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SEASONAL INCIDENCE OF THRIPS (*THRIPS TABACI* L.) INFESTING SOM PLANT LEAVES (*MACHILUS BOMBYCINA* KING) AND THEIR MANAGEMENT USING BIOPESTICIDES

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Abstract: Som plant (*Machilus bombycina* King) is an important forest tree cultivated as community forestry, useful for rearing of muga silk worm (*Antheraea assama* Ww). Nutritional value of leaves plays an important role in larval growth and silk productivity. The plant also has timber values. The plant is susceptible to various insect pests of which Thrips (*Thrips tabaci* L.) causes heavy damage to tender leaves of the plant. Thrips was active all throughout the year. Lower population level was recorded during 3rd week of March to last week of June and higher population level was maintained during last week of November to 3rd week of January. Peak population (12.77/3 leaves) was recorded on 49th standard week that on 1st week of December. thrips population had a significant positive correlation with temperature difference and relative humidity (maximum) while significant negative correlation with temperature (maximum, minimum and average). This indicates that activity of thrips population increase with the rise of relative humidity and population decrease with the rise of temperature. Imidaclorprid was found to be most effective against thrips however extracts of Garlic gave a moderate thrips control. But Imidaclorprid is a highly toxic synthetic insecticide, so there is every possibility to contaminate som plant leaf with the toxic chemicals, as som leaf is the major food component of muga silk worm rearing. Plant extracts are of biological origin having low or no hazardous effect on health and environment and so can be incorporated in IPM programme against thrips on som plant.
Keywords: Incidence, thrips, Abiotic factors, phytopesticides, Organic cultivation.

Introduction

Som plant (*Machilus bombycina* King) is an important medium sized tree cultivated by the farmers as small scale, used for rearing of muga silk worm (*Antheraea assama* West wood). *Antheraea assama* is polyvoltine in nature having 5-6 generations in a year and the seasons affect the commercial characters. Nutritional value of food plants i.e. leaves of som plant plays an important role in the larval growth and silk productivity. The plant also has timber values. Benchamin and Giridhar (2005) reported that India is the second largest producer of both the mulberry (*Bombyx mori*) and tasar varieties (*Antherea mylitta*) of silk in the world

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with a share of 18% and 10% of the total respectively, while the golden yellow muga silk (*Antherea assama*) is produced only in India. Its rearing was restricted to the north-eastern India mainly at Bhrambhaputra valley of Assam state and adjoining foothills. Northern parts of West Bengal, India mainly Coochbehar and Jalpaiguri district have immense possibility of its cultivation for eco-climatologically similarity with lower Assam.

Som plant (*Machilus bombycina*) cultivation face lot of problems from attacked of insect-pests. Due to attack of the pests, it becomes difficult for the farmers to conduct rearing (Singh *et al.*, 2000). Thrips (*Thrips tabaci* L.) (Thysanoptera: Thripidae) is emerging as a serious pest which badly affects muga culture in different ways – they suck the cell sap from newly emerged central twigs and arrest the growth of the plant, reducing photosynthesis area and hampering the general physiology of the plant. Thrips (*Thrips tabaci*) is a worldwide known insect and cause serious damage to various plants in their growing stage. It has been reported as a major pest of Kesseru. (Singh *et al.*, 2000).

