Research article **Bangladesh Journal of Entomology**
ISSN (Print): 1021-1004, ISSN (Online): 3007-3332, Website: www.bangladeshes.org
Bangladesh J. Entomol. (2025) 33(2): 49-62

SEASONAL INCIDENCE AND DAMAGE SEVERITY OF MAJOR INSECT PESTS ON BORO RICE IN KHULNA AND SATKHIRA DISTRICTS OF BANGLADESH

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Received: 1 August 2025; Accepted: 11 September 2025

ABSTRACT

Study was conducted at farmers boro rice field in Khulna and Satkhira districts of Bangladesh to find out the incidence and damage of stem borer, leaf folder and BPH at different growth stages of rice during December 2023 to June 2024. Results revealed that the highest number of white stem borer larvae was recorded from Asashuni upazila and the lowest was from Koyra. The highest number of dead heart symptoms was found in Satkhira sadar and the lowest in Paikgasa. The highest number of white head was recorded from Dumuria upazila and the lowest was from Kaliganj. At 40 DAT, the highest number of stem borer larva was found in Koyra (1.4/10 hills) and the lowest number of larva was recorded from Paikgasa (0.4/10 hills). The highest number of dead heart symptoms was recorded from Sathkhira sadar (1.4/10 hills). At 60 DAT, the highest number of stem borer larva was found in Assashuni (0.8/10 hills), the highest number of moth was recorded from Kaligonj (2/10 hills) and the lowest was from Sathkhira sadar (0.8/10 hills). The highest number of dead heart symptoms was recorded from Kaligonj (2.4/10 hills) and the lowest was in Sathkhira sadar (0.8/10 hills). At 90 DAT, the highest incidence of rice stem borer larva (2.8/10 hills) and moth (3/10 hills) was observed in Paikgasa. The highest number of white head damage was recorded in Paikgasa (3.2/10 hills) and the lowest was in Koyra (1.4/10 hills). At 110 DAT, the highest incidence of rice stem borer larva was observed in Paikgasa (2.8/10 hills) but the highest number of stem borer moth was recorded in Assashuni (1.8/10 hills) and the lowest was in Sathkhira (1.4/10hills). The highest number of white head damage was recorded in Kaligonj (4.4/10 hills) and the lowest was in Sathkhira sadar (1.8/10 hills). In case of rice leaf folder, at 40 DAT, the highest number of leaf folder larva (2/10 hills) and folded leaves (0.8/10 hills) was observed in Satkhira sadar followed by Assashuni (0.4/10 hills)

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but incidence of leaf folder larva and its damage were not found in Kaligonj, Koyra and Paikgasa. At 60 DAT, the highest number of leaf folder larva was observed in Satkhira sadar (1/10 hills) and the lowest number of leaf folder larva was in Koyra (0.4/10 hills) but the highest number of folded leaves was observed in Kaligonj (1.2/10 hills). No folded leaf was recorded from Dumuria. In case of BPH, the highest number (114/10 hills) of Brown Plant Hopper (BPH) was recorded from BR 26 rice field and the number infested tiller was 10. But from rod miniket rice, the number of BPH was 112 and the number of infested tiller was 5. No BPH was found in remaining 5 studied locations.

Keywords: White head, dead heart, WSB, BPH, rice leaf folder, YSB, seasonal incidence

INTRODUCTION

Rice (*Oryza sativa* L.) commonly known as Asian rice is a cereal food plant belongs to the family Gramineae and it is the main staple food of Bangladesh. Bangladesh is the 3rd rice production country in the world. In Bangladesh rice grows in three seasons like Aus, Aman and Boro. Boro is the best rice-growing season in Bangladesh showing moderate pest attack and highest yield with irrigation. In 2022-2023, the Bangladesh Bureau of Statistics (BBS 2024) reported a total Boro rice production of 20.77 million metric tons from 4.70 million hectares of land. The magnitude of insect damage varies depending on seasons, years and locations. The injury from feeding leads to damage symptoms of skeletonized and defoliated leaves, dead hearts, white heads, stunted and wilted plants and unfilled or pecky grains which ultimately affects the plant physiology leading to a considerable reduction in measurable yield, utility or economic return (Nasiruddin and Roy 2012). A total of 159 species of rice insect pests have been recorded (Rahman *et al*. 2018). Among these brown plant hopper (*Nilaparvata lugens*), rice stem borer (*Sciropophaga* spp.), green leafhopper (*Nephotettix* spp.), white-backed plant hopper (*Sogatella furcifera*), rice gall midge (*Orseolia oryzae*), rice hispa (*Dicladispa armigera*), and rice leaf folder (*Cnaphalocrocis medinalis*) are the major pests (Alam 2013, Nasiruddin and Roy 2012, BRRI 2009). Rice stem borer can cause 95% yield loss and leaf folder can cause 63 to 80% yield loss. Some insects act as vectors and transmit viral diseases in rice crop and cause colossal yield loss. In South and South East Asia, rice is grown in warm, humid environment which are favorable for the survival and spread of key insect pests such as yellow stem borer, leaf folders, brown plant-hoppers and

