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POPULATION DENSITY OF INSECTS INFESTING CABBAGE SEEDLINGS AND INJURY BY CHEWING INSECTS UNDER FIELD CONDITIONS OF GIZA REGION

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ABSTRACT

The present work was carried out during the two summer seasons of 2000 and 2001 at Embaba district, and during the summer season of 2001 at Auseem district, Giza Governorate. Seeds of cabbage variety " Baladi" were sown in an area of about ¼ feddan, and was kept free of any pesticidal application. Obtained results showed that cabbage seedlings were found infested with five or six different insect pest species: *Thrips tabaci* (Lind.), *Bemisia tabaci* (Genn.), *Liriomyza brassicae, Artogeia* (= *Pieris) rapae* (L.) and *Phyllotreta ćruciferae* (Goezel) in both districts, but *Brevicoryne brassicae* (L.) was present with considerable numbers only at Auseem. Aphid numbers reached its maximum (32.63 individuals / seedling) when the seedling was 3 week old. Thrips were found on seedlings with relatively high counts during seedling growth, reaching the highest rate at the transplantation age (192.53 & 63.87 individuals / seedling during the two summer seasons of 2000 & 2001 at Embaba and 151.93 individuals / seedling during the summer season of 2001 at Auseem. All seedlings were found infested with this insect species, and their leaves suffered from feeding activities. Whitefly infestation began with the seedling emergence, then increased gradually; increase in the adult counts resulted in an increase of the nymphal counts. Larvae of the leafminer mine seedling's leaves with an average rate of 0.6,

0.6 and 0.27 tunnel / seedling at the cotyledone leaf stage and this injury increased to be 1.77 , 1.5 and 0.7 tunnel/seedling in the summer season of 2000 , 2001 and 2001 at Embaba and Auseem, respectively. The positive correlation between counts of larvae and tunnels was highly significant (r =0.961**), insignificant (r =0.44) and significant (r =0.82*) at the same previous arrangement. The percentage of injury (infestation) by the cabbage worm expressed as Kasopars method (1965) was 63.33%, 45.33% or 41.33% at maximum cases in the studied seasons and districts. Correlation between larval counts and infestation percentage was insignificant in both seasons and districts. Flea beetles did not appear with considerable counts.

Key words: *Artogeia rapae* , *Bemisia tabaci* , *Brevicoryne brassicae* ,cabbage, insect infestation , *Phyllotreta cruciferae* ,*Liriomyza brassicae*, *Thrips tabaci*.

1 . INTRODUCTION

In Egypt, cabbage *Brassica oleraceae* var. Capitata (Lin.) is regarded as an important vegetable crop used as a popular food, cultivated in large areas and in all types of soils. Cabbage is subjected to infestation with many insect pest species during the seedling stage, young larvae of the cabbageworm, *Artogeia(Pieris) rapae* (L.) chew off the lower layers of leaves without touching upper layers, but older larvae eat big holes from the leaves (Fronk 1978). He also noted that cabbage aphid, flea beetles and other insects attack this cruciferous crop. Brown *et al.*, (1999a) found that cabbage aphid, *Brevicoryne brassicae* L. and the diamondback moth, *Plutella xylostella* L. were the major late – season insects in 1993 on canola species: *Brassica napus* L. and *B. rapae* L. Flea beetle an early – season insect pest, can cause considerable yield reduction in canola species (Brown *et al.*, (1999b). Bender *et al.*, (1999) cleared that flea beetles attacked seedlings of both indian mustard and cabbage soon after emergence in spring of 1993. Workman *et al.*, (1980) introduced the concept of feeding "windows" as the basis for decision – making for cabbage loopers, diamondback moths and imported cabbageworms.

Both, *Bemisia tabaci* (Genn.) and *B. brassicae* were surveyed and studied in Egypt on cabbage and other vegetable crops by El-Sayed

(1979) and El – Gindy (1997). *B. tabaci* has started to become a menace on various field and vegetable crops in recent years (Hemeida 1981). Ellsworth *et al.,* (1996) recommended with sampling both nymphs and adult whiteflies to the management of insect in Arizona cotton.

Infested cabbage seedlings *with B. brassicae* may be stunted and distorted (Hill 1975). Cabbage aphids usually do not affect seedlings, but they begin to build up after thinning or transplanting (Anonymous 1987). Aphids may kill or debilitate new legume seedlings (Haws 1978).