Farmers become increasingly dependent on chemical pesticides to which pests have developed resistance (Osteen and Szmedra, 1989). In case of thrips infestation, spraying of mulberry crops with Nuvan (DDVP) 0.02% or Rogar 0.1% is found effective, with a safe period of 8-10 days (Hadimani *et al.*, 2006). Silk worms are very much sensitive to insecticides. Therefore, use of insecticides on silk worm host plant is harmful. Neem, Pongamia, Indian privet, Adathoda, Chrysanthemum, Turmeric, Onion, Garlic, Tobacco, Ocimum, Custard apple, Zinger and some other plants have been reported as most common insecticidal plants which can be used to control pest population in sericulture (Singh and Saratchandra, 2005). It acts in different ways viz. insect growth regulators (IGR), feeding deterrents, repellents and confusants (Schmutterer, 1990). The Neem products act as insect antifeedant, repellent, growth regulator, chemosterilant and toxicant. Any pest escaping one effect may be killed by other (Vijayalakashmi *et al.*, 1995). The most abundant neem constituent, azadirachtin is considered an excellent botanical pesticide because of its biodegradability, demonstrated low toxicity to vertebrates, environmental safety, and safety to non-target organisms (Jacobson, 1989; Rembold, 1989). *Polygonum* is a well known weed in the terai agro-climatic region of West Bengal, India locally known as “Biskanthali” (Sarkar and Mukherjee, 2005). Badshah *et al*., (2005) reported from Pakistan that crude leaf and flower extracts of *Polygonum hydropiper* were responsible for mortality rates 10 days after feeding of 28% and 52% for *Heterotermes indicola* and 28% and 74.7% for *Coptotermes heimi* respectively. Ghosh *et al*., (2009) reported that polygonum plant extracts provided

59.77% aphid suppression in ladysfinger field. Nicotine, an alkaloid obtained from *Nicotiana tabacum, N. rustica* and *N. glutinosa* is another well-established botanical insecticide (Ujvary, 1999). Nicotin was found to be highly toxic to eggs and neonate larvae of *Helicoverpa armigera* Hub. and *Spodoptera litura* Fabr. and also effective against *Bemisia tabaci* Genn. (Dhaliwal and Arora, 2001). Use of synthetic and tobacco was more economically beneficial than using synthetics alone (Opolot *et al.,* 2006).

Materials and methods

Study period and location

Studies were conducted in the Instructional Farm of Uttar Banga Krishi Viswavidyalaya (State Agricultural University) at Pundibari, Coochbehar, West Bengal, India for two years (2010-11). The experimental area is situated in the sub-Himalayan region of north-east India. This so called terai zone is situated between $25^0$57' and 27^0 N latitude and $88^0$25' and $89^0$54' E longitude. The soil of the experimental field was sandy loam with pH value 6.9. The climate of this zone is subtropical humid with a short winter spell during December to February.

Population fluctuation of thrips (Thrips tabaci L.)

In view to study the seasonal fluctuation pattern of thrips som plants were grown under recommended fertilizers and cultural practices. The plants were fertilized once a year (90 g Urea+140 g SSP+30 g MOP/ plant). Spacing was taken as 3 m X 3 m in 5 m X 5 m sized plots containing 4 plants with three replications without adopting any plant protection measures. The treatments were replicated three times in a Randomized Block Design (RBD). The total thrips population/3 leaves from top, middle and bottom leaves from four randomly selected plants per replication was recorded at seven days (Standard Meteorological Week) interval throughout the year. The reading started during January and ended in December in both the years. Data obtained over two years, 2010 and 2011 were presented graphically with important weather parameters viz. temperature, relative humidity. Correlation co-efficient (r) was worked out between incidence of thrips and important weather parameters during the period to find out influence of weather on population fluctuation.

Evaluation of plant extracts (botanicals) against thrips (Thrips tabaci L.)

Cultivation practices

The experiment was conducted with an objective to evolve a technically feasible, environmentally sound and economically viable safe pest management strategy of som plant due to unique pest problem under terai zone of West Bengal, India. Som plants were grown

under recommended fertilizers and cultural practices. The plants were fertilized once a year (90 g Urea+140 g SSP+30 g MOP/ plant). Spacing was taken as 3 m X 3 m in 5 m X 5 m sized plots containing 4 plants with three replications.

Treatments

Under present investigation seven pesticides were taken and three sprays at 10 day intervals were made, starting with the initiation of infestation. Generally March-April and August-September are the suitable time for spraying to control insects pests on som plant when the plant remain vacant from rearing of muga silk worm. Hence, under the present investigation, spraying has been done during August- September.

Treatments details are given here under.

