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Effect of Tea Cultivar on Density of some Predatory Insects and their Preys in Phu Tho Province, Vietnam

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ABSTRACT: Density of predatory insects and their relationship to preys were much different across five tea cultivars ('LDP1', 'LDP2', 'Trung Du', 'PH1' and 'TRI777') which are commonly planted in Phu Tho province, Vietnam. The population densities of predatory heteropterans *Orius sauteri, Sycanus croceovittatus* and their preys including the tea thrip *Physothrips setiventri* and a group of the leaf-eating lepidopterous caterpillars (*Biston suppressaria, Darasa consosia, Acanthopsyche subera* and *Homona coffearia*) were highest (1.53 ± 0.06, 1.01 ± 0.07, 64.3 ± 0.7 and 2.03 ± 0.13 individuals/m^2 respectively) on 'Trung Du', lowest (0.57 ± 0.01, 0.55 ± 0.04, 51.7 ± 1.3 and 1.75 ± 0.07 individuals/m^2 respectively) on 'LDP1'. The population densities of predatory coccinellids *Micraspis discolor, Menochilus sexmaculatus* and their prey, the tea aphid *Toxoptera aurantii,* were highest (1.84 ± 0.04, 1.53 ± 0.08 and 42.0 ± 0.01 individuals/m^2 respectively) on 'LDP1', lowest (1.46 ± 0.08, 1.15 ± 0.06 and 33.1 ± 0.06 individuals/m^2 respectively) on 'TRI777'.

INTRODUCTION

Located in Northern Midland and Mountainous Region of Vietnam, Phu Tho province has the subtropical monsoon climate, with the rather high annual average rainfall, ranging from 500 to 1500 mm. This climatic condition is suitable for growth and development of tea plants. In Phu Tho, tea has been planted for a long time, and is nowadays an important crop of high economic value for farmers. There are five tea cultivars, namely the hybrid 'LDP1', the hybrid 'LDP2', 'PH1' of Assam origin, 'Trung du' of Chinese origin and the local 'TRI777', commonly planted due to their good quality and high yield.

Tea plants are attacked by a wide range of diseases and insect pests. Major tea insect pests in Phu Tho has been surveyed by various authors (Nguyen Van Thiep, 2000; Le Thi Nhung, 2002; Vu Thi Thuong, 2012), with more attention was paid to effect of these five tea cultivars on their population density; effect of tree shade on density of major insect pests and some predatory insects was also assessed (Vu Thi Thuong *et al.* 2017). However, effect of these five tea cultivars on predatory insects and their preys (viz. tea insect pests) is clearly unknown. Therefore, our study aims at better understanding of population fluctuation of predatory insects in relation to their preys among tea cultivars in Phu Tho province.

MATERIALS AND METHODS

The study was carried out in tea plantations in Ha Hoa district, Phu Tho province from June to October in 2016. The experimental plots were laid out followed to the method described in Le Thi Nhung (2002), Nguyen Van Thiep (2000). Five 100m^2 plots were selected, each grown with one of five tea cultivars, namely hybrid 'LDP1', hybrid 'LDP2', 'PH1' of Assam origin, 'Trung du' of Chinese origin and the local variety 'TRI777'; all these plots were insecticide-free and relatively similar in elevation, age of tea plants, farming and harvesting regimes, direction of hillside and level of tree shade. Within each plot, five 1m^2 sampling points were randomly selected along two diagonal transects intercepting at the centre of the plot.

Predatory insects selected for this study were the flower bug *Orius sauteri*, the assassin bug *Sycanuscroceovittatus*, the aphidophagous coccinellids*Micraspis discolor*, the zig zag coccinellids*Menochilus sexmaculatus*; their preys selected were the tea thrip *Physothrips setiventris*, the tea aphid *Toxoptera aurantii* Fonscolombe and a group of the leaf-eating lepidopterous caterpillars including *Biston suppressaria, Darasa consosia, Acanthopsyche subera* and *Homona coffearia*.

These predatory insects and their preys were weekly sampled for their densities (individuals/m^2) using techniques given in Plant Protection Research Institute (1997), Professional Standard TCN10 by Ministry of Agriculture and Rural Development (2003). Their occurrence was visually inspected on whole tea plants at each sampling point and collection was done using an aerial net (Φ=45 cm), an insect aspirator and hand catch. Predatory coccinelids were identified using Hoang Duc Nhuan (2007) and predatory hemipterans were identified using Claver and Ambrose (2002) and Vennion and Ambrose (1992).

