Mysore J. Agric. Sci., 59 (1) : 87-96 (2025)

Varietal Response and Spatial Distribution of Thrips and Yellow Mite, *Polyphagotarsonemus latus* (Banks) on Mulberry

Jayashree[1], K. C. Narayanaswamy[2], Manjunath Gowda[3],
C. Chinnamade Gowda[4] and K. S. Jagadish[5]
[1,2&3]Department of Sericulture, [4]Department of Apiculture, College of Agriculture, UAS, GKVK, Bengaluru - 560 065
[5]AINP Agricultural Acarology Unit, UAS, GKVK, Bengaluru - 560 065
e-Mail : jayashreeg02@gmail.com

Authors Contribution

Jayashree :
Conceptualization of research, data collection & curtion and draft manuscript prepration

K. C. Narayanaswamy; Manjunath Gowda; C. Chinnamade Gowda & K. S. Jagadish :
Designing of the experiment, guidence, supervision and editing

Corresponding Author :
Jayashree

Received : October 2024
Accepted : December 2024

Abstract

Varietal response and spatial distribution of thrips and yellow mite on eleven mulberry varieties (RFS175, MR2, S13, S34, S36, V1, DD, S54, Mysore Local, Tr10 and M5) were studied in the Department of Sericulture, UAS, GKVK, Bengaluru, during 2023-24. Results of the study revealed that both thrips and yellow mite population reached the peak at 45 days after pruning (DAP) on all the varieties studied. Out of eleven varieties of mulberry screened against thrips and mite, none was found completely free from the attack of pests, although they differed significantly in their degree of pest number to harbour. At 15, 30, 45 and 60 DAP the incidence of thrips was recorded in the range of 1.45-7.09, 3.77-12.01, 4.07-14.84 and 3.59-12.16 thrips per leaf, respectively. Mulberry varieties that contained highest number of thrips were MR2 and V1. Top two varieties, which recorded less number of thrips were Mysore Local and M5. In case of yellow mite, the incidence was in the range of 2.41-10.53, 10.82-36.32, 10.77-43.46 and 6.27-29.65 mites/cm^2 at 15, 30, 45 and 60 DAP, respectively. The two varieties showing more number of yellow mites were V1 and MR2 and the two varieties showing less number of mites were Tr10 and M5. Spatial distribution pattern of thrips and mites on mulberry plants revealed that both thrips and mite population was more dense on the younger leaves, which then became sparse on the older leaves below. The highest thrips and mite population was recorded on fourth leaf (12.08 thrips and 33.77 mites/cm^2, respectively) and negligible thrips and mite population was recorded from the 8th leaf and onwards.

Keywords : Mulberry varieties, Thrips, Mites, Spatial distribution

Being a perennial evergreen and high biomass producing plant, mulberry facilitates ideal conditions for uninterrupted and rapid multiplication of pests which is reaching alarming proportions. More than 300 species of insect and non-insect species are reported to infest mulberry in varying intensities during different stages of crop and seasons (Reddy and Narayanaswamy, 1999). The pest infesting mulberry are grouped as sap feeders, stem borers and foliage feeders (Hosmani *et al*., 2020). Among sap feeders, thrips and mites are considered as an important cosmopolitan sucking pests and regular in occurrence. Devaiah and Kotikal (1983) first reported the incidence of thrips on mulberry in Karnataka.

Thrips are considered as a highly oligophagous pests and native of northern hemisphere. Thrips have become a dominant and regular pests of mulberry. So far, 35 species of thrips are reported to inflict damage to mulberry all over the world of which 21 species are from India (Muthuswamy *et al*., 2010). Mites are one of the most common groups of arthropods found

in many habitats and a large number of mite species have been reported from mulberry. Among them seventeen species of mite belonging to Tetranychidae, Tarsonemidae and Eriophyidae are reported to cause considerable damage to mulberry leaves (Sharath *et al*., 2022).

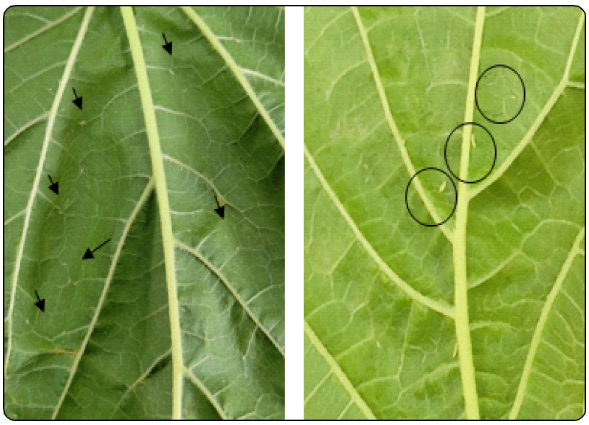

Plate 1 : Thrips on the underside of mulberry leaves

Thrips and mites prefer to feed on younger leaves and buds by sucking the sap, as a result leaf becomes rough, brittle, loses healthy green colour and looks corky in its appearance. Feeding pest attacked mulberry leaves to silkworms will have an adverse impact on their growth and development, leading to cocoon crop failures. Therefore, necessary management must be made to control the pests and diseases of mulberry plant as it is the only source of food for silkworms (Narayaswamy *et al*., 2017). The leaf quality and yield has direct impact on brushing capacity and cocoon yield / 100 dfls.

