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Population Dynamics of Thrips on Chilly, Bottle Guard and Cucumber Under Different Biochemical Agents

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ABSTRACT

Thrips tabaci is a polyphagous pest that destroys agricultural and other economically significant crop plants. *T. tabaci* scrapes its mouth parts on fragile crop sections and feeds on flowing sap, resulting in white/brown spots/stricks on leaves/flowers and fruits, affecting plant development and fruit quality. Considering the above facts experiments were conducted to study the population dynamics of *T. tabaci* pests that infest chilly, bottle gourd, and cucumber. The sessional incidence of thrips on chilly, bottle gourd, and cucumber were commenced in the second week of August and continued until the fourth week of November. The incidence was outbreak in the second and third weeks of September. Maximum outbreak of thrips population was noticed in third, fourth week of September and first and second week of October. Foliar application of G3 mixture, *Azadirachta indica* oil Spray, *Calotropis procera* leaf extract *Nicotiana tabucum* extract, *Tagetes erecta* leaf extract, and Imidacloprid 17.8% SL showed reduction in insect outbreak. Maximum pest population was observed in control condition (no treatment given), followed by CLE (Calotropis procera leaf extract), TLE (*Tagetes erecta* leaf extract), G3M (G3 Mixture) and AIO (*Azadirachta indica* oil Spray). There was a steady decline in the population in NS (*Nicotiana tabucum* extract) and finally Imida (Imidacloprid 17.8% SL) had minimal population outbreaks.

Keywords: Thrips, Chilly, Bottle guard and Cucumber.

INTRODUCTION

Thrips (Order Thysanoptera) are small to tiny flies with hooked wings that are thin and a few millimeters long[1]. The morphology is simplified: thrips have an asymmetrical arrangement of compacted suctorial mouthparts within a small, cone-shaped rostrum because they only have one functional mandibular stylet, and the second is significantly diminished[2]. There are presently 6300 known species of thrips, and they are classified as belonging to either the *Terebrantia* or the *Tubulifera suborders* of Thysanoptera[3]. The latter group, which makes

up 65 percent of all Thysanoptera species, is grouped together under the *Phlaeothripidae* family. In the *Phlaeothripidae* family 3800 species are reported, very few may be classified as pests; most species primarily feed on fungi that grow on decaying leaves and branches; these species may even help with nutrient recycling[4]. A preliminary management strategy for pepper production was proposed by Seal *et al.,* (2006)[5]. It called for applying spinosad or imidacloprid between four and seven days after the initial infestation, and then making additional applications of these insecticides every seven days or as needed. Thrips are attracted to the cotyledon leaf, leaves, and flowers, causing holes in very young leaves in early planted cucurbits to fruiting stage, resulting in reduced fruit setting[6]. However, a number of building defects and the use of infected planting material allow pests to enter, and the friendly microclimate encourages pest growth[7]. Many factors, including as diseases, insect pest damage, and adverse climate patterns, limit the amount and quality of bottle gourds and cucumber that can be produced. Thrips attacks occur during the fruiting stage of the plant[4]. Due to its great polyphagy thrips mostly eats hot peppers, tomatoes, potatoes, watermelons, muskmelon, bottle gourds, cucumbers, pumpkins, squash, and other vegetables. Due of its preference on cucurbits, this species is also referred to as "melon thrips"[2]. The preceding review of literature provides an idea for planning the current study to investigate the effect of dynamic thrips population on Chilly, Bottle Guard, and Cucumber.

MATERIALS AND METHOD

The research was performed in the 2019-20 crop year at Baba Mastnath University in Rohtak, using the varieties Hisar Shakti (HC-44; Chilly), Kashi Ganga (Bottle Gourd), and Pusa Barkha (Cucumber). Treatments given in the present study were control (no treatment given), CLE (*Calotropis procera* leaf extract), TLE (*Tagetes erecta* leaf extract), G3M (G3 Mixture), AIO (*Azadirachta indica* oil Spray), NS (*Nicotiana tabucum* extract) and Imida (Imidacloprid 17.8% SL). All of the agronomic techniques recommended were used. During the cropping season, the number of thrips were counted at weekly intervals from five randomly selected labelled plants per plot. Thrips numbers were counted to assess the frequency of various insect pests from three leaves (top, middle, and bottom) of each plant. The leafhopper population was collected using the sweep method and a hand net. Three sweeps per plot were considered, and data were collected at every week and evaluated for Two-way ANOVA using OP-Stat software developed by CCS Haryana Agriculture University.

