the highest B uptake. The uptake of B by fruits was found to be increased only with foliar applied B. The uptake of B by the fruits had a significant positive correlation with that of the yield (r =0.680* for the hybrid and r = 0.879** for Co 3). Since there was evidence of limited retranslocation of soil applied B to fruits, it can be concluded that application of foliar borax increased the weight and number of fruits, thereby contributing to the increased B uptake.

**Biomass yield of shoot and root**

The application of borax generally increased the dry weight of tomato shoot at both the flowering and harvest stages (Table 3). At 50 per cent flowering and harvest, the application of borax at 20 – 30 kg $ha^{-1}$ or as foliar application at 0.2 – 0.3% produced the highest dry weights. By contrast at harvest, highest shoot and root dry weight was obtained with the application of borax at 30 kg $ha^{-1}$.

**Fruit yield**

The fruit yield was higher in the hybrid than variety Co 3 but generally their responses to B were the same (Table 2). By contrast with shoot and root dry weight, the maximum fruit yield in the calcareous soil was obtained with the spray of 0.2 – 0.3% borax. Boron deficiency occurs as a result of increased B adsorption by soil with pH increase and as a result of co-precipitation of B with Ca $Co_3$. Hence it is suggested for calcareous soils that foliar spraying of borax could result in better fruit yield compared to soil application of borax or boronated superphosphate.

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(Received : December 1997 Revised : September 1998)

Madras Agric. J., 86(10-12): 586-589 October - December 1999
https://doi.org/10.29321/MAJ.10.A00665

# SEASONAL INCIDENCE AND MANAGEMENT OF THE MANGO LEAF MITE, *CISABEROPTES KENYAE* KEIFER (ABEROPTINAE : ERIOPHYIDAE : ACARI).

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The occurrence of the leaf mite. *Cisaberoptes kenyae* K. was continuous on varieties Malgoa and Rumani throughout the study period (December 1995 to May 1997), whereas in the varieties like Neelum, Bangalora and Sappattai the occurrence was not noticed between the months of August '96 to May '97. A similar trend was observed on the infestation of the mite. Among the treatments tested, neem seed kernal extract (10%) recorded the lowest number of mites (6.9 mites./ square inch area) with 54.3 per cent reduction over control followed by dicofol 0.03% (39.1%) endosulfan 0.07% (33.1%), Wettable sulphur – 0.02% (25.8%) and neem oil 3.0% (21.9%) after two rounds of spray.

KEY WORDS : *Cisaberoptes kenyae*, Eriophyid, Incidence, Management.

Table 1. Seasonal incidence of the mango leaf mite, *Cisaberoptes kenyae* on the selected cultivars *

| Period | Neelum | Bangalora | Malgoa | Rumani | Sappattai |
|---|---|---|---|---|---|
| December 1995 | 2.0 | - | 10.5 | 5.2 | - |
| January 1996 | 1.0 | - | 12.8 | 5.5 | - |
| February | 2.5 | - | 15.0 | 5.0 | 1.5 |
| March | 4.8 | 5.0 | 20.4 | 7.9 | 1.5 |
| April | 5.4 | 6.5 | 22.5 | 12.8 | 5.2 |
| May | 10.7 | 7.8 | 25.0 | 15.5 | 10.7 |
| June | 4.5 | 5.2 | 20.7 | 10.7 | 4.2 |
| July | 5.0 | 5.2 | 12.5 | 7.5 | 2.0 |
| August | 2.7 | - | 12.0 | 5.8 | - |
| September | 5.8 | - | 18.0 | 16.5 | - |
| October | 2.0 | - | 12.8 | 10.2 | - |
| November | - | - | 10.5 | 5.5 | - |
| December | - | - | 10.0 | 2.7 | - |
| January 1997 | - | - | 5.8 | 2.8 | - |
| February | 2.6 | - | 10.0 | 5.2 | - |
| March | 3.2 | - | 10.5 | 6.5 | - |
| April | 2.8 | - | 12.5 | 7.4 | - |
| May | 4.2 | - | 17.8 | 10.5 | - |

* Mean number of mites per square inch leaf area
* Mean of 10 leaf samples in each variety

