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Research Article

BRIEF STUDY ON THE INSECT PESTS OF JACKFRUIT IN NADIA DISTRICT OF WEST BENGAL

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Abstract: Jackfruit, *Artocarpus heterophyllus* Lamarck, is a fruit tree with multiple uses and potentials. It is said to be attacked by over 35 species of insect pest, but very little work has been done on it. A field survey was carried out to make a general assessment of the insect pest scenario and a field study was done to record the major and other important insect pests and their seasonal activities, at the Research Unit, AICRP on Tropical Fruits, BCKV, Mondouri, West Bengal during April, 2011 to June, 2012. The jackfruit shoot and fruit borer, *Diaphania caesalis* Walker (Pyralidae: Lepidoptera) was found to be the major pest. Other important insect pests found causing damage were the jackfruit bud weevil, *Ochyromera artocarpi* Marshall (Curculionidae: Coleoptera), bark eating caterpillars, *Indarbela* sp. (Metarbelidae: Lepidoptera) and the trunk borer, *Batocera rufomaculata* De Geer (Cerambycidae: Coleoptera). The study results revealed that *Diaphania caesalis* remains active and causes damage to jackfruit from October to June. Maximum shoot damage (34.20%) was recorded in January while the least was in May-June. Mean shoot damage was high in the east (40.45%) and south (37.66%) faces of the plant canopy as compared to the north and west canopy faces. Statistical analysis revealed that the activity of *Diaphania caesalis* had a positive correlation with the maximum relative humidity. Maximum fruit damage (32.96%) was observed during June. The incidence of bud weevil was observed from December to April and damage to young buds was highest (17%) during January while lowest (3%) during April. Bark eating caterpillars were seen infesting (14%) jackfruit trees almost all round the year. Infestation symptoms of the trunk borer, too, was observed in the field almost all round the year. 18% of the trees were infested and out of these, 44.44% were killed.

Keywords: Jackfruit, insect pests, *Diaphania*, seasonal incidence, damage, correlations

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Introduction

Artocarpus heterophyllus Lamarck, (Moraceae: Rosales) popularly known as Jackfruit, is one of the important and commonly found fruit trees in the homesteads/gardens of India and Bangladesh. Jackfruit tree produces the largest tree-borne fruits in the world and a mature tree can yield anywhere between 10 - 200 fruits [1-10]. Jackfruit is a popular food and ranks 3rd in total annual production after mango and banana in South India. It is the national fruit of Bangladesh and is considered to be an extremely important tree by the natives. The plant is frequently referred to as 'Poor man's food/fruit' as it is cheap and plentiful during the summer season when food is scarce [11,12]. Historical reports suggest that jackfruit tree is supposed to have originated in the rain forests of the Western Ghats in the Southwestern part of India [15, 16]. Now it is widely cultivated throughout the tropical lowland in both the hemispheres [17]. In India it is mainly grown in Assam, Bihar, Kerala, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. Jackfruit is a prized food in regions where it does not grow, but is unfortunately considered to be trivial in areas where it is found in abundance and tends to be underutilized. The jackfruit tree has many dietary, medicinal and economic uses. The raw fruits are used as vegetable and in pickles [18,19]. The seeds are nutritious and important source of diet. Reports suggest that almost all parts of the jackfruit tree are of use in the preparations of various Ayurvedic and Yunani medicines [20-23]. The jack wood with good grains is a useful and a durable timber. It is termite proof and resistant to fungal and bacterial decay. The leaves as well as the non-pulp parts of the jackfruit are of use as feed for livestock and the tree itself are used for landscaping. Jackfruit is attacked by over 35 species of insect pests [24]. Among these, the fruit and shoot borer *Diaphania*sp. Walker (Pyralidae : Lepidoptera) is the major one. Other insect species recorded in jackfruit from India were – Jackfruit bud weevil *Ochyromera artocarpi* Marshall (Curculionidae : Coleoptera), bark eating caterpillars like *Indarbela tetraonis* Moore, *I. quadrinotata* Walker (Metarbelidae: Lepidoptera), bark borers like *Batocera rufomaculata* De Geer, *Apriona rugicollis* Beeson (Cerambycidae : Coleoptera); Spittle bug *Cosmoscarta relata* Distant (Cercopidae : Hemiptera), Mealy bug *Nipaecoccus viridis* Newstead (Pseudococcidae : Hemiptera); leaf eating caterpillars like *Perina nuda* Fabricius (Lymentridae : Lepidoptera) and *Diaphania bivitralis* Guenee (Pyraustidae : Lepidoptera); Castor capsule borer *Dichocrocis punctiferalis* Guenee (Pyralidae : Lepidoptera); Scale insects like *Iceryaaegyptica Douglas* (Coccidae : Hemiptera*), Ceroplastes rubens* Maskell (Coccidae : Hemiptera) and *Coccus acuticimus* Green (Coccidae : Hemiptera); *Aphid Toxoptera* aurantii Fonscolombe (Aphididae : Hemiptera); Thrips *Pseudodendrothrips dwivarna* Ramakrishna and Margabandhu (Thripidae : Thysanoptera) and Red ants *Oecophylla smaragdina* Fabricius (Formicidae : Hymenoptera). However, these insect pests vary in their economic importance and incidence in different parts of the country. And surprisingly, very little work has been done on these insect pests of jackfruit. In the present study, the insect pest scenario of jackfruit in the Nadia district of West Bengal was taken into account.

