RESULTS AND DISCUSSION

A.1: Survey of the broomrape(*Orobanche crenata*):

Results of the survey of broomrape plants in the broad bean fields during the season 1982- 1983 after flowering of the plants in all provinces of Fayoum indicated that very high infestation of the parasite in all fields of broad bean was noticed in Ibshawai province which showed 100 % percentage of infestation, whereas severity of infestation was very high also which estimated by an average of 350 plants of broomrape in area of one m^2. Itsa province exhibited also very high infestation in both percentage by an average of 90 % and severity by an average of 0 plants of the broomrape in one m^2, but still lower than Ibshawai.

On the other hand, rerely or very low infestation was occurred and all fields were nearly clean and free from broomrape plants in Sanouris province except some spots around Seileme village , which showed 2% average percentage of infestation throughout the areas of broad bean in this province . These results seem to be somewhat realy logic because Sanouris province used to plant a semi- aquatic summer crop " *Juncus arabicus* " in most of the areas. Moreover, all fields were flooded with water most of the season for this crop,and this can affect the broomrape seeds which are located in the soil for the

successive broad bean crop. This can be accepted for it agreed with Palkin and Prockudina (1973) and Zahran (1977) which reported that long periods of flooding the soil reduced the number of attachments of broomrape to the host plants.

Tameiah province in Fayoum Governorate showed also low percentage of infestation by an average of 20 % and severity of 120 broomrape plants per m^2. This result also seems logic because this province used to grow rice in the summer season and the flooded soil may affect seeds of the parasite. These also agreed with the findings of Kott (1969) and Zahran (1977).

Fayoum province, showed also high percentage of infestation with an average of 70 % and also high severity of the parasite with an average of 250 plants per m^2.

The average percentage of infestation of broomrape plants in the broad bean fields at provinces of Fayoum was; 100 , 90 , 70 , 20 and 2 % for Ibshawai, Itsa , Fayoum , Tameiah and Sanouris , respectively. Whereas severity of infestation was; 350 , 300 , 250 , 120 and 25 plants per m^2 for the same successive provinces (Table 2). The two provinces; Ibshawai and Itsa cultivate nearly 60 % of total cultivated area of

broad been yearly at Fayoum Governorate. Moreover the percentage of infestation was 100 and 90 % for Ibshawai and Itsa, respectively. These results can indicate that the broomrape (Orobanche crenata) is becomming a major problem for the production of broad bean at Fayoum Governorate, and the control of this parasite must have more attention and priority in agricultural research.

Table 2 : Survey of percentage and severity of infestation of broomrape plants in broad bean fields in provinces of Fayoum in 1982 - 1983 season.

Provinces	*Area of broad bean/fed.	No.of tested fields		Persentage of infestation %	Severity of infestation average No. of plants / m^2
		infested fields	Healthy fields		
El-Fayoum	4292	175	75	70	250
Sanouris	2621	6	294	2	25
Tameiah	2709	70	280	20	120
Itsa	10873	315	35	90	300
Ibshawai	3139	350	-	100	350

* Area of broad bean in feddans in 1982 - 1983 season annual Report of : Agricultural Economy and Statistics Department, Ministry of Agriculture, 1983.

A. 2: Isolation and identification of the associated fungi:

Isolation of the associated fungi with broomrape plant parts (under and over ground) as bulbs, stems and flowers were done from plants either healthy or with unordinary growth in broad bean fields during the survey of 1982- 1983 season. The samples from under ground parts yielded 128 isolates for all provinces of Fayoum. Whereas over ground parts yielded 114 isolates from shoots (aerial stems and flowers) for all samples which collected together . Majority of the isolates from under ground parts were similar in growth characteristics on artificial media (70 isolates) as colour and rate of growth during the purification process but all the isolates nearly divided into three groups . On the other hand isolates from samples collected from over ground parts were divided into different groups in respect of their characteristics .

The identification of the purified fungi during this study were done in the laboratory using the light microscope at the level of the genus only for all isolates. The observations yielded to the following results (Table 3 and Fig.1);

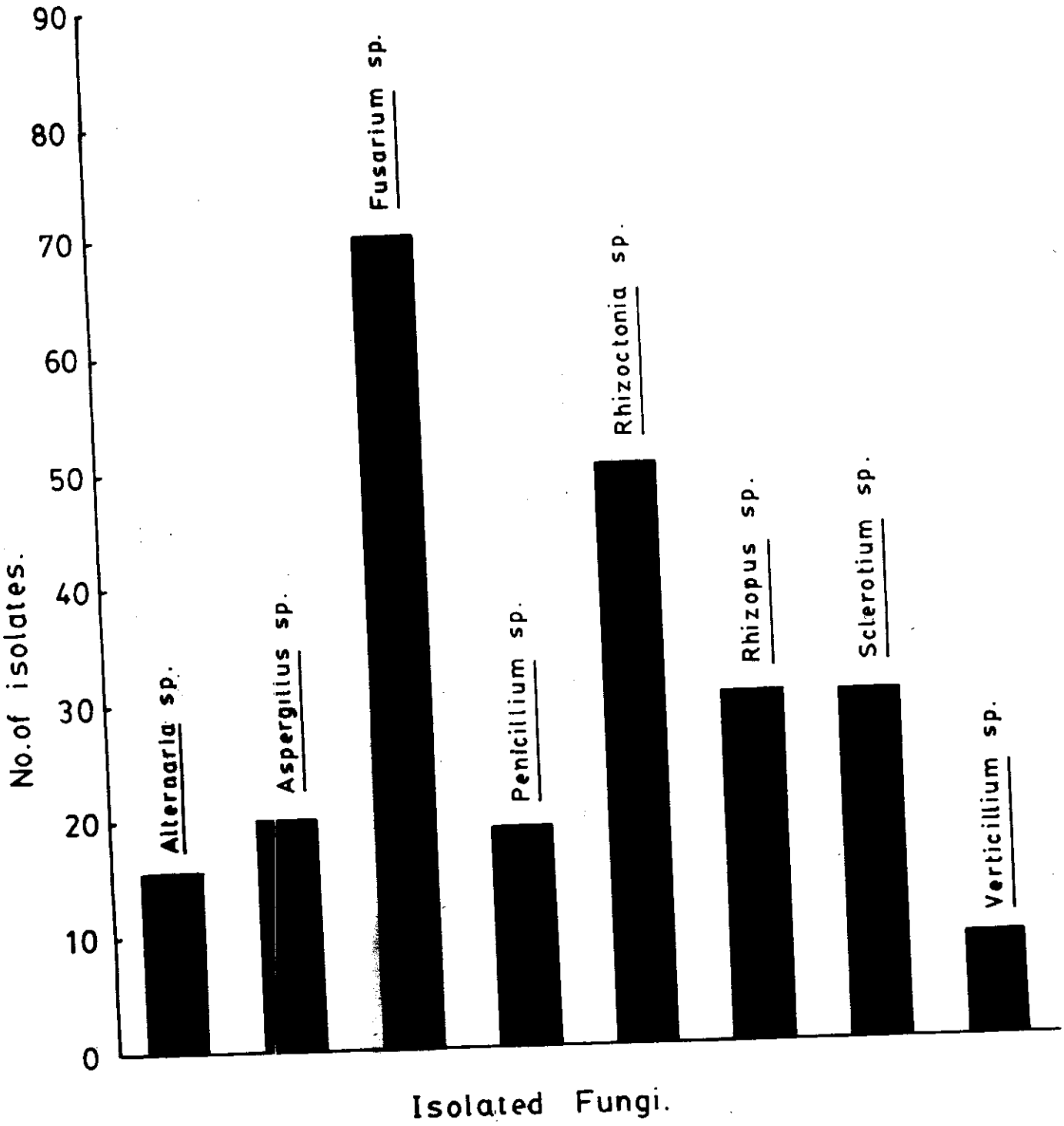
1. Fourty isolates were identified as Fusarium sp., fifty isolates were identified as Rhizoctonia sp., 30 isolates were identified as Sclerotium sp. and 8 isolates were identifiedas Verticillium sp. .

2. The other group of isolates from the shoots (stems and flowers) were identified to the fungi, Fusarium sp.,(30 isolates) ; Rhizopus sp., (30 isolates), Aspergillus sp., (20 isolates), Penicillium sp., (18 isolates) and Alternaria sp.,(16 isolates) in this study.

Table 3 : The isolated fungi from different parts of broomrape plants grown in broad bean fields in Fayoum Governorate during 1982 - 1983 .

The isolated fungi	Number of Isolates	Percentage of isolates to the total No.	Parts of broomrape Plant
Alternaria sp.	16	6.61	Shoots*
Aspergillus sp.	20	8.26	Shoots
Fusarium sp.	70	28.92	bulbs and shoots
Penicillium sp.	18	7.44	Shoots
Rhizoctonia sp.	50	20.66	bulbs
Rhizopus sp.	30	12.40	Shoots
Sclerotium sp.	30	12.40	bulbs
Verticillium sp.	8	3.31	bulbs

* The aerial part of the plant which contained stem and flowers .



