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Evaluation of Relative Host Preference of *Batocera rufomaculata* De Geer on Different Age Stages of Jackfruit Trees

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ABSTRACT

The study on host preference of *Batocera rufomaculata* De Geer is of great interest, because it is a polyphagous pest and preferred middle aged jackfruit trees. In this study the incidence of *Batocera rufomaculata* De Geer in relation to different age groups of Jackfruit trees was evaluated. The investigation was done in Gazipur, Gaibandha and Khagrachhari districts of Bangladesh. Host preference of *Batocera rufomaculata* De Geer among five age groups (<10, 10-20, 21-30, 31-40 and >40 years) of jackfruit trees was conducted during 2009-2011 in farmers' orchards. For different age groups were considered as treatments and the three districts were considered as replications. The trunk infestation was the highest (45.87%) in Gazipur for age group 10-20 years which was statistically identical (45.06%) with age group 21-30 years. The lowest infestation was 21.38% for the age group of above 40 years. However, between other two districts the infestation was the highest (27.97%) in Gaibandha in 10-20 years age group which is statistically similar (26.65%) with 21-30 years age group. The lowest infestation was found in below 10 years group (3.81%). In Khagrachhari where the highest infestation was 27.16% in 21-30 years age group and the lowest (17.06%) was in age group below 10 years. The order of host age preference was 10-20>21-30>31-40>below 10 and >above 40 years.

Key words: *Batocera rufomaculata* De geer, host preference, age groups, jackfruit trees

INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* Lam.) is one of the major commercial fruits of Bangladesh (Ahmed, 1982). Regarding fruit production, it is the second highest just after banana (*Musa* spp.) (Mondal and Amin, 1990). Every year a large quantity of timber is destroyed due to severe trunk infestation by trunk borer (*Batocera rufomaculata* De Geer) in Bangladesh (Rasel, 2004). When a tree infested by this insect the fruit bearing and timber value both are decreasing initially. After 3 to 4 years the entire trunk is destroyed, losing its fruit bearing capacity and finally the tree dies (Butani, 1979; Hill, 1983). *Batocera rufomaculata* is a phytophagous insect which usually burrow in the tissues of woody plants and feed within the stems. Jackfruit orchards of many farmers have been reported to have trees of different ages starting from 1 year to above 40 years. The nature and properties of these trees vary with the ages of the trees and thus their suitability to trunk borer also is likely to vary. Larvae of *Batocera rufomaculata* feed relatively briefly under bark, spending most

of their developmental period in the sapwood or heartwood (Hill, 1983). High nitrogen was found in pith than heartwood (Cowling and Merrill, 1966; Graham, 1925; Haack and Slansky, 1987). In jackfruit orchard any one, old or young plants can be attacked by this pest. The present study was, therefore, undertaken in order to examine preference of different aged jackfruit trees as host of *Batocera rufomaculata* with the objectives: (1) To evaluate the preference of different aged jackfruit trees as host of *Batocera rufomaculata* and (2) To determine the rank order of age groups according to rate of infestation of *Batocera rufomaculata*.

MATERIALS AND METHODS

The study was conducted in three jackfruit growing districts Gazipur, Gaibandha and Khagrachhari of Bangladesh in farmers' orchard in terms of trunk infestation during 2009-2011. The districts were selected in consideration of collecting the information regarding jackfruit based agroforestry and intensive jackfruit growing area of Bangladesh.

Data collection: For the present study, different age groups were considered as treatments and the three districts were considered as replications while the three villages under each district were considered as replications. Observations were made on the jackfruit trees on 2.5 m height of trunk from ground level. In order to determine host preference of jackfruit trees of different age groups jackfruit trees of each orchard were classified into five age groups (<10, 10-20, 21-30, 31-40 and >40 years).

Data processing and analysis: All the collected data were analyzed by using descriptive statistical methods including the computer-based statistical package SPSS 13 version, Microsoft Excel and MSTAT-C. The data obtained for different characters were statistically analyzed to find out the significance of effects/impacts of different age group of trees on trunk borer infestation including severity of infestation, percent infestation, duration of infestation, yield and yield contributing characters. The mean values of all the parameters were evaluated and analysis of variance (ANOVA) was performed by the "F" (variance ratio) test MSTAT-C program. The significance of the difference among the different combinations for different characters was estimated by Duncan's Multiple Range Test (DMRT) at 1% level of probability (Gomez and Gomez, 1984). Percent of trunk infestation were calculated as bellow:

$$\text{Infestation in each group (\%)} = \frac{\text{No. of infested trees in respective age group}}{\text{No. of total trees in respective age group}} \times 100$$

