Advances in Environmental Biology, 10(7) July 2016, Pages: 311-314

AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/AEB/

Biology of mulberry thrips, (*Pseudodendrothrips mori* NIWA) in MR2 variety under TamilNadu climatic condition

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Received 22 May 2016; Accepted 18 July 2016; Available online 8 August 2016

ABSTRACT

In the past decade, mulberry thrips, Pseudodendrothrips mori (NIWA) (Thysanoptera: Thripidae), has become one of the most important sericultural pests in India. Certain biological attributes of this insect predispose it to be a direct pest to mulberry crop. A study of the biology of thrips, P.mori on MR2 mulberry variety was carried out in laboratory conditions on Tamil Nadu Agricultural University, during 2013-14. P. mori completed the life cycle from 20 to 23 days. Duration of life cycle including egg, two active feeding nymphal stages (L1 & L2), two relatively quiescent pupal stages, adult male and adult female stage was 5.97 ± 0.61, 3.21 ± 0.71, 4.10 ± 0.35, 1.20 ± 031, 2.71 ± 0.49, 5.05 ± 0.82 and 7.06 ± 0.40 days respectively. The average length and breadth of the egg, two nymphal instars, pre-pupa, pupa, adult male and adult female was 0.26±0.02 and 0.10±0.03, 0.60±0.06 and 0.18±0.01, 0.71±0.01 and 0.23±0.03, 0.70±0.14 and 0.23±0.05, 0.74±0.05 and 0.23±0.06, 0.76±0.04 and 0.22±0.04, 0.76±0.01 and 0.24±0.04 mm respectively. Adults and nymphs aggregate in leaves and mostly prefer for residing in lower surface of leaves. Females have a saw-like ovipositor, which they use to deposit eggs into the newly sprouting tender leaves.

KEYWORDS: *biology, nymphs, pupa, adults, oviposition, fecundity, tender leaves*

INTRODUCTION

Mulberry (*Morus* spp. L.) is a deep rooted, foliage yielding and fast growing perennial crop grown for its leaf and is the sole food for silk worm (*Bombyx mori* L.). Increased production of raw silk, to large extent, depends on timely supply of quality mulberry leaves to silkworms. It is therefore clear that mulberry leaf plays a dominant role in cocoon production as a source of nutrition to the silkworm. The quality of mulberry leaf is influenced by several factors such as variety, agronomic practices, biotic and abiotic components [3].

Inspite of adopting all the good agronomical practices, sometimes, the nutritive values are degraded due to diseases and pest damage. Insect pests take a heavy toll of mulberry. The thrips *Pseudodendrothrips mori* Niwa was found to be most dominant species in different parts of world and one of the important sap sucking insect pests of mulberry, belonging to the order Thysanoptera : Thripidae. It is a highly oligophagous pest and a native of northern hemisphere [7]. *P. mori* feed on fully expanded leaves and young tissue in the bud. Infested leaves dry out and have a stippled or silver flecked appearance. Small brownish specks of excrement will usually be noticed on the underside of the leaves [4].

In Tamilnadu thrips was considered as less important pests of mulberry earlier. But during January 2000, leaf damage by *P.mori* ranged from 14.02 to 49.14% in 24 mulberry genotypes [12]. The estimated leaf loss due to this pest is about 42.55 % (Subramanian, 2003) and 40 – 50 % of the total leaf produced [6].

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MATERIALS AND METHODS

The biology of *P.mori* in laboratory condition was carried out at 29±3°C, 70±5% RH and 16:8 h (L : D) photoperiod on MR2 mulberry variety in Tamil Nadu Agricultural University, Coimbatore during 2013–14. Mulberry plants were grown in earthen pots and kept free from the other pests by covering them with mylarflim. Adult thrips, *P. mori* were collected from the Mulberry field and released into these caged plants. Rearing of nymphal stages was carried out on leaf arenas kept on wet sterile surgical cotton wad in a petriplate (9 cm diameter) with few drops of distilled water. The adults were released in a glass cage and fresh mulberry leaf was provided on daily basis for egg laying. The incubation period was studied by transferring the oviposited leaves from the rearing tubes to sterile wet cotton wad in petriplate in the laboratory at 28 - 30°C temperature and 70 - 80 % relative humidity.