Materials and methods

The field experiments were conducted in the Research Unit, AICRP on Tropical Fruits, Mondouri (22.43°N latitude and 88.34°E longitude with an altitude of 9.75 m from MSL) and also, a field survey was conducted in six places of Nadia district *viz*., Chakdah, Fulia, Krishnanagar, Mohanpur, Ranaghat and Shantipur. The different experiments were conducted during April, 2011-June, 2012.

Trees of jackfruit (*Artocarpus heterophyllus* Lamarck)

In the Research Unit, AICRP on Tropical Fruits, Mondouri, the trees were nine years old and had just started bearing fruits.

Table-1 Overall mean percentage of shoot damage by *Diaphania caesalis* Walker on the four faces of the tree canopy of jackfruit

Months & Fortnights (With year)		Mean Damage (%)	Months & Fortnights (With year)		Mean Damage (%)	Months & Fortnights (With year)		Mean Damage (%)
October (2011)	I	15.36	January (2012)	I	35.45	April (2012)	I	11.23
	II	19.51		II	32.94		II	7.78
November (2011)	I	20.32	February (2012)	I	26.56	May (2012)	I	5.30
	II	23.80		II	23.56		II	4.12
December (2011)	I	29.19	March (2012)	I	18.25	June (2012)	I	1.77
	II	31.30		II	14.77		II	1.95

Table-2 Effect of face direction of jackfruit tree canopy on the extent of damage by *Diaphania caesalis* Walker

Variables	Significant Value of the Faces	Face wise mean#				Overall mean
		East	West	North	South	
F_1	0.24	22.08 (28.02)	13.46 (21.52)	11.59 (19.90)	14.29 (22.21)	15.36 tu(22.91)
F_2	0.06	25.32 (30.21)	13.64 (21.67)	18.18 (25.24)	20.90 (27.20)	19.51 rst(26.08)
F_3	0.01**	30.86 (33.74) a	14.29 (22.21) b	15.22 (22.96) b	20.90 (27.20) b	20.32 rst(26.53)
F_4	0.01**	34.52 (35.98) a	19.15 (25.95) b	18.18 (25.24) b	23.33 (28.88) b	23.80 qrst(29.01)
F_5	0.02*	38.1 (38.11) a	22.92 (28.60) b	24.49 (29.66) b	31.25 (33.99) ab	29.19 pqr(32.59)
F_6	0.05*	37.93 (38.01) a	26.42 (30.93) b	28.00 (31.95) b	32.86 (34.98) ab	31.30 pq(33.97)
F_7	0.04*	40.45 (39.49) a	33.33 (35.26) b	30.36 (33.44) b	37.66 (37.86) ab	35.45 p(36.51)
F_8	0.35	37.08 (37.51)	30.77 (33.69)	29.73 (33.04)	34.18 (35.78)	32.94 pq(35.00)
F_9	0.18	31.96 (34.42)	23.53 (29.01)	21.62 (27.71)	29.11 (32.65)	26.56 pqrs(30.95)
F_{10}	0.17	25.00 (30.00)	18.52 (25.48)	23.21 (28.80)	27.50 (31.63)	23.56 qrst(28.98)
F_{11}	0.16	22.35 (28.21)	13.04 (21.17)	16.00 (23.58)	21.62 (27.71)	18.25 stu(25.17)
F_{12}	0.07	20.27 (26.75)	09.09 (17.55)	10.87 (19.25)	18.84 (25.72)	14.77 tu(22.32)
F_{13}	0.10	15.94 (23.53)	03.95 (11.46)	10.26 (18.68)	14.75 (22.59)	11.23 uv(19.05)
F_{14}	0.04*	12.96 (21.10) a	00.69 (04.76) b	05.41 (13.45) ab	12.07 (20.33) a	7.78 vw(14.91)
F_{15}	0.02*	08.00 (16.42) ab	00.71 (04.83) b	02.50 (09.10) b	10.00 (18.43) a	5.30 wx(12.20)
F_{16}	0.29	07.14 (15.49)	01.61 (07.29)	00.36 (03.44)	07.69 (16.10)	4.2 wx(10.58)
F_{17}	0.94	03.03 (10.02)	01.25 (06.42)	01.14 (06.13)	01.67 (07.43)	1.77 x(7.50)
F_{18}	0.91	03.45 (10.70)	01.32 (06.60)	01.32 (06.60)	01.72 (07.54)	1.95 x(7.86)

