International Journal of Multidisciplinary Research and Development

IJMRD 2015; 2(4): 82-86
www.allsubjectjournal.com
Received: 10-03-2015
Accepted: 28-03-2015
e-ISSN: 2349-4182
p-ISSN: 2349-5979
Impact Factor: 3.762

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Incidence and severity of leaf blight disease of jackfruit seedling (*Artocarpus heterophyllus* l.) in Bangladesh as influenced by weather components

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Abstract
The existing health situation of jackfruit seedling of nursery diseases of jackfruit species in Bangladesh is in a stage to be upgraded for successful fruit production to meet the national demand. Experiments were carried out during the period of July, 2012-October, 2014 to study the incidence and severity of leaf blight of jackfruit seedling in some selected area of Bangladesh on the Effect of weather components. From the experiment the highest incidence (44.17%) was recorded in April (2013 & 2014) when the average temperature, relative humidity and rainfall were 21°C, 70.72% and 3.68 cm, respectively. On the other hand, lowest incidence (3.21%) was recorded in January (2013 & 2014) having average temperature, relative humidity and rainfall 17.67°C, 74.90% and 0.56 cm, respectively. In case of disease severity of jackfruit seedling the highest severity (38.59%) was recorded in April (2013 & 2014) when the average temperature, relative humidity and rainfall were 21°C, 70.72% and 3.68 cm, respectively. On the other hand, lowest severity (1.27%) were recorded in January (2013 & 2014) having average temperature, relative humidity and rainfall 17.67°C, 74.90% and 0.56 cm, respectively.

Keywords: Jackfruit, temperature, rainfall, relative humidity, leaf blight, disease.

1. Introduction
Jackfruit (*Artocarpus heterophyllus* L.) is one of the most important popular delicious fruit crops in Bangladesh (Haque, 2009). It belongs to the family Moraceae. It stands third position in respect of area (22814 acres) and second in production (1005 thousand metric tons) of fruits in Bangladesh (BBS, 2010). It is grown in Bangladesh, Phillipines Srilanka, Thiland, India, some extent in Brazil and Queensland of Australia. Success of an orchard or homestead gardening depends on the quality of the planting material. Seedling diseases of jackfruit play a major role in reducing yields of horticultural crops in the tropic. It has been estimated that the production could be increased at least by 28% if the crop could be protected against various seedling diseases (Chowdhury, 2009). Jackfruit seedlings are vulnerable to attacked by various diseases in Bangladesh, but least concrete information regarding their distribution, incidence, severity, epidemiology and management is available. Therefore, the present study has been designed to study the occurrence and prevalence of seedling diseases of jackfruit and to study the correlation of disease development with environmental parameters in eight nurseries in four selected districts namely, Dhaka, Gazipur, Barisal and Khagrachari and to study the effective management strategies of the diseases. The effect of temperature, relative humidity and rainfall on incidence and severity of leaf blight diseases. Incidence and severity of leaf blight varied from location to location and time to time. The highest incidence and severity of leaf blight were recorded in the month of April (2013&2014) at Dhaka. The lowest incidence and severity of leaf blight were observed in January (2013&2014) at Barisal. Keeping in view of the above discussion the present study was undertaken with the following objectives. i) To know the appropriate amount of weather components such as temperature, relative humidity, and rainfall which can reduce the incidence and severity of leaf blight disease of jackfruit seedling in Bangladesh.

2. Materials and methods

2.1 Experimental site and period:

The study was carried out at Sher-e-Bangla Agricultural University, Dhaka-1207 with 3 other districts of Bangladesh and it was carried out from July, 2012-October, 2014.

2.2 Preparation of nursery soil and seedlings:

The substratum was prepared by mixing soil, sand and well decomposed cow dung and sterilized with 5 ml formalin (40%) diluted with 20 ml water for 4 kg soil. The prepared soil was heaped in square block. Soil heap was inocula. After 4 days of treatment, earthen pots were filled up with the sterilized soil.

