

THE RED-STRIPED SUGAR-CANE SOFT SCALE, *Pulvinaria tenuivalvata* (NEW STEAD) (HEMIPTERA: COCCIDAE) AS A NEW PEST ATTACKING SUGAR CANE IN GIZA REGION.

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ABSTRACT

Population dynamics of the coccid scale, *Pulvinaria tenuivalvata* (Hemiptera: Coccidae), its infestation rate and survey predators and parasitoid associated were conducted through careful inspection of sugar-cane fields in Attfieh, Giza governorate during two successive seasons (2002/2003 and 2003 / 2004).

Nymphal infestation started from apical part of plant in June in the first season (2002/2003) and in may in the second one(2003/2004). In first season infestation percentage ranged between 61.3%, to reach 100% infestation in September and October while it ranged between 30.6%to100% in second season.

Adult infestation started in July on apical part of sugar-cane plant with infestation percentage 35% to100% and from 53.7 %100% infestation in first and second season, respectively .In both season infestation disappear in January. Negative Correlation found between the population density of sugar-cane insect scale, *P. tenuivalvata* and temperature. The population growth rate decreased in November to February and it ranged between -52.12 and -100 insect scales in the first season 2002/2003 while it was -91.82 and 100 - insect scales in the second season 2003/2004.

INTRODUCTION

Sugar cane (*Saccharum officinarum* L.) is one of the major source of sugar production in Egypt. Sugar demands increase year after year due to the increase of habitant population. In spite of the continuous increase of sugar production and manufacture which succeeded to raise Egypt self satisfaction from sugar to 75% , the gap of sugar is still high, (Shalaby, 2002). Cultivate of sugar-cane in Egypt not only for sugar production but also for fresh juice production. In Egypt the sugar-cane soft scale, *Pulvinaria tenuivalvata* (New stead) (Hemiptera: Coccidae) was first noticed in September 1996 on sugar-cane plantations at El-Saff (Attfieh), Giza governorate causing severe damage to the plants, (Ali *et al*, 1997& 2000).

Recently, this insect pest is recorded as a new pest attacking sugar-cane in Middle and Upper Egypt governorates. During outbreaks, scales have been found colonizing on elephant grass (*Pennisetum purpuemum* Schum.), Cogon grass (*Imperata cylindrical* L.), and Maize (*Zea mays* L.), which growing near sugar cane. (Mamet,1958;De Lotto, 1965; Paris, 1976; Williams,1978;Williams 1980and ,1982;Tsik *et al* 1983 ,Tripathian and Omkarshuukla,1985; Campos,1997; And Dulta and Devaiah,1997). Heavy infestation appear when natural balances are upset by severe weather, Human intervention, e.g. using high levels of soluble nitrogen and heavy insecticide which may kill all the natural enemies.

The purpose of this work was to study the population dynamics of *P.tenuivalvata* in Middle Egypt, Giza governorate in order to promote a more informed about infestation development in this region and approach to the control of this pest.

MATERIAL AND METHODS

An intensive survey of the coccid scale, *Pulvinaria tenuivalvata* (Hemiptera: Coccidae) and its infestation rate were conducted through careful inspection of sugar-cane fields in Attfieh, Giza governorate during two successive seasons (2002/2003 and 2003 / 2004).

Samples collection:

Population density of *P. tenuivalvata* was estimated in sugar-cane at Attfieh, Giza governorate during two successive seasons, (2002/03 and 2003 /04). Records of temperature and relative humidity, within the inspected periods, were obtained from the meteorological station in Agriculture Research Centre. About one feddan was chosen and divided into plots, of (6X7m²) each. Weekly random samples of 10 plants / plot, in four plots, were selected to estimate insect density. Three leaves / plant, representing the three plant levels were examined; each leaf was divided into three parts (Base, Mid , and Top) and was visually examined ,then separate to infested or none infested and the infestation percentage was calculated as:

$$\text{infestation \%} = \frac{\text{No. of infested leaves}}{\text{Total no. of sampling leaves}} \times 100$$

Population density:

Population density (No of insects / leaf in three plant levels)of *P. tenuivalvata* was estimated by sampling 120 leaves representing the different plant levels at weekly intervals and each leaf was divided into three levels as mentioned before. Sampling started from April 2002 and continued until March 2004. The number of adults and different nymphal instars on both leaf surfaces were counted by binocular, and recorded.

