Website : www.asthafoundation.in
Progressive Research : An International Journal
Vol 19 (2) : 108-112 (July-2024), Print ISSN : 0973-6417, Online ISSN : 2454-6003
Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India

Biology of Yellow Spider Mite, *Polyphagotarsonemus latus* (Banks) on Cluster Bean

M.K. Kanani[1*], K.D. Shah[2], J.R. Talaviya[2], V.C. Gadhiya[3] and V.A. Savaliya[3]
[1]*Agricultural Research Station, JAU, Amreli-365610*
[2]*College of Agriculture, Junagadh Agricultural University, Junagadh-362001*
[3]*College of Agriculture, Junagadh Agricultural University, Mota Bhandariya-365610*
**Corresponding Author Email : mkkanani@jau.in*

Abstract

The investigation on biology of *Polyphagotarsonemus latus* on cluster bean was carried out at College of Agriculture, Junagadh Agricultural University (JAU), Mota Bhandariya during summer 2022 at average temperature of 28.77 ± 1.32 °C and 66.91 ± 12.97 per cent relative humidity under laboratory condition. The creamy whitish and elongated eggs were laid singly mostly on the lower side of the leaf near the veins having the incubation period of 2.35 ± 0.49 days. After this, yellowish white larva hatched out and turned to translucent white in growth (smaller & tapered male and larger & oval female) and lasted for 1.25 ± 0.30 days. The quiescent larval stage was of 1.18 ± 0.19 days and total developmental time of *P. latus* was of 4.78 ± 0.33 days. The males live shorter (8.48 ± 0.59 days) and female live longer (0.14 ± 0.53). Pre-oviposition period occupied the 1.34 ± 0.10 days while, mean oviposition period was lasted for 7.54 ± 0.33 days. The post-ovipositional period was of 1.25 ± 0.12 days and total life cycle of adult male was 13.26 ± 0.92 while, female was 14.92 ± 0.86 days. Individual females can lay 33.79 ± 8.41 eggs per day.

Key words *: Biology, yellow spider mite, P. latus, cluster bean.*

Introduction

Cluster bean, *Cyamopsis tetragonoloba* (Linnaeus) is an annual legume crop mostly grown under resource constrained conditions in arid and semi-arid regions (1) and it is believed to be native of Tropical Africa and India also (2). In India, cluster bean crop is cultivated mainly during *Kharif* season. It occupied an area of 27.07 lakh hectare with a total production of 13.02 lakh tons of guar seeds during 2020-21 in the country (3). Cluster bean is native to the India and has been cultivated in the country for ages and is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat, Punjab and to limited extent in the states of Uttar Pradesh and Madhya Pradesh.

The cluster bean crop is attacked by various insect pests (4) during its different growth stages and causing heavy yield losses. The major insect pests recorded on cluster bean are Aphid, *Aphis craccivora* (Koch); Jassid, *Empoasca kerri* (Pruthi); Thrips, *Megaleurothrips distalis* (Karny); Whitefly, *Bemisia tabaci* (Gennadiua); Mite, *Polyphagotarsonemus latus* (Banks), Gall midge, *Asphondylia cyamopsil* n. sp and Stem weevil, *Alcidodes bubu* (Fab.) (5). Among the various pests attacking the crop, the mite, *P. latus* (Banks) (Order: Acarina) is an important non insect pest at different crop growth stages (6). Acarines are of considerable economic significance and can threaten the sustainability of agro-ecosystems. Family Tarsonemidae includes more than 500 world widely distributed mite species (7).

Plant-feeding mites play an important role as agricultural pests of fruits, vegetables, forage crops, ornamentals and other agricultural crops. In case of mite, both nymph and adults are found to suck cell sap from the leaves. They prefer upper side of the leaves for feeding but in case of severe infestation, both the sides are covered. The damage is done by rasping the surface of the leaves and feeding on the exuding juice. The damage is severe under drought stress, when complete drying of the foliage can occur. According to (8), the mite infested leaves show stippling, followed by yellowing and finally turns almost white. Such plant show extensive webbing and tips of the plants may appear reddish ultimately the whole plant may withers and dies. The yield infestation relationship of cluster bean revealed that every unit increase in pest population resulted in a yield loss of 3.54-4.68 kg /ha (9). Failure to control them in the initial stages was reported to cause yield loss to the extent of 73.86 per cent (10).