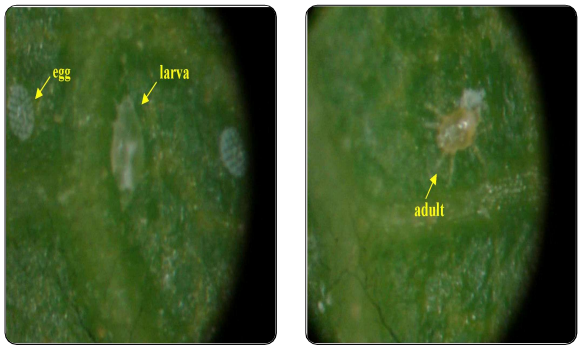

Plate 2: Developmental stages of yellow mite, *Polyphagotarsonemus latus* (Banks) on the underside of mulberry leaves

Since thrips and mites are reported to be active throughout the year on mulberry plants, proper understanding of thrips and mite abundance and associated critical crop stage is necessary for planning a management strategy. To reduce the unwanted pesticide load on the environment and with the intension of developing an economically viable management strategy, a sound knowledge of population fluctuation, varietal susceptibility and spatial distribution of thrips and mites *vis-a-vis* the phenology of mulberry is perceived as a pre-requisite and indispensable too. With this background, the present study was undertaken on the varietal response and spatial distribution pattern of thrips and yellow mites on mulberry.

Material and Methods

Mulberry Varietal Response to Thrips and Yellow mite, *Polyphagotarsonemus latus* (Banks)

The incidence of thrips and yellow mite, *Polyphagotarsonemus latus* (Banks) (*P. latus*) on mulberry was recorded from June, 2023 to April, 2024 during three crop periods. Thrips and mite counts were made from top third to seventh leaf, sampled separately from 11 popular mulberry varieties *viz*., RFS175, MR2, S13, S34, S36, V1, DD (Vishwa), S54, Mysore Local, Tr10 and M5 with a spacing of 0.6 x 0.6 m planted in the experimental block of the Department of Sericulture at GKVK, Bengaluru (130 05" N ;770 34" E; altitude of 924 m above MSL; mean annual rainfall of 915.8 mm). Recording of observations was initiated from 15 days after pruning (DAP) and continued up to 60 DAP at an interval of 15 days. The population of thrips were directly counted on the leaves with the help of 10X magnifying lens. In case of mites, leaves sampled were observed under a stereo zoom microscope to record the number of mites, including eggs and active stages at three spots in each leaf (base, middle and tip) in a 1cm^2 window. Later thrips and mites population count was averaged and expressed as the number/ leaf and number/cm^2 leaf area, respectively.

Spatial Distribution of Thrips and Yellow Mite, *Polyphagotarsonemus latus* (Banks) on Mulberry

Spatial distribution of thrips and yellow mite on 11 popular mulberry varieties mentioned above was

studied by recording the number of thrips and mites on the leaves at different canopy levels such as top (3-6), middle (7- 14) and bottom (below 14) (Arunkumar and Srinivasa, 2021) on 45 DAP during three crop seasons. Samples of thrips and mites were collected leaf-wise and variety-wise separately in brown paper covers. The plants were selected based on random sample technique. The thrips and mites population data were expressed as the number/ leaf and number/cm^2 leaf area, respectively, were subjected to statistical analysis and compared across leaves in different positions on the twig.

Results and Discussion

Response of Mulberry Varieties to Thrips Infestation

Thrips species identified were *Pseudodendrothrips darci* (Girault) and *Bathrips melanicornis* (Shumsher). Eleven mulberry varieties were assessed for thrips infestation at GKVK, Bengaluru under field condition during 2023-24. Thrips population was counted at 15 days interval throughout the season. Initially at 15 days after pruning (DAP) the average population varied from 1.45 to 7.09 per leaf (Table 1). The lowest thrips

Table 1

Response of mulberry varieties to thrips incidence at GKVK, Bengaluru during 2023-24

Varieties	Number of thrips / leaf [$]			
	15 DAP	30 DAP	45 DAP	60 DAP
RFS175	5.22 (2.39)	9.79 (3.21)	10.36 (3.30)	9.15 (3.11)
MR2	7.09 (2.75)	12.01 (3.54)	14.84 (3.92)	12.16 (3.55)
S13	2.93 (1.85)	6.11 (2.57)	6.67 (2.68)	5.42 (2.43)
S34	4.14 (2.15)	8.60 (3.02)	9.36 (3.14)	7.76 (2.87)
S36	3.27 (2.54)	7.53 (2.83)	6.53 (2.65)	5.94 (2.54)
V1	5.96 (2.54)	9.66 (3.19)	11.30 (3.44)	9.61 (3.18)
DD	3.54 (2.01)	8.35 (2.97)	8.15 (2.94)	6.27 (2.60)
S54	2.33 (1.68)	5.57 (2.46)	5.28 (2.40)	4.48 (2.23)
Mysore Local	1.45 (1.39)	3.77 (2.07)	4.07 (2.14)	3.59 (2.02)
Tr10	1.98 (1.59)	4.71 (2.28)	4.37 (2.21)	4.21 (2.17)
M5	1.76 (1.50)	4.38 (2.21)	3.52 (2.00)	3.70 (2.05)
F test	**	**	**	**
S.Em. ±	0.04	0.02	0.03	0.04
CD at 5%	0.12	0.06	0.09	0.12
CV (%)	3.50	1.28	2.04	2.65