Leafminers, often cause economic damage to seedlings , they include, *Liriomyza brassicae,* on cole crops; *L. huidobrensis* and *L.trifolii* on lettuce; and *L. sativae* which attacks both crops (Anonymous 1987). The pea leafminer, *Liriomyza huidobrensis* (Blanchard) attacks the chinese cabbage, adult flies make feeding punctures and larvae mine the leaves, so photosynthesis is reduced (Weintraub and Horowitz 1995). The total mine damage within the celery crop is used to estimate reductions in market value caused by *L. huidobrensis* and to adjust action thresholds (Heinz and Chaney 1995). Leafminers bore between top and bottom of leaf surfaces and leave winding trails in leaf of legume seedlings (Haws 1978).

Thrips tabaci (Lind.) is a polyphagous pest on brassicas and attacks 73 – 100% of cabbage plants; heavy attacks lead to the wilting of young plants (Hill 1975 and Legutowska 1997). Individuals of *T. tabaci* prefer seedlings and young plants of soybean and sunflower for infestation, as the high numbers of insect were recorded on plants at this stage (Salem 1999).

The objective of the present work was to determine insect pest species associated with cabbage seedlings, infestation timing, population size and the associated injury caused by certain chewing insects.

2. MATERIALS AND METHODS

This work was carried out during the two summer seasons of 2000 and 2001 at El-Moatamedia, Embaba district and during the summer season of 2001 at Kafr-Hakeem, Auseem district, Giza Governorate. In both districts and seasons , an area of about ¼

feddan was sown with the seeds of cabbage (variety Baladi) on May13, 2000 , May 20, 2001 and April 30, 2001 at Embaba and Auseem, respectively. All the normal agricultural practices were followed, except for the use of insecticides. This area was kept free of any pesticidal application to study the population size of insects, infestation timing and the associated injury of chewing insects. The area (15 × 70m) was divided to six replicated plots. Weekly samples were taken randomely starting one week after sowing until transplantation. Samples of 30 seedlings (5 seedlings / plot) were examined in the field to count adults of both *B. tabaci* and, *P. cruciferae,* in the morning before the adults tend to be more active, then these seedlings were picked gently and inspected in the laboratory with the aid of stereoscopic microscope. The total number of the following insect species was recorded, thrips (nymphs and adults), whitefly (nymphs), leafminer (larvae + tunnels), and cabbageworm (larvae). Percentages of infestation (injury) on seedlings were calculated according to Kasopars method (1965). This method depends on grading infestation of plant leaves to six categories as follows:
0 uninfested leaf, 1 very low infestation (windowing), 2 low infestation (small holes), 3 moderate infestation (wide holes), 4 heavy infestation (partial eaten leaf) and 5 very heavy infestation (completely eaten leaf).Subsequently, the following Kasopars formula was used :

$$P = \frac{nx\ v}{ZN} \times 100$$

Where: P = percentage of infestation. n= number of leaves in each category V= numerical value of categories. Z= numerical value of the highest category N= Total number of leaves.The simple correlation and regression were calculated between larval counts and the associated injury (Fisher, 1950).

3. RESULTS AND DISCUSSION

3.1. Insect species and population data

Tables (1&2) show that the insect species associated with cabbage seedlings were the same at both districts, Embaba and Auseem, Giza Governorate : *Thrips tabaci. Bemisia tabaci, Liriomyza brassicae, Artogeia (Pieris) rapae* and *Phyllotreta cruciferae,* but the cabbage aphid, *Brevicoryne brassicae* was the only species present in considerable numbers on seedlings only at Auseem district (Table 2). The initial infestation occurred at the beginning of emergence, its numbers increased gradually to reach the highest level (32.63 individuals / seedling) when the seedlings were 3 week old, then decreased gradually to become 8.57 individuals / seedling at 6 weeks after sowing (transplantation age).

This result agrees with the result of Bender *et al.*, (1999) who indicated that aphid population increased to high levels in late June and early July, then declined rapidly . Anonymous (1987) mentioned that aphid populations drop when temperatures rise in summer Appearance of aphids in Aussem district only may be due to the earlier sowing date (30 April 2001) which coincided with the presence of some winter fresh cabbage plantations or mature cabbage that harboured large colonies of aphids ; and represented a source of infestation to newly emerged seedlings by winged adult migration.

