RESEARCH PAPER

Seasonal Incidence and Damage Potentiality of *Basilepta subcostata* (Jacoby) and *Bhamoina varipes* (Jacoby) (Coleoptera: Chrysomelidae) in Banana Cultivars from Southern part of Bangladesh

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ABSTRACT

Experiments on seasonal incidence and damage potentiality of the *Basilepta subcostata (Jacoby) and Bhamoina varipes (Jacoby) (Coleoptera: Chrysomelidae) in banana cultivars* from Southern part of Bangladesh were carried out in the banana orchard during the period from June, 2021 to July, 2022. Four banana cultivars viz. Sabri, Amrita sagar, Kanthali and kach kala were selected to know the seasonal incidence and damage potentiality of Banana Leaf and Fruit Beetles. They occurred throughout the year but they were more active from May to October though the pick period of activity from June to October and cause severe damage to banana. The highest mean number of beetle population per plant recorded on Amrita sagar (25.2/plant) followed by Sabri (21.4/plant), Kach kala(13.4/plant) and Kanthali kala (2/plant). Highest damage per sq. inch of leaf was recorded in Amrita sagar (15.6 ± 0.8) in the month of July followed by Sabri (12.8 ± 0.8), Kach kala (9.0 ± 1.0) and Kanthali kala (0.8 ± 0.3). Considering the percent fruit damage per bunch, Banana Leaf and Fruit Beetle was found mostly harmful to Amrita sagar (85.5) followed by Sabri (77.46), Kach kala (36.93) and Kanthali kala (2.46). Among the two species, *Basilepta subcostata* was recorded highest in number per plant (19.2) in Sabri on September followed by *Bhamoina varipes* (1.8), and recognized as more potential to damage leaves and fruits of Banana. *Bhamoina varipes* was found only in two banana cultivars ie. Sabri and Kach kola whereas *Basilepta subcostata* was found in four cultivars. The incidence of beetle population and scars produced by the beetle was significantly and positively correlated with rainfall, temperature and relative humidity.

Key words: Banana leaf and fruit beetle, damage severity, occurrence, population dynamics

Introduction

Banana (Zingiberales: Musaceae) is one of the most popular, remunerative and important year round fruit crops to the growers considering total production of 817908 MT in an area of 121777 acres in Bangladesh (BBS, 2020). In the same year of banana production, 225319 MT in 11340 acres were produced only in the southern part of Bangladesh. Therefore the southern part of Bangladesh contributes a lot in net banana production in a year. Banana is possibly the world's oldest cultivated plants (Kumar et al., 2012, Hossain et al.,2016). Assani et al. (2001) claimed that it is one of the most nutritious fruits in the world and cultivated in many tropical areas where it is used both as a staple food and dietary supplements. Generally "plantain" is often used specifically to refer to cooking bananas which is iron rich food source on the other hand "banana" is mainly used to refer to dessert bananas (Sharrock et al. 1998).

Though in Bangladesh, banana is cultivated almost everywhere round the year but the production and productivity of banana is being affected by several pests and diseases. Simmonds (1996) have been reported more than 200 species of insect and non-insect pests affecting banana during cultivation. About 19 insect pests have been found associated with banana from planting to harvesting that hampered to the production of banana. Among them, Banana leaf and fruit scarring beetle

(Coleoptera: Chrysomelidae), common name of *Basilepta subcostata*, *Bhamoina varipes* and many more, is considered as one of the most economically important pests in Bangladesh (Rahman et al., 2004; Begum et al. 2022). This insect usually lives in the heart of the pseudostem within the roll of the central leaf (NAREI, 2021). The adult of the banana leaf and fruit scarring beetle feeds on various weeds and also on young skin of banana fruit, it's young leaves, stems and roots making scars and spot on the skin which deform it and create oval shaped scars, on the other hand the larvae of the beetle feed on young roots making tunnel on the older roots to eat the tissues (NAREI, 2021).