Mulberry leaves with freshly laid eggs from the rearing tubes were allowed to hatch and the period from egg laying till the emergence of first instar nymph was recorded. The nymphal instars were studied by transferring freshly hatched nymphs into the leaf arena on wet cotton wad in petriplates with the help of fine and moistened camlin hair bursh. Fresh leaf arena was provided once in two to three days. The number of instars and days required for completion of each instar were recorded by observing moulted or cast off skin.

The duration of the adult thrips from emergence till their death was recorded by enclosing them in the glass cage provide with mulberry leaf and fresh leaf was given on daily basis and the turgidity of the leaf was maintained by dipping the leaf stalk in a small beaker containing one per cent sugar solution. Observations were made on all the morphological stages viz., egg, nymphal and adult stages. The measurements (mm) on length and breadths of these stages were recorded in Leica microscope using software.

Oviposition sites were located by the technique outlined by Krishnamoorthy *et al*. [3]. The leaves from the plants exposed to oviposition by adult thrips were dipped in Carnoy's fixative (ethyl alcohol, chloroform and glacial acetic acid in 6:4:3 by volume) for 1 to 3 hours, Transferred to a Petriplate containing a thin film of malachite green for 1 to 2 minutes. Each leaf was then split and examined under a Leica microscope for the presence of stained eggs and the numbers of eggs were recorded. Studies on mating, pre-oviposition, oviposition, post-oviposition and longevity of adults were made by enclosing the adults on the host leaf.

RESULTS AND DISCUSSION

Life stages of the mulberry thrips include egg, two nymphal instars, two pupal instars, and the adult. All the stages were found on the hosts and the pupa is an inactive stage.

Eggs:

Females had an ovipositor with saw-like structure that helped to make an incision in plant tissue for egg laying. Eggs were placed singly in leaf tissue of midrib and side veins of mulberry leaf with help of a serrated ovipositor. Eggs were bean shaped with average measurement of 0.26±0.02 mm in length and 0.10±0.03 mm in breadth (Table 2) and they were whitish at deposition. A pair of red ocelli can be seen before hatching. These morphological traits and morphometry of the egg in present investigation are in close conformity with the findings of Naik [8] and Reddy and Narayanaswamy [11] who observed the similar morphological characters of egg and the morphometric observations.

The mean incubation period of thrips egg was 5.97 ± 0.61 days (Table 1) and is in agreement with the findings of Rangaswami *et al*. [10], Lim *et al.* [5], Naik [8], Reddy and Narayanaswamy [11] and Patil *et al.* [9], according to them the incubation period ranged from 6-8 days, 6-8 days, 5-7 days, 6-8 days and 5-7 days respectively.

Table 1: Biology of *P. mori* under laboratory conditions

Stage		Duration (in days) Mean ± SD
Egg		5.97 ± 0.61
Nymph	L1	3.21 ± 0.71
	L2	4.10 ± 0.35
Pupa	Pre-pupal period	1.20 ± 031
	Pupal period	2.71 ± 0.49
Total developmental period		17.19
Adult	Pre-oviposition period	2.57 ± 0.33
	Oviposition period	2.35 ± 0.20
	Post-oviposition period	1.85 ± 0.38
	Male	5.05 ± 0.82
	Female	7.06 ± 0.40
	Fecundity (nos.)	17.20 ± 0.45
Total life cycle		23.25 ± 3.09

*Mean of 10 observations

Table 2: Morphometry of different stages of *P. mori*

Life stages*	Mean ± SE	
	Length (mm)	Breadth (mm)
Egg	0.26±0.02	0.10±0.03
L1	0.60±0.06	0.18±0.01
L2	0.71±0.01	0.23±0.03
Prepupa	0.70±0.14	0.23±0.05
Pupa	0.74±0.05	0.23±0.06
Male	0.76±0.04	0.22±0.04
Female	0.76±0.01	0.24±0.04

*Mean of 10 observations

Nymph:

There were two nymphal stages. Nymph was yellowish cream color. L1 development was completed in 3.21 ± 0.71 days and L2 in 4.10 ± 0.35 days (Table 1). The newly hatched first instar nymph was initially colourless and transparent with a pair of compound eyes in dark red and then the nymph gradually changed to light creamish yellow as development continued to orange – yellow tint and the abdomen gradually tapered towards the posterior end. The nymph measured an average of length and breadth about 0.60±0.06 and 0.18±0.01 in L1; 0.71±0.01 and 0.23±0.03 in L2, respectively (Table 2). Seven-segmented antenna with light yellow at the base and brown tint at the end of two segments, directed backward over the head reaching the pro-thorax.