2.3 Location of survey area:

Prevalence of diseases occurring on Jackfruit seedlings raised in the selected nurseries was surveyed. The experiment was carried out in eight nurseries of Dhaka, Gazipur, Khagrachari and Barisal. The eight nurseries of four districts are surveyed.

2.4 Age and number of seedlings:

Age of the jackfruit seedlings and total number of seedlings in selected eight nurseries from July, 2012 to April, 2014.

Nurseries	Age of the seedling (Years)	Total number of seedlings (July,2012-July,2013)	Total number of seedlings (Oct'12-Oct'13)	Total number of seedlings (Jan'13-Jan'14)	Total number of seedlings (April'13-April'14)
Green orchid nursery Agargaon, Dhaka	1	30	70	80	60
Barisal nursery Savar,Dhaka	1	60	90	90	70
Gazipur nursery Gazipur	1	70	80	90	90
Laxmipur nursery Gazipur	1	70	60	80	70
Hill Research Center Khagrachari	1	50	70	70	50
Ramghar nursery Ramghar, Khagrachari	1	50	60	50	50
Sarchina nursery Barisal	1	60	90	80	70
Riyad nursery Barisal	1	60	60	80	70

2.5 Observation of the symptoms:

Symptoms of the diseases were studied by visual observation. Sometimes hand lens were used for critical observation of the disease and sometimes a disease was identified based on matching the observed symptoms in the infected plants with the symptoms published in Ber and other Jackfruit disease compendium.

2.6 Survey period:

Altogether eight surveys were made during the period from July, 2012 to April, 2014. where First, second, third, fourth , fifth, sixth, seventh, and eighth surveys were made in July, 2012; October, 2012; January, 2013; April, 2013; July, 2013; October, 2013; January, 2014; and April, 2014 respectively.

2.7 Collection of diseased specimen:

Diseased leaves were collected from the infected plants representing the different areas of survey. The specimens were preserved in the laboratory following standard procedure of preservation of disease specimens until isolation was made.

2.8 Data collection during survey:

During the survey in the nurseries, total numbers of jackfruit seedlings as well as number of diseased seedlings in the nurseries were recorded. Then 30 seedlings were randomly selected for counting diseased leaves and disease free leaves. Moreover, five leaves per plant were randomly selected to determine the disease severity.

2.9 Determination of disease incidence and disease severity:

For calculation of incidence of disease every seedling was counted in the nursery and also counted the infected seedlings and then expressed in percentage. The disease incidence of Jackfruit seedling was determined by the following formula (Rai and Mamatha, 2005):

$$\text{Percent plant infection} = \frac{\text{Number of diseased plants}}{\text{Number of total plants observed}} \times 100$$

Percent disease incidence (PDI) of foliar diseases was determined by the following formula (Rai and Mamatha, 2005):

$$\text{Percent Disease Incidence (Leaves)} = \frac{\text{Number of diseased leaves on each plant}}{\text{Number of total leaves on each plant}} \times 100$$

Percent Disease severity (PDI) was determined by the following formula (Rai and Mamatha, 2005):

$$\text{Percent Disease Severity (Leaves)} = \frac{\text{Area of leaf tissue infected by disease}}{\text{Total number of leaf inspected}} \times 100$$

2.10 Meteorological data collection:
Meteorological data of the experimental period were collected from Meteorological Department, Agargaon, Dhaka.

2.11 Data analysis:
On different parameters were analyzed in two factor randomized block design (RCBD) through computer software MSTAT-C (Anonymous 1989). Duncan' s Multiple Range Test (DMRT) and Least Significant difference (LSD) test were performed to determine the level of significant differences and to separate the means within the parameters.

