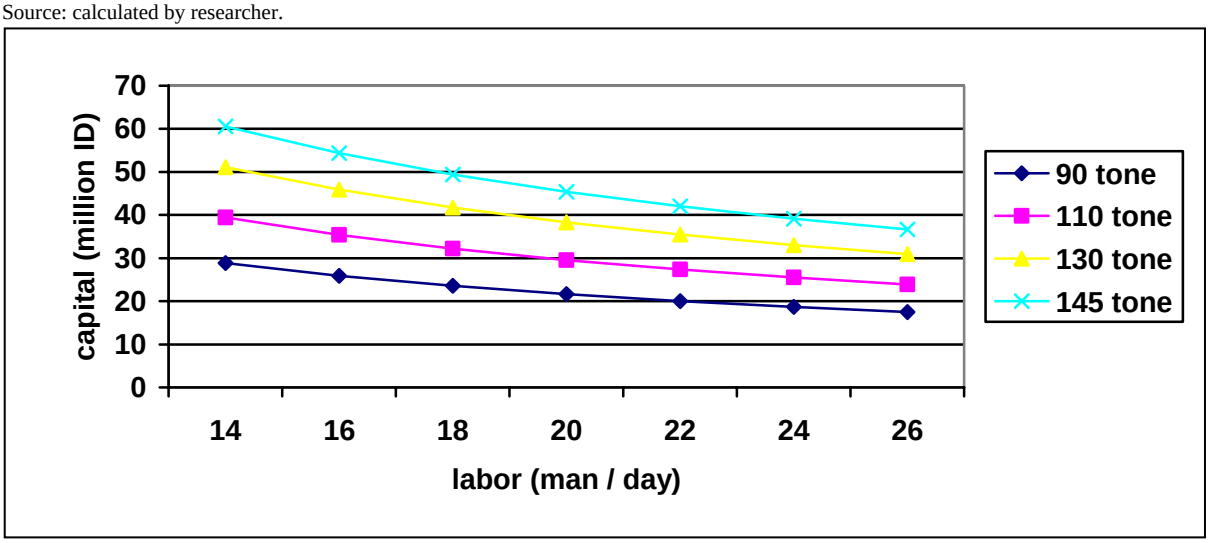

Fig (1): Isoquant curves (economic efficiency achievement).
Source: calculated by researcher.

Production levels determination & economic efficiency achievement

To achieve an economic efficiency and reach the various resources combinations that determine minimum cost, when the output is constant, the marginal rate of technical substitution between resources must be equals the inverse prices rate. When the output is constant and labor is used at different levels† The marginal rate of technical substitution is as follow:

$MRTS = b_1 x_2 / b_2 x_1$

To find the suitable combinations of labor and capital for different output levels we assume three price levels for labor and two for capital, assuming that the average labor wage is (0.015, 0.020, 0.025) millions ID/day and the price of each unit of capital is (1, 1.12) millions ID whereas the first one without interest rate while the second with interest rate of 12% †.

$0.521\ x_2 / 0.644\ x_1 = 0.015 / 1$

$x_2 = 0.019\ x_1$ ..... (3)

When the price of labor is (0.015) millions ID/day and the price of capital is (1) million ID.

Formula (3) represents optimum expansion path for this level of labor unit wage. The value of resources combination is calculated by substituting formula (3) in (2) as shown in table (4).

† Capital can not be substituted by labor as it is illogical to substitute manual work by machinery.
† According to interest rate on capital at government banks in region.

Table (4): Quantities of production resources that require minimizing the costs for each output levels.

	Output Levels (Tons)											
	90			110			130			145		
	Labor units	Capital units	Inputs costs	Labor units	Capital units	Inputs costs	Labor units	Capital units	Inputs costs	Labor units	Capital units	Inputs costs
Px_1 / Px_2	1											
0.015	186.836	3.55	6.353	221.956	4.217	7.546	256.178	4.867	8.710	281.352	5.346	9.566
0.020	160.537	4.013	7.224	190.714	4.768	8.582	220.119	5.503	9.906	241.749	6.044	10.879
0.025	142.539	4.419	7.982	169.332	5.249	9.482	195.441	6.059	10.945	214.646	6.654	12.020
Px_1 / Px_2	1.12											
0.015	198.684	3.378	6.764	236.031	4.013	8.035	272.424	4.631	9.273	299.194	5.086	10.184
0.020	172.292	3.790	7.691	204.678	4.503	9.137	236.236	5.197	10.545	259.451	5.708	11.582
0.025	150.788	4.222	8.498	179.133	5.016	10.096	206.752	5.789	11.652	227.069	6.358	12.798

Source: calculated by the researcher.

From table (4) it can be seen that the difference between input costs where capital cost is greater than labor cost because it is used in large quantities. Wheat production is not required larger number of labor units and this does not mean the decrease of technical efficiency of labor whereas technical development is combined with capital as it is larger than labor which means that the substitution occurs to replace capital by labor.

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تحليل اقتصادي قياسي لدالة انتاج محصول الحنطة في قضاء سميل بمحافظة دهوك للموسم الانتاجي 2006-2007

الخلاصة

تركز البحث على تحليل اقتصادي لدالة انتاج محصول الحنطة. و من التحليل تبين معنوية المتغيرات المستقلة في الدالة المقدرة و المتمثلة بعنصري الانتاج العمل و رأس المال. و ظهر أيضا انخفاض المرونة الانتاجية لعنصر العمل و ارتفاع المرونة الانتاجية لعنصر رأس المال نسبيا و لم يتم استخدام عنصري الانتاج بكفاءة حيث هناك هدر في تلك الموارد و أنه بالامكان الوصول الى المستويات الانتاجية في العينة بتكاليف أقل من خلال استخدام الموارد الانتاجية بشكل أمثل.

ڤە كولينەكا شروڤەكرنا فەنكشنا بەرهەمدار يا دەرامەتێ گەنمێ چاندی بو وەرزێ چاندنی2007/2006 ل قەزا سێمێلێ ل پارێزگەها دهوك

كورتی

ئەڤ ڤەكولينە ل دور ڤەكولين ل سەر فەنكشنا بەرهەمدار يا چاندنا دەرامەتێ گەنمیيە. ئەڤ فەنكشنە هاتە خەملكرن و بنكەيێن شروڤەكرنا ئابوری دگەل بەرامبەركرنا داهاتيا هاتە كرن و خەملكرنا هەژماری يا هوكارا يێن فەنكشنا خەملكری نيشان دا كو هەمی گهورين سەربەخونە, فەكتەرێ كاری و فەكتەرێ سەرمايێ واتەيىنە. و ديار بو ژ شروڤەكرنێ نزماتيا نەرموكە يا بەرهەمی يا فاكتەرێ كاری و بلنديا نەرموكە يا فاكتەرێ سەرمايێ بەرامبەری يا كاری. و ديار بو ژ ڤەكولينێ كو هەردوو فاكتەرين بەرهەمی ب رەنگەكێ ئابوری نەهاتينە بكار ئينان و شيان هەبوون خەرجاتيا كيمتر لێ بكەن.

ECONOMIC ANALYSIS OF BROILERS PRODUCTION "BADALYA PROJECT / DOHUK GOVERNORATE AS A CASE STUDY[1]".

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ABSTRACT

This research includes an economic analysis of dohuk's poultry project in Badalya. The economic analysis shows that the project takes part in the national income during the survey years by worth of $ (43337, 159491, 422108, 541396) ordinarily. According to standards of the evaluation, the results of analysis shows that the net present worth of the project is $ (573433), the benefit-cost ratio is $ (1.075), and the internal rate of return reaches to (19.8%) during the years of survey.

KEYWORDS poultry project economic analysis

INTRODUCTION

It is possible to say that during the past few years there was an increase in the demanding of the necessary nutritional goods, one of which are the animal production products, which constitute an important nutritional resources as a result of their higher nutritional value. The increase of prices of such products in divergent way led to the increase in demand on the cheaper products concerning the animal production. This is obvious in increasing the demand on the products of poultry industry in rapid averages with increasing population, and the per capita income specially the implementation of oil for food program which has resulted in expanding gap between the required quantities and the existed units of poultry industry projects despite the achieved increase in producing broilers and the attempts to reach the convenient averages of consumption. As a result of the futuristic outlook which aims at developing and increasing consumption of nutritional goods which contain large quantities of protein and which relies on designing developing programs for the different economical sectors specially the agricultural one. As a result of all this it is necessary to evaluate the existing projects to treat the suffocation which affects the projects in order to be able for achieving their production capacity and to contribute effectively in increasing the offered goods to meet the demand.

Dohuk's poultry project in Badalya is one of great productive projects of poultry belongs to mutual sectors in the region which consists of (10) fields of broiler's farming designed according to the German company (Lohmann) which is a closed system. Each field contains (20) houses with a capacity of (12500) birds for each house. It also consists of (5) other fields for layer breeder hen, hatchery, water & electricity projects.

The project resumes its production again since (1998), although of economical and political circumstances that faced the project, and the pause of production for several years, being far from achieving aims of its establishment and covering consumption.

Methodology

The research relied on the basic resources (field survey) of the Dohuk poultry project in Badalya and getting the required data from the project records during the years (1999-2002).

It seems, by study the sections of the costs of project which classified into investment cost, current cost (operation & maintenance cost, production cost), that the total costs during the survey years was $ (1635896, 1689179, 3195375, 3957198) respectively. The revenues of the project are $ (1596197, 1765628, 3578214, 4390175) respectively during the survey years. This means that both costs and revenues are increasing continuously year after year.

The interest price (12%) was used during the study which is known with agriculture debts in developing countries[1] by finding out the present value of cost and production**.**

Table (1): cost items of broilers production in Badalya project.

Year	Investment Costs	Operation & Maintenance Costs	Production Costs	Total Costs
1999	60819	225318	1349759	1635896
2000	64268	236745	1388166	1689179
2001	64294	331820	2799261	3195375
2002	76003	348170	3533025	3957198
Total	265384	1142053	9070211	10477648

Source: calculated by researcher.

Table (2): revenue items of broilers production in Badalya project.

Year	Broilers Meat	Broilers Waste	Total Revenues
1999	1580159	16038	1596197
2000	1752051	13577	1765628
2001	3553556	24658	3578214
2002	4375364	14811	4390175
Total	11261130	69084	11330214

Source: calculated by researcher.

RESULTS AND DISCUSSION

The study used number of criteria to recognize the results of the project activity. These criteria play an important role in revealing the scope of success the economical unit and its advance, besides its distribution in identifying the deviations that might results in the failure of many units[2].

A: undiscounted measures of project worth

1- Gross added value: It is equal to total production minus production requirements[3]. It reached $ (43337, 159491, 422108, 541396) with an annually change ratio (268%, 165%, 28%) respectively during the survey years. The value of this indicator expresses a better economical situation in the year (2002) than the others (figure 1).

[1] Part of M.Sc. Thesis of second author.

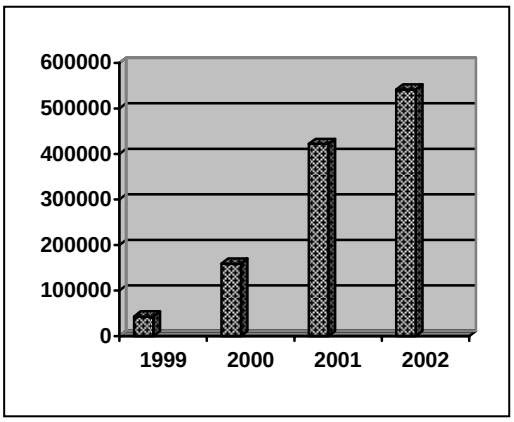

Fig (1): gross added value of the project

2- Net added value: It is equal to gross added value minus depreciations[4]. It reached $ (17482, 95223, 357814, 465393) respectively during the survey years (figure 2). It reached the lowest value in the year (1999) and the highest level in the year (2002).

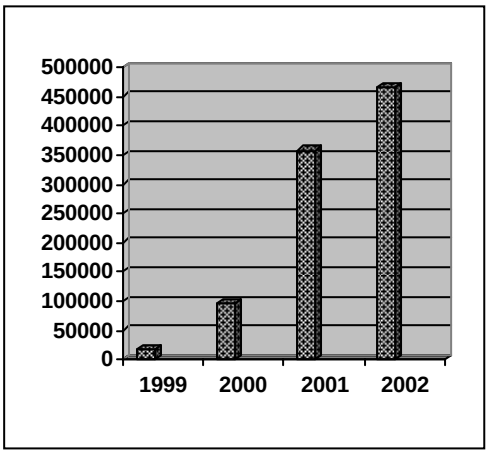

Fig (2): net added value of the project.

3- Labor productivity (dollar wage): It is equal to total added value divided by wages[5]. The dollar productivity for permanent and personal labors reached $ (2.242, 9.514, 11.385, 17.726) respectively during the survey years (figure 3). It is possible to say that in the year (2002) the single dollar used as a wage has achieved a profit of (17.726) dollars.

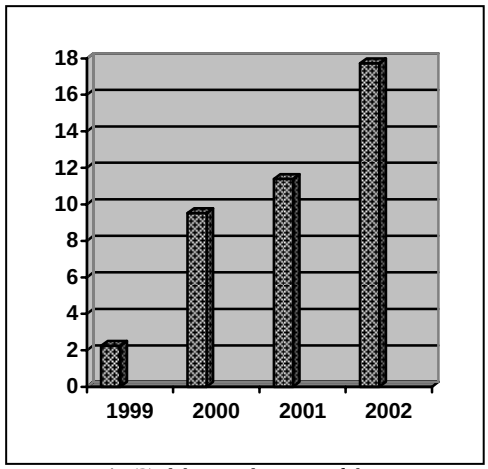

Fig (3): labor productivity of the project.

4- Variable capital product: It is equal to total revenues divided by total current costs[6]. It reached $ (1.013, 1.086, 1.143, 1.131) respectively during survey years. This shows that the efficiency of production elements is available during this period and the project achieved a profit in the dollar spent upon the production elements (figure 4).

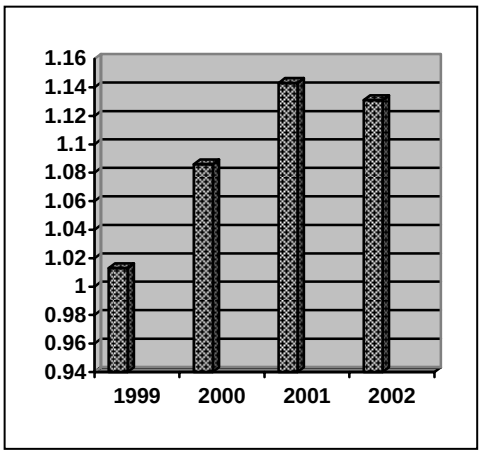

Fig (4): variable capital product of the project.

5- Average of invested dollar return: It is equal to profit divided by invested capital[7]. It reached $ (-0.243, 0.045, 0.120, 0.109) respectively during survey years while a loss appeared in (1999) and simple revenue during the others (figure 5).

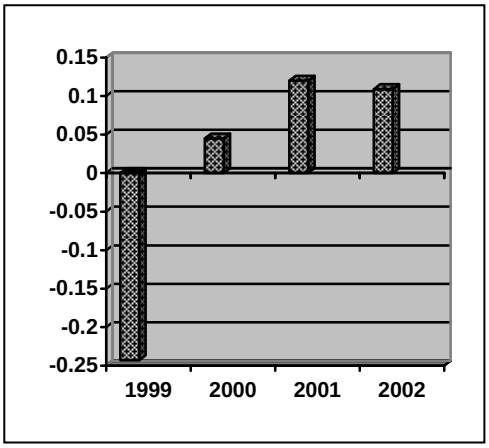

Fig (5): average of invested dollar wage of the project.

6- Net income: It is equal to total revenues minus total current costs[8]. It reached $ (21120, 140717, 447133, 508980) respectively during survey years (figure 6). It is also possible to notice that the net income witnesses an increase year after year.

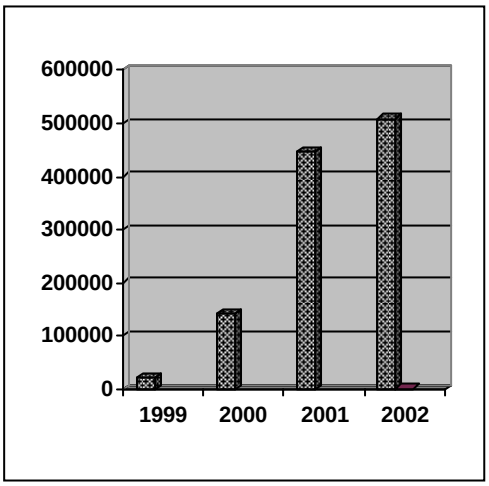

Fig (6): net income of the project.

7- Economical profit: It is equal to net income minus fixed costs[9]. The project achieved an economical profit during the survey period $ (-39699, 46449, 382839, 432977) respectively (figure 7).

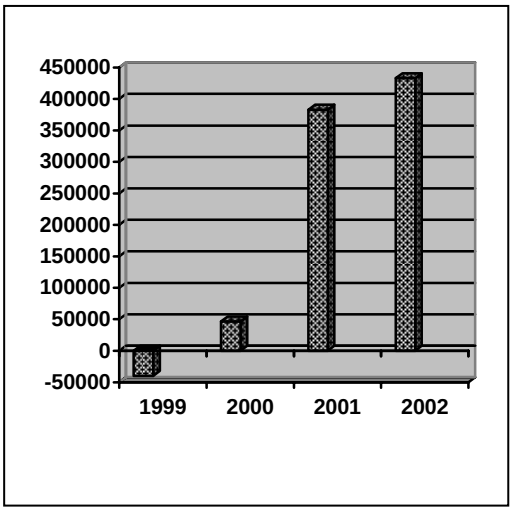

Fig (7): economical profit of the project.

8- Capital return %: It is percentage ratio of economical profit divided by total costs[10]. The project achieved a profit during the survey years except year (1999) which witnessed a loss of (2.427 %), while during the other years the profit was (4.526%, 11.981%, 10.942%) respectively (figure 8).

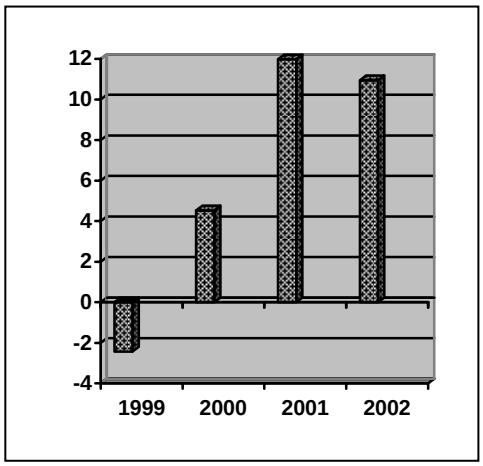

Fig (8): capital return % of the project.

B: discounted cash flow measures

1- Net present worth: through observing the table (3) we find that the project yields profits of $ (573433) during the survey years.

2- Benefit-cost ratio: through observing table (3) we find that each invested dollar in the project achieves a profit of $ (1.075) during the survey years.

3- Internal rate of return: when estimating this criterion a discount price was utilized the first (12%) and the second (15%) which the first represent the average and second the highest discount rate in the developing countries respectively. The internal rate of return of the project reaches (19.8%) during survey years (table 4).

Table (3): computation of net present worth & benefit-cost ratio of the project.

Year	Gross Costs	D.F* 12%	Present Worth 12%	Gross Benefits	Present Worth 12%	Cash Flow	Present Worth 12%
1999	1635896	0.893	1460855	1596197	1425404	-39699	-35451
2000	1689179	0.797	1346276	1765628	1407206	76449	60930
2001	3195375	0.712	2275107	3578214	2547688	382839	272581
2002	3957198	0.636	2516778	4390175	2792151	432977	275373
total	10477648	3.038	7599016	11330214	8172449	852566	573433

***** Discount factor.
Source: calculated by researcher.

Table (4): computation of internal rate of return of the project.

Year	Cash Flow	D.F*. 12%	Present Worth 12%	D.F*. 15%	Present Worth 15%
1999	-39699	0.893	-35451	0.870	-30840
2000	76449	0.797	60930	0.756	46063
2001	382839	0.712	272581	0.658	179358
2002	432977	0.636	275373	0.572	157513
total	852566	3.038	573433	2.855	352092

***** Discount factor
Source: calculated by researcher.

CONCLUSIONS AND RECOMMENDATIONS

The study shows that the project is in a good case from an economic evaluating and it includes a contribution in the national income. Some of bad economical situation was attributed to political circumstances of Kurdistan Region, which led to pause the work in the project for several years as well as tarry in providing the production requirements because of out of control of project administration.

Researcher's advice to submit these recommendations and suggestions as follow:

1- the necessity of insuring resume of all houses which is specified for broiler farming, where the employed houses for production were (35%, 25%, 60% and 18%) respectively during the survey years.

2- The necessity of putting an imported plan including providing the annually production requirements in that way, which insures the continuity of working in project without pause.

3- Given chance for making economical studies by specialists and facilitate the tasks of awareness on available details to specify periods and ways of economical forming.

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التحليل الاقتصادي لانتاج فروج اللحم في مشروع بدليا في محافظة دهوك خلال السنوات 1999-2002.

الخلاصة

تضمنت الدراسة تحليلا اقتصاديا لمشروع دواجن دهوك في بدليا. فقد اظهر التحليل الاقتصادي بان المشروع ساهم في الدخل القومي لسنوات الدراسة. اما بالنسبة لمعايير التقييم فقد ظهر نتيجة التحليل ان صافي القيمة الحالية للمشروع هـي (573433)$, نسبة المنافع الى التكاليف هي (1.075)$, و معدل العائد الداخلي للمشروع بلغ (19.8%) خلال سنوات الدراسة.

شروۆەكرنا ئابورى يا خودانكرنا مريشكێن گوشتى ل پروژێ بەدالیا ل پارێزگەها دهوكێ بو سالێن 1999-2002.

كورتى

ڤەكولين پێكهاتيه ژ شروۆەكرنا ئابورى بو پرۆژێ مريشكين دهوكێ ل بەدالیا. د شروۆەكرنا ئابورى ديار بو كـو پـروژه يـێ هاريكاره بو دەسكەفتيێن نەتەوەيى د سالێن فەكولينێ دا. سەبارەت نيشاندەرێن هەلسەنگاندنێ ئەنجامێ شروۆەكرنێ ديار كر كو نرخێ نوكه يێ سافى بو پرۆژێ گەهشته(573433)$ و رێژا داهاتيان بو لێ چونان گەهشته(1.075)$ و تێكرا داهاتيێن نـافخۆيى (19.8٪) بو ل سالێن ڤەكولينێ دا.

EFFECT OF SOWING DEPTHS AND SEED SIZE ON SEED YIELD AND YIELD COMPONENTS OF SOME WINTER CULTIVARS OF CHICKPEA (*CICER ARIETINUM* L.)•

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ABSTRACT

The research experiment was accomplished at two locations, Agriculture College farms in Duhok (situated between longitudes 43.01º E, latitudes 36.847º N, and altitude 583 meters) and Agricultural Research Center at Zakho area(situated between longitudes 42.41º E, latitudes 37.8º N, and altitude 433 meters and about 70 km far from Duhok) for the growing season 2006 it sown in 4 and 18 of January respectively in both locations, to investigate the effect of sowing depths (6 and 12 cm) and seed sizes (small, medium and large) on seed yield of some winter varieties of chickpea (*Cicer arietinum L.*) (Ghab3, Ghab4, and Ghab5) under rainfall conditions at Duhok region. The results indicated that sowing depths had no significant effect on any of the studied traits at both locations. Large and medium seeds produced better seed yield per donum (2500 m^2) at both locations. Ghab3 variety manifested higher pods and seeds per plant, while all other traits were higher for Ghab4 and Ghab5 varieties at both locations. Large seeds at 12 cm sowing depth and also large or medium seeds of Ghab4 or Ghab5 varieties gave significantly higher seed yield per donum.

KEYWORDS seed size sowing depth winter cultivars yield yield components

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the second most important grain legume after faba bean in Iraq. Its cultivation is concentrated in the northern governorates including Sulaymania, Duhok, Erbil and Mosul with covering an area of 14.000 ha in average yield of 0.74 t. ha^{-1} (Abbas, 1990) which comprises 6.4% only of the total consumption and the remaining provided by importation. Like all Mediterranean basin, chickpea is the only pulse crop that is sown in Iraq in spring without irrigation, whereas other cool-season legumes such as faba bean (*Vicia faba* L.) and peas (*Pisum sativum L.*) are grown as a winter-sown crops. However, studies on the date of sowing for chickpea have led the workers to realize that yield can be considerably ameliorating with adequate water availability and much longer reproductive period.

In this area farmers usually sown chickpeas in spring (February-March); since early sowing in very wet conditions (winter sowing) causes many diseases, especially Ascochyta blight, which has been reported to be the most destructive disease in 32 countries (Nene,1988); troubles in weed control, lodging, and sometimes a complete loss of the product The limited area cultivated by chickpea and the low productivity per unit area in Iraqi Kurdistan region, in spite of the favorable climatic conditions, are due to numerous obstacles confronting chickpea growing of local varieties (spring varieties) with the conventional methods, absence of mechanization especially in harvesting that reduce economic return and the spreading of pests.

Sowing depth has been studied over the world in different directions. Dahiya *et al*. (1988) reported that the yield of chickpea was similar with sowing depths of 5, 10, and 15 cm for two chickpea cultivars (H-208 and C-235). These are in accordance with Siddique *et al.* (1998) who found in an experiment conducted at Western Australian conditions for chickpea and other legumes, that the sowing depth (2.5, 5, and 10 cm) had no significant effect on chickpea seed yield at Merredin location in 1994, 1995, and 1996, and at Northam location in 1994. However, seed yield was reduced with sowing at shallow depth in 1995 and 1996 at Northam location. In contrast Khan *et al*. (1999) showed in an experiment conducted in Bangladesh at November 1994 with three rates of population (40, 50, and 60 kg ha-1) and three sowing depth (3,6, and 9cm) that the highest seed yield was obtained in the 9 cm sowing depth treatment. Also, Abbas and Murad (2001) revealed that the depth of sowing (8 and 12 cm) for local chickpea in three rainfall areas in Iraq, did not show significant differences in seed number per plant and final seed yield per donum. On the other hand, the use of small seeds can reduce the production costs of Kabuli chickpea by 15 to 25% by reducing the amount of seed needed per unit area, (Gan *et al*, 2003).

Many studies have been signed the mentioned factor's effect on the yield of chickpea, Wery, 1990; Ali *et al*, 1995; Singh *et al*, 1997; Malhotra *et al*, 1996; Muehlbauer and Tullu, 1997 and Singh and Saxena, 1999 they reported that the winter cultivars of chickpea are significantly gave higher yield than local or spring once.

The large seeds in many crops play an important role in producing more vigorous plants, and may influence the yield or its components. In chickpea, many studies have been reviewed all over the world, noting the direct or indirect effect of seed size on yield. Biderbost *et al*, 1980; Murray and Auld,1987; Gan *et al*, 2003; Gan *et al*, 2000 and Agung and McDonald, 1996 reported that there were no differences in yield and its components between large and small seeds. However, *et al*, 1991 stated that the large seed group of chickpeas produced an average of 31.4% greater economic yield than the small seed group.

As regard the sowing depth, the studies have been conducted to clarify the proper depth of chickpea in different countries, Khan *et al*, 1999; Siddique *et al*, 2001; Gan *et al*, 2003 and Ayaz *et al*, 2004 they found significantly positive relationship between sowing depths and chickpea yield. In contrast Dahiya

• part of M. Sc. Thesis for the first author.

*et al,*1988; Siddique *et al,* 1998 and Abbas and Murad, 2001 revealed that the depth of sowing did not show significant differences final seed yield of chickpea. Therefore, the plan was made to study the response of yield or yield component for some winter cultivars of chickpea as influenced by sowing depth and seed size under rainfall conditions of Iraqi Kurdistan Region at two different locations.

MATERIALS AND METHODS

Duhok Governorate of Iraqi Kurdistan region is situated between longitude 43.01° E, latitude 36.847° N, and altitude 583 meters. Its climate is continental and sub-tropical, which is characterized by a cool to cold winter with possible temperature below zero, and a hot dry summer with temperature elevating up to 40° C. The region is located in a secured and semi-secured rain zone.

Three winter Kabuli varieties of chickpea (*Cicer arietinum L.)* (Ghab3, Ghab4, and Ghab5) were developed by the International Center for Agriculture Research in the Dry Area (ICARDA); their registration numbers were reported by Singh *et al,*1997 as: Ghab3, Ghab4 (Reg. No. CV-245, PI 638616), and Ghab5 (Reg. No. CV-246, PI 638617). Seeds with 100% purity for each variety were graded into three sizes (small >7mm. medium 7-8mm. and large >8mm.) using sieves of 7 and 8 mm aperture's diameter.

Seed viability was estimated by germinating four replicates of 50 seeds drawn randomly from each variety incubated at 20° C for 8 days (ISTA, 1985) which was 100%. Seeds were dressed before sowing with the fungicide (Dithane S-60) at the rate of 2g/kg seeds by placing seeds for each variety in a small polyethylene bag and mixed thoroughly with the fungicide (Hansing, 1974) to protect seedlings from fungal infection during early seedling establishment. The required seeds for each experimental unit (100 seeds) were kept in a small paper bag. The experiment was applied at Duhok (532.1 mm annual rainfall) and Zakho location (636.3 mm rainfall) in clay soil at both locations.

The fields at both locations were plowed with a disk plow two weeks prior to planting, soil clots were pulverized by rotyvator and the field was leveled manually before implementation of the experiment. Plots were prepared with an area of 3x1 m; the distances between plots were kept 0.5 m; between each main plot, the distance was 1 m., and between replicates, it was 2 m. Each plot consists of 4 lines 25 cm apart. Seeds were sown at a rate of 33 plants per square meter, 12 cm apart seed to seed on 4/1/2006 and 18//1/2006 at Duhok and Zakho locations respectively.

The seeds were sown in two depths (6 and 12 cm) which was controlled also by a special tool to achieve the proper depth; Three factors were involved, sowing depth (6 and 12 cm.) as main plots, three chickpea varieties (Ghab3, Ghab4, and Ghab5) as sub plot, and three size grades of seeds (small, medium, and large) which represented as sub-sub-plots. The numbers of treatment combinations were 18 with three replications; therefore, total experimental units were 54 at each location. Hand weeding (hoeing) implemented as required; neither irrigation, nor fertilization was applied. Ten plants from the middle lines were harvested at full maturity, (when most of plants became yellowish in color) from each experimental unit, and air-dried and preserved in polyester bags for determination of yield component parameters and then the average of these 10 plants was calculated to obtain the yield per plant which included mean number of pods per plant, seed per pod, mean number of seeds per plant, mean of seed yield (g) per plant, and seed yield kg/donum (2500 m^2).

The data were analyzed statistically according to the split-split plot design in RCBD, using the statistical analysis system (SAS. 2001), Least Significant Differences (lsd), was used for means verification and for discussion of the results under probability level of 0.05.

RESULTS AND DISCUSSION

Number of pods per plant

In spite of increasing the number of pods per plant with increasing sowing depth (12 cm) at both locations, (56.08 and 70.86), they were not significantly different (Table 1) and these results agreed with those of Dahiya *et al,*1988; Siddique *et al,* 1998 and Abbas and Murad, 2001. Regarding the response of varieties, Ghab3 gave an excessive number of pods per plant (59.35) at Duhok, and (73.77) at Zakho location as compared to Ghab4 or Ghab5. This was confidently related to the higher number of branches per plant produced by Ghab3 that elevated the number of pods per plant. The effect of seed size on this trait was not significant at both locations. These results were confirmed by Gan *et al,* 2003. Moreover, Ghab3 in 12 cm depth significantly produced more pods per plant (63.34 and 79.64) at Duhok and Zakho locations respectively.

Significant differences were detected for the interactions of sowing depth and seed size only at Duhok location and the highest number of pods per plant was scored for the second sowing depth with small seeds (61.81). However, the lowest value was for the first sowing depth with large seeds (51.48). The interaction of varieties and seed size was significant at both locations. Ghab3 with large seeds in Duhok gave (62.28), but with small seeds in Zakho gave highest number of pods per plant (75.66), which marks an inconsistency in the two locations. The interaction of all factors located in the same table was significant for both locations. The highest value (66.70 pods per plant) was produced from the second sowing depth, Ghab4 and a small seed at Duhok location, whereas it was 81.96 for the second sowing depth, Ghab3 and small seed at Zakho location.

Table(1): Effect of sowing depth, varieties and seed size of chickpea and their interactions on the number of pods per plant at both locations for growing season 2005-2006

		Duhok Location				Zakho Location			
Depth X Varieties	Depth	Varieties			Mean of depth	Varieties			Mean of depth
		Ghab3	Ghab4	Ghab 5		Ghab3	Ghab4	Ghab5	
	6 cm	55.35 ab	51.85 b	51.68 b	52.96 a	67.90 b	63.43 b	67.00 b	66.11 a
	12 cm	63.34 a	55.72 ab	49.20 b	56.08 a	79.64 a	64.42 b	68.53 b	70.86 a
Mean of varieties		59.35 a	53.78 ab	50.44 b	Mean of Seed size	73.77 a	63.92 b	67.76 b	Mean of Seed size
Varieties X Seed size	Small	59.65 ab	62.36 a	53.58 abc	58.53 a	75.66 a	63.65 b	64.56 b	67.96 a
	Medium	56.11 abc	50.91 bc	49.45 bc	52.16 a	73.35 ab	64.81 ab	67.95 ab	68.70 a
	large	62.28 a	48.08 c	48.30 c	52.88 a	72.30 ab	63.31 b	70.78 ab	68.80 a
Depth X Varieties X Seed Size					Depth X Seed size	Depth X Varieties X Seed Size			Depth X Seed size
Depth 6 cm	Small	57.20 abcde	58.03 abcd	50.53 bcde	55.25 ab	69.36 abc	64.33 c	63.73 c	65.81 a
	Medium	48.90 cde	50.53 bcde	57.03 abcde	52.15 b	66.66 abc	64.36 c	63.00 c	64.67 a
	large	59.96 abcd	47.00 de	47.50 de	51.48 b	67.66 abc	61.60 c	74.26 abc	67.84 a
Depth 12 cm	Small	62.10 abcd	66.70 a	56.63 abcde	61.81 a	81.96 a	62.96 c	65.40 bc	70.11 a
	Medium	63.33 abc	51.30 abcde	41.86 e	52.16 b	80.03 ab	65.26 bc	72.90 abc	72.73 a
	large	64.60 ab	49.16 bcde	49.10 bcde	54.28 ab	76.93 abc	65.03 bc	67.30 abc	69.75 a

The letters associated the mean values for each set of means are not significantly different at P = 0.05 according to lsd.
L.S.D. values: Duhok A=6.75 B=6.33 C=6.40 AB=8.96 AC=9.03 BC=11.06 ABC=15.65
Zakho A=10.67 B=3.87 C=6.27 AB=5.49 AC=8.86 BC=10.85 ABC=15.34

Number of seeds per plant

It is obvious from table (2) that sowing depth dose not significantly affects the number of seeds per plant at both locations, this may due to available soil moisture during the growing season. Similar results have been obtained by Dahiya *et al*, 1988 and Siddique *et al*, 1998.

The same table shows that Ghab3 surpassed the Ghab4 and Ghab5 varieties at both locations in producing highest number of seeds per plant. It produced 64.09 seeds per plant at Duhok and 90.13 seeds per plant at Zakho location. This was due to the genetic potential of the variety, higher number of branches per plant and the higher number of pods per plant (Table 1).

There were significant differences between means of seed size on the number of seeds per plant at Duhok location. The highest value obtained from small seed size which was 64.40. This was due to the higher number of pods per plant or higher number of seeds per pod (Tables 1 and 3). While at Zakho location, seed size was not significant. These results are in harmony with those of Agung, and McDonald, 1996.

The effect of sowing depth with varieties interaction on the number of seeds per plant was significant. The second sowing depth of Ghab3 recorded highest value (67.78) and (96.18) at Duhok and Zakho locations respectively, whereas interaction of the second sowing depths with small seeds gave highest number of seeds per plant (67.17) at Duhok. However it was not significantly different at Zakho location. Significant differences were recorded from the interaction between varieties and seed size at both locations. (69.50 seeds/plant) was the highest value obtained for Ghab4 with small seed size at Duhok and (92.93 seeds/pant) for Ghab3 variety with small seed at Zakho location.

In respect with the interaction of the three studied factors, the second sowing depth, Ghab4 and small seed size gave the highest number of seeds per plant (72.96) at Duhok location, while it was (100.36) for the second sowing depth, Ghab3 and small seed size at Zakho location .

Number of seeds per pods

The data in table (3) reveals that the depth of sowing has no significant effect on the number of seeds per pod at both locations, the same results has been obtained by Abbas and Murad, 2001. Varieties showed significant differences only at Duhok location. Ghab3 gave the lowest number of seeds, which was 1.08 as compared with Ghab4 and Ghab5 as both gave 1.10. The effect of seed size did not significantly affect on the number of seeds per pod at Duhok, but it was at Zakho location: Medium seed size recorded highest number of seeds per pod (1.25) among other seed sizes; Similarly, Murray and Auld (1987) and Singh et al. (1989) found the same results.

The interaction of sowing depth and varieties showed significant differences at Duhok location only. The depth of 6cm sowing with Ghab4 gave a higher number of seeds per pod, which was 1.118. No significant effect was observed from the interaction between sowing depth and seed size at Duhok, but it has significantly raised the number of seeds per pod for the 12cm sowing depth with medium seeds (1.26 seeds per pod) at Zakho location.

The interaction between Gahb5 with medium seed size was recorded highest number of seeds per pod (1.13) at Duhok location, while Ghab4 with similar seed size gave highest number of seeds per pod (1.28) at Zakho location.There were no significant differences between the interactions of sowing depth with varieties with seed size for the number of seeds per pod at Duhok location. However these interactions recorded significant differences at Zakho location, 1.29 seeds per pod was the highest value recorded for the 12cm sowing depth with the Ghab4 variety and medium seed size.

Table(2): Effect of sowing depth, varieties and seed size of chickpea and their interactions on the number of seeds per plant at both locations for growing season 2005-2006.

		Duhok Location				**Zakho Location**			
	Depth	Varieties			Mean of depth	Varieties			Mean of depth
		Ghab3	Ghab4	Ghab5		Ghab3	Ghab4	Ghab5	
Depth X Varieties	6 cm	60.40 ab	58.21 ab	57.14 b	58.58 a	84.07 b	78.70 b	82.35 b	81.71 a
	12 cm	67.78 a	60.81 ab	54.52 b	61.04 a	96.18 a	80.38 b	85.45 b	87.34 a
Mean of varieties		64.09 a	59.51 ab	55.83 b	Mean of Seed size	90.13 a	79.54 b	83.90 b	Mean of Seed size
Varieties X Seed size	Small	64.51 abc	69.50 a	59.18 abc	64.40 a	92.93 a	79.36 ab	80.00 ab	84.10 a
	Medium	60.35 abc	56.06 bc	55.70 bc	57.37 b	91.38 a	82.86 ab	85.25 ab	86.50 a
	large	67.41 ab	52.96 c	52.61 c	57.66 ab	86.08 ab	76.40 b	86.46 ab	82.98 a
Depth X Varieties X Seed Size					Depth X Seed size	Depth X Varieties X Seed Size			Depth X Seed size
Depth 6 cm	Small	63.16 abcd	66.03 abc	55.66 bcd	61.62 ab	85.50 abc	79.40 bc	78.90 bc	81.26 a
	Medium	53.46 bcd	56.03 bcd	64.06 abcd	57.85 ab	84.40 abc	81.53 abc	78.30 c	81.41 a
	large	64.56 abc	52.56 cd	51.70 cd	56.27 b	82.33 abc	75.16 c	89.86 abc	82.45 a
Depth 12 cm	Small	65.86 abc	72.96 a	62.70 abcd	67.17 a	100.36 a	79.33 bc	81.10 abc	86.93 a
	Medium	67.23 abc	56.10 bcd	47.33 d	56.88 b	98.36 ab	84.20 abc	92.20 abc	91.58 a
	large	70.26 ab	53.36 cd	53.53 bcd	59.05 ab	89.83 abc	77.63 c	83.06 abc	83.51 a

The letters associated the mean values for each set of means are not significantly different at P = 0.05 according to lsd.
L.S.D. values: Duhok A=5.13 B=7.00 C=6.88 AB=9.92 AC=9.72 BC=11.90 ABC=16.83
Zakho A=12.91 B=5.28 C=8.18 AB=7.49 AC=11.55 BC=14.15 ABC=20.01

Table(3): Effect of sowing depth, varieties and seed size of chickpea and their interactions on the number of seeds per pod at both locations for growing season 2005-2006.

		Duhok Location				Zakho Location			
Depth X Varieties	Depth	Varieties			Mean of depth	Varieties			Mean of depth
		Ghab3	Ghab4	Ghab5		Ghab3	Ghab4	Ghab5	
	6 cm	1.09 bc	1. 118 a	1.10 ab	1.10 a	1.23 a	1.23 a	1.23 a	1.23 a
	12 cm	1.06 c	1.08 bc	1.110 ab	1.08 a	1.20 a	1.24 a	1.24 a	1.23 a
Mean of varieties		1.08 b	1.10 a	1.10 a	Mean of Seed size	1.21 a	1.24 a	1.23 a	Mean of Seed size
Varieties X Seed size	Small	1.08 ab	1.11 ab	1.10 ab	1.10 a	1.22 ab	1.24 ab	1.24 ab	1.23 ab
	Medium	1.07 b	1.09 ab	1.13 a	1.10 a	1.24 ab	1.28 a	1.25 ab	1.25 a
	large	1.08 ab	1.10 ab	1.09 ab	1.09 a	1.19 b	1.20 b	1.21 ab	1.20 b
Depth X Varieties X Seed Size					Depth X Seed size	Depth X Varieties X Seed Size			Depth X Seed size
Depth 6 cm	Small	1.10 a	1.13 a	1.10 a	1.11 a	1.23 ab	1.23 ab	1.24 ab	1.23 ab
	Medium	1.09 a	1.10 a	1.13 a	1.10 a	1.26 ab	1.26 ab	1.24 ab	1.25 ab
	large	1.08 a	1.12 a	1.08 a	1.09 a	1.21 ab	1.21 ab	1.21 ab	1.21 ab
Depth 12 cm	Small	1.06 a	1.09 a	1.10 a	1.08 a	1.21 ab	1.25 ab	1.24 ab	1.23 ab
	Medium	1.05 a	1.08 a	1.13 a	1.09 a	1.23 ab	1.29 a	1.26 ab	1.26 a
	large	1.08 a	1.08 a	1.09 a	1.08 a	1.16 b	1.19 ab	1.22 ab	1.19 b

The letters associated the mean values for each set of means are not significantly different at P = 0.05 according to lsd.
L.S.D. values: Duhok A=0.05 B=0.01 C=0.03 AB=0.02 AC=0.04 BC=0.05 ABC=0.07
Zakho A=0.01 B=0.04 C=0.04 AB=0.06 AC=0.06 BC=0.07 ABC=0.11

Seed yield per plant (g)

It is clear from the table (4) that there was no significant effect of sowing depths on seed yield per plant at both locations. This was due to the adequate soil moisture which is due to plentiful rain (532.1 and 636.3 mm. at Dohuk and Zakho respectively). Similar results have been recorded by Dahiya *et al*,1988 and Siddique *et al*, 1998. The same table indicates that Ghab4 gave highest value (18.90 g.) at Duhok location, whereas, Ghab5 gave (24.03 g.) at Zakho location. These values were accompanied to the number of seeds per plant. The reason behind these differences among the studied varieties may be due to their genetic factors and adaptation to the ecology of location. These results are similar to those recorded by Singh *et al*,1997. No significant differences were recorded between the means of seed size at both locations. These could be due to the fact that seed size has its effect for certain limited period. After germination, the growth and yield of plant are independent to seed size. Similar results have been recorded by Agung and McDonald, 1996; Biderbost *et al*,1980 and Gan *et al*, 2000. The interaction of sowing depth and varieties was significant at both locations. The highest seed yield per plant was for the second sowing depth with Ghab4 (19.40 g) at Duhok, while it was 24.71 g for the same depth with Ghab5 at Zakho location this may associated with the number of seeds per pod (Table 3).

Table (4) also indicates that there were no significant differences of the interaction of sowing depth with seed size at Duhok. At Zakho location, the highest seed yield per plant was recorded for the second sowing depth with medium seed size (24.57 g). On the other hand, significant differences were observed between the interactions of varieties with seed size at both locations. The highest seed yield per plant was recorded from the interaction of Ghab4 with small seeds (20.20 g) at Duhok, and from the interaction between Ghab5 with large seeds (25.85 g) at Zakho location. As regards the interaction between the involved factors, the highest seed yield per plant was obtained from the second sowing depth with Ghab4 with small seeds (20.92 g) at Duhok, and from first sowing depth with Ghab5 with large seeds (26.74 g) at Zakho location.

Table(4): Effect of sowing depth, varieties and seed size of chickpea and their interactions on seed yield per plant (g) at both locations for growing season 2005-2006.

		Duhok Location				Zakho Location			
Depth X Varieties	Depth	Varieties			Mean of depth	Varieties			Mean of depth
		Ghab3	Ghab4	Ghab5		Ghab3	Ghab4	Ghab5	
	6 cm	15.81 b	18.39 ab	17.88 ab	17.36 a	20.72 c	22.68 b	23.35 ab	22.25 a
	12 cm	17.61 ab	19.40 a	17.50 ab	18.17 a	23.27 ab	23.06 ab	24.71 a	23.68 a
Mean of varieties		16.71 b	18.90 a	17.69 ab	Mean of Seed size	21.99 b	22.87 ab	24.03 a	Mean of Seed size
Varieties X Seed size	Small	16.44 b	20.20 a	18.44 ab	18.36 a	21.79 b	21.65 b	22.42 ab	21.95 a
	Medium	15.85 b	18.71 ab	17.58 ab	17.38 a	22.33 b	23.88 ab	23.82 ab	23.34 a
	large	17.84 ab	17.78 ab	17.04 ab	17.55 a	21.86 b	23.09 ab	25.85 a	23.60 a
Depth X Varieties X Seed Size					Depth X Seed size	Depth X Varieties X Seed Size			Depth X Seed size
Depth 6 cm	Small	15.91 abc	19.49 ab	17.25 abc	17.55 a	20.14 b	21.24 b	22.07 ab	21.15 b
	Medium	14.36 c	18.36 abc	19.66 ab	17.46 a	20.99 b	24.13 ab	21.24 b	22.12 ab
	large	17.16 abc	17.33 abc	16.73 abc	17.07 a	21.03 b	22.68 ab	26.74 a	23.48 ab
Depth 12 cm	Small	16.97 abc	20.92 a	19.64 ab	19.18 a	23.44 ab	22.05 ab	22.78 ab	22.76 ab
	Medium	17.35 abc	19.06 abc	15.50 bc	17.30 a	23.67 ab	23.63 ab	26.40 a	24.57 a
	large	18.52 abc	18.23 abc	17.35 abc	18.03 a	22.69 ab	23.51 ab	24.96 ab	23.72 ab

The letters associated the mean values for each set of means are not significantly different at P = 0.05 according to lsd.
L.S.D. values: Duhok A=2.36 B=2.09 C=2.06 AB=2.96 AC=2.91 BC=3.57 ABC=5.04
Zakho A=3.67 B=1.18 C=2.02 AB=1.67 AC=2.85 BC=3.49 ABC=4.94

Seed yield per donum (kg)

Table (5) shows that sowing depth did not significantly affect seed yield per donum at both locations, these are in accordance with Dahiya *et al*, 1988 and Siddique *et al*, 2001. No significant effects were recorded between the varieties at Duhok location; and the yield ranged between 987.00 and 1028.27 kg/don. While at Zakho location, the superiority of Ghab5 and Ghab4 (1258.40 and 1232.41 kg per don.) were evident over Ghab3 which produced 1173.89 kg per don. This may have been due to the interaction of the genetic potential and environmental conditions. These results also exactly agreed with those of Singh and Saxena, 1999 and Singh *et al*, 1997.

The data in Table (5) also shows the superiority of large or medium seed size at both locations over small seed size. A higher seed yield per donum was recorded for the large seed size group (1039.72 and 1242.67 kg) and lowest seed yield was recorded for the small seed size (957.82 and 1184.22 kg) at Duhok and Zakho locations respectively; meanwhile non significant difference was appeared between medium and large seeds. This may attributed to the fact that the large seeds group produces more vigorous seedlings, which positively influences producing more growth and branches per plant, and ultimately more pods and more seed yield. Such results have been confirmed by Eser *et al*, 1991. The interaction between sowing depth and varieties was not significant at Duhok location. Whereas, significant differences were observed at Zakho location for this interaction: The second sowing depth with Ghab5 gave highest seed yield (1306.91 kg/d) and the lowest seed yield was 1157.69 kg for first sowing depth with Ghab3.

Significantly, the highest seed yield was obtained from the interaction of the second sowing depths with large seeds (1059.02 kg/don.) at Duhok location, but from the second sowing depth with both medium (1286.76 kg/don.) and large seeds (1273.24 kg/don.) at Zakho location. The lowest seeds yield per donum were obtained from the interaction between the first sowing depth with small seeds (933.66 kg/don.) and (1176.13 kg/don.) at Duhok and Zakho locations respectively, these results are in agreement with these of Eser *et a*l, 1991and Khan *et al*, 1999. This typifies a good seedling performance that was produced from large seeds with the utilization of the best benefit from the moisture which is available in the deeper soil than the shallower.

The interaction between varieties and seed size as reflected by table (5), shows significant differences between these interactions. The highest seed yield per donum was noticed from the interaction between Ghab5 with large seed size at both locations: 1068.04 kg at Duhok, and 1301.55 kg at Zakho location. While the lowest values were observed for the interaction of Ghab3 and small seed size: 924.82 kg and 1160.85 kg at both Duhok and Zakho locations respectively. These results are in accordance with those of Khan *et al*, 1999. Regarding the second

order interaction, significant differences were released, and the highest seed yield per donum was produced from the interaction between the second sowing depth, Ghab5, and large seed size (1108.67 kg) at Duhok location; however the interaction of the first sowing depth with Ghab3 with small seeds (902.33 kg) recorded lowest yield. Meanwhile, at Zakho location, the interaction between the second sowing depth, Ghab5 and medium seed size (1370.16), and the same depth, Ghab5 and large seed size (1354.07 kg), recorded the highest seed yield per donum. As for the interaction of the first sowing depth, Ghab3 and medium seeds, it gave the lowest seed yield (1128.37 kg).

Table(5): Effect of sowing depth, varieties and seed size and their interactions on chickpea seed yield per donum (kg) at both locations for growing season 2005-2006.

		Duhok Location				**Zakho Location**			
Depth X Varieties	Depth	Varieties			Mean of depth	Varieties			Mean of depth
		Ghab3	Ghab4	Ghab5		Ghab3	Ghab4	Ghab5	
	6 cm	995.50 a	998.32 a	984.79 a	992.87 a	1157.6 c	1209.4 bc	1209.8 bc	1192.36 a
	12 cm	978.50 a	1058.21 a	1023.99 a	1020.23 a	1190.0 bc	1255.3 ab	1306.9 a	1250.77 a
Mean of varieties		987.00 a	1028.27 a	1004.39 a	Mean of Seed size	1173.8 b	1232.4 a	1258.4 a	Mean of Seed size
Varieties X Seed size	Small	924.82 c	997.62 abc	951.02 bc	957.82 b	1160.8 c	1214.8 bc	1176.9 c	1184.22 b
	Medium	1021.78 ab	1050.45 a	994.12 abc	1022.12 a	1191.1 bc	1225.5 bc	1296.7 a	1237.80 a
	large	1014.40 ab	1036.73 a	1068.04 a	1039.72 a	1169.6 c	1256.8 ab	1301.5 a	1242.67 a
Depth X Varieties X Seed Size					Depth X Seed size	Depth X Varieties X Seed Size			Depth X Seed size
Depth 6 cm	Small	902.33 e	961.53 cde	937.10 de	933.66 c	1157.9 cde	1213.0 cde	1157.3 cde	1176.13 b
	Medium	1045.63 abcd	1038.10 abcd	989.87 bcde	1024.53 ab	1128.3 e	1214.9 bcde	1223.2 bcde	1188.84 b
	large	1038.53 abcd	995.33 abcde	1027.4 abcd	1020.42 ab	1186.7 cde	1200.5 cde	1249.0 bcd	1212.09 b
Depth 12 cm	Small	947.30 de	1033.70 abcd	964.93 bcde	981.98 bc	1163.7 cde	1216.7 bcde	1196.5 cde	1192.31 b
	Medium	997.93 abcde	1062.80 abc	998.37 abcde	1019.70 ab	1254.0 bc	1236.1 bcd	1370.1 a	1286.76 a
	large	990.27 bcde	1078.13 ab	1108.6 a	1059.02 a	1152.5 de	1313.1 ab	1354.0 a	1273.24 a

The letters associated the mean values for each set of means are not significantly different at P = 0.05 according to lsd.
L.S.D. values: Duhok A= 174.34 B=57.13 C=46.60 AB=80.94 AC=65.78 BC=80.57 ABC=113.95
Zakho A=172.85 B=55.96 C=40.44 AB=79.28 AC=57.08 BC=69.91 ABC=98.87
When A: Sowing Depth, B: Varieties, C: Seed size

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الخلاصة

اجريت هذه الدراسة في موقعين، حقول كلية الزراعة/جامعة دهوك (583 م ارتفاع عن مستوى سطح البحر وتقع بين خـط طول 43.01° شرقا و خط عرض 36.847° شمالا) وفي مركز البحوث الزراعية /زاخـو (433م ارتفاع عن مستوى سطح البحر وتقع بين خط طول 42.41 ° شرقا و خط عرض 37.8 ° شمالا) الذي يبعد حوالي 70 كم عن مركـز محافظـة دهـوك، للموسم الزراعي 2006، تمت الزراعة في 4 و 18 كانون الثاني للموقعين دهوك وزاخو على التوالي وذلك هدف دراسـة تاثير عمق الزراعة (6 و 12سم) وحجم البذرة (صغيرو متوسط وكبير) على الحاصل ومكوناته لبعض الاصناف الشتوية للحمص (*Cicer arietinum* L.) (غاب 3 و غاب4 و غاب5) تحت الظروف الديمية في محافظة دهوك ، اظهرت النتائج انه لم يكن لعمق الزراعة تاثير معنوي على الصفات المدروسة في موقعي التجربة واعطت البذور المتوسطة او الكبيرة الحجـم افضل حاصل للدونم في الموقعين كما ان الصنف غاب3 كان افضل في كل من عدد القرنات وعدد البـذور للنبـات في حين تفوق الاصناف غاب4 و غاب5 في الصفات الاخرى تحت الدراسة وفي الموقعين و تفوق تداخل البذور الكبيرة مـع عمق الزراعة 12سم و البذور الكبيرة والمتوسطة مع كل من الاصناف غاب4 و غاب5 في حاصل للدونم لموقعي التجربة.

كـورتى

ئەڤـ ڤەكولينە ل دوو جها هاتە ئەنجامدان، زەڤيێت كوليـژا چـاندنێ لـ زانكويـا دهـوك (583م ژێـر ئاستێ دەريـاى و دكەڤيتە دناڤبەرا هێلێن دريژاهى 43.01° روژئاڤا و پانى 37.8 ° باكور) و لـ بنگەهێ ڤەكولينێت چاندنێ لـ زاخو(433م بلندا هى ژ ئاستێ دەريا ى و دكەڤيتە دناڤبەرا هێلێن دريژاهى 42.41° روژئاڤـا و پـانى 37.8 ° بـاكور كـو نێزيكـى 70 كـم ژ سـەنتەرێ باژێرێ دهوكێ دويرە) لـ وەرزێ چاندنێ 2006 ، ژبو تاقيكرنا كويراتيا چاندنێ (6 و 12 سم) و قەبارێ توڤي (بچويك، نافنجى و مەزن) لسەر بەرهەم و پێكهاتييێت بەرهەمێ هندەك جورێت نوكێ (*Cicer arietinum* L.) ييێت زفستانێ (غـاب3، غـاب4 و غاب5) لبن كاودانێت دێمى ييێت پارێزگەها دهوكێ، ئەنجامێت ڤەكولينێ ديار كر كو كويراتيا چـاندنێ چ كارتێكرنێـت پـێش چاڤ لسەر چ سالوخەتێن ڤەكولينێ نەبون و لهەردوو جها، توڤێ نافنجى و مەزن باشترين بەرهەم لـ دونەمێ دا و هـەر وەسـا جورێ غاب3 باشتر بو د هژمارا كێليكا وتوفكا دا لسەر بنەكێ لێ هەردوو جور يێن غاب4 وغـاب5 دهـەمى سـالوخەتێن دى دا پێش چاڤ دسەركەفتى بون لهەردوو جهێن ڤەكولينێ ، توڤێ مەزن لگەل كويراتيا 12سم وهەر وەسا توڤێ مەزن و بچويك لگەل هەردوو جورێن غاب4 و غاب5 بشێوەيەكێ پێش چاڤ باشترين چەنداتيا بەرهەمى ل دونەمێ دا.

Rosa x damascena Mill. (*Rosaceae*), *Cotinus coggygria* Scop.(*Anacardiaceae*), *Arbutus andrachne* L.(*Ericaceae*), and *Salixpurpurea* L. (*Salicaceae*) New Records For The Flora Of Iraq

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ABSTRACT

***Rosa* x *damascena* Mill. (*Rosaceae*), *Cotinus coggygria* Scop. (*Anacardiaceae*), *Arbutus andrachne* L. (*Ericaceae*) and *Salix purpurea* L. (*Salicaceae*) from Kurdistan region of Iraq are new records for the flora of Iraq. *Rosa damascena* occurs in MAM (Amadiya district), western aspect of Qezey mountainside, 30km north Dohuk, east Lomana valliage, at altitude 1229m, in a dense vegetation of oak and juniper trees and shrubs. The plant is flowery, perfume-like, sweet and very pleasant. *Cotinus coggygria* was found to be in MAM, northwest of Baberey village, in a steep rocky slope of a northern aspect of Matina mountainside, in a very dense cover composed of many species of *Anacardiaceae*, *Fagaceae*, and *Rosaceae*, at the altitudinal range 864.1- 999.79m. Few individuals of *Arbutus andrachne* were observed in MAM, Dohuk, in Baikhier mountainside, about 48 – 56 km north-west Dohuk, in two sites, steep slopes of northern aspect, at the altitudinal range 791.6 – 818.65m, in a mixed oak land, mostly coppices. This red-brown bark shrub is expected to play an important role as ornamental in urban parks and gardens. *Salix purpurea* was mostly found at western sector of the mountainous region: MAM, Bakairat, 20km north Dohuk, at altitude 860m; MAM, Sarsing, 45km northeast Dohuk, at altitude 1100m; MAM, Sulav, about 65km north east Dohuk; MRO (Rowanduz district), Hagi Omaran, near Iranian frontier. An emended detailed description and illustrations photographs of plant habit, inflorescence, and fruiting are given for each species, in addition to a brief description of their natural habitats.**

KEYWORDS *Rosa x damascene Arbutus andrachne Cotinus coggygria Salix purpurea.*

INTRODUCTION

Boissier's flora orientalis (1867-88) and knowledge of the flora of Iraq by Bornmuller (1911-41) were the first two works which had added much to the body of knowledge of Iraqi flora. Flora of Iraq by Guest and his collaborators is now considered as the basic reference work to the flora of Kurdistan region of Iraq. All of these significant contributions are not comprehensive and far from being perfect. Still high number of new arborescent or herbaceous species is expected to be explored from time to time, as isolated individual plants or small groups, through extensive field collections and research work.

Flora of Iraq is rich in *Rosa* species, Townsend and Guest (1966) described 9 species and divided some of them, such as *R. canina* L. and *R. heckeliana* Tratt. into infra-specific taxa. Several plants of genus *Rosa* L. grow wild in from Western Europe to East Asia, with a center of diversity in Central Asia. Due to centuries of breeding, the original botanical relations between wild rose species are far from clear. Damask rose, *Rosa* x *damascena* is a fertile hybrid of *Rosa gallica* L. with either *Rosa phoenicia* Boiss. or *Rosa moschata* Herrm (Huxley, 1992). The Damask origins going back to pre-christian times probably originated in Persia or Anatolia several millennia ago brought to Europe by the crusaders and from there later to the rest of the word (Huxley, 1992). The species being of hybrid origin was divided in two nothovarieties (Huxley, 1992): Summer Damasks (*R.* × *damascena* nothovar. *damascena*) have a short flowering season, only in the summer. Autumn Damasks (*R.* × *damascena* nothovar. *semperflorens* (Duhamel) Rowley have a longer flowering season, extending into the autumn; they are otherwise not distinguishable from the summer damasks. The species or its cultivars are chiefly known as a decorative and fragrant ornamental, yet it has culinary importance. Rose water is often used to give a light, floral fragrance to Arabic and Iraqi rice dishes.

Native *Anacardiaceae* in Kurdistan region represents two genera namely *Pistacia* L. and *Rhus* L., there is no any indication to the presence of *Cotinus* Adan. in this region or even on the Turkish frontier. The natural distribution of *Cotinus coggygria Scop*., according to Davis (1967), lies on south and center Europe, South Russia, Crimea, Caucasia, Latakia, north Turkey and extended from Istanbul to north Urfa in south east Turkey.

Arbutus andrachne L. or Greek strawberry is less important to the forester and more important to the gardeners. It is expected that it will do well if planted as an ornamental plant in urban gardens. The shrub real beauty lies in its rich green foliage on a graceful curving and forking limbs. Species of *Arbutus* L. are botanically close to one another, their likeness lies in their leaves, flowers, and fruits, but *A. andrachne* is readily distinguished from the Mediterranean species *A. unedo* L. whose range of distribution overlap with that of *A. andrachn*e, by the serrate leaf margin of *A. unido* and its production of autumn flowers. The two species may hybridize when they come into contact to form the hybrid species *A.* x *andrachnoides* L. which resembles *A. andrachne* in its bright and red bark, but flowers from Sept. – March (Davis, 1978). The native region of *A. andrachne*, according to Davis (1978) and Allen (1992) is in the south east Europe, east Mediterranean, areas to Crimea, east Black sea coast, Cyprus, west Syria, and Lebanon.

Salix L., according to Townsend and Guest (1980) is represented in Iraq by five species, mostly in Kurdistan region of Iraq, but there is no indication to the presence of *Salix purpurea* L. in the region. The species is one of the *salix* members that could be

easily recognized from other closely related species by the pair of coalesced filaments but two anthers in female flowers, dark bracts, reddish or purplish anthers before dehiscence, small, appressed and purplish buds and young stems. This species is used extensively worldwide in soil bioengineering systems and to control erosion along streambanks resulting from flood and ice damage. Its fast growth, resilient stems, and ability to recover from mechanical damage and producing extensive root system make it ideal for such use (Thomas, 1992; Huxley, 1992). The range of the species distribution includes North Africa and most of Europe.

MATERIALS AND METHODS

***Rosa* x *damascena*:**

Kurdistan region of Iraq, MAM, 30km north east Dohuk, Qezey mountain, western aspect, opposite to Lomana and Sarky villages, N 36º 58" 775', E 43º 13" 110', elevation 1229m, on a gentle slope, limestone substrate, on a well-drained and rich in organic matter soil, in an open area of about 100m², mixed with arborescent species, mostly coppices of *Quercus aegilops* L. and *Q. infectoria* Oliv. *Juniperus oxycedrus* L., *Crataegus azarolus* L. and *Prunus microcarpa* Mey, in addition to the under story consisting primarily of *Bromus* and *Hordium* grasses and numerous herbs from *Asteraceae*, *Labiatae* and *Fabaceae*. 14 July, 20 August, 22, October, 2007. 14 April, 16 May, 17 June, 2008 (Figure 1 and 2).

***Cotinus coggygria*:**

Kurdistan region of Iraq, MAM, Dohuk, Matina mountain, 21 km. west Bamarney town, 200-250 m. north east Baberey village, N 37º 11.836' , E 43º 11.423'. Minimum and maximum elevation 864.1, 999.79m above sea level respectively, along the upper side of the road, on a steep slope, northern aspect, on a rocky ridges and slopes, limestone substrate, rich in organic matter, in a mixed arborescent species of *Quercus infectoria* Oliv., *Pistacia khinjuk* Stock. and *Amelanchier integrifolia* Boiss. Et Hoh. ex Boiss. 20, 30, May 2004. 10, 15, 20, 30 April 2005. 15, 25 May 2005. 10, 15 June 2005 (Figures 1 and 2).

***Arbutus andrachne*:**

1. Kurdistan region of Iraq, MAM, about 56 km north west Dohuk, Baikhier mountainside, northern mountain facing, about 8 km east Hassanava, about. 2 km south west Baitas village, on the east side of the Galloky dara sure (ravine of the red tree), a single shrub of about 4 m tall, altitude 818.6m above sea level, N 37˚ 02" 36.5', E 42˚ 43" 25.3', on a rocky gentle slope, limestone substrate, grassland with open scrub of *Quercus infectoria* Oliv, *Pistacia khinjuk* stock., and *Quercus aegilops* L.12 April 2005. 7, 15, 27 May 2005.17 Sept.2005. 29 Oct. 2005 (Figures 1 and 2).

2. Kurdistan region of Iraq, MAM, 48 km north west Dohuk, Baikhier mountainside, northern mountain facing, about 1.8 km west Hassanava, east side of the Galley dara sure (valley of the red tree), 3 coppices shrubs (3 – 4 years old), altitude 743.1 m, N 37˚ 05" 36.4', E 42˚ 38" 40.8', on a dry steep slope with a thicket of *Quercus infectoria and Q. aegilops* coppices. Another leant shrub found at about 50 m southward of the first group, altitude 791.6 m, among dense coppices of *Q. infectoria*, *Q. aegilops*, and *Prunus microcarpa* C.A.Mey.26 Sept 2005 (Figures 1 and 2).

***Salix purpurea*:**

Kurdistan region of Iraq, MAM, Dohuk, Bakairat, 20km north Dohuk, altitude 860m, hedgerows, mixed with *Salix alba*; MAM, Sarsing, 45km north east Dohuk, streambed, altitude 1100m, in a thicket of *Salix alba* L., *Fraxinus syriaca* Boiss., *Rubus sanctus* Schreb.; MAM, Sulaf, about 65km north east Dohuk, mountain slope, altitude 1105m, in association with *Fraxinus syriaca*, *Rubus sanctus*, *Salix alba*; MOR, Hagi Omaran, near Iranian frontier, river bank. 19 March, 15 April, 10 May 1999, 15 April 2000, 25 May 2001, 10 March, 9April, 20 June, 10 July 2007. (Figures 1 and 2). .

Repeated field trips were carried out around the year, but often at flowering and fruiting seasons for each species. Vouchers were deposited in the herbarium of the College of Agriculture, University of Dohuk.

Characters Described

Fifty leaves, 15 inflorescences, and 50 fruits from 10 plants or available ones were scored. Leaf blade length, blade width, petiole length, surface indumentums, inflorescence and its branches lengths, pedicel length, floral parts, and fruit dimensions were measured using a Fernier Caliper and Hamilton Stereoscope 10, 40x.

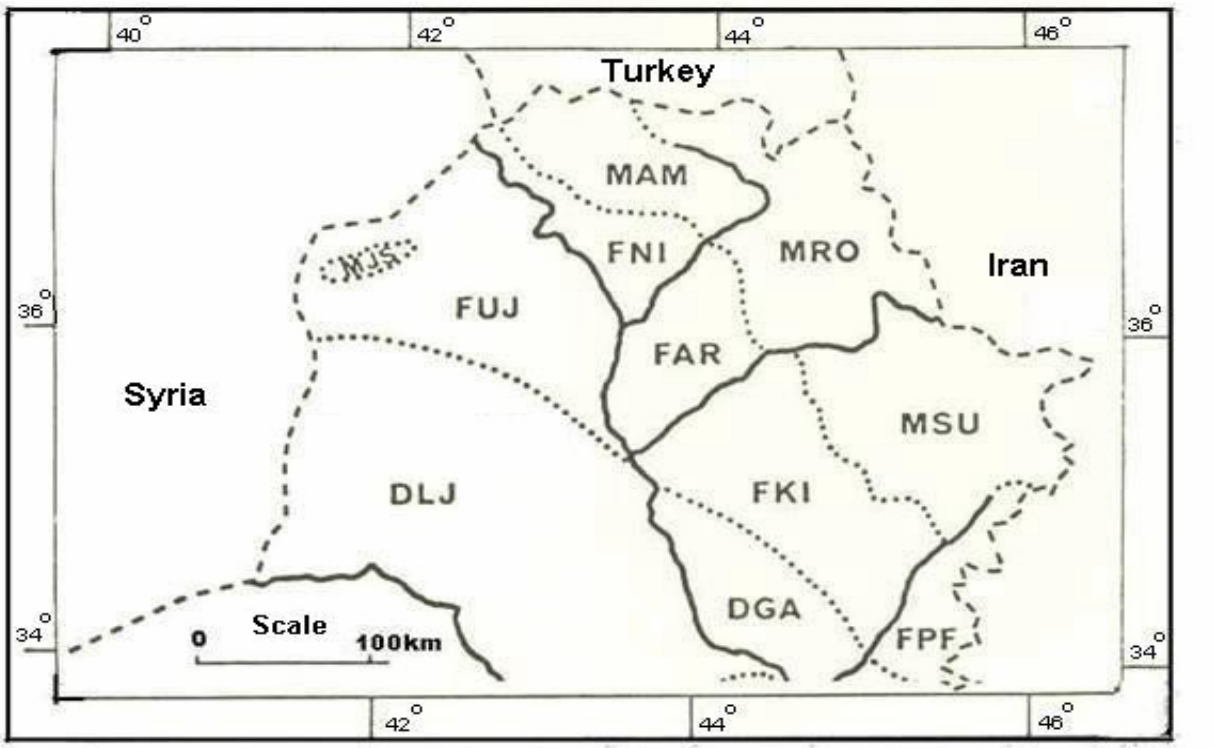

Fig (1): Map of northern iraq. Location of : = *Rosa* x *damascene* = *Cotinus coggygria* = *Arbutus andrachne.* = *Salix purpurea*

Fig (2): Physiographic sketch–map of northern Iraq, redrawn from Townsend and Guest (1985).

——— International frontier, ——— District boundary, ... Regional boundary, MAM= Amadiya District, MRO= Rowanduz District, MSU= Sulaimaniya District, MJS= Jabal Sinjar District, FUJ= Upper Jazira District, FNI= Nineveh District, FAR= Arbil District, FKI= Kirkuk District, FPF= Persian Foothills District.

RESULTS AND DISCUSSION

***Rosa x damascena* Mill.**

Synonyms:*Rosa gallica L.xmoschata J. Herrm.*; *Rosa* x *bifera* (Poir.) Pers. T

Common Names: Damask rose, Damask (En). Kulav (Kurd).

Small deciduous shrub, 15-35 cm tall, erect, not spreading, with a creeping rhizomatous root-stock; stem unbranched, usually solitary, greenish in color, densely armed with stout, reddish, more or less straight prickles with stiff bristles; prickles small, 3-7 mm long, present on the stem, petiole, and few on leaf rachis, caduceus with age, especially from the lower stem part; glandular hairs sometimes stalked on leaf margins, stipules, hypanthia, peduncles, sepals, petioles, and leaf rachises.

Leaf pinnately compound, 3-7.6 cm long; petiole 1.4-2.3 cm long; leaflets 3-5, sessile, each ovate or elliptic, rough and stiff, pale green bellow, bright green above, villous especially on the veins of the lower face, each 1.0-4.0 cm long, 0.7-2.4 cm wide; margins serrate-crenate; apex rounded; base obtuse or rounded; stipule 1.1-1.4 cm long, 0.3-0.5 cm wide.

Flowers solitary, very rarely more than one, terminal, fragrant; peduncle 1.7-2.8cm long; sepals variable in shape, at least 2 pinatifid and 2 entire, acuminate at apex, sparsely villous on the inner surface, variably relaxed in mature fruit; petals pink, obovate, 1.5-2.2 cm long, 1.1-1.8 cm wide; claw very short; stamens numerous, yellow.

Fruits globose, greenish, turning orange when mature with persistent, strongly reflexed sepals (Figure 3).

Flowering: April-June, fruiting July-August.

Reproduction most likely takes place by root suckers; the rhizomatous root-stocks are superficial, sometimes extending superficially in the soil for more than 1m with little or no tapering, sending sprouting upwards.

Habitat

The plant is found to grow well in a medium (loamy) and well-drained soils, rich in organic matter. It prefers full light, but can endure and grow well in a semi-shade (light woodland) imposed by oak and juniper trees or shrubs of the locality. It resists frost, probably down to -7ºc, commonly prevailing in the region during winter season for a period of more than two months.

The species, in its natural existence, is observed to closely associate with a mixture of woodland species of oak and juniper, the area of distribution is surrounded by arborescent elements, such as *crataegus azarolus*, *Sorbus umbelata* (Desf.) Fritsch ex Kerner, *prunus microcarpa*, and *Pyrus syriaca*. *Acer monspesulanum* L. is relatively abundant in elevations lower than that.

This very limited existence of this very ornamental and fragrant species probably represents the only distribution in Kurdistan. Individuals of the small species discovered population appear to be very similar in gross morphology, but show some differences, especially in the number of leaflets per leaf, degree and distribution of prickles, overall size of the plant, and number of flowers per twig when compared to different Damask rose cultivars which now become more available in European countries. Some of these, mainly from the East, are chiefly valued as sources of essential oil, like the *Ispahan* rose or the Bulgarian rose.

***Cotinus coggygria* Scop.**

Fl. Carn. 1: 220 (1772). Syn: *Rhus* cotinus L. Sp. Pl. 267 (1753). Ic: Bonnier, Fl. Comp. Fr., Suisse et Belge 2: t 116 (1913).

Common names: European Smoketree (En). Jarmik (Kurd).

Deciduous much-branched, spreading or prostrate shrub 1.80-3.5m tall. Twigs slender. Bark grayish becoming scaly with age or fissured longitudinally at the lower part of the stem (figure 2-c), gray brown or reddish brown on 1-3 years old twigs, sparsely pilose.

Leaves simple, alternate, ex-stipulate, 2.1-9.4 cm long, 1.2-7.1 cm broad. Leaf blade thin, elliptic, obovate, rarely ovate or orbicular, entire, rounded at the apex, rounded or rarely tapered at the base, pilose on the mid-rib and lateral veins of the lower surface, especially when young, glabrous on the upper surface, lateral veins alternate, very rarely opposite, petiole 0.2-5.8 cm long, sparsely pilose.

Inflorescence in conical panicles of 1-2 branches at the end of the shoots, bracteates throughout, bracts linear or linear-lanceolate 2.25-2.75 mm, male and female panicles usually on separate plants, sometimes on the same plant, few number of hermaphrodite flowers may occur within both male and female panicles, female panicles 4.6-22.7 cm long, male panicle 3.0-5.5 cm long, male, female, and hermaphrodite flowers small, yellowish green, 5-merous, sepals free lanceolate, acute or acuminate at the apex, petals free ovate, ovate-oblong, or elliptic, obtuse at the apex. Sepals of the female flowers 1.0-1.5 mm long, 0.37-0.62 mm broad, petals 1.06-1.48 mm long, 0.5-0.75 mm broad, pedicels 1.25-10.62 cm long. Ovary oblique 1.0-2.0 mm long, 0.62-1.63 mm, broad, styles 3 branches 0.25-0.625 mm long, stigmas 3, capitates (figure 3-b). Sepals of male flowers 0.62-1.37 mm long, 0.25-0.75 mm broad, petals 1.25-1.87 long, 0.75-1.00 mm broad, stamens broad, 5, anti-sepalous, anthers 2-celled, 0.37-0.62 mm long, 0.25-0.5 mm basifixed, dehisce lengthwise, filaments short, 0.5-1.0 mm long, pedicels 2.12-3.37 cm long.

Fruits one-seeded, drupes obliquely obovate, rugose, compressed, clustered with numerous slender feathery pedicels of abortive flowers 4.25-5.02 mm long, 1.95-2.9 mm broad. (Figure 4).

Phenology: Flowering in 10-20 April at the same time as the young leaves emerge, fruiting in May to June.

Habitat

Field observations showed that *Cotinus coggygria* Scop. is dominant over an area of about 2km², more or less mixed, especially at the boundary of the area of its distribution with oak species (*Quercus infectoria* Oliv. and *Q. aegilops* L.), *Amelanchier integrifolia* Boiss. et Hoh. ex Boiss., *Juniperus oxycedrus* L., *Daphne acuminate* Boiss. and Hoh. ex Boiss., *Teucrium chamaedrys* L. , *Paliurus spina-christi* mill .While in the area surrounding *cotinus*

coggygria Scop. the arborescent species of *Q. infectoria* Oliv. and *Q. aegilops* L. are found to dominate, with the former being most abundant. The species that are commonly associated with oak mixture in these sites are *Pistacia khinjuk* Stock. *Amelanchier integrifoia* Boiss.et Hoh. ex Boiss., *Juniperus oxycedrus* L., *Paliurus spina-christi* Mill., *Ficus carica* L., *Rosa canina* L., *Prunus microcarp.* C.A. Mey, *Daphne acuminata* Boiss. and Hoh. ex boiss.., *Celtis tournefortii* lam. *Euphorbia aleppica* L. and *Teucrium chamaedrys* L. In higher elevation *Acer monspessulanum* L., and *Lonicera arborea* Boiss. are more frequent.

Cotinus coggygria Scop. is found to live in an environmental conditions favored by most of the species of *Anacardiaceae* indicating similar areas of distribution. Although the similarity of its flower and fruit, to those of other species of Pistacia, especially *Pistacia khinjuk* Stock. and *Pistacia eurycarpa* Yalt. is apparent, it is easily distinguished from them by their simple leaves and drupes clustered with numerous feathery pedicels of abortive flowers.

It is difficult to determine whether this group of plants represents relicts of wider *cotinus coggygria* Scop. distribution over Kurdistan mountains or whether they are merely isolated population marketing the extreme natural south limit of its distribution.

