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HABITAT MANIPULATION FOR MANAGING INSECT PESTS OF BRINJAL

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ABSTRACT

Field experiments were conducted at Allengmora, Jorhat during 2017-18 and 2018-19 to study the impact of habitat manipulation on the incidence of major pests of brinjal and their natural enemies. There were four treatments comprised of brinjal intercropped with coriander and carrot as border crop (T_1); brinjal intercropped with carrot and cowpea as border crop (T_2); brinjal intercropped with cowpea and coriander as border crop (T_3) and brinjal as sole crop (T_4). The results revealed that brinjal intercropped with carrot and cowpea as border crop (T_2) was found to be the best in reducing the incidence of shoot (10.53%) and fruit (11.59%) damage. This treatment also reduced the population of *Amrasca biguttula biguttula*, *Henosepilachna vigintioctopunctata* and *Aphis gossypii* to 1.28, 1.73 and 1.89/ leaf, respectively. Moreover, maximum numbers of coccinellid predators (2.41/ leaves) with maximum yield of 19742 kg/ha and maximum cost benefit ratio (1: 4.25) was obtained with the same module. Thus, brinjal intercropped with carrot and cowpea as border crop could be adopted for effective management of key pests of brinjal.

Key words: Brinjal, *Leucinodes orbonalis*, *Amrasca biguttula biguttula*, *Henosepilachna vigintioctopunctata*, *Aphis gossypii*, coccinellids, habitat manipulation

Brinjal (*Solanum melongena* L.) is a major vegetable is a cash crop in Assam (Anon, 2017), and kitchen garden cultivation is common (Isahaque, 1979). Its production is affected by the iotic and abiotic factors, of which and among the biotic ones, insect pests play a key role (Regupathy et al., 1997). Brinjal is infested by>70 insects (Subbaratnam and Butani, 1982; Borkakati et al.,2019a), of which the major ones are the *Leucinodes orbonalis*, *Amrasca biguttula biguttula*, *Henosepilachna vigintioctopunctata* and *Aphis gossypii*. The shoot and fruit borer *L. orbonalis* alone cause upto 80-90% yield loss (Patnaik, 2000; Misra, 2008; Jagginavar et al., 2009; Borah et al., 2016). Heavy dependence on insecticides leads to development of resistance, pest outbreak and environmental pollution (David and Kumaraswami, 1989). In a recent study, Razzak et al. (2015) evaluated polyculture crop system that significantly suppressed pest population with more abundance of natural enemies. The cultural practice like polyculture or intercropping approaches has been found as a very useful. Under habitat management, diversification through intercropping is required for conserving the natural enemies. The present study evaluates the role of habitat manipulation on natural enemies of insect pests of brinjal through intercropping.

MATERIALS AND METHODS

The experiment was conducted during the *rabi* seasons of 2017-18 and 2018-19 at the Farmer's field, Alengmora, Jorhat. Five modules of main crop and trap crop/ intercrop combinations were evaluated in five replications. The observations on the incidence of insects viz., *L. orbonalis*, *A. biguttula biguttula*, *H. vigintioctopunctata*, *A. gossypii* and predatory coccinelid beetles as well as yield were made.

The four modules evaluated include: T_1: brinjal intercropped with coriander and carrot as border crop; T_2: brinjal intercropped with carrot and cowpea as border crop; T_3: brinjal intercropped with cowpea and coriander as border crop; and T_4: brinjal as sole crop (untreated check). Observations on the population of aphids/ leaf were recorded from randomly selected 5 plants at 10 days interval starting from 25 DAP. The population of predators (coccinelids) was recorded on whole plant basis at 10 days interval. To collect the parasitoids from eggs and immature stages of lepidopteran pests, the eggs and larvae were kept in the laboratory for emergence of parasitoids. Yield data of brinjal was also recorded.

The brinjal seedlings (Varity Hazari) were

Table 1. Effect of habitat manipulation on pests and coccinelid predators of brinjal

Modules	Shoot (%) (BSFB) Infestation		Pooled mean	% ROC* (avg.)	Fruit (%) (BSFB) Infest station		Pooled mean	% ROC* (avg.)	*A.biguttula biguttula*/ plant		Pooled mean	% ROC* (avg.)	E beetle/ plant		Pooled mean	% ROC* (avg.)	*A. gossypii* / plant		Pooled mean	% ROC* (avg.)	Predatory Coccinellids / plant		Pooled mean	% IOC* (avg.)
	2017-18	2018-19							2017-18	2018-19			2017-18	2018-19			2017-18	2018-19			2017-18	2018-19		
T1	11.28 [b]	13.97 [c]	12.63 [c]	9.33	14.05 [b]	13.77 [b]	13.91 [b]	27.48	1.50 [b]	2.47 [bc]	1.72 [b]	1.15	1.80 [a]	1.57 [ab]	1.86 [a]	17.33	1.59 [b]	4.60 [b]	3.09 [b]	50.32	1.52 [b]	1.87 [a]	1.56 [b]	-33.33
T2	9.19 [a]	11.37 [a]	10.53 [a]	24.41	12.94 [a]	10.08 [a]	11.59 [a]	39.57	1.0 [a]	1.56 [a]	1.28 [a]	26.44	2.08 [ab]	1.94 [c]	1.73 [a]	23.11	0.86 [a]	2.65 [a]	1.89 [a]	69.61	2.92 [a]	1.91 [a]	2.41 [a]	2.99
T3	9.25 [a]	12.64 [b]	11.95 [b]	14.21	17.09 [a]	14.05 [c]	15.37 [c]	19.86	1.27 [b]	1.80 [ab]	1.29 [a]	25.86	2.08 [ab]	1.30 [a]	1.77 [a]	21.33	2.03 [c]	5.95 [c]	3.99 [c]	35.85	1.2 [b]	1.15 [c]	1.18 [c]	-49.57
T4	13.15 [c]	14.70 [c]	13.93 [d]		19.91 [d]	18.45 [d]	19.18 [d]		1.61 [c]	3.11 [c]	1.74 [b]		2.64 [b]	1.86 [bc]	2.25 [b]		4.26 [d]	8.20 [d]	6.22 [d]		2.80 [a]	1.60 [b]	2.34 [a]	
CD	0.15	0.87	0.35		0.20	0.45	0.27		0.25	0.64	0.19		0.68	0.3264	0.38		0.36	0.88	0.42		0.50	0.20	0.22	
CV (%)	3.35	16.21	7.44		3.69	8.72	5.11		13.89	14.8	8.95		23.04	14.22	14.45		11.71	11.9	8.09		17.02	9.15	8.65	