green leaf-hoppers (Gianessi 2014). A group of entomologists have been surveying the rice insect pests from several agro-ecological zones considering different rice crops, growing seasons and growth stages (BRRI 2014). Rice crop is attacked by several insect pests from seedling to harvest, which cause severe yield loss in one region of the country of Bangladesh. The yellow stem borer, *Scirpophaga incertulas* (Walker) is the principle devastator causing 'dead heart' and 'white ear' leading to major economic damage (Satpathi *et al.* 2012). The rice leaf folder, *Cnaphalocrocis medinalis* (Guenee), so far, was considered as a minor pest, has assumed major pest status during the last two decades (Nanda *et al.* 2000). BPH cause orange-yellowish leaves before turning brown and dry and this condition is called hopper burn that kills the plant. YSB feed upon tillers and causes dead hearts or drying of the central tiller, during vegetative stage; and causes whiteheads at reproductive stage. Generally, rice growers do not apply insecticides in proper doses or appropriate chemical to control those insect pests. This often led to severe reduction of natural enemies. Population dynamics of insect pest and natural enemies in different rice growing seasons could help us to understand incidence pattern of major insect pest as well as their natural enemies which could facilitate biological control rather than chemical control. In general, the fauna which are harmful to rice plant and cause economic loss in paddy fields are termed as insect pests of rice while the fauna which acts as biological control agents of those harmful insect pests are known as beneficial insects (Khan 2013). Moreover, incidence of insect pests and abundance of their natural enemies vary greatly depending on climate and crop growing conditions of each location. For this reason, there was no scientific survey and study on major insect pest of rice basically insect pest of boro in Satkhira and Khulna, coastal districts of Bangladesh. Considering above facts, the present study was undertaken to record the major insect pests in boro season and their incidence and damage in Satkhira and Khulna districts of Bangladesh.

MATERIALS AND METHODS

Figure 1 illustrated the geographical areas of coastal region of Khulna and Satkhira districts of Bangladesh. To study the incidence of major insect pests and their infestation on rice, roving survey was carried out in 30 fields of Satkhira and Khulna districts where 5 from Satkhira sadar, 5 from Assashuni, 5 from Kaligonj upazila

of Satkhira district and 5 from Dumuria,5 from Paikgasa and 5 from Koyra upazila of Khulna district during January to April 2024. Satkhira and Khulna districts were under the AEZ -no. 11 and 13. This area is High ganges Flood plain area and Ganges Tidal Flood plain area and is 2 m elevation from sea level mainly cropping pattern and diversity totally differ from other area of AEZ of Bangladesh. In each upazila 5 fields were inspected at different crop growth stages of the crop. In this study, the random samplings of ten hills were carried out for the purpose of population fluctuation of the BPH, RSB, RLF and RGM in the 30 rice fields. These plants were observed regularly at 20 days interval at different growth stages of rice. The stage of eggs, larvae, nymph and adult of insect population of BPH, RSB, RLF and RGM in the 30 rice fields among 6 upazilas of two districts was recorded per hill starting from the seedling stage till the harvest of the rice plant. Observations were taken from 10 randomly selected plants from each field at 7.00 - 10.00 am and 4.00-6.00 pm during seedling (at 20 DAS), vegetative (at 40 DAS), flowering (at 60 DAS), dough stage (at 90 DAS) and maturity or harvesting (at 110 DAS) stages of rice plant. The insect species from rice fields were collected by hand picking and with a fine nylon cloth sweep net (25 cm dia.). Sweeping was done from the plant canopy level including the inter spaces between plants as well as close to basal region as far as possible. In each field, 20 complete sweeps were made to collect the