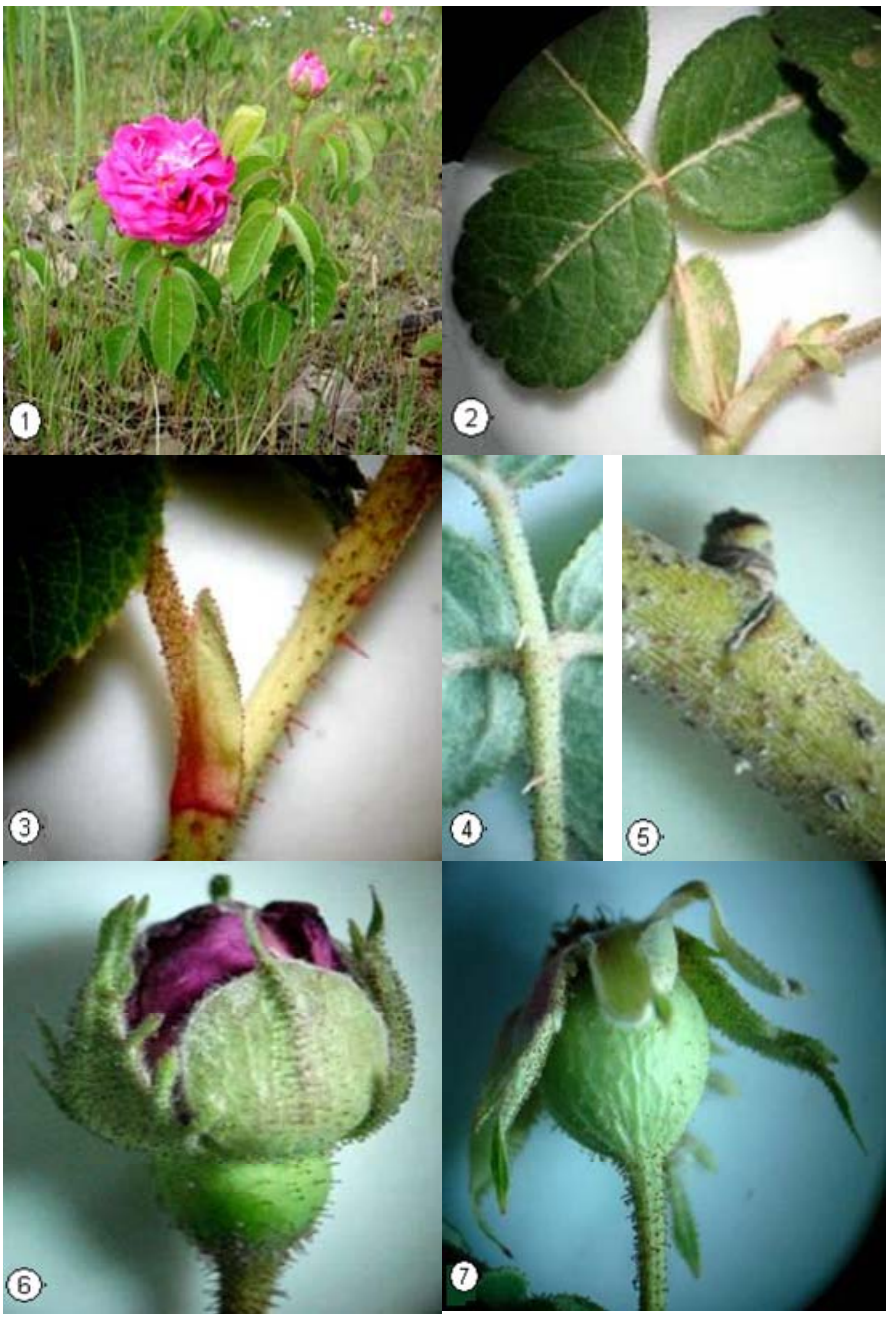

Fig (3): *Rosa* x *damascena*: 1.Habit, 2. Upper leaf surface with adnate stipules (2x), 3. Prickles and bristles on a young branch with glandular hairs on the branch, petiole and stipule margins (3.5x). 4. Lower leaf surface showing prickles and glandular hairs on the leaf rachis (2x), 5. Stem bark, showing places were prickles had fallen of, 6. Flower details before anthesis showing the hypanthium, circular and pinatifid sepals and the pink unopened petals, 7. Hip with the reflexed persistent sepals.

Fig (4): *Continus coggygria*: 1. Habit, Matina Mountain rang, 71km north Dohuk, 2. Flowering twigs, early May, 3. Bark of the lower stem part, 4. Part of a male panicle showing staminate flowers 11x. 5. Part of a female panicle showing pistillate fertile and abortive flowers 11x, 6. Drupes clustered with numerous feathery pedicels of abortive flowers 4x.

***Arbutus andrachne* L.**

Sp. Pl.ed. 2: 566(1762).In: Bot. Meg. 46: t. 2024(1818); Sibth. and Sm., Fl. Graeca 4: t. 374(1824).

Common names: Greek Strawberry tree (En). Dar Sur (Kurd).

Large, magnificent, evergreen shrubs, up to 4 m tall. Bark red – brown, peeling in thin strips; brownish yellow when freshly exposed. Leaves simple, alternate, ex-stipulate, leaf blades elliptic, broadly ovate, or obovate, 2.7 – 9.7 cm long, 1.3 - 4.7 cm broad, shiny dark green above, glaucous beneath, margin entire, slightly dentate above the middle part, especially on the vigorous shoots, obtuse to acute at the apex , rarely emarginate, rounded rarely cuneate at the base, petiole more than 1 cm (1.2 – 2.6 cm) long, blade length\blade width usually less than 2x as long as broad .

Inflorescences more or less erect panicles at the end of the shoots, 6.5 – 10.4 cm long with 2 – 8 branches, bracteates throughout, bracts more or less narrowly triangular, 1.43 – 2.29 mm long, panicles densely villous throughout with white glandular hairs, calyx with five triangular lobes, 1.29 – 2.00 mm long, 0.86 – 1.57 mm broad, corolla greenish white, urceolate with the tube 2.57 – 4.15 mm long, 2.00 – 2.86 mm diameter, glabrous outside, long hairs inside, lobes of corolla reflexed. Ovary papillate, fleshy in fruit, densely villous, 1.72 – 3.15 mm long, 1.14 – 2.43 mm wide, style continuous with ovary, 2.15 – 3.00 mm long, stigma capitate. Stamens 10

inverting during development, anthers with paired spurs at apex of filaments (figure 3 – b), dorsifixed,1.16 – 1.49 mm long, 0.36 – 0.79 mm wide, dehiscing by pair of pores at the apex of the anther, filaments 1.32 – 2.15 mm long. Pedicels 5.29 – 7.15 mm long.

Fruit spherical, papillate, at first greenish- yellow later orange-red, 0.57 – 1.11 cm in diameter, edible but tasteless (Figure 5).

Phenology: Flowering in May, fruiting in July to October.

Habitat

Field observations indicate that *A. andrachne* in Kurdistan region prefers well drained light to moderate soils, rocky slopes of the middle forest zone (Guest,1966), where fuel cutting and grazing have been less than many places owing to distance from permanent water sources and difficulty of access. It also prefers open oak wood land and areas that are very dry in summer. *A. andrachne* shrubs are found to be light demanding trying to appear in sites where more days light hours could be received avoiding low warm and high cold elevations.

Analysis of samples of pollen of the nearby regions did not indicate the presence of *A. andrachne* or any other member of *Ericaceae* in our region (Brelie 1961 ; Zohary 1973).The occurrence of few individuals of this species in a limited area of distribution and in a degraded state might indicate that the plant is a relict and had entered Kurdistan region probably during Pleistocene, but evidences in support of the later idea are needed.

Fig (5): *Arbutus andrachne*: 1. Habit (indicated by Arrow), 56 km NW of Dohuk, Baikhier mountain, Galloky dara sur, 2. Tree in blossom, 3. Red-brown bark of the stem 4. coppices, 3-4 years old, 5. Flowering twigs, 6. Part of a panicle inflorescence. An anther with paired spurs is shown after of removal of the corolla (indicated by arrow) 6x, 7. Fruiting branches.

***Salix purpurea* L. Sp. pl. 2:1017. 1753.**

Common Names: Purple Osier Willow, Purpleosier Willow, Blue Arctic Willow, or Basket Willow (En). Bi, Bihuk, Bihuka Sur (Kurd), the later is a suggestion from the author.

Medium-sized to large-sized shrub, 1.5-5 m tall with similar spread. Branches growing upright in youth, quickly becoming rounded and spreading with age. Twigs slender contributing to the shrub's fine texture. Buds small, appressed, purplish. Bark of young stems purplish-red, light gray on mature stems.

Leaves oblong, oblanceolate or narrowly obovate and variable, densely arranged along the very thin stems, 1.2-6.2 cm, in length and, 0.2-1.2 cm, in width, 5-6 times as long as wide, dark blue-green above, paler silvery-blue below; apex acute to obtuse; base cuneate; margins entire, sometimes finely-toothed at tip only ; petiole sessile or very short, less than 3mm long.

Catkins dioecious, light green to dark or grayish-yellow, upright, relatively stiff, cylindrical 0.8-2.9 cm long, 0.25-0.7 cm wide, 3-4 times as long as wide, arise in almost opposite pairs, generally parallel to the stems, co-emergent with the foliage. Male flowers with a pair of coalesced filaments but two anthers.

Note: Female plants are not found throughout its natural distribution.

Phenology: Flowerig March-April.

Habitat

Apparently rather rare in the north western sector of the mountainous region, altitude 800 up to1200 m, by streambed, wet ground, on damp hillsides, river margin, hedgerow, mountain valley, pool seepage,

Salix purpurea is found to perform best in full sun in moist to wet soils of average fertility. It seems adaptable to poor soils, dry soils, and drought, but not especially tolerant of the combination of heat and high humidity, normally avoiding very hot sites, tolerating partial shade. It often associates with water-demanding plants, rarely in open areas, often in stream or river thickets, mixed with willow species (*Salix alba* and *Salix acmophylla*), *Fraxinus syriaca*, *Rubus sanctus*, *Neruim oleander*, and sometimes with *Crataegus monogyna* and *Cornus sanguinea*.

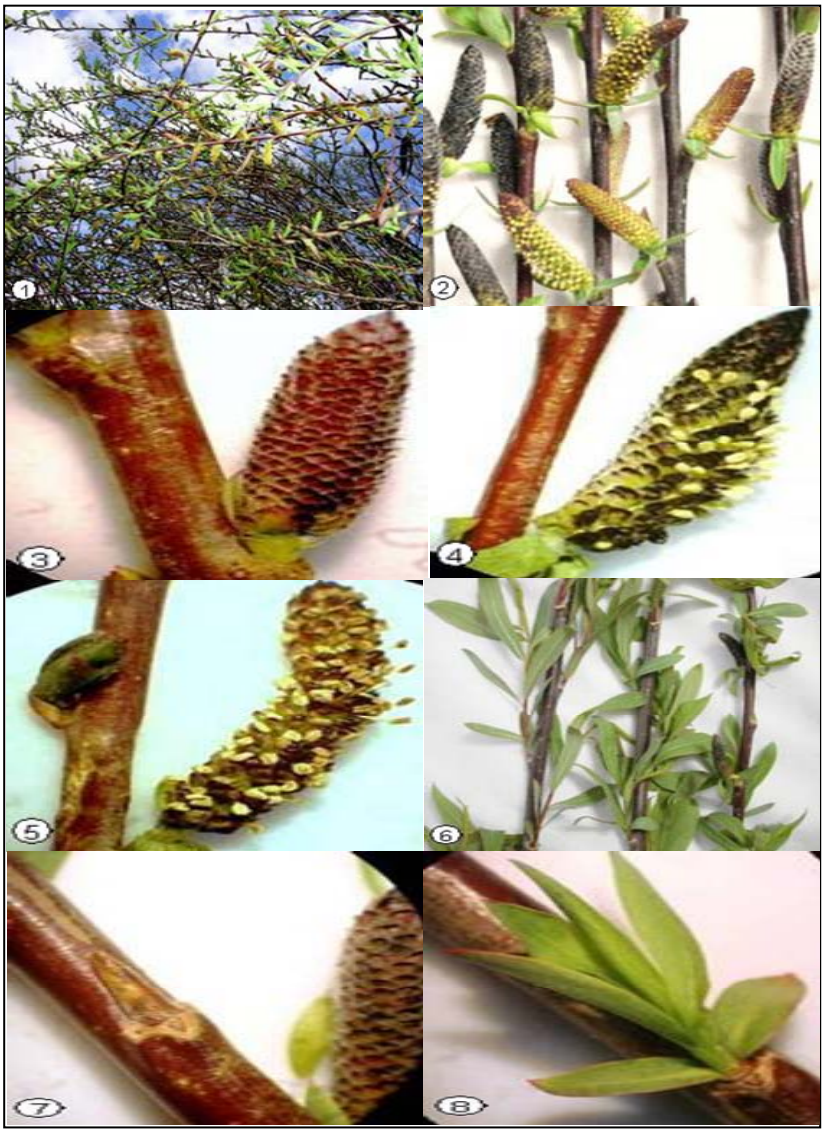

Fig (6): *alix purpurea* 1. Habit in hedgerow, 2. Flowering twigs at variable stages of development, 3-5. Developing stages of male catkins, 6. Foliage branches, 7. Lateral adpressed bud, 8. Dwarf sprouting shoot.

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25- (*Anacardiaceae*) *Cotinus coggygria* Scop. , (Rosaceae) *Rosa* x *damascena* Miller

26- *Salix purpurea*, (*Ericaceae) Arbutus andrachne*, (*Salicaceae*)

***Rosa x damascena* Mill. (*Rosaceae*), *Cotinus coggygria* Scop. (*Anacardiaceae*), *Arbutus andrachne* L. (*Ericaceae*), and *Salix purpurea* L. (*Salicaceae*) تسجيلات جديدة لفلورا العراق**

الخلاصة

Rosa x damascena و *Cotinus coggygria* و *Arbutus andrachne* و *Salix purpurea* من منطقة كوردستان العراق تعد تسجيلات جديدة لفلورا العراق. وجد *Rosa x damascena* في MAM على الواجهة الغربية لسفح جبل كيزبي، 30 كم شمال دهوك، شرق قرية لومانا بارتفاع 1229 م في كثيف من اشجار وشجيرات البلوط والعرعر. النبات كثيف الزهر، معطر. وجد *Cotinus coggygria* في MAM، جنوب شرق قرية بابيري، عند انحدار حبلي شديد، عند الواجهة الشمالية لسفح جبل متينه، عند غطاء كثيف من انواع نابعة لعوائل *Anacardiaceae* و *Fagaceae* و *Rosaceae*، عند ارتفاع 864.1 – 999.79 م. لقد وجدت افراد قليلة من *Arbutus andrachne* في MAM، دهوك، على سفح جبل بيخير، حوالي 48 – 56 كم شمال غرب دهوك، عند موقعين، على انحدار شديد للواجهة الشمالية، وعند ارتفاع 791.6 – 818.65 م، في ارض مغطاة بـانواع البلوط، معظمها اخلاف ومن المتوقع ان يلعب هذا النوع ذو الفلف الاحمر دورا مهما في الحدائق الحضرية. لقد وجد النوع *Salix purpurea* على الاغلب في القطاع الغربي من المنطقة الجبلية،في MAM، في باكيرات،15 كم شمال دهوك عند ارتفاع 860 م كذلك في MAM، في سرسنك حوالي 40 كم شمال شرق دهوك عند ارتفاع 1100م، ووجد ايضا في MAM، في سولاف حوالي 60 كم شمال شرق دهوك، ووجد كذلك فيMRO، عند حاجي عمران، قرب الحدود الايرانية.

لقد زود كل نوع بوصف مفصل وصور توضيحية لهيئة النباتات ونورا ـا وازهارهـا وثمارهـا اضافة الى وصف مختصر لبيئا ا الطبيعية.

Rosa x damascena Mill. (_Rosaceae_), _Cotinus coggygria_ Scop. (_Anacardiaceae_), _Arbutus andrachne_ L. (_Ericaceae_), and _Salix purpurea_ L. (_Salicaceae_) تومارکرینێن نوینه بو فلورا ئیراقێ

بوختە

ژدەڤەرا کوردستان تومارکرنێن نوینه بو فلورا ئیراقێ. _Salix purpurea_و _Arbutus andrachne_ و _Cotinus coggygria_ و _Rosa x damascene_

Rosa x damascena ئاکینجی یه ل MAM, لروژ ئاڤایێ چیایێ کویزیێ, 30 کم باکورێ دهوکێ لروژ ئافایێ لومانا لبلنداهیا 1229 م لسەر ئاستێ دەریایی لناڤ دارو دارکوکێن بەری و بەری مازیا و هیڤرستا, ئەڤ رووەکه کولدارو بێندارە.

_Cotinus coggygria_دکەفتە MAM, روژ هەلاتێ گوندێ بابیرێ لنزارێ چیایێ مەتینە لسەر جهەکێ زور رك لداروباراەکێ زور مشه ژ خوێزانێن جوراوجور وەك _Anacardiaceae_ و _Fagaceae_و _Rosaceae_لناڤ بەرا بلنداهییێن 864.1 – 999.79 م.

کێم ژ _Arbutus andrachne_ هاتنه دیتن ل MAM, لپاریزگەها دهوکێ لچیایێ بێخێر نێزیك 48 – 56 کم باکورێ روژ ئاڤایێ دهوکێ ل دوو جها دکەڤنە نزارێ چیایێ بێخێر لجهەکێ زور رك لناڤبەرا بلنداهییێن 791.6 – 818.65 م لناڤ دارێن بەری.

Salix purpurea تێتە دیتن بارا پتر لروژ ئاڤایێ دەڤەرا چیایی ل MAM, لباگێرا 15 کم باکورێ دهوکێ لئاستێ 860 م بلنداهی هەروەسا ل MAM لسەرسنکێ 40 کم باکورێ روژهەلاتێ دهوکێ لبلنداهیا 1100م هەروەسا ل MAM لسولاڤێ نێزیك 60 کم باکورێ روژهەلاتێ دهوکێ دیسان ل MRO نێزیك حاجی عومەران دکەفتە نێزیك سنورێ ئیرانێ.

هەر ئێك ژ ڤان جورا هاتە شروڤەکرن بتێرو تەسەلی ژلای بەژنێڤە و گول و فێقییێن وان زێدەباری دیارکرنا ژینگەهیێ هەرئێك ژوان.

EVALUATION OF SOME CANOLA (*BRASSICA NAPUS L.)* VARIETIES GROWN UNDER RAIN-FED CONDITIONS IN SULAIMANI –IRAQI KURDISTAN REGION

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ABSTRACT

A field experiment was conducted at two locations: the Kanypanka research station and the Bakrajo field belong to the Agriculture College- Sulaimani University. Six Canola(*Brassica napus L.)* varieties, (Oscar, Brad-1, Dunkeld, Sultan, 19H-Mixture and Shiralee) which are considered as containing a low erucic acid and glucosinolated content, referred to a "double low" or "O, O", were arranged with RCBD(Randomized complete block design) , with three replications. The aim of the study was to evaluate the varieties performance regarding some growth characteristics, yield and oil content.

The results indicated that the varieties Brad-1 and Sultan significantly surpassed the other varieties in plant height, while Shiralee gave more days to %50 of flowering with significant differences, and there was no significant difference among varieties for days to maturity. Significant different were observed among varieties in terms of yield. Dunkeld gave the highest yield (1790.7 kg/ha), but Oscar gave the lowest yield (1415.3 kg/ha). There were no significant differences between the varieties for oil content.

Kanypanka location was significantly different from Bakrajo for days to 50% flowering and days to maturity. There were no significant differences among the locations for plant height and oil content. Regarding the yield, the Kanypanka location was significantly different from Bakrajo location.

INTRODUCTION

Canola is a type of rapeseed (*Brassica napus L.)* and a close relative of mustards and it belongs to the mustard family (1). Many of the old rapeseeds varieties produce oil that contains large amounts of erucic acid. This acid has been related to heart disease and glucosinolates have breakdown products that are toxic to animals. Both characteristics make rapeseed products poor candidates for human and animals consumption (2, 3). Canadian plant breeders looked over both of these problems, and in 1970, they developed a new edible type of rapeseed which contains up to 40 percent oil (4, 5, 7). The name "Canola" is a registered name by Western Canadian oil seed crushers Association (4, 5). Canola varieties must have an erucic acid content of less than 2 percent and also have less than 30 micromoles of glucosinolates per gram of seed. Canola is used for edible oil extraction and feed meal. The oil is considered one of the high quality edible oils available. Consequently, canola is also referred to as "double low" or "0, 0" rapeseed (5, 6). Winter canola has been proposed as a crop to fit in rotation with winter cereals or to fallow in rotation (5, 7).

Canola reduces weather risks by allowing production of an oil seed crop during the winter when drought is not as likely as during the summer (5). Furthermore, in a study of canola varieties at University of Minnesota including 19 varieties at three locations, the results indicated that the average plant height was 172.5cm, and that a period of 128 days was needed to 50% of flowering and 190 days to maturity from planting time (6). However, (7) reported that location has a significant effect on varieties under rain-fed conditions. Productivity studies of canola varieties reveal yields of 1000 kg /ha to 2400 kg/ha and an oil% content from 34 to 40 % (7, 8, 9). In a study at the College of Agriculture, University of Baghdad, which was carried out to evaluate performances of eight canola varieties, significant differences were found between the varieties in terms of yield which range from 803 to 1207 kg/ha (10). In the Sulaimani region, some canola varieties were introduced as a new crop through the industrial crops improvement program of FAO. This experiment was conducted to evaluate six canola varieties in terms of yield, oil content and some other characteristics.

MATERIAL AND METHODS

The experiment was accomplished as randomized complete block design with three replications at two locations, Bakrajo and Kanypanka, during fall growing season 2004.The soil properties and meteorological information were in tables (1) and (2). The prepared plots were fertilized with nitrogen 120 kg /ha, 35 kg/ha p_2o_5 and 35 kg/ha k_2o (3). The varieties were seeded in three rows, 18cm apart and 4m in length, on the bases of 8 kg/ha on 9/11/2004 at both locations. Growth characteristics studied were plant height, days to flowering 50% and maturity as well as yield/ha and oil content. The later were determined using ether extract (11). Means were obtained using the Duncan's test. (12). The varieties included were: Oscars, Brad-1, Dunkeld, Sultan, 19H-Mixture and Shiralee.

Table (1): Some Physical and Chemical Properties of Soil *

Locations	Potassium(K^+)	$CaCo_3$ (g/kg)	Available Phosphate (mg/g)	Total Nitrogen(mg/g)	Organic matter%	pH	Soil Texture	Electrical Conductivity (ds/m)
Kany panka	0.16	11.94	5.45	1.03	2.78	7.64	Clay	0.54
Bakrajo	0.17	11.54	3.58	0.66	1.92	7.71	Silty clay	0.46

***** Mphammad, K.A. (2006).

Table (2): Meteorological data for the Sulaimani region/ 2004

Months	Kanypanka			BakrajBakrajo		
	Air temperature (C^0)		Precipitation (mm)	Air temperature (C^0)		Precipitation (mm)
	Max	Min.		Max	Min	
January	21.5	10.0	48.0	21.5	4.0	272.0
February	12.6	4.4	195.6	11.2	2.9	103.0
March	21.5	9.9	48.0	19.8	9.4	13.3
April	22.7	12.1	75.7	21.1	11.3	74.0
May	28.3	17.0	73.3	26.0	15.8	95.6
June	38.4	25.5	0.0	34.9	22.7	0.0
July	42.1	27.3	0.0	38.8	26.2	0.0
August	41.3	26.8	0.0	38.1	25.0	0.0
September	38.3	23.2	0.0	35.1	22.9	0.0
October	31.7	18.3	2.8	29.0	17.1	13.4
November	16.5	9.7	196.4	15.7	8.6	116.4
December	10.2	2.6	40.7	10.9	2.9	64.7

*****Sulaimani meteorological office (2004)

RESULTS AND DISCUSSION

Table (3): Effect of varieties (means over locations) on some growth characteristics.

Varieties	***Plant heig*ht *(cm)***	***Days to Flower (50%)***	***Days t0 maturity***
O scar	150.67 bc	118.33 b	178.19 a
Brad-1	178.00 a	106.90 d	179.12 a
Dunkeld	153.67 bc	110.15 c	181.00 a
Sultan	176.50 a	106.83 d	181.17 a
19H-Mixture	149.17 c	117.17 b	179.20 a
Shiralee	155.18 b	121.13 a	180.83 a
average	160.53	113.42	179.91

* The means shared with the same letters are not significantly different at $p< 0.05$

Table (4): The effect of varieties (mean over locations) on yield and oil percentage:

Varieties	***Yield(kg/ha)***	***Oil (%)***
O scar	1415.323 d	39.00 a
Brad-1	1502.670 cd	38.17 a
Dunkeld	1790.670 a	39.00 a
Sultan	1570.000 bc	38.20 a
19H-Mixture	1424.000 d	38.68 a
Shiralee	1630.670 b	38.65 0a

***** The means shared with the same letters are not significantly different at $p<0.05$

Table (5): Effect of locations (mean over varieties) on some growth characteristic

Location	**Plant height/ (cm.)**	**Days to flower (50 %)**	**Days to maturity**
Kanypanka	163.55 a	125.39 a	191.61 a
Bakrajo	157.56 a	101.44 b	168.39 b

***** The means shared with the same letters are not significantly different at $p < 0.05$

Table (6): Effect of location (mean over varieties) on yield kg/ha and oil%

Location	Oil (%)	Yield (kg/ha)
Kanypanka	39.00 a	1684.66 a
Bakrajo	38.56 a	1462.49 b

*****The means with the same letter are not significantly different significant at $p<0.05$

The data in table (3) reveal the combined analysis for the two locations of the effect on varieties regarding some growth characteristics. Varieties Brad-1 and Sultan were significantly better than the other varieties for the plant height and the average of the varieties was 160.53 cm. While varieties Sultan and Brad-1needed fewer days to flower than other varieties, the average of varieties was 113.42 days, no significant differences between the varieties for maturity were recorded and the average of varieties was 179.91 days. These values support what was mentioned in (4, 10).

The data in table (4) shows combined analysis of the two locations of the effect of varieties on yield kg/ha. and oil content characteristics. The Dunkeld variety over-yielded the other varieties significantly. For oil content there was no significant difference between varieties, but Oscar has the highest value of 39.00%. Both yield and oil content were in the ranges which are mentioned in (7, 8, 9, 10).

Information in table (5) shows the effect of locations (for mean of varieties) on some growth characteristics. There were no significant differences between locations for the height of the plants, but there were significant differences for both days to flowering and maturity. The varieties at Bakrajo location were needed a shorter period than those in Kanypanka for both cases (5, 7).

The oil content and yield kg/ha for both locations (for mean of varieties) are shown in table (6). In terms of yield, the location of Kanypanka was more significant and that could be due to some difference between the two locations in the amount of precipitation. For the oil content, there was no significant difference between the two locations (4, 5, 7). It can be concluded from this study that canola can be grown successfully in the Sulaimani region in the future. It can be concluded that canola can be consider as one of the promising crop in future.

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13- Effect of plant population on productivity of some peanut (*Arachis hypogaea L.)* Cultivars under Sulaimani region condition M.Sc. Thesis. Dep. Field Crop College of Agri. Univ. of Sylaimani.

تقييم بعض اصناف كانولا المزروعة فى ظروف المطرية في منطقة السليمانية

خلاصة

طبقت دراسة في موقعين محطة ابحاث كاني نانكة و حقل كلية الزراعة جامعة السليمانية في بكرةجو لعام 2004 لغرض تقـيم ستة اصناف من كانولا (Canola) وهي (Oscar,Brad-1,Dunkeld,Sultan,19H-Mixture and Shiralee) والتي تعتبر ذات احتواء واطىء من حامض ايروسك (Erucic) و مادة كلوكوسينولبت (Glucosinolated) الضارتين و كان الهدف من الدراسـة هو تقيم الاصناف من حيث الحاصل والاحتواء الزيتي و بعض الصفات الاخرى.

استخدم ترتيب القطاعات الكاملة العشوائية RCBD حيث اظهرت النتائج ان صنفى Bread-1 وSultang تفوقا على اصناف الاخرى من حيث طول النبات و في حين ظهرت فروقات معنوية بين الاصناف في الازهار و ان صنف Shiralee سجل اطول مدة لوصول الى 50% من الازهار و لم يظهر اية فروقات معنوية بين الاصناف من حيث المدة اللازمة للنضج.

كانت هناك فروقات معنوية بين الاصناف من حيث الحاصل حيث ان صنف Dunkled اعطـى اعلـى حاصـل 1970.610 كغم/هكتار و ان صنف Oscar اعطى اقل حاصل1415.323كغم /هكتار ولم تظهر اية فروقات معنوية بين الاصناف مـن حيـث المحتوى الزيتي ان موقع كانى بانكة يختلف معنويا عن موقع بكرةجو من حيث عدد الايام اللازم للازهار والنضج و كمية حاصـل البذور، لم تظهر فروقات معنوية بالنسبة لطول النباتات و المحتوى الزيتي بين الموقعين.

هەڵسەنگاندنی چەند جۆرێك لە كانولا لە بارودۆخی دیمیدا لەناوچەی سلێمانی

پوختە

ئەم توێژینەوەیە ئەنجام درا لە دوو شوێنی ویستگەی توێژینەوەی كانی پانكە و كێڵگەكانی كۆلێجی كشتوكاڵ سەر بە زانكۆی سلێمانی لە بەكرەجۆ لە ساڵی 2004 بە مەبەستی هەڵسەنگاندنی شەش توخم لە كانولا ئەوانیش بریتین لە (Oscar,Brad-1,Dunkeld,Sultan,19H-Mixture and Shiralee) كەوا بڕێكی كەم لە ترشی ایروسك و مادەی كلوكوسینولین ی تێدایە كە ئەمانیش زیان بەخشن وە مەبەستی ئەم لێكۆلینەوە بریتی یە لە هەڵسەنگاندنی ئەم توخمانە لە رووی بەرهەم و پێكهاتەی زەیتی و هەندێن سیفاتی تر .

وەدیزاینی RCBD بەكارهات وە ئەنجامەكان دەریان خست كە توخمیSultan وە Brad-1زاڵ بوو بەسەر توخمەكانی تردا لە رووی درێژی رووەك وە لە كاتێكدا گۆرانكاری بەرچاو دەركەوت لە نێوان توخمەكاندا لە گوڵكردندا وە توخمی Shiralee درێژترین ماوەی تۆمارکرد بۆ گەیشتن بە 50 ٪ ی گوڵكردن وە هیچ جۆرە جیاوازیەكی بەرچاو بەدی نەكرا لە نێوان توخمەكاندا وە لە روی كاتی پێویست بۆ گەیشتن وە جیاوازی بەرچاو بەدیكرا لە نێوان توخمەكاندا لە رووی بەرهەمەوە. توخمی Dunkled زۆرترین بەرهەمی دا 1970.610 كغم/هكتار وە توخمی Oscar كەمترین بەرهەمی بووە323 .1415 كغم/ هكتار وە هیچ جیاوازیەكی بەرچاو بەدی نەكرا لە نێوان توخمەكاندا لە رووی پێكهاتەی زەیتی یەوە وە شوێنی كانی پانكە بە شێوەیەكی بەرچاو جیاوازبوو لە شوێنی بەكرەجۆ لە رووی ژمارەی رۆژە پێویستەكان بۆ گوڵكردن و پێگەیشتن وە بڕی بەرهەمی تۆو. وە هیچ جۆرە جیاوازیەكی بەرچاو بەدی نەكرا لە رووی درێژی رووەكەكان و پێكهاتەی زەیتی لە نێوان شوێنەكاندا .

EFFECT OF STAND DENSITY ON RING WIDTH, SPECIFIC GRAVITY AND FIBER DIMENSIONS OF *Populus nigra* L. GROWN IN ZAKHO/IRAQ DISRRICT

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ABSTRACT

The area of the farmer's Black poplar plantations of about 20 hectare, established from cutting, on eastern Hezil Riverside/ Zakho/Iraq, at an initial uniform spacing of 0.5 x 0,5m between trees and rows,the plantation was subjected to selective thinning during ages 4, 5, and 6 years. After the last thinning operation achieved, the plantations recognized into 60 plots of densities ranging from 6800-25200 trees/hectare. Wood quality characters of growth rate (represented by ring width), specific gravity, and fiber anatomy were measured too estimate the effect of thinning commonly done by the farmers on these characters.

Plot density affected wood specific gravity none significantly. Both fiber length and fiber double wall thickness regressed significantly on plot density, while no significant association was apparent between fiber diameter and plot density. The correlation coefficients 0.199 and 0.111 for fiber length and fiber double wall thickness respectively indicated a relatively weak relationship between the variables. Plot density exerted consistent effect on ring with, which was observed to decrease constantly within the tree stem, both horizontally from pith to bark at different stem heights and vertically from ground level to the stem tip. Specific gravity correlated significantly to both plot height, and plot dbh. Fiber length also correlated significantly with plot dbh, but negatively with ring width.

KEYWORDS Thinning stand density fiber dimensions growth increment and specific gravity.

INTRODUCTION

Black poplar is an established high value timber tree for commercial planting; its wood is used for construction lumber, major carpentry work, agricultural tools, and match sticks, but the quality and yield of the timber often fail to meet expectations. Increasing yield of high uniformity and searching for superior quality trees are considered as key incentives for developing intensively managed poplar plantation.

The important property requirements of end-users in fast-growing Black poplar are straight boles with cylindrical form with few knots, low proportions of juvenile and tension wood, high proportions of heartwood, optimum of wood specific gravity (0.45). In local markets pools and logs are often graded on the bases of defect system, which depend on visual assessment. The defects of bend taper, splits, sound and unsound knots, twist, surface and heart cracks, lumber surface wool are always taken inconsideration when grading the poplar wood.

Early thinning at close spacing, in the view point of most researchers (Robert, 1978) needed to promote continued, vigorous diameter growth, Individual tree productivity is often assumed to relate inversely to stand density at higher stocking levels (Evert., 1971 and Smith et al., 1997). Fiber length of *Populus trichocarpa* Torr. et Gray x *P. deltoides* Bartr. ex Marsh. hybrid (Jeffrey, et al. 1998) was found to increase with overall growth rate as measured by stem diameter, moreover Kang, et al. (2004) reported that wood yield and tracheid properties of Jack pine plantations can be improved through stand density regulation. On the other hand stand density can be controlled by thinning of already established stands, and according to Zobel and Van Buijtenen (1989) this method of stocking control may result in the production of wood with different qualities.

It is well known that wide spacing produces large diameter trees; however information on the effects of thinning or plantation density on growth of Black poplar represented by annual growth increment, specific gravity, and fiber anatomy have not as yet been tested in our region. The aim of this study is not to find out the best thinning method for this important commercial tree but to evaluate the effect of thinning operation commonly followed by the farms of Zakho district on some wood quality characters.

MATERIALS AND METHODS

Farmer's Black poplar plantations of about 20 hectare area were established from cutting, during 1988-1999 on the eastern side of Hezil River, west Zakho city/Iraq, at an initial uniform spacing of 0.5 x 0.5m between trees, as well as between rows, this density is much higher than normal in order to conduct later thinning, and leaving some trees for final harvest size. The site is very productive, continuously used for poplar cultivation; soils are deep, well drained loams. Different parts of relatively homogeneous poplar plantations were subjected to thinning at ages 4, 5, and 6 year, with 3 plots never thinned, but the dominant and co dominant trees usually thinned in order to meeting local market demands. At the end of the growing season of the year 2004, the total plantation area was divided into 60 plots of an area (10 by 10m), each to represent different densities ranging from 6800-28200 trees/hectare (hectare = 10000m²).

A single dominant or co dominant tree free from wood defects was selected from each plot (Abdul-Qader, 2006), felled and cut into 1m boles starting from 0.3m above ground level up to 4cm diameter of the leading stem. Disks (stem sections) of 3-5cm thick were sampled from the lower end of each bole; trees and disks were labeled and conditioned in the laboratory to constant ambient moisture content. Each disk was subjected to the following measurements:

1. Annual ring width to the nearest 0.01mm using stereoscopic microscope of 10 and 40 magnifications.

2. Specific gravity: the specific gravity for each disk was determined using the displacement method (Mitchell, 1958); disk volume at moisture content in the laboratory and weight in the oven.

3. Growth rings 4 and 5, starting from the pith, removed from disks at dbh (diameter at breast height) for each tree, were macerated using Franklin solution (Franklin, 1946). A sample of fibers was removed and spread over glass slide. Forty measurements of fiber length, fiber diameter at mid-point, and fiber double wall thickness were recorded for each tree.

Simple descriptive statistics and regression equations were used to show relationships between wood variables and plot density, Duncan's multiple range tests was also used to compare means of different variables. All analyses were achieved using stat graph package, version 4.

Mean dbh and height for each plot were obtained from a previously conducted master project (Abdul-Qader, 2006).

RESULTS AND DISCUSSION

Ring width

The overall mean value of ring width was 3.363mm, with minimum and maximum values of 0.64; 10.41mm respectively (table 1).

Table (1): Mean and Ranges of Specific Gravity, Width of Annual Ring, Fiber Dimensions, Plot Height, and Diameter at DBH.

Tree And Plot Characters		Mean	Maximum	Minimum	Standard Deviation
Width of annual ring (mm)		3.363	10.41	0.64	1.501
Specific Gravity		0.458	0.585	0.363	0.032
Fiber Dime-nsions	Fiber Length (mm)	0.945	1.24	0.73	0.088
	Fiber Diameter (µm)	21.525	30.96	14.5	2.870
	Double Wall Thickness (µm)	12.494	20.5	4.14	2.927
Plot Height (m)		12.865	14.7	10.2	1.102
Plot Diameter at DBH (cm)		9.570	12.9	6.5	1.350

The linear model used to describe the relationship between ring width and stand density is found to be: ring width = 28.050 - 0.0000445*plot density.

The fitting model indicates a statistically significant relationship between ring growth and plot density at 0.01 level of probability. The R-Squared statistic indicates that the model explains 34.742% of the variability in ring width. The correlation coefficient equals -0.589, indicating a moderately strong relationship between the variables. In plotting stand densities against mean ring widths a significant reduction in ring width was observed with increasing plot density, however, there was significant deviation from linearity for the lower disks (figure 1); this prominent reduction in ring width can be attributed to a strong competition among trees leading to growth suppression in mature wood (Zhu, et al. 2006). On the other hand, the mean ring width (3.363) was found to be lower about 20%o in unthinned plots compared to highly thinned ones, indicating the need for more thinning, in dense plots, to improve the growth rates and optimize wood yield. These results prove that the average ring width was a reliable parameter to represent tree growth conditions (plantation density). In general, our findings were in harmony with those of Itoh, et al. (1980); Wang and Chen (1992) and Fujisawa, et al. (1995) who observed a decrease in annual ring width with an increase in plantation density, but differ from those of Ishiguri, et al. (2005) who reported no change in ring width caused by differential stand density formed from various initial spacings.

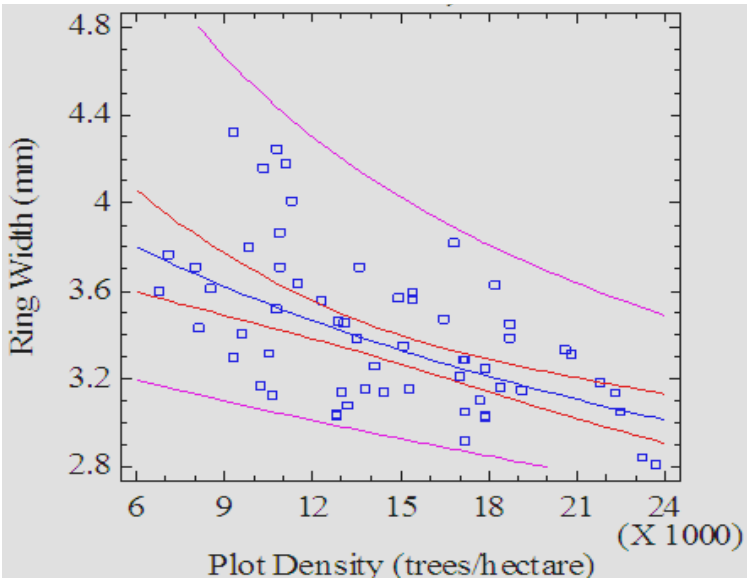


Fig (1): Mean ring width as a function of plot density.

(Figure 2) shows the mean radial growth increment for each one of the 9 vertical disks. The pattern with age, however, was rather similar among different height levels. Most rings in the same position from the pith at different heights were produced in different years and under different weather conditions. Ring width decreased consistently from pith to bark with similar trend of decline for each disk. The ring width of age 1 decreased from 8.275mm in disk 1 to 3.52mm in disk 9.

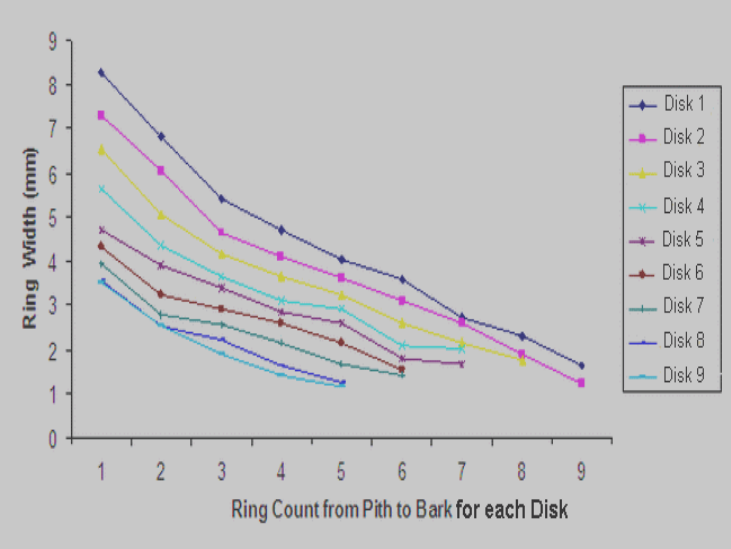
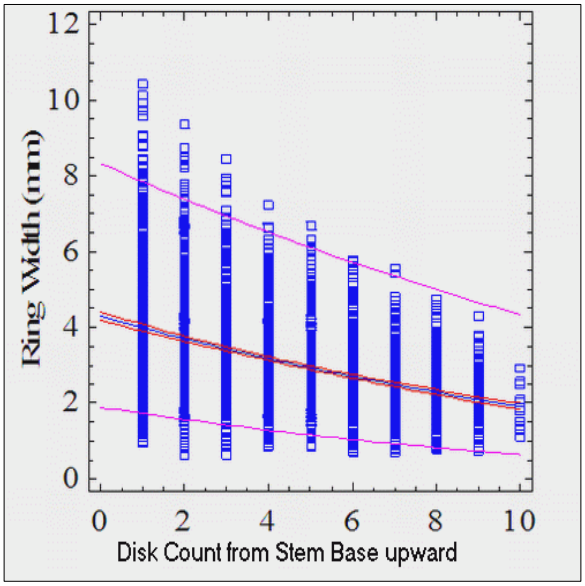


Fig (2): Ring width variation from pith to bark for each cross disk.

Mean ring width over the disk cross section at different height level seemed to decrease sharply from ground level to the stem tip (figure 3-A) in a manner similar to its decline from pith to bark (figure 3-B). Mean ring width decreased from 4.307mm in the lower most disks to 1.822 mm in the upper most one. Comparison of means using Duncan's test proved significant differences among disks 1-7, while disks 8, 9, and 10 differed non-significantly.
(Figure 3-B) showed radial growth increment for the mean of the 9 vertical disks. The variability of mean ring width was typical of that expected in Black poplar plantations. Ring width (starting from the pith) decreased from 5.00mm to 1.33mm during a decade of growth, with the first ring (age 1) at peak, growth then began gradual decline, eventually decreasing to a mean value of 1.33mm. Testing means using Duncan's test (table 2) showed significant differences among ring widths 1-7, while the last three ones did not or weakly differed significantly among one another.



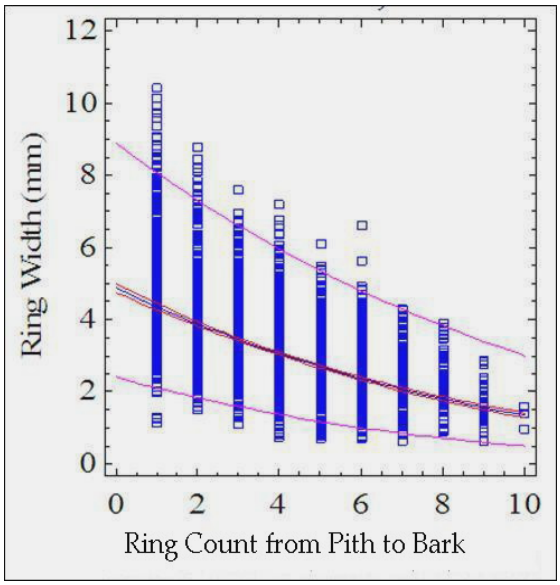


Fig (3-A, B:): A. Mean ring width as a function of disk count from stem base to stem tip.
B. Mean ring width as a function of ring count from pith to bark.

Specific gravity

The overall mean specific gravity value was 0.458 with range of 0.363 to. 0.585. The regression model fitted specific gravity and plot density was found to be statistically non-significant. Differences in wood density (after age was considered by using covariance analysis) did not appear to be related to stand density. General trend in specific gravity in relation to vertical direction in the tree was illustrated in (figure 4). From this figure it was apparent that specific gravity increased steadily from stem base upward, irrespective of the stand density, the specific gravity of the disk 1 was found to be about 7.20% lower than the overall mean specific gravity.

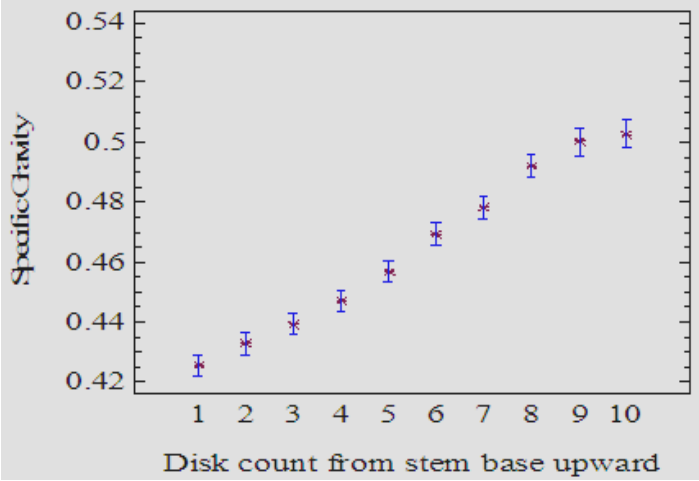


Fig (4): Variation of wood specific gravity vertically from stem base upward.

Duncan's test of means (table 2) indicated that specific gravity of stem disks 1, 2, and 3 differ non-significantly from one another, while they differed significantly from all other means. Disks 1, 2 and 2, 3 also showed no significant differences from one another, but 1 differed significantly from 3. Specific gravity seemed to increase very uniformly and consistently through 3 to 8. The high density values observed near the pith, i.e. the juvenile wood may result in part from large amount of tension wood and effect of branches in the crowned formed wood. This trend in the change of Black poplar wood density was in agreement with findings of Koga, et al. (1996) who reported that in *Cryptomeria japonica* wood, thinning largely affected the radial growth and volume increment but not the late wood percentage and basic density of the wood, moreover Ishiguri, et al. (2005) found that initial spacing ranging from 1.0-2.6m did not affect basic density. Three more studies disagree with our results and had documented a negative correlation between wood density and growth rate for wood outside what was considered to be the juvenile core (Krahmer 1966; DeBell et al. 1994; Jozsa 1998). Only two studies had provided data suggesting that growth rate had no effect on density of western hemlock wood (Megraw 1985; Watson et al. 2003).

Wood density is an important indicator of wood quality and strength, therefore the significant correlation that existed between Black poplar wood specific gravity and plot height was considered valuable as it offered a scope for developing plots of high wood density, while its weak correlation with stem diameter at breast height was found to be of less importance.

Fiber Length

The overall mean value of fiber length was 0.945. While the range varied from 0.73-1.24mm.

comparison of fiber dimensions was made among wood blocks of the same age, which is important because fiber length is proportioned to wood age, the data scattering for a specific section is due to fiber length variation from tree to tree (figure 5), unfortunately, early wood and latewood were not separated before maceration because of difficulties in cutting, therefore, the effect of plantation density on fiber length can not be separately quantified.

The linear fitted model: fiber length (mm) = 0.881 + 0.0000043*plot density (tree/hectare) describes the relationship between fiber length and plot density, such relationship is found to be statistically significant at 0.01 level of probability. The R-Squared statistic indicates that the model as fitted explains 21.799% of the variability in fiber length. The correlation coefficient (0.466), indicating a relatively weak relationship between the variables.

Plot of stand density against mean fiber length for each tree (figure 5) revealed a significant increase in fiber length with increasing plot density. Fiber length from the never thinned or light-thinned plantation plots was found to increase by about 4.76 % from the overall mean value providing opportunities to influence fiber length through silvicultural applications.

A significant negative correlation was observed between fiber length and mean annual ring width; i.e. narrower rings contained more fibers that were longer than the average, while it correlated non-significantly to wood specific gravity. Fiber length was also found to correlate significantly to tree diameter; large tree diameters produce longer fibers, similar to the relationship documented by DeBell et al. (1998) between tree diameter and weighted fiber length in young hybrid *Populus* stems.

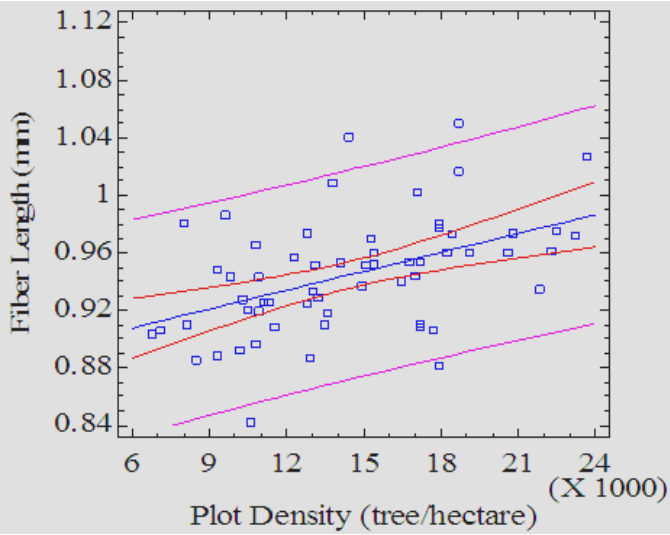


Fig (5): Fiber length as a function of plot density.

Fiber diameter and Double wall thickness (dwt)

The overall mean values of fiber diameter, and dwt were observed to be 21.525, 12.494 respectively. The values of fiber diameter varied from 30.96-14.5µm, dwt from 4.14-20.5µm (table 1).

While the fiber diameter was found to vary non-significantly by changing plot intensity, the regression model fitted to demonstrate the relationship between plot density and fiber dwt proved to be significant, under 0.01 level of probability with the correlation coefficient of 0.111, indicating a relatively weak relationship between the variables. The R-Squared statistic indicates that the model as fitted explains a very small fraction of the total variability in dwt. The fiber wall thickness from high plot density was thicker than the wall thickness of low density plot (figure 6). The high stand density, according to Zhu, et al. (2006), may cause early shift from earlywood to latewood and consequently increasing cell wall thickness. Both fiber diameter and dwt were found to correlate positively to one another (table 3), also both correlated significantly to dbh, which indicated that fibers of larger diameters and thicker walls were produced by trees of bigger dbh. Relatively, fiber wall thickness correlated strongly to fiber diameter, while it associated rather poorly but significantly to fiber length. Moreover, the wide average ring width resulting from low plot density showed no significant association with higher fiber diameters.

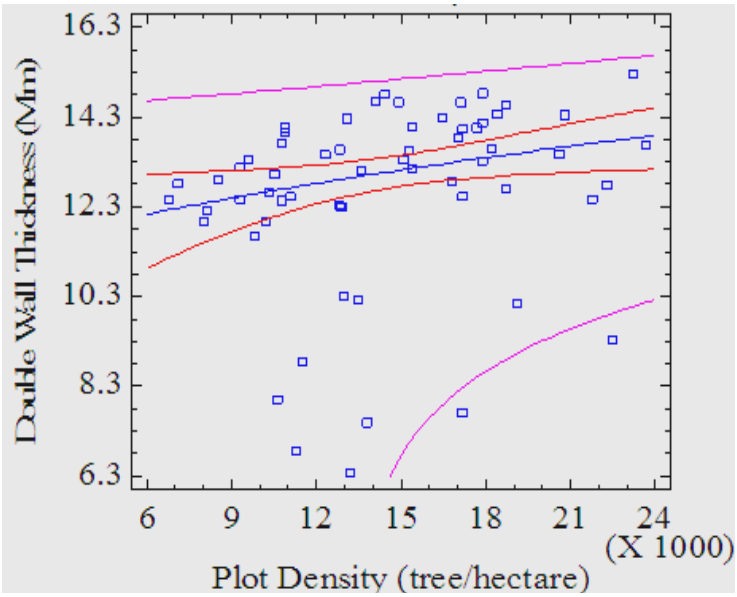


Fig (6): Fiber double wall thickness as a function of plot density.

Table (2): Duncan's Multiple Test for comparing means of ring width and specific gravity characters.

Ring Width Radial Growth	Ring Width Vertical Disks	Specific Gravity Vertical Disks
1.330 h	1.822 h	0.425 h
1.640 h	2.186 h	0.432 hg
2.123 g	2.349 h	0.439 fg
2.274 g	2.589 g	0.446 f
2.564 f	2.848 f	0.459 e
2.793 e	3.140 e	0.469 d
3.045 d	3.364 d	0.479 c
3.457 c	3.628 c	0.493 b
3.824 b	3.883 b	0.500 b
5.000 a	4.307 a	0.502 ab

Note: means with similar letters differ nonsignificantly.

Table (3): correlation coefficient between characters surveyed

	Plot Height	Fiber Length	Fiber Diameter	Fiber Dwt	Ring Width	Specific Gravity
plot dbh	-0.097 (0.017)	0.141 (0.0005)	0.093 (0.022)	0.099 (0.015)	0.031 (0.439)	0.090 (0.026)
plot height		-0.046 (0.258)	0.046 (0.255)	-0.037 (0.360)	0.034 (0.403)	-0.162 (0.0001)
fiber length			0.030 (0.462)	0.170 (0.00)	-0.150 (0.0002)	0.025 (0.527)
fiber diameter				0.418 (0.000)	0.017 (0.674)	0.079 (0.051)
fiber dwt					-0.009 (0.821)	0.071 (0.079)
ring width						-0.013 (0.747)

Note: each correlation coefficient was based on 60 values.

CONCLUSIONS

1. Plot density after thinning had a significant effect on annual ring width. It was found that trees grown in a high-density plot (growth suppression) produced logs with a low average ring width or average annual radial growth rate, while trees in a low-density plot produce logs with a high mean ring width. Mean ring width appeared to be a reliable parameter to correlate the effect of tree growing conditions (thinning effect or plot density) on fiber length. High growth rate could no doubt be extended considerably through judicious early thinning, and growth rates could be markedly improved at older ages via later thinning, but the negative correlation implies that increasing ring width cause considerable reduction in fiber length.

2. Widest mean ring width occurred at lower stem base, while narrowest in the upper stem part, on the other hand lightest wood specific gravity occurred on the lower stem part and heaviest in upper stem part, i.e. crown-formed wood of the upper stem part, where branches and tension wood increased, had narrower rings with relatively higher specific gravity.

3. Plot dbh correlated significantly to fiber dimensions (fiber length, diameter, and dwt); these meant that larger fibers were commonly observed in trees of greater dbh, while plot height was found to be less sensitive to associate with wood quality characters, the only significantly, negative association was that found between specific gravity and plot height; trees of taller plots produced lower-density wood.

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تأثير كثافة المشجر على عرض حلقات النمو ,الوزن النوعي وأبعاد ألياف لخشب القوغ الأسود النامي في مشاجر أصطناعية بمنطقة زاخو/العراق. *Populus nigra* L.

الخلاصة

انشأت مشاجر اهلية للقوغ الأسود عن طريق الأفلام على مساحة تقدر بحوالي 20 هكنار عندالجانب الشرقي لنهر الهيزل شرق مدينة زاخو. زرعت الأفلام على مسافات 0.5 * 0.5م بين الأشجار والصفوف. عرضت المشاجر للتخفيف حسب حاجة السوق عند الأعمار 4, 5, 6 سنوات ,وهناك ثلاث قطع لم تخفف وبعد انتهاء التخفيف قسم المشاجر الى 60 قطعة لتمثل كثافات مختلفة تتراوح بين 6800 – 25250 شجرة/هكنار. تم قياس الصفات النوعية لمعدل النمو (عرض حلقة النمو السنوية), الوزن النوعي، وتشريح الليفة بغية تقدير تأثير التخفيف الذي أجري من قبل الفلاحين على هذه الصفات النوعية.

لوحظ تأثيرا لكثافة القطعة على الوزن النوعي بشكل غير معنوي بينما أثبت تحليل الأنحدار عدم معنوية العلاقة بين كثافة القطعة وكل من طول الليفة وسمك جدارها. نجد انه معاملتي الرتباط 0.199 و 0.111 لطول الليفة وسمك جدارها على التوالي تشير الى علاقة ضعيفة بين المتغيرات. لقد أثرت كثافة المشجر بشكل ثابت على حلقة النمو السنوية, حيث لوحظ تناقص عرض الحلقة ضمن ساق الشجرة بالاتجاهين الأفقي من اللب الى القشرة عند مختلف ارتفاعات الساق, وكذلك العمودي من مستوى سطح الأرض إلى قمة الساق.

لوحظ أرتباط الوزن النوعي بشكل معنوي بكلا من أرتفاع القطعة وقطرها عند مستوى ارتفاع الصدر, ولكن ارتبط بـشكل سلبي مع عرض حلقة النمو السنوية.

كارتيكرنا تيژييياتيا هنالستانا لسەر پەهناتيا خرگين گەشەكرنا سالانە ,سەنگا جورى و هژمارتنين فايبەرين ين داریٚ سپيندارا رەش ين شينبوى د نهالستانين دەستكرد ل دەڤەر زاخو – عيراق

كورتى

نهالستانين خومالى ين سپيندارا رەش ين هاتينە چێكرن بريٚكا چاندنا قەلەما دروبەرتى دگەهيتە 20 هكتارا ل رەخ كەرتى روژهەلاتا رويبار هيزل ل روژهەلاتا باژيركى زاخو .قەلەم دبەياڤىٚ 0.5 × 0.5 ميتر دناڤبەرا دارا وخەتكا دا هاتينە چاندن.ئەڤ نهالستانە برنگەگىٚ بژارە ولدويڤ پيتڤين باژارى دژيين 4, 5 ,6 سالىٚ دا كرى راسڤككرنىٚ بو هاتنە ئەنجام دان وپشتى كرنا راسڤككرنىٚ بدوماهى هاتى نهالستان هاتنە دابەشكرى بو 60 پارچا ژ بو دەستنيشانكرنا تژياتين جوراجور دناڤبەرا 6800 – 25250 دارا/هكتار. ساخلەتين جورى ين تێكرا گەشەكرنى (پەهنيا خروكين گەشەكرنا سالانە) سەنگىٚ جورى وشروڤەكرنا فايبەرا هاتنە حيسبكرن ژ بو دياكرنا كارتيكرنا سڤككرنا دهێتەكرن ژ لايىٚ جوتيارانڤە لسەرڤان ساخلەتان. ديار بو كو كارتێكرنا تژييياتيا پارچا لسەر سەنگىٚ جورى برەنگەگىٚ نەپيشجاڤ بەلى شروڤەكرنا Regression Analysis بو مە دياركر كوگوهولين نەدپيشجاڤن دناڤبەرا تژييياتيا پارچا وهەرئيك ژ دريژاهيا فايبەرا وستويراتيا ديوارىٚ وىٚ. ديار بو كو هەردوو سەرەدەريين پێوەنديكرنىٚ ين 0.199 و 0.111 بو دريژاهيا فايبەرا وستويراتيا ديوارىٚ وىٚ لدويڤ ئيكرا پيوەندى ين سست دناڤبەرا جوداهيا دەستنيشان دكەن.

تژييياتيا نهالستانىٚ كارتيكرى ب رەنگەگىٚ ئێكسان لسەر خركين گەشكرنا سالانە كو كێم دبون دپەهناتيا خركاد قورمىٚ داریٚ دا ب هەر دوو لايانڤە هوريزونىٚ ژ نافكا دارى تاكو تيڤكلىٚ ریٚ دبلنداهين جورا جور ژ قورمىٚ و هەروەسا ستوينى ژ ئاستى لسەر ئەردى تاكو كوپيتكا قورمىٚ هەبون.

ديا بو پێوەندييا سەنگا جورى برەنگەگەكىٚ پيشجاڤ بهەر دوو بلنداهيا پارچا وتيىٚ دارا دئاستىٚ بلنداهيا سينگىٚدا بەلىٚ ئەڤ پيوەندييە برەنگەكى نەريتى بو دگەل پەهناتيا خركان گەشەكرنا سالانە.

STEM CANKER DISEASE ON DECLINE POPLAR TREES

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ABSTRACT

The symptoms of poplar decline and stem cankers were more conspicuous on 44 – 66 % in the eastern plantations of Duhok on 4 – 7 years old trees with 5 – 9.58 cm in stem diameter at DBH . In west of Duhok , disease distributed on 20 – 68 % of total trees (4 – 5 years old) . The most common cankers were concentric (target shape) , eccentric type , stripping (girdling) phloem with sap flow and sooty cankers (limb wilt)caused by *Nattrassia mangiferae* H.&P. Sydow)Sutton &Dyko .

KEYWORDS stem canker poplar trees

INTRODUCTION

Stem canker is broadly used to mean a disease that causes the death of definite and relatively areas of the bark on branches or trunks of trees. Strictly speaking, repeated callusing is necessary before a lesion can be classed as a canker. Death of the bark and cambium is followed by death of the underlying wood, although the causal organism may or may not penetrate the wood (Boyce, 1961).

Cankers also defined cankers as a necrosis of woody tissues in

which the symptoms frequently become apparent during the dormant season or shortly after(Roberts and Boothroyd ,1984).

Poplar decline should be clearly distinguished from its dieback. The latter refers to the unseasonable partial or complete loss of foliage on many poplar trees within a forest, (Mueller-Dombois, 1988). Dieback may be a symptom of decline but the reverse is not necessarily the case.

The symptoms of poplar decline include abnormally small leaves, loss of foliage from the ends of branches (crown thinning), chlorosis and marginal leaf necrosis, early leaf discoloration, branch die back, tap holes in the trunk taking longer to clear as cankers, exfoliated bark (girdling), reduced vigor and mortality of trees (Bernier and Brazeau, 1986; Gagnon *et al*., 1986; McIlveen *et al*., 1986; Bauce and Allen, 1991; Renand and Mauffette, 1991).

According to Innes and Boswell (1991) and Greig (1992), symptoms and timing of poplar decline include:

1. Discoloration of foliage.
2. Premature shedding of leaves and death of fine shoots.
3. Extensive development of epicromic shoots in the crown.
4. Dieback of larger shoots and eventually of the entire crown.

In France, symptoms include crown thinning, stunted leaves and chlorosis which eventually lead to the eventual death of trees (Landmann, 1992).

The aim of this study is application of the standard method in surveying poplar decline in duhok plantation depend upon description of the most common stem cankers at DBH .

MATERIALS AND METHODS

Field survey

For general observation of the Poplar declines and their geographical distribution in Duhok, a number of surveys were conducted during spring 2002 and 2003. The surveying included fifteen representative poplar plantations of *Populus nigra* and *P. xeuramercana* in eastern and western locations of Duhok Governorate and as follows: Kerbaly, Duhok plantation (1), Duhok plantation (2), Beshenky, Benarinky, Siarospendar (Eastern Locations); Mullarab, Wadikashkan, Zakho-Barzan (1), Zakho-Barzan (2), Zakho-Barzan (3), Toyan, Bank, Bawardi, Dolly (Western Locations).

The standard method of plot assessment according to UN-ECE and Commission of the European Community (CEC) was used. Four sub-plots on each plot were located and between 5-8 trees on each sub-plot. Sub-plots are at the cardinal points of the compass, with their centres usually being 25m from a central point as in Fig (1).

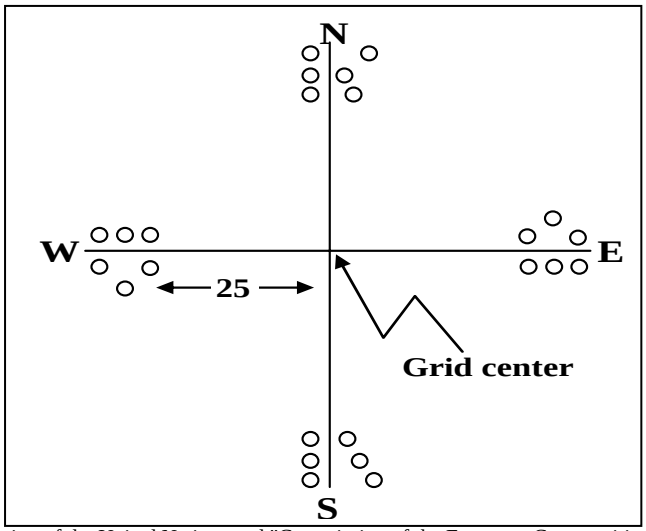

Fig (1): Plot design of the United Nations and "Commission of the European Communities" forest health surveys.

***** Apart of M. Sc. thesis

Trees are located at the end of each 25m arm where the five or more near trees are assessed. In plantations, suppressed trees are frequently removed by selective thinning and no suppressed trees are included in the plots used as in the British Monitoring Program.

The size of the tree to be sampled in the UN-ECE and CEC was above 40cms height, while the sample size used in this program was been less than 30 trees for each sub-plot.Severity of stem cankers was assessed depending on the total area of different types of cankers at Diameter Breast Height (DBH) in the previously mentioned plantations of *Populus nigra* and *P. xeuramericana*. Stem area was counted by the equation:

The lateral area of the right circular cylinder = 2 x π x radius x height Cankered area measured by using planimeter HAFF-planimeter No.317 (for cm^2) (ordering No. 317E) Germany.

In each selected plantation, the following statements were also recorded: plantations area trees age, percentage of cankered trees, diameter at DBH, cankers area, cankers area: stem area% in addition to canker description.

RESULTS AND DISCUSSION

Field survey

Assessment of crown decline of Poplar

Results of poplar decline survey in poplar plantations east and west of Duhok during 2002-2003 indicated that most of trees were declined with different grades (Fig.2) .

Fig (2): Symptoms of natural decline on Poplar (Zawita plantations).

The results presented in (Table 1) revealed that decline and stem canker symptoms were 44-60% in the eastern plantations in 4-7 years old trees and 5.02-9.58 cm stem diameter. In the west of Duhok, disease was greatly varied to 20-68% of total tress 4-5 years old and 4.70-9.71 cm in diameter. However, the dependent assessments are stem area at DBH "Diameter at Breast Height" (Garcia, 1976; Saeed *et al*., 1975).

The variation of cankers area in surveying plantations were 17.20-79.00 cm^2 and 43.88-116.05 cm^2 in the east and west of Duhok respectively..

The ratio of cankers stem area at DBH occasionally depends on canker area and stem diameter according to the equation used for counting stem area which is based on their radius, height and π. Thus, the important causes of the unstaidy infections and canker's expanse contribute of poplar species, field's inspection and management particularly, availability of water irrigation during the hot months and pests control of weed, such insects as *Capanodis miliaris*, they bore holes through the bark, and emerge, with the sticky masses of conidia of the fungi clinging to them and also making the wounds through which the trees are inoculated with conidia under wetness condition that are more favorable to poplar growth (Abdullah, 1988).

Table(1): Percentage of infection, cankers description and the ratio of canker's area: stem area at DBH of some Poplar plantations during 2001 in Duhok Province.

]	Location	Plantation Area (Donum)	Tree's Age (Year)	Dbh (Cm)	Canker's Description	Canker's Area (Cm^2)	Canker's Area: Stem Area %	Infection %
1	Kerbaly	1	4	7.55**	+++, +*	18.14**	0.63**	48
2	Duhok Plantation No. 1	1	4	5.02	+++, +	17.20	0.85	60
3	Duhok Plantation No. 2	1.5	4	9.58	+++, +	75.00	2.02	48
4	Beshenky	1	5	8.67	+++, +	26.77	0.78	52
5	Benarinky	1	5	7.41	+++, +	64.90	2.43	48
6	Siaroaspendar	1	7	5.71	+	79.00	3.36	44
7	Mulla-Arab	1	4	4.94	+	52.64	2.69	32
8	Wadi Kashkan	1	4	4.7	+++	116.05	6.95	20
9	Zakho Barzan No. 1	16.5	4	5.27	+++, +	73.77	3.31	36
10	Zakho Barzan No. 2	11	4	6.65	++, +	43.88	1.59	40
11	Zakho Barzan No. 3	11	4	6.03	+++, ++, +	93.22	3.78	32
12	Toyan	1	4	5.31	++, +	53.52	2.46	32
13	Bank	1	5	9.71	+++, +	80.00	1.98	28
14	Bawardi	10	5	6.27	+++, +	78.81	3.12	36
15	Dolly	1	5	8.27	+++, +	47.15	1.30	68

***** + Concentric and eccentric cankers with callus
++ Cankers caused by *Nattrassia mangiferae*
+++ Girdling with callus formation and sap/ resine flow.
****** Each value represents means of 50

The most common stem cankers were the following:

a. Concentric (target shape) and eccentric type

The first indication of infection is small depressed or flattened areas of bark in the vicinity of small wounds or around the base of dead side twigs or branches.

These areas may have a darker color and water soaked appearance. Cracking of the bark or the development of callus tissue at the outer edge of the cankered area commonly makes these young cankers more apparent; they may be concentric or target shaped with the bark completely sloughed off, exposing the underlying regular ridge of callous tissue in the wood (Fig. 3A).

Other open cankers are irregular in shape with indefinite callus ridges with the horizontal axis sometime longer, again a covering cankers covered by bark may remain over the cankered area, and even large cankers covered by bark are not conspicuous. Occasionally the cankered area is partially or completely covered by a roll of callous, indicating that the tree is overcoming the infection such healing over is often characterized by pronounced swelling (Fig. 3B) therefore when a cankered area is completely grown over, it is hard to tell weather the callus covering a wound or a canker. Decay rarely develops in the wood underlying cankers. These symptoms were similar with that of Boyce (1961).

b. Stripping (girdling) phloem with sap flow

Generally attain a length of 1 or more feet before the tree is girdled and killed (Fig. 3C). The first evidence is small yellowish-orange slightly sunken areas with irregularly lobed advancing margins, centered around some wound. These areas increase in size until they coalesce to form a canker, delimited by vertical cracks, the affected bark become mottled taking on a greenish color in which black patches occur owing to the superficial periderm flaking off to exposure the black end cortex. A brownish sap flow may occur at the canker margin, the advancing margin is irregular and wavy and yellow to brown in color. Symptoms were similar to that of Witzell (2001) in Germany.

c. Cankers of *Nattrassia mangiferae* .

The symptoms were described as being purplish to black areas on bark that later sloughed off to form elongated sunken cankers with a callused margin. The inner bark in the area around the cankers is discolored brown and contains the fungus.

In general, it attacks the cambium and spreads downward causing wilt, dieback or cankering, and staining the wood brown. Eventually, the bark blisters and cracks open, exposing the masses of conidiospores to the wind (Fig. 3D).The above descriptions of the symptoms on the trunks are in consistent with the descriptions of Karim, 1984; Sutton and Dyko, 1989.

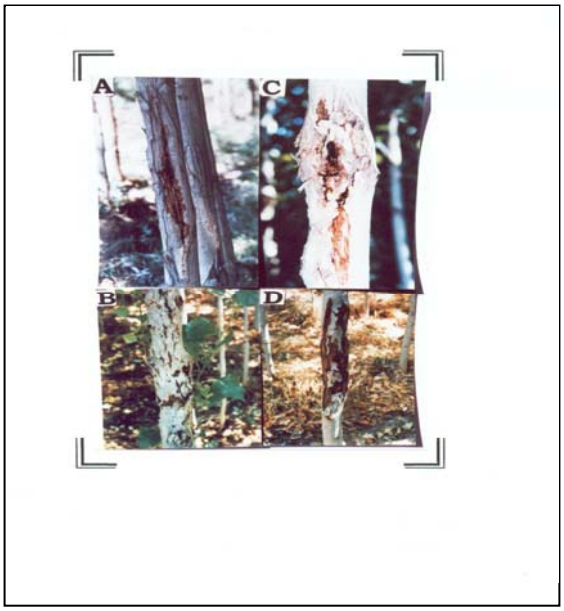

Fig (3): Symptoms of stem cankers.
A = Concentric and eccentric cankers with callus formation
B = Irregular canker characterized by pronounced swelling
C=Girdling phloem cankers with callus formation andsap/resin flow
D = Canker caused by *Nattrassia mangiferae* .

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تقرحات الساق على أشجارالقوغ المتدهورة

الخلاصة

ظهرت اعراض تدهور اشجار القوغ وتقرحات سيفا ا بشكل واضح وبنسبة 44 -66 % في المشاجر الشرقية في **دهوك البالغة 4- 7 سنوات من العمر وافطار سيفا ا 5 -9.58 سم عند مستوى الصدرDBH . اما المشاجر الغربية فقد انتـشرت التقرحـات بنسبة 20 – 68 % من مجموع الاشجار البالغة عمرها 4 – 5 سنوات كانت التقرحات الاكثر شيوعا هي تقرحات مركزية (بـشكل هدف الرماية) ، تقرحات متشققة (تحليق اللحاء مع جريان عصارة النبات) والتقرحات الفحمية المتسببة عن الفطر *Nattrassia mangiferae***

کولبونا قورما لسەر داریێت سپیندارێت تێکچوێی

پوختەِ

نێشانێن تێکچون و کولبونت دارێن سپندارا دیاربو ب شێوەیەکێ بەرچـاڤ ل نـاڤ نهالێـستانێت سـپێندارا ئـەوێن ژێـی وان دناڤبەرا 4–7 سالاندا و فرەهیا قورمێن وان ژ 5–9.58 سم ل دێف ریژا بلنداهیا سنگی ل روژهەلاتا دهوکێ ب ریژێی 44–66 ٪ . نهالێستانێت روژ ئاڤایێ ریژا گولبونێ گەهشتە 20–68 ٪ ژ وان دارێن ژێی وا ژ 4–5 سالابوون .

پرانیا گولبونا ژ جورێی سەنتەری بوو (بازنێت تێکەل) ، گولبون دگەل تەحلیقا ئاڤی و رژاندنا شێرافی ژێی و گولبونێت ژ ئەگەری گەرو *Nattrassia mangiferae*.

A STUDY OF JOINT NUMERICAL RANGE

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ABSTRACT

The purpose of this paper is to define joint Hermitian, joint skew-Hermitian and joint quasi nilpotent of n-tuple operators on a complex Hilbert space with some reasonable results concerning the joint numerical range of n-tuple operators on a complex Hilbert space.

KEY WORDS joint numerical range joint Hemitian joint spectaloid joint normaloid

1-INTRODUCTION

The study of joint Hermitian, joint skew-Hermitian and joint quasi nilpotent of n-tuple operators arises naturally in many branch of mathematics. We are going to study the following areas joint Hermitian, joint skew-Hermitian and joint quasi nilpotent of n-tuple operators: joint eigenvalue, extreme point, joint spectraloid, joint normaloid and inclusion of generalized numerical range.Let $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ be an n-tuple operators on a complex Hilbert space H. The joint numerical range and the joint numerical radius of $\boldsymbol{T}$ are defined respectively as follows: $W(\boldsymbol{T})=\{<T_1f,f>,<T_2f,f>,\ldots,<T_nf,f>: f\in H, \|f\|=1\}$, $w(\boldsymbol{T})=\sup\{|z|: z\in W(T)\}$ where $|z|=(\sum_{i=1}^{n}|z_i|^2)^{1/2}$ }[6].

One of the basic properties of W ($\boldsymbol{T}$) which is pointed out by many authors is that the joint numerical range of commuting normal operator is convex set [6], and it is plays an important role of in the study of over damped vibrating systems, with a finite number of degree of freedom [8] and its useful in various theoretical and applied subject (see[1,2,3 and 4]) and their references. The aim of this paper is to define the joint Hermitian, skew-Hermitian and quasi nilpotent of n-tuple operators on a complex Hilbert space with some reasonable results concerning the joint numerical range and joint numerical radius. The rest of this paper is organized as follows. In section 2, we present definitions and some basic results which will be used on joint numerical range of n-tuple operators on a complex Hilbert space. In section 3, we proved that if $T_1,T_2,\ldots,T_n$ are bounded linear operator of n-tuple operators on a complex Hilbert space then the joint numerical radius belongs to joint numerical range if and only if joint numerical radius is a joint eigenvalue of Hermatian operators, and if $T_1,T_2,\ldots,T_n$ are commuting normal operators on a complex Hilbert space then every joint normaloid is joint spectrloid.

2- PRELIMINARIES

In the following, we give some definitions and results on W(A) that are useful in this study.

Lemma 2.1 [7]: If H is an inner product space with the inner product < , >, then

$$\langle f,g\rangle=\frac{1}{4}\left[\|f+g\|^2-\|f-g\|^2+i\|f+ig\|^2-i\|f-ig\|^2\right]$$

Definition 2.2[7]: If T is an operator on a Hilbert space H, Then there exists a unique operator s on H such that $<Tf, g> = <f, sg>$ for all f and g in H , s is called the adjoint of T and is denoted by T^*.

Definition 2.3[7]: An operator $T\in B(H)$, where B(H) the set of all bounded linear operators is said to be self adjoint if $T=T^*$, and normal if $T^*T=TT^*$.

Definition 2.4[9]: Let $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ be an n-tuple of operators on a complex Hilbert space H. A point $z=(z_1,z_2,\ldots,z_n)$ of C^n is called a joint eige value of $\boldsymbol{T}$ if and only if there exists a non-zero vector $f\in H$ such that $(T_i-z_i)f=\mathbf{0}$, for each i, $i=1,2,\ldots,n$. The set of all joint eigenvalues of T is said to be joint point spectrum.

Definition 2.5[5]: Let $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ be an n-tuple of operators on H, we define the joint spectrum of $\boldsymbol{T}$ to be the set $sp(\boldsymbol{T})$ consisting of all $z=(z_1,z_2,\ldots,z_n)$ of C^n such that (T_i-z_iI), $i=1, 2, \ldots, n$ is not invertable.

Theorem 2.6[6]: Let $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ be an n-tuple of commuting normal operators on H, then $sp(T_1,T_2,\ldots,T_n)\subseteq ClW(T_1,T_2,\ldots,T_n)$.

Definition 2.7[10]: A subset A of a vector space X is said to be convex if $x,y\in A$ implies $M=\{z\in X: z=\alpha x+(1-\alpha)y, 0\le\alpha\le 1\}\subset A$.

Theorem 2.8[6]: Let $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ be an n-tuple of commuting normal operators on H , then $W(T_1,T_2,\ldots,T_n)$ is convex.

Definition 2.9[11]: A point z in the closure of a convex subset $E\subseteq C$, is an extreme point of E if it is not in the interior of a line segment with endpoints in E.

Definition 2.10[5]: Let $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ be an n-tuple of operators on H, we define the joint spectral radius of $\boldsymbol{T}$ to be the set $r(\boldsymbol{T})$ consisting of all $z=(z_1, z_2,\ldots, z_n)$ of C^n such that $r(\boldsymbol{T})=\sup\{|z|: z\in sp(T)\}$ where $|z|=(\sum_{i=1}^{n}|z_i|^2)^{1/2}$.

Definition 2.11[5]: The joint normaloid of an n-tuple $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$ operators on H, is define by $r(T)=\|T\|$.

Definition 2.12[5]: The joint spectraloid of an n-tuple $\boldsymbol{T}=(T_1,T_2,\ldots,T_n)$operators on H,is define by r($\boldsymbol{T}$) = w($\boldsymbol{T}$)

3-MAIN RESULTS

To prove the main results needs to define joint Hermiatian and joint skew-Hermitian as follows:

Definition3.1: Let $\boldsymbol{T}=(T_1,T_2,...,T_n)\in$ B(H), the joint Hermitian of $(T_1,T_2,...,T_n)$ operators on a complex Hilbert space is define as follows: $T_{+_1}=\frac{(T_1+T_1^*)}{2}$, $T_{+_2}=\frac{(T_2+T_2^*)}{2}$, …, $T_{+_n}=\frac{(T_n+T_n^*)}{2}$.

Definition 3.2: Let $T=(T_1,T_2,...,T_n)\in$ B(H), the joint skew-Hermitain of $(T_1,T_2,...,T_n)$ operators on a complex Hilbert space is define as follows:

$T_{-_1}=\frac{(T_1-T_1^*)}{2}$, $T_{-_2}=\frac{(T_2-T_2^*)}{2}$, **…,**

$T_{-_n}=\frac{(T_n-T_n^*)}{2}$.

Theorem 3.3: Let $T=(T_1,T_2,...,T_n)\in$ B(H), then $\boldsymbol{w}(T_1,T_2,...,T_n)\in W(T_1,T_2,...,T_n)$ If and only if $\boldsymbol{w}(T_1,T_2,...,T_n)$ is a joint eigenvalue of T_{+_1}, T_{+_2},..., T_{+_n}.

To prove Theorem 3.3. we need the following:

Theorem 3.4: Let $T=(T_1,T_2,...,T_n)$ be an n-tuple operators on a complex Hilbert space. If $\boldsymbol{w}(T_1,T_2,...,T_n)\in W(T_1,T_2,...,T_n)$ such that $w(T_i)=\|T_i\|$, i=1, 2,…,n. Then $\boldsymbol{w}(T_1,T_2,...,T_n)$ is a joint eigenvalue of $(T_1,T_2,...,T_n)$.

