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EFFECT OF TEMPERATURE AND RELATIVE HUMIDITY ON THE DEVELOPMENT OF RED SPIDER MITE, *TETERANYCHUS LUDENI* ZACHER AT VARANASI

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ABSTRACT

Lab experiment conducted to study the life cycle of spider mite, *Teteranychus ludeni* Zacher at mean room temperature in two different months March and May, 2009 on the leaves of cowpea (*Vigna sinensis* L.). The incubation period took 5.00±0.70 days in March and 4.20±0.40 in the month of May. Whereas, larval, protonymph and deutonymph period lasted for 2.00±0.54, 1.80±0.86 and 1.23±0.41 days, respectively in the month of March and 1.40±0.40, 1.60±0.74 and 1.80±0.56 days in the month of May, respectively. In male mite life cycle was completed 11.56±1.15 and 8.90±2.15 days, respectively in the month of March and May. But in female was complicated 13.99±1.02 days and 11.60±2.80 days, respectively at the mean temperature 25.95^{O}C with relative humidity 72.50% in March and 35.30^{O}C with relative humidity 52.50% in the month of May. Measurements and sexual behavior were studied in detail. The duration of life cycle of female was found longer than the male. The sex ratio was found 1:2.9 and 1.3.2 (male: female) in the respective month.

INTRODUCTION

The red spider mite, *Teteranychus ludeni* Zacher. Is one of the most important pests of several host plant *i.e*. vegetables, fruits, ornamental etc (Sadana and Kanta, 1972). The economic loss caused by this mite is estimated to be 2 to 35 per cent in vegetables in Uttar Pradesh (Singh, 1995 and 1995a). The mite not only damages the crop but also acts as vector of fungal and viral diseases (Banu and Channa Basavanna, 1972).

At optimum conditions the populations build up of mite increase which results heavy egg lying all over the leaves. In view of the importance of this pest, it has drawn the attention of vegetables growers and a good amount of work has been done on diverse aspects of this mite including bio-ecology and management. Since the pest host relationship plays the important role in development of pest and its consequence population builds up. The present paper gives an account of the developmental strategies of *T. ludeni* infesting on cowpea crop.

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MATERIALS AND METHODS

The biology of *Teteranychus ludeni* Zacher was studied on cowpea leaves under the laboratory condition in different two months *i.e*. March and May, 2009 at mean room temperature 25.95^{O}C with relative humidity 75.50 per cent and 35.30^{O}C with relative humidity 52.50 per cent at laboratory of Network project on "Insect Biosystematics", Department of Entomology and Agricultural Zoology, Banaras Hindu University, Varanasi. The tender leaves of cowpea were plucked as and when required and were bought to laboratory. The mites were reared by leaf floatation method as described by Banu and Channa Basavanna (1972). The cotton swab of 7 cm diameter of petriplates was soaked in distilled water. Excised leaf piece (approximately 3 cm^2) free from mite infestation was placed on it in such a manner that lower surface of the leaf remained on lower side, while, the upper surface was in continuous and complete touch to cotton swab. The cotton swab was always kept saturated with distilled water to prevent escape of mites. The adult mites were collected from the cowpea field, for developing stock culture. A large number of 24 h old female mites were released from the stock culture on the leaves of cowpea with the help of fine camel hair brush. Each experiment was replicated in to five sets. The observations on the duration of different stages *i.e.* eggs, larva,

protonymph, deutonymph and adult (male and female) were recorded at six hourly intervals. Fecundity of a single fertilized female was observed by isolating an adult female to separate leaf disc as soon as it was fertilized by one of attending males just after the emergence of the female from deutonymph quiescent stage. In case of unfertilized female, the deutonymph quiescent stage was transferred to a separate leaf disc very carefully. As there was no male around, the female remained unfertilized. From the same set of experiment, total life span of adult female was recorded. The longevity of a male was obtained by isolating a male at deutonymph stage and by transferring it to a separate leaf disc. The observations were made under the stereoscopic binocular microscope. Measurements of different stages were taken. The data thus obtained was pulled and analyzed statistically to find mean and standard deviations.

RESULTS AND DISCUSSION

Life cycle and morphmetric character of various stages of *Tetranychus ludeni* is presented in Table 1 and 2 respectively. The life cycle of spider mite consists of 8 developmental stages. These stages are egg, larva, nymphochrysalis (1st quiescent stage), protonymph, deutochrysalis (2nd quiescent stage), deutonymph, teliochrysalis (3rd 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 128 to 130 micron (Table 2). The incubation period was 4 to 5 days.

