



Insect diversity and extent of infestation of major rice pests in Burdwan district, West Bengal, India

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ABSTRACT: Insects collected from different rice fields of Burdwan District of West Bengal from February 2012 to November 2014 by light trapping, netting, sweeping or hand picking method recorded 32 species of arthropods under eight orders. The population of rice leaf folder, yellow stem borer, striped stem borer, army worm, hispa, brown plant hopper, green leaf hopper, gandhi bug and grasshoppers were found to be 7.95/hill and 7.86/hill; 2.36/hill and 1.62/hill; 0.19/hill and 0.27/hill; 0.98/hill and 0.73/hill; 0.87/hill and 1.04/hil; 4.89/hill and 3.47/hill; 4.24/hill and 3.76/hill; 2.15/hill and 2.68/hill; 4.17/hill and 3.82/hill in Galsi and Memari, respectively. Infestation of the crop and population of *C. medinalis* and *S. incertulas* in the rice fields at different locations of Galsi and Memari during dry and wet season in 2012, 2013 and 2014 were studied. Leaffolders were more prevalent in wet season than dry season. During the dry season of 2012, 2013 and 2014 the infestation of *S. incertulas* and the population of larvae in the rice fields were 90.24 - 90.47; 90.12 - 92.50; 89.56 - 91.98 percent and 7.00 - 7.33; 7.00; 6.33 - 7.00 per hill respectively. During the wet season of 2012, 2013 and 2014, the infestation and population of *S. incertulas* in the rice fields were 73.01 - 75.90; 68.44 - 70.1; 74.56 - 77.3 percent and 3.00 - 3.33; 2.67 - 3.67; 3.33 - 3.67 larvae per hill, respectively.

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KEY WORDS: Insect, rice pest, rice leaf folder, yellow stem borer, infestation

INTRODUCTION

Reduction in the rice yield is dependent on many biotic and abiotic stresses such as, pests, diseases, soil fertility, rainfall, water logging and climatic conditions. Of the biotic stresses, insect pests are the major contributors in yield losses. Out of about 60% yield loss of rice due to pest and disease infestation, 35 - 50% is contributed by the insects (Teng *et al.*, 1993). Many species of arthropods inhabit rice fields. Some of them are harmful to the

crops, but majority of them are not noxious to rice plant (Singh and Singh, 2014).

About 500 species of insects and spiders come into sight in a rice field in different seasons and only few of them are potential enemies of rice. Other arthropods are either beneficial being predators, parasites and parasitoids that control the insect pests or innocent visitors. The crop is infested by about 90 insects and a dozen of them viz. stem borers (SBs), gallmidge, plant hoppers, leaffolders (LFs),

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rice skipper, rice bug, grain weevil etc. are major pests (Teng *et al.*, 1993). In India, annually 41% economic loss has been estimated due to the infection of insect pest in crop plants.

In rice, the economic loss is measured at 26.3 metric tons with an estimated value of Rs. 9468 crores (Agarwal, 2011). Among five recorded species of LFs (*Cnaphalocrocis medinalis* Guenee, *Marasmia exigua* Butlar, *M. pentalis* Bradley, *M. ruralis* Walker and *Brachmia auroreana* Mayrick), *C. medinalis* is the most serious and regular pest of rice in India (Teng *et al.*, 1993). Besides, out of six stem borers viz. *Scirpophaga incertulas* Walk. (yellow stem borer, YSB), *Scirpophaga innotata* Walk. (white stem borer, WSB), *Chilo suppressalis* Walk. (striped stem borer, SSB), *C. polychrysus* Meyr. (dark headed stem borer, DHSB), *C. auricilius* Dudgeon (stalked stem borer, DHSB) and *Sesamia inferens* Walk. (pink stem borer, PSB), YSB (dominant) and SSB are serious pests in India (Teng *et al.*, 1993). It is really important to study the ecology of different arthropods present in rice fields for controlling the insect pests and checking the yield loss. Several works have been done on the biology and ecology of the rice pests in Asian subcontinent (Pathak and Khan, 1994; Chaudhary *et al.*, 2002; Islam *et al.*, 2004; Arora and Dhaliwal, 1996) but no such information is available on the prevalence of rice pests in West Bengal. The present investigation was aimed to study the diversity of insects present in the rice fields and to observe the seasonal prevalence of the major pests of rice in Burdwan district, West Bengal, India.