Proof: Suppose $w(T_1,T_2,...,T_n)\in W(T_1,T_2,...,T_n)$, then there exist a unit vector $f\in$H such that, $w(T_i)=\langle T_i f,f\rangle$, i=1, 2, …, n. Therefore, $\|T_i\|=|\ \langle T_i f,f\rangle\ |\le\|T_i f\|\,\|f\|$, i=1, 2, …, n. So that equality holds everywhere, moreover where the Schwarz inequality becomes an equation imply that $T_i f=w(T_i')f$, i=1,2,…,n, where $(T_1',T_2',...,T_n')$ be an n-tuple operator on a complex Hilbert space H, and for some unit vector f in H, and this in turn implies that:

$w(T_i')=w(T_i')\langle f,f\rangle=\langle w(T_i')f,f\rangle=$

$\langle T_i f,f\rangle=w(T_i)\langle f,f\rangle=w(T_i)$,

$i=1,2,...,n$. Hence $w(T_1,T_2,...,T_n)$ is a joint eigenvalue of $T_1,T_2,...,T_n$.

Proof of Theorem 3.3: Suppose $w(T_1,T_2,...,T_n)$ is a joint eigenvalue of T_{+_1}, T_{+_2},..., T_{+_n}, then there exist a unit vector f in H, such that, $T_{+_i}f=w(T_i)f$, $i=1,2,...,n$,

therefore, $\langle T_i f,f\rangle=\langle T_{+_i}f,f\rangle+\langle T_{-_i}f,f\rangle$,

$=w(T_i)+\langle T_{-_i}f,f\rangle$, i = 1, 2, ..., n.

Since $\langle T_{-_1}f,f\rangle,\langle T_{-_2}f,f\rangle,...,\langle T_{-_n}f,f\rangle$ are imaginary part of $(T_1,T_2,\ldots,T_n)$ and $w(T_i)\ge\mathbf{0}$, i=1,2,…,n, then, $\langle T_{-_1}f,f\rangle=0$, $\langle T_{-_2}f,f\rangle$ =0,…, $\langle T_{-_n}f,f\rangle$ =0.

Hence, $w(T_1,T_2,...,T_n)\in W(T_1,T_2,...,T_n)$.

Conversely, Let $\boldsymbol{w}(T_1,T_2,...,T_n)\in W(T_1,T_2,...,T_n)$,then $w(T_1,T_2,...,T_n)\in W(T_{+_1},...,T_{+_n})$, since $w(T_i)\ge\mathbf{0}$, for i=1,2,…,n. But $w(T_{+_i})=\|T_{+_i}\|$, $i=1,2,...,n$, hence, we obtain that $w(T_1,T_2,...,T_n)$ is a joint eigenvalue of T_{+_1}, T_{+_2},..., T_{+_n}, by Theorem 3.3.

Theorem 3.5: Let $\boldsymbol{T}=(T_1,T_2,...,T_n)$ be an n-tuple operators on a complex Hilbert space H. If $\langle T_{+_j}f,f\rangle\ge\mathbf{0}$, $j=1,2,...,n$, for some unit vector f∈H and $\mathbf{0}\in W(T_1,T_2,...,T_n)$, then $T_j f=-T_j^* f$, $j=1,2,...,n$.

Proof: $\langle(T_j+T_j^*)f,f\rangle\ge\mathbf{0}$, j=1, 2,...,n. Since, $\mathbf{0}\in W(T_1,T_2,...,T_n)$, then there exists some unit vector f in H, such that $\langle T_j f,f\rangle=\mathbf{0}$, $j=1,2,...,n$ .This implies that $\langle(T_j+T_j^*)f,f\rangle=\mathbf{0}$, j=1,2,..,n. By Lemma 1.1, $\|(T_j+T_j^*)f\|^2=\mathbf{0}$, j=1,2,..,n. Hence, $T_j f=-T_j^* f$, j=1,2,..,n .

The proof of the following Theorem is essentially the same as that of theorem 3.5 and hence it is omitted.

Theorem 3.6: Let $\boldsymbol{T}=(T_1,T_2,...,T_n)$ be an n-tuple operators on a complex Hilbert space H. If

$\langle T_{-j} f, f\rangle \geq 0$, $j = 1,2,...,n$, for some unit vector $f \in H$ and $0 \in W(T_1, T_2, ..., T_n)$, then $T_j f = T_j^* f$, $j = 1,2,...,n$.

Theorem 3.7: Let $\boldsymbol{T} = (T_1, T_2, ..., T_n)$ be an n-tuple of commuting normal operators on a complex Hilbert space H. If **0** is an extreme point of $W(T_1, T_2, ..., T_n)$, and $\langle T_{+j} f, f\rangle \geq \mathbf{0}$, $i = 1,2,...,n$ then $M = \{ f \in H, \langle T_i f, f\rangle = \mathbf{0}, \quad i = 1,2,...,n \}$ is closed subspace of H.

Proof: It is sufficient to show that, $\langle T_i(\alpha f + \beta u), (\alpha f + \beta u)\rangle = \mathbf{0}$, $i = 1,2,...,n$, where $f, u \in M$, $\alpha, \beta \in C^n$. Note that,

$\langle T_i(\alpha f + \beta u), (\alpha f + \beta u)\rangle = \langle T_i(\alpha f + \beta u), \alpha f\rangle +$

$\langle T_i(\alpha f + \beta u), \beta u\rangle$

$= \langle T_i(\alpha f), \alpha f\rangle + \langle T_i(\beta u), \alpha f\rangle + \langle T_i(\alpha f), \beta u\rangle +$

$\langle T_i(\beta u), \beta u\rangle$

$= \alpha\overline{\alpha}\langle T_i f, f\rangle + \beta\overline{\alpha}\langle T_i u, f\rangle + \alpha\overline{\beta}\langle T_i f, u\rangle +$

$\beta\overline{\beta}\langle T_i u, u\rangle = \alpha\overline{\beta}\langle T_i f, u\rangle + \beta\overline{\alpha}\langle u, T_i^* f\rangle$

$= \alpha\overline{\beta}\langle T_i f, u\rangle - \beta\overline{\alpha}\,\overline{\langle T_i f, u\rangle}$ (by Theorem 3.5)

$= 2\mathrm{Im}\,\overline{\alpha}\beta\langle T_i f, u\rangle$, $i = 1, 2,..., n$.

Assume $\mathrm{Im}\,\overline{\alpha}\beta\langle T_i f, u\rangle \neq \mathbf{0}$, then take $\alpha = -\beta = 1$, hence the value of $\mathrm{Im}\,\overline{\alpha}\beta\langle T_i f, u\rangle$, $i = 1, 2,..., n$, lies in both upper and lower half-plane, thus **0** is not an extreme point of joint numerical range, this contradicts the hypothesis.

DEPENDING ON THE PERVIOUS RESULTS, THE PROOF OF THE FOLLOWING THEOREM IS CLEAR

Theorem 3.8: Let $\boldsymbol{T} = (T_1, T_2, ..., T_n)$ be an n-tuple operators on a Hilbert space H. Then $M = \{ z_j : |z_j| < 1 \} \cup \{ cos(a_j) + isin(a_j)$ where a_j is irrational number, $j = 1, 2,..., n \}$, is a joint numerical range of $T_1, T_2, ..., T_n$, respectively.

Theorem 3.9: For an n-tuple of commuting normal operators $T = (T_1, T_2, ..., T_n)$ on a complex Hilbert space H, $r(T_i) \leq w(T_i)$, $i = 1, 2,..., n$.

Proof: Since

$r(T) = \sup\{|(z_1, z_2, ..., z_n)| : (z_1, z_2, ..., z_n) \in sp(T)\}$, then

$r(T) \leq \sup\{|(z_1, z_2, ..., z_n)| : (z_1, z_2, ..., z_n) \in Cl\,W(T_1, T_2, ..., T_n)\}$ (by Theorem 2.6)

$= \sup\{|(z_1, z_2, ..., z_n)| : (z_1, z_2, ..., z_n) \in W(T_1, T_2, ..., T_n)\}$

$= w(T)$.

Theorem 3.10: Every joint normaloid of an n-tuple commuting normal operators $T = (T_1, T_2, ..., T_n)$ on a complex Hilbert space H. is joint spectraloid.

Proof: Since $(T_1, T_2, ..., T_n)$ is a joint normaloid, $r(T_i) = \|T_i\|$, $i = 1, 2,..., n$. But we have, $w(T_i) \leq \|T_i\|$, $i = 1, 2,..., n$. Then by Theorem 3.9 $r(T_i) \leq w(T_i) \leq \|T_i\|$, $i = 1, 2,..., n$. and hence $w(T_i) = \|T_i\|$, $i = 1, 2,..., n$.

Theorem 3.11: Given an n-tuple $T = (T_1, T_2, ..., T_n)$ operators on a complex Hilbert space H. If $(T_i - z_i)$, $i = 1, 2,..., n$, is a joint normaloid, Then $\|(T_i - z_i) f\| \geq |\langle T_i f, f\rangle - z_i|$, $i = 1, 2,..., n$.

Proof: By assumption, $r(T_i - z_i) = \|(T_i - z_i)\|$, $i = 1, 2,..., n$. Now let f be a unit vector in H, such that,

$\|(T_i - z_i)\| = \|(T_i - z_i) f\| \geq |\langle T_i f - z_i f, f\rangle|$

$= |\langle T_i f, f\rangle - z_i\langle f, f\rangle| = |\langle T_i f, f\rangle - z_i|$

$= dist.(z_i, W(T_i))$, $i = 1, 2,..., n$.

Hence, $\|(T_i - z_i) f\| \geq |\langle T_i f, f\rangle - z_i|$, $i = 1, 2,..., n$.

Definition3.12: An operator $T = (T_1, T_2, ..., T_n) \in$ B(H), is said to be joint quasi nilpotent if $r(T_i) = \lim_{k\to\infty} \|T_i^K\|^{1/K} = \mathbf{0}$, $i = 1, 2, \ldots, n$.

Theorem 3.13: Given an n-tuple $\boldsymbol{T} = (T_1, T_2, ..., T_n)$ operators on a complex Hilbert space H. Then the joint spectraloid quasi nilpotent operators is identically zero.

Proof: Suppose $T = (T_1, T_2, ..., T_n)$ is a joint spectraloid quasi nilpotent operators, then the following equality holds:

$w(T_i) = r(T_i) = \lim_{k\to\infty} \|T_i^K\|^{1/K} = \mathbf{0}$, i=1, 2, ..,n. Therefore,

$\sup\{|(z_1, z_2, ...z_n)| : (z_1, z_2, ...z_n) \in W(T_1, T_2, ...T_n)\} = \mathbf{0}$,

where

$|z_i| = \left(\sum_{i=1}^{n} |\langle T_i f, f \rangle|^2 \right)^{1/2}$ which implies that, sup $\{ \left(\sum_{i=1}^{n} |\langle T_i f, f \rangle|^2 \right)^{1/2} \} = \mathbf{0}$,

and $\mathbf{0} \leq \left(\sum_{i=1}^{n} |\langle T_i f, f \rangle|^2 \right)^{1/2} \leq \sup \{ \left(\sum_{i=1}^{n} |\langle T_i f, f \rangle|^2 \right)^{1/2} \} = \mathbf{0}.$

Hence $\left(\sum_{i=1}^{n} |\langle T_i f, f \rangle|^2 \right)^{1/2} = \mathbf{0},$ which implies that $|\langle T_i f, f \rangle| = \mathbf{0}$, i=1,2,…,n, by lemma 1.1, $\|T_i\|^2 = \mathbf{0}$, $i = 1, 2, ..., n$, and this shows that, $(T_1, T_2, ..., T_n) = \mathbf{0}$.

THE PROOF OF THE FOLLOWING THEOREMS ARE CLEAR

Theorem 3.14: Given an n-tuple $T = (T_1, T_2, ..., T_n)$ operators on a complex Hilbert space H. Then the joint normaloid quasi nilpotent operators is identically zero.

Theorem 3.15: Let $T = (T_1, T_2, ..., T_n)$ be an n-tuple operators on a complex Hilbert space H. If the joint spectral radius is a joint eigenvalue of $(T_1, T_2, ..., T_n)$, then $(T_1, T_2, ..., T_n)$ is a joint spectraloid.

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دراسة المدى العددي المشترك

الخلاصة

الغرض في هذا البحث هو تعريف هرمت,هرمت المتخالف و كوازى العديم لمتجة ذوn من الابعاد من المؤثرات مع بعض النتائج للمدى العددي المشترك لمتجة ذو n من الابعاد من المؤثرات في فضاء هلبرت المعقد.

لێکۆڵینەوە لەسەر ماوەی ژمارەیی هاوبەش

کورتی

ئامانج لەم توێژینەوە پێناسەکرنی هێرمایت، هێرمایتی سەرپێچیکارو و نیمچە نەماو لە ئاڕاستەی خاوەن n دووری لە کاریگەریەکان لەگەڵ هەندێك ئەنجامی ماوەی ژمارەیی هاوبەش بۆ ئاڕاستەی خاوەن n دووری لە کاریگەریەکان لە بۆشایی هیلبەرتی ئاوێتە.

EFFECT OF VANILLA ON CHROMOSOMES AND GROWTH OF *VICIA FABA*

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ABSTRACT

Many studies had confirmed existence of relationship between food flavorants and occurring of many types of cancer such as stomach, liver and kidney carcinomas. In this study we found that synthetic Vanilla (vanillin) which is a food flavorant widely used in food industry and homemade pastry causes many types of chromosomal disorder in *Vicia faba* root tips cells such as gaps ,breakage, stickiness, translocation and braiding of sister chromatids .There was a progressive reduction in plant height, primary and secondary root length when plants treated with 0.2% , 0.5% ,1% , 3% , 5% concentrations of synthetic vanilla as a result of mitotic index reduction.In contrast to these results , the low concentration of 0.2%vanillin increased plant height and mitotic index .

KEYWORDS vanilla chromosome disorder plant growth.

INTRODUCTION

Vanillin (4-hydroxy-3-methoxybenzaldehyde) is a pleasant smelling aromatic compound occurs naturally in vanilla beans which is a tropical orchid plant (*Vanill planifolia*) grows as a vine and needs the support of trees[8]. Vanillin is also can be found in plants bound to sugar as glucoside. Another source is lignin a by product of paper pulp manufacture. It may be also prepared by synthesis.[4] It is used widely as flavoring additive for beverages, cooking and as an aromatic additives for candles, incense, potpourri, fragrances, perfumes and air fresheners at concentration ranging from 0.005% to 0.8% .

Effects of vanillin on different organisms and environments have been thoroughly studied, [8] as well it's safety and handling[10]. In many experiments has shown to be acute toxic to fish, [1, 11] Daphnia, [8] and reduced growth of many Algae species after 7,14 and 21 days of exposure[3]. Germination test with lettuce and cotton produced a great reduction in germination, while no effects was observed on wheat.[14, 16] Great reduction in weed seeds germination has been observed when treated with high concentration of the phenolic compound.[13] Substantial effects was observed in *Vicia faba* these were reduction of root length and mitotic index as well different types of cytological malformation and chromosomal aberrations.[18] High concentration of vanillin has also increased number of aberrations in human lymphocytes only when chromosome gaps are included.[7] Testing of vanillin mutagenicity in mammalian cells *in vitro* have shown positive effects in some testing systems.[8] In contrast to these observations vanillin is considered to be antimutagen, anticlastogen and anticarcinogen compound, It also inhibited non-homologous DNA end joining (NHEJ).[2] Vanillin also was able to inhibit mutation of the CD59 locus on human Chromosome 11 induced by hydrogen peroxide, N-methyl-N-nitrosoguanidine and mitomycin C (in human hamster mutations at the *hprt* locus induced by x-ray and UV.[2] In another study it seems that vanillin is a promising anti-sickling agent, it interact with hemoglobin and inhibits polymer formation [19]. The aim of the present study is to investigate the effects of vanilla on growth and chromosomes of *Vicia faba* as a lot of these investigations that have been done with these compound resulted in controversial conclusions.

MATERIALS AND METHODS

Concentrated solution of synthetic vanilla was purchased from local market, originally has been imported from Foster Clark's company Malta, It ingredients was; water, Glycol E1520, vanilla flavor, colour E150, with no alcohol added .The seeds of *V.faba* minor were obtained from local shop. 4-6 seeds were sown in small plastic pots containing sandy soil. After germination the seedlings were thinned to two plants per pot. Healthy plants of 2-4 cm in height were selected for the treatment with 6 different concentration of vanilla. These were arranged in randomized complete blocks design (RCBD) with 5 replicates, least significant differences (LSD) were used to test the differences between means. The used concentrations of aqueous solution of vanilla. were (0.00, 0.2, 0.5, 1.0, 3.0, 5.0 % v/v). 20ml of each concentration was used to water the plants three times in 3-4 days interval. Data then scored for the different parameters listed in table (1).

To determine the effects of vanilla on chromosoes, secondery roots of 1-2cm in length from non-treated plants were immerged in a freshly prepared aqueous solutions of vanilla. The concentrations were the same that have been used for watering plants. Root tips were treated with 0.01% of colchicin for three hours then they were fixed for 15 min, 1h ,18h after initiation of the treatments in acetic alcohol 1:3 fixative. Squashed root tips preparations were stained with Giemsa stain for cytological examinations. Data were recorded for percentage of dividing cells and chromosomal disorders.

RESULTS

Table (1) present effects of vanilla concentrations on different plant parameters.It's obvious that vanilla affected all parameters measured in compare with the untreated plants and there were significant differences between the means of the treatments. Generally,

when plants treated with concentrations of 0.2 and 0.5% of the aqueous solutions of Vanilla an increase in plant fresh and dry weight, fresh weight of the roots, plant height (cm) and primary root length were scored. The higher concentrations of the substance caused adversed effects on the plants and there was significant reductions in all parameters measured, table (1) and fig (1)

Table (1): effects of vanilla on different parameters of *Vicia faba*.

Vanilla Conc.% V/V	Plant Fresh Weight (G)	Plant Dry Weight (G)	Root Fresh Weight (G)	Plant Height(Cm)	Primary Root Length (Cm)
Control	6.43 a	1.18 b	3.75 b	9.63 c	15.75 a
0.2%	7.40 a	1.75 a	4.49 a	15.00 a	16.00 a
0.5%	7.54 a	1.68 a	4.59 a	13.88 a	15.48 ab
1%	6.42 a	1.04 b	3.62 a	11.88 b	12.50 bc
3%	4.56 b	0.83 b	2.23 c	7.25 d	11.63 c
5%	4.66 b	0.85 b	1.99 c	6.75 d	7.80 c

Means carrying the same letter has no significant differences according to Duncan test at P<o.o5

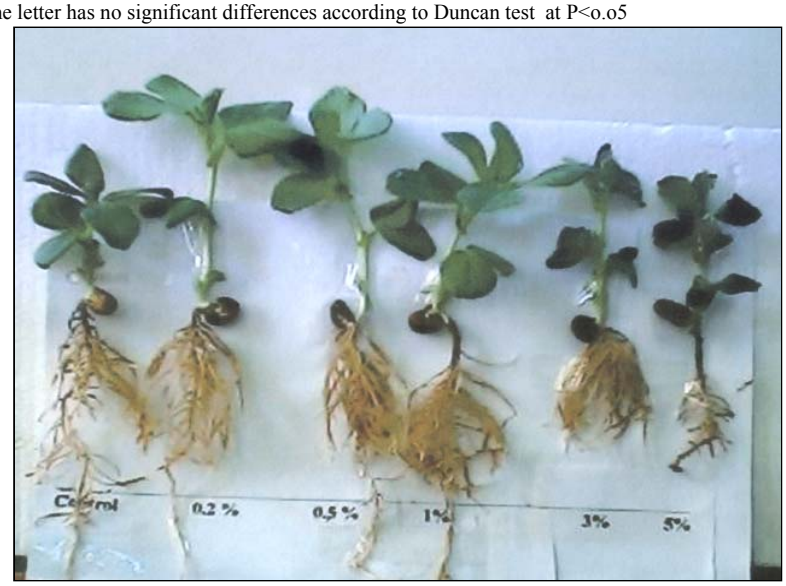

Fig (1): effect of different concentrations of vanilla solution on plant hight and root length

Table (2) presents effect of vanilla on the percentage of dividing cells in the root tips of *V. faba* exposed to the substance for different periods as well parcentage of cells at prophase and metaphase stages.

An increase in the percentage of dividing cells was observed only in treatment of 0.02% concentration of the substance and all other treatments caused adversed effects when compared with untreated root tips and this effects increased with extending period of exposure. The results also revealed that vanilla effects the percentage of cells at metaphase stage much more than anaphase stage specially when the time of the exposure to the substance was extended and the average of cells at metaphese reduced from 3.48% in 15 min treatments to 1.89% in one hour, treatments and to o.99 % in 18hour treatments while the reduction in the percentage of cells at prophase stage was much lesser.

Another observation seen in the experiments is that the adverse effects of vanilla started with the treatment of 0.5% concetration when root tips were directly exposed to the substance, while the adverse effects on the plant parameters generally started when the concentrations of the substance increased to 1% and more.

The microscopic examinations revealed different types of chromatid and chromosomal disordors. The types of damages occurred were gaps, twesting or braiding of sister chromatids. Increasing the concentrtion of Vanilla in the treatments, accompanied by increase in chromosome digestion fig (2). Other chromosomal disorders such as translocation, fragmentations, were occuring in lesser degree

Table (2): percentage of dividing cells, cells in metaphase and prophase stag

Vanilla Conc.% V/V	15 min of exposure			One hour of exposure			18hour			Total % Of Dividing Cells
	% of cells at prophase	% of cells at metaphase	% of dividing cells	% of cells at prophase	% of cells at metaphase	% of dividing cells	% of cells at prophase	% of cells at metaphase	% of dividing cells	
Control	5.52	4.91	10.43	5.92	4.88	10.80	5.76	2.58	8.33	29.56
0.2%	5.91	6.36	12.27	9.39	3.83	13.22	8.27	1.62	9.88	35.56
0.5%	4.22	2.82	9.04	4.70	1.92	6.62	3.73	1.24	4.97	20.63
1%	3.88	4.82	6.46	5.46	1.82	7.27	1.54	0.64	2.18	15.91
3%	3.01	2.26	5.26	1.94	0.97	2.90	1.61	0.63	2.24	10.4
5%	2.82	1.13	3.93	2.41	0.89	2.68	1.21	0.81	2.03	8.64
Average of treatments	3.97	3.48	7.39	4.78	1.89	6.54	3.27	0.99	4.26	

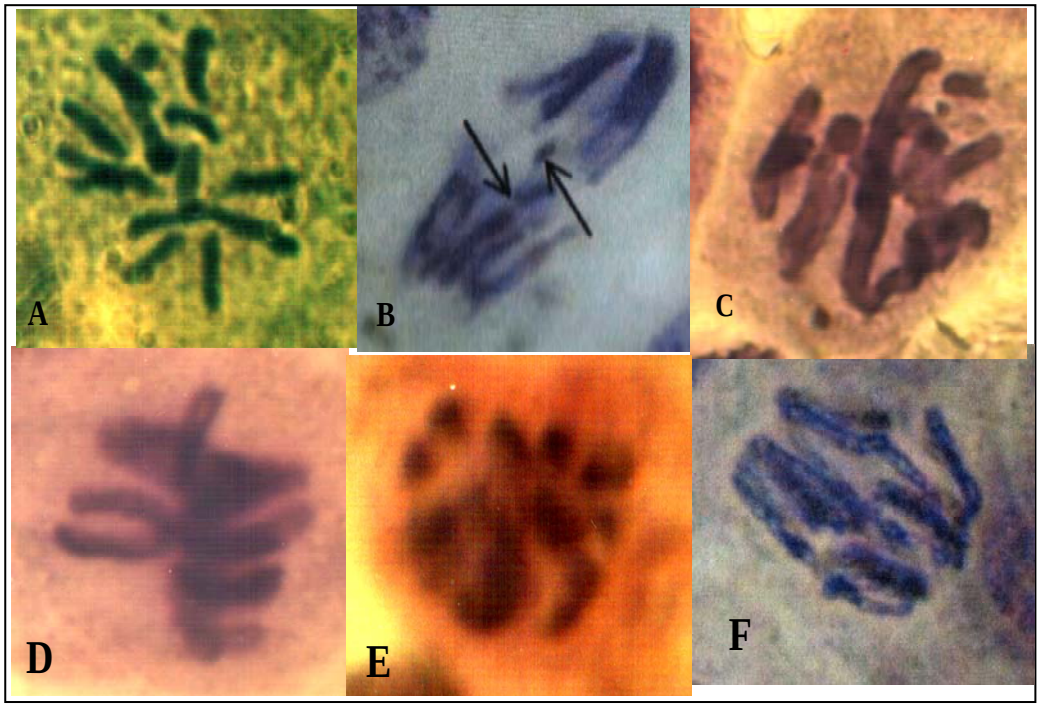

Fig (2): examples of aberrations induced in *V. faba* root tips by vanilla treatments (A) Normal Karotype (B) Gaps , (C) sister chromatid stickiness, D) Chromosomes stickiness , (E) Chromosome digestion , (F) Braiding of sister chromatids. Figuers; B,C&F were trated with the conc 0.5% vanilla D&E were treated with the conc. 1.0%

DISCUSSION

Many observations had confirmed the toxicity of vanilla when used at high concentrations to a variety of organisms such as plants, [17,13], earth worm *Eisenia foetid* [6] , fungi [12] , fishs ,[1,11] daphnia [9] and Algae, [3] and many other organisms reviewd in OECD screening Information Data Sets (SIDS).[8] The results of this experiments support the reviewed observations, and that using vanilla in a high concentrations will have a toxic effects, beside that we have noticed that long period of exposure even to low concentration of the substance will have an adverse effects, these remarks comes in agree with other observations mentioned. Never the less as we see from fig (1) and table (2) the concentration of o.2% of vanilla had stimulated plant growth and caused increases in all parameters measured, as well inculding percentage of dividing cells and percentage of cells in metaphase stage,table (2). These observations indicates the interaction of vanilla in some way in chromosomal condensation and spiralisation, more studies is needed to declare these roles as well it's interactions in the cell cycle phases. In this experiment we have used these concentrations for watering the plants in the pots , therefore It's sure that the amount of vanilla that have been absorbed by the plants is much lesser than the solution concentration and much of the substance had been absorbed by the soil it self. Therefore more studies needed to determine the exact concentration that stimulate plant growth and incrcases pecentage of the dividing cells. Perhapes we should use concentrations less than o.2% of the pure substance.

Many studies had considered vanilla to be an antioxidant agent [17] antimutagen [2] as well anti carcinogen. In another study indicated that vanilla inhibits Non-homologous DNA end-joining [5] while others have used vanilla to treat sickle-cells disease and it has shown to be apromising drug as anti-sickling agent. In the literature we can find a lot of controversial biological properties of the compound, this is true and it may be mainly due to different range of concentrations used . as we saw from the results in table (I)and (2) which support the controvesity effects of the substance on different characters included in the study. Therefore we suggest to de more investigations in the effects of this compound on different aspects of animal and plant cells and starting with very low concentration of pure vanillin. As we need to understand it's role at molecule and gene level, More good microscoscopy with high resolution studies is needed to acknowldge all detials about chromosomal disorders.

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تأثير مادة الفانيلا على كروموسومات ونمو نبات البافلاء Vicia faba

الخلاصة

العديد من الدراسات أثبتت وجود علاقة بين نكهات الأطعمة وظهور العديد من أنواع السرطانات منها سرطان المعـدة . في هذه الدراسة وجد أن مادة الفانيلا المستخدمة بصورة واسعة في الصناعات الغذائية والمعجنات تتسبب في العديد من الاضطرابات الكروموسومية في خلايا جذر نبات البافلاء مثل حدوث فواصل ، تكسر ، لزوجة ، انتقالات والتفاف الكروماتيـدات الـشقيقة حول بعضها ، فضلا عن ذلك وجود تنافس في ارتفاع النبات وطول الجذور الثانوية عند معاملتها بـالتراكيز 0.5 % ، 1.0 %، 3.0 % ، و 5.0 % وذلك نتيجة لتنافس الانقسام الخلوي ، وعلى العكس من هذه النتائج استخدام التركيز الواطئ 0.2 % من مادة الفانيلا أدى إلى زيادة في ارتفاع النبات ودليل الانقسام الخيطي .

كارتێكرنا ماددە ى ڤانيلا لەسەر كروموسوموكانى رەگى رووەكى وكەشەى رووە ك پاقلە Vicia faba

پوختە

زوربەى ليكولينە كان دە سەلينە بو وونى پەوندیك نيوانى تاملا خوارنكان و ديـاركردنى زوربـەى جوركـانى شـيربە نجـە لەنيواندا شيربە نجەى گـدە. لەم ليكولينە وە دا دە ركوت كە ماددە ى ڤانيلا بە كارەينراوە بە شيوە يـەكى فـراوان لـە پيـشە سازى خورانەكدا وهويركاندا دبنە هوى زوربە ى تيكدانەوى كروموسومەكان لە خانەكانى رە گى رووەكى پاقلە وەك رودانە وى جياكردن شكاندن،لى چبوون،ليك ئالاندن وكواستنەوەى كروماتيدكاني برادورى يەكدا.

سەرارای ئە وەش بوونى كەم بوونە لە بەرزبونى رووك ودريژى رەگى دووانيان كاتى بە كارهينانى خەستى يەكانى 0.5 ٪، 1.0 ٪ ، 3.0 ٪، 5.0 ٪ لە بەرئەنجامىكەم بوونە وەى بلـگەى دابەشبوونى راستە وخو وله بيجاوانى ئەم ئەنجامانە بە كارهينانى پە يتى(خەستى) نزم لە ماددەى ڤانيلا دە بيتە هوى زيادبوونى لە بە رزبوونى رووە ك و بلـگەى دابەشبوونى راستەوخو .

PLASMA SPRAYING COATING OF TUNGSTEN CARBIDE 12% COBALT TO REHABILITATE AIRCRAFT TURBINE VANES

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ABSTRACT

Robotic vacuum plasma spraying system from Plasma-Technik AG Company was used to rehabilitate vanes of aircraft turbine engines. Two types of vanes were chosen, one of them is stainless steel alloy (X II Cr Ni Mo 12) and the other is titanium. Vanes face hard conditions like high temperature and aerodynamics environment. The plate suffers from wearing, scratching, pitting, cracking, corrosion and misses clearance. Tungsten carbide- 12% cobalt powder from Amdry Company was used as a coating layer. Cleaning process was done by sand blasting and degreasing by chemical solvent, the roughness about 100-150 μm.

The optimum plasma spraying parameters were fixed after many experiments and evaluations. The superficial hardness, resistance to thermal cycling oxidation, resistance to thermal fatigue cracking, optical microscope and the adhesion evaluation were studied. The superficial hardness test reveals that the hardness of the blade was increases significantly after coating of the two types. The thermal cycling experiments results reveal that the adhesion of the coating layer is very good .

KEYWORD Plasma Spraying Thermal Behavior

1- INTRODUCTION

Operating conditions in aircraft engines are so demanded in terms of power-to-weight ratio and life time that the choice of materials with respect to properties can be critical. The choice of the base material depends on the creep and fatigue strengths that the material can provide at a given operating temperature. However, materials in aircraft engines are subject to surface phenomena, such as oxidation, corrosion, carburization or wear. Materials chemistry provides the mechanical properties but does little to provide sufficient resistance to surface phenomena. This problem is solved principally by the use of a thin layer of a second material (coats) applied to the component surface by plasma spraying which provides resistance without degrading the mechanical properties of the substrate [1]. Oxidation and hot corrosion of coatings continue to be major factors limiting the life of the turbine airfoils in aircraft gas turbine engines [2]. The development of gas turbine material, in particular super alloys, has been extensively reported in the literatures [3-7] and, therefore, will not be described in detail in the present paper. It is now a generally accepted practice to apply surface coatings to high temperature components in gas turbines. The two principle reasons for the application of surface coatings to high temperature component are:

(i) To maintain component shape.

(ii) To ensure that the component is capable of operating for design life time.

Obviously, the development of coating system to satisfy the complete range of property requirements would be extremely difficult to accomplish and a more realistic approach involves the use of systems offering a compromise between the required properties [8].The successful application of plasma sprayed coating depends upon the optimization and control of the spray powder,the spray parameters and the deposition procedure. Quite often, however, the spray powder is pre-determined by a particular industrial satisfaction and so the required coating properties must be achieved purely by optimization of the process. The central feature of the spraying process concern the heat and momentum transfer from the plasma to the powder. In general, the plasma characteristics are selected in order to enhance particle velocity while, at the same time, insuring that the particles are sufficiently heated. A balance is thus required between plasma gas velocity (and hence particle velocity and dwell time) and the thermal properties of the gas (enthalpy and heat transfer) [9]. The balance is made according to the material properties, the powder size range and the powder size distribution. For spray powder which contains more than one constituent, for example WC-CO, this balance becomes more difficult to achieve. In particular, care must be taken to minimize natural interaction within the powder particles and the formation of unwanted, mixed phases [10]. Such considerations mean that there is generally less latitude in parameter selection and has in the past led to difficulties (due to poor process control) in terms of both ultimate coating quality attainable and the reproducibility of the coating. Plasma spraying plays an important role in the researches till now [11-13]. Consequently, one can consider that the plasma spraying technology can give a good solution to rehabilitate the vanes of the aircraft turbines.

2-MATERIALS AND EXPERIMENTS

2-1- Sprayed Powder

Tungsten carbide-12% cobalt blended powder (WC-12% Co) was used as a sprayed powder. Its particle size ranges from 20 to 70 μm. The 12% cobalt plays an important role in the process and it is considered as a binder of the tungsten carbide powder.

2-2-Substrate

Two types of vanes were chosen as substrates, the one is stainless steel type (XIICrNiMo12) and the second one is titanium alloy type (1 M 1550)

2-3- Spraying System

Fully automated robotic plasma spraying system was chosen from Plasma Technik GMBH in

Switzerland. The type of plasma controller is A 3000 S and the gun power is 40 KW.

Plasma spraying is a line-of-sight process, which involves the injection of powder into a high temperature plasma jet.The coating consists of a collection of molten or semi molten particles which are deposited from the plasma according to the morphology of the substrate or the previously deposited material. Related movement of the torch to the component provides deposition over the area to be coated. Plasma spraying is carried out in a vacuum. Computer controller powder feeder was used to feed the powder at a constant rate into the plasma torch.

2-4- Sample Preparation

Sand blasting of the surface to be coated is considered the most important way to have a good adhesion property of the coated layer. The roughness range was from 100 to 150 μm, followed by chemical cleaning(degreasing solvent)and using ultrasonic bath.

3- RESULTS AND DISCUSSION

Using above mentioned Robotic vacuum plasma spraying system with 4VB gun and power 40 KW, several attempts were made to find the optimum parameters of spraying process. The optimum parameters were:

Spraying pressure (under controlled Ar gas)	**70 mbar**
Plasma gas :	**Argon 99.999% 50 lit/min**
Plasma gas : Hydrogen	**9 lit/min**
Plasma current	**650 amp**
Gun	**4 VB**
Spraying distance	**170 mm**
Nozzle Diameter	**1.8 mm**

The coating thickness was 150 μm and the substrate before spraying was at room temperature.
The test procedure comprised the following:

a- Superficial Hardness

The superficial hardness was taken after calculating the average of five readings of each sample.Table 1 shows the superficial hardness.

Table (1):- superficial hardness of Vanes before and after spraying.

sample	superficial hardness before spraying	superficial hardness after spraying
Titanium	73 R15N	81.8 R15N
Stainless steel	70 R15N	81.5 R15N

The results are similar to those reported by Grinell and Chandler [14].

b- Thermal Behaviors

Vanes in aircraft gas compressor faces a wide variety of thermal and mechanical loading during service. According to these conditions one has to exam the thermal behavior of coating layer and can be summarize as follow:

a- Resistance to thermal cycling oxidation.
b- Resistance to hot corrosion.
c- Resistance to thermal fatigue cracking.

The following experiments have been carried out to exam the above thermal behavior of the coating layer.

Experiment (1) :

Rehabilitated samples were heated up to 250 C° for 10 minutes and cooled to room temperature. This process was repeated three times. After that the coated layer was tested by using optical microscope (X 200 magnifying). No crack appears. In addition to that the samples weighted before and after the heating process and there was no weight loss.

Experiment (2):

The experiment(1)was repeated by heating the samples up to 400C°and cooling to room temperature. The same results as in experiment (1) were obtained.

From the above results one can conclude that the coated layer can resist the thermal cycling, thermal fatigue cracking and hot corrosion. In addition to this result one can conclude that the adhesion of the sprayed layer was very good.

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طلاء الرش البلازمي لالتنكستن كاربيد – 12% كوبلت لتأهيل دوارات الهواء الخاصة بتوربين الطائرات

الخلاصة

استخدمت منظومة الرش البلازمي ذات الذراع الألي من شركة Company Plasma-Technik AG لاعادة بنـاء دوارت الهواء الخاصة بتوربين الطائرات.

اختير نوعان من دوارات الهواء احداهما مصنعه من سبيكة الحديد المقاومة للصداء نوع stain less steel alloy (X II Cr Ni 23) Mo والاخرى من التيتانيوم. دوارات الهواء تعمل تحت ظروف قاسية جدا من درجات حرارة ومحيط من الديناميكية الهوائيه. دوارات الهواء تعاني من السوفان و الخدوش و التنقر و الفطور والتاكل.

استخدم مسحوق التنكستن كارباید مع 12% كوبلت من شركة Amdry لغرض تحضير طبقة الطلاء.عملية تنظيف دوارات الهواء المستخدمة تمت باستخدام جهاز القصف الرملي للحصول على خشونه مقدارها 100- 150 مايكرون ومن ثم استخدام مواد كيميائية لغرض ازالةالدهون للحصول على سطوح نظيفة.

بعد العديد من التجارب تم تثبيت متغيرات الرش البلازمي المثلى. تم اعتماد الصلادة السطحية، مقاومة التاكل ، مقاومة تصدع الاعياء الحراري وتقيم التصاق طبقة الطلاء لتحديد كفاءة الطلاء. أظهرت فحوصا ت الصلادة السطحية أن الصلادة الـسطحية للدوارات المعاد بنائها قد ازدات بصورة واضحة بينما أظهرت نتائج تجارب التكرار الحراري ان طبقة الطلاء ذات التصاق جيـد جداً.

قاتكرنا رەشاندنا پلازما یێ ب (Tungsten Carbide 12% Cobalt) بوشياندنا یە روانێت توربابنێت باله فرا

كورتى

دڤێ ڤەكولینێدا سیستە مێ رەشاندانا پلازما یيێ یێ خودان دە ستێ روپوتى هاتە بكارئینان ژ كومپانیا Plasma-Technik AG بو شیاندنا پەروانێت تورپاینێت پال فرا. دوو چورێت پەروانە هاتنە یكارئینان ئیك ژوانا ژ پولایێ یيێ دى ژەنگك (X II Cr Ni Mo 12) یيێ دى ژ تیتانیومى. كاركرنا ڤان پەروانا ل پلێت گەرماتێت بەرزو ناڤەندا دایناميكا بایيێ توشى وەستیان، ڤەرەنین ، نكلاندن ، دەرزین، ژێك خوارن و پیس بوونێ دین. هویركێ (Tungsten Carbide 12% Cobalt) ژ كومپانیا (Amdry) هاتە بكارئینان بو قاتكرنا پەروانا. شویشەبەرك وتوێنەرێت گیماپى هاتنە بكارئێنان بو پاڤژكرنێ وحلیكرنا وان نزیكى 100-150 µm.

باشترین پارامێەریت رەشاندنا پلازمایێ هاتنە دەستنیشانكرن پشتى چوندین تاقیكرن وحەلسە نگاندنا. رەڤاتیا روى، بەرهەلستیا ژەنگاربوونێ مابەرهەلستیا ماندي بوونا دەرزاندنێ و هەلساندنا ستركیێ هاتنە ڤەخواندن. ژئە نجاما دەركەڤت كو رەڤاتیا روپێت پەروانا زێدە دبیت پشتێ ڤانكرناوان ب هەردوو جورێت ڤاتكرنێ وهەروەسا ژ تاقیكرنێت گەرماتیا گەردار ویاربوكو سترکى ژ كەلەك یا پاش بووپشتى قاتكرنێ.

TRANSMISSION ELECTRON AND OPTICAL MICROSCOPES INVESTIGATION IN THE LASER AND HEAT INDUCED CRYSTALLIZATION OF GeSe AND $GeSe_2$ THIN FILMS

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ABSTRACT

A stoichiometric amorphous GeSe and $GeSe_2$ thin films have been prepared by thermal evaporation. The as deposited and after heat treatment films, from room temperature to above the crystallization temperature were examined, by optical and transmission electron microscopes. Laser pulsed beam of various powers have also been used to induce crystallization. Electron diffraction revealed an exact distribution of crystalline spots over halo rings. These observations indicated that the crystallization of both compounds did not accompany by changing atomic bonds but a rearrangements of atoms lead to crystalline state.

KEYWORDS The Films Crystallization

1-INTRODUCTIONS

The work in chalcogenides is in progress since late sixties after the discovery of switching and memory effect [(1)]. The composition of chalcogenide systems, in general, have no limits [(2)] consequently their physical properties have no limit as well, therefore we observe nowadays that chalcogenide entered most of the sophisticated optical and electronic device [(3)]. From the point of view that a binary system could give different measurable physical properties, depending on the thermal history and the method of preparation, such as energy gap and electronic conductivity[(4)].It has been pointed out [(5)] that Ge_XSe_{1-X} system form amorphous state from X=0 to about X=0.42, and as X changes the optical and electrical properties change as well.

The germanium monoselenide GeSe has a distorted NaCl type structure i.e. an orthorhombic structure in the crystalline state in which each Se atom has three Ge neighbors and vise versa. On the other hand claims that GeSe exists in three different configurations i.e.orthorhombic, cubic and hexagonal. [(6)]

The germanium diselenide $GeSe_2$ is of monoclinic structure in the crystalline state while the amorphous state has a tetrahedral unit with random distribution of Ge and Se atoms[(5)]. However it is believed that there are wrong bonds in GeSe[(7)]. The wrong bonds may be arises from the history of $GeSe_2$ thin films, because the as deposited GeSe is amorphous this means it is not necessary to have a continuous GeSe bonds only without Ge-Ge or Se-Se bonds[(8)]. However such bonding should rarely take place in a-state, if the preparation condition are well controlled, Al-Jeboori[(9)] in our laboratory have showed that x-ray analysis of the thermally crystallized a-GeSe and a-$GeSe_2$ thin films each has exact stoichiometric structure, and each may undergo rearrangement of atoms on crystallization.

The state of the art of the a-c transition is the fact that the switching and memory effect in the a-state are attributed to the a-c transition[(10)].

Haro et al [(11)] carried out laser-induced glass transition study of $GeSe_2$, they pointed out that there is a threshold radiation power below which no crystallization takes place. Above the threshold power, three stages of transformation took place the first stage was identified by the creation of sub microcrystallines embedded in a continuum amorphous state. The second stage was identified by the appearance of clusters of different sizes; however the system did not show a stable crystalline state because up to this stage the change is fully reversible. The crystallization was characterized by the coalesce of the clusters or the sub micro-crystallites to form crystallites this was considered as the third state. Griffiths et al investigated the kinetic barrier which inhibit the crystallization of glassy materials, they, also identified more than one stage of transformation, which degenerate to the account of the vitreous state on removal of the effect, for $GeSe_2$ they tested it by using 1.9 eV radiation which is below its band gap (2.2 eV). The penetration depth at the 1.9 eV laser energy was 30 μm, whereas when 2.4 eV laser energy was used [(11)] the penetration depth was about 0.5 μm the large difference may be attributed to the formation of large coalesced crystallites which prevent the laser beam from penetrating while for 1.92 eV the crystallites are small enough that the laser beam could penetrate to a relatively, large depth.

GeSe synthesization and crystallization has been investigated by laser irradiation [(6)]. GeSe has a direct band gap of 1.53 eV and indirect, 1.16 eV. A pulsed irradiation 15 and continuous laser beam of power 2.5 W for 10s were used at a fixed position, the sample had been crystallized; the spectrophotometer showed a direct band gap for GeSe of ~1.54 eV. The color of the film was brown. On the other hand a laser power of 1.7 eV was also enough for transformation of GeSe and the color of the film get yellow.

Investigation the phase transformation of $Ge_2Sb_2Te_4$ system by a femtosecond laser exposure. The morphology and contrast of marks written in both amorphous and crystalline backgrounds by single fs pulses were characterized using an optical microscope [(14)].

In this work a stoichiometric compounds of GeSe and $GeSe_2$ were deposited onto glass and NaCl single crystal substrates for variable measurements. The crystallization process has been performed by thermal heating [(9)] and by pulsed laser beam of variable powers. Transmission electron microscope were used to examine the crystallization,

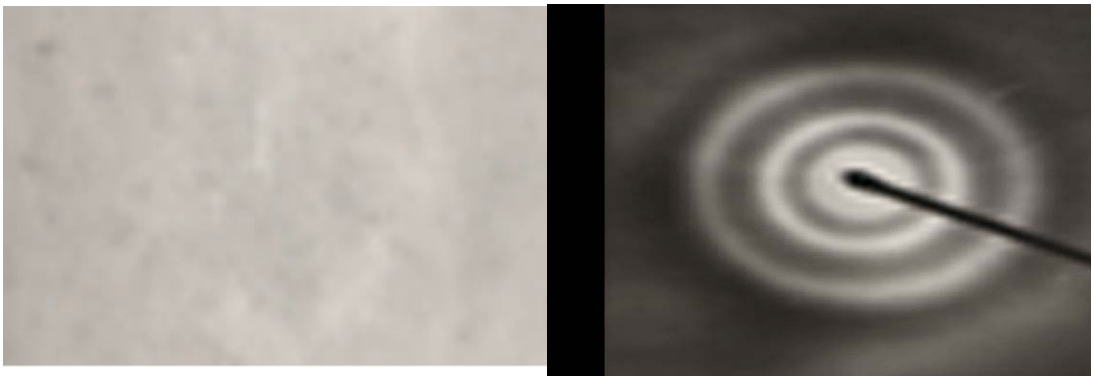
2. EXPERIMENTAL WORK:-

The alloys of GeSe and $GeSe_2$ were prepared in quartz tube, sealed under vacuum and melted in a furnace at temperature well above the melting point of the Ge and kept in the melt state for about 3-4 hours, then quenched in cold water. The alloys were examined by X-ray, GeSe appeared to be orthorhombic with one peak belong to the cubic structure of the same compound and $GeSe_2$ is observed to be amorphous. GeSe and $GeSe_2$ thin films were prepared by thermal evaporation from molybdenum boats on glass and single crystal NaCl substrates for variable measurements. For transmission electron microscopy (TEM) examination the thin films were prepared on single crystal NaCI and get floated off on a distilled water and picked up on a TEM copper grids, X-ray analysis as well as the electron diffraction pattern were the tool to demonstrate the a- and c-states of the as deposited films and laser or heat treated films at different temperatures, in order to find the exact temperature of transformation and the effect of different laser power on the structure of the films.

3. RESULTS AND DISCUSSIONS;

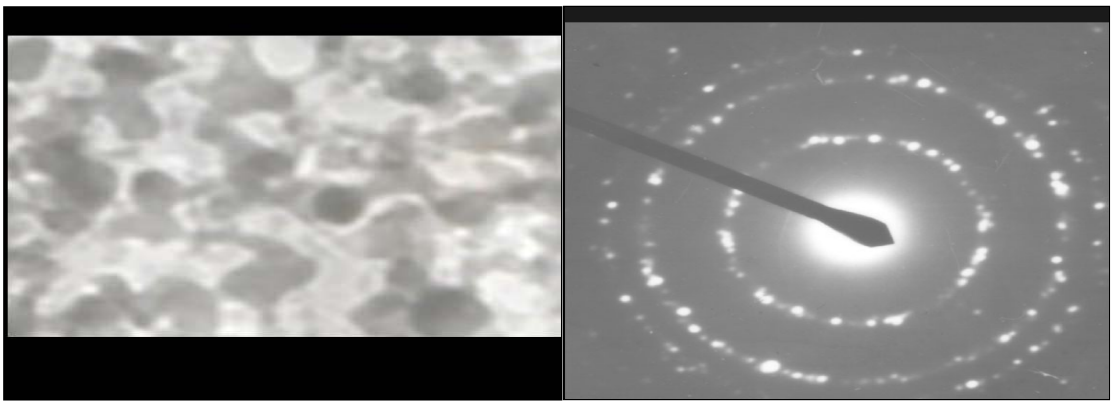
3.1 Thermal treatment

The as-deposited GeSe and $GeSe_2$ have been found to be amorphous when examined carefully under the electron beam. $GeSe_2$ films annealed up to 573 K were still amorphous as shown in fig (la) and its diffraction patter fig. (1b) in which four halo rings appeared. Similar results were obtained for GeSe. It is also remained amorphous up to 573 K, i.e. the energy barrier of crystallization could not be surmounted at 573 K. If we assume in the course of heating that sub micro crystallites were formed, as has been pointed out by Haro et al [11] they would had been annihilated to a-state when cooled down to room temperature, unfortunately a heating stage in the TEM was not available to testing this claim, but the resistometric measurements of Al-Jeboori [9] in our laboratory did not show any deviation from the linear behavior of the plot $\ln\sigma$ vs 1/T where σ is the conductivity, T absolute temperature, before the onset of the crystallization. This could cast doubt over the degenerousy of the transformation below the threshold temperature. Heating to 623 K $GeSe_2$ crystallized to a c-state as shown in fig. (2a), which obviously composed of hexagonal shaped crystallites large enough to give rise to a diffraction pattern of spotted rings as shown in fig. (2b). this kind of diffraction pattern is hexagonal close packed and indeed no orthogonal structure has been observed for $GeSe_2$ annealed at 623 K. This finding is in agreement with the observation of Antoniades and Joliet [6] for $GeSe_2$.



(1a) (1b)

Fig (1a,b):- Electron micrograph and its diffraction pattern showing the a-$GeSe_2$ state at 573 K.

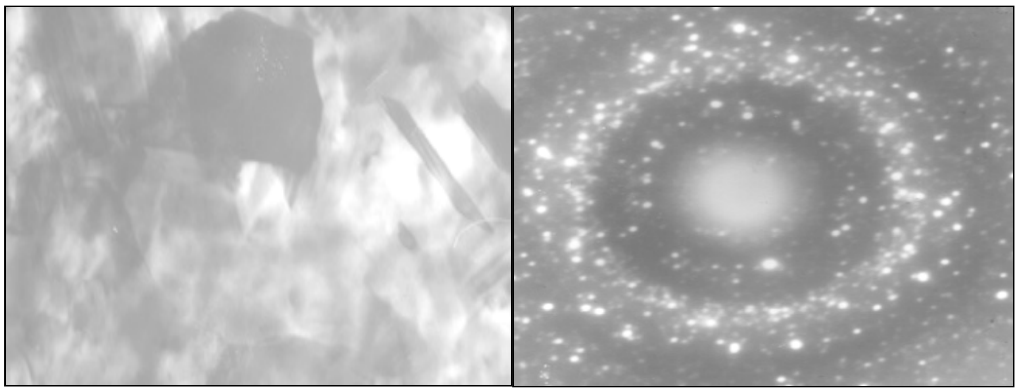


(2a) (2b)

Fig (2a,b):- Showing the crystallized $CeSe_2$ at 623 K and the related diffraction pattern.

.

GeSe I s observed to start crystallization at 585K as shown in fig. (3a). But its diffraction pattern revealed a features of crystallites embedded in an amorphous matrix as shown in fig. (3b), where the spots are randomly distributed over the halo rings. We believe that such sort of diffraction pattern may arise from multilayer platlets which are randomly oriented. The texture of such pattern my be bcc and hexagonal. The X-ray analysis of such films [9] did not reveal rhombohedral [12] or orthorhombic structure [6]. It may lead us to assume that the yield crystalline structure depends on the amount of energy (heat in this case) given to the atoms to rearrange themselves, so long as the stoichiometric composition of GeSe or $GeSe_2$ is reserved in the polymorphic states as indicated by the ASTM Cards [9]and ref. (6) and the references sited their.

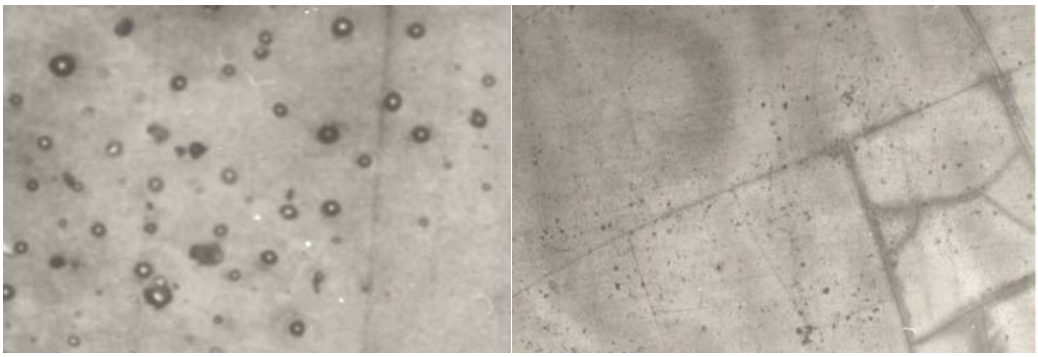


(3a) **(3b)**

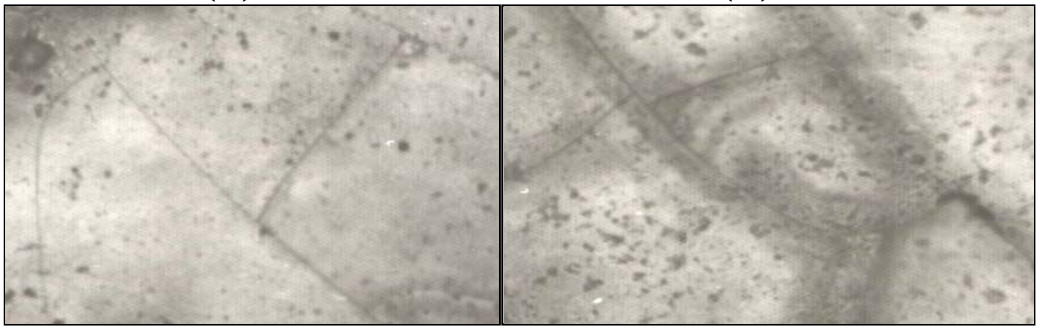
Fig (3a,b):- Electron micrograph shows GeSe crystallites embedded in an amorphous matrix as evidenced from its diffraction pattern after treatment at 585 K.

3.2 Laser Treatment:-

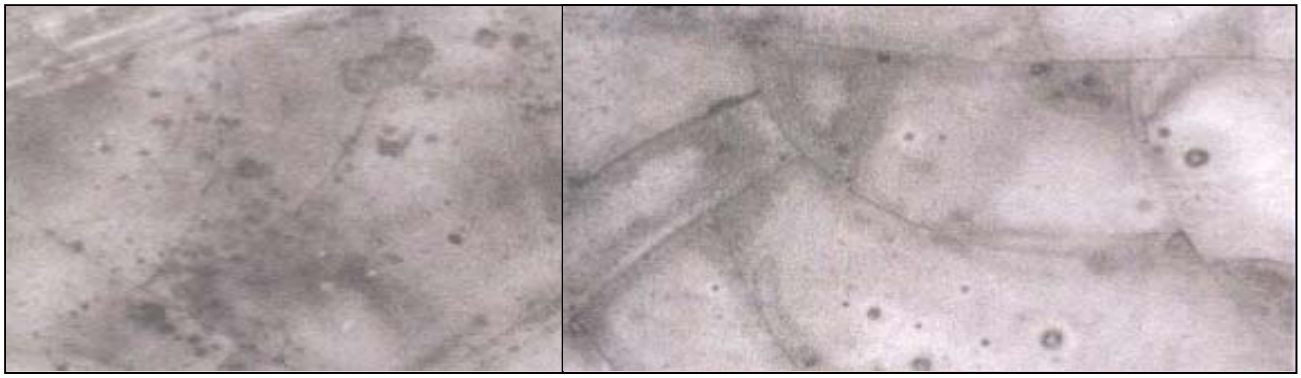
Pulsed laser Nd-Yag laser beam (300 μs) of different energies (0.15-1.0) J have been used to process GeSe. The processed samples were examined by optical microscope, the results are shown in figs 4a-4f, the power used for each sample is as indicated in the captions, the magnification of these figures was X1500. Clearly the low energy pulse has only pinned the sample while higher energies, in addition to that, divided the matrix to domains and the nucleation appeared to be favored at the boundaries of the domains. The $GeSe_2$ pattern of crystallization was almost the same, the 0.1 J laser beam has just created pin holes as in fig. (5a) while higher powers 0.8, 1.28, 1.8 J induced crystallizations and created domains as shown in figs. (5b,c,d) without pin holes, apparently energy of 0.8 J and more could cycle the a-state to the crystalline and back to a partially crystallized matrix as we will be stated in discussing the TEM examination.



(4a) **(4b)**

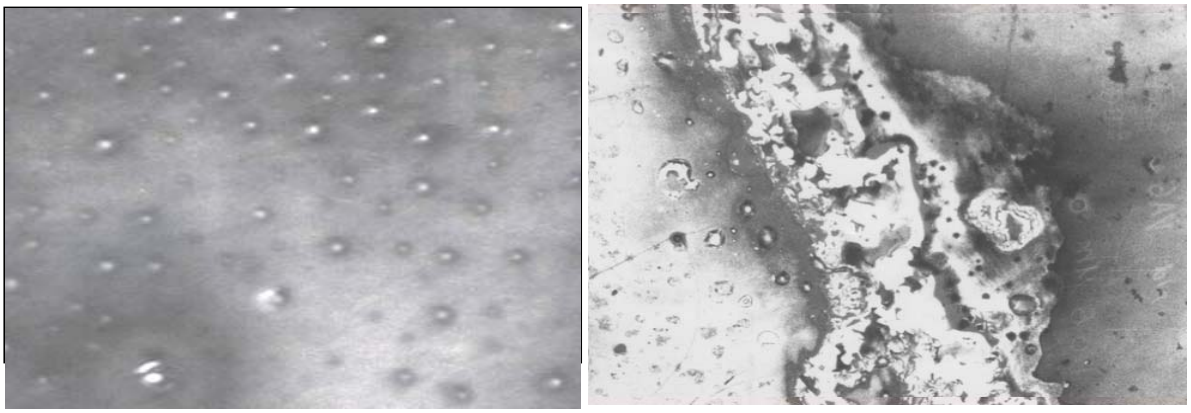


(4c) **(4d)**

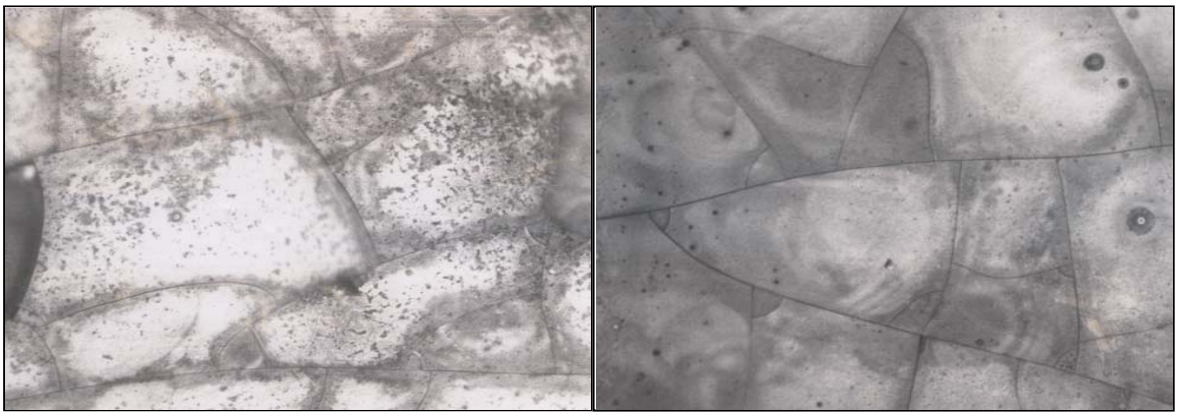


(4e) **(4f)**

Fig (4a-4f):- Optical microscope image (mag. X1500) of GeSe showing treated in sequence by 0,15, 0.3, 0.4, 0.5, 0.8 and 1.0 J ulsed aser showing the growth is preferable on the boundaries of the domains.



(5a) **(5b)**

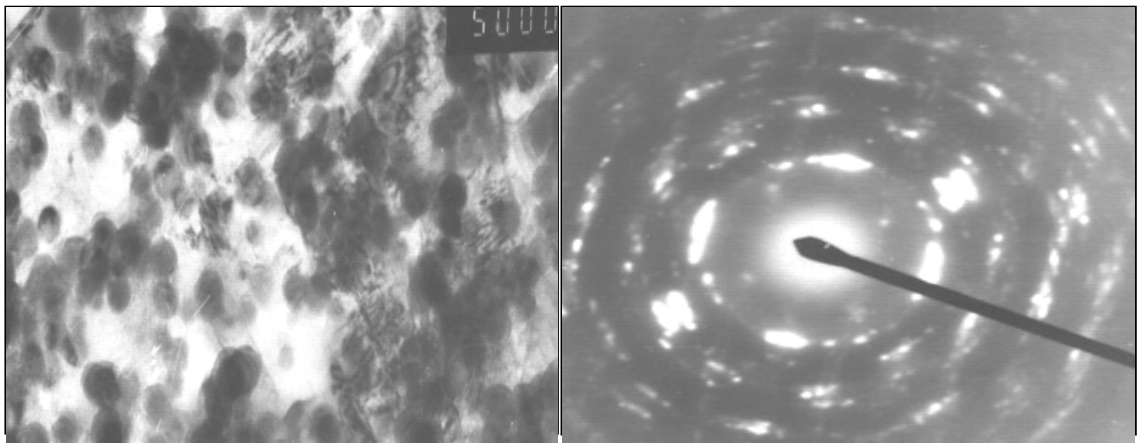


(5c) **(5d)**

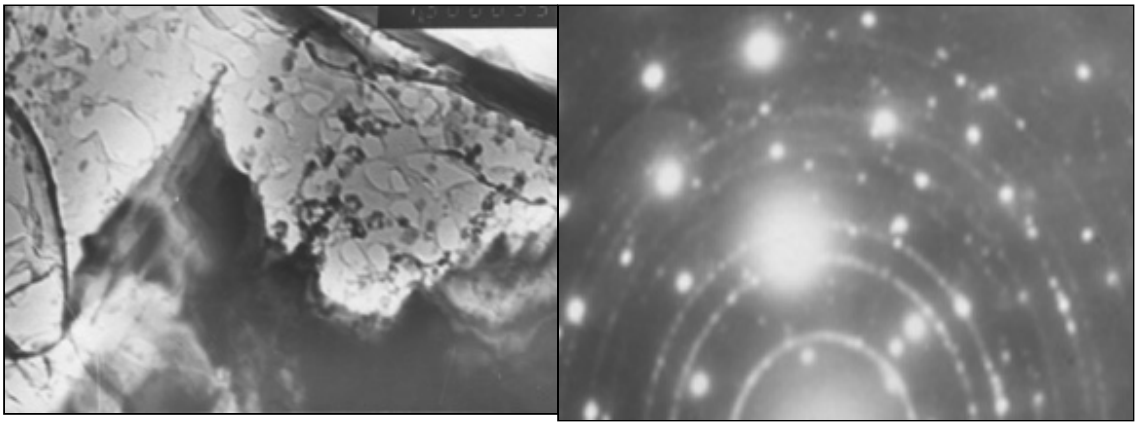
Fig (5a-5d):- Optical microscope images of $GeSe_2$ showing the pattern of its crystallization after laser treatment with energies 0.1, 0.8, 1.2 and 1.8 J respectively

Another range of treatment of GeSe for electron microscopy has been carried out, namely with 0.3-1.9 J. In the series of figures (6a-6g) we exhibit the treated samples with 0.3, 0.4, 0.5, 0.6, 0.9, 1.1 and 1.9 J respectively. It is very clear that 0.3 J for 300 μs has led to formation of uniform hexagonal size particles most of them are overlapping one over the other composing two or three layers as shown in fig. 6a. On the other hand some of the islands have different orientation or what is called double positioning [13] with respect to the other, such that when they coalesced, they formed a triangular side shape island and a double positioning boundary is formed. It is more likely that the driving force of such boundary energy is that of the boundary energy. The diffraction pattern of fig. 6a reveals its texture. Figure (6b) shows a micrograph and its diffraction of a sample treated with 0.4 J (300 μs). Obviously this pulse rendered the grain size much larger and crystallized completely the whole area of incidence. This could be inferred from its diffraction pattern which showed a very fine spotty rings with the spots more significantly indicating the domination of single crystalline phase which is mostly here hexagonal. Also in this figure we can observe the a-c boundaries. It is interesting to note the effect of 0.5 J laser pulse,

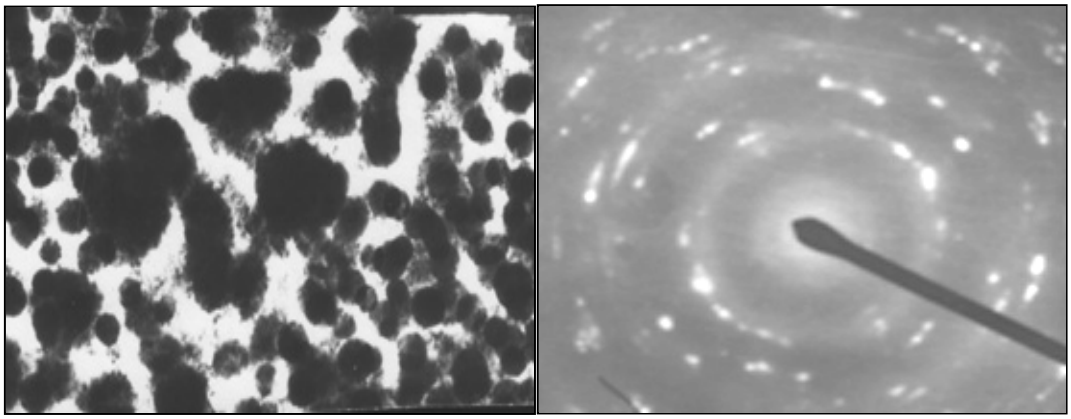
although the crystallites are much larger diameter 4.5 µm, fig. (6c) but their diffraction pattern revealed a crystalline phase superimposed on amorphous phase. This lead us to deduce that the laser energy (0.5 J) pulse enhanced the formation of large grains and in the same time was high enough to either distort the lattice or rendered the crystallites instantly after formation to the amorphous phase. The 0,6 J power laser pulse changed the a-GeSe thin film to double layer islands as shown in fig. 6d the double layer islands are inferred from the diffraction layer of fig. 6d. However an amorphous phase is a clear grown in the diffraction pattern. Figure (6e) shows the effect of 0.9 J laser pulse on the a-GeSe phase. Obviously the islands are much larger than the previous figures to the extent that it produced a clear single crystalline diffraction pattern in the (111) direction as well as a prominent amorphous phase as a base of the spotted diffraction pattern. It is a quite interesting in this figure to note that the diffraction rings of the crystalline phase are exactly coincides on the diffused rings of the amorphous phase. Thus the fig. (6e) is a definite indication that the coordination's of the amorphous phase are the same as the crystalline phase, and the crystallization is a mere shifting of the atoms and not interchanging the atomic positions that is there is no wrong bonds as stated [8]. Increasing the laser power to 1.1 J produced a similar to the previous pattern but a little bit smaller islands with less significant crystalline phase and more dominant amorphous phase as shown in fig. (6f). Further increasing the laser power pulse to 1.9 J did not produced significant crystalline phase but a very faint spots distributed over the amorphous diffused rings as shown in fig.(6g). The feature of the micrograph of fig, (6g), as it is different from the pre-processed one, presumably similar to fig. 1 oblige one to assume that the laser power of 1.9 J has taken the a-GeSe solid state to the melt momentarily and then back to a-solid state after the pulse period. Thus we find our selves forced to deduce that the a-GeSe and a-$GeSe_2$ are suitable materials for memory and switching effect [15], since one pulse could take it to the crystalline state and the other to set it back to the a-state, on the one hand, and the a-c transition means it could be taken from the high resistance state to the low resistance state.



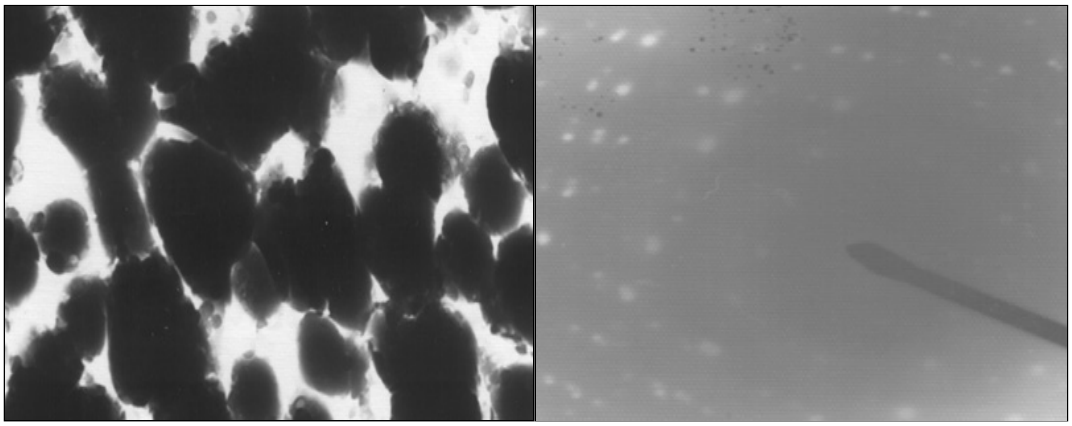
(6a)



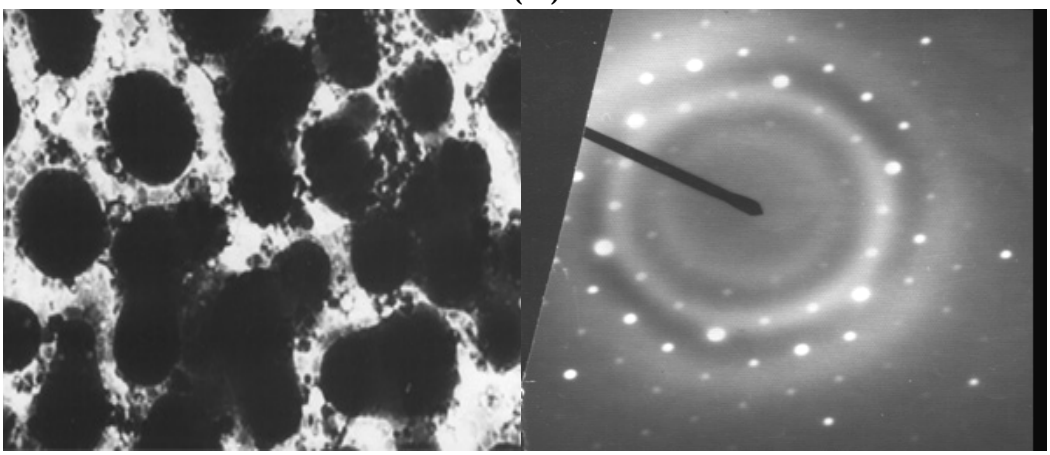
(6b)



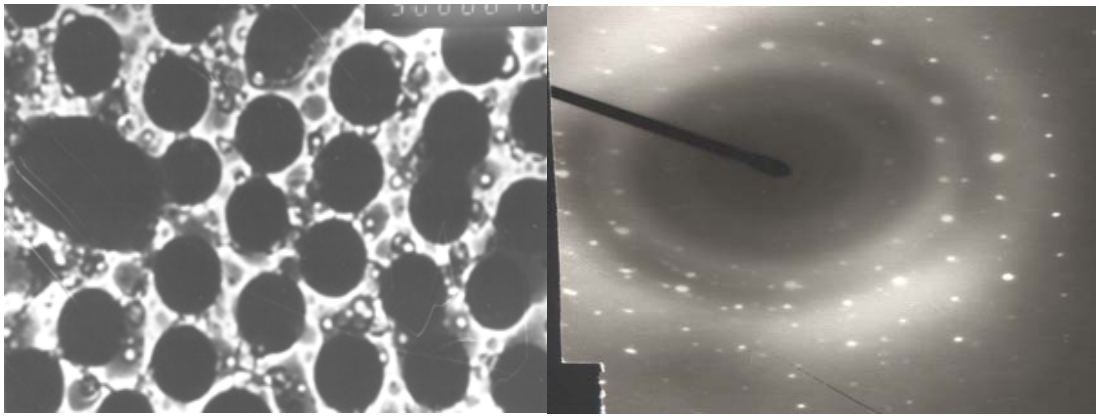
(6c)



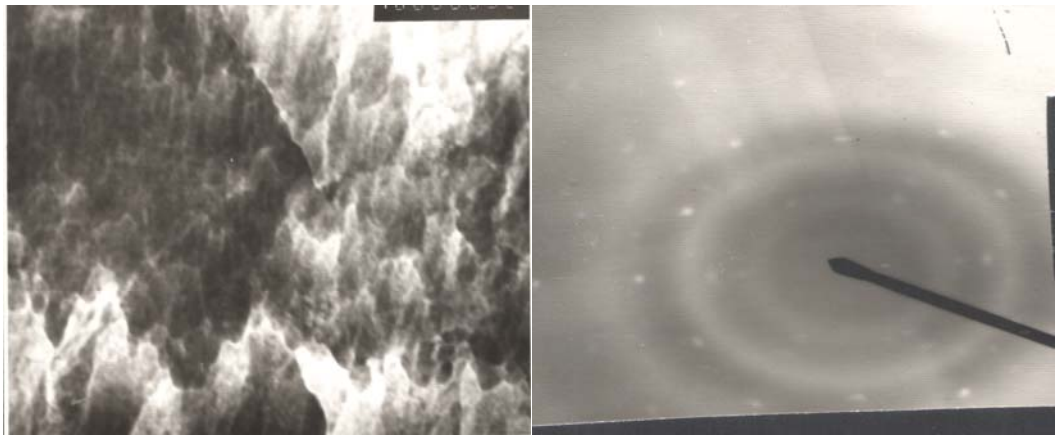
(6d)



(6e)



(6f)



(6g)

Fig (6a-6g):- Series of electron micrographs and their diffraction pattern showing the development of crystallization of a-GeSe thin films after treatment with Nd-Yag laser pulses for (300**s)** of different powers; **(a)** 0.3 J, (b) 0.4 J,**(c)** 0.5, (d) 0.6 J, (e) 0.9 J, **(f)** 1.1 J, and **(g)** 1.9 J.

CONCLUSIONS

Our results showed that the laser beam could play the same rule of heating that could be a good tool for a-c transition, but it must be taken with careful consideration. Because using laser power beyond, a threshold power, it could take the texture to a mixed a- and c- phases or melt the material and become amorphous solid after the pulse is over. Another interesting point has been revealed from the electron diffraction pattern that the coordination number in the crystalline and amorphous phase are the same and the bonds are between different atoms and not between similar atoms.

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فحص ا هر الالكتروني النافذ والضوئي لتبلور اغشية GeSe و $GeSe_2$ المستحثة بالليزر وحراريا

الخلاصة

تم تحضير اغشية رقيقة من نوع GeSe و $GeSe_2$ المتجانسة بطريقة التبخير الحراري. درست الاغشية المحضرة بدون معالجة و الاغشية المعالجة حراريا من درجة حرارة الغرفة الى اعلى من درجة حرارةالتبلور باستخدام ا هر الالكتروني الماسح والضوئي. تم استخدام الليزر النبضي وبطاقات مختلفة لحث عملية تبلور الاغشية.اظهر الحيود الالكتروني توزيع منتظم لبقع التبلور فوق هالة حلقات الحيود الالكتروني. هذة الملاحظات تشير ان التبلور لكلا الغشائين لايصاحبة تغير بالاواصر الذرية ولكن فقط اعادة ترتيب الذرات يقود الى تبلور الغشاء.

بكارئينانا ميكروسكوبێت ئەلكترونى يا دەربازبوى و بيناهيێ بو پشكنينا بەلوربونا پەردێت تەنك ($GeSe_2$ و GeSe) ب هاندانا ليزەرێ و گەرماتيێ

كورتى

دڤێ ڤەكوينيدا پەردێت تەنك ژجورێ $GeSe_2$ و GeSe ييێت هەڤيەك هاتنە ئامادەكرن ب رێكا هەلەماندنا گەرمێ. ڤەخواندنا هاتنەكرن لسەر پەردێت تەنكێت نەچارەسەركرى و پەردێت چارەسەركرى ب گەرماتيێ هەر ژ پلاكەرماتى يا ژورێ بو پلا گەرماتى يا بلند تر ژ پلا بەلوربونێ ب رێكا مايكروسكوپا ئەلكترونيێ يا يادەربازبونيێ وبيناهيێ. هەروەسا ليزەرا برتە كري ب ووزێت جوداجودا هاتە بكارتينان بو هاندانا بەلوربونا پەردێت تەنك. دابەشبوونا خالێت بەلوربونيێ ب شێوەيەكيێ رێك وپێك لسەرخەرمانا بازنێت لادانا ئەلكترونيێ هاتنە ديتن. ژڤان تێبينى يا دەركەت كو بەلوربون بوهەردوو جورێت پەردێت تەنك نابنە ئەگەرێ گهورينا گرێدانا گەردىلا بەلكو د بنە ئەگەريێ دووبارە رێك و پێك بونا گەردىلا و پەيدا بوونا بەلوربونا پەردێت تەنك.

EFFECT OF SOIL DEPTH ACCUMULATION, FERTILIZER LEVELS AND TIME ON THE GROWTH AND SEED YIELD OF *GUNDELIA TOURNEFORTII* L.

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ABSTRACT

This experiment has been conducted for the first time at the Grdarasha research field station in Erbil during the years 2001-2005 to study the growth and yield response of wild plant *Gundelia tournefortii* L. and the effect of depth of soil accumulation on residual roots of previously growing plants for experimental purposes. This plant is used as a fresh vegetable or after cooking by people in Kurdistan. Using N.P.K (18:18:0) fertilizer levels of 0, 50, 100, 150 and 200 kg / donum applied at two times. Results of the combination effect of soil depth accumulation and fertilizer levels revealed that plant height with or without edible portion was between 7.21 and m 24.12 cm and 15.41 to 31.82 cm. Length of edible portion reached 5.1-15.3 cm. Length of leaves ranged between 11.70 and 24.70 cm. Mostly, all studied parameters were significantly (P>0.05) affected by the studied factors particularly from low to high soil depth accumulation and fertilizer levels with the passage of time. Fresh weight of edible portion ranged from 20.2 to 73.7 g / plant, and the total plant fresh and dry weight ranged from 41.1 to 145.7 and from 2.01 to 8.07 g/plant respectively. Number of seeds / plant and seed weight was between 16.67-21.67 and 6.72 - 9.06 g respectively. However, the results suggested that the effect of soil depth accumulation was more than the level of fertilizer addition.

KEYWORDS Accumulation fertilizer levels time vegetable wild plant propagation yield production.

INTRODUCTION

As described by Rechinger (1964) and Chakravarty (1976) *Gundelia tournefortii* L. is a perennial plant belonging to compositae (Asteraceae) family. The stem is 40-50 cm high with few branches in upper parts. Leaves are leathery rigid thick with clear pale veins oblong to lanceolate pinately lobed, spiny-toothed, heads ovate subtended by three spiny leaves longer than the head with spiny broad leaves, attenuated to long needle like-structure, grow well in various range of environmental conditions in Asia, including Iraq and most parts of Kurdistan. As other plants, it prefers wet and light soil habitats (Salter.1963 and Ricklefs and Miller, 2000) . Ploughing is harmful, which may destroy roots and kill plants, because regerminaton occur from remain part of parental taproot tissues under soil surface (Aziz *et. al.*, 1999) . So an early rainfall and long term moist condition are effecting positively on germination and vegetative growth, edible portion under soil surface and seed (Ce Ce – local name) production (Harper,1977, and Wilman and Simpson, 1988). The morphology, nutritional values and economical importance of this plant have been reported by Davis, *et. al.* (1975) and Chakravarty (1976). However, Aziz, *et. al.* (1999) revealed that under grown portion near soil surface uses by people (as a vegetative cooking plant) to prepare different types of delicious meals. Therefore, this portion of plant is a marketable fresh yield and their seeds (referred to Ce Ce) using as nut determine the cash return to the villagers in plain and mountain areas. The protein and oil characteristics of seeds were reported by Pellet and Shadarvian (1970), Al-Shaibani *et. al* .(1986) and Aziz, *et. al.* (1999) indicating that it is rich in some minerals especially calcium and vitamin-C as represented in Table (1).