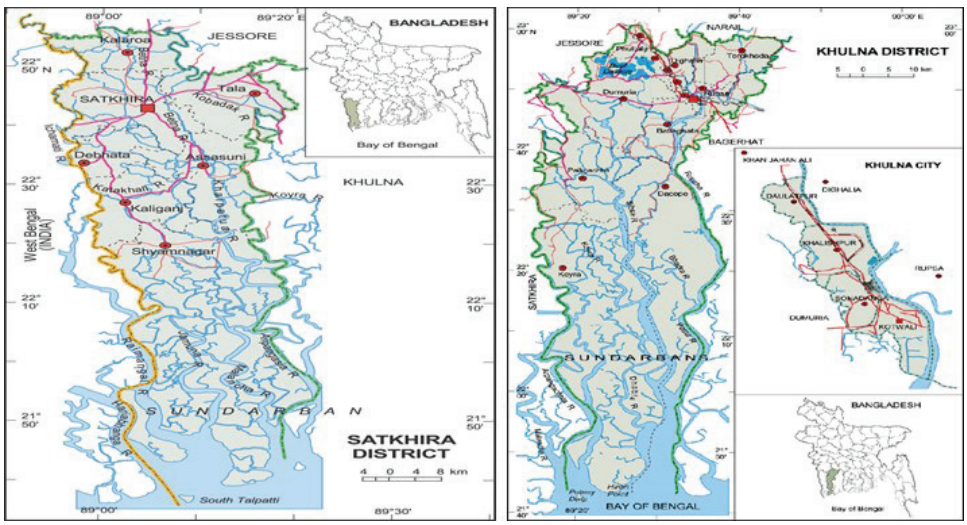

Fig. 1. Geographical area of Coastal region of Khulna and Satkhira districts of Bangladesh

insect species from each growth stage at 5 growth phase. Sweeping was done in the morning from 9:00 to 11:00 am in all the experimental plots. Data were recorded on the number of nymph and adult of BPH/plant, number of leaf folder and larvae/10 plant, number of folded leaves/10 plants, and number of larvae of rice stem borer/per plant; number of white heart/dead-heart, number of infested and healthy panicle/10 randomly selected plants of each plot. Data were analyzed statistically using SPSS and MS Excel programs.

RESULTS AND DISCUSSION

Incidence and damage of white rice stem borer and yellow rice stem borer: The highest number larvae of white stem borer was recorded from Asashuni upazila followed by Kaliganj and Satkhira sadar while the lowest was from Koyra followed Paikgasa and Dumoria upazila of Khulna district. In case of adult moth, the highest number moth was recorded from Paikgasa followed by Satkhira sadar and Dumuria upazila while the lowest was from Asashuni followed by Kaliganj and Koyra. The highest number of white head symptoms was observed from Dumuria upazila followed by Paikgasa and Koyra where the lowest was observed from Satkhira sadar followed by Asashuni and Kaliganj. The highest number of dead heart symptoms was found at Satkhira sadar followed by Asashuni and Dumuria while the lowest was in Paikgasa followed by Koyra and Kaliganj. In case of yellow stem borer, the number of larvae was lower than that of white stem borer in all locations but the adult moth was maximum in Koyra upazila followed by Satkhira sadar, Paikgasa and Dumuria while the lowest was in Asashuni followed by Kaliganj. In case of damage symptoms, the highest number of white head was recorded from Dumuria upazila followed by Koyra and Satkhira sadar while the lowest was from Kaliganj followed by Asashuni and Paikgasa. The number of dead heart symptoms by yellow stem borer was lower than that of white stem borer in all locations (Fig. 2).