Fig[1]: No of isolates for the mentioned Fungi isolated from broomrape plants grown with broad bean plant at Fayoum Governorate.

Previous workers isolated many fungi from broomrape plants ; Duafala et al, (1975) isolated Rhizoctonia solani from necrotic stem of Orobanche ramosa. Some other fungi : i.e Sclerotinia orobanche (Narasimhan and Thirumalacher, 1954) ; F. orobanche (Barloy and Pelhate, 1962) ; Sphaerotheca fulizinea (Poletaeva et al,1963) and Fusarium latoritium , F.gibbosum, F. sambucinum and Verticillium microsporum (Talsakh'yan and Grigoryan , 1978) were isolated from different species of Orobanche. In this connection, Al- Menoufi (1982) isolated Fusarium solani , F. oxysporum, Alternaria spp., Sclerotinia spp. and Gliocladium sp. from rotted broomrape fruits from samples collected from broad bean (Vicia faba L.) fields at Behera , Gharbia and Kafrel - Sheikh Governorates in Egypt.

A.3: Pathogenicity tests:

Experiments for pathogenicity were carried out on broomrape plants grown with broad bean in pots during the season 1983- 1984, the first experiment was conducted to study the pathogenicity test of under ground parts of the parasite in 45 pots . Results showed that infestation of the soil in the pots by the isolated fungi did not affect the under ground parts of the broomrape plants as seeds, bulbs and part of the

stem after periods of 30 , 50 and 90 days from sowing. In all these mentioned periods, the seeds of broomrape in the soil were still clean and healthy without any effect on it by any fungus in the soil. The seeds in all infested pots germinated well and the shoots of the parasite appeared over the ground level, whereas under ground parts as bulbs were healthy at the last inspection same as the control. After inoculating the shoots of the broomrape plants in the same experiment (45 pots) which inoculated for under ground parts and the other 45 pots which were not inoculate before by the fungal growth suspensions, reactions were taken continuously till the end of the experiment. The results showed that all broomrape plants in all treatments became wilted and somewhat dried, also some parts of the shoots were rotted, moreover the bulbs in the soil became rotted and separated from roots of the host easily during observation with dark colour.

All these reactions appeared in all inoculated and uninoculated pots for under ground parts of the parasite, indicating that inoculations on the shoots of the broomrape plants were more effective in appearing the disease symptoms and also in controlling this parasite in broad bean fields than soil infestation. The isolated fungi were pathogenic on the broomrape plants in all

tested treatments and all these tested fungi established a systemic infection with the parasite tissues resulting these mentioned reactions . Moreover, Al-Menoufi (1982) stated that all the isolated fungi, Fusarium solani, F. oxsysporum , Alternaria spp., Sclerotinia spp. and Gliocladium sp. were pathogenic on broomrape plants , on the other hand they were found non pathogenic on broad bean, tomato, flax and wheat plants. Their seeds germinated normally and the developed plants were similar to those of the control treatments.

B. Control of broomrape plants :

B.I: Chemical control:

An experiment was conducted to study the effect of different doses of glyphosate alone to control the broomrape plants in broad bean fields and also with the indole acetic acid (IAA) as a growth regulator to minimize the harmful effect of this used herbicide on the host plants.

Germination of broad bean seeds started to appear after 7 days and completed after 13 days, whereas the plants started to bloom after 31 days from sowing the experiment. The broomrape plants (Orobanche crenata) did not appear over the soil surface at the date of the first sample, while it appeared only in four treatments (B , C , D and E) just before date of the second sample and completed appearing in the pots before date of the third sample.

It was noticed that no differences were detected between morphological characters of the host and parasite in the first sample for all treatments during the study. Application of the growth regulator (IAA) product was sprayed on top of the host plants in respect of the named treatments 48 hours before applying the glyphosate by its doses on the host and parasite plants.

1- Effect of Glyphosate and IAA on broomrape appearance:

Results in Table 4 and Figures 2 and 3 show the real effect of this herbicide in controlling the broomrape plants in broad bean field during this experimental study.

Seeds of broomrape germinated and appeared on soil surface in all treatments (B , C , D and E) except the treatments which contain the growth regulator IAA, but in the third sample, broomrape plants appeared in all treatments under the study.

In this connection, applying IAA might reduce the concentration of CA_3 in the roots and this will retard broomrape germination for sometimes.

Application of glyphosate with different concentrations on the infected plants showed significant decrease in number of broomrape plants if compared with the infected untreated plants (treatment B). However , the high dose of glyphosate gave better control than

Table 4 : Average number of broomrape (Orobanche crenata) plants per pot (3 broad bean plants) as affected the different treatments of chemical control experimental study.

Treatments	Plant age(days)					
	32	56	77	98	119	140
A	-	-	-	-	-	-
B	*	3.0	10.0	21.0	18.8	36.3
C	-	1.5	4.3	16.3	14.0	17.0
D	-	1.0	3.0	4.5	8.3	15.0
E	-	0.5	1.8	2.3	4.5	7.5
F	-	-	3.8	11.5	22.8	13.8
G	-	-	4.0	11.3	20.8	15.0
H	-	-	3.0	5.0	17.8	6.3
I	-	-	4.0	7.8	6.0	16.0
J	-	-	5.0	16.5	12.8	8.8
LSD 5%	-	0.684	0.400	NS	NS	4.963
1%	-	0.923	0.540	NS	NS	6.703

* No broomrape plants appeared .

Fig.2:

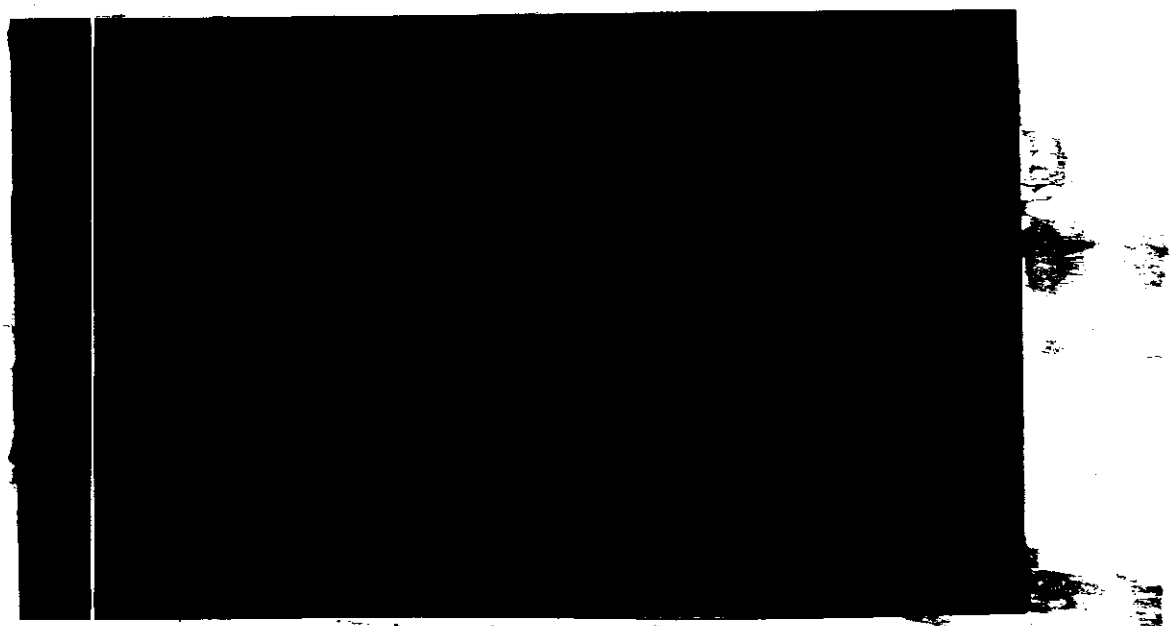


Fig.3:

Fig.2 and Fig.3: Showing stem height and appearance of Orobanche in the different treatments:@

1.Treat.A:Healthy Plants. 6-Treat.F:40ppm IAA+70ppm glypho.*
2. " B:Infected Plants. 7. " G:60 " " + " " " .
3. " C: 50 ppm glypho. . 8. " H:80 " " + " " " .
4. " D: 70 " " . 9. " I:60 " " +50 " " .
5. " E: 90 " " 10. " J:60 " " + 90 " " .

@ 2-10 Treatments B-J: Infected with Orobanche .

* glypho. = glyphosate.

the other two doses in all samples. Similar results were reported by Kasasian (1973a and b), Basler (1979), Zahran et al, (1979) and Ahmed (1981). It was mentioned before that applying glyphosate on the infected plants with broomrape induce ethylene formation in the plants which is a powerful inhibitor to cell division, bud growth and also seed germination.

On the other hand, Zahran et al, (1979) explained that the action of glyphosate resulted as a degredation of the herbicide which released CO_2 and this might affect the germination of broomrape seeds as well as the development of parasite seedlings. Other investigators commented with a considerable evidence that glyphosate undergoes degredation to release CO_2(Ching et al ,1976; Lund Hoie, 1976; Nomura and Hilton, 1977 and Moshier 1978). Klingman (1961) reported that the process of germination is affected by the axcess of released CO_2 and the deficiency of O_2 in the soil . Moreover, Daubenmire(1959) pointed out that excess of CO_2 favours the formation of H_2S and bicarbonates of Ferrous, Iron and Manganese and these may increase to reach toxic concentrations.