It is well known that the variation in nutrient uptake have been attributed to genetic characteristics and to the physical, chemical and biological aspects of all environmental factors affecting plant growth characteristics (Aziz , 1985 and 1991, Goss *et. al.*,1988, and Nebel and Wright,1998). But yet, it is not well known for *Gundelia tourneforti* L**.**

The aim of this study is to improve yield production in both quantity and quality of underground portion (stem) and seeds (Ce Ce) brought by N.P.K addition and soil accumulation on remaining part of root under soil surface with the passage of time.

Table (1): The main components of stem,seeds (Ce Ce) and caloric contents in *Gundelia tourneforti* L. based on fresh weight.

Components	Pellet & Shadarvian(1970) in stem %	Al-Shaibani *et. al.*(1986)		Aziz *et. al.*, (1999) In Stem %
		Stem %	Seeds %	
Humudity	92.30	95.0	3.9	94.2
Protein	1.1	1.4	22.2	1.87
Oil	0.90	0.10	46.6	2.1
Ash	0.90	0.84	7.5	-
Fiber	-	2.2	4.8	-
Carbohydrate	3.16	3.16	14.8	-
	Mg / g	mg / 1000g		%
Vitamin –C	-	8.4	-	-
Calcium	85.0	28.0	63.0	12.95
Phosphorous	15.0	8.5	31	8.93
Iron	0.90	0.30	1.8	0.47
Sodium	-	-	-	4.95
Potassium	-	-	-	5.78
Magnesium	-	-	-	9.85
Calori (Kelo / 100 g)	17.0	19.4	58.92	-

- = not detected

MATERIALS AND METHODS

A factorial experiment was conducted for 5 years on *Gundelia tournefortii* L. In the field research station of Collage of Agriculture, Salahaddin University - Erbil at the first time to study the effect of three soil depth accumulation (0, 10 and 20 cm) on plots above roots or under grown remain portion of plant sown in 2001 for experimental purposes. After 2 years, the measurements carried out for another 3 years during 2003, 2004 and 2005. Half of the fertilizer levels (0, 50, 100, 150 and 200 kg / donum) of N.P.K (18:18:0) was added during soil preparation and ploughing the other half was added to the soil after ploughing. The experimental design was Completely Randomized Block Design (C.R.B.D) with 4 replicates.

The seeds were sown on 15th October 2001 in plots of 3.0×2.0 m. The seeds were setout at depth of 6-7cm after preliminary soil preparation. The space between and within plants was nearly 35 cm, providing a density of about 25 plants m^2, or 150 plants per plot. Throughout the experimental period the plants were watered as necessary with fine rose. The properties of soil of the experimental site are presented in Table 2, reported by Tahha (2003), and the climatic conditions of the area based on temperature, rainfall and air humudity are presented in Table 3 and 4 received from Agro-meteorological station at the same field in Grdarasha. Each year from 2003 to 2005. The plants of each plot were harvested on 15th march for each year to study the stem length and diameter, fresh and dry weight of edible portion of the plants, number of branches and heads, fresh and dry weight of shoots and seed number and their weights. Statistical analysis was conducted according to Snedecor and Cochran (1980).

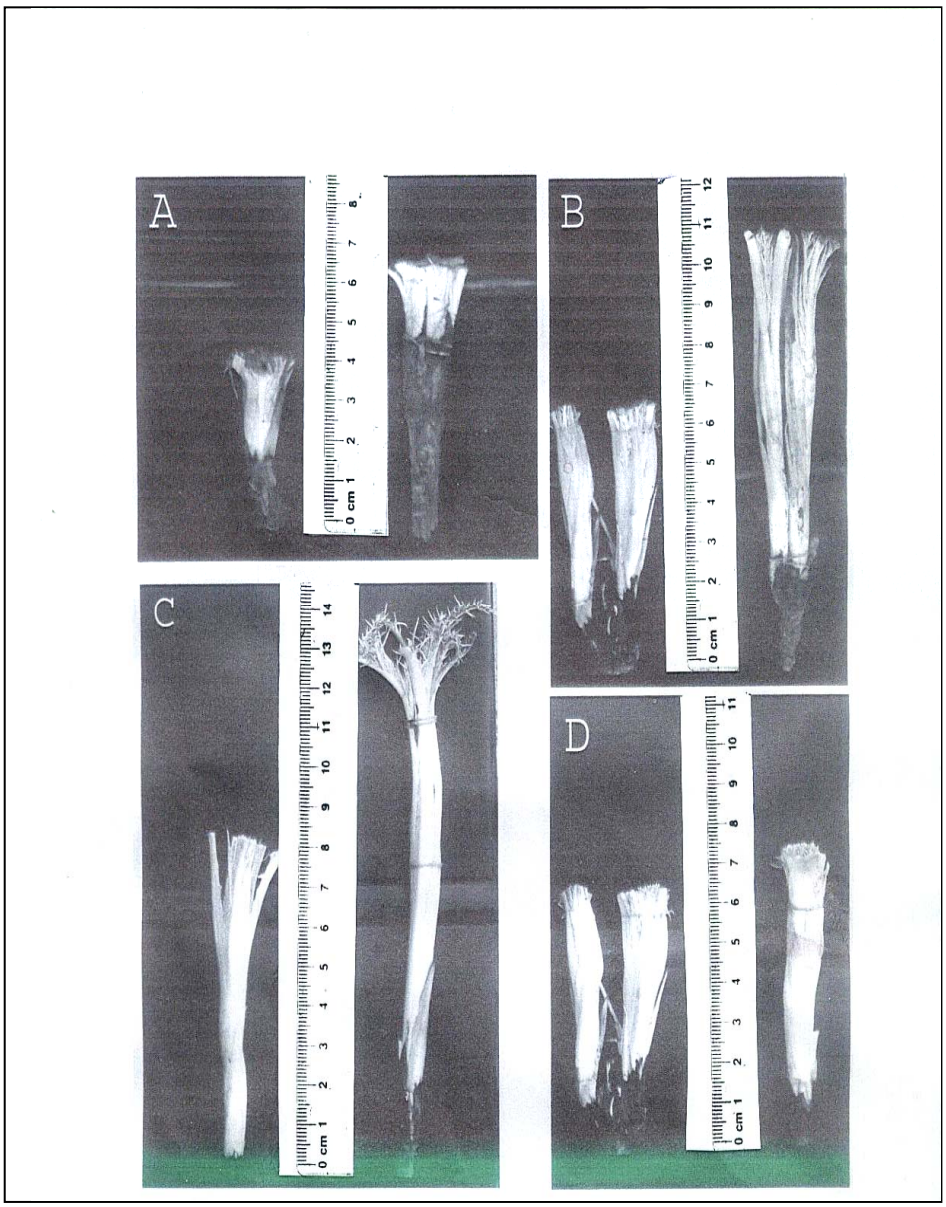

Fig (1): The effect of soil depth accumulation and fertilizer levels, A= zero depth without fertilizer (left), and with fertilizer 50 Kg/ donum (right), B= 10 cm soil depth with 100 Kg/ donum fertilizer (left) and 20 cm soil depth with 100 Kg/donum fertilizer (right), C= 20 cm depth without fertilizer (left), and with 150 Kg/donum fertilizer (right), D= 10 cm soil depth with 50 Kg/donum fertilizer (left) and with 100 Kg/donum fertilizer (right).

Table (2): Some Physical and chemical characteristics of the soil at the experimental site.

Soil texture (mg/kg of soil)=(SCL):-						
Clay	377.30					
Silt	497.80					
Sand	122.00					
Soluble ions (mg/liter)						
Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{-2}
3.8	1.6	0.3	0.48	5.00	0.8	0.38
Cation exchange						
Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}			
22	1.3	0.82	1.01			
Soil humudity (%)						
Field capacity		Field capacity %		Wilting point %		
27.80%		24.70%		13.4%		
Nutrient availability						
Available Phosphors	Available Nitrogen	Organic matter	Total Nitrogen			
3.8 ppm	3.6 ppm	0.99 %	0.086 ppm			
Others						
pH		EC m mhos/cm				
7.69		0.6				

Table (3): The average of rainfall in mm/year from 2001 to 2005 of the experimental site in Grdarasha field station–area near Erbil city

Month	Years				
	2001	2002	2003	2004	2005
Oct.	1.7	33.0	8.5	9.0	-
Nov.	19.30	31.4	61.0	116.1	-
Dec.	72.3	158.9	79.2	44.9	-
Jan.	24.8	77.9	50.2	106.0	76.9
Feb.	39.6	20.5	54.9	72.6	70.3
March	64.8	75.2	92.9	5.2	51.7
April	28.8	48.8	47.0	79.0	18.0
May	4.0	1.0	12.2	2.7	10.5
June	-	-	5.6	-	-
Total	251.3	446.7	411.5	435.5	-

(-) not detected

Table (4): Mean of monthly air temperature (C^o) and humidity (%) from 2001-2005 in Grdarasha field station –Erbil

Month	Years									
	2001		2002		2003		2004		2005	
	Temp. C^o	Humud. %	Temp. C^o	Humud. %	Temp. C^o	Humud. %	Temp. C^o	Humud. %	Temp. C^o	Humud. %
Oct.	22.66	35.78	24.56	35.13	23.51	35.46	31.46	29.17	-	-
Nov.	13.65	55.58	7.78	79.8	20.6	48.08	13.67	70.19	-	-
Dec.	10.02	74.73	15.35	44.77	9.28	71.72	6.96	1.41	-	-
Jan.	8.85	67.32	6.75	76.25	10.26	6.62	8.25	74.2	7.2	68.32
Fab.	10.22	65.96	10.33	66.48	8.10	73.65	8.6	68.53	6.7	68.32
March	15.94	64.96	13.71	55.4	10.66	64.2	14.14	50.23	58.6	50.83
April	19.13	58.65	16.2	61.7	17.69	57.71	17.34	10.88	18.77	44.04
May	23.58	37.62	23.5	30.4	32.8	28.88	30.17	34.27	24.04	31.02
June	29.5	22.41	29.4	17.75	29.77	20.41	29.48	38.49	31.3	20.99

(-) not detected

RESULTS & DISCUSSION

The suitable soil environment is very necessary to provide plants by water nutrients and air-oxygen for roots, however, adaptation of plants for obtaining food and water from the soil is another important factor (Nebel and Wright, 1998; and Ricklef and Miller, 2000).

Plant height with and without edible portion and length of edible portion (stem) was positively and significantly (P>0.05) increased as affected by the studied factors and with the passage of time (Table 5). The plant height from the soil surface to the higher portion on 15th March was ranged from 7.21 cm under 20 cm depth, and zero kg / donum fertilizer level in 2003, to 24.12 cm under zero cm soil depth and 200kg / donum fertilizer level in 2005. The effect of soil accumulation, fertilizers and time ranged from 9.41-20.03 cm, 13.24 to 15.88 cm and 9.08 to 21.47 cm respectively. The plant height without soil accumulation was higher than plants grown under soil accumulation, because any increment of edible portion is on the expense of original plant height

The length of edible portion under soil surface (Table 6) ranged from 5.1 to 15.4 cm, the mean value of time and soil accumulation was 5.86-14.22 cm, and the effect of fertilizer was between 8.20 and 9.57. That means the plants were grown better by combination of these two factors, which agrees with the comments of Harper (1977) who revealed that plants grow better under the effect of two benefit factors (water and nutrients).

It appears from Table 7 that the plant height from the edible portion under soil surface to the higher portion above soil surface was between 15.41 - 31.82 cm on 15th march. The differences in plant height above soil surface and the length of edible portion was contributed to the depth of soil accumulation.

The differences in plant height as affected by time and fertilizer is in agreement with outcomes obtained by Goss,*et. al.* (1988) for Medicago, El-Maeni and El-Sahookic (1986) for weed and Aziz (1991) for ***Cephalaria syriaca*** weed and Aziz, *et. al.* (1999) for ***Gundelia tournefortii***. Such differences may be related to differences in rainfall during the period of the study, which probably increased the availability of fertilizer to the plants (Abdul and Aart, 1986; Wilman and Simpson, 1988,;Nebel and Wright, 1998 and Ricklefs and Miller, 2000). Finally the results of plant height were similar to those described by Chakravarty (1976).

Table (5) : Plant height (cm) from the soil surface to the higher portion as affected by depth of soil accumulation, fertilizer levels and time. Plants were harvested on the 15th of March .

Depth of soil accumulation above soil surface and time.													
Fertilizer level	0 cm			Mean	10 cm			Mean	20 cm			Mean	Grand mean
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	16.12	19.57	20.67	18.74	12.8	12.53	13.67	12.79	7.21	8.61	8.68	8.17	13.24
50	16.88	19.23	19.23	18.48	12.10	14.23	13.33	13.22	8.91	9.46	9.33	9.23	13.64
100	18.15	20.33	20.67	19.72	14.15	14.17	14.33	14.22	9.21	9.23	9.72	9.39	14.42
150	18.25	19.50	22.67	20.14	13.81	14.40	16.00	14.74	10.38	9.97	9.62	10.01	14.96
200	21.11	21.53	24.12	22.11	14.78	14.42	16.67	15.29	9.67	10.54	9.67	9.96	15.88
Mean	18.10	20.03	21.47	19.84	13.52	13.95	14.80	14.05	9.08	9.56	9.41	9.35	14.43
SD	1.60			1.44	0.63			1.04	0.25			0.74	0.84
$LSD_{0.05}$	0.92			0.82	Ns			1.47	ns			1.33	1.38

ns= not significant

Table (6): Length (cm) of edible portion (stem in part) under soil surface as affected by depth of soil accumulation, fertilizer levels and time. Plants were harvested on the 15th of March**.**

Depth Of Soil Accumulation Above Soil Surface And Time.													
Fertilizer Level	0 Cm			Mean	10 Cm			Mean	20 Cm			Mean	Grand Mean
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	5.2	5.1	6.2	5.5	6.5	7.8	8.4	7.6	8.2	13.0	13.3	11.5	8.20
50	5.3	5.3	6.3	5.6	6.4	7.8	8.4	7.3	8.2	13.0	13.4	11.5	8.20
100	5.8	6.6	7.2	6.5	6.6	8.4	8.8	7.9	8.6	13.2	14.1	12.1	8.83
150	6.2	6.6	7.5	6.8	6.8	8.8	9.1	8.2	9.2	14.2	15.0	12.8	9.27
200	6.8	6.8	7.7	7.1	6.8	9.1	9.2	8.4	9.0	15.4	15.3	13.2	9.57
Mean	5.86	6.08	6.98	6.31	6.62	8.38	8.78	7.88	8.64	13.76	14.22	12.22	8.80
SD	0.58			0.72	1.15			0.44	3.12			0.77	0.64
$LSD_{0.05}$	0.36			0.32	0.67			ns	1.81			ns	1.13

ns= not significant

Table (7): Plant height (cm) from soil surface to the higher portion of the plant plus length of edible portion under soil surface as affected by the depth of the soil accumulation, fertilizer levels and time. Plants were harvested on the 15th of March.

Fertilizer level	Depth of soil accumulation above soil surface and time.												Grand mean
	0 cm			Mean	10 cm			Mean	20 cm			Mean	
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	21.22	24.61	26.87	24.24	19.38	20.33	22.07	20.39	15.41	21.61	21.98	19.67	21.44
50	22.18	24.53	25.53	24.08	18.50	22.03	21.73	20.52	17.11	22.46	22.73	22.43	21.87
100	23.23	26.93	27.87	26.22	20.75	22.57	23.13	22.12	20.81	22.43	23.82	20.73	23.25
150	24.45	26.10	30.70	26.94	20.61	25.20	28.10	22.94	19.58	24.17	24.62	21.49	24.23
200	27.91	28.33	31.82	29.21	22.58	23.52	25.87	23.69	16.67	25.94	24.97	22.81	25.45
Mean	23.79	26.09	28.60	26.06	20.4	22.7	24.2	21.93	17.92	23.32	23.62	21.43	23.25
SD	2.08			2.18	1.72			3.66	2.57			2.81	2.83
$LSD_{0.05}$	1.20			1.98	1.99			1.61	1.49			1.26	1.27

ns= not significant

It is obvious from Table 8 that the mean number of branches (1.61) and heads (3.99) were slightly increased with both fertilizer levels and depth of soil accumulation. The maximum mean number of

branches was 2.67 and that of heads was 5.67. The effect of soil accumulation and time was little in comparison with fertilizers. Aziz (1985 and 1991) revealed that the rate of tillers of cereals and branches of weeds depend on light intensity and nutrient availability. However, the scientists realized that despite the environmental conditions, the genetic makeup of the plant itself caused the variation in root growth of ***Fragaria anannasa*** , (Tahha,2003) in stem diameter of Cauliflower (Aziz,1985) and increasing head production of a flower plant ***Antherdium majus*** (Salih and Aziz,1991) and in Maize grain production El-maeni and El-Sahookie (1986).

In the present work, stem diameter is the most important portion of the plant especially of that under soil surface (edible portion), ranged from 1.28 cm to 3.20 cm (Table 9). The higher value was obtained from a plant growing without soil accumulation and low values found in plants grown under 20 cm soil accumulation. However, the stem diameter increased with fertilizer levels and with the passage of time, which is the common phenomenon in green plants resulting from heredity, age and resource availability (Donald ,1958 and 1963, and Harper 1977). Again, when stem length of edible portion slightly increases under stress of soil accumulation, its diameter decreases (Fig.1). This may be related to photosynthetic activity of stem exposed to light in nature, e.g for Peas (Aziz,1985) and for ***Paranella vulgaris*** (Miller,*et. al.* 1994).

The consequences of length of tallest leaf (Table 10) is another growth characteristic of ***G. tournefortii*** L. , which was ranged from 10.0 to 28.0 cm with a significant differences as affected by all studied factors was observed. Particularly, the effect of soil accumulation it was between 13.06 and 22.49 cm and that of fertilizer between 11.7 to 13.93 cm. This is probably attributed to the photosynthetic activity of stem containing chlorophyll above soil surface (Aziz, 1985). Aziz (1991), who worked with the same plant showed that the leaf length of plants of 4 year old regrowing every year was increased with passage of time and from year to year ranged from 10.79-46.81 cm until senescence. This was consistent with higher values of N.P.K. addition. The variation in plant growth characteristics is contributed to soil accumulation and fertilizer application that may be related to the variation in advantage conditions for establishing vigur root system caused by soil humudity maintenance (Aspinal , 1960, Donald , 1963, Salter, 1963, Wilman and Simpson , 1988, Ricklefs and Miller 2000).

Table (8): Mean number of branches and heads per plant as affected by studied factors. Plants were harvested on the 15th of March.

Depth of soil accumulation above soil surface and time.										
Fertilizer level	No. of branches			Mean	LSD	No. of heads			Mean	LSD
	0	10 cm	20 cm			0	10 cm	20 cm		
0	1.00	1.33	1.0	1.11	ns	3.67	3.33	3.33	3.44	ns
50	1.00	1.00	1.40	1.13	ns	3.67	3.33	3.33	3.44	ns
100	1.67	2.0	1.33	1.67	ns	4.33	3.67	3.67	3.89	ns
150	2.67	1.67	1.67	2.00	ns	4.67	4.0	4.0	4.22	ns
200	2.67	2.00	1.67	2.11	ns	5.67	4.67	4.67	5.00	ns
Mean	1.80	1.60	1.41	1.61	ns	4.40	3.80	3.73	3.99	
SD		0.20		0.47			0.37		0.65	1.87
$LSD_{0.05}$	ns			ns		ns			ns	ns

ns= not significant

Table (9): Stem diameter (cm) of plants harvested on the 15th of March as affected by studied factors.

Depth of soil accumulation above soil surface and time.													
Fertilizer level	0 cm			Mean	10 cm			Mean	20 cm			Mean	LSD
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	1.83	1.67	2.47	1.99	1.54	1.77	2.58	1.28	1.76	1.42	2.15	2.25	1.94
50	1.92	2.50	2.81	2.41	1.72	2.11	2.40	2.8	1.66	2.21	2.30	2.6	2.18
100	2.20	2.27	2.86	2.44	1.78	2.35	2.45	2.19	1.54	2.33	2.47	2.11	2.25
150	2.30	2.87	2.89	2.69	1.99	2.33	2.63	2.32	1.71	2.38	2.55	2.21	2.41
200	2.70	3.3	3.20	2.98	2.85	2.86	2.86	2.86	2.35	2.50	2.88	2.58	2.81
Mean	2.19	2.52	2.85	2.50	1.97	2.28	2.58	2.29	1.80	2.17	2.49	2.47	2.35
SD	0.33			0.37	0.28			0.38	0.39			0.24	0.33
$LSD_{0.05}$	ns			ns	ns			ns	ns			ns	ns

ns= not significant

Table (10): Length of talest leaf (cm) of plants harvested on the 15th of March as affected by studied factors.

Depth of soil accumulation above soil surface and time.													
Fertilizer level	0 cm			Mean	10 cm			Mean	20 cm			Mean	LSD
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	17.7	19.8	21.0	19.50	10.0	10.6	11.7	10.77	10.4	12.0	12.7	11.7	13.99
50	21.3	20.7	22.33	21.44	12.8	11.6	12.8	12.4	11.9	12.33	12.4	12.21	15.35
100	22.3	21.9	22.68	22.29	14.7	14.4	14.8	14.63	13.8	13.0	13.6	13.47	16.79
150	22.9	22.8	24.18	23.13	15.3	16.8	16.8	16.3	13.9	13.7	14.2	13.93	17.78
200	24.7	25.6	28.0	26.1	16.0	16.5	16.7	16.4	14.5	14.7	12.8	13.77	18.74
Mean	21.78	22.16	23.64	22.49	13.76	13.98	14.56	14.1	12.9	13.15	13.14	13.02	16.53
SD	1.02			2.42	0.34			2.47	0.14			0.92	1.90
$LSD_{0.05}$	ns			ns	ns			ns	ns			ns	ns

ns= not significant

Table (11): Fresh weight. of edible portion (stem) under soil surface/g/ plant as affected by studied factors harvested on the 15th of March.

Depth of soil accumulation above soil surface and time.													
Fertilizer level	0 cm			Mean	10 cm			Mean	20 cm			Mean	Grand mean
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	20.2	38.9	49.9	36.33	28.8	46.3	60.4	45.17	36.4	51.3	67.1	51.64	44.37
50	25.6	39.6	55.7	40.3	29.5	44.7	63.2	45.8	38.1	55.5	67.5	53.79	46.6
100	33.3	40.2	60.8	44.77	37.1	50.4	64.7	50.73	40.2	60.9	67.4	56.17	50.56
150	38.7	52.8	63.9	51.8	41.0	58.7	67.9	55.87	50.9	64.6	70.1	61.87	56.51
200	41.8	57.7	65.1	54.87	50.0	62.6	70.0	60.87	50.3	70.7	73.7	64.77	60.17
Mean	31.92	45.84	59.08	45.61	37.28	52.54	65.24	51.69	43.18	60.6	69.08	57.63	51.71
SD		13.48		7.73		13.99		6.71		13.21		5.53	6.67
$LSD_{0.05}$	7.79			3.47	8.09			3.01	7.63			2.47	2.99

Table (12): Total plant fresh weight including edible portion (g) as affected by studied factors harvested on the 15th of March.

Depth of soil accumulation above soil surface and time.													
Fertilizer level	0 cm			Mean	10 cm			Mean	20 cm			Mean	Grand mean
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	41.1	65.3	72.9	59.77	65.1	81.6	102.8	83.17	68.9	90.2	104.6	87.9	76.95
50	46.2	67.2	78.3	63.90	68.1	91.1	106.5	88.57	78.2	100.2	127.0	101.8	84.76
100	55.2	77.2	80.8	71.07	72.5	97.5	112.6	94.2	80.8	104.1	129.2	104.7	89.99
150	66.6	87.8	90.6	81.67	77.4	98.9	121.2	99.17	96.4	116.5	130.2	114.37	98.40
200	73.3	98.4	100.1	90.6	81.4	110.8	128.2	106.8	100.2	126.7	145.7	124.2	107.2
Mean	56.48	79.18	84.56	73.40	72.9	95.98	114.26	94.38	84.9	107.54	127.34	106.59	91.46
SD		14.90		12.70		20.73		9.17		21.25		13.66	11.76
$LSD_{0.05}$	8.61			5.69	11.98			4.11	12.28			7.89	5.27

Fresh weight of edible portion (Table 11). It was ranged from 20.2-73.7 g/plant, suggesting significant differences (P>0.01) and revealed that it was increased nearly by 10 g/plant. The mean values ranged from 44.37 -60.17 g/plant as affected by soil depth accumulation and increased by two- fold in fresh weight as affected by time and fertilizers (ranged from 31.92- 57.61 g / plant).

The statistical analysis of total plant fresh weight and total plant dry weight which was came from contribution and accumulation of number of branches (Table 8), stem diameter (Table 9), length of leaves(Table 10) and fresh weight of edible portion (Table 11). They performed the same trends of above mentioned parameters as affected by studied factors. This Phenomenon is common in plants in general (Aspinal, 1960, Harper, 1997, and Aziz, *et. al.*1999). Total plant fresh weight Table 12 showed the same trend of the edible portion as affected by studied factors which was ranged from 41.1 to 145.7 g / plant. The mean increment of 30 g / plant has resulted from both soil accumulation and fertilizer levels with the passage of time.

The dry weight of edible portion (Table 13) performed the similar pattern of total plant dry weight, which ranged from 2.01- 8.36 g / plant.

The range magnitude of increasing dry matter production as affected by studied factors agreed with that of Donald (1963) for pasture plants, Aspinal (1960) for weeds Aziz (1985) for Cauliflower and Aziz,*et. al.*(1999) for ***Gundella tournefortii* L.**

The mean number of seeds per plant ranged from 16.67 to 21.67 (Table 14) and seed weight g /plant ranged from 6.72-9.06 g/plant. Even the effect of studied factors was not significant, the differences were about 2 seeds (Ce Ce) and about 2 g/plant of seed weight. This finding agree with those of Harper (1977) who postulated that seed number is mostly less affected by environmental factors but, seed weight is sensitive to plant growth requirement, especially light (Aziz, 1985, Donald, 1958 and Aspinal, 1960).

Table (13): Dry weight (g / plant) of edible portion (stem in part) up to the level of soil surfaces as affected by studied factors havested on the 15th of March.

Depth of soil accumulation above soil surface and time.													
Fertilizer level	0 cm			Mean	10 cm			Mean	20 cm			Mean	Grand mean
	2003	2004	2005		2003	2004	2005		2003	2004	2005		
0	2.01	3.61	4.11	3.24	3.80	5.73	5.73	5.09	4.21	6.43	6.93	5.86	4.73
50	2.82	4.11	4.65	3.86	4.51	5.82	6.81	5.71	4.81	6.75	7.95	6.50	5.36
100	3.34	4.81	5.89	4.74	5.75	6.28	7.77	6.60	5.82	7.57	8.40	7.26	6.20
150	3.18	5.43	7.27	5.29	6.02	7.83	8.90	7.58	6.45	8.69	8.70	7.95	6.94
200	4.5	6.73	7.98	4.74	5.37	6.84	7.62	6.61	5.61	7.63	8.36	7.20	6.17
Mean	3.29	4.95	5.98	4.74	5.37	6.84	7.62	6.61	5.61	7.63	8.36	7.20	6.17
SD	1.35			1.23	1.14			1.24	1.42			0.93	1.17
$LSD_{0.05}$	0.71			0.56	0.66			0.56	0.83			0.42	0.53

Table (14): Number of seeds / plants and seed weight (g/plant) as affected by studied factors harvested on the 15th of March 2005.

Depth of soil accumulation above soil surface and time.										
Fertilizer level	No. of seeds per head			Mean	LSD	Seed wt. g/plant			Mean	LSD
	0cm	10 cm	20 cm			0 cm	10 cm	20 cm		
0	16.67	17.33	17.33	17.11	ns	6.72	7.11	6.96	6.93	ns
50	17.0	17.33	17.0	17.11	ns	7.13	7.67	7.33	7.38	ns
100	18.0	18.33	18.33	18.22	ns	7.22	8.26	7.99	7.82	ns
150	18.67	20.0	19.26	19.31	ns	8.42	7.95	8.0	8.12	ns
200	20.67	20.3	21.67	20.88	ns	8.87	8.58	9.06	8.83	ns
Mean	18.2	18.66	18.71	18.52	ns	7.67	7.91	7.86	7.75	
SD		0.28		1.60			0.24		0.72	
$LSD_{0.05}$	ns			ns		ns			Ns	

ns= not significant

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تأثير سمك تراكم التربة و مستويات التسميد والزمن على النموالخضري وانتاج بذور نباتات الكعوب

الخلاصة

اجريت هذه التجربة الاقتصادية المهمة لاول مرة في محطة الابحاث الحقلية في كرده رشه –اربيل خلال الفترة بين عـام 2001-2005 . لدراسة استجابة لبقايا الجذور النامية والمتبقية للسنوات السابقة تحت سطح التربة لنباتات الكعوب وهـي نباتـات بريـة تستعمل كخضروات من قبل اهالي المنطقة في كوردستان لدراسة تأثير لسمك وتراكم وكذلك مستويات السماد المركب N.P.K (18:18:0) مع مرور الزمن .

وقد أظهرت النتائج ان ارتفاع النباتات تراوح بين 15.41- 31.82 سم وبين 40.7-64.2 في الحصاد الثاني. وكان طول الجـزء الذي يؤكل بين 5.1-15.3 سم. وكان طول الورقة 11.70-24.7 سم. وتراوح الوزن الطازج والجاف للجزء الذي يؤكـل بـين 20.2- 73.7 و 2.1- 8,7غم/نبات. وتراوح الوزن الطازج و الجاف الكلي كانت بين 41.01-145.7 و 8.21- 36.62 غم/نبـات. وتراوح معدل البذور للنبات الواحد بين 16.67-21.67 مع وز ا الجاف 6.72-9.06 غم/نبات واحد. واظهرت النتائج ان تـأثير هذه النباتات باستثناء عدد البذور تاثراً معنويا (P>0.05) او(P>0.01) بالعوامل المدروسة وخاصة بين سمك تراكم التربـة فـوق سطح الارض وإضافة الاسمدة .

پوختە

ئەم جۆرە توێژینەویە بۆ یەکەم جار لە وێستگەی توێژینەوەی بەروبوومی رووەکی لە گردەرشە/ هەولێر لە ساڵانی 2001–2005 ئەنجامدرا. بە مەبەستی لێکۆینەوە لە چۆنیەتی زیادکردنی بەروبوومی رووەکی کەنگر بەبەکارهێنانی کەڵەکە کردنی خۆڵ لەسەر پاشماوەی رەگەکانی لە ژێر زەوی ئەوانەی کە لە ساڵانی رابردوو گەشەیان کردبوو . و بە بەکارهێنانی ئاستی جیاجیای پەییی کیمیاوی (N. P. K. 18:18:0) لە کاتی جیا جیادا.

لە ئەنجامدا وا دیارکەوت بەرزی رووەکەکان گەیشتە 15.41 – 31.82 سم و درێژی ئەو پارچەی ژێر زەوی کە بۆ خواردن دەشێ گەیشتە 5.1 – 15.3 سم لە هەمان کاتدا درێژی گەڵاکان گەیشتە 11.7 – 24.7 سم. کێشی تەڕی و وشکی خۆیدا لە 41.01 – 145.7 و 8.21 – 36.62 غم / رووەك. هەروەها ژمارەی تۆوی کەنگر لە یەك رووەك گەیشتە 16.67 – 21.67 بە کێشی ووشکی 6.72 – 9.06 غم / رووەك. بەم جۆرە لەم توێژینەوەیە وا دەرکەوت سەرجەم ئەو خەسەتانەی کە لە سەرەوە و لەم توێژینەوەیە باسمان کرد کاریگەری لێکراوە لە رووی ئاماریەوە بە ئاستی (P <0.05) و (P<0.01) لە ئاکامی بەکارهێنانی کەلەکە کردن خۆڵ لەسەر پاشماوەی ژێر زەوی و بە بەکارهینانی پەیینی کیمیاوی و لەکاتی جیاجیادا، جگە لەژمارەی تۆیەکان.

SPECTROPHOTOMETRIC DETERMINATION OF BENZOCAINE IN PHARMACEUTICAL FORMULATIONS VIA OXIDATIVE COUPLING REACTION

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ABSTRACT

A simple, rapid and sensitive spectrophotometric method for the microdetermination of benzocaine is described. The method is based on the oxidative coupling reaction of benzocaine with promethazine hydrochloride reagent using *N*-bromo succinimide as oxidizing agent in acidic medium to form a green colored complex, which is water soluble, stable and has a maximum absorption at 611 nm. Beer's law is obeyed in a concentration range of 5 - 300 μg of benzocaine in a final volume of 25 ml (i.e. 0.2 – 12 ppm), with a molar absorptivity of 1.51×10^4 L.mol^{-1}.cm^{-1}, and the sandell's sensitivity is 0.01097 μg.cm^{-2}, with a relative error of –0.51 to +1.31% and relative standard deviation of ±0.31 to ±1.96% depending on the concentration levels. The proposed method has been successfully applied to the determination of benzocaine in two pharmaceutical formulations.

KEYWORD Spectrophotometric Benzocaine Promethazine Oxidative coupling

INTRODUCTION

Benzocaine, *p*-aminobenzoic (ethyl 4-aminobenzoate) acid ester is a local anesthesia used as surface anesthetic, for the local and temporal relief of pain related, among other disorders, to buccal affections for such reasons, it is a drug extensively used in odontology[1]. Benzocaine acts as local anesthesia by preventing transmission of impulses along nerve fibres and at nerve endings. It is comparatively non-irritating and has low systemic toxicity[2,3]. This essential drug is found in the liquid, gel, lozenge, lotion, ear drop and aerosol spray forms. It used as a temporary topical anesthetic that numbs the nerve endings near the surface of the skin where applied. Physicians throughout the world prescribe benzocaine for people four months and older[4].

A considerable number of publications have appeared describing different methods for the determination of benzocaine in pure form and in pharmaceutical formulations, these methods included colorimetric [5], spectrophotometric [6,7], and kinetic[8].Other methods includes the using of chemiluminescence[9], and luminescence[10]. High performance liquid chromatography (HPLC) is also described for determination benzocaine [11,12] , beside to gas chromatography method [13].

The oxidative coupling reaction is one type of organic reactions that have a big importance in analytical chemistry because of the high sensitivity of such reactions. Oxidative coupling reactions depend on the reaction of two or more of organic compounds in presence of an oxidizing agent to yield a colored product in most cases[14].

The purpose of the investigation reported in this paper is to evaluate a simple spectrophotometric method for the microdetermination of benzocaine based on it is oxidative coupling reaction with promethazine hydrochloride in the presence of *N*-bromo succinimide as oxidizing agent yielding highly colored dye in acidic medium. Application part included determination of benzocaine in two pharmaceutical formulations.

EXPERIMENTAL

Apparatus

All spectral and absorbance measurements were performed on UNICAM Helios Beta 9423 UV-Visible recording spectrophotometer using 1 cm silica cell, pH meter type HANNA 301 pH - Ion meter is used for pH readings, and OHAUS® – Voyager® analytical balance was used for weighing processes.

Reagents

All chemicals used in this investigation were of analytical – reagent grade and the standard pharmaceutical materials was provided from general establishment for medical appliance and drugs / SDI – Samaraa / Iraq.

Solutions

Benzocaine solution, 100 μg.ml^{-1}.

This solution was prepared by dissolving 0.01 g of benzocaine in 2 ml of ethanol and 20 ml of distilled water to increase solubility and diluted to 100 ml in a volumetric flask with distilled water.

Promethazine hydrochloride solution, 0.1 % (w/v).

This solution was prepared by dissolving 0.1 g of promethazine hydrochloride reagent in 100 ml of distilled water in a volumetric flask.

N-Bromo succinimide solution, 0.1 % (w/v).

This solution was prepared by dissolving 0.1 g of *N*-bromo succinimide in 25 ml of distilled water with heating and the volume completed to 100 ml in a volumetric flask.

Hydrochloric acid solution, 0.1 N.

This solution is prepared by diluting 2.13 ml of the concentrated hydrochloric acid (36%) solution to 250 ml with distilled water in a volumetric flask.

Eardrop (OTIC) solution.

A suitable volume (1 ml) of the pharmaceutical solution containing exactly 0.05 g of benzocaine was treated with 2 ml of ethanol and diluted to 100 ml with distilled water to give 500 μg.ml^{-1} solution of benzocaine, different volumes of this solution latter was used to be determinates by proposed method.

Sore lozenge solution.

One lozenge which contains exactly 0.01g of benzocaine was allowed to be dissolved in a solution

of 20 ml distilled water and 2 ml ethanol with heating, then the volume completed to 100 ml by distilled water in a volumetric flask to give 100 μg.ml^{-1} solution of benzocaine, different volumes of this solution latter was used to be determinates by proposed method.

Interferences solutions, 1000 μg.ml^{-1}.

These solutions were prepared by dissolving 0.1 g of each interferent in minimum amount of a suitable solvent (distilled water or methanol) and then diluted to 100 ml by distilled water in a volumetric flask. Different volumes of these solutions were use to check the selectivity of the proposed method.

RESULTS AND DISCUSSION

The preliminary Study

In the preliminary study a green dye that have a maximum absorption at 611 nm was obtained by the addition of 3 ml of 0.1% promethazine hydrochloride reagent, 2 ml of 0.1% *N*-bromo succinimide, and 1 ml of 0.1N hydrochloric acid to 200 μg of benzocaine in a final volume of 25 ml.

Optimization of Conditions

The effect of various variables on the color development of the product is tested to establish the optimum conditions.

Effect of pH

The preliminary experiments have shown that the formation of the colored dye occurs in acidic medium .The effect of amounts of different widely used acids had been studied (Table 1).

Table (1):- Effect of pH on absorbance

ML ADDED OF 0.1 N ACID	H_2SO_4		HCL		CH_3COOH		H_3PO_4	
	Abs.	pH	Abs.	pH	Abs.	pH	Abs.	pH
0	0.014	4.91	0.014	4.91	0.014	4.91	0.014	4.91
1	0.657	2.97	0.653	2.98	0.565	3.87	0.664	3.15
2	0.673	2.78	0.692	2.75	0.571	3.77	0.702	2.96
3	0.686	2.61	0.709	2.60	0.571	3.68	0.698	2.84
4	0.685	2.50	0.713	2.45	0.572	3.63	0.687	2.65
5	0.688	2.39	0.719	2.36	0.578	3.56	0.677	2.57
6	0.689	2.33	0.714	2.29	0.579	3.53	0.673	2.51
7	0.688	2.30	0.715	2.23	0.578	3.51	0.676	2.42

The results indicates that addition of 5 ml of hydrochloric acid (0.1 N) solution give the highest intensity of the colored dye at pH 2.36 and therefore it is recommended for subsequent experiments.

Selection of oxidizing agent

Different types of oxidizing agents (0.1%, w/v) were investigated in acidic medium (pH 2.36), the results are shown in table 2.

Table(2):- Effect of oxidizing agent

OXIDIZING AGENT*, (0.1%)	ABSORBANCE	λ_{MAX}, NM
N-Bromo succinimide	0.717	611
$K_2Cr_2O_7$	0.159	602
K_2CrO_4	0.246	602
KIO_3	0.207	608
NH_4VO_3	Turbid	---

* 2 ml added

The results illustrated in table 2 indicated that using of *N*-bromo succinimide as oxidizing agent give the more sensitive reaction (highest intensity) and therefore it is recommended for subsequent experiments.

Selection of coupling reagent

Various organic compounds (0.1%, w/v) have been tested as coupling reagent for the oxidative coupling reaction with benzocaine in presence of *N*-bromo succinimide (Table 3).

Table(3):- Effect of coupling reagent

COUPLING REAGENT TESTED*, (0.1%)	ABSORBANCE	λ_{MAX}, NM
4-Amino antipyrine	0.091	481
3-Amino phenol	0.181	449
Promethazine. HCl	0.721	611
Orcinol	0.101	597
Resorcinol	0.100	570

* 3 ml added

The results in table 3 indicate that the promethazine hydrochloride reagent gives highly colored (green) dye comparing with the other coupling reagents and therefore promethazine hydrochloride reagent is recommended for subsequent experiments.

Effect of the concentration of oxidizing agent

The effect of different volumes (0.5 - 3 ml) of *N*-bromo succinimide (0.1%) solution on the color intensity has been studied and it was observed that 1 ml of *N*-bromo succinimide (0.1%) solution is the more suitable amount since it gives the highest value of correlation coefficient of measurements (Table 4).

Table(4):- Effect of oxidizing agent amount

ML OF 0.1% NBS * SOLUTION	ABSORBANCE / μG OF BENZOCAINE ADDED						CORRELATION COEFFICIENT (R)
	10	25	50	100	200	250	
0.5	0.045	0.117	0.209	0.410	0.554	0.552	0.95183
1.0	0.045	0.100	0.206	0.400	0.791	0.978	0.99994
1.5	0.054	0.094	0.210	0.386	0.719	0.973	0.99807
2.0	0.049	0.069	0.164	0.350	0.715	0.969	0.99777
2.5	0.033	0.069	0.159	0.344	0.686	0.971	0.99642
3.0	0.001	0.058	0.154	0.309	0.606	0.802	0.99908

* **NBS =** *N*-bromo succinimide

Therefore, the volume of 1 ml of *N*-bromo succinimide (0.1%) solution is recommended for the subsequent experiments.

Effect of the concentration of the coupling reagent

Various volumes of promethazine hydrochloride (0.1%) solution were tested and the results indicated that using 2 ml of promethazine hydrochloride (0.1%) solution give the highest value of correlation coefficient (Table 5).

Table(5):- Effect of coupling reagent amount

ML OF 0.1% PROMETHAZINE. HCL SOLUTION	ABSORBANCE / μG OF BENZOCAINE ADDED						CORRELATION COEFFICIENT (R)
	20	40	80	160	200	260	
0.5	0.003	0.011	0.033	0.099	0.148	0.271	0.96704
1.0	0.020	0.050	0.243	0.504	0.650	0.961	0.99594
2.0	0.096	0.150	0.318	0.639	0.796	1.015	0.99966
3.0	0.079	0.149	0.320	0.621	0.796	0.997	0.99952
4.0	0.095	0.159	0.320	0.629	0.797	0.965	0.99856
5.0	0.087	0.163	0.322	0.644	0.801	0.939	0.99631

The volume of 2 ml of promethazine hydrochloride (0.1%) solution is recommended for the subsequent experiments

Effect of Surfactants

The effect of surfactant was studied by the addition of different volumes of various types of surfactant (cationic, anionic and neutral) to the medium of reaction. The results are shown in table 6. The selected surfactants are:

Cetyltrimethylammonium bromide (CTAB) (cationic)
Sodium dodecyl sulphate (SDS) (anionic)
iso-Octylphenoxypolyethoxyethanol (Triton X-100) (neutral)

Table(6):- Effect of surfactants and the order of additions

SURFACTANTS ADDED	ABSORBANCE /VOLUME OF SURFACTANTS ADDED			
	0.0 ml	1.0 ml	2.0 ml	4.0 ml
CTAB, 1×10^{-3}M	0.797	0.673	0.654	0.606
SDS, 1×10^{-3}M		0.387	0.301	0.219
Triton X-100, 1% (v/v)		0.644	0.642	0.638

The results in table 6 indicate that all types of surfactant had a negative effect on the intensity of the colored dye absorption and therefore, the addition of surfactant not recommended.

Order of addition of reagents

The order of additions of reagents was examined in a final volume of 25 ml and the results are shown in table 7.

Table(7):- Effect of order of addition

NO.	ORDER OF ADDITIONS OF REAGENTS	ABSORBANCE
I	200μg Benzocaine+ 2ml 0.1% Promethazine+ 5ml 0.1N HCl+ 1ml 0.1% NBS	0.310
II	200μg Benzocaine+ 2ml 0.1% Promethazine+ 1ml 0.1% NBS + 5ml 0.1N HCl	0.795
III	200μg Benzocaine+ 1ml 0.1% NBS + 2ml 0.1% Promethazine+ 5ml 0.1N HCl	0.565
IV	200μg Benzocaine+ 1ml 0.1% NBS+ 5ml 0.1N HCl + 2ml 0.1% Promethazine	0.416
V	200μg Benzocaine+ 5ml 0.1N HCl + 2ml 0.1% Promethazine + 1ml 0.1% NBS	0.657
VI	200μg Benzocaine+ 5ml 0.1N HCl+ 1ml 0.1% NBS + 2ml 0.1% Promethazine	0.614

The results in the above table indicate that the order (II) (given under present procedure) of addition of reagents is the optimum order that gives the highest intensity of the colored dye.

Effect of reaction time

The effect of time on the development and stability period of the colored dye was investigated under the optimum conditions of the reaction. The results indicate that the absorbance of the colored dye remained constant for at least 30 minutes (Table 8).

Table(8):- Effect of time on absorbance

μG OF	*ABSORBANCE / MINUTES

BENZOCAINE IN 25ML	5	10	15	20	30	40	50	60
10	0.075	0.073	0.072	0.072	0.071	0.069	0.069	0.068
50	0.225	0.225	0.224	0.223	0.223	0.221	0.221	0.220
100	0.382	0.381	0.381	0.380	0.378	0.377	0.375	0.373
150	0.577	0.574	0.572	0.572	0.571	0.567	0.565	0.564
200	0.798	0.796	0.796	0.794	0.794	0.791	0.788	0.786

* Absorbance readings after 10 minutes of developing time.

The results shown in table 8 indicate that the stability period is sufficient to allow several measurements to perform sequentially.

Final Absorption spectra

The absorption spectra of the colored complex formed from the reaction between benzocaine and promethazine hydrochloride reagent in presence of *N*-bromo succinimide in an acidic medium shows maximum absorption at 611 nm in contrast to the reagent blank, which shows a weak absorption at the same wavelength (Fig.1**)**

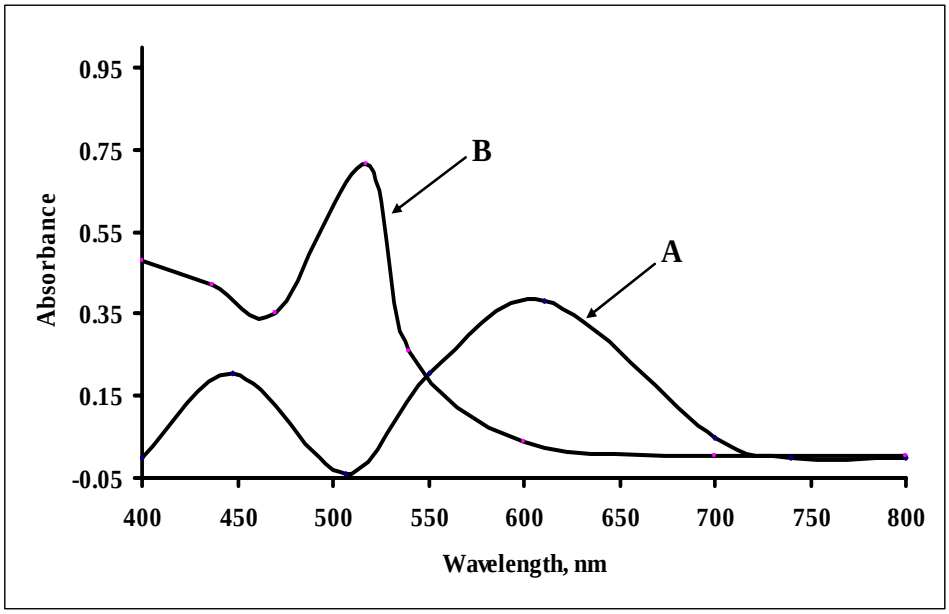


Fig (1):- Absorption spectra of 100 µg of benzocaine / 25 ml treated according to the recommended procedure and measured **(A)** against reagent blank**, (B)** reagent blank measured against distilled water.

Procedure and calibration graph

To a series of 25 ml calibrated flasks, an increasing volumes (0.05- 5 ml) of (100 µg.ml^{-1}) of benzocaine are transferred followed by addition of 2 ml of (0.1% ,*w/v*) promethazine hydrochloride reagent solution, with shaking, followed by 1 ml of (0.1% ,*w/v*) *N*-bromo succinimide solution and then a 5 ml of 0.1N of hydrochloric acid is added to the flasks, the volumes are completed to the mark with distilled water, after 10 minutes the absorbances are read at 611 nm against reagent blank. The calibration graph is linear over the range 5 - 300 µg of benzocaine in a final volume of 25 ml (i.e. 0.2 – 12 ppm) (Fig. 2). The apparent molar absorptivity has been found to be 1.51×10^4 L.mol^{-1}.cm^{-1}.

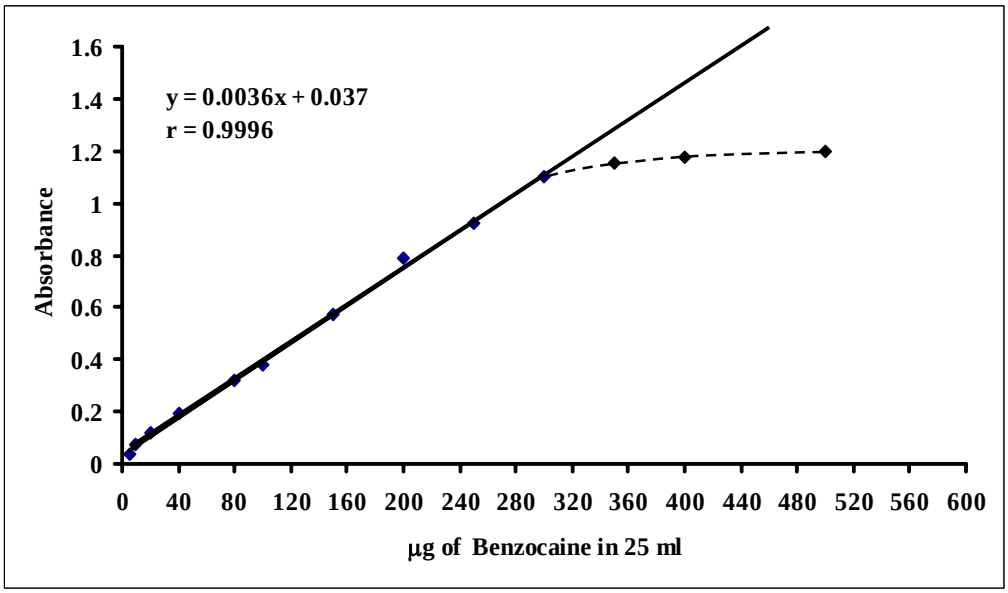


Fig (2):- The calibration graph for benzocaine determination by oxidative coupling reaction with promethazine and *N*-bromo succinimide.

Accuracy and precision

To check the accuracy and precision of the method, benzocaine has been determined for five replicates at four different concentrations. The results illustrated in table 9 indicate that satisfactory precision and accuracy could be obtained.

Table(9):- Accuracy and precision of the proposed method

Amount of benzocaine taken (µg / 25ml)	Relative error*, (%)	Relative standard deviation*, (%)
20	+0.56	±1.96
50	+1.31	±0.60
100	-0.42	±0.49
200	-0.51	±0.31

* Average of five determinations

Interferences

To demonstrate the selectivity of the proposed method, the interfering effect of various pharmaceutical additives were examined by determining 100µg of benzocaine in presence of each of the interferences in final volume of 25 ml using the recommended procedure. The results obtained are summarized in table 10.

Table(10):-Effect of interferences on the determination of 100 µg of benzocaine

Interference	Relative error, (%) / µg of interference added		
	100	200	300
Glucose	+2.50	-2.40	-3.60
Dextrose	+0.76	-2.60	-3.30
Lactose	+1.30	-2.90	-4.50
Starch	-1.40	-1.80	-4.80
Acacia	-0.78	+2.33	+3.32
Salicylic acid	-0.62	+0.71	+1.40
Benzoic acid	-0.32	-0.76	-1.10

Nature of the dye

The composition of the colored dye yielded from the oxidative coupling reaction between benzocaine and promethazine hydrochloride reagent has been established using continuous variation (Job's) method[15] (Fig. 3) indicate that the colored dye has a composition of 1:2, benzocaine to promethazine hydrochloride reagent at 611 nm.

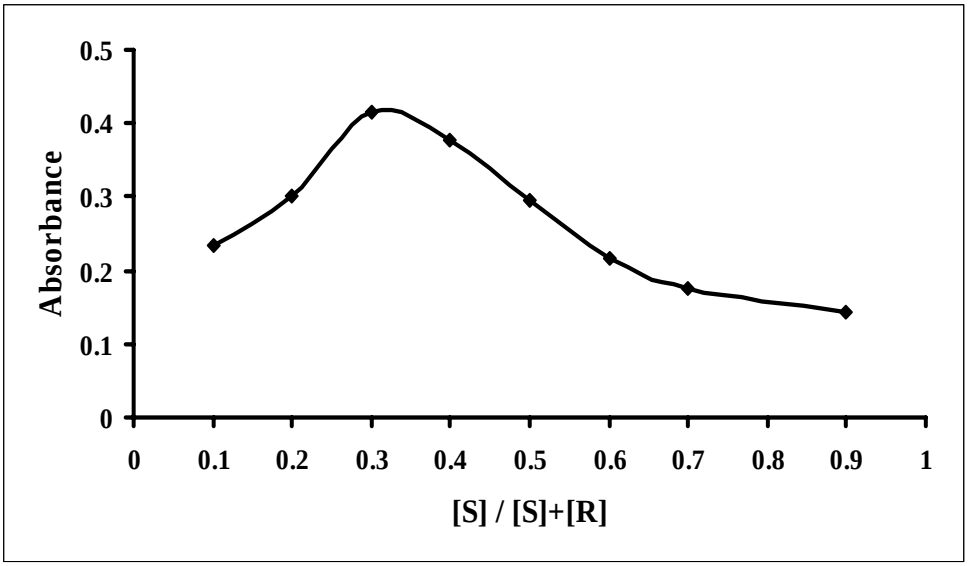
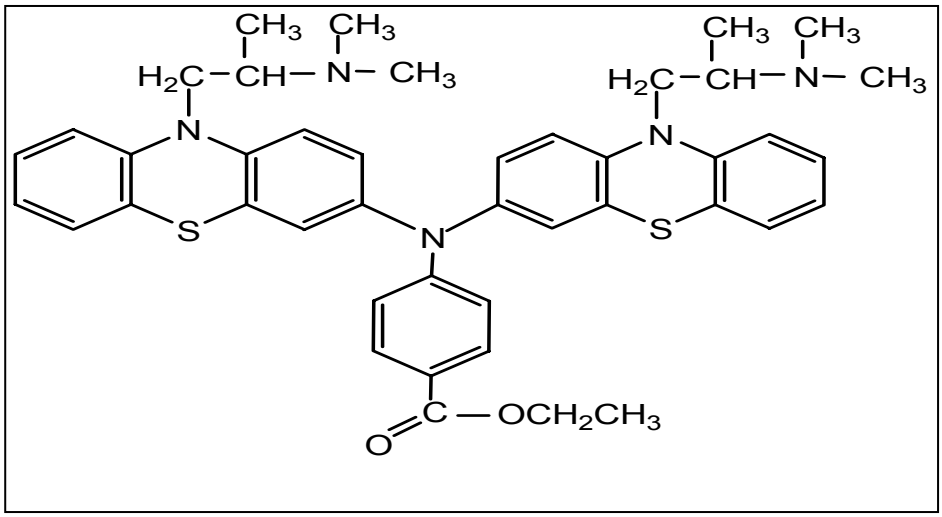


Fig (3) :- Job's plot for benzocaine (S)- promethazine hydrochloride(R)

The apparent stability constant has been calculated [16] and is found to be 1.50×10^{8} $L^{2}.mol^{-2}$, indicate that the formed dye is stable. Therefore, the structure of the formed dye may be written as follows.



Green complex

APPLICATION OF THE METHOD

The proposed method is applied to determine benzocaine in two pharmaceutical formulations. On applying proposed procedure, good recovery is obtained as shown in table 11.

Table(11):- Application of the proposed method for the determination of benzocaine

Drug	Pharmaceutical preparation	Supplier	Certified value	µg of Benzocaine present /25 ml	µg of Benzocaine measured/25 ml	Recovery (%)
Tampain®	OTIC solution (Eardrop)	DIAMOND PHARMA (Syria)	50 mg	50	48.95	97.90
				100	98.40	98.40
				150	148.65	99.10
				200	189.80	94.90
Cepacol®	Anesthetic sore lozenges	BAYER (Germany)	10 mg	50	49.98	99.96
				100	102.30	102.30
				150	149.85	99.60
				200	200.2	100.10

Comparison of the method

Table 12 shows the comparison between some of analytical variables obtained from the present method with that of a recent analytical method.

Table (12):-Comparison of the methods

ANALYTICAL PARAMETERS	PRESENT METHOD	LITERATURE METHOD [5]
pH	Acidic	Acidic
Temperature (°C)	At room temperature	At room temperature
Development time(minutes)	10	10
λ_{max} (nm)	611	525
Medium of reaction	Aqueous	Aqueous
Reagent	Promethazine. HCl	*p*-Benzoquinone
Type of analytical reaction	Oxidative coupling	Charge-transfer
Beer's law range (ppm)	0.2 – 12	5 – 70
Molar absorptivity ($L.mol^{-1}.cm^{-1}$)	1.51×10^{4}	1.7×10^{3}
Relative error (%)	–0.51 to +1.31	±1.5
RSD (%)	±0.31 to ±1.96	±0.83
Color of the dye	Green	Red
Sandell's sensitivity ($\mu g.cm^{-2}$)	0.01097	0.0972
Nature of the dye	1 : 2	1 : 1
Application of the method	Determination of benzocaine in two pharmaceutical formulations	Determination of benzocaine in one pharmaceutical formulations

The results indicate that the proposed method has a good sensitivity compared with the above literature method.

CONCLUSION

A simple, rapid and sensitive method has been proposed for the microdetermination of benzocaine in aqueous solution. The method based on the oxidative coupling reaction of benzocaine with promethazine hydrochloride reagent using *N*-bromo succinimide as oxidizing agent in acidic medium. The proposed method requires neither temperature control nor solvent extraction and provides accurate and precise results when applied successfully to the determination of benzocaine in two types of pharmaceutical formulations.

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THE EFFECT OF OXIDATIVE STRESS ON THE LEVELS OF SOME ENZYMES AND TRACE ELEMENTS IN SERA OF STOMACH CANCER PATIENTS

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ABSTRACT

The study was concerned with investigation the effect of oxidative stress on some biochemical parameters in patients with gastric cancer. It was conducted on (43) patients with gastric cancer from both sexes. Control and patient groups were closely related in their age which range between (18-80) years.

Histological biopsies were taken for the pathological and bacteriological tests. *Helicobacter pylori* infection was observed which confirmed the presence of cancer cells. Blood samples of patients groups were compared with (62) blood samples taken from healthy individuals as a control group. The measured parameters in sera were included the activity of some enzymes (xanthine oxidase, deoxyribonuclease (acid and alkaline)) and some trace elements(selenium, cupper and zinc). Also glutathione, ceruloplasmin, lipid peroxidation (malondialdehyde) and peroxynitrate radical were also tested in the present study.

The results showed a significant increase in the activity of xanthine oxidase (X.O), acid and alkaline DNase in serum of patients with stomach cancer compared with control, while a decrease in the levels of antioxidants (glutathione and ceruloplasmin) was observed. The results showed a significant reduction of trace elements (copper ,zinc and selenium) concentrations for patients with stomach cancer.

Finally, the results also demonstrated a significant elevation in blood free radicals (lipid peroxidation and peroxnitrite) concentrations for patients with stomach cancer in comparison with control group.

KEYWORDS Stomach cancer Oxidative stress Helicobacter pylori

INTRODUCTION

Oxidative stress defined as an imbalance between the formation of reactive oxygen species (ROS) and antioxidative defense mechanisms. In the view of the profound biological effects of ROS, in recent years, numerous clinical and experimental studies focused on detection of signs of oxidative stress in cancer patients (Saleem, 2002). Where antioxidative defense mechanisms are attenuated, it is the imbalance between formation of ROS and defense mechanisms that creates oxidative stress (Galle, 2001; Langseth, 1995).

Most of the potentially harmful effects of oxygen are believed to be due to the formation and activity of reactive oxygen species as oxidants. These are, compounds with a tendency to donate oxygen to other substances. Many reactive oxygen species are free radicals. These free radicals are unstable and highly reactive (Tepel, 2003). Formation of ROS is part of the unspecific defense system of an organism against, for example, bacteria and other microbes. However, ROS may also affect cells of the host organism, in particulars at sites of inflammation (Galle, 2001).

As far as cancer, it is believed it begins when a cell reproduces for no obvious reason and is not receptive to the normal signal to stop reproducing. This unchecked growth spreads through the body and interferes with the ability of the body and its cells, organs, and other structures to perform their normal functions (Luciano *et al*., 2001). In fact, along last years, oxidative stress, showed an important pathologic mediator in divers and many clinic sites as carcinogenesis. The reasoning is due to these reactive oxygen species which can be found in several cells including macrophages and vascular smooth muscle cells (Sartori, 1984).

The stomach is part of the digestive system and connects the esophagus to the small intestine. Once food enters the stomach the muscles in the stomach help to mix and mash the food using a motion called peristalsis (Sperelskis and Banks, 1996). Stomach cancer can develop in any part of the stomach and can spread throughout the stomach and to other organs such as the small intestines,lymph nodes, liver, pancreas and colon(Casciato and Lowitz,2000;Pazdure *et al*.,2004).

There is a great evidence that *Helicobacter pylori* usually live in the stomach antrum and require urease enzyme to colonize mucus layer, and cause 90% of peptic ulcer diseases and participate in70% with other factors in incidence of stomach cancer (Kearney, 2003). Modern studies showed that the *Helicobacter pylori* considered a primary cause of gastric cancer because *Helicobacter pylori* infection causes increased production of reactive oxygen species within the gastric mucosa. This, possibly leading to the *Helicobacter pylori* associated diseases .Severity of inflammation and damage associated with *Helicobacter pylori* infection is dependent on stomach cells ability to counteract the increased reactive oxygen species load. The increase of reactive oxygen species which are formed by *Helicobacter pylori* lead to large effect on the cell and cell membrane as were as to oxidative stress, which has an important role in many diseases like cancers (Everett *et al*., 2001; Cobbs *et al*., 2003; Tokudome *et al*., 2005).

MATERIALS AND METHODS

The patients were enrolled in the gastroendoscopy unit of Al-Salam general hospital in Nineva governorate /North of Iraq in the fasting state. Different individuals were selected as control healthy groups. Venous blood samples (10) ml were drawn from (43) patients of stomach cancer. Samples, then transferred immediately to a clean dry plain tube. After removing the needle, the blood was allowed to

clot for at least (10-15 min.) at room temperature, centrifuged for (10) min. at (4000xg). Serum was removed for the measurement of biochemical parameters (Tietz, 1999). Blood serum was obtained from (62) healthy individuals ranging in age between (18–80) years as a control groups. Biopsies (tissue samples) were taken from patients using a lighted, flexible tube with a camera, called an endoscope, inserted through the mouth into the esophagus and then into the stomach and examined under a microscope to investigate cancer cells.

Table (1): Determination of biochemical parameters in blood serum.

Biochemical Parameters	Method Of Determination	Technique	References
1-Xanthine Oxidase(X.O)	Colorimetric	Spectrophotometer	Ackermann & Brill, 1974
2-Acid DNase	Colorimetric	Spectrophotometer	Kunitz, 1950
3-Alkaline DNase	Colorimetric	Spectrophotometer	Kunitz, 1950
4-Glutathione (GSH)	Colorimetric	Spectrophotometer	Sedlak & Lindsay,1968, Ozaras *et al*., 2003
5-Lipid peroxidation (MDA)	Colorimetric	Spectrophotometer	Beuge & Aust,1978,
6-Ceruloplasmin	Colorimetric	Spectrophotometer	Menden *et al*., 1977
7- Peroxnitrite ($ONOO^-$)	Colorimetric	Spectrophotometer	Vanuffelen *et al*., 1998
8- Selenium(Se)	Colorimetric	Spectrophotometer	Cummins *et al*., 1965
9- Copper (Cu)	Atomic absorption	Atomic absorption spectrophotometry	Tietz, 1999
10-Zinc(Zn)	Atomic absorption	Atomic absorption spectrophotometry	Tietz, 1999

Statistical analysis

Statistical analysis was performed using SAS statistical software (SAS, 1996). The results were expressed as mean ± SD. Duncan test was used to differentiate between the mean values for blood biochemical parameters. The comparison included patients of stomach cancer and healthy control groups. The means were distinguished among statistical groups at $P < 0.05$, has been taken as statistically significant.

RESULTS

The results of the measured biochemical parameters are summarized in table (2) and figures (1, 2, 3). The xanthinoxidase, acid DNase and alkaline DNase activity showed a significant increase ($P < 0.05$) in serum of stomach cancer patients compared to control group. There was a significant reduction ($P < 0.05$) in glutathione and ceruloplasmin levels in serum of stomach cancer patients. Lipid peroxidation (MDA) and peroxnitrite were higher in patients of stomach cancer compared to control groups. The trace elements (selenium, copper and zinc) concentrations were significantly lower in serum of patients than control.

Table (2): Values of biochemical parameters in patients of stomach cancer and control groups ± standard deviation.

Biochemical parameters	Mean ±SD		P- value
	Stomach cancer sample no.(43)	Control Sample no.(62)	
1-Xanthine Oxidase(X.O) (U/L)	14.31±3.26	8.50 ±2.86	p<0.05
2-Acid DNase (U/L)	37.90±5.83	15.80± 3.34	p<0.05
3-Alkaline DNase (U/L)	12.55±4.05	4.1 ±1.24	p<0.05
4-Glutathione (GSH) µmol/L	3.63 ±1.37	5.99±1.62	p<0.05
5-Lipid peroxidation (MDA) µmol/L	0.42±0.08	0.20 ± 0.09	p<0.05
6-Ceruloplasmin µmol/L	171.31±16.94	260.76 ±53.97	p<0.05
7- Peroxnitrite($ONOO^-$) µmol/L	108.94±19.39	71.04 ±23.47	p<0.05
8- Selenium(Se) µmol/L	0.39±0.16	0.82±0.28	p<0.05
9-Copper (Cu) µmol/L	11.21±2.05	17.06±2.63	p<0.05
10-Zinc(Zn) µmol/L	14.08±3.05	22.09±4.58	p<0.05

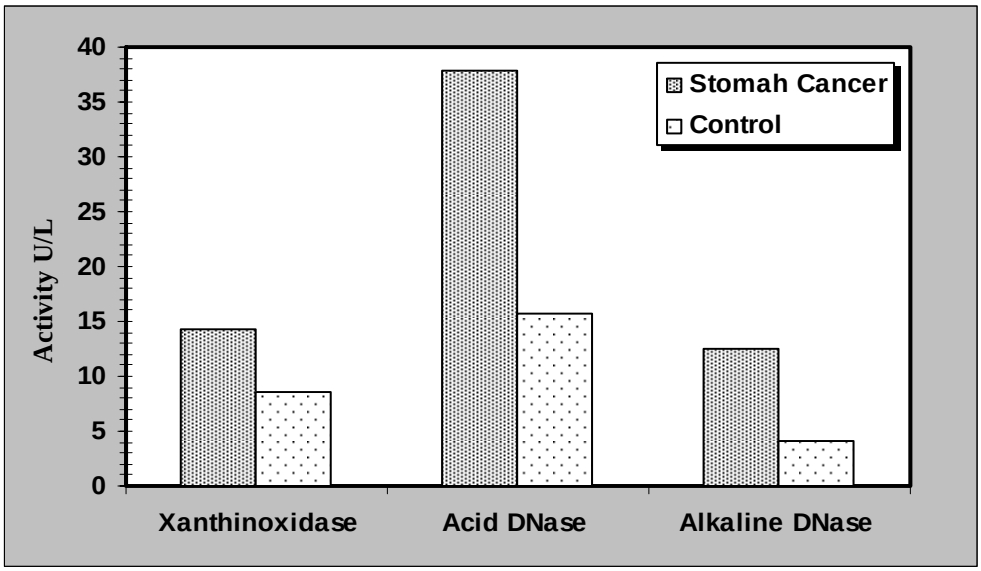

Fig (1): Effect of oxidative stress on enzymes activity.

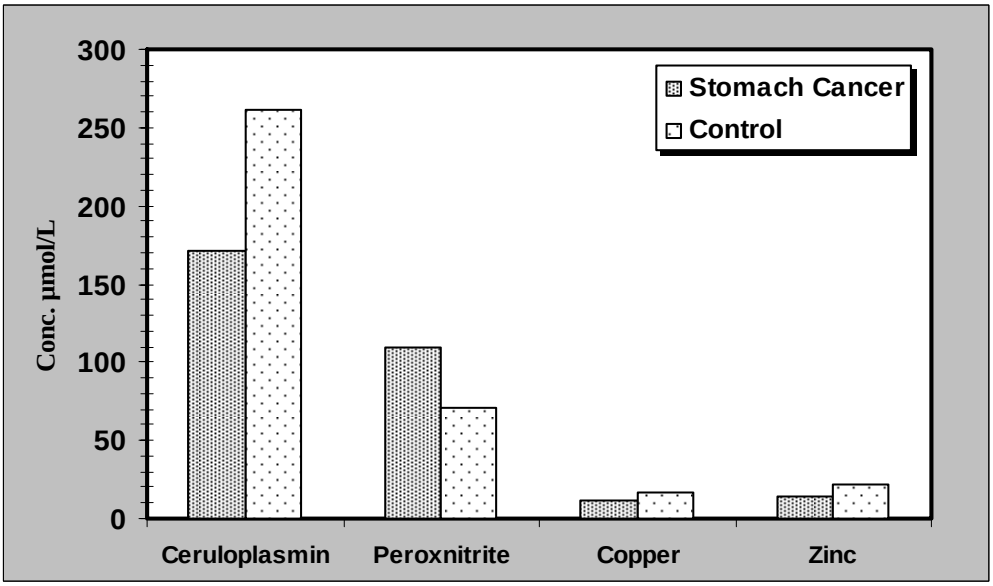

Fig (2): Effect of oxidative stress on ceruloplasmin, peroxnitrite, copper and zinc concentrations

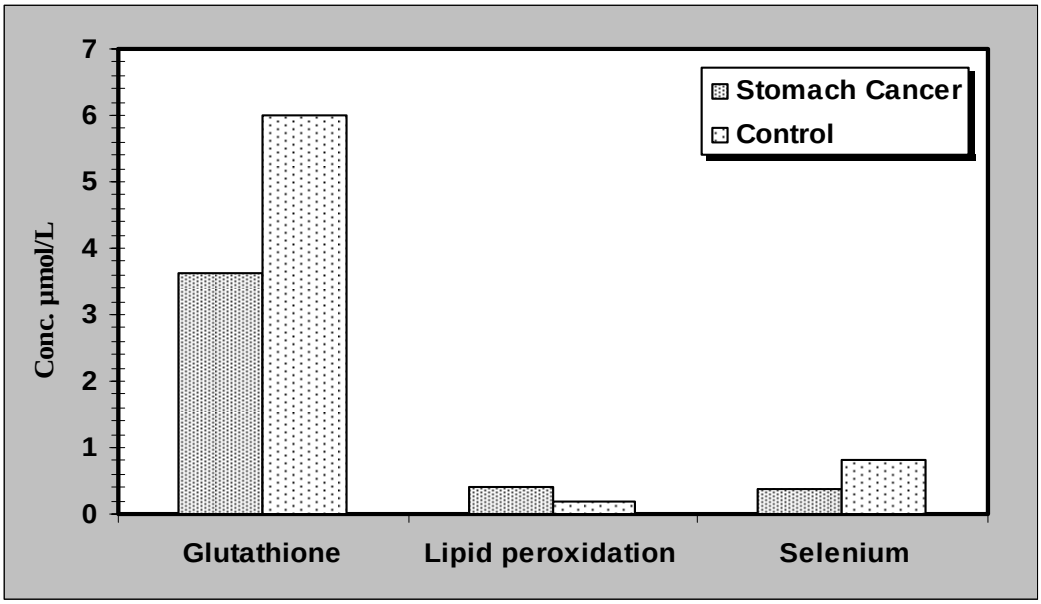

Fig (3): Effect of oxidative stress on glutathione, lipid peroxidation and selenium concentrations

DISCUSSION

1-Xanthine Oxidase activity (X.O):

The results in table (2) and figure (1) showed a significant increase ($P < 0.05$) in xanthine oxidase activity in stomach cancer patients compared to healthy control group. The higher activity of X.O may be due to the function of the enzyme which catalyzes the breakdown of nucleotides to form uric acid. Uric acid contributes to the antioxidant capacity of the blood. The enzyme serves as a source of oxygen derived free radicals which include both cellular injury and edema as well as changes in vascular permeability during the damaging cell membrane by reacting with membrane fatty acids which lead to release of the enzyme into the blood (Kokoglu *et al.*,1990;Griguer *et al.*,2006). Other studies showed that the X.O levels in blood significantly increased in different pathological cases, like aging, ischemia reperfusion, inflammation and cancer and that ROS generated in the enzymatic process are involved in oxidative damage (Borges *et al*., 2002).

2- Deoxyribonucleases activity (DNase):

The correlation of serum DNase levels with tumor histological type shows that enzyme elevations occur only in the clinical course of the tumor. These finding warrant investigations of the biologic significance and possible clinical usefulness of serum DNase determination in cancer patients (Tolun and Myers,2003).It was suggested that elevation of DNase activity in cancer of the endometrium help the detection of the early disorder in the proliferation processes coursing in endometrial tissue and thus prevent tumor development (Taper *et al*., 1971).

Table (2) and figure (1) showed a significant increase in the activity of acid DNase in stomach cancer patients ($P < 0.05$) compared to control groups. The increase of acid DNase activity might be due to the high turnover of DNA in proliferating cells than normal cells (Dale, 1965). The increase of serum acid DNase in cancer patients might be due to a sign tissue damage which lead to the changes in cell membrane permeability and the enzyme released in to the serum (Lykourinas *et al.*, 1982).

The results in table (2) also showed a significant increase ($P < 0.05$) in alkaline DNase activity in serum of patients with stomach cancer compared with control group. The variation in serum DNase activity could be a simple, rapid and valid marker for monitoring cancer therapy and disease evolution. It was showed (Patel *et al*., 2000) that the serum alkaline DNase (a known circulating tumor marker) could be used for treatment monitoring of cancer patients. The activity of these enzymes in serum appeared to be useful in predicting treatment response in the long term follow up of patients. It has been suggested that the measurement of acid and alkaline DNase could be considered as malignant disease markers (Lykourinas *et al.,* 1982).

3-Ceruloplasmin (Cp):

Statistical analysis (table 2 and figure 2) showed a significant decrease ($P < 0.05$) in ceruloplasmin levels, in serum of stomach cancer patients compared to control groups. The reasons for the decreasing ceruloplasmin concentrations in stomach cancer patients might be due to considering the ceruloplasmin as one of the important preventive antioxidants which prevent new free radicals formation, and bind with minerals then, prevent the reaction of these minerals with hydrogen peroxide to form free radicals. These radicals lead to damage of cellular component therefore, the level of ceruloplasmin decreased in blood (Halliwell and Gutteridge, 2000).

4- Peroxy Nitrite:

Peroxy nitrite in the blood serum was determined depending on the formation of nitro phenol which reverses the level of peroxy nitrite radical in blood. Peroxynitrite ($ONOO^-$) is a highly reactive molecule produced by excess NO and $O_2^{\cdot-}$. Increase levels of the free radicals nitric oxide (NO) and superoxide O_2^- occur in malignancies *in vivo*. The Concentrations of peroxy nitrite associated with a tumor inflammatory environment (Cobbs *et al.,* 2003).

Results in table (2) and figure (2) showed a significant elevation in peroxy nitrite radicals in serum of stomach cancer patients compared with control croups. The increase of peroxy nitrite radicals might be due to the excess of super oxide radicals (O_2^-), which is formed as a result of reaction between nitric oxide NO and super oxide radical (O_2^-) (Paul *et al.,* 1998; Cobbs *et al.,* 2003).

5- Copper (Cu):

The level of copper in serum of patients with stomach cancer are found to be significantly decreased ($P < 0.05$), when compared to control group. Similar results showed that the copper concentrations decreased in serum of patients with different types of cancer (Alta´ee, 2003). The reason for the decreasing of copper in cancer patients might be due to the importance role of copper as a component of enzyme or proteins involved in redox reaction such as ceruloplasmin, superoxide dismutase (SOD), dopamine β-hydroxilase, ascorbate oxidase,tyrosinase and cytochrom C oxidase (Prohaska,1988). Several studies attributed the redox activity of copper to its electronic configuration of d–orbital which helped it to scavenger the free radicals as Cu-Zn-SOD reaction (King, 2004). The decrease of copper level also may be due to malnutrition or malabsorption which are found in stomach cancer patients (Vanholder *et al.,* 2002)

6- Zinc (Zn):

Zinc is the second most abundant trace elements in human body. It is an essential cofactor for enzymes which control many cell processes including DNA synthesis, normal growth, brain development, reproduction, membrane stability, bone formation wound healing and protection from free radicals damage (Keen, 1990; Bishop *et al.*,2005).It was noted (Alta´ee ,2003) that the zinc concentration in serum of patients with different types of cancer was significantly decreased when compared with control groups. Statistical analysis showed a significant decrease ($P < 0.05$) in zinc levels in serum of stomach cancer patients compared to control groups. The obtained results were in agreement with those reported by other (Kabuto *et al.,* 1994).

The reduction of zinc concentration might be due to loss of zinc from the membrane resulting in an increase susceptibility to oxidative damage, structural strains and alteration in specific receptor sites and transport system (Lehninger, 2005).

7- Selenium (Se):

Selenium plays a key role in the maintenance of normal health in human populations and a part of the active site of glutathione peroxidase (GSH-Px), as an antioxidant enzyme (King, 2004).It was reported **(**Safaralizadeh *et al*., 2005), that vitamin E and selenium supplements taken in combination resulted in a 13% reduction in cancer mortality in a population with high rates of esophagal and stomach cancer.

Selenium concentration in patients serum with different kinds of cancer included in stomach cancer was determined and found to be significantly decreased, when compared to control groups (Allwsh, 2000).

The results in table (2) and figure (3) showed that there was a significant decrease ($P < 0.05$) in selenium concentration in serum of stomach cancer patients. The obtained results were in agreement with those reported by other invistigators (Díez ,2003; Knekt *et al*.,1990; Kabuto *et al.,*1994), which showed a lower selenium levels in stomach and pancreatic cancer patients. Decrease selenium concentration might be due to that the selenium enhancement of immunity or effects on the metabolism of carcinogens or the formation of anti-cancer selenium metabolism (Garry and Larry,2003; Dönder *et al*.,1998). It also might be due to that the stomach cancer is a one of gastrointestinal disorders which lead to the decrease in the absorption of selenium resulting in depletion or deficiency of selenium might be destroyed when foods are refined or processed .It also, might be due to that the benefits of selenium were attributed to its ability to scavenge DNA-damaging free radicals and to help in the elimination of damage, potentially cancerous cells (Larsen.2003**)**. The decrease might occur because of the important role of selenium in controlling the interacellular level of hydrogen peroxide, reducing the formation of reactive oxygen species (the main cause of cancer) that could induce oxidative stress and lipid peroxidations with consequent damage to the cellular membranes. An experimental study had showed that an increase in selenium level is associated with decreased cancer mortality (Safaralizadeh *et al*., 2005; Larsen. 2003).