MATERIALS AND METHODS

The rice field insect pests were collected from the paddy fields of different areas of Burdwan district of West Bengal from December 2012 to November 2014 to determine their prevalence in two rice growing seasons, i.e. wet and dry. The study was conducted in different spots extending six km away from each other and five fields at each spot for each season were selected as replicates.

Collection of Pests:

The insects were collected by adopting the methods of light trapping, netting, sweeping or hand picking depending upon the insect types. All suction and sweep net samplings were done between 8.00 and 11.00 a.m. and between 4 pm and 6 pm. The pests were collected on weekly basis from each field. Two types of sweeping nets were used. For the seedling stage, the diameter of the net was 16 cm and in both transplanting and flowering stages the diameter of the net was 23 cm. The length of the handles of both the nets was 60 cm and 95 cm, respectively. Five suitable quadrat (20 m × 20 m) plots were selected and marked at diagonal line by using bamboo sticks without disturbing the crop plant in situ. Mylar cages with potted plant, test tubes with seedlings and small boxes with seedlings were also used as collection cage (Kraker, 2000; Rani *et al.*, 2007). Alternatively, collected insects were transferred to rearing cages with clean potted plants. Collection cages were labeled with the respective collection dates, location names, and geographic positions.

The insects having economic importance were identified at the specific level by morphology (Bradly, 1981; Barrion *et al.*, 1991; Khan *et al.*, 1988; Dale, 1994; Maes, 1995); using keys (Barrion and Litsinger, 1994), photographs available (Pathak and Khan, 1994), and by taking the help of the subject experts. Other insects of less economic importance as rice pest were not identified as specific level.

Incidence of infestation:

Leaf folder:

The degree of infestation was calculated by counting the number of folded leaves per unit area per week. The number of leaves with more than 1/3 damaged leaf area (DL %) were recorded and were used for calculating degree of infestation following the given formula.

$$DL (\%) = \frac{\text{Number of damaged leaves}}{\text{Total number of leaves considered}} \times 100$$

Stem borer:

Sampling for stem borer damage was done in a 10-m² area at the center of each plot. The following formula was used for measuring the percentage of deadhearts:

$$\% \text{ deadhearts} = \frac{\text{deadhearts in infested hills}}{\text{Total no. of tillers observed in infested hills}} \times \frac{\text{No of infested hills}}{\text{Total hills observed}} \times 100$$

For determining the percentage of whiteheads the following formula was used.

$$\% \text{ whiteheads} = \frac{\text{No of whiteheads}}{\text{Total no. of panicles observed}} \times \frac{\text{No of infested hills}}{\text{Total no of plants observed}} \times 100$$

RESULT AND DISCUSSION

During the study period 32 species of arthropods under eight orders were recorded (Table 1). Among them, leaf folders (*Cnaphalocrocis medinalis*), yellow stem borers (*Scirpophaga incertulas*), striped stem borer (*Chilo suppressalis*), army

worm (*Mythimna* sp.), hispa (*Dicladispa armigera*), white leaf hoppers (*Cofana* sp.), green leaf hopper (*Niphotittix* sp), gandhi bug (*Leptocorisa* sp.) were the important pests. Prevalence of grasshoppers (*Oxya hyla*, *Atractomorpha lata*, *Acrida exaltata* and *Paratettix* sp.) was also observed. During the study it was observed that lepidopteran population was abundant in all the spots than the population of the other insect orders. Among the lepidopteran pests, *C. medinalis* and *S. incertulas* were present in almost all stages of rice plants and seasons.