Using the growth regulator "IAA" with different doses before applying glyphosate on the infected

plants reduced the number of Orobanche if compared with the infected untreated plants (B) , but the number of the parasite plants were equal or somewhat higher to glyphosate treatments (C, D and E) . This can indicate that applying IAA might reduce the injurious effect of glyphosate on broomrape seeds and this will induce more germination of seeds and consequently the infection.

2. Characters of the host plant:-

a. Growth characters of the host plant:-

a.1. Stem height:

Data in table 5 and Figures 2 and 3 show that the broomrape (Orobanche crenata)parasitism generally affected the plant height until the plants reached 140 days old . It inhibits the plant stem elongation at later stages of growth especially in the second treatment(B)if compared by the healthy treatment A (Control) . The broomrape infection caused tremendous losses as reduction in stem height of the infected host plant, this was mentioned by previous workers whom concluded that growth inhibition of broad bean plants seems to be due to the continuous depletion of growth substances by the attached parasite (Bakr and Zahran, 1958 and El-Ghamrawy, 1968). Bakr et al., (1969 a) indicated that throughout the period of plant growth, the infected broad bean plants by O. showed highly significantly lower mean value of plant height than the healthy ones. Ahmed (1981) found that stem height of healthy plants was significantly or highly significantly greater than infected ones.

Application of the glyphosate product with its three concentrations 50, 70 and 90 ppm on broad bean plants showed highly significant decrease in plant height and the plants were appeared by abnormal elongation of upper internodes

Table 5 : Average stem height and length of root of broad bean plant in cm as affected by the different treatments of chemical control experimental study.

Treatments	Plant age (Days)											
	32		56		77		98		119		140	
	stem	root	stem	root	stem	root	stem	root	stem	root	stem	root
A	14.8	27.8	23.4	51.3	39.3	54.6	36.0	59.4	54.3	84.6	61.9	75.2
B	13.3	37.9	22.9	53.2	34.7	61.6	38.3	65.3	52.9	64.1	54.7	62.7
C	11.4	32.7	22.4	37.8	30.7	59.8	33.4	53.3	54.2	66.7	47.8	58.7
D	11.8	42.2	32.1	34.5	34.4	56.7	34.6	29.7	57.8	66.8	45.8	59.6
E	14.3	44.3	22.5	36.4	31.9	44.1	27.2	46.2	47.9	61.3	45.8	55.6
F	12.9	36.1	18.8	37.5	35.8	56.8	32.8	70.4	55.4	68.9	48.9	68.7
G	12.8	35.9	22.6	35.5	35.2	58.9	34.6	55.4	40.8	53.9	53.5	67.1
H	13.2	43.7	22.2	36.5	34.4	55.6	32.7	47.2	51.1	66.7	54.7	65.7
I	12.9	37.8	23.9	40.5	24.8	54.8	37.5	61.2	50.8	66.2	55.2	69.6
J	12.8	42.7	23.4	42.9	33.4	62.9	38.7	59.9	43.9	62.9	55.2	68.9
LSD at 5%	1.482	5.661	1.069	NS*	2.997	2.36	2.997	10.078	6.339	8.751	6.204	2.673
LSD at 1%	2.001	7.644	1.444	NS	4.048	3.187	4.048	13.60	8.559	11.818	8.368	3.610

* NS = Not Significant.

in addition to thin shoot apex. Moreover, the plant height was more affected in the high concentration used (90 ppm) than the other two treatments with concentrations 50 and 70 ppm . Several investigators used this product with different doses in controlling the broomrape plants with different hosts which gave significant results and complete control of the parasite (Kasasian, 1973 a ; Schluter and Aber , 1979; Zahran et al , 1979; Basler, 1979 ; Schmitt, 1979; Saghir, 1979; Schluter and Aber 1980; and Ahmed,1981).

On the other hand , many researchers emphasized the inhibitory effects of glyphosate on the host plants. In this connection , Zahran et al ,(1979) reported that glyphosate decreased the height of Vicia faba plants when used against Orobanche crenata. Glyphosate treated plants showed pronounced yellowing or even chlorosis of foliage, growth inhibition as a toxicity symptoms (Murphy and Jand , 1973 ; Ashton and Crafts, 1973 ; Osgood et al , 1975 ; Haderlie et al , 1976 and Blackwell, 1977).

Using the growth regulator "indole acetic acid " with three concentrations 40, 60 and 80 ppm, spraying on the plants before using the glyphosate with the recommended concentrations 70 ppm, had a clear effect in minimizing the injurious effects of glyphosate on plant growth as reducing stem height which showed higher records more than using glyphosate alone but still lower than the control. Moreover, spraying low(50 ppm)and high (90 ppm) concentrations of glyphosate after using 60 ppm of IAA on the plants gave the same results.

The growth inhibition or no-elongation of plant stem after using glyphosate on the broad been plants may be due to ethylene effect. In this respect, Abu-Irmaileh (1977) found that glyphosate enhanced the production of ethylene and cellulose with the red kidney beans plant. Wilde (1971) stated that ethylene is a powerful inhibitor of bud growth and it may have a controlling influence on apical dominance. Burg (1962), Webester (1968), and Burg (1973) reported that ethylene inhibited cell division of maristematic tissues. Meanwhile, using the growth regulator before spraying the glyphosate may be effective in reducing the production of ethylene, in the plant which was produced after using glyphosate on treated plants. So the plants in the treatments of glyphosate and IAA appeared longer comparing with those of the treatments of glyphosate alone.

a.2, Root length:

Data in Table 5 and Figures 4 and 5 indicate that broom-rape parasitism caused prominent reduction in root length of the host plant if compared with the control (healthy plant) in most of the samples during this study especially in the last stages. Similar results were reported by Singh et al , (1971) and Ahmed (1981). The infected plants sprayed with three concentrations of glyphosate (treatments C,D and E) showed also highly significant decrease in root length comparing with the plants in treatment A (control) and also the infected untreated treatment (B) nearly in all samples. Probably, the reduced or limited root growth of the treated plants might be due to the effect of ethylene

Fig.4:

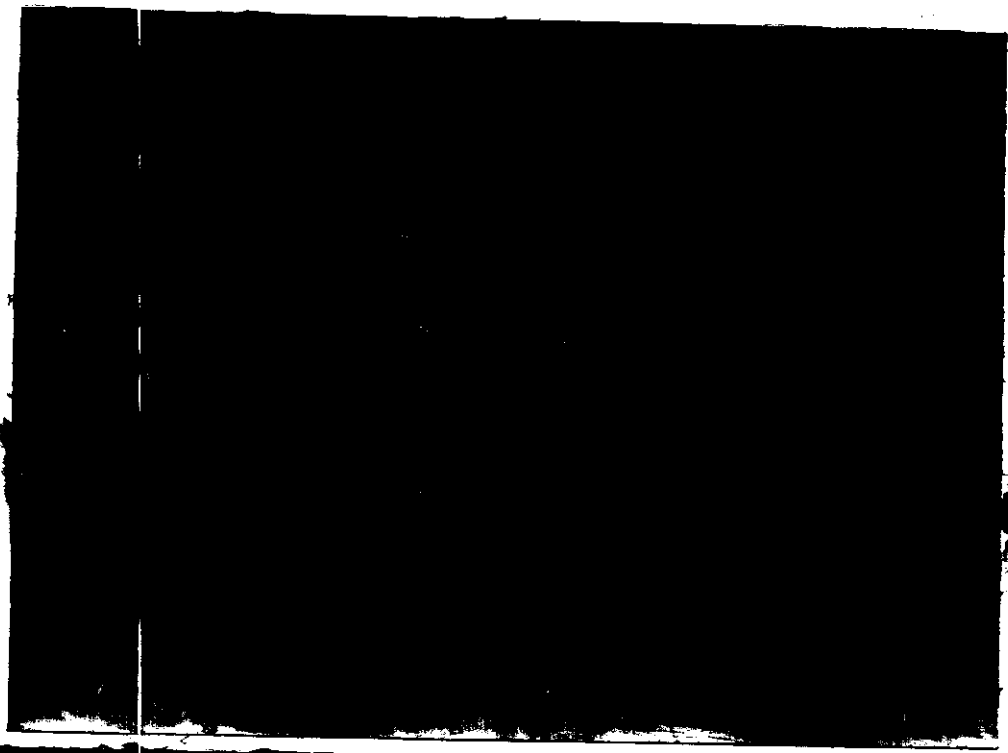


Fig.5:

