Susceptibility of Some Pepper Varieties to *Polyphagotarsonemus latus* (Banks) infestation (Acari: Tarsonemidae)

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(*Received: August 29, 2010*)

ABSTRACT

The broad mite *Polyphagotarsonemus latus* (Banks) causes serious damage to apical leaves of pepper seedlings (*Capsicum annuum* L.) into nursery of plastic houses. Population density and seedling damage were estimated after artificial mite infestation of pepper seedling varieties traveta, top star and habeba, with unfolded first, second, and third true leaves. Thrity thee days after infestation, seedling damage was greater in those infested at the first true leaf unfolded. Hot pepper habeba seedlings were the most susceptible variety to broad mite, followed by the two sweet pepper varieties top star and traveta.

Key Words: *Polyphagotarsonemus latus*, Tarsonemidae, *Capsicum annuum*, Plant growth, Damage, Plastic house

INTRODUCTION

Polyphagotarsonemus latus (Banks) is one of the most injurious tarsonemid mites having different common names i.e. broad mite, chilli mite, citrus silver mite, white mite and yellow tea mite. It is world – wide distributed in the tropical and subtropical regions attacking more than 60 plant families (Gerson, 1992). *P. latus* has been recorded in Africa in 1890 where symptoms on cotton are known as "acariose" (Jeppson *et al.*, 1975). Recently, it was recorded on pepper plants by Abou-Awad in Egypt, then infested other vegetables in plastic houses and open field (Mostafa, 2007).

Broad mite feeds on plant juice and possibly inject toxic compounds in plant tissues (Gerson, 1992). Individuals are found on young leaves along the central vein damaging the primordia or corona. During vegetative growth, the damage is mainly limited to the terminal shoots and young leaves. The leaves exhibit various symptoms, most commonly leaf rolling towards the lower surface, the blade becoming corrugated in appearance. The plant may stop developing and appears dwarfed.

The present work aimed to study, the susceptibility of pepper varieties to *P. latus* infestation and the resulted damage on the three apical seedling leaves, to establish the suitable pest management to control the broad mite.

MATERIALS AND METHODS

The experiment was conducted on the farm of Modern Agriculture Company at Tahrir province, El-behera Governorate .Two sweet pepper varieties , traveta and top star , and one hot pepper variety, habeba , were raised on 15 August ,2009 in a 70 % peatmoss and 30% vermiculate in 84-cells (2.5 ×2.5 and 6.5 cm height) polystyrene transplant flats in nursery of plastic houses . No pesticides were demonstrated.

Treatments were replicated 3 times in addition to control, and maintained at 27±3 °C and 75-85 % RH. Broad mite population and seedling damage were assessed after two adult mite females were placed on each seedling at three different developmental stages of the plants: a) unfolded first true leaf, b) unfolded second true leaf and c) unfolded third true leaf. Uninfested seedlings were left as a check.

Seedlings of the different treatments were daily observed, recording feeding behavior and damage symptoms for 35 days after seeding. The control treatment reached the transplant size (five-six leaves) after 33 days. Then , seedling damage was assessed including growth loss to dry weight , fresh weight , water content , stem diameter , stem length and leaf area . Seedling shoot and leaves were washed in ethanol solution (70%) (Weintraub *et al.*, 2003). Mite population, nymphs and adults, per seedling (means from 2 to 3 seedlings) were assessed by counting all broad mites recovered in the ethanol solution. Leaf area was measured using a leaf area meter. The data analyzed statistically by F- test for comparison.

RESULTS AND DISCUSSION

The pattern of population distribution of *P. latus* differed according to position of apical plant leaves. Among the five apical leaves from top, the first and second leaves were found to harbour maximum number of mites , while less number of mites was noted on third leaf irrespective to pepper varieties .Similar result was reported by Jovicich *et al* .,(2004). It was also noted that traveta and top star varieties harbour more mites, compared with habeba. Seedlings could not support increasing numbers of mite perhaps due to the low plant quality, attributed to the mite damage. At transplanting (33 days old) seedling hosted (380, 277 and 179), (300, 179 and 99) and (220, 139 and 77) broad mites when infested at developmental stages of unfolded first true leaf , second true leaf and third true leaf of traveta , top star and habeba varieties , respectively (Table 1). Preference of broad mite to the aforementioned varieties can be ranked as follows: traveta > top star > habeba.

It was noted that the lower leaf surface was preferable to mite feeding and oviposition. Eggs are elongate-oval, flattened, translucent and have longitudinal rows of round white knobs. Larva is white immediately after hatching but later becomes translucent. The sedentary nymph remains in the exuviae of the larva until the adult has developed. Females and larvae do not normally move from one leaf to another but males transfer the sedentary female pupae from damage to undamaged apical leaves.

About one day after infestation, symptoms of elongation and curling of unfolded apical leaves were observed in all three seedlings developmental stages; the edges turn upwards as *P. latus* feeds on the upper surfaces (Smith, 1939 & Schoonhoven *et al.*, 1978); more often the mite prefer feeding on the lower leaf surfaces, which consequently curl dawnwards. Three days after infestation, leaves turn to dark green. One week after infestation, the leaves assume a shriveled and scorched aspect. At 15- 17 days old, the leaves become rigid or bronzed with a hard brittle texture, cupped down and zigzagged veins, then finally turning dark brown. When the under sides are exposed to sun. Thirty three days after infestation, most seedlings turned to be useless. These results are relatively similar to those recorded by Cross (1979), Bassett (1981), Cross & Bassett (1982), Peña & Bullok (1994) and Cho *et al.*, (1996). However, broad mite is believed to be cell feeders, having styletform simple chelicerae that are only slightly reversible (Jeppson *et al.*, 1975), with an approximate extended length of 43 microns (Gui *et al.*, 2001). Thus, *P. latus* mouthpart appendages are unable to penetrate renitent tissues or puncture the more lignified tissues of 14 week old plants as opposed to these tissue in 5–10 week old plants (de Cros-Romero and Peña, 1998). This clarifies the susceptibility of some pepper varieties to broad mite infestation.