RESULTS AND DISCUSSION

As shown in Table 1, among five tea cultivars surveyed, 'Trung Du' of Chinese origin was the most heavy infested by the thrip *Physothrips setiventris*, with the mean monthly density of 64.3 ± 0.7 individuals/m^2, followed by 'PH1', with the mean monthly density of 60.0 ± 1.4 individuals/m^2; 'LDP1' was the least infected, with the mean monthly density of 51.7 ± 1.3 individuals/m^2. This result agreed with that given by Du Pasquier (1932) that level of infestation by thrips was different among tea cultivars, more heavily infested on Chinese cultivars than on Assam and Manipur cultivars.

Its predator, the flower bug *Orius sauteri* also exhibited its varied population densities among tea cultivars. Its highest mean monthly density of 1.53 ± 0.06 individuals /m^2 was recorded on 'Trung Du', followed by 1.15 ± 0.09 individuals/m^2 on 'TRI777', 1.10 ± 0.07 individuals /m^2 on 'PH1', and the lowest mean monthly density of 0.57 ± 0.01 individuals /m^2 on 'LDP1'. It is likely that availability of food source (viz. tea thrips) contributed to those different densities of predators.

Table 1: Effect of tea cultivar on density of the flower bug *Orius sauteri* and its prey *Physothrips setiventris* in Ha Hoa, Phu Tho province in 2016.

Predator and prey	Month surveyed	Density on each tea cultivar (individuals/m^2)					$LSD_{0,05}$
		LDP1	LDP2	PH1	Trung du	TRI777	
Orius sauteri	6	0.51	0.55	0.75	1.05	0.78	
	7	0.45	0.59	0.81	1.11	0.87	
	8	0.28	0.61	0.67	1.29	0.94	
	9	0.59	0.7	1.59	1.96	1.53	
	10	1.04	1.34	1.67	2.23	1.62	
	Mean	0.57^{c} ±0.01	0.76^{c}±0.11	1.10^{b}±0.07	1.53^{a}±0.06	1.15^{b}±0.09	0.25
Physothrips setiventris	6	42.5	43.1	45.5	53.8	52.8	
	7	65.7	64.5	70.5	74.1	73.4	
	8	60	60.6	69.4	73.4	61.9	
	9	51.6	51.8	57.6	61.6	52.5	
	10	38.9	39.7	57.1	58.6	39.9	
	Mean	51.7^{c} ±1.3	51.9^{c} ±0.8	60.0^{b} ±1.4	64.3^{a} ±0.7	56.1^{b} ±0.5	4.00

Legend: means followed by different uppercase letters were significantly different (ANOVA, P < 0.05)

Table 2: Effect of tea cultivar on the density of *Sycanus croceovittatus* and its group of lepidopterous preys in Ha Hoa, Phu Tho province in 2016.

Predator and group of lepidopterous preys	Month sampled	Density on each tea cultivar (individuals/m^2)					$LSD_{0.05}$
		LDP1	LDP2	PH1	Trung du	TRI777	
Sycanus croceovittatus	6	0.93	0.9	1.19	1.18	0.93	
	7	0.81	0.55	1.05	0.75	0.81	
	8	0.29	0.9	0.83	1	0.81	
	9	0.38	0.53	1.15	1.18	2.21	
	10	0.33	0.5	1.24	0.95	1.04	
	Mean	0.55^{b}±0.04	0.68^{b}±0.09	1.09^{a}±0.02	1.01^{a}±0.07	1.16^{a}±0.12	0.23
Group of Lepidopterous preys	6	2.46	1.99	2.55	2.82	2.91	
	7	2.42	2.53	2.47	2.73	2.65	
	8	1.38	1.52	1.30	1.74	1.42	
	9	1.18	1.18	1.20	1.35	1.23	
	10	1.30	1.24	1.26	1.50	1.32	
	Mean	1.75^{b}±0.07	1.69^{b}±0.09	1.76^{b}±0.02	2.03^{a}±0.13	1.91^{a}±0.05	0.13

Legend: means followed by different uppercase letters were significantly different (ANOVA, P < 0.05)

The higher densities of thrips on the heavily infected tea cultivars led to the higher density of *O. sauteri,* indicating the numerical response of the prey – predator relationship. Regarding occurrence of the lepidopterous pests of tea, 'Trung Du' of Chinese origin and the local cultivar 'TRI777' had the highest incidence of the lepidopterous pests, with the mean monthly density of 2.03 ± 0.13 and 1.91 ± 0.05 individuals/m^2, respectively. Three remaining tea cultivars 'PH1', 'LDP1' and 'LDP2' had the significantly lower mean monthly densities (1.76 ± 0.02, 1.75 ± 0.07 and 1.69 ± 0.09 individuals/m^2, respectively) (Table 2).