Rate of growth:

The fluctuation of *P.tenuivalvata* in sugar-cane field can be used to estimate, the growth rate of scale insect population which calculated according to the equation according to Mansour *et al.* (1994) as :-

$$r = \frac{P2-P1}{P1} \times 100$$

Where: r = population growth rate;

P1= adult and nymphal numbers of first count,

P2= adult and nymphal numbers of second count, during the period of this study.

Natural enemies associated:

On each sampling date, the infested leaves were examined for the natural enemies. Insect association were collected, identified and counted according to El-Serwy (2001/2002).

RESULTS AND DESCUSSION

Seasonal fluctuation and population dynamics of the red-striped soft scale *Pulvinaria tenuivalvata* (Newstead) attacking sugar-cane plantations at Atfieh (Giza governorate) were investigated throughout two sugar-cane growing seasons 2002/2003 and 2003/2004. Population density was estimated weekly as number of scales (nymphal and adult stages) per plant leaf from different plant levels (Basal, Middle, and Apical).

1-Percentage of infestation:-

As shown in Table (1) nymphal infestation started from apical part of plant on June 2002 with infestation percentage 61.3%, then increased gradually to reach 100% infestation in September and October, then decreased specially in basal & middle parts of sugar-cane plant to disappear in January to May.

Table (1): Infestation percentage of *Pulvinaria tenuivalvata* (Newstead) on sugar-cane plant levels, At Giza governorate, during seasons 2002/03 and 2003/04.

Months	Season 2002/03						Season 2003/04					
	Adult stage			Nymph stage			Adult stage			Nymph stage		
	Basal	Middle	Apical	Basal	Middle	Apical	Basal	Middle	Apical	Basal	Middle	Apical
April	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	48.13	53.75
June	0	0	0	0	0	61.3	0	3.33	5	0	55	84.17
July	0	25	35	0	68.75	68.75	0	1.25	20.63	0	67.5	90
August	21.87	25	30.63	14	71.25	76.3	4.38	1.25	20.63	49.38	77.5	93.75
September	96.25	92.5	94.38	100	100	100	40	50.63	40	97.5	97.5	100
October	99.5	100	100	100	100	100	95.6	94	79.5	100	100	100
November	29.38	22.5	58.75	26.25	32.5	97.5	83.75	86.25	81.4	92.5	92.5	100
December	0	58.13	68.75	0	0	100	3.43	11.25	15.63	13.13	18.75	90
January	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0

Adult infestation started in July on apical part of sugar-cane plant with infestation percentage 35% and decreased in August 30.6%, increased gradually from September to reach maximum infestation 100% in October then decreased gradually to disappear in January (Table 1).

During the second season (2003/04) nymphal infestation started from apical part of plant in May with infestation percentage 53.8%, then increased gradually to reach 100% infestation in September, October, and November, then decreased to disappear in January.

Adult infestation started in June on apical part of sugar-cane plant with infestation percentage 5%, then increased gradually from September to reach maximum infestation 95.6 % in October, then decreased gradually to disappear in January, table(1).

2-Influence of plant levels on the insect population;-

A-first season 2002/03

1- The immature stages:-

Infestation started from plant apical part, where occurred in middle plant part and lately in basal part. In apical plant part the occurrence of insects represented by nymph was 37.1/leaf, in June while increased in middle and

apical part in July. From August until November insect scales found in all plant parts reached the highest number in November then insect scales number disappeared in basal plant part in December, while continued in apical part.

