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Life Cycle and Chemical Control of Red Spider Mite *Tetranychus urticae* on Brinjal *Solanum melongena* L.

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Abstract

An experiment was conducted to study the life cycle and chemical control of red spider mite on brinjal in summer months of 2005—2006. Various life stages, their duration, measurements and sexual behavior were studied in detail. The duration of life cycle of female was found longer than the male. Eight insecticides/acaricides were used to control the mite in field conditions. Dicofol (0.04%) was found to be best whereas, triazophos (0.05%) was found to be least effective.
Key words : Life cycle, Red spider mite, Chemical control, Brinjal, Dicofol, Triazophos.

Brinjal or egg plant (*Solenum melongena* L.) is one of the most popular vegetable crops grown in India and other parts of the world. It can be grown in almost all parts of India except higher attitude, all the year round. India after China is the second largest vegetable producer in the world. The majority of the Indian population is vegetarian in their diet and according to dietician about 295 g of vegetable/head per day is essential for proper health. The brinjal is of much importance in the warm areas being grown extensively in India, with problem of common insect pests and diseases of vegetables. Unfortunately, most of the farmers are not aware about the mite pest of vegetable due to its microscopic size and obscure in nature. Now the mites are known as primary or major pest of vegetable. The red spider mite, *Tetranychus urticae* is a cosmopolitan species with a wide range of hosts including weeds, ornamental plants, fruit trees, vegetable crops and green house plants (1). Among vegetables, brinjal and okra are worst sufferers by the attack of this mite (2—4). The regular infestation of *Tetranychus urticae* on brinjal is being observed in agro-climatic zones of Varanasi during summer months. The mites are generally found feeding under surface of the leaves by stippling the leaf tissue. The removal of plant pigments result in appearance of yellow spots or blotches. Webbing is also found on the leaves. The severely infested leaves dry and fall off. Considering the pest status of mite and less information on life cycle and control of this mite on brinjal, the present work was undertaken to generate some information on these aspects.

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Methods

Life Cycle of Tetranychus urticae on Brinjal

The life cycle was studied in laboratory on leaves kept on cotton swabs in petridishes at room temperature of 35 ± 5 C and relative humidity 68.65 ± 5%. The cotton swab was kept moist so that the leaves containing mites remained green. The leaves were changed once in 3—4 days. Life cycle of fertilized female of mite was studied by releasing one female deutonymph and one adult male on leaf disc. As soon as the females emerged from deutonymph, the male mated with female and the fertilized female thus obtained was allowed to lay eggs. The egg were counted and onwards observations on life history of different stages i.e., incubation period, larval period, protonymphal and deutonymphal periods, inactive periods, oviposition and post-oviposition periods, fecundity and longevity of adult male and female were

Table 1. Life cycle of red spider mite, *Tetranychus urticae* on brinjal (*Solanum melongena*).

Stages	Mean	SD
Incubation period	3.15	0.60
Larva	1.88	0.43
Ist quiescent stage	1.03	0.18
Protonymph	1.24	0.31
IInd quiescent stage	1.86	0.23
Male		
Adult male	9.16	1.23
IInd quiescent stage	1.20	0.28
Female		
Deutonymph	0.93	0.39
IIIrd quiescent stage	0.73	0.21
Adult female	10.16	1.02
Pre-oviposition	1.88	0.72
Oviposition	17.65	7.35
Post-oviposition	2.22	0.98
Longevity of male	17.62	6.75
Longevity of female	25.55	9.20
Fecundity	101.25	27.45
Average daily fecundity	5.39	0.74
Sex ratio (male : female)	1:4.47	
Mortality (%)	10	
Mean temperature (C)	-25.30 (23—27)	
Mean relative humidity (%)	-68.65 (60—80)	

recorded. A standardized ocular microscope fitted to a research microscope was used for measuring the various stages of mite.

Chemical Control of Tetranychus urticae on Brinjal

The field experiment to control *Tetranychus urticae* by using different insecticides/acaricides was conducted in randomized block design with three replication in the field of Departmental Research Farm, Department of Entomology, Institute of Agricultural Sciences, Banaras Hindu University during May, 2007. The total number of treatments were nine. The plots size was 2 × 3 meters. A total of eight insecticides/acaricides were used in present experiment. The control plot was treated with water. For taking observations, five plants from each plot were selected, tagged and numbered. A total of 10 leaves from the upper, middle and lower portions of each plant were selected. The population of mites was counted by stereoscopic binocular microscope after 24, 72, 168 and 316 h of treatments. The corrected per cent mortality was calculated by Abbot's formula (5).

Results and Discussion

Life Cycle of Tetranychus urticae

Life cycle and morphmetric characters of various stages of *Tetranychus urticae* are presented in Tables 1 and 2 respectively. The life cycle of spider mite consists of eight developmental stages. These stages are egg, larva, nymphochrysalis (first quiescent stage), protonymph, deutochrysalis (second quiescent stage), deutonymph, teliochysalis (third quiescent stage) and adult.

Egg. Both fertilized and unfertilized females were found to lay eggs. The eggs were smooth round, pearl white translucent when freshly laid and later changed into light yellow and prior to hatching the color became pinkish. The diameter of eggs varied from 130 to 135 micron. The incubation period was 3 to 4 days.