Fig. 1 showed prevalence of different rice pests in the rice fields of the study area. The population of rice leaf folder, yellow stem borer, striped stem borer, army worm, hispa, white plant hopper, green leaf hopper, gandhi bug and grasshoppers was found to be 7.95/hill and 7.86/hill; 2.36/hill and 1.62/hill; 0.19/hill and 0.27/hill; 0.98/hill and 0.73/hill; 0.87/hill and 1.04/hill; 4.89/hill and 3.47/hill; 4.24/hill and 3.76/hill; 2.15/hill and 2.68/hill; 4.17/hill and 3.82/hill in Galsi and Memari, respectively. Among these insect species rice leaf folder, yellow stem borer and gandhi bug showed highest prevalence and crossed economic threshold level (ETL) viz, 1-2 damaged leaves/hill, 1 moth/ hill and 1 - 2 bugs/hill, respectively. The prevalence of striped stem borer,

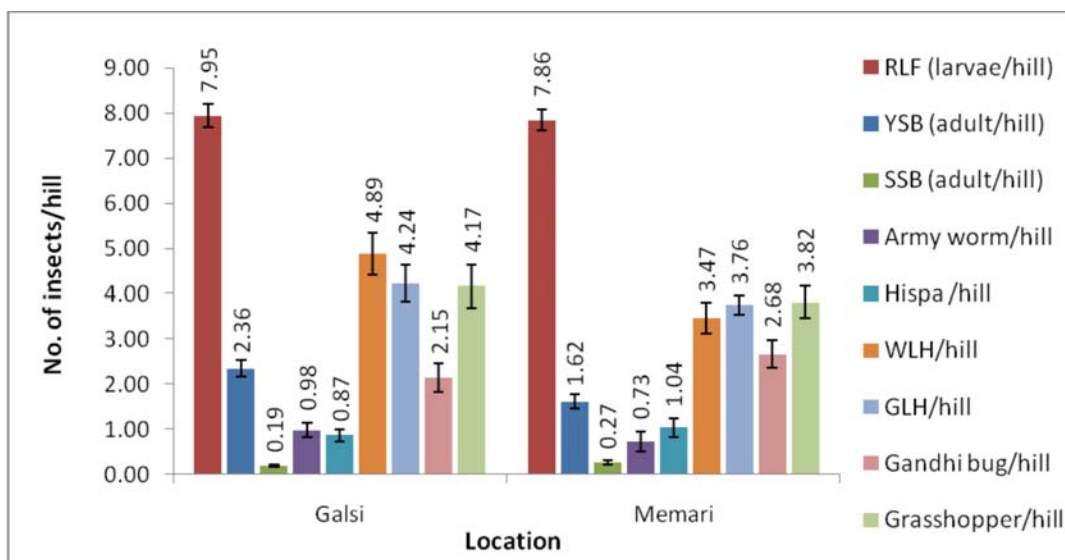


Fig 1. Insect pest prevalence in the rice field. RLF = leaf folder, YSB = yellow stem borer, SSB = striped stem borer, WLH = white leaf hopper, GLH = green leaf hopper.

Table 1. List of the arthropods recorded during the field study in the rice ecosystem