First appear of nymphal stage observes in June on apical part of plant, as first and second instars and increased gradually during July and August. Infestation reaches its maximum in September and October. then decreased gradually during November, while disappear from January till May (Fig. 1-A-) In middle part first nymphal infestation started in July, 9.9/ leaf. Few numbers observed during July & August and increased gradually to record peak in October, 279.9/ leaf, then decreased sharply in November while disappeared from December until July. (Fig. 1-B-)

In basal part first nymphal infestations noted in August 3.2/ leaf, and increased gradually in September and reach its maximum in October 391.4, then decreased in November and disappear from December to July.(Fig.1-C).

2-The Adult stage: -

Occurrence during 6 months, from July until December, reach it s minimum inspected in July and August, and then augment in Sept. to reach it s maximum in October and recorded 345.6, 366.4 and 322.5 adult /leaf in basal, middle and apical leaves, respectively. Correlation between the population density of sugar-cane insect scale, *P. tenuivalvata* and weather factor such as temperature were negative (r value = 0.125, 0.137, - 0.20) in basal, middle, and apical part of sugar-cane plant, so the relationship is non significant.

B-Second season 2003/04:-

1- Immature stage:-

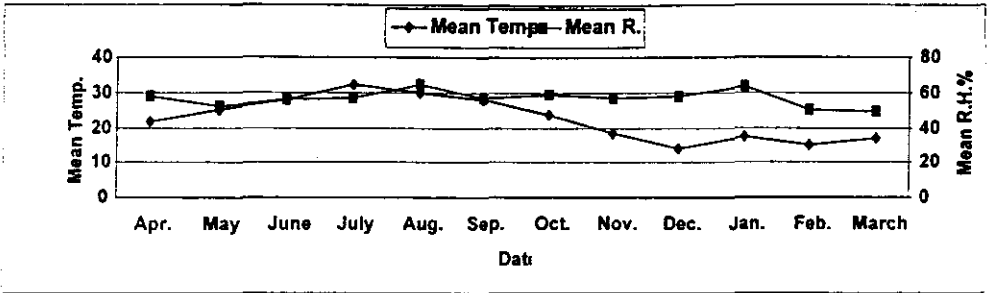
On the second season 2003/04 first insect scales were observed in May as a nymphal stage in apical and middle part and continued in the same two plant level (apical & middle) during June and July, while the first occurrence of scales in basal plant part was in August. Insect scales recorded in all plant levels from August until December reached its maximum in October, then decreased in December and disappeared from January till March except few nymphal staged found in January on apical plant part as 2nd nymph instars.(Fig. 2-A-).

On apical part first infestation by nymphal instars noted in May, then increase by very few number during June, while numbers augmented gradually during August and October recorded the maximum in November then decreased gradually in December but disappeared from January, (Fig. 2-A-).

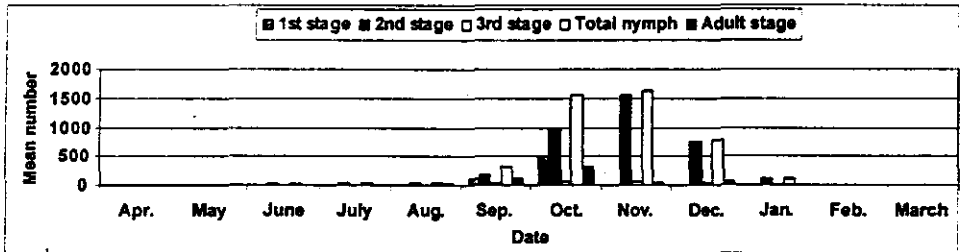
In middle part few numbers recorded in May, June, July, and August while from September nymph's number increased gradually to reach highest level in November, then decreased during December and disappeared from January,(Fig. 2-B-)

In basal part first insect observed in August by few numbers then increased gradually to reach its maximum in November and safer infestation noted during December but insects disappear from January,(Fig. 2-C-).