Materials and Methods

Biology of yellow spider mite, *Polyphagotarsonemus latus* (Banks) infesting cluster bean was carried out at College of Agriculture, JAU, Mota Bhandariya, Amreli during summer 2022.

Maintenance of stock culture of *P. latus* : Stock culture of the mite, *P. latus* was maintained on the leaves of cluster bean. Initially heavily infested leaves having mite infestation were collected from instructional farm, College

Received : May-2024; Revised : May-2024; Accepted : May-2024

Table-1 : Duration of various life stages of yellow spider mite, *P. latus* on cluster bean.

Sr. No.	Stages*	Mean duration (days)	Range (days)
1.	Incubation period	2.35 ± 0.49	1.80 – 3.00
2.	Larval period	1.25 ± 0.30	1.00 – 1.90
3.	Quiescent larvae stage	1.18 ± 0.19	0.82 – 1.48
4.	Total development period	4.78 ± 0.33	3.62 – 6.38
5.	Adult period Male	8.48 ± 0.59	7.40 – 9.60
	Female	10.14 ± 0.53	9.20 -11.20
6.	Pre-oviposition period	1.34 ± 0.10	1.10 - 1.48
7.	Oviposition period	7.54 ± 0.33	7.10 – 8.20
8.	Post oviposition period	1.25 ± 0.12	0.80 – 1.35
9.	Total life span male	13.26 ± 0.92	11.02 – 15.98
10.	Total life span female	14.92 ± 0.86	12.82 – 17.58
11.	Fecundity**	33.79 ± 8.41	25.20 – 47.25

* Mean number of 20 observations, **Number of eggs laid per female.

of Agriculture, JAU, Mota Bhandariya, Amreli for mass multiplication.

Rearing method used for *P. latus* : The rearing method used by (11) 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 20 rearing arenas were prepared and the cotton wad was maintained moist with distilled water. Fresh cluster bean 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. The gravid females were used to study the different parameters for which, a fine hair brush was used and care was taken that no female was injured during released into the Petri plates (Plate 1). Further, the edges of leaf arena were lined with petroleum jelly to restrict the movement of mites out of leaf area.

Determination of duration of different life stages of *P. latus* : Ten gravid female mites from the mass culture were released on a fresh leaf bit (2 cm) maintained in turgid conditions and allowed to lay eggs overnight. Next day morning the number of eggs laid by the mites was counted and adults were removed. After egg hatching, the newly emerged larvae were lifted carefully with the help of a moistened zero size hair brush and kept on leaf bits (2 cm^2) at the rate of one larva per leaf bit in a leaf arena. Such twenty plates were maintained to study the biology. The development of various stages of the mite was observed at 12 hours interval with the help of stereo binocular 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 stereo binocular microscope (Plate-1). The data recorded on duration of life stages were analyzed to work out standard deviation.

Oviposition and post oviposition period : The oviposition period was recorded from set containing twenty 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 12 hours interval.

Incubation period : Twenty 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 area was recorded at 12 hours interval and incubation duration was worked out.

Larval and quiescent duration : Twenty freshly emerged larvae were collected with the help of a brush and transferred to fresh cluster bean leaf bit (2 cm^2) in a leaf arena individually. Observations were recorded on larval and quiescent duration at 12 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 twenty adult females released in ten leaf area. Number of eggs laid in each rearing area was recorded daily and expressed in terms of number of eggs laid per female per day.

