DIVERSITY OF INSECT PEST, NATURAL ENEMIES AND OTHER BENEFICIALS ARTHROPODS COMMUNITY IN SELECTED BRINJAL VARIETIES/LINES

S. M. R. Amin*, M. Z. Alam, M. M. Rahman**, M. M. Hossain*** and I. H. Mian******

* Department of Agricultural Extension, Khamarbari, Dhaka, ** Entomology department, *** Horticulture Department, **** Plant Pathology Department, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Salna Gazipur-1706, INDIA.

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ABSTRACT: Five brinjal varieties viz., BL099, BARI brinjal-6,BL117,BL072 BARI brinjal-1 were grown in replicated trial laidout in randomized block design at experimental farm and Entomology laboratory of BSMRAU for the measurement of diversity and equitability of arthropod community during 2005. The finding indicated that lower abundance of insect family in resistance variety/lines while a higher number of families are available in susceptible variety/line. All the resistant varieties showed higher equitability compare to that of susceptible one. A positive relationship was evident between the number of fswmilies and diversity index at all the crop growth stages (r=0.77). A negative relationship was observed between the number of families and equitability at all crop stages. (r= 0.31).

KEY WORDS: Insect pest, arthropod community, Brinjal varieties/lines

Brinjal (*Solanum melongena*) is one of the most popular and principal vegetable crop grown in Bangladesh and other part of the world. The major constraints of the brinjal production is that the crop is attacked by a large number of insect pests among which Brinjal shoot and fruit borer BSFB, *Lencinodes orbonalis* Guenee is most destructive pest of brinjal in Bangladesh (Alam, 1969; Cattopadhy, 1987) and India (Tewari & Sandana, 1990) and also a major pest in other country of the world. For controlling insect pest of brinjal, farmer's usually spray chemical pesticide many times during the crop season which leads to environmental pollution and consequent increase in health hazard to the growers and consumers. Moreover, it also leads to the development of resistance to target pests (David & Kumaraswami, 1989) and also had a negative effect on natural enemies and other beneficial and causes disruption of biodiversity. The growing awareness of the shortcoming of the chemical insecticides has necessitated the exploration of alternative method of pest control which is relatively free from adverse side effects. Among the various alternatives, the exploitation of host plant resistance is perhaps the most effective, convenient, economical and environmentally acceptable method of insect control (Dhaliwal & Dilawary, 1993). Varieties of brinjal with some morphological and physiological bases provide resistance against different brinjal pests. Different varieties of brinjal showed different reaction to different insect pests.

For better understanding and identifying suitable resistant variety of brinjal it is important to measure the species diversity that gives us clear idea about herbivore load of a variety. Therefore the present study was undertaken with the following objectives:

1. to determine the diversity and equitability of insect communities in different brinjal varieties/lines and

2. to find out the relationship between species richness of taxonomic categories with the diversity index and equitability in brinjal grown with different varieties/line

MATERIALS AND METHODS

The experiment was conducted using 5 brinjal varieties/ lines viz., BL 099, BARI brinjal-6, BL 117, BL 072 and BARI brinjal -1 in the experimental farm of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur during the period from April 2005 to September 2005. The experiment was laid out in a randomized block design with three replications. The individual plot size was 3mX3m. The distance between plots and blocks were 0.5 meter and 1 meter, respectively. The seedling were transplanted at spacing of 1 m between lines and 60 cm between plants. The crop was grown following the recommended practices except application of insecticide.

Data collection for the measurement of diversity index and equitability

The simplest measure of species diversity is to count the number of species present. The concept was extended to order and family level. Capturing the insects was performed using two relative methods viz., pitfall trapping and sweep netting.

Pitfall trap method

This method was used for the species that roam in the soil surface such as ground beetles, spiders, collembola etc. Small plastic pots having 6 cm diameter and 8 cm deep were used as pitfall traps each of which was filled with water. Three traps were placed in soil in each of the plots at early, mid and late stage of crops to trap the insects. The trap mouth of the pot was kept with the ground level so as avoid obstruct insect movement. After 48 hours of setting traps, insects were collected from each plot/treatment and kept separately.