Generally most of the scarring occurs at the base of the fruit as the beetle chose the most sheltered spots for feeding. As infected fruits get spotted and severe scarring of fruit skin leads to underdeveloped fruit with less commercial value. Paul et al. (2020) revealed that the peak incidence of this pest in India was in April and continued till end of the rainy season and the extent of damage inflicted upon banana crop by this pest has been reported to be around 80 per cent and in case of severe infestation, the percentage of infested orchards, and intensity of the pest have been recorded up to 100 per cent. As the beetle population causes serious damage (by scars) on leaves and banana peel, has tremendously influenced on both quantity and quality of banana which reduces the market acceptability in the highly competitive export market. The market value may be reduced upto 50% due to attack of this pest (Alam et al. 2000).

Furthermore, information on incidence and damage potentiality of these pests were limited. In this background present investigation was planned to study intensively the incidence and damage potential of these pests.

Methods and materials

Experiments on seasonal incidence and damage potentiality of the *Basilepta subcostata (Jacoby)* and *Bhamoina varipes* (Jacoby) (Coleoptera: Chrysomelidae) in banana cultivars from Southern part of Bangladesh were carried out in the banana orchard during the period from June, 2021 to July, 2022.

Crop Selection and beetle collection-Four cultivars of banana (Amrita sagar, Sabri, kanthali and Kach kala) were selected for the collection of insect samples. Samples were collected from the furled leaf, freshly opened and mature infected leaves of banana plant. Due to the observation of seasonal incidence and damage potentiality of Banana Leaf and Fruit Beetle, four cultivars of Banana (Amrita sagar, Shabri, kathali and Attia kala) were selected for field trial.

Climate-The southern part of Bangladesh shows a tropical climate that is individualized by high temperature and humidity. April to September is characterized by heavy rainfall with occasional gusty winds. In winter, there is much less or little rainfall occurred than in summer. The average annual temperature is 25.9℃. The average annual rainfall is 2184 mm. The driest month is January, with 10 mm of

rainfall. With an average of 444 mm, the most precipitation falls in July.

Seasonal incidence and damage potentiality-The experiment to assess the incidence and the damage potential of Banana Leaf and Fruit Beetles on four banana cultivars (Amrita sagar, Sabri, Kanthali and Kach Kala) of Southern part of Bangladesh was laid out in RBD with 4 treatments (4 cultivars) and 3 replications (each replication has 5 plants). The natural population and scars of beetle on four banana cultivars was recorded at fortnightly intervals during July, 2021 to June, 2022. Beetle population was observed from four youngest leaves of randomly selected 3 plants in each replication. The beetle populations was recorded by counting the beetles on leaves and also inside whorl of crown leaves during morning and evening hours and the average number of beetle / plant also worked out. Total number of scars made by the beetles also counted from per sq. inch of leaf surface area of top, middle and lower portion of three youngest leaves of the 3 randomly selected plants (each replication) and the mean scars per sq. inch of leaf area was worked out.

Correlation studies with meteorological data-The data on the mean number of beetle population per plant and mean number of scars per sq. inch of leaf area was subjected to correlation studies to know the relationship between pest incidence and weather parameters prevailed in the Southern part of Bangladesh.

Percent (%) fruit damage per bunch-Fruit damage (%) per bunch was calculated at harvesting stage from randomly selected 3 plants in each replication and the mean percentage of damage was calculated.

$$\text{Percent (\%) fruit damage per bunch} = \frac{\text{No of infested finger per bunch}}{\text{Total no. of finger in a bunch}} \times 100$$

Percent (%) leaf damage-Percent leaf infestation and leaf area consumption by Banana Leaf and Fruit beetles were used as a parameter for incidence and damage potentiality. The observation was taken at fortnightly intervals during July, 2021 to June, 2022 during morning and evening hour to record the number of scars and damage symptom produced by the beetles as a result of feeding on epidermis of the leaf. Total number of scars made by the beetles counted from per sq. inch of leaf surface area of top, middle and lower portion of three youngest leaves of the 3 randomly selected plants (each replication) and the mean scars per sq. inch of leaf area was worked out and the length and width of the infected leaf was also measured for calculating the total leaf area. The number of infested leaves per plant also counted for calculating the percent leaf infestation. Percent leaf area consumption and percent leaf infestation were calculated by using the following formula-

$$\text{\% leaf area consumption} = \frac{\text{Consumed leaf area}}{\text{Total leaf area}} \times 100$$

$$\text{\% leaf infestation} = \frac{\text{Number of infested leaves per plant}}{\text{Total number of leaves per plant}} \times 100$$