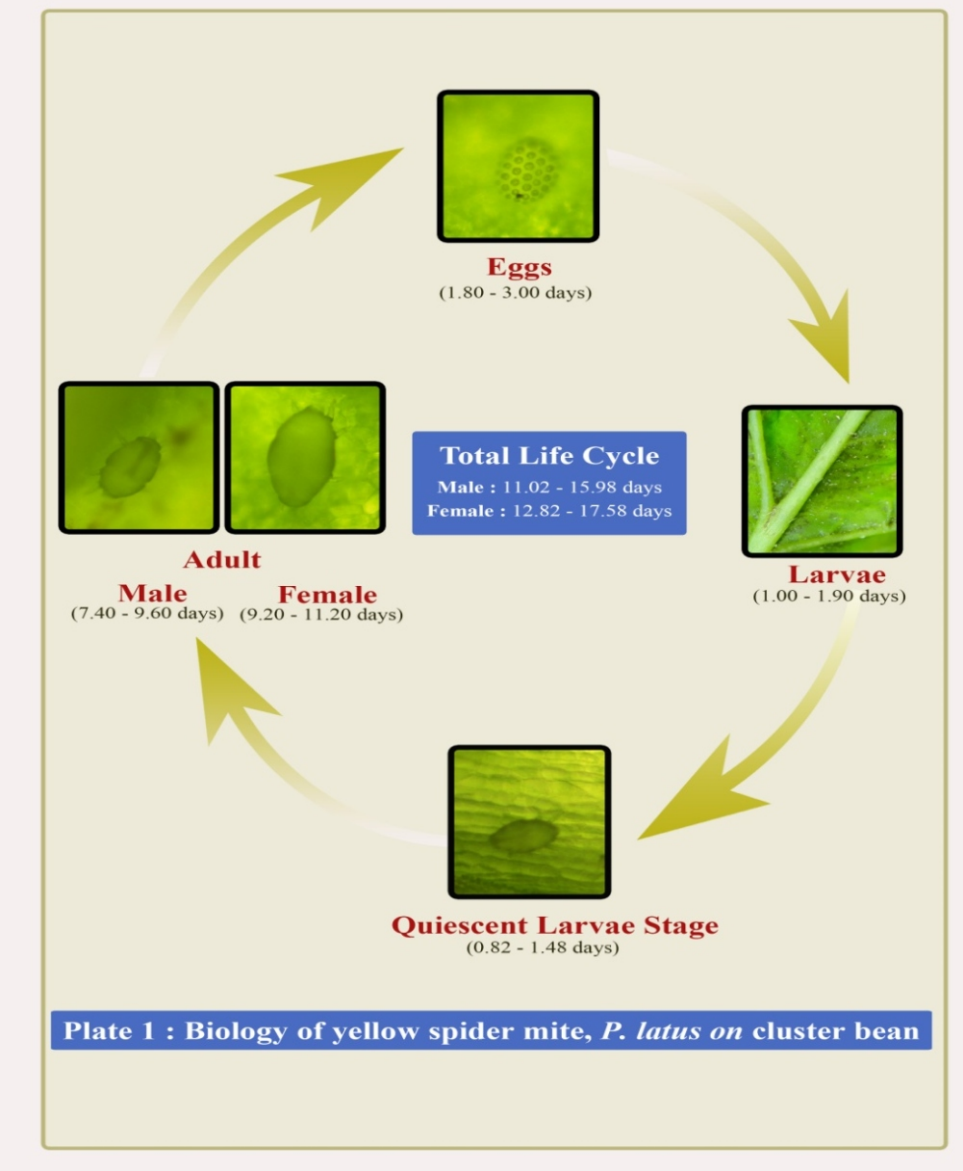

Plate 1 : Biology of yellow spider mite, *P. latus on* cluster bean

Results and Discussion

The biology of *Polyphagotarsonemus latus* on cluster bean was carried out during summer 2023 under the average temperature of 28.77 ± 1.32 °C and 66.91 ± 12.97 per cent relative humidity at Under Graduate Laboratory, Department of Entomology, College of Agriculture, JAU, Mota Bhandariya, Amreli. The duration of various stages of *P. latus* was recorded under the laboratory conditions are given in Table-1. The yellow spider mite, *P. latus* in their development from hatching to adult passed through only one larval stage before becoming an adult. Thus, four stages were observed in biology of *P. latus viz.* egg, larva, quiescent and adult male and female (Plate-1).