SL.No.	Common Name	Genus and Species	Order and Family
1.	Rice leaf folder	<i>Cnaphalocrocis medinalis</i> (Guenee, 1854)	Lepidoptera : Crambidae
2.	Yellow stem borer	<i>Scirpophaga incertulas</i> (Walker, 1863)	Lepidoptera : Crambidae
3.	Rice white stem borer	<i>Scirpophaga innotata</i> (Walker, 1863)	Lepidoptera : Crambidae
4.	Striped Stem Borer	<i>Chilo suppressalis</i> (Walker, 1863)	Lepidoptera : Crambidae
5.	Dark- headed striped borer	<i>Chilo polychrysus</i> (Meyrick, 1932)	Lepidoptera : Crambidae
6.	Rice case worm moth	<i>Nymphula depunctalis</i> (Guenee, 1854)	Lepidoptera : Crambidae
7.	Rice Leaf folder	<i>Brachmia arotraea</i> (Meyrick, 1911)	Lepidoptera : Gelechiidae
8.	Sugarcane Looper moth	<i>Mocis frugalis</i> (Fabricius, 1775)	Lepidoptera : Erebiidae
9.	Loreyi Leaf worm	<i>Mythimna loreyi</i> (Duponchel, 1827)	Lepidoptera : Noctuidae
10.	Common evening brown	<i>Melanitis leda ismene</i> (Linnaeus, 1758)	Lepidoptera : Nymphalidae
11.	Rice skipper	<i>Pelopidas mathias</i> (Fabricius, 1798)	Lepidoptera : Hesperidae
12.	Rice hispa	<i>Dicladispa armigera</i> (Oliver, 1808)	Coleoptera : Coccinellidae
13.	Lady beetle	<i>Menochilus sexmaculatus</i> (Fabricius, 1781)	Coleoptera : Coccinellidae
14.	Transverse ladybird	<i>Coccinella transversalis</i> (Fabricius, 1781)	Coleoptera : Coccinellidae
15.	Hyla rice grasshopper	<i>Oxya hyla intricata</i> (Stal, 1861)	Orthoptera : Acrididae
16.	Short horned grasshopper	<i>Acrida exaltata</i> (Walker, 1895)	Orthoptera : Acrididae
17.	Vegetable grasshopper	<i>Atractomorpha lata</i> (Saussure, 1862)	Orthoptera : Pyrgomorphidae
18.	Pygmy grasshoppers	<i>Paratettix</i> sp.	Orthoptera : Tetrigidae
19.	Silent leaf runner	<i>Metioche vittaticollis</i> (Stal, 1861)	Orthoptera : Gryllidae
20.	Marsh fly	<i>Sepedon</i> sp. (Latreille 1804)	Diptera : Sciomyzidae
21.	Gandhi bug	<i>Leptocoris</i> sp.	Hemiptera : Alydidae
22.	White backed pl. hopper	<i>Sogatella furcifera</i> (Horvath, 1899)	Hemiptera : Delphacidae
23.	White rice leafhopper	<i>Cofana spectra</i> (Distant, 1908)	Hemiptera : Cicadellidae
24.	Green leaf hopper	<i>Niphotettix nigropictus</i> (Stal, 1870)	Hemiptera : Cicadellidae
25.	Stinkbug	<i>Cletus punctiger</i> (Dallas, 1852)	Hemiptera : Coreidae
26.	Pygmy wisp	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	Odonata : Coenagrionidae
27.	Blue-tailed damselfly	<i>Ischnura elegans</i> (Vander Linden, 1820)	Odonata : Coenagrionidae
28.	Scarlet dragonfly	<i>Crocothemis erythraea</i> (Brulle, 1832)	Odonata : Libellulidae
29.	Yellow Ichneumon Wasp	<i>Xanthopimpla punctata</i> (Fabricius, 1781)	Hymenoptera : Ichneumonidae
30.	Zipper spider	<i>Argiope catenulate</i> (Doleschall, 1859)	Arachnida : Araneidae
31.	Lynx spider	<i>Oxyopes javanus</i> (Thorell, 1887)	Arachnida : Oxyopidae
32.	Decorative silver orb spider	<i>Leucauge decorata</i> (Walckenaer, 1841)	Arachnida : Tetragnathidae

Table 2. Population of *C. medinalis* larvae and the extent of infestation in rice at different locations during dry and wet seasons