Prepupa and pupa:

There were two inactive, non-feeding stages called pre-pupa and pupa. The pre-pupal period with an average of 1.20 ± 031 day and pupal period with 2.71 ± 0.49 days (Table 1). The average length and breadth of prepupae and pupae was 0.70±0.14 and 0.23±0.05mm, and 0.74±0.05 and 0.23±0.06mm respectively (Table 2). The pre pupa was yellow coloured characterized by two pairs of short wing pads reaching almost to one third of abdominal segmented with forwarded antennae and stout legs. The pupa was robust with three red ocelli arranged in triangular manner over the vertex and wings were much longer.

Observations recorded on nymphal characters, prepupa, pupa, nymphal durations of each instar and morphometry are in close conformity with the findings of Rangaswami *et al*. [10], Lim *et al.* [5], Yey and Guz [14], Naik [8], Reddy and Narayanaswamy [11] and Patil *et al.* [9] who observed the similar nymphal, pre-pupa and pupal characters. However, the duration and morphometry of the nymphal instars, pre-pupa and pupa in the present findings had slight variations with the findings of earlier workers which might be attributed to the changes in experimental set up, environmental conditions prevailed during experimentation and the host variety used for the study which supplied nutrition.

Adults:

Adults were about 0.8 mm long. A pair of compound eyes with dark red, three simple eyes with attractive red colour and arranged in triangular shape in vertex. Antenna dark brown with 7 - 8 segments of which three segments at the end are fused and look like one segment and it is filiform type. Their body color ranged from pale yellow; males were exceedingly rare. Male insect body was darker; the wings cover the abdominal end while it is resting. Adult male and female development was completed in 5.05 ± 0.82 and 7.06 ± 0.40 days, respectively (Table 1). The average length and breadth of adult male and female was 0.76±0.04 and 0.22±0.04, 0.76±0.01 and 0.24±0.04 mm respectively (Table 2). Females live for 6 to 7 days and each of them could lay about 27.00 ± 1.56 eggs as observed in the present study which is in close agreement with the findings of Rangaswami *et al*. [10]. However, contrary to our findings, Reddy and Narayanaswamy [11] and Patil *et al.* [9] reported the fecundity of 12 - 18 eggs and 14 – 19 eggs per female and this variation in fecundity may be attributed to nutrition provided by the mulberry variety used in the study, environmental conditions during experimentation and experimental set up. The egg was inserted by the female in soft plant tissue; it was slightly protuberant and visible to the unaided eye.

Large populations are able to develop quickly under high temperature where there are many overlapping generations throughout the year. Reproduction of thrips species is mostly through a process called parthenogenesis in which females are able to reproduce without mating. As a result, populations consist of females at a ratio of 1 male per 1000 females [1,4].

The total life cycle from egg to adult emergence is with a mean of 23.25 ± 3.09 days (Table 1). The results of adult longevity and total life cycle are in close conformity with the results of Naik [8], Reddy and Narayanaswami [11] and Patil *et al.* [9]. However, Yey and Guz [14] and Jalali *et al*. [2] recorded the duration of total life cycle as 10-15 days and 29.95 days, respectively. These differences may be attributed to environmental variation prevailed during the study and nutrition provided by mulberry variety used in the study. And also the total life cycle may vary based on different climatic conditions. Yey and Guz [14] recorded longevity of adult as 10-15, 7-12, 8-9 and 6 days during May, June, July and August respectively. The life cycle

recorded was 26 - 34 days in spring and autumn and 16 - 23 days in summer [2]). The difference in duration might be attributed to the variations in weather parameters, host variety used in the study and variation in experimental set up under laboratory conditions.