Incubation period : The eggs were laid singly mostly on the lower side of the leaf near the veins. The freshly laid eggs were creamy whitish in colour and elongated in shape. They had a convex dorsal surface and a flattened ventral surface that is attached to the leaf surface. The dorsal surface of eggs was covered with prominent shiny white coloured protuberances that were arranged in 6-7 distinct longitudinal rows in rhombic fashion. The incubation period was varied from 1.80 to 3.00 days with an average of 2.35 $\pm$ 0.49 days (Table-1). Similar ovipositional sites, shape, size, colour and incubation period were observed by (12, 13).

Larval stage : The newly hatched larvae larva immediately after its emergence was yellowish 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 male and female larvae could be distinguished by their size and shape before entering into quiescent stage. The male larvae

were comparatively smaller, tapering posteriorly, while the female larvae were larger and oval in shape. This stage was lasted from 1.00 to 1.90 days with an average of 1.25 ± 0.30 (Table-1). Similar larval stages and periods were reported by (13) on pepper and cucumber (2.20 ± 0.24 and 1.89 ± 0.22, respectively), (12) on capsicum (0.98 ± 0.18).

Thus, only one active feeding immature stage *i.e.,* larva was recorded under the present study as against nymphal instars reported by (14) while working on biology of *P. latus* on chilli at Coimbatore. (12, 13) reported only one larval stage in entire life cycle of *P. latus.*

Quiescent stage : The fully matured larva entered to resting stage (quiescent) without shedding the skin and settled along the sides of midribs, lateral and sub lateral veins of the leaf. During this 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 1.18 ± 0.19 days with a range of 0.82 to 1.48 days (Table-1). The quiescent stage of *P. latus* lasts for 0.75 ± 0.22 reported by (12), 0.70 ± 0.01 days (15) are in consonance with present findings. While (13) observed quiescent stage from 2.75 to 3.0 days and 1.47 ± 0.02 days (16).

Development period (from egg to adult emergence) : The total developmental time of *P. latus* was ranged from 3.62 to 6.38 days with a mean duration of 4.78 ± 0.33 days (Table-1). These findings are more or less in agreement with 5.87 days on chilli (Hosamani, 2007), 4.1 ± 0.1 days for females and 4.1 ± 0.3 days for male on cotton (Vieira, 2017) and 5.13 ± 0.20 days on *Bt* cotton (16).

Adult period : The quiescent stage developed into adult male or female having four pairs of legs. The adults were shiny and translucent with yellowish tinge. Males were translucent with dorsal white patch, which gradually turned to faint white line along dorsomedian line with brownish appearance. They are active and fast moving than female. The females were broad and elliptical in shape. While, males narrowed posteriorly and had papilla projection on the tip of the abdomen to hold quiescent female.

The males live shorter (7.40 – 9.60, av. 8.48 ± 0.59 days) and this period for female was 9.20 to 11.20 days, av. 10.14 ± 0.53 days. This indicates that the female lived longer than male. (17) reported that adult male and female lived for 11-14 days and 7-8 days on bean leaves. The longevity was 10.0 ± 1.5 days for females and 8.8 ± 1.1 days for males on cotton (18), longevity period 13.45 days for female and 8.50 days for male on jute (15) and longevity for male was 14.56 ± 0.39 days whereas the adult female lived for 15.59 ± 0.31 days on *Bt* cotton (16). Almost similar observations were made by (19) who reported that the adults were yellow, female oval, the abdomen of males narrowed posteriorly and the end having papillae to hold the quiescent female.

Sexual behavior : Adult males were generally seen congregating near quiescent females. They usually carried the quiescent female on its abdominal projection at the tip, which were near to emergence as an adult. This phenomena of carriage of female by male lasted for about half an hour. Mating took place sown after the emergence of female from quiescent stage. Mating between male and female took place in opposite direction (tail to tail position) at a slight angle keeping abdominal tip of both sexes joined together.