T. tabaci, was found on cabbage seedlings with dominant numbers in both districts and seasons (Tables 1&2), its numbers were firstly 6.93, 5.9 and 8.6 individuals / seedling, then incraesed gradually as the seedlings grew to reach its maximum just before transplantation 192.03, 63.87 and 151.93 individuals / seedling during the summer seasons of 2000, 2001 and 2001 at Embaba and Auseem districts, respectively. All seedlings were noticed harbouring individuals of this insect species, their leaves (some or all) suffered from insect feeding activities. This finding is in accordance with Hill (1975) and Legutowska (1997) who concluded that thrips is a pest on cabbage, presented with dominant numbers, injurious to seedling, as well as similar with finding on soybean and sunflower by Salem (1999).

Data in Tables (1&2) illustrate that whitefly counts in the 1st season at Embaba district were relatively higher than in the 2nd season

Table (1) : Weekly mean counts of insects / cabbage seedling and injury parameters of certain chewing insects during the two summer seasons of 2000 and 2001 at Embaba district, Giza Governorate.

Growing season	Inspection date		*Thrips tabaci*	*Bemisia tabaci* adults	*Bemisia tabaci* nymphs	*Liriomyza brassicae* larvae	*Liriomyza brassicae* tunnels	*Artogeia rapae* larvae	*Artogeia rapae* infestation (%)	*Phyllotreta cruciferae*
2000	May	22	6.93	1.17	1.93	0.6	0.6	0.17	6.67	0.0
		29	27.13	4.63	3.77	1.23	1.23	0.27	16.0	0.0
	June	5	18.33	0.77	7.43	1.37	1.77	0.067	43.33	0.0
		12	27.33	1.3	13.4	0.67	1.03	0.2	54.0	0.0
		19	36.93	15.2	24.43	0.23	0.3	0.03	63.33	0.0
		26	192.03	114.43	176.2	0.03	0.17	0.17	55.34	2.0
Total			308.68	137.5	227.16	4.13	–	0.907	–	2.0
Simple correlation (r) =							0.961^{**}		-0.55^{ns}	–
Simple regression (b) =							1.101		-143.98	–
2001	May	28	5.9	0.17	0.23	0.4	0.6	0.07	8.67	0.0
	June	4	13.27	0.47	1.13	0.87	1.17	0.133	16.67	0.0
		11	23.43	0.77	2.77	0.63	1.5	0.2	28.67	0.0
		18	24.93	2.03	4.77	0.33	1.43	0.1	45.33	0.0
		25	28.1	4.8	10.97	0.1	0.93	0.53	43.33	0.0
	July	2	63.87	4.4	10.37	0.23	0.63	0.23	38.0	0.0
Total			159.5	12.64	30.24	2.56	–	1.263	–	0.0
Simple correlation (r) =							0.44^{ns}		0.56^{ns}	–
Simple regression (b) =							0.615		48.14	–

Table (2) : Weekly mean counts of insects / cabbage seedling and injury parameters of certain chewing insects during the summer season of 2001 at Auseem district, Giza Governorate.

Inspection date		*Brevicoryne brassicae*	*Thrips tabaci*	*Bemisia tabaci* adults	nynphs	*Liriomyza brassicae* larvae	tunnels	*Artogeia rapae* larvae	infestation (%)	*Phyllotreta cruciferae*
May	7	3.2	8.6	0.0	0.0	0.2	0.27	0.07	6.67	0.0
	14	12.97	23.23	0.0	0.0	0.33	0.47	0.17	32.0	0.0
	21	32.63	34.67	0.0	0.0	0.3	0.7	0.27	41.33	0.0
	28	5.33	100.0	0.17	0.9	0.27	0.6	0.5	40.67	0.0
June	4	8.17	191.17	0.7	3.0	0.1	0.37	0.13	34	0.37
	11	8.57	151.93	0.4	1.9	0.0	0.133	1.33	30	0.7
Total		70.87	509.6	1.27	5.8	1.2	–	1.273	–	1.07
Simple correlation (r) =							0.82^{*}		0.685^{ns}	–
Simple regression (b) =							1.34		56.78	–

