RESULTS AND DISCUSSION

1- Cowpea Varieties in relation to Infestation with Different Pests:

1.1- Season 1997:

1.1.1- *Tetranychus* sp., eggs:

Data presented in Table (1) and Fig. (1) show the infestation rates with *Tetranychus* sp. on the three varieties. It is clear that, egg numbers varied according to variety. Regarding weekly average numbers of *Tetranychus* sp., eggs recorded per leaflet, the highest averages occurred on June, 4*th* for Dokki-331 variety with average 11.9 eggs/leaflet, on June 11th for Cream-7 variety with average 11.7 eggs/leaflet and on June, 18th for Balady variety with average 7.2 eggs/leaflet.

Meanwhile, the estimated allover average of 1997 season for *Tetranychus* egg numbers, on the tested cowpea varieties were 6.1, 6.0 and 3.5 eggs/leaflet for Dokki-331, Cream-7 and Balady varieties, respectively. This result indicates clearly, that Balady variety harboured significantly less *Tetranychus* eggs than the other tested cowpea varieties.

1.1.2- *Tetranychus* sp., moving stages :

Table (1) and Fig. (2) shows the weekly average numbers of *Tetranychus* sp. moving stages recorded per leaflet. The highest average numbers occurred on May, 28th for Dokki-331 variety with an average number of 12.0 moving stages/leaflet, on June 25th for Cream-7 variety with average 10.9 moving stages/leaflet and on June, 18th for Balady variety with average 6.3 moving stages/leaflet.

Table (1) : Evaluation of three cowpea varieties to *Tetranychus* sp. eggs and moving stages in 1997 season at Moshtohor Qalubyia Governorate.

Variety / Inspection Date	Dokki-331		Cream-7		Balady	
	Egg	Moving stages	Egg	Moving stages	Egg	Moving stages
23/4/97	2.0	1.5	1.6	0.5	0.5	0.5
30/4	1.4	1.0	0.5	0.5	1.3	1.4
7/5	6.1	3.2	5.4	2.9	2.7	1.2
14/5	4.3	5.3	5.0	4.9	1.4	1.5
21/5	6.9	5.4	6.3	3.1	2.5	2.2
28/5	9.9	12.0	9.1	6.3	4.2	3.8
4/6	11.9	6.2	6.7	4.3	4.5	3.1
11/6	10.5	7.1	11.7	8.8	3.3	4.5
18/6	6.9	5.5	11.6	8.8	7.2	6.3
25/6	9.2	6.3	10.9	10.9	5.8	4.6
2/7	4.1	5.6	4.9	5.6	4.0	3.6
9/7	3.5	3.0	4.0	3.3	0.9	3.1
16/7	3.5	2.3	3.3	3.4	5.3	4.3
23/7	7.0	4.4	3.7	4.3	4.7	4.4
30/7	4.9	5.7	5.9	6.6	4.7	3.7
Total	91.9	74.5	90.6	74.2	53.0	48.2
Mean	6.1	5.0	6.0	4.9	3.5	3.2

L.S.D.$_{0.05}$ between varieties for :

Eggs = 1.07

Moving stages = 0.69

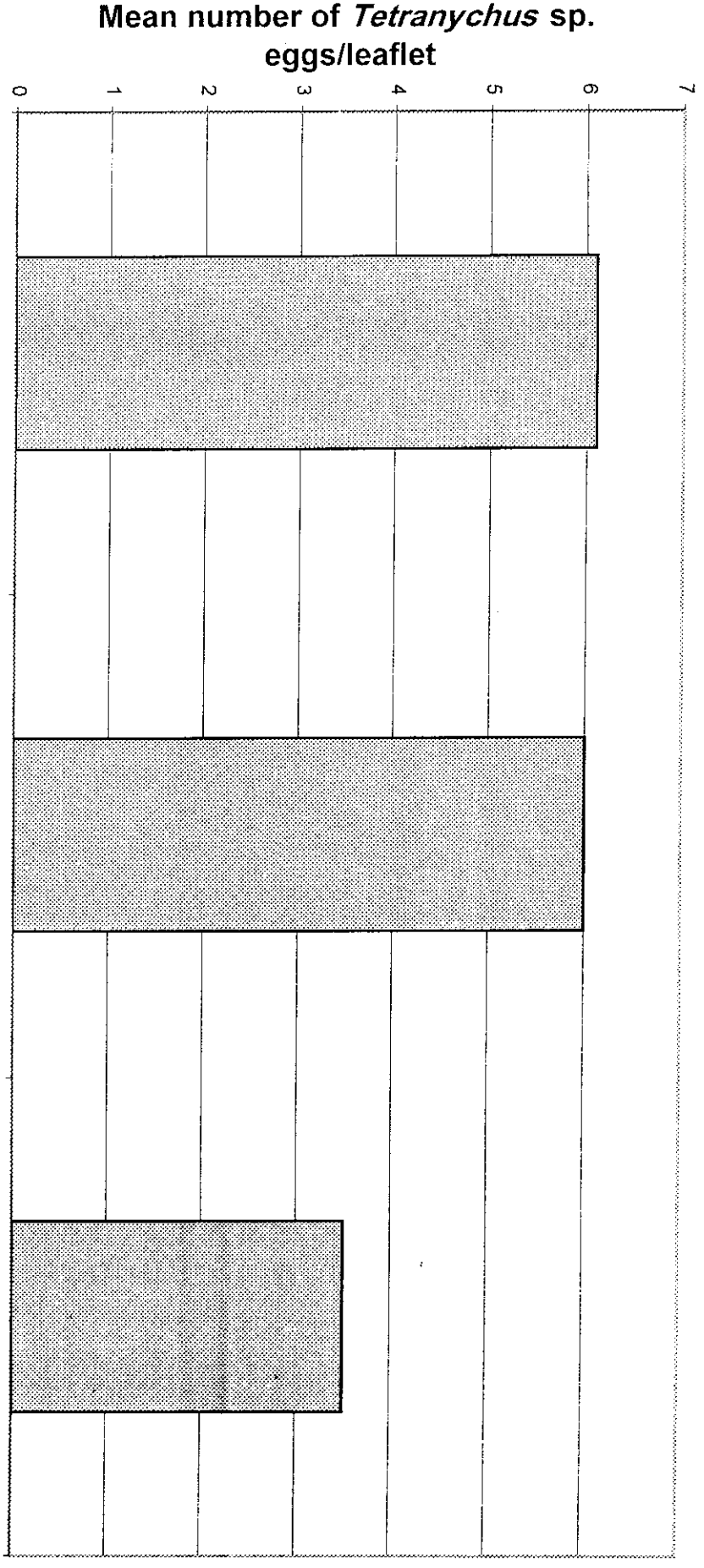

Fig. (1): Population of *Tetranychus* sp. eggs on plants of three cowpea varieties during summer plantation of 1997 season in Moshtohor area, Qalubia governorate"

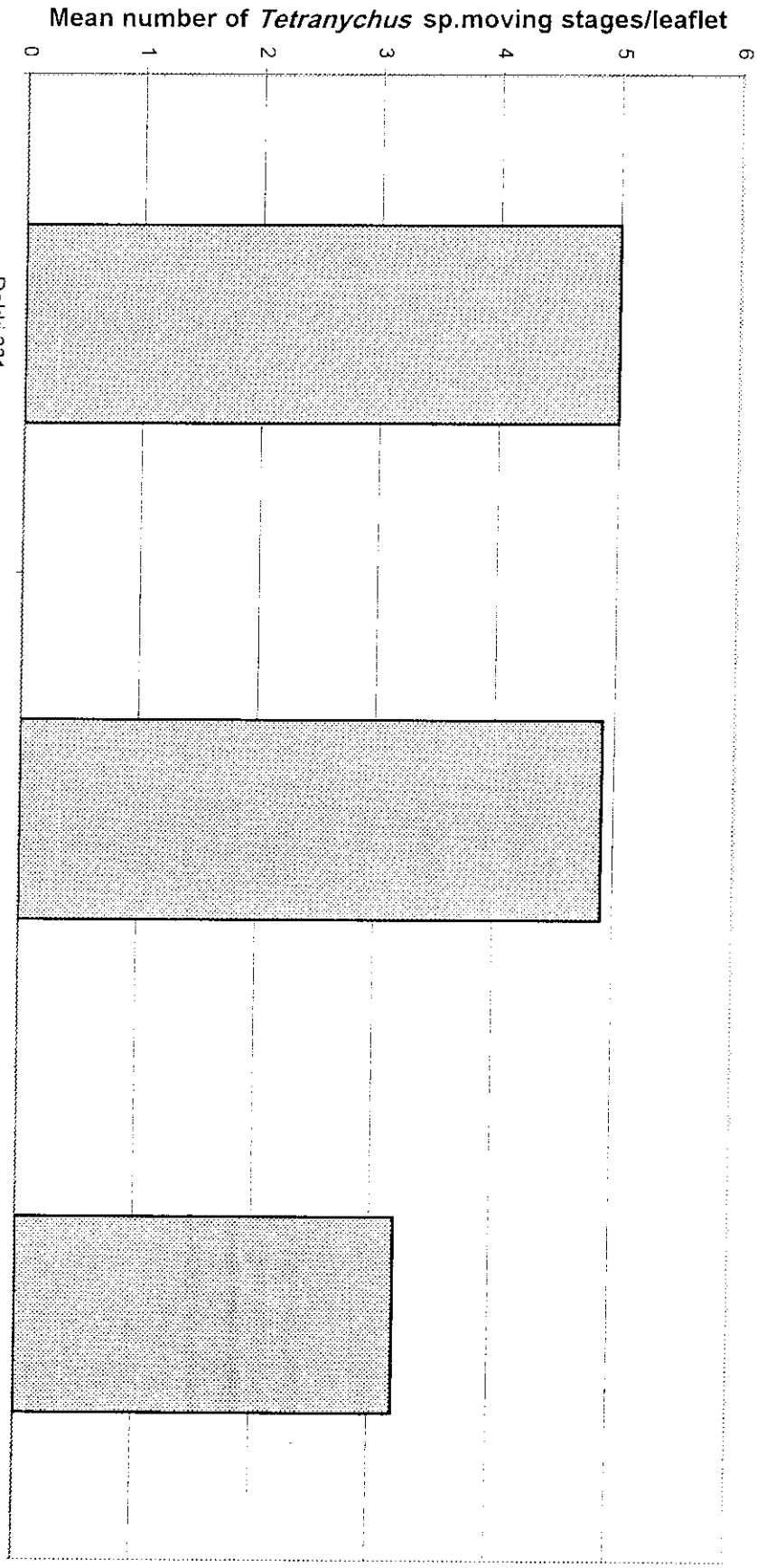

Fig. (2): Population of *Tetranychus* sp.moving stages on plants of three cowpea varieties during summer plantation of 1997 season in Moshtohor area, Qalubia governorate

Meanwhile. estimated allover averages of Tetranychus moving stages during 1997 season, on the three tested cowpea varieties were 5.0, 4.9 and 3.2 moving stages/leaflet for Dokki- 331, Cream-7 and Balady varieties, respectively. Balady showed also the least mean count of *Tetranychus* sp. moving stages and this result differed significantly when compared with other varieties.

These results are similar to those reported by Sawires (1978), Sawires *et al.* (1990) and Flexner *et al.* (1991) who indicated that their tested varieties differed from one to another in infesttion with *Tetranychus* sp.

1.1.3- Aphids:

Data presented in Table (2) show the infestation rates with Aphids on the three varieties. It is clear that, Aphids varied in number according to the infested cowpea variety. Regarding the weekly average numbers of Aphids recorded per leaflet, the highest infestation occurred on April, 30th for Dokki-331 variety with average 3.2 aphids/leaflet, on April, 30th for Cream-7 variety with average 7.3 aphids/leaflet and on April, 30th for Balady variety with average 3.7 aphids/leaflet.

Meanwhile estimated allover mean counts in 1997 season for aphids on various investigated cowpea varieties were 0.8, 1.8 and 1.4 aphids/leaflet for Dokki-331, Cream-7 and Balady varieties, respectively. Dokki-331 harboured the lowest aphids count with a significant difference compared with the other varieties. While, Cream-7 harboured the highest count, being insignificantly more infested than Balady variety which took the second position (Table 2).

Table (2) : Evaluation of three cowpea varieties to Aphids in 1997 season at Qalubyia Governorate.

Variety / Inspection date	Dokki-331	Cream-7	Balady
23/4/97	1.4	4.3	0.5
30/4	3.2	7.3	3.7
7/5	0.5	1.1	3.0
14/5	1.0	1.6	8.0
21/5	0.5	2.9	0.5
28/5	0.5	3.1	0.5
4/6	0.5	1.1	0.5
11/6	0.5	0.5	0.5
18/6	0.5	0.5	0.8
25/6	0.5	0.5	0.5
2/7	0.5	0.5	0.5
9/7	0.5	0.5	0.5
16/7	0.5	0.8	0.8
23/7	1.3	0.8	0.5
30/7	0.8	1.1	0.5
Total	12.7	26.6	21.3
Mean	0.8	1.8	1.4

L.S.D.$_{0.05}$ between varieties : 0.41

El-Hawary (1980), Mansour *et al.* (1982), Reddy *et al.* (1983), Verma *et al.* (1983) Kaakeh & Putcher (1993), Rarghali *et al.* (1996) and Kuang & Xias (1997) indicated also the infestation rates to different variety with aphids, differed from one to other. The present results are similar to their results.

1.1.4- Thrips nymphs:

Data presented in Table (3) and Fig. (3) show the infestation rates with Thrips on the three varieties. It is clear that, immature stage counts varied according to variety. Regarding weekly average numbers of Thrips nymphs recorded per leaflet, the highest infestation occurred on June, 25th for Dokki-331 variety with average 1.5 nymphs/leaflet, on May 7th for Cream-7 variety with average 2.3 nymphs/leaflet and on July, 30th for Balady variety with average 1.6 nymphs/leaflet.

As for the allover mean counts in 1997 season for Thrips, on various investigated cowpea varieties, those were 1.0, 1.3 and 0.9 nymphs/leaflet for Dokki-331 variety, Cream-7 variety and Balady varieties, respectively. Balady and Dokki-331 were the best varieties as they manifested significantly, lower infestation rates by Thrips nymphs than Cream-7 variety.

1.1.5- Thrips adults:

Data presented in Table (3) and Fig. (4) show weekly average counts of Thrips adults recorded per leaflet. The highest averages occurred on May, 7th for Dokki-331 (1.8 adults/leaflet) on April, 30th for Cream-7 (1.4 adults/leaflet) and on May, 7th for Balady (1.0 adults/leaflet).

Table (3) : Evaluation of the infestation rates by Thrips of three cowpea varieties in 1997 season at Qalubyia Governorate.

Variety / Inspection date	Dokki-331		Cream-7		Balady	
	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
23/4/97	0.5	0.8	1.1	0.8	0.5	0.5
30/4	0.5	0.9	0.5	1.4	0.8	0.5
7/5	1.1	1.8	2.3	0.5	0.5	1.0
14/5	0.5	0.8	1.0	0.9	0.9	0.8
21/5	1.3	0.5	0.8	0.5	0.8	0.5
28/5	1.1	0.5	1.1	0.8	0.8	0.8
4/6	1.4	0.5	1.1	0.8	0.8	0.5
11/6	1.0	0.5	1.0	0.8	0.8	0.5
18/6	1.2	0.5	1.2	0.8	1.4	0.5
25/6	1.5	0.5	1.8	1.0	1.0	0.5
2/7	1.0	0.5	1.9	0.5	0.8	0.5
9/7	0.8	0.5	0.9	0.5	0.8	0.5
16/7	1.0	0.5	1.1	0.5	1.4	0.5
23/7	1.2	0.5	1.5	0.5	1.1	0.8
30/7	1.4	0.5	1.5	0.8	1.6	0.8
Total	15.4	9.8	18.8	11.1	14.0	9.2
Mean	1.0	0.7	1.3	0.7	0.90	0.6

L.S.D.$_{0.05}$ between varieties for :

Nymphs = 0.26

Adults = n.s.

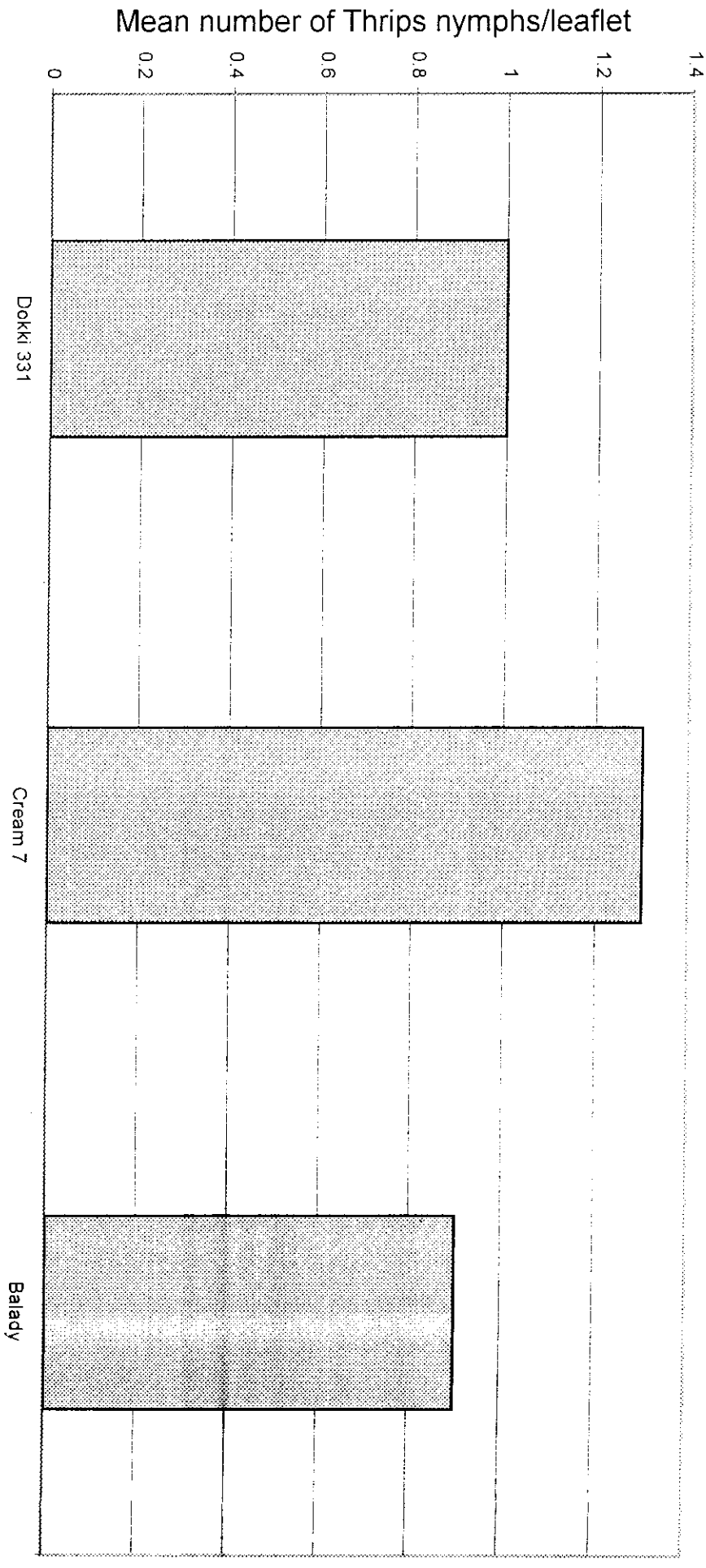

Fig. (3): Population of Thrips nymphs on plants of three cowpea varieties during summer plantation of 1997 season in Moshtohor area, Qalubia governorate"

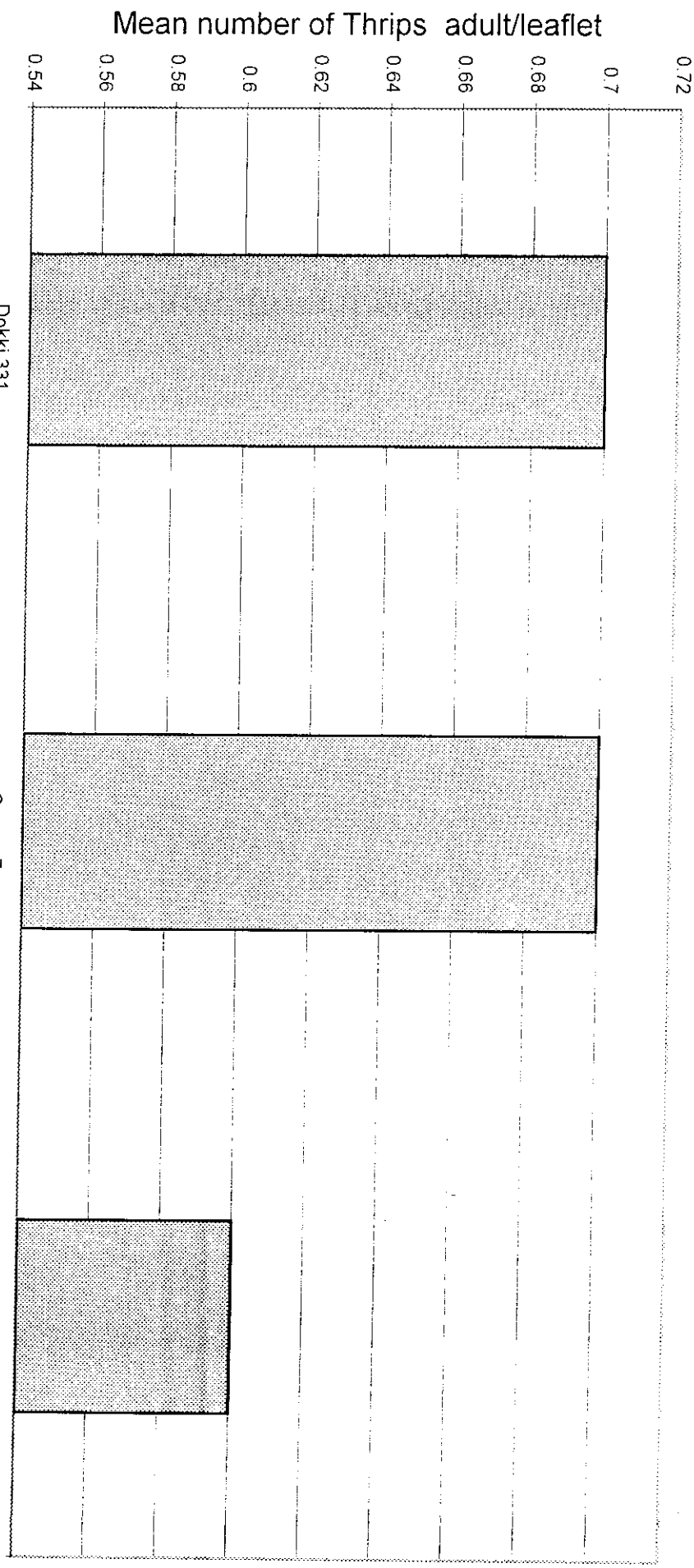

Fig. (4): Population of Thrips adults on plant of three cowpea varieties during summer plantation of 1997 season in Moshtohor area, Qalubia governorate

The allover mean counts of thrips adults in 1997 season were 0.7, 0.7 and 0.6 adults/leaflet for Dokki-331 variety, Cream-7 variety and Balady variety, respectively. Statistical analysis of data showed that the susceptibility of the three cowpea varieties to infestation with thrips. adults in 1997 season were nearly similar as the differences between infestation to three varieties were insignificant.

Darshan *et al.* (1986), Patial *et al.* (1988) and Brar *et al.* (1993) indicated that their tested varieties were highly resistant to infestation with thrips.

1.1.6- Whitefly, *Bemisia tabaci*, immature stages :

Data presented in Table (4) and Fig. (5) show the infestation rates with *B. tabaci* on the three varieties. It is clear that, immature stages varied according to variety. The highest weekly mean count of *B. tabaci* immature stages/leaflet occurred on May, 14*th* for Dokki-331 variety being 2.2 immature stages/leaflet, on May, 28*th* for Cream-7 variety with average 3.1 immature stages/leaflet and on May, 28*th* for Balady variety with average 2.6 immature stages/leaflet.

Concerning the allover mean count of *B. tabaci* immatures in1997 season those were 1.4, 2.0 and 1.8 immature stages/leaflet for Dokki-331, Cream-7 and Balady varieties, respectively. Dokki-331 proved as the best variety related with *B. tabaci* immature stages infestation with significant difference compared with the two other varieties.

1.1.7- Whitefly, *Bemisia tabaci*, adults :

The highest weekly average of *B. tabaci* adult occurred on June 25th and on July 30th for Dokki-331 variety with average 1.7 adults/plant,

Table (4) : Evaluation of three cowpea varieties to whitefly, *Bemisia tabaci* in 1997 season at Qalubyia Governorate.

Variety / Inspection date	Dokki-331		Cream-7		Balady	
	Immature stages	Adults	Immature stages	Adults	Immature stages	Adults
23/4/97	1.3	-	1.8	-	0.5	-
30/4	1.0	-	2.4	-	2.3	-
7/5	1.2	-	2.8	-	1.6	-
14/5	2.2	0.8	2.7	0.5	2.2	0.5
21/5	1.4	0.5	2.5	0.8	1.5	0.5
28/5	2.1	0.5	3.1	0.5	2.6	0.5
4/6	1.2	0.5	1.6	0.5	2.2	0.5
11/6	1.7	0.9	2.1	1.3	1.5	1.3
18/6	1.4	1.3	1.2	1.4	1.6	1.2
25/6	1.4	1.7	1.3	2.0	1.6	1.6
2/7	1.0	1.0	1.0	1.4	0.8	1.0
9/7	1.3	1.6	2.0	1.4	1.5	0.9
16/7	1.1	0.5	1.4	1.0	2.1	1.3
23/7	1.5	0.5	1.4	0.8	2.5	1.0
30/7	1.2	1.7	2.0	2.4	2.2	0.8
Total	21.0	11.5	29.3	14.0	26.7	10.9
Mean	1.4	1.0	2.0	1.2	1.8	0.9

L.S.D.$_{0.05}$ between varieties for :

Immature stages = 0.31

Adults = n.s.

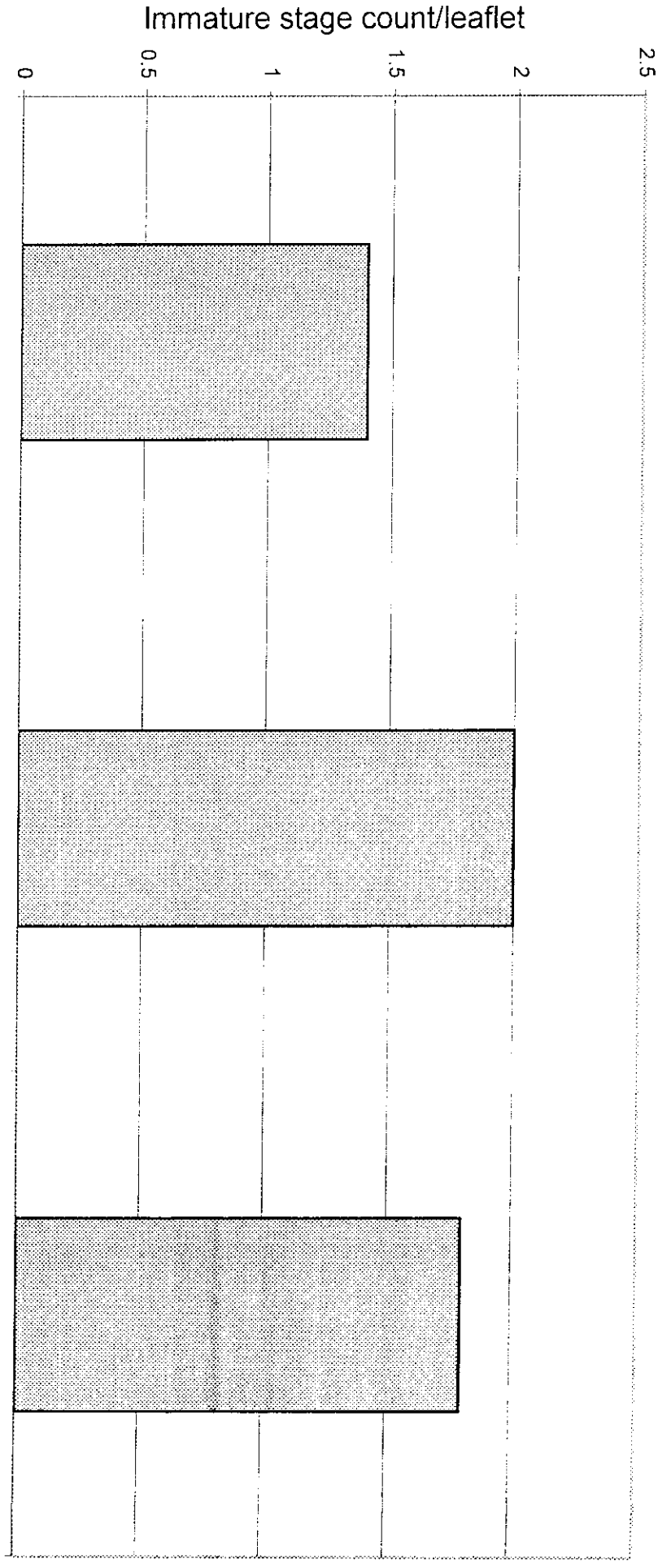

Fig. (5): Population of *B. tabaci*, immature stages on plants of three cowpea varieties during summer plantation of 1997 season in Moshtohor area, Qalubia governorate

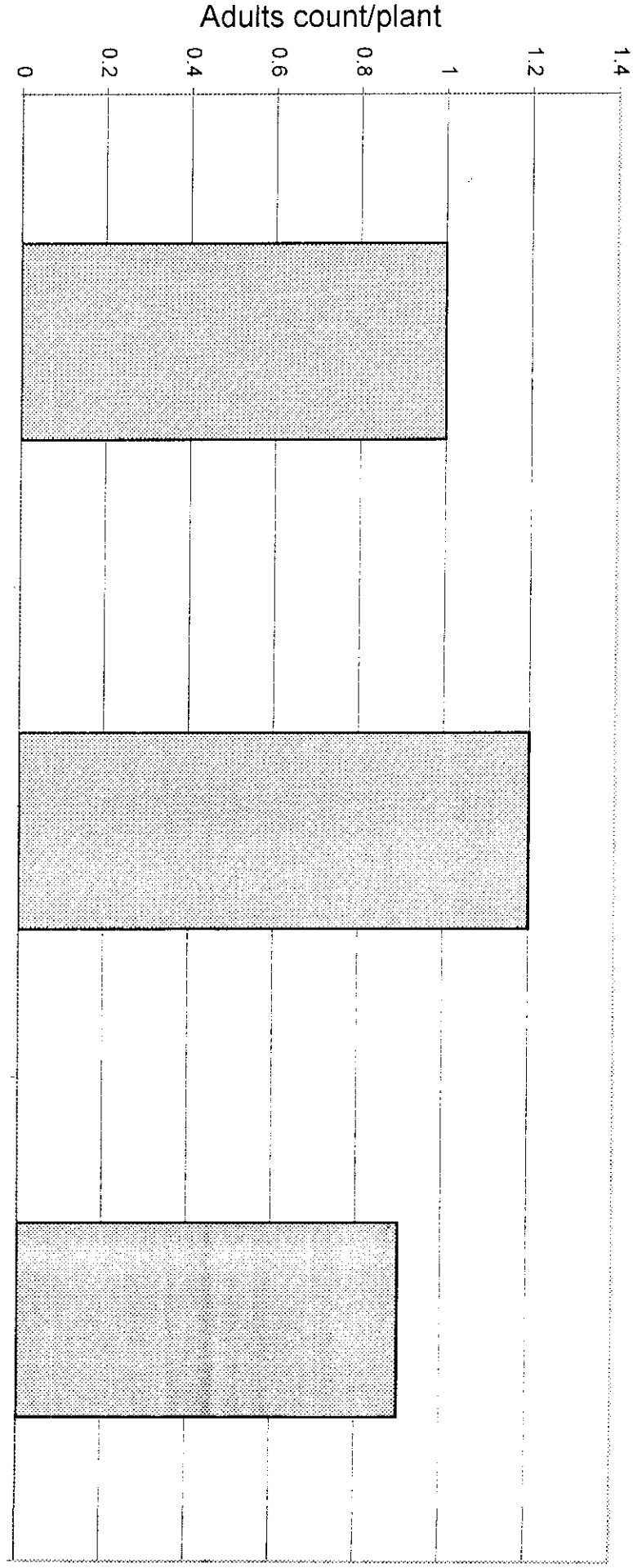

Fig. (6): Population of *B. tabaci* Adults stages on plants of three cowpea varieties during summer plantation of 1997 season in Moshtohor area, Qalubia governorate

on July, 30th for Cream-7 variety with average 2.4 adults/plant and on June, 25th for Balady variety with average 1.6 adult/plant.

On the other hand, the allover mean counts of *B. tabaci* adults in 1997 season were 1.0, 1.2 and 0.9 adults/plant for Dokki-331 variety, Cream-7 variety and Balady variety, respectively. Showing insignficant differences in the rate of infestation by *B. tabaci* adults to the three tested varieties.

These data agree with those previously reported by Djuwarso & Siryawan (1989) and Patel & Jhola (1992).

1.1.8- Nymphs of *Empoasca* sp. :

It is clear that, nymphs of *Empoasca* sp. varied according to variety.

Regarding the weekly average numbers of *Empoasca* sp. nymphs, the highest average occurred on June, 11*th* for Dokki-331 variety being 1.7 nymphs/leaflet, on July, 23*rd* for Cream-7 variety (1.5 nymphs/leaflet and on June, 11th and July, 30*th* (two peaks) for Balady variety with average 1.2 nymphs/leaflet.

Meanwhile, the estimated allover mean count of *Empoasca* sp. nymphs in 1997 season, on the previously mentioned three cowpea varieties were 0.9, 0.8 and 0.8 nymphs/leaflet respectively. Statistical analysis of data, showed that the differences between the mentioned means were insignificant indicating similar susceptibility of the three varieties to infestation by *Empoasca* sp. nymph stages.

Table (5) : Evaluation of three cowpea varieties to infestation by *Empoasca* sp. in 1997 season at Moshtohor (Qalubyia Governorate).