3. Result and discussion

3.1 Effect of weather components on the incidence and severity of leaf blight of jackfruit seedling during July, 2012 to April, 2014:

The incidence of leaf blight of jackfruit was influenced by average temperature, relative humidity and rainfall. The highest incidence (44.17%) was recorded in April (2013 & 2014). When the average temperature, relative humidity and rainfall were 21°C, 70.72% and 3.68 cm, respectively. On the other hand, lowest incidence (3.21%) was recorded in January (2013 & 2014) having average temperature, relative humidity and rainfall 17.67°C, 74.90% and 0.56 cm, respectively. In the month of July (2012 & 2013) the incidence was 37% when the temperature, relative humidity and rainfall were 30.08°C, 82.45% and 6.53 cm, respectively and in the month of October (2012 & 2013) the incidence was 29.8% while the temperature, relative humidity and rainfall were 29.07°C, 80.85% and 6.54 cm, respectively (Fig 1).

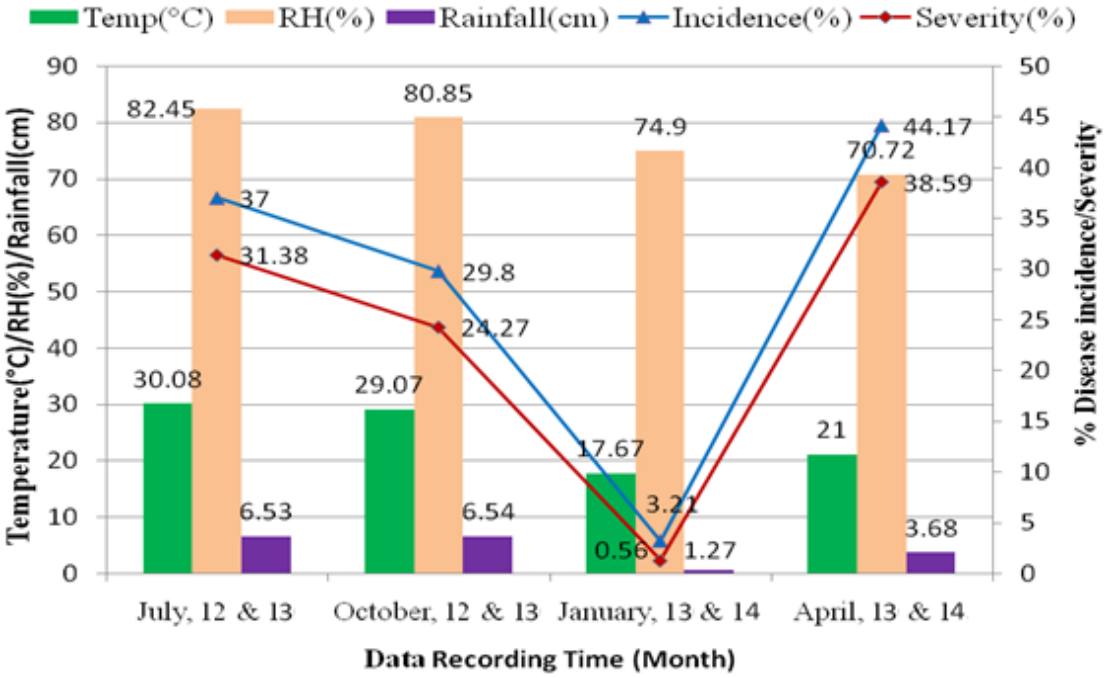

Fig 1: Effect of different weather factors on the incidence and severity of leaf blight of jackfruit seedling during July, 2012 to April, 2014. (Each data represents the mean value of consecutive two years)

The severity of leaf blight of jackfruit was influenced by average temperature, relative humidity and rainfall. The highest severity (38.59%) was recorded in April (2013 & 2014) when the average temperature, relative humidity and rainfall were 21°C, 70.72% and 3.68 cm, respectively. On the other hand, lowest severity (1.27 %) were recorded in January (2013 & 2014) having average temperature, relative humidity and rainfall 17.67°C, 74.90% and 0.56 cm, respectively. In the month of July (2012 & 2013) the severity was 31.38% when the temperature, relative humidity and rainfall were 30.08°C, 82.45% and 6.53 cm, respectively and in the month of October (2012 & 2013) the severity was 24.27% while the temperature, relative humidity and rainfall were 29.07°C, 80.85% and 6.54 cm, respectively (Figure 1).