Incidence and damage of rice stem borer at 40 DAT: The number of stem borer larva and dead heart symptom in different locations at 40 days after transplanting is shown in Fig. 3. The highest number of stem borer larva was found in Koyra (1.4/10 hills) followed by Sathkhira sadar (1.2/10 hills). The lowest number of larva was recorded from Paikgasa (0.4/10 hills) followed by Dumuria (0.8/10 hills). No larva was recorded from Kaligonj and Assashuni upazila. The highest number of dead

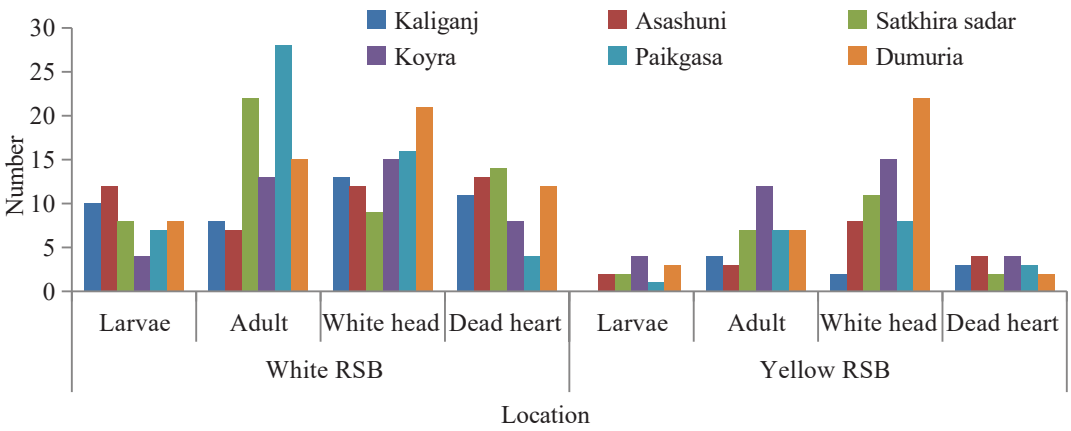

Fig. 2. Incidence and damage of white rice stem borer and yellow rice stem borer at different upazila of Satkhira and Khulna districts during January to April 2024

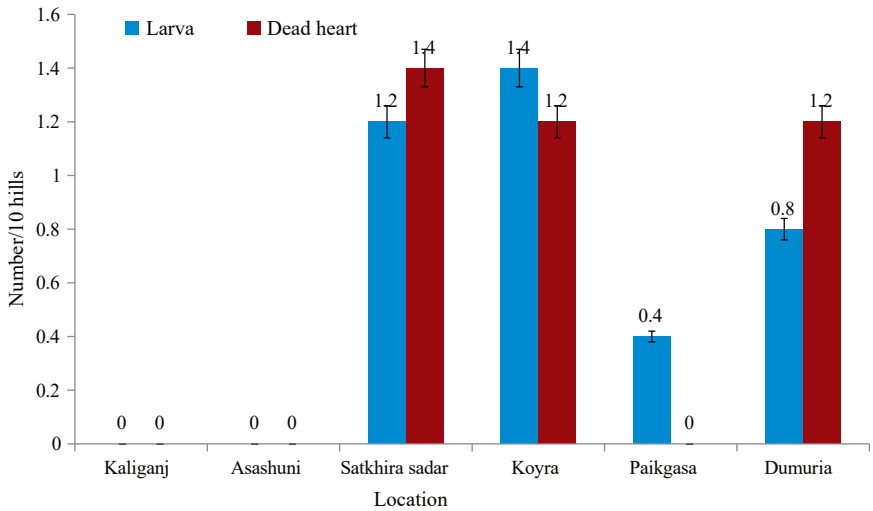

Fig. 3. Number of stem borer larva and dead heart symptom in different locations at 40 days after transplanting

heart symptoms was recorded from Sathkhira sadar (1.4/10 hills) followed by Koyra (1.2/10 hills) which was identical to that of Dumuria (1.2/10 hills). No dead damage was found in Kaligonj, Assashuni and Paikgasa upazila.

Incidence and damage of rice stem borer at 60 DAT: The number of stem borer larva, moth and dead heart white head symptom in different locations at 60 days after transplanting is shown in Fig. 4. The highest number of stem borer larva was

found in Assashuni (0.8/10 hills) and Sathkhira sadar (0.6/10 hills). No larva was recorded from other 4 study locations. The highest number of moth was recorded from Kaligonj (2/10 hills) followed by Paikgasa (1.8/10 hills) and the lowest was from Sathkhira sadar (0.8/10 hills) and was followed by Assashuni (1.4/10 hills). No moth was found in Koyra and Dumuria. The highest number of dead heart symptoms was recorded from Kaligonj (2.4/10 hills) followed by Assashuni (2.2/10 hills). The intermediate level of dead heart damage was observed in Koyra (1.4/10 hills) followed by Paikgasa (1.2/10 hills) which was identical to Dumuria and the lowest was in Sathkhira sadar (0.8/10 hills). No white head symptom was found in all locations.