ROC* Reduction over control; IOC** Increase over control; # Mean of 7 observations; Mean followed by same letter in a column do not differ significantly -DMRT (P=0.05).

Table 2. Economics of intercropping treatments of brinjal

Modules	Yield (kg/ha)			Increased over control (kg/ha)	Increase % over control	Price of yield (Rs./ha)	Cost of treatment (Rs./ha)	Net profit (Rs./ha)	Cost benefit ratio
	First year (2017-18)	Second year (2018-19)	Pooled mean						
T1	19072 [b]	20200 [b]	19611.00 [b]	5061.00	31.87	98055	18757	79298	1: 4.23
T2	20187 [a]	21067 [a]	19742.00 [a]	5192.00	32.69	98710	18797	79913	1: 4.25
T3	18415 [c]	18440 [c]	19314.00 [c]	4764.00	30.00	96570	18656	77914	1: 4.18
T4	13863 [d]	15237 [d]	14550.00 [d]			72750	15000	57750	1: 3.85
CD	6.55	7.68	5.54						
CV (%)	2.66	2.98	2.20						

7 observations. Mean followed by same letter in a column do not differ significantly- DMRT (P=0.05). Price of brinjal Rs. 5/kg

transplanted at spacing at 60 cm x 75 cm during second fortnight of October in a large plot size of 20 x 15 m^2 for each module. As such five plots were prepared. Since aphids and coccinellids were congregated towards terminal parts of the plant, three leaves were sampled from each of the five random plants and the number of aphids/ leaf were counted under stereozoom microscope. As regard to yield, fruit weight from 100 m^2 plots were clubbed together and converted to per ha basis. The data were subjected to ANOVA with least significant difference (p=0.05). The yield/ ha basis for was used for the economics of benefit cost analysis, expressed in the form of benefit cost ratio (= Net return (Rs. /ha) divided by cost of cultivation (Rs. /ha)

RESULTS AND DISCUSSION

As given in Table 1, T_2 (brinjal intercropped with carrot and cowpea as border crop) was found to be the best reducing the larval population of *L. orbonalis, A. biguttula biguttula*, *H. vigintioctopunctata* and *A. gossypii*, and increase in coccinelids was observed. In case of *L. orbonalis*, the least shoot damage of 9.19% and 11.37% was observed during 2017-18 and 2018-19 as against 12.94% and 10.08%, respectively with 10.53% shoot damage and 11.59% fruit damage. Similarly, 1.28, 1.73 and 1.89/ plant were observed against *A. biguttula biguttula*, *H. vigintioctopunctata* and *A. gossypii*, respectively. Maximum numbers of coccinelids (2.92 and 1.91/ plant) was observed from same module during 2017-18 and 2018-19, respectively. The treatment T_2: brinjal intercropped with carrot and cowpea as border crop also was observed to yield of 19742 kg/ha, which gave maximum cost benefit ratio of 1: 4.25 (Table 2).

The odoriferous plants, when raised with host plants of insect plants, could deter recognition, feeding and reproduction of the pests on their host plants. (Dethier et al. 1960; Schoonhoven, 1968; Sujayanand et al. 2015). The present results confirm those of Razzak et al. (2015), who observed that brinjal + coriander, brinjal + radhuni and brinjal + chilli systems reduce aphid population. Cowpea used in present study was also reported as good intercrop to reduce the aphid population in cabbage (Borkakati et al., 2019b). Razzak et al. (2015) observed less incidence of leafhopper with brinjal + coriander followed by brinjal + fenugreek polyculture system. Elanchezhyan and Muralibaskaran (2008) from Tamil Nadu, found that intercropping of brinjal with cluster bean and onion harbored less population of leafhoppers. Colonization and residence time of the leafhopper on a host plant were influenced by the presence of non-host plants (Sujayanand et al. 2015). Results obtained now agree with those of Khorsheduzzaman et al. (1997) on intercropping coriander with brinjal reducing *L. orbonalis* infestation. The present observations on coccinellids agree with those of Patro et al. (2014) on brinjal + cowpea intercropping.

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