3.2 Relation between leaf blight disease incidence as well as severity of jackfruit seedlings and temperature:
A positive correlation between leaf blight disease incidence and severity with temperature was observed. The relationship between disease incidence and temperature could be expressed by the equation $Y= 1.544X + 9.217$ (R^2 =0.275), where X = temperature and Y = disease incidence. Here, the R^2 value indicates that the contribution of temperature was 27.5% on the incidence of leaf blight of jackfruit (Figure 2). On the other hand, the relationship between disease severity and temperature could be expressed by the equation $Y= 1.321X – 8.440$ (R^2 =0.247), where X = temperature and Y = disease severity. Here, the R^2 value indicates that the contribution of temperature was 24.7% on the severity of leaf blight of jackfruit (Figure 3).

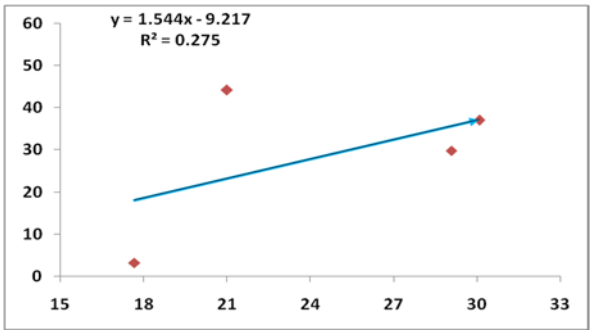

Fig 2. Linear regression analysis of the effect of monthly average temperature on incidence of leaf blight of jackfruit during July, 2012 to April, 2014

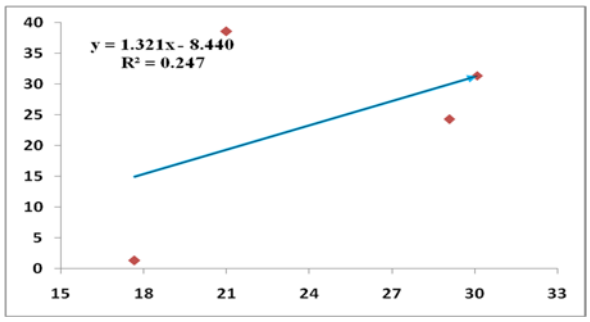

Fig 3: Linear regression analysis of the effect of monthly average temperature on severity of leaf blight of jackfruit during July, 2012 to April, 2014

3.3 Relation between leaf blight disease incidence as well as severity of jackfruit seedlings and relative humidity:

A positive correlation between leaf blight disease incidence and severity with relative humidity was observed. The relationship between disease incidence and relative humidity could be expressed by the equation Y= 0.067X + 23.29 (R^2 =0.000), where X = relative humidity and Y = disease incidence (Figure 4).

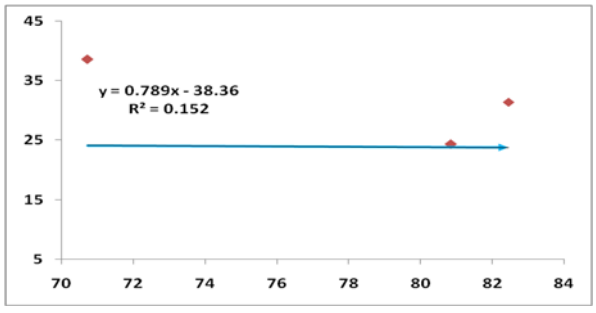

Fig 5: Linear regression analysis of the effect of monthly average relative humidity on severity of leaf blight of Jackfruit during July, 2012 to April, 2014.

