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First Trial for Integrated Control of the Two Spotted Spider Mite, *Tetranychus urticae* Koch. on Strawberry Plants Grown in the High Plastic Tunnels in Egypt

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ABSTRACT

The predatory mite *Amblyseius californicus* McGregor successfully suppressed the population of the two spotted spider mite *Tetranychus urticae* Koch onto strawberry plants grown in a high plastic tunnels. Releasing rate of one individual/plant seemed to be less adequate for sufficient bio-control practices. Hence one treatment with Neoron beside several treatments with Micronised Sulfur was necessary, when temperature extremely rose in the late season. Leaf damage due to the two spotted spider mite infestation varied slightly among the tested cultivars Rosalinda, Shandler and Seascape expressed as population density individuals/leaf.

Key Words: *Amblyseius californicus*, Bio-control, Plastic tunnel, Strawberry, *Tetranychus urticae*

INTRODUCTION

The area cultivated with strawberry in the arid zones of Egypt has incredibly increased in the last decade Okasha (1994). The light sandy soil of arid zones is more suitable for strawberry plantings as compared to the clay soil or the sandy loam of Nile Delta. Therefore, the Egyptian farmers have been encouraged for intense cultivation of strawberry in arid zones not only as a mean of land reclamation but also due to the high profit gained from strawberry high production and export return to either Arabic or European countries.

Strawberry plantations however, are potentially damaged by the two spotted spider mite *T. urticae* Koch world wide (Oatman, *et al.*, 1977, Charles, *et al.*, 1987; Waite, 1988; Coop and Croft 1995). *T. urticae* is usually controlled by repeated applications of acaricides during the long harvest period in Egypt from October to end of May. Such strategy increases the chance of developing acaricidal resistance to those registered for use on export strawberry. It is also very expensive to produce export quality fruit. Several investigations dealt with a successful biological control of *T. urticae* in commercial strawberry farms by mass release of phytoseiid predatory mites *Phytoseiulus persimilis* Athias-Henriot, *Amblyseius californicus* McGregor and *A. womersleyi* Schicha (Oatman *et al.*1977; Charles, *et al.*, 1987; Waite 1988; Coop and Croft, 1995).

The questions arose about the right name of the two spotted spider mite which have been ended by the diversified study mentioned by Attiah *et al.*(1993) concluding that green form of the Egyptian species is *Teranychus arabicus* Attiah. Self observations on forms of the two spotted spider mite collected from plastic tunnels either in Delta or Nubaria provinces in Egypt, during the work granted from the French organization BLAFE on bio-control of the two spotted spider mite in plastic tunnels, were mixed populations of green , red besides black ones. These forms varied in the shape of the two spots found dorsally on the individuals as a colored longitudinal strip and in some individuals by the time they fainted and shortened to the normal size. Protein analysis was carried out to differentiate between these strains in addition to experiments to isolate genetic markers which will reduce confusion encountered between closely related species.

The present investigation was conducted as a pilot experiment for biological control of *T. urticae* using release of the predatory mite *A. californicus* under extreme condition of the plastic tunnel preceding more trials in the out door farms.

MATERIALS AND METHODS

The experiment was carried out in a plastic tunnel of 12x50x 3m at Bahteem Research Station, Qualubia Governorate, Egypt during 1998/99 season. Three strawberry cultivars, Rosalinda; Chandler and Seascape were transplanted on October 5th in three beds of 1.2m width using the quaternary-row per bed planting method. Each cultivar was represented by about 1000 plant. A subbed of 100 plants was kept as check for chemical control and the rest was devoted for predatory mites releasing. The predatory mite *A. californicus*

was released when the mean population density of *T. urticae* was near 1 individual per leaflet early February. Acaricides used in the experiment were micronised Sulfur 70% WP at the rate of 2g/L and the Bromoesterified compound of Kelthane which called Promopropylate (Common name) or Neoron (trade name) at the rate of 2.5 ml/L. Statistical analysis was carried out using ANOVA test with mean separation at 5% level of significance according the method of Snedecor and Cochran (1967).