Variety / Inspection date	Dokki-331	Cream-7	Balady
23/4/97	0.5	0.5	0.5
30/4	0.5	0.5	0.5
7/5	0.5	0.5	0.5
14/5	0.8	0.5	0.8
21/5	1.3	0.8	0.5
28/5	0.5	1.1	0.5
4/6	1.0	0.8	1.1
11/6	1.7	0.9	1.2
18/6	1.4	0.5	0.8
25/6	0.8	0.5	0.9
2/7	0.8	1.0	0.5
9/7	0.9	0.5	0.5
16/7	0.8	0.8	0.7
23/7	1.0	1.5	1.1
30/7	1.3	1.0	1.2
Total	13.8	11.4	11.2
Mean	0.9	0.8	0.8

L.S.D.$_{0.05}$ between varieties : n.s.

1.2- Season 1998:

1.2.1- *Tetranychus* sp., eggs:

Data presented in Table (6) and Fig. (7) show the infestation rates with *Tetranychus* sp. on the three tested varieties. It is clear that rate of infestation by eggs varied according to variety.

The weekly average numbers of *Tetranychus* sp., eggs recorded per leaflet was the highest on July, 1*st* for Dokki-331 variety (15.2 eggs/leaflet) on June 3*rd* for Cream-7 variety (13.6 eggs/leaflet) and on July, 1*st* for Balady variety (16.7 eggs/leaflet).

The overall seasonal means for *Tetranychus*, eggs on tested cowpea varieties were 7.0, 6.0 and 5.6 eggs/leaflet for Dokki-331 variety, Cream-7 variety and Balady variety, respectively. Statistical analysis of data showed that the susceptibility of the three cowpea varieties to infestation with *Tetranychus* sp. eggs in 1998 season were insignificant.

1.2.2- *Tetranychus* sp., moving stages:

As shown in Table (6) and Fig. (8) the highest averages occurred on July, 1*st* for Dokki-331 variety (9.2 moving stages/leaflet), on June 24*th* for Cream-7 variety (7.8 moving stages/leaflet) and on July, 8*th* for Balady variety (11.4 moving stages/leaflet).

The allover mean count of *Tetranychus* moving stages in 1998 on Dokki-331, Cream-7 and Balady varieties were 5.1, 4.6 and 4.9 moving stages/leaflet respectively, indicating insignificant differences between the three cowpea varieties (Table 6).

Table (6) : Evaluation of three cowpea varieties infestation rates by *Tetranychus* sp. eggs and moving stages in 1998 season at Qalubyia Governorate.

Variety / Inspection date	Dokki-331		Cream-7		Balady	
	Egg	Moving stages	Egg	Moving stages	Egg	Moving stages
22/4/98	1.2	1.4	0.5	0.5	0.8	1.0
29/4	1.2	1.2	0.5	0.5	0.5	0.5
6/5	5.6	2.3	4.0	2.3	1.5	2.6
13/5	3.2	3.7	5.6	3.3	2.9	2.4
20/5	8.0	4.8	9.7	5.2	7.3	3.2
27/5	7.7	4.1	3.9	4.2	4.0	2.8
3/6	9.5	6.9	13.6	7.0	9.9	7.3
10/6	8.4	7.6	6.5	6.9	4.5	2.7
17/6	9.8	7.8	7.9	6.2	5.8	4.9
24/6	13.5	8.1	9.7	7.8	9.0	6.1
1/7	15.2	9.2	9.1	5.6	16.7	8.3
8/7	7.1	6.7	6.2	6.0	11.2	11.4
15/7	4.6	3.1	5.3	5.1	2.8	3.8
22/7	5.3	5.6	5.7	4.7	2.7	2.6
29/7	4.5	4.2	2.5	3.4	4.8	2.9
Total	104.2	76.7	90.7	68.7	84.4	23.9
Mean	7.0	5.1	6.0	4.6	5.6	4.9

L.S.D.$_{0.05}$ between varieties for :

Eggs = n.s.

Moving stages = n.s.

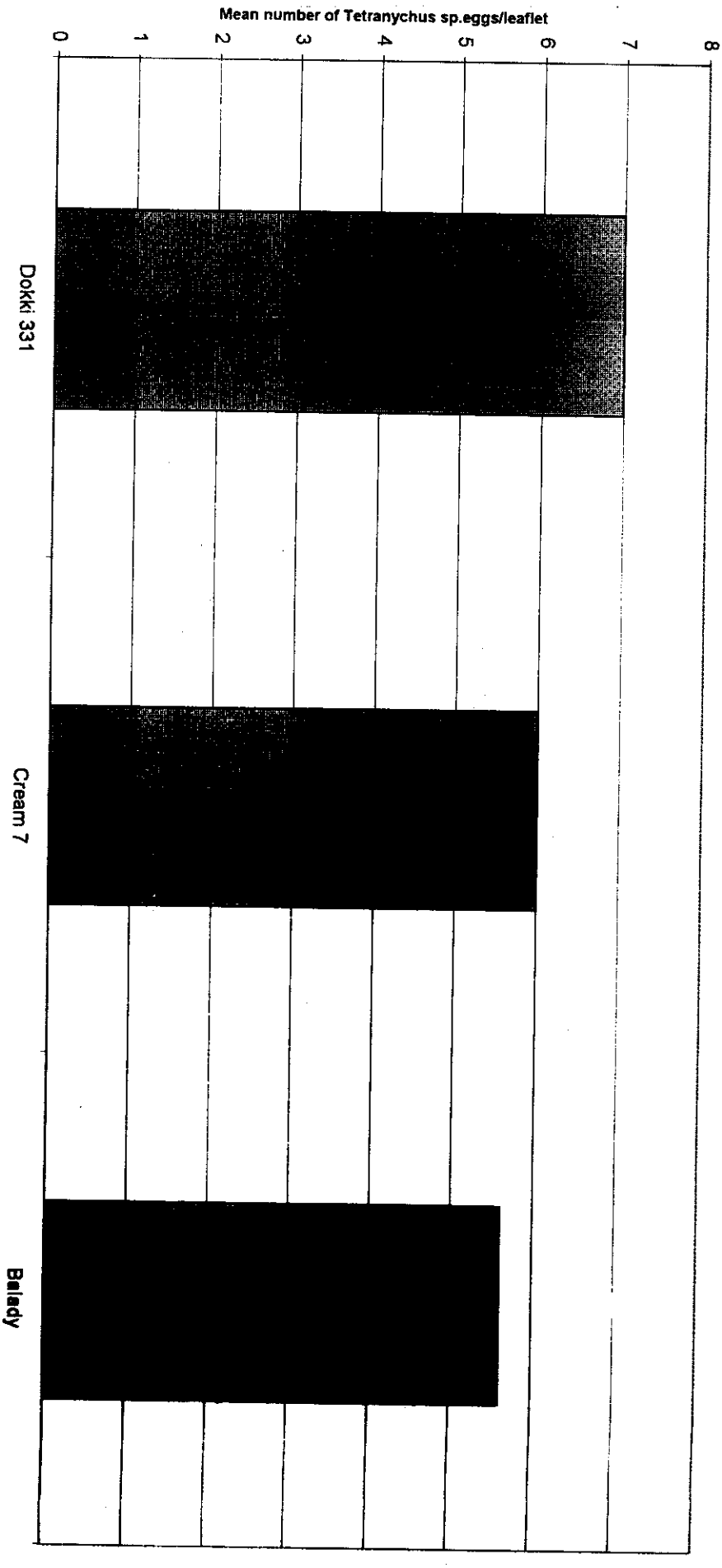

Fig. (7): Population of *Tetranychus* sp. eggs on plants of three cowpea variety during 2998 summper plantation in Moshtohor area, Qalubiyah Governorate

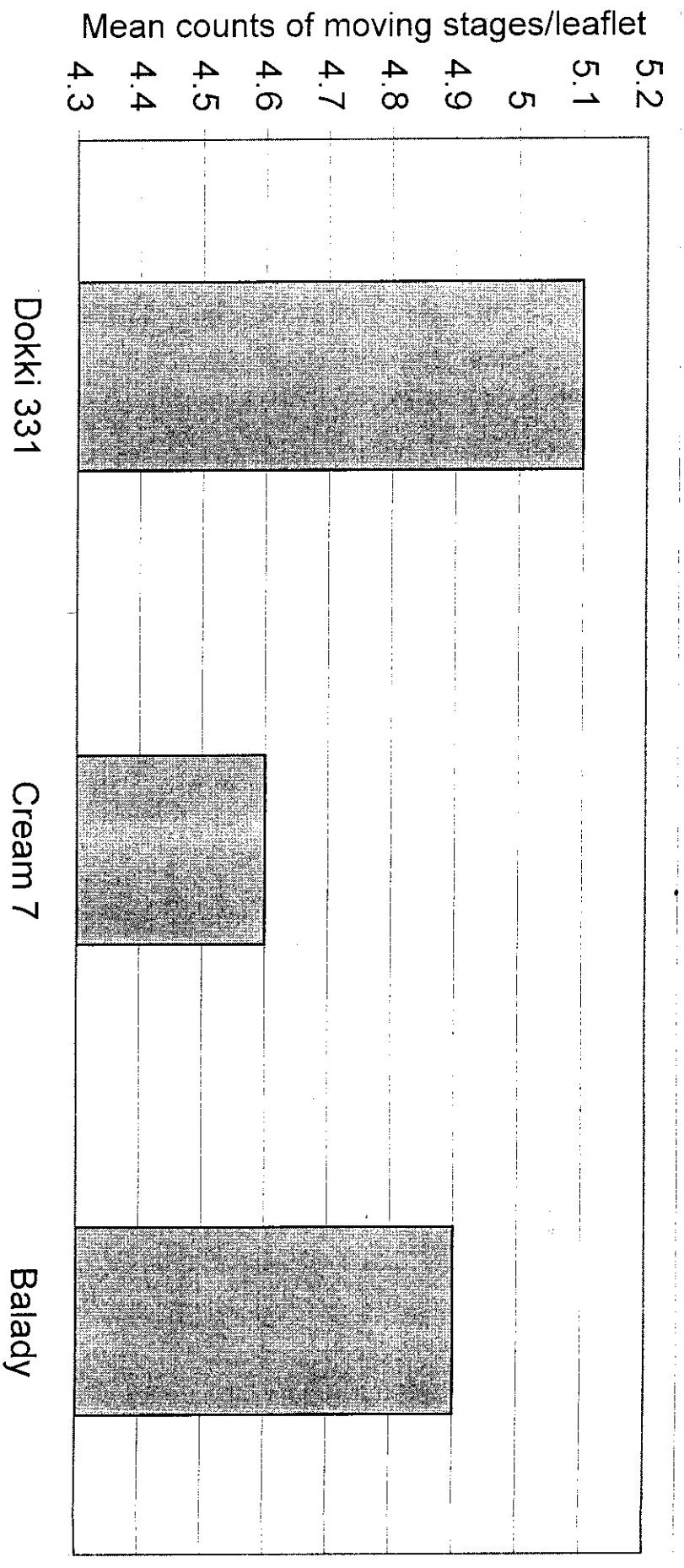

Fig. (8): Population counts of *Tetranychus* sp. moving stages on plants of three cowpea varieties during summer plantiation of 1998 season in Moshtohor area, Qalubia governorate

varieties, respectively, being insignificantly different indicating that the three varieties were, nearly, of the same susceptibility to aphids infestation.

1.2.4- Thrips nymphs:

Data presented in Table (8) and Fig. (9) show the weekly average numbers of Thrips nymphs recorded per leaflet were the highest averages occurred on June, 17*th* for Dokki-331 variety (2.5 nymphs/leaflet), on July, 2*nd* for Cream-7 variety (3.3 nymphs/leaflet) and on July, 8*th* for Balady variety (2.6 nymphs/leaflet).

Meanwhile, the estimated allover mean counts of thrips nymphs in 1998 season on various cowpea varieties were 1.5, 1.3 and 1.1 nymphs/leaflet for Dokki-331 variety, Cream-7 variety and Balady variety, respectively. Balady showed the lowest Thrips nymphs mean number the recorded value for this variety was singificatny, lower than those recorded on the two other varieties.

Table (7) : Evaluation of three cowpea varieties to aphids infestation in 1998 season at Moshtohor (Qalubyia Governorate).

Variety / Inspection date	Mean count/leaflet		
	Dokki-331	Cream-7	Balady
22/4/98	0.8	0.5	1.5
29/4	2.7	2.6	1.9
6/5	0.5	0.5	0.5
13/5	0.5	1.0	0.5
20/5	0.8	0.5	0.8
27/5	0.5	0.5	0.5
3/6	0.5	0.5	0.5
10/6	0.5	0.5	0.8
17/6	0.5	0.5	0.5
24/6	0.5	0.5	0.5
1/7	0.5	0.5	0.5
8/7	0.5	0.5	0.5
15/7	0.5	0.5	0.8
22/7	0.5	0.8	0.5
29/7	0.5	1.7	1.1
Total	10.3	11.6	11.4
Mean	0.7	0.8	0.8

L.S.D.$_{0.05}$ between varieties :n.s.

Table (8) : Evaluation of three cowpea varieties to infestation by *Thrips* sp. nymphs and adults in 1998 season at Qalubyia Governorate.

Variety	Dokki-331		Cream-7		Balady	
Inspection date	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
22/4/98	0.8	0.5	0.5	0.8	0.8	0.5
29/4	2.2	0.5	0.3	0.5	1.5	1.0
6/5	1.1	0.8	1.9	0.5	1.2	0.8
13/5	0.5	0.5	0.5	0.8	0.5	0.5
20/5	1.7	0.5	0.8	0.5	0.8	0.8
27/5	0.8	0.5	0.8	0.5	0.8	0.5
3/6	1.2	0.5	1.2	0.5	1.0	0.5
10/6	2.0	0.5	0.5	0.5	0.5	0.5
17/6	2.5	0.5	0.5	0.5	0.5	0.5
24/6	1.4	0.5	0.8	0.5	0.8	0.5
1/7	1.5	1.2	1.8	0.8	1.3	0.8
8/7	1.1	0.5	1.9	0.5	2.6	1.2
15/7	1.8	0.5	3.2	0.5	1.2	0.8
22/7	2.4	0.8	3.3	0.8	1.6	0.5
29/7	1.6	0.5	2.2	0.5	0.8	0.5
Total	22.6	8.8	20.2	8.7	15.9	9.9
Mean	1.5	0.6	1.3	0.6	1.1	0.7

L.S.D.$_{0.05}$ between varieties for :

Immature stages = 0.28

Adults = n.s.

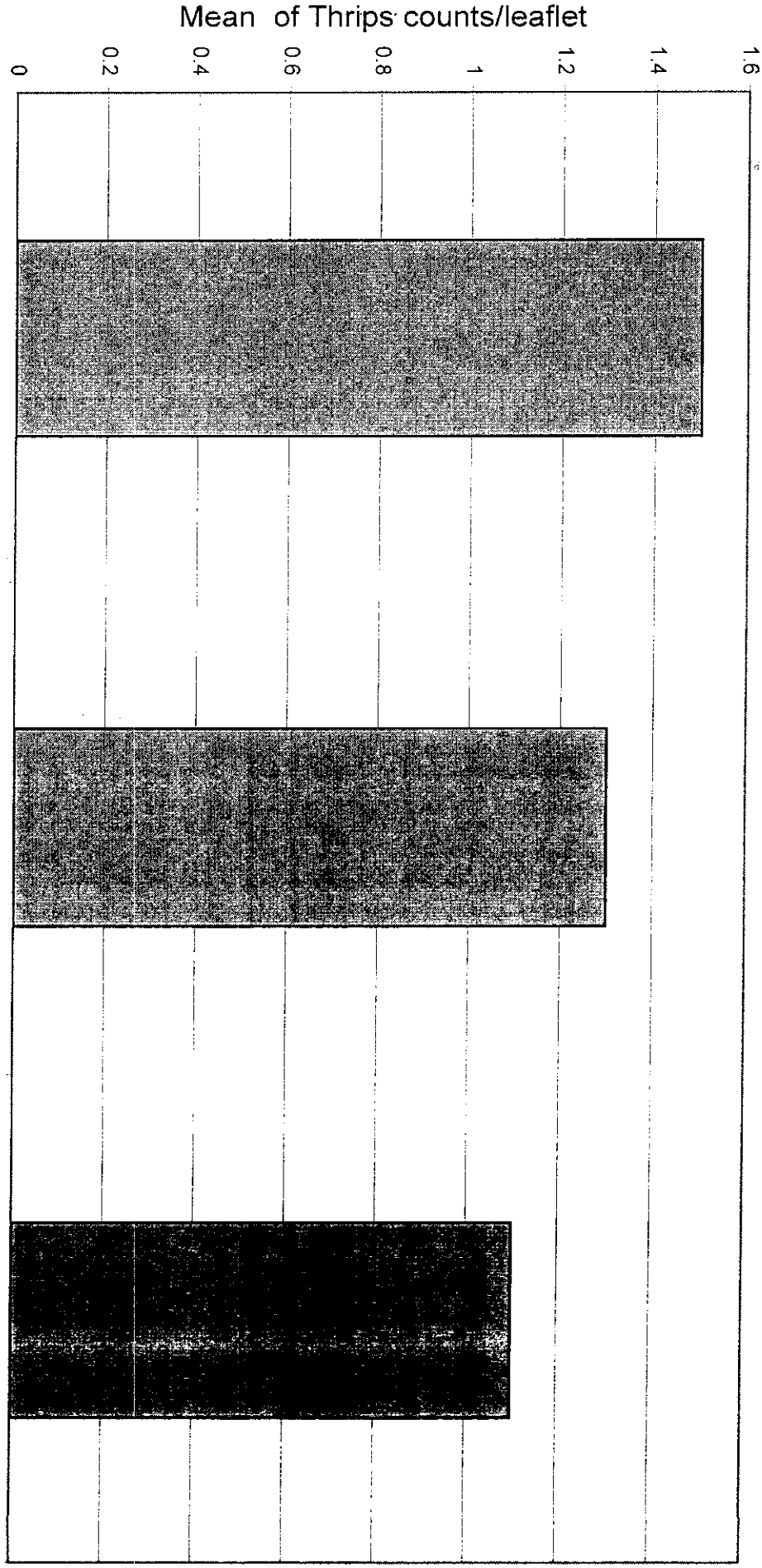

Fig. (9): Population counts of Thrips nymphs on plants of three cowpea varieties during summer plantation of 1998 season in Moshtohor area, Qalubia governorate

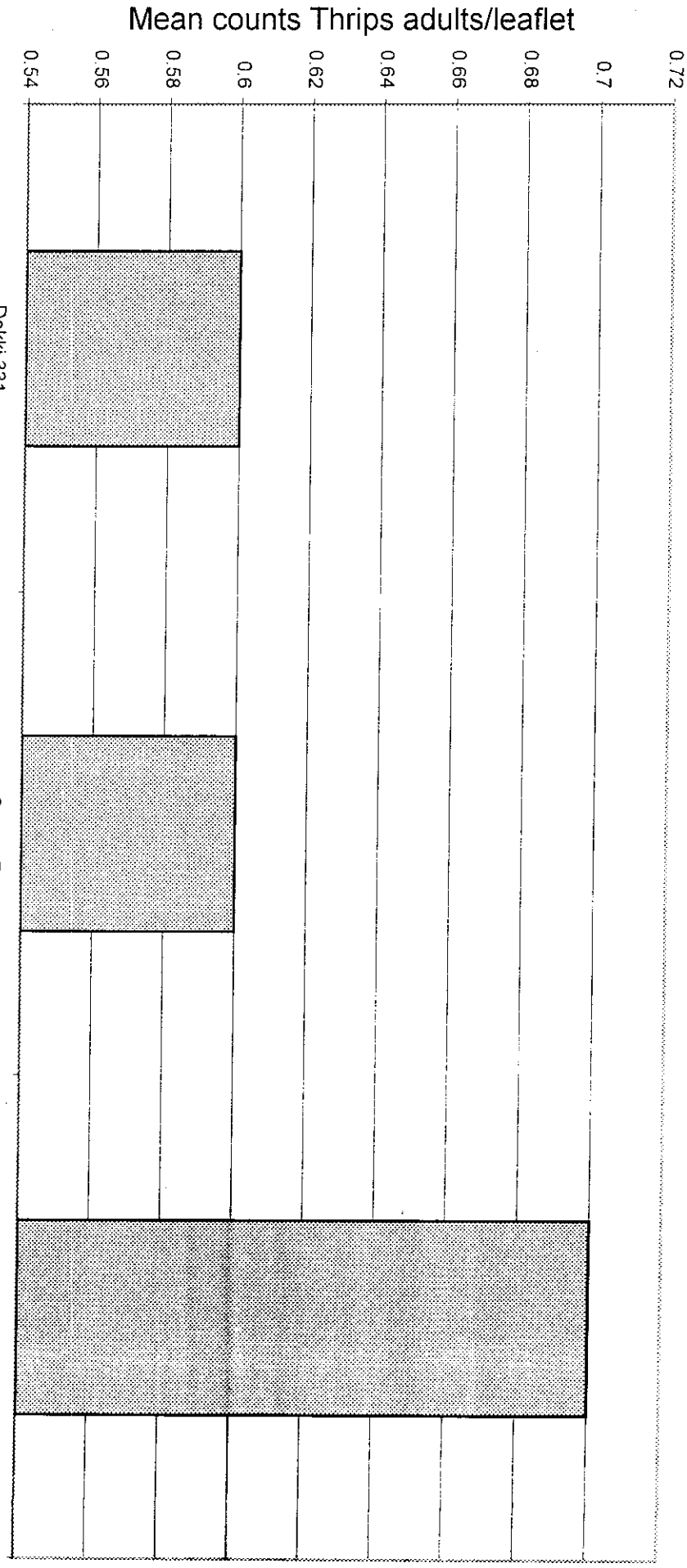

Fig. (10): Mean counts of Thrips adults on plants of three cowpea varieties during summer plantation of 1998 season in Moshtohor area, Qalubia governorate

1.2.5- Thrips adults:

Data presented in Table (8) and Fig. (10) show the means of weekly counts of Thrips adults/a cowpea leaflet. The highest averages occurred on July, 1*st* for Dokki-331 variety (1.2 adults/leaflet), on April, 22*nd*, on May, 13*th*, on July, 1*st* and on July, 22*nd* for Cream-7 variety (0.8 adult/leaflet) and on July, 8*th* for Balady variety (1.2 adults/leaflet).

Meanwhile, the estimated allover means of 1998 season for Thrips adults on the three cowpea varieties were 0.6, 0.6 and 0.7 adults/leaflet for Dokki-331 variety, Cream-7 variety and Balady variety, respectively, being insignificantly different indicating that the three varieties were, nearly, of the same susceptibility to thrips adults infestation

1.2.6- Whitefly, *Bemisia tabaci*, immature stages:

Data presented in Table (9) and Fig. (11) show the infestation rates with whitefly, *B. tabaci* on the three varieties. It is clear that the, immature stage counts varied according to variety.

Regarding weekly average numbers of *B. tabaci* immature stages recorded per leaflet, the population began high from the first week of inspection, April, 22*nd* and 29*th* for the three varieties (5.7, 8.3 and 5.5 immature stages/leaflet) and decreased gradually towards the end of season. A re increase in relative population density occurred from mid-July until the end of the season (3, 2.7 & 3.8 immatures/leaflet on July, 29th, Table (9).

As for the allover mean count of *B. tabaci* immatures throughout 1998 cowpea season for those were 2.8, 3.3 and 3.1 immature

Table (9) : *B. tabaci* immature stages and adult counts (count/leaflet) on three cowpea varieties in 1998 season at Qalubyia Governorate.

Variety	Dokki-331		Cream-7		Balady	
Inspection date	Immature stages	Adults	Immature stages	Adults	Immature stages	Adults
22/4/98	5.7	1.6	8.3	1.6	5.2	0.8
29/4	4.9	1.2	5.4	3.5	5.5	0.8
6/5	4.3	1.4	5.6	2.0	4.3	1.3
13/5	3.4	0.5	4.6	1.6	3.8	0.5
20/5	3.2	0.5	3.4	0.5	4.1	0.5
27/5	2.7	1.5	3.7	0.8	3.1	0.8
3/6	2.5	1.3	3.4	1.6	2.7	0.5
10/6	2.3	2.2	2.1	1.9	2.8	1.5
17/6	1.5	1.0	1.0	0.5	1.7	0.5
24/6	1.6	0.5	1.0	1.5	1.6	1.3
1/7	1.7	0.5	2.4	1.2	1.5	2.0
8/7	1.0	1.2	1.6	1.2	2.5	1.8
15/7	2.3	1.5	2.0	1.9	1.8	2.4
22/7	1.2	2.1	2.0	2.6	2.0	2.9
29/7	3.0	2.7	2.7	5.1	3.8	3.5
Total	41.3	19.7	49.2	27.5	46.4	20.2
Mean	2.8	1.3	3.3	1.8	3.1	1.3

L.S.D.$_{0.05}$ between varieties for :

Immature stages = 0.36

Adults = 0.25

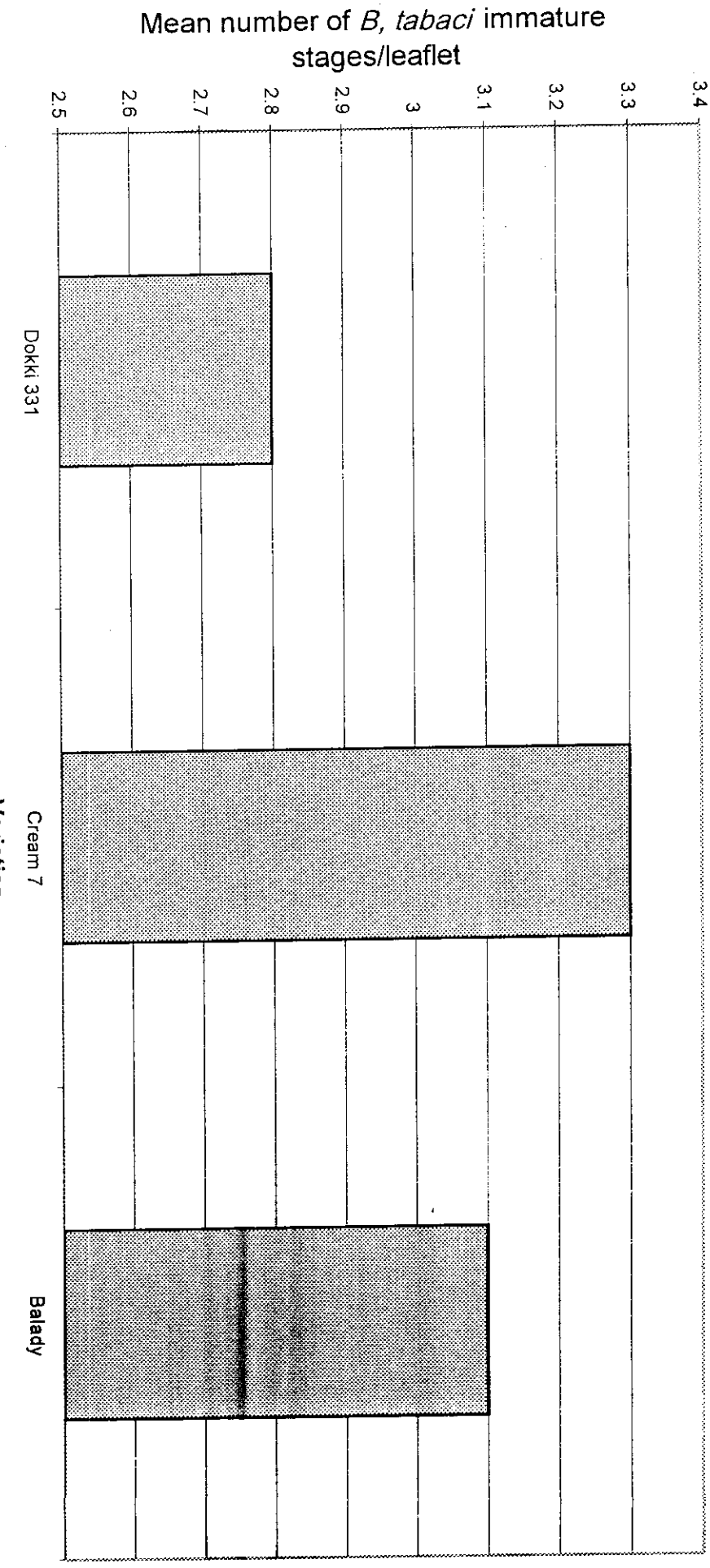

Fig. (11): Population of *B. tabaci*, immature stages on plants of three cowpea varieties during summer plantation of 1998 season in Moshtohor area, Qalubia governorate

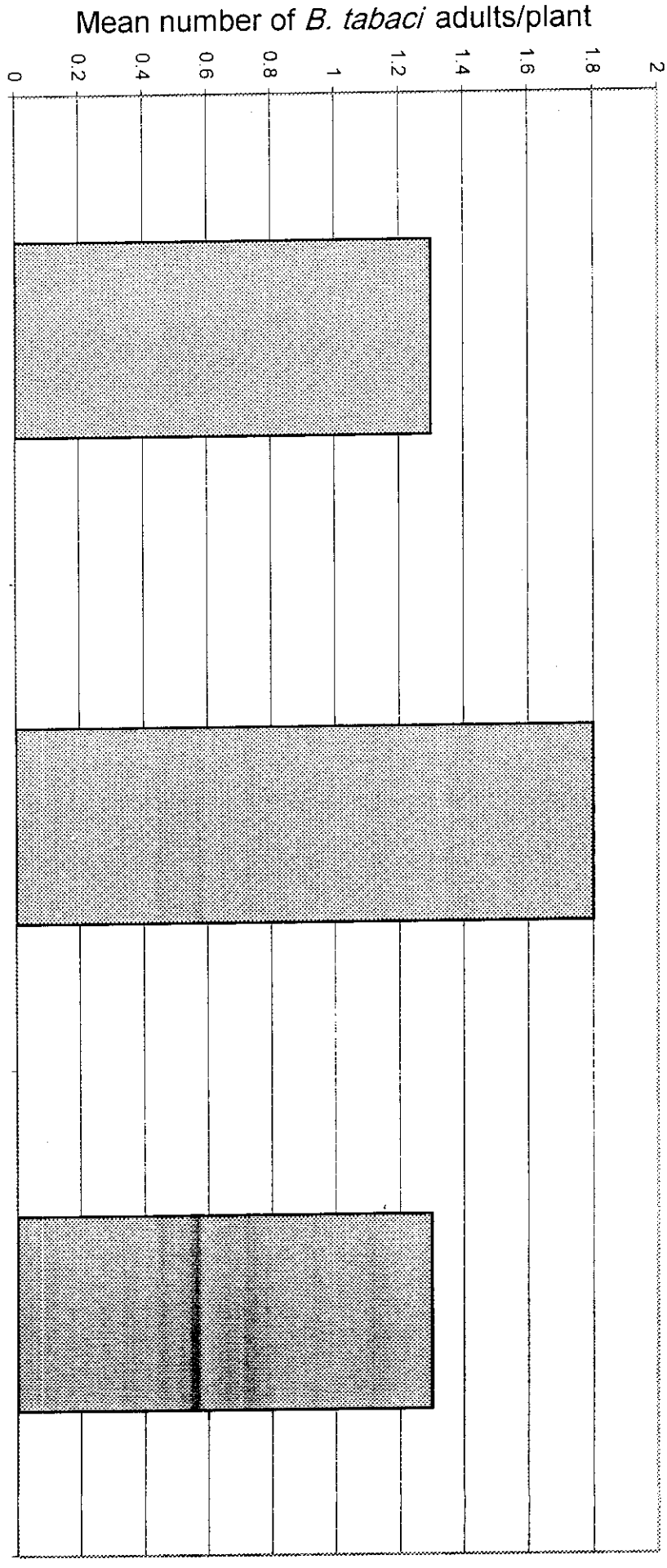

Fig. (12): Population of *B. tabaci* adults on plants of three cowpea varieties during summer plantation of 1998 season in Moshtohor area, Qalubia governorate

stages/leaflet for Dokki-331, Cream-7 and Balady varieties, respectively. Dokki-331 harboured the lowest number of *B. tabaci* immature being significantly lower than that recorded on Balady variety and significantly lower than that recorded on Cream-7 variety which manifested highest susceptibility on infestation by *B. tabaci* immatures.

1.2.7- Whitefly, *Bemisia tabaci*, adults:

As shown in Table (9) and Fig. (12) the infestation rates with whitefly, *B. tabaci* varied between different varieties. Regarding the weekly average numbers of *B. tabaci* adults recorded per plant, the highest averages occurred on July, 29*th* for Dokki-331, Cream-7 and Balady varieties with averages 2.7, 5.1 and 3.5 adults/plant, respectively. The grand seasonal mean for *B. tabaci*, on the three cowpea varieties were 1.3, 1.8 and 1.3 adults/plant for Dokki-331, Cream-7 and Balady varieties, respectively. The obtained date proved that Dokki-331 and Balady are the best varieties as they harboured the lowest infestation levels by *B. tabaci* adults with significant difference compared with the remaining variety (Cream-7 variety).

1.2.8- *Empoasca* sp. nymphs:

The obtained data indicated that the rate of infestation by *Empoasca* sp. nymphs on cowpea plants varied significantly, between different varieties Table (10). The highest weekly average numbers of *Empoasca* sp. nymphs occurred on June, 3rd for Dokki-331 and Balady varieties with averages 4.4 and 2.5 nymphs/leaflet, respectively, and on July, 22nd for Cream-7 variety with average 3.1 nymphs/leaflet.

The allover 1998 seasonal mean of *Empoasca* sp. nymphs counted on the three cowpea varieties were 1.9, 1.7 and 1.3 nymphs/leaflet for

Dokki-331, Cream-7 and Balady varieties, respectively. These data indicated that Balady variety harboured, significantly, the least mean count of *Empoasca* sp. nymphs, followed by Cream-7, while Dokki-331 variety appeared as the most favourable of Empoasca sp. nymphs infestation.

Table (10) : Evaluation of infestationby *Empoasca* sp. nymphs on plants of three cowpea varieties in 1998 season at Qalubyia Governorate (count/leaflet)

Variety / Inspection date	Dokki-331	Cream-7	Balady
22/4/98	0.5	0.5	0.5
29/4	0.5	0.5	0.8
6/5	1.6	1.4	0.5
13/5	2.9	1.9	0.5
20/5	3.5	2.6	1.2
27/5	3.7	2.8	1.4
3/6	4.4	2.4	2.5
10/6	2.6	2.2	2.5
17/6	1.3	0.8	1.3
24/6	1.2	1.1	0.5
1/7	1.0	1.2	1,0
8/7	0.8	1.6	0.5
15/7	1.3	1.0	1.7
22/7	1.6	3.1	1.8
29/7	1.3	2.3	2.4
Total	28.4	25.4	19.1
Mean	1.9	1.7	1.3

L.S.D.$_{0.05}$ between varieties : 0.31

2- Effect of Planting Dates on the Infestation with Different Pests:

2.1- Season 1997:

2.1.1- *Tetranychus* sp., eggs:

Data presented in Table (11) and Fig. (13) show the weekly averages of *Tetranychus* sp., egg counts recorded per leaflet on cowpea plants cultivated in three planting dates during 1997 season. The highest averages occurred on June, 18th for the first planting date (13.7 eggs/leaflet); on June, 25th for the second planting date (7.3 eggs/leaflet); and on July, 30th for the third planting date (7.6 eggs/leaflet).