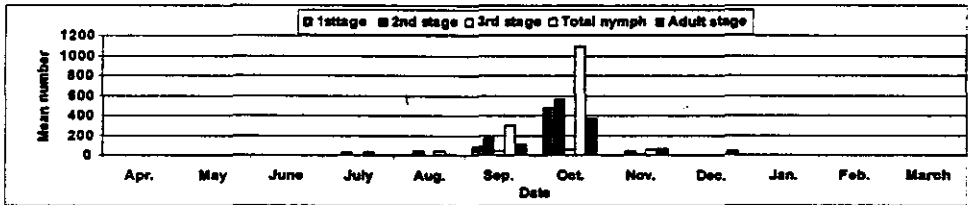
Relation with temperature and nymph's illustrated that nymph's number decreased under low temperature (15-20^oC).



(A)



(B)



(C)

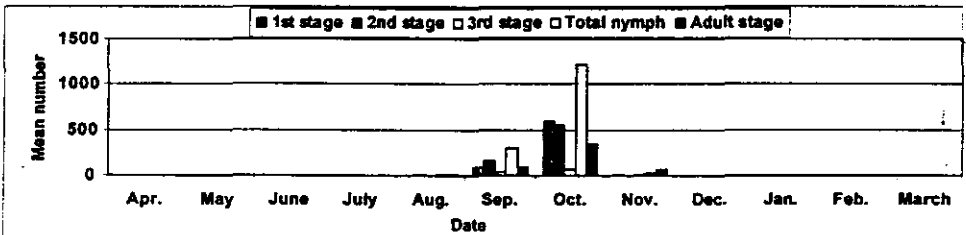
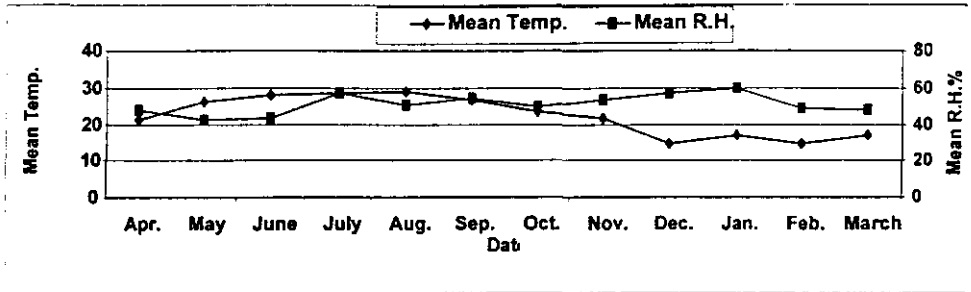
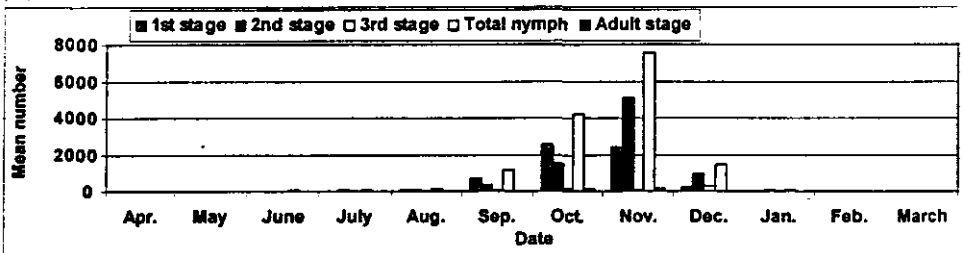


Fig. (1): Mean number of scales on three sugar-cane plant levels ,Attfieh, Giza governorate 2002/2003

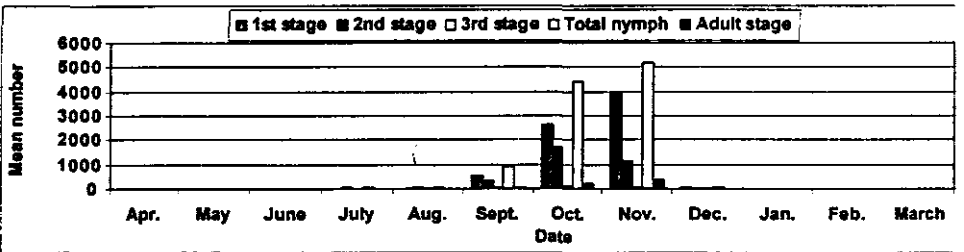
- (A) Apical part of sugar-cane plant,
- (B) Middle part of sugar-cane plant,
- (C) Basal part of sugar-cane plant.