Predatory mite stock cultures

Predatory mite colony of *A. californicus* used in this study was obtained from the culture maintained in the National Research Center laboratory since 1996 after it was collected from apple orchard in southern France (Dr. G. Fuvel, INRA and El-laithy pers. communication). Predatory mite colony was reared in large plastic boxes (260 mm x 150 mm x 100 mm), a tangle foot strip was ringed near the edge in the inner side of the boxes to prevent predatory mites from escaping, besides water barrier was also used. Bean leaves highly infested with the prey *T. urticae* were provided when needed. Temperature in the rearing incubator was 28±2 °C and the R. H. ranged from 50-60 %.

Monitoring of mites population

Samples for estimation average of leaf damage class and the mean population density of mites were collected weekly. Thirty compound leaves from strawberry cultivars were randomly taken from lower leaves. Samples were transported in an ice box to the laboratory, where they were examined using the streomicroscope. Numbers of mobile, resting, and eggs were counted. The predatory mite *A. califjornicus* obtained from the mass production unit and introduced twice during the whole season. Total of 4000 individuals were distributed in two releases onto infested leaves of strawberry plants at the rate of one individual/plant by mid-February and mid-March. Predatory mite was distributed by dispersing bean leaves on which they were bred.

RESULTS AND DISCUSSION

As shown in Fig. (1) in bio-control subplots infestation of Seascape cv. with *T. urticae* was at the lower level of 1.8, than the two others 18.1 and 3.5 individuals /leaf for Chandler and Rosalinda, respectively. Population density in chemical control subplots were 5.6, 15.4 and 2.9 for Rosalinda, Chandler and Seascape, respectively. The population peak reached 26.6 individuals per compound leaf in Seascape as compared with 49.1 and 44, 9 for Rosalinda and Chandler, respectively. Such population density which occurred by the end of February approached the threshold of damage proposed by Garcia-Mari & Gonzalez-Zamora (1999) of 20-30 individual/leaf required one acaricidal application of Neoron and was followed by another release. Also strawberry plants of biocontrol subplots adjacent to plastic on the sides were sprayed with micronised Sulfur after the second release. This treatment was practiced in order to reduce the quick build up of *T. urticae* and help the predatory mite to reduce the population of *T. urticae*. In chemical control, plots the population density which received a weekly spraying with acaricides reached a max. of 39.7, 49.1 and 31.6 in the Rosalinda, Shandler and Seascape, respectively. The reintroduction of the predatory mite *A. californicus* replaced acaricidal applications in the bio-control subplots and *T. urticae* population level approached 10 individuals per compound leaf after its peak.

Results obtained in the present investigation are very promising for extensive use of the predatory mite in out door strawberry plantations. These findings are in agreement with those reported by Waite (1988) in Queensland–Australia using the native predatory mites *Amblyseius womersly* Schicha and *Phytoseiulus persimilis* Athias-Henriot using the same releasing rate and both of us concluded that it will be preferable to be 2 individuals or more/strawberry plant. Studies carried out in California by Oatman *et al.*, 1966, 1968, 1977, 1981 for release of phytoseiid predatory mites *P. persimilis*, *A. californicus* and *Metaseiulus occidentalis* against *T. urticae* in strawberry fields revealed that a releasing rate of 5-10 individuals /plant several times will be enough to suppress pest population. The findings mentioned by Coop and Croft (1995), in a humid region (Oregon State, USA) showed that about 15 point for release for about 100 individuals per 1.6 m x 0.3m row were repeated three times, was sufficient for an area of 2.5 hectare using the predatory mite Neoseiulus *fallacies* (Garman). Population density decreased occurred in both chemical and biological subbeds from April could be due to the physiological characteristics of strawberry plants which became unsuitable for spider mite feeding as mentioned by Goodwin (1990).

Statistical analysis of data revealed mainly insignificant differences between bio-control and chemical control subplots which indicated that this release rate of 1-2 individuals/plant of *A. californicus* was enough

to keep *T. urticae* population relatively similar to that under frequent spraying of Neoron. Such results enhance more studies for replacement of acaricides by predatory mites

Table (1)*: Population density of the two spotted spider mite *Tetranychus urticae* Koch. individuals /leaf in biological and chemical (check) control subbeds of strawberry plants at Bahteem Farm Research Station, 1998/99 season.