Survey period (season)	Location	Hill			Larvae ^a	
		Total (No./m ²)	Infested (No./m ²)	Infestation (%)	No./m ²	No./hill
Feb.-April 2012 (dry)	Galsi	50.33 ± 1.5	41.67 ± 0.9	82.86 ± 2.0	727.00 ± 47.0	13.33 ± 0.9
	Memari	49.00 ± 1.7	44.67 ± 0.9	91.3 ± 2.4	619.00 ± 42.3	11.33 ± 0.7
Sept.-Nov. 2012 (wet)	Galsi	48.67 ± 1.8	46.00 ± 1.7	94.51 ± 0.7	1296.67 ± 30.3	29.00 ± 1.2
	Memari	47.00 ± 1.7	27.67 ± 1.5	60.61 ± 0.1	1133.3 ± 110.9	26.00 ± 1.2
Feb.-April 2013 (dry)	Galsi	39.00 ± 1.2	31.33 ± 0.88	80.35 ± 0.5	480.67 ± 7.6	14.00 ± 0.6
	Memari	51.67 ± 0.9	44.33 ± 0.9	85.8 ± 0.6	691.33 ± 47.8	12.33 ± 0.9
Sept.-Nov. 2013 (wet)	Galsi	47.33 ± 1.2	29.00 ± 1.2	61.223 ± 1.0	940.00 ± 37.9	22.66 ± 1.5
	Memari	48.67 ± 0.9	45.00 ± 0.7	93.856 ± 1.1	1330.00 ± 66.6	29.00 ± 2.1
Feb.-April. 2014 (dry)	Galsi	46 ± 2.08	17.66 ± 0.7	38.53 ± 1.9	358.33 ± 24.6	7.67 ± 0.3
	Memari	45.33 ± 1.5	24.00 ± 1.7	52.91 ± 3.1	306.00 ± 22.7	7.00 ± 0.6
Sept.-Nov. 2014 (wet)	Galsi	43.33 ± 0.9	32.33 ± 1.5	74.54 ± 1.8	533.00 ± 46.0	13.67 ± 0.9
	Memari	47.67 ± 1.2	40.33 ± 1.5	84.57 ± 1.0	666.00 ± 30.6	15.00 ± 0.6

Table 3. Population of *S. incertulas* larvae and the extent of infestation in rice at different locations during dry and wet seasons

Survey period (season)	Location	Hill			White earhead	
		Total (No./m ²)	Infested (No./m ²)	Infestation (%)	No./m ²	No./hill
April-2012 (dry)	Galsi	49.00 ± 1.5	44.33 ± 1.5	90.47 ± 0.7	362.33 ± 33.6	7.33 ± 0.7
	Memari	48.00 ± 2.3	43.33 ± 2.4	90.24 ± 1.4	333.00 ± 4.9	7.00 ± 0.0
Oct.-2012 (wet)	Galsi	47.00 ± 1.5	34.33 ± 1.5	73.01 ± 0.9	170.33 ± 1.0	3.33 ± 0.3
	Memari	51.33 ± 1.8	39.00 ± 2.1	75.90 ± 1.9	154.67 ± 14.3	3.00 ± 0.0
April-2013 (dry)	Galsi	49.00 ± 1.0	45.33 ± 1.5	92.50 ± 1.8	333.67 ± 12.0	7.00 ± 0.0
	Memari	47.33 ± 0.9	42.67 ± 1.2	90.12 ± 1.5	323.67 ± 10.9	7.00 ± 0.6
Oct.-2013 (wet)	Galsi	48.00 ± 1.0	33.67 ± 1.5	70.1 ± 2.1	125.00 ± 16.5	2.67 ± 0.3
	Memari	50.67 ± 0.7	34.67 ± 1.5	68.44 ± 2.9	192.33 ± 11.5	3.67 ± 0.3
April-2014 (dry)	Galsi	51.00 ± 1.5	45.67 ± 1.5	89.56 ± 1.6	343.67 ± 17.1	7.00 ± 0.0
	Memari	49.67 ± 1.8	45.67 ± 1.5	91.98 ± 1.0	323.00 ± 27.1	6.33 ± 0.3
Oct.-2014 (wet)	Galsi	46.33 ± 3.0	36.00 ± 3.8	77.3 ± 3.3	154.00 ± 5.5	3.33 ± 0.3
	Memari	48.33 ± 0.9	36.00 ± 0.6	74.56 ± 2.3	169.67 ± 11.7	3.67 ± 3.7

