

RESEARCH ARTICLE

Effect of date of sowing on rice yellow stem borer, *Scirpophaga incertulas* Walker (Lepidoptera: Pyraustidae) in aerobic paddy

■ S.V. HUGAR*, MOHAN I. NAIK, M. MANJUNATH AND MYTHRI

Department of Agricultural Entomology, College of Agriculture, University of Agricultural and Horticultural Sciences, SHIMOGA (KARNATAKA) INDIA

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ABSTRACT

Field experiments were conducted at the College of Agriculture, Shimoga during *Kharif* and *Rabi* seasons of 2005-2006 to assess the effect of date of sowing on infestation by yellow stem borer (YSB) in rice. During *Kharif* season in aerobic rice, peak activity was noticed at 60 DAS in all the dates of sowing with 2.13, 3.85, 6.23, 7.97, 9.94 and 12.03 per cent DH, respectively. Grain yield of 30th May and 15th June aerobic rice sowing crop was higher with 48.55 and 46.48 q/ha, respectively, whereas, in 30th July and 15th August aerobic rice sowing crop, yield was as low as 18.92 and 15.93 q/ha, respectively. During the *Rabi* season, the per cent DH infestation in aerobic rice was least in 30th November sowing with 0.05, 0.20, 0.70, 1.55 and 1.45 per cent at 30, 45, 60, 75 and 90 DAS, respectively and per cent WH of 0.82 prior to harvest with higher yield of 49.86q/ha followed by 15th December, 30th October, 15th November and 30th September sown crop with yield of 47.89,37.96, 22.16 and 19.81 q/ha, respectively with decreased order in incidence. Whereas, the infestation was highest in 15th October sown crop with per cent DH of 0.72, 1.63, 6.75, 9.40 and 6.4 at 30, 45, 60, 75 and 90 DAS, respectively and per cent of WH of 7.4 prior to harvest with lowest yield of 16.60 q/ha.

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*Corresponding author:
Email: hugar2000@gmail.com

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important staple food crop for more than two thirds of the population of India and more than 65 per cent of the world population (Mathur *et al.*, 1999). The world's annual production is 589.13 mt of rough rice (Anonymous, 2003). India has the largest acreage (446 m ha.) under rice, with a production of about 90 mt and it ranks next to China (Mishra, 2005). In Karnataka the crop was grown over an area of 1,449.80 ha during 1999-2000 with annual production of 3.64 mt and the productivity was 2512 kg/ha, which was greater than national average (Anonymous, 2005).

Rice consumes almost 50 per cent of irrigation water and the water crisis is the greater threat to rice cultivation. Inadequate rainfall, lack of water harvesting measures, depleting of ground water, inadequate water reservoirs and

misuse of water for irrigation have brought down the per capita availability of water by 40-60 per cent in Asian countries. It is time to initiate movements like "More crop per drop" which has been quite successful in Israel. Aerobic rice is one such option to minimize water requirement for rice crop. Growing rice with aeration or under non-flooded condition is termed as aerobic rice. Traditionally rice grown in uplands with low or no inputs is also referred as aerobic rice (Mishra, 2005). With the new aerobic rice technology, it would be possible to get reasonably good yields, with only 2-3 irrigations, thus saving 30-40 per cent of the water. Major changes in this system are lower seed rate (5 kg/ha); sowing at wider spacing (25-30 cm) and regular weeding. The larvae of *Scirpophaga incertulas* cause dead hearts during vegetative stage and white ear heads during reproductive stage. Even though rice plant can

compensate if dead heart infestation does not exceed 10 per cent, it cannot compensate for white ear loss. It has been reported that the pest causes one to three per cent of white ears (Velusamy *et al.*, 1978). Unlike other rice stem borers, *S. incertulas* is well adapted to the aquatic deep water environment (Islam and Catling, 1991). There is no much information available with regard to pest incidence and other related activities on aerobic rice.

MATERIAL AND METHODS

Field experiments were conducted at College of Agriculture, Shimoga during *Kharif* and *Rabi* seasons of 2005-2006 to assess the effect of date of sowing on infestation by yellow stem borer (YSB) in rice variety Rasi with spacing of 25 × 25 cm. The experiments were laid out in randomized block design with six treatments of six dates of sowing at 15 days intervals from 30th May to 15th August during *Kharif* and from 30th September to 15th December during *Rabi*, 2005-06 and four replications in aerobic conditions. Recommended agronomic practices were adopted for both the seasons except for YSB control (Anonymous, 1999 and Anonymous, 2004). Observations were recorded at fortnightly interval on total tillers and infested tillers at tillering stage and total ear heads and white ear heads at ear head stage in five plants selected at random in each treatment, adopting the methodology of standard evaluation system (SES) for rice (Anonymous, 1988) and the per cent dead heart (DH) and white ear (WE) was calculated.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Kharif paddy :