Statistical analysis-Four banana cultivar Amrita sagar, sabri, Kanthali and Kach kala were used in the experiments with three replications of each following the

layout of Randomized Block Design. Data were expressed in three individual replicates, and mean values ± standard error were plotted using Sigma plot 8.0 (Systat software, Inc., Point Richmond, CA,USA).

Analysis of variance (ANOVA) was carried out in order to analyze the means by using PROC General Linear Model (GLM) with the Statistical Analysis System (SAS, 2002-2003 SAS Institute Inc., Cary, NC, USA) version 9.1 program.

Results and discussion

Seasonal incidence of Banana Leaf and Fruit Beetle

Banana Leaf and Fruit Beetle is a major pest of banana. In Bangladesh banana is cultivated almost everywhere round the year because of its high nutritous value. Since the demand of banana is increasing day by day but now, the production and productivity of banana is hampered due to the attack of Banana Leaf and Fruit Beetle. In case of severe attack this pest may cause damage up to 100%. Seasonal incidence indicates the time of outbreak of insects. The rainy season had the biggest population and the greatest amount of damage, although populations were reported in other months as well (Singh and Sangeetha, 2015). In my research beetle population also increased in rainy season and the highest beetle population was found on Amrita sagar variety in the month of July (Fig.1). So if we know about the seasonal incidence of Banana Leaf and Fruit Beetle we can able to reduce the damage of banana by escaping the time of higher incidence in banana cultivation with keeping the insect ecology quiet and reducing the cost of production. In this experiment, four banana cultivars viz. Sabri kala, Amrita sagar kala, Kanthali kala and Kach kala were selected to know the incidence of Banana Leaf and Fruit Beetle.

The incidence of *Basilepta subcostata* on Amrita sagar was noticed throughout the year i.e. from June, 2021 to July, 2022 (Fig.1). The mean population on Amrita sagar kala was ranged from 8.2 to 25.2 per plant with an average of 15.74 (Fig.2). Paul et al. (2020) noted that during the 27th standard week (July 3rd week) to the 39th standard week, the largest beetle population and peak infestation (scars) of *Basilepta subcostatum* (Jacoby) were observed on Sept. 4th week. In my research the maximum number of beetles/plant (25.2/plant) and the maximum mean number of scars (16.2 per sq. inch of leaf) were also recorded in July, 2021. Whereas the average number of sacrs /sq. inch 10.07 (Fig.2).

The beetle population on Sabri ranged from 7.2 to 21.4 per plant with an average of 13.33. Whereas the maximum beetle population (21.4/plant) was observed in the month of August 2021(Fig.1). The mean number of scars /sq. inch of leaf ranges from 4.4 to 13.8 with an average of 8.65 (Fig.2). The maximum leaf damage also observed in the month of July, 2021.

The maximum density of *B.subcostatum* on Kach kala ranged from 2.4 to 13.4 /plant. The maximum appearance and the highest infestation of beetle were noticed during July,2021 (Fig.1). The average number of

scars per sq. inch was 5.5 (Fig.2). Maximum leaf sacrs also recorded in July, 2021.