Meanwhile, the allover seasonal mean for *Tetranychus* sp., egg counts on the three planting dates were 5.6, 5.0 and 5.0 eggs/leaflet for the first, second and third planting date, respectively, showing insignificant effect of the date of planting on the rate of infestation with *Tetranychus* sp., eggs.

2.1.2- *Tetranychus* sp., moving stages:

Data presented in Table (11) and Fig. (14) show weekly average numbers of *Tetranychus* sp., moving stages on cowpea plants cultivated in three planting dates. The highest averages occurred on June, 11th for the first planting date (8.8 moving stages/leaflet); on June, 25th for the second planting date and third planting dates (6.1 and 6.2 moving stages/leaflet), respectively.

Table (11) : Infestation rates by *Tetranychus* sp. eggs and moving stages on cowpea plants cultivated in 3 planting dates in 1997 season at Qualyubia Governorate.

Planting dates / Inspection date	First date		Second date		Third date	
	Eggs	Moving Stages	Eggs	Moving stages	Eggs	Moving stages
30/4/97	1.9	1.8	-	-	-	-
7/5	2.1	1.9	-	-	-	-
14/5	1.8	1.3	-	-	-	-
21/5	3.3	1.8	3.5	4.1	-	-
28/5	3.7	3.1	3.6	3.7	-	-
4/6	6.9	4.7	6.0	3.3	-	-
11/6	11.7	8.8	7.1	4.6	4.8	3.3
18/6	13.7	8.3	5.2	5.2	6.2	3.9
25/6	-	-	7.3	6.1	6.3	6.2
2/7	-	-	3.4	3.8	3.0	3.0
9/7	-	-	4.2	3.9	4.3	4.5
16/7	-	-	-	-	1.7	2.6
23/7	-	-	-	-	6.3	4.9
30/7	-	-	-	-	7.6	5.6
Total	45.1	31.7	40.3	34.7	40.2	34.0
Mean	5.6	4.0	5.0	4.3	5.0	4.3

L.S.D.0.05 for :
Eggs : n.s.
Moving stages : n.s.

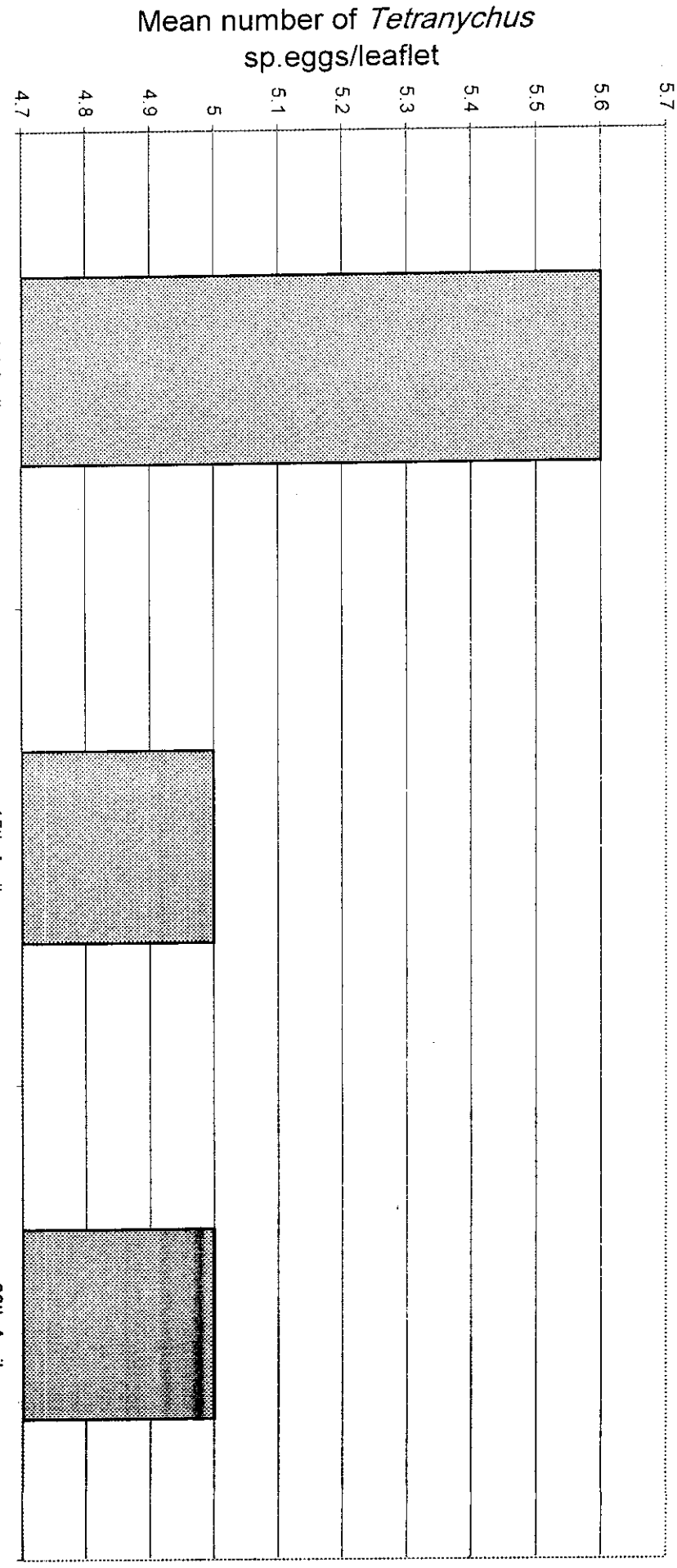

Fig. (13): Population of *Tetranychus* sp., eggs on Cream variety plants cultivated in three planting dates during summer plantation in 1997 season in Moshtohor area, Qalubia governorate

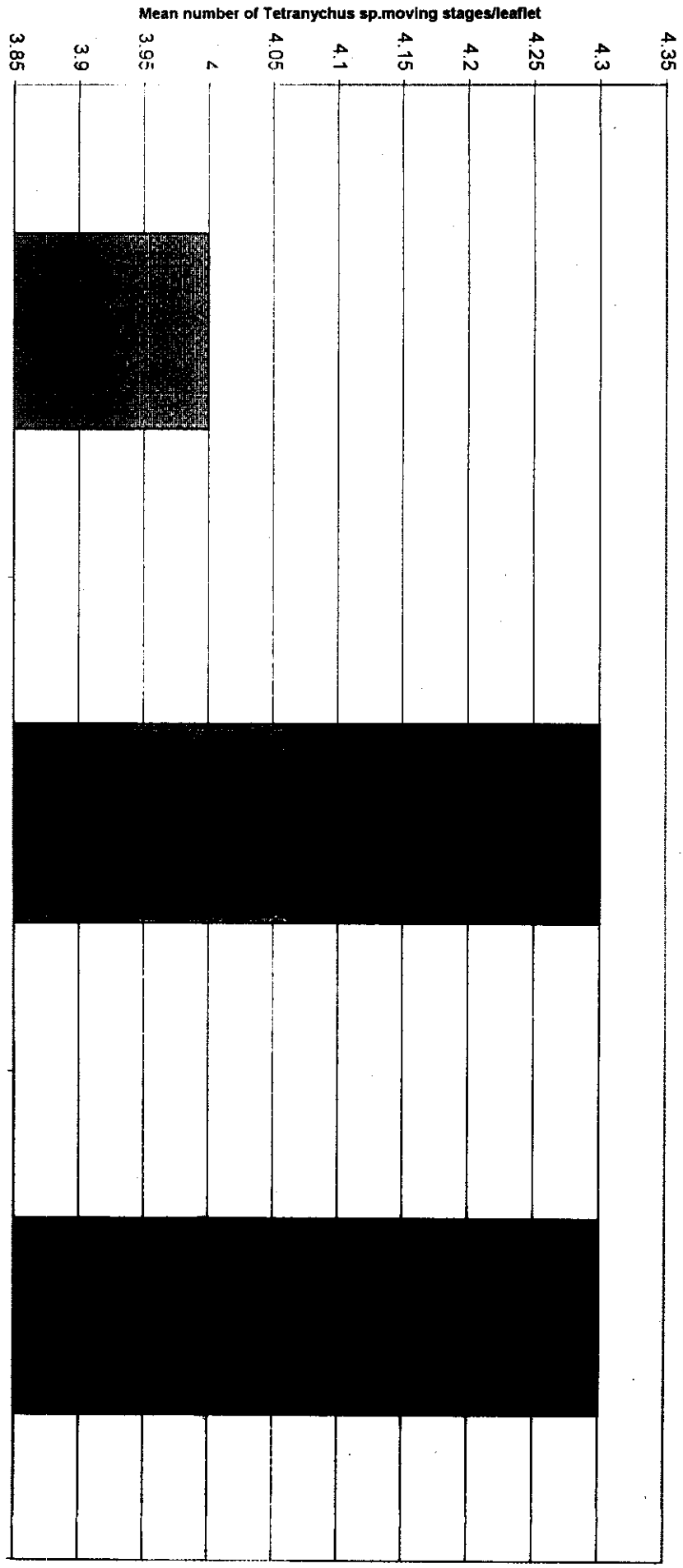

Fig. (14): Population of *Tetranychus* sp.moving stages on Cream variety cultivated in three planting dates during summer plantation in Moshtohor area, Qalubiyah Governorate

The allover mean counts of *Tetranychus* sp. moving stages/leaflet on plants of the three planting dates were 4.0, 4.3 and 4.3 moving stages/leaflet for the first, second and third planting date, respectively, indicating insignificant effect of the date of planting to infestation rate by *Tetranychus* sp. moving stages

These data go in line with the findings of **Singh and Singh (1987)**, in India; **Singh (1995)** in India and **Sawires (1978)** and **Abou-Awad (1984)** in Egypt.

2.1.3- Aphids:

Regarding weekly average numbers of aphids recorded per a cowpea leaflet from different varieties, the highest averages occurred on June, 18th for the first planting date with average 7.4 aphids/leaflet on May, 28th for the second planting date with average 1.0 aphids/leaflet and on July, 30th for the third planting date with average 1.7 aphids/leaflet.

The overall seasonal mean of aphid counts on the plants of the three planting dates were 3.4, 0.6 and 0.7 aphids/leaflet for the first, second and third planting date, respectively. These data indicated that cowpea plants cultivated in the first planting date (April, 1st) received, significantly, the highest infestation rate by aphids, while the second and third planting dates were the best related with aphids.

These data agree with those previously reported by **Galal (1989), Carmen *et al.* (1993)** and **Helaly (1982)** in Egypt.

Table (12) : Evaluation of three planting dates in relation to aphids infestation to cowpea plants in 1997 season at Qualyubia Governorate (count/leaflet)

Planting date / Inspection date	First date	Second date	Third date
30/4/97	5.4	-	-
7/5	1.0	-	-
14/5	0.9	-	-
21/5	3.0	0.9	-
28/5	4.0	1.0	-
4/6	5.3	0.5	-
11/6	0.5	0.5	0.5
18/6	7.4	0.5	0.5
25/6	-	0.5	0.5
2/7	-	0.5	0.5
9/7	-	0.5	0.5
16/7	-	-	0.8
23/7	-	-	0.5
30/7	-	-	1.7
Total	27.5	4.9	5.5
Mean	3.4	0.6	0.7

L.S.D.$_{0.05}$: 1.30

2.1.4- Thrips nymphs:

Data presented in Table (13) show the weekly infestation rates with Thrips nymphs and adults on the three planting dates. It is clear that nymphs counts varied according to planting date. The highest weekly average of nymphal infestation occurred on May, 7th for the first planting date (2.2 nymphs/leaflet); on June, 18th for the second planting date (1.3 nymphs/leaflet) and on July, 30th for the third planting date (1.9 nymphs/leaflet).

As shown in Table (13) and Fig. (15), the overall seasonal means of Thrips nymphs infestation to cowpea plants cultivated in three planting dates were 1.1, 0.8 and 1.0 nymphs/leaflet for the first, second and third planting dates, respectively. Statistical analysis indicated that the second planting date is the best in relation to *Thrips* sp., nymphs infestation as the plants of this planting date harboured significantly, the lowest infestation rate than the two other dates.

2.1.5 Thrips adults:

As shown in Table (13) and Fig. (16) the highest weekly average numbers of *Thrips* sp. adults averages occurred on April, 30*th* for the first planting date with average 1.4 adults/leaflet; on May, 21*st* for the second planting date with average 1.0 adults/leaflet; and on July, 30*th* for the third planting date with average 0.8 adults/leaflet.

The allover seasonal mean of Thrips adult counts on cowpea plants of the three planting dates were 0.7, 0.6 and 0.5 adults/leaflet for the first,

Table (13) : Evaluation of three planting dates to Thrips nymphs and adults in 1997 season at Qualyubia Governorate.

Planting dates / Inspection date	First date		Second date		Third date	
	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
30/4/97	0.5	1.4	-	-	-	-
7/5	2.2	0.5	-	-	-	-
14/5	1.5	0.5	-	-	-	-
21/5	1.1	0.9	0.9	1.0	-	-
28/5	1.0	0.5	0.5	0.8	-	-
4/6	0.5	0.5	0.8	0.5	-	-
11/6	1.0	0.8	0.5	0.5	0.5	0.5
18/6	1.4	0.5	1.3	0.5	1.4	0.5
25/6	-	-	1.1	0.5	1.0	0.5
2/7	-	-	1.1	0.5	0.5	0.5
9/7	-	-	0.5	0.5	1.2	0.5
16/7	-	-	-	-	0.5	0.5
23/7	-	-	-	-	1.1	0.5
30/7	-	-	-	-	1.9	0.8
Total	9.1	5.6	6.7	4.8	8.1	4.3
Mean	1.1	0.7	0.8	0.6	1.0	0.5

L.S.D.0.05 for :

Nymphs : 0.29
Adults : 0.14

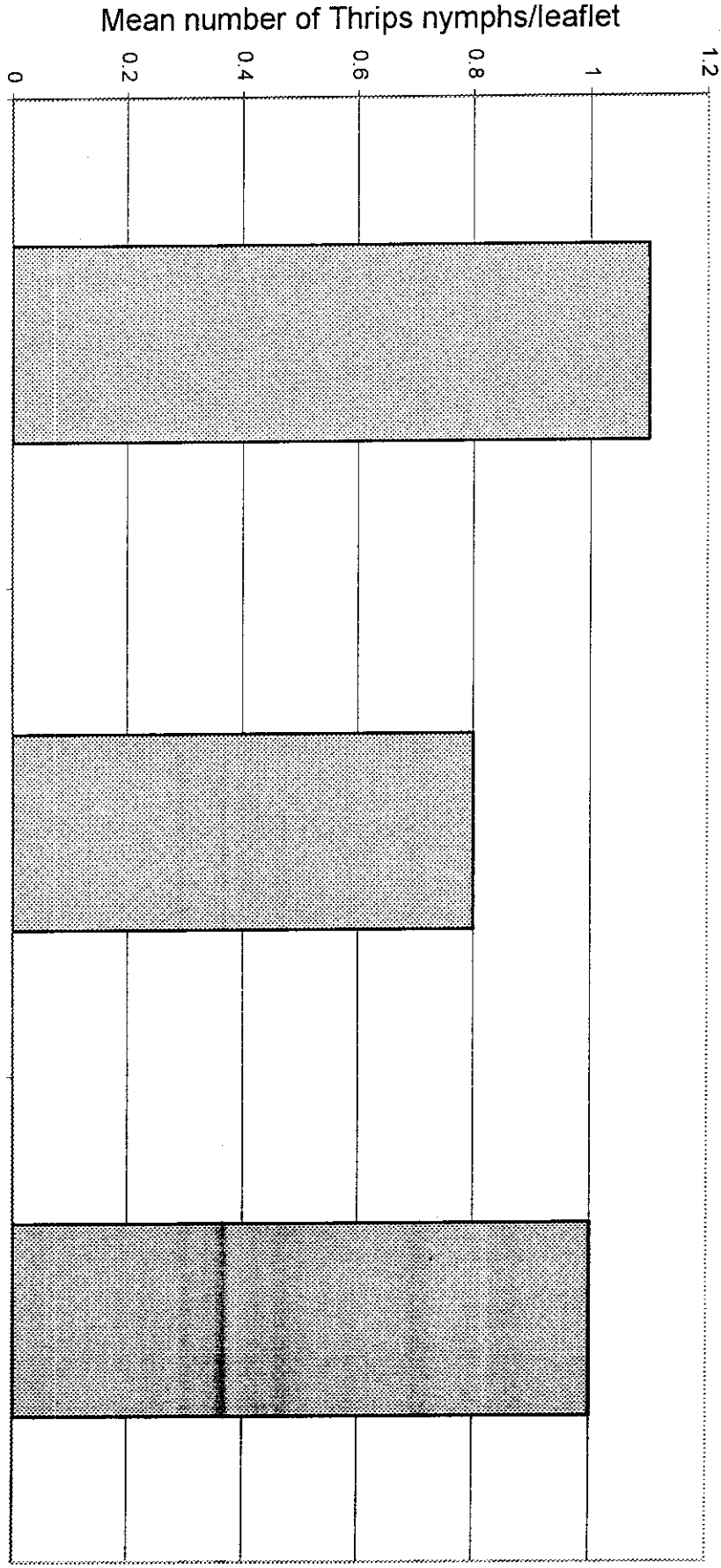

Fig. (15): Thrips nymphal counts on Cream variety plants cultivated in three planting dates in 1997 season at Moshtohor - Qalubia governorate

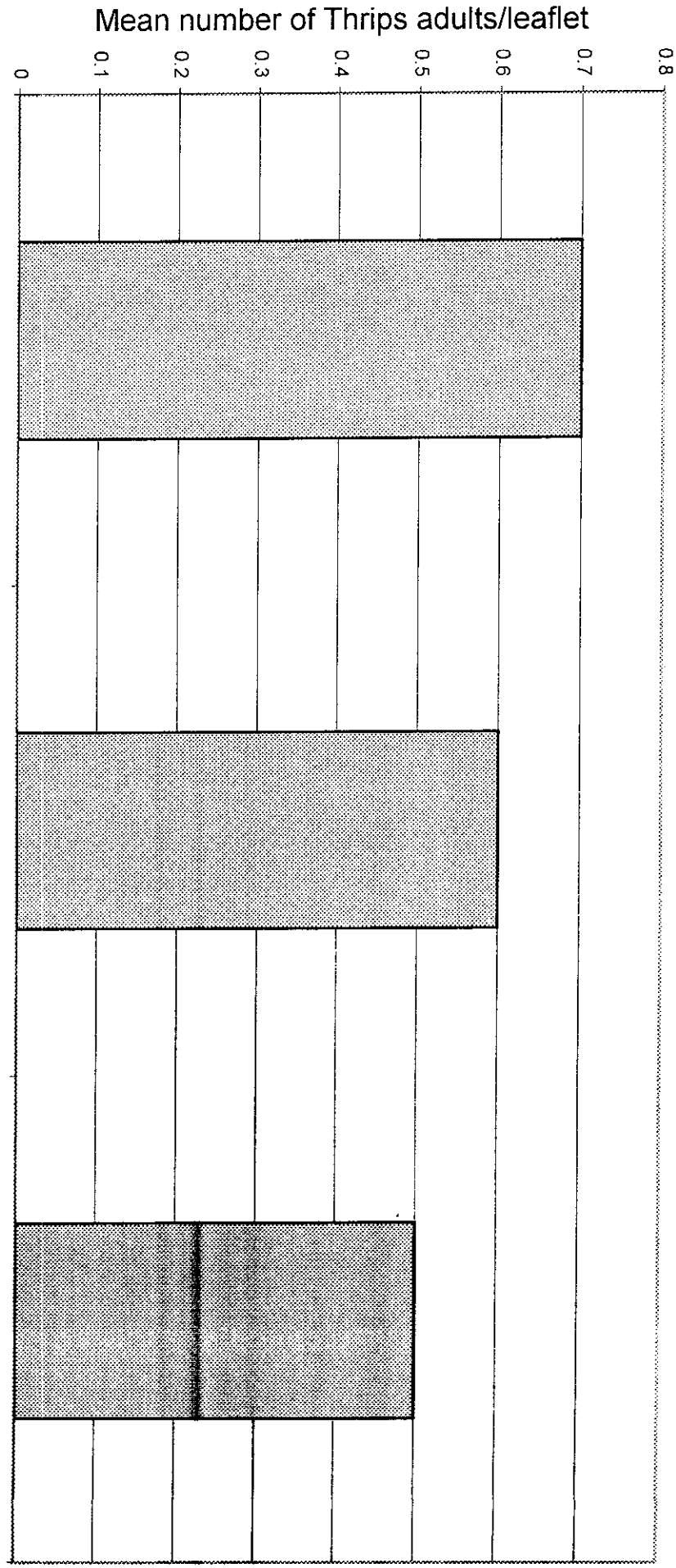

Fig. (16): Population of Thrips adults on cowpea Cream variety plants during summer plantation of 1997 season in Moshtohor area, Qalubia governorate

second and third planting date, respectively. These data showed that planting of cowpea on April 30th led to significantly, the least infestation rate by Thrips adults than in cases of the first and second dates.

These results are in agreement with those of **Morishita (1988)** in Japan; **Neuzen *et al.* (1953); Donchen (1996)** in Bulgaria; **Hayder & Sherif (1987)** in Egypt.

2.1.6- Whitefly, *Bemisia tabaci*, immature stages:

Data presented in Table (14) show that the weekly average number of *Bemisia tabaci* immatures were the highest averages occurred on May, 14*th* for the first planting date (2.5 indivedual/leaflet); on May, 21*st* for the second planting date (2.4 indivedual /leaflet) and on July, 30*th* for the third planting date (2.2 indivedual /leaflet).

The allover seasonal mean of *B. tabaci* immatures on the three planting dates were 2.0, 1.6 and 1.3 individuals/leaflet for the first, second and third planting date, respectively, indicating lower mean count on plants of the third planting date being the best for avoiding high infestation by *B. tabaci* immature stages with significant difference compared with the second planting date which came the next while the first planting date appeared unsuitable as plants received the highest infestation rate with *B. tabaci* immatures (Table 14 and Fig. 17).

2.1.7- Whitefly, *Bemisia tabaci*, adults:

Data presented in Table (14) and Fig. (18) show the infestation rates with whitefly *B. tabaci*, on the three planting dates.

Table (14) : Evaluation of cowpea planting in three planting dates on infestation rates by *Bemisia tabaci* immature and adults stages in 1997 season at Qualyubia Governorate (count/leaflet)

Planting dates / Inspection date	First date		Second date		Third date	
	Immature Stage	Adults	Immature stage	Adults	Immature stage	Adults
30/4/97	2.3	0.5	-	-	-	-
7/5	2.3	0.5	-	-	-	-
14/5	2.5	0.8	-	-	-	-
21/5	2.2	0.5	2.4	0.5	-	-
28/5	2.1	0.5	2.0	0.5	-	-
4/6	1.3	0.5	2.1	0.5	-	-
11/6	2.1	0.9	1.7	0.5	0.8	0.5
18/6	1.3	1.3	1.1	0.8	1.4	1.4
25/6	-	-	1.4	1.8	1.3	1.1
2/7	-	-	0.9	0.5	1.2	1.0
9/7	-	-	0.9	1.4	0.9	5.0
16/7	-	-	-	-	1.5	0.5
23/7	-	-	-	-	1.1	0.5
30/7	-	-	-	-	2.2	0.8
Total	16.0	5.5	12.5	6.5	10.4	6.3
Mean	2.0	0.7	1.6	0.8	1.3	0.8

L.S.D.0.05 for :

Immature stages : 0.48

Adults : n.s.

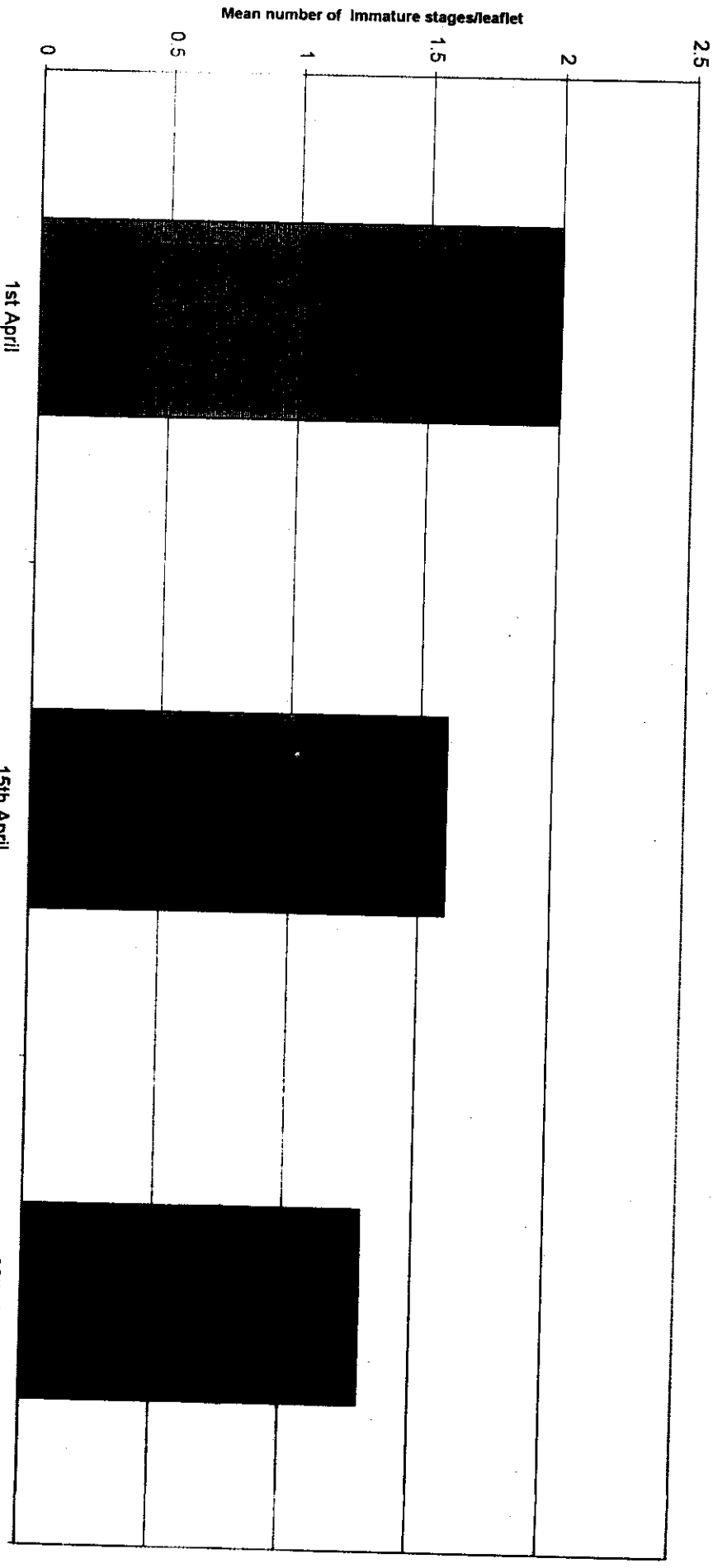

Fig. (17): Population of *B. tabaci immature* stages on Cream 7 plants cultivated in three planting dates of 1997 season in Moshtohor area, Qalubiyah Governorate

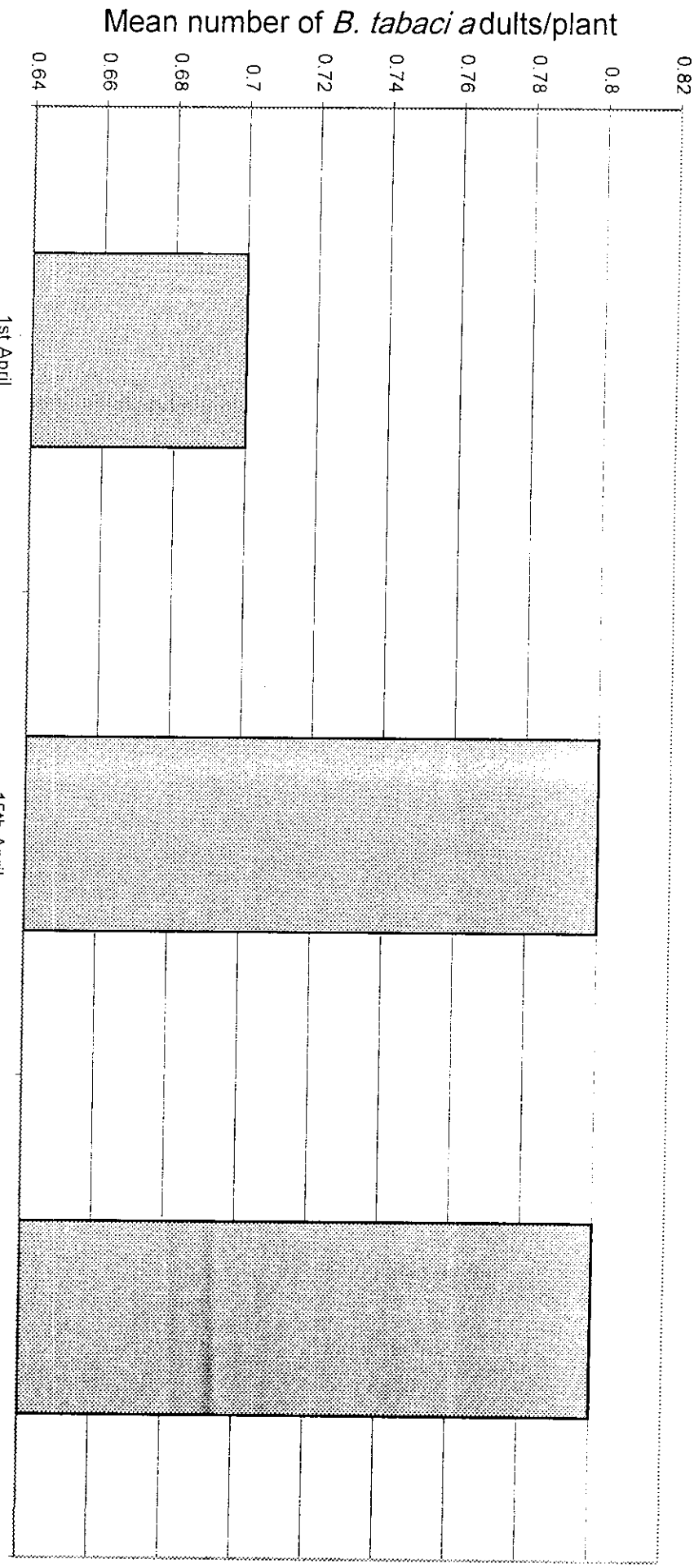

Fig. (18): Seasonal mean counts of *B. tabaci* adults on cowpea of Cream 7 plants cultivated in 3 planting datess of 1997 season in Moshtohor area, Qalubia governorate

Regarding weekly average numbers of *B. tabaci* adults on different planting dates, the highest average occurred on June, 18*th* for the first planting date and third planting date with averages 1.3 and 1.4 adults/plant, respectively; and on June, 25*th* for the second planting date with average 1.8 adults/plant (Table 14).

The differences in *B. tabaci* adult mean counts on cowpea leaves after cultivation in three planting dates of 1997 season were, statistically insignificant, being 0.7, 0.8 and 0.8 adults/plant for the first, second and third planting date, respectively. Thus indicating, nearly, no effect of the date of planting of cowpea seeds throughout April on the rate of infestation by *B. tabaci* adults.

This data agree with those of **Nour-El-Din (1984), El-Sayed *et al.* (1991)** and **Paiva and Goulart (1995).**

2.1.8- *Empoasca* sp. nymphs:

From data presented in Table (15) show the infestation rates with *Empoasca* sp. nymphs on cowpea plants cultivated in three planting dates. It is clear that nymphs varied according to planting date. The weekly mean counts of *Empoasca* sp. nymphs were the highest averages occurred on June, 18*th* for the first planting date (1.1 nymphs/leaflet); on July, 9*th* for the second planting date (1.6 nymphs/leaflet) and on July, 30*th* for the third planting date (3.2 nymphs/leaflet).

As shown in the mentioned table, the allover seasonal means of *Empoasca* sp., nymphal counts on plants of the three planting dates were 0.8, 0.9 and 1.4 nymphs/leaflet for the first, second and third planting

Table (15) : Evaluation of three planting dates on cowpea infestation rates by *Empoasca* sp. nymphs in 1997 season at Qualyubia Governorate (count/leaflet)

Planting date / Inspection date	First date	Second date	Third date
30/4/97	0.5	-	-
7/5	0.5	-	-
14/5	0.8	-	-
21/5	0.9	0.8	-
28/5	0.8	0.8	-
4/6	0.8	0.5	-
11/6	0.9	1.0	1.0
18/6	1.1	1.0	0.5
25/6	-	1.0	1.0
2/7	-	0.5	0.9
9/7	-	1.6	1.0
16/7	-	-	1.4
23/7	-	-	1.9
30/7	-	-	3.2
Total	6.3	7.2	10.9
Mean	0.8	0.9	1.4

L.S.D.$_{0.05}$: 0.33

date, respectively. Statistical analysis indicated that plants of the third planting date (April, 30th) received the highest infestation rate with significant difference compared with the two other planting dates.

2.2- Season 1998:

2.2.1- *Tetranychus* sp., eggs:

Data presented in Table (16) show the infestation rates with *Tetranychus* sp., on cowpea plants cultivated in three planting dates. The highest weekly average numbers of *Tetranychus* sp. eggs occurred on June, 10*th* for the first planting date (10.1 eggs/leaflet); on May, 20*th* for the second planting date (9.8 eggs/leaflet) and on July, 1*st* for the third planting date (13.5 eggs/leaflet).

The allover seasonal mean of *Tetranychus* sp. eggs throughout 1998 season on cowpea plants cultivated in three planting dates were 6.4, 6.2 and 6.0 eggs/leaflet for the first, second and third planting date, respectively. (Fig. 19) indicating insignificant effect of the date of planting of the rate of infestation by *Tetranychus* sp. eggs.

