Original Article

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Life Cycle of a Citrus Mite Pest, *Schizotetranychus Baltazari* Rimando (Acari: Tetranychidae) at Varying Temperaturesunder Laboratory Condition in Kolkata

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Abstract

*Schizotetranychusbaltazari*Rimando is a common pest of citrus in many parts of India and its feeding causes the appearance of yellowish white striplings on the leaves which later wither and defoliate. The occurrence of this pest on citrus plants grown in the orchard of Narendrapur campus was seen during the pre-monsoon and post-monsoon periods during 2008-2011. Since information on its life cycle is unavailable and as this pest is going to be a menace in citrus orchards, attempts were made to study life cycle of this pest mite at three varying temperatures, *viz.* 25, 27 and 29°C on citrus under laboratory condition and the results thereof are presented in this paper.

This paper discusses the duration of different stages besides incubation, preoviposition, oviposition and post oviposition periods, fecundity, longevity, percentage of hatching, percentage of larva attaining adulthood etc. at three temperature regimes, 25, 27 and 29°C. Incubation period was shorter at higher temperature and so also was the larval, protonymphal and deutonymphal periods. So far as egg-adult period is concerned, the duration was 13.70±0.21 days, 10.20±0.72 days and 7.30±0.76 days at 25, 27 and 29°C, respectively. The preoviposition period was shorter (1.80±0.21 days) at 29°C as compared to other two temperatures where it was 2.00±0.00 days and 2.00±0.45 days at 25 and 27°C, respectively. The maximum oviposition period was 24.00±0.02 days at 29°C and the minimum was 15.80±0.19 days at 25°C. The postovipositionperiod(2.12±0.24days) was also higher at 29°C as compared to other two temperatures. Fecundity both in case of mated and unmated females was much higher at 29°C as compared to that at 25°C but in case of 27°C the difference was almost nil in case of mated female though in case of unmated female, the difference was quite noticeable. The longevity was more or less closer in males at all the temperatures but in case of female though there were differences but the values were quite close. So far as percentage of larva attaining adulthood and percentage of hatching, 29°C proved to be better as compared to the other two temperatures. This indicated that 29°C was more preferred by this mite as compared to 25°C and 27°C.

Keywords: Life cycle; Varying temperatures; *Schizotetranychusbaltazari;* Citrus; Sapota; West Bengal, India.

Introduction

S. baltazari is an important pest of citrus causing stipling of leaves and has been reported from many of the citrus growing areas of the country. The damage symptoms may be sometimes so serious that the leaves wither and the tree suffers from defoliation. Though it is an important pest of citrus but its life cycle has not been worked out earlier. In view of this as well because of the fact that this pest mite was regularly available on citrus, it was thought desirable to work out its life cycle under laboratory conditions at three constant temperatures, viz, 25°C, 27°C and 29°C on two hosts namely citrus and sapota

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and the result of that study is presented in this communication.

Material and Methods

The infestation of *S. baltazari* was seen in the orchard of Rama Krishna Mission Ashrama Narendrapur and the collection of mites was made from there. The life cycle was studied following methodology of Helle & Sabelis (1985) using petridishes of 2.5 cm diameter and keeping the incised test leaves of citrus and sapota on wet cotton pad and keeping those petridishes in BOD incubator maintained at 25C, 27C and 29C. The observations regarding duration of different stages of life cycle were recorded at 24 hrs interval. The data regarding the duration of pre-oviposition, oviposition and post-ovipositionperiods, longevity and fecundity (both mated and unmated), percentage of hatching etc were recorded at the same interval.

Copulation

Both males and females attain sexual maturity immediately after emergence but males emerge earlier than females as they miss the deutonymphal stage. Many a times it was seen that several males encircle the quiescent female deutonymph awaiting the emergence of the female so as to mate the female immediately after its emergence. During the process of mating, the male crawls underneath the female and arches its posterior portion in such a way so that they transfer the spermatophore into the female genital opening. Interestingly, both the sexes show polyandry and polygyny. Normally, the mating process is completed within 2-2.5 minutes. The present observation confirms the findings of Andrews (1928) who also reported that female mated with more than one male but disagrees with Das (1959) who reported that the female did not allow the second male to mate with it after its first mating.

Egg

The eggs are translucent, creamish initially but later on turn slightly brownish, laid scatteredly on the undersurface of leaves. A female lays 3-6 eggs per day and in her lifetime a total number of eggs which are laid was 100-110 eggs incase of mated females and 178-200 eggs in case of unmated females. The eggs split and the larva emerged which was initially very sluggish.