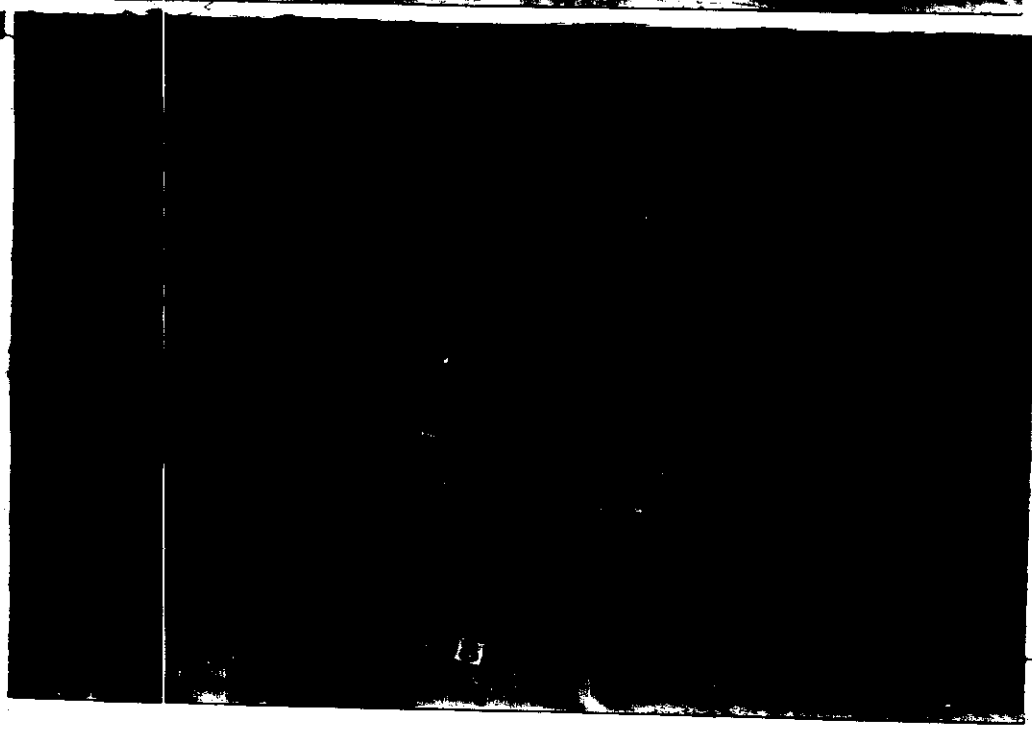


Fig.4 and Fig. 5 : Showing stem height and appearance of *Orobanche* in the different treatments:©

1. Treat.A:Healthy Plants.
2. " B:Infected Plants.
3. " G:50 ppm glypho.
4. " D:70 " " .
5. " E:90 " " .
6. Treat.F:40ppm IAA+70ppm glypho.*
7. " G:60 " " + " " .
8. " H:80 " " + " " .
9. " I:60 " " + 50 " .
10. " J:60 " " + 90 " .

© 2-10 Treatments(B-J): Infected with *Orobanche*.

* glypho. = glyphosate

resulting from glyphosate break down as previously mentioned by Abu-Irmaileh (1977) who found that the isopropylamine salts of glyphosate enhanced the production of ethylene by red Kidney beans (Phaseolus vulgaris). These findings also mentioned by Ahmed (1981) with broad bean plant.

These result had been previously mentioned also by Burg (1962) and Pratt and Goeschl (1969), they reported that exposure of plants to ethylene inhibited root elongation and stimulated adentitious root initiation and reduced the longitiudinal expansion and inhibited also cell division.

Spraying the indole acetic acid on the infected broad bean plants with broomrape before spraying the glyphosate for the parasite control in five treatments (F,G,H, I and J) resulted in highly significant decrease in root length in comparison with the control treatment but still much higher in root length than the treated treatments with glyphosate alone, (C,D and E treatments).

a.3: Number of branches:

Data in Table 6 and Figures 2 and 3 show that number of branches of the infected broad bean plants with broomrape (treatment B) seems not be affected if compared with the healthy plants (treatment A) in most of the samples under the study. However, Bakr and Zahran(1958), El-Ghamrawy (1968) and Ahmed (1981) reported that broomrape(Orobanche crenata) reduced number of branches of broad bean (Vicia faba)plants.

Application of glyphosate with its three concentrations used on the infected broad bean plants with broomrape did not clearly affect the number of branches in all samples during the study if compared with the control treatment (A).

This relationship between glyphosate application and number of branches was mentioned by Ahmed (1981) who showed that glyphosate did not significantly affect the number of branches in the first three samples whereas , it increased at later stages of growth especially at high rates of glyphosate which was mainly due to the damage of the growing points and hence inducing the growth of lateral buds to new branches.

Previous investigators explained this relationship. Ashton and Crafts (1973) stated that aliphatic acid herbicides gave increase in tillers. Blackwell (1977) indicated that sub-lethal doses of glyphosate can cause growth regulatory effect within the plants, and affected tillering . Also, Zahran et al, (1979) reported that glyphosate gave significant increase in the number of branches per horse bean plant.

a.4: Number of leaves:

Data in Table 6 and Figures 2 and 3 indicate that Orobanche cremata parasitism did not clearly affect the number of leaves through the first two samples. However , slight decrease in number of leaves was noticed due to the infection

Table 6 : Average number of branches and leaves per broad bean plant as affected by the different treatments of chemical control study.

Treatments	Plant age (days)											
	32		56		77		98		119		140	
	Branches	Leaves	Branches	Leaves	Branches	Leaves	Branches	Leaves	Branches	Leaves	Branches	Leaves
A	1.5	8.5	1.9	11.7	2.1	24.4	2.3	19.2	1.8	22.9	3.4	17.3
B	1.2	7.5	2.9	11.2	2.6	21.9	2.4	15.0	1.9	19.4	3.2	13.2
C	1.0	6.3	2.4	8.0	3.2	26.3	2.4	9.8	1.7	19.5	2.8	21.2
D	1.0	7.3	1.8	10.0	2.8	21.5	2.7	13.6	1.8	23.4	3.1	18.9
E	1.2	7.2	3.1	9.0	2.5	18.0	3.4	15.0	1.4	16.4	2.9	18.0
F	1.2	7.7	3.2	11.7	3.4	18.7	4.2	23.1	2.6	18.7	2.6	20.0
G	1.3	7.7	1.9	12.2	2.7	16.7	3.6	18.2	2.3	18.2	2.3	26.4
H	1.0	7.9	1.9	11.7	2.3	16.0	2.9	17.7	1.7	21.7	2.5	28.0
I	1.1	7.5	1.8	9.4	3.4	19.8	3.4	16.6	1.8	17.4	2.6	26.7
J	1.0	7.6	2.3	11.0	2.2	17.6	3.2	18.0	2.3	18.3	2.1	23.3
LSD at 5%	0.229	0.808	1.030	0.812	NS	3.277	0.682	6.607	NS	NS	NS	2.517
1%	0.310	1.097	1.391	1.097	NS	4.425	0.920	8.923	NS	NS	NS	3.400

with broomrape in treatment (B) in the other samples. Previously, El-Ghamrawy (1968), Singh et al., (1971), Hassan (1977) and Ahmed (1981) reported that broomrape affected the host plant by causing great reduction in number of leaves.

Decrease in number of leaves was noticed significantly after application of glyphosate by its three doses used (C,D and E) but highly significant decrease was very clear only in the high concentration, 90 ppm (treatment E) in the 2 nd, 3 rd, 4 th , 5th samples. Whereas in the last sample, the number of leaves increased more than the control for the three concentrations. Similar results were reported by Ahmed (1981) with horse bean plants. Several investigators reported that leaves developing on new branches of glyphosate treated plants was generally very small and suffered from toxic effect of glyphosate. Bischof and Koch (1974) noticed that glyphosate gave the best control of Orobanche aegyptiaca but was toxic to the tomato plants. Blackwell (1977) and Kline (1977) proved that glyphosate caused chlorosis to leaves of several plants.

Applying different doses of IAA resulted an increase in the number of leaves if compared with the control only in the last sample and the high concentration (80 ppm) more than all other treatments, and this can explain that IAA can promote plant growth and minimize the injurious effect of glyphosate.

a.5: Number of pods:

Results in table 7 for the 5th and 6th samples indicate

that broomrape parasitism (treatment B) affected greatly the number of pods per broad bean plant with highly significant decrease if compared with the healthy plant of treatment A (control) in the only two samples taken. Similar results were reported by Bakr and Zahran (1958), El-Ghamrawy (1968), Hassan (1977), Zahran et al , (1979) and Ahmed (1981) with broad bean plant.

Applying also glyphosate on the plants to control broomrape resluted in much decrease in number of pods per plant than the healthy plants (control) but somewhat higher than the infected untreated treatment (B) without significant differences between treatments. The decrease in number of pods in plants treated with glyphosate was reported by Ahmed (1981), this relationship may be happened due to the inhibition of flowering by ethylene which has been observed by Pratt and Goeschl (1969). Spraying the growth regulator IAA with different doses before using the glyphosate caused highly decrease in number of pods per plant in comparing with the control (A). No effects were noticed on broad bean plants by using IAA in case of number of pods under this study.

a.6: Seed yield

Results in Table 8 indicate that the fresh and dry weight of seeds per plant were decreased by Orobanche parasitism (B), comaring with the healthy plants (A).

Table 7: Average number of pods per broad bean plant as affected the different treatments chemical experimental study (during the 5th and 6th samples).