*** Significant at 1% level, * Significant at 5% level, # Similar alphabets denote homogenous means where set (a,b) and set (p,q,...) are used respectively for comparing within fortnights between face means of percent infected shoots and the same due to fortnights. $ Figures in parenthesis are angular transformed values, Fi – ithfortnight (F1 = 1st fortnight of observation and F18 = 18th fortnight of observation)*

Table -3 Correlation between meteorological parameters (fortnightly average) and the extent of shoot damage by *Diaphania caesalis* Walker

Variables	Values of Correlation co-efficient				
	Percentage damage on east face	Percentage damage on west face	Percentage damage on north face	Percentage damage on south face	Mean percentage damage on the four faces
Max. Temp.	-.859**	-.915**	-.882**	-.836**	-.862**
Min. Temp.	-.914**	-.919**	-.937**	-.931**	-.931**
Max. R.H	.546*	.448	.495*	.380	.484*
Min. R.H	-.310	-.239	-.329	-.427	-.356
Rainfall$	-.601**	-.512*	-.536*	-.611**	-.594**
Wind Speed	-.731**	-.850**	-.738**	-.608**	-.732**

*$ Total rainfall of fortnights, ** Significant at 1% level, * Significant at 5% level*

Table-4 Multiple Regression Model among the significant meteorological parameters with dependent variables

Meteorological Parameters	Dependent Variables (Faces)	R	R Square	Adjusted R Square	Std. Error of the Estimate
Min. Temp., Max. RH, Rainfall	East face	0.974	0.949	0.938	2.38
Min. Temp., Wind	West face	0.975	0.950	0.943	2.48
Min. Temp., Max. RH	North face	0.958	0.919	0.908	2.94
Min. Temp.	South face	0.931	0.866	0.857	3.38

For experimental studies regarding shoot damages, these trees were taken. The trees were mixtures of many germplasms like Hazari, Red Flake *etc.* The experiments were done on randomly selected ten trees. During the fruiting season, another ten trees were randomly selected for the experimental studies regarding fruit damages.

Target pests

The target pest on which the main experiments were done was the jackfruit fruit and shoot borer, *Diaphania caesalis* Walker (Pyralidae: Lepidoptera).

Target pests of minor status

Other target pests (minor) were the jackfruit brown/bud weevil, *Ochyromera artocarpi* Marshall, bark eating caterpillars *Indarbela* sp. and *Coleopteran* trunk borers. First, the different insect pests attacking jackfruit trees were taken into account. To find out the status and the incidence scenario of insect pests among farmers, a field survey was conducted in six different locations of Nadia district, *viz.* Chakdah, Fulia, Krishnanagar, Mohanpur, Ranaghat and Shantipur. Then, the seasonal incidence of the pest *Diaphania caesalis* Walker was studied systematically. For this, ten trees were selected randomly from the plantations of jackfruit in the Research Unit, AICRP on Tropical Fruits, Mondouri. These trees were tagged and observed properly. From each of these ten trees, observations were taken from the four sides of the tree canopy facing East, West, North and South respectively. Observations were taken on weekly basis starting from October 2011 to June 2012. During this period the trees were observed for the shoot and fruit damaged by the larvae of *Diaphania* sp. Walker. Number of shoots were counted in a 200 cm2 or 0.5 m2 trees canopy area and the number of shoots damaged by the larvae of the pest along the four geographical directions *i.e.* east, west, north and south. Percentage shoot infestation by the pest was estimated. In case of fruiting trees, percentage fruit infested by *Diaphania caesalis* was estimated.