Incidence and damage of rice stem borer at 90 DAT: The number of stem borer larva, moth and white head symptom in different locations at 90 days after transplanting is shown in Fig. 5. The highest incidence of rice stem borer larva was observed in Paikgasa (2.8/10 hills) followed by Dumuria (2/10 hills). No stem borer larva was found in Kaligonj, Assashuni, Sathkhira sadar and Koyra. The highest number of stem borer moth was recorded in Paikgasa (3/10 hills) followed by Dumuria (2.6/10 hills) and the lowest was in Sathkhira (1.4/10hills) while no moth was recorded from Kaligonj, Assashuni and Koyra. The highest number of white head damage was recorded in Paikgasa (3.2/10 hills) which was identical to

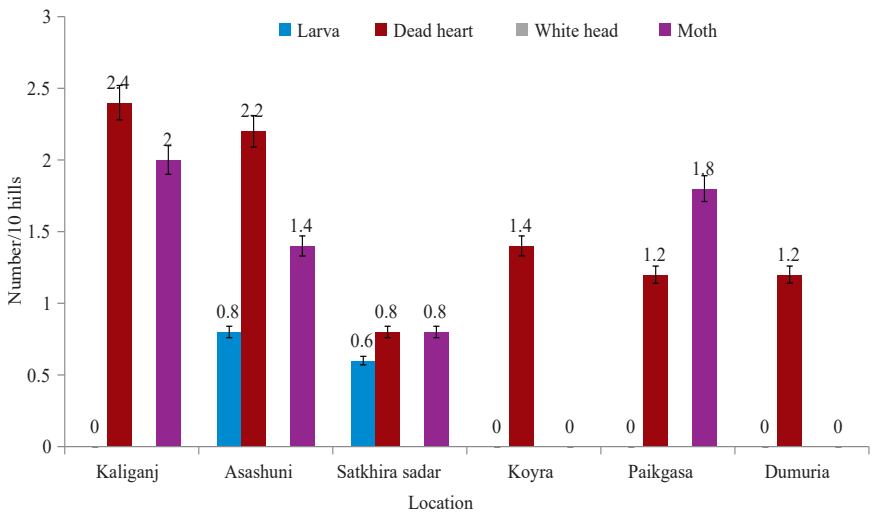

Fig. 4. Number of stem borer larva, moth, dead heart and white head symptom in different locations at 60 days after transplanting

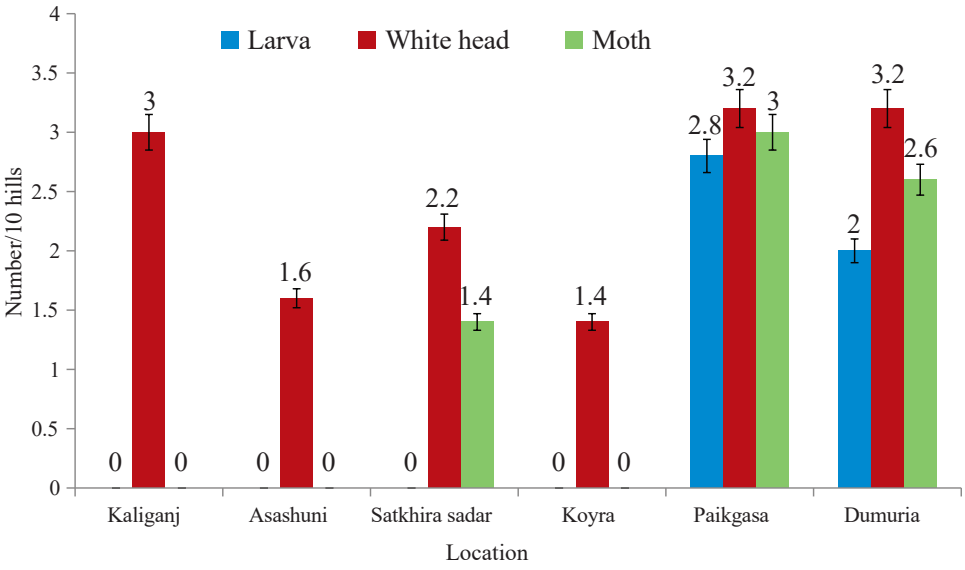

Fig. 5. Number of stem borer larva, moth and white head symptom in different locations at 90 days after transplanting

that of Dumuria (3.2/10 hills) followed by Kaligonj (3/10 hills). The intermediate level of white head damage was observed in Sathkhira sadar (2.2/10 hills) followed by Assashuni (1.6/10 hills) and the lowest was in Koyra (1.4/10 hills).