8- Lipid peroxidation (Malondialdehyde) :

Malondialdehyde is very reactive species, represents hydrolysis of unsaturated fatty acids in cellular membranes by chain of autocatalysis reaction of free radicals. These reactive species react with protein thiol groups, and also cross-link amino group in proteins producing functionally defective aggregates (Gillham *et al*., 2000). It was noted (Everett *et al*., 2001) that the malondialdehyde can react with DNA bases to form the mutagenic adduct malondialdehyde-deoxyguanosine. In *Helicobacter pylori* infection, the reactions with the lipid bilayer results in the accumulation of degradation products, such as MDA a compound that has been shown to be present in increased concentrations in *Helicobacter pylori* gastritis.

Table (2) and figure (3) showed a significant increase in malondialdehyde concentration in serum of stomach cancer patients ($P < 0.05$) when compared with control groups. These results were in agreement with other (Everett *et al*., 2001) which showed increased concentrations of lipid peroxidation products in serum of stomach cancer patients.

The reasons for increased malondialdehyde concentration possibly due to morbidity of stomach cancer, since stomach cancer patients undergo oxidative stress which lead to break down of cell components by free radicals and reactive oxygen species ROS as a result of increasing of its concentration in the body and decrease the efficiency of antioxidant system (Weinstein *et al.*,2000). Also, it might be due to presence of *Helicobacter pylori* in stomach cancer patients which mediated carcinogenesis through induction of DNA damage and mutations as a result of increased activity of reactive oxygen species in the gastric mucosa. These compounds could damage DNA directly by causing strand breaks, a purinic sites, or DNA adducts. The accumulation of MDA in *Helicobacter pylori* infected gastric mucosa not only provides evidence of increased oxidative stress and lipid peroxidation, but might also have a carcinogenic role (Everett *et al*., 2001). On the other hand, there was a consistently significant positive relationship between the presence of *Helicobacter pylori* and increasing MDA concentration. *Helicobacter pylori* infection of human stomach stimulates the generation of reactive oxygen and nitrogen species. Cell membranes, which are rich in polyunsaturated fatty acids, are readily attacked by these compounds, producing fatty acid radicals and lipid hydroperoxides.This might decompose in complex ways, yielding more radical species and a wide range of compounds, notably aldehydes (Neiva *et al*.,2002). It is also can be attributed due to glutathione loss from the tissue, increasing malonyldialdehyde levels and impairing antioxidant defense systems in humans (Ozaras *et al*.,2003).

9- Glutathione (GSH):

Glutathione is the body's most important internal antioxidant, i.e. its main defense against damage and disease (cardiovascular disease cancer, cataracts, hypertension, diabetes, hepatitis, HIV, and cystic fibrosis) caused by free radical reactions (Larsen, 2003).

Results in table (1) and figure (3) showed a significant decrease in glutathione level in serum of stomach cancer patients ($P < 0.05$) when compared with control groups. Reduction of glutathione level might be due to glutathione availability importance in mounting an adequate defense against the reactive oxygen species generated by the *Helicobacter pylori* infection and also to the increasing glutathione availability which could provide a novel method for preventing or reducing the damage caused by *Helicobacter pylori*. Glutathione might absorb free radicals, then it becomes oxidized and loses its antioxidant properties (Shekhar *et al*., 2004; Matthews and Butler, 2005).

CONCLUSIONS

From the foregoing results, it could be concluded that the oxidative stress, can be used to help the diagnoses and identify the severity of process and even can determine the stage of stomach. Also the levels of these parameters might be a great help in the management of such patients as these parameters can be standardized and used as usual investigations.

The decrease in antioxidants minerals (copper, zinc and selenium) might be considered as a biochemical marker of oxidative stress association. Also the increase in activity of the following enzymes (X.O, acid and alkaline DNase and free radicals (MDA and Peroxy radical) could be as good marker for stomach cancer. Finally the decrease in the concentration of glutathione and ceruloplasmin which was noted in malignant stomach cancer.

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تأثير الجهد التأكسدي على مستويات بعض الأنزيمات والعناصر النادرة في مصل دم مرضى سرطان المعده

الخلاصة

تضمنت الدراسه الحالية التعرف على تأثير الجهد التأكسدي على مستويات بعض المتغيرات الكيموحيويه عند مرضى سـرطان المعده. أجريت هذه الدراسة على (43) مصاباً بسرطان المعدة ومن كلا الجنسين, وكانت مجاميع المرضى والسيطرة بأعمار متقاربة (18-80) سنة, إذ استؤصلت الخُزع النسيجية لأجراء الفحوصات النسيجية والبكتريولوجية من اجل التحري عـن الأصـابة بالبكتريا الملوية البوابية وعن وجود الخلايا السرطانية. كما فورنت مجاميع المرضى مع (62) نموذجاً من الدم لأشـخاص أصـحاء كمجموعة سيطرة.

تضمنت المتغيرات الكيموحيوية المقاسة في مصل الدم كلاً من فعالية أنزيم الزانثين أوكسيديز (X.O) والديوكسي رايبونيوكليز DNase الحامضي والقاعدي، بالإضافة إلى مستوى بعض العناصر النادرة (النحاس، الخارصين والـسيلينيوم). كمـا تم في هـذه الدراسة قياس بعض مضادات الأكسدة الأخرى كالكلوتاثايون والسيريلوبلازمين بالاضافة إلى التعرف على مستوى بعض الجذور الحرة كالبيروكسي نايتريت والمالونالديهايد.

اشارت النتائج إلى أن هناك ارتفاع معنوي في فعالية أنزيم الزانثين اوكسيديز X.O والديوكسي رايبونيوكليز DNase الحامضي والقاعدي عند مرضى سرطان المعدة مقارنة مع مجموعة السيطرة، بينما لوحظ العكس في مستوى الكلوتاثايون والسيريلوبلازمين. كما أشارت النتائج أيضاً إلى وجود انخفاض معنوي في تركيز كل من النحاس، الخارصين والسيلينيوم في مصل دم المرضى مقارنـة مع الأصحاء، كما أثبتت الدراسة الحالية وجود زيادة معنوية في تركيز الجذور الحرة كالبيروكسي نايتريت والمالونالديهايـد عنـد مرضى السرطان مقارنة مع مجموعة السيطرة.

كاريگەری ژەبری ئۆکساندن لەسەر ئاستی هەندێك ئەنزیم وتوخمە کەمە کانمی ناو پلازمای خوێن بۆ نەخۆشی شێر پەنجەکا گەدە

کورتی

مەبەست (ئارمانج) ژ ڤێ ڤەکۆلینێ بۆ ڤەراستگرنا کارتێکرنا زەبرا ئۆکساندنێ لسەر هندەك تبابا نە گهورین کیمیاژیاني یێ نەخوشێن پەنجەشیرا گەدەی. ئەڤەژی هاتە گەهاندن (کرن) لسەر (43) نەخوشین پەنجەشیرا گەدەی بۆهەردوو توخما. گروپێن زالگەھ و نەخوشا بهوری گەراندنە سەر ژینێن وان ئەوێن لناڤبەرا (18–80) سالین بوون.

هەلکیشان ئو ئەزمونکرنا تەڤنێ زندیی یێ لەش بۆ هەردوو نەخوشی زانـی و بـەکتریا زانـی هاتـە کـرن. تەشـەنەبوون ب لوولەبەکتریا Helicobacter pylori هاتە دیتن، ئەوژی ب بەرچـاڤ بوونـا شـانێت پەنجەشـەرێ ب پـشت راسـتی. بـژارێت (نموونێت) خوینێ یێت گروپا نەخوشا هاتنە هەڤبەرکرن (بەرامبەرکرن) دگەل (62) بژارێن دن ییَن خونێ یا لەش ساخا وەك گروپێ زالگەھ. پیڤەکا تبابا نە گوًرا یێت خـونێ برێـژا خویـاکر کـو هنـدەك ئـەنزیمێت چـەلەنگ xanthine oxidase, acid DNase and alkaline DNase وهندەك هوکارێت پێتڤی (Copper, Zinc and Selenium) دناڤدا هاتنە خو یاکرن. هەروەسا (glutathione ,malondialdehye , peroxy nitrate and ceruloplasmin) ییّت بنەرەتی هاتنە تاقیکرن د ڤێ ڤەکولینێدا.

ئەنجاما دیارکر زێدەبوونا بەرچاڤ د چالاکیا xanthine oxidase و ترش و تفتێت DNase دناڤ خونێ سیرێژا نەخوشێت پەنجەشێرا گەدەی وەختێ دهێتە بەراوردکرن دگەل گروپا لەش ساخا. بەلێ کێمکرن دئاستێت دژە ئوکساندنا (glutathione and cerulopasmin) هاتە دەست نیشانکرن.

هەروەسا ئەنجاما دیارکر کـو داشـکاندن دخەسـتي یـا هوکاریـت بیتفـي(copper,zinc, and selenium لـدف نەخوشـیَن پەنجەشیَرا گەدەیدا هەیە. ل دوماهیێ ئـەنجاما نیـشاندا بلندیـەکا شـوپەوەر د خەسـتیا بنـەرەتیَن ئـازا ییَـت خـونیً (lipid peroxidation (MDA) and peroxnitrite (ONOO-)) دناف خونـا نەخوشـیَت پەنجەشـیَرا گـەدەی دبەراوردیـدا دگـەل گروپیً لەش ساخا.

IN *Vitro* AND *Vivo* EFFECTS OF GREEN TEA EXTRACT ON ANTIBIOTIC RESISTANCE OF *Staphylococcus aureus*.

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ABSTRACT

Fifty isolates of *Staphylococcus aureus* were obtained from different human specimens, and dairy products. Identified through cultural, morphological and biochemical examination, in addition to API staph test. Susceptibility test to nineteen antimicrobials were performed for all isolates. The isolates were grouped to eighteen antibiogram, according to their resistance to tested antimicrobials, 70% of the isolates were resist to Cefixime (Fox),while 45% were resist to Chloramphenicol (Cm) and (Nal) Nalidixic acid, and all of them were sensitive to Ampicillin (Am), Amoxicillin (Amc), and lincomycin (Ln). One isolate (No.S32) was resist to fourteen out of nineteen antimicrobials used, while others showed different resistance. Transformation process indicate that the genes responsible for (Cm), Erythromycin (Ery), Cephalexin (Kf), Cloxacillin (Clx), Streptomycin (Sm), Tobramycin (Tob), Tetracyclin (Te), and Trimethoprim (Tm) resistance were located on the plasmid DNA, and others were either chromosomally located or located on large plasmid that braked during extraction. The minimum inhibition concentration (MIC) of water and alcohol extract of green tea was determined (250 and 400µg/ml) respectively. Sub-Minimum inhibition concentration 240, 390µg/ml and 0, 5% Sodium dodesyl sulphate (SDS) were used as curing agents using isolate S32. Alcoholic extract was more effective, and reduced 70% to 100% resistance of S32 isolate to Amk, Augmentin (Aug), Cefotaxime (Cef), Cm, Doxycilin (Do), Fox, Nal, Sm, And Te. Water extract reduced 10% to 100% resistance of same isolate to Am, Aug, Fox, Cm, Clx, Dox, Nal, Ery, Kf, Sm, and Tob, and did not affected Cef, and Te resistance genes. Treating *Mus Musculus* mice (WBC count of 3000-4000x10^3) with Sub-MIC of green tea extract, after orally infected with more resistant isolate S32, and appearance of disease septum (with 6000x10^3WBC count). After treating the mice with Cloxacillin to which the bacteria normally had resistance to, the WBC count was 4900x10^3/µl which is high comparing with the control. When infected mice treated with sub-MIC with Cloxacillin the WBC count reduced to 2100-3000x10^3/µl which is in the normal range, and the mice were healthy with good physiological behavior.

KEY WORDS Staphylococcus aureus antibiotic resistance extract Green tea extract.

INTRODUCTION

Staphylococcus aureus is common bacteria, and found in up to 40% of normal people in the nose, the skin, the axial or perineum (Gillespie and Bamford, 2000). Its infections are difficult to treat, due to the multi-drug resistance and organisms remarkable ability to persist in the host. Persistence and the evolution of resistance may be related to several complex regulatory networks, which modify transcription in response to environmental stress, or by conjugation through the plasmids(Cirz *et al*.,2006).Factors contributing to the resistance problem have include the molecular mechanisms of genetic variability (mutation, homologues recombination, site-specific integration,transposition),and the mechanisms of intercellular gene transfer in bacteria (transformation, transduction and conjugation) (Kayser *et al*., 2005).

There is a continuing search for new antimicrobial agents from other sources including plant extracts. These plants which emerged as compounds with potentially significant theatric application against human pathogen (Kath et al., 2003). Most of the investigations showed that Green tea can be used for treating many diseases caused by many pathogen, due to its chemical components (Hamilton-Miller, 1995 & Toda *et al*., 1989).

The aim of the study is to determine the antibiotic resistance and site of antibiotic resistance genes In *S. aureus* bacteria isolated from different specimens of patients in Erbil city. Elimination the antibiotic resistance by green tea extracts in *vitro* and *vivo* using a laboratory mice.

MATERIALS AND METHODS

Local bacterial isolates

Fifty isolates of *Staphylococcus aureus* were obtained from different clinical specimens (urine, nose, throat and wound), recruited from teaching hospital, public health Laboratary, maternity and Rizgary Teaching Hospital in Hawler city, and samples from dairy products.

Antibiotics

Nineteen antimicrobials: Amoxicillin (Amc), Ampicillin (Am),Amikacin (Amk), Cefotaxime (Cef), Cephalexin (Kf), Cefixime (Fox), Chloramphenicol (Cm),Ciprofloxacin(Cip),Cloxacillin(Clx), Doxycyclin (Do),Erythromycin(Ery),Augmenten(Aug), Lincomycin (Ln),Nalidixic acid (Nal),Rifampin (Rif), Streptomycin (Sm),Tetracyclin (Te), Trimethoprim (Tm), Tobramycin (Tob), were used with their final concentrations, after autoclaving and cooling to 50^{o}C. Antimicrobials were added to Muller-Hinton agar using dilution method, then sensitivity was performed by streaking on the surface of the medium after incubation time.

Identification of *S. aureus*

Morphological characteristics of isolates were performed after preparation of smears. Coagulate, agglutination test (Reynolds, 2005), and API staph test were employed.

Extraction of plasmid DNA

Plasmid DNA was extracted followed the method that described by (Birnboim and Doly, 1979). Transformation process was performed to determine the location of antibiotic resistance genes of tested isolates using the method of (Mandel and Hige, 1970). The isolated plasmid DNA has been

transformed to a laboratory *E. coli* K12JM83 strain which has the following genotype {ara, Δ (lac pro A, B), rpsl, Ø80, lacZ ? M15, JM83 r^{+k} m^{+k} piR}. Competent cells were prepared using the method described by (Mandel and Hige, 1970), then five ml of nutrient broth inoculated with single colony of *E. coli* Jm83, then incubated with shaking (100rpm) for 18-24 h. at 37 ° C, then one ml of bacterial culture added to 50 ml nutrient broth, incubated with shaking at 37ºC 100rpm until the culture reach to active logarithmic phase with optical density of 0.5 at 600nm. The cells were harvested by centrifuge at 8000 rpm, and then resuspended in 1 ml of cooled transformation buffer, and then 39 ml of the same buffer added, the resuspended cells left on ice for one hour, centrifuged for 15 minutes at the same velocity, and resuspended in one ml of cooled transformation buffer. To increase the efficiency of genetic transformation, the competent cells were kept at 4ºC for 24 hours before adding the plasmid. The method of (Lederberg and Cohn, 1974) used for plasmid DNA uptake for process of transformation. One µg of prepared plasmid DNA added to tube containing 0.2 ml of competent cells, the mixture was placed on ice for 30 minutes, exposed to heat shock at 42ºC for 6 minutes (Hoekstra *et al*., 1980), then one ml of fresh nutrient broth was added to transformation mixture, then incubated at 37ºC for 60 minutes. Five samples of 0.1 ml from transformation mixture were separated on nutrient agar plates containing appropriate antibiotic, and 0.1 ml of competent cells spread on nutrient agar containing same antibiotics used as control. All plates were incubated at 37ºC for 48 hours. The number of transforming colonies were scored and purified several time on plates containing different antibiotics used. The genetic transformation frequency was calculated according to (Puhler and Timmis, 1984).

Extraction of green tea

Watery and alcohol crude extracts were prepared according to (Harborne *et al* 1975), fifty gram with 250 ml of D.W. or ethyl alcohol with the magnetic stirrer, and mixed at room temperature. After 72 h. The solution was filtered by muslin cloth then by filter paper, the above steps were repeated 3-5 times, till a clean colorless supernatant was obtained. The extract was subjected to rota-evaporation at 55°C.

Determination of MIC

MIC (minimum inhibition concentration) of plant extracts were determined through preparation of different concentration (50-600 µg/ml) of plant extract in sterilized nutrient broth, and 0.1ml of overnight culture of bacterial suspension, after incubation time the turbidity was recorded using spectrophotometer at 600nm (Atlas *et al*., 1995), then the bacterial number was adjusted using standard curve that prepared previously.

Total WBC count

Blood samples were obtained from the heart of anesthetized mice, and put in heparinized tubes, mixed well, them the WBC was counted using culture instrument, by classical way (Themel *et al*, 2004).

RESULTS AND DISCUSSION

Fifty bacterial isolates were collected from different clinical specimens in human, and dairy products Table (1), Nasal isolates are the most frequent (38%), while the rate of isolates obtained from urine, wound, throat and dairy product were 34%, 22%, 4%, and 2% respectively. These isolates were identified as *S. aureus* according to cultural, morphological and biochemical test including API staph system (Chambers, 1988, Sheagren, 1984, Morello *et al*, 2003).

Table (1): Distribution of *S. aureus* isolates according to their sources.

Source Of Isolation	Isolate No.	No. Of Bacterial Isolates	% Of Isolates
Nasal swab	1, 2, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 24, 25, 35, 36, 42, 44, 47	19	38
Urine	3, 4, 5, 6, 22, 23, 26, 27, 29, 30, 33, 37, 38, 39, 40, 48, 49	17	34
Wound swab	7, 9, 12, 20, 28, 31, 32, 41, 43, 46, 50	11	22
Throat swab	24, 45	2	4
Dairy product	21	1	2
Total	1-50	50	100

Susceptibility of all isolates against 19 widely used antimicrobials were studied (Table 2) and appeared that highest resistance was 70% to Fox, 45% to Cm and Nal, and the isolates were susceptible to Am, Amc, Cip, and Lin.

Table (2): Resistance of *S. aureus* to antimicrobials used.

Antimicrobials	No. Of Resistant Isolates	% Of Resistant
Am	0	0
Amc	0	0
Amk	3	6
Aug	1	2
Cef	4	8
Cip	0	0
Cm	27	54
Clx	4	8
Do	3	6
Ery	8	16
Fox	35	70
Kf	6	12
Ln	0	0
Nal	27	54
Rif	1	2
Sm	5	10
Te	7	14
Tm	6	12
Tob	6	12

According to the type and number of antimicrobial resistance the *S. aureus* isolates were grouped to 18 types (Table 3). The range of resistance was either sensitive to all, or resist to 14 among 19 antimicrobials used. 28% of isolates are multiresistant (resist to more than three antibiotics).

To determine the site of antibiotic resistance genes, either located on plasmid DNA or chromosomal DNA, transformation process performed successfully (Fig. 1) between purified plasmid from S32 and S15 isolates, representing more resist and more sensitive isolates respectively. The result of transformation (Table 4) showed that the genes which are responsible for Cm, Ery, Kf, Clx, Sm, Tob, Te, and Tm resistant are located on plasmid DNA, while others were either located on chromosomal DNA or on large plasmid and not

Table (3): Groups of *S. aureus* isolates according to type and number of antimicrobial resistance.

No. Of Antimicrobial Resistant	Antimicrobials That *S. Aureus* Resist To	No. Of Bacterial Isolates	% Of Resistance
0	Sensitive to all	1,3,4,7,13,14,17,20,26,34,35	22
1	cef	2,5,8,9,18,23	12
1	nal	16,47	4
1	tet	33	2
2	Cef+chl	21,27	4
2	Cef+nal	12,15	4
3	Cef+chl+nal	6,22,24,25,28,36,37,38,41	18
3	Cef+ery+co-tri	10,48	4
3	Cef+chl+tob	44	2
4	Cef+chl+nal+tet	11,30,39	6
4	Cef+chl+nal+co-tri	43	2
4	Cef+chl+nal+ery	19,49	4
5	Cef+chl+nal+dox+tob	29	2
5	Cef+chl+nal+tet+cef	40,50	4
5	Cef+chl+nal+ref+st	45	2
10	Cef+chl+nal+st+cefa+cefo+ery+co-tr+ami+tob	31,46	4
11	Cef+chl+nal+st+cefa+cefo+ery+co-tet+clo+dox+tob	42	2
14	Cef+chl+nal+st+cefa+cefo+ery+tet+clo+dox+tob+aug+co-tr+ami	32	2

succeeded to transfer to competent cell. These results are in agreement with results of Lyon and Skurray, (1987). Mojumdar and Khan, 1988 found that

the resistance to Erythromycin and Tet are located on plasmid DNA, Rouch *et al,* 1987 found that St gene was located on plasmid DNA, Rouch *et al*, 1989 cleared that trimethoprime resistance gene is located on plasmid DNA, and was encoded by (*drfB*) gene through dihydrofolate reductase, or by acquisition of a second gene (*dfrA*) via plasmid that encodes Trimethoprim-resistant. Shaw, 1983 showed that the resistance of *S. aureus* to Chl is due to

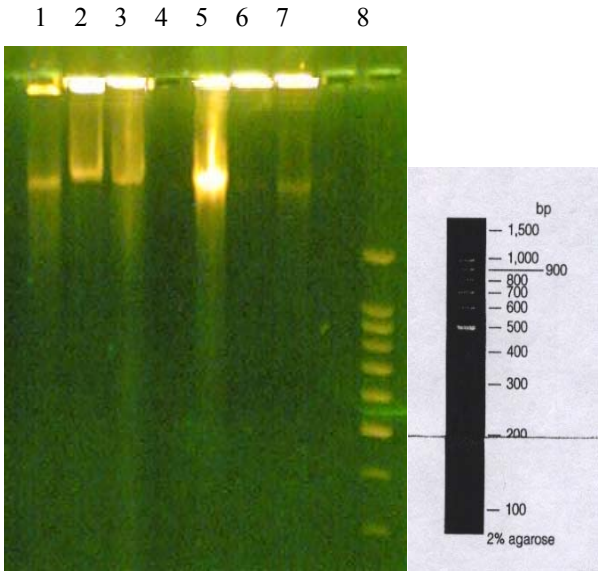

Fig (1): Plasmid profile for *S. aureus* S32 and S15 isolates.

Table (4): Number of transformation colonies and transformation frequency of *S. aureus* S32 isolate

Isolate	No. Of Transformation Colonies	No. Of Colonies Grow On Nutrient Agar Containing Antimicrobials In Mg/Ml												Transformation Frequency
		amk*	aug	cef	cm	do	ery	kf	clx	sm	tob	te	tm	
S32	102	s	s	s	87	s	80	53	100	40	93	10	87	$0.3x10^{-5}$

S: Bacteria are sensitive to antimicrobials

(*cat*) gene on the plasmid DNA, and by mechanism of chloramphenicol acetyl transferase (CAT) that acetylates chloramphenicol via acetyl coen Some other

antibiotic resistant genes may also be located on plasmid but not transferred, because some plasmid were large and may be broken during the extraction process an number of transformation colonies decreased when sub cultured on antimicrobial plates (10 colonies for tet, 40 for st, 53 for cep, 80 for Ery, 87 for Ch andCo-tri 93 for tob and 100 for Clo). These variation in colonies number may be related to the plasmid fragments,

Transformation frequency for tested isolate *S. aureus* S32 was $0.3x10^{-5}$ is not too high, same results obtained by (Khder 2002, Abdulrahman, 2005, Mawlud, 2006, and Khder, 2006) for *P. aeruginosa*, *S. aureus*, *K. pneumonia*, and *P. mirabilis* respectively they found that transformation frequency was low and differed from one bacterium to another, this may be due to the size of the plasmids that transferred from one strain to another, and may not be transferred.

The Sub-MIC of alcoholic green tea extract 240 µg/ml for S32 isolate (Table 5) affected on Nal, Aug, Cef, Cm, Do, and Amk and 100% reduced the resistance, while affected on Fox, Clx and Te resistant genes and eliminated the resistance 90%-95%, and for Kf, Sm and Tob the resistance reduced 10%-70%. There was no any effect observed on Ery resistant gene.

The aques extract decreased resistance for S32 isolate of Dox, Kf, Amk, Sm, and Aug by 100%, 55%, 50%, respectively, and 25%-40% for Clx, Tob, Ery, and Nal, and 20% for both Fox and Cm (Table 5). These results are in contrast with the finding of Yan *et al*, 1998 and Zhao *et al*, 2001.

Table (5): Effect of SMIC of alcoholic and watery green tea extract on S32 isolate.

Antibiotics At Final Concentration	Alcoholic Extract 240µg/Ml		Watery Extract 240µg/Ml	
	% Number of colonies grow	Decreasing % of resistance	% Number of colonies grow	Decreasing % of resistance
Amk	0	100	50	50
Aug	0	100	50	50
Cef	0	100	100	0
Cm	0	100	80	20
Do	0	100	0	100
Ery	100	0	70	30
Fox	5	95	80	20
Kf	30	70	45	55
Nal	0	100	75	25
Clx	10	90	60	40
Sm	40	60	50	50
Tob	90	10	65	35
Te	10	90	100	0
Tm	95	5	100	0

To evaluate the effect of Green tea extract on antibiotic resistance genes, laboratory mice were orally infected with *S. aureus*, and after 6 days the symptoms of disease appeared and the mice become weak, with total WBC count of $6000x10^3$/ml comparing with $3000\text{-}4000x10^3$/ml for control group. Abnormal enlargement of gastrointestinal tract were observed as shown in (Fig. 2-B) comparing with uninfected mice (normal gastrointestinal tract) (Fig. 2-A). After treating the infected mice with cloxacillin for three days (which the bacteria was normally revealed be resistant) the mice continued unhealthy and weak and did not recover by the antibiotic, while the total WBC count was $4900x10^3$/µl. Then the infected mice were treated with Cloxacillin and Sub-MIC of Green tea extract (240µg/ml) for three days, the mice become healthy, and all symptoms of disease were removed, and the total WBC count decreased to $2100\text{-}3000x10^3$/µl, with normal gastrointestinal tract (Fig. 2-C). There for we may expected that Green tea extract decreased the resistance of bacteria to Cloxacillin, and treating the infected mice with mixture of Cloxacillin at final concentration and plant extract at SMIC, the bacteria responded to Cloxacillin as normal sensitive bacteria to Cloxacillin.

The chemically important part of Green tea that have antimicrobial effect, is due to polyphenolic catechins which includes -epigallocatechin3-gallate (EGCG), -epigallocatechin (EGC), -epicatechin 3-gallate (ECG), and –epicatechin (EC) (Lee, *et al*., 2004). The MIC of EGCG reversed the high level

resistance of MRSA to all types of β-lactams, including benzyl penicillin, oxacillin, methicillin, and cephalexin. EGCG also induced a super susceptibility to β-lactams in MRSA which does not express *mecA*, encoding PBP2. Both EGCG and β-lactams directly or indirectly attack the same site of peptidoglycan on the cell wall. EGCG synergizes the activity of β-lactams against MRSA owing to interference with the integrity of the cell wall through binding to peptidoglycan (Zhao *et al*.2001).

Green tea components will not directly affect the genes that are responsible for antibiotic resistance and for supporting these results, electrophoresis technique was performed for the purified plasmid DNA for S32 and S15 isolates, when treated with green tea extract at sub-MIC (240and 390 µg/ml) respectively, as shown in fig. (3), it is clear that green tea extract did not

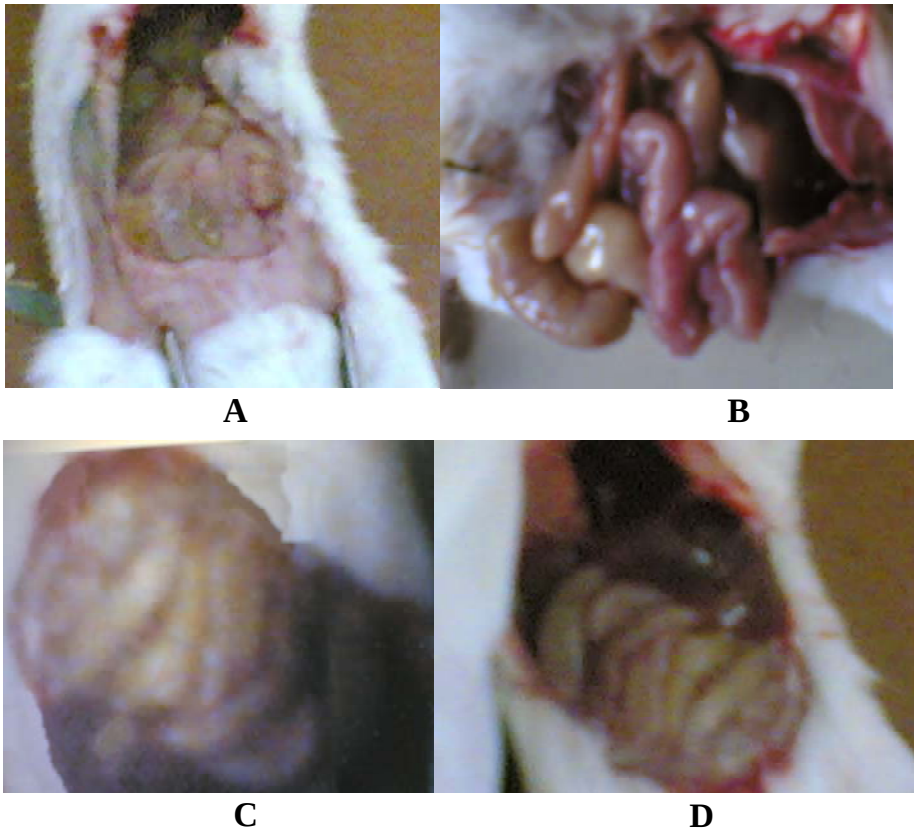

Fig (2): Gastrointestinal tracts of dissected mices.
A. Gastrointestinal tract of normal mice (control)
B. Gastrointestinal tract of infected mice with *S. aureus* after 6 days.
C. Gastrointestinal tract of infected mice treated with Cloxacillin
D. Gastrointestinal tract of infected mice treated with Cloxacillin and SMIC of green tea extract.

eliminated antibiotic resistance through curing the plasmid DNA for both

isolates lane 4 and 1, comparing with the effect of 0.5% SDS acting as curing agent for S32 isolate lane 5. Moreover, the same concentration did not affected on S15

1 2 3 4 5 6

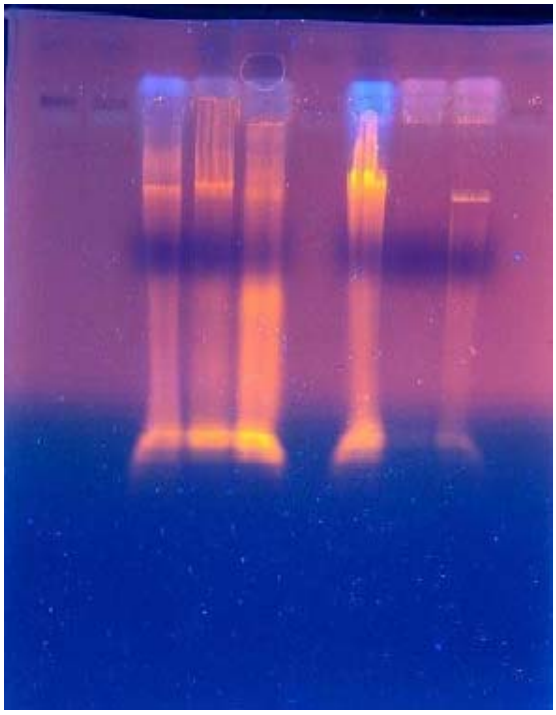

Fig (3):- The plasmid profile of *S. aureus* isolates (S32 and S15).
Lan1: Isolated plasmids fromS32 isolate.
Lane 2: Isolated plasmid from S32 isolate after treating with 0.5% SDS.
Lane 3: Isolated plasmid from S32 isolate after treating with green tea extract.
Lane 4: Isolated plasmid from S15 isolate.
Lane 5: Isolated plasmid from S15 isolate after treating with 0.5% SDS.
Lane 6: isolated plasmid from S15 isolate after treating with green tea extract.

isolate plasmids lane 2. Zhao *et al.* 2001 found that EGCG did not cured the *mecA* gene expression and PBP2 synthesis, and the result was obtained after

running in RT-PCR, but they found that EGCG largely reduced the tolerance of MRSA and MSSA to high ionic strength and low osmotic pressure in their external atmosphere indicating damage of the cell wall.

It is clear from this study that green tea extracts have great effects on decreasing the resistance of *S. aureus* isolates to antibiotics, in *vitro* and *vivo*, and can be used for resolving the problem of antibiotic resistance in pathogenic bacteria, after studding the side effect of such materials.

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الخلاصة

تم الحصول على خمسون عزلة من بكتيريا Staphylococcus aureus من المرضى الوافدين الى مستشفيات مدينة اربيل, اضاف الى نماذج من مشتقات الحليب. شخصت هذه العزلات اعتمادا على الصفات المزرعية, الصفات المجهرية و الصفات البايوكيمياوية, اضافة الى ذلك استخدم نظام API staph. اجريت فحص الحساسية لجميع العزلات تجاه تسعة عشر مضادا حيويا. قسمت العزلات الى ثمانية عشر مجموعة اعتمادا على حساسيتهم للمضادات الحياتية. كانت 70% من العزلات مقاومة الى سيفاكسيم, في حين45% كانت مقاومة الى كلورمفينيكول وناليدكسك اسد, وجميع العزلات كانت حساسة الى امبيسيلين, اموكسيسيلين و لينكوميسين. كانت العزلة رقم S32 مقاومة الى اربعة عشر مضادا حيويا من بين تسعة عشر المستخدمة, في حين اضهرت السلالات الاخرى مقاومة مختلفة.

اظهرت نتائج النقل الجيني ان الجينات المسؤلة عن مقاومة كلورمفينيكول, ايرثروميسين, سيفاليكسين, كلوكساسيلين, ستربتوميسين, توبراميسين, تيتراسيكلين و كوترايميكساسول با ا وافعة على DNA البلازميدي او وافعة على بلازميد كبير والتي انكسرت خلال عملية التحضير.

وجد ان التركيز الادنى المثبط للمستخلص المائي و الكحولي للشاي الاخضر كان 250 و 400 مايكرو غرام/ سم^3 (µg/ml) على التوالي, و القيمة التحت التركيز المثبط SMIC كانت 240 و390 ميكرو غرام /سم^3, ولمادة SDS بتركيز 5و0% كمواد مجيدة للبلازميدات, واستخدم العزلة S32. كما واظهرت النتائج بان المستخلص الكحولي كان اكثر فاعلية من المستخلص المائي واختزلت مقاومة العزلة S32 من 70-100% لكل من المضادات اميكاسين, اوكمنتين, سيفوتاكسيم, كلورمفينيكول, دوكسيسيلين, سيفيكسيم, ناليدكسك اسد, ستربتوميسين و تيتراسيكلين, في حين المستخلص المائي اختزلت مقاومة نفس العزلة من 10-100% لكل من اموكسيسيلين, اوكمنتين, سيفيكسيم, كلورمفينيكول, كلوكساسيلين, دوكسيسيلين, نالي دكسيك اسد, ئيريثروميسين, سيفالكسين, ستربتوميسين و توبراميسين, ولم تؤثر على الجينات المسؤلة عن مقاومة سيفوتاكسيم, تيتراسيكلين, و كو ترايميكساسول.

عوملت فأران مختبرية Mus Musculus والتي عدد كريا ا البيضاءالكلية TWBC كانت بين 3000-4000x10^3 /ميكروليتر مع SMIC لمستخلص الشاي الاخضر بعد ان اصيبت بواسطة العزلة الاكثر مقاومة S32, حيث ظهربعد ستة ايام من الاصابة الاعراض المرضية عليها و شلت حركتها وان عدد كريا ا البيضاء وصلت الى 6000x10^3/ µL وبعد معاملتها بالمضاد الحيوي كلوكساسيلين والتي اظهرت البكتيريا مقاومتها لها, فأن عدد الكريات البيضاء الكلية بلغت 4900 x10^3/مايكرو ليتر(µL) والتي تعتبر عالية مقارنتا بمعاملة المقارنة, ولكن عندما عوملت الفأران المريضة بواسطة SMIC للمستخلص الكحولي مع المضاد الحيوي كلوكساسيلين فأن قيم TWBC انخفضت الى2100-3000x10^3/ µL والتي تعتبر ضمن المدى الطبيعي, وان الفأران تحسنت حالتها الصحية و ذات نشاط و حركات طبيعية و جيدة.

پوختە

پەنجا جیاکراوەی بکتیریای S. aureus دەست کەوت لە نەخۆشەکانی نەخۆشخانەکانی شاری هەولێر. جگە لە جیاکراوە لە شیرە مەنیەکان. جیاکراوەکان ناسرانەوە بە هۆی خاسیەتی کێلگەیی، وخاسیەتی خودی بکتیراکان وخاسیەتی بایوکیمیاوی هەر وە ها بەکارهینانی API staph. تاقی کردنەوەی هەستیاری جیاکراوەکان بۆ نۆزدە دژە تەن ئەنجام درا. جیاکراوەکان دابەشکران بەسەر هەژدە بەشدا لەسەر بنەمای هەستیاریان بەرانبەر بەو دژە تەنانەی کە بەکار هینران. وە دەرکەوت کە 70٪ جیاکراوە کان بەرگریان هەیە بۆ سیفاکسیم و 45٪ بەرگرە بۆ کلورمفینیکۆل و نالیدیکسك اسد وە هەر وە ها جیاکراوەکان هەستیاربون بەرانبەر امبیسیلین، اموکسیسیلین، و لینکومیسین. جیاکراوەی ژمارە S32 بەرگری دەربری دژی 14 دژە تەن لە کۆی نۆزدە کە لەم تووێژینەوەیەدا بەکار هاتووە، لە لایەکی ترەوە جیاکراوەکانی تر بەرگری جیاوازیان هەبو.

لە ئەنجامی گواستنەوەی بۆماوەیی بۆ ئەو جینانەی کە بەرپرسن لە بەرگری کلورمفینیکۆل، ایریسرومیسین، سیفالکسین، کلوکساسیلین، ستریبتومیسین، تۆبرامیسین، تتراسیکلین، کوترایمیکسساسۆل دەرکەوت کەوتونەتە سەر پلازمیدی DNA یان کەوتونەتە سەر پلازمیدێکی گەورە لەوە ئەچیت شکابێت لەکاتی ئامادە کردندا. کەمترین چری ئاوي و کحولی چای سەوز کە گەشەی بکتیریا رائەگری گەیشتە 250 و 400 مایکرۆگرام/سم^3 بۆ هەر یەکەیان. وچری کەمتر لە چری ناوبراو SMIC بۆ هەردو پالاوتەکە 240 و 390 میکرۆگرام/ سم^3 و SDS 5و0٪ وەکو مادەی بێلایەن کردنی پلازمیدەکان بەکارهینران لە سەر جیاکراوەی S32. هەر وە ها ئەنجامی لێکۆلینەوەکە دەریخست کە پالاوتەی کحولی باشتر بو لە پالاوتەی ئاوی، پالاوتەی کحولی بەرگری جیاکراوەی S32 کەمکردەوە بەرێژەی 70-100٪ بۆ هەریەك لە امیکاسین، اوگمنتین، سیفیکسیم، کلۆرمفینیکول، کلۆکساسیلین، دوکسیسیلین، نالیدیکسیك اسید، ئیروسرومیسین، سیفالکسین، ستربتومیسین، تۆبرامیسین، وەکاریگەری نەبو لەسەر جینەکانی کە بەرپرسن لە بەرگری بۆ سیفۆتاکسیم، تیتراسیکلین، کۆترایمیکساسول.

مشکی تاقیگەیی Mus musculus بەکار هات کە ژمارەی خرۆکە سپیەکانی TWBC 400-3000 x^{3}10/ µL وە دوای چارەسەر کردنیان تەنها بە دژە تەنی کلوکساسیلین کە بکتیریاکە بەرگرە بۆی ژمارەی خرۆکەسپیەکانی گەیشتە 4900x10/µL ئەم ریژەیە بەرزە بەبەراورد کردنی لەگەل کۆنترۆل. بەلآم کە مشکە نەخۆشەکان چارەسەر کران بە SMIC پالاوتەی کحولی و دژەتەنی کلۆکساسیلین ریژەیTWBC کەم بووەوەو گەیشتە 2100-3000 x ^{3}10 / µL وەئەم ریژەیە ریژەیەکی ئاساییە و مشکەکان چالاك بونەوە.

THE EFFECT OF X-RAY AND PLANT EXTRACT ON THE RESISTANCE OF *Klebsiella aerogenes*.

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ABSTRACT

This study includes the isolation of *Klebsiella aerogenes* from operations, X-ray (with intensity 100, 120, 200 kilovolt/ sec) and patients rooms in hospital. The isolates were subjected to several tests and antibiotic susceptibility test to antibiotics Ampicillin, Kanamycin, Cephalexin, Carbenicillin and Tetracycline, to investigate the presence of resistant *Klebsiella aerogenes* in these places in hospital. Different concentrations of watery extracts of Myrtle and Mentha piperita were used to observe resistance changes.

The results showed the contamination of these rooms in the hospital with *Klebsiella aerogenes*. All the isolates in operation and patient rooms had a middle resistance to the antibiotics. The inhibition zones were (12, 14, 12, 18, 14) and (13, 15, 16, 20, 16) mm respectively while in x-ray rooms the isolates were resistant. The inhibition zones were (8, 10, 10.5, 13, 11) respectively, because of daily exposure to X-ray caused bacterial resistance.

The watery extracts of Myrtle increased the inhibition zone around the saturated discs with (0.2% , 0.4% , 0.6% , 0.8% , 1% , 2%) to (21.3 , 21.9 , 22.4 , 23.1 , 23.9 , 23.8)mm for operation rooms isolates and (18.9 , 19.3 , 20 , 20.5 , 21,4 , 21.5) mm for patients rooms isolates respectively, as compared with control, and (7.9 , 10 , 8.5 , 10.5 , 11.2, 11) mm for X-ray rooms isolates, , inhibition zone around saturated discs with (0.2% , 0.4% , 0.6% , 0.8% , 1% , 2%) Mentha piperita watery extracts were (16.4 , 17 , 17.5 , 17.8 , 17.8)mm for operation rooms isolates and (17 , 17.6 , 18.1 , 18.9 , 19.3 , 19.5) mm for patients rooms isolates respectively and (8.3 , 7.9 , 8.2 , 10 , 10.6, 10.9) mm for x-ray rooms isolates. The most effective concentrations against *Klebsiella aerogenes* were 0.8% , 1% and 1% , 2% for Myrtle and Mentha piperita respectively.

KEYWORD *Klebsiella aerogenes* Plant extract X-Ray Resistance

INTRODUCTION

Microorganisms can be removed, inhibited or killed by various physical agents, physical processes or chemical agents. A variety of techniques and agents are available; they act in many different ways, and each has its own limit of application.(1) The expanding usage of radiation has necessitated an understanding of its interaction with humans because our knowledge of the effects of radiation on biological systems still remains to be rather perfunctory while a number of researches have been involved in examining this problem, physical factors influencing microorganisms, the effects of ionizing radiation , UV radiation and ultra sound have been rather well looked into, and it is clear that bacteria differ from each other in their response to the action of these factors (2).

The X-ray discovered by Rotenjen in 1896 , its ionizing ray and electromagnetic wave (3) (4) affected bacteria and caused resistance by mutation in target site of antibiotic effect, mutated strain resistance to streptomycin in rate 10^{-10} increased to 10^{-6} to 10^{-5} after exposure to X-ray (5). On the other hand there are many medical plants which contain materials that decreased the resistance of microorganisms to the antibiotics (6) show that Raphonus sativum plant seed conation Rhaphanin act on Gram positive and Gram Negative bacteria. In study on inhibition effect of 231 kind of plant 46 plant has inhibitor effect on *Staphyloccus aureus* and *Erwinia cartovora*(7). Other studies show that garlic extract (80% v/v) and tablets (2%w/v) exhibit bactericidal activity against *Bacillus cereus* and it was found that *Nigella sativa* oil (black seed oil) exhibit bactericidal activity against *Bacillus cereus*. (8)Because there is no any study on the decreasing resistance of resistant strain *Klebsiella aerogenes* to antibiotics. The intention of the present study is to isolate this bacterium from X-ray, operation and patients rooms in hospital, to demonstrate the resistance of bacteria to different antibiotics then use different concentrations of watery extracts of myrtus communis linn and Mentha piperita to observe changes in the resistance by measuring the inhibition zone.

MATERIALSE AND METHODS

Klebsiella aerogenes were isolated from X-ray (with intensity 100, 120, 200 kilovolt/sec), operation and patients rooms in Erbil teaching hospital. The swabs cultured on MacConkay agar several times to obtain pure and single colonies (The size of microbe was 0.3 – 0.5 Micron diameter, 0.6 – 6 Micron length, mucous colony after incubation for 24 – 48 hrs). Eighteen colonies (3 colonies for each place, and 3 for control) were transferred to the surface of nine nutrient agar slant incubated for 24 hrs at 37^{o}c.

Gram stain was prepared from the slant and a microscopic examination of *Klebsiella aerogenes* reveal gram negative bacteria surrounded by capsule (9).

To study the effect of different antibiotics on the growth of *Klebsiella aerogenes*, disc diffusion method was carried out, with a sterile loop. Some colonies were transferred to 10 ml nutrient broth , and incubated for 18 hrs at 37^{o}c. Then 0.1 ml of suspension was used to streak over the dry surface of duplicate Mueller Hinton agar with L shaped glass rod. The plates were left to dry at room temperature for (10) min. Sterile forceps were used to place antibiotic discs on the surface of media and the plates were incubated for 18 – 24 hrs at 37^{o}c.(10) (11).

All the isolates (24 hrs bacterial suspension) were subjected to Indol, Methyl red, Vogese- proskauer, citrate, glucose, lactose and sucrose fermentation, motility, catalase, urease and oxidase tests as described in (10).

MEDICINAL PLANT EXTRACTS

In the present study watery extracts of two medical plants with different concentrations were used:

1- Myrtle (*Myrtus communis* linn). It belongs to the Myrtaceae family. This plant has many names in Arabic: Raihan , As, yas, and Mirsin. In Turkish, it called Murt whereas in Kurdish it is Murtek(12).

2- *Mentha piperita* It belongs to the Laminaceal family. In Arabic naona . Nmam(13) (14).

The procedure of (15) was used for preparing the water extracts. Each plant was washed by tap water for soil and dust removing, then they were cut several times by a sterile knife. One hundred grams were weighed and placed into a sterile clean blender's glass and 100 ml of sterile distilled water was added to it. The mixture was mixed and filtered by sterile Buchner funnel using filter paper.

The suspension was collected in a sterile Buchner flask. This supernatant concentration was considered as 1:1. All the treatments were done on it.

The concentrations of watery plant extract (volume/volume) 0.2 , 0.4, 0.6, 0.8, 1 , 2% were prepared and transferred to sterilized test tubes containing (9.8 , 9.6 , 9.4 , 9.2 , 9 , 8 ml) sterilized nutrient broth and one test tube containing only 10 ml nutrient broth without plant extracts used as control.

Disc diffusion method of (16) was used. Six mm diameter filter paper was sterilized at 150^{o}c for half an hour. After cooling, the discs were saturated with each concentration of each plant and placed on the surface of Mueller Hinton agar (inoculated with 24 hrs bacterial suspension). After incubation at 37^{o}c for 24 hrs, the diameters of inhibition zone were measured in millimeter using a ruler compared with the inhibition zone of antibiotics.

RESULTS AND DISCUSSION

The Presence of *Klebsiella aerogenes* in operation, X-ray (with intensity of 100, 120, 200 kv/sec), and patients rooms indicate the contamination of these rooms in hospital because the hospital environment is a selective environment for the growth and multiplication of these bacteria which lead to hospital cross infection, and from multiple antibiotic and disinfectants resistant. Therefore they become more resistant to the therapy environment. They transfer to the digestive system of patients in hospital by contaminated food and fluids. The intestines of patients become a reservoir and endogenous source to infection. Seventeen percent of the health care staff in the intensive care unit carry this microbe in their hands(17). Sometimes the antibiotic resistance bacilli transferred from patient to patient in one hall, and from hall to hall in hospital, but the attack rate depends on the number of cases and carriers(18). Table (1) show some identification tests of *Klebsiella aerogenes* isolated from differ rooms in hospitals.

Table (1): Some tests of *Klebsiella aerogenes* isolated from different places in the hospital

Place In Hospital	Tests											
	Gram stain	Capsul stain	Motility	Indol	Methyl red	Vogues proskaure	Citrate	Glcose fermentation	Lactose	Sucrose	Catalose	Oxid asc
Operation rooms	-	+	-	-	-	+	+	+	+	+	+	-
x-ray rooms (100,120, , 200) kilov./sec	-	+	-	-	-	+	+	+	+	+	+	-
Patients rooms	-	+	-	-	-	+	+	+	+	+	+	-

Table (2): The sensitivity test of *Klebsiella aerogenes* isolated from different place in the hospital

Place In Hospital	Inhibition Zone (mm)				
	Ampicillin AMP(10) µg	Kanamycin K(30)µg	Cephalexin CL(30)µg	Carbenicillin CAR(100)µg	Tetracycline TE(30)µg
Operation rooms	12	14	12	18	14
X-ray rooms	8	10	10,5	13	11
Patients room	13	15	16	20	16

The sensitivity test of *Klebsiella aerogenes* to some antibioties was presented in Table (2). For operation rooms isolates, the rates of inhibition zone around antibiotics were (12, 14, 12, 18, 14) millimeters for Ampicillin, Kanamycin, Cephalexin, Carbenicillin and Tetracyclin respectively. In X-ray rooms the rates of inhibition zone were (8, 10, 10.5, 13, 11) mm for antibiotics respectively and for patients rooms isolates, the rates were (13, 15, 16, 20, 16)mm for antibiotics respectively. The results refer

that the inhibition zone for patients rooms were more than operation room isolates, because the operation rooms were sterilized daily several times concern with number of operations by different disinfectants like soluble phenolics, black or white fluid phenolics, chloroyl lenols, hypochlorite and dichloroiso cyanurales like chloros, domestos sterite , Millon , kirbychchior and presept (QACs), quaternary ammonium compounds like roccal, zephiron and cetavlan (19) (20) (21). Repeatedly used of some disinfectant reproduce resistant strain, but patients rooms were sterilized once or twice daily(22). The inhibition zone of the isolates of both rooms were of middle resistance(23). On the other hand, extra-chromosomal genetic element R-plasmids contain a gene which is responsible for antibiotic and disinfectant resistance(24).

Table (3) illustrated the effect of different concentrations of watery extracts of Myrtle on the resistance of *Klebsiella aerogenes*. The results demonstrate that myrtle extract increased inhibition zone especially at 1% and 2% in both operation and patients rooms isolates. This result concordant with (25) who used myrtle leaves for mouth, wound and boil treatment, because these leaves contain essential oils. The results also agreed with (26) who observed that dry watery extracts of myrtle leaves inhibit urinary tract infection bacteria. Also these leaves contain glycoside rateniges and phenols which inhibited microbial growth(27) (28) (29).

Table (3): Effect of Myrtle watery extract on the resistance of Klebsiella aerogenes

Place Of Isolates	Inhibition Zone(mm) According to Concentration						
	0.2%	0.4%	0.6%	0.8%	1%	2%	Control (With Out Extract)
Operation rooms	21.3	21.9	22.4	23.1	23.9	23.8	0
X-ray rooms (100, 120, 200) kilovolt/sec	7.9	10	8.5	10.5	11.2	11	0
Patients room	18.9	19.3	20	20.5	21.4	22	0

Table (4) shows the effect of different concentrations of watery extracts on the resistance of Klebsiella aerogenes. The results showed that the bacterial sensitivity increased according to an increase in the Mentha piperita concentration in culture media.

This effect may be due to the oil of this plant which contain B-pinene linoloae , α-thujone, limonene, acetate, kotones, alchols, esters, and .Menthone B. Thujone(29) when (30) observed that Batenj, Spearmint and Zater extract without mutant effect on white mouse and this view reassure the side effects of these extract.

Nowadays, medicinal plants have an important place in agricultural production and are an essential source for medical drugs, because plants contain essential substances like carbohydrates, proteins and fatty acids and other subsidiaries like phenols, glycoside and and alkalins which have an important act in medicine.

Many scientific researches were carried out substantially and still continually tested plant extraction activity and wonderful active substance on micro organisms veracity to rebirth antibiotic have wide antiactivity and speedy sound effect with less side effects on patients health because bacterial resistance to antimicrobial drugs is important difficulty that face doctor in order to recover from bacterial diseases

Table (4): The effect of Mentha piperite watery extracts on the resistance of Klebsiella aerogenes

Place Of Isolates	Inhibition Zone(mm) According to Concentration						
	0.2%	0.4%	0.6%	0.8%	1%	2%	Control (with out extract)
Operation rooms	16	16.4	17	17.5	17.8	17.9	0
X-ray rooms (100, 120, 200)kilovolt/sec	8.3	7.9	8.2	10	10.6	10.9	0
Patients room	17	17.6	18.1	18.9	19.3	19.5	0

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الخلاصة

هذه الدراسة تتضمن عزل بكتريا Klebsiella aerogenes من غرف العمليات وغرف الأشعة بقوة (100 ، 120 ، 200) كيلو فولت/ ثانية)وغرف المرضى في المستشفى، وقد خضعت العزلات موعة اختبارات مع اختيار الحـساسية للمـضادات الحيانيـة (أمبيسيلسن، كانامايسين، سيفالكسين، كاربينيسين وتتراسايكلين)، وذلك لبحث وجود بكتريا Klebsiella aerogenes مقاومـة في هذه الأماكن من المستشفى، تم استخدام الملخص المائي لنباتي الآس والنعناع بتراكيز مختلفة لملاحظة تغيير في المقاومة.

أظهرت النتائج تلوث هذه الأماكن في المستشفى بـ Klebsiella aerogenes وكان جميع الإختبـارات طبيعيـة لبكتريـا Klebsiella aerogenes ، وكان عزلات غرف العمليات وغرف المرضى كلها متوسطة المقاومة ، إذ وصل قطر التثبيط إلى (12 ، 14 ، 12 ، 18 ، 14)، (13 ، 15 ، 16 ، 20 ، 16) ملم على التوالي، في حين كانت عزلات غرف الأشعة مقاومة للمضادات الحيانيـة حتى وصل قطر التثبيط (8 ، 10 ، 10.5 ، 13 ، 11) على التوالي.

وقد أدى المستخلص المائي لنبات الآس إلى آزدياد قطر التثبيط حول الأقراص المشبعة بـ (0.2% ، 0.4% ، 0.6% ، 0.8% ، 1% ، 2%) إلى (21.3 ، 21.9 ، 22.4 ، 23.1 ، 23.9 ، 23.8) ملم لعزلات غرف العمليات، و إلى (18.9 ، 19.3 ، 20 ، 20.5 ، 21.4 ، 21.5) لعزلات غرف المرضى على التوالي، وإلى (7.9 ، 10 ، 8.5 ، 10.5 ، 11.2 ، 11)ملم لعزلات غرف الأشعة؛ وذلك مقارنـة بعزلات السيطرة.

كما أدى المستخلص المائي لنبات النعناع إلى آزدياد قطر التثبيط حول الأقراص المشبعة بـ (0.2% ، 0.4% ، 0.6% ، 0.8% ، 1% ، 2%) وصلت إلى (16 ، 16.4 ، 17 ، 17.5 ، 17.8 ، 17.8) ملم لعزلات غرق العمليـات، وإلى (17 ، 17.6 ، 18.1 ، 18.9 ، 19.3 ، 19.5) ملم لعزلات غرف المرضى على التوالي، وذلك مقارنة بمجموعة السيطرة ، أما بالنـسبة لغـرف الأشـعة فكـان قطرالتثبيط (8.3 ، 7.9 ، 8.2 ، 10 ، 10.6 ، 10.9)ملم ، كما بينت الدراسة أن التركيز 0.8% ، 1% و 1% ، 2% أكثر فعاليـة ضد البكتريا لنباتي الآس والنعناع على التوالي.

پوختە

ئەم لێکۆڵینەوە پێکهاتووە لە جیاکردنەوەی بەکتریای Klebsiella aerogenes لـە ژوورەکـانی نەشـتەرگەری وتیـشک (بـە چـەند هێـز (100، 120، 200 کیلـۆ ڤۆلـت/چـرکە) وژووری نەخۆشـەکان لـە نەخۆشـخانە، هـەموو جیاکراوەکـان چـەند

تاقیکردنەوەیەکیان لەسەر ئەنجام درا، لە تاقیکرنەوەی هەستیاری بکتریاکە بۆ دژە ژیانی (ئەمپیسیلین، کانامایسین، سیڤالکسین، کاربینیسین وتتراسایکلین) بۆ گەران بە دوای بوونی بەکتریای Klebsiella aerogenes بەرگر لەم شوێنانەی نەخۆشخانە.

هەڵێنجراوی ئاوی مورتك و نەعناع به خەستی جیاواز بەکار هات بۆ پێویستی کردنی گۆران لە بەرگری بەکتریا، ئەنجامی لێکۆڵینەوەکان پیشان دەدات کەئەم شوێنانە لە نەخۆشخانە پیس بوونە بەم بەکتریایە، وە هەموو تاقیکرنەوەکان بۆ Klebsiella aerogenes ئاسایی بوون.

هەموو جیاکراوەکانی ژووری نەشتەرگەری و ژووری نەخۆشەکان بەرگری ناوەندی هەبوو، چونکە تیرەی ناوچەی شیبوونەوەی بەکتیری بۆ دژە ژیانەکان گەیشتە (12، 14 ، 12 ، 18، 14) و (13، 15، 16، 20، 16) ملم لە دوای یەك، بەڵام جیاکراوەکانی ژووری تیشك بەرگر بوون تیرەی ناوچەی شیبوونەوەی بەکتیری گەیشتبووە (8 ، 10 ، 10.5 ، 13 ، 11) ملم لە دوای یەك.

هەڵێنجراوی ئاوی رووەکی مورتك بووە هۆی زیاد بوونی زیاد بونی تیرەی شیبوونەوەی بەکتیری بۆ خەستی (0.2٪ ، 0.4٪ ، 0.6٪ ، 0.8٪ ، 1٪ ، 2٪) گەیشتە (21.3 ، 21.9 ، 22.4 ، 23.1 ، 23.9 ، 23.8) بۆ جیاکراوەکانی ژووری نەشتەرگەری، وە گەیشتە (18.9 ، 19.3 ، 20 ، 20.5 ، 21.4 ، 21.5) ملم بۆ جیاکراوەکانی ژووری نەخۆشەکان لە دوای یەك، (7.9 ، 10 ، 8.5 ، 10.5 ، 11.2 ، 11)ملم بۆ جیاکراوەکانی تیشك، ئەمەش بە بەراورد کردن لەگەڵ جیاکراوەکانی کۆنترۆڵ.

هەڵێنجراوی ئاوی رووەکی نەعناع بووە هۆی زیاد بوونی تیرەی شیبوونەوەی بەکتیری بۆ خەستی (0.2٪ ، 0.4٪ ، 0.6٪ ، 0.8٪ ، 1٪ ، 2٪) کە گەیشتە (16 ، 16.4 ، 17 ، 17.5 ، 17.8 ، 17.8) ملم بۆ جیاکراوەکانی ژووری نەشتەرگەری، وە گەیشتە (17 ، 17.6 ، 18.1 ، 18.9 ، 19.3 ، 19.5) ملم بۆ جیاکراوەکانی ژووری نەخۆشەکان لە دوای یەك، بەڵام لە ژووەکانی تیشك تیرەی شیبوونەوە (8.3 ، 7.9 ، 8.2 ، 10 ، 10.6 ، 10.9)ملم بوو. ئەمەش بە بەراورد کردن بە جیاکراوەی کۆنترۆڵ.

باشترین خەستی بۆ رووەکی مورتك (0.8٪ ، 1٪) وە بۆ رووەکی نەعناع (1٪ ، 2٪) بوو.

EXPERIMENTAL STUDY OF THE LIFE CYCLE OF THE ANCHOR WORM *Lernaea Cyprinacea* LINNAEUS, 1758

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ABSTRACT

The present study deals with the life cycle of the Anchor worm *Lernaea cyprinacea* in the laboratory. Eggs of this parasite were derived from the common carp (*Cyprinus carpio* L.) obtained from Ainkawa fish hatchery, situated north-west of Erbil city, Kurdistan region- Iraq. The eggs were incubated at 25±1°C in plastic cup. Then, the eggs development was followed, naupliuses were appeared after 48-72 hours. Three days later, copepodid I and II were observed in the cultuer. The content of the plastic cup were added to the small aquarium with a small healthy fishes. After 24 hours copepodid III was isolated, then after 18 days the young sedentary female and adult stage with egg sacs were obtained on the exprimental fishes.

KEYWORDS Life cycle *Lernaea cyprinacea* *Cyprinus carpio*

INTRODUCTION

Lernaea cyprinacea causes a disease known as lerneosis, leads to scale, fins, tissue sore, growth retardation and infertility when affecting the sexual glands, while in the blood it causes the decreasing of leukocytes (Silva-Souza *et al.*, 2000). This parasite in crowded breeding ponds cause serious economic problems and live on different sites of fishes bodies (Mhaisen, 1983). Davis (1953) reported the death of 18 tons of common carp and two of goldfish within two weeks in a fish farm. This copepod is very nonspecific, infecting any freshwater fish, it reproduces quickly, it difficult to control, and it very damaging to fishes. So, every effort should be made to keep this parasite out of fish farms (Bunkley-Williams and Williams, 1994).

In Iraq, most studies on *L. cyprinacea* were mainly restricted to surveying different fish species from different localities. The first observing and recording of this parasite was in April, 1969 from seven species of fishes at Zaafaraniyan fish-cultuer station, south of Baghdad (Al- Hamed and Hermiz, 1973). Later on, it was reported from different fish farms in middle and south of Iraq, a total of 18 fish species are so far known for *L. cyprinacea* in Iraq (Mhaisen, 2006).

In Kurdistan region, *L. cyprinacea* was recorded for the first time from *Barbus luteus*, *C. carpio* and *Leuciscus lepidus* from Dokan lake (Abdullah, 1990). Later, it was recorded from two new hosts (*Barbus barbulus* and *Barbus grypus*) from Dokan lake and some aquatic habitats (Abdullah and Ismail, 2004; Abdullah, 2004) respectively.

Al-Hamed and Hermiz (1973) have studied the life of *L. cyprinacea*, but did not deal with it in detail that numerated the life cycle stages, and determined the live span of each stage only, and did not describe the general morphology of any of them. As no previous study on the life cycle of *L. cyprinacea* was performed in Iraq completely, the present investigation is designed to follow up the whole life cycle of this parasite. Such this information are very important for known how the parasites transported from one host to another host and for determining the best point in their life cycle stages for controlling and treatment of it, after determining the weakest point (Ginetsinskaya, 1961).

MATERIALS AND METHODS

The adult individuals of *L. cyprinacea* with egg sacs were derived from the common carp (*Cyprinus carpio* L.) obtained from Ainkawa fish hatchery, situated north-west of Erbil city, Kurdistan region-Iraq. Infested fish were cultured in small aquaria and observed during alive under dissecting microscope when the adult female of this parasite reach maturity, it began to produce the egg sacs, then the egg sacs were removed from the adult by using dissecting tools, then egg sacs were placed in small petri dish with little amount of distal water, than incubated at 25 ± 1°C. After that the shells were torn and the eggs were distributed on a plastic cups, and drops of water at 25°C were added every six hours by using small syringe for reaeration. Then they were placed in incubator at 25 ± 1°C during the period of study (Grabda, 1963; Tsotetsi, 2005). The parasite was identified according to Paperna (1996).

Every day plastic cups checked under dissecting microscope and the life stage observation made daily. Photos taken for each stage by using digital camera directly (alive). The figures were drawn by using a Camera Lucida (Drawing tube). Measurements of parasite were made with an Olympus ocular micrometer.

The eggs developed well and when we get the copepodid stage I and sometime II the content of cup with larvae were added to aquaria with experimental fishes which include juvenile of common carp (non-infection, healthy) and then we observed the fishes alive under the dissecting microscope for parasite stage searching.

Specimens of the parasite were killed and fixed with 5% formalin for one hour and then transferred into 80% alcohol. Specimen was cleared with 85% lactic acid and stained by a drop of neutral red then

permanent slides prepared by using jelly glycerin (Kim, 2004).

RESULTS AND DISCUSSION

The following is an account on description and measurements of these stages of life cycle from this parasite.

Egg

Egg sacs removed from adult females were of colors varying between white, bright and dark green, with a number of eggs ranging between 90-160 in each egg sac. Only dark yellow eggs hatched into nauplius stage and the rest did not hatch. Hatching occur after two to three days of culturing.

Eggs were ovoid, measured 0.02-0.05x0.01-0.04mm in size. They have a distinct double thin shell and greenish color, the fully- formed nauplius appeared Fig. (1).

According to Al- Hamed and Hermiz (1973) the mature eggs of *L. cyprinacea* incubated at 22-25°C, hatched within 24-48 hours. Paperna, (1996) reported the life cycle of Lernaeidae as follow: parasitic females of *L. barnimiana* produce egg sacs containing 75-205 eggs. Hatching occurs after 2 days at 21-25°C.

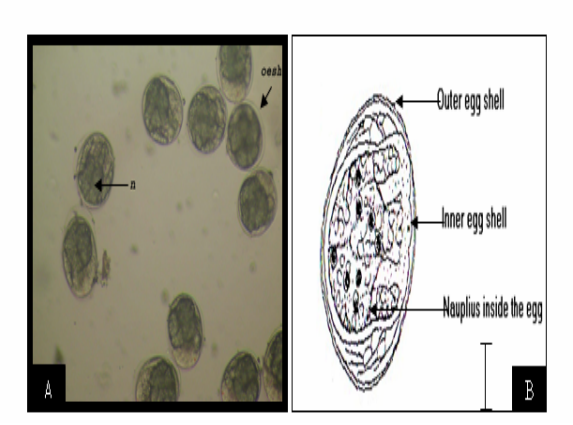
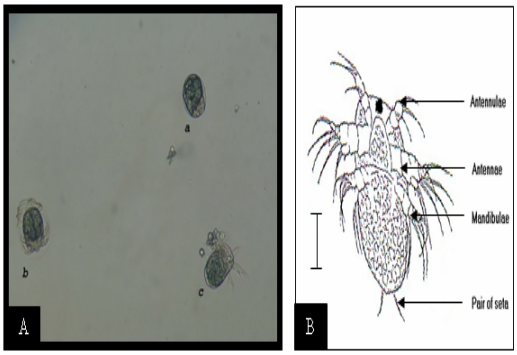


Fig (1): Egg of *Lernaea cyprinacea*. A- Photomicrograph (400x). B- A camera lucida drawing (Scale bar= 0.01mm). n= nauplius inside the egg, oesh= outer egg shell.

NAUPLIUS STAGES

Nauplius I

This stage was demonstrated after two to three days immediately after egg hatching at 25 ± 1°C. It is elliptical in shape, has slightly narrowed ends. It is 0.13-0.16 mm in length and 0.09-0.11 mm in width. The larvae at this stage provided with three pairs of typical appendages, antennulae, antennae and mandibulae. One pair of setae of furca was found at the posterior part of the body. Antennulae consist of three segments: the basic one unarmed, the central one is provided with a long plumose bristle on the ventral part and one small spin at the medial edge. At the end of the third segment two long plumose bristles are presented. Antennae are biramous, they composed of two segments and mandibulae are biramous, with two segments. Four plumose bristles are on exopodite and two on endopodite and protopodite is unarmed Fig. (2).



Fig(2): Nauplius stage I. A- Photomicrograph (100x). B- A camera lucida drawing (Scale bar = 0.1mm). a = mature egg, b = first nauplius leave egg shell. c = first nauplius stage

Nauplius II

Nauplius stage I molted to give this stage after 20-30 hours of incubation. The body oval in shap, larvae narrowed toward the posterior end, 0.14-0.20 mm in length and 0.09-0.11 mm in width. The amount of yolk is lesser than that of nauplius I. two pairs of setae of furca are at the body end. Antennulae consist of three segments, two additional spines are on the final segment. Antennae consist of the exopodite and endopodite. Mandibulae without any change Fig. (3).

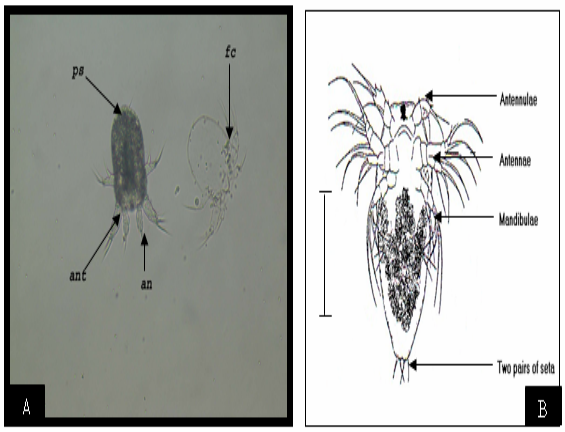


Fig (3):- Nauplius stage II. A- Photomicrograph (100x). B- A camera lucida drawing (Scale bar = 0.1mm). an= antennulae, ant= antennae, fc= first cuticle, ps= posterior setae.

Nauplius III

Nauplius stage II molted to liberate this stage after 20-25 hours. The body is much slimmer than in previous stage, 0.15-0.26 mm in length and 0.1-0.12 mm in width. A decrease of the yolk amount was noticed. Furca with three pairs of the setae. The number of appendages dose not change, only the number of setae and spines increased, especially on the final segment of the antennulae Fig. (4).

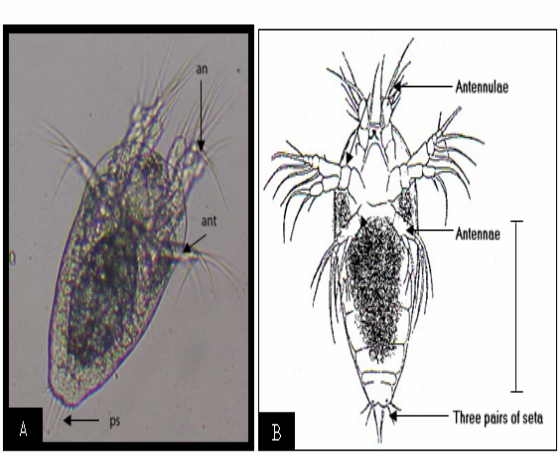


Fig (4):- Nauplius stage III. A- Photomicrograph (400x). B- A camera lucida drawing (Scale bar = 0.1mm). an = antennulae, ant = antennae, ps = posterior setae.

LATE STAGE OF THE NAUPLIUS

Nauplius III stage lasted for about two to three days or more (by decreasing the degree of temperature the remaining time of parasite at this stage will increase) later it molted to emerge copepodid stage I. The body is elongated, 0.25-0.36 mm in length and 0.11-0.13 mm in width, with little amount of yolk. The translucent segmentation of copepodid developing inside this old stage appeared Fig. (5).

The description and measurements of the present specimens for nauplius stages are similar to those reported by Grabda (1963), he obtained only three stages of nauplius in vitro after four days from oviposition, designated as nauplius I, II and III without using the term of metanauplius and the formation of each stage was accompanied by one moult. But he states that some other authors described the fourth stage as older metanauplius, probably this stage was the third stage but more advanced. Al-Hamed and Hermiz (1973) reported that the eggs of the parasite, hatched within 24-48 hours, incubated at 22-25°C, releasing nauplius, and it moults for three successive days before developing into the first copepodid larval stage.

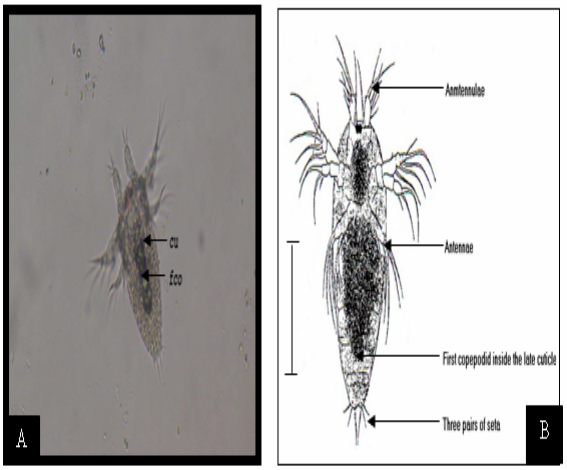


Fig (5):- Late stage of nauplius. A- Photomicrograph (100x). B- A camera lucida drawing (Scale bar = 0.1mm). cu= cuticle, fco= first copepodid stage.

COPEPODID STAGES

Copepodid I

Segmentation took place inside the last stage of the nauplius during two to three days or more then it molted to emerge the first copepodid. The body is transparent with dark intestine, the eye consists of three ocelli. The total body length with seta and furca is 0.50-0.55 mm, consistsing of cephalothorax, four free segments, furca and two pairs of biramous swimming limbs and the third pair of limb is vestigial. Antennulae, antennae, mandibulae, maxillulae, maxillae, maxillipedes and one pair of swimming limbs are on the cephalothrax.The fourth segment of the body terminated with furca, and on the bases segment of it, there are two small setae. Antennulae uniramous consists of three segments. Antennae consist of three segments and the number of segments remain the same at all further stages Fig. (6).

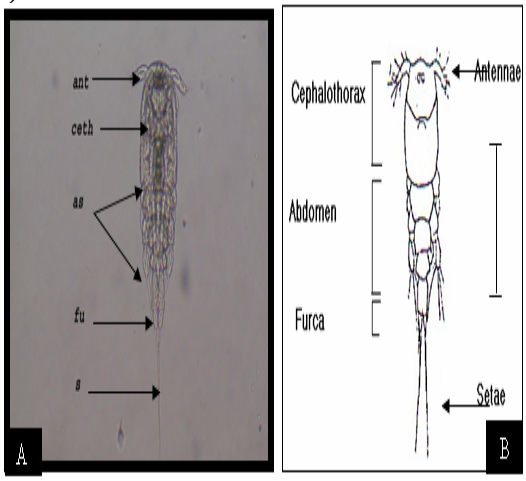


Fig (6):- Copepodid stage I. A- Photomicrograph (150x). B- A camera lucida drawing (Scale bar = 0.2mm). ant= antennae, as= abdomen segments, ceth= cephalothorax, fu = furca, s= seta.

Copepodid II

Copepodid I metamorphosed and increased in length then it molted to give rise to copepodid II after 24 hours. Body 0.60-0.67mm in length, consists of cephalothorax, five free segments, and furca, three biramous swimming limbs. At this stage one new free segment and one new pair of swimming limbs appear. Cephalothorax is more rounded than at previous stage. The last segment is slightly longed than that of copepodid stage I. arrangement of the setae on the furca changes and the structure of the furca at this stage repeated in further development stages. Antennulae consist of four segments. Antennae consist of three segments Fig. (7).

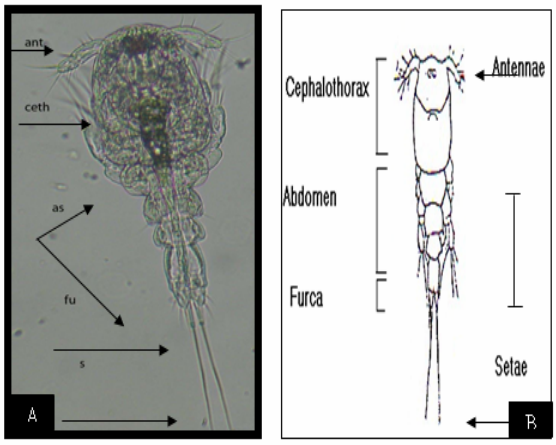


Fig (7):- Copepodid stage II. A- Photomicrograph (150x). B- A camera lucida drawing (Scale bar= 0.2mm). ant= antennae, as= abdomen segments, ceth= cephalothorax, fu= furca, s= seta.

Copepodid III

The development of copepodid II to copepodid III required 20-30 hours and it isolated after a day approximately on experimental fishes cultured in small glass aquaria with controlled temperature. The body increased in this stage by one new free segment and one new pair of swimming limbs, 0.71-0.77 mm in length. Body consists of cephalothorax, six free segments, furca, four biramous swimming limbs. Antennulae consist of five segment Fig. (8). This stage may parasitized fishes for obtaining their nutrient from fish blood due to complete reduction of the yolk.

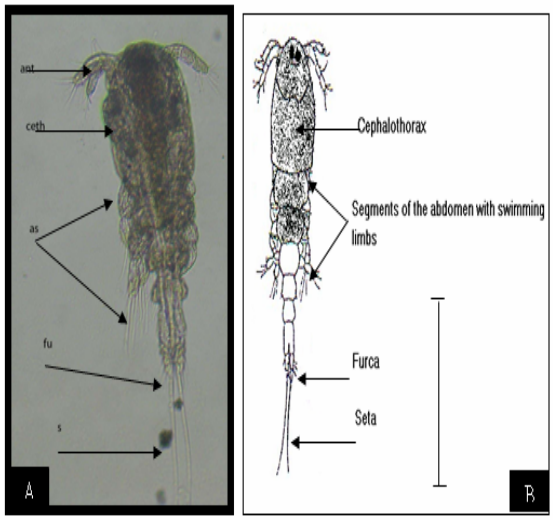


Fig (8):- Copepodid stage III. A- Photomicrograph (120x). B- A camera lucida drawing (Scale bar= 0.25mm). ant= antennae, as= abdomen segments, ceth= cephalothorax, fu= furca, s=setae

Copepodid IV

This stage was not observed in this study. According to Mhaisen (1983) the body 0.80-0.86 mm in length, consists of cephalothorax, seven free segments, and furca. Antennae consists of three segments with the same armature as in the previous stage. Antennulae consist of six segments, new free segment and one new pair of swimming limbs appeareds compared with copepodid III. Endopodites and exopodites of the first three pairs of the swimming limbs consists of two segments Fig. (9).

Copepodid V

After ten hours from isolation of copepodid III copepodid V obtained from the experimental fish cultured in small glass aquaria. The body of the parasite at this stage 0.85-1.20 mm, consists of cephalothorax, eight free segments, and furca. Four pairs of biramous swimming limbs possess endopodites and exopodites while a 5th pair is uniramous and the sixth pair is vestigial Fig. (10). Sexual differentiation into male and female occurs at this stage.

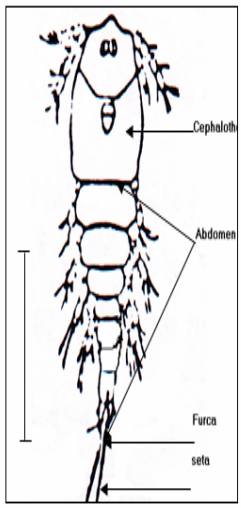


Fig (9):- Copepodid stage IV, redrawing from Mhaisen, 1983 (Scale bar = 0.25mm).

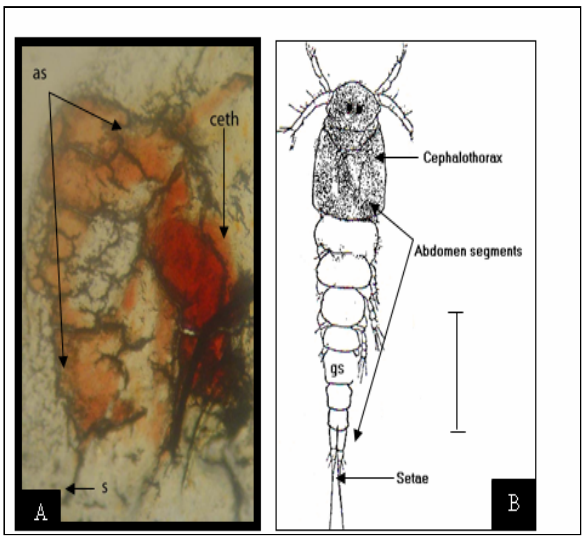


Fig (10):- Copepodid stage V. A- Photomicrograph (30x). B- A camera lucida drawing (Scale bar =0.25mm). as= abdomen segments, ceth= cephalothorax, s= seta.