Incubation Period

The incubation period was 2.93±0.31, 2.19±0.72, and 1.80±0.45in case of citrus at 25° C, 27°C and 29°C respectively and the corresponding figure for sapota were 2.70 0.31, 1.70 o.44 and 1.64 0.96respectively. From the table (Table No.1) it is quite evident that higher was the temperature, shorter was the incubation period. Among the two hosts, this period was shorter incase of sapotaat all temperatures as compared to citrus. Both Channa Basavanna (1981) and Singh *et al* (1979) reported higher incubation period at lower temperature as was observed in the present study.

Larval period

This period varied both with temperature and host as evident from the fact that this period was 3.10±0.45 in case of Citrus at 25°C but at higher temperatures, the corresponding figures were 3.10±0.50, 2.60±0.22 at 27C and 29C respectively. In case of sapota, the respectective figures were 3.49 0.57, 4.30 0.45 and 1.90 0.30 days. The longest larval period on sapota was at 27C and the shortest was on sapota at 29C. In this case also, higher was the temperature, shorter was the larval period. Puttaswamy and Channa Basavanna (1982) reported that the duration varied with hosts and in the present study also, similar result was obtained. As usual, the larva had 3 pairs of legs and its movement was very slow and was not seen to feed very actively.

Protonymphal period

The size of this stage increased as compared to that of larva and color became deeper with showing faster movement and active feeding. The protonymphal period was 2.40±0.19, 1.60± 0.42 and 1.10 ±0.50 in case of citrus and 2.80± 0.61, 1.80± 0.48 and 2.70± 0.51 in case of Sapota at 25°C, 27°C and 29°C respectively. This period was longer on sapota irrespective of temperature. Further, this period proportionately shortened with the rise in temperature from 25°C to 29°C irrespective of hosts. Mallik and ChannaBasavanna (1983) reported this period close to the duration observed in the present study but the observation made by Singh *et al* (1989) was much shorter than those observed in the present case. In case of male, the protonymphalperiod transformed into adult whereas, in case of females, this stage passed through a quiescent stage before moulting into deutonymph.

Deutonymphal period

Deutonymphs are larger in size, reddish or orange in color, feed and move actively than the previous two mobile stages. The duration of this stage varied with temperature as was seen in the case of the earlier stages and as evident from fact that at 25°C on Citrus this period was 2.39±0.19 while at 27°C this was 2.80±0.11 and at 29°C this period was 1.10±0.50. This result was similar in case of Sapota also as the durations were 2.70 0.35, 1.70 0.78 and 1.11 o.31 days respectively.

Unlike the previous case, deutonymphal period was of longer duration on sapota at 25C compared to that on citrus but shorter at other two temperatures.

Egg-Adult Period

From Table 1 it is quite clear that this period was shorter at higher temperature and longer at lower temperature irrespective of hosts. As it appears from Table 1 that in case of Citrusthis period was 13.70± 0.21 at 25C, 10.20± 0.72 at 27°C and 7.30± 0.76 at 29°C. The corresponding figures for Sapota was 11.80± 0.84, 9.30± 0.11and 7.20± 0.24 respectively. The difference in duration among the hosts was highly significant. It was apparent from the data that sapota was a better host as compared to citrus at all the tested temperatures.

Mallik and Channa Basavanna (1983) reported this period at 222 hours in case of females and 200 hours in case of males. The observations regarding the period made by other workers are Singh and Singh (1993) on Okra, Nandagopal and Gedia (1995) on groundnut on *T. urticae*.

So the present observations are more or less akin to those of Manjunatha and Puttaswamy (1990), Malaviya and Rai (1995) etc.

Pre-oviposition Period

The pre-oviposition period in case of 25°C was 2.00± 0.00 on Citrus and these periods were slightly higher on Sapota (2.60 0.35) at the same temperature. Although at 27°C on citrus, this period (2.00 0.45) was quite close to that of 25°C on Citrus but on Sapota it took shortertime which was 1.80± 0.41. In case of 29°C, strikingly, it took lesser time on citrus where it was 1.80± 0.21 and was 2.60± 0.45 in case of sapota. From these results, it is quite difficult to interpret the effect of temperature on this period because no direct relationship could be established either with varying host plant or with varying temperatures.

Oviposition period

The maximum oviposition period was 24.00± 0.92 in case of citrus at 29°C followed by 21.07± 0.61 on the same host at 27°C and it was 15.80± 0.99 at 25°C on the same host. As compared to that the oviposition period increased gradually with the increase of temperature in case of Sapota which was 12.60±0.62 at 25°C becoming 16.50± 0.51 at 27°C and the maximum was 16.80± 0.76 at 29°C. These results indicated that for oviposition, Citrus was the better host and 29C was more preferred temperature. Puttaswamy

andChannaBasavanna(1981) reported that it was higher on Cucurbits (22.72 days) as compared to 10.85 days in case of brinjal. Singh *et. al*. (1989) reported that this period was of shorter duration at 30.9°C.