The maximum beetle population on Kanthali kala (2/plant) was observed in July, 2021 (Fig.1). The average number of scars per sq. inch 0.16 (Fig.2). The maximum scars were also recorded in July, 2021.
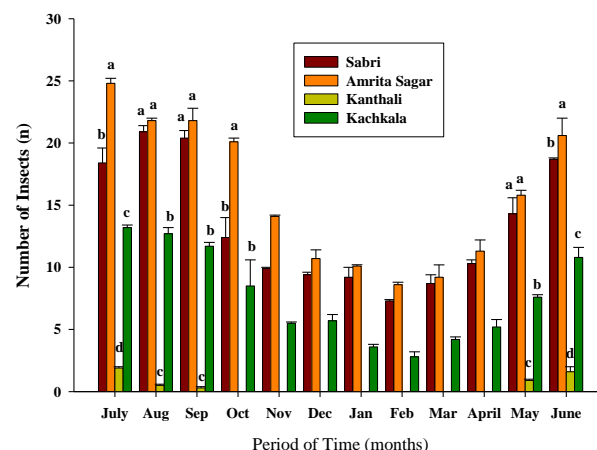

Fig.1: Seasonal incidence of Banana Leaf and Fruit Beetle against Sabri kala, Amrita sagar kala, Kanthali kala and Kach kala.
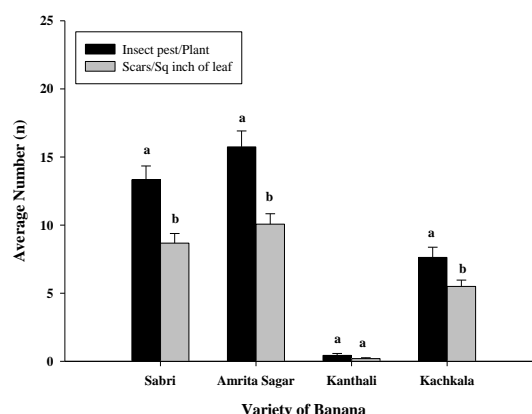

Fig. 2: Average number of insect pests/plant and scars/sq. inch of leaf against Sabri kala, Amrita sagar kala, Kanthali kala and Kach kala.

Zahan et al. (2004) Carried out a study to evaluate the abundance and fruit damage of Banana Leaf and Fruit Beetle, *Nodostoma viridipennis Mots.* and cited that the abundance of Leaf and Fruit Beetle in the banana orchard commenced at the beginning of april and continued till August and about 50% of the total plants were attacked by the beetles in first week of July and rest of the plants were infested in a month which also showed by my research where I found the maximum beetle population on Amrita sagar variety in July (25.2/plant). But they were active most from May to October.

Sah et al. (2018) report that, in 2013–14, the highest population (51.32 adults per plant was recorded at the

second fortnight of September and in the second fortnight of December the lowest population (7.34 adults per plant) was recorded. On the contrary, in 2014-15, in the second fortnight of September the highest population (68.0 adults per plant) had been seen and the second fortnight of December recorded the lowest population (9.24 adults per plant). In my research highest beetle population was found in the month of May to October which tends to decreased from December.

Comparative Incidence between *Basilepta subcostata* and *Bhamoina varipes*

In this present investigation two species of Banana Leaf and Fruit Beetle were found in the southern part of Bangladesh i.e. *Basilepta subcostata* and *Bhamoina varipes*. *Basilepta subcostata* which is erroneously named in Bangladesh as *Nodostoma varidipennis* observed feeding on all the cultivars examined in this research i.e. Sabri, Amrita sagar, Kanthali and Kach kala.
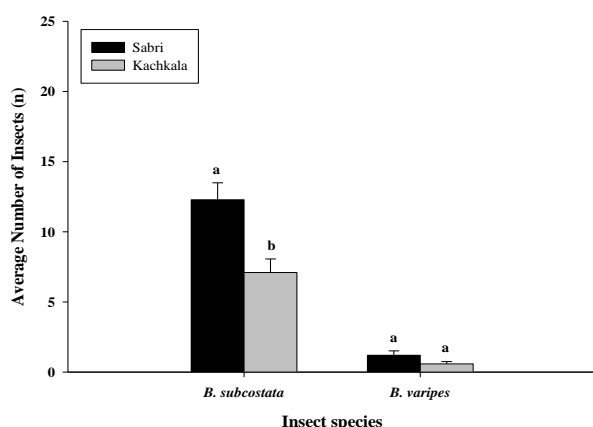

Fig. 3: Average number of insects of *Basilepta subcostata* and *Bhamoina varipes* agaist Sabri and Kach kala.

