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Research Note

A New Occurrence of Broad Mites in Peppers in the Lower Rio Grande Valley of Texas

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ABSTRACT

The broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae), was identified in peppers from a greenhouse in Hidalgo county and in several pepper fields in Hidalgo and Starr counties in Texas in 1992. The symptoms associated with this pest include a narrowing and downward cupping of young to mature pepper leaves, a bronzing of leaf and bud tissue, and finally a resseting of developing fruit with extensive bud drop at the apical meristem. The terminal buds exhibited a burned appearance along with bud abscission. Symptoms were reported in several hundred acres in various locations near Rio Grande City, La Joya and Mission. Chemical tests for the control of broad mite indicated that dicofol (Kelthane MF®) and abamectin (Agri-Mek 0.15 EC®) provided good control of all stages of the broad mite, but it was noted that plant damage symptoms persisted at least two weeks after mites were destroyed. The within-field distribution of symptoms ranged from highly clumped at lower infestation levels to nearly uniform within areas of higher infestation levels.

RESUMEN

El ácaro *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae), fué identificado en chiles de un invernadero en el condado de Hidalgo y en varias plantaciones de chile en los condados de Hidalgo y Starr en 1992. Los síntomas asociados con esta plaga incluyen angostamiento y encopamiento hacia abajo de las hojas jóvenes o maduras de chile, un bronceado de la hoja y del tejido de la yema, y finalmente bronceado del fruto en desarrollo con una caída abundante de yemas en el meristemo apical. Las yemas terminales exhibieron una apariencia quemada acompañada de abscisión. Los síntomas fueron reportados en varios cientos de acres en diferentes localidades cerca de Rio Grande, La Joya y Mission. Pruebas químicas para el control del ácaro indicaron que dicofol (Kelthane MF®) y abamectín (Agri-Mek 0.15 EC®), proporcionaron buen control para todos los estadios del ácaro, pero fué notorio que los síntomas del daño en la plantas persistieron al menos dos semanas después de que los ácaros fueron destruidos. La distribución de los síntomas dentro del campo de cultivo varió de altamente agrupados en los niveles de infestación más bajos hasta casi uniforme dentro de las áreas con altos niveles de infestación.

The broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae), is a cosmopolitan pest known to occur in Australia, Asia, Africa, Europe, North America, South America, and the Pacific Islands (Black et al., 1991). In a recent comprehensive review of broad mite literature by Gerson (1992) broad mites were reported to occur on a wide range of plant species encompassing 57 different plant families. Some of the important crops that broad mite attacks include peppers, cotton, tea, rubber, citrus, tobacco, tomatoes, potatoes, beans, gerberas, dahlias, zinnias, and chrysanthemums. The mites are reported to feed primarily on the lower leaf surface and tend to concentrate on the young foliage or flower buds (Jeppson et al., 1975). Affected pepper leaves develop a bronzed appearance on the lower side of the leaf, the leaf generally curls (or cups) downward and can appear elongated or narrow. Later stages of damage include thickened and brittle leaves, russeted and distorted pods, and death of the apical meristem (Black et al., 1991).

Broad mites are very small (100 to 300 microns in length) and their body color varies, but can be readily recognized with proper magnifification. The eggs are transparent, oval and elongate with a flat base (Figure 1). Broad mite eggs are distinctive in that longitudinal rows of white tubercles can be seen within the egg sac. The immatures are morphologically similar to the adults except for a slightly smaller size, a less oval shape (subcircular or tapered posteriorly), and less pigmentation than the adult. The adult female is oval and broad with a slightly darker pigmentation (this varies with host plant). The body of the adult male is shorter, broad, and tapers posteriorly with longer legs than the female (Figure 1). The males can carry female "pupae" on their back from old leaves to younger leaves (mites appear to be more numerous on the younger plant tissue near damaged tissue than directly on severely affected plant tissue). The life cycle is 4-5 days in warm weather and 7-10 days in cold weather with an average egg deposition of 4 eggs per day during the summer (Jeppson et al., 1975). The broad mite reproduces best with mild temperatures (25°C) and high humidity and does not generally survive harsh winter unless in a greenhouse (Gerson, 1992). Broad mite populations generally build up rapidly and then decline due to a lack of suitable food source, unfavorable climatic conditions, or an increase in natural enemies. Dispersal of broad mites occurs by contamination of field equipment or personnel, by males carrying female mites, through wind dispersal, by crawling from plant to plant, or by attaching itself to other insects, such as the sweetpotato whitefly (Gerson 1992).

The purpose of this study was to document the occurrence of broad mite in the Lower Rio Grande Valley of Texas and to provide information relative to chemical control. Also, basic information relative to broad mite biology and identification are provided as a guide to crop pest managers.