army worm, white plant hopper, green leaf hopper were very low and below the ETL viz, 1 moth/hill, 1-2 larvae/hill, 15-20 insects/hill, 10-20 insects/hill, respectively in the rice fields of the study area. Infestation of the crop and population of *C. medinalis* and *S. incertulas* in the rice fields at different locations of Galsi and Memari during dry

and wet season in 2012, 2013 and 2014 were studied. During the dry season the infestation of *C. medinalis* (number of larvae per hill) in the rice fields ranged from 82.86 - 91.30; 80.35 - 85.80; 38.53 - 52.91 percent and 13.33 - 11.33; 14 - 12.33; 7.67 - 7.00 respectively. During the wet season of 2012, 2013 and 2014, infestation of *C. medinalis*

(number of larvae per hill) in the ricefields was 94.51 - 60.61; 61.22 -93.86; 74.54 - 84.57 and 29.00 - 26.00; 22.66 - 29.00; 13.67 - 15.00, respectively (Table 2).

Infestation of the hills (94 and 93%, respectively) and population of LF larvae (29 and 26 larvae/hill) at Galsi and Memari respectively (Table 2). Leaf-folders were more prevalent in wet season than dry season. Crop infestation or pest prevalence varied significantly in different fields without having a common trend. The infestation of the hills varied from 38% to 94% and the population (larvae/hill) of LF larvae varied from 7-29.

During the dry season of 2012, 2013 and 2014, the infestation of *S. incertulas* and the population of larvae in the rice fields was 90.24 - 90.47; 90.12 - 92.50; 89.56 - 91.98 and 7.00 -7.33; 7.00; 6.33 - 7.00 respectively. During the wet season of 2012, 2013 and 2014, infestation of *S. incertulas* (the number of larvae per hill) in the rice fields were 73.01 -75.90; 68.44 - 70.1; 74.56 - 77.3 and 3.00 - 3.33; 2.67 - 3.67; 3.33 - 3.67 respectively (Table 3).

The rice crop was infested by different pests viz. leaf folder (LF), yellow stem borer (YSB), striped stem borer (SSB), army worm, rice hispa, white leaf hopper (WLH), green leaf hopper (GLH) and gandhi bug at different locations of Burdwan district of West Bengal during 2012 to 2014. Many species of arthropods inhabit rice fields but most of them are not truly noxious to the crops. For instance, some 500 species of insects and spiders may appear in a rice field in a particular season (Singh and Singh, 2014). Few of them seem to be casual visitors in search of food or hosts (parasitic wasps). The LF (*C. medinalis*) and YSB (*S. incertulas*) were the major and serious pests found to be infesting the rice plants cultivated in the study area. The rice leaf folder is a widely distributed migratory pest of rice in humid tropical and temperate regions of Asia, Oceania and Africa (Teng *et al.*, 1993; Nathan, 2011). There are more than 100 insect pests that inflict damage to rice-crop in India and among them, stem borers, gall midge, plant hoppers, leaf folders, rice hispa, gundhi bug, case worm are the most

important ones (Pathak and Khan, 1994). Chakraborty (2012) recorded guild composition of both pest and natural enemies in ricefields of West Bengal, and found four species of stem borers to be prevalent in the fields among which Yellow stem borer, *Scirpophaga incertulas*, Walker shared about 79.23% of the total borer population. The results of the field survey indicated that infestation of the crop would be different among the fields and seasons. As the crop infestation exceeded the economic threshold limit (ETL) (two fresh leaf damage/hill at flag leaf stage) and the action threshold level (ATL) (5-10% leaf damage) by the pest (Teng *et al.*, 1993), yield was reduced by about 80%. The observations supported the prediction that *C. medinalis* would be a major pest of rice with 60% or more loss in rice yields in India (Teng *et al.*, 1993).

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