Treatments	Dose ml/L (%)
Polygonum hydropiper (T1)	50.00 ml/L (5%)
Pongamia ponnata (T2)	50.00 ml/L (5%)
Azadirachtin (NIMARIN 1500 ppm) (T3)	2.5 ml/L
Garlic (*Allium sativum*) (T4)	50.00 ml/L (5%)
Immidachlorprid (C0NFIDOR 17.8 SL) (T5)	1 ml/ 5L
Tobacco (*Nicotiana tabacum)* (T6)	50.00 ml/L (5%)
Spilanthes paniculata (T7)	50.00 ml/L (5%)
Untreated Control (T8)	---

Preparation of Extracts

The polygonum (*Polygonum hydropiper*) plants (floral parts), pongamia (*Pongamia pinnata*) leaves, garlic (*Allium sativum*), spilanthes (*Spilanthes paniculata*) (floral parts) were extracted in methanol. The plant parts after washing with water were dried and powdered in grinder. 50 g powder of plant parts were transferred separately to the conical flask (500 ml capacity) field with 250 ml methanol. The powdered material was dipped in 250 ml of methanol. The material was allowed to stand for 72 hours at room temperature with occasional stirring. After 72 hours the extract was filtered through whatman 42 filter paper and residues was washed twice with methanol.

The tobacco (*Nicotiana tabacum)* leaves were extracted in water as follows. After washing with water the leaves were dried and powdered in a grinder. The powdered sample (100 g) were transferred to a container and dipped in 1 litre water. The material was allowed

to stand for 72 hours at room temperature with occasional stirring. After 72 hours the extract was filtered through Whatman 42 filter paper and added 15 ml liquid soap.

Data recording

Three sprays at 10 day intervals were made, starting with the initiation of infestation. Thrips population densities were recorded 3, 6, and 9 days after each spraying. The total thrips population/3 leaves from top, middle and bottom leaves from four randomly selected plants per replication was recorded. The results were expressed as thrips population suppression (%) compared to densities recorded on the control treatment. Percent reduction of thrips population over control was calculated by the following formula (Abbott, 1925):

$$Pt = \frac{Po - Pc}{100 - Pc} \times 100$$

Where, Pt = Corrected mortality, Po = Observed mortality and Pc = Control mortality.

$$\text{Percent reduction over control} = \frac{\text{Percent reduction in treatment} - \text{Percent reduction in control}}{100 - \text{Percent reduction in control}} \times 100$$

Data were analyzed by using INDO-STAT- software for analysis of variance following randomized block design (RBD) treatment means were separated by applying CD Test (critical difference) at 5 % level of significance.

Results and discussion

Population fluctuation of thrips (Thrips tabaci L.)

Thrips (*Thrips tabaci* L.) (Thysanoptera: Thripidae) population was found both the years of 2010 and 2011 (Fig. 1). In 2010, the thrips population was recorded throughout the year except in the month of March to June. Population increased gradually and steadily from July onwards and higher population level was maintained during 47th standard week (November) to last week of December. Peak population (13.87/3 leaves) was recorded on 49th standard week that is 1st week of December when the average temperature, relative humidity and weekly rainfall were 22.05^{0}C, 77.83% and 19.20 mm, respectively. However, at the beginning of the year the population was recorded very high (11.33-13.67/3 leaves). Thrips population decreased gradually from 5th standard week that is from February onwards and lower population level was maintained during 8th standard week to 26th standard week that is from the month of March to June when average temperature, relative humidity and weekly rainfall were 25.74^{0}C-31.96^{0}C, 50.14%-86.71% and 0.00mm-112.50mm, respectively.