RESULTS AND DISCUSSION

Among the different age groups, the *Batocera rufomaculata* De Geer showed preference significantly ($p < 0.01$) in Gazipur and Gaibandha districts as presented in Table 1. The trunk infestation was maximum (45.87%) in Gazipur in age group of 10-20 years which was statistically similar with age group of 21-30 years (45.06%) followed by 33.85 and 34.73% in 31-40 years and below 10 years age group, respectively. But the trunk infestation was minimum (21.38%) in the age group of above 40 years. However, between other two districts infestation was maximum (27.97%) in Gaibandha in 10-20 years age group which is statistically identical with 21-30 years age group (26.65%) which was followed by 31-40 years, age group (8.33%). In this district, there

Table 1: Infestation by *Batocera rufomaculata* according to the age groups of jackfruit trees in three districts during 2009-2011

Age groups (years)	Mean infestation (%)		
	Gazipur	Gaibandha	Khagrachhari
<10	34.73 ^{ab} (5.88)	3.81 ^b (1.58)	17.06 (2.80)
10-20	45.87 ^a (6.76)	27.97 ^a (4.95)	23.79 (4.49)
21-30	45.06 ^a (6.69)	26.65 ^a (5.05)	27.16 (5.21)
31-40	33.85 ^{ab} (5.81)	8.33 ^{ab} (2.14)	22.75 (5.41)
>40	21.38 ^b (4.61)	0.00 ^b (0.71)	19.57 (3.57)
p<(ANOVA)	0.01	0.01	ns

Means followed by common letter(s) in a column are not significantly different at 1% level by DMRT. Values are the averages of three replications. Figures in parentheses indicate data based on square root transformation

was no infestation in above 40 years age group and the lowest infestation was in below 10 years age group (3.81%). In Khagrachhari the infestation was the highest (27.16%) in 21-30 years age group and the lowest was in age group below 10 years (17.06%). In case of trunk infestation, the order of age groups of jackfruit trees was 10-20>21-30>31-40>below 10 and >above 40 years old. The susceptibility to borer infestation may be the tender age tree which does not develop woody tissue in the trunk that may be difficult for feeding by grub stage. Infested trees were larger in trunk diameters of the trunks than non-infested trees (Ezaki, 1995). Kannan and Rao (2006) found *Batocera rufomaculata* De Geer were more predominant on the old age trees (>15 years) than young age trees (0-5 years). Similar higher rate of infestation or susceptibility of trunk infestation was reported by Sing and Sing (1986) and Rasel (2004). They explained the probable reason of higher rate of trunk infestation of middle age group was that with the increase of age the tree loose their vigor and the initial infestation become predominant through a longer duration. Tissues of woody plants vary in the following ways in their nutritional quality for wood-boring insects: (a) Bark is generally very low in nutrients (carbohydrates, nitrogen), (b) Subcortical zone tissues (inner bark, cambium, immature xylem) have many times higher concentrations of nutrients, (c) The much thicker sapwood is low in nutritional quality and (d) High nitrogen was found in pith than heartwood (Cowling and Merrill, 1966; Graham, 1925; Haack and Slansky, 1987; Hosking and Hutcheson, 1979; Savely, 1939). The cellulase is a major factor influencing the infestation by insects. Larvae that feed in nutrient-deficient tissues, however, may depend on cellulose-digesting enzymes to assist in nutrient assimilation (Mishra and Singh, 1978).

Many insects can produce cellulases (Bhat, 2000; Marsden and Gray, 1986; Watanabe and Tokuda, 2001). The cellulase of some cerambycid contains higher percentages of sulfur containing amino acid residues (Cys) (Lee *et al.*, 2004, 2005). Reflecting relative nutritional quality of woody tissues according to their age, the preference is detected for feeding of trunk borer.

In case of Gazipur district, a strong second order polynomial regression was also found between percent infestation (Y) and tree age (X) as presented in Fig. 1. Relationship between percent infestation and tree age reflected an increasing infestation with increasing tree age up to a certain

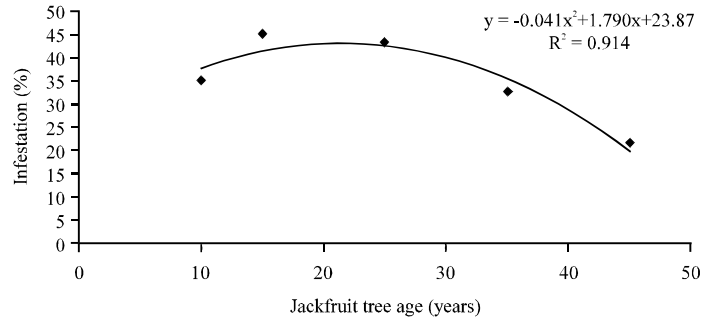


Fig. 1: Relationship between age of jackfruit trees and trunk infestation by trunk borer during 2009-11 at Gazipur region