MATERIALS AND METHODS

Initial Identification An initial sample (RLM 100) was collected on April 3, 1992 from peppers grown in a greenhouse at the Texas Agricultural Experiment Station at Weslaco where mite damage had become evident. The samples where sent to USDA/ARS Systematic Entomology Laboratory at Beltsville, Maryland for identification. A complete report was returned on April 24, 1992 with mite identifications.

First Field Test On October 3, 1992 samples were collected from a pepper field at Shuford Farm in Starr county where B. Villalon of the Texas Agricultural Experiment Station had observed damage apparently related to mite activity. The samples were found to have mites with several characteristics associated with the broad mite. Also, the damage observed in the pepper field was the same as that caused by broad mite feeding, including leaves elongated and curling downward, bronzed leaf and bud tissue, and a russeting of developing fruit. Single plant applications of bifenthrin (Talstar 10WP®) and abamectin (Agri-Mek 0.15EC®) at approximately 0.022 kg. AI/ha and 0.013 kg AI/ha (0.09 kg and 296 ml formulated material per 93.5 liters per hectare), respectively, were made to evaluate mite control. Applications were made with a garden plant misting sprayer held approximately 30 cm from the underside leaf surface to insure uniform coverage (volume = 0.7 ml per 1000 cm^2 treated area). The treated plants were compared to untreated plants in a completely random design. Mites were sampled by collecting ten leaves after treatment (once the foliage had dried) and holding these samples at 25°C for 72 hours for an evaluation of resulting mite mortality in numbers of affected individuals per leaf. Mites were considered dead if they were completely immobilized and showed signs of desiccation. Those mites that fit the broad mite description (Jeppson et al., 1975) were counted separately by the following groups: female mites (immature and adult) and adult male mites. Adult male mites could be seen carrying female broad mites, had relatively prominent legs, and were distinctively tapered at the posterior end. Eggs were not counted in the first test.

Second Field Test A field test to evaluate commercial chemical applications for broad mite control was conducted in Hidalgo county in cooperation with the Texas Agricultural Extension Service (Edinburg, TX) and Valley Onion Inc. (McAllen, TX). The treatments were ground applied with 440 liters to the hectare using two overhead and two drop nozzles per row. The CO_2 sprayer consisted of four TX 8 (Spraying Systems Company) hollow cone tips and the pressure was set at 3.5 kg/cm^2. Treatment plot dimensions were 0.76 m × 15.24 m (0.001 ha) and each treatment was replicated four times in a randomized complete block design. Treatments tested were abamectin (Agri-Mek 0.15 EC® 0.01 kg AI/ha), bifenthrin (Talstar 10 W® 0.02 kg AI/ha), cyromazine (Trigard WP® 0.14 kg AI/ha), dicofol (Kelthane MF® 0.84 kg AI/ha), and an untreated check. Resulting mite counts one week after the initial application and 24 hours after the second application were analyzed with ANOVA (SAS Institute 1987) and summarized with LSD separation of the treatment means. Broad mite counts were based on a leaf area of 3.5 cm^2 averaged over 10 samples from younger leaves near the terminal bud cluster. A single leaf per plant was taken from randomly selected plants within each plot.

Samples from both tests were sent to the USDA/ARS Systematic Entomology Laboratory at Beltsville, Maryland for species verification. Mite samples in both spray tests were compared to descriptions by Jeppson et al. (1975) and the RLM 100 sample. The observed damage in the field plots was typical of broad mite damage and symptoms continued to occur in several fields near the test location (C. Chamber, personal communication).

RESULTS AND DISCUSSION

Broad mites were confirmed in the sample sent in April 1992 determined by Taxonomic Services Unit, USDA/ARS Systematic Entomology Laboratory (Beltsville, MD) along with other species in the *Tarsonemus* genus. Mite samples taken in the first and second spray tests were categorized into life stages based on a description by Jeppson et al (1975); male and female mites matched the figures provided in this description.

Pre-treatment mite counts were not available in the first test, but total mites (dead + alive) after treatment were not significantly different. Also in the first test, some leaf desiccation occured, but not enough to significantly reduce mite numbers on the untreated leaves (Table 1) and a reasonable comparison between treatments was achieved. Pre-treatment counts for the second test were not significantly different. Results of both tests indicated that abamectin provided good mite control (Tables 1 and 2). Abamectin and dicofol provided excellent control (98%) at low and high recommended rates, respectively (Table 2). Plant damage symptoms were observed to persist several weeks after mites had been controlled. This suggests that earlier detection

Table 1. Number of broad mites per leaf remaining on treated leaves 72 hours after application of chemical treatments in the first field test (Starr County, 1992).