Nymph and adults were found mainly on the underside of foliage. Mulberry thrips feed by piercing individual cells and sucking the contents. These cells lose their normal color, and when many adjacent cells were damaged, the tissue appeared as whitish spots or silvery spots or streaks. Infested foliage was disfigured by many silvery marks corresponding to groups of empty cells. In the open, populations might be very large during hot, dry weather [4]. Mulberry thrips prefered to feed on the young plant tissue on the newest emerged leaves. When the leaf grew, the previous damage produced by the thrips enlarged, leaving empty spaces in the surface of the leaf. The appearance of the damage was silvery patches. When damage was severe, these small patches could occupy most of the surface of the leaf and the plant could not adequately photosynthesize. The plant lost more water than normal through the damaged tissues and injured the plant easily.

REFERENCES

[1] Clausen, C.P., 1978. Introduced Parasites and Predators of Arthropod Pests and Weeds: A World Review. USDA, Agric. Handbook, 480: 545.
[2] Jalali, S.J., M. Hasheminia, K. Etebari and M. Shojaee, 2001. The laboratory biology and seasonal occurrence of mulberry thrips, Pseudodendrothirps mori (Niwa) (Thysonoptera; Thripidae) in Guilan Province, (Passikhan region). J. Entomol. Soc. Iran, 21: 87-100.
[3] Krishnaswami, S., M.K.R Noamani and M. Ahsan, 1970. Studies on the quality of mulberry leaves and silkworm crop production, Part-I, quality differences due to varieties. Indian J. Seric., 9: 1-10.
[4] Lewis, T., 1997. Thrips as Crop Pests. CAB international publication, pp: 740.
[5] Lim, S., Y. Kim, S. Lee, I. Rhee, J. Lim and B. Lim, 1990. Sericulture training. Manual, Agri. Service Bull., FAO, Rome, pp: 111.
[6] Mahadeva, A., 2011. Influence of thrips (Pseudodendrothrips mori) infestation on the biochemical constituents and photosynthetic pigments of mulberry (Morus spp.) Leaves. International Journal of Plant, Animal and Environmental Sciences, 1: 57-63.
[7] Mound, L.A., 1999. Saltatorial leaf-feeding Thysanoptera (Thripidae: Dendrothripinae) from Australia & New Caledonia, with newly recorded pests of ferns, figs and mulberries, Aust. J. Entomol., 38: 257-273.
[8] Naik, S.L., 1997. Bio ecology of thrips infesting mulberry. M.Sc. (Agri.) Thesis, Univ. of Agric. Sci., Bangalore, p: 77.
[9] Patil, J., J. Ashoka, M. Bheemanna, A.G. Sreenivas and A. Naganagoud, 2013. Bio-ecology of mulberry thrips, Pseudodendrothrips mori (NIWA). J. ent. Res., 37: 325-329.
[10] Rangaswami, G., M.N. Narasimhanna, K. Kasiviswanathan and C.R. Sastry, 1976. Manual on sericulture-1 mulberry cultivation. FAO, Agri. Service Bull., 15/1, Rome, pp: 150.
[11] Reddy, D.N.R. and K.C. Narayanaswamy, 2001. Thrips fauna and bio ecology of Pseudodendrothrips mori (Niwa) infesting mulberry. Proc. Natl. Sem. Mulb. Seri. Res., India, pp: 853-60.
[12] Subramanian, A., 2000. Screening of mulberry genotypes against the thrips, Pseudodendrothrips mori (Nawa). Paper presented at National workshop on Management of Sericultural Germplasm for Posterity, held on 26 and 27th July 2000 at Central Sericultural Germplasm Resources Centre, Hosur, Abstract. p: 20.
[13] Subramanian, A., 2003. Management of mulberry thrips Pseudodendrothrips mori (Nawa) by chemical method. Madras Agric. J., 90: 746-748.
[14] Yey, B. and F. Guz, 1990. Chemical control of the mulberry thrips Pseudodendrothripsmori (Niwa), Sericologia, 30: 389-92.