RESULTS

Thrips incidence on chilly: The sessional incidence of thrips on chilies commenced in the second week of August and continues until the fourth week of November, whereas in the second and third weeks of September the incidence was outbreak. Incidence of thrips continuously raised from first week of August till last week September; after that there was a sharp decline pattern was observed (Table 1). The order of pest population observed was control condition (no treatment given), followed by CLE (*Calotropis procera* leaf extract)> TLE (*Tagetes erecta* leaf extract)>G3M (G3 Mixture) >AIO (*Azadirachta indica* oil Spray). There was a steady decline in the population in NS (*Nicotiana tabucum* extract) and finally Imida (Imidacloprid 17.8% SL) had minimal population outbreaks. In controlled condition mean thrips population in chilly crop varied from 0.00 (AW-1) to 9.19 (SW-3), in first G3M treatment found between 0.00 (August 1st week; AW-1) to 5.36 (September 3rd week; SW-3) it had 41.7% reduction, *Azadirachta indica* oil spray showed variation between 0.00 (AW-1) to 4.21 (SW-3) it had 54.2% reduction, *Calotropis procera* leaf extract had variation from 0.00 (AW-1) to 7.20 (SW-3) it had 21.7% reduction, *Nicotiana tabucum* extract ranged between 0.00 (AW-1) to 4.14 (SW-3) it had 55.0% reduction, *Tagetes erecta* leaf extract showed variation from 0.00 (AW-1) to 6.80 (SW-3) it had 26.0% reduction and finally Imidacloprid 17.8% SL application range found between 0.00 (AW-1) to 3.52 (SW-3) it had reduction 61.7% reduction over the control respectively.

Table 1: Sessional population dynamics of thrips (*Thysanoptera*) on chilly under different biochemical agents

Incidence Days		Control	G3M	AIO	CLE	NS	TLE	Imida	Mean (T)
August	Week-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Week-2	1.76	1.00	0.95	1.52	0.45	1.18	0.14	1.00
	Week-3	2.89	1.64	1.12	2.54	0.80	1.86	0.22	1.58
	Week-4	3.16	2.19	2.00	3.02	1.72	2.57	1.21	2.27
September	Week-1	4.47	2.90	2.63	3.41	2.19	3.16	1.04	2.83
	Week-2	6.06	4.13	3.58	5.45	3.10	5.14	2.40	4.27
	Week-3	9.19	5.36	4.21	7.20	4.14	6.80	3.52	5.77
	Week-4	7.89	5.12	4.00	6.41	3.64	6.10	3.24	5.20
October	Week-1	4.97	4.80	3.85	5.43	3.27	5.12	2.84	4.33
	Week-2	6.14	3.70	3.42	4.21	3.17	4.12	2.25	3.86
	Week-3	6.36	3.18	3.10	4.13	2.64	3.65	2.13	3.60
	Week-4	5.38	2.88	2.51	3.58	2.25	3.20	1.95	3.11
November	Week-1	4.44	1.77	1.42	3.17	1.32	2.81	1.26	2.31
	Week-2	2.80	1.52	1.23	2.19	1.15	2.00	1.05	1.71
	Week-3	2.18	1.23	1.10	1.67	1.00	1.50	1.00	1.38
	Week-4	1.82	1.09	1.01	1.42	0.08	1.35	0.05	0.98
Mean (W)		4.34	2.66	2.26	3.46	1.93	3.16	1.52	
Factors		C.D.			SE(d)			SE(m)	
Treatments (T)		0.031			0.016			0.011	
Week (W)		0.047			0.024			0.017	
interaction W×T		0.125			0.063			0.045	

Control (No treatment given), G3M- G3 Mixture, AIO-*Azadirachta indica* oil Spray, CLE-*Calotropis procera* leaf extract, NS-*Nicotiana tabucum* extract, TLE-*Tagetes erecta* leaf extract, Imida-Imidacloprid 17.8% SL, C.D-Critical Difference

Mean incidence of sessional thrips population in august was 1.12, in September 4.52, in October 3.47 and in November 1.59. Maximum outbreak of thrips population was noticed in third, fourth week of September (5.77 and 5.20, respectively) and first and second week of October (4.33 and 3.86, respectively). Foliar application of G3 Mixture, *Azadirachta indica* oil Spray, *Calotropis procera* leaf extract *Nicotiana tabucum* extract, *Tagetes erecta* leaf extract, and Imidacloprid 17.8% SL showed reduction in mean insect outbreak from 4.34 to1.52. G3 mixture {garlic (*Allium sativum*) + green chilli (*Capsicum annuum*) + ginger (*Zingiber officinale*)} reduce the risk of thrips 38.7% weekly, *Azadirachta indica* oil spray reduce 47.9%, *Calotropis procera* leaf extract reduce 20.3%, *Nicotiana tabucum* extract reduce 55.5%, Tagetes erecta leaf extract 27.2% and Imidacloprid 17.8% SL reduce 65.0% over the control, respectively. From the Table 1, it was clear that the difference of mean between the treatments and control from treatment was higher than critical difference (C.D), indicating significance difference between treatments. Significance difference also exist in the mean values of weeks.