The description and measurements of the present specimens for copepodid stages are similar to those reported by Grabda (1963), he obtained five copepodid stages successively after nine days from egg culturing, designated as I, II, III, IV and V and the formation of each stage was accompanied by one molt. He states that some other authors described the cyclopoid stage as sixth stage of copepodid and also Mhaisen (1983) state that five copepodid stages appear after 9-10 days from egg hatching. In this study copepodid IV was not observed because, copepodide IV stages were molted quickly due to the presence of the nutritional available that obtained from their host blood.

Cyclopoid Stage

The body of the parasite at this stage is 0.9-1.4 mm. While male 0.72-1.05 mm, and the size of genital structure 0.13-0.18 mm depending on the study of Grabda (1963). It consists of cephalothorax, nine free segments, and furca but the size of male was smaller than the size of female. The structure of appendages is in general the same as in copepodid V stage but the external sexual features differentiated much more than in the previous stage Fig. (11). Copulation took place at this stage outside the body host for this reason, isolation of this stage was difficult and not observed.

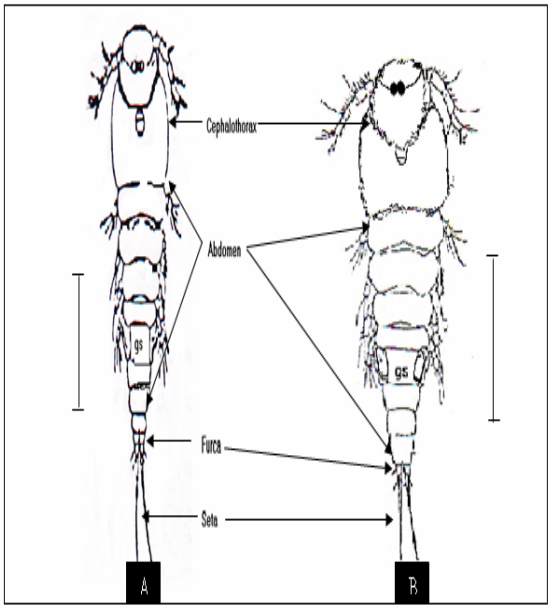


Fig (11):- A camera lucida drawing cyclopoid stage redrawing from Mhaisen (1983).
A- Female (Scale bar= 0.3mm). **B-** Male (Scale bar= 0.3mm).
gs= genital segment.

YOUNG SEDENTARY FEMALE

This stage was obtained from the skin and fins of the experimental fish during working after two weeks from obtaining of copepodid V. A significant change in the morphology of the parasite body took place at the moment when a female passed from free swimming stage to sedentary one. Body size 4.6 mm. The remainder of the appendages (swimming limbs, Antennulae, antennae, furca and setae) were observed at this stage under dissecting microscope Fig. (12). Grabda (1963) mentioned that this stage appeared on the experimental fishes 22 days after fertilization depending on the temperature degree.

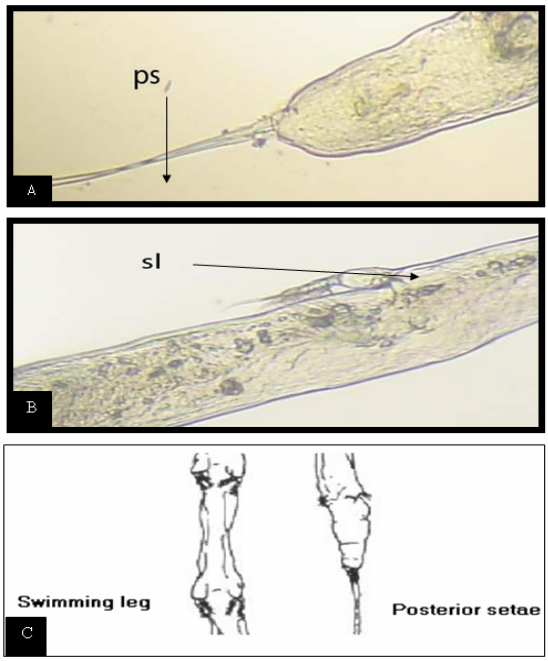


Fig (12):-Photomicrograph of the sedentary female(30 x). A-Remainder of the furca with setae.(ps).B-Remainder of the swimming limbs.(sl).C-A ncamera lucida drawing(Scale bare= 0.5).

THE ADULT FORM OF THE PARASITE

After three days the young sedentary females produce egg sacs. The length of the parasite with egg sac range between 18-28 mm while without egg sac is 13-20 mm. It has a number of arms at the tip of cephalothorax around the mouth which resemble anchors and for this reason it is known as anchor worm. Those arms arranged as a T-shaped structure Fig. (3) and the parasite uses it as adhesive apparatus for attachment to their host. Black intestine made peristaltic movements and this description and measurement agreed with that of Mahisen (1983) and Amlachar (1970).

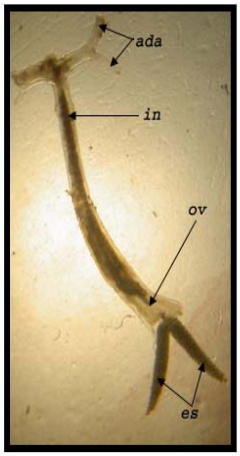


Fig (13): Photomicrograph of the adult female of *Lernaea cyprinacea* with egg sacs (40x). ada= adhesive apparatus, in= intestine, ov= oviducts, es= egg sacs.

During the egg sacs formation, eggs were passed through the narrow canal of the oviduct toward the vulva appeared in the terminal segment of the oviducts and the process finished with the complete evacuation of the oviducts (Grabda, 1963). As the number of eggs increased the egg sac elongated. When the size of egg sac reached maturity it is ruptured and the naupliuses developed. Temperature was among the important factor which affected the processes of egg sac formation because the number of generation (egg sac formation) depends on this factor (Grabda, 1963; Amin, 1981).

The total time required for the development of three nauplius stage, late stage of nauplius, four copepodid stage and cyclopoid stage in the present study is approximately 10-12 days (25±1°C) and this is agree with the study of Grabda (1963) who obtained all the stages of this parasite experimentally, he defined the whole life cycle span of the parasite as follows: the development of eggs lasted three days, the liberation of the nauplius from egg sacs was observed on the fourth day, then naupliuses underwent further metamorphosis during four days (I, II and III).Copepodid I,II, III,IV and V was successively observed within further nine days, free swimming males and females (Cyclopoid) appeared on the experimental fishes on the tenth day. The first specimens of the sedentary females with egg sacs were found after 22 days. So, the total time required for the development of *L. cyprinacea* from egg to cyclopoid stage depending on the study of Grabda (1963) is 17 days at 22-25 °C. Also Al- Hamed and Hermiz (1973) state that life cycle of *L. cyprinacea* laboratory required approximately two weeks. Generally,Tsotetsi (2005) suggested that temperature, aeration and water movement are important for successful hatching and to the whole life cycle span in copepods. Also, the generation of the parasite depended on the temperature, Grabda (1963) stated that in cold winter only two generation were recorded for the parasite per a year. Amin (1981) reported two generation for *L. cyprinacea* from some fishes in southeast Wisconsin. Abdullah and Ismail (2004) recorded more generation for this crustacean from some fishes in Dokan lake. While in this study we recorded 4-5 generation under controlled temperature (25±1°C).

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دراسة تجريبية لدورة حياة الدودة الكلابية *Lernaea cyprinacea* L.

الخلاصة

تمت دراسة دورة حياة الطفيلي القشري الدودة الكلابية Anchor worm (Lernaea cyprinacea) في المختبر. حيث اخذت بيوض هذا الطفيلي من أسماك الكارب الاعتيادي Cyprinus carpio مصابة من مفقس أسماك عينكاوة، الواقعة في شمال غـرب مدينة اربيل, أقليم كردستان- العراق. وضعت البيوض في اطباق زجاجية وحضنت عند درجة حرارة 25±1°C. ثم تمت متابعـة تطور البيوض، وبعد 48-72 ساعة تم الحصول على الاطوار اليرقية المسماة النابليوس Nauplius، ومن ثم على الأطـوار اليرقيـة المسماة الشبيهة بمجذافية الأقدام الاولى والثانية Copepodid I, II، وضعت هذه الاطوار في احواض حاوية اسماك سليمة وبعد 24 ساعة تم الحصول على Copepodid III ومن ثم تم الحصول على الطور البالغ بعد 18 يوما.

پوختە

ئەم توێژینەوەیە بریتی یە لە خوێندنی سوڕی ژیانی توێکڵدار *Lernaea cyprinacea* لـە تاقیگـەدا لەسـەر بنـچینەی چاندنی هێلکە لە دەرەوەی لەشی مشەخۆرەکە (in vitro) لە 25±1°C . قۆناغەکانی گەشەکردنی هێلکە بـەم شـێوەیە بـوو ، نەوپلیەسەکان پاش 48–72 سەعات بە دەر کەوتن ، پاشان لە پاش سێ ڕۆژ کۆپێپۆدی یەکـەم و دووەم بـە دی کـران ، لـە دەرەوەی لەشی ماسی یەکە. لە دوای دا هەردوو قۆناغی کۆپێپۆدە خرانە ناو حەوزی شوشەی بچووک لە گەڵ ماسـی تـووش نەبوو. قۆناغی کۆپێپۆدی سێیەم پاش 24 سەعات دیارکەوت وە لە دوای 18 سەعات قۆنـاغی مـشەخۆری هـەراش لەسـەر ماسی تاقیگەدا دەستنیشان و پێناسەکرا .

VARIABLE- STRUCTURE CONTROLLER DESIGN FOR MULTI-AREA POWER SYSTEMS USING POLE ASSIGNMENT TECHNIQUE

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ABSTRACT

This paper presents a variable structure load-frequency controller for multi-area power system. The proposed controller is designed based on the theory of the variable structure system using pole assignment technique. The variable-structure controller effectively improves the transient performance of the system while keeping the steady state error at zero. Moreover, when the variable structure system is operated in the so called sliding mode, the response of the system becomes insensitive to plant parameter variations. Simulation results with upper and lower parameter variations reveals that the proposed controller guarantees the stability and desired performance of the system.

1- INTRODUCTION

Different theories and techniques were adopted by the researchers to study the Load- Frequency Control (LFC) as follows:

1- Classical control theory [1].
2- Optimal control theory [2].
3- Robust control theory [3-5].
4- Variable structure (VSS) theory [6-7].
5- Adaptive control theory [8].

Chan and Hsu [6] applied the concept of variable-structure system (VSS) theory to design the load frequency controllers for both single and multiple area systems.

Sivaramarkrishnan, Hariharan, and Srisailam [7], applied develop systematic approach based on a pole assignment technique for specifying the elements of the switching vector. However, this approach is applied to study LFC problem for single area power system.

In this paper the VSS theory using pole assignment technique applies to multi- area power system which consist of two area power system with reheat steam turbines.

2- DYNAMIC MODEL FOR THE POWER SYSTEM:

Fig. (1) show the block diagram of two area power system with reheat steam turbines [5].

The dynamic model in state variable form can be obtained from the transfer function model and is given by the state equation

$$\dot{x} = Ax + Bu + \Gamma\Delta Pd \quad \ldots\ldots\ldots(1)$$

where

$$\left[B^T = \begin{bmatrix} 0 & 0 & 0 & \frac{1}{T_{g1}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \frac{1}{T_{g2}} & 0 & 0 \end{bmatrix}\right]$$

$$\Gamma^T = \begin{bmatrix} -\frac{K_{p1}}{T_{p1}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{K_{p2}}{T_{p2}} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$A = \begin{bmatrix} -\frac{1}{T_{p1}} & \frac{K_{p1}}{T_{p1}} & 0 & 0 & -\frac{K_{p1}}{T_{p1}} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1}{T_{r1}} & (\frac{1}{T_{r1}} - \frac{K_{r1}}{T_{t1}}) & \frac{K_{r1}}{T_{t1}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{T_{t1}} & \frac{1}{T_{t1}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{1}{R_1 T_{g1}} & 0 & 0 & -\frac{1}{T_{g1}} & 0 & 0 & 0 & 0 & 0 & -\frac{1}{T_{g1}} & 0 \\ T_{12}^* & 0 & 0 & 0 & 0 & -T_{12}^* & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\frac{a_{12}K_{p2}}{T_{p2}} & -\frac{1}{T_{p2}} & \frac{K_{p2}}{T_{p2}} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{T_{r2}} & (\frac{1}{T_{r2}} - \frac{K_{r2}}{T_{t2}}) & \frac{K_{r2}}{T_{t2}} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{T_{t2}} & \frac{1}{T_{t2}} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -\frac{1}{R_2 T_{g2}} & 0 & 0 & -\frac{1}{T_{g2}} & 0 & -\frac{1}{T_{g2}} \\ B_1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & a_{12} & B_2 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

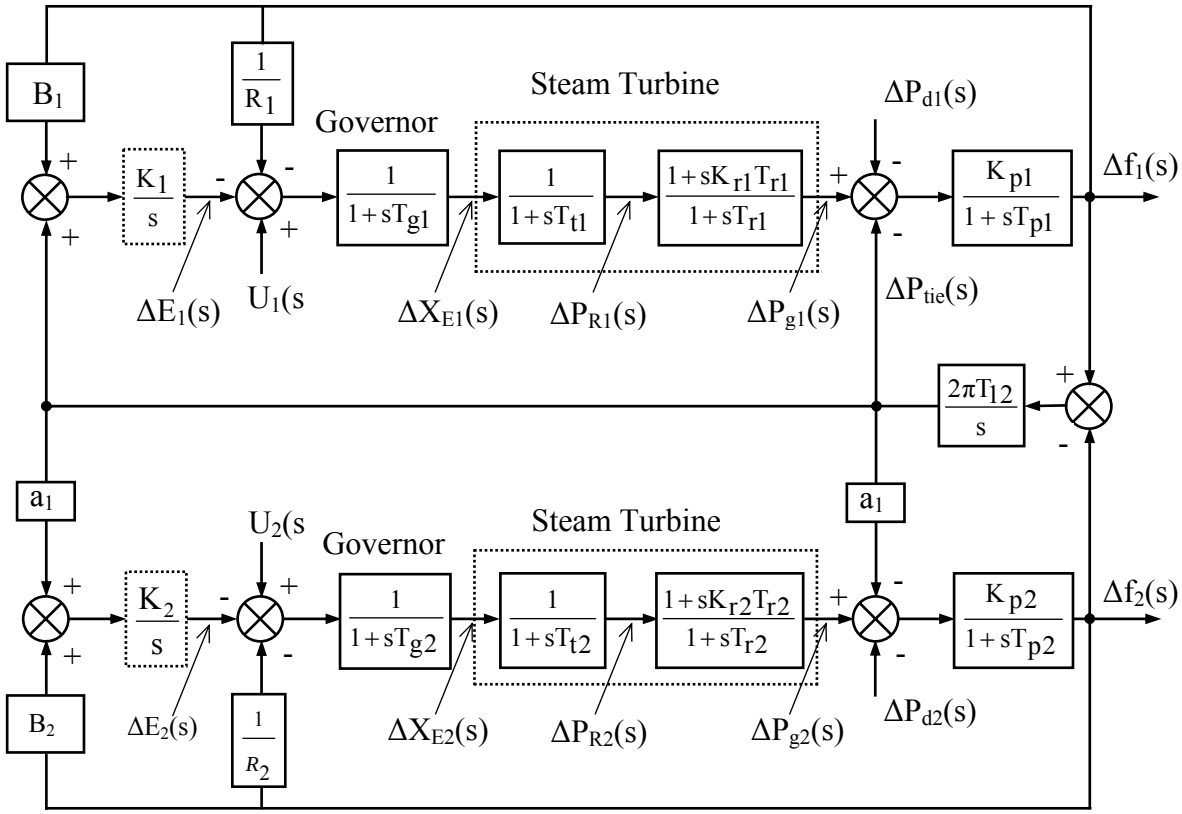
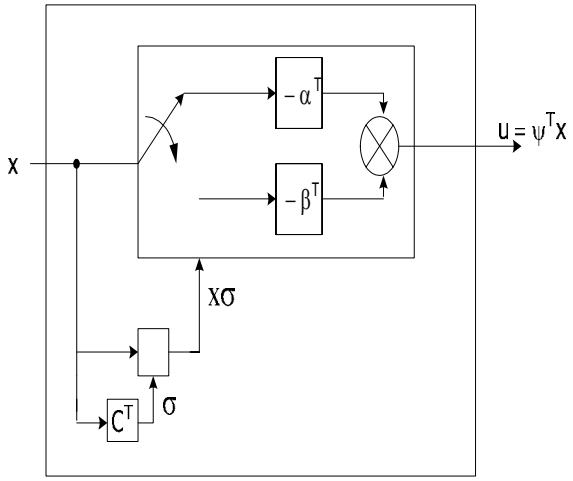


Fig (1): Block diagram of a two-area power system with reheat steam turbines for LFC.

3- VARIABLE-STRUCTURE LOAD FREQUENCY CONTROLLER AND SELECTION OF SWITCHING VECTOR

The function and concepts of VSS s and switching hyperplane have been explained briefly in Ref. [6]. The block diagram of the Variable-Structure Control is shown in Fig.(2)



Fig(2):- The block diagram of the VSS controller.

where the switch is operated according to the change of signs of the signal $x\sigma$ $\sigma = c^T x$

$\sigma_i = \sum_{j=1}^{ni} c_{ij} x_{ij}$ where i=1,2,-------N

x_{ij} is the state variable of subsystem i, ni is the dimension of x_i.

$c_i = [c_{i1}, c_{i2}, \ldots\ldots\ldots c_{ini}]^T$ is the switching vector of subsystem i,

$x_i = [x_{i1}, x_{i2}, \ldots\ldots\ldots x_{ini}]^T$ is the state vector of subsystem i.

The control law u_i of the subsystem in eq.(1) are chosen as:

$u_i = -\Psi_i x_{i1}$ i=1,2, ……N

where Ψ_i is the piecewise constant function defined by

$$\Psi = \begin{cases} \alpha_i & if \quad x_{i1}\sigma_i > 0 \\ \beta_i & x_{i1}\sigma_i < 0 \end{cases}$$

The necessary and sufficient condition for the existence of a sliding mode on the hyperplanes $\sigma_i = 0, \quad i = 1,2,\ldots..N$ is given by

$$\lim_{\sigma_i \to 0} \sigma_i \frac{\partial \sigma_i}{\partial t} \le 0 \quad \text{i=1, 2, ……. N}$$

The design procedure for selecting the constant switching vector c is described in Ref. [7]

$[c_{11} \;\; c_{12}] = c^T M^{-1}$

with $c_{12} = I$

$c^T = [c_{11}\ M]M$

where M is a non-singular n*n coordination transformation matrix. The C_{11} matrix obtained by choosing the poles of the matrix $A_{11} - A_{12}c_{11}$ arbitrarily.

3- SIMULATION RESULTS AND DISCUSSION:

The proposed controller is simulated using the MATLAB software. The nominal system parameters are used from Ref. [5] and the range of system parameters variations are listed in Appendix B.

The nominal system matrices are as follows:

$$B = \begin{bmatrix} 0 & 0 & 0 & 5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 & 0 \end{bmatrix}^T$$

$$\Gamma = \begin{bmatrix} -6 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -6 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}^T$$

$$A = \begin{bmatrix} -0.05 & 6 & 0 & 0 & -6 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.05 & -1.061 & 1.111 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -3.33 & 3.33 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -2.083 & 0 & 0 & -5 & 0 & 0 & 0 & 0 & 0 & -5 & 0 \\ 0.4442 & 0 & 0 & 0 & 0 & -0.4442 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 6 & -0.05 & 6 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -0.05 & -1.061 & 1.111 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -3.33 & 3.33 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & -2.083 & 0 & 0 & -5 & 0 & -5 \\ 0.425 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0.425 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Taking the matrix M as

$$M = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

The matrix MAM^{-1} turn out to be $MAM^{-1} = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}$

$$= \begin{bmatrix} -0.05 & 6 & 0 & 0 & -6 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.05 & -1.061 & 0 & 0 & 0 & 0 & 0 & 0 & 1.111 & 0 \\ 0 & 0 & -3.33 & 0 & 0 & 0 & 0 & 0 & 0 & 3.33 & 0 \\ 0.425 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.4442 & 0 & 0 & 0 & 0 & -0.4442 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 6 & -0.05 & 6 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -0.05 & -1.061 & 0 & 0 & 1.111 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -3.33 & 0 & 0 & 3.33 \\ 0 & 0 & 0 & 0 & -1 & 0.4250 & 0 & 0 & 0 & 0 & 0 \\ -2.083 & 0 & 0 & -5 & 0 & 0 & 0 & 0 & 0 & -5 & 0 \\ 0 & 0 & 0 & 0 & 0 & -2.083 & 0 & 0 & -5 & 0 & -5 \end{bmatrix}$$

Choosing the poles of the matrix $[A_{11} - A_{12}C]$ arbitrarily at $-6, -6, -4+1j, -4-1j, -0.15, -0.15, -2+1j, -2-1j, -10$

The switching vector is obtained as

$$c = \begin{bmatrix} [16.3776 & 19.9069 & -2.2460 & 1.0000 & 22.6364 & -6.7046 & 0.8322 & -1.4809 & 0 & 56.9511 & -17.4607 \\ -7.0000 & -2.4084 & -0.4889 & 0 & -13.8417 & 12.9553 & 15.3140 & -1.2646 & 1.0000 & -28.3048 & 40.7594] \end{bmatrix}$$

The gain ψ are chosen in such away that the control effort required is moderate and their values are given by

$$\alpha = [12 \quad 8 \quad 6 \quad 10 \quad 10 \quad 12 \quad 8 \quad 6 \quad 10 \quad 5 \quad 5]$$

$$\beta = [-12 \quad -8 \quad -6 \quad -10 \quad -10 \quad -12 \quad -8 \quad -6 \quad -10 \quad -5 \quad -5]$$

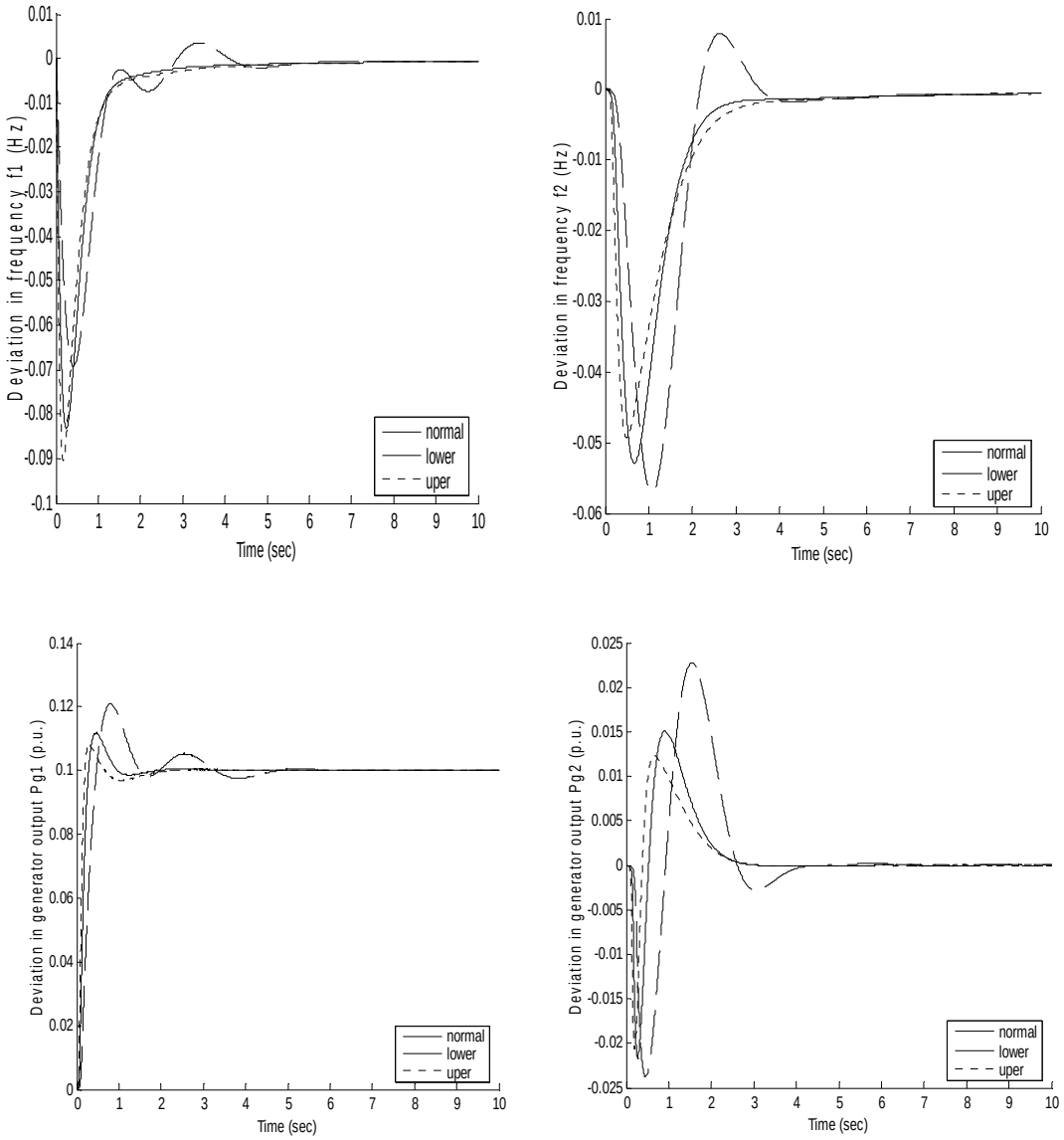


Fig (3): System response for 10% load change

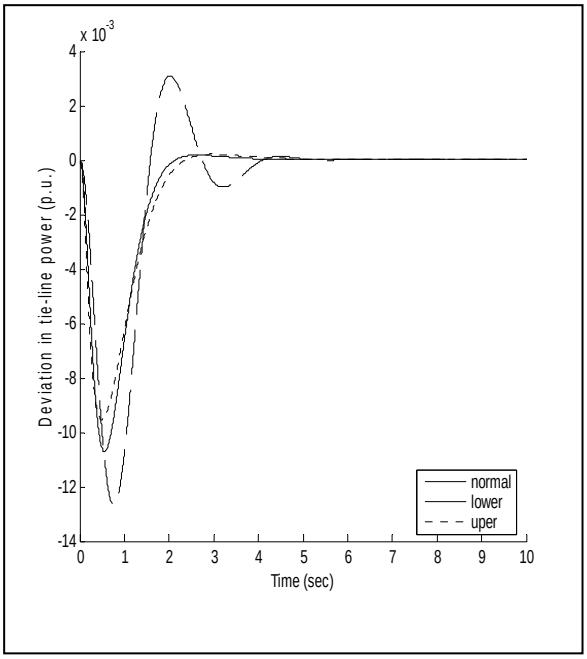


Fig (4):- System response for 10% load change

To examine the effectiveness of the proposed controller, suppose that the system is subjected to a step load change of 10% p.u. in area 1.

The dynamic behavior of the system under controller action are obtained by changing Kp, Tp, R by 50% and Tg, Tt, Tr, Kr by 30% simultaneously from their nominal values. The simulation results with upper and lower bound parameter variations are presented in Figs 3 and 4. Fig. 3 shows the frequency and generator output power deviations of area 1 and area 2 respectively. Fig. 4 shows tie-line power deviation. The results show that the system responses under proposed controller are insensitive to plant parameter variations.

Figure 5 shows the response of frequency for two different specifications of the feedback gains:

The feedback gains are arbitrarily specified as $\alpha = [10 \quad 0 \quad 0 \quad 12 \quad 0 \quad 10 \quad 0 \quad 0 \quad 12 \quad 1 \quad 1]$ and $\beta = -[10 \quad 0 \quad 0 \quad 12 \quad 0 \quad 10 \quad 0 \quad 0 \quad 12 \quad 1 \quad 1]$; The response of the frequency clearly demonstrate that the performance of the system is insensitive to variations in the feedback gains.

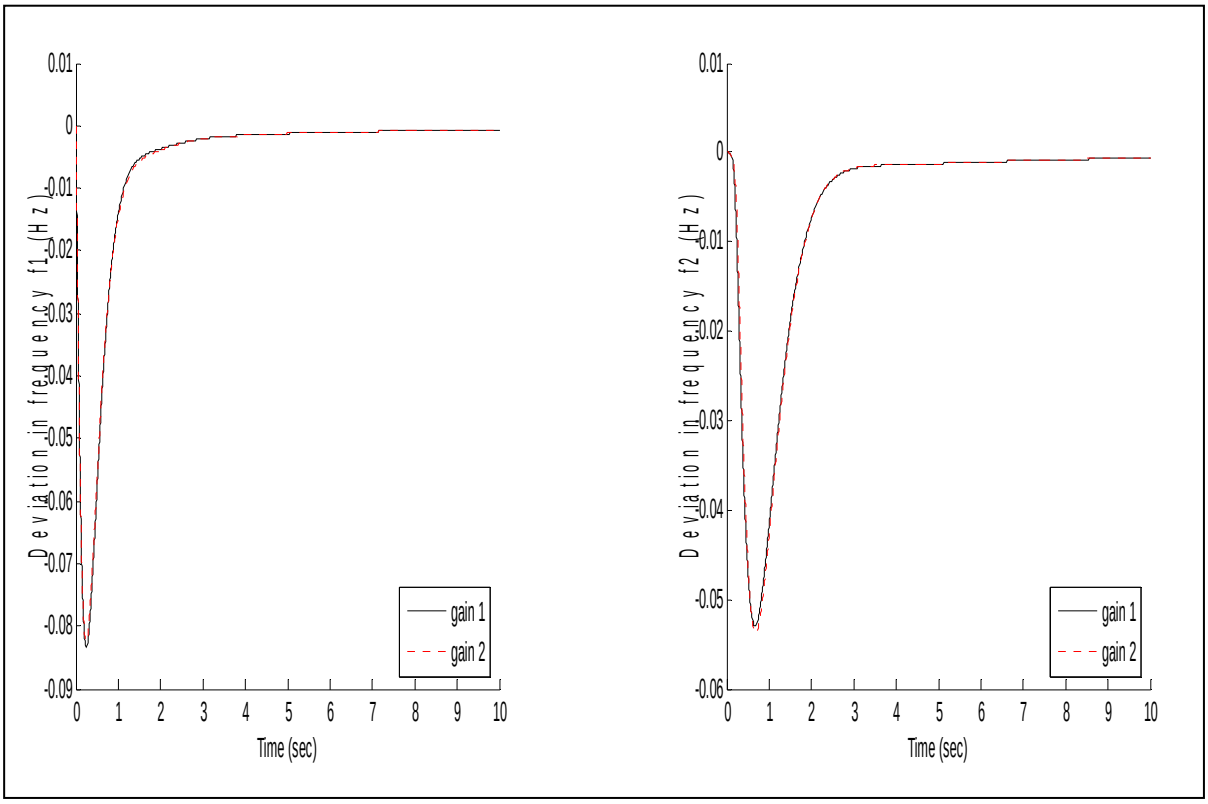


Fig (5):- Effect of the feedback-gain variations on the system response

4- CONCLUSIONS

In this paper a VSS controller for two-area power system with reheat steam turbines is presented. This control is developed based using the variable structure systems theory. The pole assignment technique is used to specify the elements of the switching vector. When the system parameters subjected to changes from their nominal values, no

significant changes in the system performance have been observed. It's concluded that the performance of the system is insensitive to variations in the feedback gains.

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Appendixes:

1. Nominal Parameters of the System

Parameter	Area 1	Area 2	Unit
f	60	60	Hz
R	2.4	2.4	Hz / p.u.MW
H	5	5	sec
Pr	2000	2000	MW
PL	1000	1000	MW
D	$8.33 \times 10\text{-}3$	$8.33 \times 10\text{-}3$	p.u.MW/ Hz
Tg	0.2	0.2	sec
Tt	0.3	0.3	sec
Kr	0.333	0.333	--
Tr	20	20	sec

$T_{12}^{*} = 2\pi \times 0.0707$

2. The Range of System Parameter Variations

$\frac{1}{T_p} \varepsilon \quad [0.025 \quad 0.075], \quad \frac{k_p}{T_p} \varepsilon \quad [3.0 \quad 9.0]$

$\frac{1}{RT_g} \varepsilon \quad [1.0415 \quad 3.1245],$

$\frac{1}{T_t} \varepsilon \quad [2.33 \quad 4.33], \quad \frac{1}{T_r} \varepsilon \quad [0.035 \quad 0.065],$

$\frac{1}{T_g} \varepsilon \quad [3.5 \quad 6.5], \quad \frac{K_r}{T_t} \varepsilon \quad [0.777 \quad 1.444],$

Nomenclature:

Δf_i incremental frequency deviation in Hz

ΔP_{gi} incremental change in the ith subsystem's output in p.u. MW

ΔP_{Ri} incremental change in the output energy of the ith reheat type turbine in p.u. MW

ΔX_{gi} incremental change in the ith governor valve position in p.u. MW

ΔE_i incremental change in the integral controller

ΔP_{tie} incremental change in the tie-line power

ΔP_{di} load disturbance for the ith area in p.u. MW

U_i output of the load frequency controller for the ith area

T_{gi} ith governor time constant in s

T_{ti} ith turbine time constant in s

T_{ri} ith reheat time constant in s

T_{pi} ith subsystem-model time constant in s

K_{pi} ith subsystem gain

K_i ith subsystem's integral control gain

B_i ith subsystem's frequency-biasing factor

K_{ri} the ratio between output energy of the ith stage of turbine to total output energy

R_i speed regulation for ith subsystem due to the ith governor action in Hz/p.u. MW

T_{12} synchronizing coefficient of the tie-line between area 1 and area 2

a_{12} the ratio between the base values of two areas

تصميم مسيطر ذو التركيب المتغير لانظمة قدرة كهربائية متعددة المناطق باستخدام تقنية تحديد القطب

الخلاصة

يقدم هذا البحث مسيطر ذو التركيب المتغير للتحكم في تردد انظمة القدرة الكهربائية متعددة المناطق. صمم المسيطر المقترح اعتمادا على نظرية انظمة ذوات التركيب المتغير مستعملا تقنية تحديد القطب. طبقت الطريقة المقترحة على منظومة ذى منطقتين مستخدما البرنامج الحاسوبي MATLAB . اثبتت نتائج المحاكاة مع الحد العلوي والسفلي لتغير العناصر المختلفة فعالية المسيطر في تحقيق الاستقرارية والمواصفات الجيدة للمنظومة.

نەخشكيشانا كونترولەكي بنيات گوراو بو سيستيمێت كارەبێ جورى هەمي دەڤەر بكارئينانا تكنيكا دەسنيشانكرنا جەمسەري.

كورتى

دڤێ ڤەكولينيدا كونترولەكى بنيات گوراو بو كونترولكرنا فريكوێنسيا سيستيميت كارەبێ جورى هەمي دەڤەر هاتە پێشكيشكرن. ئەڤ كونترولە هاتە دانان لديوف تيورا سيستيميت بنيات گوراو و بكارئينانا تكنيكا دەسنيشانكرنا جەمسەرى. ئەڤ رێكە مە بكارئينا لسەر سيستيمەكا دوو دەڤەر و بكارئينانا بەرنامێ كومپوتەرى MATLAB . انجاما ديماركر لگەل گوهورينا پاراميترا بۆ رادەيەكي بەرچاڤ ئەڤى كونترولى جيگيريەكا(Stability) باش بدەست ڤەئينا بۆ ڤى سيستيمى.

DISPERSIVE CHARACTERISTICS OF DUHOK GOVERNORATE SOIL

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ABSTRACT

Many contemporary water quality problems involve application of the advection –dispersion equation . The advection – dispersion equation describes spatial and temporal variation in solute concentration ,with specific initial and boundary condition .The distribution of the concentration of the solute can be determined by solution of the advection-dispersion equation which needs the determination of the dispersion coefficient. So the determination of the dispersion coefficients will be essential in the solution of the water quality problems.

In this paper ,field techniques are used to determine the longitudinal and lateral dispersion coefficients . Data of pumping test for several wells distributed over the area covered Duhok governorate were obtained .The hydraulic conductivity was calculated and relation between the hydraulic conductivity and the dispersivity coefficients was obtained in order to investigate the distribution of the longitudinal and lateral dispersivity coefficients over the Duhok governorate area.

Distribution of these coefficients are of great importance in the selection of the sites for the activities such as the suitable landfill locations, artificial recharge location and the contamination effect on the groundwater due to waste disposal to the lands.

Longitudinal and lateral dispersivity coefficient in general was found to be 0.7362 cm and 0.0133 cm for Duhok region ,while the longitudinal and lateral dispersivity coefficient for the basins of Duhok region was found to be 0.0838 cm , 0.004 cm for Sumil basin ,0.0351 cm , 0.0013 cm for Duhok basin and 0.2721 cm , 0.0061 cm for Aqre basin.

KEYWORDS dispersion water contamination landfill quality

INTRODUCTION

Hydrodynamic dispersion phenomena occur in many problems of groundwater flow, chemical engineering processes and oil reservoir engineering ,it is encountered in the artificial recharge operations where water of one quality is introduced into aquifers containing water of different quality ,also in radioactive and reclaimed sewage waste disposal into aquifer .

Hydrodynamic dispersion is the macroscopic outcome of the actual movements of the individual tracer particles through the pores and the various physical, chemical phenomena which take place within the pores, (Bear[1])

There are two basic transport phenomena , convection and molecular diffusion. Convection is due to local velocity variation in magnitude and direction through the flow paths within the pores, while the molecular diffusion is the transport of matter by molecular mobility. According to the general two dimensional equation of tracer transport, the dispersion coefficient was the major factor controlling the phenomena.

$$\frac{\partial c}{\partial t} + u\frac{\partial c}{\partial x} + v\frac{\partial c}{\partial y} = \frac{\partial}{\partial x}\left(D_1\frac{\partial c}{\partial x}\right) + \frac{\partial}{\partial x}\left(D_2\frac{\partial c}{\partial x}\right) \quad \ldots\ldots(1)$$

Where : C: concentration , u ,v : local velocity in x and y direction and D_1, D_2 : longitudinal and lateral dispersion coefficients.

There are different approaches to determine the dispersion coefficient and then the dispersivity coefficient (dispersion coefficient is the property of the fluid and medium(soil) ,while the dispersivity is the properties of the medium only).Most of these approaches are experimentally determination in the laboratory , so determination a relation between the dispersion and dispersivity properties of the porous media with the other properties of the soil was carried out by several investigator .

Dispersion coefficient determination:

Scheidegger [7] describe the dispersion coefficient when neglecting the molecular diffusion as:

$D=(\text{constant}).q$ ……(2)

Where : D : is the dispersion coefficient $[L^2/T]$ and q: is the seepage velocity which is equal to mean velocity divided by porosity of soil.

When the molecular diffusion coefficient is considered equation (2) becomes :

$D=(\text{constant}).q^2$ ……(3)

Scheidegger [7] obtain various expression for the dispersion coefficients,one such configuration leads to:

$D_1=q^{1.2}$ ……(4)

and

$D_2=q$ ……(5)

Harleman and Rumer [6] also described the dispersion coefficient as:

$D=(\text{constant}).q^n$ ……(6)

The constant n is considered larger than unity for longitudinal dispersion coefficient and less than unity for lateral dispersivity.

Shamir [8] found that the dispersion coefficient is the product of the dispersivity of the medium times the seepage velocity as follows:

$D_1=A_1.q$ ……(7)

and

$D_2=A_2.q$ ……(8)

Where : A_1 : is the longitudinal dispersivity coefficient of the medium[L] and A_2 : is the lateral dispersivity coefficient of the medium [L].

Dispersivity is the ability of the porous media to disperse fluid through it. Freeze [4] indicated that the dispersivity in longitudinal and lateral direction are of

higher values in the field than those obtained in the laboratory measurements, relation of the dispersivity property of the medium to the other property of the soil such as mean particle diameter , hydraulic conductivity ,hydraulic conductivity Peclet number and hydraulic conductivity Reynolds number, can be found as stated by Hammed [5] as:

$A_1 = 4.418\ d_{50}^{1.359}$ ……..(9)

$A_2 = 0.047\ d_{50}^{0.995}$ ……(10)

$A_1 = 2.384\ K^{0.924}$ …..…. (11)

$A_2 = 0.034\ K^{0.68}$ ……(12)

Where : d_{50} : is the mean particle diameter [L] and K: hydraulic conductivity of the porous medium [L/T] .

Fattah[2] in his investigation described the dispersion coefficients as:

$D_1 = A_1 .q^{1+n1}$ ……..…..(13)

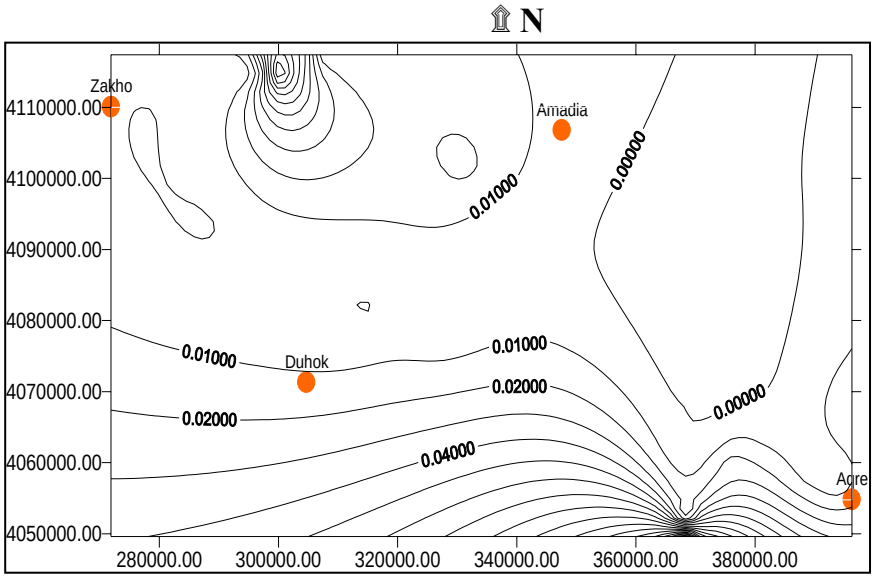
$D_2 = A_2 . q^{1+n2}$ …….. (14)

Where : n1 ,n2 are the exponent of the seepage velocity in longitudinal and lateral dispersion coefficient.

RESULT AND DISCUSSION

In order to determine the field longitudinal and lateral dispersivity coefficient of the soil of Duhok governorate ,the pumping test data for drilled wells distributed over the area of the Duhok region was obtained from food and agricultural organization (Duhok office) [FAO] ,hydraulic conductivity and transmissivity of the aquifers was determined using Theis & Jacob recovery test method ,a computer program called aquifer test version 2.55 (Waterloo hydro geologic Inc.) was used for the determination of hydraulic conductivity coefficients . [FAO,2002] [3]

The distribution of the hydraulic conductivity over the area of the governorate was show in Fig(1).

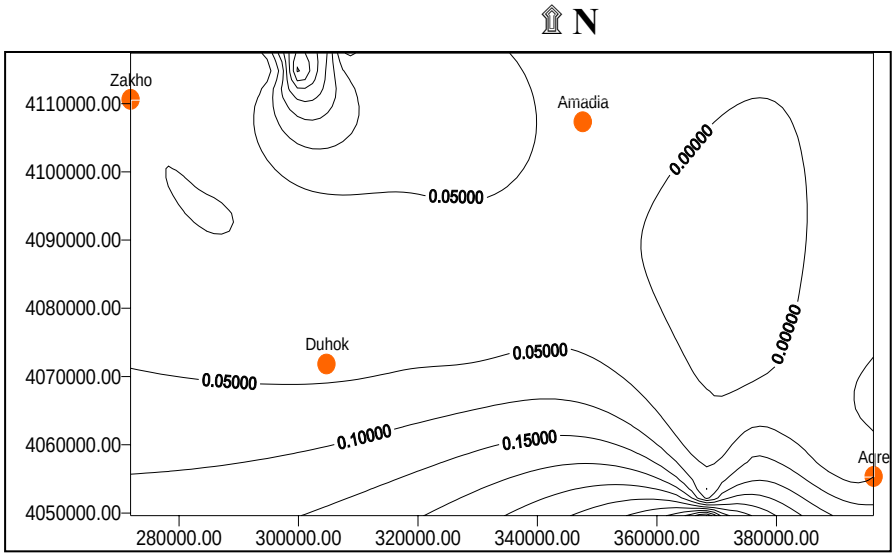


Fig(1): Distribution of hydraulic conductivity in cm/sec over Duhok governorate

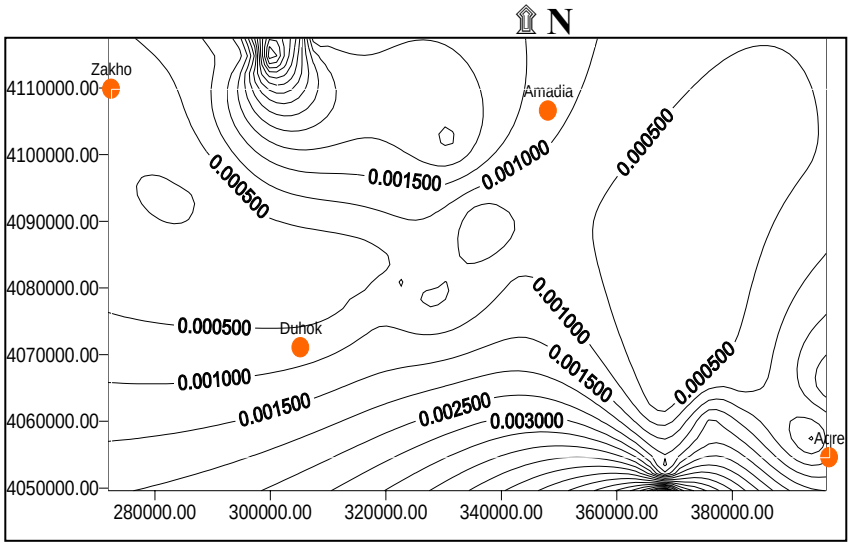
From Fig(1) the hydraulic conductivity coefficient was increased toward the south, south-east and north-west of the region while the hydraulic conductivity coefficient was very low in the east of the region.

Applying equation (11) and equation (12),the longitudinal and lateral dispersivity coefficient at the well locations can be determined .The distribution of these coefficients over the Duhok region was shown in Fig(2) and Fig(3).

Fig(2) shows the distribution of longitudinal dispersivity coefficient over the Duhok region, while Fig(3) shows the distribution of the lateral dispersivity coefficients over the Duhok region.



Fig(2): Distribution of longitudinal dispersivity A_1 in cm over Duhok region



Fig(3): Distribution of lateral dispersivity A_2 in cm over Duhok region

It was clearly shown in Fig(2) and Fig(3), that the dispersivity coefficient in longitudinal and lateral direction increased toward the south ,south-east and north-west of the region ,same as the distribution of the hydraulic conductivity.

The porosity of the medium for each well location can be determined using the relation between the hydraulic conductivity and the porosity of the data which was investigated by Hammed [5] as :

$$\Theta = 0.1506\ K^{-0.2035} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (15)$$

Where: Θ : is the porosity of the medium.

The seepage velocity of the medium at well location can also be determined by dividing the yield discharge of each well over the surface area of the permeable depth of the well as :

$$q = Q/(2\pi .r. L) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (16)$$

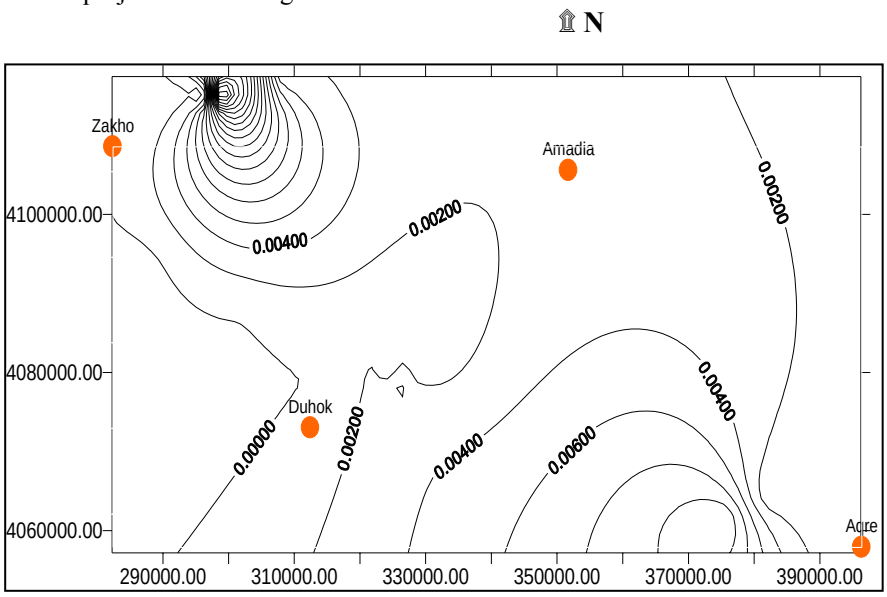
where: q: is the seepage velocity in cm/sec , Q: is the yield discharge of the well in cm^3 /sec , r: radius of the well in cm and L: is the permeable depth of the well(screen depth) in cm.

As described previously, the exponent of the seepage velocity in dispersion coefficient equation varies from 1 to 2 . In this investigation the exponent of 1 was considered as stated by Shamir [8] for the determination of the longitudinal and lateral dispersion coefficient (D_1 and D_2) .

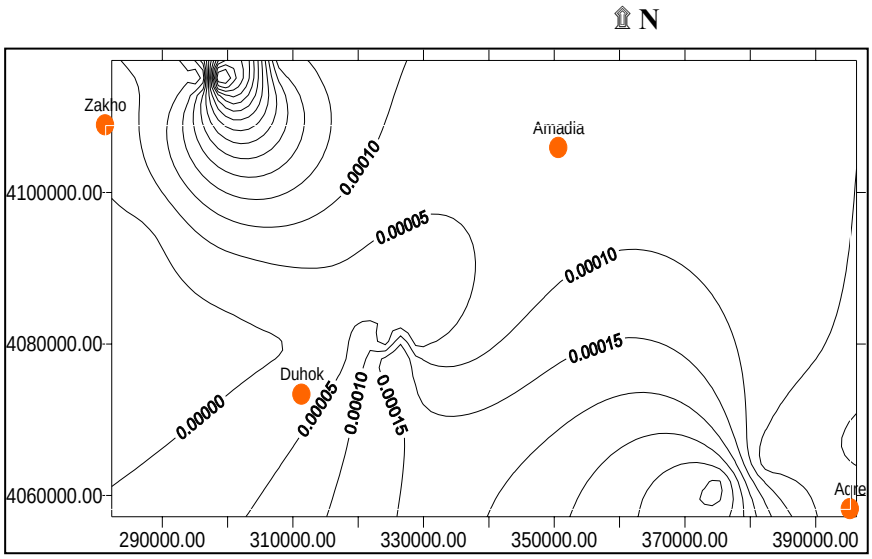
The distribution of the longitudinal dispersion coefficient over Duhok region was shown in Fig(4) while the distribution of the lateral dispersion coefficient over Duhok region was shown in Fig(5).

From Fig(4) the longitudinal dispersion coefficient was shown to be increased toward the north-west part of the region and also increased toward the south – east of the region ,while it is decreased toward the east and also the west part of the region. Similarly for the lateral dispersion coefficient the distribution of the coefficient as shown in Fig (5) to be increased toward the north –west and south-east part of the region and decreased toward the west part of the region .

From the above result the conclusion of the suitable location in the region for the artificial recharge and landfill projects in the region can be determined as in the north-west (Zakho basin) and south-east (Aqre basin) part of the region.



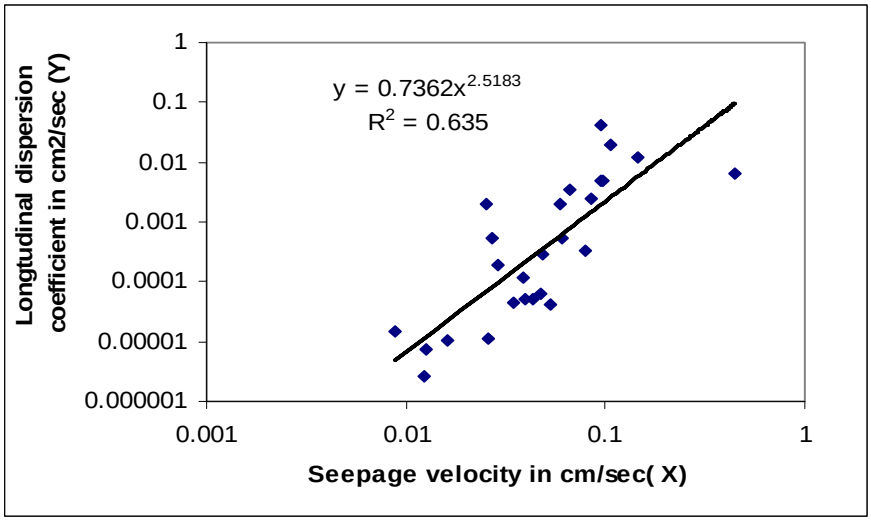
Fig(4): Distribution of longitudinal dispersion coefficient D_1 in cm^2/sec



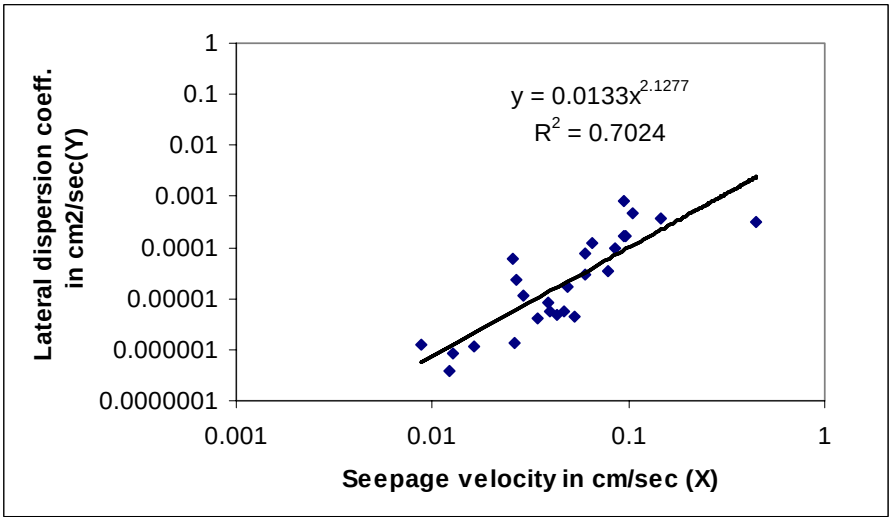
Fig(5): Distribution of lateral dispersion coefficient D_2 in cm^2/sec

If the calculated values of the dispersion coefficients plotted against the corresponding values of the seepage velocity on log-log paper ,the values of the dispersivity coefficients and the exponent in equation (13) and equation(14) may be obtained from the straight line which forms the best fit plotted points [5].

To determine the longitudinal and lateral dispersivity coefficients of Duhok region in order to use it in the general equation of tracer transport (equation1) ,the values of the calculated dispersion coefficients for all soils in well location were plotted against the calculated values of the seepage velocities at these location on log-log paper . The best line fit equations for the longitudinal and lateral dispersivity coefficients were obtained as shown in Fig(6) and Fig(7) respectively. The results are:



Fig(6): Relation between longitudinal dispersion coefficient and seepage velocity



Fig(7): Relation between lateral dispersion coefficient and seepage velocity

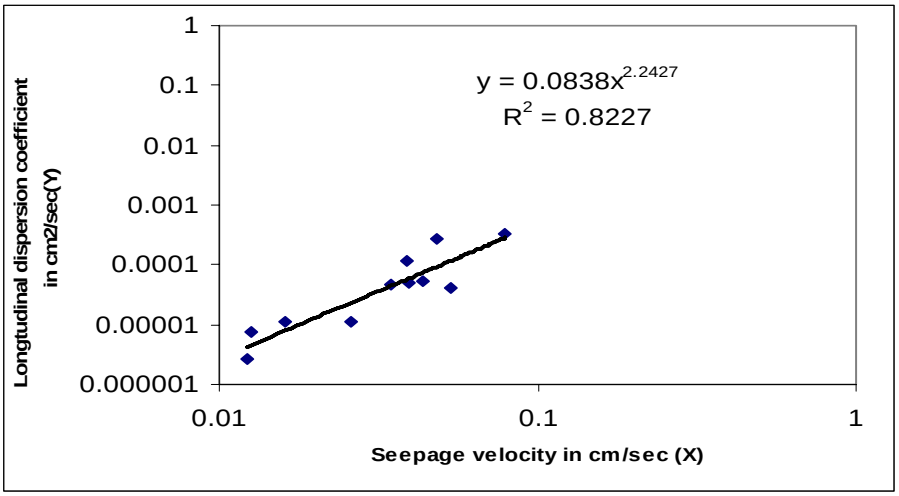
$D1 = 0.7362\ q^{2.5183}$ ……. (17) (for Duhok region)
and
$D2 = 0.0133\ q^{2.1277}$ ……(18) (for Duhok region)

In general the value of longitudinal dispersivity coefficient of Duhok region may be considered 0.7362 cm and the lateral dispersivity coefficient of Duhok region may be considered s 0.0133 cm ,with the values of n1 and n2 as 1.5183 and 1.1277.

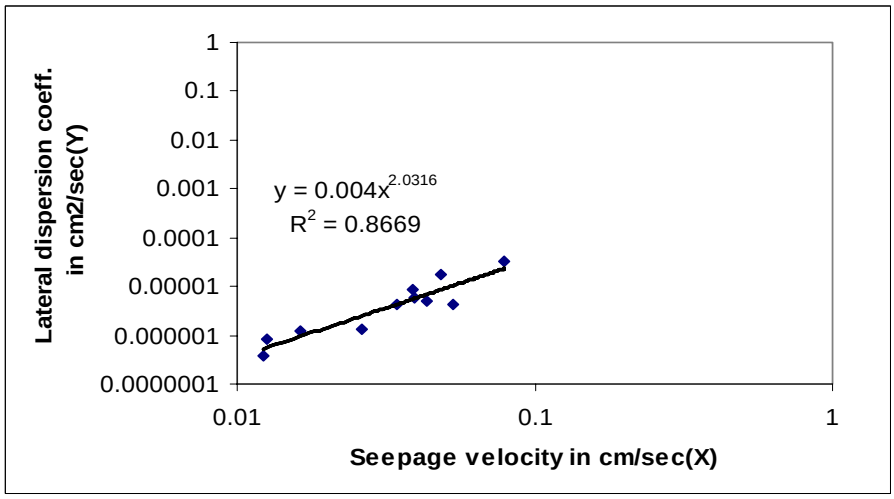
If the same procedure was conducted to the wells which are situated in the basins of Duhok region individually ,the values of longitudinal and lateral dispersivity were found to be more real than general value obtained above. For Sumil basin(which are in the north part of Duhok city and about 15 km from it) the following relation was obtained as shown in Fig(8) and Fig(9) as follows:

$D1 = 0.0838\ q^{2.2427}$ …….. (19) (for Sumil basin)
and
$D2 = 0.004\ q^{2.0316}$ …….. (20) (for Sumil basin)

So , the value of 0.0838 cm may be considered as the longitudinal dispersivity coefficient for the soils in Sumil basin and the lateral dispersivity coefficient as 0.004 cm for the soils in Sumil basin.



Fig(8): Relation between longitudinal dispersion coefficient and seepage velocity For Sumil basin



Fig(9): Relation between lateral dispersion coefficient and seepage velocity For Sumil basin

In the same manner the following relations may be obtained:

$D1 = 0.035\ q^{1.6604}$ …… (21) (for Duhok basin)

$D2 = 0.0013\ q^{1.486}$ …….. (22) (for Duhok basin)

And

$D1 = 0.2721\ q^{1.6933}$ ……. (23) (for Aqre basin)

$D2 = 0.0061\ q^{1.5102}$ ……. (24) (for Aqre basin)

From the above relations the longitudinal and lateral dispersivity coefficients was found to be 0.035 cm and 0.0013 cm for soil in Duhok basin , while the value of 0.2721 cm and 0.0061 cm was found to be the longitudinal and lateral dispersivity coefficients for Aqre soil . For more investigation these values may be compared with the values obtained by Hammed [5] for Iraqi soils as shown below in table (1)

Table (1): dispersive coefficient of Iraqi soil

Result Of Iraqi Soil Obtained By Hammed[5]			Duhok Soil		
Soil type	A_1 in cm	A_2 in cm	Soil type	A_1 in cm	A_2 in cm
Karbala	0.065	0.00210	Sumil	0.0838	0.004
Ara`ar	0.072	0.00242	Duhok	0.035	0.0013
Baghdad	0.024	0.00110	Aqre	0.2721	0.0061
Akhaither	0.13	0.00301			
Coarse sand	1.4	0.02100			

CONCLUSION AND RECOMMENDATION FOR FURTHER STUDIES

The longitudinal dispersivity coefficient for the basins in this investigation were found to be 0.2721cm ,0.0838cm and 0.035 cm for Aqre ,Sumil and Duhok basins respectively, this indicate that the dispersion of pollutant in the soil of Aqre basin will be rapid more than the soils of Sumil and Duhok basins, so the Aqre and Sumil basin were found to be more suitable for waste water disposal and artificial water recharge projects. The same conclusion can be found for the lateral dispersivity coefficient.

For further investigation a series of experimental tests in the laboratory for different locations distributed over the region of Duhok can be

conducted to obtain the experimental values of the longitudinal and lateral dispersion coefficients and then it may be compared with the field values as obtained above.

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الخلاصة

يعتبر مشاكل تلوث المياه من المشاكل المعاصرة والتي تحتاج الى حل معادلات التشتت والتي تبين كيفية انتشار تراكيز الملوثات خلال جريا ا في الاوساط السامية وبتحديد الشروط الاولية والحدية فان معرفة معامل الانتشار تصبح من الامور الجوهرية لحـل هذه المعادلات .

في هذا البحث تم ايجاد معامل التشتت الطولية والعرضية لتربة محافظة دهوك وكيفية توزيعها باستخدام الاساليب الحقليـة ، تم تجميع المعلومات المطلوبة من خلال اختبار الضخ للابار المنتشرة على مساحة منطقة دهوك.

وجد من خلال الدراسة بانه وبشكل عام فان معامل التشتت الطولية والعرضية لمنطقة دهوك تكون(0.7363 cm)و(0.0133 cm). وعند اخذ الاحواض المائية على انفراد فان معامل التشتت الطولية والعرضية تكون (0.0838 cm) و(0.004 cm) لحوض سيـل (Sumil basin) بينما معامل التشتت الطولية والعرضية لحوض دهوك (Duhok basin) تكـون (0.0351 cm) و(0.0013 cm) وكذلك فان (0.272 cm) و(0.0061 cm) هي معامل التشتت الطولية والعرضية لحوض عقرة (Aqre basin).

پوختە

ئاریشا پیس بوونا ئاڤێ ئێکە ژ ئاریشێن هەڤ چەرخ کو پێدڤی ب شیکارکرنا هاوکێشیا بەر بەلاڤ بوونێیە کـو تێـدا دیـار دبیت چەوانیا بەلاڤ بوونا تیرکردنا پیس بوویا د دەمێ روویین کرنێدا د ناڤبەرا ناوەندێن کون دار دەست نشیان کرنا مەرجێن سەرەتایی و ڤەبری هندی کە زانینا سەر داکرونێن بەلاڤ بوونێ نە دهێنە دروست کرن ژ فاکتەرێن گەوهەلەری پێین شیکارکرنا ڤێ هاوکێشێ.

دڤێ ڤەکولینێدا فاکتەرێن بەربەلاڤ بوونا د رێژاهیێ و پانیێ یا ئاخا پارێزگەها دهوکێ هاتە دیتن و چەوانیا دابەشکرنا وێ بکارئینانا شێوازێن تێلگەی پاش کومکرنا پێزانینێن پێدڤی د ماوێ تاقیکرنا هاڤێتنا ئاڤا بیرێن بەلاڤبووی ل دەڤەرا دهوکێ د ماوێ ڤەکولینێدا هاتە دیتن و بشێوەیەکێ گشتی فاکتەرێن بەربەلاڤ بوونا درێژاهیێ و پانیێ ل دەڤەرا دهوکێ دبیتە(0.07363 cm) و (0.0133cm) .

و ل دەمێ وەرگرتنا ئاوەروێن ئاڤێ کت کتە هندی فاکتەرێن بەربەلاڤ بوونـا د رێـژاهیێ و پـانیێ یـە دبیتـە (0.0838cm) و (0.004cm) بو ئاوەرویەکاستویر (Sumil Basin) بـە لێ فاکتـەرێن بەربـەلاڤ بوونـا درێـژاهیێ و پـانیێ یـا ئاوەرویـا دهـوکێ (Duhok Basin) دبیتە (0.0351cm) و (0.0013cm) وهەروەسا (0.272cm) و (0.0061cm) دێ بیتە فاکتەرێن بەربەلاڤ بوونا درێژاهیێ و پانیا ئاوەروا ئاکرێ (Aqre Basin) .

SWELL-SHRINK PROPERTIES OF EXPANSIVE SOILS SUBJECTED TO WETTING AND DRYING CYCLES UNDER DIFFERENT LOADING

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ABSTRACT

This study covers swelling properties of Summel soils western of Dohuk governorate. The changes in swelling and shrinkage properties (ΔH/H), and degree of saturation of remolded and undisturbed samples under different loading (ranged from 6.7-200 kPa) and by subjecting to number of wetting and drying cycles have been investigated. Tests are performed by adding different amount of water, (15, 30, 60, 120) cm^3 in wetting stages and then fully drying the samples by heating up to 65ºC.

The samples were subjected to 6-cycles of wetting and drying. The results indicated that upon repeated wetting and drying, the swelling and shrinkage amounts and also degree of saturation are reduced until reaching an equilibrium state in the 4^{th} cycle. The volume changes of soil during wetting and drying cycles are reduced by increasing the amount of loading and about (40-50) % of the reduction was happened under loading equal to 25% of the swelling pressure.

KEYWORDS Swelling Shrinkage Expansive Soil Wetting Drying Cycles Loading

INTRODUCTION

The surface layer soil at Summel Area (Dohuk Governorate-Northern Iraq) is fine textured soil with medium to high swelling potential {Karim and Khalid (2000), Khalid (2002), Abdy (2003)}.

The cyclic volume change of this soil due to seasonal variation in the moisture content (during winter and summer seasons) causes many problems to the engineering projects in the area (i.e. cracks in the buildings and roads) and finally loss of economy. Previous research works in this area were limited and more research work to study the behavior of this soil under different boundary condition is very important and will help in designing and implementation of new projects as well as protection of the old projects. This work concerns with effect of wetting and drying cycles on swelling properties of expansive soil at summel area under different loading conditions and defines the depth of the active zone of swelling.

PREVIOUS WORK

Several research works have been carried out in this field over the world. Depending on the degree of shrinkage experienced by the samples during drying, these researches mainly fall into two groups.

The first group performed partial drying during wetting /drying cycles (samples were dried to its initial water content in each drying stage). The results of this group show that swelling of soils was reduced when subjected to wetting/drying cycles and indicated that the fatigue of soil in each cycle is the main reason of reduction of swelling potential. Basma et al. (1996), Day (1994) and Khalid (2003) explained that the fatigue is resulted from soil structure changes. Allam and Sirdharan (1981) and Kodikara et al. (1991) highlighted that a new structure with higher shear strength and large resistance to swelling is developed in soil during its exposure to wetting and drying cycles. Some investigators showed that excess wetting and drying cycles causes increasing of soil particle size and formation of large particles (Cluster). The aggregation of particles are resulted from development of new chemical bonds between clay particles which cause reduction of the total surface area and less exposure to the water, consequently reducing swelling potential, [Lin and Benson (2000) and Al-Homoud et al. (1995)].

The second group of investigators, brought soil water content in each cycle below shrinkage limit (wetting and full drying) and stated that the swelling are increased with cycles of wetting and drying comparing with a first cycles.The increase in swelling was explained by Osipove et al. (1987) as the dry clay is wetted, it possesses entrapped air, which causes the growth of internal pressure and swelling of the clay. In this manner, Basma et al (1996) showed that as the water was removed, it pushes the clay particles apart and increases the apparent voids. This in turn creates more pores to be filled with water when the samples are rewetted, consequently, the swelling potential increases.

Tripathy et al. (2002) highlighted that during analysis of second group research results (wetting-full drying), the amount of swelling in the second cycle is greater than the first cycles, but is less than other cycles, so the second cycle should be taken as critical one for comparing the results of future cycles. In both cases (full and partial drying), the vertical swell potentials reached an equilibrium state after about three to five cycles that named as equilibrium cycle.

Effect of loading on swelling and shrinkage soils during its exposure to wetting and drying cycles was studied by some other researchers such as [Khalid (2003), Subba Rao and Tripathy (2003), Tripathy et al. (2002), Dif and Bluemel (1991),Subba Rao and Satyadas (1987)], who indicated that swelling is reduced by increasing the applyed load and wetting and drying cycles, as well as, it reached to an equilibrium state after (3-5) cycles.

The depth of the active zone in Mosul and Arbil have been studied by Al-Layle and Al-Ashou (1985) and Al-Saeigh (1988) who observed that the depth of active layers in Mosul and Arbil areas are ranged between (4.0-5.0) m while, no research work is available about that for Summel area.

MATERIALS AND METHODS

A brownish clayey soil from Summel site at Dohuk governorate in Northern Iraq was used in this study. Some engineering and index properties of the soil at different depths are shown in Table (1).

Table (2) and Table (3) present the chemical and mineralogical properties of the studied soil at depth 1.5 m that contain 29.73 % $CaCO_3$, 37.65 (meq/100gm soil) CEC and 34 % (meq/100gm soil) CEC and 34 % montmorillonite as the dominant clay mineral.

To get a clear idea about the effect of climatic condition and moisture content changes with depth and also to determine the depth of active layer, the seasonal variation of natural moisture content with depth was measured to depth of about 7.5m using a mechanical auger (type KORES-INDIA).

Oedometer apparatus were used for measuring OCR (Over Consolidation Ratio) with depth and vertical swelling and shrinkage of soil samples during wetting-drying Cycles. Undisturbed samples with initial dry density (γ_{dry}=16.2 kN/m^3) and initial water content (W_o=16.2%) and a remolded sample with the same properties from 1.5m depth were used for this study. Remolded samples were prepared using Static Compaction and by compacting the soil (passing Sieve # 4 and water content16.2%)with constant rate of loading (2 mm/ min), directly into the consolidation ring (75 mm diameter and 19.1 mm in height).

Table (1):-Some Engineering properties of the investigated soil

Depth (M)		0.5	1.0	1.5	2.0
Gs		2.74	2.71	2.73	2.74
Modified Compaction	O.M.C	17.4	17.0	19.5	16.2
	Max.γdry (kN/m^3)	17.0	17.5	16.9	16.7
Over Consolidation Ratio O.C.R		-	10.08	4.96	2.67
L.L		51	54	60	59
P.L		22	24	24	24
P.I		29	30	36	35
S.L		15.1	15.1	14.12	14.12
% Clay		44	43	53	54
% Silt		50	51	42	40
% Sand		6	6	5	6
Activity		0.66	0.69	0.68	0.65
Classification symbol (USCS)		CH	CH	CH	CH

Table (2):- Mineralogical analysis of the investigated soil

Group	Type	%
Clay Minerals	Montmorillonite	34
	Kaolinite	5
	Palygorskite and illite	trace
Non-Clay Minerals	Calcite	28
	Quartz	27
	Plagioclase	5

Table (3):- Chemical analysis of the investigated soil.

Cec (Meq/100gm Soil)	37.65
Total Soluble Salts (%)	0.57
$CaCO_3$ (%)	29.73
% SO_3^{--}	0.069
Gypsum Content (%)	0.11
Organic Matter (%)	1.4
pH	8.1

After preparation, samples were loaded in Oedometer apparatuses under the required load and then were subjected to partial drying stages to reach a water content about shrinkage limit value. First wetting/drying cycle was started by adding the required amount of water to the samples and measuring its total swelling after 24 hrs. Then removing water from the cell around the samples and allowing samples to full dry at 65ºC. The soils are then subjected to 6 repeated wetting and full drying cycles same as the first cycle.

Oedometers were installed on a concrete base inside a special thermally controlled room so that the samples were dried under temperature of 65±1ºC with out removing the load on the samples during wet/dry cycles. Four increments of water (15,30,60,120)cm^3 were used for each of applied load increments (6.7,50,100,200) kPa.

Preliminary trial tests were carried out to define the drying time required for soil sample inside the Oedometer under different load increments to reach water content above or below the SL. Then, form drying time versus water content relations, the drying time required to reach SL under each load increment were predicted, in that way no need to remove the sample to check the water content. The results of this test for partial drying are shown in figure (1). Same principle were used for full drying stages but after subjecting samples to one cycle of partial drying and wetting (same amount of water). Trail test results are shown in Table (4).

The water The water content changes of samples during wetting and drying stages are also measured using additional samples which were prepared for each increment of water added.

In order to compare the volume changes of remolded samples with undisturbed samples, a set of undisturbed samples which have the same properties (γdry=16.3 kN/m^3,Wo=16.2%) of remolded samples were loaded by 100 kPa and subjected to same wetting and drying procedure.

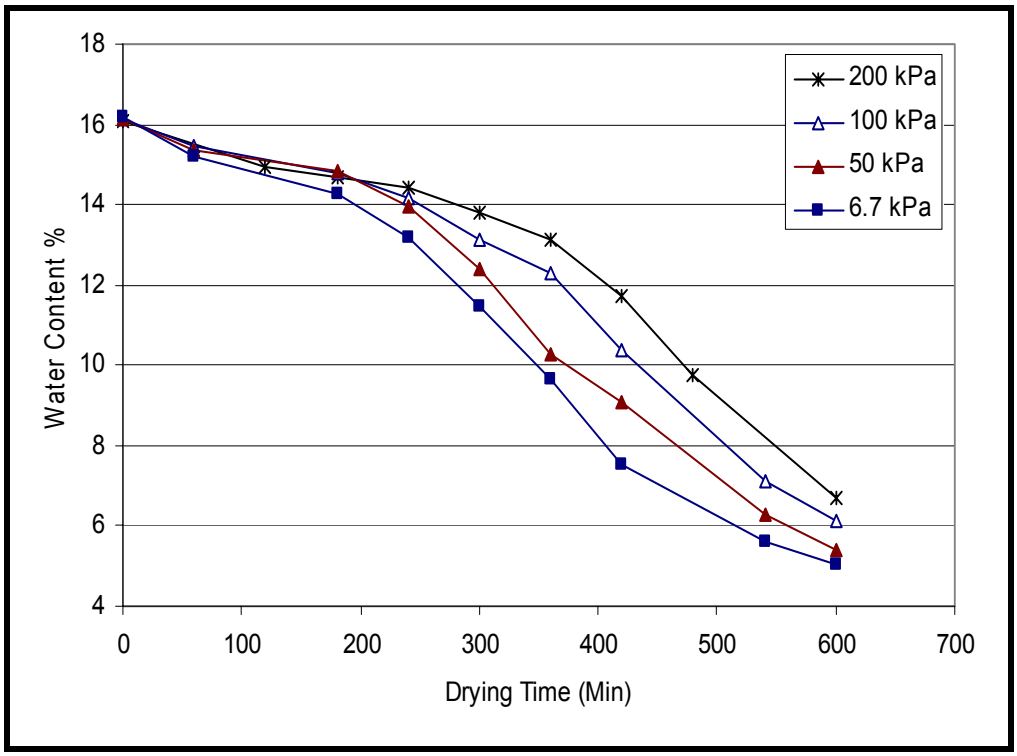

Fig (1):- Trail test results for partial drying condition under different loading.

Table (4):- Trail test results and required time for drying stages during wetting and drying cycles.

Applied Load Kpa	Partial Drying		Full Drying				
	Water Content %	Required Drying Time (Min)	%Water Content at required drying time				Required Drying Time (Min)
			15 cc	30 cc	60 cc	120 cc	
6.7	13.20	240	6.5	8.35	9.20	9.80	2010
50	13.20	270	6.3	8.75	9.50	9.90	2160
100	13.17	300	6.5	8.10	9.50	10.00	2280
200	13.14	360	6.5	7.50	9.80	11.00	2400

RESULTS AND DISCUSSION:

Depth of Active layer

Monthly variations of the moisture content with depth during the years (2005-2006) are shown in figure (2). Moisture content at depth 2.0 m becomes almost constant, which indicates that active layer depth is 2.0 m in the studied area. Soils of high gravel content were observed in some bore holes at depth 5.5-7.5 m. This was the reason behind the low water content that not consistent with results from other bore holes. The values of over consolidation ratio (OCR) are higher near the surface and decrease with the depth. However the geological history indicated that the area has not been subjected to previous overloading, so this changes of soil OCR values can be explained due to repeated cycles of wetting and drying and climatic seasonal moisture content in the field as shown in Table (1).

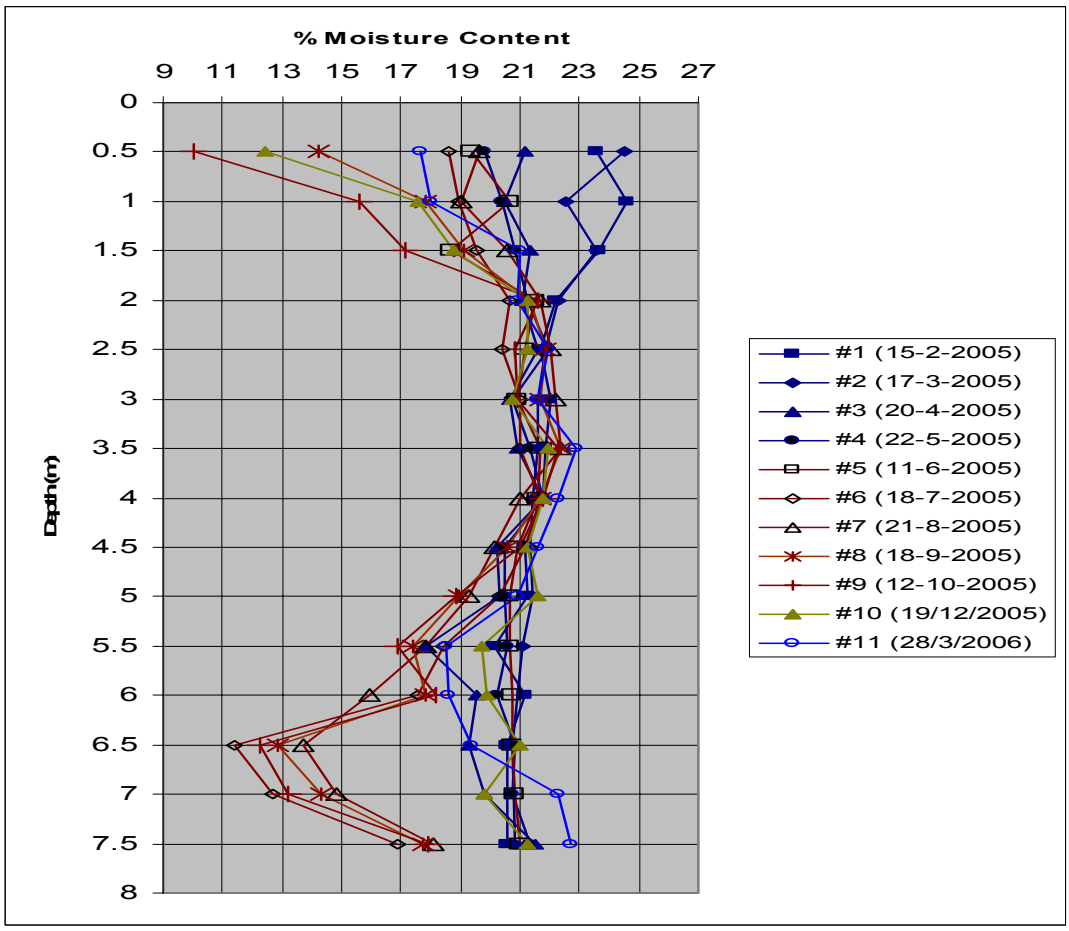

Fig (2):- Seasonal variation in moisture content with depth.