2.2.2- *Tetranychus* sp., moving stages:

The highest weekly mean of *Tetranychus* sp. moving stage counts on cowpea plants cultivated during April in three planting dates occurred on June, 10*th* for the first planting date (8.4 moving stages/leaflet); on July, 8*th* for the second planting date (7.4 moving stages/leaflet) and on July, 1*st* for the third planting date (10.7 moving stages/leaflet) (Table 16).

Table (16) : Evaluation of three planting dates of cowpea in relation to *Tetranychus* sp. eggs and moving stages infestation in 1998 season at Qualyubia Governorate (count/leaflet)

Planting dates / Inspection date	First date		Second date		Third date	
	Eggs	Moving Stage	Eggs	Moving stage	Eggs	Moving stage
22/4/97	0.8	1.0	-	-	-	-
29/4	0.8	0.8	-	-	-	-
6/5	6.8	4.1	2.5	2.8	-	-
13/5	5.6	4.7	3.6	3.0	-	-
20/5	8.3	4.8	9.8	7.0	3.4	1.2
27/5	3.7	3.6	3.4	4.0	2.9	1.3
3/6	8.3	5.6	6.7	4.8	2.4	1.3
10/6	10.1	8.4	5.7	4.3	6.1	3.4
17/6	7.1	6.1	5.2	3.0	2.9	3.9
24/6	9.2	6.1	8.9	4.3	6.0	4.1
1/7	10.0	6.2	7.6	4.2	13.5	10.7
8/7	-	-	8.6	7.4	12.3	9.2
15/7	-	-	6.2	5.3	10.3	8.9
22/7	-	-	-	-	4.6	5.9
29/7	-	-	-	-	1.4	2.3
Total	70.7	51.4	68.2	50.1	65.8	52.2
Mean	6.4	4.7	6.2	4.6	6.0	4.7

L.S.D.0.05 for :

Eggs : n.s.

Moving stages : n.s.

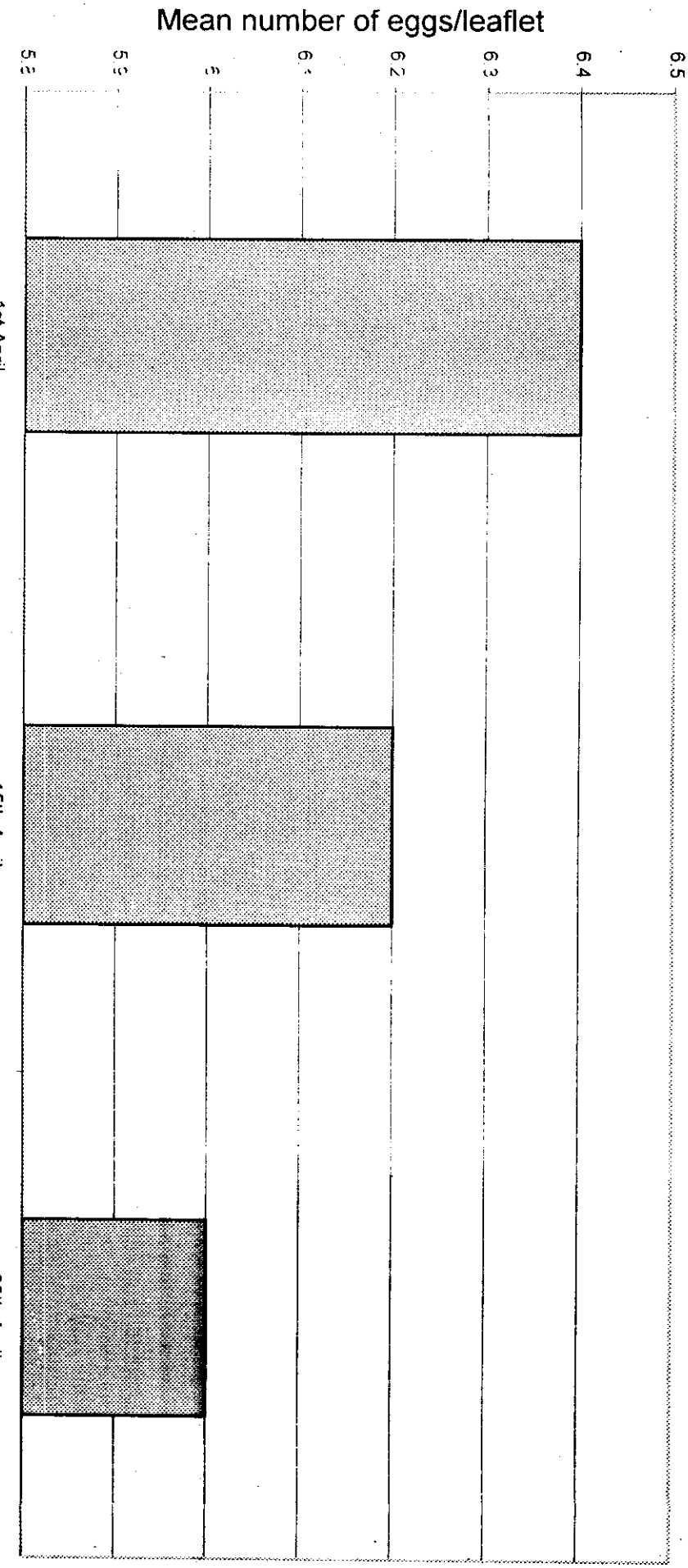

Fig. (19): *Tetranychus* sp., egg counts on cowpea plants during summer plantation of 1998 season in Moshtohor area, Qalubia governorate

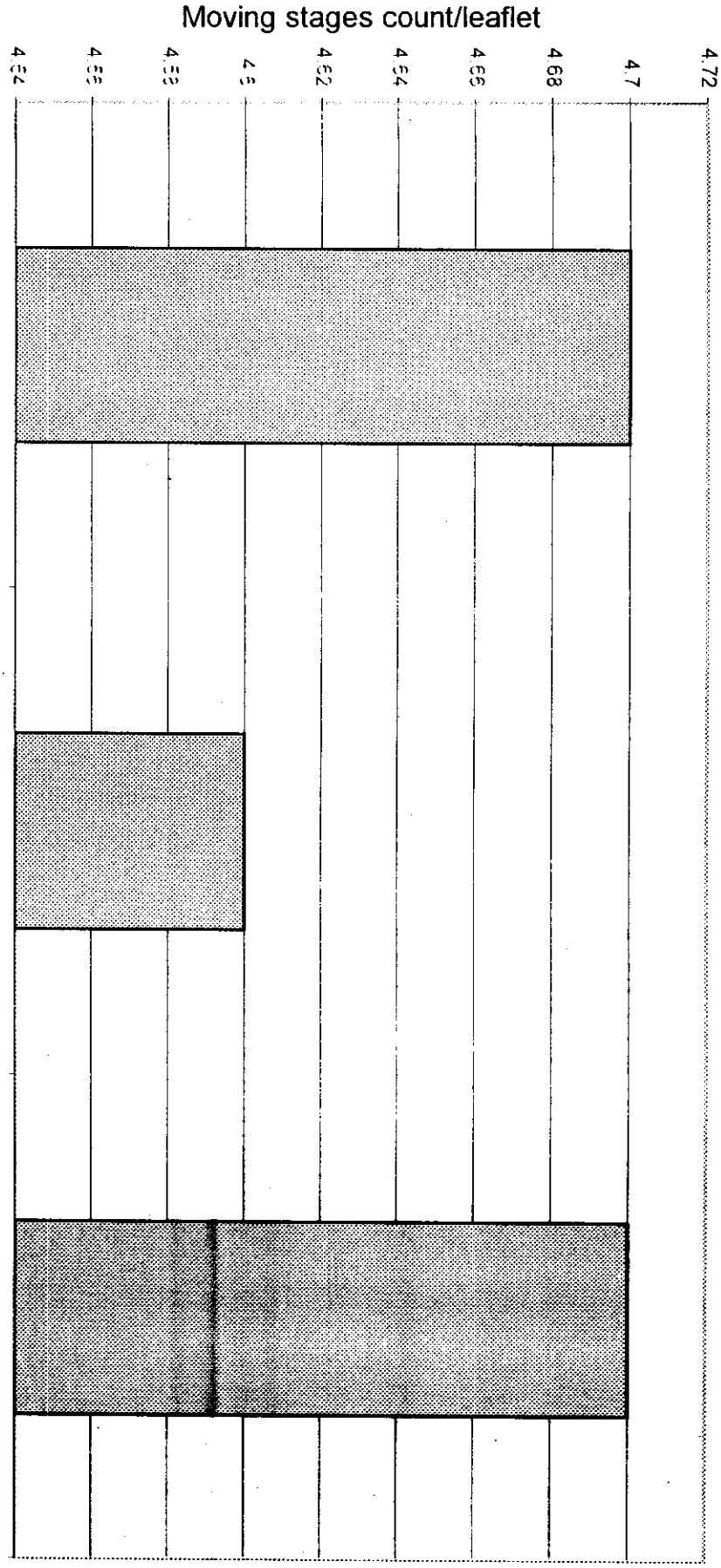

Fig. (20): *Tetranychus* sp.moving stage counts on cowpea plants during summer plantation of 1998 season in Moshtohor area, Qalubia governorate

While the seasonal means of *Tetranychus* sp., moving stages, on the three planting dates were 4.7, 4.6 and 4.7 moving stages/leaflet for the first, second and third planting date, respectively, (Fig. 20), with insignificant differences between the three planting dates.

2.2.3- Aphids:

Data presented in Table (17) show the weekly infestation rates with Aphids on cowpea plants cultivated in three planting dates. The highest weekly means of aphids counts occurred on April, 29*th* for the first planting date (1.9 Aphids/leaflet); on May, 6*th* for the second planting date (1.6 Aphids/leaflet); and on July, 29^{th} for the third planting date (1.2 aphids/leaflet). The same table shows also the overall seasonal mean of aphid counts in 1998 season. Those were 0.7, 0.6 and 0.7 aphids/leaflet for the first, second and third planting date, respectively.

Statistical analysis showed that the susceptibility of the three planting dates to infestation with Aphids in 1998 season were non-significant.

2.2.4- Thrips nymphs:

Data presented in Table (18) show the weekly infestation rates with Thrips on cowpea plants cultivated in three planting dates. Regarding weekly average numbers of Thrips nymphs, the highest averages occurred on July, 1*st* for the first planting date with average (2.8 nymphs/leaflet); on July, 15*th* for the second planting date (2.9 nymphs/leaflet); and on July, 22*nd* for the third planting date (3.4 nymphs/leaflet).

Table (17) : Evaluation of three planting dates of cowpea plants to aphids infestation rate in 1998 season at Qualyubia Governorate.

Planting date Inspection date	First date	Second date	Third date
22/4/97	0.8	-	-
29/4	1.9	-	-
6/5	0.5	1.6	-
13/5	0.5	0.5	-
20/5	0.5	0.5	0.8
27/5	0.5	0.8	1.1
3/6	0.5	0.5	0.8
10/6	0.5	0.5	0.5
17/6	0.5	0.5	0.5
24/6	0.5	0.5	0.5
1/7	0.8	0.5	0.5
8/7	-	0.5	0.5
15/7	-	0.5	0.5
22/7	-	-	0.5
29/7	-	-	1.2
Total	7.5	6.9	7.4
Mean	0.7	0.6	0.7

L.S.D.$_{0.05}$: n.s.

Table (18) : Evaluation of cowpea cultivation in three planting dates on Thrips nymphs and adults infestation in 1998 season at Qualyubia Governorate (count/leaflet)

Planting dates / Inspection date	First date		Second date		Third date	
	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
22/4/97	1.7	0.8	-	-	-	-
29/4	2.3	0.5	-	-	-	-
6/5	2.7	0.5	2.0	0.5	-	-
13/5	0.8	0.5	1.8	0.5	-	-
20/5	1.9	0.8	2.7	0.5	1.0	0.5
27/5	1.4	0.5	0.8	0.5	1.5	0.5
3/6	0.8	0.5	1.4	0.5	0.5	0.5
10/6	1.7	0.5	0.5	0.5	0.5	0.5
17/6	1.2	0.5	1.2	0.5	1.2	0.5
24/6	0.8	0.5	0.8	0.5	0.8	0.5
1/7	2.8	0.8	1.3	0.5	0.8	0.5
8/7	-	-	2.2	0.5	2.4	0.5
15/7	-	-	2.9	0.5	2.1	0.5
22/7	-	-	-	-	3.4	0.5
29/7	-	-	-	-	2.8	0.5
Total	18.1	6.4	17.6	5.5	17.0	5.5
Mean	1.6	0.6	1.6	0.5	1.5	0.5

L.S.D.0.05 for :

Immature stages : n.s.

Adults : 0.09

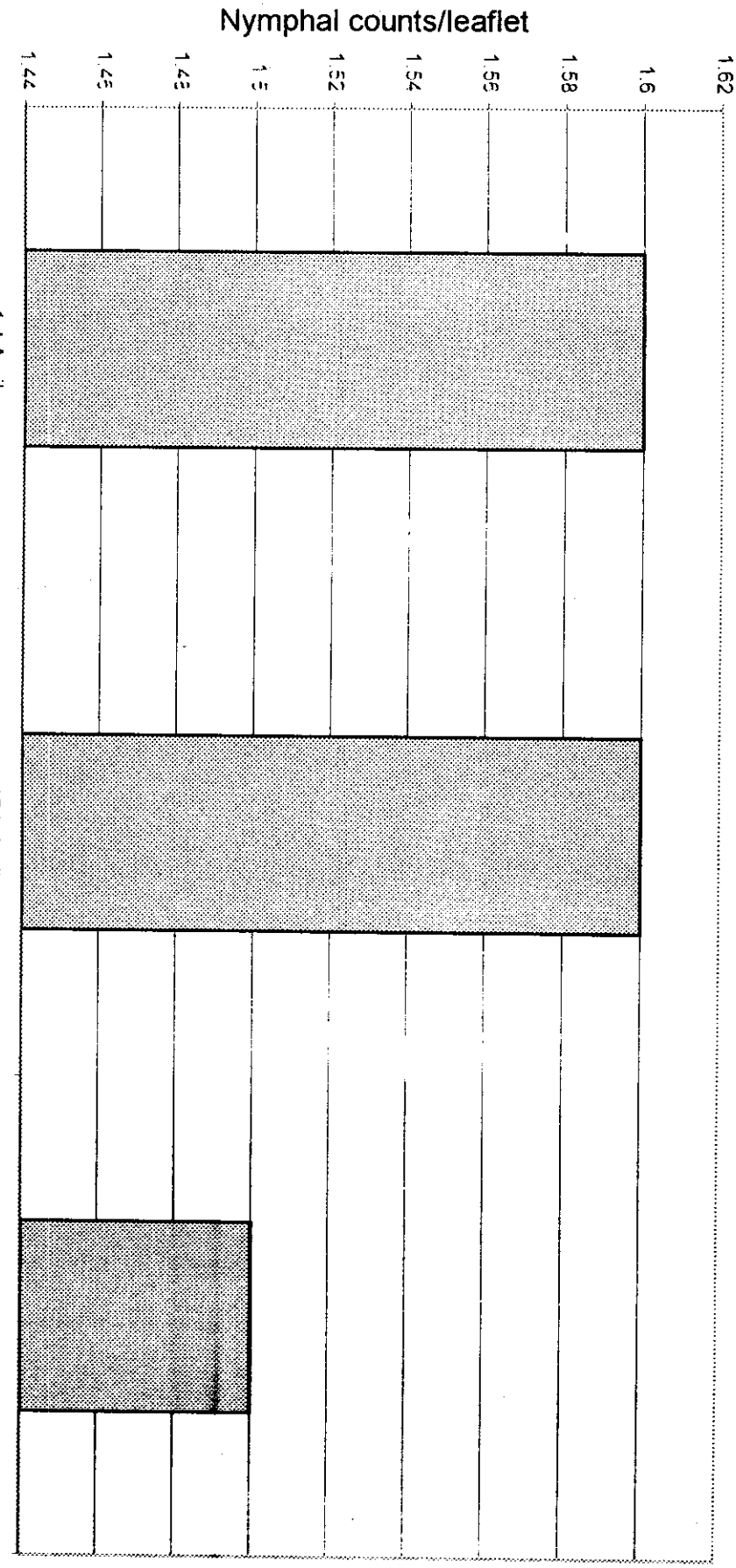

Fig. (21): Thrips nymphal counts on cowpea plants cultivated in three planting dates in 1998 during summer plantation in Moshtohor area, Qalubia governorate

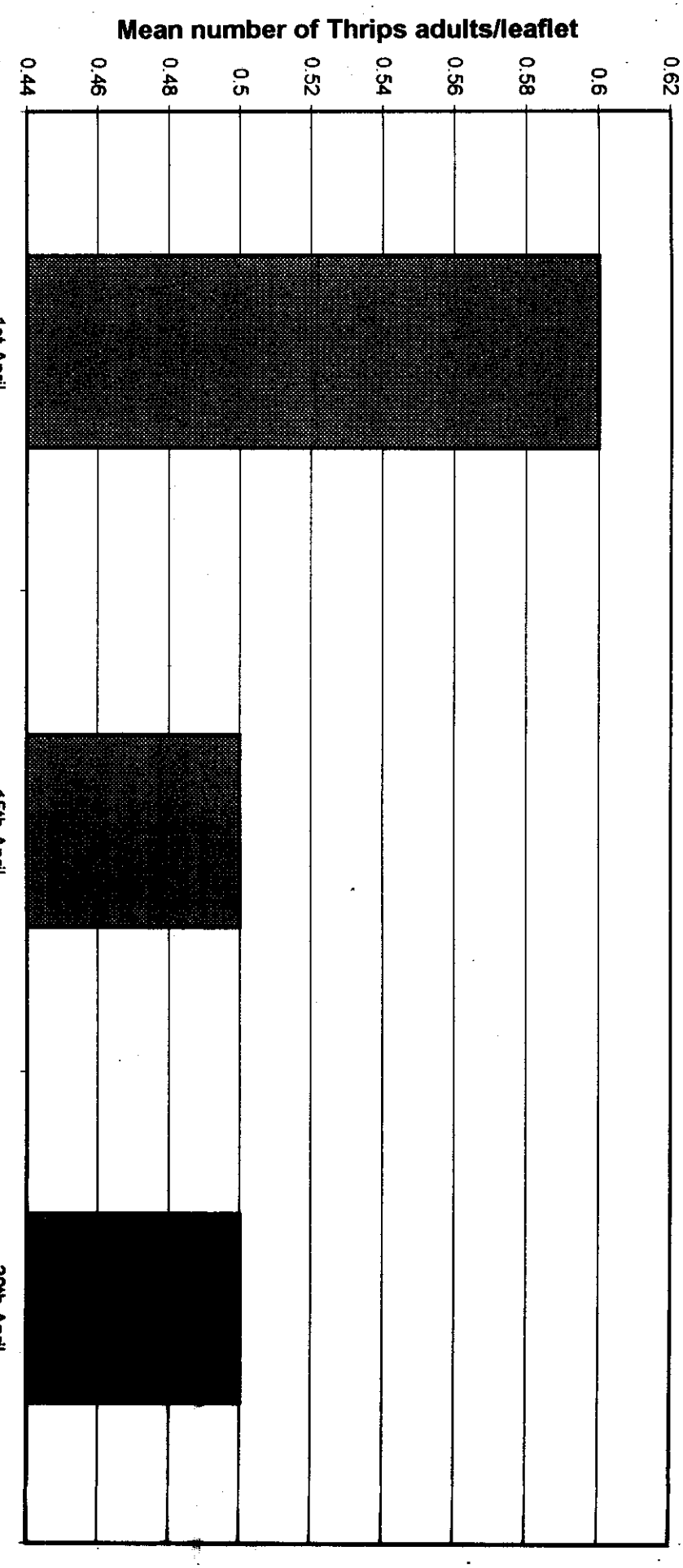

Fig. (22): Thrips *a*dults counts on cowpea plants cultivated in 3 planting dates in 1998 during summer plantation in Moshtohor area, Qalubiyah Governorate

Meanwhile the allover seasonal mean counts of 1998 season for Thrips nymphs were 1.6, 1.6 and 1.5 nymphs/leaflet for the first, second and third planting dates, respectively, (Fig. 21).

Statistical analysis of data showed that the differences in whole mean count of nymphs were insignificant for the three planting dates.

2.2.5 Thrips adults:

From data presented in Table (18) it is clear that the highest weekly averages of thrips adults on cowpea plants occurred on April, 22*nd*, May, 20th and July, 1*st* for the first planting date with averages 0.8 adults/leaflet. While no appreciable changes in the population of Thrips adults occurred on plants of second and third planting dates.

Meanwhile, the allover seasonal mean of 1998 season for Thrips on the three planting dates were 0.6, 0.5 and 0.5 adults/leaflet for the first, second and third planting date, respectively, (Fig. 22) indicating lower infestation rates to cowpea plants of the second and third planting dates.

2.2.6- Whitefly, *Bemisia tabaci*, immature stages:

Data presented in Table (19) show the infestation rates with whitefly *Bemisia tabaci*, on cowpea plants cultivated in three planting dates. It is clear that immature stages infestation rate varied according to planting date.

Regarding the weekly average numbers of *B. tabaci* immature stages, the highest averages occurred on April, 22*nd* for the first planting date (8.5 immature stages/leaflet); on May, 6*th* for the second planting

date (9.2 immature stages/leaflet); and on June, 3*rd* for the third planting date (4.4 immature stages/leaflet).

As for the overall mean counts of *B. tabaci* immatures counted in 1998 season on the three planting dates were 3.8, 4.0 and 2.7 immature stages/leaflet for the first, second and third planting dates, respectively, (Fig. 23). Thus the best planting date in relation to *B. tabaci*, immature stages infestation was the third, as in this case plants harboured the lowest numbers of *B. tabaci* immatures, being significantly lower than those recorded on plants of the two other dates.

2.2.7- Whitefly, *Bemisia tabaci*, adults:

The highest weekly mean counts of *B. tabaci* adults occurred on April, 29*th* for the first planting date with average 2.8 adults/plant; on May, 6*th* for the second planting date with average 2.5 adults/plant; and on July, 30*th* for the third planting date with average 2.4 adults/plant (Table 19).

Regarding the allover seasonal mean of *B. tabaci* adults counts in 1998, those were 1.6, 1.3 and 1.1 adults/plant for the first, second and third planting date, respectively, (Fig. 24). The first planting date appeared unsuitable, as cowpea plants harboured significantly, the highest infestation rate with *B. tabaci* adults. While on the contrary, the third planting dates was the favorable as plants harboured the least seasonal count of *B. tabaci* adults with insignificant difference than the second planting date and significant difference than the first planting date.

Table (19) : Evaluation of cowpea planting in three planting dates on whitefly, *Bemisia tabaci* immature stages and adults infestation in 1998 season at Qualyubia Governorate.

Planting dates / Inspection date	First date		Second date		Third date	
	Immature Stage	Adults	Immature stage	Adults	Immature stage	Adults
22/4/97	8.5	1.2	-	-	-	-
29/4	4.4	2.8	-	-	-	-
6/5	5.9	2.2	9.2	2.5	-	-
13/5	5.5	1.2	6.5	0.8	-	-
20/5	3.1	1.3	5.6	0.8	4.2	2.0
27/5	3.6	1.2	5.7	0.8	3.7	1.7
3/6	2.6	1.3	4.7	1.7	4.4	0.8
10/6	2.1	2.1	2.5	0.8	2.5	0.5
17/6	2.4	1.0	1.8	1.3	1.9	0.8
24/6	1.7	1.2	1.8	0.8	2.0	0.8
1/7	1.9	1.6	1.7	1.2	1.7	0.5
8/7	-	-	2.2	1.5	2.4	0.8
15/7	-	-	2.4	2.1	1.3	0.5
22/7	-	-	-	-	2.7	1.0
29/7	-	-	-	-	2.6	2.4
Total	41.7	17.1	44.1	14.3	29.4	11.8
Mean	3.8	1.6	4.0	1.3	2.7	1.1

L.S.D.0.05 for :

Immature stages : 0.49

Adults : 0.29

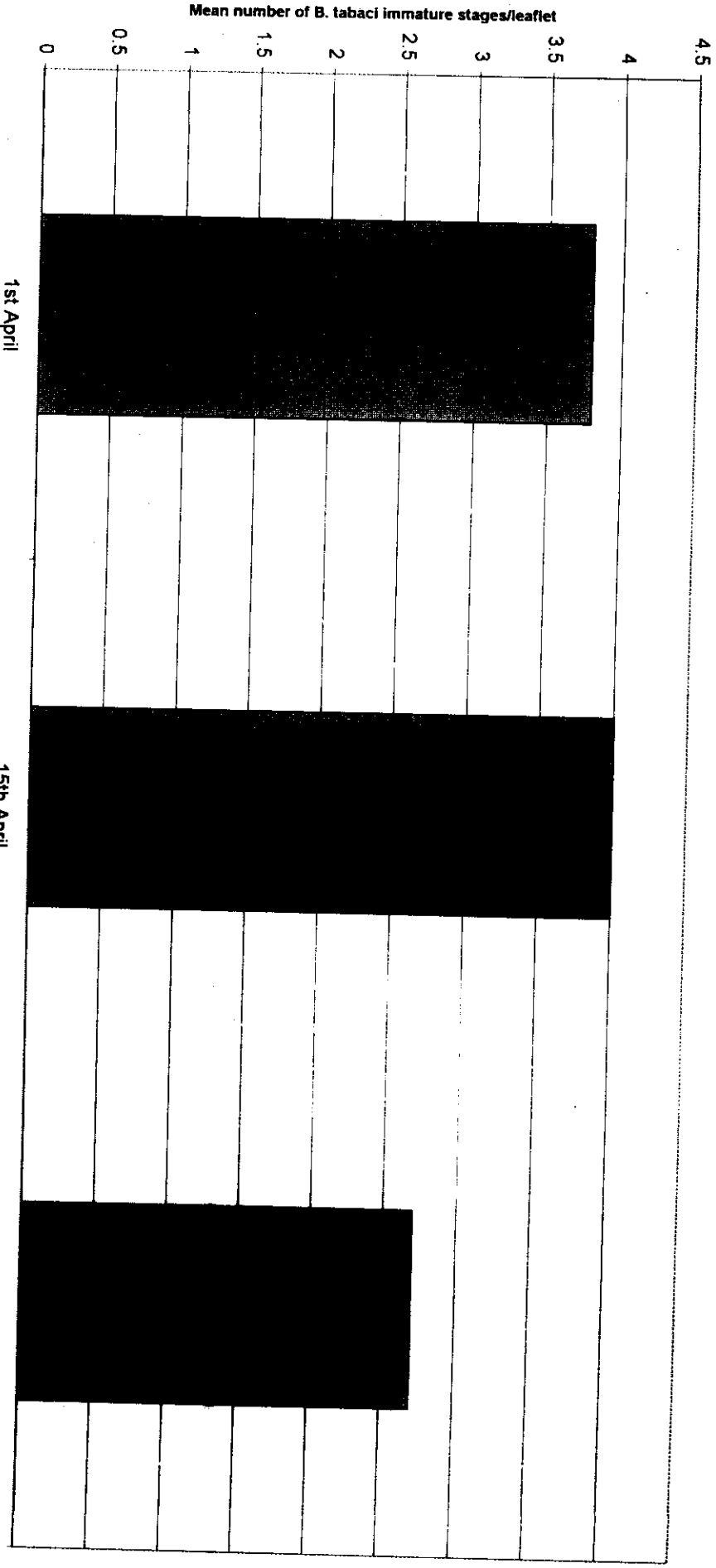

Fig. (23): Population of *B. tabaci immature* stages on cowpea plants during 1998 summer season in Moshtohor area, Qalubiyah Governorate

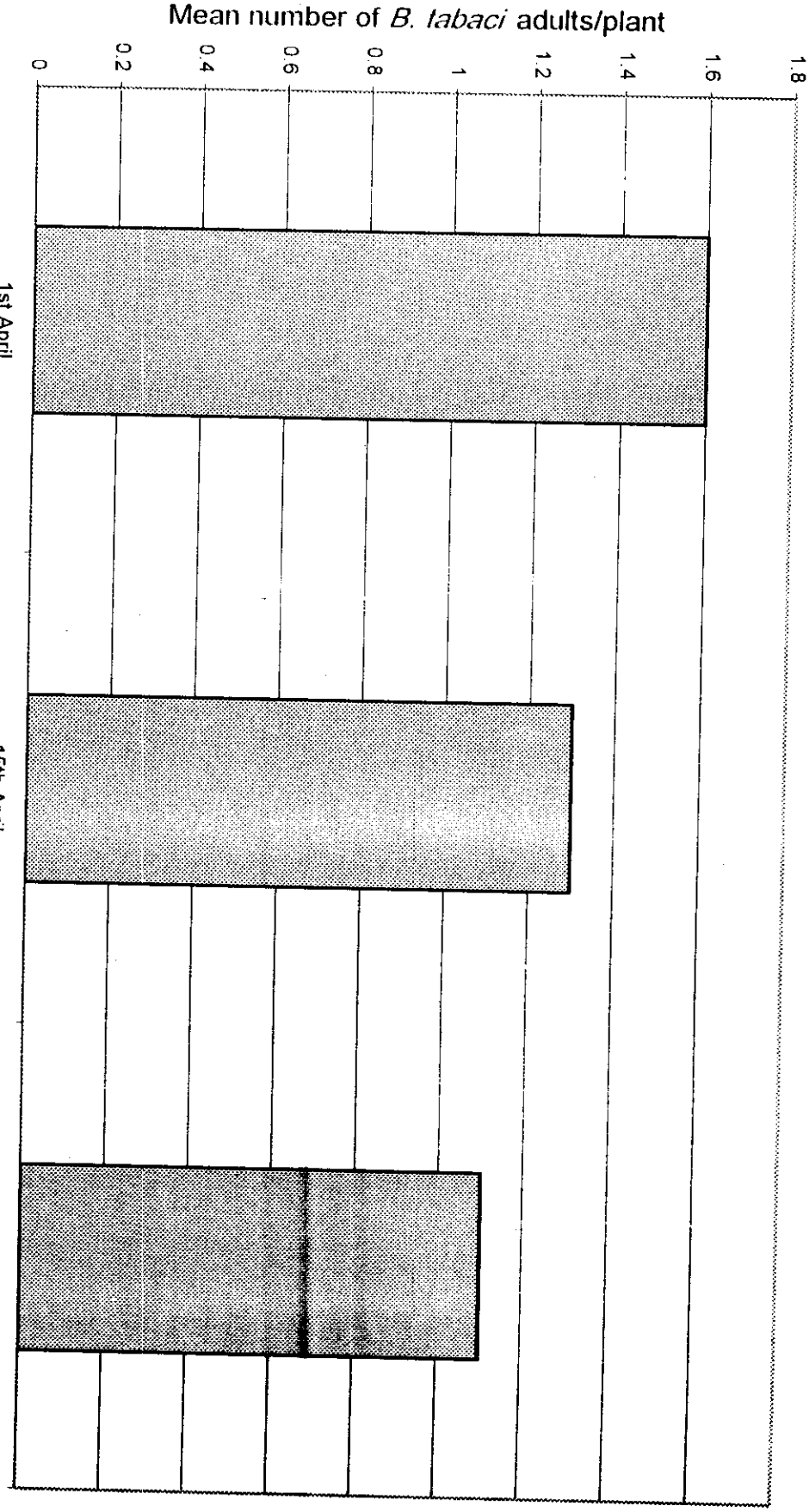

Fig. (24): Population of *B. tabaci* adult counts on cowpea plants cultivated in 3 planting dates of 1998 summer season in Moshtohor area, Qalubia governorate

2.2.8- *Empoasca* nymphs:

Data presented in Table (20) show the infestation rates by *Empoasca* sp. nymphs on cowpea plants cultivated in three planting dates. It is clear that nymph stages varied according to planting date. Regarding the weekly average number of nymphs of *Empoasca* sp. the highest averages occurred on June, 3*rd* for the first planting date and second planting date with averages 2.9 and 2.9 nymphs/leaflet, respectively; and on May, 27*th* for the third planting date with average 1.9 nymphs/leaflet.

Meanwhile, the estimated allover seasonal mean counts of *Empoasca* sp. nymphs were 1.4, 1.8 and 1.3 nymphs/leaflet for the first, second and third planting dates, respectively. The lowest seasonal mean infestation occurred on plants of the third date with insignificant difference than the first date and significant difference than the second planting date which appeared unsuitable as plants harboured, significantly, the highest level of infestation.

Table (20): Evaluation of three planting dates to immature stages of *Empoasca* sp. in 1998 season at Qualyubia Governorate

Planting date / Inspection date	First date	Second date	Third date
22/4/97	0.5	-	-
29/4	0.5	-	-
6/5	1.5	0.8	-
13/5	0.5	1.4	-
20/5	1.9	2.3	1.0
27/5	2.7	2.3	1.9
3/6	2.9	2.9	1.0
10/6	2.1	2.4	1.8
17/6	0.5	1.8	1.7
24/6	1.5	1.8	1.2
1/7	0.5	0.8	1.3
8/7	-	1.6	0.5
15/7	-	1.5	1.3
22/7	-	-	1.5
29/7	-	-	1.7
Total	15.1	19.6	14.8
Mean	1.4	1.8	1.3

$L.S.D._{0.05}$: 0.35

3- Effect of Fertilization on the Infestation with Different Pests:

Phosphorous and nitrogenous fertilizers were applied in the following rates:

- Calcium superphosphate at three rates, 250, 200 and 150 kg/fed.
- Ammonium nitrate at three rates, 150, 100 and 50 kg/fed.
- Mixture of calcium superphosphate and Ammonium nitrate at three rates: 125:75, 100:50 and 75:25 (P:N) kg/fed. The forementioned fertilization levels were applied to soil in addition to the control check, which did not receive any fertilizer treatment aiming to the investigate their effect on the infestation by rates of the cowpea pests.

3.1. 1997 season

3.1.1 *Tetranychus* sp.

A- *Tetranychus* sp. eggs:

From data presented in Table (21) it could be deduced that *Tetranychus* sp. Eggs could be detected on cowpea leaflets throughout the whole period of 1997summer season. But, the rates of infestation varied from one week to another. The highest rate of infestation (22.3 eggs/leaflet) occurred on June, 11th on cowpea; leaflets of the control check (plants that did not receive any fertilizer). While the lowest rate was only 0.5 egg/leaflet and was recorded on July, 16th & 23rd on plants that received the mixture of 125 kg calcium superphosphate: 75 Kg ammonium nitrate/feddan on May, 21st on plants that received the same mixture at the lowest level (75:25) and also on July 23rd on the untreated plants (Table 21).