Table 2: Sessional population dynamics of thrips (*Thysanoptera*) on bottle gourd under different biochemical agents

Incidence Days		Control	G3M	AIO	CLE	NS	TLE	Imida	Mean (T)
August	Week-1	0.48	0.36	0.32	0.37	0.36	0.35	0.18	0.35
	Week-2	1.86	1.10	1.08	1.57	0.54	1.32	0.23	1.10
	Week-3	3.54	2.28	1.78	3.19	1.44	2.54	0.86	2.23
	Week-4	3.95	2.98	2.77	3.78	2.51	3.35	2.00	3.05
September	Week-1	4.96	3.38	3.15	3.76	2.67	3.76	1.52	3.32
	Week-2	7.40	5.47	5.09	6.75	4.44	6.48	3.74	5.62
	Week-3	10.44	6.61	5.51	8.34	5.40	8.29	4.78	7.05
	Week-4	11.54	8.78	7.50	10.41	7.29	9.65	6.89	8.87
October	Week-1	8.50	8.34	7.43	8.02	6.80	8.68	6.37	7.73
	Week-2	9.37	6.93	6.57	7.69	6.41	7.22	5.48	7.10
	Week-3	9.97	6.78	6.46	7.57	6.24	7.41	5.74	7.17
	Week-4	7.67	5.17	4.83	5.71	4.54	5.57	4.24	5.39
November	Week-1	5.77	3.10	2.73	4.49	2.65	4.11	2.59	3.63
	Week-2	4.30	3.02	2.71	3.58	2.65	3.57	2.55	3.20
	Week-3	2.86	1.92	1.79	2.31	1.69	2.19	1.69	2.07
	Week-4	2.31	1.57	1.52	1.92	0.56	1.79	0.53	1.46
Mean (W)		5.93	4.24	3.83	4.97	3.51	4.77	3.09	
Factors		C.D.			SE(d)			SE(m)	
Treatments (T)		0.057			0.029			0.02	
Week (W)		0.086			0.044			0.031	
interaction WxT		0.227			0.115			0.081	

Control (No treatment given), G3M-G3 Mixture, AIO-*Azadirachta indica* oil Spray, CLE-*Calotropis procera* leaf extract, NS-*Nicotiana tabucum* extract, TLE-*Tagetes erecta* leaf extract, Imida-Imidacloprid 17.8% SL, C.D-Critical Difference

Thrips incidence on bottle gourd: The sessional outbreak of pest on bottle gourd initiated in the first week of August and continues through the fourth week of November, whereas the epidemic occurred in the second and third weeks of September as well as first and second week of October. Thrips occurrence increased gradually from the first week of August to the last week of September, whereas second and third weeks of September as well as first and second week of October had maximum outbreak; last week of October and November preceding an abrupt decrease (Table 2). Maximum pest population was observed in control condition (no treatment given), followed by CLE (*Calotropis procera* leaf extract) < TLE (*Tagetes erecta* leaf extract) < G3M (G3 Mixture) < AIO (*Azadirachta indica* oil Spray). There was a steady decline in the population in NS (*Nicotiana tabucum* extract) and finally Imida (Imidacloprid 17.8% SL) had minimal thrips population outbreaks in bottle guards. In controlled condition mean thrips population in chilly crop varied from 0.48 (AW-1) to 11.54 (SW-3), in first G3M treatment found between 0.36 (August 1st week; AW-1) to 8.78 (September 4th week; SW-4) it had 23.9% reduction, *Azadirachta indica* oil spray showed variation between 0.32 (AW-1) to 7.50 (SW-4) it had 35.0% reduction, *Calotropis procera* leaf extract had variation from 0.37 (AW-1) to 10.41 (SW-4) it had 09.7 % reduction, *Nicotiana tabucum* extract ranged between 0.36 (AW-1) to 7.29 (SW-4) it had 36.8% reduction, *Tagetes erecta* leaf extract showed variation from 0.35 (AW-1) to 9.65 (SW-4) it had 16.4% reduction and finally Imidacloprid 17.8% SL application range found between 0.18 (AW-1) to 6.89 (SW-3) it had reduction 40.3% reduction over the control respectively.