Treatments		Plant age (days)	
		119	140
A		25.0	18.25
B		3.75	3.0
C		5.00	6.0
D		11.00	13.75
E		7.00	7.50
F		15.25	15.00
G		11.50	12.50
H		11.00	8.50
I		5.50	7.25
J		5.75	7.75
LSD	5%	1.356	NS
	1%	1.834	NS

Using glyphosate caused an increase in the fresh and dry weight of seeds per plant comparing with infected untreated plants (B), Similar results were obtained by Bakr Ahmed et al,(1969a) and Ahmed, 1981.

Also treating by glyphosate and IAA caused an increase in fresh and dry weight of seeds per plant comparing with infected untreated plants except the treatments I and J which showed a decrease in both of fresh and dry weight.

Orobanche parasitism (B) caused a decrease in the fresh weight of 100 seeds comparing with the healthy plants(A).

Treating the plants with the low (50 ppm) and high (90 ppm) doses of glyphosate alone or with IAA caused a highly decrease in fresh weight of 100 seeds, whereas the dose of 70 ppm of glyphosate alone or with IAA (treatments D,F,G, and H) increased it under this study.

In case of dry weight of 100 seeds, the infected untreated plants (treat. B) increased it comparing with the healthy plants (A), this obtained result indicate that the parasite takes its watery requirements from the host plant and this may push the plant to early maturity.

Also treating the plants with glyphosate alone (50,70, and 90 ppm) caused more increase in the dry weight of the 100 seeds similarly as the infected untreated plants. Similary results were obtained by Schluter and Aber, 1978; Zahran et.al.,1979; Zahran (1981) and Ahmed (1981).

Table 8 : Average fresh and dry weight of seed yield per plant of broad bean in gms for the chemical control experimental study.

Treatments	Seeds weight/ plant in gms		weight of 100 seeds in gms	
	fresh weight	dry weight	fresh weight	dry weight
A	39.56	12.34	84.73	28.95
B	11.35	4.13	82.65	34.68
C	13.18	5.35	81.40	36.20
D	18.12	8.38	93.05	47.55
E	10.35	6.42	78.09	51.27
F	17.19	7.86	84.72	28.15
G	13.18	5.38	85.32	28.34
H	12.08	5.35	86.35	28.56
I	9.35	3.29	81.50	28.20
J	8.36	3.02	77.08	25.32
L.S Dat 5%	14.710	0.129	0.399	0.307
1%	19.864	0.175	0.538	0.415

Shoots :- Regarding N content in the shoot system of the different treatments, it appeared that N content tended to increase generally till the 4th and 5th in the treatments of glyphosate alone ,followed by a marked decrease in the last one, though with some fluctuations. Similar results were obtained by Bakr Ahmed et al ,(1969b) and Ahmed (1981) on Vicia faba plants. Considering the differences between the different treatments, it is obvious that at 5th sample, the healthy plants had a large quantities of N content than the infected ones followed by the infected plants treated with glyphosate only at 70 ppm. The lower N content of the infected plants (treated or untreated) than healthy ones might be mainly due to reduction in dry matter production by either treated or untreated infected plants.

Pods :- The pods of both healthy and infected plants showed a continuous increase in the total N content during its development till maturity when it reached the maximum at the end of the season.

As regards to the differences between the different treatments in total N content of the pods, Table 9 indicates that , the healthy plants recorded the highest values in this connection, followed by those infected plants treated with glyphosate (70 ppm) and IAA (40 ppm).

Infected plants treated with glyphosate at 90 ppm, recorded the lowest values in N content of their pods . This is a result of the fact that Orobanche obtains all nutrient from the host plant.

In this connection, Okonkwo (1960) indicated that materials were translocated only in the direction of the parasite. This means that the shoots of the infected plants would not contain sufficient nitrogen for proper pods and seed development.

Our results are also in accordance with those obtained by Bakr Ahmed et al, (1969b) on Vicia faba plants.

Orobanche :- Data in Table 9 clearly indicate that total N content of Orobanche generally increased reaching its maximum in the 5th sample and a noticable decrease occurred in the last one with some fluctuations.

Concerning the effect of treating the plants with the used substances, it appeared that these substances generally decreased total N content of the attached parasite plants. The highest effect was obtained by treating with glyphosate (at 90 ppm followed with 50 ppm).

This is substantially due to the great inhibition of parasite growth after glyphosate application. Moreover, it is interesting to note that treating the infected plants

with the conduct of glyphosate and IAA delayed the germination of Orobanche seeds and also delayed the appearance of Orobanche on the surface of the soil till the 3rd sample.

Table 9: Total nitrogen content as mg N per the various organs of the broad bean plant and of Orobanche as affected by the different treatments of chemical control during the experimental study.

Treatments	Plant Orgnas	Plant age (days) 32	56	77	98	119	140	Average mean
A	Roots	11.72	24.64	27.3	49.93	138.88	20.64	45.52
	Shoots	32.22	43.36	66.44	117.08	52.26	36.53	57.98
	Pods	-	-	-	-	160.13	327.45	243.79
B	Roots	12.24	8.29	22.37	52.41	23.62	12.33	21.88
	Shoots	39.84	37.92	40.6	73.36	77.48	17.69	47.82
	Pods	-	-	-	-	36.6	103.98	70.29
	Orobanche	-	0.06	14.69	84.51	66.89	77.83	48.80
C	Roots	14.43	20.58	36.79	62.69	22.52	18.50	29.25
	Shoots	40.26	48.11	45.75	54.99	74.72	24.05	47.9 8
	Pods	-	-	-	-	33.38	102.26	67.82
	Orobanche	-	0.73	7.15	31.82	21.48	23.83	17.00
D	Roots	13.00	25.86	29.8	51.43	49.35	14.18	30.60
	Shoots	32.16	51.66	39.29	90.48	70.30	24.50	51.39
	Pods	-	-	-	-	98.08	209.52	153.80
	Orobanche	-	00.38	2.89	16.19	18.45	18.85	11.35
E	Roots	11.79	21.89	24.04	34.14	22.28	9.90	20.67
	Shoots	31.47	53.59	42.28	29.29	21.08	22.36	33.35
	Pods	-	-	-	-	55.63	67.86	61.75
	Orobanche	-	0.16	1.33	0.74	16.74	17.29	7.25

Table 9 : (contd.):

Treatments	Plant Organs	Plant age (days)						Average mean
		32	56	77	98	119	140	
F	Root	13.0	21.44	28.25	55.37	15.39	18.99	25.41
	Shoot	30.98	49.61	38.78	51.57	40.49	27.99	39.90
	Pods	-	-	-	-	106.75	250.71	178.73
	Orobanche	-	-	2.83	20.44	59.68	36.8	29.94
G	Root	10.76	22.47	25.61	78.74	16.02	14.88	28.82
	Shoot	30.31	49.45	51.73	29.32	29.88	22.69	35.56
	Pods	-	-	-	-	84.09	87.62	85.86
	Orobanche	-	-	1.86	23.63	22.69	29.13	19.33
H	Root	9.39	18.20	27.64	23.16	15.09	17.20	18.45
	Shoot	30.71	35.91	58.65	22.65	32.56	27.09	34.60
	Pods	-	-	-	-	101.55	161.31	131.43
	Orobanche	-	-	2.89	9.61	32.18	18.25	15.73
I	Root	9.45	22.21	34.66	33.55	12.27	16.74	21.48
	Shoot	23.89	52.89	72.94	30.12	41.13	26.72	41.28
	Pods	-	-	-	-	60.37	107.18	83.78
	Orobanche	-	-	15.70	33.82	10.41	47.25	26.80
J	Root	8.88	19.81	39.78	22.81	17.15	16.56	20.83
	Shoot	31.73	44.01	55.45	53.38	44.73	22.29	41.93
	Pods	-	-	-	-	38.09	143.11	90.6
	Orobanche	-	-	19.25	31.91	32.58	19.24	25.75

1.b: Phosphorus content :-

Table 10 represents total phosphorus content of different organs of broad bean plant and Orobanche , as affected by the different treatments during the experimental period.

Total phosphorus content of the roots in all treatments generally increased continuously to reach its maximum value in the 5th sample and then the values decreased in the last sample . Phosphorus content of shoots behaved as similar to that exhibited by the roots. The decline in P content of both roots and shoots of the various plants, occuring in the last sample could be attributed to translocation of phosphorus from these parts to the developing pods.

Comparing total P content in the healthy plants with that of the infected ones treated or untreated with the used substances in this investigation, it appeared that the total amount of P in the former exceeded the infected plants generally.

The data also show that treating the plants with glyphosate (90 ppm) and 60 ppm IAA (J treat.) recorded the best effect followed with I treatment .

The lowest effect was exhibited by treating the plants with glyphosate only at 90 ppm (E treatment).

It is clear from the present data that treating the infected plants with both glyphosate and IAA resulted stimulate the accumulation of P in both roots and shoots more than the untreated infected plants. The phosphorus content of the pods of all treatments showed a continuous increase from the 5th to the 6th sample. It appears that the trend observed in the total amount of P in the pods was a result of the continuous accumulation of this element . As for the infected plants their values were extremely low as compared with those found in the pods of the healthy plants. It is to be pointed out that treating the infected plants with the substances under investigation favoured P accumulation in the pods more than in the untreated infected plants which recorded the lowest values in this connection.