Comparing the whole season mean counts of *Tetranychus* sp. Eggs on plant leaflets from different treatments, it is clear from Fig. (25) that highest rate of infestation (7.9 eggs/leaflet) occurred on plants which received the lowest rate of nitrogenous fertilizer (50 kg ammonium nitrate/feddan), followed by 7.6 eggs/leaflet on plants that received the highest rate of phosphorous fertilizer (250 kg calcium superphosphate). On the contrary, plants that received the P : N mixtures harboured lower infestation rates by *Tetranychus* sp. Eggs (5.2, 5.4 and 4.1 eggs/leaflet on plants that received the P : N mixtures at(125:75, 100:50 and 75:25 kg/feddan) indicating that the P : N mixture at the lowest rate resulted cowpea plants that received the lowest rate of infestation by *Tetranychus* sp. eggs (Fig. 25). On the other hand, Fig. (25) and Table (21) show that the overall seasonal mean of infestation on the untreated plants (control) was 5.9 (0.5-22.3) eggs/leaflet.

B- *Tetranychus* sp. moving stages:

As occurred with the egg stage of *Tetranychus* sp., the moving stages of this spider mite were detected on cowpea leaflets among all samples collected throughout 1997 summer season. Also, the infestation rates varied between the successive samples collected throughout the season. On different treatments of P and N fertilizers, the highest infestation rate varied from 6.1 individuals/leaflet on June, 4th on plants that received the highest level of P : N mixture (125:75 kg/feddan) to 12.7 individuals/leaflet recorded on June, 11th on plants that did not receive any fertilizer (control). On the contrary, the lowest infestation levels on different treatments varied from 0.5 individual/leaflet on July, 16th on plants that received the fertilizer mixture (P & N) at the highest rate, and also on May 21st on plants of the control check to 4.1

Table (21) : Evaluation of different levels of fertilizers to Cream 7 variety cowpea plants on *Tetranychus* sp. eggs and moving stages counts in season 1997 at Moshtohor, Qalubyiah Governorate (count/leaflet).

Treatments / Inspections	Phosphate						Nitrogen						Mixture						Control	
	High		Normal		Low		High		Normal		Low		High		Normal		Low			
	Eggs	Moving stages	Eggs	Moving stages	Eggs	Moving stages	Eggs	Moving Stages	Eggs	Moving stages	Eggs	Moving stages	Eggs	Moving Stages	Eggs	Moving stages	Eggs	Moving stages	Eggs	Moving stages
21/5	7.3	5.4	3.2	3.8	3.1	5.1	2.2	2.9	1.5	4.9	9.4	8.7	6.9	5.2	2.2	5.3	0.5	1.5	0.5	0.5
28	5.0	4.1	8.1	5.2	7.4	6.2	4.7	4.0	5.8	3.3	7.8	10.1	4.2	4.1	9.4	5.8	2.8	4.1	11.2	3.7
4/6	10.6	6.2	5.9	2.7	2.2	2.2	7.2	4.5	10.4	6.2	15.7	7.4	11.9	6.1	7.5	4.4	4.6	2.2	10.0	6.1
11	8.3	7.0	8.7	6.8	6.2	5.4	4.1	3.5	8.7	7.9	12.3	9.4	6.8	4.7	10.0	8.9	5.5	6.0	22.3	12.7
18	11.9	10.8	12.7	10.6	7.8	4.4	7.3	6.0	7.0	5.3	7.7	4.1	7.5	4.6	3.3	3.1	3.1	2.9	6.7	5.6
25	9.2	4.7	8.1	6.4	6.9	6.9	6.0	6.3	8.1	6.4	8.5	6.7	3.1	5.2	6.3	9.2	2.9	6.4	5.4	4.7
2/7	10.0	8.0	4.9	4.1	6.6	3.8	7.0	5.5	6.6	5.2	3.7	5.3	6.7	5.8	1.5	1.9	5.9	4.4	2.5	6.3
9	5.9	3.7	6.5	4.7	3.8	5.6	3.7	5.0	2.2	3.5	5.6	6.7	5.8	2.5	6.0	4.4	4.4	4.5	0.5	2.5
16	3.1	4.1	2.9	4.1	4.1	3.1	10.2	6.2	4.2	4.1	5.7	5.0	0.5	0.5	3.7	3.8	1.9	3.3	2.2	2.2
23	6.2	7.1	2.5	3.3	5.4	4.1	3.1	5.0	2.5	3.5	4.1	5.3	0.5	1.5	4.5	4.6	6.2	5.1	0.5	1.5
30	6.5	5.5	5.2	4.2	12.5	10.2	5.7	4.9	8.2	8.0	6.8	5.2	3.5	3.1	5.2	3.5	7.4	5.7	2.7	1.5
Total	84.0	66.6	68.6	55.9	66.0	57.0	61.2	53.8	65.2	58.3	87.2	73.9	57.4	43.3	59.6	54.9	45.2	46.1	64.6	47.3
Mean	7.6	6.1	6.2	5.1	6.0	5.2	5.6	4.9	5.9	5.3	7.9	6.7	5.2	3.9	5.4	5.0	4.1	4.2	5.9	4.3

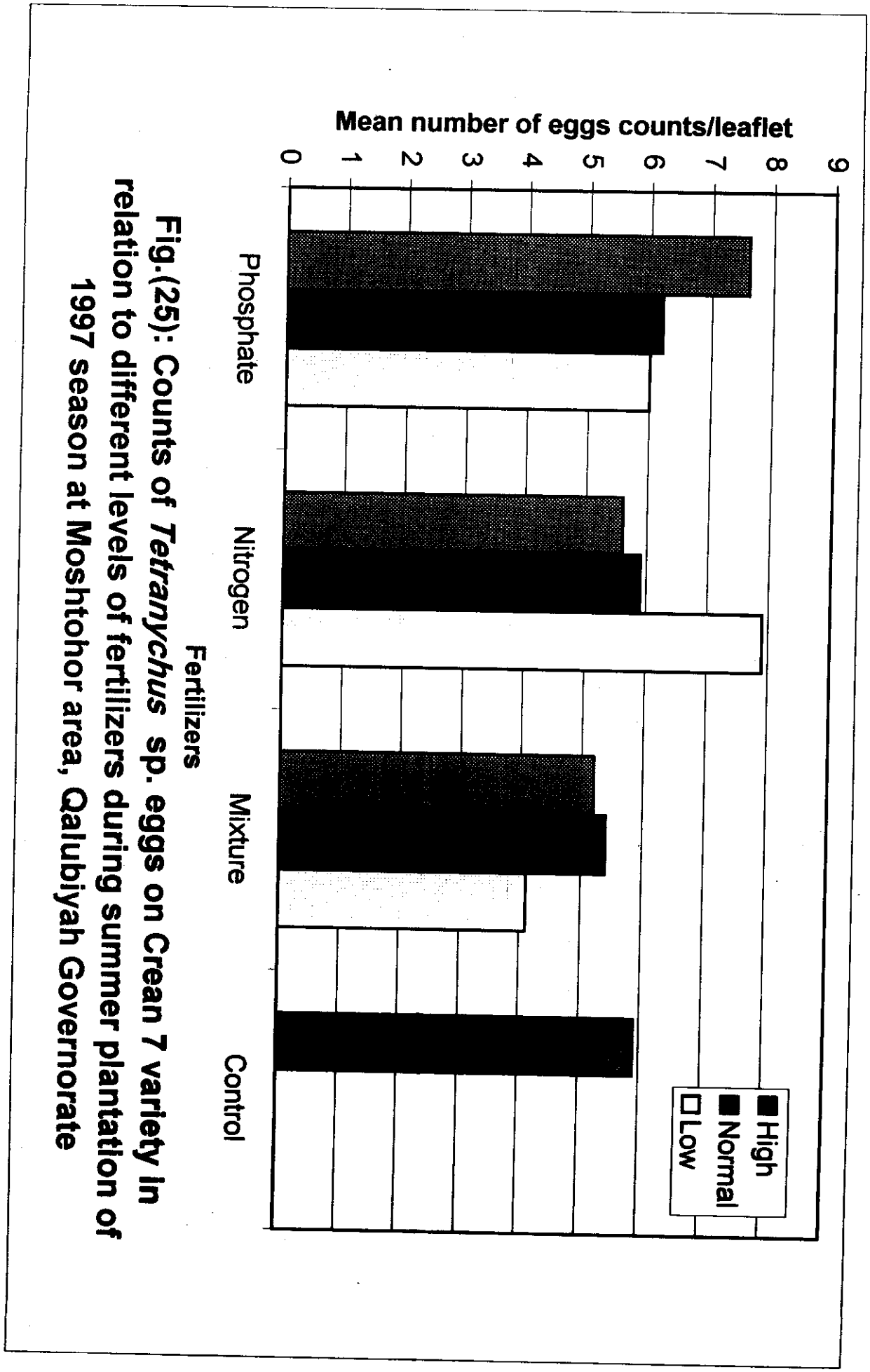

Fig.(25): Counts of *Tetranychus* sp. eggs on Crean 7 variety in relation to different levels of fertilizers during summer plantation of 1997 season at Moshtohor area, Qalubiyah Governorate

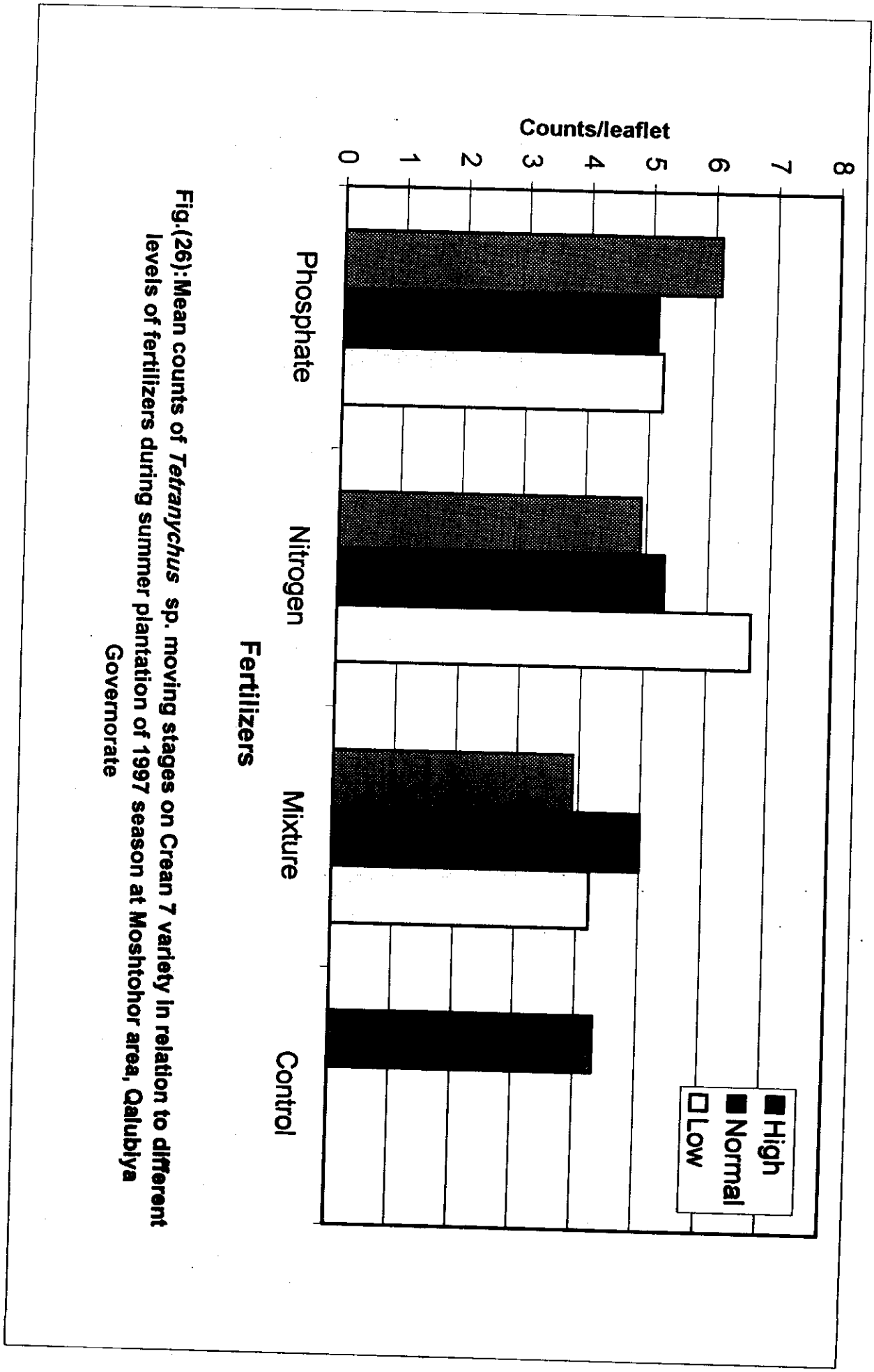

Fig.(26):Mean counts of *Tetranychus* sp. moving stages on Crean 7 variety in relation to different levels of fertilizers during summer plantation of 1997 season at Moshtohor area, Qalubiya Governorate

individuals/leaflet, recorded on June, 18th on plants that received ammonium nitrate fertilizer at the rate of 50 kg/feddan (Table, 21).

Concerning the overall seasonal mean rates of infestation by *Tetranychus* sp. moving stages on cowpea plants from different treatments, it could be observed from Fig. (26) that the effects of fertilization treatments on these seasonal rates were nearly as those occurred in case of the egg stage. The highest overall mean rate of infestation (6.7 individuals/leaflet) occurred on plants that received ammonium nitrate as the lowest level (50 kg/feddan). That was followed by 6.1 individuals/leaflet, recorded on plants which received the highest level of calcium superphosphate ((250 kg/feddan). While, the lowest overall seasonal mean infestation level (3.9 individual/leaflet) occurred on plants that received the P & N mixture at the highest rate (125 kg/calcium superphosphate: 75 kg ammonium nitrate /feddan, Fig 26 and Table 21). It is worth mentioning that the rate of infestation by *Tetranychus* sp. moving stages on plants which did not receive any fertilizer was 4.3 individuals/leaflet; being lower than those recorded after phosphorous and nitrogenous fertilizers application, on one hand, and not so far different from the rates of infestation after P & N mixture treatments.

3-1-2- Aphids

Data on the rates of aphids infestation to cowpea plants (Cream 7 variety) throughout 1997 summer season are tabulated in (22) and the mean season rates of infestation are graphically illustrated in Fig. (27).

As shown in Table (22), The unfertilized plants (control) received infestation rates from a minimum of 0.5 individuals/leaflet in the first two samples and that of July, 2nd to maximum mean of 29.7

aphid individuals/leaflet on July, 23rd. The overall seasonal mean of aphids' infestation on these plants was 12.62 individuals/leaflet (Table, 22 and Fig. 27), indicating the highest rate of infestation in case of absence of any fertilizers. On the hand, cowpea plants which received only calcium superphosphate fertilizer at either of the three applied rates manifested the lowest infestation rates by aphids. In case of applying the fertilizer at rates 0f 250 or 200 kg/feddan, a mean of only 0.5 individual were counted/leaflet within all the collected samples (Table, 22). This mean showed slight increase to an overall seasonal mean of 0.68 (0.5-1.5) individuals/leaflet by decreasing the rate of phosphorous fertilizer to 150 kg/feddan. Also by adding the nitrogenous fertilizer alone, slight aphids infestation rates were detected; being 0.59 (0.5-1.5), 0.75 (0.5-1.9) and 0.92 (0.5-3.1)individuals/leaflet by applying ammonium nitrate at 150:100 and 50 kg/feddan, respectively (Table 22 and Fig. 27). While using mixtures of calcium superphosphate and ammonium nitrate in different rates led to obvious increases in the rate of infestation by aphids. These rates averages 11.32 (0.5-45.6), 12.39 (0.5-31.3) and 9.95 (0.5-18.2) aphid individuals/leaflet when the mixtures were added at high (125 kg calcium superphosphate: 75 kg ammonium nitrate), moderate (100:50) and low (75 kg P fertilizer: 25 kg N fertilizer) rates, respectively (Table, 22 and Fig. 27). It could be, generally, observed from Table (22) that aphid individuals were present on cowpea plants throughout the whole period of sampling (from May, 21st to July, 30th) but the rate of infestation by this sap-sucking pest varied by changing the applied regimes of soil fertilization. This variation is also clearly evident between the overall seasonal means presented in Fig. (27).

Table (22) : Evaluation of different levels of fertilizers to cowpea plants on the rate of phids infestation during 1997 season at Moshtohor, Qualyubia Governorate(count/leaflet)

Treatments / Inspection date	Phosphate			Nitrogen			Mixture			Control
	High	Normal	Low	High	Normal	Low	High	Normal	Low	
21/5/97	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.6	0.5	0.5
28/5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	7.9	8.3	0.5
4/6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	7.0	5.2	2.5
11/6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.5	13.0	9.8
18/6	0.5	0.5	0.5	1.5	0.5	0.5	0.5	14.3	9.4	6.6
25/6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	7.1	24.5
2/7	0.5	0.5	1.5	0.5	0.5	0.5	0.5	31.3	16.1	0.5
9/7	0.5	0.5	0.5	0.5	0.5	1.5	24.4	23.8	10.8	20.1
16/7	0.5	0.5	0.5	0.5	1.9	1.5	45.6	28.8	18.2	15.7
23/7	0.5	0.5	1.5	0.5	0.5	3.1	30.9	11.7	15.8	29.7
30/7	0.5	0.5	0.5	0.5	1.9	0.5	20.1	2.9	5.0	28.4
Total	5.5	5.5	7.5	6.5	8.3	10.1	124.5	136.3	109.4	138.8
Mean	0.50	0.50	0.68	0.59	0.75	0.92	11.32	12.39	9.95	12.62

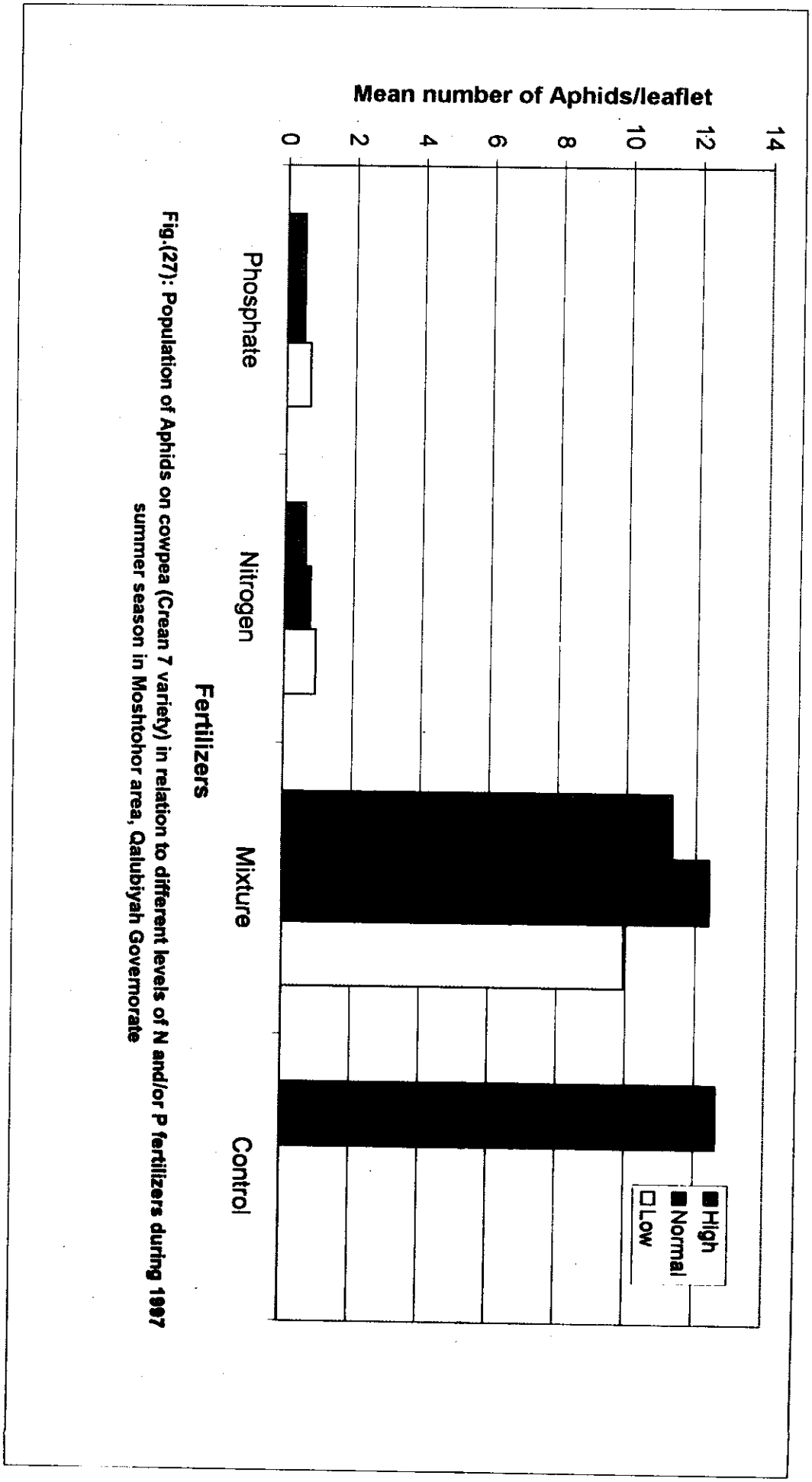

Fig.(27): Population of Aphids on cowpea (Crean 7 variety) in relation to different levels of N and/or P fertilizers during 1997 summer season in Moshtohor area, Qalubiyah Governorate

3.1.3- Thrips:

A-Nymphs:

No definite correlation could be detected between the different regimes of soil fertilization and the rates of infestation by thrips' nymphs to cowpea leaves. The unfertilized plants received thrips infestations, throughout the whole period, ranged from 0.5 to 2.2 nymphs/leaflet with an average of 1.4 nymphs/leaflet (Table 23). By adding calcium superphosphate at the high, moderate and low rates (250, 200 and 150 kg/feddan), the recorded whole season means of infestation were 1.4 (0.5-2.5), 1.2 (0.5-1.9) and 1.1 (0.5-3.1) nymphs/leaflet, respectively. In case of ammonium nitrate fertilizer at 150, 100 and 50 kg/feddan, the seasonal means of infestation by thrips' nymphs were 1.3 (0.5-2.7), 1.4 (0.5-2.7) and 1.2 (0.5-3.5) nymphs/leaflet. While by using both fertilizers mixed at 125.75, 100: 50 and 75:25 (P:N) kg/feddan, these rates of infestation became 1.3 (0.5-1.9), 1.5 (0.5-2.7) and 1.1 (0.5-2.3) nymphs/leaflet, respectively (Table 23).

From data illustrated in Fig. (28), it could be fairly observed that the highest seasonal mean of thrips' nymphs infestation (1.5 nymphs/leaflet) was associated with fertilization by the P:N mixture at the normal rate (100:50 kg/feddan). But, this average is nearly the same as that recorded from plants that received P fertilizer at highest rate, N fertilizer at normal rate and those of the control check (1.4 nymphs/leaflet). On the other hand, the lowest rate of infestation (1.1 nymphs/leaflet) was recorded from plants that received P fertilizer at lowest rate and those fertilized by the P & N fertilizers mixture at the lowest rate.

Table (23) : Evaluation of different levels of fertilizers in relation to thrips nymphs and adults infesting cowpea plants in 1997 at Moshtohor, Qalubyiah Governorate (count/leaflet).

Treatments / Inspections	Phosphate						Nitrogen						Mixture						Control	
	High		Normal		Low		High		Normal		Low		High		Normal		Low			
	Nymp.	Adults	Nym	Adults	Nym.	Adults	Nym.	Adults	Nym	Adults	Nym	Adults	Nym	Adults	Nym.	Adults	Nym.	Adults	Nym.	Adults
21/5	2.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	1.9	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5
28	0.5	0.5	1.5	0.5	2.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	1.9	0.5
4/6	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
11	1.5	0.5	1.9	0.5	3.1	1.5	2.7	0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	1.9	0.5	0.5	1.9	0.5
18	1.5	0.5	1.9	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5
25	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	1.5	0.5	2.5	0.5	1.5	0.5	1.9	0.5
2/7	1.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	2.2	0.5
9	0.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	2.9	0.5	1.5	0.5	2.7	0.5	0.5	0.5	0.5	0.5
16	1.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	2.7	1.5	1.5	0.5	1.9	0.5
23	1.5	0.5	0.5	0.5	0.5	0.5	2.5	0.5	2.7	1.5	0.5	1.5	1.9	0.5	1.5	0.5	2.3	0.5	1.9	0.5
30	1.9	0.5	1.5	0.5	1.5	1.9	2.7	1.5	2.3	0.5	3.5	0.5	1.5	0.5	1.5	0.5	1.9	0.5	2.2	0.5
Total	14.9	5.5	13.3	5.5	12.1	7.9	13.9	6.5	15.9	6.5	12.9	6.5	13.9	6.5	16.9	7.9	11.7	5.5	15.9	6.5
Mean	1.4	0.5	1.2	0.5	1.1	0.7	1.3	0.6	1.4	0.6	1.2	0.6	1.3	0.6	1.5	0.7	1.1	0.5	1.4	0.6

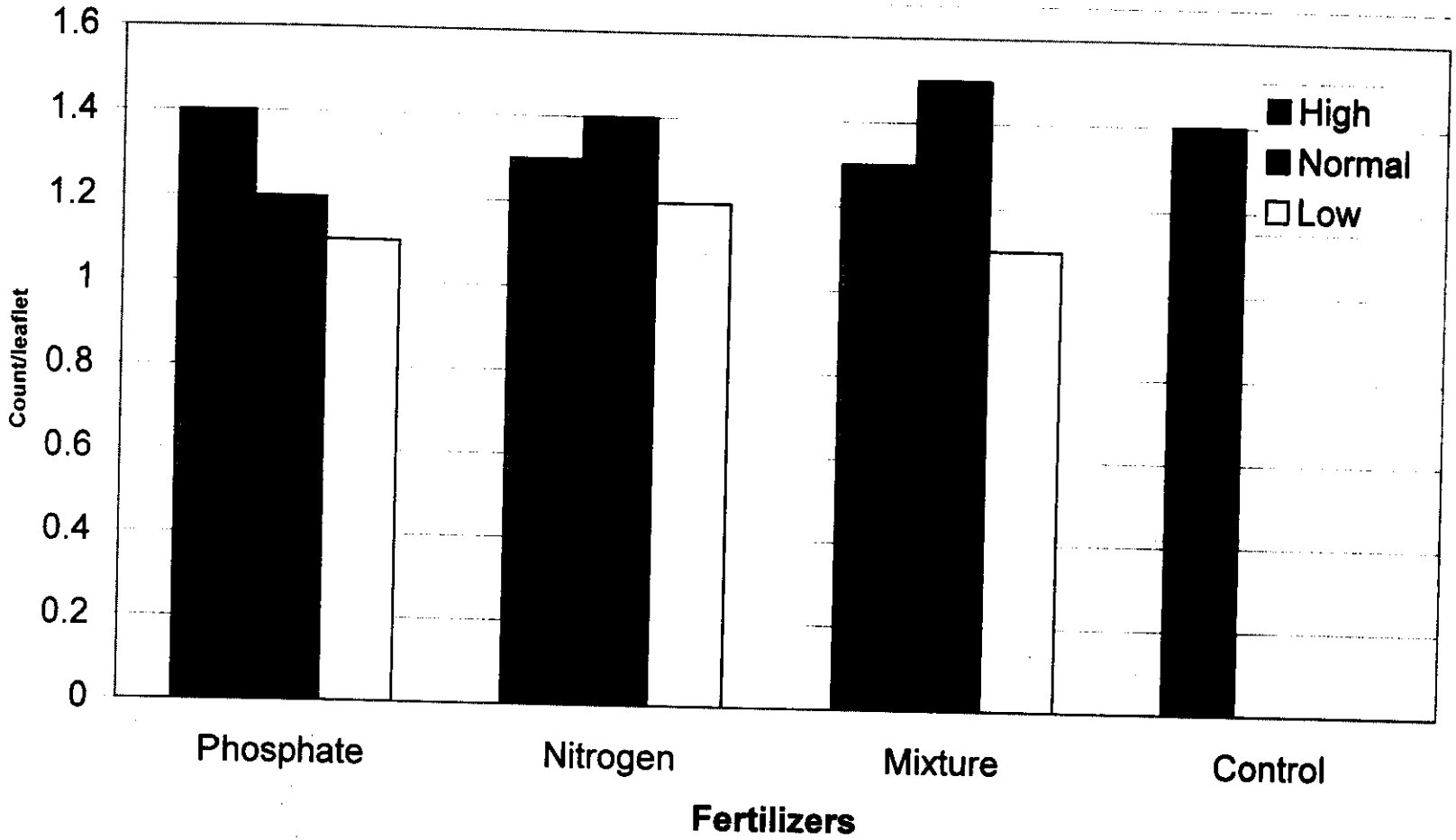

Fig.(28): Overall seasonal mean counts of of Thrips nymphs on cowpea (Crean 7 variety) plants in relation to different levels of P & N fertilizers during 1997 summer plantation at Moshtohor area, Qalubiyah Governorate

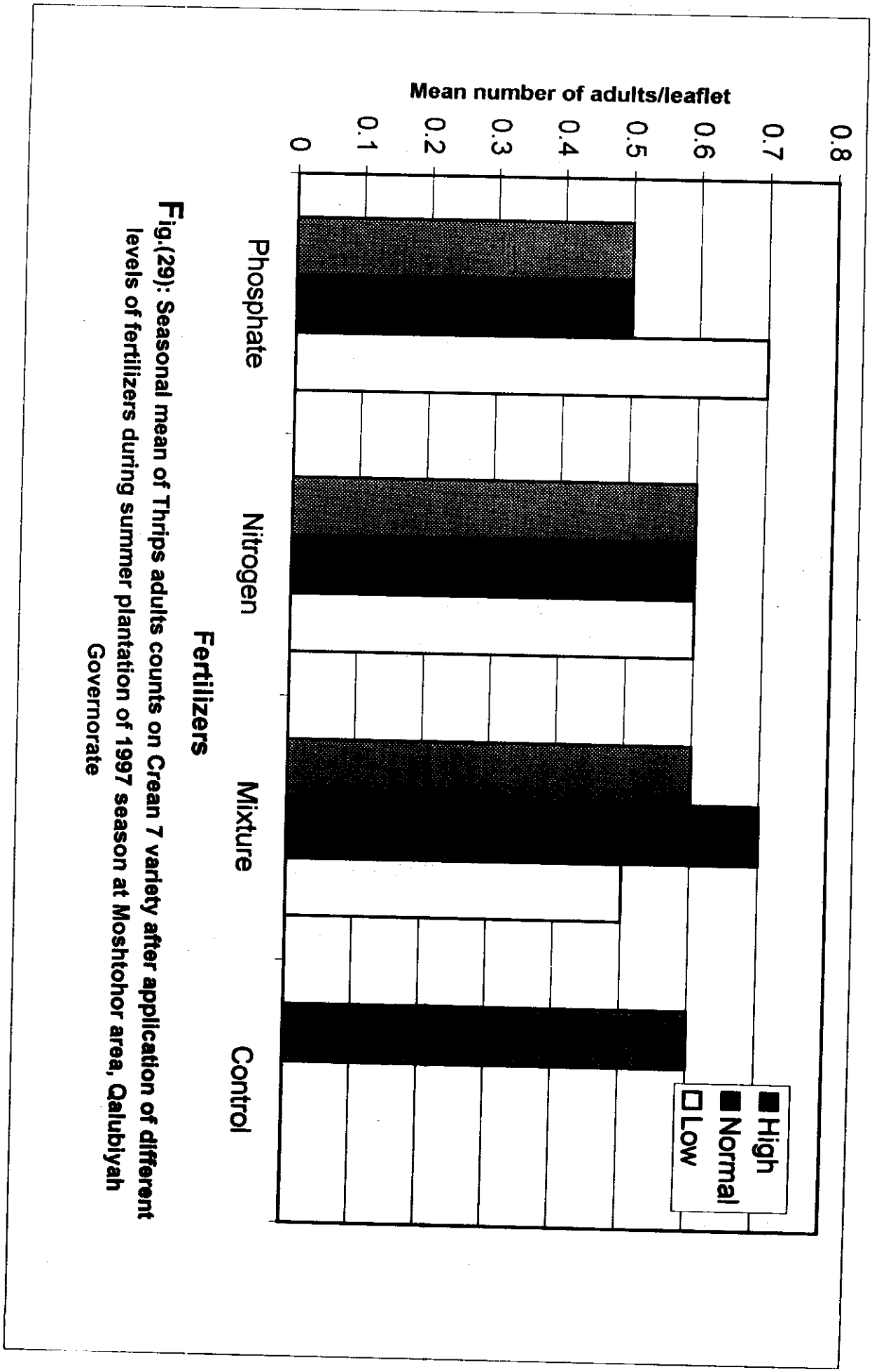

Fig.(29): Seasonal mean of Thrips adults counts on Crean 7 variety after application of different levels of fertilizers during summer plantation of 1997 season at Moshtohor area, Qalubiyah Governorate

B-Adults:

As shown in Table (23), the mean counts of thrips' adults from all fertilization treatments and control were relatively, much lower than those recorded from the nymphal stage (0.5-0.7 adult/leaflet apposed to 1.1 – 1.5 nymphs/leaflet). Only 0.5 adult/leaflet was counted with each of the 11 samples collected throughout the 1997 cowpea summer season in cases of fertilization by calcium superphosphate at the highest and normal rates and by the P & N mixture at the lowest rate. Also, only 0.6 adult/leaflet was recorded as an overall seasonal mean count in cases of fertilization with either of the three applied rates of ammonium nitrate and also on plants of the control check. While, an overall seasonal count of 0.7 adult/leaflet was recorded by fertilization by P fertilizer at the lowest rate and by P & N fertilizers mixture at the normal rate (Table, 23 and Fig. 29).