On the other hand, *Bhamoina varipes* was observed feeding on Sabri and Kach kala. From the figure 3, it is clear that average number of insects in case of *B.subcostata* against Sabri and Kach kala are 12.28 and 6.08 respectively. On the other hand, in case of *Bhamoina varipes* average number of insects against Sabri and Kach kala are 1.02 and 0.5 respectively (Fig. 3).

Correlation of incidence of beetle population with weather parameters

The incidence of beetle population on different banana cultivars was correlated with meteorological parameters (temperature, relative humidity and rainfall). It indicates significant positive relationship with all the meteorological parameters. The correlation studies revealed that population had positive and significant correlation with maximum temperature (Fig.4). Also the correlation coefficient of rainfall and relative humidity shows significant and positive correlation with the incidence of *Basilepta subcostatum* and *Bhamoina varipes* (Fig.5-6).

Incidence and damage potentiality of banana leaf and fruit beetle Incidence of beetle had positive and significant correlation with temperature and rainfall except relative humidity (Paul et al. 2020). But a significant and positive correlation between incidence of beetle population and weather parameters (temperature, rainfall and relative humidity) was found in this present investigation.
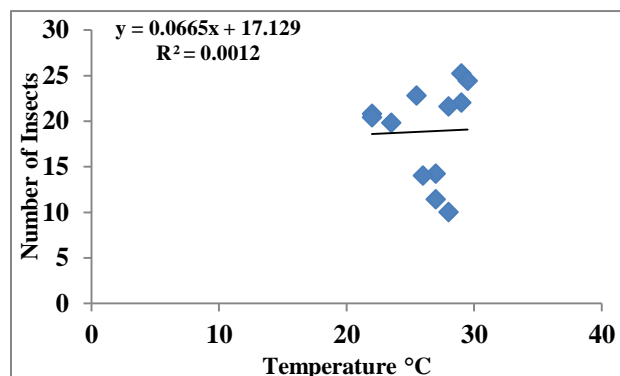
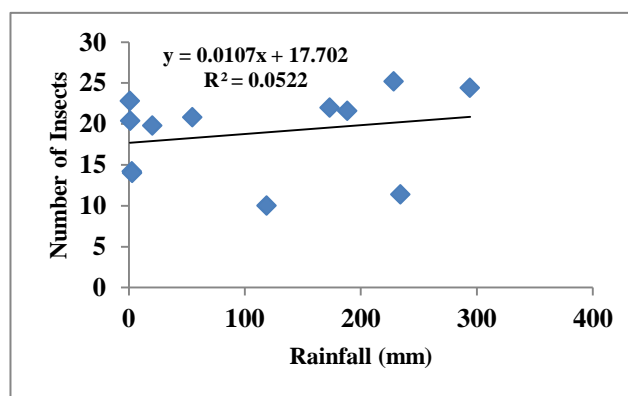

Fig.4: Number of beetle regression with temperature

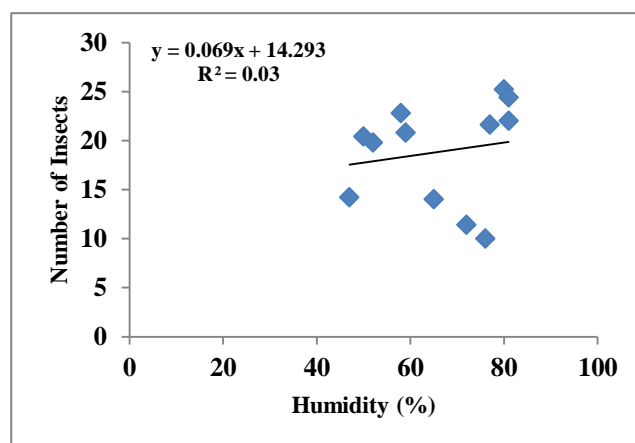Fig.5: Number of beetle regression with rainfall

Fig.6: Number of beetle regression with humidity

Percent (%) leaf damage (mean number of scars/sq. inch of leaf)

Highest damage per sq. inch of leaf was recorded in Amrita sagar (15.6 ± 0.8) in the month of July followed by Sabri (12.8 ± 0.8), Kach kala (9.0 ± 1.0) and Kanthali kala (0.8 ± 0.3) (Table 1).