in both districts. Nymphs and adults had a close relationship since the increase in adult counts was always followed by an increase in nymphal counts . At Embaba district , the initial infestation occurred just when seedlings emerged with rates of 1.17 & 0.17 and 1.93 & 0.23 individuals for adults and nymphs in May 22, 2000 and May 28, 2001 in arrangement . Insect counts increased by time until reached its maximum level (114.43 & 4.8 adults /seedling and 176.2 & 10.97 nymphs / seedling in June 26, 2000 and June 26, 2001 in arrangement. At Auseem district, the initial infestation appeared nearly at the same time of Embaba district (May 28, 2001), in spite of its disappearance before this date, also its low numbers in summer 2001 generally in both districts in comparison with the summer 2000. Nymphal counts were always higher than adult counts (Tables 1&2), this may be explained by the numerous eggs layed by one adult, that hatch to nymphs. Using adults and nymphs in sampling whitefly is more useful in the management of insect (Ellsworth *et al* ., (1996).

Larvae of *L. brassicae* were found infesting leaves of the cabbage seedlings with considerable numbers. Its tunnels appeared on the upper or lower surface of the leaves . Infestation began on cotyledon leaves. As presented in Tables (1&2), larvae reached its maximum at the 2*nd* or 3*rd* week after sowing at a mean no. of 1.37, 0.87 and 0.33 larva/seedling during the summer seasons of 2000, 2001 and 2001 at Embaba and Auseem districts, respectively . For the scarcity of available information about the ecology of this insect, it is refered to the infestation of cole crops by *L. brassicae* (Anonymous 1987) ; and chinese cabbage by *L. huidobrensis* (Weintraub and Horowitz 1995).

Tables (1&2) show that counts of *A. rapae* larvae did not vary greatly during the seedling stage and between seasons. At Embaba district, its numbers were 0.17, 0.27, 0.067, 0.2, 0.03 and 0.17 larva/ seedling for the inspection dates May 22&29, June 5, 12, 19&26 in the summer season of 2000 and were 0.07, 0.133, 0.2, 0.1, 0.53 and 0.23 larva / seedling for the inspection dates May 28, June 4, 11, 18&25, July 2 in the summer season of 2001. Also, a similar trend was observed at Auseem district: 0.07, 0.17, 0.27, 0.5, 0.13 and 0.133 larva / seedling for the inspection dates May 7, 14, 21&28, June 4&11 in the summer season of 2001 .

Flea beetle, *P. cruciferae* appeared in low numbers at the end of

the seedling stage, just before transplantation as shown in Tables(1&2).

Insects infesting cabbage seedlings could be arranged descendingly according to the percentage of their occurrence throughout the whole period of study and at the two districts as follows : thrips 66.172% ,whitefly 28.059% ,cabbage aphid 4.8%, leafminer 0.534 % , cabbageworm 0.23 % and flea beetle 0.21 % .

3.1.1. Injury caused by chewing insects

The number of tunnels / seedling was used as an injury index of leafminer (Tables 1&2) . Activity of larvae in mining leaves was companionship with counts of tunnels. The positive correlation was highly significant (r =0.961 **), insignificant (r =0.44) and significant (r =0.82 *) between counts of larvae and tunnels during the seedling stage in the growing seasons of 2000, 2001 and 2001 at Embaba and Auseem, respectively . The number of tunnels reached its highest level when seedlings were 3 week old, at rates of 1.77, 1.5 and 0.7 tunnel / seedling, with the same above mentioned arrangement. The larval feeding represented in tunnels impacts the efficiency of photosynthesis. Obtained results are in agreement with the results of Weintraub and Horowitz (1995) and Heinz and Chaney (1995) .

The percentage of infestation by the cabbageworm expressed as Kasopars method was used as an injury index. At Embaba district(Table 1), the infestation began as soon as seedlings emerged above soil (6.67% and 8.67% in May 22, 2000 and May 28, 2001 then increased and accumulated till 63.33% and 45.33% in June 19, 2000 and June 18, 2001, respectively; and it followed the same trend at Auseem district (Table2) to reach 41.33%in May 21, 2001 . This indicates that larvae can cause injury by about 41.3, 45.3 or 63.3% for the seedlings leaves at maximum under natural infestation. The infestation percentage decreased at transplantation may be explained by dropping or eating of some infested leaves and producing new leaves by seedlings . Insignificant correlation (r =0.55,0.56 and 0.685) was obtained between larval counts and infestation percentage in the summer seasons of 2000, 2001 and 2001 at Embaba and Auseem, respectively This result coincided with those suggested by Bender *et al.*, (1999), Workman *et al.*, (1980) and Fronk (1978).

