



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(4): 18-21

© 2020 JEZS

Received: 11-05-2020

Accepted: 13-06-2020

KA Biradarpatil

Ph.D Scholar (Agricultural Entomology), University of Agricultural Sciences, Dharwad, Karnataka, India

ST Prabhu

Professor and Head, Department of Agricultural Entomology, College of Agriculture Hanumanamatti, University of Agricultural Sciences, Dharwad, Karnataka, India

CK Venugopal

Professor, Department of Horticulture, College of Agriculture Dharwad, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:**KA Biradarpatil**

Ph.D Scholar (Agricultural Entomology), University of Agricultural Sciences, Dharwad, Karnataka, India

Studies on biology of yellow mite, *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae) on *Bt* cotton in laboratory condition

KA Biradarpatil, ST Prabhu and CK Venugopal

Abstract

Biology of yellow mite, *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae) on *Bt* cotton was studied under laboratory conditions during *khariif*-2017 and 2018 at the College of Agriculture, Dharwad. The results indicated that duration of incubation period, larval period and quiescent larval period was 2.05 ± 0.08 , 1.61 ± 0.07 and 1.47 ± 0.02 days respectively. So total development period was 5.13 ± 0.20 days whereas pre-oviposition, oviposition, post-oviposition period was 1.28 ± 0.05 , 7.95 ± 0.34 and 1.22 ± 0.08 days respectively. Adult longevity for male was 14.56 ± 0.39 days whereas the adult female lived for 15.59 ± 0.31 days. Mated female lays eggs singly on upper surface of leaf with an average of 35.50 eggs per female. The length and breadth of egg was $108.34 \pm 5.87 \mu\text{m}$ and $71.59 \pm 3.13 \mu\text{m}$ respectively. The length and breadth of larva was $228.09 \pm 6.51 \mu\text{m}$ and $122.22 \pm 3.64 \mu\text{m}$ respectively. The length and breadth of quiescent larva was $294.1 \pm 16.04 \mu\text{m}$ and $137.95 \pm 13.64 \mu\text{m}$ respectively. The length of female and male was $194.54 \pm 14.59 \mu\text{m}$ and $194.25 \pm 19.80 \mu\text{m}$ whereas breadth was $120.47 \pm 9.70 \mu\text{m}$ and $109.92 \pm 10.07 \mu\text{m}$ respectively.

Keywords: Cotton, biology, life cycle, yellow mite

Introduction

Cotton is harvested as 'seed cotton' which is then 'ginned' to separate the seed and lint. The long 'lint' fibres are further processed by spinning to produce yarn which is knitted or woven into fabrics. It accounts for 45 per cent of the world fiber and supplies 10 per cent of the world edible oil [10]. Despite the promising scenario in cotton, several factors are responsible for reduction in yield and quality deterioration of cotton in India. Insect pests form a vital factor. About 162 species of insects occur in cotton at various stages of growth of which 15 are key pests [15]. The development of transgenic cotton has resulted in an immense increase in the seed cotton yield and reduction in the number of insecticidal sprays from 3.10 to 1.17 and second generation *Bt* cotton has given solution to the bollworm complex to the large extent but at the same time they are susceptible to most of the sucking pests. In Karnataka, yellow mite, *Polyphagotarsonemus latus* is serious pest on chilli and causes considerable damage but in recent past years, it is assuming a major status on *Bt* cotton ecosystem also and causing puckering of leaves, reddening and stunted growth [7]. It was felt necessary to study the biology of *P. latus* on *Bt* cotton.

Material and Methods

Biology of *P. latus* was studied at Department of Agricultural Entomology, College of Agriculture, Dharwad under laboratory condition during *khariif* 2017 and 2018.

Stock culture

A stock culture of the mite, *P. latus* was maintained on cotton seedling. Quiescent larvae were collected from field and after the emergence it was released on to the cotton seedlings maintained in the laboratory.

Rearing unit

The rearing method used by [12] was followed with slight modification. The rearing unit consists of a petri plate of size 9.0 cm diameter and surgical cotton wad was cut into circular

pieces of size 8.0 cm diameter. Totally 10 rearing arenas were prepared and the cotton wad was maintained moist with distilled water. Fresh cotton leaf was cut into 2 cm diameter and was placed keeping ventral surface up on wet sterilized cotton wad in half filled water held in position to maintain the freshness of leaves for a longer period of time. The leaf discs were changed at three days interval and the mites were transferred to fresh leaf.