sampling date	Rosalinda	Chandler	Seascape	Ros.-check	Chan.- check	Seasc.-check
14-Feb	3.5	18.1	1.8	5.6	15.4	2.9
21-Feb	10.4	22.1	2.75	12.8	17.6	5.7
28-Feb	10.4	11	8.5	8.4	14.3	20.4
7-Mar	32.2	44.9	26.6	39.7	49.1	31.6
14-Mar	49.1	22.5	26.5	9.1	24.2	12.3
21-Mar	8.6	22.1	24.7	10.9	0.9	22.5
28-Mar	13.5	10.9	4.1	3.12	0.7	1.8
5-Apr	2.5	0.5	6.5	0.7	7.3	6.1
12-Apr	1.4	2.3	15.6	0.3	11.1	4.7
19/04/	1.06	2.65	13.1	0.5	4.9	13.2
26-Apr	5.3	4.1	18.6	7.9	7.5	12.8
4-May	7.6	12.95	3.25	8.1	8.5	15.9
13-May	6.85	1.1	1.69	3.9	1.72	5.1
17-May	0.8	0.5	9.4	0.8	6.6	4.62
26-May	0.5	0.8	0.8	0.2	0.3	0.7

Statistical analysis showed NS differences between mean populations recorded on the strawberry cultivars (F value = 0.746) also between chemical and biological control subplots (F value=0.836).

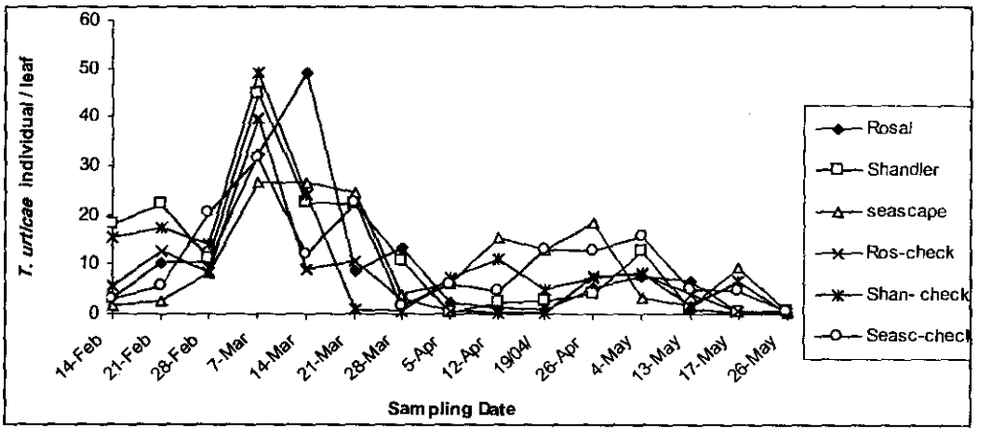

Fig. (1): Population dynamic trend of two spotted spider mite *Tetranychus urticae* in chemical and biological control plots of three strawberry varieties at Bahteem Farm Research Station, 1998/99 season

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المكافحة المتكاملة للعنكبوت الأحمر على محصول الفراولة فى الصوبات البلاستيكية

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تمثل هذه الدراسة والتى اجريت فى موسم ١٩٩٨ دراسة أولية عن امكانية تطبيق المكافحة الحيوية للعنكبوت الاحمر داخل أحد الأنفاق العالية والتى عادة لاتستعمل لانتاج الفراولة نظرا لأنها تتسم بحرارة عالية ورطوبة منخفضة، وكلاهما من الظروف المناسبة لسرعة نمو العنكبوت الاحمر. وتمت الدراسة على أصناف روزاندا – سويت شارلى – سيسكاب. وتم إطلاق المفترس الأكاروسى أمبلسيوس كاليفورنيكس بمعدل فرد/ نبات فراولة ولكن كما ذكر سلفا بسبب الحرارة العالية داخل تلك الانفاق لم يكن هذا المعدل كافيا لضبط أعداد العنكبوت الاحمر، مما تطلب المعاملة بمركب نيرون مرة واحدة علاوة على معاملة حواف الصوبة بالكبريت الميكرونى لعدد ٤ مرات – وهذا يفيد ان زراعة الفراولة والتى تحدث عادة فى الأنفاق المنخفضة ذات المناخ المعتدل نسبيا ربما تكون أكثر مناسبة لتطبيق المكافحة الحيوية.