For this, ten random jackfruit trees bearing fruits were observed in the different fruiting months (January to June, 2012). From each tree, fruits were chosen randomly and the number of fruits infested by the larvae were counted. Thereafter percentage of fruit infestation was estimated. For the other three target pests, ten jackfruit trees were selected randomly and tagged and observations were made and recorded throughout the whole year, from which the pest's incidence and damage percentage were determined. For the bud weevil, total number of very young buds/fruits and number of infested buds were recorded. The data was used to find out the infestation percentage. For bark eating caterpillars, number of infested trees, number of galleries and/or holes were counted and the damage percentage was calculated. For the Coleopteran trunk borer *Batocera* sp., number of infested trees, bore holes and number of trees killed, were counted and the damage percentage was determined.

Statistical analysis

Percent shoots infested by *Diaphania caesalis* were observed weekly for shoots of each canopy face or direction (East, West, North and South) of jackfruit trees. Then, by taking the mean of two week's data of each month, the weekly data were corrected to fortnightly data, *i.e*., four week's data were transformed to two fortnight's data. The study duration for *Diaphania* sp. damage was eighteen fortnights starting from October, 2011 to June, 2012. All data were corrected for frequent zeroes and then transformed by angular transformation. One-way ANOVA [5] technique was used for each fortnight just to compare the canopy face differences using F tests. Duncan's test [6] at 5% level of significance was followed to compare the fortnight wise face means of transformed percent shoots infected. Standard errors of means were also calculated for each fortnight data. General linear model technique, repeated over fortnights, was also used to compare overall face means for all fortnights and overall fortnight means for all canopy faces using F tests along with their interaction effect.

Results and Discussion

Field survey

Field survey was conducted in six different locations of Nadia district (West Bengal), *viz*. Mohanpur, Chakdah, Fulia, Ranaghat, Shantipur and Krishnanagar, to make a general assessment of the status of insect pests on jackfruit and their incidence scenario. Twenty farmers were selected from each location, making a total of 120 respondents. 97.5% of the farmers gave a positive response to insects as a limiting factor in jackfruit production. The jackfruit shoot and fruit borer was the dominant pest in all the cases, followed by few incidence of bud weevil, occasional killing of trees by trunk borers and infestations by bark eating caterpillars. 1.67% farmers referred monkeys and squirrels to be a menace during fruiting season. And 0.83% of the respondents do not care whether their jackfruit trees are infested by insect pests or not, as long as it yields some amount of fruit.

Jackfruit shoot and fruit borer, *Diaphania caesalis* Walker

The pest was observed in the field condition during the present study throughout the year except the months of July, August and September. The caterpillars have yellowish head and prothorax with reddish-brown body with numerous black flattened horny warts, each bearing one short bristle-like hair. Full-grown larvae are 2.5 - 3.0 cm in length but before pupation the larvae become pale in color [Plate 1 (a & b)]. Pupae are reddish/yellowish-brown [Plate 1 (e)]. Adults are whitish-brown moths, having greyish elliptical patterns and a marginal series of black specks [Plate 1 (f)]. The length of the adult wing expanse is about 26 to 34 mm. Female moths are slightly bigger than males. Initially, the caterpillars bore into tender shoots, flowering buds and developing fruits. As a result, the shoots and buds' wilts, droop or dries up and the fruits start rotting or get deformed [Plate 1 (c & d)]. Pupation takes place inside the infested buds or leaves folded by them or in tunnels, cracks and crevices of stem.