(A)



(B)



(C)

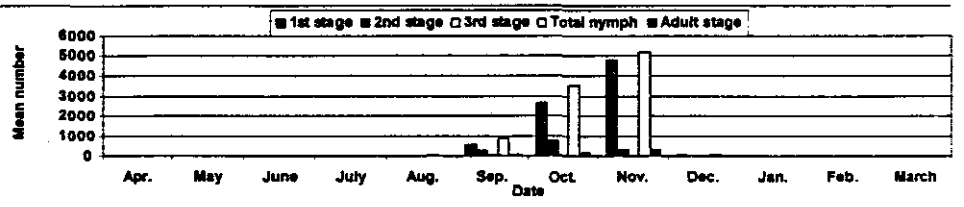


Fig. (2): Mean number of scales on three sugar-cane plant levels, Attfieh, Giza governorate 2003/2004:

- (A) Apical part of sugar-cane plant,
- (B) Middle part of sugar-cane plant,
- (C) Basal part of sugar-cane plant

2- On the Adult stage: -

Few number of adult stage observed in September and increased in October & November while disappear from January in the second season 2003/04.

Relationship between mean temp. and adult stages number illustrated negative relation between mean temp. and numphal number, then high number observed in November under low temperature level (15to20) (Fig. 2).

Ali *et al.* (2000) mention that the occurrence of *P. tenuivalvata* on sugar-cane plantations at Giza region from May until December with enormous numbers, with period of occurrence 8 months on sugar-cane, the differentiation with our results my be return to experimental conditions especially weather factors.

3- Influence of The leaf part on the insect population:-

Highest nymphal number was observed in top part of leaf, but the lowest number found in base part while medium numbers were in the mid part of leaf, may be due to drying leaves in the base part and nymphs prefer fresh parts. In July adults found in leaf top only while those appeared in all leaves parts in August and increased in September. and recorded high numbers in October then decreased during December and disappear from January till June except certain numbers as 2nd nymphal instars. Correlation between the population density of sugar-cane insect scale, *P. tenuivalvata*, and temperature were negative (r value = -0.119,-0.096,-0.005) in basal, middle, and apical part of sugar-cane plant, so the relationship is non significant

4-Growth rate of *P. tenuivalvata*:

Results in tables (1) show that the growth rate of red-striped sugar cane scale, in season 2002/03, started to appear in July and increased until September. The development rate ranged between 42.04 and 881.81 insect scales. The population growth rate decreased in November to February, it ranged between -52.12 and -100 insect scales.

In season 2003/04, the growth rate of the red striped sugar-cane scale increased in June and continued until November, it ranged between 48.04 to 1126.84 insect scales. The population growth rate decreased in December and January and the developmental rate was -91.82and- 100 insect scales, respectively. It is obvious that when growth rate increased, insecticidal treatment must be applied.

5-Insects and mites associated with *P. tenuivalvata*:

Many predators and were collected and identified as. Predaceous insects such as *Scymnus glivifrons* (Muls) and *Stethorus punctillum* (Wiese) (Coccinellidae); *Chrysoperla carnea* (Stephens) (Chrysopidae) and many predaceous mites were collected such as *Amblyseius swirski* (Athias-Henrooit) and *Typhlodromus pelargonicus* (phytoseiidae); hymenopteraus parasitoid namely, *Coccophagus semicircularis* (Foerster).(Aphelinidae) had emerged from parasitized females.

Table(2): Monthly average numbers and growth rate of *P.tenuivalvata* on sugar -cane leaves, at Giza Governorate during seasons 2002/03 and 2003/04.