As regards to total P content of Orobanche , it is clear from the data that in most cases, it increased gradually with the age to reach its maximum in the last sample.

It is interesting to point out that treating the plants with the different substances inhibit the accumulation of P in the parasite tissues.

Table 10: Total phosphorus content as mg P_2O_5 per the various organs of broad bean plant and of Orobanche as affected by the different treatments of chemical control during the experemintal study.

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
A	Roots	2.06	5.41	9.07	11.61	22.55	10.12	10.14
	Shoots	4.91	16.39	25.58	30.8	55.61	36.53	28.30
	Pods	-	-	-	-	37.95	69.00	53.48
B	Roots	2.02	5.12	7.34	10.18	11.55	5.48	6.95
	Shoots	4.88	13.33	20.65	15.78	26.27	20.89	16.97
	Pods	-	-	-	-	10.32	20.40	15.36
	Orobanche	-	0.03	2.09	10.14	41.16	70.13	24.71
C	Roots	2.02	4.29	8.28	8.94	13.52	7.52	7.43
	Shoots	5.02	14.11	22.45	21.24	27.31	25.53	19.28
	Pods	-	-	-	-	16.73	30.12	23.43
	Orobanche	-	0.08	2.11	8.02	11.72	21.05	8.60
D	Roots	1.97	5.34	8.05	9.91	21.38	8.91	9.26
	Shoots	4.93	15.5	23.72	26.32	33.19	28.21	21.98
	Pods	-	-	-	-	28.06	61.07	44.57
	Orobanche	-	0.05	0.72	3.28	10.71	19.31	6.81
E	Roots	1.97	3.96	6.11	5.67	8.99	4.62	5.22
	Shoots	4.83	15.19	16.45	13.2	21.08	25.46	16.04
	Pods	-	-	-	-	16.43	43.85	30.14
	Orobanche	-	0.02	0.27	0.57	12.10	14.36	5.46

Table 10 :(Contd.):

Treatments	Plant organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
F	Root	1.97	4.57	6.22	13.38	8.55	9.07	7.29
	Shoot	4.93	14.41	23.52	32.04	32.14	24.01	21.84
	Pods	-	-	-	-	28.34	64.04	46.19
	Orobanche	-	-	1.22	6.35	32.34	23.46	15.84
G	Root	1.97	4.79	5.30	10.44	8.48	8.45	6.57
	Shoot	4.82	14.50	16.49	20.88	24.24	28.87	18.30
	Pods	-	-	-	-	22.15	61.92	42.04
	Orobanche	-	-	0.48	7.22	16.84	36.18	15.18
H	Root	1.97	5.23	5.46	8.36	8.88	7.88	6.30
	Shoot	4.82	13.03	11.73	19.80	29.93	23.90	17.20
	Pods	-	-	-	-	25.20	43.60	34.40
	Orobanche	-	-	0.36	2.96	20.79	14.94	9.76
I	Root	2.02	4.73	7.42	11.15	12.70	8.74	7.79
	Shoot	9.82	13.52	18.13	22.82	33.82	22.04	19.19
	Pods	-	-	-	-	15.71	38.21	26.96
	Orobanche	-	-	1.95	11.93	5.68	39.5	14.77
J	Root	1.97	4.35	7.70	8.40	13.94	8.10	7.41
	Shoot	4.98	13.62	23.29	23.41	35.78	25.04	21.02
	Pods	-	-	-	-	16.07	38.60	27.34
	Orobanche	-	-	2.11	8.84	19.55	16.28	11.70

1.c :Potassium content:-

The data in table 11 represent the results of total potassium content expressed as mgm K per different parts of horse bean plant and Orobanche at the various stages of growth.

It can be observed from the present data that K content of the different plant parts of all treatments generally increased towards maturity though with some fluctuations especially in the root system in which K content was decreased at the last sample (treat. A, b, D, E, HandI)

This decrease might be a result of the translocation of the element towards other parts, as well as of its back movement to the soil. This is in accordance with those obtained by Bakr Ahmed et al, (1969 c) on Vicia faba plant.

Total K content of the different parts of broad bean plants (root, shoot and pods) decreased in infected plants if compared with the healthy ones.

It is clear from the data that glyphosate clearly reduced total K content of the Orobanche, especially at the concentration of 70 ppm.

The foregoing results indicate that treating with glyphosate increased total K content of the different

parts of the infected plants. Moreover, this treatment reduced K content of the parasite, these results lead to the suggestion that glyphosate inhibite the translocation of the element from the host to the parasite. This findings were generally in conformance with those obtained by Ahmed (1981) on Vicia faba.

Table 11: Total potassium content as mg K per the various organs of broad bean plant and of Orobanche , as affected by the different treatments of chemical control during the experimental study.

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
A	Roots	12.18	32.23	65.22	29.04	51.15	19.68	39.92
	Shoots	16.65	43.02	112.75	80.85	51.48	81.49	64.37
	Pods	-	-	-	-	115.17	644.40	379.79
B	Roots	13.86	34.13	22.37	27.12	16.47	13.70	21.28
	Shoots	21.79	33.32	103.47	36.19	35.53	28.65	43.16
	Pods	-	-	-	-	32.35	199.56	115.96
	Orobanche	-	0.0003	30.38	55.16	78.03	363.55	105.42
C	Roots	14.78	25.34	56.58	28.91	19.49	21.24	27.72
	Shoots	27.45	35.71	114.19	55.91	36.16	75.48	57.48
	Pods	-	-	-	-	48.24	271.08	159.66
	Orobanche	-	0.0094	16.90	32.85	45.94	94.30	38.08
D	Roots	11.74	25.03	45.30	29.17	26.10	23.92	26.88
	Shoots	18.60	39.37	102.0	60.34	79.48	81.73	63.59
	Pods	-	-	-	-	76.86	495.81	286.34
	Orobanche	-	0.0004	4.08	9.38	35.32	52.88	20.33
E	Roots	17.47	19.93	25.53	10.19	41.38	10.78	20.88
	Shoots	13.47	26.51	43.75	14.88	48.96	45.68	32.21
	Pods	-	-	-	-	58.56	273.74	166.15
	Orobanche	-	0.0002	0.70	0.78	42.21	59.58	20.65

Table 11: (Contd.)

Treatments	Plant organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
F	Roots	14.37	21.30	39.32	21.90	10.26	24.05	21.87
	Shoots	19.05	30.08	61.74	62.62	21.26	71.34	44.35
	Pods	-	-	-	-	117.04	499.51	308.28
	Orobanceh	-	-	6.44	17.71	126.74	87.77	59.67
G	Roots	14.79	14.98	38.73	21.30	17.60	38.94	24.39
	Shoots	20.75	25.57	50.25	31.92	49.07	64.48	40.34
	Pods	-	-	-	-	107.53	556.66	332.10
	Orobanche	-	-	3.2	17.65	65.92	118.07	51.21
H	Roots	12.14	19.53	33.23	9.62	29.97	21.00	20.92
	Shoots	13.47	21.52	26.34	17.05	54.82	63.88	32.85
	Pods	-	-	-	-	141.81	303.10	222.46
	Orobanche	-	-	1.83	4.28	68.31	52.64	31.77
I	Roots	13.10	17.75	31.31	8.32	27.43	24.74	20.44
	Shoots	16.80	22.08	52.32	22.89	54.02	46.63	35.79
	Pods	-	-	-	-	73.54	246.79	160.17
	Orobanche	-	-	7.99	17.10	11.36	96.98	33.36
J	Roots	10.41	13.78	35.51	14.78	21.21	26.53	20.37
	Shoots	15.82	20.13	45.82	34.19	47.91	45.21	34.85
	Pods	-	-	-	-	40.11	248.20	144.16
	Orobanche	-	-	17.87	27.49	34.61	59.44	34.85

1.d: Calcium content:

The data concerning total calcium content of the different parts of horse bean plant as well as Orobanche plant are calculated in Table 1 2.

It is clear from the present data that Ca content both of the roots and shoots generally increased till the 5 th sample then decreased in the last one. This result might indicate the continuous accumulation of this element in these parts with advancing in age . On the other hand, the decrease noticed in the last sample especially in roots might be a result of its migration either to the soil or to the pods during the later stages of growth.

It is interesting to notice that Ca content of the pods increased till the last sample. Ca content of the different parts of the healthy plants was higher in general than that of either treated or untreated infected ones. In this connection, El-Ghamrawy (1968) and Ahmed (1981)reported also that Ca content of the whole healthy plants was higher than that of the infected ones plus Orobanche, except in the first three samples.

Comparing Ca content both in treated or untreated Orobanche , it appeared that Ca in the latter exceeded that in the former in all samples.

This result indicates that the effect of glyphosate is not limited to the accumulation of Ca in the parasite plant, but it may also cause an increase in the absorption of the element from the soil by host plants or may reduce the translocation of this element from the host plant to the parasite one.