Table 1: Mean number of scars per sq. inch of leaf of four banana cultivars against weather parameter.

Period of observation (month)	Mean ± SE of scars/sq. inch of leaf			
	Sabri	Sagar	Kanthali	Kach kala
July/21	12.8 ± 0.8b	15.6 ± 0.8 a	0.8 ± 0.3 d	9.0 ± 1.0 c
August/21	13.6 ± 0.9 a	13.8 ± 1.3 a	0.2 ± 0.1 c	8.5 ± 0.9 b
September/21	13.1 ± 1.1 a	13.9 ± 1.3 a	0.2 ± 0.1 c	7.8 ± 1.1 b
October/21	10.2 ± 0.8b	13.1 ± 1.3 a	0.0 ± 0.0 d	5.6 ± 0.6 c
November/21	8.0 ± 0.6 b	11.1 ± 0.9 a	0.0 ± 0.0 d	4.4 ± 0.5 c
December/21	6.9 ± 0.8 b	8.2 ± 0.9 a	0.0 ± 0.0 d	4.7 ± 0.7 c
January/22	5.2 ± 0.9 a	6.8 ± 0.7 a	0.0 ± 0.0 c	2.3 ± 0.7 b
February/22	4.6 ± 0.7 a	5.2 ± 0.7 a	0.0 ± 0.0 c	2.8 ± 0.6 b
March/22	4.9 ± 0.6ab	5.4 ± 0.9 a	0.0 ± 0.0 c	3.5 ± 0.8 b
April/22	5.8 ± 0.7 a	6.2 ± 0.8 a	0.0 ± 0.0 c	4.2 ± 0.9 b
May/22	6.7 ± 0.7 b	8.2 ± 0.9 a	0.4 ± 0.2 c	5.6 ± 0.7bc
June/22	12.3 ± 0.6 a	13.3 ± 1.5 a	0.8 ± 0.3 c	7.6 ± 0.7 b

**at 5% level of significance [DMRT]

Percent (%) fruit damage per bunch

Beetle feeds on upper and lower surface of the flower bracts, the skin of newly emerged young and tender fruits causing countless scars on them. Scars on the fruits become bigger with the maturity of the fruit and fruits become disfigured. Infested fruits got spotted and severe scarring of fruit skin led to under developed fruit.
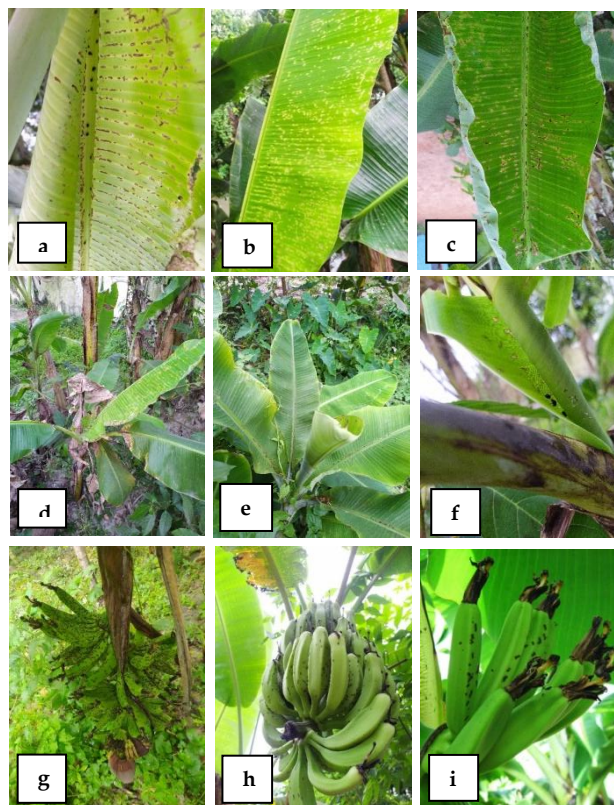