Mean incidence of sessional thrips population in august was 1.68, in September 6.21, in October 6.85 and in November 2.59. Maximum outbreak of thrips population was noticed in third, fourth week of September (8.87 and 7.05, respectively) and first and second week of October (7.33 and 7.10, respectively). Foliar application of G3 Mixture, *Azadirachta indica* oil Spray, *Calotropis procera* leaf extract *Nicotiana tabucum* extract, *Tagetes erecta* leaf extract, and Imidacloprid 17.8% SL showed reduction in mean insect outbreak from 5.93 to 3.09. G3 mixture {garlic (*Allium sativum*) + green chilli (*Capsicum annuum*) + ginger (*Zingiber officinale*)} reduce the risk of thrips 28.6% weekly, *Azadirachta indica* oil spray reduce 35.5%, *Calotropis procera* leaf extract reduce 16.3%, *Nicotiana tabucum* extract reduce 40.8%, *Tagetes erecta* leaf extract 19.6% and Imidacloprid 17.8% SL reduce 48.0% over the control, respectively. Tested foliar applicant and month/week showed significant difference with control and also with each other.

Table 3: Sessional population dynamics of thrips (*Thysanoptera*) on cucumber under different biochemical agents

Incidence Days		Control	G3M	AIO	CLE	NS	TLE	Imida	Mean (T)
August	Week-1	0.62	0.49	0.46	0.52	0.51	0.51	0.32	0.49
	Week-2	2.14	1.37	1.30	1.89	0.82	1.57	0.53	1.38
	Week-3	3.94	2.65	2.18	3.44	1.76	2.92	1.30	2.60
	Week-4	4.68	3.66	3.62	4.58	3.24	4.04	2.76	3.80
September	Week-1	5.12	3.64	3.25	3.96	2.76	3.80	1.71	3.46
	Week-2	8.02	5.83	5.70	7.49	4.93	7.29	4.38	6.23
	Week-3	10.81	6.92	5.91	8.75	5.95	8.48	5.06	7.41
	Week-4	12.00	9.14	8.35	10.79	7.80	10.14	7.33	9.37
October	Week-1	9.15	9.10	7.71	8.60	7.80	9.47	7.17	8.43
	Week-2	10.47	8.10	7.97	8.75	7.70	8.23	6.61	8.26
	Week-3	10.94	7.98	7.68	8.66	7.42	7.98	6.73	8.20
	Week-4	8.13	5.67	5.23	6.38	5.09	5.95	4.74	5.89
November	Week-1	5.78	3.01	2.74	4.68	2.66	4.13	2.60	3.66
	Week-2	5.62	4.51	4.10	4.96	4.00	4.83	3.83	4.55
	Week-3	3.41	2.44	2.30	2.89	2.29	2.78	2.17	2.61
	Week-4	3.04	2.25	2.24	2.68	1.29	2.54	1.23	2.18
Mean (W)		6.49	4.80	4.42	5.57	4.13	5.29	3.66	
Factors		C.D.			SE(d)			SE(m)	
Treatments (T)		0.066			0.034			0.024	
Week (W)		0.100			0.051			0.036	
interaction WxT		0.265			0.134			0.095	

Control (No treatment given), G3M- G3 Mixture, AIO- Azadirachta indica oil Spray, CLE- Calotropis procera leaf extract, NS- Nicotiana tabucum extract, TLE- Tagetes erecta leaf extract, Imida- Imidacloprid 17.8% SL, C.D-Critical Difference

Thrips incidence on cucumber: The sessional spread of the thrips in cucumber began in the first week of August and continues through the fourth week of November, whereas the epidemic