For transfer of the mobile adult mite, a camel hair brush of size 000 was used. Mites were accidentally jabbed while picking them up for transference. However the hair selected which was flexible enough to avoid injury on mite. The tip of the hair was thrust beneath the venter of mite from the caudal end until the entire body comes to rest on the hair before lifting the mite off the plant surface. To each rearing arena gravid female was released and before the actual study, the mites were subjected to pre test conditioning by rearing in a similar situation for four to five days to minimize the movement of adult mite away from the rearing leaf arena and getting entrapped in a wet cotton wad. Further, the edges of leaf arena were lined with vaseline to restrict the movement of mites out of leaf arena.

Determination of duration of different stages of *P. latus*

Ten gravid female mites from the mass culture were released on a fresh leaf bit maintained in turgid conditions and allowed to lay eggs overnight. Next day morning the numbers of eggs laid by the mites were counted and adults were removed from the leaf. It was kept in a BOD incubator at a temperature of $26 \pm 2^\circ\text{C}$ and 65 to 75 per cent relative humidity. After egg hatching, the newly emerged larvae were lifted carefully with the help of a moistened zero size camel hair brush and kept on leaf bits (2 cm^2) at the rate of one larva per leaf bit in a leaf arena. Such ten plates were maintained to study the biology. The development of various stages of the mite was observed at 8 hours interval with the help of stereobinocular microscope. The leaf bits were replaced regularly to avoid leaf deterioration and consequent poor nutrition.

The observation on life history included incubation period, duration of larva, quiescent stage, pre-oviposition, oviposition and post oviposition periods, fecundity, and longevity of adults were recorded with the help of stereobinocular microscope. The data recorded on duration of life stages were analysed to work out standard deviation.

Pre-oviposition period

Ten pairs of adult females were selected, since the quiescent stage of presumed female carried by the early emerged male released into petri plates containing fresh cotton leaf bits and observed for mating. After mating, the adults were lifted carefully with the help of a moistened zero size camel hair brush and kept on leaf bits (2 cm^2) and observed for egg laying at an interval of 8 hours.

Oviposition and post oviposition period

The oviposition period was recorded from the set containing ten pairs and observations recorded from first egg laid by the female to the last egg and total number of eggs laid by each female was recorded. The observation on post oviposition was also made at 8 hours interval.

Incubation period

Ten gravid female mites from the mass culture were released on a fresh leaf bit (2 cm^2) maintained in turgid conditions and allowed to lay eggs overnight. Emergence of larvae on

individual leaf arena was recorded at 8 hours interval and incubation duration was worked out.

Larval and quiescent duration

Ten freshly emerged larvae were collected with the help of a brush and transferred to fresh cotton leaf bit (2 cm^2) in a leaf arena individually. Observations were recorded on larval and quiescent duration at 8 hours interval.

Adult longevity

Adult longevity was computed by combining pre-oviposition, oviposition and post-oviposition period in case of female while in male, the longevity was worked out by counting the date of emergence of adult male till its death.

Total life span

Total life span of both male and female was worked out by combining developmental period and adult longevity.

Fecundity

Observation on the daily fecundity was made on ten adult females released in leaf arena. Number of eggs laid in each rearing arena was recorded daily and expressed in terms of number of eggs laid per female in its life cycle.

Results and Discussion

Pooled data on duration of different developmental stages and other biological parameters of *P. latus* on *Bt* cotton are presented hereunder.

Incubation period

Each adult female laid eggs singly near the midrib and side veins of leaf. Eggs were oval in shape with a flattened ventral surface and the dorsal surface had 6 to 7 longitudinal rows of tubercles and in each row 4 to 5 tubercles were noticed. Totally 26 to 30 tubercles were recorded with high refractive index. The opaque white colour of the egg remained unchanged till they hatched. The mean duration of egg was 2.05 ± 0.08 days with a range of 2.02 to 2.27 days (Table 1). Eggs measured $108.34 \pm 5.87 \mu\text{m}$ in length and $71.59 \pm 3.13 \mu\text{m}$ in breadth (Table 2).

Larval duration

The neonate larva immediately after its emergence was snow white in colour and gradually turned to translucent white and on the dorsal surface a distinct white stripe was noticed. The larva had three pairs of legs and in the beginning they were very sluggish in movement. The mean duration of larva was 1.61 ± 0.07 days with a range of 1.58 to 1.76 days (Table 1). The larva measured $148.09 \pm 6.51 \mu\text{m}$ in length and $92.22 \pm 3.61 \mu\text{m}$ in width (Table 2).

Quiescent larva

The fully matured larva turned to resting stage (quiescent) without shedding the skin and settled along the sides of midribs, lateral and sub lateral veins of the leaf. In the quiescent stage, the body was extended to its fullest length giving an elongated spindle shaped appearance. The matured quiescent larvae were often seen to be carried by the early emerged adult males. The duration of quiescent larva was 1.47 ± 0.02 days with a range of 1.44 to 1.50 days (Table 1). The quiescent larva measured $185.1 \pm 16.04 \mu\text{m}$ in length and $116.95 \pm 13.64 \mu\text{m}$ in width (Table 2).

