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Nature and Extent of Damage of Jackfruit Borer, *Diaphania caesalis* Walker in Bangladesh

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Abstract: Field investigation was carried out on nature and extent of damage of jackfruit borer, *Diaphania caesalis* Walker (Pyralidae: Lepidoptera) at Jackfruit Research Project, Bangladesh Agricultural University, Mymensingh and in some jackfruit growing areas in Bangladesh. Jackfruit borer attacks the tender shoots, male and female spikes and fruits of all development stages. At flowering stage the larva bores into spike and feeds on internal tissues. At initial infestation, anthesis of the male spikes do not occur and later on the affected spikes are rotten and shaded off from the plant. Severely infested female spikes drop off before fruit setting. The jackfruit borer attacks the jackfruit at different stages of fruit development. Early infestation results in deformation of fruits and sometimes dropping off the immature fruits. The larvae bore into the mature fruit and cause damage to the edible part. Later infested fruits frequently get rotten due to entrance of rainwater in to the fruits. In nursery, caterpillars damage the tip of jackfruit sapling causing retardation of growth of the saplings and initiation of lateral branches. The average percentage of fruit infestation was 27.44. The number of bore and amount of damage per infested fruit was 1.47 and 525.37 g, respectively. The reduction of market price due to jackfruit borer infestation in six locations of Bangladesh ranged from 27 to 39%.

Key words: Jackfruit borer, *Diaphania caesalis*, nature of damage, extent of damage, market price

INTRODUCTION

Jackfruit is the national fruit of Bangladesh and grown throughout the country in high land and homestead areas where rain and floodwater does not stand^[1]. Jackfruit is considered as a multipurpose fruit tree because each and every part of the plant is utilized. The pulp of the unripe fruit is used as vegetables. The pulp of the ripe fruit is eaten fresh and sometimes it is preserved in syrup or dried. Many people consume seeds after boiling and roasting. The rind of the jackfruit is an excellent cattle feed. Green leaf is a popular fodder, particularly for goats in the rainy season. Jackfruit is a good source of carbohydrate, protein, vitamin and minerals^[2].

Thirty five species of insect pest have been recorded on jackfruit, among them jackfruit borer, *Diaphania caesalis* (Walker) is the major insect pest of jackfruit^[3,4]. The destructive Lepidopteran insect pest *Diaphania caesalis* Walker belongs to the family Pyralidae. The adult moth lay eggs on tender shoots and flower buds. On hatching, the reddish brown caterpillar bore into shoots, flower buds and fruits. In nursery, caterpillars bore into the apical bud of jackfruit sapling and collapse the growing tip. The insect infests the jackfruit at different stages of fruit development and causes considerable damage to the fruit. Early infestation may cause

deformation of fruits and dropping of the immature fruits. Later infested fruits suffer frequently from rotting. The borer infestation may reduce the market price of the jackfruit. Although the jackfruit borer is known to cause damage to different parts of the plant, there is no scientific report on the nature and extent of damage of the borer. The present study was undertaken to investigate the nature and extent of damage of jackfruit borer in Bangladesh.

MATERIALS AND METHODS

Experiment were conducted in Jackfruit Research Project, Bangladesh Agricultural University, Mymensingh and in six different locations of Bangladesh during January 2002 to August 2003. The damage of jackfruit borer were studied in nursery and jackfruit orchard. In nursery of Jackfruit Research Project saplings were observed carefully to find out the nature of damage of jackfruit borer larvae on jackfruit sapling. Three nurseries were included in this study. One year old two hundred saplings were observed from each nursery.

In another experiment, the nature and extent of damage of jackfruit borer were studied in jackfruit orchard. Nine plants were selected from the orchard taking 3 from each block. The fruits of the plants were carefully observed to investigate time of infestation, place of

infestation, damaging activity of larva, amount of damage per infested fruit, harboring of insect during off-season. Observation was made during January to December 2002. Extent of damage was determined by percentage of fruit infestation, number of bore and damaged portion of infested fruit.