[$]Mean of three cropping seasons, figures in parenthesis are $\sqrt{x+0.5}$ transformed values;

**- significant at P ≤ 0.01; DAP- days after pruning

population of 1.45/leaf was recorded on Mysore Local, followed by M5 (1.76 thrips/leaf) variety and highest was on MR2 (7.09 thrips/leaf) variety. There was considerable change in the thrips population at 30 DAP. The lowest thrips population was recorded on Mysore Local (3.77 thrips/leaf) and highest was on MR2 (12.01 thrips/leaf). Almost similar population build-up was observed, when crop was at 45 DAP. However, there was slight deviation as the M5 (3.52 thrips/leaf) recorded significantly lowest thrips population, followed by Mysore Local (4.07 thrips/leaf) and differed significantly from all the other varieties. At all different days after pruning thrips population was highest on MR2 (7.09, 12.01, 14.84 and 12.16 thrips/leaf at 15, 30, 45 and 60 DAP, respectively) variety. However, at 60 DAP, there was distinct decline in the thrips population on all the varieties.

From the above results on incidence of thrips, it was found that the variety Mysore Local had minimum number of thrips exhibiting tolerance against thrips. Maximum number of thrips was observed in MR2 variety indicating its susceptibility. Out of 24 mulberry

Table 2

Response of mulberry varieties to yellow mite, *Polyphagotarsonemus latus* (Banks) (egg + active stages) incidence during 2023-24

Varieties	Number of mites / cm^2 leaf area[$]			
	15 DAP	30 DAP	45 DAP	60 DAP
RFS175	6.07 (2.54)	23.95 (4.94)	26.49 (5.19)	18.70 (4.37)
MR2	8.37 (2.94)	31.47 (5.65)	36.01 (6.04)	25.05 (5.05)
S13	3.46 (1.94)	15.33 (3.98)	17.01 (4.18)	10.55 (3.31)
S34	7.11 (2.74)	26.87 (5.23)	30.31 (5.55)	21.68 (4.71)
S36	4.50 (2.20)	19.07 (4.42)	19.57 (4.48)	12.35 (3.57)
V1	10.53 (3.27)	36.32 (6.07)	43.46 (6.63)	29.65 (5.49)
DD	5.69 (2.46)	22.38 (4.78)	24.86 (5.04)	14.89 (3.91)
S54	3.71 (2.01)	17.48 (4.24)	17.26 (4.21)	9.71 (3.18)
Mysore Local	3.10 (1.86)	14.75 (3.90)	15.18 (3.96)	7.68 (2.85)
Tr10	2.41 (1.66)	10.82 (3.36)	10.77 (3.36)	6.27 (2.59)
M5	2.78 (1.76)	12.62 (3.62)	12.96 (3.67)	7.88 (2.89)
F test	**	**	**	**
S.Em. ±	0.06	0.06	0.07	0.04
CD at 5%	0.19	0.17	0.20	0.12
CV (%)	4.77	2.2	2.42	2.65

[$]Mean of three cropping seasons, figures in parenthesis are √ x+0.5 transformed values;
**- significant at P ≤ 0.01; DAP- days after pruning

genotypes assessed for thrips incidence by Subramaniam (2000), three genotypes *viz*., S635, S30 and MR1 have shown less than 20 per cent damage. Whereas, V1, China white and C20 have shown more than 40 per cent damage and thus found susceptible to thrips infestation. Similarly, when five mulberry cultivars (K2, S13, S36, S34 and V-1) were evaluated for resistance to thrips (*Pseudodendrothrips mori*), pest population was highest on V-1, moderate on S36 and least on S13 (Prasad *et al*., 2002).

Response of Mulberry Varieties to Yellow Mite, *Polyphagotarsonemus latus* (Banks) Infestation

The incidence of yellow mite, *P. latus* on different mulberry varieties at different days after pruning is presented in Table 2. Mite population was very low at 15 DAP in the range of 2.41-10.53 mites/cm^2. Gradually it increased at 30 DAP (10.82-36.32 mites/cm^2) and continued up to 45 DAP (10.77-43.46 mites/cm^2) in all the varieties. The peak activity of mite was found at 45 DAP and thereafter it declined. Infestation of mite was more in V1 (10.53, 36.32, 43.46 & 29.65 mites/cm^2 at 15, 30, 45 and 60 DAP, respectively) and MR2 (8.37, 31.47, 36.06 and 25.05 mites/cm^2 at 15, 30, 45 and 60 DAP, respectively) compared to other varieties. Incidence of mite was the least in Tr10 (2.41, 10.82, 10.77 & 6.82 mites/cm^2 at15, 30, 45 & 60 DAP, respectively), followed by M5 at 15, 30 and 45 DAP (2.78, 12.62 and 12.96 mites/cm^2, respectively) and Mysore Local at 60 DAP (7.68 mites/cm^2).