Total developmental period

The total developmental time ranged from 5.02 to 5.58 days with a mean duration of 5.13 ± 0.20 days (Table 1).

Pre-oviposition: Pre oviposition period occupied a mean duration of 1.28 ± 0.05 days with a range of 1.21 to 1.34 days (Table 1).

Oviposition: Mean oviposition period lasted for 7.95 ± 0.34 days with a range of 7.12 to 8.15 days (Table 1).

Post-oviposition: Post oviposition period occupied a mean duration of 1.22 ± 0.08 days with a range of 1.07 to 1.29 days (Table 1).

Fecundity: Number of eggs laid by individual female in its life span was 35.50 eggs with a range of 26.45 to 43.60 (Table 1).

Total life cycle

The total life cycle of adult male from egg to natural death under laboratory conditions ($28 \pm 1^\circ\text{C}$) was 14.56 ± 0.39 days, while female survived for period of 15.59 ± 0.31 days. The total life span of both male and female on *Bt* cotton under laboratory conditions were ranged from 13.70 to 14.95 and 14.90 to 15.80 days respectively (Table 1). The adult female measured $217.54 \pm 14.59 \mu\text{m}$ in length and $120.47 \pm 9.70 \mu\text{m}$ in width, while male was $184.25 \pm 19.80 \mu\text{m}$ in length and $103.92 \pm 10.07 \mu\text{m}$ in width (Table 2).

Eggs were laid singly on the under surface of leaf, but under crowded conditions they were found on upper surface of leaf also. Majority of the eggs were laid near the midrib and veins of leaf. The duration of egg (incubation period) ranged from 2.02 to 2.27 days with a mean duration of 2.05 days and the

present findings are in accordance with the report of [11, 3, 5, 6, 2] and [9].

The mean duration of larva and quiescent larva (resting) stage was 1.61 and 1.42 days, respectively. The pre-oviposition, oviposition and post-oviposition periods lasted for 1.28, 7.95 and 1.22 days, respectively. It is in line with the earlier findings of [14] who reported that the incubation period ranged from 2.02 to 2.38 days in the *Bt* cotton crop. Similar results were also observed by [4] in chilli, [13] in cotton, [1] and [16] in chilli crop.

The fecundity was 26.45 to 43.60 eggs with a mean of 35.50 eggs per female lifespan. The present findings are in conformity with that of [14] in *Bt* cotton crop who reported 29.06 to 46.74 eggs per female. The mean length of egg, larva and quiescent larva was $108.34 \mu\text{m}$, $148.09 \mu\text{m}$, and $185.10 \mu\text{m}$, respectively whereas mean breadth of egg, larva and quiescent larva was $71.59 \mu\text{m}$, $92.22 \mu\text{m}$ and $116.95 \mu\text{m}$. Adult male measured $184.25 \mu\text{m}$ and $103.92 \mu\text{m}$ and female measured $217.54 \mu\text{m}$ and $120.47 \mu\text{m}$ length and width, respectively. The females lived for a period of 15.59 days, while the male lived for 14.56 days only. This is also in accordance with [11] who reported that females were about 1.5 mm long and males are slightly shorter and broader [8]. observed similar results who reported that the male measured $120 \mu\text{m}$ in length and $70 \mu\text{m}$ in breadth in bell pepper.

Conclusion

Adult female laid eggs singly on the under surface of leaf, but under crowded conditions they were found on upper surface of leaf also. Majority of the eggs were laid near the midrib and veins of leaf. Adult female lay with an average of 36 eggs in its life cycle. Adult female was larger than male and occasionally male carry the quiescent larvae. Male and female completed its life cycle in 14 to 16 days.

Table 1. Biology of yellow mite, *Polyphagotarsonemus latus* on *Bt* cotton under laboratory condition

Stages	Mean duration (Days)			Range (Days)
	2017	2018	Pooled \pm SD	
Incubation period	2.04	2.06	2.05 ± 0.08	2.02-2.27
Larvae	1.60	1.63	1.61 ± 0.07	1.58-1.76
Quiescent larvae	1.48	1.46	1.47 ± 0.02	1.44-1.50
Total development period	5.12	5.15	5.13 ± 0.20	5.02-5.58
Pre-oviposition	1.27	1.29	1.28 ± 0.05	1.21-1.34
oviposition	7.95	7.95	7.95 ± 0.34	7.12-8.15
Post-oviposition	1.21	1.24	1.22 ± 0.08	1.07-1.29
Total life span male	14.50	14.62	14.56 ± 0.39	13.70-14.95
Total life span female	15.55	15.63	15.59 ± 0.31	14.90-15.80
Fecundity	34 eggs / female	37 eggs / female	35.50 eggs / female	26.45-43.60

