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Rice Insect-pest Status Just after Devastating Cyclonic Storm '*Dana*' in West Bengal during *Kharif* 2024

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ABSTRACT

Background: Rice is one of the major staple foods in India. The population of our country is being increased day-by-day but the agricultural land is fixed and is also being decreased due to increase of civilization, homestead, mill factory *etc.* Rice production is also hampered by biotic stresses, among them insect-pests play a major role to reduce the productivity of rice. Among the rice insect-pests, rice yellow stem borer (YSB) [*Scirpophaga incertulas*], rice leaf folder (RLF) [*Cnaphalocrocis medinalis*], brown planthopper (BPH) [*Nilaparvata lugens*] and white backed plant hopper (WBPH) [*Sogatella furcifera*] are the most dominant as well as most destructive insect-pests occurring throughout the country causing a major yield loss.

Methods: The cyclonic storm with high wind speed and heavy rainfall in *kharif* season are also serious obstacles to rice production in our country. Just after cyclonic storm 'Dana' in West Bengal, this study was conducted by roving survey in Singur blocks of Hooghly district, West Bengal.

Result: It was recorded during the field survey that slight attack of yellow stem borer (white ear head) and rice leaf folder and severe attack of brown plant hopper and white backed plant hopper insect-pests with 'Hopper burn' symptoms caused damage to rice crop. The rice crop variety '*Jamuna'* was mostly affected by hopper complex which may be a susceptible variety to the rice hoppers. The YSB and RLF infestation were very low due to occurrence of 'Dana'.

Key words: BPH, Cyclonic storm, 'Dana', Hopper burn, Rice insects, Roving survey, WBPH.

INTRODUCTION

The cyclonic storm 'Dana' made landfall in Odisha on the early morning of October 25, 2024 with high wind speed and heavy rainfall. In West Bengal, South and North 24 Parganas, Purba and Paschim Medinipur, Jhargram, Howrah, Hooghly, Kolkata and Bankura districts were mostly affected with heavy rain and flooding which affected *kharif* paddy in field before harvesting.

Among the rice insects, rice yellow stem borer (*Scirpophaga incertulas*) and rice leaf folder, (*Cnaphalocrocis medinalis*) are the dominant and most destructive insect-pest occurring throughout the country causing yield loss ranging from 10 to 60% (Chatterjee and Mondal, 2014; Chatterjee and Mondal, 2020). Among the insect-pests brown plant hopper (BPH), white back plant hopper (WBPH), plant hopper (PH), green leaf hopper (GLH), stem borer, leaf folder (LF) and whorl maggot (WM) in field condition are the important pests of West Bengal (Dana and Chatterjee, 2021). Over 90 per cent of the borer populations the yellow stem borer (YSB) [*S. incertulas*] is one of the major insects in *kharif* rice from seedling to maturity stage in new alluvial zone of West Bengal (Chatterjee *et al.,* 2017; Chatterjee *et al.,* 2020). The yield loss due to *S. incertulas* was estimated to be approximately 10-60 per cent in India (Panda *et al.,* 1976; Pasalu, *et al.,* 2005). Brown plant hoppers constitute one of the most important pests causing substantial yield losses (Konchada *et al.,* 2017). Brown planthopper (BPH) [*Nilaparvata lugens*] and white backed plant hopper (WBPH) [*Sogatella furcifera*] have emerged as a major pest of rice in several Asian countries (Ramesh *et al.,* 2014). These are the important sucking pests of rice and both adults and nymphs damage the phloem of rice plants and damage the plant directly by sucking on plant sap which may cause 25 to 75% loss (Kumar *et al.,* 2022). Of the different insect pests attacking rice, BPH is an important sucking pest causing upto 100% yield losses (Anjali *et al.,* 2024). Both adults and nymphs of brown plant hopper suck cell sap from paddy, congregate at the base of the plant just above the water level. The rice brown planthopper is a rice pest, which one is very harmful when the nitrogen fertilizer is applied at a higher rate (Singh *et al*., 2019). Affected plants leaves turn pale, yellow and later wither away leading to total drying of plant and if excessive attack occurs, the rice plants give a scorched appearance called 'Hopper burn' where circular patches of quick drying and lodging of matured plants are found. BPH may act as

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a vector of grassy stunt, ragged stunt and wilted stunt diseases. They secret honeydew at plant base exposing the plant to fungal and bacterial infections resulting "sooty mould". Small sized hoppers are brown to grey in colour. A prominent white line is found in the neck region of WBPH.

MATERIALS AND METHODS

The field roving survey was conducted by Rice Research Station, Government of West Bengal, Chinsurah, Hooghly during *kharif* 2024 at different villages of Singur block of Hooghly district. The survey was done on behalf of the all India coordinated research project on rice (AICRPR) of ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad, Telangana State. The scientists of RRS, Chinsurah has visited for roving survey at Nasibpur (GPS Coordinates: 22°48′N and 88°16′E) and Antisara (GPS Coordinates: 22°49′N and 88°16′E) villages of Singur block during *kharif* 2024.