Varieties Tr10, M5 and Mysore Local displayed relatively high tolerance against yellow mite, *P. latus*. The varieties V1 and MR2 were vulnerable to mites. dar (2001) studied the reaction of true potato seed (TPS) varieties to yellow mite infestation and observed varied reaction among the varieties evaluated. Kufri Jyothi variety recorded maximum number of mites (158.83 - 168.50 mites/leaf), while TPS 1/16 recorded the lowest number of mites (22.33/leaf). Dar *et al*. (2017) measured the population dynamics of *Tetranychus turkestani* (Ugarov and Nikolskii) on four commercial mulberry varieties *viz*., Goshoerami, KNG, Tr10 and Ichinose at CSRTI, Pampore in Kashmir valley. Ichinose, KNG and Goshoerami varieties registered highest population while, Tr10 variety relatively resisted population buildup. Arunkumar and Srinivasa (2021) studied population distribution of yellow mite on twenty different popular mulberry varieties. Highest number of mites/cm^2 leaf area was recorded in V1 (101.60), followed by RFS 175 (98.00), S54 (93.10). Least population was observed on Tr-10 (68.30), followed by S41 (69.70).

Spatial Distribution of Thrips on different Mulberry Varieties

Thrips population recorded on different leaf position showed significant differences. The population (thrips/leaf) ranged from 0.03 to 12.08 (Table 3) across different leaf positions. The highest number of thrips was found on the 4th leaf from the tip (12.08 thrips/leaf), followed by the 3rd leaf (10.72 thrips/leaf) and the 5th leaf (7.64 thrips/leaf). A very low population was recorded from the 8th leaf down wards and up to the 14th leaf. As shown in the Fig. 1, the thrips population was more dense on the younger leaves, which then became sparse on the older leaves. The interaction effect between varieties and leaf position was found to be significant with regard to the thrips population with a maximum being on 4th leaf in MR2 variety (24.33 thrips/leaf). This was followed by combination of 4th leaf and V1 variety (18.08 thrips/leaf) and 3rd leaf position and RFS175 (16.15 thrips/leaf) varieties. Negligible thrips population was recorded from the 8th leaf and onwards in all the varieties.

Ghosh *et al*. (2000) studied the pattern of population distribution of thrips on mulberry leaf. Maximum thrips population was confined on third, fourth and fifth leaf (49.39 %) from the top. Hesami *et al*. (2007) reported on the spatial distribution of thrips on tree mulberry. Distribution of thrips showed that the larval instars were located on lower canopy (leaves 5-10 from top) of trees but adults preferred the upper canopy (leaves 1-5 from top). The distribution and dispersion of all the life stages of *Anaphothrips obscurus* (Muller) (Thysanoptera: Thripidae) in timothy,

TABLE 3

Spatial distribution pattern of thrips (no./leaf) on different mulberry varieties at 45 DAP (Mean of three cropping seasons)