Table 2. Morphometry of various stages of yellow mite, *Polyphagotarsonemus latus* under laboratory conditions

Stages	Mean length (μm)				Mean breadth (μm)			
	2017	2018	Pooled \pm SD	Range	2017	2018	Pooled \pm SD	Range
Egg	107.46	109.22	108.34 ± 5.87	100.32-117.45	70.83	72.36	71.59 ± 3.13	65.30-74.16
Larvae	144.35	149.83	148.09 ± 6.51	145.28-159.32	89.85	93.60	92.22 ± 3.61	89.29-95.65
Quiescent larvae	184.76	187.44	185.10 ± 16.04	181.4-189.50	115.56	116.35	116.95 ± 13.64	109.58-121.69
Female	215.15	217.93	217.54 ± 14.59	210.64-223.60	121.16	119.78	120.47 ± 9.70	95.32-124.25
Male	182.82	185.68	184.25 ± 19.80	178.21-188.25	103.38	104.46	103.92 ± 10.07	96.76-107.80

References

- Ahmed K, Hanumanth Rao V, Rao NHP, Purnachandra Rao P. Biology of yellow mite *Polyphagotarsonemus latus* (Banks) on chillies. Pestology. 2000; 24(2):20-22.
- Ashraf A, Montasser Ahmed M, Taha Hanafy, Gamal M Hassan. Biology and control of the broad mite

- Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae) on pepper and cucumber plants. Int J Envir Sci Engineering. 2011; 1:26-34.
- Bansi AB. Studies on the biology of yellow mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) thrips, *Scirtothrips dorsalis* Hood

- (Thysanoptera: Thripidae) and their incidence on chilli in Tungabhadra Project (TBP) area. *M.Sc.(Agri.) Thesis, Univ. Agric. Sci., Dharwad, 2004.*
4. Borah DC. Bio-ecology of *Polyphagotarsonemus latus* (Banks) and *Scirtothrips dorsalis* (Hood) infesting chilli and their natural enemies. *Ph.D. Thesis, Uni. of Agril. Sci., Dharwad, 1987, 234.*
 5. Eswarareddy SG, Krishna Kumar NK, Ashok Kumar CT. Seasonal incidence of yellow mite *Polyphagotarsonemus latus* (Banks) on sweet pepper grown under protected and open field cultivation. *J Acarol. 2007; 16(1-2):65-67.*
 6. Hosamani AC, Bansi AB, Bheemanna M. Biology of chilli mite, *Polyphagotarsonemus latus* (Banks). *J Acarol. 2007; 16(1-2):68-69.*
 7. Hosamani AC, Bheemanna M, Sharanabasappa Hanchinal SG, Shivaleela. Incidence of yellow mite on *Bt* cotton National Symposium on *Bt* cotton: Opportunities and Emerging Threats, CICR, Nagpur, 2009, 65-69.
 8. Hugon R. Biologie et ecologie de *Polyphagotarsonemus latus* (Banks) ravageur sur agrumes aux Antilles. *Fruits. 1983; 38:635-646.*
 9. Kamruzzaman ASM, Alam MZ, Miah MRU. Bionomics and fertility life table of the yellow mite, *polyphagotarsonemus latus* (banks) (acari: tarsonemidae) in jute (*corchorus olitorius* l.) at different temperature-humidity. *Mun. Ent. Zool. 2013; 8:223-235.*
 10. Kannan M, Uthamasamy S, Mohan S. Impact of insecticides on sucking pests and natural enemy complex of transgenic cotton. *Curr. Sci. 2004; 86:726-729.*
 11. Lavoipierre MMJ. *Hemitarsonemus latus* (Banks), a mite of economic importance new to South Africa. *J Entomol. Soc. Southern Africa. 1940; 3:116-123.*
 12. Mc Murtry JA, Badii MH, Johnson HG. the broad mite *Polyphagotarsonemus latus* as a potential prey for phytoseiid mite in California. *Entomophaga, 1984; 29(1):83-86.*
 13. Marineide Rosa, Vieira Luiz, Gonzaga Chiavegato. Biology of *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) in Cotton, ESALQ / USP, 1997.
 14. Ramya PR. Bio-ecology and management of yellow mite, *Polyphagotarsonemus latus* (banks) on *Bt* cotton. *M.Sc. (Ag.) Thesis, Univ. Agric. Sci., Raichur, 2012, 65.*
 15. Rathore PS. Tech. and Managt. of Field Crop Prod., Agrobios (India) Publishers Jodhpur, 2005.
 16. Srinivasulu P, Naidu VG, Rao NV. Biology and bionomics of chilli mite, *Polyphagotarsonemus latus* (Banks) on chilli. *J. Applied Zool. Res. 2002; 13(1):19-21.*