Sweeping net method

This method was used for counting flying and stationary insects on host plants to know the abundance pattern of insects in the present study. Five (5) times return sweeping was done in each plot to make a composite sample by a sweeping net at early, mid and late crop stages. Each sample was examined separately without killing the insects and released them immediately after counting in the same plot. The individuals of each sample were counted by family.

On the basis of phenotypic similarity, trapped and sweep net caught insects were then sorted and further identified to family and order they belong to with the help of identified specimens kept with the museum of the dept. of Entomology, BSMRAU and other standard taxonomic keys. Data were recorded against each treatment.

Measurement of diversity index and equitability

To assess both the abundance pattern and the species richness, Simpson's diversity index was used (After Simpson's, 1949).

$$\textit{Simpson's Index, (D)} = \frac{1}{\sum_{i=1}^{s} P_i^2}$$

Where, Pi is the proportion of individual for the ith insect family and S is the total numbers of insect family in the community (i.e., the richness).

Equitability was quantified by expressing Simpson's index, D as a proportion of the maximum possible value of D.

$$\text{Equitability, } E = \frac{D}{D_{max}} = \frac{1}{\sum_{i=1}^{s} P_i^2} \times \frac{1}{S} \quad [\text{As } D_{max} = S]$$

Insect pests and their natural enemies i.e., predators and parasitoids, as well as other beneficial insects like pollinators and spiders were taken into account.

Statistical analysis

Linear regression analysis was performed to explore the relationships between the number of taxonomic categories with diversity index and equitability.

RESULTS AND DISCUSSION

Diversity of arthropod /insect community

Trends of diversity pattern of insect roaming in different brinjal resistance and susceptible varieties using pitfall and sweep net at early. mid and late stage of crop growth are shown in Table 1.1 , 1.2. Some insects which were not regarded as crop pest , were also found in the trap incidentally in both the method. They were also included in data because the relative significance of their presence in a particular ecosystem is not clearly known.

Diversity of arthropod /insect community measured by pitfall trap at different stage of crop growth

From Table 1.1 it is evident that the higher richness and also the higher diversity index were observed in BARI brinjal-6 and BARI brinjal-1 with the equitability of 0.55 and 0.33, respectively. In the mid stage of crop growth the highest equitability (0.80) was observed in BL117 with lower species richness. On the other hand BL099, BARI brinjal-6 produce higher equitability with relatively lower species richness. BARI brinjal -1 showed comparatively higher richness but low equitability (Table 1.1). The result indicated that lower abundance of insect family in resistant varieties/lines of brinjal while a higher number of families were found in susceptible BARI brinjal-1 variety.

In the late stage of crop growth the higher diversity index was found in all the varieties/lines except BL 099 (Table 1.1). But all the resistant varieties showed higher equitability. Brinjal variety, BARI brinjal-1 showed lowest equitability and BARI brinjal -6 showed highest equitability (0.79).

Diversity of arthropod/insect community measured by sweeping net at different stage of crop growth

Table 1.2 indicated that the early stage of crop growth the higher richness and also the higher diversity index were observed in BL 117 and BARI brinjal-6 with the equitability of 0.23 and 0.25, respectively. In the mid stage of crop growth the highest equitability (0.46) was observed in BL 099 with lower species richness. And BARI brinjal -1 showed highest richness but lowest equitability (0.20) (Table 1.2). The result indicated that lower abundance of insect family in resistant varieties/lines of brinjal while a higher number of families were found in susceptible BARI brinjal-1 variety.

In the late stage of crop growth the diversity index was found similar in all the varieties/lines (Table 1.1). But all the resistant varieties showed higher equitability. Brinjal variety BARI brinjal-1 showed lowest equitability (0.19) and BL099 showed highest equitability (0.58).

Relationship between species richness , diversity index and equitability

The relationship between richness with diversity index and equitability of insect/arthropod community under different brinjal varieties/line at different growth stage are presented in Table 1.3.