The mean monthly density of *Sycanus croceovittatus* also showed the difference across five tea cultivars. significantly higher on the cultivars 'TRI777', 'PH1' and 'Trung Du' (1.16 ± 0.12. 1.01 ± 0.07 and 1.09 ± 0.02 individuals/m^2 respectively) than on the hybrid cultivars 'LDP1' and 'LDP2' (0.55 ± 0.04. 0.68 ± 0.09 individuals/m^2 respectively).

For incidence of the predatory coccinellids on five tea cultivars surveyed, the mean monthly density of *M. discolor* was highest (1.84 ± 0.04 individuals/m^2) on "LDP1", a bit lower (1.83 ± 0.09 individuals /m^2) on "LDP2", lowest (1.43 ± 0.05 individuals/m^2) on "PH1"; the mean monthly density of *M. sexmaculatus* was highest (1.53 ± 0.08 individuals/m^2) also on "LDP1", somewhat lower (1.45 ± 0.04 individuals/m^2) on "LDP2", lowest (1.15 ± 0.06 individuals/m^2) on "TRI777". Similarly, the aphid prey *T. theicola* of these coccinellids was the first most abundant (with the mean monthly density of 42.0 ± 0.01 individuals/m^2) on "LDP1", the second most abundant (40.2 ± 0.04 individuals/m^2) on "LDP2", the least abundant (33.1 ± 0.06 individuals/m^2) on "TRI777".

In terms of prey- predator relationship, a close correlation in population fluctuation was found between *Ornius sauteri* and its prey *Physothrips setiventris* on the tea cultivar 'Trung Du', between *Sycanus croceovittatus*and its lepidopterous pests. *Micraspis discolor* and its aphid prey and *Menochilus sexmaculatus*and its aphid prey on 'LDP1', 'LDP2', and 'TRI777'. However, the close correlation between these two coccinelids and their aphid prey on 'PH1' did not occur because of the low density of aphids. This result agreed with that in Vu Thi Thuong *et al.* (2005).

Table 3: Effect of tea cultivar on density of predatory coccinellids and their prey *Toxoptera theicola* in Ha Hoa, Phu Tho province in 2016.

Prey and predatory coccinellids	Month sampled	Density on each tea cultivar (individuals/m^2)					$LSD_{0.05}$
		LDP1	LDP2	PH1	Trung du	TRI777	
Micraspis discolor	6	2.75	2.95	1.65	1.15	1.95	
	7	2.05	1.85	1.55	0.95	1.03	
	8	1.33	1.36	1.41	1.4	1	
	9	1.51	1.61	1.22	2.03	1.49	
	10	1.54	1.38	1.31	2.28	1.83	
	TB	1.84^{a}± 0.04	1.83^{a}± 0.09	1.43^{c}± 0.05	1.56^{b}± 0.12	1.46^{c}± 0.08	0.13
Menochilus sexmaculatus	6	1.68	1.45	0.58	1.89	0.6	
	7	1.55	1.37	0.64	1.93	0.47	
	8	1.95	1.42	1.7	1	1.12	
	9	1.35	1.43	1.46	1.26	1.64	
	10	1.13	1.59	1.51	0.74	1.91	
	TB	1.53^{a}±0.08	1.45^{a}±0.04	1.18^{b}±0.03	1.36^{c}±0.07	1.15^{b}±0.06	0.08
Toxoptera theicola	6	40.5	33.5	9	15	7.5	
	7	22	22.5	13	5.5	10.5	
	8	61	58.5	53	67	58.5	
	9	45	46.5	51	52	47	
	10	41.5	40	43.5	45	42	
	TB	42.0^{a}±0.01	40.2^{a}±0.04	33.9^{c}±0.02	36.9^{b}±0.07	33.1^{c}±0.06	2.05

Legend: means followed by different uppercase letters were significantly different (ANOVA, P < 0.05).

CONCLUSION

Four predatory insects exhibited their varied densities among five tea cultivars. SHeteropterans *Orius sauteri, Sycanus croceovittatus* and their preys including *Physothrips setiventris* and a group of four lepidopterous pests (*Biston suppressaria, Darasa consosia, Acanthopsyche subera* and *Homona coffearia*) had all their highest densities on 'Trung Du' with the close prey-predator correlation, while their lowest densities were on 'LDP1', Coccinellids *Micraspis discolor, Menochilus sexmaculatus* and their prey, Viz, *Toxoptera aurantii*, had all their highest densities on 'LDP1' with the close prey-predator correlation, while their lowest densities were on 'TRI777'.

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