Position of leaf from tip downwards	RFS175	MR2	S13	S34	S36	V1	DD	S-54	Mysore Local	Tr10	M5	Mean No. of thrips/ leaf
III	16.15	17.70	7.82	15.30	8.63	16.63	13.55	6.89	4.63	5.70	4.96	10.72
	(4.80)	(4.26)	(2.88)	(3.88)	(3.02)	(4.13)	(3.74)	(2.71)	(2.26)	(2.48)	(2.34)	(3.35)
IV	15.19	24.33	11.55	13.59	11.00	18.08	11.48	8.26	5.63	7.18	6.55	12.08
	(3.96)	(4.98)	(3.46)	(3.75)	(3.39)	(4.31)	(3.46)	(2.96)	(2.47)	(2.77)	(2.65)	(3.55)
V	11.48	15.56	7.04	8.22	6.82	10.74	7.44	5.96	4.48	3.11	3.19	7.64
	(4.22)	(4.00)	(2.74)	(2.95)	(2.70)	(3.35)	(2.81)	(2.54)	(1.99)	(1.89)	(1.91)	(2.85)
VI	5.41	10.67	3.00	5.74	3.89	7.30	5.00	3.15	2.41	3.44	2.67	4.88
	(3.46)	(3.34)	(1.87)	(2.49)	(2.08)	(2.81)	(2.34)	(1.90)	(1.69)	(1.98)	(1.77)	(2.32)
VII	3.59	5.93	3.96	3.96	2.33	3.78	3.26	2.15	1.44	2.41	1.70	3.05
	(2.43)	(2.53)	(2.11)	(2.11)	(1.68)	(2.06)	(1.92)	(1.90)	(1.38)	(1.70)	(1.48)	(1.88)
VIII	2.29	3.48	1.78	2.00	1.41	2.85	2.18	1.67	1.00	1.19	0.92	1.89
	(2.02)	(1.99)	(1.50)	(1.58)	(1.37)	(1.83)	(1.63)	(1.46)	(1.22)	(1.29)	(1.19)	(1.55)
IX	1.22	1.85	1.52	0.74	0.56	2.18	1.07	0.96	0.70	1.37	1.52	1.24
	(1.67)	(1.52)	(1.41)	(1.11)	(1.02)	(1.63)	(1.24)	(1.20)	(1.08)	(1.37)	(1.40)	(1.32)
X	0.74	1.26	1.11	0.85	0.52	1.26	0.85	0.41	0.30	0.52	0.63	0.77
	(1.31)	(1.30)	(1.26)	(1.14)	(1.00)	(1.32)	(1.15)	(0.95)	(0.89)	(1.01)	(1.06)	(1.13)
XI	0.52	0.67	0.33	0.37	0.26	0.82	0.85	0.67	0.22	0.30	0.30	0.48
	(0.11)	(1.08)	(0.90)	(0.91)	(0.86)	(1.14)	(0.77)	(1.07)	(0.84)	(0.89)	(0.88)	(0.99)
XII	0.63	0.63	0.41	0.44	0.41	0.59	0.07	0.15	0.11	0.22	0.11	0.34
	(1.05)	(1.05)	(0.95)	(0.97)	(0.94)	(1.03)	(0.75)	(0.80)	(0.78)	(0.84)	(0.78)	(0.92)
XIII	0.07	0.30	0.19	0.04	0.07	0.11	0.04	0.04	0.04	0.07	0.18	0.10
	(0.76)	(0.88)	(0.82)	(0.73)	(0.75)	(0.78)	(0.73)	(0.73)	(0.73)	(0.75)	(0.82)	(0.77)
XIV	0.11	0.15	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.03
	(0.78)	(0.80)	(0.71)	(0.73)	(0.71)	(0.73)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.73)
Mean No. of thrips/leaf/var.	4.78	6.88	3.23	4.27	2.99	5.36	3.82	2.52	1.66	2.13	1.89	
	(2.30)	(2.72)	(1.93)	(2.18)	(1.87)	(2.42)	(2.08)	(1.74)	(1.47)	(1.62)	(1.55)	

** Significant at P ≤ 0.01; Figures in the parentheses are √ x+0.5 transformed values

Comparision	F-test	S. Em±	CD at 5%
i) Varieties	**	0.35	0.70
ii) Leaf position	**	0.37	0.73
iii) Interaction (i×ii)	**	1.23	2.44