It is worth to mention that in the case of heavy infestation by *L. brassicae,* seedling leaves wilted and dropped. The leaves of heavily

infested seedlings by *A.rapae*,were completely eaten and the plants died.

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الكثافة العددية للآفات الحشرية التى تصيب بادرات الكرنب ، والضرر المصاحب للحشرات القارضة تحت ظروف منطقة الجيزة

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ملخص

يعتبر الكرنب أحد محاصيل الخضر الهامة فهو غذاء شعبى متميز. تتعرض نباتات الكرنب لإصابات حشرية خطيرة تهدد المحصول. أجرى هذا البحث على بادرات الكرنب البلدى المزروعة بمنطقة الجيزة فى مساحة ٤/١ فدان بكل من منطقة إمبابة فى صيف عامى ٢٠٠٠ ، ٢٠٠١ وبمنطقة اوسيم بمنطقة الجيزة عام ٢٠٠١ لتحديد الآفات الحشرية التى تصيب البادرات وتوقيت الاصابة والكثافه العددية للحشرات وكذا الضرر الناتج عن الاصابة بكل من أبى دقيق الكرنب وناخرة أوراق الصليبيات .

أوضحت النتائج أن بادرات الكرنب تصاب بحشرات التربس *T.tabaci* ، الذبابة البيضاء *B. tabaci* ، من الكرنب *B. brassicae* ، ناخرة أوراق الصليبيات *Liriomyza brassicae* ، أبى دقيق الكرنب *A. rapae* والخنفساء البرغوثية *P. crucifera* . وصلت أعداد المن أقصاها (٣٢,٦٣ فرد / بادره) عند ما كان عمر الشتلات ٣ أسابيع. وجد التربس بأعداد كبيرة نسبياً خلال فترة نمو البادرات ووصل أقصي تعداد له (١٩٢,٠٣ ، ٦٣,٨٧ حشرة / بادرة) عند عمر الشتل فى صيف عامى ٢٠٠٠ ، ٢٠٠١ بمنطقة إمبابة، على التوالي وكان أقصي تعداد له ١٥١,٩٣ حشرة / بادرة فى صيف ٢٠٠١ بأوسيم. كانت كل البادرات مصابة وتعاني أوراقها من مظاهر تغذية الحشرة .

بدأت الإصابة بالذبابة البيضاء بمجرد إنبات البادرة ثم تزايدت تدريجياً . تزايد الاطوار الكاملة يعقبه تزايد أعداد الحوريات. تحدث يرقات ناخرة أوراق الصليبيات انفاقاً بمعدل ٠,٦ ، ٠,٦ و ٠,٢٧ نفق / بادرة فى مرحلة الأوراق الفلقية ثم يزداد الضرر تدريجياً ليصل الى ١,٧٧ ، ١,٥ نفق / بادرت فى مواسم ٢٠٠٠ ، ٢٠٠١ بمنطقة إمبابة على التوالى و ٠,٧ نفق / بادرة فى موسم ٢٠٠١ بأوسيم. كان هناك ارتباط موجب (عالي المعنوية ، غير معنوي) بين تعداد اليرقات والانفاق خلال نمو البادرات فى مواسم ٢٠٠٠ ، ٢٠٠١ بإمبابة على التوالى ومعنوى فى موسم ٢٠٠١ بأوسيم .

كانـــت نســـبة الاصـــابة (الضرر) بأبى دقيق الكرنب معبرا عنها بطريقة كاسبر ٦٣,٣٣% , ٤٥,٣٣% , ٤١,٣٣% فى اقصى حالاتها فى مناطق ومواسم الدراسة . كان الارتباط بين تعداد اليرقات ونسبة الاصابة غير معنوى. الإصابة بالخنفساء البرغوثية على البادرات قليلة الاهميه .

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (٥٣) العدد الثانى (إبريل ٢٠٠٢): ٣٢٧-٣٤٠.