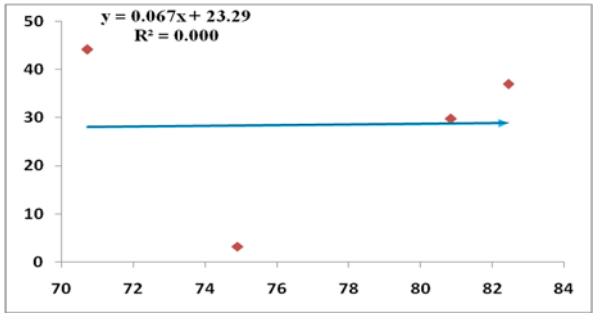

Fig 4: Linear regression analysis of the effect of monthly average relative humidity on incidence of leaf blight of jackfruit during July, 2012 to April, 2014.

Here, the R^2 value indicates that the contribution of relative humidity was 0.0% on the incidence of leaf blight of jackfruit. On the other hand, the relationship between disease severity and relative humidity could be expressed by the equation Y= 0.789X – 38.36 (R^2 =0.152), where X = relative humidity and Y = disease severity. Here, the R^2 value indicates that the contribution of relative humidity was 15.2% on the severity of leaf blight of jackfruit (Figure 5).

3.4 Relation between leaf blight disease incidence as well as severity of jackfruit seedlings and rainfall:

A positive correlation between leaf blight disease incidence and severity with rainfall was observed. The relationship between disease incidence and rainfall could be expressed by the equation Y= 4.381X + 9.584 (R^2 =0.487), where X = rainfall and Y = disease incidence. Here, the R^2 value indicates that the contribution of rainfall was 48.7% on the incidence of leaf blight of jackfruit (Figure 6).

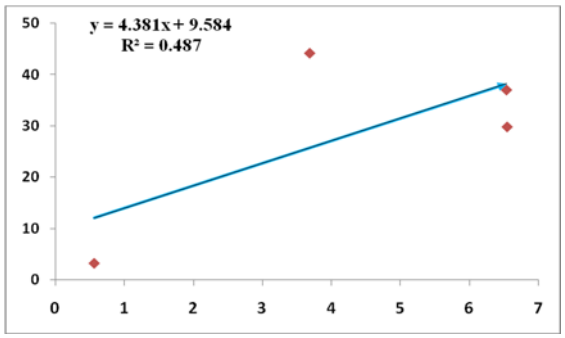

Fig 6: Linear regression analysis of the effect of monthly average rainfall on incidence of leaf blight of jackfruit during July, 2012 to April, 2014.

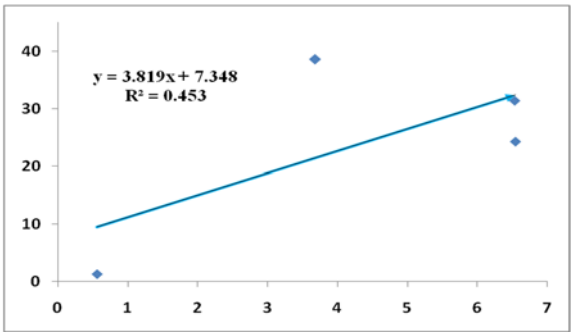

Fig 7: Linear regression analysis of the effect of monthly average rainfall on severity of leaf blight of jackfruit during July, 2012 to April, 2014.

On the other hand, the relationship between disease severity and rainfall could be expressed by the equation Y= 3.819X + 7.348 (R^2 =0.453), where X = rainfall and Y = disease severity. Here, the R^2 value indicates that the contribution of rainfall was 45.3% on the severity of leaf blight of jackfruit (Figure 7).

4. Conclusion

From this study we can know that the highest incidence (44.17%) was recorded in April. On the other hand, lowest incidence (3.21%) was recorded in January. In case of disease severity of jackfruit seedling the highest severity (38.59%) was recorded in April. On the other hand, lowest severity (1.27%) was recorded in January.

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