occurred between the second and third weeks of September. Thrips occurrence gradually increased from the first week of August to the first week of September, with maximum outbreaks occurring in the second, third, and fourth weeks of September, as well as the first to third week of October, with the last week of October and November preceding a sudden decrease (Table 3). Maximum pest population was observed in control condition (no treatment given), followed by CLE (Calotropis procera leaf extract) < TLE (Tagetes erecta leaf extract) < G3M (G3 Mixture) < AIO (*Azadirachta indica* oil Spray). There was a steady decline in the population in NS (*Nicotiana tabucum* extract) and finally Imida (Imidacloprid 17.8% SL) had minimal thrips population outbreaks in cucumber. In controlled condition mean thrips population in cucumber crop varied from 0.62 (AW-1) to 12.00 (SW-4), in first G3M treatment found between 0.49 (August 1st week; AW-1) to 9.14 (September 4th week; SW-4) it had 23.8% reduction, *Azadirachta indica* oil spray showed variation between 0.46 (AW-1) to 8.35 (SW-4) it had 30.4% reduction, *Calotropis procera* leaf extract had variation from 0.52 (AW-1) to 10.79 (SW-4 and NW-1) it had 10.1% reduction, *Nicotiana tabucum* extract ranged between 0.51 (AW-1) to 7.80 (SW-4) it had 35.0 % reduction, *Tagetes erecta* leaf extract showed variation from 0.51 (AW-1) to 10.14 (SW-4) it had 15.5% reduction and finally Imidacloprid 17.8% SL application range found between 0.32 (AW-1) to 7.33 (SW-3) it had reduction 38.9% reduction over the control respectively.

Mean incidence of sessional thrips population in august was 2.07, in September 6.62, in October 7.69 and in November 3.25. Maximum outbreak of thrips population was noticed in third, fourth week of September (7.41 and 9.37, respectively) and first and second week of October (8.43 and 8.26, respectively). Foliar application of G3 Mixture, *Azadirachta indica* oil Spray, *Calotropis procera* leaf extract *Nicotiana tabucum* extract, *Tagetes erecta* leaf extract, and Imidacloprid 17.8% SL showed reduction in mean insect outbreak from 6.49 to 3.66. G3 mixture {garlic (*Allium sativum*) + green chilli (*Capsicum annuum*) + ginger (*Zingiber officinale*)} reduce the risk of thrips 26.1% weekly, *Azadirachta indica* oil spray reduce 31.9%, *Calotropis procera* leaf extract reduce 14.3%, *Nicotiana tabucum* extract reduce 36.5%, *Tagetes erecta* leaf extract 18.5% and Imidacloprid 17.8% SL reduce 43.7% over the control, respectively. Foliar applicant and month/week were found to have a significant difference with control and also with each other.

DISCUSSION

Thrips attack the buds, leaves, and flowers of plants, among other plant components. The quality of agricultural goods can be significantly reduced by up to 50% when there was a strong infestation of these pests. IPM alternatives for onion thrips include aromatic insecticides derived from plants and biological suppression agents[8].

The efficiency of imidacloprid observed against *S. dorsalis* in the current investigation is consistent with the findings of Samota *et al.,* (2017)[9] and Yadav *et al.,* (2022)[10], where they had also revealed Imidacloprid 17.8% SL to be the most impressive against chilli thrips. The outcomes of the present study about the effectiveness of *Nicotiana tabucum* extract against *S. dorsalis* align with the findings of Ghosh's (2022) study, which reported a 47% decrease in the thrips population[11]. In the nervous system, the alkaloid nicotine (constituent of NS extract) competes with the primary neurotransmitter, acetylcholine, by binding to its receptors at nerve synapses and causing uncontrollable nerve firing triggering the body systems that depend on nerve input for proper functioning to fail quickly[12].

The upright performance of imidacloprid against thrips on bottle gourd noticed in present study is in conformity with the report of Halder *et al.,* (2020) who evaluated five synthetic insecticides against sucking pests of bottle gourd and found that imidacloprid 17.8 SL most effective to control thrips population[13]. Shivaleela and Chowdary (2020) investigated 6 insecticides against various different pests of cucumber and reported that imidacloprid 17.8% SL to be of importance to minimize the thrips, population infesting cucumber that supports the conclusions we have made thus far[14]. As per the report of Rustamani *et al.,* (2021), Imidacloprid was shown to be the most effective insecticidal treatment among the five, beginning to reduce the pest population a week after its application[15].

CONCLUSION

The sessional outbreaks of thrips on chilly, bottle gourd, and cucumber started in the second week of August and continues until the fourth week of November, maximum outbreak noticed in the second and third weeks of September in respect of all biochemical treatments. Dynamics in the thrips population was maximum in the control condition and followed by *Calotropis procera* leaf extract > *Tagetes erecta* leaf extract > G3 Mixture > *Azadirachta indica* oil > *Nicotiana tabucum* extract and finally Imida (Imidacloprid 17.8% SL) had minimal thrips population outbreaks. Imidacloprid 17.8% SL was found to be the most effective foliar applicant among all foliar applications, followed by *Nicotiana tabucum* extract and *Azadirachta indica* oil spray.

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Conflict of Interest

Authors have no relevant financial or non-financial interest to declare.

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