Immature stages

The immature stages consists of larval, protonymphal and deutonymphal stages. During March month larval, protonymphal and deutonymphal periods averaged 2.00± 0.54 days, 1.80± 0.86 days and 1.23 ± 0.41 days respectively. But 1.40±0.40, 1.60±0.74 and 1.80±0.56 days found in the month of May, respectively. The larvae were oval in shape (body length 227.35µ and width 145.76 µ) with three pairs of legs size 1st leg 170.20 µ, 2nd 118.25 µ and 3rd 122.35 µ, respectively (table-2). The larvae at the beginning was amber in color, gradually it became greenish. 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.

Table 1. Life duration of different stage of red spider mite *Tetranychus ludeni* on cowpea

Stages	March 2009		May 2009	
	Mean	S.D.	Mean	S.D.
Incubation period	5.00	0.70	4.20	0.40
Larva	2.00	0.54	1.40	0.40
Ist Quiescent stage	1.00	0.18	0.80	0.20
Protonymph	1.80	0.86	1.60	0.74
IInd Quiescent stage	1.76	0.56	0.90	0..35
Male				
Adult male	11.56	1.15	8.90	2.15
IInd Quiescent stage	1.20	0.28	1.00	0.85
Female				
Deutonymph	1.23	0.41	1.80	0.56
IIIrd Quiescent stage	1.20	0.21	0.90	0.21
Adult female	13.99	1.02	11.60	2.80
Pre-oviposition	1.45	0.72	1.10	1.40
Oviposition	15.09	2.35	12.40	5.35
Post-oviposition	2.12	0.98	1.90	1.20
Longevity of male	17.62	4.75	13.50	2.30
Longevity of female	32.65	6.20	27.00	3.20
Fecundity	69.25	16.45	122.5	21.45
Average daily fecundity	4.59	0.74	9.88	4.80
Sex ratio (Male:female)	1:2.9		1:3.2	
Mortality (%)	16.23	3.40	9.23	2.30
Mean temperature (^{O}C)	25.95 (22.40 - 29.50)		35.30 (32.10 – 38.50)	
Mean Relative humidity (%)	72.5 (62 - 83)		52.5 (40 - 65)	

Table 2. Measurements [micron (µ)] of different stages of *Tetranychus ludeni*

Morph metric character*	Egg	Larva	Protonymph	Deutonymph	Male	Female
Diameter	129.00					
Body length		227.35	317.55	365.56	325.25	601.25
Body width		145.76	198.61	231.75	138.40	321.00
1st leg		170.20	179.40	253.45	195.65	342.45
2nd leg		118.25	132.85	207.80	159.35	270.25
3rd leg		122.35	126.36	190.35	159.35	270.25
4th leg		-	137.60	198.65	171.35	310.30

* Average of 5 mites

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 teliochrysalis was found to be only in case of female. Inactive period, during developmental stages was found to be occupied 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 cycle of adult male found 11.56±1.15 days in month of March and 8.90±2.15 days in May, but in female mite 13.99±1.02 and 11.60±2.80 days, respectively.