For determining the effect of jackfruit borer infestation on market price of jackfruit, a survey was carried out in different markets of six areas of Bangladesh viz., Kotwali, Muktagasa and Valuka of Mymensingh district, Modhupur of Tengail district, Sripur of Gazipur district and Kotwali of Comilla district in the month of June 2003. Three markets from each upazila and five jackfruit growers from each market who brought at least 10 jackfruits for selling were randomly selected for interviewing. Data were collected on percentage of fruit infestation, price of healthy and infested fruit. Percentage of loss was calculated. Data were analyzed statistically and means were separated using LSD at different level of significance^[5].

RESULTS AND DISCUSSION

Nature of damage: Observation on the nature of damage of jackfruit borer is given below:

In orchard, jackfruit borer, *D. caesalis* attacked the tender shoots, male and female spikes and fruits. The female moth of jackfruit borer laid eggs on tip of tender shoots, male and female spikes. After hatching of the eggs, the tiny caterpillar started feeding on host plant. In absence of flower bud and fruits, caterpillars bored into apical buds, shoots and feed internal tissues leading damages to buds and shoots (Fig. 1). Damage proceeded towards the base up to hard woody portion of the branches. Therefore, affected shoot failed to produce new leaf causing reduction of photosynthesis to some extent. The caterpillars were also found to feed on young leaves. Alam^[6] reported that young caterpillars bore in to buds and mine the midribs of leaves and feed on the leaves. Similar observations were reported by Tandon^[7], Butani^[7], Azad and Haq^[2].

At flowering stage caterpillar first stuck the spathes with the male and female spikes by white thread like structure secreted by the larva itself. The caterpillar remained beneath the spathes and starts feeding on spikes. In early of the season the pest attacked the male inflorescence. This is because male spike appears earlier than female spike^[8,9]. Larva bored into spikes and feed internal tissues. Anthesis of infested male spikes was stopped due to the borer attack and failed to produce pollen grain. Affected male spikes were rotten and shaded off. As jackfruit is a cross-pollinated crop male spikes play



Fig. 1: A damaged shoot of jackfruit plant by jackfruit borer



Fig. 2: A Jackfruit borer is boring the mature fruit

vital role in fruit setting. Due to lack of pollen grain, pollination of female spikes may not successfully occur and may cause dropping of female spikes before fruit setting. Deformation of fruit resulted due to irregular pollination. Dropping of the spikes and misshapen or irregular shaped fruits are mainly due to lack of pollination or uneven pollination and fertilization and unavailability of viable pollen grains^[1]. As the fruit is monoecious, the fruit setting requires the transfer of the pollen from the male spike to the female. So infestation of male spike by jackfruit borer have indirect effect in fruit dropping and reduction of yield.



Fig. 3: Longitudinal section of mature jackfruit showing damage by jackfruit borer

Table 1: Extent of damage of jackfruit borer to the fruit

Harvesting of fruit in different time	% of fruit infestation	No. of bore per infested fruit	Average damaged portion of infested fruit/plant (g)
May-15 to June-14	17.56 ^b	1.33	376.11 ^b
June-15 to July-14	29.82 ^a	1.43	454.45 ^b
July-15 to August-14	34.92 ^a	1.65	745.56 ^a
Average	27.44	1.47	525.37
Level of significance	P<0.01	NS	P<0.05

Figures having different letter(s) in the superscript in same column are significantly different
NS = Non significant

Table 2: Percentage of fruit infestation and reduction of price in the market of six locations

Location of market	% of fruit infestation	Price of healthy and infested fruit in Taka		
		Healthy fruit	Infested fruit	Reduction of market price (%)
Kotwali, Mymensingh	33.28	46.67	28.33	39
Muktahasa, Mymensingh	31.81	33.33	21.67	35
Valuka, Mymensingh	31.69	29.33	18.33	38
Modhupur, Tengail	26.69	25.00	18.33	27
Sripur, Gazipur	32.75	41.66	26.67	36
Kotwali, Comilla	27.14	26	17.33	32

In case of female spike, the borer fed on internal tissues voraciously. Severely infested spikes dropped off before fruit setting. The insect infests the jackfruit at different stages of development and caused considerable damage. The larvae bored into the fruit and damaged the edible part (Fig. 2 and 3). If the fruit can tolerate the injury in early stage and not dropped off, deformation of fruit may occur.