Pre-oviposition, oviposition and post-oviposition period : The female after emergence laid eggs after a lapse of certain time, the period was mentioned as pre-oviposition period. Pre oviposition period occupied a mean duration of 1.34 ± 0.10 days with a range of 1.10 to 1.48 days (Table-1). Similar findings of pre-oviposition period 1.28 ± 0.05 days with the range of 1.21 to 1.34 days were noted by (16) also observed pre-oviposition period with an average of 1.15 days and this is in agreement with present findings.

The period of egg laying *i.e.*, after the pre-oviposition till the termination of egg laying was considered as oviposition period, mean oviposition period lasted for 7.54 ± 0.33 days with a range of 7.10 to 8.20 days. More or less similar findings were observed by 6.30 days on chilli (Srinivasulu *et al.,* 2002), 7.05 days on chilli (Hosamani, 2007), 6.64 days on pepper (20), 7.95 ± 0.34 days on *Bt* cotton (16) and 7.90 days on capsicum (17).

The period between last egg laid and death of female adult individual was considered as post-ovipositional period. Post oviposition period occupied a mean duration of 1.25 ± 0.12 days with a range of 0.80 to 1.35 days. The Post oviposition period of 1.17 days (21), 1.78 days (22) and 1.22 ± 0.08 days (16).

Total life cycle : The total life cycle of adult male from egg to natural death under laboratory conditions was 13.26 ± 0.92 days, while female survived for period of 14.92 ± 0.86 days. The total life span of both male and female was ranged from 11.02 to 15.98 days and 12.82 to 17.58 days, respectively on cluster bean under laboratory conditions (Table-1). The present findings are in accordance with 10.0 ± 1.5 days for females and 8.8 ± 1.1 days for males (Vieira, 2017) and 13.45 days for female and 8.50 days for male (15).

Fecundity : There was no apparent variation in the fecundity as affected by mating. Number of eggs laid by

individual female in its life span was 33.79 ± 8.41 eggs with a range of 25.20 to 47.25 (Table-5). The present findings are also supported by 19 to 40 eggs (23), 35.50 eggs (16) and 28.60 eggs (15).

Conclusion

The adult female laid creamy whitish and elongated eggs were singly mostly on the lower side of the leaf near the veins having the incubation period of 2.35 ± 0.49 days. After this, yellowish white larva hatched out and turned to translucent white in growth (smaller & tapered male and larger & oval female) and lasted for 1.25 ± 0.30 days. The quiescent larval stage was of 1.18 ± 0.19 days and total developmental time of *P. latus* was of 4.78 ± 0.33 days. The males live shorter (8.48 ± 0.59 days) and female live longer (0.14 ± 0.53). Total life cycle of adult male was 13.26 ± 0.92 while, female was 14.92 ± 0.86 days. Individual females can lay 33.79 ± 8.41 eggs per day.