a.Larvae in shoot

Plate -1

b.Larvae in fruit

c.Shoot damage

d.Fruit damage

e.Pupa

Plate-4 a.Adult Batocera beetle

f.Adult

b.Exudation of sap from infested trees

Plate-2 Bud weevil, Adult Bud weevil

c.Bore holes and sawdust like materials

Plate-3 Bark eating caterpillar, Bark eating caterpillar galleries

d. Dried up tree

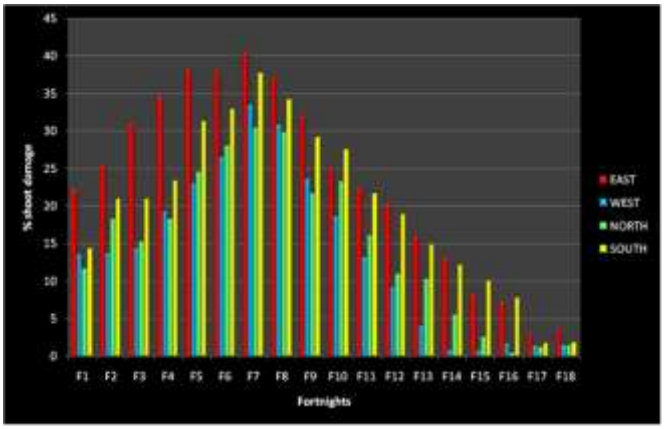

Fig-1 Percent jackfruit shoot damaged by *Diaphania caesalis* Walker on different faces of the plant canopy in different fortnights.

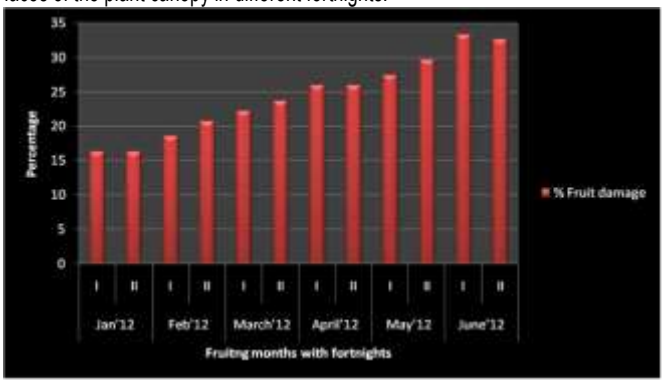

Fig-2 Percent fruit damaged by *Diaphania caesalis* Walker, in different fruiting months.

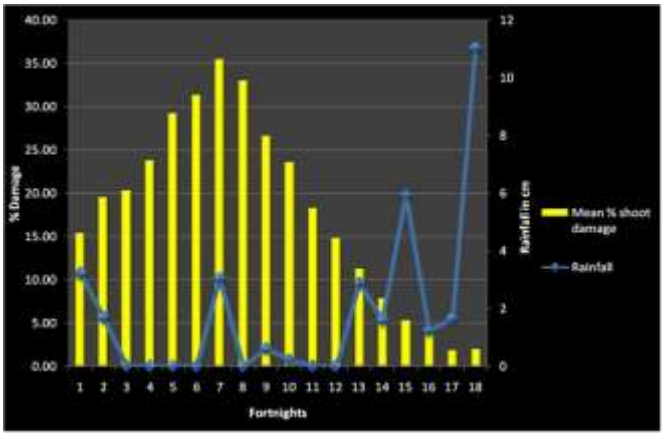

Fig-3 Mean percent jackfruit shoot damaged by *Diaphania caesalis* Walker, along with significantly correralated meteorological parameter (Rainfall) in different fortnights.

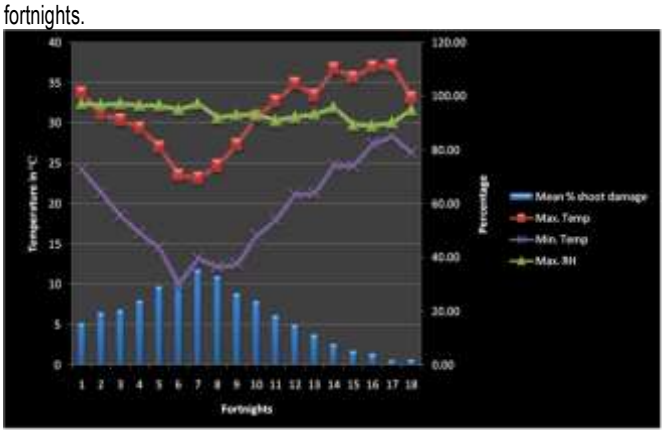

Fig-4 Mean percent jackfruit shoot damaged by *Diaphania caesalis* Walker, along with significantly correralated meteorological parameters (Max. and Min. Temperature, Max. RH) in different fortnights.

