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DYNAMICS OF SPECIES COMPOSITION OF STEM BORERS IN RICE CROP

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ABSTRACT

As the stem borers are harmfull insent for rice crop it is very important to know the dominant species population to management of these insect. In order to determine the population dynamics of harm full stem borer to develope ecological and economicale viable strategies, a field experiment was conducted at the Research Farm, R.A.U., Pusa and in the Laboratory, Department of Entomology, R.A.U., Pusa. Results pertaining the dynamics of species composition of stem borers of rice reveal that all the four species of stem borer of rice viz. yellow stem borer, *Scirpophaga incertulas* (Walker), pink stem borer, *Sesamia inferens* (Walker), white stem borer, *Scirpophaga innotata* (Walker) and dark headed striped borer, *Chilo polychrysus* (Meyrick) were prevalent during the crop season. The population of yellow stem borer was found to be dominant over other species of stem borer and recorded 87.00% to 93.00% at 30 DAT during two *kharif* seasons respectively. The population was 82.50% to 89.00% at 50 DAT and 85.00% to 91.50% at 90 DAT.

KEY WORDS
Chilo polychrysus (Meyrick)
Rice
Scirpophaga incertulas (Walker)
Scirpophaga innotata (Walker)

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INTRODUCTION

Rice (*Oryza sativa*) belonging to the family Graminae, is one of the most important staple food crops not only in India but the world too. Rice is grown in all the continents except Antarctica, occupying 158 million hectare in 111 countries in the world (Agricultural statistics at a glance, 2011), out of which Asia accounts for 90 per cent and America, Australia, Africa and Europe cover the rest 10 per cent (Ampong-Nayarko and De Datta, 1991, Roy *et al*., 2013 and Saxena and Murty 2014) with a production of 685 million tonnes and productivity of 4328kg/ha (Agricultural statistics at a glance, 2011).

Rice is grown in both *kharif* and *rabi* season under diverse ecological and climatic conditions apart from socio-economic diversities of the state. The unholy triple alliance of pests (insects, diseases and weeds) act as a great impediment in achieving desired level of rice production (Gupta *et al*., 2002, Balakrishna and Satyanarayana 2013 and Manikandan *et al*., 2014). Intensive use high yielding varieties, sequential cropping and indiscriminate use of insecticides have resulted in various insect pest problems in rice crop. Among various depressing factors, biotic stress as insect pest infestation is the most crucial factor due to which rice production is unpredictable. In India, approximately 100 insect pests have been reported as pests of rice and 20 of these are considered to be major pests causing 30 per cent yield loss from seedling to maturity (Cramer, 1967; Pathak and Dhaliwal, 1981 and Atwal and Dhaliwal, 2005). All together 21 species of lepidopteran stem borers have been recorded as rice pests throughout the world. Of these, 8 species are known to occur in India (Rao, 1965 and Pathak, 1975). Of various lepidopteran insect pests attacking on rice, yellow stem borer, *Scirpophaga incertulas* Walker, white stem borer, *Scirpophaga innotata* (Walker), dark headed borer, *Chilo polychrysus* (Meyrick) and pink stem borer, *Sesamia inferens* (Walker) are economically important. They damage most of the crop and harm the productivity of Rice. The newly emerged larva enters into the stem for feeding on inner tissues at vegetative and reproductive stage of the crop. As a result of their feeding inside the stem around the nodes, central leaf whorl remains unfold, turn brownish, dry up and easily be pulled out, while lower leaves remain green and healthy. This condition is known as deadheart (DH). The affected tillers do not produce panicles. If infestation continues to the ripening stage of the crop then plants bear panicles without grains (chaffy ears). This condition is known as white earhead (WEH). Keeping the harmful nature of these stem borer in view, the present investigation is undertaken in agro-climatic zone-I of North Bihar.