Relationship between number of insect/ arthropod families with diversity index

A positive relationship was found between the number families and diversity index in all the crop growth stage (Table 1.3). In all stages of crop growth except the early stage, significant relationship between richness and diversity index of insect/arthropod community was observed (r=0.71-0.96). Assessment of the whole crop period revealed significant positive relationship between richness and diversity index. It is clearly evident that diversity index of insect/arthropod community influenced by the number of insect family (e. i., species richness).

Relationship between number of insect/ arthropod families with equitability

A negative relationship was observed between the number of families with equitability in all the crop stages (r=0.31)(Table 1.3). However the result during the late stage of crowth revealed a strong significant negative relationship (r=-0.97) between richness and equitability. The value of diversity index depends on the species richness and the evenness (equitability) with which individual are distributed among the species. For a given richness 'D' increases with equitability and for a given equitability 'D" increases with richness (Begon et al., 1990).

In the present study, when diversity was assessed by relative method, BARI brinjal-1 showed higher diversity index in all the growth stages but resistant varieties showed comparatively lower diversity index. The results indicated that the pest insect were less abundant in resistant varieties / lines of brinjal and greater number belongs to different natural enemies and beneficials. May (1975) reported that diversity index is strongly influenced by species richness. A completely novel concept of Tailor et al. (1976) of viewing diversity as a reflection of basic environmental structure, the two meaningfull characteristics are not species richness and evenness but (1) diversity as represented by the common, the slope of the line is dominated by the moderately common species and (2) the fluctuation in number from occasion to occasion (eg., year to year).

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Table 1.1. Diversity and equitability of arthropod community of different resistant and susceptible brinjal varieties/lines recorded in pitfall trap at early, mid and late stages of crop during summer 2005.

Variety /line	Early stage			Mid stage			Late stage		
	No. of insect families recorded	Diversity index	Equita bility	No. of insect families recorded	Diver sity index	Equita bility	No. of insect families recorded	Diver sity index	Equita bility
BL-099(R)	4	2.07	0.52	6	4.62	0.77	4	2.85	0.71
BARI brinjal6(R)	5	2.74	0.55	8	5.52	0.69	4	3.17	0.79
BL-117(R)	4	2.29	0.57	9	7.19	0.80	5	3.59	0.72
Bl-072(R)	5	1.79	0.36	9	4.79	0.53	5	3.83	0.77
BARI brinjal-1(S)	7	2.32	0.33	11	5.08	0.46	6	3.02	0.50

R=Resistant S= Susceptible

Table 1.2. Diversity and equitability of arthropod community of different resistant and susceptible brinjal varieties/lines recorded in sweeping net at early, mid and late stages of crop during summer 2005.

Variety /line	Early stage			Mid stage			Late stage		
	No. of insect families recorded	Diversity index	Equita bility	No. of insect families recorded	Diversity index	Equita bility	No. of insect families recorded	Diversity index	Equi tabil ity
BL-099(R)	5	1.52	0.30	10	4.55	0.46	5	2.89	0.58
BARI brinjal-6(R)	7	1.73	0.25	12	4.89	0.41	6	2.78	0.46
BL-117(R)	8	1.83	0.23	14	4.60	0.33	7	2.83	0.40
Bl-072(R)	7	1.46	0.21	13	4.26	0.33	5	2.16	0.43
BARI brinjal-1(S)	9	1.56	0.16	15	3.04	0.20	11	2.14	0.19

R=Resistant S= Susceptible

Table 1.3. Relationship between number of families (x) and diversity index (y), equitability (y) at different plant growth stages of brinjal during summer 2005.

Relationship between	Crop growth stages			
	Early stages	Mid stages	Late stages	Whole crop period
No. of insect families (x) and diversity index(y)	Y= 0.13x +1.44 r = 0.71	Y= 0.25x +3.82 r = 0.87	Y= 0.26x +3.25 r = 0.96	Y= 0.39x +0.25 r = 0.77
Probability (p)	NS	0.01	0.05	NS
No. of insect families (x) and equitability (y)	Y=-0.008x+0.35 r = 0.58	Y= -0.023x+0.87 r = 0.80	Y= -0.05x +1.02 r = 0.97	Y= 0.008x+0.49 r = 0.31
Probability (p)	NS	NS	0.05	NS