Post-oviposition Period

This period was always found to be on higher side onCitrus at all temperatures as compared to Sapota where this was of shorter duration at the temperatures described. The highest was 2.12±0.24 on Citrus at 29C followed by 2.00±0.00 on the same host at 25C. The minimum was was 1.00 0.11 on sapota at 25C.Puttaswamy and ChannaBasavanna (1982) reported the post-oviposition to be 3.30 days on Bhendi, 2.30 days on brinjal and 3.11 days on curcubits and 2.10 days on castor. The present observations fall within that range.

Fecundity

From the fecundity data it is clear that unmated females had shown higher fecundity on both the hosts and at all the temperatures excepting in case of sapota at 25°C. In case of mated females, the highest fecundity was 112.40±0.17 eggs on citrus at 29°C and it was more or less same on the same host at 27°C. But it was 49.00±0.18eggs at 25°C which was higher as compared to that of Sapota. In case of unmated females, the maximum fecundity was 199.00±0.14 eggs on Citrus at 29°C followed by 178.20±0.12 eggs and 55.95±0.12 eggs at 27°C and 25°C respectively on the same host. The corresponding figures on sapota were 27.29.10 0.77, 40.00 0.20 and 69.90 0.99 at 25°C, 27°C and 29°C respectively. The fecundity on Sapota was always lesser as compared to Citrus irrespective of temperatures. Puttaswamy and Channa Basavanna (1982) reported fecundity of 165.88±4.70 eggs and 132.00±28.54 eggs for mated and unmated females at temperatures around 28.4°C on potted French bean plants. Contrary to this, Singh *et al* (1989) reported that fertilized females had shown higher fecundity which was just opposite to the present observation.

Longevity

Irrespective of temperature, the females have higher longevity as compared to that of males. The highest longevity was found in case of female of 26.00±0.63 days at 29°C on citrus followed by 24.10±0.69 and 22.30±0.00 days at 27°C and 25°C both in case of Citrus. In case of Sapota, the highest longevity in female was 22.10±0.45 days at 29°C and the minimum was 16.70±0.13 days on the same host at 25°C. So it is quite clear that longevity was always higher at all temperatures on Citrus as compared to that onSapota proving that Citrus is a more preferred host. In case of male, the longevity did not follow any definite pattern with regard to different temperature and host as evident from the fact that at 25°C the longevity was lower in Sapota as compared to Citrus but at the other two temperatures the result was just reverse.

The maximum longevity in case of male was 17.80±0.74 days at 29°C on Sapota and minimum was also on the same host (12.00±0.45) days at 25°C. At 27°C and 29°C male longevity was higher on Sapota as compared to Citrus but at 25°C it was just reverse. Puttaswamy and ChannaBasavanna (1981) reported longevity as 27.98± 4.50 days and 32.14 ±4.08 days for male and female respectively while Singh *et al* (1981) reported longevity as 27.98 ±4.50 days and 32.14 ±4.08 days for male and female respectively while Singh *et al* (1989) reported male and female longevity as 5.60 and 5.40 days at 30.9C for male and 9.45 and 9.60 days at 30.9C and 33.01C respectively for female.

Percentage of larva attaining adulthood

Percentage of Larva attaining adulthood increased with increase of temperature as those were 84.21, 88.91 and 90.46% on Citrus at 25°C, 27°C and 29°Crespectively. In case of Sapota, though almost similar trend was seen at 25°C, 27°C but at 29°C this percentage abruptly lowered as compared to that at 27°C. The reason is very difficult to explain.

Percentage of Hatching

The percentage of egg hatchability was higher in case of citrus at both 27C and 29C being 70.00 and 84.10 compared to 67.66 and 73.16 on sapota respectively. But at 25C it lowered on citrus (52.71) as compared to sapota (60.74) and the reason is unexplainable.

Discussion

The analysis of overall result revealed that as both fecundity and longevity at all temperatures on citrus were higher compared to those on sapota, citrus appeared to be a preferred host though, the life cycle was compared at a shorter time on sapota. Recently, Kottalagi *et al* (2014) studied the biology of this mite on acid lime and reported 4.07 days for eggs, 2.32 days for larvae, 2.37 days for protonymph and 2.23 days for deutonymphs and the present data are more or less close to those. However differences found with the present study in case of fecundity which they reported to be 66.53 eggs/female. The pre-oviposition, oviposition and post-oviposition periods were reported to be 1.99 days, 10.54 days and 2.57 days respectively which were again closer to the present observations. The egg-adult period was 13.31 days and longevity of male and female was 8.58 days and 15.25 days respectively.

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