Immature Stages. The immature stages consists of larval, protonymphal and deutonymphal stages. The larval, protonymphal and deutonymphal periods averaged 1.88 ± 0.43 days, 1.24 ± 0.31 days and 0.93 ± 0.39 days respectively. The larvae were oval in shape with three pairs of legs. The larvae at the beginning

Table 2. Measurements (micron) of different stages of *Tetranychus urticae.* Average of 5 mites.

Morphometric character	Egg	Larva	Protony-mph	Deutony-mph	Male	Female
Diameter	135.00					
Body length		231.16	321.60	373.96	326.00	611.13
Body width		154.74	203.61	238.12	143.16	325.49
1st leg		173.95	184.36	260.80	201.60	348.16
2nd leg		124.68	137.34	212.80	164.12	279.05
3rd leg		126.78	131.34	195.20	164.12	279.05
4th leg			143.43	205.56	176.38	314.33

Table 3. Overall efficacy of insecticides/acaricides against red spider mite, *Tetranychus urticae* on brinjal, *Solanum melongena* under field condition during May 2007.

Insecticides/acaricides	Concentration (%)	Mean percent mortality (corrected) days after spraying 24 h	72 h	168 h	316 h	Mean
Ethion 50 EC	0.05	64.33	68.79	71.83	44.56	62.38
Monocrotophos 35 EC	0.03	34.77	39.94	42.88	31.93	37.38
Dicofol 18.5 EC	0.03	71.06	76.48	78.28	54.13	69.99
Triazophos 40 EC	0.05	32.98	39.17	41.09	30.17	35.83
Cypermethrin 25 EC	0.005	82.34	62.57	67.34	52.69	66.24
Phosalone 18.5 EC	0.015	62.79	56.43	51.36	46.73	54.33
Quinolphos 25 EC	0.037	58.43	54.66	50.96	44.32	52.09
Sulfur 80 WP	0.25	57.19	61.93	64.64	54.82	59.65
Mean		57.99	57.49	58.54	44.92	

were amber in color, gradually it became geeenish. The protonymph was slightly bigger than the larva with four pairs of legs. The color of protonymph changed to dark green with two red eye spots. The deutonymph was slightly bigger than the protonymph with body coloration changed to dark red. The adult mite emerged after the hatching of this stage.

Quiescent Stages. It has been observed that there are two and three quiescent stages in male and female sexes respectively. During this stage matured larvae anchoring itself to the leaf surface or webs in which anterior and posterior legs well stretched out, during this period, mite suspended all its activity of feeding. Deutochrysalis, which comes after maturity of protonymph, in this stage body shrunk and reduced in size. Generally male had longer deutochrysalis than female. The last quiescent stage or teliochrysalin was found to be only in female. Inactive period, during developmental stages was found to occupy 31.89 and 29.40% of total egg to adult life span of male and female sexes respectively (Table 1).

Adult Male and Female. The females were bigger than males in size and had rounded abdomen. Body color is dark red. The males were easily distinguishable from the females by their attenuated body shape, shorter size, pointed abdomen and light reddish pink body color. The life span of adult male and female averaged 9.16 ± 1.23 days and 10.16 ± 1.02 days respectively.

Fecundity and Longevity. The number of eggs laid by female averaged 101.15 ± 27.45 with average daily fecundity 5.39 ± 0.74. Oviposition and post-oviposition periods averaged 17.65 ± 7.35 days and 2.22 ± 0.98 days respectively. The longevity of male was found to be shorter than female which had 31% less duration as compared to female. The female on an average completed 25.55 ± 9.20 days in laboratory conditions.

Sexual behavior. The male emerged earlier than the female and wandered in search of female. The male has been observed to mate with several females. The act of copulation lasted 1 to 5 minutes. Unfertilized female produced male only while fertilized female produce both sexes. Earlier the biology of tetranychid mites was reviewed in general (6, 7) the biology of *Tetranychus urticae* was studied (8—10).

Chemical Control of Tetranychus urticae

Data pertaining to individual and overall efficacy of various insecticides/acaricides against red spider mite (*Tetranychus urticae*) on brinjal (*Solanum melongena*) are presented in Table 3. All treatments were found to be significantly effective in reducing the mite population. The treatment cypermethrin (0.055%) caused the highest mortality (82.34%) mortality after 24 hrs. of treatment. The lowest mortality (32.91%) was recorded in treatment Triazophos (0.05%) at 24 hrs. The effectiveness of insecticides/acaricides started showing decreasing treand after 168 hrs. Among the periods, the lowest mortality was noticed at 316 hrs. Among the treatments, dicofol (0.03%) was found to be significantly superior to the rest of the treatments. Other treatments accept triazophos and monocrotophos were found to be equally effective in reducing the mite population. Triazophos (0.05%) and monocrotophos (0.03%) were found to be least effective.

In the present study, dicofol (0.03%) was found to be the most effective among the chemicals tested for controlling *Tetranychus urticae* on brinjal. Ethion, phosalone, cypermethrin, quinolphos and sulfur were found to be equally effective in reducing the population of red spider mite were in general agreement with the observations of several workers (8, 10, 11—13). Dicofol was also found to be best treatment for chemical control of *Tetranychus urticae* on okra (14).

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