Azad and Haq^[2] described that infestation during flowering stage causes fruit drop of jackfruit. Average 2.86% fruit drop occurred due to insect infestation^[10]. The entrance hole of the borer is easily visible and associated with mass of excreta. In the later stage of the development of the fruit the borer caused damage to the pulp directly

and exposed the fruit to the microorganisms and other small creatures. Later infested fruits frequently were found rotten. Fruit rotting was due to the entering of rain water and microorganisms through the entrance hole of larva. The rotten fruit becomes unfit for human consumption. Butani^[7] reported fruit rotting due to jackfruit borer infestation. Infestation of jackfruit borer was common when the jackfruits were in crowded condition.

In nursery, caterpillars bore into apical buds, feed internal soft tissues and damage the tip. They also bore and feed on internal soft tissues of growing shoot of jackfruit sapling and proceeds towards the base by making tunnel. As a result the affected parts wilt and dry, that induces lateral branching of sapling. The growth of the affected saplings was retarded and zigzag stem formation may occur. Ultimately the market prices of the infested sapling is reduced.

Extent of damage: The extent of damage of *D. caesalis* to jackfruit, includes the percentage of fruit infestation, number of bore per infested fruit and amount of damage portion of infested fruit per plant was studied during harvesting of jackfruit are presented in Table 1. percentage of fruit infestation was significantly different when fruits were harvested at different times during jackfruit growing season. The percentage of fruit infestation was 17.56, 29.82 and 34.92 in early, mid and late season. Lower infestation was found in early harvested fruit (May 15 to June 14) while higher infestation was found in late harvested fruit (July 15 to August 14). Statistically percentage of fruit infestation was similar in mid and late harvested fruit (June 15 to July 14 and July 15 to August 14).

The difference in number of bore per infested fruit was not significant in early, mid and late harvested fruit. The average number of bore per infested fruit were 1.33, 1.43 and 1.65 in early, mid and late season, respectively. A significant difference was found among the amount of damage portion of infested fruit of different plants ranging from 333.33 to 966.67 g. The average damage portion of infested fruit of nine plants was 525.37 g. In the early season (May-15 to June-14), mid season (June-15 to July-14) and late season (July-15 to August-14) the average fruit damage was 376.11, 454.45 and 745.56 g, respectively. The amount of fruit damage was higher in the late and lower in early harvested fruit. In late season rain came frequently and caused rotting of fruit due to entering of water through the entrance hole of larva. Sometimes the fruit become unfit entirely for human consumption due to rotting.

Effect of borer infestation on market price of jackfruit:

Eighteen market of six upazila were surveyed to investigate the loss due to the infestation of jackfruit borer. Data were collected from the jackfruit grower who brought at least 10 jackfruits to market for selling. Results are presented in Table 2

There was no significant difference in fruit infestation and loss in different locations. The percentage of fruit infestation in six locations viz., Kotwali, Muktagasa and Valuka of Mymensingh district, Modhupur of Tengail district, Sripur of Gazipur district and Kotwali of Comilla district were 33.28, 31.81, 31.69, 26.69, 32.75 and 27.14. The economic loss due to jackfruit borer infestation in the above locations were 39, 35, 38, 27, 36 and 32, respectively. The differences on percentage of fruit infestation and economic loss of six locations were insignificant. This study revealed that fruit infestation and losses of market price were similar in the six survey areas. Jackfruit borer reduced the market price to a considerable extent. The average fruit infestation and losses of taka in the market of six locations were 30.56 and 34.70%, respectively. Azad and Haq^[2] highlighted that jackfruit fetches less price in the market due to jackfruit borer infestation. From the present study it appears that a high amount of economic loss occurs in all the surveyed jackfruit growing areas due to attack of jackfruit borer.

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