Treatment	Rate in kg AI per ha	Live female mites	Dead female mites	Live male mites	Dead male mites
Abamectin	0.013	0.0 a	5.7 a	0.03 a	3.06 a
Bifenthrin	0.022	3.5 ab	2.1 b	3.38 b	0.95 ab
Nontreated (check)	—	6.6 b	0.1 b	6.38 c	0.03 b

*Means followed by the same letter not significantly different at $P \leq 0.05$, LSD.

and control before symptoms are prevalent are needed to prevent widespread damage from affecting yields. The cost of control using abamectin was higher than using dicofol, but dicofol is limited to 0.8 lb active ingredient per acre per year and may not provide season long control. Bifenthrin was not effective at the low rate, but is generally applied at higher rates for mite control and should probably be reevaluated in future tests. The results indicate that both abamectin and dicofol are good products for the control of broad mite. A small number of live mites remained after the second application suggesting that the control, although good, does not completely eliminate the mite. There is still some concern that two applications may not be sufficient to completely avoid economic damage if the infestation begins early in the growing season.

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Table 2. Number of broad mites per leaf remaining on treated leaves one week after an initial application and 24 hours after a second application of chemical treatments in the second field test (Hidalgo County, 1992).

Treatment	Rate in kg AI per ha	Eggs	Immature mites	Adult mites	Total alive	Total dead
Dicofol	0.84	0.20 a	0.05 a	0.05 a	0.30 a	5.3
Abamectin	0.01	0.23 a	0.00 a	0.08 a	0.30 a	5.9
Cyromazine	0.14	5.28 b	1.25 ab	2.40 ab	8.93 b	7.2
Bifenthrin	0.02	5.23 b	3.08 bc	4.65 b	12.9 b	4.6
Nontreated (check)	—	7.00 b	3.88 c	4.40 b	15.3 b	1.3

*Means followed by the same letter are not significantly different at $P \leq 0.05$, LSD.

Severely affected plants did not produce marketable fruit at Shuford Farm (W. Shuford, personal communication), so the situation was serious enough for immediate control of broad mites by pepper growers in the affected areas. Dicofol was recommended for immediate control action based on availability, labeling, the recommendations in the literature, and the results in this study. The current label restrictions on dicofol prompted the application for emergency use of abamectin in peppers in the Lower Rio Grande Valley of Texas in 1992-1993 for additional protection against this pest. The observed damage in moderately affected fields (approximately 10% with symptoms) was clumped. However, in fields where greater than 50% of the plants exhibited symptoms, the distribution of symptoms in those areas appeared fairly uniform.

The number of broad mites in the second field test declined in the check plots over the three week period of the trial. This may have been related to commercial spraying of dicofol in fields adjacent to the test plots. Also, broad mites did not appear to be prevalent on older or severely damaged plant tissue. This suggests that the decline of host quality negatively affects broad mite populations. In a broad mite culture that was established in a laboratory at Weslaco during the field testing, an accidental introduction of an unidentified predaceous mite resulted in rapid decline of the culture. These observations indicate that broad mite populations are subject to rapid fluctuations and, because of this, severe broad mite infestations are expected to occur only sporadically in the Lower Rio Grande Valley of Texas. The cause of the recent broad mite outbreak in Texas is not known, but scouting and early detection will be essential to prevent economic losses associated with this pest in the future.

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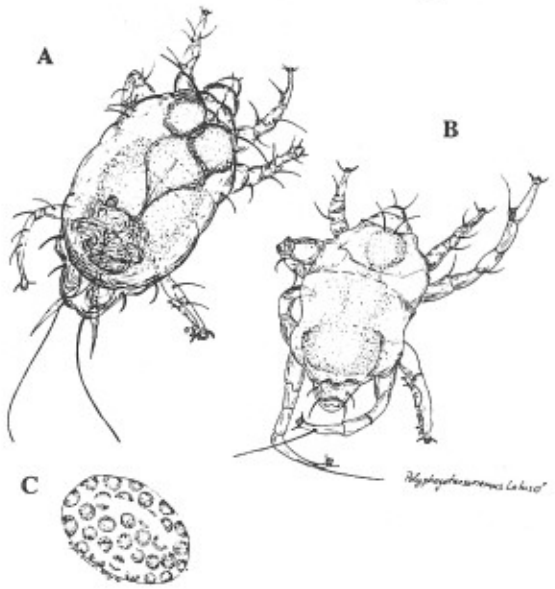

Fig. 1. The adult female (A), adult male (B), and egg (C) of the broad mite, *Polyphagotarsonemus latus*, on peppers (illustrated by A. Riley). The approximate body length of the slide mounted male specimen (B) was 130 microns excluding legs. The illustrations show some internal structures and colorations visible in the live specimens.