The farming community of Nasibpur and Antisara villages cultivated *Jamuna, Swarna* and *Pratiksha* rice varieties during *kharif* 2024. The soil was clay loam type. After harvesting of *kharif* rice, farmers normally used to cultivate *boro* paddy, potato, vegetables and mustard. The cultivation practices followed by the farmers are presented in Table 1. Planting was done randomly without maintaining any spacing but in some of the areas the rice plants were planted with very closer spacing which might be 15 cm × 15 cm or 15 cm × 10 cm. It was also informed by the farmers that in some areas, twice floods occurred in earlier of the season. The farmers applied fertilizers as IFFCO (10:26:26) @ 150 kg ha^{-1} with urea @ 40-50 kg ha^{-1} in their field; they also applied chlorantraniliprole 0.4% GR @ 11 kg ha^{-1} or fipronil 0.3% GR @ 15 kg ha^{-1} to manage insect-pests in their fields at around 30 days after transplanting (DAT). At the time of survey, the age of plants was 100-110 days *i.e.* they were very close to the maturity but, some fields were still full of moist and even in few places of the field, lower level of water stagnant was noticed.

The photographs of rice fields along with pest and their symptoms during survey conducted were recorded with and without GPS coordinates and placed in five plates.

RESULTS AND DISCUSSION

A lot of insect-pests attack on *kharif* paddy were recorded during the survey in Singur block of Hooghly district in West Bengal. The pest infestation was very low except hopper because high rainfall during the cropping season and the cyclonic storm 'Dana' at the end of *kharif* season. The pest population and their incidence cannot be increased due to high level of rainfall.

The yellow stem borer attack causing white ear head, leaf folder, brown planthopper (BPH) and white backed planthopper (WBPH) attack were recorded (Table 2). The stem borer and leaf folder attack were below ETL. The 'White ear head' symptoms were recorded by the attack of stem borer. In Antisara village, rice was affected by hopper complex in vast areas and the typical hopper burn symptoms were appeared. The symptoms of attack by green leaf hopper (GLH) [*Nephotettix virescens* and *N. nigropictus*], another important rice hopper in all over World was not recorded. The GLH attack may show various symptoms on rice plants, such as stunted growth, yellowing and deformed leaves, increased tillering, or withering of plants. It was found that the *Jamuna* variety was most susceptible to hopper complex *i.e.*, BPH and WBPH. Both the nymphs and adults of BPH and WBPH remain at the ground level and above the ground level, respectively and suck the plant sap. They are typical vascular feeder primarily sucking phloem sap leading to hopper burn. During the early infestation, sporadically in scattered way, the circular yellow patches appear which turn brownish soon due to the drying up of the plants. The patches of infestation by the hopper complex then may spread out and cover the entire rice field very quickly. The paddy grain setting is also affected severely. During sustained continuous feeding, they excrete a large amount of honeydews which attracts different fungus and bacteria.

Table 1: Cultivation practices followed by the farmers.

Parameters		
Varieties grown	:	*Jamuna, Swarna* and *Pratiksha.*
Type of variety	:	Long duration popularly rice variety cultivated in West Bengal.
Planting methods	:	Farmers used to following two methods of planting methods: a) Transplanting method. b) Double transplanting method.
Sowing time	:	June last week to July second week.
Spacing	:	Randomly planted without maintaining any spacing but in some areas, the rice plants were planted with very closer spacing (15 cm × 15 cm or 15 cm × 10 cm) .
Inorganic fertilizer applied their rice fields by the farmers	:	IFFCO (N: P_2O_5:K_2O::10:26:26) @ 150 kg ha^{-1} with urea as 'N' source @ 40-50 kg ha^{-1}.
Mode of application of inorganic fertilizer	:	Full IFFCO (N: P2O5:K2O::10:26:26) was applied as basal and urea was applied in two splits with equal amount during first and second top-dressing in main transplanted field.
Days of planting	:	a) Transplanting method: 22-30 days old seedlings. b) Double transplanting method: 55-65 days old seedlings.

Table 2: Survey observation on insect pests of rice in *kharif* season.