In 2011, thrips population was found throughout the year with a little gap. Higher population level was maintained during 47th standard week to 52nd standard week that is mid of

November to last week of December and peak population (16.73/3 leaves) was recorded on 48th standard week that is last week of November when the average temperature, relative humidity and weekly rainfall were 21.71^{0}C, 76.49% and 0.00 mm, respectively. Lower population level was maintained during 11th standard week to 27th standard week that is during 3rd week of March to 1st week of July when average temperature, relative humidity and weekly rainfall were 23.14^{0}C-29.85^{0}C, 52.00%-92.50% and 0.40mm-291.40mm, respectively. At the beginning of the year that is during January the population fluctuation follows the previous year where population was maintained very high (5.67-13.13/3 leaves). The pooled data on thrips incidence for the two years (2010 and 2011), showed that thrips was active all throughout the year. Lower population level was recorded during 11th standard week to 26th standard week that is during 3rd week of March to last week of June and higher population level was maintained during 48th standard week to 3rd standard week that is during last week of November to 3rd week of January. Peak population (12.77/3 leaves) was recorded on 49th standard week that on 1st week of December.

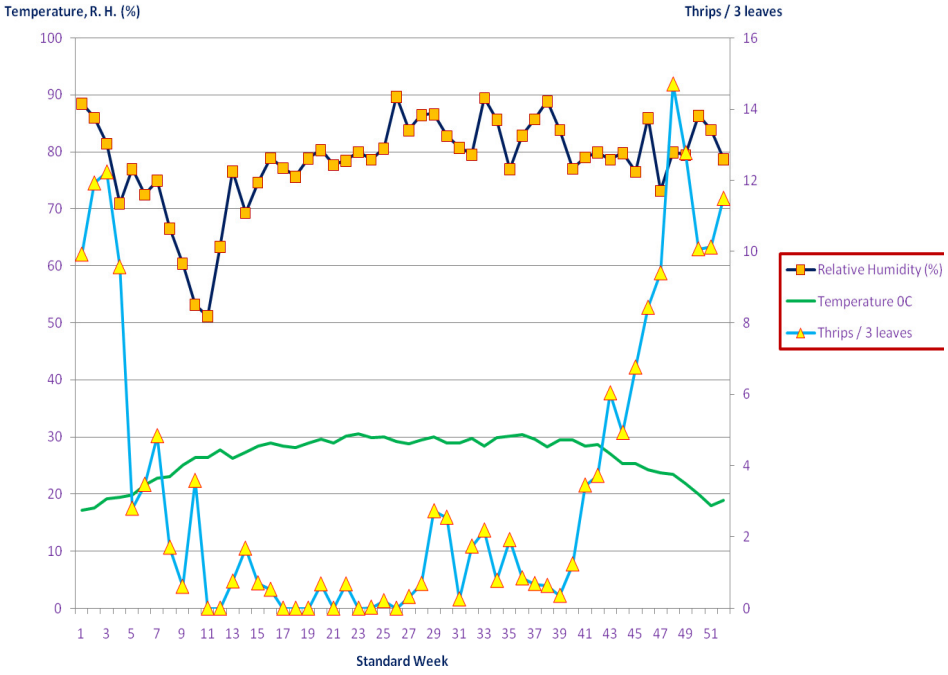

Fig.1 Seasonal incidence of thrips (*Thrips tabaci*) population (Average) as influenced by temperature and relative humidity

Correlation studies (Table 1) between thrips population and Environmental parameter revealed that thrips population had a significant positive correlation with temperature difference and relative humidity (maximum) while significant negative correlation with temperature (maximum, minimum and average). On the other hand non-significant positive

correlation was found between thrips population and relative humidity (minimum and average). This indicates that activity of thrips population increase with the rise of relative humidity and population decrease with the rise of temperature.

Table 1: Correlation co-efficient between thrips (*Thrips tabaci*) and environmental parameters

Environmental parameter		Correlation co-efficient (r)	Co-efficient of determination (R^2)	Regression equation
Temperature ^{0}C	Maximum	- 0.793**	0.628	Y= - 1.157x + 39.50
	Minimum	- 0.782**	0.610	Y= - 0.627x + 17.11
	Difference	0.585**	0.341	Y= 0.793x - 3.937
	Average	- 0.811**	0.657	Y= - 0.866x + 26.37
Relative Humidity (%)	Maximum	0.238*	0.056	Y= 0.144x - 8.484
	Minimum	0.075	0.005	Y= 0.030x + 1.290
	Average	0.150	0.022	Y= 0.078x - 2.617

* Significant at 5% level of significance; ** Significant at 1% level of significance

Evaluation of plant extracts (botanicals) against Thrips (Thrips tabaci L.)