Fig. 7: Damage caused by *B.subcostatum* on banana. (a-c) scars on leaf; (d,e) infested plant; (f) leaf whorl showing scarring damage; (g) damage on young fruits and emerging bunch; (h,i) damage on fruits.
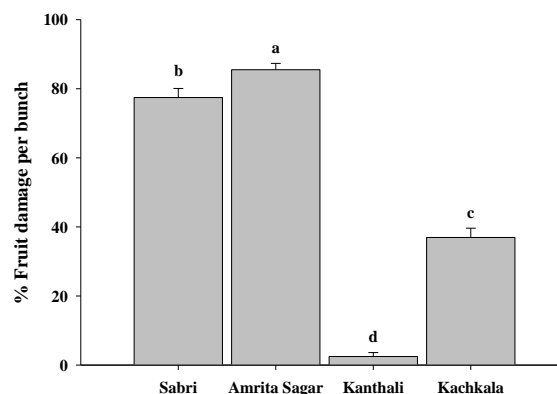

Fig.8: % Fruit damage per bunch against Sabri, Amrita sagar, Kanthali and Kach kala.

The damage potential of *Basilepta subcostatum* on four banana cultivars (Amrita sagar, Sabri, Kanthali and Kach kala) ranged from 2.46 percent to 85.5 percent (Fig. 8). The amount of damage caused by this fruit-feeding Chrysomelid to banana crops is estimated to be over 80%, with the percentage of affected orchards and pest intensity reaching 100% in severe infestations (Roy and Sharma, 1952). This present research also support this statement because in my research among the different cultivars Amrita sagar bunch was recorded significantly highest damage of 85.5 percent (Fig.8). The Shabri cultivar (87.53%) had the most fruit damage per bunch, followed by Mizo-Cavendish (78.13%) and Champa (65.86%) (Paul et al., 2020) but in this investigation the second highest bunch damage was recorded on sabri, 77.46 percent (Fig.8). The damage on kach kala and kanthali bunches were 36.93 and 2.46 percent (Fig.8) respectively were another two preferred host. Sarma et al. (2018) reported that the level of damage caused by *Nodostoma subcostatum* Jacoby to the banana crop has been estimated to be over 80%, with the percentage of affected orchards and pest intensity reaching 100% in

cases of severe infestation. In my present investigation the same result had revealed.

According to Prabha et al. (2021) during rainy seasons, roughly 30% of banana bunches are reported to have been damaged by *Basilepta subcostatum* (Jacoby) in Bihar. My research findings also support this statement.

According to Paul et al. (2020) the Shabri cultivar (87.53%) had the most fruit damage per bunch, followed by Mizo-Cavendish (78.13%) and Champa (65.86%). The least infested bunches were also Kanai Basi, Musa flaviflora, and Attia Kela, which had infestation rates between 2 and 5%. In this research Amrita sagar kala was found to be most susceptible cultivar with 85.5% damage and Sabri kala was the second damaged bunch with 77.46% damage.

Conclusion

In conclusion, four banana cultivars viz. Sabri, Amrita sagar, Kanthali and Kachkala were selected to know the incidence and damage potentiality of Banana Leaf and Fruit Beetle. They occurred throughout the year but they were active from May to October though the pick period of activity June to October and cause severe damage to banana. The highest incidence of beetle per plant (25.2) was observed on Amrita sagar kala and the lowest (2) on Kanthali kala. Considering the percent fruit damage per bunch Banana Leaf and Fruit Beetle was found mostly harmful to Amrita sagar (85.5%) followed by Sabri (77.46),Kach kala (36.93) and Kanthali kala (2.46). Amrita sagar kala was found as more vulnerable to Banana Leaf and Fruit Beetle than the other tested cultivars. Again considering scars per sq. inch of leaf, Amrita sagar kala shows maximum leaf sacrs per sq. inch of leaf (16.2) followed by Sabri (13.8) Kach kala (9.2) and Kanthali kala (0.8). The incidence of beetle population and scars produced by the beetle was significantly and positively correlated with rainfall, temperature and relative humidity.

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