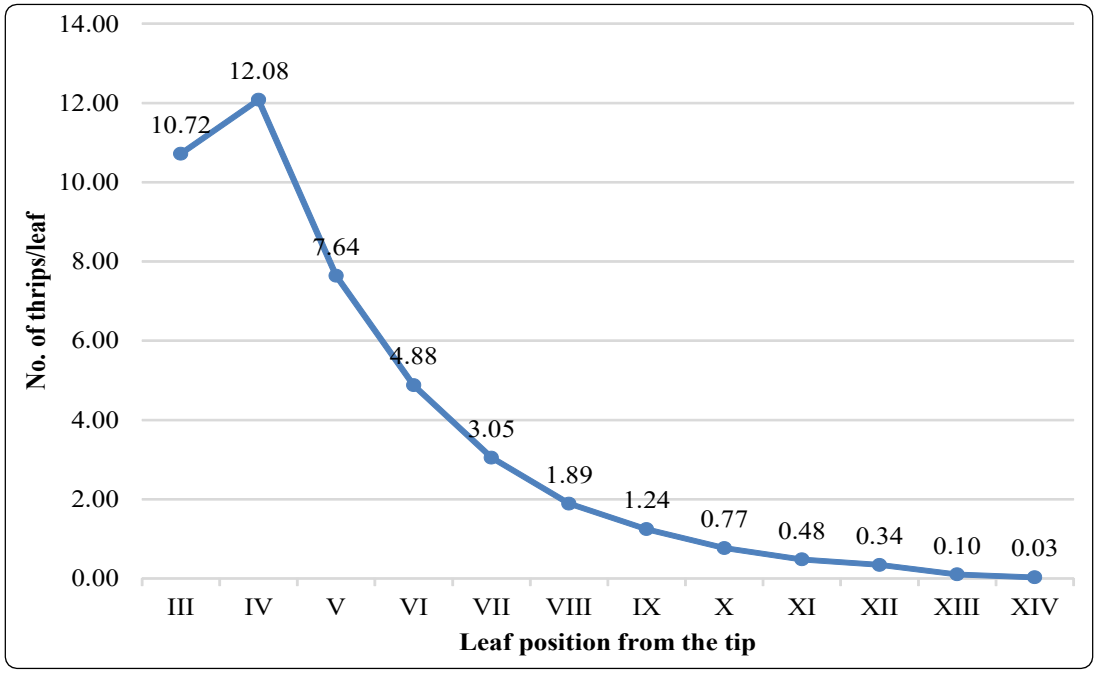

Fig. 1 : Spatial distribution pattern of thrips on mulberry

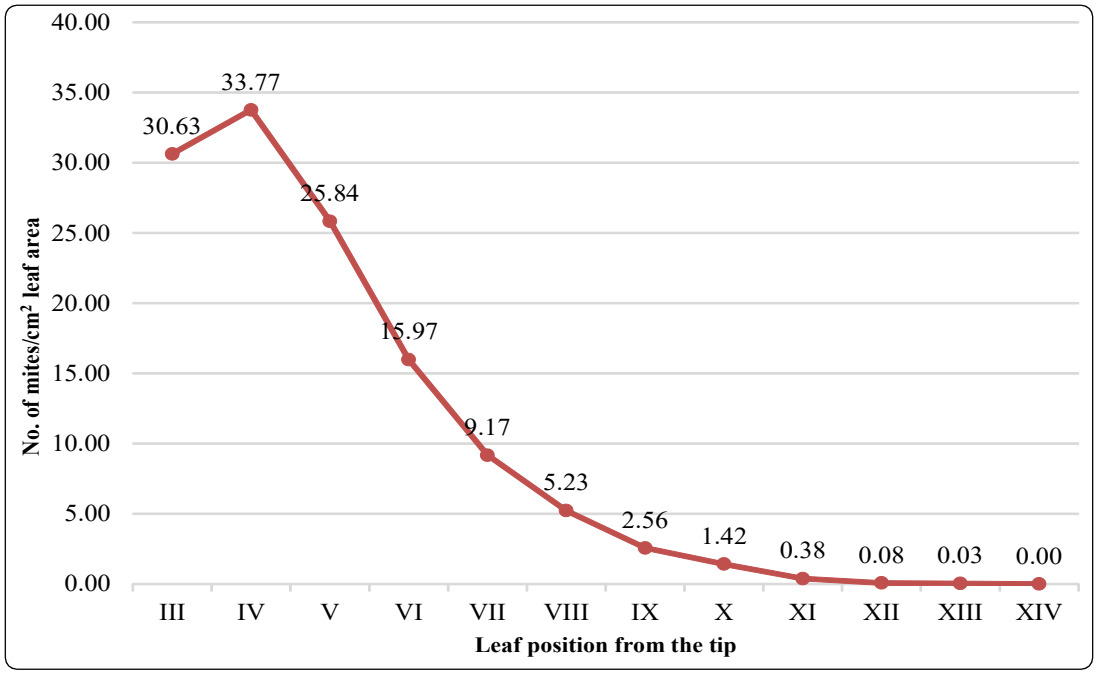

Fig. 2 : Thrips on the underside of mulberry leaves

Phleum pretense L. (Poaceae) was highly spatially dependent and more thrips were found near the top of the plant than the bottom (Reisig *et al*., 2011). The present results corroborate with the above findings.

Spatial Distribution of Yellow Mite, *Polyphagotarsonemus latus* (Banks) on different Mulberry Varieties

Mean number of mites per cm² leaf area varied significantly from 0 to 33.77 on leaves at different

TABLE 4

Spatial distribution pattern of yellow mite, *Polyphagotarsonemus latus* (Banks) (egg + active stages) (no./cm²) on different mulberry varieties at 45 DAP (Mean of three cropping seasons)