Seasonal incidence and level of infestation by *Diaphania caesalis* Walker on different faces of the plant canopy

The mean percentage of shoot damaged by *Diaphania caesalis* ranged from 1.77-35.45%, when all the four faces of the tree canopy were considered [Table-1 and Fig-1]. The highest damage was observed in the first forth night of January, 2012. (average maximum temperature 23.19° C, minimum temperature 13.23° C, maximum RH 97.31% and minimum RH 71%), whereas the least damage was observed in the 1st fortnight of June, 2012 (average maximum temperature 37.18° C, minimum temperature 28.36° C, maximum RH 90.25% and minimum RH 68.94%). The trend of incidence pattern of *Diaphania caesalis* Walker, in different faces of the tree canopy shows that there is a significant difference in mean percentage of shoot damage starting from October, 2011 to June, 2012. The mean percentage of damage varied from 3.03% - 40.45% on the east face, 0.69% - 33.33% on the west face, 0.36% - 30.36% on the north face and 1.67% - 37.66% on the south face of the tree canopy. January, 2012 recorded the maximum percentage of shoot damage (34.20%), irrespective of canopy faces. Whereas, the least shoot damage was observed during June, 2012 (3.24%) on the east face, 2nd fortnight of April, 2012 (0.69%) and 1st fortnight of May, 2012 (0.71%) on the west face, 2nd fortnight of May 2012 (0.36%) on the north face and June, 2012 (1.70%) on the south face. The effect of face direction of the plant canopy of jackfruit on the extent of damage by the shoot borer is depicted by [Table-2], after analyzing by Duncan's Multiple Range Test (DMRT). After reaching the peak period of incidence, during the month of January, the percentage of shoot infestation gradually declined due to the initiation of inflorescences or reproductive buds. The incidence of the pest was not found during the period from July to September. On the basis of summarized data it may be concluded that out of the four faces of jackfruit canopy, the mean shoot damage was maximum on the east face followed by south face. Bai and Marimadaiah, (2002) [3] also reported severe infestations of *Diaphania* sp. In mulberry, during the months of October to December and is in conformity with the present findings. The least damage was observed inthe month of June, 2012 (Average maximum temperature 37.18°C, minimum temperature28.36°C, maximum RH 90.25% and minimum RH 68.94%). The minimum percentage of infestation of *Diaphania*in April to June was earlier reported by Gowda *et al*.,(2001) [8] on mulberry. It can be seen from the analyzed data [Table-3] that, significant correlation exists between maximum temperature, minimum temperature, maximum RH, rainfall and wind speed with the percentage of shoot damaged by *Diaphania caesalis* Walker among the six meteorological parameters taken (Fig.3 and 4). But the meteorological parameter minimum RH, was not found to correlate with the percentage damage by the pest species. This parameter was not only non-significant at 1% level but also at 5% level of significance. Pozo *et al*., (2002) [18] established a negative correlation of precipitation with the incidence of *Diaphania* sp. though the pest species as well as the crop plants were different in their experiment. The analyzed data indicated that maximum temperature (r = -0.862), minimum temperature (r = -0.931), rainfall (r = -0.594) and wind speed (r = - 0.732) were negatively correlated with the mean percentage damage done by the pest, whereas maximum RH (r = 0.484) was positively correlated with the pest damage. The positive correlation between the relative humidity and the *Diaphania* sp. infestation was earlier established by Gowda *et al*., (2001) [8] though the species of as well as the test crop were different. Huang, (2003) [11] also reported the negative effect of high temperature and low R.H. on the damage done by larvae of *Diaphania pyloalis* Walker. The reduction of developmental period of *Diaphania* sp. on cotton with the increase of temperature *i.e*. the negative correlation of temperature on *Diaphania* biology was earlier reported by Kinjo and Arakaki, (2002) [14]. The results were similar in case of separate correlation studies of the meteorological parameters with the percentage shoot damage in a particular face of the tree canopy of jackfruit. The analyzed data presented in [Table-4] reveals the fact that maximum RH and minimum temperature and rainfall, are the best regressors to predict the damage of shoots on east face by the pest. These three parameters together have 93.8% ability of prediction about damage by the pest. But the mean shoot damage on west face depends mostly on minimum temperature and wind. They can predict together 94.3% of the pest attack.