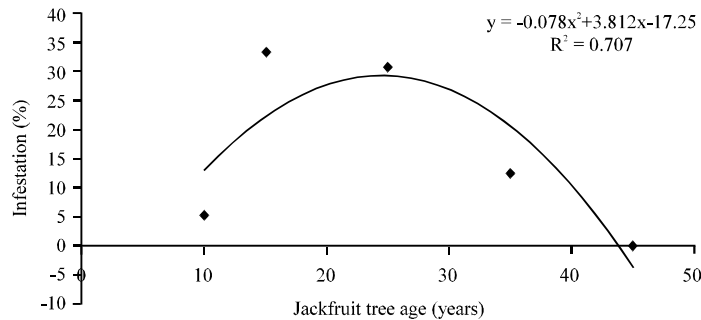


Fig. 2: Relationship between age of jackfruit trees and trunk infestation by trunk borer during 2009-11 at Gaibandha region

point (45.06% infestation at 15 years) beyond which a decreasing trend was recorded. The maximum percent infestation was recorded at age range 10-30 years (34.93-45.06% trunk infestation). This polynomial regression was fitted between trunk borer infestation and tree age. The regression equation:

$$Y = a + b_1X + b_2X^2$$

where, Y is trunk infestation (%), a is 23.871, b_1 is 1.7907, b_2 is -0.0418 and X is tree age, was obtained. The contribution of the regression ($R^2 = 0.9144$) was 91%.

In Gaibandha district, a strong second order polynomial regression was also found between percent infestation (Y) and tree age (X) as presented in Fig. 2. Relationship between percent infestation and tree age reflected an increasing infestation with increasing of tree age up to a certain point (33.33% infestation at 15 years) beyond which a decreasing trend was recorded. The maximum percent infestation was recorded at age range 15-30 years (30.57-33.33% trunk infestation). This polynomial regression was fitted between trunk borer infestation and tree age. The regression equation:

$$Y = a + b_1X + b_2X^2$$

where, Y is trunk infestation (%), a is -17.251, $b_1 = 3.8121$, b_2 is -0.078 and X is tree age, was obtained. The contribution of the regression ($R^2 = 0.7077$) was 70%.

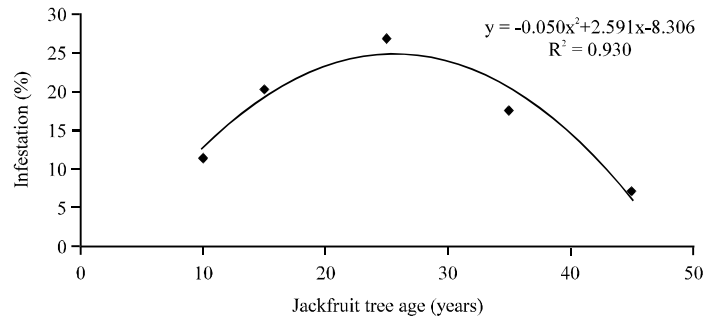


Fig. 3: Relationship between age of jackfruit trees and trunk infestation by trunk borer during 2009-11 at Khagracharri

In Khagrachhari district, a strong second order polynomial regression was also found between percent infestation (Y) and tree age (X) as presented in Fig. 3.

Relationship between percent infestation and tree age reflected an increasing infestation with increasing of tree age up to a certain point (26.85% infestation at 25 years) beyond which a decreasing trend was recorded. The maximum percent infestation was recorded at age range of 15-30 years (11.38-26.85% trunk infestation).

This polynomial regression was fitted between trunk infestation and tree age. The regression equation:

$$Y = a + b_1X + b_2X^2$$

where, Y is trunk infestation (%), a is -8.3068, b_1 is 2.5917, b_2 is -0.0505 and X is tree age, was obtained. The contribution of the regression ($R^2 = 0.930$) was 93%.

CONCLUSION

From the results of the study it is concluded that the trees of middle age group suffered more severe infestation than tender age trees or very old trees in three selected regions. The preference of age of trees as attractive host as observed in this study complies with jackfruit trunk borer *Batocera rufomaculata* De Geer preferred a particular age of host plant or group of plants. Relationship between percent infestation and tree age reflected an increasing infestation with increasing of tree age up to a certain point beyond which a decreasing trend was recorded.

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