Table 2. Percent infestation of mango leaves damaged by *Cisaberoptes kenyae* on selected cultivars*

| Period | Neelum | Bangalora | Malgoa | Rumani | Sappattai |
|---|---|---|---|---|---|
| December 1995 | 1.0 | - | 7.5 | 2.8 | 1.0 |
| January 1996 | 2.0 | - | 10.2 | 3.2 | 1.0 |
| February | 2.5 | - | 10.8 | 3.0 | 1.0 |
| March | 2.5 | 1.0 | 15.2 | 6.5 | 1.5 |
| April | 4.8 | 1.6 | 25.4 | 8.4 | 2.5 |
| May | 7.2 | 2.5 | 48.5 | 12.0 | 3.6 |
| June | 7.0 | 1.5 | 16.5 | 10.0 | 2.4 |
| July | 5.2 | 1.0 | 15.2 | 2.5 | 2.0 |
| August | 2.0 | 1.5 | 10.4 | 2.0 | 1.0 |
| September | 1.0 | 1.0 | 20.5 | 5.4 | 1.0 |
| October | 1.0 | 1.0 | 10.0 | 2.6 | 1.2 |
| November | 1.5 | - | 5.7 | 2.0 | 1.0 |
| December | 1.0 | - | 5.0 | 2.0 | 2.0 |
| January 1997 | - | - | 5.5 | 2.2 | - |
| February | 1.0 | - | 7.4 | 1.8 | - |
| March | 1.0 | - | 12.0 | 2.5 | - |
| April | 2.5 | - | 20.5 | 10.0 | 1.0 |
| May | 3.0 | - | 24.7 | 12.5 | 1.5 |

* Mean per cent leaves infested
* Mean of 10 observations in a month.

Mango fruit trees economically grown in different parts of the tropical world are infested by about 10 different eriophyid mites causing different types of damage. The infestation by *Cisaberoptes kenyae* Keifer results in the formation of webs of silvery white layer under which the mites thrive. Except for sporadic systematic account, none other aspect of this mite has been studied. The present studies were carried out to find the seasonal incidence of *C. kenyae* on five selected cultivars and the management of the mite with a few acaricides/insecticides and botanicals.

## MATERIALS AND METHODS

The study on the seasonal incidence of *C. kenyae* was carried out at the Regional Research Station (RRS) of Tamil Nadu Agricultural University (TNAU), Paiyur, Dharmapuri district from December 1995 to May 1997 on five mango cultivars viz., Neelum, Bangalora, Malgoa, Rumani and Sappattai. Monthly observations on the population of the mite was made on five to six year old trees. The leaf samples (10 numbers) possessing symptoms of attack from each tree were collected at regular intervals of 10 days throughout the study period. The leaves were collected in separate polybags, properly labelled and observed

Table 3. Weather factors during 1995-97 at RRS, Paiyur.

| Period | Temeperature (oC) | | RH(%) | | Rainfall (mm) |
|---|---|---|---|---|---|
| | Maximum | Minimum | Morning | Evening | |
| December 1995 | 30.9 | 16.1 | 99.2 | 58.6 | - |
| January 1996 | 31.9 | 16.0 | 98.6 | 55.1 | - |
| February | 33.9 | 17.1 | 98.1 | 52.7 | - |
| March | 37.6 | 19.0 | 94.1 | 50.6 | - |
| April | 37.0 | 23.6 | 92.7 | 53.6 | 143.0 |
| May | 39.6 | 24.2 | 88.7 | 53.7 | 42.8 |
| June | 35.5 | 23.3 | 89.3 | 58.5 | 157.1 |
| July | 34.6 | 23.9 | 84.7 | 87.5 | 25.2 |
| August | 33.3 | 23.0 | 90.0 | 63.0 | 178.2 |
| September | 32.5 | 22.3 | 95.7 | 67.8 | 468.0 |
| October | 32.0 | 21.9 | 96.0 | 70.7 | 268.0 |
| November | 32.2 | 20.2 | 96.1 | 66.3 | 13.8 |
| December | 29.3 | 17.6 | 97.1 | 72.2 | 114.4 |
| January 1997 | 30.5 | 18.0 | 97.9 | 64.9 | 2.4 |
| February | 33.6 | 17.2 | 97.8 | 56.9 | - |
| March | 36.5 | 19.6 | 94.7 | 55.9 | - |
| April | 34.4 | 22.6 | 91.5 | 62.9 | 111.2 |
| May | 38.1 | 24.0 | 90.5 | 62.6 | 63.4 |

under binocular stereo microscope. The number of mites present per square inch area was ascertained by direct counting. Subsequently, the infestation by the mite was also assessed on the selected mango cultivars by monthly observations. The infestation percentage was worked out with the mite infested and the total leaves collected, based on the silvery white web symptom. Slide mounting of the eriophyids was done on Hoyer's medium (Baker and Wharton, 1952) and the species identity was confirmed following taxonomic procedures (Umapathy, 1996). Data on the daily temperature (maximum and minimum), humidity (morning and evening) and rainfall were also recorded during the study period from the meteorological observatory located at the Research Station.

Management studies were conducted with six treatments comprising three acaricides, two botanicals and an untreated check. The experiment was conducted with a susceptible variety Malgoa in RBD, each treatment replicated thrice. The treatments were given twice at an interval of 15 days during flowering period. Pre-treatment count 24 hours before and post-treatment counts on three, seven and 15 days after spraying were recorded and the percentage reduction of incidence was worked out.