Fecundity and Longevity

The average number of eggs laid by female 69.25±16.45 and 122.50±21.45 eggs found in the month of March and May, 2009 in average temperature 25.95^{O}C with relative humidity 72.50% and 35.30^{O}C with relative humidity 52.50%. Average daily fecundity was also observed 4.59±0.74 and 9.88± 4.80 during this month. Mean Oviposition periods were observed 15.09±2.35 days in March, 12.40±5.35 in May month and post-oviposition 2.12± 0.98 days and 1.90±1.20 days, respectively. The longevity of male was found to be shorter than female which have 46%-50% less duration as compared to female. The life span was observed in male17.62±4.75 days and 13.50±2.30 days, in female 32.65 ± 6.20 days and 27.00±3.20 days in the month of March and May 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. Information gathered on the developmental aspects of *T. ludeni* depicted a common pattern of developmental processes involving a larval and two nymphal instars as in other tetranychid mite species described by earlier authors (Puttaswamy and Channa Basavanna, 1980, 1980a; Rai *et al*., 1996; Gotoh *et al*., 2003; Haque *et al*., 2007). Majority of the tetranychid species were found depositing eggs adjacent to the midrib of the leaves of the host plant (Banu and ChannaBasavanna, 1972; Puttaswamy and ChannaBasavanna, 1980a; Sangeetha and Ramani, 2007). However, *T. ludeni* showed no specific preference during oviposition. The silken web in *T. ludeni* (Puttaswamy and ChannaBasavanna, 1980a) served adequate protection to the eggs and the subsequent instars, which may be the possible reason for the randomised deposition of eggs. The pre-oviposition and oviposition periods of *T. ludeni* recorded by Puttaswamy and ChannaBasavanna (1981) on brinjal leaves were 0.98 day and 10.85 days. This is almost in agreement with the current findings although the post-oviposition periods recorded by the authors were three folds higher up to 2.4 days. However, at 19.3 ^{o}C - 28.4 ^{o}C and 53% - 88% RH, the pre-oviposition, oviposition and post-oviposition periods were 1.54 days, 12.75 days and 3.61 days respectively (Puttaswamy and ChannaBasavanna, 1980a). The biological phenomenon of aggregation as observed in many groups of organisms, serving various life activities of the species in question, was a feature noted in *T. ludeni*. Repeated occurrence of the process at the time of each quiescent period has indicated the significance of the phenomenon in the ontogeny of the species. Hence, further studies on the aggregation behaviour of this species particularly, of the larval and nymphal instars are warranted. More studies on the mediation of pheromones in this behaviour will help in unveiling the exact nature of the relationship among the members of the species.

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REFERENCES

Banu, K. and Channa Basavanna, G. P. 1972. Plant feeding mites of India I. A preliminary account of the biology of the spider mite Eutetranychus orientalis (Klein) (Acari: Tetranychidae). *Mysore Journal of Agricultural Sciences*, 6(3): 253-268.

Gotoh, T., Ishikawa, Y. and Kitashima, Y. 2003. Life- history traits of the six Panonychus species from Japan (Acari: Tetranychidae). *Experimental and Applied Acarology* 29 241-252.

Haque, M., Wahab, A., Naher, N. and Begum, A. 2007. Developmental stages of the red spider mite, Oligonychus coffeae Neitner (Acari: Tetranychidae) infesting rose. *Uttar Pradesh Journal of Zoology* 26 : 71- 72.

Puttaswamy and Channabasavanna, GP. 1980a. Life history of *T. ludeni* (Acari: Tetranychidae) under field condition. *Indian Journal of Acarology* 4 (1) 41-48.

Puttaswamy and Channabasavanna, GP. 1981. Influence of host plants on the development, fecundity and longevity of *Tetranychus ludeni* Zacher (Acari: Tetranychidae). *Indian Journal of Acarology* 5 (1) 80-84.

Puttaswamy and G. P. CannaBasavanna, 1980. Effect of temperature and relative humidity on the development and oviposition of *Tetranychus ludeni* (Acari: Tetranychidae). *Indian Journal of Acarology*, 4 (1) :31-40.

Rai, S.N., Singh, R.K. and Singh, J. 1996. Biology and chemical control of *Tetranychus cinnabarinus* (Boisd.) (Acarina: Tetranychidae) on Ashwagandha, *Withania somnifera*, *Pestology*, XX(11) : 23-27.

Sadana, G.L. abd V. Kanta, 1972. Susceptibility of different varieties of citrus to the citrus mite, *Eutetranychus orientalis* Klein. *Sci. & Cult.,* 38 (12): 525-526.

Sangeetha, GK. and Ramani, N. 2007. Biological studies of Tetranychus neocaledonicus Andre (Acari: Tetranychidae)

infesting *Moringa oleifera* Lam. *Bulletin of Pure and Applied Sciences,* 26A (2) 51-57.

Singh, R.N. 1995. Mites of deciduous fruits and vegetables of Eastern Part of India and their economic status. *Adv. Agric. Res. India*, 3: 179 - 193.

Singh, R.N. 1995a. Studies on seasonal abundance of *Tetranychus ludeni* Zacher (Acari: Tetranychidae) on cowpea (*Vigna unguiculata* Savi.) *Jour. Rec*. *Adv. Appl. Sci*. (JRAAS), 10 (1 & 2): 59 – 63.

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