Multiple regression analysis again shows that minimum temperature and maximum RH together are the best regressors to predict the percent shoot damage on the north face with 90.8% prediction capacity of the pest attack. However, the shoot damage on south face depends mostly on minimum temperature which can alone predicts 85.7% of the pest infestation. Therefore, it can be concluded from the above study that maximum RH is the most important regressor for prediction of percent shoot damage. Gowda *et al*., (2001) [8] also reported that relative humidity had a major effect on the incidence of *Diaphania* sp. Huang, (2003) [11] also reported that, under cloudy and humid weather conditions, the rate of egg eclosion of *Diaphania pyloalis* Walker is high.

Observations of fruit and shoot borer *Diaphania caesalis* Walker during different fruiting seasons

Maximum fruit damage (33.33%) was recorded in the month of June, 2012 (1st fortnight) and the minimum (16.30%) in both the fortnights of January, 2012. The infestation ranged from 16.30 - 33.33 % (January to June, 2012) (Fig. 2). Khan and Islam, (2004) [13] reported the average percentage of fruit damage by *Diaphania caesalis* Walker, was 27.44% in Bangladesh. From February onwards (February to June) maximum number of infested fruits were recorded instead of shoots. It may be due to the preference of the insect pest to the tender inflorescence and young fruits than the shoots.

Occurrence and infestation of the jackfruit bud weevil, *Ochyromera artocarpi* Marshall on jackfruit

The jackfruit bud weevil are small brown weevils [Plate-2], seen feeding, boring and infesting the young reproductive buds of jackfruit, because of which bud dropping occurs. The population of the bud weevil was observed from December till April, in the field, infesting the young buds that are found among the developing or developed fruits. Their infestation starts to cease when all the buds developed into fruits and grows in size. The mean percentage of bud damage, on a fixed plot, by *Ochyromera artocarpi* Marshall, ranged from 3 - 17%. Maximum infestation was recorded in the 2nd fortnight of January, 2012 and the minimum during April, 2012. After that, there was no considerable infestation on buds, maybe because most of the buds were developed into fruits and were growing in size.

Occurrence and infestation of the bark eating caterpillars, *Indarbela* spp. on jackfruit

Bark eating caterpillars are polyphagous pests infesting fruit trees, including jackfruit as well. They infest the trees by scrapping or eating away the bark and make webs that contains their excreta, frass and chewed wood materials [Plate-3]. They also bore into the tree. Such holes were seen at the fork points of branches or on depression on stems *etc*. with webs, mostly, above these holes.

Out of fifty trees observed, seven trees were infested with the bark eating caterpillars *i.e*., 14% of the trees were showing signs of infestation.

More number of webbings was observed on old trees as compared to young trees. Fresh symptoms (webbings) were seen almost all round the year, on the observed trees, except during April to early June, where no fresh webbings were seen. Maybe, it was due to pupation and moth emergence during this period.

Occurrence and infestation of the stem borer, *Batocera rufomaculata* De Geer on jackfruit

The Coleopteran trunk borer, *Batocera rufomaculata* De Geer [Plate-4a], or popularly, the mango stem borer, is also a polyphagous pest of many fruit and other economically important trees including jackfruit. The adult beetle lay eggs in the bark of the tree and the grub bores inside the tree, making tunnels and stays inside, before emerging out as adults. Infestation symptoms [Plate-4 (b & c)] such as oozing of sap or gummy substances from the bore holes or protrusion of saw dust like materials from the holes, that falls down and lie around the infested trees, are seen. Damage symptoms were seen all round the year. Out of fifty trees observed, nine trees (18%) were infested with the insect pest. Out of the senine infested trees, four trees (44.44%) were totally dried up and killed during the observation period. *Batocera rufomaculata* De Geer may be a minor pest, but it is an important one because under severe infestation, this pest has the capacity to kill an entire tree [Plate-4d], thus seriously affecting production.

Application of research: The present research aspires to help farmers and researchers alike in identifying the insect pests of jackfruit, their seasonal incidence, extent of damage and their correlation with the weather parameters. The present findings will also contribute to the scope of future research in determining the ETL (Economic Threshold Level) of the insect pests of jackfruit and in designing a sustainable pest management system.

Research Category: Crop protection.

Abbreviations: R.H.- Relative Humidity, MSL- Mean Sea Level

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