The different treatments and their persistence at different days after application varied significantly in their suppression of thrips populations (Table 2 and Table 3).

Among the seven pesticides evaluated (Table 3) under the present investigation Imidaclorprid was found most effective against thrips providing 75.18% suppression, closely followed by Azadirachtin providing 64.94% suppression. From over all observation it was revealed that extracts of Garlic, extracts of Tobacco, extracts of *Spilanthes* and extracts of *Polygonum* plant gave moderate results, recording about 53.33%, 48.55%, 47.24% and 46.71% thrips suppression respectively. Least effectiveness against thrips was recorded from *Pongamia* leaf extracts providing 33.01% suppression.

Three days after spraying, Imidaclorprid was found most effectively against thrips providing 80.67% suppression, closely followed by Azadirachtin providing 69.69% suppression. Among the botanical extracts, Garlic extracts and Tobacco leaf extracts were found to be moderately effective against thrips providing 59.14% and 58.48% suppression, respectively. Six days after spraying, Imidaclorprid was found to be superior insecticide (80.41%

suppression) closely followed by botanical insecticide, Azadirachtin (63.95% suppression). Among the botanical extracts, Garlic extracts and *Polygonum* plant extracts were found to be moderately effective against thrips providing 54.45% and 47.11% suppression, respectively. Nine days after spraying, also Imidaclorprid was found to be most effective (64.45% suppression) against thrips, closely followed by Azadirachtin (61.17% suppression). Among the botanical extracts, Garlic extracts and Tobacco leaf extracts were found to be moderately effective against thrips providing 46.39% and 42.26% suppression, respectively. From the overall observations it was revealed that Imidaclorprid was found to be most effective against thrips providing more than 75% suppression however extracts of Garlic gave a moderate thrips control, recording more than 50% suppression.

Conclusions

Thrips was active all throughout the year. Lower population level was recorded during 11th standard week to 26th standard week that is during 3rd week of March to last week of June. At this period no control measure against thrips should be adopted. Thrips population had a significant positive correlation with temperature difference and relative humidity (maximum) while significant negative correlation with temperature (maximum, minimum and average). This indicates that activity of thrips population increase with the rise of relative humidity and population decrease with the rise of temperature. Imidaclorprid was found to be most effective against thrips however extracts of Garlic gave a moderate thrips control. But Imidaclorprid is a highly toxic synthetic insecticide, so there is every possibility to contaminate som plant leaf with the toxic chemicals, as som leaf is the major food component of muga silk worm rearing. Plant extracts are of biological origin having low or no hazardous effect on health and environment and so can be incorporated in IPM programme against thrips on som plant.

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Table 2 Efficacy of plant extracts against Thrips (*Thrips tabaci)* on Som plan (2010 and 2011)