Table 12: Total calcium content as mg Ca per the various organs of broad bean plant and Orobanche as affected by the different treatments of chemical control during the experimental study.

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
A	Root	1.47	5.61	8.23	15.77	28.60	13.92	12.27
	Shoots	7.01	16.56	30.25	46.97	84.85	72.50	43.02
	Pods	-	-	-	-	19.80	46.00	32.90
B	Roots	1.93	6.79	9.30	15.54	18.32	10.14	10.34
	Shoots	8.19	15.50	27.61	28.77	47.54	42.13	28.29
	Pods	-	-	-	-	4.32	12.00	8.16
	Orobanche	-	0.03	2.38	8.88	54.54	75.63	28.29
C	Roots	1.93	5.83	10.35	12.07	18.22	13.69	10.35
	Shoots	8.28	15.41	27.33	32.43	41.33	40.70	27.58
	Pods	-	-	-	-	8.95	17.32	17.32
	Orobanche	-	0.09	2.31	6.69	7.91	16.84	6.77
D	Roots	1.89	6.79	9.69	12.90	21.75	13.86	11.15
	Shoots	8.28	18.45	28.82	38.82	56.70	53.20	34.05
	Pods	-	-	-	-	14.03	39.26	26.65
	Orobanche	-	0.06	0.94	3.28	11.42	10.32	5.20
E	Roots	1.89	4.97	6.55	5.99	14.00	7.70	6.85
	Shoots	8.10	17.83	19.08	22.44	32.91	44.03	24.07
	Pods	-	-	-	-	8.88	24.01	16.45
	Orobanche	-	0.03	0.34	0.44	12.74	7.98	4.31

Table 12 : (Contd.).

Treatments	Plant organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
F	Roots	1.89	5.89	7.27	15.16	9.41	14.98	9.10
	Shoots	9.21	16.91	27.93	50.66	50.68	41.16	32.76
	Pods	-	-	-	-	13.55	41.62	27.59
	Orobanche	-	-	1.39	6.77	36.19	12.88	14.31
G	Roots	1.89	6.18	6.89	12.18	8.97	12.10	8.04
	Shoots	9.01	17.02	21.73	34.32	40.50	50.13	28.79
	Pods	-	-	-	-	11.85	34.06	22.96
	Orobanche	-	-	0.64	6.88	17.64	16.28	10.36
H	Roots	1.89	6.65	6.74	8.63	10.55	12.25	7.79
	Shoots	9.01	15.56	15.59	30.10	47.08	40.17	26.25
	Pods	-	-	-	-	12.89	20.76	16.83
	Orobanche	-	-	0.48	2.65	22.28	7.47	8.22
I	Roots	1.93	5.59	8.96	14.36	13.72	11.72	9.38
	Shoots	9.01	15.59	22.66	35.19	57.13	41.75	30.22
	Pods	-	-	-	-	7.85	18.64	13.25
	Orobanche	-	-	2.28	9.09	6.39	20.36	9.53
J	Roots	1.89	5.25	8.32	9.24	19.70	11.41	9.30
	Shoots	9.31	16.26	26.37	40.66	59.64	42.19	32.41
	Pods	-	-	-	-	7.11	20.27	13.69
	Orobanche	-	-	2.64	7.07	18.1	8.88	9.17

2. Soluble Sugar content:

Data concerning reducing , non-reducing and total soluble sugars of various orgons of horse bean plant and Orobanche as affected by the different treatments are represent in Table 13, 14 and 15 , respectively.

2.a: Reducing sugar content:

It appears from Table 13 that reducing sugar content both of the roots and shoots increased markedly from the first sample reaching its maximum in 5 th one , then a marked decrease was occurred in the last sample.This decrease could be attributed to the transformation of reducing sugars to more complex carbohydrates in the healthy plant.

As for the infected plants either treated or untreated ones, the decrease in reducing sugars could be attributed to the continuous withdrawal of sugar by Orobanche in which reducing sugar content increased continuously till the last sample . This result agreeds with the fact that the parasite is destitute of chlorophyll.

Many workers have reached similar conclusions with Orobanche sp., and with other parasitic flowering plants. Thus Baccarini and Melandri (1967), Bakr Ahmed et al , (1969 b) and Ahmed (1981) concluded that it was an entirely heterotrophic plant. It is also clear from

the present data that reducing sugar of either treated or untreated infected plants were greatly lower than those of the healthy ones. This results are in conformance with these obtained by Ahmed (1981).

Regarding reducing sugar of pods, it is clear from the data that some treatments caused a continuous accumulation of reducing sugar till the last sample (B, E, G, I and J treatments), on the other hand, the other treatments resulted a decrease in reducing sugar content towards the last sample (A, C, D, H and F treatments).

These results lead to the conclusion that some treatments favoured the transformation of the reducing sugars to more complex carbohydrates.

Glyphosate generally increased reducing sugar content of different parts if compared with the untreated plants, except in the high dose which decreased it (treatment E). Moreover, using auxin IAA stimulate the glyphosate effect in increasing reducing sugar content. In this connection, Ahmed (1981) on Vicia faba found that glyphosate increased reducing sugar content of the different plant parts.

Table 13 : Reducing sugar content of the different organs of broad bean plant and Orobanche (mg.glucose) as affected by the different treatments of chemical control during the experimental study.

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
A	Roots	3.19	11.63	18.14	32.19	51.7	30.61	24.58
	Shoots	24.64	49.52	58.85	108.57	313.72	157.92	118.90
	Pods	–	–	–	–	379.5	357.56	368.53
B	Roots	2.94	9.86	11.53	21.65	28.11	16.30	15.07
	Shoots	21.16	31.82	39.90	73.54	168.05	84.59	69.84
	Pods	–	–	–	–	41.28	103.2	72.24
	Orobanche	–	0.08	12.96	121.41	309.73	554.13	199.66
C	Roots	2.94	8.83	16.15	16.84	28.43	17.20	15.07
	Shoots	21.39	34.70	55.63	108.77	136.89	118.77	79.36
	Pods	–	–	–	–	168.05	130.27	149.16
	Orobanche	–	0.23	5.28	40.68	74.13	122.09	48.48
D	Roots	2.87	11.64	13.26	28.99	41.25	22.37	20.06
	Shoots	21.39	36.74	55.34	144.49	217.59	109.21	97.46
	Pods	–	–	–	–	187.27	173.03	180.15
	Orobanche	–	0.16	1.75	14.27	51.65	72.26	28.02
E	Roots	2.87	8.28	15.65	13.59	22.36	11.22	12.33
	Shoots	20.93	38.44	34.3	47.35	144.43	71.21	59.44
	Pods	–	–	–	–	99.36	148.25	123.81
	Orobanche	–	0.08	0.62	2.51	37.15	45.49	17.17

Table 13 (Contd.)

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
F	Roots	2.87	10.04	10.06	36.57	21.03	25.74	17.72
	Shoots	21.39	34.10	53.66	151.55	202.70	96.04	93.24
	Pods	–	–	–	–	209.44	206.53	207.99
	Orobanche	–	–	2.55	17.91	180.95	104.88	76.57
G	Roots	2.87	9.92	8.79	28.36	19.56	23.23	15.46
	Shoots	20.93	37.0	39.77	100.67	162.68	117.09	79.69
	Pods	–	–	–	–	176.65	202.79	189.72
	Orobanche	–	–	1.12	22.63	94.24	139.29	64.32
H	Roots	2.87	11.68	9.31	22.19	20.35	19.60	14.33
	Shoots	20.93	31.92	29.26	91.87	191.52	97.61	77.19
	Pods	–	–	–	–	191.04	139.09	165.07
	Orobanche	–	–	0.85	8.69	112.86	58.02	45.11
I	Roots	2.94	10.32	14.34	23.06	27.94	21.58	16.70
	Shoots	20.93	34.64	44.29	122.68	147.12	116.9	81.09
	Pods	–	–	–	–	159.58	168.69	164.14
	Orobanche	–	–	5.07	64.75	36.78	226.09	83.17
J	Roots	2.87	9.02	21.09	20.16	30.91	20.24	17.38
	Shoots	21.62	32.11	48.64	93.32	268.88	72.72	89.55
	Pods	–	–	–	–	100.43	145.72	123.08
	Orobanche	–	–	4.82	47.07	65.88	51.21	42.25

2.b: Non reducing sugar content :-

As regarding non-reducing sugar content, data in Table 14 generally reveal that non-reducing sugar content of roots generally increased from the first sample, reaching its maximum values in the 4th sample, then tended to decrease till the last sample, except in the healthy plants which reached its maximum content in the 5th sample and then declined.

A similar trend was generally exhibited in shoots in spite of the marked increase which was observed in reducing sugar content at the last sample.

The gradual increase which occurred during the first stage of growth of all treatments might be attributed to a relatively high rate of sucrose formations as compared with its translation to the other organs.

On the other hand, the decrease in sucrose content which occurred either in the 5th sample (except the high dose of glyphosate alone or with IAA) might be due to a higher translocation then that of its formation as a result of the increased demands for carbohydrates during the pod filling stage, which recorded a continuous increase till the last sample in addition to the effect of Orobanche parasitism especially in the infected plants either treated or untreated with the used substances.