Incidence and damage of rice stem borer at 110 DAT: The number of stem borer larva, moth and white head symptom in different locations at 110 days after transplanting is shown in Fig. 6. The highest incidence of rice stem borer larva was observed in Paikgasa (2.8/10 hills) followed by Kaligonj (2/10 hills) which was identical to that of Dumuria (2/10 hills) while the lowest incidence was in Assashuni (0.2/10 hills) which was identical to Satkhira (0.2/10 hills). No incidence of stem borer was found in Koyra. The highest number of stem borer moth was recorded in Assashuni (1.8/10 hills) and the lowest was in Sathkhira (1.4/10hills) while no moth was recorded from Kaligonj, Koyra, Paikgasa and Dumuria. The highest number of white head damage was recorded in Kaligonj (4.4/10 hills) followed by Assashuni (3.2/10 hills) which was identical to that of Dumuria (3.2/10 hills). The intermediate level of white head damage was observed in Paikgasa (3.0/10 hills) followed by koyra (2.4/10 hills) and the lowest was in Sathkhira sadar (1.8/10 hills).

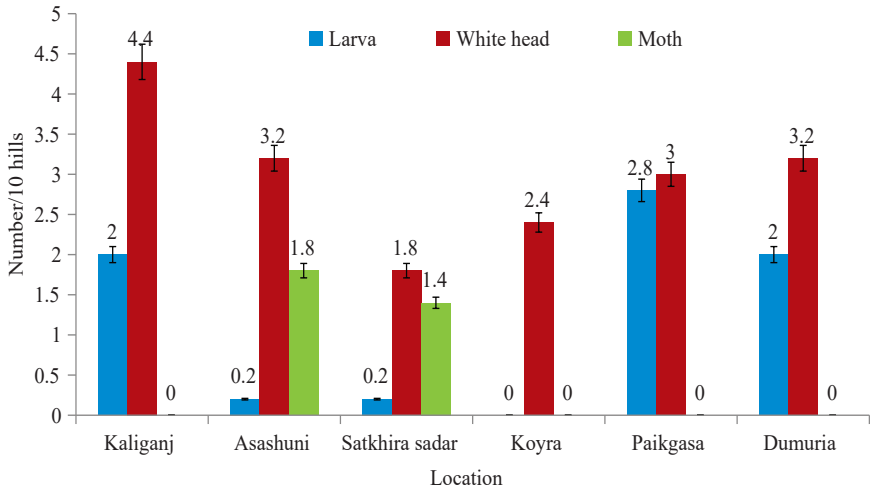

Fig. 6. Number of stem borer larva, moth and white head symptom in different locations at 110 days after transplanting

Incidence and damage of leaf folder at 40 DAT: The number of leaf folder larva and folded leaves in different locations at 40 days after transplanting is shown in Fig. 7. The highest number of leaf folder larva was observed in Satkhira sadar (2/10 hills) followed by Assashuni (0.4/10 hills) which was identical to that of Dumuria (0.4/10 hills). No incidence of leaf folder larva was found in Kaligonj, Koyra and Paikgasa. The highest number of folded leaves was also observed in Satkhira sadar (0.8/10 hills) followed by Dumuria (0.6/10 hills) and Assashuni (0.4/10 hills). No folded leaf was recorded from Kaligonj, Koyra and Paikgasa.

Incidence and damage of leaf folder at 60 DAT: The number of leaf folder larva and folded leaves in different locations at 60 days after transplanting is shown in Fig. 8. The highest number of leaf folder larva was observed in Satkhira sadar (1/10 hills) followed by Assashuni (0.8/10 hills) which was identical to that of Kaligonj (0.8/10 hills) while the lowest number of leaf folder larva was in Koyra (0.4/10 hills) followed by Paikgasa (0.6/10 hills). No incidence of leaf folder larva was in Dumuria. The highest number of folded leaves was observed in Kaligonj (1.2/10 hills) followed by Assashuni (0.8/10 hills) which was identical to those of Satkhira sadar (0.8/10 hills) and Paikgasa (0.8/10 hills). No folded leaf was recorded from Dumuria.