References

1. Kumar D. (2005). Status and direction of arid legumes research in India. *Indian Journal of Agricultural Sciences,* 75: 375-391.
2. Joshi T., Kumar S., Arya L., Tiwari Sushma and Amritbir Riar (2023). Distance only brings you closer: application of issr markers to analyze molecular relationships in roses (*Rosa spp.*)—The symbol of love. *Frontiers in Crop Improvement,* 11(2): 69-77.
3. Anonymous (2022). Agricultural Statistics at a Glance 2022 published by Economics & Statistics Division, Department of Agriculture and Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India. pp. 66. Source: https://desagri.gov.in/document-report-category/agriculture-statistics-at-a-glance/ accessed on 05/06/2023.
4 Dhaliwal J.S. (1980). Important insect pests of guar in the Punjab state. *Guar Newsletter,* 1: 18.
5. Kumar R., Sharma R.K., Sinha S.R., Sharma K. (2018). Population dynamics of *Bemisia tabaci* in okra. *Indian Journal of Entomology*, 80 (3): 605-608.
6. Nanda S.R., Mahto J., Prasad K., Mahto C.S. and Chakraborty Manigopa (2023). Stability of faba bean genotypes under terminal heat. *Frontiers in Crop Improvement,* 11(2): 92-97.
7. Zhang Z.Q. (2003). Mites of Greenhouses: Identification, Biology and Control. *CABI Publishing,* Cambridge, UK, 244 pp.
8. Amin, P.W. (1988). Insect and mite pests and their control. In groundnut (ed. Reddy. P.S.) ICAR, New Delhi. pp. 393-452.
9. Sharma K.K.. Yadav H.S. and Chandra A. (2000). A note on seasonal activity of pod borer complex on dolichos bean. *JNKV Research Journal,* 33(1/2): 74-77.
10. Pandey S.N., Singh R., Sharma V.K. and Kanwat P.M. (1991). Losses due to insect pests in *kharif* pulses. *Journal of Entomological Research,* 53(4): 629-631.
11. Mc Murtry J.A., Badii M.H. and Johnson H.G. (1984). The broad mite *Polyphagotarsonemus latus* as a potential prey for phytoseiid mite in california. *Entomophaga*, 29(1): 83-86.
12. Shukla A. and Radadia G.G. (2018). Biological attributes and seasonal incidence of yellow mite, *Polyphagotarsonemus latus* Banks (Acari: Tarsonemidae) on polyhouse capsicum. *Journal of entomology and zoology studies,* 6(2): 411-415.
13. Ashraf A.M., Ahmed M.T., Hanafy A.R.I. and Gamal M.H. (2011). Biology and control of the broad mite *Polyphagotarsonemus latus* (Banks). *International Journal of Environmental Science and Engineering,* 1: 26-34.
14. Karuppuchamy P. and Mohanasundaram M. (1987). Biocenology and control of chilli muranai mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae). *Indian Journal of Plant Proection,* 15(1): 1-4.
15. Islam M.N., Islam K.S., Mahbuba Jahan and Rahman M.S. (2020). Bionomics of the Jute yellow mite, *Polyphagotarsonemus Latus* (Banks) (Acari: Tarsonemidae) in Jute (*Corchorus Olitorius* L.) at different temperature - humidity. *Acta Scientifica Malaysia,* 4(1): 27-33.
16. Biradarpatil K.A., Prabhu S.T. and Venugopal C.K. (2020). Studies on biology of yellow mite, *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae) on *Bt* cotton in laboratory condition. *Journal of Entomology and Zoology Studies,* 8(4): 18-21.
17. Scheunhoven A.V., Piedrahita J., Valderrama R. and Galvez G. (1978). Biology, injuriousness and control of the tropical mite, *Polyphagotarsonemus latus* (Banks) (Acarine: Tarsonemdae) on Beans. *Turialba*, 28(1): 77-80.
18. Vieira A.R. (2017). Biology of *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae) on cotton. *Pesquisa Agropecuaria Brasileira*, 33(9): 1437-1442.
19. Senapati S.K. and Ghose S.K. (1992). Life history, composition and distribution of the yellow and red spider mite population on jute leaves. *Annals of Entomology,* 10(1): 13-17.
20. Badawi A., Abou Awad, Gafez S.M and Farahat A.M. (2014). Bionomics and control of broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae). *Archives of Phytopathology and plant protection*, 47(5): 631-641.
21. Srinivasulu P., Naidu V.G., Rao N.V. and Babu K.H. (2002). Seasonal occurance of chilli mite, *P. Latus* (Banks) with reference to biotic and abiotic factors. *Journal of Applied Zoological Researches*, 13(2/3): 142-144.
22. Hosamani A.C. (2007). Management of chilli murda complex in irrigated ecosystem, *Ph.D. thesis, University of Agricultural Sciences, Dharwad.*
23. Bansi A.B. (2004). Studies on the biology of yellow mite, *Polyphagotarsonemus latus* (Bank) (Acari: Tarsonemidae) thrips, *scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) and their incidence on chilli in Tungabhadra project (TBP) area. *M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad.*