This was early confirmed by Bakr Ahmed et al, (1969 b) and Ahmed (1981) . As for non- reducing sugar content, it appears that infection with Orobanche decreased the content of these sugars in various organs of host plant. Nevertheless, treating the infected plants with glyphosate either alone or with IAA favour the accumulation of sucrose especially in shoot system over the healthy plants. In this connection Ahmed (1981) on Vicin faba concluded that the increase of sucrose which was observed in the infected plants either treated or untreated with glyphosate was due to the favouring effect of the developing parasite seedlings on sucrose formation as the main translocatable sugar .

Glyphosate greatly decreased the content of non-reducing sugars in the parasite especially when used alone (E and D treatments). This results mainly from reduction in dry weight of the parasite due to the application of glyphosate.

These results are generally in conformance with those obtained by Ahmed (1981).

Table 14 : Non-reducing sugar content of the different organs of broad bean plant and of Orobanche (mg.glucose)as affected by the different treatments of chemical control during the experimental study.

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
A	Roots	1.09	4.39	7.56	16.43	26.95	9.87	11.05
	Shoots	2.37	9.29	26.95	38.5	27.09	38.78	23.83
	Pods	-	-	-	-	48.68	167.28	107.98
B	Roots	1.09	4.37	1.97	14.8	13.05	3.15	6.41
	Shoots	2.39	10.61	17.17	22.50	20.43	26.29	16.57
	Pods	-	-	-	-	21.6	37.8	29.7
	Orobanche	-	0.04	1.44	25.04	60.71	61.88	29.82
C	Roots	1.09	4.86	3.31	11.77	9.94	9.52	6.75
	Shoots	2.42	12.67	21.96	22.09	14.39	35.89	18.24
	Pods	-	-	-	-	19.06	66.26	42.66
	Orobanche	-	0.12	3.3	14.71	20.22	16.42	10.95
D	Roots	1.07	4.85	7.45	15.52	14.63	8.82	8.64
	Shoots	2.42	15.04	25.25	42.11	28.58	33.05	24.41
	Pods	-	-	-	-	50.02	139.58	94.8
	Orobanche	-	0.08	0.96	5.83	15.47	9.66	6.4
E	Roots	1.07	3.74	5.44	8.03	6.69	4.29	4.88
	Shoots	2.37	12.4	15.4	16.01	17.41	10.66	12.38
	Pods	-	-	-	-	13.16	84.56	48.86
	Orobanche	-	0.04	0.16	1.07	15.77	7.98	5.00

Table 14 : (contd.)

Treatments	Plant organs	Plant age (days)						Average Mean
		32	56	77	98	119	140	
F	Roots	1.07	4.32	5.99	18.51	6.84	10.55	7.88
	Shoots	2.42	14.70	26.95	63.65	26.78	28.13	27.11
	Pods	-	-	-	-	52.98	160.1	106.54
	Orobanche	-	-	1.63	12.69	54.67	13.8	20.70
G	Roots	1.07	4.52	5.41	14.44	6.52	9.79	6.96
	Shoots	2.37	15.09	21.34	37.47	21.58	34.89	22.12
	Pods	-	-	-	-	41.2	156.35	98.78
	Orobanche	-	-	0.72	14.76	28.87	18.09	15.41
H	Roots	1.07	5.13	5.56	11.65	7.59	8.58	6.60
	Shoots	2.37	13.57	15.18	33.79	27.53	27.22	19.94
	Pods	-	-	-	-	46.88	96.53	71.71
	Orobanche	-	-	0.53	5.67	34.65	6.97	11.96
I	Roots	1.09	5.42	4.48	15.31	9.39	8.93	7.44
	Shoots	2.37	12.69	22.66	25.36	18.28	26.72	18.01
	Pods	-	-	-	-	17.85	84.81	51.33
	Orobanche	-	-	2.86	22.72	10.22	19.63	13.86
J	Roots	1.07	4.51	8.01	11.93	9.99	9.02	7.42
	Shoots	2.44	11.95	26.88	31.42	34.79	27.78	22.54
	Pods	-	-	-	-	12.36	84.92	48.64
	Orobanche	-	-	2.05	21.66	27.15	7.69	14.64

2.c: Total sugar content :-

It appears from Table 15 that total sugar content of all treatments both in roots and shoots increased markedly till the 5 th sample, therefore, a sudden decrease was observed generally in the last sample. On the other hand, total sugar content of pods increased till the last sample. This indicates that the marked decrease which occurred at the last sample in both roots and shoots was due to the translocation of sugars to the developing pods.

As for total sugar content of Orobanche, it is clear from the present data that these sugars tended to increase in most treatments towards the last sample. Moreover treating the plants with glyphosate only, reduced the values of sugar content in the parasite if compared with either infected untreated or infected treated plants with both glyphosate and IAA. The best effect was recorded by treating with 90 ppm glyphosate (E treatment).Regarding the effect of the different treatments on the total sugar content, it is clear that treating the plants with both IAA and glyphosate favour the accumulation of sugars of the different plant parts more th n treating only with glyphosate.This leads to the suggestion that treating with IAA leads to a change in the hormonal balance within the plant under these balance more sugars were accumulated in the treated plants.

Table 15 : (Contd.):

Treatments	Plant Organs	Plant age (days)						Average Mean
		32	36	77	98	119	140	
F	Roots	3.94	14.36	16.05	55.08	27.87	36.29	25.60
	Shoots	23.81	48.8	80.61	215.2	229.48	124.17	120.35
	Pods	-	-	-	-	262.42	366.63	314.53
	Orobanche	-	-	4.18	30.6	235.62	118.68	97.27
G	Roots	3.94	14.44	14.2	42.8	26.08	33.02	22.41
	Shoots	23.30	52.09	61.11	138.14	184.26	151.98	101.81
	Pods	-	-	-	-	217.85	359.14	288.50
	Orobanche	-	-	1.84	37.39	122.31	157.38	79.73
H	Root	3.94	16.81	14.87	33.84	27.94	28.18	20.93
	Shoots	23.30	45.49	44.44	125.66	219.05	124.83	97.13
	Pods	-	-	-	-	237.92	235.62	236.77
	Orobanche	-	-	1.38	14.36	147.51	64.99	57.06
I	Root	4.03	15.74	18.82	38.37	37.33	30.51	24.13
	Shoots	23.30	47.33	66.95	148.04	165.40	143.62	99.11
	Pods	-	-	-	-	177.43	253.50	215.47
	Orobanche	-	-	7.93	87.47	47.0	245.72	97.03
J	Root	3.94	13.53	29.1	32.09	40.9	29.26	24.80
	Shoots	24.06	44.06	75.52	124.74	303.67	100.5	112.09
	Pods	-	-	-	-	112.79	230.64	171.72
	Orobanche	-	-	6.87	68.73	93.03	58.90	56.88

Fig.6: Showing the biological control of broomrape by the different isolated Fungi :

Control Treat.I : Broomrape inoculated with D.W.*

1-Treat.A: Broomrape inoculated with Fusarium sp.

2- " B: " " " Rhizoctonia sp.

3- " C: " " " Sclerotium sp.

4- " D: " " " Alternaria sp.

5- " E: " " " Rhizopus sp.

6- " F: " " " Aspergillus sp."a".

7- " G: " " " Aspergillus sp."b".

8- " H: " " " Penicillium sp.

* D.W. = Distilled Water.

naturally. Thus , seeds failed to disseminate consequently, inoculum of such parasite would not be added to the soil.

It was found also that wounds were essential for broomrape invasion by the fungi. Wounds caused by the insect Phytomyza orobanche, the natural enemy of Orobanche spp. feeding on its seeds (Hammad et al , 1967 and Manjunath and Nagarkatti, 1977), would help the infection of broomrape fruits by the isolated fungi.

Data in table 16 and Figure 6 indicate that Fusarium sp., Rhizoctonia spp., Sclerotium sp., Alternaria spp., and Rhizopus sp. were pathogenic and affected the seed germination of broomrape plants after inoculation with 28.8% , 38.8 % , 45.6 % ,24.6 % and 67.6 % , respectively, and showed great reduction in germination throughout the 15 days of the test than the control treatment.

Whereas no apparent reduction in seed germination occurred in case of Aspergillus sp."a" and "b§ and Penicillium sp. but nearly the germination percentage was equal that of the control.

In this connection , Al-Menoufi (1982) found that

Table 16: Germination percentage of Orobanche crenata seeds from the expriment of biological control by different fungi.

Treatments	250 seeds after 15 days. Germinated seeds	Non germinated seeds	% germination
A	72	178	28.8
B	97	153	38.8
C	114	136	45.6
D	59	191	23.6
E	169	81	67.6
F	177	73	70.8
G	177	73	70.8
H	177	73	70.8
I	177	73	70.8

the percentage of germination of Orobanche crenata seeds obtained from rotted fruits was less than that of healthy ones, and suggested, also that the use of the insect Phytomyza orobanchia combined with the pathogenic fungal isolates for successive several years could be a considerable biological control method for Orobanche crenata.