Swell-Shrink properties of remolded soils during wetting and drying cycles under different loading

The Swell percent and swelling pressure of the remolded and undisturbed soil samples were found to be (4.87%, 3.31%) and (181 kPa, 147kPa) respectively.

The results of swell/shrinkage changes during wetting and drying cycles under different applied loading and adding different amounts of water for remolded samples are shown in figure (3). The vertical change in the sample height (ΔH/H) indicates the amount of its swelling or shrinkages. The value of (H) in calculation is the thickness of samples after loading (when no thickness change was observed).

Generally, the results obtained in this study indicated that the swelling increased in second cycle but it decreased in other cycles and reaches to an equilibrium state in (4-6) cycles. Within the range of the experimental work and during cycles of wetting and drying, swelling and shrinkage were increased by increasing the amount of added water, but decreased with increase of applying loads.

The percentage of reduction in swelling and shrinkage during the second and the fourth cycles under different loading in comparison of (applied load= 6.7 kPa) are shown in Tables (5 and 6). It was observed that about (40-50)% of the reduction happened when the load increased from (6.7 to 50) kPa. It is worth mentioning that 50 kPa is equal to 25% of the swelling pressure.

The height marked by the symbol (ρ) in figure (4) indicates the amount of heave that occurred in the ground surface in the field. It can be observed clearly that under low loaded soil samples (6.7 kPa), the amount of (ρ) are reduced by increasing the applied load.

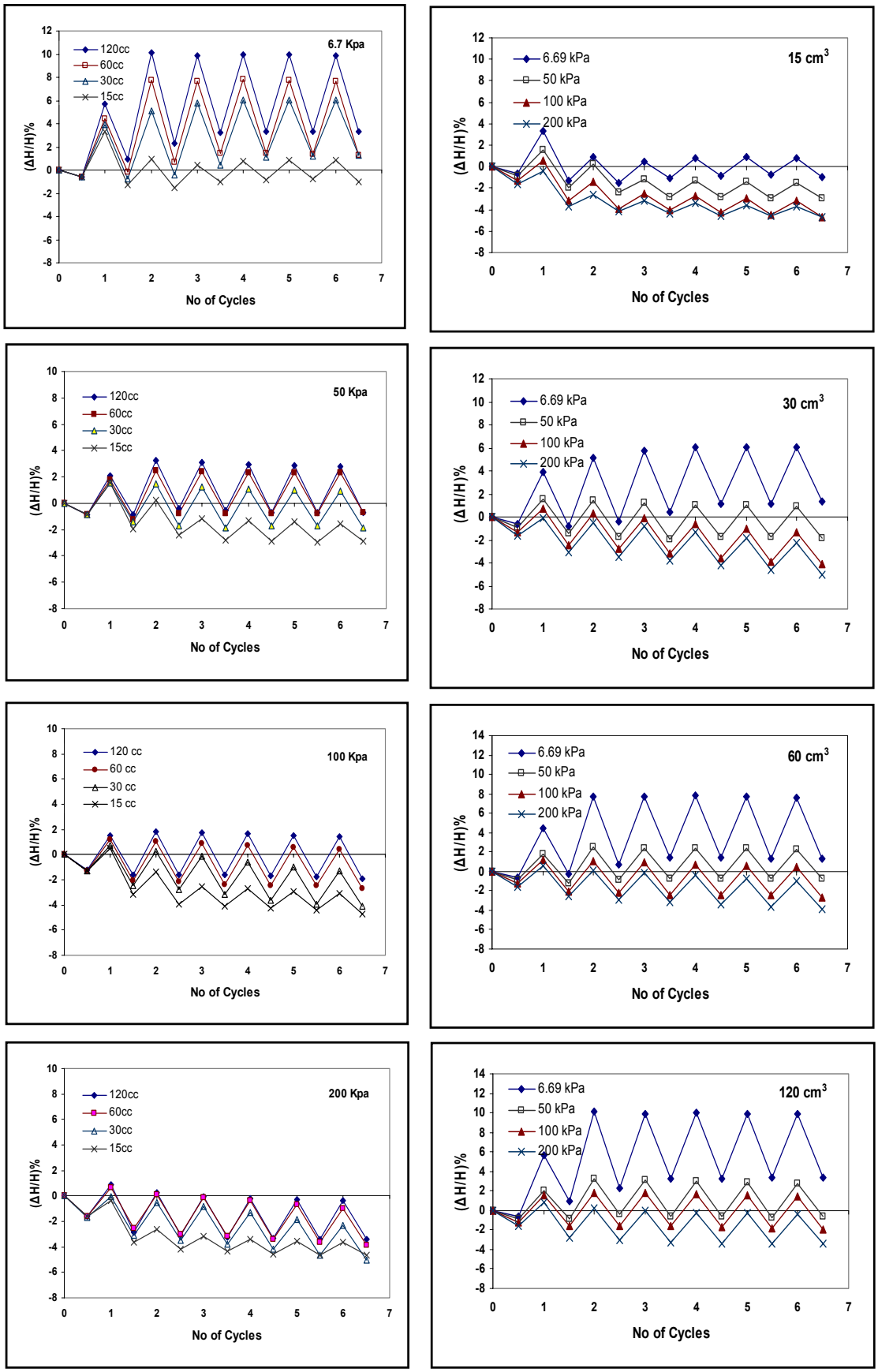

Fig (3):- Swelling /shrinkage behavior of the remolded soil during wetting and drying cycles under different loading.

Table (5):- Percent of swelling reduction during wet/dry cycling.

Applied Load (Kpa)	% Swelling Reduction					
	Added Water (cm^3)					
	30		60		120	
	2nd Cycle	4th Cycle	2nd Cycle	4th Cycle	2nd Cycle	4th Cycle
6.7	-	-	-	-	-	-
50	50.6	47.8	52.6	51.3	54.5	47.7
100	53.8	54.0	60.7	52.0	62.3	50.5
200	56.4	56.6	66.5	55.9	66.3	55.0

Table (6):- Percent of shrinkage reduction during wet/dry cycling.

Load (Applied Kpa)	**% Shrinkage Reduction**					
	Added Water (cm^3)					
	30		60		120	
	2nd Cycle	4th Cycle	2nd Cycle	4th Cycle	2nd Cycle	4th Cycle
6.7	-	-	-	-	-	-
50	41.5	43.9	53.0	50.9	52.7	45.7
100	44.0	39.0	54.3	50.6	55.9	49.3
200	45.8	42.1	56.3	52.0	56.9	53.1

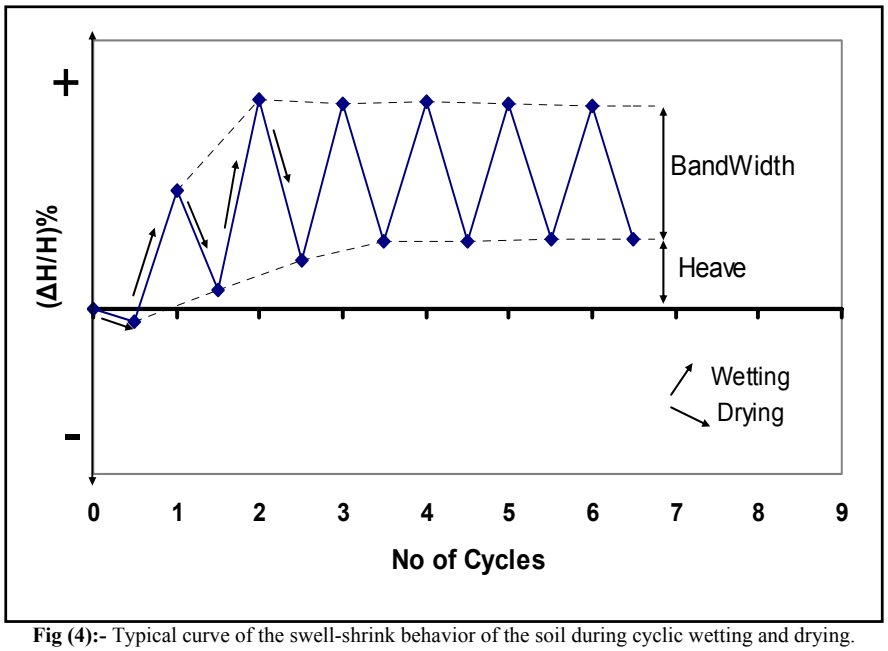

Fig (4):- Typical curve of the swell-shrink behavior of the soil during cyclic wetting and drying.

One of the interesting results was that, during drying and wetting stages, lateral and vertical shrinkage and swelling were occurred over the low loading range (6.7, 50) kPa. While, only vertical swelling and shrinkage were occurred under greater applying loads (100, 200) kPa. This behavior may be due to more than one reason. The vertical load will act positively to increase the lateral forces which act negatively to resist the lateral shrinkage. At the same time, the increase in the applied normal loads cause an increase in the friction between the soil sample surface and both porous stones which also resist the lateral shrinkage.

The degree of saturation changes in of the soil samples during wetting and drying cycles are shown in Figure (5). It was observed that the degree of saturation was reduced with increasing cycles and reached to a stable values in equilibrium cycles. During the swelling stages there was a high increase in degree of saturation in the first cycle, whereas, a uniform reduction happened to its value at the later cycles; while in the shrinkage stages, the reduction was continuous from initial drying stages. The reduction in degree of saturation during swelling stages was explained on the basis of the fact that when dry clay is wetted, it posses entrapped air, which causes an increase in the amount of voids (Va+Vw). This in turn causes a decrease in degree of saturation and also a reduction in water content in swelling stages during wetting and drying cycles. While, in the shrinkage stage, the decrease in water content and the increase in the amount of voids controls this reduction. To clarify the effect of loading on degree of saturation during wetting and drying cycles, the results are represented in other form according to 30 cm^3 adding of water as shown in figure (6).

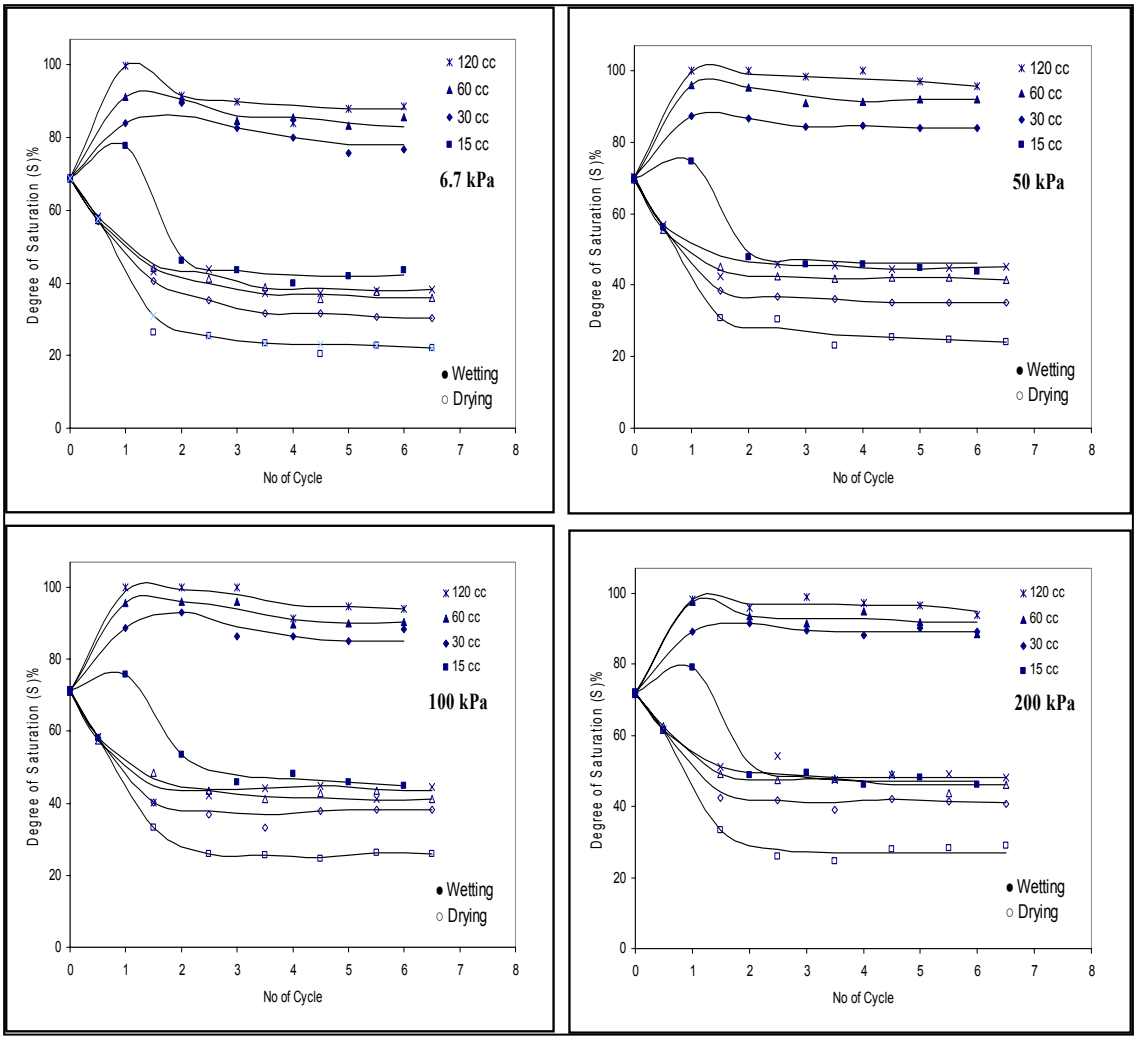

Fig (5):- Changes in the degree of saturation during cyclic wetting and drying.

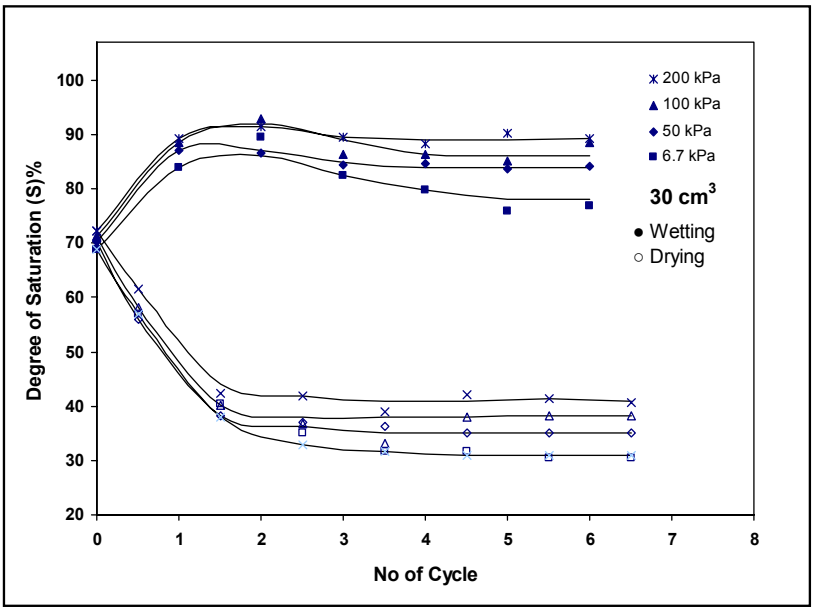

Fig (6):- Changes in degree of saturation during wet/dry cycles under different loading and by adding 30cm^3 of water in the wetting stages.

EXPLANATION OF SWELLING POTENTIAL CHANGES DURING WET/DRY CYCLES:

Soil drying gave arise to negative pore pressure development in soil which affects the internal structure and consolidation of soil occurred due to desiccation. But in the wetting stages, the chemical bonds produced by drying are broken down and the soil tends to swell. This mechanism was repeated during wetting and drying cycles and resulted in formation of a new dispersed structure with high durability, low void ratio and low swelling ability.
Al-Homud et al. (1995), and Basma et al. (1996),and Khalid (2003) obtained similar results and showed that the soil structures are changed to a more dispersed structure with a low swelling potential when subjected to several wetting and drying cycles.
The major reason for reduction in swelling under applying loads is stated by previous researches as; reduction in void ratio and development of a more dense structure in soil which causes reduction in water absorption capability. as well as, a reduction in the thickens of diffuse double layer and consequently a reduction in swelling potential. From other point of view, external loads act as reverse forces which neutralize swelling forces. [Brackley (1975) and Basma et al. (1995)]

COMPARISON BETWEEN UNDISTURBED AND REMOLDED SOILS SWELLING PROPERTIES DURING WETTING AND DRYING CYCLES:

All the tests that carried out on compacted soil samples were repeated on undisturbed samples. The results demonstrates that undisturbed specimens have lower swelling and shrinkage potential in each cycle as shown in figure (7). This behavior is due to the existing bonds between soil particles in undisturbed soils, but in remolded samples these bonds are broken during compaction and sample preparation, leading to higher swelling ability than undisturbed soils [Mitchell (1980)]. During subjecting of undisturbed samples to wetting and drying cycles, the bonds are partially broken in wetting stages and also some of the broken bonds were recovered in drying stages that cause a low swelling tendency.

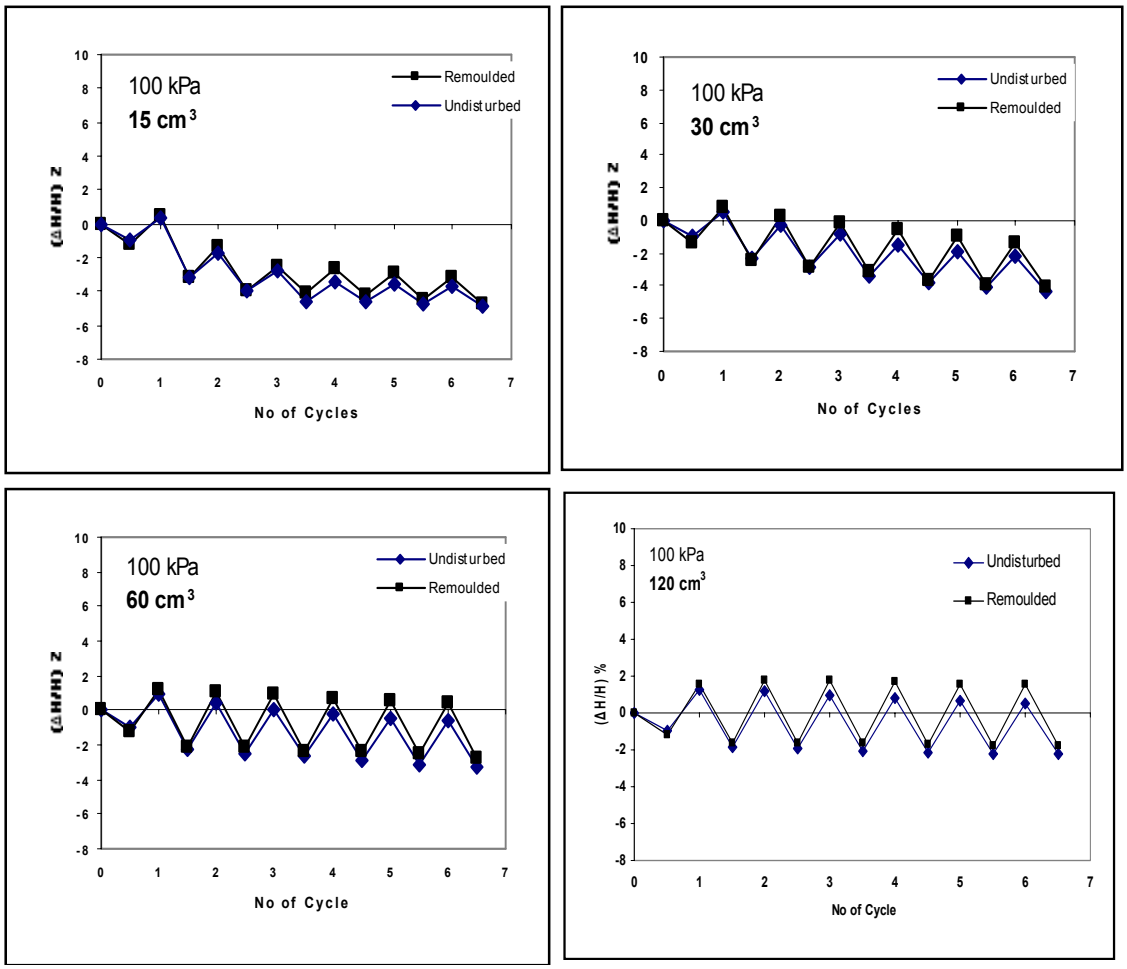

Fig (7):- Comparison between swell-shrink properties of undisturbed and remolded soil samples during wetting and drying cycles.

STATISTICAL ANALYSIS

From Statistical Nonlinear Regression analysis of the results using SPSS program (Release 11.5) and by assuming that all cycles are subjected to full drying, the following mathematical model was produced which is helpful to predict the value of (ΔH/H) follows:

$$\frac{\Delta H}{H} = 0.202 - 2.171 \log P + 2.922\ W_{add}^{0.202} + 1.731 * (\frac{1}{N}) \quad , \ R^2 = 0.78 \quad \text{----- (1)}$$

where:

(ΔH/H) : % of Swelling — W_{add}: Amount of added water (cm^3)

P: Applied load (kPa), — N: Number. of wet/dry cycles

This Equation shows that the applying load is the major factor that affects swelling potential and then number of cycles and amount of added water respectively. Figure (8) shows the relation between the measured (observed) and predicated results from equation (1).

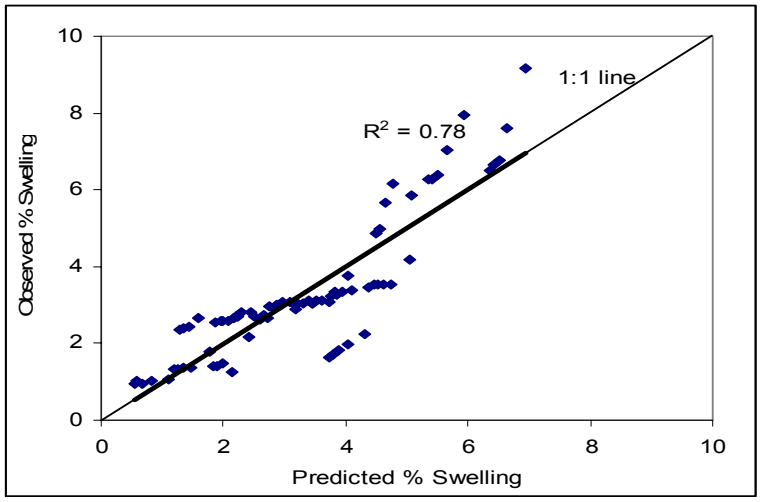

Fig (8):- Relation between Predicated and observed results

CONCLUSION

1- The depth of active layer in studied area is 2m.

2- Lateral shrinkage occurs during drying over the low loading range (6.7 and 50 kPa) but does not occur over the high loading range (100 and 200 kPa).

3- Swelling and shrinkage potential of the soil were reduced when subjected to wetting and drying cycles and reached to an equilibrium state after (4-6) cycles.

4- The amount of swelling and shrinkage in equilibrium state were equal.

5- Swelling and shrinkage of the soil increased by increasing the amount of added water. But they were reduced with increase in applying loads, and about (40-50)% of reduction occurs by applying a small initial loads; its value was equal to 25% of the swelling pressure.

6- The water content, water absorption capability and degree of saturation of the studied soil were reduced due to increase in applying loading and an increase in number of wetting and drying cycles.

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الخلاصة

يتضمن البحث دراسة الخواص الانتفاخية لتربة منطقة سميل الواقعة غرب مدينة دهوك في شمال العـراق . تم دراسـة الـتغير الحجمي (ΔH/H) والمحتوى الرطوبي ودرجة التشبع لتربة مسبوكة وأخرى غير مشوشة عند تعـرض النمـاذج إلى دورات مـن الترطيب والتجفيف وتحت أحمال مختلفة تتراوح بين (6.7-200) كيلو باسكال وباستخدام كميـات مختلفـة مـن المـاء وهـي (120,60,30,15) سم^3 في عملية الترطيب وبتم تجفيف النماذج بدرجة حرارة 65ºC.تم تعريض النمـاذج إلى سـت دورات (6-Cycles) من الترطيب والتجفيف. كان هناك انخفاض في مقدار الانتفاخ والانكماش و كذلك درجة التشبع مـع الـدورات وفي الدورة الرابعة تصل النماذج إلى حالة الاستقرار. كما إن التربة تفقد بحدود (40-50)% من قابليتها لتغيرات الحجمية إذا كانـت تحت ضغط (25)% من ضغط الانتفاخ.

پوختە

د ڤە كولينا هان دا گهورينا قەبا رێ ئاخێ(ΔH/H) و هندەك سالوخەتێن دیيێن ئاخا دە ڤە را سمیلێ ئـەو وا دكـە ڤێتـە روژئاوا باژێرى دهوكێ ل كوردستانا عیراقێ كو یا ناڤدارە بئاخەاكا كۆ شیانێت وە رمینێ هەین هاتـە گـە نگـشە ولبەرچـاڤ وە رگرتن لدەمێ هاتیە تەر و هێشك كرن بشە ش سایكلا(6 Cycles) وب زیدە كرنا ریژە كا جیوازا ئاڤێ(120,60,30,15) سـم3 و لبن فشار و بارەكێ جیواز ((6.7-200) كیلو پاسكال. دە ركەفت كو ریژا گهوورینا هە ر سێ سالووخەتین ئاخى ئان كو زیـدە بونا قەبارێ (وە رمینى) ئاخێ (Swelling)و كێم بوونا قە بارەێ (Shrinkage) هە روەسا ریژا تێربوونا ئاخێ دى كێم بن دى گەل زێدە بوونا سایكلێن تەر و هێشك كرنێ و دراوستین پشتى سایكلا چارێ.هە روە سا دە ركە فت كوو ئەف ئاخـە بكێمـى (40–50)٪ ژ شیانێن خۆو بو گهورینا قە بارێ لبن فشارەكا نیزیك 25٪ ژ فشارا وەرماندنێ ژ دەست دێدەت.

EFFECT OF SOIL REINFORCEMENT ANGLE ON THE SAFETY FACTOR OF EARTH SLOPES

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ABSTRACT

In this study, a computer program named (*Slide*) using the traditional slope stability (limit equilibrium) methods is utilized to analyze stability of reinforced vertical faced walls and 10, 20, 25, 30 and 45° batter slopes. The main purpose of this work is to investigate the effect of soil reinforcement angle on the critical slip surface and the associated minimum factor of safety.

The analysis of the results of this study showed that the reinforcement should not be laid horizontally in all cases and for all used methods but should be laid with an angle of (α = 5 to 15°) depending on the used method of analysis for ($\beta < 15°$). Also the results of all methods are coincident that the FS increases with increasing (α) for ($\beta > 15°$). Only in Janbu method the FS increases with increasing (α) and for all values of (β).

KEYWORDS soil reinforcement factor of safety earth slopes.

INTRODUCTION

It is very well known fact that slopes fail. They fail for a variety of reasons. One may be excavation of the toe of an embankment removing the balancing moment of the slope and causing failure. Another could be an increase in pore water pressure along the failure plane and corresponding decrease in vertical effective stress and loss of strength, all of these lead to decrease the factor of safety.

There have been methods developed to help failing slopes. One of these methods is soil reinforcement. This method can be very effective, if utilized correctly, stabilizing existing failures and increasing the strength of slopes, (Yaeger, 1998).

The fundamental idea of earth reinforcement is not new, the basic principles are demonstrated abundantly in nature by animals and birds and the action of tree roots, it goes back to biblical times. However, the present concept of systematic analysis and design was developed by French engineer Henry Vidal 1966(Das, 1995). The construction of reinforced soil structures, including both slopes and walls, has increased considerably over the last 20 years as the advantages associated with this construction alternative are more widely recognized.

The beneficial effects of soil reinforcement drive from, (Das, 1995):

1- The soil's increased tensile strength, and

2- The shear resistance developed from the friction at the soil reinforcement interface.

The major shortcoming of limit equilibrium methods is the disregard for the stress-strain behavior of the soil. This limitation can be essentially overcome by the use of numerical methods such as finite element and finite difference. Many researchers used a method combining the theory of limit equilibrium with a finite element as (***Kulhawy, 1969; Resendiz, 1972; Zienkiewicz et al., 1975 cited in Pham, 2002***). Others compared between the safety factor results obtained using numerical methods and limit equilibrium methods, the analysis of results concluded that there was a good agreement between them (***Martins et al. 1999***; ***Han and Leshchinsky, 2004; Hammah et al. 2005***).

The main purpose of this work is to explain the effect of the reinforcement angle and number of reinforced layers (reinforcement spacing) on the critical slip surface and the associated minimum factor of safety. This adopted by using a computer program named (*Slide*), which used the famous traditional slope stability (limit equilibrium) methods to determine the critical slip surface and the associated minimum factor of safety such as Bishop, Fellenius, Janbu, and others, for more details see **(slide manual, 2003).**

Theory

Reinforced soil is somewhat analogous to reinforced concrete in which the reinforcement is bonded to the soil in the case of reinforced soil, or to the concrete in the case of reinforced concrete.

Applications

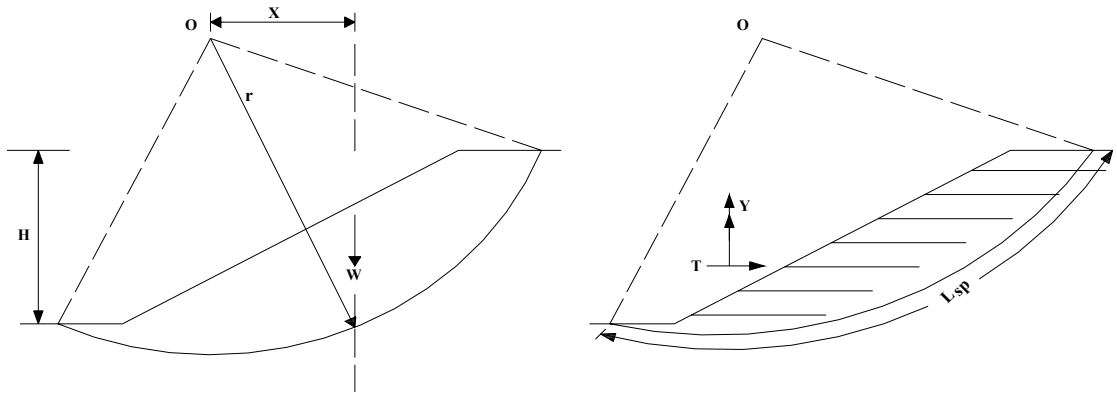
a) Vertical Walls and Abutments

Many shapes of failure occur in this case such as overturning, tilting and rotational slip. In case of rotational slip all potential slip surfaces should be investigated, including those passing through the structure. The factor of safety for reinforced soil structures against rotation slip is the same as for conventional retaining structures.

b) Sloping structures and embankment

Embankments may be constructed of cohesive and cohesionless soils. In case of homogeneous soils, slip surfaces are normally rotational with the slip surface approximating to an arc of a circle. The critical slip circle is defined as the slip circle producing the lowest factor of safety, (FS).

The FS is computed using the following formula (***Jones, 1985***) for two cases shown in Fig.(1).



a) Without reinforcement b) With reinforcement

Fig. (1): Slope stability analysis

1) Without reinforcement:

$$FS = \frac{\text{Restraining (Resisting) Moment, } M_r}{\text{Distrubing Moment, } M_d}$$

$$FS = \frac{SL_{sp}}{WX}$$

2) With reinforcement:

$$FS = \frac{SL_{sp} + TY}{WX}$$

where,

S = Shear strength of soil $= c + \sigma \tan\phi$

c = Soil Cohesion,

σ = Normal over burden stress,

ϕ = Internal friction angle,

L_{sp} = Length of the slip surface,

W= Weight of the soil segment,

X= Lever arm about the center of rotation of the soil mass,

Y= Lever arm about the center of rotation of the reinforcement,

T= Total tension resistance of the n layers of reinforcement, for ith layer

$$T_i = \frac{n}{n+1} K_a \gamma H \Delta H ,$$

$$K_a = \frac{1-\sin\phi}{1+\sin\phi} = \tan^2\left(45 - \phi/2\right)$$

K_a = Active earth pressure coefficient,

γ = Soil unit weight,

H = Overall height of slope, and

ΔH = Zone of action of an individual layer of reinforcement.

Verification of the Program

A number of slope stability problems were analyzed so as to check the verification of the *Slide* version 5.0 program, these problems were taken from published examples found in references as journals and conference proceeding were solved using either hand solutions or computer programs. The conclusion of the verification is that the results obtained using *Slide* was very close to those when using other methods **(Slide verification manuals, 2003).**

Method of Approach

The geometry and material properties of a model used in this investigation are presented in Fig. (2) and Tables (1) & (2). The critical slip surface and the associated minimum factor of safety of the model used is determined using limit equilibrium methods through a computer program named (*Slide*) which used numbers of the famous slope stability analysis methods such as Bishop and Fellenius methods. The model will first be analyzed without support (reinforcement), and then support will be added and the analysis re-run. Various types of supports can be modeled in *Silde* program, including geo-textile, soil nail, tiebacks, and rock bolts, in this work the tiebacks are used with length of 10m and row spacing of 2m. The concept of tiebacks is basically that one carries the lateral earth pressure with a "tie". The tie transfers the lateral load of the soil to a zone of soil located beyond the failure plane. First the model with vertical face is adopted without and with horizontal reinforcement installation, then the reinforcement angle is changed (α= 0, 5, 10, 15, & 20). For the other cases the angle of the face is changed (β= 10, 20, 25, 30, & 45) with also changing the reinforcement angle (α) by the above mentioned values.

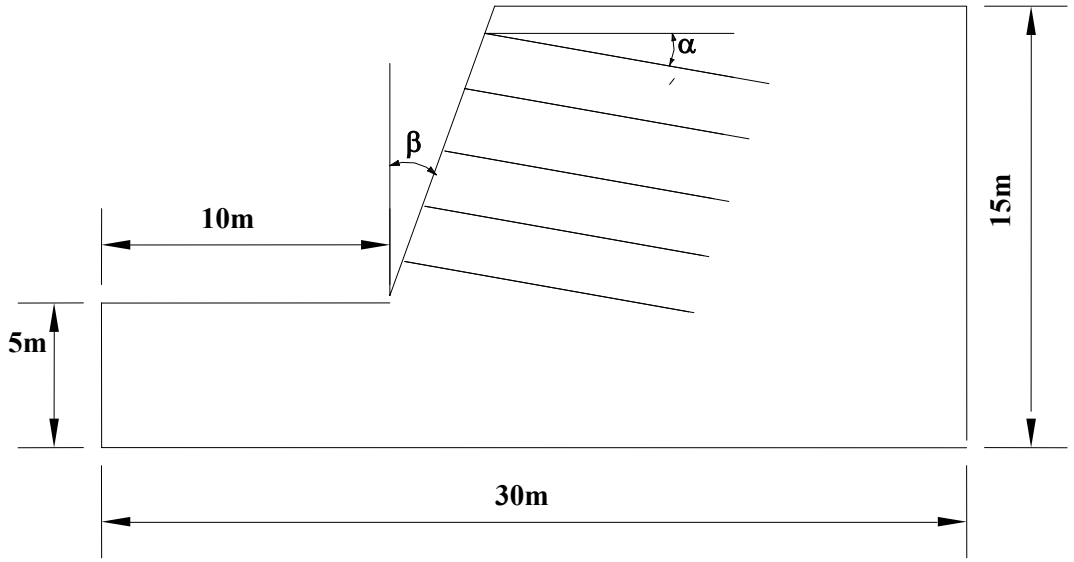


Fig. (2): Model geometry for slope reinforcement analysis

Table (1): Material Properties

	C (kN/m^2)	Φ (deg.)	γ(kN/m^3)
Soil	5	22	20

Table (2): Grouted Tieback Properties

Tensile Capacity (kN)	Plate Capacity (kN)	Bond Strength (kN/m)	Bond Length (m)
100	100	20	5

ANALYSIS AND DISCUSSION OF THE RESULTS

The results of the minimum safety factors (Bishop and Fellenius methods) obtained from the application of the program to the model used in this investigation are presented in Table (3) for convenience. The analysis of results showed that the safety factors increase with the increasing of the face angle (β) for case of without reinforcement. In case of reinforcement the results indicated that the reinforcement should not be laid horizontally for vertical or incline faced structures because the FS is not the biggest, although some works suggest that the optimum plane occurs with the reinforcement angle at 10-15^o from horizontal **(Smith and Brigisson, 1979)**. But for (β) greater than 15 degree the safety factor increases with increasing the reinforcement angle (α) this achieved in all used methods and these results agreed well with that mentioned by **(Yaeger, 1998)** who recommended that the inclination of the tiebacks should be between 10-30 degree from the horizontal. The reason of the some cases that give the FS values decrease with increasing the (α) is that the reinforcement is not laid in the correct position; therefore so as the reinforcement act it function effectively it is very important to know how it should be laid with respect of its orientation and location. For optimum effect, the reinforcement should be positioned within the critical strain fields in the locations of greatest tensile strains. If the reinforcement is not orientated in the corrected direction an overall reduction in the strength of the reinforced soil may result **(Jones, 1985).**

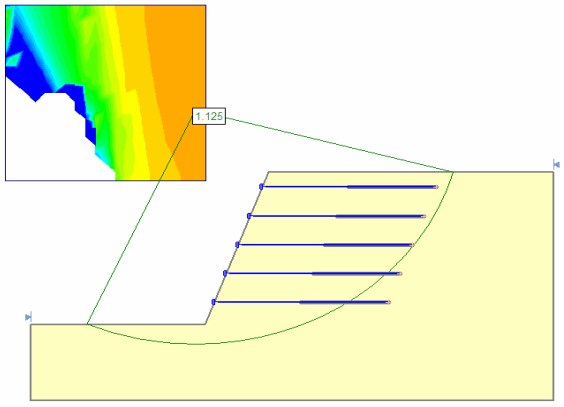
Table (3): Minimum factor of safety

β	Without Reinforcement	With Reinforcement				
		α= 0	5°	10°	15°	20°
0	0.390*	0.991	0.993	0.987	0.956	0.935
	0.429**	1.076	1.116	1.096	1.040	0.984
	0.438***	1.057	1.092	1.118	1.126	1.023
	0.423****	1.109	1.169	1.205	1.197	1.138
10°	0.420	1.141	1.122	1.096	1.055	1.013
	0.427	1.068	1.102	1.136	1.124	1.037
	0.433	1.058	1.090	1.119	1.143	1.159
	0.427	1.178	1.234	1.280	1.228	1.163
15°	0.447	1.149	1.199	1.252	1.211	1.150
	0.450	1.037	1.079	1.114	1.143	1.164
	0.455	1.022	1.063	1.101	1.129	1.149
	0.452	1.144	1.194	1.243	1.290	1.282
20°	0.484	1.125	1.176	1.227	1.271	1.294
	0.472	1.020	1.058	1.096	1.129	1.156
	0.477	1.009	1.047	1.079	1.109	1.134
	0.477	1.120	1.171	1.220	1.262	1.305
30°	0.570	1.113	1.176	1.234	1.279	1.327
	0.546	1.017	1.056	1.095	1.138	1.165
	0.546	1.004	1.042	1.088	1.124	1.153
	0.567	1.109	1.173	1.227	1.278	1.321
45°	0.757	1.146	1.204	1.264	1.326	1.381
	0.722	1.051	1.094	1.129	1.177	1.204
	0.716	1.046	1.086	1.124	1.162	1.193
	0.752	1.142	1.202	1.261	1.327	1.378

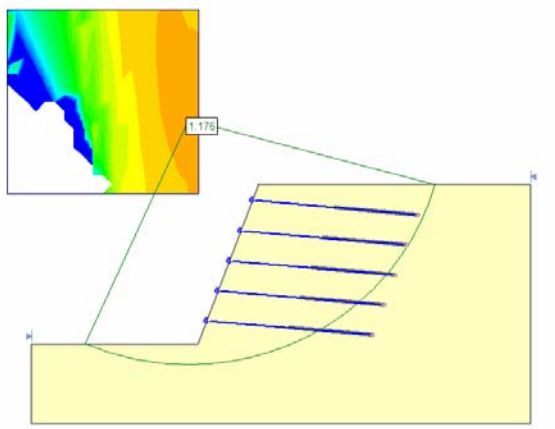
*Bishop simplified method
**Fellenius method
***Janbu simplified method
**** Spencer method

Fig. (3) shows the results of the minimum FS (Bishop simplified method) for slope angle of 20 degree and all cases of reinforcement.

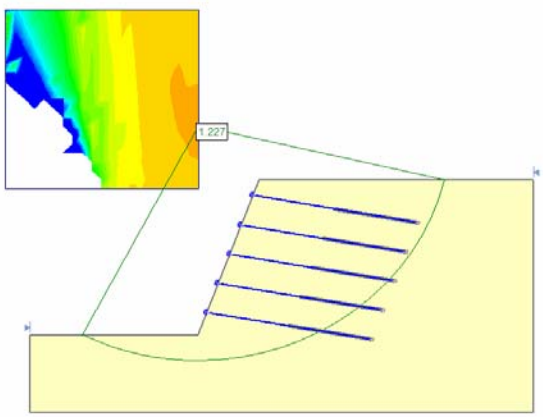
Fig. (4) and Fig. (5) show the all and minimum slip surfaces generated by the analysis respectively.



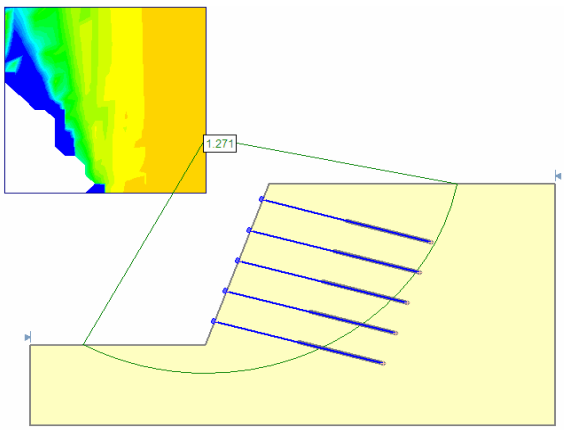
a) α = 0 degree



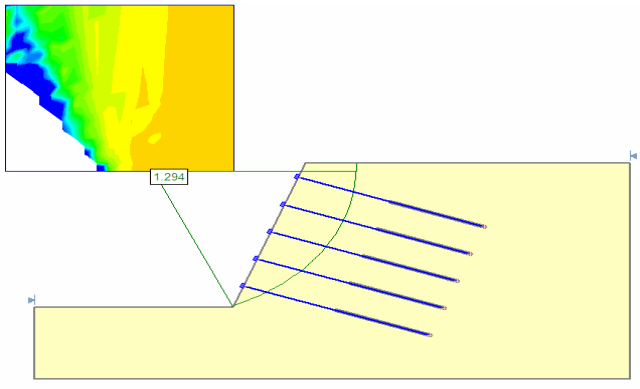
b). a = 5 degree



a) α = 10 degree



b) α = 15 degre



e) α = 20 degree

Fig (3): Critical slip surface and associated minimum FS for β = 20°

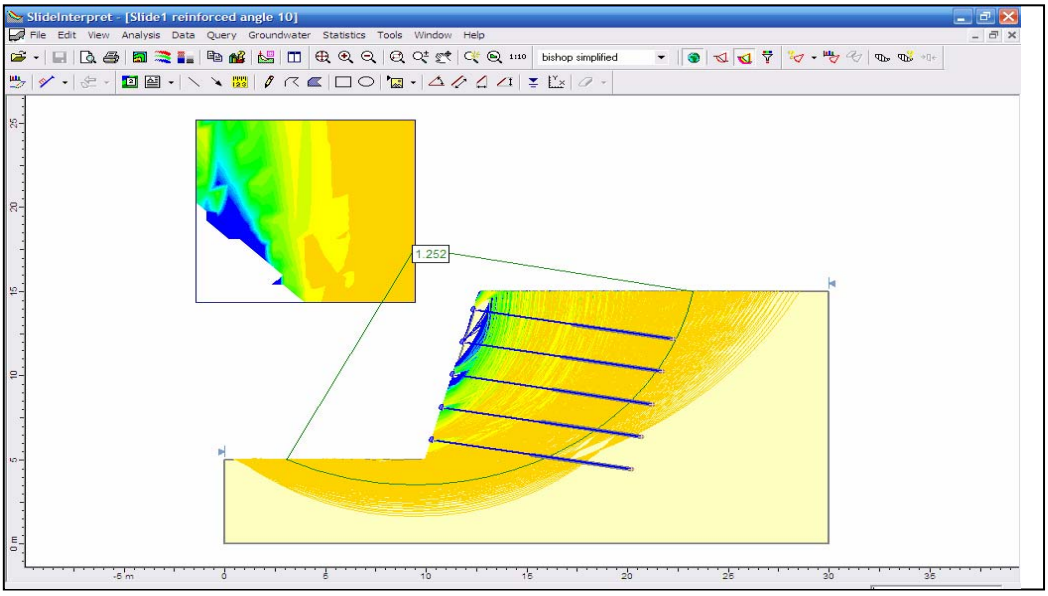


Fig (4): All slip surfaces for slope of (β = 15, α = 10) (Bishop Method)

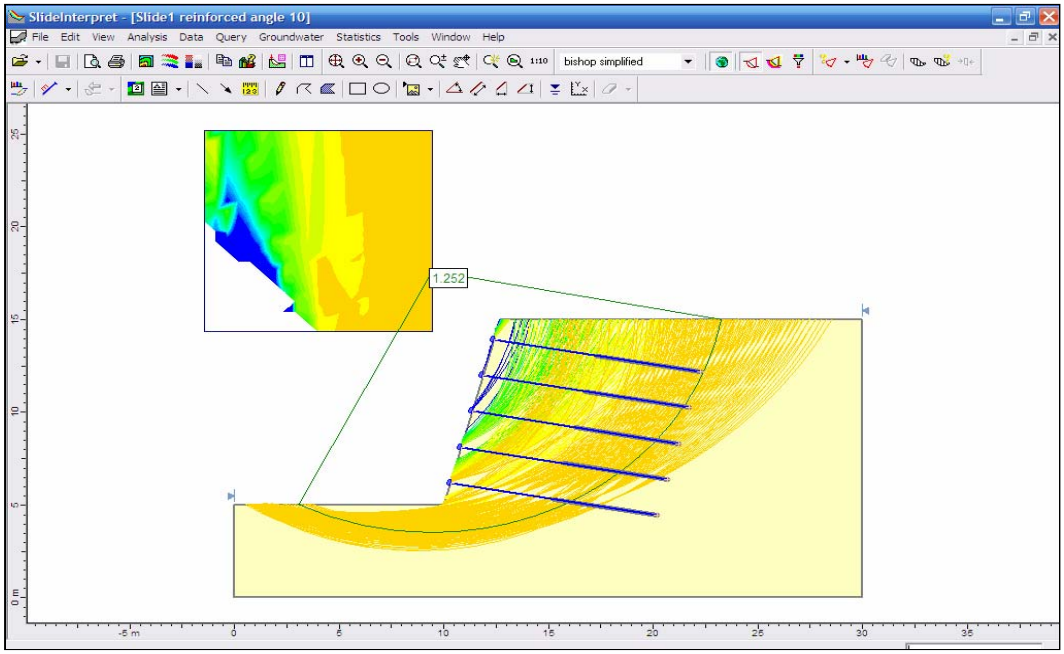


Fig (5): minimum slip surfaces for slope of (β = 15, α = 10) (Bishop Method)

CONCLUSIONS

There is no doubt that the reinforcement increases the soil strength and then reduces the soil failure. The reinforcement so as to act effectively the location and orientation of the installation should be done correctly; therefore, the primary objective of this study is to investigate the effect of reinforcement angle on the safety factor. The following conclusions are drawn form analysis of results:

1- For vertically or inclined face structures, the reinforcement should not be laid horizontally.

2- For β greater than 15^o , the FS increases with the increasing the value of α.

3- In Janbu method, FS increases with increasing the value of α and for all cases of β.

Recommendations

The following suggestions for future research work may be recommended:

4- Analyze the model taking into account the effect of the pore water pressure.

5- Solving the model to take the effect of soil layering (2 or 3 types of soil).

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الخلاصة

مما لا شك فيه ان وضع التسليح(reinforcement) في التربة يؤدي الى زيادة مقاومتها اذا تم وضع التسليح بالشكل الصحيح، حيث من المهم جدا معرفة كيفية وضع التسليح في التربة من حيث الموقع والوضعية(location and orientation) المناسبين ليقوم التسليح بالعمل الفعال الذي وضع من اجله وهو زيادة مقاومة التربة وبالتالي زيادة عامل الامان(factor of safety) ضد الفشل. لذلك ان الهدف الاساسي من هذه الدراسة هو التحري عن تاثير زاوية ميلان تسليح التربة على عامل الامان ولتحقيق ذلك تم استخدام برنامج كومبيوتر باسم (*Slide*) الذي يستخدم عدد من الطرق التقليدية المشهورة في تحليل استقرارية الميول مثل (Spencer, Janbu, Fellenius, Bishop). تم اخذ نموذج للتحليل عمودي الوجه وتطبيق البرنامج عليه في الحالتين بدون تسليح وبتسليح ثم تم تغير زاوية ميل وجه النموذج (β = 10, 15, 20, 30, 45)، وفي حالة استخدام التسليح تم التغير في زاوية ميل التسليح عن الافق (α = 0, 5, 10, 15, 20).

من تحليل نتائج هذه الدراسة تبين بان جميع الطرق المستخدمة تتفق على انه لا يجوز استخدام التسليح بشكل افقي سواء كان المنشأ عمودي الوجه او مائلا بزاوية معينة، ولكن الطرق تختلف على زاوية ميل التسليح (α) المستخدمة وهي بين ($\alpha = 5 - 15^o$) وفي حالة الزوايا (β = 0, 10, 15). وكذلك اثبتت الدراسة بان كافة الطرق تتفق على ان عامل الامان يزداد بزيادة قيمة (α) للمنشات مائلة الوجه وللزوايا اكبر من 15 درجة ($\beta > 15^o$). وكذلك تم استنتاج ان طريقة (Janbu) هي الوحيدة التي فيها عامل الامان يزداد بزيادة قيمة (α) ولجميع قيم الزاوية (β).

پوختە

بێ گومان دانانا (reinforcement) دئاخێ دا دێ بەرگێریا ئاخێ زێدەکەت ئەگەر ب شێوەکێ دروست هاتەدانان، زور یا پێدڤی یە زانینا چەوانیا دانانا (reinforcement) دئاخێ دا ژ لایێ (location and orientation) یێ گونجایی دا (reinforcement) ب کارێ خو یێ کاری گێر رابیت بو وێ مەرەما بو هاتیە دان کو ئەو ژی زێدەکرنا بەرگێریا ئاخی یە کو مەرەما دماهیێ ژی زێدەکرنا فاکتەرێ ئێمناهی یە (factor of safety) دژی نووجدانێ. ئارمانجا سەرەکی ژ ڤێ ڤەکولینێ بشکنینا کارتێکرنا گوشا لارا (reinforcement) تێ ئاخێ ل سەر فاکتەرێ ئێمناهی و بو بدەستڤە ئینانا ڤی کاری بەرنامکێ کومپیوتەری بنافێ (slide) هاتە بکارئینان ئەوێ چەند رێکێت زافەکری یێن بەرنیاس بکاردئینیت بو شروڤەکرنا سەقامگیریا لاریێ دا وەك (Spencer, Janbu, Fellenius, Bishop). نمونێن رویێ ئەستونی بو شروڤەکرنێ هاتنە وەرگرتن و جێ بەجێ کرنا بەرنامەی ل سەر هاتەکرن د هەردوو بارادا یێ (reinforcement)ویێ بێ (reinforcement)وپشتی هینگێ گهورینا گوشا لاریێ رویێ نموونەی ب ڤی رەنکی هاتەکرن (β = 10, 15, 20, 30,) ودباریێ ب کارئینانا (reinforcement)دا گهورینا گوشا لاریا (reinforcement)تی یا ئاسویی هاتەکرن وبڤی رەنگی (α = 0, 5, 10, 15, 20).

دماوێ شروڤەکرنا ئەنجامێن ب دەست ڤەهاتی دیار بو کو هەمی رێکێن ب کارئینای رێککەفن کو نابیت (reinforcement) بهێتە دانان ب شێوەی ئاسویی چ بنەجهیا رویی ستونی بیت یان یا لاری بیت ب گوشەیەکا دیارکری، بەلێ رێك دجاوازن ل سەر گوشەیا لاریا (reinforcement) یا ب کارئینای ئەوژی دناڤبەرا (α = 5-15)دباریێ گوشەییێن (β = 0, 10, 15)دا.هەروەسا ڤەکولینی خویاکر کو هەمي رێك د رێککەفتینە کو فاکتەرێ ئێمناهی زێدەدبیت ب زێدەبوناگوشا (α)یا بنەجهیا رویێ لار ییێن گوشێن ($\beta > 15^{o}$). هەروەسا دەرئەنجام خویادکەن کو رێکا (Janbu) یا ئێکانەیە کو تێدا فاکتەرێ ئێمناهی زێدەدبیت ب زێدەبونا گوشا (α)وبو هەمی گوشەییێن (β).

ANATOMICAL AND HISTOLOGICAL STUDY OF GOAT'S KIDNEY

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ABSTRACT

Kidneys from both male and female goats are freshly collected from Duhok Slaughter House. The anatomical study presents that the right kidney of the male is heavier than the left one while the right and left kidneys of the female have the same weight. The left kidney of both sexes is slightly larger than the right one. The kidneys were used for presenting a systematic study between the left and right renal arteries by injecting latex and corrosive cast (resin). The result shows that there is only one renal artery per kidney. The right renal artery, before entering the hilus is divided into three branches: dorsal, intermediate, and ventral while the left renal artery is divided, before entering the hilus into two branches: dorsal and ventral. Other important result is the present of artery from ventral branch of both renal arteries that supply the ureter. Kidneys were used for studying the pelvic recesses which are described by injecting the ureter with resin (corrosive cast) revealed that there are ten pelvic recesses in both kidneys. The histological results were shown the organization of the Native goat's kidney. They were dissected, processed and sectioned for light microscope. The results shown that the kidney is surrounded by capsule and the cortex consists of renal corpuscles, proximal tubules, distal tubules and medullary rays surrounded by myoepithelial cell, also numerous blood capillaries and connective tissue present. Medulla composed of thin and thick limb of henle's loop and collecting tubules.

INTRODUCTION

The domestic goats are widely distributed especiallyin the mountain countries and provide meat, leather and milk (1).Whatever, the excretory structures of th e farm animals are paired kidneys have important role to eliminate the waste products from the blood. Metabolism of food by the body to release energy also involves in protein metabolism, especially, waste materials are formed, the removed metabolic waste is the principal activity that the kidney perform for the body and its fluid. Besides, the kidney regulate blood pressure, water balance, PH, osmotic pressure, major ions including hydrogen, sodium, potassium, chloride, bicarbonate and concentration of many plasma substances. It can also act as an organ of endocrine by secretion, releasing renin, rostaglandins, erythropoietin, hydroxylation of Vitamin -D- and other substances in to blood stream (2). The morphological features of the kidney in most domestic animals have been reported in literatures (3; 4; 5; 6;7; 8). There are, however, few accounts on the gross microscopic anatomy of the goat´s kidney (4 ; 3 ;9;10). For instance, (10) reported morphometric observations on the kidney , (11) studied the pattern of renal arteries in goat., (12), (13) described the juxtaglomerular complex of the kidney in the goat. Presence of recesses in the renal pelvis of the goat kidney was the most important anatomical characteristic feature which was designated as specialized fornices in sheep, camel and dog (14;15). (16) stated that the goat, similar to the horse, sheep and dog possesses a renal crest-type kidney.

MATERIALS AND METHODS

The Experimental Animals

Sixty kidneys of healthy goats (thirty male and thirty female from both sides left and right) were collected from Duhok Slaughter House. They were used for anatomical and histological observation.

Anatomical Study

Fifty two kidneys from both male and female goats were used for anatomical observation (26).

The following anatomical indices were used in this work :

1 - Shape and Position of the kidney .

2- The biometric study of the kidney:- After collection of fourty kidneys (twenty male and twenty female), the measurements havebeen recorded absolutely after removing the fat

3- Cast of the kidney:- It is done by injection of four kidneys through the ureter with liquid resin [medicus coldcure & self cure resin]

4- Blood supply:- four kidneys of the Native goat were injected through arteries by latex and another four kidneys were injected by liquid resin mixed with red carmine to give the red color to the arteries.

Histological Study

Eight kidneys from both sexes (four male and four female)were used for the histological observations. After taking the specimen from each kidney they are fixed in the 10 % buffer neutral formalin solution. After fixation the steps of processing will begin as the following:- Dehydration, Clearing, Embedding, Blocking, Cutting and Staining. The slides are stained with the following stains:- H & E, PAS, Van Gieson and Mason Trichrom (37).

RESULT AND DISCUSSION

The present research shows that both kidneys of the native goat are covered by perirenal fat while the right kidney is embedded in very thick mass of perirenal fat than the corresponding left (fig.1). This designed as a specialized feature in goats is in parallel with literature (5; 9; 8) that the kidneys of the farm animals have a mass of protective fat surrounding the kidney to holding it in place. While (17)mentioned that the kidneys are partially embraced by perirenal fat that covers their ventral borders and present in the region of the hilus. The functional significance of these fat is not clearly understood, it might play an important role in the protection against distorting pressures from neighboring

organ (8) or act as a good insulator and give it stability to external environment, on the other hand, in cows, camels, sheep and goats particularly with a full rumen pushed the left kidney to the right as far as the median plane or beyond (2; 15). In these animals the left kidney much more loosely attached to the body wall than right one and consequently the left kidney has less perirenal fat than the right kidney.

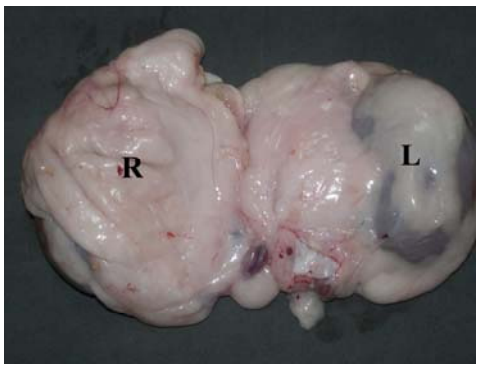

Fig (1): Photograph of kidney illustrate the fat on right (R) , left (L) kidneys

Generally, both kidneys are dark brown–red in color and smooth bean in shape surrounded by thin transperant capsule. There are many dark red haemal lymphnodes within perirenal fat(fig. 2). This is corresponded to finding of (7) in small ruminant. The anatomical study revealed that the paired kidneys of the native goat are located retroperitoneally inside the abdominal cavity on each side of the aorta and vena cava, ventral to the first lumbar vertebrae . The right kidney is located more cranially than the left. They are bean–shaped with smooth surface and red to brown coloration -Similar observation mentioned in the literature (18; 4; 19 ; 20; 21; 8; 22). Our present study shows that the right kidney of the male is heavier than the left one(Table. 1) which supports those findings of (10), while in female the right and left kidneys have similar weight which disagrees with the observation of (10) who stated that the right kidney is heavier than the left kidney. In our finding the left kidneys of both sexes are slightly larger than the right one(Table. 1) and the observation of (10) is supporting our finding. After doing cross longitudinal section, in both kidneys. It is revealed that each one composed of two areas, an outer dark brown granular area the cortex and inner lighter area the medulla. Renal pyramids united forming renal crest which is project into renal pelvis. Corticomedullary junction appear as a separate boundaries between the cortex and medulla and evaded by abundant of blood vessels (fig. 3) This is similar to the horse, sheep, camel and dog possesses a renal crest type kidney (9 ; 23 ; 15) .

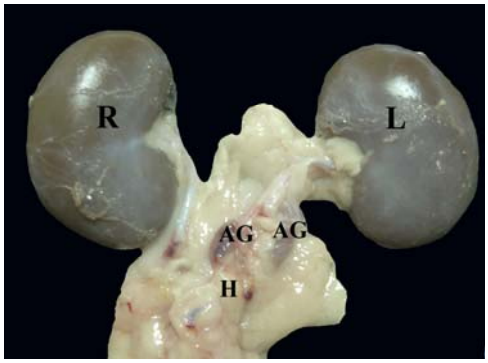

Fig (2): photograph shows shape of kidneys hemal lymphnode and adrenal gland

Table (1): Shows the different anatomical measurements of the kidney of the Native goat .

Measurement	Left Kidney		Right Kidney	
	Male μ ± SD	Female μ ± SD	Male μ ± SD	Female μ ± SD
Weight (gm)	58.088±6.182	55.582±3.082	59.315±6.625	55.402±5.403
Length (cm)	6.683±0.355	6.42±0.69	6.306±0.485	6.112±0.544

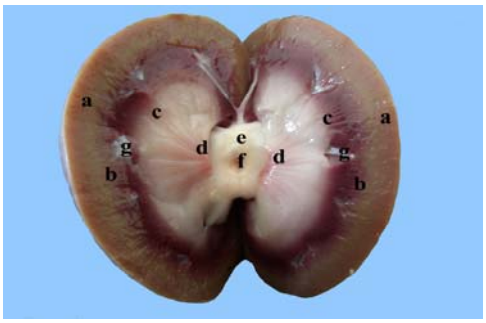

Fig (3): Photograph of longitudinal sectionof kidney illustrate : a – cortex , b – corticomedullary junction , c – medulla , d – renal crest , e – renal pelvis, f – opening of the ureter , g – blood vessel .

The examination of the cast of an excretory part of the kidney of the native goat is done by using resin, both kidneys revealed a crescent pelvis with 10 recesses (fig. 4).This is in agreement with finding in camel (24; 15)and in dog (23)and corresponded to (14) called fornices in sheep and classified it as type II kidney.Pfeiffer,[14](1968) reported that urea concentration is much higher in mammals with fornices than in those without them. It is possible that urea recycled from renal pelvic urea and that urine formation is not complete until it enters the ureter.These renal recesses might play an important role in economy of the water.

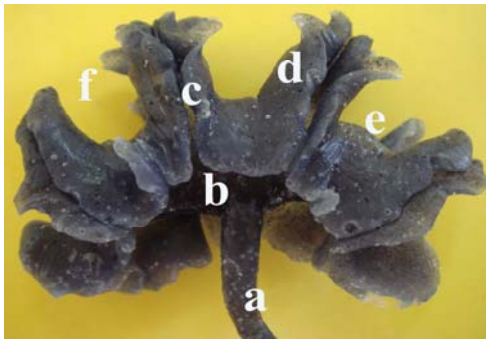

Fig.(4): photograph of cast excretory system of kidney, a - ureter , b – renal pelvis c – groove of interlobar , d- pelvic recess e- papillary duct , f– groove . of pseudopapilla

After using the latex and corrosive cast revealed that each kidney is vascularized by the renal artery arising from the lateral aspect of the abdominal aorta. This in agreement in relation with literature(3; 4; 9; 22) and disagree with (25) who reported that their origin from the ventral surface of the aorta. The right renal arterybefore coursing the hilus, is divided into three branches: dorsal, ventral and intermediate (fig. 5,6). This is not agree with (11) in Iraqi sheep and goat, (26) in tuj sheep.(22) in sheep and (20) in bovine stated that the renal artery is divided into the dorsal and ventral branches before entering the hilus. On the other hand, (26) reported in right kidney in one sheep a third branch a rising from the junction of the dorsal and ventral branches this give supporting to our study. The left renal artery before entering the hilus, is divided into two branches: dorsal and ventral. The dorsal branch in turn divided into two branches before entering the hilus: cranial and caudal branches (fig.7,8). This is parallel to finding of (26),(11) and (22).These branch gives off interlobar arteries, these arteries supply the parenchyma of the kidney. Each interlobar arteries is divided into several arcuate arteries which at the corticomedullary junction gives off many interlobular arteries. Different arterioles leave these vessels to vascularize the glomeruli and also form subcapsular plexus to supply the renal capsule(fig . 5).

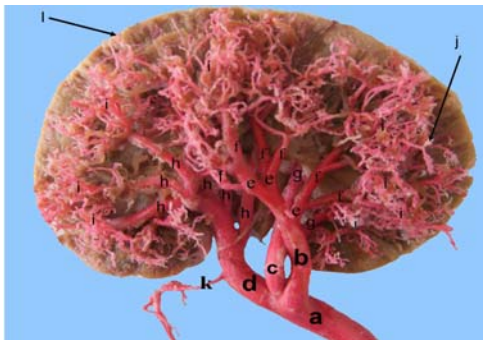

Fig (5): Photograph of latex's cast of the right kidney showing: a – renal artery , b – dorsal branch , c – intermediate branch, d – ventral branch , e – interlobar branch of dorsal b., f – arcuate ateries , g – interlobar branch of intermediate b., - h – interlobar branch of ventral b.,I – interlobular arteries , j – glomeruli , l – subcapsular plexus , k – cranial ureteric artery .

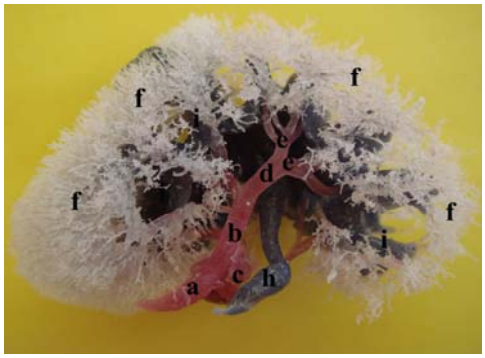

Fig (6): Photograph of cast of of the right kidney showing: a – renal artery , b – dorsal branch , c – intermediate branch , d – interlobar branch, e-arcuate branch , f – interlobular branch, h– ureter , i- pelvic recess .

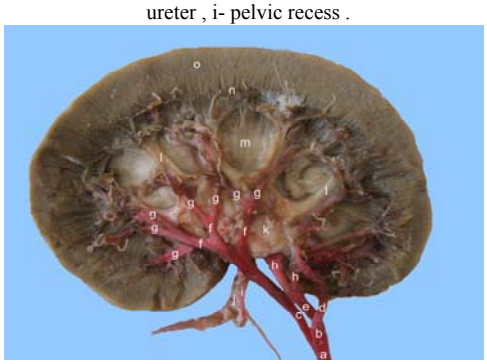

Fig (7) : Photograph of latex's cast of the left kidney showing : a – renal artery , b – dorsal branch , c – ventral branch ,d – cranial branch of dorsal b. , e – caudal branch of dorsal b. , f – interlobar arteries of ventral b. , g – arcuate branch of ventral b. , h – interlobar branch of caudal b. , i – ureteric branch , j – ureter , l – pelvic recess , k – pelvis , m – medulla

Fig (8): Photograph of cast of the left kidney showing: a – renal artery, b – dorsal branch, c – ventral branch , d – cranial branch, e–audal branch , f - interlobar branch of cranial , g – interlobar branch of caudal , h- arcuate branch , i– interlobular branch

The capsule that surrounding the kidney consist of two thick layers: the superficial one composed of dense irregular connective tissue with very dense collagen fibers and little amount of elastic fibers**.** The deep layer is compact strongly adhere to the cortex and contains smooth muscle fibers and blood vessels. both layers are infiltrate with fat cell (fig. 9). This is in agreement with literature of (17; 27; 28). On the other hand, (24) and (29) did not observe such smooth muscle cells in the inner capsule of the camel. The capsule restrict the kidney ability to expand (8) and play a role in renal function especially that it has smooth muscle fiber in its inner layer which gives the kidney

capability and flexibility to do its function (17). The cortex mainly composed of nephrons that strongly adhere to each other with little amount of interstitial connective tissue between them. The medullary rays seen penetrating the cortical parenchyma (fig.10). Medulla divided into outer and inner zones, the outer zone is mostly composed of collecting tubules and little amount of thin and thick limbs of henle among them there are few amount of interstitial connective tissue which become abundant in the inner zone of medulla. Similar observation is written by (30; 31). Nephron is composed of renal corpuscle, proximal, distal convoluted tubules and loop of henle. Renal corpuscle is consist of a tuft of anatomizing branched capillaries, the glomerulus surrounded by a double layered cup–shaped Bowman's capsule strongly reacted $with PAS stain. The outer parietal layer of Bowman's capsule was lined by simple squamous epithelium, thesecells are supported by myoepithelial cell. The inner or visceral layer is represented by podocytes. The space between the two layers of Bowman's capsule is the Bowman space(fig. 11, 12). This observation is supported by (32; 33). Proximal convoluted tubule is in superficial cortex strongly adhere to capsule lined by high simple cuboidal epithelium like pyramid. Its cytoplasm is acidophilic with prominent brush border. It has narrow lumen. The nucleus is pale oval or rounded in shape with 2-3 nucleoli located in the center of cell, it was strongly positive with PAS stain(fig.13). The most important feature is the presence of the myoepithelial cell (basket cell) which lies between the cells of the Proximal convoluted tubule and its basement membrane. It have dark flat elliptical nucleus (fig.14). This is in agreement with observation(31) in buffalo kidney. Loop of henle consist of thin and thick limbs in the juxtamedullary and medullary zones. Thin limbs are lined by flattened squamous epithelium and surrounded by huge number of interstitial cells and blood capillaries. Their nucleus is circular or oval in shape with prominent nucleoli and bulging from cell. The cytoplasm is very little weakly stained with PAS. The epithelium of the thick limb of henle is simple cuboidal, it has narrow lumen, with distinct nucleoli. It is strongly surrounded by collagen fibers, interstitial cells and blood capillaries.This observation supported by(34). Distal Convoluted Tubule present between the Proximal convoluted tubule and closely attached together in superficial cortical zone then the distance between them become wide in midcortical and juxtamedullary zones. It has wide lumen (fig.15) similarities for our observation with literatures written with farm animals(28;34).

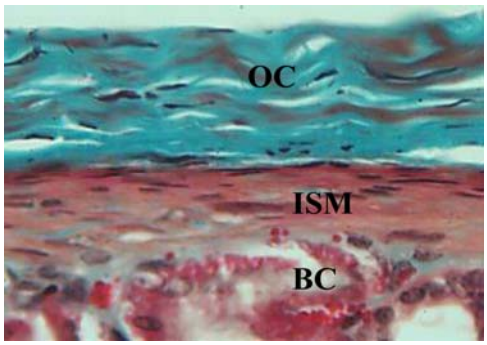

Fig (9): Micrograph of goat 's kidney showing the capsule (C) consist of : outer collagen layer (OC) , inner smooth muscle layer (ISM) and blood capillary (BC) . (Masson Trichrom stain , 400 X)

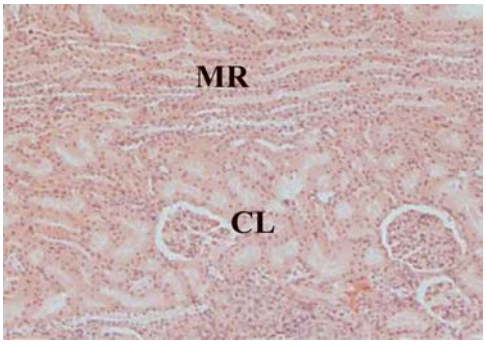

Fig (10): Micrograph of kidney showing cortical labyrinth (CL) and medullary rays (MR) . (H & E stain . 40 X)

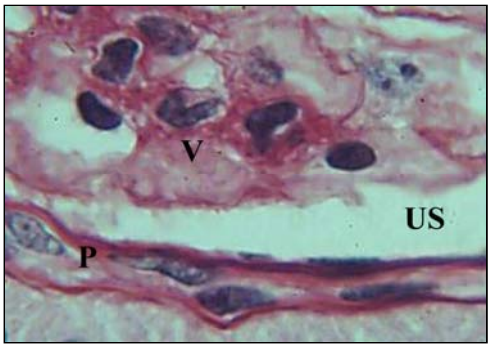

Fig (11): Micrograph of renal corpuscle of the kidney showing Bowman 's capsule layers : parietal (P) and visceral (V) and urinary space (US) . (PAS stain.1000 X)

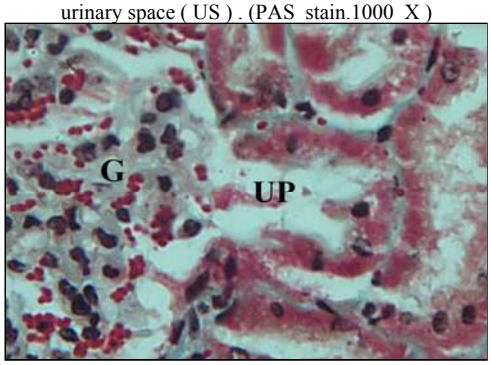

Fig (12): Micrograph of renal corpuscle of the kidney showing the urinary pole(UP) , glomeruli (G).(Masson Trichrom stain . 400 X)

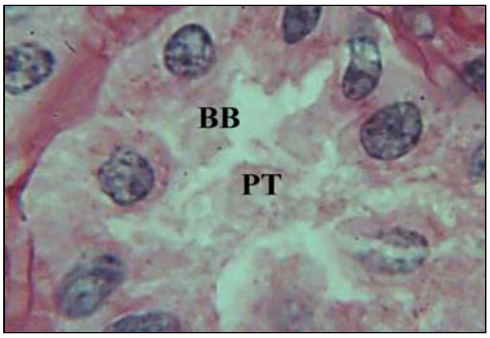

Fig (13): Micrograph of the kidney showing proximal convoluted tubule (PT) showing brush border (BB).(PAS stain. 1000 X).

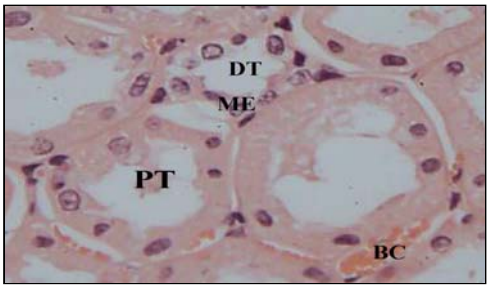

Fig (14): Micrograph of the kidney showing proximal convoluted tubule (PT) and distal convoluted tubule (DT), myoepithelial cell (ME) and blood capillaries (BC). (H & E stain . 400 X)

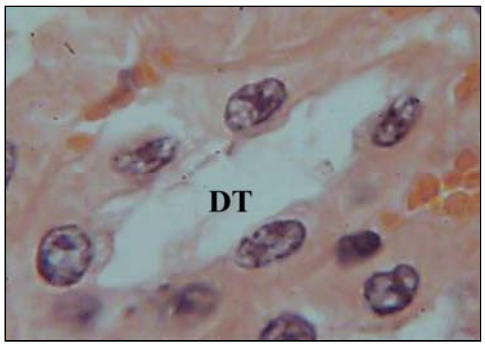

Fig (15): Micrograph of the kidney showing distal convoluted tubule (DT) showing their cells.(H & E stain . 1000 X).

Collecting tubules are seen in the medullary rays. It is lined by one layer of simple cuboidal epithelium. It is composed of two types of cells. The light cell has pale oval basilly located nucleus. The dark cell has dense dark rounded centrally located nucleus (fig.16). The epithelium of collecting tubule changes to transitional epithelium to form papillary duct which consists of two layers of cells thickness. Basal cell contain nucleus dark oval in shape and located in the base of the cell, while the apical layer of the cell has rounded or oval shape nucleus occupied the center of the cell (fig. 17).This result similar to dog (35).

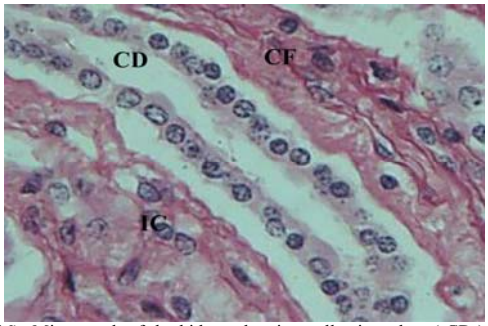

Fig (16): Micrograph of the kidney showing collecting duct (CD) in the medullary rays surrounded by collagen fibers and interstitial cells .(PAS stain. 400 X).

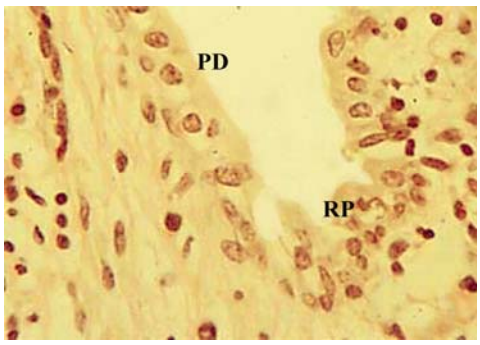

Fig (17): Micrograph of the kidney showing the change of epithelium of papillary duct (PD) to renal pelvis (RP) . (Van Gieson stain . 400 X)

In our study presented that the Juxtaglomerular apparatus have three types of cells (Fig. 18), macula densa modified part of distal convoluted tubule cells near the corpuscle, extraglomerular mesangial cells between the afferent and efferent arteriole, juxtaglomerular cells are modified smooth muscle cell of the afferent arterioles secreting renin it is similar to literature (36; 34).

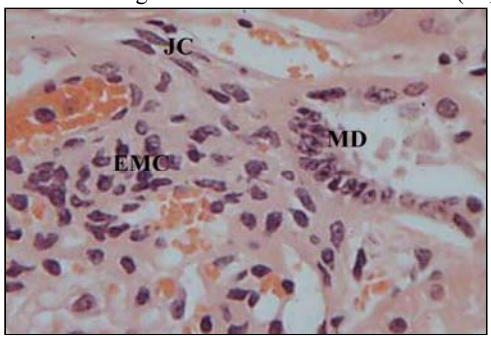

Fig (18): Micrograph of the renal corpuscle of the kidney showing macula densa (MD), juxtaglomerular cell(JC) and extraglomerular mesangial cell (EMC) (H & E stain . 400 X).

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الخلاصة

عملت الدراسة على كلى الماعز التي جمعت من مجزرة دهوك ومن كلا الجنسين (ذكر و انثى).الدراسة التشريحية بينت ان الكلية اليمنى فى ذكر الماعز كانت اكثر وزنا من اليسرى بينما تكون الكلية اليمنى و اليسرى فى انثى كانت لها نفس الوزن. الكلية اليسرى فى كلا الجنسين اكبر طولا بقليل من اليمنى. لتوضيح التركيب التشريحية للكليتين وعلاقتها مع المد الدموي الغذي للكليتين اليمنى و اليسرى وذلك بحقنها بمادة latex و resin وقد وجدت ان كل كلية تجهز بشريان كلوي واحد من الا ر البطني. الشريان الكلوي الايمن ينقسم قبل دخوله السرة الكلوية الى ثلاثة فروع(ظهري, بيني, بطني) بينما ينقسم الشريان الكلوي الايسر قبل دخوله السرة الكلوية الى فرعين(ظهري و بطني). اظهرت النتائج وجود فرع مهم ينشا من الفرع البطني لكلا الشريانين الكلويين يغذي الحالب. تم دراسة الجيوب الحوضية وذلك بحقنها من خلال الحالب بمادة resin وقد بينت الدراسة وجود عشرة جيوب حوضية في كلا الكليتين.

اظهرت نتائج الدراسة التركيب النسيجي للكلية حيث تم تقطيعهم وعوملت نسيجيا وفحصت بواسطة الميكروسوب الضوئي. بينت النتائج ان الكلية محاطة بمحفظة capsule. تتكون القشرة cortex تتركب من الكبيبات الكلوية ونبيبات الدانية proximal, القاصية distal واشعاعات النخاعية medullary rays تحاط الانابيب الكلوية بخلايا ظهارية متفلصة myoepithelial cells مع وجود شعيرات دموية وخلايا بينية. النخاع medulla تتالف من ذراع الرفيع و السميك لعروة هينلي loop of henle ونبيبات الجامعة collecting.