Position of leaf from tip downwards	RFS175	MR2	S13	S34	S36	V1	DD	S-54	Mysore Local	Tr10	M5	Mean No. of mites/cm²
III	29.77	56.74	20.11	47.59	25.29	50.59	36.67	20.51	19.22	13.59	16.89	30.63
	(5.49)	(7.56)	(4.54)	(6.93)	(5.07)	(7.15)	(6.09)	(4.58)	(4.44)	(3.74)	(4.16)	(5.58)
IV	41.89	41.88	25.74	34.59	28.56	66.48	43.55	26.18	23.89	17.59	21.15	33.77
	(6.50)	(6.51)	(5.12)	(5.91)	(5.39)	(8.17)	(6.64)	(5.16)	(4.93)	(4.25)	(4.65)	(5.85)
V	28.29	40.55	20.96	34.04	20.93	49.29	24.00	21.33	17.55	12.26	15.04	25.84
	(5.36)	(6.40)	(4.62)	(5.87)	(4.62)	(7.04)	(4.94)	(4.67)	(4.24)	(3.56)	(3.92)	(5.13)
VI	21.44	26.30	11.81	20.37	14.04	33.85	13.26	11.81	8.82	6.66	7.34	15.97
	(4.67)	(5.17)	(3.50)	(4.56)	(3.80)	(5.85)	(3.70)	(3.50)	(3.05)	(2.65)	(2.76)	(4.06)
VII	11.04	14.57	6.44	14.96	9.03	17.07	6.81	6.44	6.41	3.74	4.41	9.17
	(3.42)	(3.88)	(2.63)	(3.92)	(3.08)	(4.19)	(2.67)	(2.63)	(2.61)	(2.05)	(2.21)	(3.11)
VIII	6.07	9.66	4.55	5.11	5.18	12.58	2.00	4.48	1.85	2.44	3.59	5.23
	(2.56)	(3.18)	(2.24)	(2.34)	(2.38)	(3.61)	(1.57)	(2.22)	(1.52)	(1.69)	(2.01)	(2.39)
IX	2.30	4.11	1.44	3.81	1.55	6.44	1.30	1.44	1.81	2.00	2.00	2.56
	(1.64)	(2.13)	(1.39)	(2.07)	(1.42)	(2.60)	(1.33)	(1.39)	(1.48)	(1.55)	(1.55)	(1.75)
X	0.93	2.63	0.74	3.37	1.00	3.78	0.93	0.74	0.41	0.48	0.63	1.42
	(1.16)	(1.73)	(1.07)	(1.96)	(1.22)	(2.04)	(1.16)	(1.07)	(0.95)	(0.98)	(1.04)	(1.39)
XI	0.63	0.81	0.15	1.70	0.22	0.18	0.11	0.15	0.22	0.00	0.00	0.38
	(1.05)	(1.14)	(0.80)	(1.48)	(0.84)	(0.82)	(0.77)	(0.80)	(0.84)	(0.71)	(0.71)	(0.94)
XII	0.04	0.04	0.00	0.52	0.04	0.04	0.04	0.00	0.11	0.00	0.00	0.08
	(0.73)	(0.73)	(0.71)	(1.00)	(0.73)	(0.73)	(0.73)	(0.71)	(0.78)	(0.71)	(0.71)	(0.76)
XIII	0.04	0.11	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.11	0.00	0.03
	(0.73)	(0.77)	(0.71)	(0.71)	(0.71)	(0.71)	(0.77)	(0.71)	(0.71)	(0.77)	(0.71)	(0.73)
XIV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
Mean no. of mites/leaf/var.	11.87	16.45	7.66	13.85	8.82	20.03	10.73	7.76	6.69	4.91	5.92	
	(3.52)	(4.12)	(2.86)	(3.79)	(3.05)	(4.53)	(3.35)	(2.87)	(2.68)	(2.33)	(2.53)	

** Significant at P ≤ 0.01; Figures in the parentheses are √ x+0.5 transformed values

Comparision

		F-test	S. Em±	CD at 5%
i)	Varieties	**	0.051	0.100
ii)	Leaf position	**	0.053	0.105
iii)	Interaction (i×ii)	**	0.177	0.349

positions. The highest number of mites was found on the 4th leaf from the tip (33.77 mites/cm^2) followed by the 3rd leaf (30.63 mites/cm^2) and the 5th leaf (25.84 mites/cm^2). The 6th, 7th and 8th leaves harboured the next higher number of mites (15.97, 9.17 and 5.23 mites/cm^2, respectively) (Table 4). Negligible number of mites was observed on leaves in the 9th position and further below. Mite population decreased from the top to the bottom of the canopy (Fig. 2). The interaction effect between varieties and leaf position was found to be significant with regard to mite population with a maximum being on 4th leaf in V1 variety (66.48 mites/cm^2). This was followed by a combination of 3rd leaf and MR2 variety (56.74 mites/cm^2) and 3rd leaf and S34 variety (47.59 mites/cm^2).

Spatial distribution pattern of yellow mite, *P. latus* on V1 mulberry variety was studied by Arunkumar and Srinivasa (2021). The highest mite density was on the 3rd leaf (125.86/cm^2 leaf area), followed by 4th and 2nd leaf (93.03 and 90.08 mites/cm^2, respectively). Further, the density of mites was in the decreasing order of 5th leaf (48.63), 1st leaf (40.17), 6th leaf (17.89) and the growing tip (7.52) and the mite population on leaves in the lower positions *i.e.*, 6th leaf onwards decreased more rapidly. In the present study, highest number of mites was found on the 4th leaf, followed by 3rd and 5th leaf and the mite population decreased more rapidly from 9th leaf onwards. girz-Otero *et al*. (2007) reported that the yellow mite developed and multiplied on tender leaves of *Camellia japonica* owing to suitable conditions of moisture, shade and food on such leaves. The yellow mite population comprising of eggs as well as active stages were more abundant on leaves in the top canopy (165.69/leaf) of the chilli plant compared to the leaves in the middle canopy (111.18/leaf) (Girish *et al.*, 2019). In both tree and bush type of mulberry, yellow mite was observed only in the top canopy (top 6-7 leaves). The top canopy leaves of mulberry are soft and succulent with high moisture content as compared to middle and bottom leaves, which would have facilitated the individuals of yellow mite to confine themselves to the top leaves for sucking the sap (Kumar and Varshney, 2020). The results revealed that among different leaf positions, yellow mite preferred top one followed by middle, indicating its preference for the soft and succulent leaves.

Response of mulberry varieties against major sucking pests *viz.,* thrips and mites revealed that thrips, *Pseudodendrothrips darci* (Girault) and *Bathrips melanicornis* (Shumsher) infestation was maximum in variety MR2 and minimum was observed in Mysore Local, which was significantly superior over all varieties. Similarly, minimum infestation of yellow mite, *Polyphagotarsonemus latus* (Banks) was found in variety Tr10 and maximum infestation was observed in variety V1. Maximum infestation of both thrips and mites was recorded at 45 days of pruning. The distribution of the thrips and mites were noticed on the under surface of the leaves. Fourth and third leaves from the tip harboured significantly greater number of thrips and mites and negligible thrips and mite population could be recorded from the 8th leaf and onwards. It is evident that both thrips and mites prefers to feed on younger leaves.