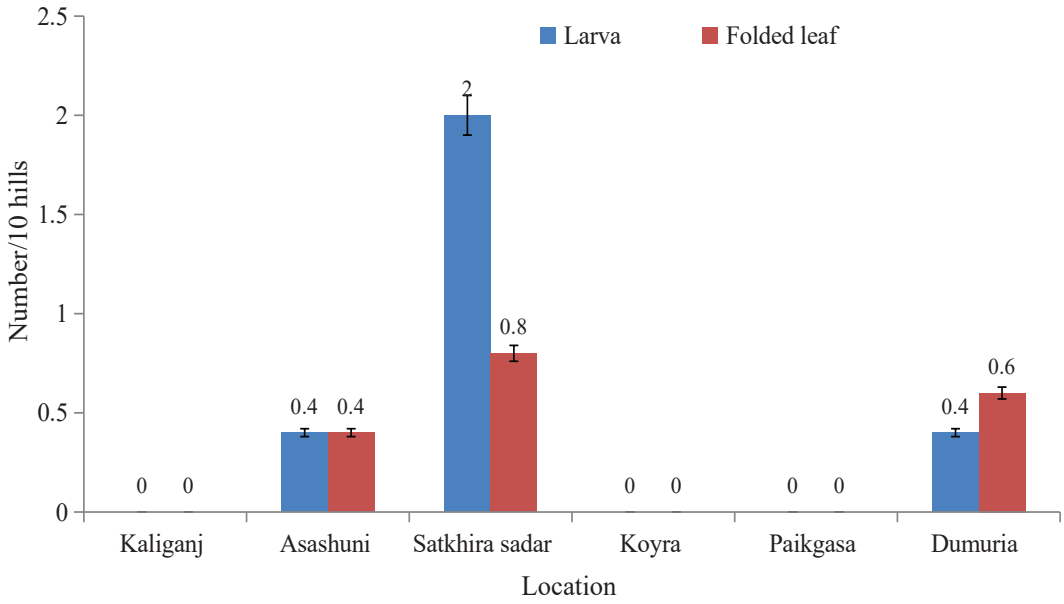

Fig. 7. Number of leaf folder larva and infested Folded leaf at 40 DAT in Satkhira and Khulna districts

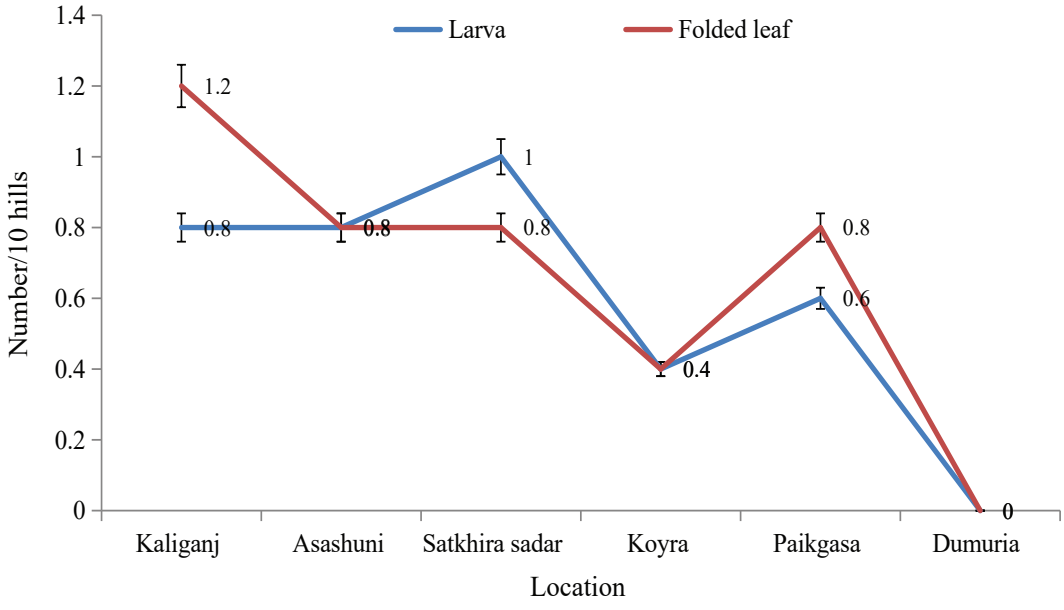

Fig. 8. Number of leaf folder larva and infested Folded leaf at 60 DAT in Satkhira and Khulna districts