## RESULTS AND DISCUSSION

The incidence of *C. kenyae* from December 1995 to May 1997 for the five mango varieites is presented in Table 1. Malgoa and Rumani harboured more number of mites ranging between 5.8 and 25.0 per square inch and 2.7 to 16.5 respectively throughout the period of study. The occurrence was also noted to be quite regular and consistent on these two varieties, followed by Neelum which recorded zero population of mite from November 1996 to January 1997. In Bangalora the incidence of the mite (5.0 to 7.8) was noticed during March to July 1996 and in Sappattai (1.5 to 10.7) from February to July 1996. The mite population per unit area (one square inch) was high in Malgoa (25.0). The mite population exceeding 20.0/square inch was noticed between March and June 1996, which coincides with relatively lower humidity (84.7 to 92.7%) and maximum temperature (34.6 to 36.7°C). A gradual reduction in the mean mite population was noticed between July 1996 and April 1997. Again the mite population increased to a maximum of 17.8 per square inch in the month of May 1997 due to the increase in temperature. The data pertaining to the per cent infestation by *C. kenyae* based on the leaves with silvery white layer also recorded a similar trend as that of "mite population incidence" (Table 2). The per cent infestation was observed to be more (48.5%) in cv. Malgoa during the month of May 1996. The mean incidence and the level of infestation had a similar trend indicating that the peak infestation was during May 1996 and 1997.

The relatively warm weather during March to June seemed to be more favourable for the mite build-up. Bourdreaux (1958) in a study on biology of spider mites postulated that high temperature coupled with relatively low humidity favoured high

Table 4. Efficacy of selected acaricides / insecticides and botanicals against *C. kenyae* (Mean of three replications)

| S.No. | Treatments/ Conc. | Pre-treatment Count | I Spray 3 DAS | I Spray 7 DAS | I Spray 15 DAS | I Spray Mean | II Spray 3DAS | II Spray 7 DAS | II Spray 15 DAS | II Spray Mean | Overall Mean | % reduction over control |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Dicofol 18.5 EC -0.07% | 15.5 | 12.1 | 10.6 | 9.2 | 10.6 | 7.8 | 7.5 | 8.1 | 7.8 | 9.2 | 39.1 |
| 2. | Wettable - Sulphur 80 WP - 0.02% | 14.8 | 13.5 | 10.2 | 11.9 | 11.9 | 10.3 | 10.8 | 10.1 | 10.4 | 11.2 | 25.8 |
| 3. | Endosulfan 35 EC -0.07% | 17.0 | 14.2 | 10.6 | 9.1 | 11.3 | 8.4 | 9.2 | 9.1 | 8.9 | 10.1 | 33.1 |
| 4. | Neem oil 3% | 16.2 | 15.3 | 12.6 | 12.2 | 13.4 | 10.5 | 10.2 | 9.5 | 10.1 | 11.8 | 21.9 |
| 5. | NSKE 10% | 15.5 | 14.0 | 10.8 | 9.3 | 11.4 | 9.3 | 9.5 | 9.1 | 9.3 | 6.9 | 54.3 |
| 6. | Control | 16.4 | 15.6 | 15.3 | 14.1 | 15.0 | 15.6 | 15.5 | 14.5 | 15.2 | 15.1 | |
| | SEd | 0.226 | 0.087 | 0.168 | 0.781 | 0.087 | 0.072 | 0.182 | 0.338 | | | |
| | CD (P=0.05) | 0.503 | 0.193 | 0.374 | 1.74 | 0.197 | 0.159 | 0.405 | 0.753 | | | |

* DAS - Days after spray

reproduction and development. Alam and Wadud (1963) also reported that the hot and dry weather periods favoured the multiplication of the eriophyid, *Aceria litchi*, while damp weather and considerable rains detered the population build-up. The drastic decline in mite number and per cent infestation on the varieties Malgoa (from 20.7 to 5.8 / square inch) and Rumani (10.7 to 2.7), that set in between August and January was characterised by considerable rainfall (468.0 mm in September '96) accompanied by high levels of atmospheric humidity. Similar observations were made by Huang (1967) on *A. litchi* that the rainfall rather than temperature had an overwhelming impact on the seasonal populations of the mite.

The reasons for the occurrence of *C. kenyae* on Bangalora and Sappattai during the first year of study (1996) and its non occurrence thereafter might be due to their non preference of the host or low population level.

Among the treatments tested, neem seed kernal extract (NSKE 10%) was the most effective responsible for 54.3 per cent reduction over control followed by dicofol, endosulfan, wettable sulphur and neem oil with a mean per cent reduction of 39.1, 33.1, 25.8 and 21.9 respectively (Table 3). Chinniah and Mohansundaram (1995) also reported the effectiveness of neem products *viz.*, NSKE, neem oil against *A. cajani* on pigeon pea.

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(Received : May 1998 Revised : August 1999)