References

Arunkumar, K. and Srinivasa, N., 2021, Spatial and temporal distribution of yellow mite (*Polyphagotarsonemus latus*) on mulberry. *Mysore J. Agric. Sci.*, **55** (4) : 28 - 38.

Dar, S. A., Rather, B. A., Wani, A. R. and Ganie, M. A., 2017, Resistance against insect pests by plant phenolics and their derivative compounds. *Chem. Sci. Rev. Lett.*, **6** (23) : 1941 - 1949.

Devaiah, M. C. and Kotikal, Y. K., 1983, Incidence of thrips on mulberry, *Morus alba* L. under Dharwad conditions. *Natl. Sem. Silk Res. Dev*., Central Silk Board, Bangalore, pp. : 101.

Ghosh, J., Chatterjee, H. and Senapati, S. K., 2000, Incidence of thrips and pattern of population distribution on mulberry leaf. *J. Entomol. Res*., **24** (1) : 49 - 53.

Girish, R., Srinivasa, N., Basanth, Y. S. and Shruthi, H. R., 2019, Response of chilli genotypes to the yellow mite, *Polyphagotarsonemus latus* Banks population and biochemical basis of resistance. *J. Entomol. Zool. Stud*., **7** (1) : 250 - 255.

HESAMI, S., ETEBARI, K., POURBABAEF, H. AND KAMELMANESH, M. M., 2007, Spatial distribution of mulberry thrips, *Pseudodendrothrips mori* (Niwa) (Thysanoptera : Thripidae). *Zool. Res.*, **28** (3) : 265 - 270.

HOSAMANI, V., YALAGI, M., SASVIHALLI, P., HOSAMANI, V., NAIR, K. S., HARLAPUR, V. K., HEGDE, C.R. AND MISHRA, R. K., 2020, Sucking pest and their management in mulberry (*Morus alba*): A review. *Int. J. Chem. Stud.*, **8** : 1065 - 1070.

KUMAR, P. S. AND VARSHNEY, R., 2020, Efficacy of *Hirsutella thompsonii* and two other biological control agents against the broad mite in mulberry. *Arthropod Manage. Tests*, **45** (1) : 89 - 96.

MUTHUSWAMI, M., SUBRAMANIAN, S., KRISHNAN, R., THANGAMALAR, A. AND INDUMATHI, P., 2010, Quantitative and qualitative damage caused in mulberry varieties due to infestation of thrips *Pseudodendrothrips mori* Niwa. *Karnataka J. Agric. Sci.*, **23** (1) : 146 - 148.

NARAYANASWAMY, K. C., BABU, S. H. AND JAGADISH, K. S., 2017, Effect of NSKE and IPM module treated leaves on rearing performance of the silkworm, *Bombyx mori* L. *Mysore J. Agric. Sci*., **51** (1) : 102 - 107.

PEREZ-OTERO, R., MANSILLA-VAZQUEZ, J. P. AND SALINERO - CORRAL, M. C., 2007, First report of the broad mite, *Polyphagotarsonemus latus* (Banks) on Camellia japonica in Spain. *Pontevedra American Camellia Year Book*, pp.: 52 - 56.

PRASAD, K. S., SREEDHAR, S., SINGHVI, N. R., KODANDA-RAMAIAH, J. AND SEN, A. K., 2002, Screening of popular mulberry varieties for their tolerance to thrips infestation. *Adv. Plant Sci.*, **15** (2) : 651 - 652.

RANI, H., 2001, Bioecology of yellow mite, *Polyphagotarsonemus latus* (Banks) infesting potato (*Solanum tuberosum* L.) and chilli (*Capsicum annum* L.). *M.Sc. (Agri.) Thesis*, University of Agricultural Sciences, Bangalore, pp. : 135.

REDDY, D. N. R. AND NARAYANASWAMY, K. C.,1999, Present status of thrips infesting mulberry. *Indian J. Seri*., **38** (1) : 1 - 7.

REISIG, D. D., GODFREY, L. D. AND MARCUM, D. B., 2011, Spatial dependence, dispersion and sequential sampling of *Anaphothrips obscurus* (Thysanoptera: Thripidae) in timothy. *Environ. Entomol.*, **40** (3) : 689 - 696.

SHARATH, M., NARAYANASWAMY, K. C., GOWDA, C. C., JAGADISH, K. S. AND GOWDA, M., 2022. Demographics and developmental biology of mites infesting mulberry. *Pharm. Innov*., **11** (11) : 1495 - 1500.

SUBRAMANIAM, A., 2000, Screening of mulberry genotypes against the thrips, *Pseudodendrothrips mori* (Nawa). *National Workshop on Management of Sericultural Germplasm for Posterity*, 26-27th July 2000. CSGRC, CSB, Hosur, pp. : 20.