Treatments	Dose ml / Litre (%)	Over all efficacy (% reduction or increase) 2010					Over all efficacy (% reduction or increase) 2011				
		Pre-Treatment Obs. Thrips / 3 Leaves	3 DAT	6 DAT	9 DAT	Mean	Pre-Treatment Obs. Thrips / 3 Leaves	3 DAT	6 DAT	9 DAT	Mean
Polygonum (T1)	50.00 ml/L (5%)	11.67	55.90 (48.41)	43.80 (41.42)	37.18 (37.54)	45.62 (42.46)	11.67	55.73 (48.33)	50.42 (45.26)	37.30 (37.62)	47.81 (43.73)
Pongamia (T2)	50.00 ml/L (5%)	08.91	35.76 (36.71)	32.24 (34.55)	27.30 (31.46)	46.28 (34.24)	09.33	37.09 (37.50)	34.44 (35.89)	31.23 (33.94)	34.25 (35.78)
Azadirachtin (NIMARIN 1500 ppm) (T3)	2.5 ml/L	09.33	69.23 (56.41)	62.97 (52.58)	62.74 (52.44)	64.98 (53.81)	10.57	70.16 (56.93)	64.93 (53.75)	59.61 (50.60)	64.90 (53.76)
Garlic (T4)	50.00 ml/L (5%)	08.53	60.38 (51.01)	53.84 (47.21)	45.11 (42.19)	53.11 (46.80)	09.83	57.40 (49.56)	45.68 (47.92)	41.56 (43.67)	48.21 (47.05)
Imidaclorprid (C0NFIDOR 17.8 SL) (T5)	1 ml/ 5L	10.03	80.36 (63.75)	75.47 (60.44)	65.29 (53.92)	73.70 (59.37)	07.53	80.99 (64.91)	85.36 (67.58)	63.62 (52.92)	76.66 (61.57)
Tobacco (T6)	50.00 ml/L (5%)	07.35	58.72 (50.04)	47.05 (43.31)	43.64 (41.34)	49.80 (44.89)	08.42	58.25 (49.76)	42.77 (40.82)	40.88 (39.74)	47.30 (43.44)
Spilanthes (T7)	50.00 ml/L (5%)	10.27	55.07 (47.91)	46.15 (42.78)	37.62 (37.81)	31.77 (42.84)	11.05	57.90 (49.28)	55.07 (42.51)	47.68 (40.10)	53.55 (43.93)
Untreated Control (T8)	---	08.33	0.00	0.00	0.00	0.00	08.76	0.00	0.00	0.00	0.00
S Em (±)	---	---	1.66	1.70	1.50	---	---	1.56	1.44	1.84	---
CD at 5%	---	NS	5.13	5.25	4.63	---	NS	4.83	4.45	5.67	---

Figure in the parenthesis are angular transformed values, DAT = Days after treatment, NS = Not significant

Table 3 Over all efficacy of plant extracts against Thrips (*Thrips tabaci*) on Som plan
(Grand Mean of 2010 and 2011)

Treatments	Dose ml / Litre (%)	Over all efficacy (% reduction or increase)				
		Pre-Treatment Obs. Thrips / 3 Leaves	3 DAT	6 DAT	9 DAT	Mean
Polygonum (T1)	50.00 ml/L (5%)	11.67	55.81 (48.37)	47.11 (43.34)	37.24 (37.58)	46.71 (43.90)
Pongamia (T2)	50.00 ml/L (5%)	09.12	36.42 (37.10)	33.34 (35.22)	29.26 (32.70)	33.01 (35.01)
Azadirachtin (NIMARIN 1500 ppm) (T3)	2.5 ml/L	09.95	69.69 (56.67)	63.95 (53.16)	61.17 (51.52)	64.94 (53.78)
Garlic (T4)	50.00 ml/L (5%)	09.18	59.14 (50.28)	54.45 (47.56)	46.39 (42.93)	53.33 (46.92)
Imidaclorprid (C0NFIDOR 17.8 SL) (T5)	1 ml/ 5L	08.78	80.67 (63.97)	80.41 (64.01)	64.45 (53.43)	75.18 (60.47)
Tobacco (T6)	50.00 ml/L (5%)	07.88	58.48 (49.90)	44.91 (42.06)	42.26 (40.54)	48.55 (44.16)
Spilanthes (T7)	50.00 ml/L (5%)	10.66	56.23 (48.59)	45.91 (42.64)	39.59 (38.95)	47.24 (43.40)
Untreated Control (T8)	---	08.54	0.00	0.00	0.00	0.00
S Em (±)	---	---	1.61	1.57	1.67	---
CD at 5%	---	NS	4.98	4.85	5.15	---

Figure in the parenthesis are angular transformed values, DAT = Days after treatment, NS = Not significant

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