Number of BPH and infested hills at 110 DAT: Figure 9 revealed that the highest number (114/10 hills) of Brown Plant Hopper (BPH) was recorded from BR 26 rice field and the number infested tiller was 10. In case of rod miniket rice, the number of BPH was 112 and the number of infested tiller was 5. No BPH was found in remaining 5 locations. The scenario of BPH infestation was sudden and unexpected due to climate change. In that time, suddenly heavy rain fall occurred at the end of April month.

Most of the rice plant parts are vulnerable to insect feeding from the time of sowing till harvesting. In present study, populations of stem borer, leaf folder and BPH, and their damages are measured at 6 upazila of Khulna and Satkhira districts. The number of stem borer larvae, dead heart and white head damaged symptoms varied among 6 locations. These variations may be due to changing climatic condition of the study sites. The warm and humid climate of Bangladesh is conductive to the proliferation of insect pests. The three rice crops grown under diverse ecological conditions are attacked throughout the growing periods by a number of insect pests. YSB is the most destructive insect pests of rice crop (Mahar *et al*. 1985) and responsible for an annual yield loss of 10-15% with local catastrophic outbreaks causing up to 60% damage (Daryaei 2005). Feeding of stem borers during the reproductive stage (panicle initiation to milk grain) causes

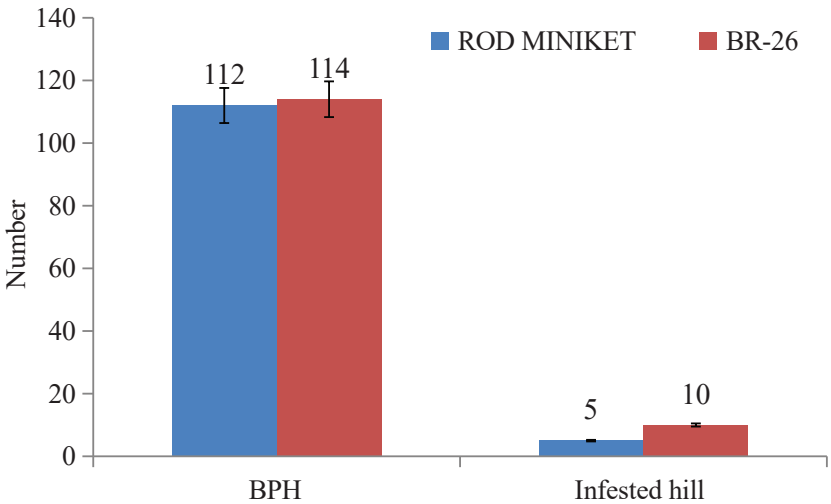

Fig. 9. Number of BPH and infested hills at 110 DAT in Satkhira sadar upazila

a severing of the developing panicle at its base. As a result, the panicle is unfilled and whitish in color, rather than filled with grain and brownish in color. Such empty panicles are called "whiteheads". The average yield loss in rice have been accounted for 30% by stem borers, while plant hoppers 20%, gall midge 15%, leaf folder 10% and other pests 25% (Krishnaiah 2015). Sucking pests cause huge damage to rice by sucking plant sap, devitalizing plants and also act as vectors of several viral diseases (Mohanta *et al.* 2020). Plant hoppers such as brown plant hopper, *Nilaparvata lugens* (Stal.) infest the rice crop severely during tillering to panicle initiation stage. The brown plant hopper (BPH) is one of the serious pests responsible for large-scale devastation of rice crop, causing yield losses amounting to as high as 60% (Kumar *et al.* 2012, Srivastava *et al*. 2009). In producing more rice, farmers are using modern varieties, fertilizers, pesticides, water and other technologies intensively which have eventually changed the ecology and escalated pest proliferation (Parvin 2010). Population density of borer pest complex in different growth stages of the rice plant would be useful to decide appropriate time of insecticide application.

ACKNOWLEDGEMENTS

The authors are highly grateful to Research and Training Centre, Patuakhali Science and Technology University for providing financial assistance to conduct the experiment.

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