MATERIALS AND METHODS

In order to study the dynamics of pest species composition of stem borers of rice viz. yellow stem borer, *Scirpophaga incertulas* (Walker), pink stem borer, *Sesamia*

inferens (Walker), white stem borer, *Scirpophaga innotata* (Walker) and dark headed striped borer, *Chilo polychrysus* (Meyrick) in North Bihar condition, a field trial was conducted at research farm, R.A.U., Pusa, Samastipur, Bihar during *Kharif*, 2010 and *Kharif*, 2011. For this purpose, field preparation was done by ploughing once by tractor drawn disc plough and second ploughing was done by mould board plough. A well established susceptible variety Rajendra Kasturi was transplanted with 15cm (plant to plant) x 20cm (row to row) spacing in 100 sq.m plot area. The entire plot was quarterised into equal sized blocks and demarcated with bunds (1m) and channels (1m). Before transplanting, the recommended doses of fertilizers (N:P:K : 100:60:40) were applied before transplanting of seedlings into main plots. Nitrogen in the form of urea (220kg/ha), Phosphorous in the form of single super phosphate (375kg/ha) and potassium in the form of muriate of potash (66.4kg/ha) were utilized. However, the half of nitrogen was given as top dressing and remaining half of nitrogen was top dressed after 30 days after transplanting and balance half dose was applied at panicle initiation stage. All the recommended agronomic practices were conducted but there was no application of any pesticides during the crop season. Observations were recorded at tillering stage (30DAT), maximum tillering stage (50DAT) and heading stage (90DAT) during the crop season by dissecting fifty infested tillers (deadhearts and white earheads) from each block. The larvae were kept under observation for the confirmation of the species of stem borers of rice. The species were identified based on larval characters described by Kok and Varghese (1966) as mentioned in table- 4.

The same morphological parameters were also utilized by Nishida and Torii (1970), Rai (1984) and Hattori and Siwi (1986) for the identification of stem borer species of rice. After the confirmation of species of stem borers, number of larvae were counted and computed in the form of percentage of each species of the stem borers at respective stages of the crop.

RESULTS AND DISCUSSION

The pooled data presented in Table 3 and Fig. 1. exhibited that all the four species of stem borer of rice viz. yellow stem borer, *Scirpophaga incertulas* (Walker), pink stem borer, *Sesamia inferens* (Walker), white stem borer, *Scirpophaga innotata* (Walker) and dark headed striped borer, *Chilo polychrysus* (Meyrick) were prevalent during *kharif*, 2010 and *kharif*, 2011. Among all the four species, the population of yellow stem borer was found to be dominant over other species of stem borer and recorded 87.00% to 93.00% at 30 DAT during two *kharif* seasons respectively. The population was 82.50% to 89.00% at 50 DAT and 85.00% to 91.50% at 90 DAT with respect to all the stages (Table 1 and 2) viz. tillering stage, maximum tillering stage and heading stage of the crop growth.

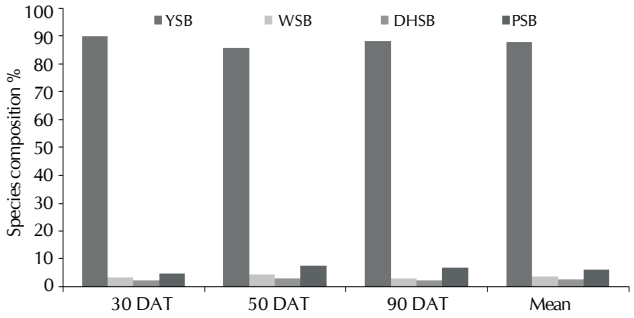

Figure 1: Species composition of stem borers of rice (pooled mean of kharif, 2010 and kharif, 2011)

Species composition found during the investigation during *kharif*, 2010 that yellw stem borer recorded higher population 93.00% followed by pink stem borer (3.00%), white stem borer (2.25%) and dark headed striped borer (1.50%) at 30 DAT. Yellow stem borer also showed higher population (89.00%) followed by pink stem borer (5.50%), white stem borer (3.50%) and dark headed striped borer (2.00%) at 50 DAT. At 90 DAT, yellow stem borer also revealed its dominancy with higher population (91.50%) followed by pink stem borer (5.00%), white stem borer (2.00%) and dark headed striped borer (1.50%).

It was found during the investigation during *kharif*, 2011 that yellow stem borer recorded higher population (87.00%) followed by pink stem borer (6.00%), white stem borer (4.00%) and dark headed striped borer (3.00%) at 30 DAT. Yellow stem borer also showed higher population (82.50%) followed by pink stem borer (9.00%), white stem borer (5.00%) and dark headed striped borer (3.50%) at 50 DAT. At 90 DAT, yellow stem borer also revealed its dominancy with higher population (85.00%) followed by pink stem borer (8.50%), white stem borer (3.50%) and dark headed striped borer (3.00%).