Month	Season 2002/03						Season 2003/04					
	Mean n.o. of scales /leaf				Weather factors		Mean no. of scales /leaf				Weather factors	
	Nymph	Adult	Total	Growth rate	Mean Temp.	Mean R.H. %	Nymph	Adult	Total	Growth rate	Mean Temp.	Mean R.H.%
April	0	0	0	0	21.6	58	0	0	0	0	21.1	48
May	0	0	0	0	25	52	30.8	0	30.8	0	26.1	42
June	37.1	0	37.1	0	27.9	56	61	1	62	101.3	28.2	43
July	88.2	16.7	104.9	182.75	32.1	57	101.7	8.7	110.4	78.06	28.7	57
August	105.3	43.7	149	42.04	29.9	65	242.2	10	252.2	128.44	28.9	51
September	930.2	316	1246.2	736.4	27.8	57	2994.4	99.7	3094.1	1126.84	26.5	54
October	3868.6	1034.5	4903.1	293.4	23.6	59	12138.4	544.6	12683	309.91	23.5	50
November	1708.9	176.4	1885.3	-61.5	18.2	57	17911.8	864.2	18776	48.04	21.6	53
December	788.9	113.7	902.6	-52.12	14.0	58	1502.1	32.9	1535	-91.82	14.5	57
January	0	0	0	-100	17.4	64	0	0	0	-100	17.2	60
February	0	0	0	0	14.8	50	0	0	0	0	14.7	49
March	0	0	0	0	16.9	49	0	0	0	0	16.8	48
Total	7527.2	1701	9228.2									

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الحشرة القشرية الرخوة, (*Pulvinaria tenuivalvata* (Hemiptera: Coccidae), كآفة جديدة على قصب السكر في منطقة الجيزة.

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** الممرز القومي للبحوث- قسم آفات ووقاية النبات.

تم دراسة الحشرة القشرية الرخوة على قصب السكر في منطقة أطفيح التابعة لمحافظة الجيزة خلال موسمين زراعيين متتاليين هما ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤ وكذلك تم حصر الأعداء الحيوية المصاحبة لها.

بدأ ظهور الإصابة بالحوريات على أجزاء النبات الغضة في منطقة القمة في شهر يونيو خلال موسم الزراعة الأول وفي شهر مايو خلال موسم الزراعة الثاني حيث تراوحت نسبة الإصابة من ٦١,٣% إلى ١٠٠% في الموسم الأول بينما سجلت ٣٠,٦% إلى ١٠٠% في الموسم الثاني. كان أول ظهور للحشرات الكاملة خلال شهر يوليو على الأجزاء القمية وتراوحت نسبة الإصابة بالحشرات الكاملة من ٣٥% إلى ١٠٠% في الموسم الأول بينما سجلت ٥٣,٧% إلى ١٠٠% في الموسم الثاني. بينما اختفت أفراد الحشرة خلال موسمي الدراسة من يناير وحتى مايو. وقد وجدت علاقة ارتباط سلبية بين درجات الحرارة وحجم المجتمع حيث ارتفع تعداد الحشرات بانخفاض درجات الحرارة. كما أظهرت النتائج أن معدل نمو جمبور الحشرة يتزايد من نوفمبر حتى فبراير حيث تراوح هذا المعدل بين ٥٢,١٢ إلى ١٠٠ في الموسم الأول و ٩١,٢ إلى ١٠٠ في الموسم الثاني. وتم رصد بعض الحشرات النافعة مصاحبة للحشرة منها المفترسات *Scymnus*

Stethorus punctillum (Wiese) (Coccinellidae); و *glivifrons* (Muls) مثل و
(*Chrysoperla carnea* (Stephens) (Chrysopidae) وبعض الطفيليات من رتبة غشائية الاجنحة مثل *Coccophagus semicircularis* (Foerster). (Aphelinidae) و *Typhlodromus pelargonicus* (phytoseiidae) و *Amblyseius swirski* (Athias-Henrooit) وبعض اللحم المفترس مثل