3.1.4. The whitefly *Bemisia tabaci* (Genn.)

A. Immature stages:

Data presented in Table (24) showed the weekly means of infestation by *B. tabaci* immatures and adults to Cream 7 variety of cowpea throughout 1997 summer season when different regimes of P & N fertilizers were applied. By calcium superphosphate application to soil at 250, 200 and 150 kg/feddan, the rates of infestation by *B. tabaci* immatures ranged from 0.5-3,1, 0.5-3.3 and 0.5-2.5 individuals/leaflet, respectively. When the soil was fertilized by ammonium nitrate at 150, 100 and 50 kg/feddan, the recorded rates of infestation were 0.5-3.1, 0.5-2.5 and 0.5-3.7 individuals/leaflet. While by using P & N fertilizer mixers these rates were 0.5-3.3, 0.5-1.9 and 0.5-2.5 individuals/leaflet,

respectively apposed to 0.5-2.5 individuals/leaflet on leaves of the control check plants (Table 24).

Concerning the overall seasonal means *B. tabaci* immatures counts in relation to fertilization treatments, it could be deduced from Fig. (30) that the highest mean (2.2 individuals/leaflet) was obtained when calcium superphosphate was applied at the highest level (250 kg/feddan). By decreasing this rate to 200 and 150 kg/feddan, the seasonal mean of infestation was, subsequently, found to be reduced to 1.7 and 1.3 individuals/leaflet, respectively. On the other hand, the lowest seasonal mean of infestation (0.8 individual/leaflet) was recorded when the mixture of P & N fertilizer was applied at the normal (100:50 kg/feddan) and low (75:25 kg/feddan) rates, respectively (Fig. 30). While, application of ammonium nitrate led to moderate seasonal mean rates of infestation (1.8, 1.6 and 1.8 individuals/ leaflet, respectively (Fig. 30).

Table (24) : Evaluation of the effect of different levels of fertilizers to cowpea plants on the rates of infestation by *B. tabaci* immatures and adults throughout 1997 season at Moshtohor, Qalubyiah Governorate. (count/leaflet)

Treatments	Phosphate						Nitrogen						Mixture						Control	
	High		Normal		Low		High		Normal		Low		High		Normal		Low			
Inspections	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults
21/5	2.2	0.5	0.5	0.5	1.5	0.5	1.9	0.5	2.5	0.5	1.9	0.5	2.9	0.5	0.5	0.5	0.5	0.5	1.5	0.5
28	3.1	0.5	3.3	0.5	2.2	0.5	3.1	0.5	1.9	0.5	3.7	0.5	2.9	0.5	0.5	0.5	0.5	0.5	2.2	0.5
4/6	1.9	0.5	1.5	0.5	2.5	0.5	1.5	0.5	1.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
11	3.1	0.5	1.5	0.5	1.9	1.5	2.2	0.5	1.9	0.5	2.2	0.5	3.3	0.5	1.5	0.5	2.5	0.5	2.5	0.5
18	2.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5	0.5
25	1.5	2.2	1.9	1.5	0.5	2.2	1.9	0.5	1.9	2.2	1.5	0.5	1.9	1.5	1.5	0.5	0.5	0.5	0.5	1.5
2/7	1.9	1.5	0.5	0.5	0.5	0.5	1.5	0.5	0.5	1.5	0.5	0.5	0.5	1.9	0.5	0.5	0.5	1.5	1.9	1.9
9	0.5	0.5	0.5	0.5	0.5	0.5	1.5	2.2	1.9	1.9	1.5	1.5	1.5	1.5	0.5	1.5	0.5	0.5	0.5	0.5
16	1.9	0.5	1.9	0.5	0.5	1.5	2.2	0.5	0.5	1.5	0.5	0.5	0.5	0.5	1.9	0.5	0.5	0.5	0.5	0.5
23	2.7	0.5	2.7	0.5	1.9	0.5	1.5	1.5	2.2	1.9	2.9	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.5
30	2.7	0.5	3.1	0.5	2.2	2.2	1.9	2.2	1.9	2.2	3.3	1.9	0.5	2.5	0.5	0.5	1.5	0.5	1.5	0.5
Total	24.0	8.2	18.9	6.5	14.7	10.9	19.7	9.9	17.2	13.7	20.0	8.9	16.5	10.9	8.9	6.5	8.5	6.5	13.6	8.9
Mean	2.2	0.8	1.7	0.6	1.3	1.0	1.8	1.0	1.6	1.2	1.8	0.8	1.5	1.0	0.8	0.6	0.8	0.6	1.2	0.8

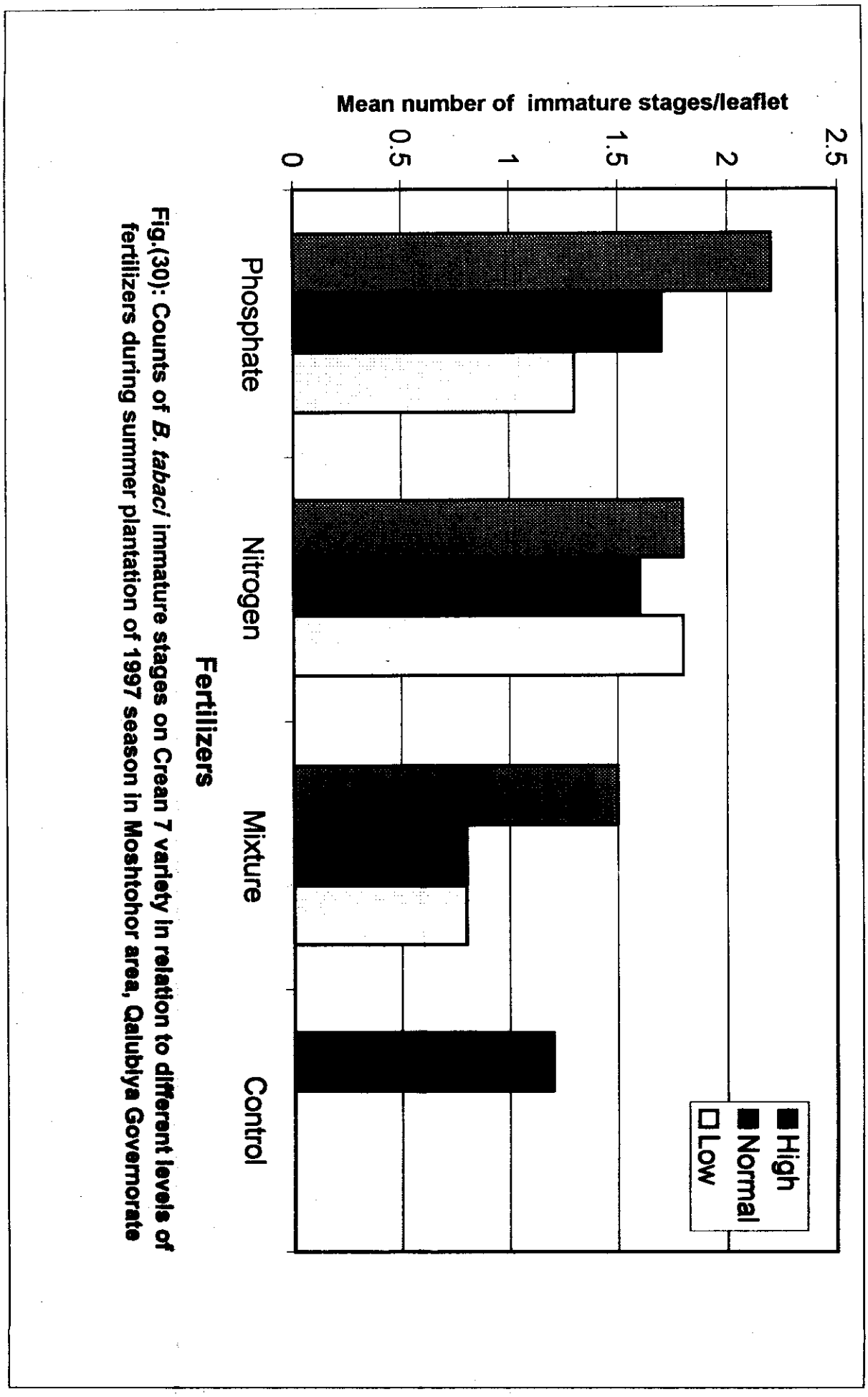

Fig.(30): Counts of *B. tabaci* immature stages on Crean 7 variety in relation to different levels of fertilizers during summer plantation of 1997 season in Moshtohor area, Qalubiya Governorate

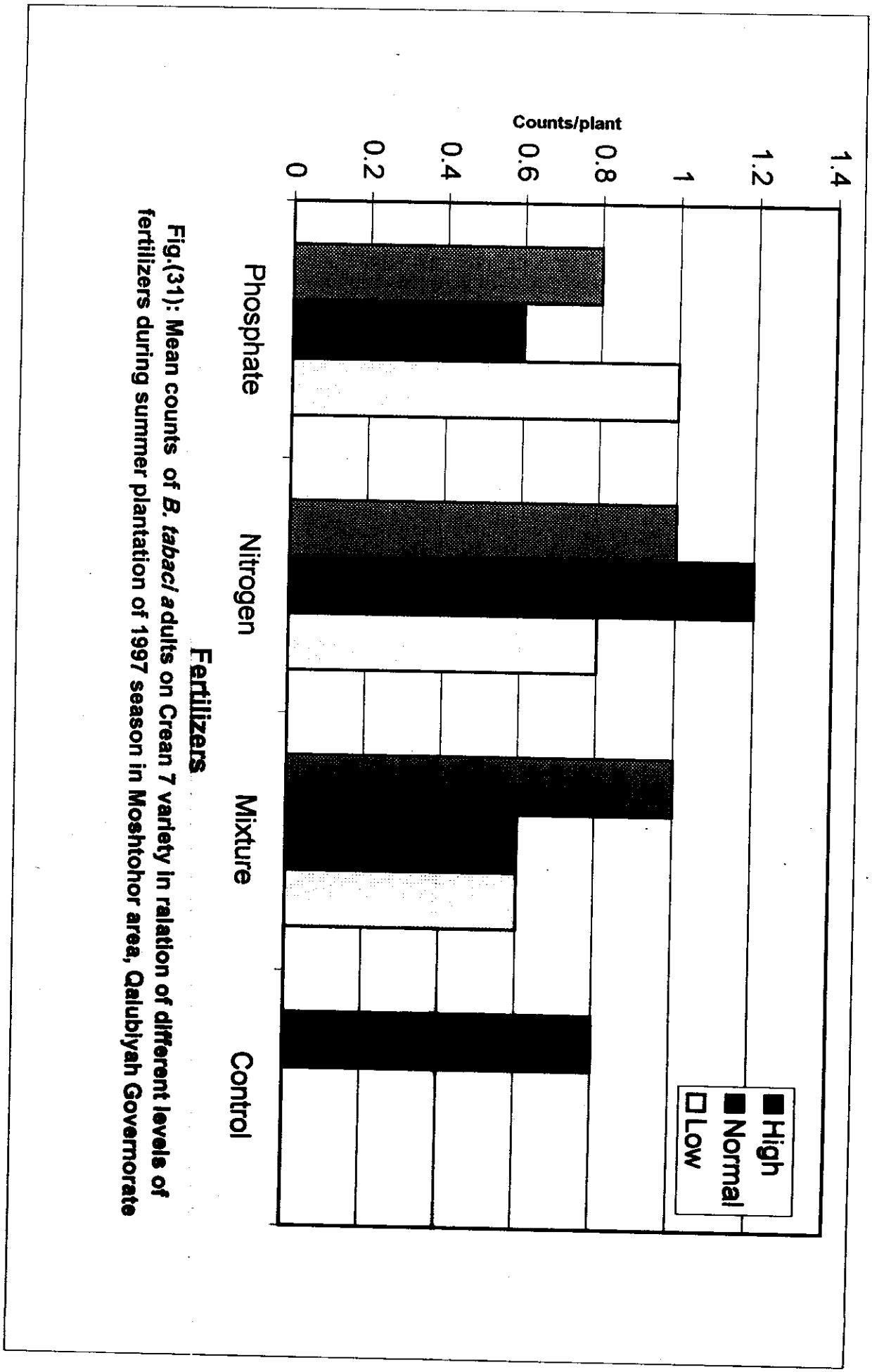

Fig.(31): Mean counts of *B. tabaci* adults on Crean 7 variety in ralation of different levels of fertilizers during summer plantation of 1997 season in Moshtohor area, Qalubiyah Governorate

B. Adults

The weekly mean rates of infestation by *Bemisia tabaci* (Genn.) adults ranged from 0.5-2.2, 0.5-1.5 and 0.5-2.2 individuals/plant when the phosphorous fertilizer was applied at 250, 200 and 150 kg/feddan, respectively. These means were 0.5-2.2, 0.5-2.2 and 0.5-1.9 adults/plant by application of ammonium nitrate at 150, 100 and 50 kg/feddan respectively. While, by soil treatment by P & N fertilizer mixture at 175:75, 100:50 and 75: 25 kg/feddan, the recorded means of infestation to cowpea plants ranged from 0.5-2.5, 0.5-1.5 and 0.5-1.5 adults/plant respectively, opposed to 0.5-1.9 adults/untreated plant (Table 24).

From date illustrated in Fig. (31), it is clear that the lowest seasonal mean of infestation by *B. tabaci* adults (only 0.6 adult/plant) was recorded when the cowpea plants were fertilized by the P fertilizer at the normal rate (200 kg/feddan) and also those fertilized by the P & N mixture at the normal (100: 50 kg/feddan) and the low (75:25 kg/feddan) rates. While, the normal N fertilizer rate (100 kg ammonium nitrate/feddan) led to the highest infestation rate to cowpea plants (1.2 adult/feddan).

3.1.5 Nymphs of the leaf-hopper *Empoasca* sp.

From data presented in Table (25) and those illustrated in Fig. (32) it could be deduced that the cowpea plants (Cream 7 variety) which did not receive any fertilizer harboured, relatively, much lower rate of *Empoasca* sp. nymphs infestation (0.8, 0.5, 1.9 nymphs/leaflet) than those receive either the phosphorous or the nitrogenous fertilizers. In case of using calcium superphosphate, the cowpea plants harboured 1.3; 0.5-2.2, 1; 0.5-3.1 and 1.3; 0.5-3.1 nymphs/leaflet when the fertilizer

was applied at 250, 200 and 150 kg/feddan, respectively. While by applying ammonium nitrate at three rates (150, 100 and 50 kg/feddan), the subsequent infestation rates by *Empoasca* sp. nymphs increased to 1.5; 0.5-2.7; 1.6; 0.5-3.5 and 1.3; 0.5-3.3 nymphs/leaflet, respectively. As shown in the mentioned table and Figure the overall seasonal rate of infestation to cowpea plants decreased by using the mentioned fertilizers, both in mixtures as in this case the overall seasonal mean rate of infestation decreased to 0.8; 0.5-1.5, 0.8; 0.5-2.9 and 0.9; 0.5-2.9 nymphs/leaflet by using the mixtures at 125:75, 100: 50 and 75:25 kg/feddan, respectively (Table 25).

AS seen in Fig. (32), the overall seasonal mean of infestation by *Empoasca* sp. nymphs to cowpea plants was doubled from 0.8 nymphs/leaflet from the unfertilized plants to 1.6 nymphs/leaflet from plants which received ammonium nitrate fertilizer at the normal rate (100 kg/feddan). The seasonal mean rate of infestation remained high by applying the N fertilizer at the highest (150 kg/feddan) and lowest (50 kg/feddan) rates (1.5 and 1.3 nymphs/leaflet), respectively.

3.2- Season 1998:

3.2.1- *Tetranychus* sp. eggs:

Data tabulated in Table (26) presented the weekly counts of *Tetranychus* sp. eggs and moving stages on leaves of cowpea plants (Cream 7 variety) throughout 1998 summer season at Moshtohor district, Qalubiyah Governorate.

Table (25) : Evaluation of different levels of fertilizers to cowpea plants on the rate of *Empoasca* sp. nymphs infestation during 1997 season at Qualyubia Governorate (count/leaflet)

Treatments / Inspection date	Phosphate			Nitrogen			Mixture			Control
	High	Normal	Low	High	Normal	Low	High	Normal	Low	
21/5/97	1.5	1.5	0.5	0.5	3.5	0.5	0.5	0.5	0.5	0.5
28/5	0.5	0.5	1.5	0.5	0.5	1.5	0.5	0.5	0.5	0.5
4/6	0.5	0.5	0.5	2.2	2.5	0.5	0.5	0.5	0.5	0.5
11/6	1.5	0.5	0.5	1.9	1.9	2.5	1.5	1.5	1.5	0.5
18/6	1.5	0.5	1.9	1.9	0.5	0.5	1.5	0.5	1.5	0.5
25/6	1.5	0.5	0.5	2.2	0.5	0.5	0.5	0.5	0.5	0.5
2/7	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.9
9/7	1.5	0.5	1.5	1.5	1.5	0.5	0.5	0.5	0.5	0.5
16/7	0.5	0.5	1.5	0.5	1.9	1.9	0.5	0.5	0.5	0.5
23/7	1.9	2.2	2.2	2.5	1.5	2.2	0.5	0.5	0.5	1.9
30/7	2.2	3.1	3.1	2.7	2.5	3.3	1.5	2.9	2.9	1.5
Total	14.6	10.8	14.2	16.9	17.3	14.4	8.5	8.9	9.9	9.3
Mean	1.3	1.0	1.3	1.5	1.6	1.3	0.8	0.8	0.9	0.8

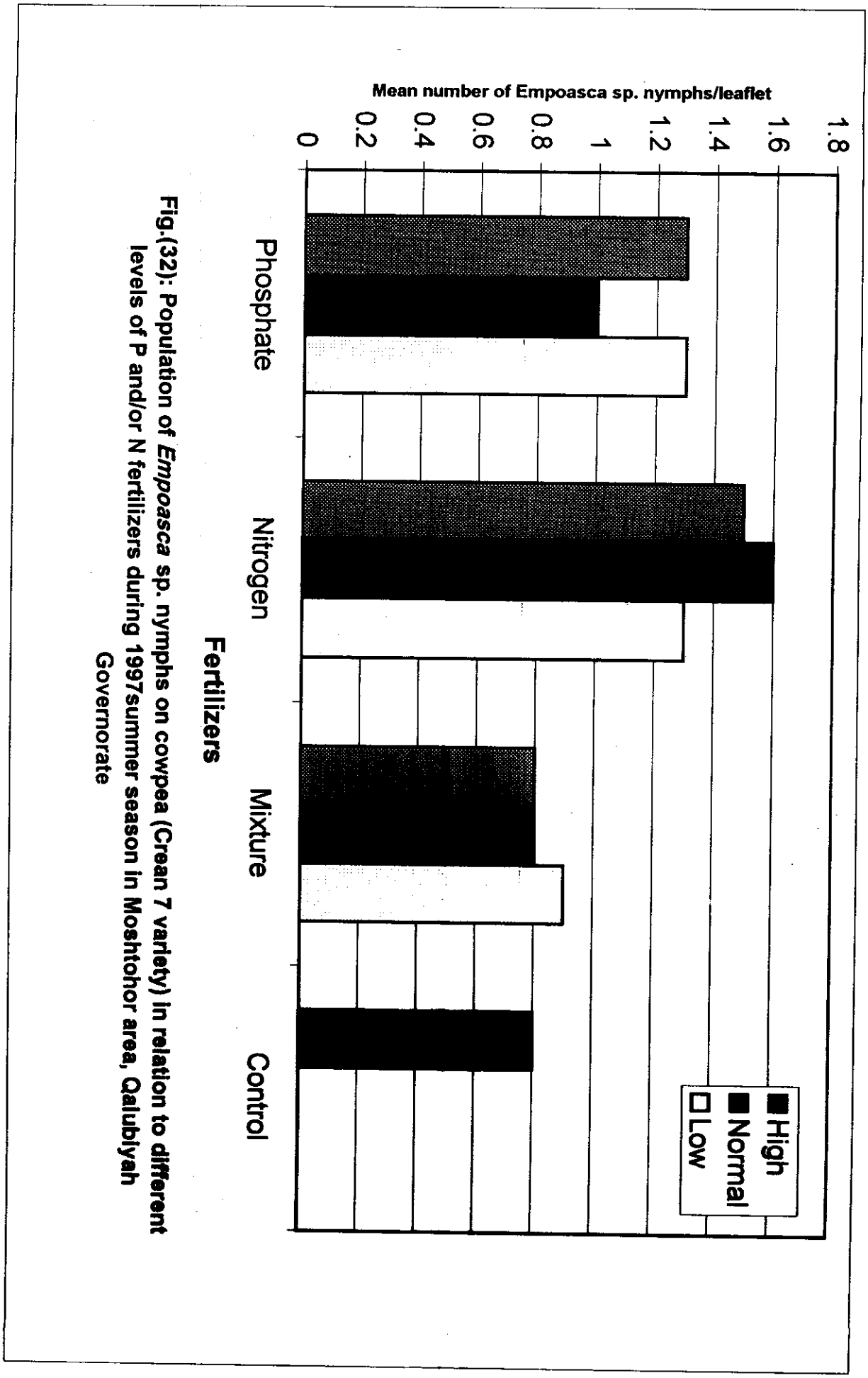

Fig.(32): Population of *Empoasca* sp. nymphs on cowpea (Crean 7 variety) in relation to different levels of P and/or N fertilizers during 1997summer season in Moshtohor area, Qalubiyah Governorate

A. Eggs

Egg counts on leaves of the control plants (plants which did not receive any P or N fertilizer) varied between different samples, reaching a minimum of 1.6 eggs/leaflet on the first sample (May, 6th) and a maximum of 14.6 eggs/leaflet on the sample of July, 8th, and showing an overall seasonal mean of 5.9 eggs/leaflet (Table 26 and Fig. 33). By applying the phosphorous fertilizer (calcium superphosphate) at three different levels; high (250 kg/Feddan), moderate (200 kg/Feddan) and low (150 kg/Feddan); the weekly mean counts of *Tetranychus* sp. eggs ranged from 2.5-10.5, 1.9-13.8 and 1.2-15.6 eggs/leaflet, respectively. In case using the nitrogenous fertilizer (ammonium nitrate) at three levels (150, 100 and 50 kg/feddan), the weekly mean egg counts ranged from 1.9-18., 0.5-15.3 and 0.5-11.6 eggs/leaflet, respectively. While, as the fertilizer was added to soil in mixtures of P & N in three levels also (125 P + 75 N, 100 + 50 and 75 + 25 kg/Feddan), the weekly mean counts of *Tetranychus* sp. eggs ranged between 1.5 & 14, 3.3 & 12.3 and 1.8 & 9.9 eggs/leaflet, respectively, (Table 26). It could be, generally, observed from the same table, that the highest population of the spider mite eggs occurred mostly at the beginning of July, while, on the contrary the lowest population was detected at the beginning and the end of the season.

From results presented in Fig. (33), it could be observed that the highest overall seasonal mean of *Tetranychus* sp. eggs (7.1 eggs/leaflet) was associated by applying the calcium superphosphate fertilizer at the highest level (250 kg/Feddan), followed by the ammonium nitrate fertilizer application at the highest level (150 kg/feddan), as the overall seasonal mean of eggs was 6.9 egg/leaflet, then that detected on

cowpea plants that received the P & N fertilizers mixture at the intermediate level of 100 P + 50 kg/feddan N which was associated by 6.5 eggs/leaflet. On the other hand, the lowest overall seasonal mean of eggs (5.1 eggs/leaflet) occurred when the cowpea plants received the P & N mixture at the lowest level (75 calcium superphosphate + 25 kg ammonium nitrate/feddan). While, the overall seasonal mean of *Tetranychus* sp. eggs on cowpea leaves was 5.9 eggs/leaflet which did not receive any fertilizer (control) (Table 26 and Fig. 33).

B. Moving stages

Throughout the successive 13 weeks of sampling throughout 1998 cowpea summer season, the mean counts of *Tetranychus* sp. moving stages ranged from 0.5 individuals/leaflet in the first sample of May, 6th to a maximum of 7.4 individuals/leaflet in the sample of July, 8th with an overall seasonal mean of 4.2 individuals/leaflet for control (plants which did not receive any fertilizers) (Table 26).

By adding calcium superphosphate fertilizer to cowpea plants at three levels, 250, 200 and 150 kg/feddan, the overall seasonal means of *Tetranychus* sp. moving stages were 5.5 (1.2-7.8), 4.8 (1.3-9.6) and 4.6 (1.5-10.6) individuals/leaflet, respectively (Table 26). When, the nitrogenous fertilizer (ammonium nitrate) was added, the overall seasonal means of infestation reached 5(1.12.3), 4.5 (1.6-10.1) and 4.3 (0.5-8.2) individuals/leaflet in relation to the high (150 kg), moderate (100 kg) and low (50 kg/feddan) rates of fertilizer. While, using the P & N mixture at high, moderate and low rates (125 + 75, 100 + 50 and 75 kg.P + 25 kgN/Feddan) resulted overall seasonal counts of 4.8 (1.2-9.5), 5.1 (2.7-8.9) and 3.5 (1.3-6.7) individuals of *Tetranychus* sp. moving stages/leaflet, respectively (Table 26).

Table (26) : Rates of infestation by *Tetranychus* sp. eggs and moving stages infesting Cream 7 variety of cowpea received different level of P & N fertilizers at 1998 season at Moshtoher, Qalubiyah Governorate (Count/leaflet)

Treatments	Phosphate						Nitrogen						Mixture						Control	
	High		Normal		Low		High		Normal		Low		High		Normal		Low			
Inspections	Eggs	Moving Stages	Eggs	Moving stages	Eggs	Moving stages	Eggs	Moving stages	Eggs	Moving Stages	Eggs	Moving Stages	Eggs	Moving stages	Eggs	Moving Stages	Eggs	Moving Stages	Eggs	Moving Stages
6/5/1998	2.5	1.2	2.4	1.4	2.1	1.7	1.9	1.0	2.7	1.6	2.0	1.4	2.4	1.2	4.0	2.7	2.4	1.3	1.6	0.5
13	4.7	3.1	1.9	2.4	2.2	1.9	4.3	3.1	4.1	2.8	1.2	1.3	4.2	2.8	5.1	2.7	3.2	2.4	3.0	0.9
20	7.2	3.7	3.8	1.7	5.0	3.3	4.5	2.7	5.7	3.7	2.5	1.3	3.1	1.2	6.6	4.2	1.8	2.5	4.5	2.6
27	5.6	5.7	2.6	4.4	1.2	1.5	5.9	4.4	3.3	4.1	2.6	3.3	2.5	3.7	6.4	5.1	2.3	2.4	2.6	4.3
3/6	10.1	6.6	5.3	3.6	7.2	4.2	7.1	4.8	5.8	4.2	11.0	5.0	9.7	5.2	6.4	4.5	5.3	2.0	6.9	4.6
10	10.4	7.8	6.7	4.5	5.3	3.9	6.6	4.9	7.0	4.9	11.6	6.4	7.7	6.9	6.7	4.7	6.5	3.7	7.3	4.0
17	9.3	6.6	7.1	6.7	7.2	4.3	9.8	5.6	5.8	3.5	6.3	4.6	5.2	5.1	7.0	5.3	5.7	3.4	6.2	4.3
24	10.5	6.2	9.1	7.6	15.1	9.4	10.1	7.5	7.9	4.1	7.3	6.0	9.7	7.7	8.6	8.6	5.4	4.1	7.5	5.5
1/7	8.4	7.4	13.8	9.6	15.6	10.6	18.0	12.3	15.3	10.1	8.8	6.0	9.3	6.4	12.3	6.5	9.9	5.5	6.0	5.0
8	8.9	6.7	9.5	6.7	9.3	7.8	8.7	8.8	10.7	7.6	11.4	8.2	14.0	9.5	10.6	8.9	8.7	6.7	14.6	7.4
15	5.8	6.5	7.6	6.6	3.5	4.4	3.1	3.5	5.9	5.6	9.1	7.5	4.9	5.3	3.3	5.0	5.7	4.6	6.9	6.2
22	5.6	5.6	5.5	5.1	3.9	3.1	2.1	3.1	3.2	3.8	4.9	4.9	5.017	5.2	4.2	4.4	4.7	4.4	5.6	6.6
29	3.8	4.1	2.3	1.3	3.9	3.2	6.9	2.9	0.5	2.3	0.5	0.5	1.5	2.8	3.7	3.3	4.6	2.7	4.4	3.0
Total	92.6	71.2	77.6	61.6	81.6	59.4	89.1	64.6	77.9	58.2	79.2	56.4	78.6	62.9	84.9	66.9	66.2	46.7	77.1	54.9
Mean	7.1	5.5	6.0	4.8	6.3	4.6	6.9	5.0	6.0	4.5	6.1	4.3	6.0	4.8	6.5	5.1	5.1	3.5	5.9	4.2

L.S.D. for levels of fertilizer: eggs = n.s. moving stages = 0.74

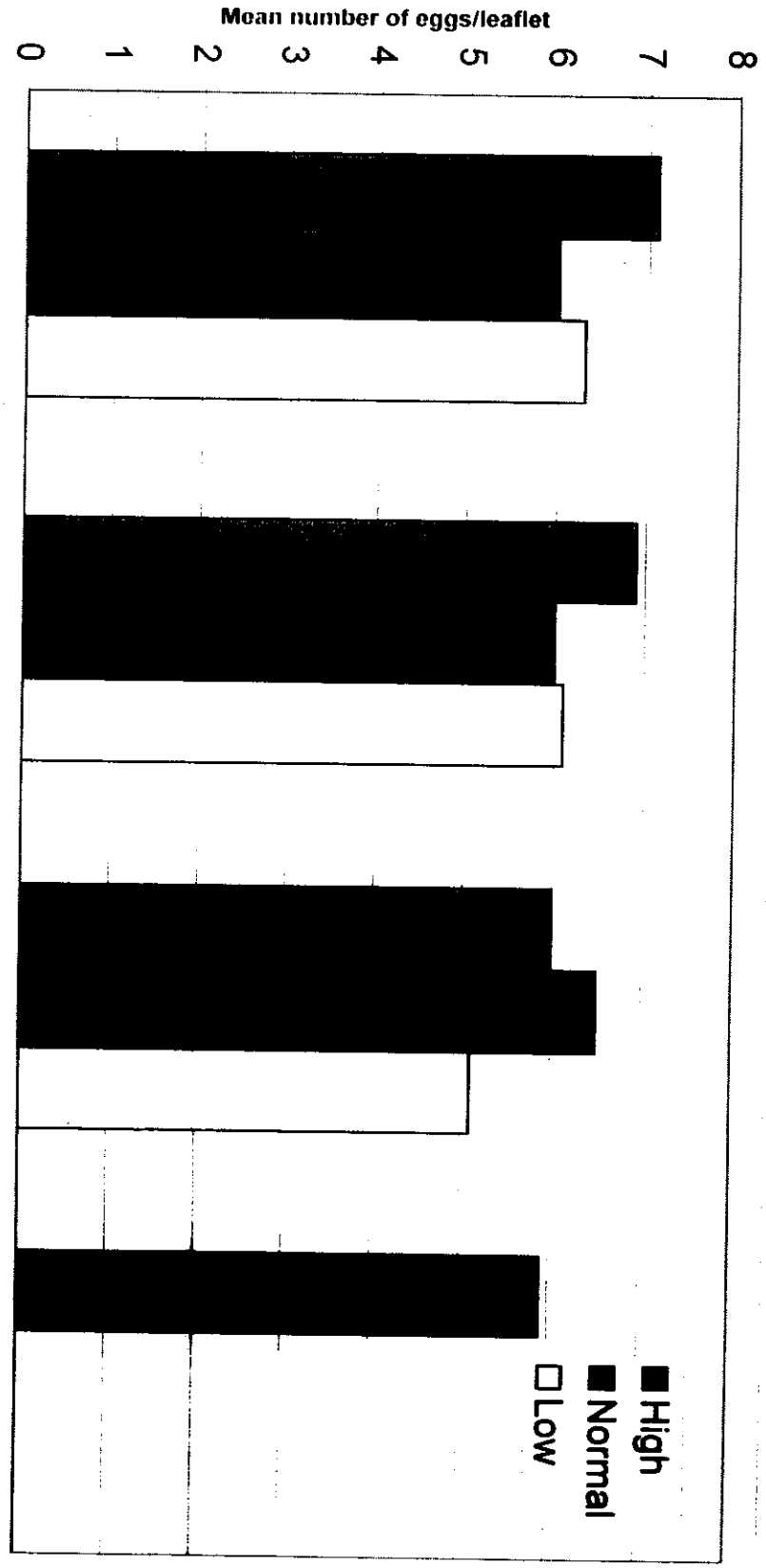

Fig.(33): Relative population densities of *Tetranychus* sp. eggs on Crean 7 variety of cowpea received different levels of fertilizers during 1998 summer plantation at Moshtohor area, Qalubiyah Governorate

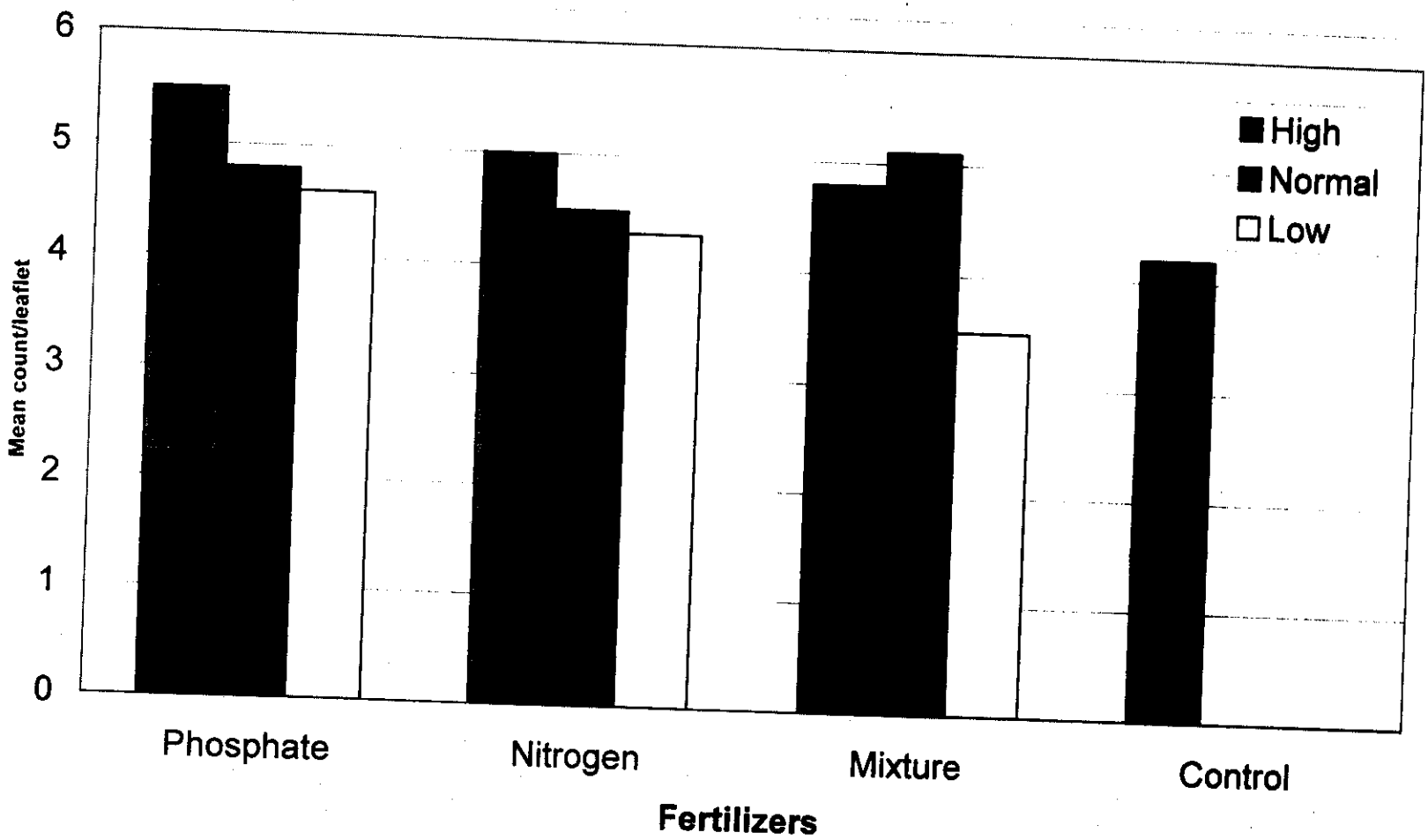

Fig.(34): Mean counts of *Tetranychus* sp. moving stages on Crean 7 variety of cowpea throughout different levels of fertilizers during 1998 summer plantation at Moshtohor area, Qalubiyah Governorate

From data illustrated in Fig. (34), it could be easily detected that the highest overall seasonal mean of *Tetranychus* sp. moving stages infestation (5.5 individuals/leaflet) was associated with using the phosphorous fertilizer, calcium superphosphate at highest rate (250 kg/Feddan), followed by using the P + N fertilizers at the moderate rate,i.e.100 + 50 kg/Feddan (5.1individuals/leaflet), then by adding the nitrogenous fertilizer at highest rate (5 individuals/leaflet by using ammonium nitrate at 150 kg/Feddan). While, on the contrary, the lowest rate of overall seasonal mean infestation (3.5 individuals/leaflet) was associated by adding) P & N fertilizer mixture at the lowest rate (75 P + 25 N/feddan).