The mean percentage during *kharif*, 2010 and 2011 it was observed that the population of yellow stem borer was dominated with 90.00% followed by pink stem borer with 4.50%, white stem borer with 3.25% and dark headed striped borer with 2.25%. Yellow stem borer also showed higher population (85.75%) followed by pink stem borer (7.25%), white stem borer (4.25%) and dark headed striped borer (2.75%) at 50 DAT. At 90 DAT, yellow stem borer also revealed its dominancy with higher population (88.25%) followed by pink stem borer (6.75%), white stem borer (2.75%) and dark headed striped borer (2.25%).

Table 1: Species composition of stem borers of rice during *kharif*, 2010

Stem Borer Species	Percentage Composition (%)			
	30DAT	50DAT	90DAT	Mean
1.Yellow stem borer (*Scirpophaga incertulas*)	93.00	89.00	91.50	91.16
2.White stem borer (*Scirpophaga innotata*)	2.50	3.50	2.00	2.67
3.Dark headed striped borer (*Chilo polychrysus*)	1.50	2.00	1.50	1.67
4.Pink stem borer (*Sesamia inferens*)	3.00	5.50	5.00	4.50

Table 2: Species composition of stem borers of rice during *kharif*, 2011

Stem Borer Species	Percentage Composition (%)			
	30DAT	50DAT	90DAT	Mean
1.Yellow stem borer (*Scirpophaga incertulas*)	87.00	82.50	85.00	84.83
2.White stem borer (*Scirpophaga innotata*)	4.00	5.00	3.50	4.17
3.Dark headed striped borer (*Chilo polychrysus*)	3.00	3.50	3.00	3.17
4.Pink stem borer (*Sesamia inferens*)	6.00	9.00	8.50	7.83

Table 3: Species composition of stem borers of rice (pooled mean of *kharif*, 2010 and *kharif*, 2011)

Stem Borer Species	Percentage Composition (%)			
	30DAT	50DAT	90DAT	Mean
1.Yellow stem borer (*Scirpophaga incertulas*)	90.00	85.75	88.25	88.00
2.White stem borer (*Scirpophaga innotata*)	3.25	4.25	2.75	3.42
3.Dark headed striped borer (*Chilo polychrysus*)	2.25	2.75	2.25	2.42
4.Pink stem borer (*Sesamia inferens*)	4.50	7.25	6.75	6.16

Table 4: The species were identified based on larval characters described by Kok and Varghese (1966)

Species	Head	Body	Prothoracic shield	Crochets of prologs
1. *Scirpophaga incertulas* (Yellow stem borer)	Yellowish brown	Creamy yellow 20-25 mm 1st abdominal segment white	Yellowish brown	Biordinal, sometimes almost uniordinal, arranged in an ellipse.
2. *Scirpophaga innotata* (White stem borer)		Creamy yellow 20-25 mm	Yellowish brown, anterior margin tinged with dark color	
3. *Chilo polychrysus*	(Dark headed striped borer) Black to blackish brown	Dull white tinged with pink gray with longitu dinal stripes 17-22mm.	Black to blackish brown	Almost triordinal arranged in a circle
4. *Sesamia inferens* (Pink stem borer)	Reddish brown	Milky white tinged with pink or purple 30-35mm.	Brown	Uniordinal arranged in a longitudinal band

From mean percentage composition of stem borers of rice, it is quite cleared that during *kharif*, 2010 and *kharif*, 2011 yellow stem borer was found dominant with higher population (88.00%) followed by pink stem borer (6.16%), white stem borer (3.42%) and dark headed striped borer (1.42%).

The present findings are in close agreement with the findings of DRR (2008) that yellow stem borer was the dominant species (89.50%) and while pink stem borer, white stem borer and dark headed borer were prevalent during the crop period at Pusa. Similar observations were also reported by Husain and Begum (1985), Damayanti *et al*. (1991), Rahim *et al*. (1992), Pathak and Khan (1994), Islam (1996), Catling and Islam (1999), Ragini *et al*. (2000), JunMing *et al*. (2003), Lal (2006), Rai *et al*. (2006), Rahman (2007), DRR (2009), Joshi *et al*. (2009) and DRR (2011) that yellow stem borer was predominating species throughout the crop season. For preventing the damage rice crop caused by yellow stem borer it is important to control the dominant species to increase agricultural productivity of rice and raise economic condition.

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