Village	Area covered (in ha)	No. of fields specifically examined	Major pest(s) noticed	Scientific name	Control measure undertaken by the farmers'	Damage symptoms	Severity of damage	% severity of damage
Nasibpur	20	8	Yellow stem borer (YSB)	*Scirpophaga incertulas*	Chlorantraniliprole 0.4% GR granule insecticide @ 11 kg ha^{-1} or fipronil 0.3% GR granule insecticide @ 15 kg ha^{-1}	White ear head	Slight	2-3%
			Leaf folder	*Cnaphalocrocis medinalis*	Chlorantraniliprole 0.4% granule insecticide GR @ 11 kg ha^{-1} or fipronil 0.3% GR granule insecticide @ 15 kg ha^{-1}	Whitened folded leaves	Slight	1-2%
Antisara	25	15	YSB	*Scirpophaga incertulas*	Chlorantraniliprole 0.4% GR granule insecticide @ 11 kg ha^{-1} or fipronil 0.3% GR granule insecticide @ 15 kg ha^{-1}	White ear head	Slight	2-3%
			Leaf folder	*Cnaphalocrocis medinalis*	Chlorantraniliprole 0.4% GR granule insecticide @ 11 kg ha^{-1} or fipronil 0.3% GR granule insecticide @ 15 kg ha^{-1}	Whitened folded leaves	Slight	1-2%
			Brown planthopper (BPH)	*Nilaparvata lugens*	No control measure was undertaken	Hopper burn	Severe	
			White backed planthopper (WBPH)	*Sogatella furcifera*	No control measure was undertaken	Hopper burn	Severe	

The affected plants of the fields were completely dried up in 'Hopper burn' areas of the field. Irregular patches in some fields and in some areas the whole fields were affected and the 'Hopper burn' symptoms appeared. The rice plants became yellowish, brownish and straw coloured. Straws were brittle which were easily broken when lightly pressed by fingers. Plants were completely lodged in affected areas.

Why the infestation of YSB and RLF were low

The heavy rainfall along with high wind velocity during the cyclonic storm 'Dana', the adults of YSB and RLF were killed in rice fields as the soft bodied moths could not tolerate heavy rainfall and wind. Therefore, the laying of eggs by adult females were not done and the most destructive stages of the crop *i.e.*, larvae of YSB and RLF could not emerge out to damage the crop. Farmers applied granules at 30 DAT to manage yellow stem borer and leaf folder and the applied chlorantraniliprole 0.4% GR found to be one of the best granules against YSB and RLF (Chatterjee *et al.,* 2015).

Why symptoms of attack by GLH were not recorded

The important rice hopper, GLH population normally increases during October to November months. Other hopper, BPH and WBPH population increase just after the increased GLH population. The cyclonic storm 'Dana' with heavy rainfall and high wind killed the soft bodied leaf sucking insect, GLH which caused very poor population of GLH in the rice fields.

Why 'Hopper burn' symptoms were happened by hopper complex (BPH and WBPH)

The hopper population increased surprisingly for the favourable weather condition; due to high rainfall during the cyclonic storm 'Dana', water stagnation in the rice field just after completion of flowering of the crop favoured to create the congenial microclimate at the base of the plants for hopper complex and finally to multiply them to produce their progenies very quickly. Besides this, planting of susceptible rice variety (cv. *Jamuna*), the closer spacing,

Plate 1: 'Hopper burn' symptoms in rice fields with GPS coordinates.

Plate 2: 'Hopper burn' symptoms along with stagnant water in rice fields.

Plate 3: 'Hopper burn' symptoms in rice fields without GPS coordinates.

application of high doses of nitrogenous fertilizer, without application of any insecticide against hopper complex (sucking insect-pest), no pest survey and surveillance favoured hopper complex attack severely to the rice fields to generate 'Hopper burn' symptoms.

The photographs of 'Hopper burn' symptoms in rice fields with GPS coordinates (Plate 1). 'Hopper burn' symptoms along with stagnant water in rice fields (Plate 2). 'Hopper burn' symptoms in rice fields without GPS coordinates (Plate 3). RLF and white ear head symptoms in rice fields and adult YSB (Plate 4) and field survey in rice fields with GPS coordinates (Plate 5) have been presented with following five plates. It is clear from the plates that the BPH and WBPH have severely attacked rice plants during *kharif* season after the cyclone 'Dana' and clearly produced the 'Hopper burn' symptoms. The hoppers secreted honeydew at the base of the plant which exposed the plant to fungal and bacterial infections resulting grey to black coloured 'sooty mould'. Sooty mould is a dark grey to black coloured fungus which grows on honeydew excreted by BPH and WBPH. Common genera of sooty mould fungi found are *Aethaloderma* spp., *Capnodium* spp., *Scorias* spp., *Cladosporium* spp., *Euantennaria* spp. and *Trichomerium* spp. *etc.* Framers were very much worried about the hopper attack in their rice fields and they would not harvest any rice from the severely affected fields. They wanted to know about the strategies to overcome the hopper attack in the next season. Therefore, the farmers were advised to follow the below-mentioned instructions from the next season to avoid hopper attack.