These data agree with Hamstead & Gould (1957), Henneberry and Schriver (1964),Storms (1969), Leigh *et al.,* (1974), (El-Khateeb, 1977, Nasr *et al.,* 1982 and Hafez *et al.,* 1982) and Farrag *et al.,* (1980b).

3.2.2- Aphids

As occurred in the previous year, aphid counts on cowpea plants (Cream 7 variety) throughout 1998 summer season were generally low indicating low population of this pest during the two years of study (Tables 22 & 27).

As presented in Table (27), throughout 1998 season,aphids' infestation on cowpea plants of the control plots (which did not receive any fertilizer were estimated by 0.5-1.3 individuals/leaflet with an average of 0.73 aphid/leaflet. As the plants received calcium superphosphate at 3 rates(250, 200 and 150 kg/Feddan), the rates of

infestation by aphids ranged between 0.5-2, 0.5-1.5 and 0.5-0.8 individuals/leaflet, respectively. When the nitrogenous fertilizer, ammonium nitrate was added at high (150 kg), normal (100 kg) and low (50 kg/Feddan) levels, the weekly mean counts of aphids ranged from 0.5 to 1.2, 0.5-1.2 and 0.5-1 individuals/leaflet, respectively. While, fertilization by the mixture of P + N fertilizers at high (125 & 75 kg), moderate (100 & 50 kg) and low (75 & 25 kg/Feddan) led to weekly mean infestation counts by aphids, that were estimated by 0.5-1.3, 0.5-4.2 and 0.5-2.6 individuals/leaflet, respectively.

Regarding the data illustrated in Fig. (35), it could be deduced the fertilization by the mixture of P & N fertilizers at the moderate and low levels led to an increase in the overall seasonal mean of infestation by aphids on cowpea plants increased than that recorded on the untreated plants (1.17 and 0.97 individuals, opposed to 0.73 individual/leaflet, respectively). While, on the contrary, application of calcium superphosphate or ammonium nitrate at low level, or the mixture of P & N fertilizers at high levels were associated with decreases in the overall seasonal means of aphid counts than control (0.55, 0.6 and 0.58 individual/leaflet, respectively). On the other hand, fertilizing the soil by calcium superphosphate at the high and normal levels or ammonium nitrate at the high and normal levels led to aphids' infestations which were nearly equal to that recorded on the control plants (0.68, 0.72, 0.68 and 0.69 individual/leaflet, respectively opposed to 0.73 individual/leaflet from the control cowpea plants (Table 27 and Fig. 35).

These data agree with Isely (1946), legge and Palmer(1968), Becham (1969), Harrwijn (1970) and Bentz *et al.*, (1995).

Table (27) : Mean aphids counts on leaves of cowpea plants (Cream 7 variety) that received phosphorous and/or nitrogenous fertilizers at defferent levels during 2998 season at Moshtohor, Qualyubia Governorate (count/leaflet)

Treatments / Inspection Date	Phosphate			Nitrogen			Mixture			Control
	High	Normal	Low	High	Normal	Low	High	Normal	Low	
6/5/98	0.8	0.8	0.5	1.0	1.1	1.0	0.5	2.8	2.6	0.8
13/5	0.5	0.8	0.5	0.5	0.8	0.5	0.8	4.2	1.5	0.8
20/5	0.5	0.5	0.8	0.8	0.5	0.8	0.5	0.8	0.5	1.0
27/5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5	1.2	0.5
3/6	0.5	1.5	0.5	0.5	0.8	0.5	0.5	0.5	1.8	1.0
10/6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8
17/6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
24/6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1/7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
8/7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
15/7	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5
22/7	1.0	0.8	0.5	1.0	1.2	0.5	0.5	0.5	0.5	0.8
29/7	2.0	1.2	0.8	1.2	1.1	1.0	1.3	2.9	0.8	1.3
Total	8.8	9.4	7.1	8.8	9.0	7.8	7.6	15.2	12.2	9.5
Mean	0.68	0.72	0.55	0.68	0.69	0.60	0.58	1.17	0.94	0.73

LS.D. for level of fertilizers : 0.34

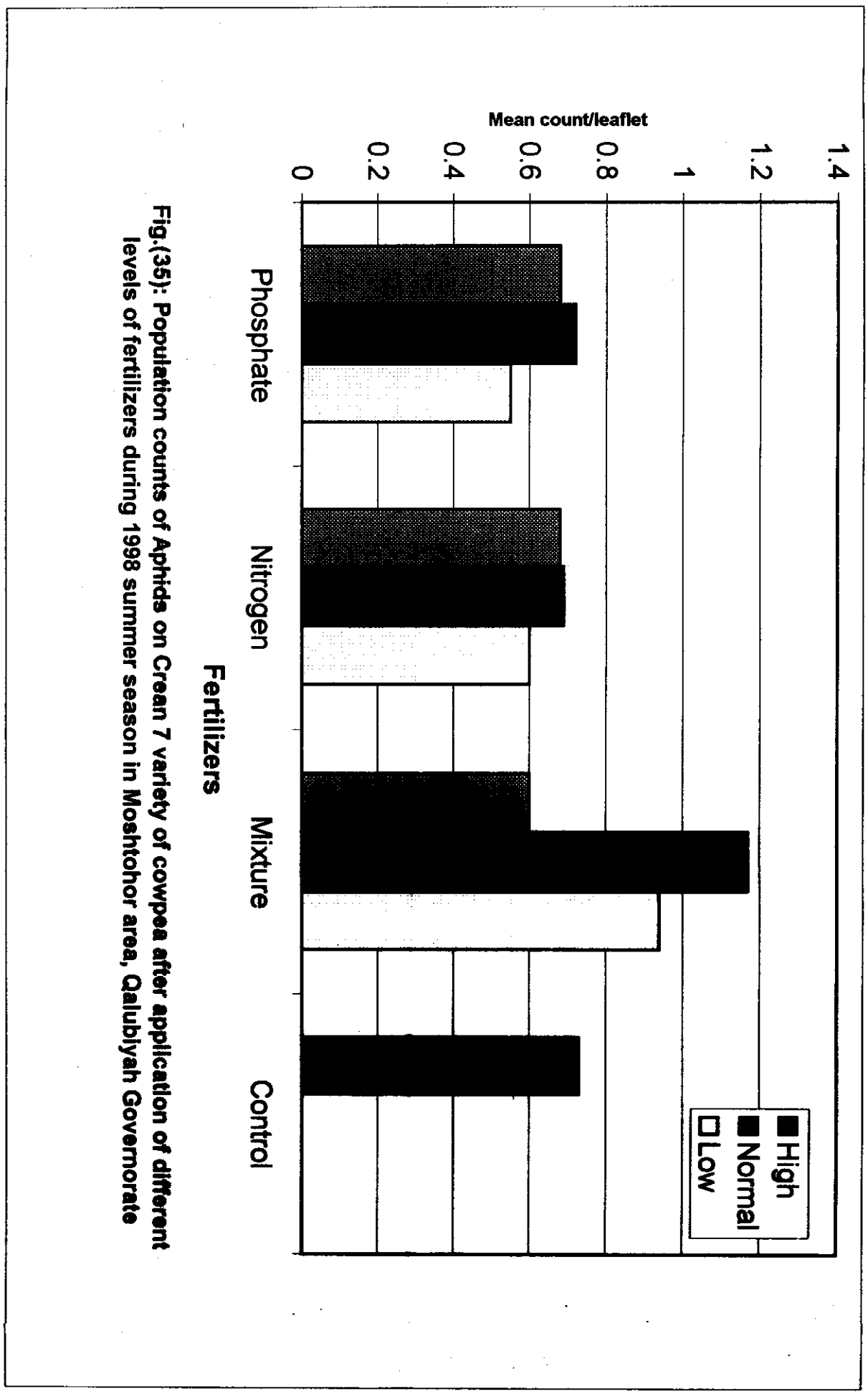

Fig.(35): Population counts of Aphids on Crean 7 variety of cowpea after application of different levels of fertilizers during 1998 summer season in Moshtohor area, Qalubiyah Governorate

3.2 3- Thrips

Data tabulated in Table (28) show the means of weekly counts of thrips nymphs and adults on cowpea leaves (Cream7 variety) in relation to application of calcium superphosphate or ammonium nitrate or their mixtures at different levels in 1998 summer season.

A-Nymphs

The weekly mean counts of thrips nymphs ranged from 0.5 to 4.4, 0.5 to 4 and 0.5 to 4.8 nymphs/leaflet from cowpea plants received the phosphorous fertilizer at 250, 200 and 150 kg/feddan, respectively (Table 28). In case of application of ammonium nitrate fertilizer at high (150 kg), moderate (100 kg) and low (50 kg/feddan) levels, the recorded weekly mean infestation levels throughout the season were 0.5-4.5, 0.5-5.4 and 0.5-5.1 nymphs/leaflet, respectively. While, by using the mixture of both fertilizers at 125 + 75, 100 + 50 and 75 + 25 kg/Feddan, the weekly means of infestation by thrips nymphs ranged from 0.5 to 4.3, 0.8-5.4 and 0.5-4.9 individuals/leaflet, respectively. On the other hand, cowpea plants which did not receive any fertilizer harboured 0.5-5.1 nymphs/leaflet (Table 28). It could be, generally, observed from the same table that the highest infestation level to cowpea plants by the nymphs of thrips occurred during the third and the fourth weeks of July.

The overall seasonal means of nymph counts is also recorded in Table (28) and illustrated in Fig. (36). The highest seasonal mean of nymph counts was associated with the normal fertilization level of P & N mixture (100 kg. P + 50 kg N/Feddan) as in this case the recorded

mean was 2.5 nymphs/leaflet. That was followed by applying ammonium nitrate at the moderate level (100 kg/feddan), being 2.4 nymphs/leaflet. These means were found higher than the 2 nymphs/leaflet recorded as a seasonal mean on the control plants. Application of the P & N mixture at the highest rate (125 kg P + 75 kg N) resulted a seasonal mean count of 2 nymphs/leaflet, being equal to that recorded from the control plants. While, using calcium superphosphate at either of the three levels, ammonium nitrate at the high and low levels or the P & N mixture at the low rate resulted seasonal means of 1.8 or 1.9 nymphs/leaflet which are not far from the 2 nymphs/leaflet recorded from plants of the control plants.

B-Adults

The weekly mean counts of thrips adults on cowpea plants which did not receive any fertilizer throughout 1998 summer season ranged from 0.5 to 0.8 adult/leaflet by adding calcium superphosphate to soil at high (250 kg), normal (200 kg) and low (150 kg/feddan), the recorded numbers of adults averaged 0.6 (0.5-1), 0.6 (0.5-1.2) and 0.5 (0.5-0.8) adult/leaflet respectively. The overall seasonal means of thrips adults counted on plants received three rates of ammonium nitrate were 0.6 (0.5-0.8), 0.6 (0.5-1) and 0.5 (0.5-0.8) adult/leaflet by using the fertilizer at 150, 100 and 50 kg/feddan, respectively. While adding the phosphorous and nitrogenous fertilizers mixtures at high (125 + 75 kg), normal (100 + 50 kg) and low (75 + 25 kg/Feddan) rates, the overall seasonal mean counts of thrips adults on cowpea plants were 0.6 (0.5-1), 0.7(0.5-1) and 0.6 (0.5-1.2) adults/leaflet, respectively (Table 28). It is clear from the same table that the population of thrips adults was, always, lower than that of nymphs.

Table (28) : Evaluation of thrips' infestations on cowpea plants (Cream 7 variety) after P and/or N fertilizing at different levels in 1998 summer season at Moshtohor, Qalubyiah Governorate (count/leaflet).

Treatments	Phosphate						Nitrogen						Mixture						Control	
	High		Normal		Low		High		Normal		Low		High		Normal		Low			
Inspections	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults
6/5/1998	1.5	0.5	2.0	0.5	0.8	0.8	1.5	0.5	1.7	0.5	1.7	0.5	1.0	0.5	2.2	0.8	1.0	0.5	1.1	0.8
13	0.5	0.5	0.8	0.5	0.8	0.8	1.8	0.5	1.9	0.5	0.8	0.5	1.2	0.5	1.6	0.5	0.8	0.5	1.0	0.5
20	1.3	0.5	0.8	0.5	1.3	0.5	1.2	0.5	1.9	0.5	1.5	0.5	1.6	0.5	1.2	0.5	1.2	0.5	2.0	0.8
27	1.8	0.5	0.8	0.5	0.8	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	2.4	0.8	1.2	0.5	1.3	0.5
3/6	1.4	0.5	0.5	0.5	0.8	0.5	0.8	0.5	2.0	0.5	0.8	0.5	1.3	0.5	1.1	0.8	1.0	0.5	0.8	0.5
10	0.8	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	1.3	0.8	1.0	0.5	0.5	0.5	0.5	0.5
17	0.8	0.5	1.3	0.5	1.0	0.5	1.5	0.5	1.5	0.5	1.2	0.5	1.0	0.5	1.9	0.5	0.8	0.5	1.3	0.5
24	0.8	0.8	1.2	0.5	0.8	0.5	0.8	0.5	0.8	1.0	0.5	0.5	0.5	0.5	0.8	0.5	0.8	0.5	0.8	0.5
1/7	1.6	0.5	1.7	0.5	1.8	0.5	1.5	0.8	1.9	1.0	0.5	0.5	2.2	0.5	1.8	0.8	1.8	0.8	0.8	0.5
8	2.9	0.5	2.9	1.0	4.8	0.5	4.2	0.8	3.6	0.5	3.8	0.5	3.8	0.8	5.3	0.5	4.4	0.5	3.1	0.8
15	4.0	1.0	4.0	1.2	4.1	0.5	4.5	0.5	3.9	0.5	5.0	0.8	4.3	1.0	5.4	1.0	4.0	0.5	5.0	0.8
22	4.4	0.8	3.5	0.5	2.6	0.5	2.6	0.8	5.4	0.5	5.1	0.5	4.2	0.5	4.5	0.5	4.9	1.2	5.1	0.5
29	3.2	0.5	3.4	0.5	2.7	0.5	2.4	0.5	4.9	0.5	2.6	0.5	2.9	0.8	3.5	0.8	2.9	0.8	3.4	0.5
Total	25.0	7.6	23.4	7.7	22.8	7.1	24.1	7.4	30.8	7.5	24.4	6.8	25.8	7.9	32.7	8.5	25.3	7.5	25.0	7.7
Mean	1.9	0.6	1.8	0.6	1.8	0.5	1.9	0.6	2.4	0.6	1.9	0.5	2.0	0.6	2.5	0.7	1.9	0.6	2.0	0.6

L.S.D. for levels of fertilizer : Immature stages = 0.37 Adults = n.s.

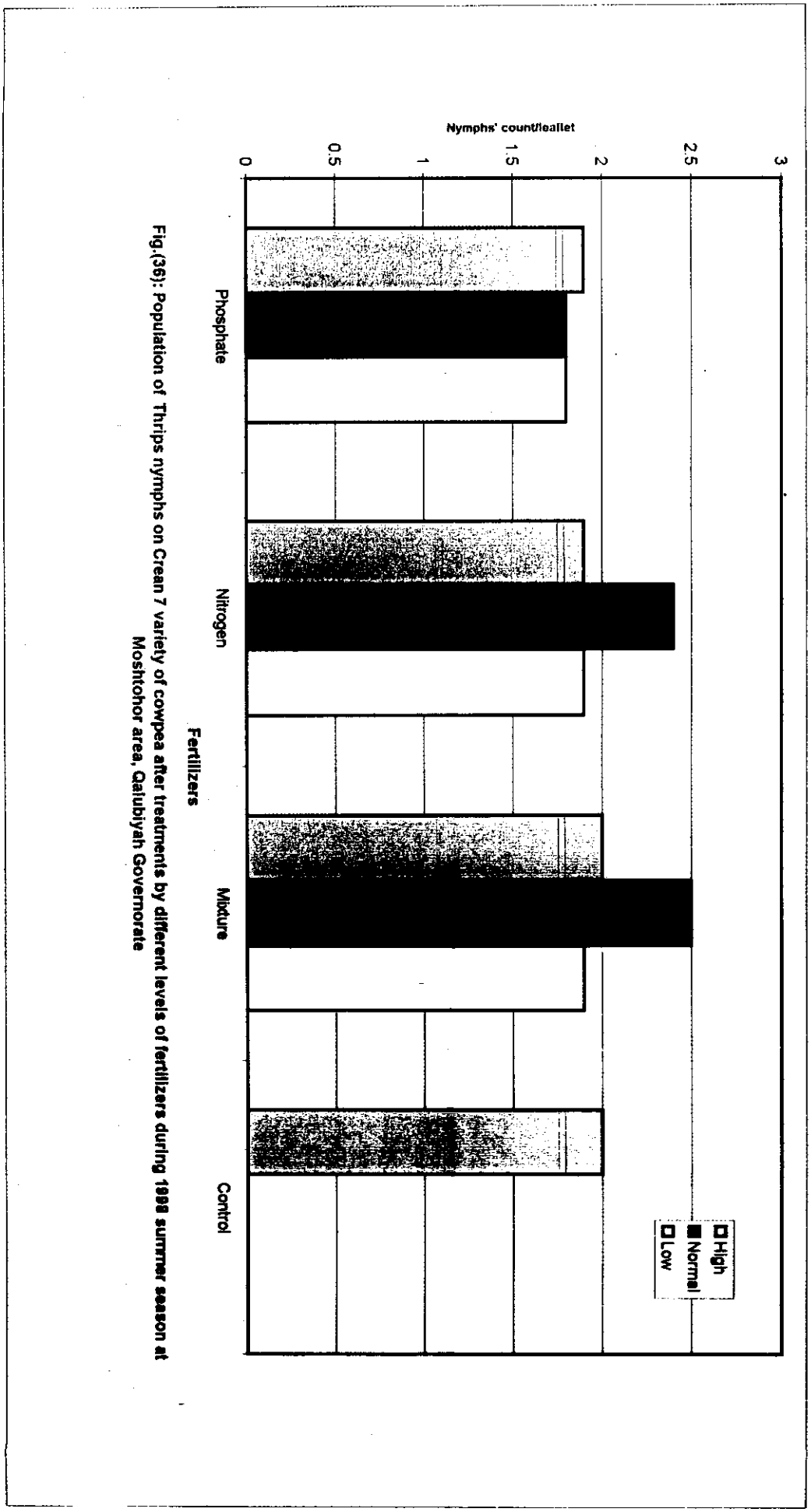

Fig.(36): Population of Thrips nymphs on Crean 7 variety of cowpea after treatments by different levels of fertilizers during 1998 summer season at Moshtohor area, Qalubiyah Governorate

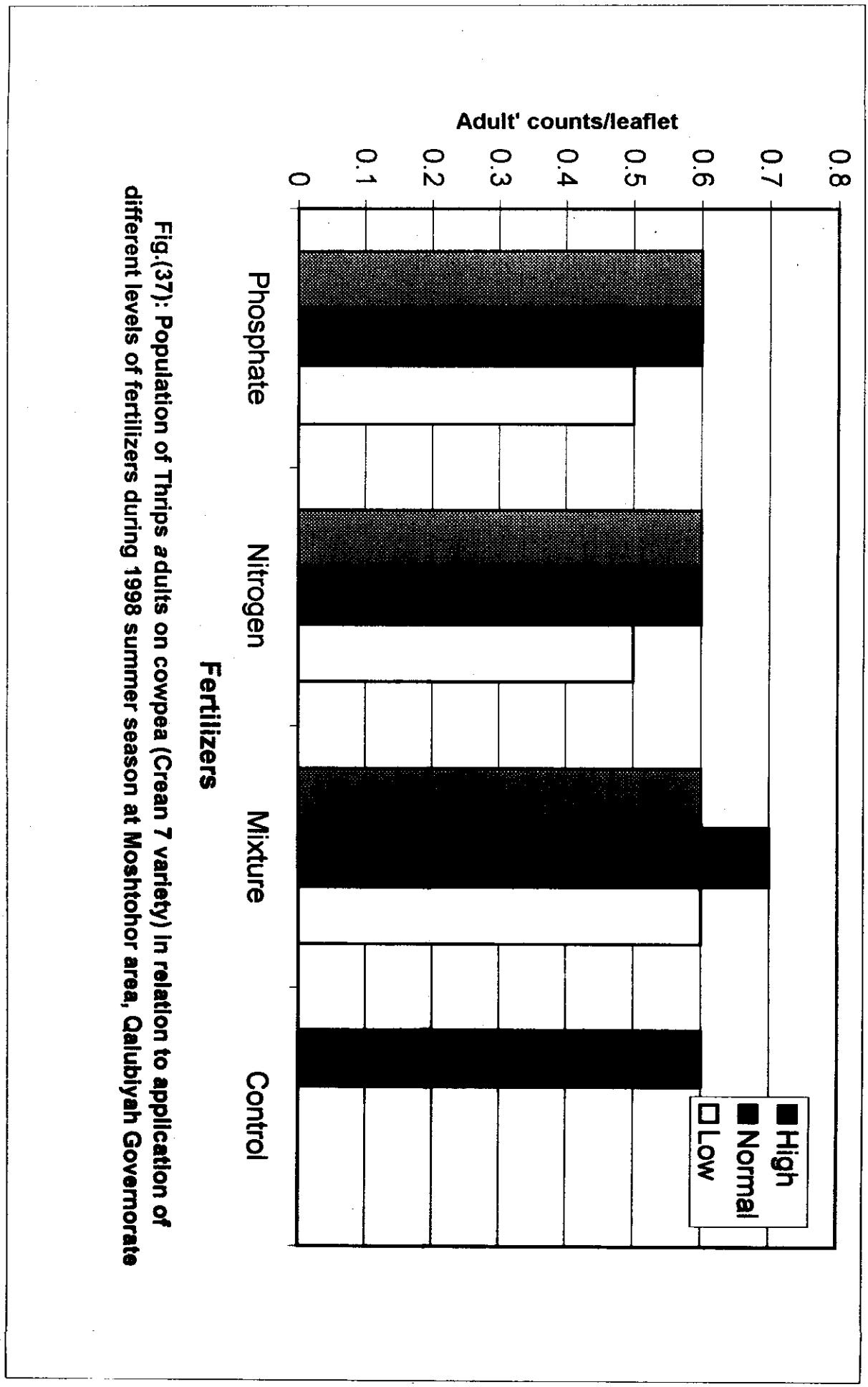

Fig.(37): Population of Thrips *a*dults on cowpea (Crean 7 variety) in relation to application of different levels of fertilizers during 1998 summer season at Moshtohor area, Qalubiyah Governorate

As shown in Fig. (37), the overall seasonal means of thrips adults were, generally, low, ranging from 0.5 to 0.7 adult/leaflet. The lower mean was associated with using either calcium superphosphate or ammonium nitrate at low rate, while the higher mean occurred by applying P & N mixture at the normal rate. The remaining treatments of fertilization (high and normal rates of either calcium superphosphate or ammonium nitrate, or high and low levels of the P & N mixture) resulted plants that harboured thrips adults at the same rate as that of the control (0.6 adult/leaflet; Fig. 37).

These data agree with El-Adl *et al.*, (1983) and Jonsson *et al.*, (1991).

3.2.4. *Bemisia tabaci* (Genn.)

The weekly mean counts of *B. tabaci* immature stages and adults on untreated cowpea plants, and on those received phosphorous or nitrogenous fertilizers or their mixtures throughout 1998 summer season are tabulated in Table (29).

A. Immature stages

The weekly mean counts of *B. tabaci* immature stages on cowpea plants that received calcium superphosphate at high (250 kg). Normal (200 kg) and low (150 kg/feddan) levels averaged 3.9 (1.9-7.2), 3.4 (1.4-7.9) and 3.3 (1.0-7.7) individuals/leaflet. By applying ammonium nitrate at high, normal and low levels (150, 100 and 50 kg/feddan), the growing cowpea plants harboured 3.1 (1.4-6.3), 3.5 (1.0-8.1) and 3.5 (1.1-7.5) individuals/leaflet, respectively. While, in

case of adding the P & N mixture at the high (125 kg. P + 75 kg N), normal (100 + 50 kg) and low (75 kg P + 25 kg N/feddan) levels, the recorded means of immature stage counts were 3.4 (1.2-8.3), 3.3 (1.5-6.1) and 3.3 (1.4-5.9) individuals/leaflet. On the other hand, cowpea plants which did not receive any fertilizer harboured 3.4 (1.4-6.4) individuals/leaflet, Generally, the highest immature stages mean counts were recorded from the first sample that had been collected on May 6th (Table 29).

From data illustrated in Fig. (38), it could be deduced that the overall mean counts of *B. tabaci*, immature stages ranged from a minimum of 3.1 individuals/leaflet on plants that received ammonium nitrate fertilizer at its highest level, and a maximum of 3.9 individuals/leaflet from treatment which received the highest rate of calcium superphosphate (250 kg/feddan). While, all the remaining treatments gave results similar to that of the control (3.4 individuals/leaflet) as the recorded overall seasonal means of infestation ranged from 3.3 individuals to 3.5 individual/leaflet (Table 29).

B. Adults

As shown in Table (29) the *B. tabaci* adult counts were generally, less than those recorded for the immature individuals. The untreated cowpea plants harboured 1.3 (0.5-2.7) adults/plant. By application of calcium superphosphate at 250, 200 and 150 kg/feddan, the recorded weekly mean counts of *B. tabaci* adults averaged 1.7 (0.8-2.7), 1.5 (0.5-2.7) and 1.6 (0.8-2.8) adults/plant, respectively. As for ammonium nitrate treatments, the adults

Table (29) : Effect of applying different levels of fertilizers to cowpea (Cream 7 variety) on infestations by *B. tabaci* immature stages and adults throughout 1998 summer season at Moshtohor, Qalubylah Governorate (immature stage count/leaflet and adult count/plant).

Treatments	Phosphate						Nitrogen						Mixture						Control	
	High		Normal		Low		High		Normal		Low		High		Normal		Low			
Inspections	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults	Imm.	Adults
6/5/1998	7.2	2.7	7.9	2.7	7.7	2.2	6.3	1.0	8.1	1.8	7.5	1.0	8.3	1.7	6.1	1.0	5.9	0.8	6.4	1.9
13	7.1	1.6	5.7	1.6	6.3	1.6	5.3	0.5	6.0	1.4	6.5	1.7	6.2	0.8	5.9	0.6	5.0	1.7	5.5	1.3
20	6.2	1.9	5.0	0.8	5.6	1.4	4.5	1.0	5.9	1.3	5.2	0.8	5.0	1.8	4.6	1.6	4.6	1.4	4.4	1.9
27	6.3	1.9	5.2	1.2	4.1	1.0	4.0	1.6	5.8	1.2	4.9	1.0	5.4	1.3	4.1	1.1	3.7	1.9	4.9	0.8
3/6	4.7	1.6	3.8	2.0	2.4	1.0	3.0	1.4	2.8	1.9	4.0	1.5	3.1	1.2	3.8	1.4	4.4	1.7	4.1	1.0
10	3.0	1.1	3.0	1.4	2.9	1.4	2.2	2.2	2.8	1.8	3.5	2.3	3.5	1.3	2.4	1.5	2.3	2.1	3.0	1.5
17	2.9	1.3	2.6	0.5	2.2	0.8	1.4	0.8	2.5	0.8	2.4	0.8	2.2	0.8	2.4	1.7	1.4	1.9	2.3	1.2
24	2.0	1.4	1.6	1.3	1.8	1.3	2.7	0.8	2.1	1.3	2.8	0.5	1.8	1.8	1.7	1.2	2.7	1.8	2.2	0.5
1/7	1.9	1.2	2.1	1.4	2.2	1.5	1.9	2.0	2.5	0.8	2.3	0.8	1.3	1.4	2.7	1.9	2.4	0.8	2.2	0.8
8	2.3	0.8	1.4	0.5	1.7	1.5	1.8	1.4	1.0	1.3	1.1	0.8	1.9	0.8	1.5	2.0	2.7	1.8	2.8	1.2
15	2.1	1.9	2.2	1.7	1.0	2.1	2.0	1.8	1.8	1.1	1.2	0.5	1.2	0.8	2.4	1.8	2.1	1.8	1.4	0.8
22	2.5	1.7	2.2	2.0	2.1	2.5	2.7	2.2	2.3	2.0	1.6	1.9	2.1	1.7	2.8	2.5	2.9	2.7	1.7	1.4
29	2.7	2.7	2.2	2.7	3.2	2.8	2.6	3.3	2.1	2.1	2.3	1.6	2.4	1.9	2.5	3.1	2.2	3.8	3.0	2.7
Total	50.9	21.8	44.8	19.8	43.2	21.1	40.4	20.0	45.8	18.8	45.2	15.2	44.4	17.3	43.0	21.6	42.5	23.6	43.9	17.0
Mean	3.9	1.7	3.4	1.5	3.3	1.6	3.1	1.5	3.5	1.4	3.5	1.2	3.4	1.3	3.3	1.7	3.3	1.8	3.4	1.3

L.S.D. for levels of fertilizer : Immature stages = 0.39 Adults = 0.27

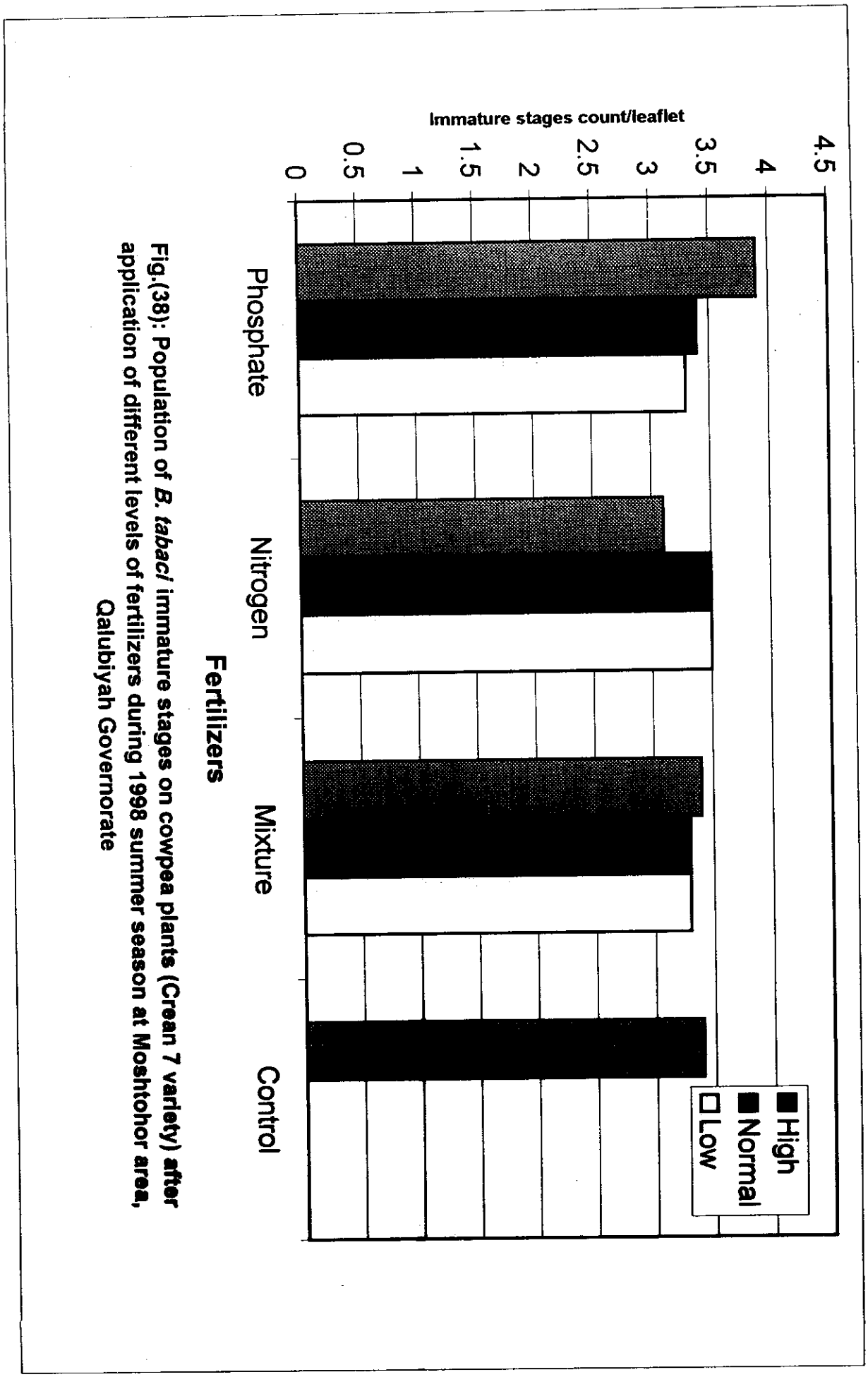

Fig.(38): Population of *B. tabaci* immature stages on cowpea plants (Crean 7 variety) after application of different levels of fertilizers during 1998 summer season at Moshtohor area, Qalubiyah Governorate