Therty three days after infestation, seedlings of habeba, top star and traveta varieties, at the first true leaf unfolded had more damage than seedlings infested at two or three unfolded leaves. Reductions of fresh weight, dry weight, water content and leaf area compared to uninfested seedlings were (94, 92, 92 and 78%), (87, 90, 91 and 92%) and (58, 66, 67 and 91%) in seedlings infested at first unfolded true leaf of the three pepper varieties, respectively. Reductions of stem length and stem diameter were (45 and 72%), (38 and 60%), (38 and 40%), respectively. Less reduction was noted in infested seedlings when two or three leaves unfolded. These results are relatively similar to those recorded by Jovicich *et al.*, (2004) who reported that bell pepper seedlings infested at the cotyledonary stage had the most damage compared to seedlings at two or four unfolded leaves. It was also observed that the hot pepper habeba seedlings having more damage and harbour lower mite density compared to sweet pepper varieties (table 1). This perhaps might be due to chronic mite feeding on narrow habeba leaf area compared to the wide leaf area of both top star or traveta. Thus, it could be concluded that hot pepper habeba seedlings were the most susceptible variety to broad mite, followed by top star, then traveta.

Relationship between level of seedling damage, after artificial mite infestation, and number of mites present on seedlings before transplanting showed that the relative growth loss caused by *P. latus* to different pepper varieties was noticeable shortly after infestation occurred, while less damage was noted on seedlings that were infested at 3-leaf stage (table 1). Dhooria and Bindra (1977) placed various growth of broad mites on young chilli as a hot pepper variety and concluded that as few as ten mites per plant could cause characteristic injury symptoms .However, the sequence of motile mites observed 7 days after infestation for all studied pepper varieties explains why seedlings at early ages have the potential for inducing damaging mite outbreaks. Such seedlings are usually grow distorted and not used for saleable transplants. Effective control of the mite is then more difficult to be achieved. Consequently, careful and frequent scouting will be needed in plastic houses where

Table (1): Mean ±SD of *Polyphagotarsonemus latus* / plant on pepper seedlings and its effect at ifferent developmental stages at transplanting age (33 days old) compared to uninfested seedlings with (5-6) unfolded leaves.

Growth parameters and mite density	Infested seedlings			Check	Infested seedlings			Check	Infested seedlings			Check
	Traveta				Top star				Habeba			
	T1	T2	T3		T1	T2	T3		T1	T2	T3	
Dry weight (g)	0.461	0.497	0.71	1.104	0.213	0.51	0.51	1.689	0.206	0.55	1	3.643
Fresh weight (g)	2.146	2.217	3.16	6.246	0.903	2.731	5.531	9.36	1.431	3.046	4.76	19.046
Water content (g)	1.685	1.72	2.45	5.142	0.69	2.221	5.021	7.671	1.225	2.496	3.76	15.403
Stem diameter (cm)	1.99±0.06[b]	2.10±0.05[b]	2.14±0.03[b]	3.23 ±0.17[a]	1.82±0.02[b]	2.16±0.05[a]	2.54±0.06 [a]	2.93±0.06[a]	1.63±0.03[b]	1.87±0.47[b]	2.34±0.05[a]	2.95±0.16[a]
Stem length (cm)	3.92±0.23[c]	4.23±0.12[c]	4.93±0.16[b]	6.51±0.24[a]	3.55±0.17[c]	5.51±0.24[b]	5.89±0.36[b]	8.95±0.39[a]	3.91±0.17[d]	5.72±0.24[c]	8.14±0.36[b]	13.78±0.39[a]
Leaf area (cm^2)	1.53±0.10[c]	4.68±0.47[c]	7.18±0.43[b]	16.87±1.98[a]	1.31±0.07[c]	4.32±0.31[c]	10.20±0.64[b]	15.86±1.65[a]	1.54±0.19[c]	2.27±0.29[c]	3.14±0.30[b]	7.13±0.75[a]
No. mite/ plant	380	277	179	0	300	197	99	0	220	139	77	0

T1: Unfolded 1[st] true leaf T2: Unfolded 2[nd] true leaf T3: Unfolded 3[rd] true leaf cm = centimeter g = gram
Mean with similar letters in a horizontal column denote significant difference ($p < 0.05$, $p < 0.01$)

P. latus is common problem in protected pepper production in Egypt.

Strategies of integrated pest management in regions where broad mite problems are frequent should probably based on preventive of mite infestations and early control of infestation by recent safe chemical treatments i.e. Abamectin and Spinosad (Mostafa, 2007). The efficacy of biological control by using predatory phytoseiid mites to control this injurious mite in greenhouses and or in field were also reported by several workers (Brown and Jones, 1983; Badii and McMurtry, 1984; Fan and Petitt, 1994; Peña and Osborne, 1996; Weintraub *et al.*, 2003 & Rodriguez and Ramos, 2004).

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