Strategies to be undertaken to overcome 'Hopper burn'

The farmers were advised to follow the below-mentioned scientific techniques for next onwards seasons to manage hopper complex and to devoid 'Hopper burn' in rice fields. The hopper resistant rice varieties should be cultivated and *Jamuna* variety should be avoided.

The closer spacing (15 cm × 15 cm or 15 cm × 10 cm or 10 cm × 10 cm) should be avoided and transplanting should be done with proper spacing of 20 cm × 15 cm. The

Plate 4: RLF and white ear head symptoms in rice fields and adult YSB.

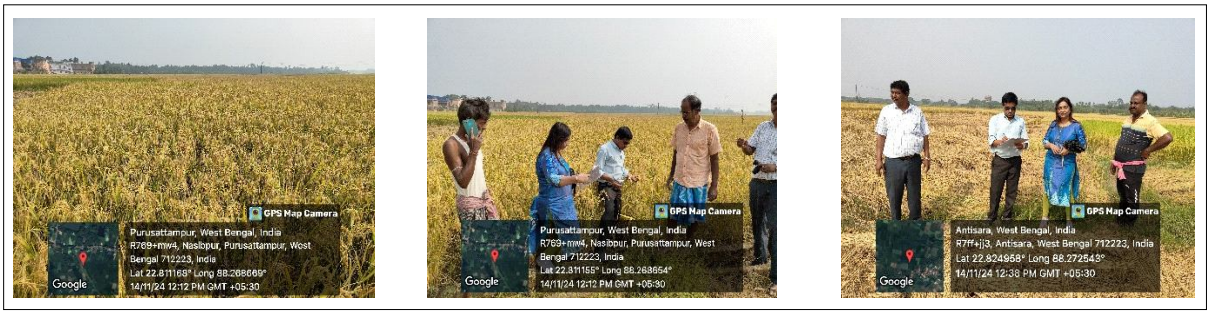

Plate 5: Field survey in rice fields with GPS coordinates.

Table 3: Recommended insecticides with their doses to manage rice hoppers.

Chemical name	Commercial name	Dose per litre (l) of water (High volume spray @ 500 l/ha)
Triflumezopyrim 10% SC	Pexalon	0.5 ml/l
Pymetrozine 50% WG	Chess, Clue, Pymax, BPH super, Pyramit	0.6 g/l
Buprofezin 15% + Acephate 35% WP	Tapuz, Kabusee	2.5 g/l
Ethiprole 40% + Imidacloprid 40% WG	Glamore	0.5 g/l
Dinotefuran 20% SG	Token, Osheen, Simbola	0.3-0.4 g/l

hopper susceptible varieties should be avoided and the resistant/ tolerant varieties should be grown in the next season.

During transplanting one row may be skipped after each of 8-10 rows.

Application of more 'N' fertilizer should be avoided in endemic areas as well as excess application of potassic fertilizer is encouraged which can help to tolerate/resist hoppers.

During the flowering period, the stagnant water may be drain out /pumping out from the rice fields, if possible. Continuous field monitoring of randomly selected plants and survey are to be conducted diagonally in the field and chemical insecticides should be applied if the population of hoppers crosses economic threshold level (ETL).

The hopper predator, mirid bug may be released in the rice field.

The light trap @ 1 No./ha may be installed in the rice field.

The rice plants can be push aside at an interval of each of 8-10 rows after completion of flowering, if hopper attack starts.

Apply dust insecticides like malathion 2% D with dusters or spray any of the insecticides presented in Table 3, if ETL crossed.

For one ha area, 500 liters of water should be used and the nozzle mouth of the sprayer should be placed downwards towards the base of the plants.

CONCLUSION

The cyclonic storm 'Dana' in West Bengal with high wind speed and heavy rainfall during *kharif* season very poor infestations of YSB and RLF were recorded and 'Hopper burn' symptoms due to severe attack of the hopper complex; BPH and WBPH were recorded during roving survey in Singur blocks of Hooghly district, West Bengal. The rice cultivar *Jamuna* was mostly affected by hopper complex. The YSB and RLF infestation were very low due to occurrence of 'Dana' as well as application of chlorantraniliprole 0.4% GR granules in due time and the hopper population surprisingly increased to create 'Hopper burn' symptoms by inducing the favourable weather condition *viz.* water stagnation which favoured to create the favourable microclimate at the base of the plant to increase their population too fast. Besides this, cultivation of susceptible rice variety, the closer spacing, high doses of nitrogen application, no application of insecticide against hoppers as well as no pest survey and surveillance just after flowering favoured hopper complex attack severely to the rice fields to generate 'Hopper burn' symptoms.

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Disclaimers

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Informed consent

All animal procedures for experiments were approved by the Committee of Experimental Animal care and handling techniques were approved by the University of Animal Care Committee.

Conflict of interest

We, the authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish or preparation of the manuscript.

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