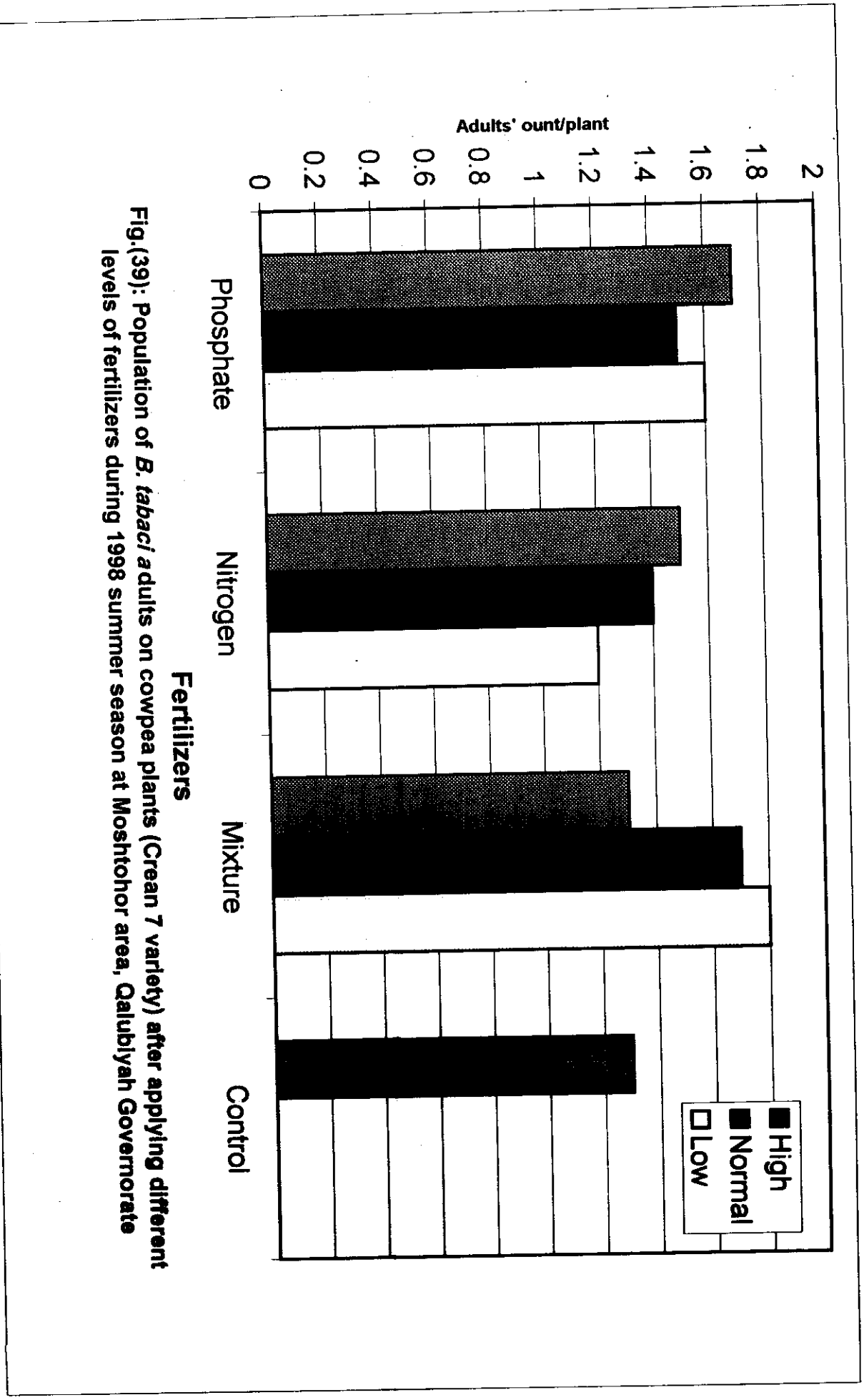

Fig.(39): Population of *B. tabaci a* dults on cowpea plants (Crean 7 variety) after applying different levels of fertilizers during 1998 summer season at Moshtohor area, Qalubiyah Governorate

mean counts averaged 1.5 (0.5-3.3), 1.4 (0.8-2.1) and 1.2 (0.5-2.3) adults/plant when the fertilizer was applied at 150, 100 and 50 kg/feddan, respectively. While adding the p: N mixture at 125-75, 100 + 50 and 75 + 25 kg/feddan led to infestation by *B. tabaci* adults that were estimated by 1.3 (0.8-1.9), 1.7 (0.8-3.1) and 1.8 (0.8-3.6) adults/plant, respectively.

As illustrated in Fig. (39), the highest overall seasonal mean of infestation (1.8 adults/plant) was recorded from cowpea plants of treatments which received the lowest rate of the P & N mixture, followed by 1.7 adults/plant those received the P & N mixture at the normal rate and those received the calcium superphosphate fertilizer at the highest rate (250 kg/feddan), then by 1.6 adults/plant received the low rate of calcium superphosphate. The recorded overall seasonal means from plants of the remaining treatments gave, nearly, equal results as that from the control plants (1.2-1.5 adult/plant; Fig. 39).

These data agree with Mostafa *et al.*, (1983), Rote and Puri (1992) and Bentz *et al.*, (1995)

3-2-5- *Empoasca* sp. nymphs

As shown in Table (30), high abundance of *Empoasca* sp. nymphs on cowpea plants occurred during the first week of June and the last week of May (3.4.1 nymphs/leaflet). Otherwise, the population of the leaf hopper nymphs varied between the different samples collected throughout the successive weeks of 1998 summer season.

On cowpea plants which did not receive any fertilizer, the weekly means of nymphs relative population density varied from 0.5 to 3.1 nymphs/leaflet with an overall seasonal mean of 1.5 nymphs/leaflet (Table 30). Plants which received calcium superphosphate fertilizer harboured 1.8 (0.8-3.4), 1.6 (0.5-3.6) and 1.6 (0.5-3.8) nymphs/leaflet when the fertilizer was applied at 250, 200 and 150 kg/feddan, respectively. Those received ammonium nitrate were found to be infested by the leaf-hopper nymphs mean numbers which averaged 1.8 (0.5-4.1), 1.8 (0.5-3.6) and 1.5 (0.5-3.4 nymphs/leaflet in correlation with the high (150 kg), normal (100 kg) and low (50 kg/feddan) levels of fertilizer while, in case of adding both fertilizers (P & N) in mixtures at high (125 kg P + 75 kg N), normal (100 + 50) and low (75 + 25) rates, the recorded overall seasonal means of infestation were 1.4 (0.5-3.1), 1.6 (0.5-3.5) and 1.5 (0.5-3.0) nymphs/leaflet, respectively.

Regarding the data illustrated in Fig. (40), it is clear that the highest overall seasonal mean of infestation (1.8 nymphs/leaflet) occurred on plants which received the high level of calcium superphosphate and those received ammonium nitrate at high and normal levels. While all the remaining treatments (calcium superphosphate at normal & low levels, ammonium nitrate at low level and P & N mixture at either of the three levels) resulted plants that harboured *Empoasca* sp. nymphs' infestation (1.4-1.6 nymphs/leaflet) which were found, nearly, equal as that occurred on the untreated cowpea plants (1.5 nymphs/leaflet; Table 30 and Fig. 40).

Table (30) : Mean *Empoasca* sp., nymphs counts on leaves of cowpea (Cream 7 variety) that received phosphorous and/or nitrogenous fertilizers at different levels during 1998 season at Moshtohor, Qalubiyah Governorate (count/leaflet).

Treatments / Inspection date	Phosphate			Nitrogen			Mixture			Control
	High	Normal	Low	High	Normal	Low	High	Normal	Low	
6/5/98	1.2	0.5	0.8	0.5	0.8	1.1	0.5	0.5	0.5	0.5
13/5	0.8	0.5	1.4	1.4	1.2	1.2	1.2	1.2	0.8	0.5
20/5	1.6	1.2	1.2	1.0	1.8	2.2	2.1	1.6	1.3	0.8
27/5	3.4	2.6	3.1	3.7	3.6	2.0	1.2	2.7	2.2	2.5
3/6	3.3	3.6	3.8	4.1	3.1	3.4	3.1	3.5	3.0	3.1
10/6	2.8	2.6	2.5	2.8	2.4	2.3	2.6	2.6	2.7	2.7
17/6	1.8	1.3	1.9	1.2	2.4	1.1	1.3	1.5	1.3	1.7
24/6	1.3	1.8	1.9	1.9	1.9	1.1	0.5	1.0	0.5	2.2
1/7	0.8	0.8	1.2	1.2	1.2	1.5	0.8	1.2	1.4	1.2
8/7	0.8	1.5	0.8	1.2	0.5	0.5	1.2	1.1	0.8	0.5
15/7	1.8	1.2	0.5	0.8	1.0	0.5	0.5	0.8	1.5	1.0
22/7	1.3	1.0	1.3	1.5	1.5	1.5	1.0	1.5	1.3	1.2
29/7	2.3	2.7	1.0	2.3	2.3	1.7	2.4	1.2	1.9	1.7
Total	23.2	21.3	21.4	23.6	23.7	20.1	18.4	20.4	19.2	19.6
Mean	1.8	1.6	1.6	1.8	1.8	1.5	1.4	1.6	1.5	1.5

L.S.D. for levels of fertilizers for immature of *Empoasca* sp. : 0.29.

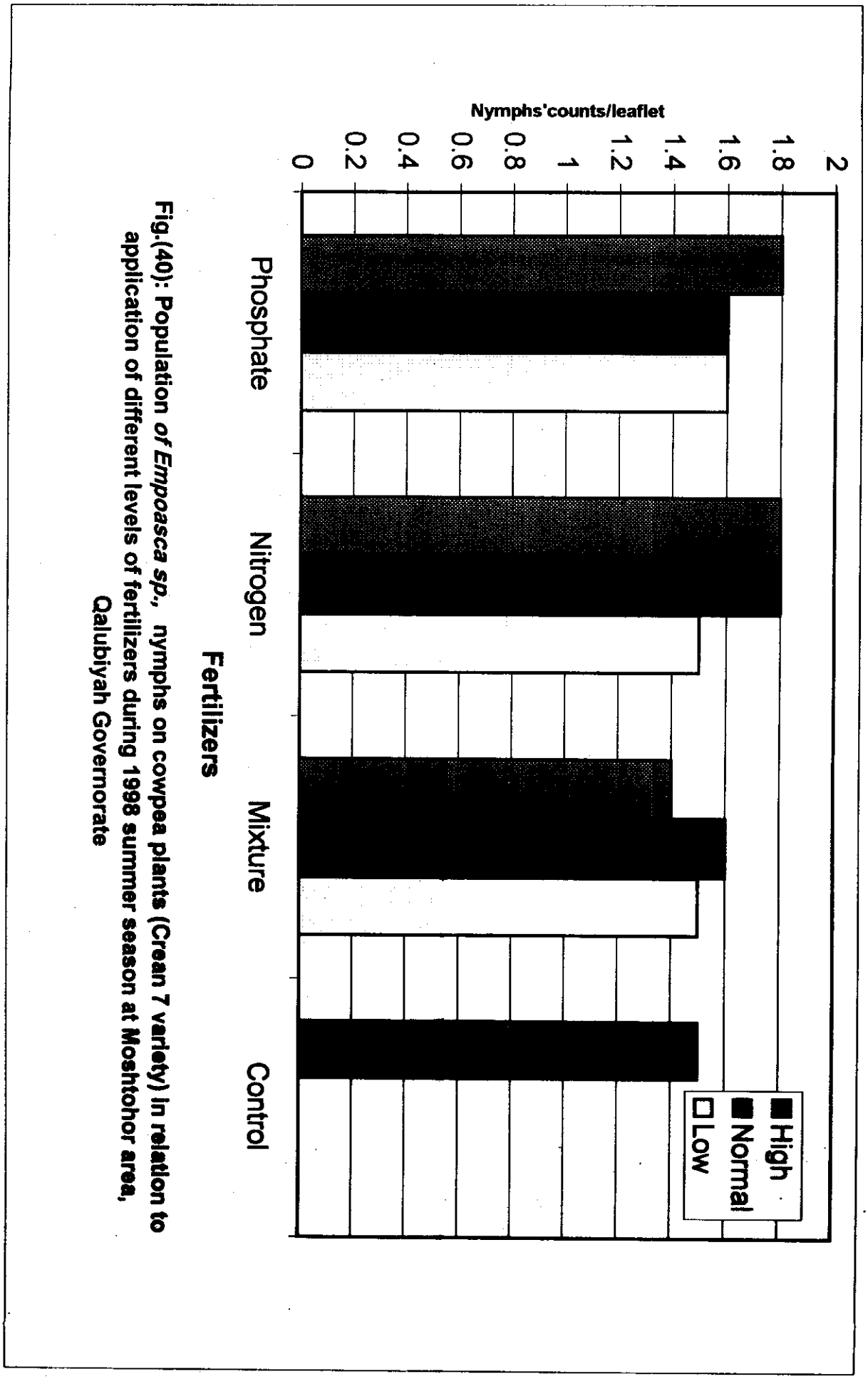

Fig.(40): Population *of Empoasca sp.,* nymphs on cowpea plants (Crean 7 variety) in relation to application of different levels of fertilizers during 1998 summer season at Moshtohor area, Qalubiyah Governorate

4. Effect on Yield

4.1. Varieties:

Data presented in Table (31) show the averages of yield/feddan for three different varieties; Balady, Dokki-331 and Cream-7 varieties in two successive seasons 1997 and 1998.

In 1997 season data show that Dokki-331 variety gave the highest yield (1127.78 and 685.5 kg/feddan in 1997 and 1998 seasons, respectively) with significant different compared with other varieties. That was followed by Cream 7 variety (797.22 and 471 kg/feddan) while the lowest yield resulted from the Balady variety (583.33 and 255.8 kg/feddan, respectively, Table 31). It could be also noticed that the yield was, generally higher in 1997 than 1998 season. This may be due to differences in weather condition and pests' infestation.

These data similarized with the data of Wahba *et al.*, (1986) and El-Khawalka *et al.*, (1996).

4.2. Planting dates:

Statistical analysis of data concerning the relations between planting dates and the resultant yield showed insignificant effect of the planting date. But, from the two seasons mean of yield, it could be observed from Table (32) that the highest yield was associated with sowing in the first planting date (285.75 kg/feddan), followed by the third planting date (256.96 kg/feddan).

4.3. Fertilizers:

Data presented in Table (33) show the averages of cowpea dry pods yield/feddan after application of different levels of P & N fertilizers

and their mixture. Depending on means of yields/feddan from the two seasons of experiment, it could be stated that the application of ammonium nitrate at the normal rate resulted the highest yield (635.22 kg/feddan) follow by the P & N mixture at the high rate (626.75 kg/feddan) and calcium superphosphate at the low rate (470.95 kg/feddan), being better than all the remaining treatment (185.11-441.59 kg/feddan and control treatment (228.33 kg/feddan, Table 33).

5- Survey of insect pests on cowpea in the field and the associated predators

A survey of insect pests was carried out on cowpea plants in the field starting from May 21st in the first season and from June, 3rd in the second one. The insect predators were also surveyed on cowpea plants at the same time. This work was carried out at the experimental farm of the faculty of Agriculture at Moshtohor, Tukh, Qalubiyah governorate.

The collected insects were: grasshoppers, Egyptian locust, *Anacridium aegyptiaum* L., *Cosmolyce baeticus* L., jassid, *Nezara viridula* L., beanfly, *Melanagromyza phaseoli.*

The associated predators collected were: *Coccinella undecimpunctata* L., *Scymnus syriacus* Mars., *Scymnus punctillum* Weise, *Cryptolaemus montrouzieri* Muls., *Paederus alfierii* Koch, aphid lion, *Chrysoperla carnea*, *Syrphus corollae* F. *Mantis religiosa* L., *Hemianax ephipigger* Selys, *Ischneura sengalensis* Ramb. And *Polistes gallica* L.

Table (31): Evaluation of three cowpea varieties on yield in 1997 and 1998 seasons at Qalubiyah Governorate.

Sesaons / Varieties	First season (1997)	Second season (1998)	Mean
Balady	583.33	255.83	419.85
Dokki-331	1127.78	685.50	906.64
Cream-7	797.22	471.00	634.11
$L.S.D._{0.05}$	374.65	249.30	

Table (32) : Evaluation of planting cowpea at three planting dates on yield in 1997 and 1998 seasons at Qalubiyah Governorate

Sesaons / Planting dates	First season (1997)	Second season (1998)	Mean
First date	291.67	279.83	285.75
Second date	194.45	242.83	218.64
Third date	330.58	183.33	256.96
$L.S.D._{0.05}$	n.s.	n.s.	

Table (33): Effect of application of P & N fertilizers at different levels on the resultant yield of cowpea dry pods/feddan in 1997 and 1998 seasons at Qalubiyah Governorate

Fertilizers	First season (1997)	Second season (1998)	Mean
Calcium superphosphate:			
High	466.67	416.50	441.59
Normal	155.56	214.67	185.11
Low	388.89	553.00	470.95
Ammonium nitrate:			
High	233.33	454.33	343.83
Normal	777.78	492.67	635.22
Low	233.33	383.83	308.58
P & N mixture:			
High	933.33	320.17	626.75
Normal	311.11	232.17	271.64
Low	77.78	326.33	202.06
Control	155.56	301.10	228.33
L.S.D.0.05		210.0	

N.P. data of the first season (1997) was obtained from only one replicate

CONCLUSION

From data presented in this thesis, the following points may be concluded:

1- The first part in this thesis was concerned by the varietal resistance of three cowpea varieties to the main sap-sucking pests known to infest cowpea plants. That was estimated depending on comparing the rates of infestation by different pests to each variety throughout 1997 and 1998 cowpea summer seasons. Regarding the whole mean seasonal infestation and also to the two years' means, it could be concluded that Balady variety was the least infested variety by *Tetranychus* sp. Eggs & moving stages, thrips Nymphs, whitefly *B. tabaci* adults, and also the leaf-hopper *Empoasca* sp. Nymphs. Dokki 331 was the least infested variety by aphids and also by *B. tabaci* immature stages, compared to the two other varieties (Balady and Cream 7) in both years of study, Dokki 331 and Cream 7 varieties were, nearly, equal in the infestation rates by *Tetranychus* sp. Eggs & moving stages and also by thrips Nymphs & adults. On the contrary, Crean 7 variety was the heaviest infested by aphids and also by whitefly immature stages & adults as in Fig. (41). It could be generally, considered that Balady variety of cowpea as the best variety from the varietal resistance point of view to the majority of the studied sap-sucking pests. This may be due to any physical and/or chemical properties, the point which need further investigations.

2- As for the effect of planting date on the rate of infestation by different cowpea pests, it could be concluded that the third planting date (end of April) may be, fairly, considered as the best, followed by the second (mid-April). While, the first planting date (the beginning of April)

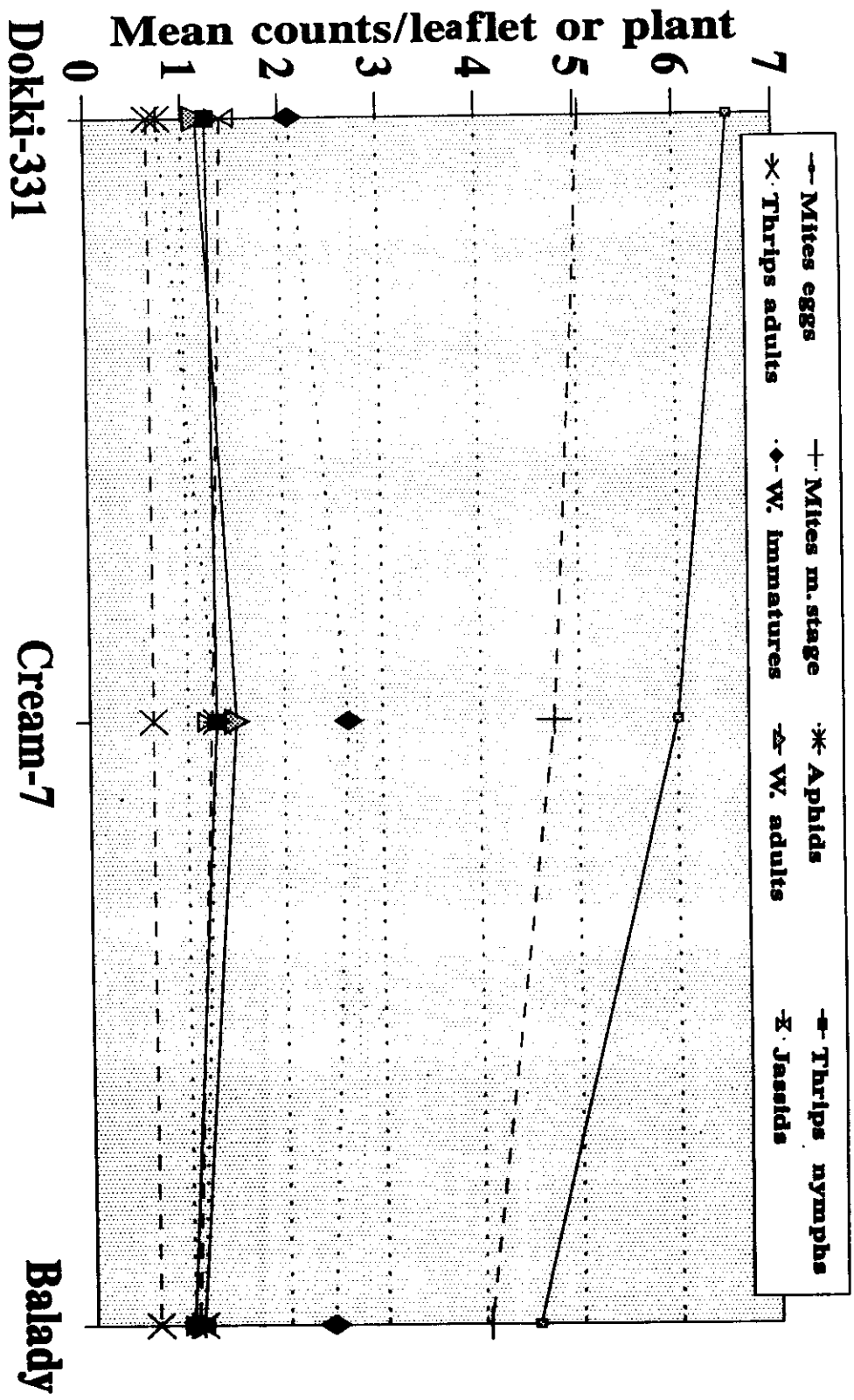

Fig. (41) : Population counts of different stages of five sap sucking pests on plants of three cowpea varieties during summer plantation of 1997/1998 seasons at Moshtohor area, Qalubiyah governorate.

appeared as unsuitable date because of the highest infestation rates on plants of this date by *Tetranychus* sp. eggs, aphids, thrips nymphs & adult and also by *B. tabaci* immature & adults. While, on the contrary, the third planting date proved as the most suitable as plants of this date received the lowest infestation rates by *Tetranychus* sp. eggs (with insignificant difference than the first and second planting dates), Thrips sp. adults (with insignificant difference than the second planting date), and also by *B. tabaci* immature & adults. Insignificant differences could be detected between the second and third planting dates in the overall seasonal rates of infestation by *Tetranychus* sp. eggs & moving stages, aphids, thrips nymphs & adults and also by *B. tabaci* adults as in Fig. (42). It could be generally, concluded that the second and third planting date appeared as better to be recommended for planting cowpea to overcome high infestations by most of the sap-sucking pests concerned in this investigation.

3- The third part of this thesis was concerned by the correlation between application of phosphorous (Calcium superphosphate), and nitrogenous (ammonium nitrate) and their mixture at different levels, on one side and the rates of infestation by each of the concerned sap-sucking cowpea pests, on the other side. The previously recorded and explained data showed clearly, that adding the fertilizers in some cases, led to rates of infestations which were, nearly, equal to those recorded from the control plants. That was clearly evident in cases of thrips nymphs and adults. It could be also, noticed that using the P+N mixtures led to lower rates of infestation than using either of the calcium superphosphate or the ammonium nitrate alone; that occurred in cases of *Tetranychus* sp. eggs & moving stages, *B. tabaci* nymphs & adults, and also in case of *Empoasca* sp. nymphs. On the contrary,

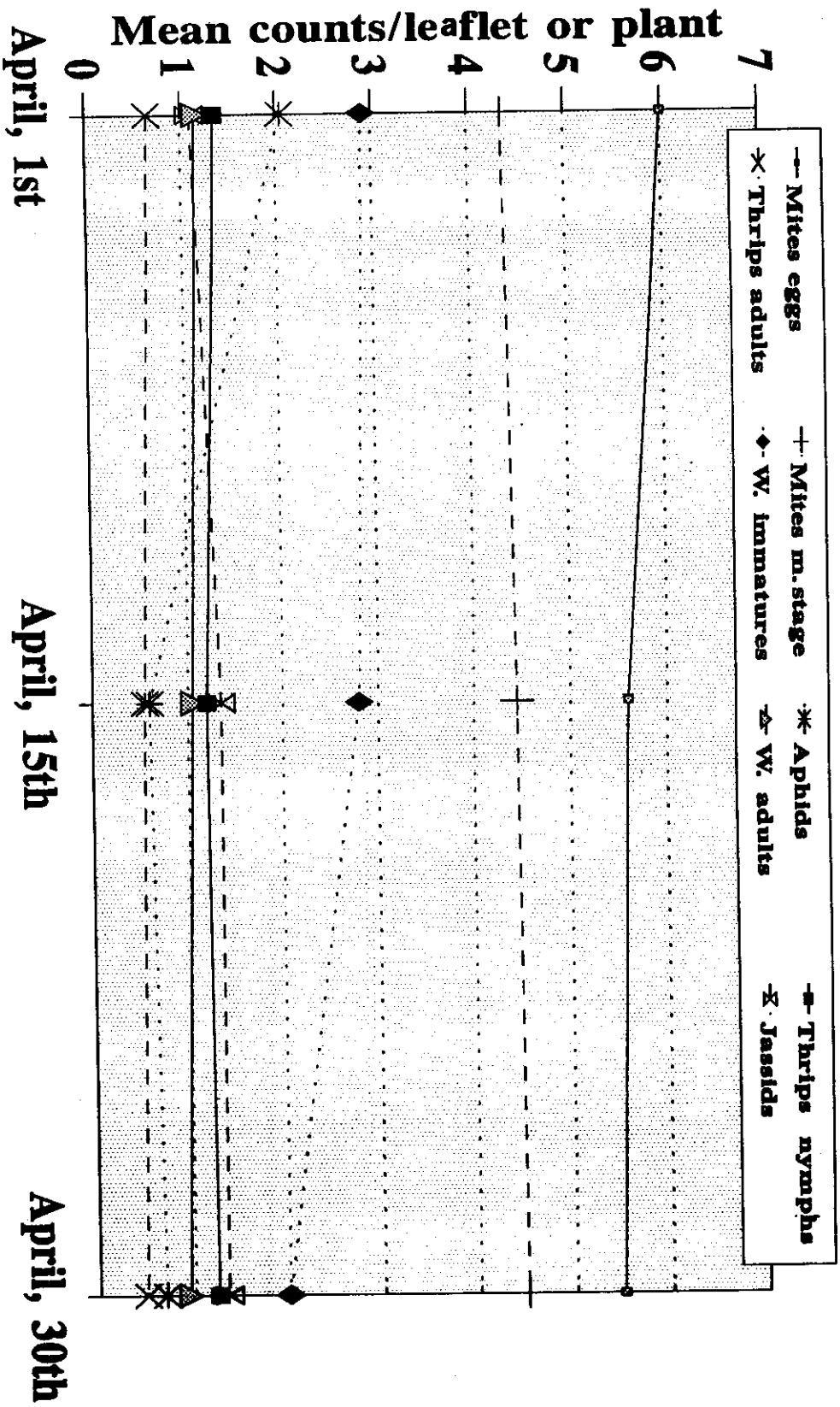

Fig. (42) : Different stages of five Sap sucking pests on cowpea plants cultivated in three planting dates during summer plantation of 1997/1998 seasons at Moshtohor area, Qalubiyah governorate.

applying the P&N mixtures led to higher infestation rates by aphids. While, using ammonium nitrate as the only applied fertilizer to cowpea plants was associated with higher infestation rates by *Empoasca* sp. nymphs. In case of applying calcium superphosphate alone, higher infestation rates by *Tetranychus* sp. eggs & moving stages, and also by *B. tabaci* nymphs were detected as in Fig. (43). It could be, generally, stated that using the P & N mixtures at the lower and normal rates appeared as the best treatment to cowpea plants, as in this case the plants harboured lowest infestation rates by most of the studied pests.

4- The obtained dry pods yield from different treatments was transferred to that produced per feddan. Data proved that Dokki 331 gave the highest yield followed by Cream 7 variety. While, Balady variety gave the lowest yield/Feddan. As for the effect of planting date, the highest yield was obtained from plants of the first planting date, followed by those of the third planting date. While plants of the second planting date gave the lowest yield of dry pods. The obtained yield of dry pods varied also between treatments of fertilizers applications. From the two years means, it could be determined the application of ammonium nitrate alone at the normal rate (100 Kg./F.) or application of the p & N mixture at the highest rate (125 Kg of P fertilizer + 75 Kg of N fertilizer) led to highest yield than all the remaining levels of fertilizer.

It may be, finally, recommended that in order to obtain highest dry pods yield, it is advised to chose seeds of the Dokki 331 variety to be cultivated at the beginning of April (first planting date), the plants which sown in the first planting date (1st April) and to apply the mixture of P : N fertilizer at the rate of 125 Kg calcium superphosphate : 75 Kg ammonium nitrate/F.

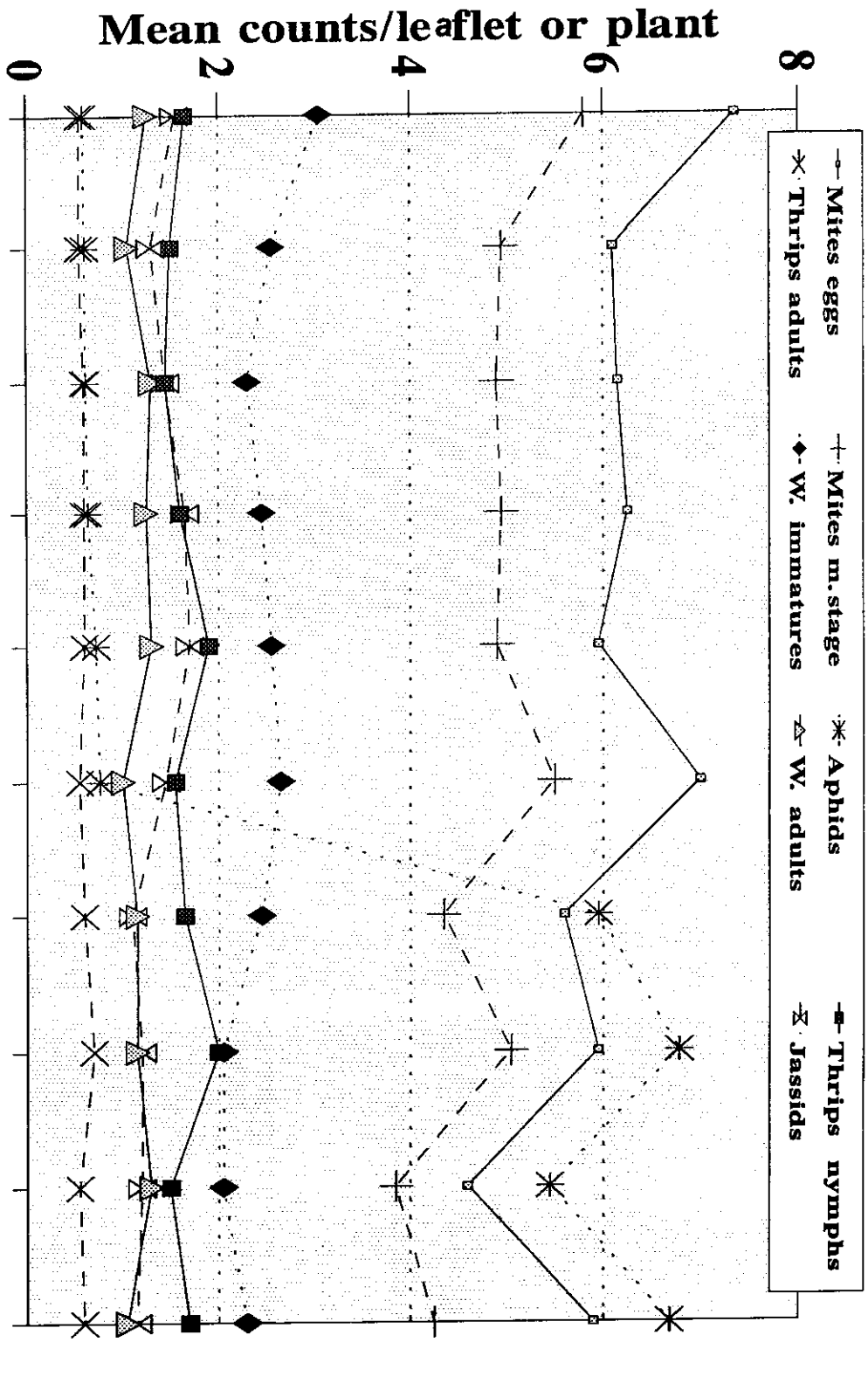

Fig. (43) : Mean counts of five sap sucking pests on Cream-7 variety in relation to different levels of fertilizers during summer plantation of 1997/ 1998 seasons at Moshtohor area, Qalubiyah governorate.