پوختە

ڤەکولین هاتە ئەنجام دان لسەر گولچیسك ییین هەر دوو رەگەزین نیر و می ییین بزنین ساخلەمین تازە هاتینە سەرژیکرن ئەوین هاتینە کومکرن ژ سەرژیکەها دهوکی. ڤەکولینا کەلشتێ دیار بو گولجیسکا راستي یا گیانەوەري نیر گرانتر بو ژ یا چەپي بەلام کولجیسکین راستي و چەپي یا گیانەوەري مي وەك ئیکین. و گولجیسکا چەپی کیمەك مەزنتر بو ژ یا راستي لهەر دوو رەگەزا .

بو ڤەکولینا ریزکی systematic یا ڤەیوندیا کەلشتنی د ناڤبەرا دەمارین راست و چپ ییین د ناڤ گولجیسکا دا ب ریکا دەرزیدانا دارشیری latex وقالبی داخوراندار corrosive cast. مە ڤەیداکر کو تنی ئیك دەمارا گولجیسکی renal artery یا هەي بو هەر گولجیسکەکی, دەمارا گولجیسکی یا راستی بەری د ناڤ ڤەچوون hilus دهیتەدابەشکرن بو سي تایان (پشتي dorsal, ناڤین intermediate, زکي ventral) لی دەمارا گولجیسکی یا چەپي بەری ناڤ ڤەچوون hilus دهیتەدابەشکرن بو دوو بەشا (پشتی, زکی).

بو ڤەکولینا ڤالاتیین قورکی pelvic recesses وهاتە شروڤەکرن ب ریکا دەرزیدان میزکیشی ب resin و دەھ ڤالاتیین قەرکی د هەردوو گولجیسکا دا دیاربوون.

ئەنجامین تەڤنزانی لسەر گولجیسکا بزنا بنەجی هاتنە پەل پەل کرن و هاتنەسازاندن و هاتنەدابەشکرن بو هوربینا روناهیی light microscope دەئەنجام دیار بو گولجیسك یا هاتیە دورپیچکرن ب کەپسولەکا. کەلیك cortex پیك دهیت ژ توپکین گولجیسکی, لولەکین سەري, لولەکین بنی و تیشکین کاکلوکا گولجیسکی دورپیچکرینە ب خانەیین myoepithelial cell و تەڤنی گریدانی. کاکلوکا گولجیسك medulla پیکهاتیە ژ limb henle ییین ستور و زراڤ و لولەکین کوم کەر.

PREVALANCE OF SUBCLINICAL MASTITIS IN COWS IN DOHUK/KURDISTAN REGION, IRAQ.

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ABSTRACT

The performance of California Mastitis Test (CMT) and somatic cell count (SCC) and bacteriological culture, for the detection of subclini-cal mastitis was evaluated with 410 healthy cows from different areas of Dohuk province, North Iraq. The results showed that the prevalence of sub clinical mastitis was 14.4% and coagulase positive *Staphylococcus aureus* was the predominant organism isolated 85% from subclinical mastitic cows.

INTRODUCTION

Mastitis may vary from subclinical to clinical with mild to marked inflammation (Sears, 1993).Subclinical mastitis constitutes one of the most serious forms of the disease, where infected udders look appar-ently healthy and act as invisible source for dissemination of infection. Although many field tests have been developed and used in the diagnosis of this form of mastitis, yet bacteriology examination still considered the most accurate and confirmative method(Ismail etal.,1984).

California mastitis test is the most available indirect field test used by Veterinarians for measuring herd prevalence of mastitis (Batu and Friat, 1981; Coles, 1986; Radostits *etal*., 2000).

Somatic cell count SCC in milk has been accepted as the best index to use both to evaluate milk quality and to predict udder infection in the cow (Poutrel and Rainard, 1982).Determination of SCC in cow's milk is usually performed by coulter counter and Fossomatic, which are the methods most widely used in laboratories and by California mastitis test, and mostly applied under field conditions (Poutrel and Lerondelle, 1983).

Many infective agents have been implicated as causes of mastitis. The common causes in cattle are *Streptococcus agalactiae* and *Staphy-lococcus* with *Escherichia coli* becoming a significant cause in housed or confined cattle (Radostitis *et al*., 2000).

The aim of this study was to estimate the prevalence of subclinical mastitis and bacteria in the milk and the relationship between California mastitis test and leukocytes count.

MATERIALS AND METHODS

Sampling:-

A total of 1640 individual milk samples were collected from410 healthy cows from different areas (Bateel, Sumeel, Atrosh, Zawita, and Carbelle) of Dohuk province, Kurdistan region of Iraq.

California Mastitis Test:-

The CMT was carried out on all samples collected using the method described by Schalm *etal*., (1971). Scores represented four categories: 0, negative or trace;1.positive(+);2, positive (++) and and 3, positive (+++).By an equal amount of CMT reagent was added to each of four shallow cups in the white paddle contain a squirt of milk from each quarter of the udder. A gentle circular motion was applied to the mixture, in a horizontal plane and positive, gelling reaction occurs in a few seconds with positive samples.

Direct Microscopic Somatic Cell Count:

Direct microscopic examinations carried out on milk samples was considered positive result by CMT using the method described by Coles (1986).A known volume of milk (0.01ml) was spread over $1cm^2$ on a microscopic slide, defatted and stained by the Newman- Lampert stain (Methylene blue), this stain has the advantage of fixing the milk on the glass slide removing the fat and staining both bacteria and leukocytes.

Bacteriological Examination:-

Samples of milk were taken from CMT positive cow's and then cultured on blood, MacConky and Mannitol salt agars. After 24-48 hrs, incubation at $37c^o$ the plates were examined. For the identification of bacteria, subcultures were performed from original cultures and further microscopical examination (using Gram stain) and biochemical assays were carried out according to the methods described by Carter and Cole (1990).

RESULTS

The results of field test (CMT) was interpretated according to simplified method of Schalem *et al*.,(1971) and results were graded with only four scores 0 negative,1 trace,2 positive reaction,3 strong positive. In this study consequently we have chosen two group together in one class, scores 0(negative and trace) as negative result for CMT and in other class scores (2 and 3) as positive result.

The results of CMT were shown in table (1), out of 410 apparent healthy cows 155(37.8%) were positive by this test and out of these 155 only59 (38.1%) samples were bacteriologically positive.

Table (1): Results of CMT and bacteriological examination:-

Area	Number Of Cows	CMT+Ve %	Bacteria +Ve
Bateel	66	36 (54.6)	7 (19.4)
Artosh	157	63 (40.1)	21 (33.3)
Zawita	116	36 (31)	18 (50)
Atrosh	59	15 (25.4)	10 (66.7)
Carbele	12	5 (41.7)	3 (60)
Total	410	(37.8) 155	(59) 38.1

The scores of CMT with bacteriological results were shown in table (2).Out of 351 bacteriologically negative samples 200, 55, 78, 18, at scores 0,1,2,3 respectively and out of 59 bacteriologically positive samples 45 and 14 at score 2 and 3 respectively.

Table (2): The proportion of milk samples with CMT scores

CMT Scores	Bacteriologically -Ve Samples (%)	Bacteriologically +Ve Samples (%)	Total
0*	200		200
1*	55	---	55
2**	78	45	63
**3	18	14	92
Total	351	59	410

***** Scors0, 1(negative results), scores 2, 3(positive result)

Table (3) showing the relationship between somatic cell count and CMT scores of the estimated milk samples 150, 30,78 and 18 had scores of 0,1,2,3 of CMT respectively and had SCC less than 0.75×10^6 cell/ml of milk, and 40, 20,20,8 samples of scores 0,1,2,3 of CMT respectively, they had SCC more than0.75×10^6 cell/ml, while 10, 5, 25, and 6 samples had of scores0, 1, 2, 3 of CMT respectively, they had SCC equal and more than 1.0×10^6 cell/ml.

Those samples were positive by CMT, bactriologically and SCC equal or more than 1.0×10^6 cell/ml. Considerd the final true prevalent rate and (14.4%) 59/410 of subclinical mastitis in the Dohuk province.

Table (3): Distribution of SCC for CMT in cow milk.

CMT Scores	SCC >0.75×10^6 cell/ml	SCC <0.75×10^6 cell/ml	SCC >1.0×10^6 cell/ml	Total
0*	150	40	10	200
1*	30	20	5	55
2	78	20	25	123
3	18	8	6	32
Total	276	88	46	410

***** Scors, 1(negative results) for CMT

A total of 80 bacterial isolates were obtained from 59 samples of milk that were positive by bacteriological examination and CMT.Table (4). Coagulase positive *Staphylococcus aureus* was the predominant organism isolated 70(85%) and followed by *Klebsiella spp*. 6(7.5%)and *Escherichiacoli* 5(5%)and 43 samples of content were the *Staphylococcus aureus* more prevalent in the samples had of 2 scores of CMT and 27 samples had scor 3.

Table (4): Relationship between isolated bacteria with CMT scores

Type Of Bacteria	CMT Scores				Total
	0	1	2	3	
Staph. aureus	--	--	43	27	70(87.5%)
Klebsiella spp	--	--	4	2	6(7.5%)
E.coli	--	--	2	2	4(5%)
Total	--	--	49	31	80

DISCUSSION

In a survey of subclinical mastitis would be expected to be from healthy mammary glands and consequently the specificity of the diagno-stic method must be high. Diagnosis of subclinical mastitis is not straight ford ward usually and based on detection of bacteria and increased leukocyte numbers in milk (Schalem et al., 1971).

According to definition of El-Masanmat (1987), Fthenakis (1994); Witkins *et al*., (1991) mammary glands without clinical abnormalities and with milk apparently normal, bacteriologically positive and somatic cell counts more than 1.0×10^6 cell /ml of milk were considered to have sub-clinical mastitis. In current study the 59 cows out of 410 cows had positive reaction to CMT and were positive bacteriologically and milk samples contain more than1.0×10^6cell /ml of milk. This results true indicative for prevalence of subclinical mastitis in cows in Dohuk city.

California Mastitis Test and White Side Test are widely used in the detection of subclinical mastitis because they are reliable easy to perform and inexpensive (Schalem et al., 1971). El-Masanmat (1987), Maisi *et al*. (1987) and Watkins et al.,(1991) Fthenakis (1995) indicated that CMT and the WST were useful in diagnosing subclinical mastitis in meat producing flock.

Somatic cell count in milk has been accepted as the best index to use both to evaluate milk quality and to predict udder infection in the cow (Poutrel and Rainard 1982). Determination of SCC in cow's milk is usually performed by Coulter Counter and Fossomatic, which are methods most widely used in laboratories and by California Mastitis Test (CMT) mostly applied in field conditions (Poutrel and Lerondelle, 1983).

In the CMT and White side test (WST) the leukocyte of milk ruptured by the reagent of test, and releasing their DNA which is the active principle in the test by different degrees or grades, trace scores have slight precipitate from which dissolves with mixing and scores+1 have slime to gel formed, score+2 gel becomes thick and flocculuens and score+3 gel becomes viscous and thick, these scores were denticed to those menthioned by Coles, 1986 and Schalm et al, 1971.

In our investigation, leukocytic values lower1.0×10cell per ml and CMT scores of 0, 1 has been observed in only (351) cows were bacterial-ogically negative, while only59 (14.4%) cows had bacteriologically positive and more than 80 bacterial isolates were demonstrated. *Staphylococcus aureus* was more frequently isolated 70 (87.5%).

Further more, in the present study, samples in which *Staphylococcus aureus* was isolated have had SCC higher than 1.0×10^6cell per ml and CMT scores higher than 2.

Although SCC increased during out break of *Staphylococcus aureus* infections, its absolute value may still be considered relatively low, others also observed that *Staphylococcus aureus* infection may be present in a quarter with out a dramatic increase in SCC (Schukken et al., 1989; Hoblet et al., 1988)*Staphylococcus aureus* was the most common pathogen in sub clinical mastitis.

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الخلاصة

تم **استخدام فحص الكاليفورنيا (California Mastitis Test) مع عد كريات الدم البيض** في الحليب**(Somatic cell count) للكشف عن التهاب الضرع** تحت السريري التي **اجريت على 410 بقرة حلوبة** وفي مناطق مختلفة من محافظة **دهـوك** في **افلـيم كردستان العراق.اظهرت النتائج بان معدل انتشار المرض** في المحافظة **كانت14.4% وان جرثومة المكـورات العنقوديـة الذهبيـة (Coagulase positive, *Staphylococcus aureus*) كان المسبب الرئيسي او السائد وبنسبة 85% من حالات التهاب الضرع** تحت السريري.

كورتى

بكارئينانـا هـەردوو پێـشكنينن (California Mastitis Test) دگـەل هـەژمارتنا رێـژا تـەبكيێن سـپى دنـاڤ شـيريدا ژبـو ديـاركرنا هەبوونا ئيشا گوهان رەشيا نە ديار ل 410 جێلا ل هەنديك دەڤەريێن جودا جودا ل پارێزگەها دهوكێ . ل ئەنجامادا هاتـە ديـاركرن كـو رێـژا بـەلاڤبوونا ئيـشێ ل پارێزگەهـدا (14. 4٪) بـو وهەروەسـا ئاريـشكرێ سـەرەكى يـێ ڤـێ ئيـشێ (*Staphylococcus aureus*- Coagulase positive) بوو وب رێژا 85٪ ل هەمى جيێليين ئيش هەيين.

ANATOMICAL AND HISTOLOGICAL STUDY OF LOWER URINARY SYSTEM AND ACCESSORY SEX GLANDS OF INDIGENOUS RAM

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ABSTRACT

The anatomical results show that the normal Ram's urinary bladder is oval to pear shaped. Its mucosa consisting of transitional epithelium. The thickness of epithelium differs according to the degree of distension of urinary bladder with urine. Our present study revealed that the urethra is divided into two parts (pelvic and penile). Another important result is the presence of urethral process at the end of the urethra which is worm like extension project beyond the glans penis, and is lined by nonkeratinized stratified squamous epithelium and covered by skin. The course of urethra can be well described by injection the urethra with resin (corrosive cast). Cross sections of the pelvic urethra reveal their layers. The penile urethra consists of tunica mucosa lined by stratified columnar epithelium. The lamina propria has fewer cavernous spaces in comparison with the pelvic urethra.

The accessory genital glands of indigenous ram are composed of ampullae, vesicular gland, disseminates part of prostate gland and bulbourethral gland.The ampulla was longer than the vesicular and bulbourethral gland while the vesicular gland was heavier than ampulla and bulbourethral glands. Ampullae has elongated fusiform shape. The vesicular gland is S-shaped. The bulbourethral gland is pea-ovoid shaped. Our results show that all the accessory genital glands are lined by simple columnar epithelium; the secretion of prostate gland is serous to seromucoid, while bulbourethral gland is mucous to mucoserous secretion. The ducts of the glands are usually lined by simple columnar epithelium except in the duct of prostate gland which changes from simple columnar epithelium to pseudostratified columnar epithelium.

INTRODUCTION

Native sheep of Iraq are adapted to the hard environment of the region and have developed into well – differentiated breeds. In the Iraqi Kurdistan, there is cross breed between Arabi and karadi. They are all–tailed, carpet–wool producers with some potential to produce milk(1).Applications of morphometric and histological techniques have increased in medical research and been well recognized as a new approach in morphological study as well, among the animals, especially the laboratory animals, rat and mice (2). But the domestic animals have less research including Ram-(3)

However the metabolic processes break down protein and nucleic acids, nitrogen is released into the blood stream.Most of the nitrogen is bound with hydrogen as NH_3 (ammonia), which is readily dissolved in water (4). The mixture of urea, water, and other wastes is called urine, which is still very concentrated in comparison to the blood and the organ; structure that facilitates this concentration is the kidneys, ureters, urinary bladder and urethra (5;6).

Thus the urinary bladder and urethra are a genitourinary passage way which shared the urinary and reproductive system. In most domestic animals, the seminal plasma is made by the accessory sex glands, both mucous and serous in composition and functions to nourish and provide the necessary energy source for spermatozoa motility, lubricate and clear the urethral tract prior to ejaculation, serve as a vehicle of transport of the spermatozoa in the female tract, and to plug the female tract after placement of spermatozoa to help ensure fertilization.

MATERIALS & METHODS

The Experimental Animals

This study is performed on the urinary bladder, urethra and associated accessory sex glands of 30 adult male of local breed of sheep which were collected from the Duhok Slaughter House and used for anatomical and histological observation.

Anatomical Study (Gross dissection)

Fifteen adult male of local breed of sheep aging between2-4years were used for anatomical observation.

The following anatomical indices were used in this work:

1. **Position, fixation and shape of the urinary bladder and associated sex accessory gland.**
2. **Studying the parts of urethra.**
3. **Cast of the penile urethra**. By injection of five penis in adult male of local breed sheep through penile urethra with liquid resin [medicus coldcure and self cure resin] (liquid and powder).
4. **The biometric study**. After the collection of the samples from ten animals which include the urethral process,ampullae,vesicular and bulbourethral glands, the measurements of the weight, length and width have been recorded absolutely after removing the fat. The dissected material were immediately weighted in mg. on a sensitive electric balance* without Losing the seminal fluid.The lengths were taken by using a vernier caliber from the cranial extremity to the caudal extremity and the widths were taken at extremity also by using a vernier caliber.

Histological Studies

Histological and histochemical analysis of various parts of the urogenital tract were done. The samples were taken immediately after slaughtering in Duhok Slaughter House as pieces of the urinary bladder, urethra and associated accessory sex glands and were fixed in appropriate solution of 10% of buffer neutral formalin solution. (7).

After fixation, the tissue was trimmed into 3 mm and the specimen washed by using tap water for 4-6 and the specimen washed by using tap water for 4-6 hours to remove the formalin solution. Steps of processing were done as the following :-

Dehydration**,**Clearing,Wax impregnation,Blocking, Sectioning and Staining.

The sections were stained with the following stains (Luna 7):

1- **Harris Hematoxylin & Eosin**
2- **Periodic Acid Schiff (PAS)**
3- **Masson Trichrome Stain**
4 - **Van Gieson Stain**
5- **Alcian Blue stain(PH 2)**

***** Electric balance –Mark 800. Chimica Omnia Co. Italy

Stained slides were examined by using light microscope* with digital camera USB connected with the computer slides which were pictured directly from computer at various adjustment powers (100 x 40 x 20 x10^{x}4).

RESULTS AND DISCUSSION

Urinary Bladder

The urinary bladder of the indigenous sheep is relatively large, has the shape of a long oval to pear; there is a mass of scar tissue in its apex, fixed in its position by lateral and median ligaments.The free edges of lateral ligament have firm band–like structure of the large obliterated tube as rounded ligament (fig.1). This is in parallel with the literature (8;9). Under light microscop, the urinary bladder appears as highly folded mucosa with irregular lumen.The transitional epithelium of empty urinary bladder is composed of 6 to 8 cells thick and in the distended bladder the transitional epithelium is composed of 2 to 3 cells (fig.2,3). Similar observation was recorded in bull (10; 11) and in human (12; 13; 14).

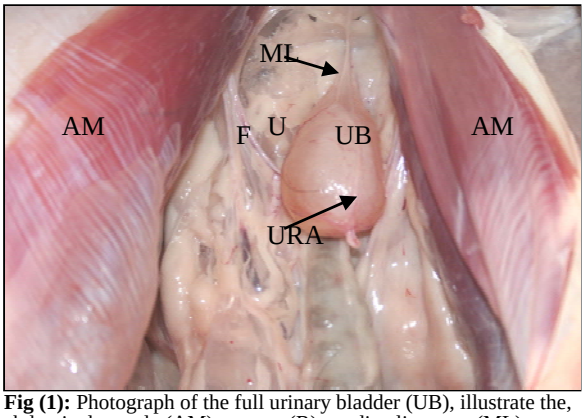


Fig (1): Photograph of the full urinary bladder (UB), illustrate the, abdominal muscle (AM), rectum (R), median ligament (ML), urachus (URA), ureter (U), fat (F).

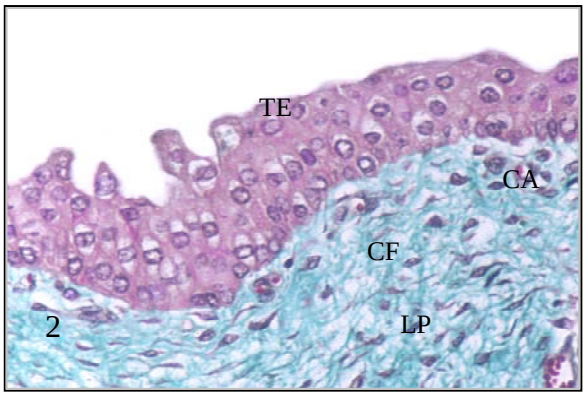


Fig (2): Micrograph of the Urinary Bladder (Empty) showing the transitional epithelium (TE), lamina propria (LP). capillary (CA) collagenous fiber (CF). (Masson Trichrom stain. 400 X

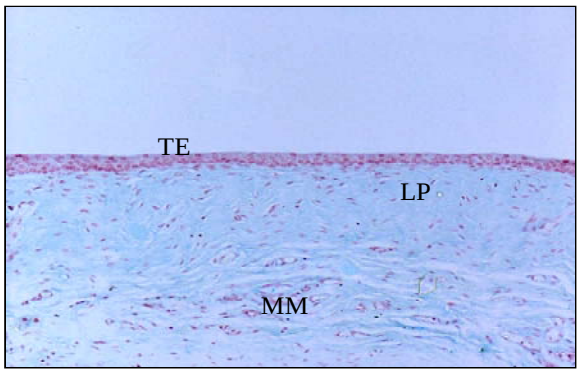


Fig (3): Micrograph of the Urinary Bladder (Full) showing the transitional epithelium thickness (TE), lamina propria (LP), muscularis mucosa (MM). (Alcian blue stain PH 2.5 100 X)

Urethra

This study showed that the urethra of the indigenous sheep presented two portions; pelvic and penile (spongy) portions (figure 4, 5). This coincide in literature of (15 - 22). On other hand.The male urethra of rat and mouse showed also two portions: pelvic and penile portions.(23)

However (24 - 26), in horse, (27 - 29), in human reported that the urethra consists of three parts, prostatic, membranous, and spongiosus parts. While (30 -32) in human, stated that the urethra consists of four parts, prostatic, membranous, bulbous and pendulous; this division stated on the present of well developed prostate gland.

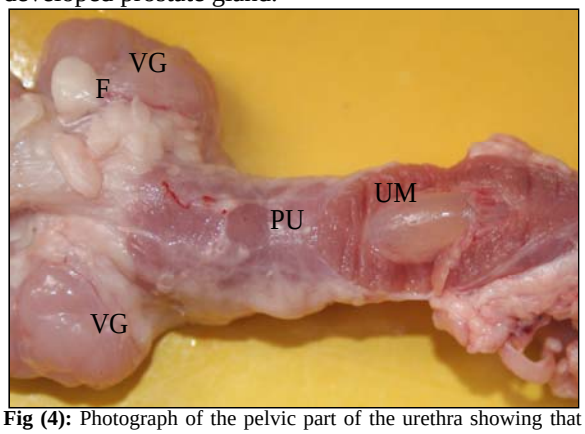


Fig (4): Photograph of the pelvic part of the urethra showing that the pelvic urethra (PU) full with urine, urethralis muscle (UM), vesicular gland (VG), fat (F)

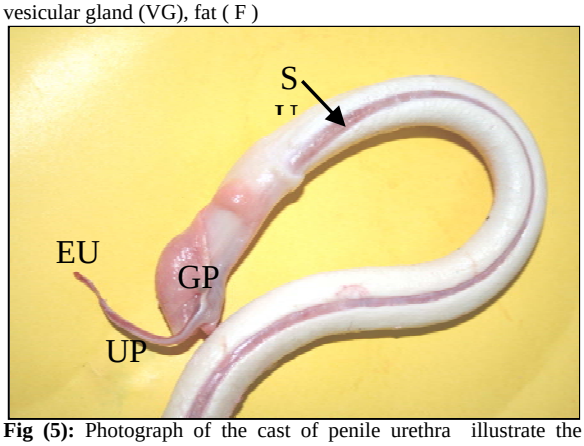


Fig (5): Photograph of the cast of penile urethra illustrate the penile urethra (SU) embedded in deep penile groove, urethral process (UP), glans penis (GP) , external

* Microtome - Leica.RN 2235. Germany.

The penile (spongy) part of urethra extends from the penile bulb to the external urethral orifice. It's longer than the pelvic urethra (Fig5). Dissecting pelvic urethra of the indigenous sheep revealed that the presence of a very well developed prominent urethral crest on the dorsal surface and extend caudally only to the middle of the urethra (Fig. 7) and this is not described in the literature(20)in ram, but (9;33) they mentioned the presence of urethral crest in ram. The penile urethra appears as a long tube that embedded with a deep groove in the spongiosum cavernosum.The cross–section through the penis illustrate the urethra which is associated with an unpaired body of erectile tissue of corpous spongiosum and above this there is a layer of the tendenous fiber or corpous cavernosum which is surrounded by thick tunica albuginea (Fig. 6). The terminal portion of the urethra of indigenous sheep has a tortuous worm like projects commonly beyond the glans penis called the urethral process. At the base of glans penis ending, the urethral process is dilated to form an ampullae (Fig 5) and its length presents in(Table 1).This finding is not mentioned by the literature (21;34;35;36;) they found that the urethral process is measured (4 cm) only.

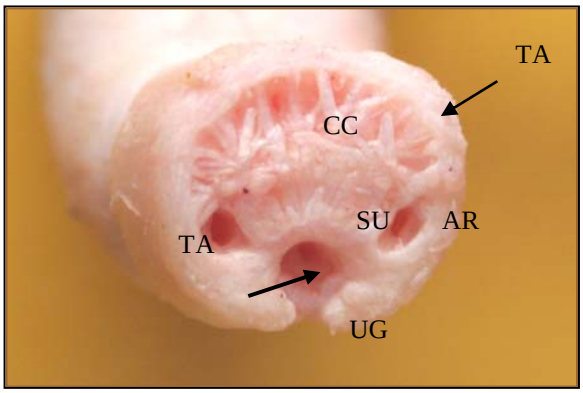


Fig (6): Photograph of the penis (cross section) illustrate the tunica albuginea (TA), corpous cavernous (CC), penile urethra (SU), artery (AR), urethral grove (UG) and corpous spongiosum (CS)

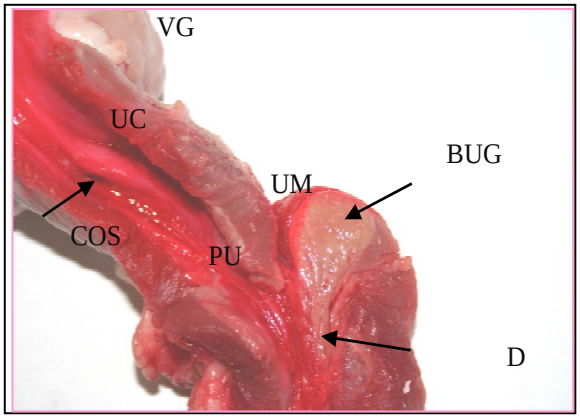


Fig (7): Photograph of the median ventral incision through the urethral muscle (UM) and open the pelvic urethra (PU) illustrate the urethral crest (UC), vesicular gland (VG), colliculus seminalis (COS), bulbourethral gland (BUG) and duct of gland (D).

Table (1): The Distances average of Ampullae, Vesicular gland, Bulbourethral gland and urethral process of indigenous sheep.

Measurement	Avg. Of Length (Cm)	Avg. Of Width (Cm)	Avg. Of Weight(Gm)
Vesicular gland	3.2055	1.16	4.534
Ampullae	5.951	0.935	1.9735
Bulbourethral gland	1.713	1.3405	1.5185
Urethral process	4.307		

Under light microscope the pelvic part of urethra has folded mucosa with irregular wide urethral lumen, while the penile urethral lumen is very narrow and rosette-like appearance (fig.8). This is in accordance with the literature (9). According to (14;37;38), the pelvic part of urethra lines by tunica mucosa which consists of transitional epithelium and presence of a layer of fatty cells under it(fig 9).

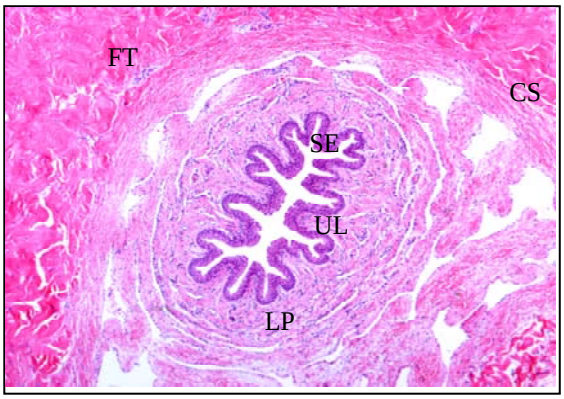


Fig (8): Micrograph of the penis (cross-section) showing the penile urethral lumen (UL), stratified columnar epithelium of penile urethra (SE), lamina propria (LP) and erectile tissue of corpus spongiosum (CS), fibrous tissue (FT). (H & E stain. 40 X**)**

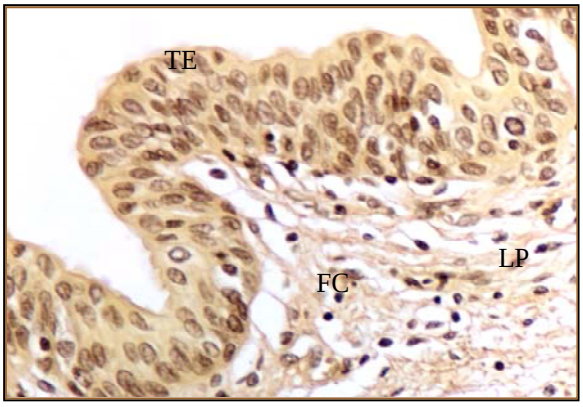


Fig (9): Micrograph of the pelvic urethra (cross-section) showing the transitional epithelium (TE), lamina propria (LP)and numerous fat cell (FC) under the epithelium (Van Gieson stain. 400 X)

The propria submucosa of pelvic urethra contains erectile tissue lining by endothelial cells and contains the disseminate portion of the prostate gland (fig.10). This in agreement with the finding of (26;39;40). The tunica muscularis is composed of inner, outer longitudinal layers and middle circular layer and surrounded by tunica adventitia. Our observation supports these findings . The present observation indicates that the penile urethra has very narrow lumen,and the mucosa forms longitudinal folds which give it a rosette-like appearance on cross–section (Fig.8), and lined by stratified columnar epithelium. Similar finding observed in horse (40) and in human (28;32). According to (41;42) in human, the penile urethra is lined by transitional epithelium and the lamina propria contains urethral gland (gland of litter). This finding dose not supporting our work, the Litter gland is not present in ram. The ampulla of urethral process. Thus, is lined by stratified squamous epithelium with patch's of transitional epithelium while the free end of urethral process is lined by keratinized stratified squamous epithelium. The penile urethra at the glans penis, appears as folded mucosa and lined by non keratinized stratified squamous epithelium (Fig.11) with patch of transitional epithelium and contains a layer of glycoprotein on the surface of the cell. The epithelium rests on a basement membrane which strongly reacted with PAS stain (Fig.12). The lamina propria of the base of the urethral process contains small cavernous spaces. The oblique section through the free end of the urethral process presents the urethral lumen with folded mucosa lined by stratified squamous epithelium with few cavernous structures and is covered by cutanous membrane (skinny structure) that appears keratinized stratified squamous epithelium with keratin layer (Fig.13).

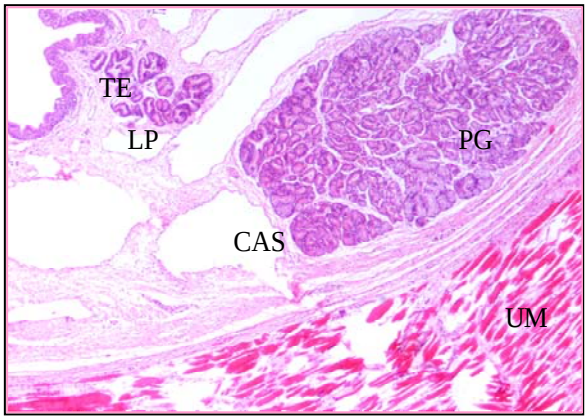


Fig (10): Micrograph of the pelvic urethra (cross-section) showing the transitional epithelium(TE), lamina propria (LP), cavernous space (CAS), prostate gland (PG), urethralis muscle (UM).(H & E stain. 40 X)

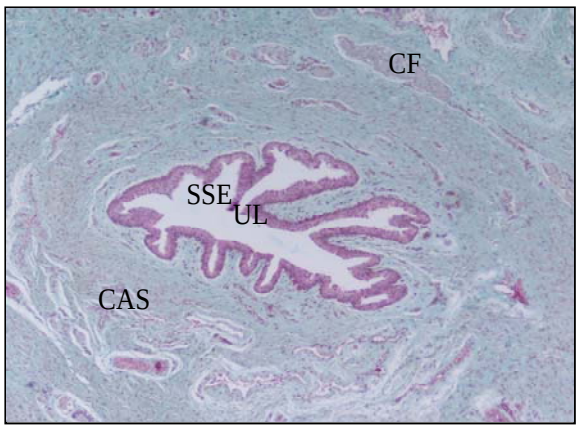


Fig (11): Micrograph of the base of the urethral process (cross-section) showing the stratified squamous epithelium (SSE), urethral lumen (UL), cavernous space (CAS), collagen fiber (CF). (Masson Trichrom stain. 40 X)

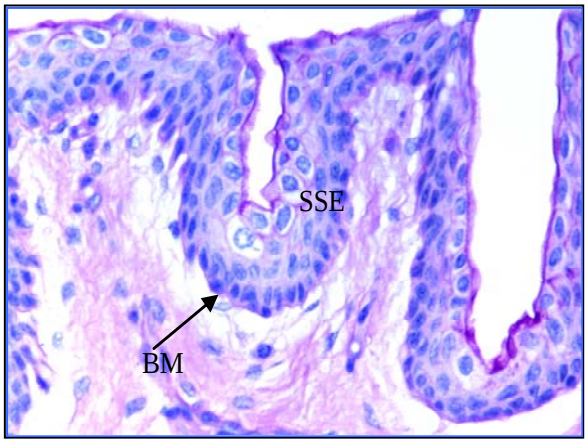
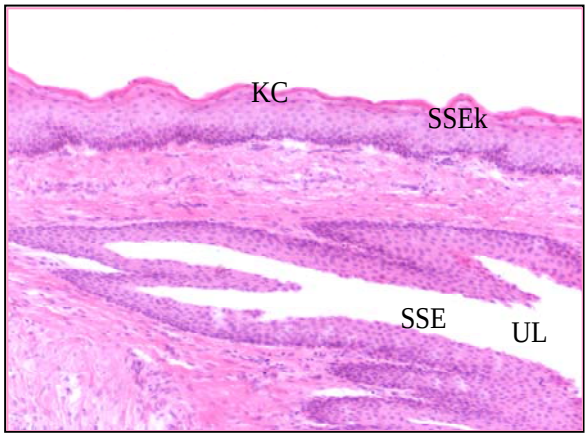


Fig (12): Micrograph of the base of the urethral process (cross-section) showing stratified squamous epithelium (SSE) and Basement membrane (BM). (PAS stain 400X).



Fig€(13): Micrograph of the free end of the urethral process (oblique section) showing the urethral lumen (UL), non keratinized stratified squamous epithelium (SSE), keratinized stratified squamous epithelium (SSEK) and keratinized cell (KC). (H & E stain. 100 X)

Ampulla

This study showed that the ampulla of indigenous sheep is considered as an enlargement of the terminal portion of the ductus deferens, situated at the caudal part of the bladder and between the lobe of vesicular gland (fig.14). It is elongated to fusiform in shape and morphometrically illustrated in (Table 1). This is corresponding to the literature of(10;17;43;44). This study, evident that the ampulla is longer than the vesicular gland and bulbourethral gland (Table 1) which act as a storage of spermatozoa. It is parallel with literature of(45 - 48) who stated that ram, bull and stallion have the ejaculatory duct formed by union of the duct of the ampullae with excretory duct of vesicular gland and that is similar to our study .

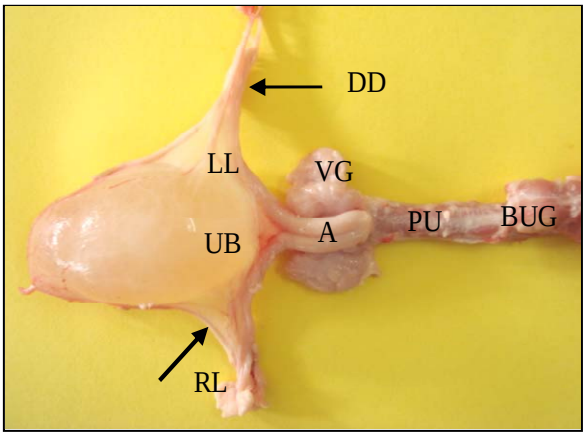


Fig (14): Photograph of the Accessory sex glands showing their relation to the pelvic urethra (PU), urinary bladder (UB), ampulla (A). vesicular gland (VG), bulbo urethral gland (BUG), lateral ligament (LL), rounded ligament (RL), ductus deferens (DD). Fig. Photograph of the Accessory sex glands showing their relation to the pelvic urethra (PU), urinary bladder (UB), ampulla (A). vesicular gland (VG), bulbo urethral gland (BUG), lateral ligament(LL), rounded ligament (RL), ductus deferens (DD).

A section through the ampulla shows branched and tubular with sac like dilatation. The lumen of ampulla is large. The mucosa is irregular because of numerous elongated thin–branching folds with crypts and release the serous secretion (Fig .15). This support (37;38), while the ejaculatory duct of the gland at the urethral passage lined by pseudostratified columnar epithelium (fig.16). According to(49), the lumen of ampulla is larger and the mucosa exhibits numerous thin, irregular, branching folds. Banks mentioned that the lamina propria–submucosa of horse, ruminant and dog contains a gland. These results did not support our finding.

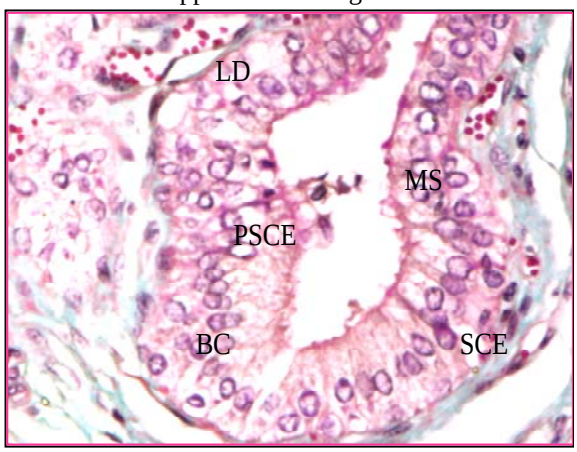


Fig (15): Micrograph of the ampullae showing simple columnar epithelium (SCE), Pseudo stratified columnar epithelium (PSCE), basal cell (BC), lipid droplet (LD) and merocrine secretion (MS). (Masson Trichrom stain. 400 X)

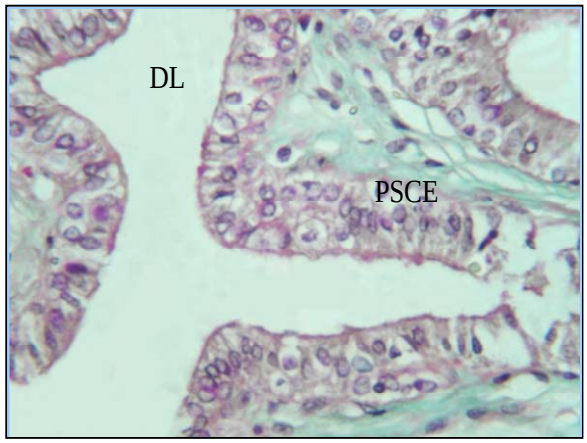


Fig (16): Micrograph of duct of ampullae showing the Pseudo stratified columnar epithelium (PSCE), duct lumen (DL) (Masson Trichrom stain. 400 X)

Vesicular Gland

The vesicular glands of indigenous sheep arranged in grape like covered by thick layer of fatty tissue, with compact lobulated surface that have S-shape and located dorsolateral to the neck of bladder adjacent to the ampullae (fig.17). The excretory duct of the gland joins the terminal part of the ductus deferens to form the short ejaculatory duct which open on the colliculous seminalis in the dorsal wall of the pelvic urethra (fig.7). This finding is similar to the reports of (33;44;50;51;52). While (53; 54; 56) found that the vesicular glands in horse, are of two elongated hollow, pear shaped sac. The observation of (46; 57) that the vesicular gland in boar, consists of two pyramidal masses. While (58)

described that the vesicular gland in rabbits is bilobed which located between two ampullae and ontogenetically arises by fusion of a pair of outgrowths budding from the deferent ducts.

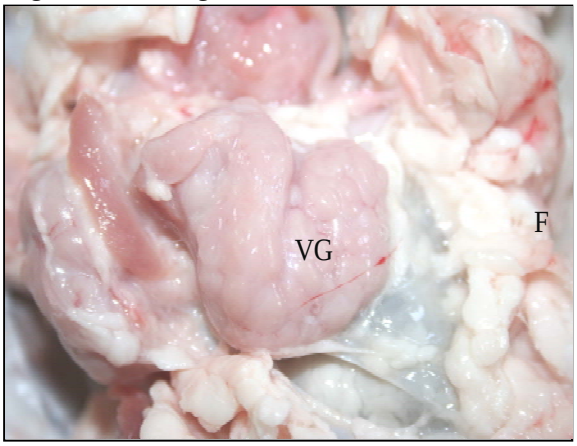


Fig (17): Photograph illustrate the shape of the vesicular gland (VG), fat (F)

Our observation revealed that the vesicular gland is heavier than ampullae and bulbourethral gland (Table 1). It can be concluded that the vesicular gland of indigenous sheep produce large quantity of the seminal plasma for the nourishment of spermatozoa.

The vesicular gland is a compound tubuloalveolar gland, that surrounded by capsule of loose connective tissue mostly contains collagen and smooth muscle fibers strongly reacted with masson trichrom stain send trabecule to divided the gland into lobules (fig .18). The gland is lined by simple columnar epithelium consisting of tall columnar cells that reach the surface, with small basal cells. The secretory cells each of which has a single ovoid nucleus (fig.19). This is in agreement with finding of (37;50; 59). According to (39) in bull, (12) and (14) in human, it is stated that the vesicular gland is lined by pseudostratified columnar epithelium. Our Present observation indicates that the duct of vesicular gland is lined by simple columnar epithelium (fig.20). These finding is supported by (38) While (40) found that the duct of gland is lined by stratified columnar epithelium, this does not support our finding.

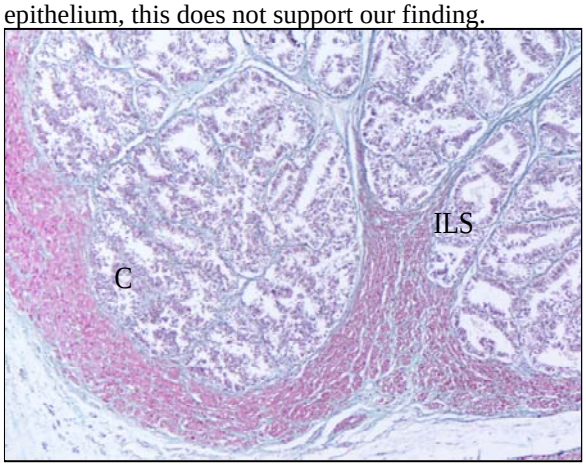


Fig (18): Micrograph of vesicular gland showing the capsule of gland (C) interlobular septum(ILS).(Masson Trichrom stain. 40 X).

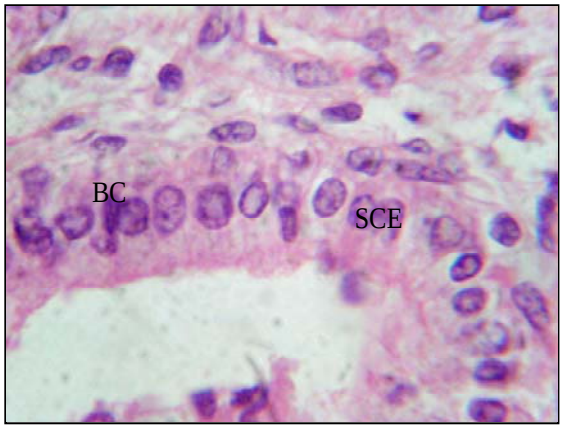


Fig (19): Micrograph of vesicular gland Showing the simple columnar epithelium (SCE),short basal cell (BC). (H & E stain. 1000 X)

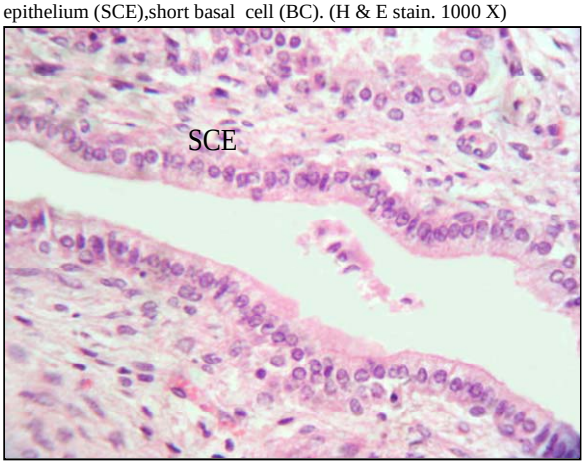


Fig (20): Micrograph of the vesicular gland showing the duct that lined by simple columnarepithelium (SCE). (H & E stain. 400 X).

Prostate Gland

The prostate glands of indigenous sheep are not well developed only the disseminate part of prostate is observed by light microscope. This is in agreement with literature (9;10;36;56;60). In contrast (52) stated that the prostate gland of sheep consists of two lateral lobes which are connected by an isthmus, this does not support our result.

According to the (46) in bull and (17) in boar they mention that the prostate gland is composed of two portions; body and disseminate parts .In horse (50;51;61) the prostate gland consists of two bodies and a small connecting isthmus. In contrast the prostate gland of camel has an H-shape . (62)

The microscopic result of our study shows that the disseminate part of prostate gland is distributed within submucosa of pelvic urethra (fig .21). This is supported by(50;56) .The secretory alveoli are lined by simple columnar cell or pyramidal cell and the secretion of gland is seromucoid which showing strong to moderate reaction with PAS stain (fig.22). These results were similar to the findings in bull (38;40) .According to(26)in bull,(13;42;63)in human, they reported that the epithelium of gland is pseudostratified columnar epithelium. The observations in the present study do not support these findings. The epithelium of duct is pseudostratified columnar epithelium which strongly reacts with PAS when opens in the pelvic urethra (fig.23).This finding is not previously described in

literature.The epithelium then changed to pseudostratified columnar epithelium when reaching the pelvic urethra. On other hand the secretion of the gland is seromucoid (Fig. 24)

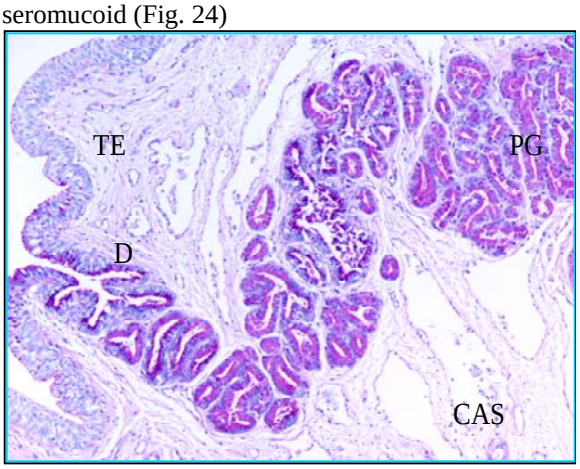


Fig (21): Micrograph of the pelvic urethra (cross-section) showing the prostate gland (PG), ransitional epithelium (TE), cavernous space (CAS), duct of prostate gland (D). (PAS stain 100X)

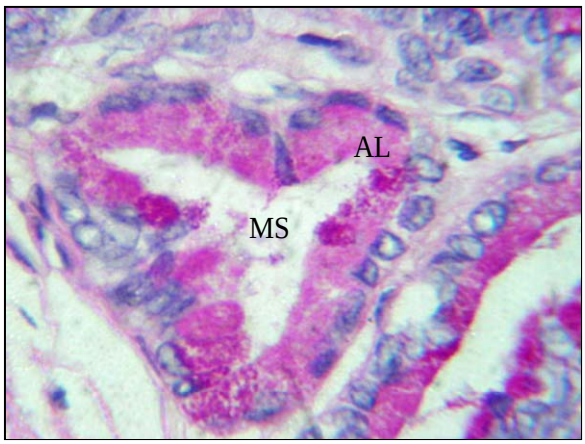


Fig (22): Micrograph of prostate gland showing the alveoli of gland (AL), merocrine secretion (MS). (PAS stain. 1000 X)

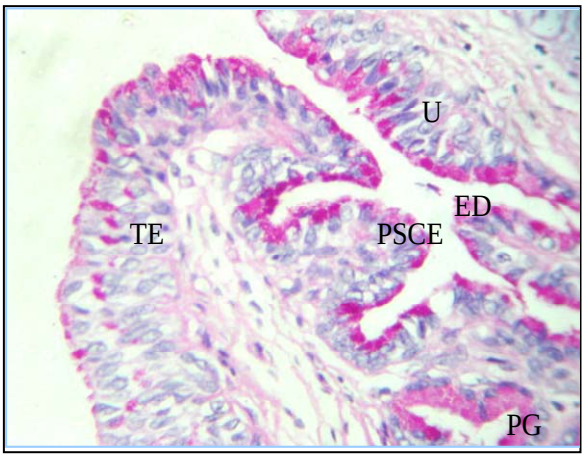


Fig (23): Micrograph of the pelvic urethra (cross-section) showing the transition from glandular to transitional epithelium (TE) when an excretory duct (ED) of prostate gland (PG) open into pelvic urethra (PU), pseudostratified columnar epithelium (PSCE).(PAS stain 400X)

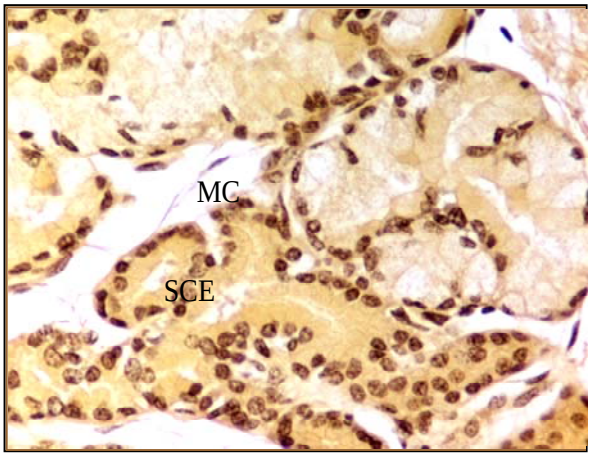


Fig (24): Micrograph of prostate gland showing the seromucoid type of secretion, simple columnar epithelium (SCE), myoepithelial cells (MC). (Van Gieson stain. 400 X)

Bulbourethral Gland

The bulbourethral gland is closely related to the bulb of the penis and has almond or ovoid in shape (fig 25). This is in parallel with the literature of (10;17;33). In addition(46;51;54;64)it was found that the bulbourethral gland in pig consists of two large cylindrical lobes that lie on either side of the pelvic urethra.However(8;57) observed that the bulbourethral gland in bull and horse are spherical and cylindrical respectively and lie dorsal to the urethra.

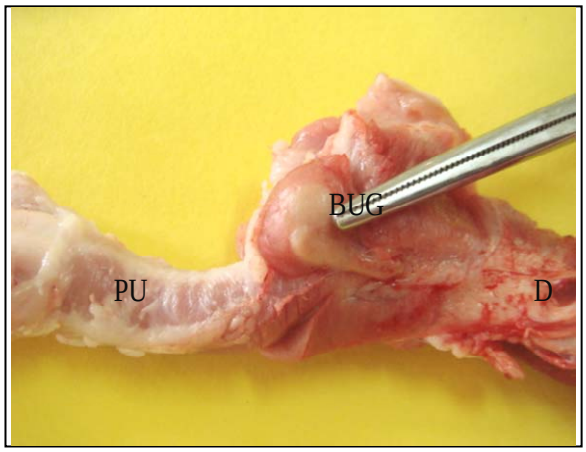


Fig (25): Photograph illustrate the position of the bulbourethral gland (BUG), pelvic urethra (PU), the duct of gland (D).

The right and left lobes of the glands have one excretory duct that opens into urethra (Fig:26)

The present study revealed that the capsule surrounding the bulbourethral gland of indigenous sheep is composed of dense collagen fibers, blood vessels and nerves with striated muscles (fig.27), as this finding is described in literature of (26;38). According to (58;65) in rabbit, (37)in ram, (28;63)in human, the gland lined by simple columnar epithelium. This is in parallel to our finding. The gland is lined by simple columnar to pyramidal epithelium with basophilic cytoplasm and basaly displaced rounded or flattened nuclei (Fig.28). The secretory units vary in structure and size, most of them are alveoli, saccular and others are tubular, or of varying shapes.

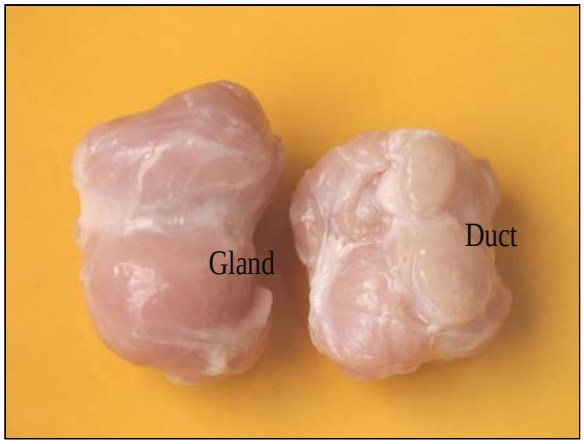


Fig (26): Photograph of the Bulbourethral gland showing the paired gland at left side (dorsal), theduct of gland at right side (ventral).

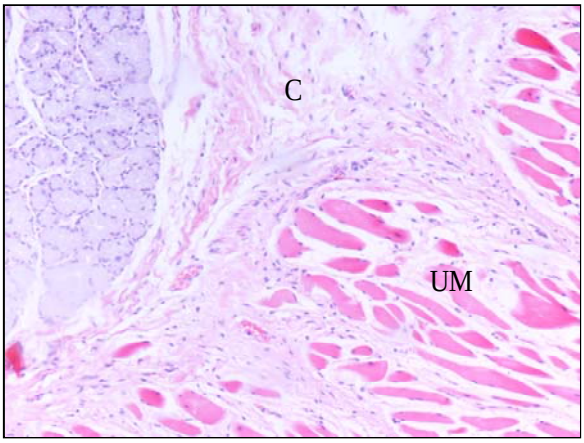


Fig (27): Micrograph of bulbourethral gland showing the capsule of gland (C), urethral muscle (UM). (H & E stain. 100 X)

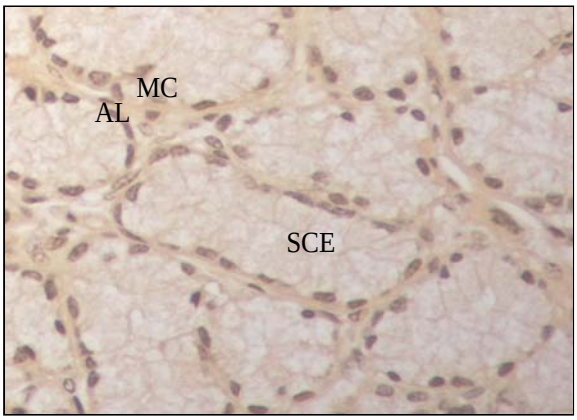


Fig (28): Micrograph of bulbourethral gland showing the alveoli (AL),the simple columnar epithelium (SCE)with basally displaced nucleus, myoepithelial cells (MC). (Van Gieson stain. 400 X)

secretion of bulbourethral gland in the indigenous sheep was mucous with patch's of serous unit which was in agreement with the finding of (38). However, (32;41) in human, illustrated that the secretion of gland was mucous. The excretory duct of the bulbourethral gland of indigenous sheep is lined by simple columnar epithelium even at its ending at the urethral passages (fig.29). This finding is supported by (38;40;49). In our study, it is presented that the spindle shaped myoepithelial cells found between the alveoli of bulbourethral gland in the indigenous sheep to have a contractile effect on gland for releasing their secretion and clearing urethra then acts as lubricate (fig.30). This is in agreement with the observation of (39;41;66).

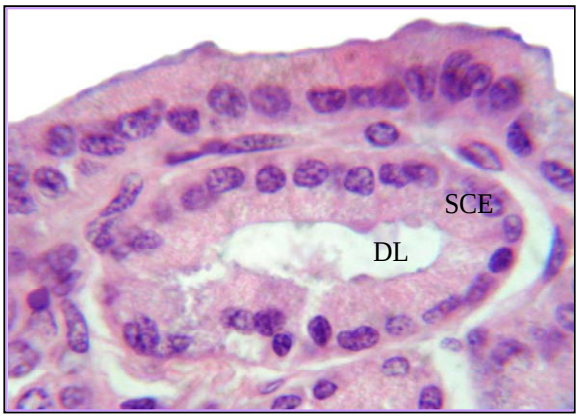


Fig (29): Micrograph of duct of bulbourethral gland showing the simple columnar epithelium(SCE),duct lumen (DL). H & E stain. 1000 X)

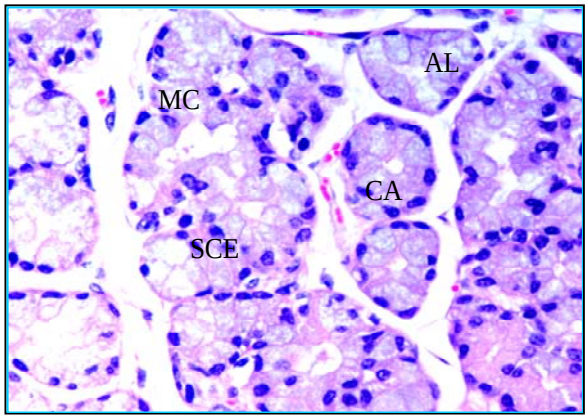


Fig (30): Micrograph of bulbourethral gland showing the seromucoid type of secretion alveoli (AL), the simple columnar epithelium (SCE), myoepithelial cells (MC), Capillary (CA). (H & E stain. 400 X)

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الخلاصة

أظهرت الدراسة إن المثانة البولية للأغنام المحلية تمتلك شكلاً بيضوياً إلى شكل كمثري. كما وجد إن سمك الطبقة الظهارية الانتقالية (transitional epithelium) للمثانة البولية تعتمد على درجة امتلاء المثانة بالبول وأظهرت الدراسة على ان الاحليل يقسم إلى قسمين هما الاحليل الحوضي (pelvic urethra) والاحليل القضيبي (penile urethra).

ومن النتائج المهمة التي توصلنا اليها وجود (urethral crest) في داخل الاحليل الحوضي وكذلك نتوء احليلي(urethral process) يبرز على شكل امتداد دودي ملتوي ,يبطن بالنسيج المطبق الحرشفي (non stratified squmaous epithelium keratinized).

ويمكن تحديد مسار الاحليل بحقنه بمادة (corrosive cast) .كما تبين ان الاحليل القضيبي يتألف من الغلالة المخاطية التي تبطن بظهارة مطبقة عمودية (stratified columnar epithelium)

والغدد الجنسية اللاحقة تتألف من أمبورة الاسهر(ampullae) الحوصلة المنوية (vesicular gland) غدة البروستات (prostate gland) و غدتا كوبر (bulbourethral gland) تبينت النتائج إن أمبولة الاسهر تكون أطول من الحوصلة المنوية وغدتا كوبر, بينما كانت الحوصلة المنوية اكبر وزناً من أمبولة الاسهر وغدتا كوبر. تشير النتائج إلى إن أمبولة الاسهر تمتلك شكلاً طولياً مغزلياً وتقع الغدة في عنق المثانة بينما الحوصلة المنوية تمتلك شكلاً يشبه حرف S بالانكليزي وتقع على الجهة الجانبية السطحية من عنق المثانة في حين ان غدتا كوبر تمتلك شكلاً يشبه حبة البزاليا إلى شكل بيضوي وتقع على السطح الظهري من الناحية الخلفية للاحليل الحوضي. أظهرت نتائج الدراسة النسيجية للغدد الجنسية اللاحقة بأن جميع الغدد تتألف من نوع واحد من الظهارة وتشمل الطبقة الظهارية العمودية البسيطة (simple columnar epithelium), إن إفراز غدة البروستات يكون إفراز مصلي (serous secretion) إلى إفراز مصلي مخاطي (seromucos secretion)بينما غدتا كوبر تنتج إفراز مخاطي (mucous secretion),وجميع قنوات الغدد تبطن بنوع واحد من الظهارة وتتضمن الظهارة العمودية البسيطة (simple columnar epithelium) ما عدا قناة غدة البروستات التي تبطن بالظهارة المطبق الكاذب(pseudo stratified columnar epithelium).

پوختە

ئەنجامێن کەلشتنێ دیار بو کو میزدانکا بەزێ ئاسایێ ب شێوێ هێلکەیێ تا شێوێ هەرمی. دئەنجام دا دیار بو کو میزدانك یا پێك هاتیە ژ Tunica mucosa کو پێك دهێت ژ پەردەیا دەرقەیا گوهێزی Transitional epithelium و Lamina propria of connective tissue ستیراتیا پەردەیا دەرقەیا گوهێزی Transitional epithelium یا جیاوازە لدیف رادەیا مەزن بونا (پف بونا) میزدانکێ ب میزێ هەروەسا مە د ڤەکولینا خودا دیارکریە کو زاما پەزێ سروشتی هاتیە دابەشکرن بو دوو بەشا Pelvic and Penile Urethra ئەنجامەکا دیتر یاگرنگ هەبوونا پێشڤەچونێن زامی ل دیماهیکا زامێ بو کو وەکو کرمەکێ درێژ بویی (urethral process) بو ل دەرفەی Glans penis. نیشانا گرنگ هەبونا پێشڤەچونێن زامی بو هاتیە روکێش کرن ب stratified squamous epithelium non keratinized و هاتیە نخافتن ب پیستی دڤێ ڤەکولینێ دا مە دیت کو penile urethra پێك هاتیە ژ tunica mucosa کو دهێتە روکێش کرن ب stratified columnar epithelium دگەل lamina propria کو کێم تر ڤالاتیا cavernous یا هەی بەراور دگەل pelvis urethra .

ئەف ڤەکولینە دیار دکەت کو لفکێن زایەندی یێن بەزێ بنەجی یێ سروشتی بێك دهێت ژ Ampullae , Vesicular gland , Prostate gland و Bulbourethral gland, ڤەکولین شروڤەتکەت برێژایێ ئەنجاما لێگەریانا کەلشتنێ و شێوێ لێفکێ gland morphology یا بەزێ سروشتیدا و ڤان ئەنجاما بەراوەرد دکەت دگەل ئەنجامێن بەری نوکە ل گیانەوەرێن دیتر . Ampullaeدرێژتر بو ژ Vesicular glandو Bulbourethral gland لێ Vesicular glandگرانتر بو ژ Ampullae و Bulbourethral gland.

ڤەکولینا مە دیاردکەت کو Ampullae یا درێژە وەکو شێوێ تەشی یێ و یا ل گەردەنا میزدانکێ , vesicular gland وەکو شێوێ بیتا S ە و یال dorsolateral ل گەردەنا میزدانکێ , Bulbourethral gland وەکو شێوێ گروڤر یان هێلکەیێ و یال دوماهیکا جوکا میزێ Pelvic urethra .

ئەنجامێن مە دیار دکەت کو هەمی لفکێن زایندی هاتین روکێش کرن ب simple columnar epithelium رژاندنا لفکا serous ,prostate بو seromucous لێ یا لفکا Mucous,bulbourethral بو mucoserous, بوریێن لفکا بشیوەیەکێ ئاسایێ هاتنە روکێش کرن ب simple columnar epithelium ژبلی بوریا لفکا prostate کو دهێتە گوهرین ژ simple columnar epithelium بو Psedostratified columnar epithelium .

رێنمايێن بەلاڤكرنێ ل گوڤارا (زانكويا دهوك) ێ

گشتی:

پێدڤيە ڤەكولين يا بزارە و سەراپايی بيت و پێشوەخت نەهاتبيتە بەلاڤكرن يان شاندن بۆ چ گوڤارێن ديتر. ديسان پوختەيەك و پێشەكيەك و رێبازەكا فەكولينێ يا يەكگرتی و ئەنجام و ژێدەران بخوڤە بگريت، زێدەباری وێ چەندێ كو نابيت هيچ ڤەكولينێن لقێ زانستی ژ (20) لاپەڕان پتربن و ڤەكولينێن لقێ زانستێن مروڤايەتی ژی ژ (25) لاپەڕان پتر بن .

ناڤەروك:

پێدڤيە ڤەكولين ب رێنڤيسەكا ئاسايی (نورمال) بهێتە نڤێسين و ب فۆنتێن نڤێسينا كوردی (Ali-k-traditional) قەباريێ (16) بيت. دەربارەی دەسپێكرنا پەرەگرافان ژی ، پێدڤيە ل دەسپێكا هەر پەرەگرافەكی بۆشايەكا پێويست هەبيت .

پەراوێز:

نابيت پەراوێز د ناڤ تێكستيدا بهێنە بكارئينان .هەمی پەراوێز دێ كەڤنە دوماهيا ڤەكولينێ.

بەرهەڤكرنا لاپەری :

پێدڤيە لاپەڕ ژ جورێ (A-4) بيت و بۆشايا ل سەرێ وی و ل بنێ وی (2,5 سم) بن و لايێ ڕاستێ (3 سم) بيت و لايێ چەپێ ژی (2 سم) بيت .

رێزبەندیا لاپەڕان:

دەربارەی رێزبەندیا لاپەڕان پێويستە ژمارە ل كوژێ چەپێ يێ بنێ هەر لاپەڕەكی بهێتە دانان .

ناڤونيشان:

ناڤونيشانێن ڤەكولينێ دێ ب خەتێ ()قەباريێ(18) فۆنتێن كوردی قەباريێ (18) ل نيڤا لاپەڕی هێنە نڤێسين ، ديسان ناڤو نيشان و سەرەبابەتێن ژ ناڤدا ژی دێ ب نڤێسينەكا ديار هێنە نڤێسين . هەمی ناڤونيشانێن لاوەكييێن ناڤ ڤەكولينێ دێ بڤی ڕەنگێ ژێری هێنە ژمارەكرن ، يێن سەرەكی (1.، 2.، 3.، ..) ، يێن لاوەكی ژی (1.1) يێن لاوەكی تر ژی (1.1.1.) و هتد .

ناڤێ ڤەكولەری:

ناڤێ ڤەكولەری پێويستە ب خەتی(Ali-k-traditional)قەباريێ (13) بهێتە نڤێسين و ل نيڤا لاپەڕی ، ب مەرجەكی بكەڤيتە بن ناڤونيشانێن ڤەكولينێ و بۆشايی د ناڤبەرا هەردووكاندا هەبيت ، هەروەسا نەگەهيتە هەردوو لايێن ڕاست و چەپێ يێن لاپەڕی . پاشی د رێزا دبندا ناڤونيشانێن زانستی و كاريێن ڤەكولەری ، هەروەكو ڤێ نموونا ژێری بهێنە تومار كرن :

1-پشكا جوگرافی ، كوليژا ئادابێ ، زانكويا دهوكێ ، عێراق ، ههرێما كوردستانێ ، عێراق .

2-پشكا زانستێ ئاخ و ئاڤێ ، كوليژا چاندنێ ، زانكويا دهوكێ ، عێراق ، ههرێما كوردستانێ ، عێراق .

كورتيا ڤەكولينێ:

پەيڤا (كورتيا ڤەكولينێ) دێ ب خەتەی (Ali-k-traditional)قەباری(15) ل لايێ ڕاستێ يێ لاپەڕی هێتە نڤێسين . نابيت كورتيا ڤەكولينێ ژ (300) پەيڤان تێ بپەڕيت و هەرچار كليلێن پەيڤان (Key word) دێ كەڤنە بنێ كورتيا ڤەكولينێ و پێدڤيە ب خەتەكێ ديار و لار (Italic)قەباريێ(13) بهێنە نڤێسين . بۆ نموونە :
كليلێن پەيڤان : زانستێ زمانی ، دەنگسازی ، دەنگسازيا كوردی ، هێز و ئاواز .

دیسان پێدڤیه ، ئەگەر ڤەكولین ب چ زمان بوو (كوردی ، عەرەبی ، ئنگلیزی) كورتیا ڤەكولینێ ب هەردوو زمانێن دیتر ژی د گەلدا بیت . بۆ نموونه : ئەگەر ڤەكولین ب (زمانێ كوردی) بوو ، پێویسته كورتیا وێ ب هەردوو زمانێن (عەرەبی و ئنگلیزی) ژی د گەلدا بیت .

وێنه و خشته:

ژبلی خشتا هەمی هێلكاری و نەخشه و وێنه، وەك وێنه دهێنه هژمارتن . پێدڤیه ژمارێن عەرەبی ل سەر هەمی نەخشه و وێنا بهێنه دانان ، دیسان پێدڤیه ئەڤ نەخەشه و وێنه نەهێنه كەرتكرن بۆ لاپەڕەیەكێ دیتر و جهێ وان د ئێك لاپەڕەدا بكەت و نەكەڤنه سەر پەراوێز و هژمارێن لاپەڕان . هەروەسا پێدڤیه ناڤێن وێنه و خشتا د سەر واندا بهێنه نڤێسین ، كو ناڤەراستێ بگریت و ژ ڕێزەكێ و پتر بۆشایی د ناڤبەرا خشته و وێنا و ناڤێن واندا هەبیت . بۆ نموونه :

خشته (1): هندەك زانیاری ل سەر دامەزراندنا كولیژێن زانكویا دهوك

كولیژ	سالا دامەزراندنێ	پشكێن وێ
پزیشكی	1992	نشتگەری ، ..
ئاداب	1994	زمانێ كوردی ، ..

ژێدەر:

پێدڤیه بۆ تومارگرنا ژێدەران ، ل دەسپێكێ ناڤێ ڤەكولەری بهێته نڤێسین ، پاشی سال دناڤبەرا دوو كڤانادا ، واته شێوازێ (APA) بهێته پەیڕەوكرن و ئەگەر زانیاریێن ژێدەرەكی ژ ڕێزەكێ بورین ، وی دەمی درێزا دبندا دێ هێنه تەواوكرن ، ب مەرجەكی (1) سم بۆشایی ل سەرێ ڕێزێ بمینیت . ئەگەر ژ ژێدەرەكی پتر یێن ئێك نڤێسەر دڤەكولینێدا هاتنه بكارئینان وی دەمی ، هەمان شێوازێ (APA) دێ هێته بكارئینان ، بەلێ پشتی تومارگرنا سالێ دێ بۆ ژێدەرێ ئێكێ (أ) ب ڕەخ سالێڤه هێته نڤێسین و بۆ یێ دوێ (ب) و ..هتد .بۆ پتر پێزانینا ل سەر بكارئینانا ژێدەرا چ كتێب بن یان گۆڤار و ڕۆژنامه و تورا ئەنترنێتێ ..هتد . بەرێ خوبدە خالا (References) ژ ڕێنمایێن بەلاڤكرنێ ل گۆڤارا زانكویا دهوك ب زمانێ ئنگلیزی .

پێشكێشكرنا ڤەكولینێ:

پێشكێشكرنا ڤەكولینێ بۆ گۆڤارێ دێ بقی ڕەنگی بیت :

1- چار دانەیێن كۆپیكری ژ ڤەكولینێ .
2- CD یێ ڤەكولینێ كو تێدا فایلەكا (Microsoft word document Format) هەبیت ڤەكولینێ بخوڤه بگریت و ل سەر ڤی ناڤونیشانێ ل خارێ بهێته پێشكێشكرن بۆ گۆڤارێ :

هەرێما كوردستانێ – عێراق
پاریزگەها دهوك
سەروكاتیا زانكویا دهوك
سكرتاریەتا دەستەكا نڤێسەرێن گۆڤارا زنكویا دهوك
ژمارا تەلەفونێ : 062-7225259
E-mail:jdu@uod.ac

ئەگەر ڤەكولەر یێ ژ دەرڤەی پاریزگەها دهوكێ بیت د شێت ب ڤی ناڤەنیشانێ ژێری ڤەكولینا خو پێشكێشی گۆڤارێ بكەت (www.jdu.uod.ac/Submissions.htm)

تێبینی:- كوڤار بتنێ ئەوان ڤەكولینان بلاڤ دكەت ئەوێن ناستێ هەلسەنگاندنا وان دگەهیته پلا (رەسەن) یان (بەهادار).

تعليمات النشر في المجلة جامعة دهوك

يجب ان تكون البحوث المنشورة في المجلة مستوفية لقواعد النشر وخاضعة للتقييم العلمي، ولم يسبق ان نشرت او قدمت للنشر الى اية جهة اخرى، ويجب ان يتضمن البحث خلاصة ومقدمة، وان يتبع الباحث طريقة موحدة ومنهجا واضحاً في البحث، وان يحدد النتائج التي توصل اليها والمصادر التي اعتمد عليها، وأن لا تتجاوز عدد صفحاته عن (20)عشرين صفحة بالنسبة للبحوث العلمية، و(25)خمس وعشرين صفحة للبحوث الإنسانية.

التعليمات الخاصة بشكل وترتيب البحث:

1. المضمون:

يجب ان يكون مطبوعا بنمط (عادي)، خط (Traditional Arabic)، حجم (14)، تباعد الأسطر(تقريبي 12)، المحاذاة (مضبوطة).

2. الهوامش :

تكتب الهوامش في اخر البحث.

3. اعداد الصفحة:

يطبع البحث على ورق حجم (A4) مع ترك (2.5 سم)من يمين الصفحة، (2 سم) من يسار الصفحة و(3 سم)من الجهتين العليا و السفلى.

4. ارقام الصفحات:

تكتب أرقام الصفحات في الجهة اليسرى من أسفل الصفحة.

5. العناوين:

يكتب العنوان الرئيسي للبحث بخط بارز وسط الصفحة، ويفضل ان يكون شاملا ومختصرا، نوع الخط (Traditional Arabic) و بحجم (15).وأما العناوين الرئيسة داخل البحث فتكتب بحجم (15) وبخط بارز في وسط الصفحة، أما العناوين الثانوية داخل البحث فتكتب بحجم (14) وبخط بارز على يمين الصفحة، مع التأكيد على استخدام طريقة الاعداد (1-1-1)، (1-1-2) في ترتيبها.

6. اسم الباحث:

يتكب اسم الباحث (الباحثين) والقابهم العلمية وعناوين عملهم تحت العنوان الرئيسي للبحث في وسط الصفحة، نوع الخط (Traditional Arabic)،حجم(11).

(انظر المثال الاتي)

محمد علي أمين* و ريبر فتاح ظاهر**

*** قسم ادارة الاعمال- كلية الادارة و الاقتصاد- جامعة دهوك- اقليم كردستان العراق- العراق.**

** **قسم الاقتصاد-كلية الادارة و الاقتصاد - جامعة دهوك- اقليم كردستان العراق- العراق.**

7. الخلاصة:

يكتب الباحث ملخصاً لبحثه ، يوضح فيه باختصار هدف البحث والنتائج وأهم التوصيات على ان لاتزيد كلمات الملخص عن (300) ثلاثمائة كلمة، و تكتب الخلاصة بخط (Traditional Arabic)، حجم(12)، تباعد الأسطر (مفرد)، يجب على الباحث اختيار ما لا يقل عن أربع كلمات دالة ليتم استخدامها كمفاتيح للبحث، تكتب بخط(Traditional Arabic) مائل، حجم(12) في نهاية الخلاصة.

(انظر المثال الآتي)

التجارة الدولية، القانون التجاري، منظمة التجارة الدولية، الدول النامية.

من الضروري ان يكتب الباحث فى نهاية البحث ملخصا للبحث باللغتين الكردية والانكليزية ان كان البحث مكتوبا باللغة العربية،او بالعربية والانكليزية ان كان البحث مكتوبا باللغة الكردية، او بالعربية والكوردية ان كان مكتوبا باللغة الانكليزية.

8. الصور والجداول:

- ترقم جميع الجداول والاشكال التي قد ترد في البحث، وتطبع على اوراق منفصلة، وبواقع جدول في كل صفحة، ويعطى لكل جدول عنوان مختصر يكتب في اعلاه بخط بارز، اما الاشكال التي قد تكون عبارة عن خطوط بيانية او خرائط او صور فتوضع داخل صفحات البحث وترقم، وتعنون بعناوين مختصرة توضع اسفل الشكل.

المصادر العلمية المعتمدة:

*يفضل استخدام الطريقة العلمية في كتابة المصادر، بالنسبة للبحوث العلمية فتكتب كل التفاصيل المتعلقة بالمصادر، وفي حال تجاوز عنوان احد المصادر السطر الواحد، يترك فراغ(1سم) في بداية السطر التالي وترتب المعلومات على النحو التالي :

أ . اسم المؤلف أو المؤلفين .

ب . تاريخ الطبع أو النشر .

جـ . اسم المصدر (كتاب أو بحث) .

د . دار النشر بالنسبة للكتب ، والمجلة بالنسبة للأبحاث العلمية.

وكما هو مبين في الأمثلة الآتية :

- د .عبد المقصود محمد عبد المقصود ،(1423هـ - 2006 م)، دراسة البنية الصرفية في ضوء اللسانيات الوصفية ،ط1، الدار العربية للموسوعات، بيروت.

- أ.د حسام سعيد النعيمي ،(شوال 1423هـ -كانون الثاني 2003 م)،جهود القدماء في دراسة المقطع الصوتي ،مجلة آفاق الثقافة والتراث ،دبي ،السنة العاشرة ،العدد الأربعون ،الصفحات : (65-87).

*أما بالنسبة للبحوث الإنسانية فتكتب مصادرها بالطرق التقليدية المعروفة والمتبعة. وعلى النحو التالي: اسم المؤلف أو المؤلفين، اسم المصدر، رقم الطبعة، مكان الطبع (دار النشر والدولة)، سنة الطبع، رقم الصفحة. وأما إن كان المصدر من أجزاء متعددة فيكتب الجزء بعد اسم المصدر.

*الانترنيت :

في حالة اعتماد الباحث على الانترنيت عليه الرجوع إلى الأبحاث العلمية الخاضعة للتقييم العلمي، والمنشورة على شبكة الانترنيت مثل المجلات الالكترونية والكتب والمراجع العلمية الالكترونية .

9. يحفظ البحث على قرص (CD) ويسلم إلى مجلة جامعة دهوك مع أربع نسخ مطبوعة، إما بشكل مباشر ، أو يرسل عن طريق عنوان المجلة البريدي:

إقليم كردستان – العراق
رئاسة جامعة دهوك
سكرتارية هيئة تحرير مجلة جامعة دهوك
البريد الالكتروني :
Email: jdu@uod.ac.

ملاحظة :تنشر المجلة الأبحاث التي يرتقي تقويمها الى مستوى الأصيل أو القيم فقط.

گوڤارا زانکویا دهوک
زانستی - ئەکادمییە

پەرپەندا 11 | کانونا ئێکێ
هژمارا 2 | 2008

گـوڤـارا زانـكويـا دهـوك

سەرنڤیسەر
پ.د. عمر عبدالمجید الحبیب

سكرتێرێ نڤیسینێ
د. اسماعیل ابابكر

زانكویا دهوك
گوڤارەكا زانستی- ئەكادیمییە
زانكویا دهوك سالانە دەردئێخیت

ناڤ و نیشان:
هەرێما كوردستانا عیراقێ
پارێزگەها دهوك
سەروكاتیا زانكویا دهوك
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