During *Kharif* season (Table 1) in aerobic rice the infestation of YSB was least with per cent DH of 0.46, 1.5, 2.13,

2.02 and 2.48 in the 30th May sown crop at 30, 45, 60, 75 and 90 days after sowing, respectively and 2.47 per cent WH before harvest. Whereas, the incidence gradually increased as the date of sowing advanced. The per cent DH reached maximum of 6.03, 9.41, 12.03, 10.37 and 11.18 at 30, 45, 60, 75 and 90 days after sowing, respectively and 12.61 per cent WH before harvest which was sown on 15th August. Thus, it showed that the percentage of dead hearts and white ear heads were lower in the crop sown earlier on 30th May and was higher on crop sown later on 15th August sowing. A low stem borer infestation in early planted crop could be attributed to low pest load and subsequent slower growth of the insect resulting in low population in early part of the season. The severity of stem borer damage obviously may be due to the migration of the adults from near by early planted rice crop. Similar observations have been made by several past workers (Heinrichs *et al.*, 1981; Safique and Anwar, 1986; Singh *et al.*, 1990; Rustamani *et al.*, 1995; Sharma *et al.*, 1995; Sonatkke *et al.*, 1997; Korat *et al.*, 1999 and Ganguly *et al.*, 2001). Similarly, Hilario *et al.* (1998) reported that yield advantage of directed seeded rice crop was attributed to more panicles per unit area, heavier grains and lower incidence of pests (Table 1).

Grain yield of 30th May and 15th June aerobic rice sowing crop was higher with 48.55 and 46.48 q/ha, respectively, whereas, 30th July and 15th August aerobic rice sowing crop, yield as low as 18.92 and 15.93 q/ha, respectively. These results are in corroboration with the studies of Gangawar and Sharma (1997). Sontakke *et al.* (1997) and Korat *et al.* (1999), have also reported that late sown crop during Mechil (*Kharif*), average moth catches of 40.33 and 21.00 moths caused only 5.1 per cent DH and 3.1 per cent WH, respectively. While, in the late planted crops, catches of 25.0 and 62.2 moths resulted in 8.5 per cent DH and 10.9 per cent white ears, respectively indicating that YSB infestation densities will be more pronounced in late planted crops. Similar observations were made by Rubia (1994) who concluded that crops tend to be more sensitive to stem borer damage when planted late. Vijante

Table 1 : Per cent dead hearts (DH) and white ears (WH) incidence in aerobic rice variety Rasi by *Scirpophaga incertulas* during *Kharif* season

Date of sowing	Per cent dead heart					WH (%) prior to harvest	Combined mean per cent of DH and WH	Grain yield (q/ha)
	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS			
30 th May	0.46 (4.20) ^f	1.5 (6.96) ^e	2.13 (8.17) ^d	2.02 (8.13) ^f	2.48 (9.0) ^e	2.47 (8.93) ^d	1.81 (7.62) ^e	48.55 ^a
15 th June	0.68 (5.02) ^e	2.3 (8.70) ^d	3.85 (11.26) ^c	3.33 (10.49) ^e	3.58 (10.8) ^d	3.36 (10.49) ^d	2.72 (9.39) ^d	46.48 ^a
30 th June	2.05 (8.19) ^d	3.45 (10.67) ^c	6.23 (14.39) ^b	6.1 (14.29) ^d	6.05 (14.20) ^c	6.04 (14.18) ^c	4.73 (12.45) ^c	31.06 ^b
15 th July	3.05 (10.04) ^c	4.74 (12.56) ^b	7.97 (16.37) ^b	7.58 (15.96) ^c	7.84 (16.25) ^b	7.94 (16.32) ^{bc}	6.92 (15.23) ^b	21.51 ^c
30 th July	4.13 (11.72) ^b	5.49 (13.53) ^b	9.94 (18.36) ^a	8.98 (17.41) ^b	9.75 (8.15) ^a	10.38 (18.75) ^{ab}	8.37 (16.78) ^b	18.92 ^{cd}
15 th Aug.	6.03 (14.19) ^a	9.41 (17.85) ^a	12.03 (20.28) ^a	10.37 (18.77) ^a	11.18 (19.50) ^a	12.61 (20.75) ^a	10.65 (19.04) ^a	15.93 ^e
S.Em ±	0.49	0.44	0.64	0.44	0.55	0.81	0.58	1.30
C.D. (P=0.05)	1.49	1.32	1.94	1.33	1.66	2.44	1.75	4.02
C.V (%)	11.0	7.49	8.71	6.22	7.5	10.87	8.65	8.76

Figures in parentheses are arc sin transformed values. Means showing similar alphabet in the columns are on par. DAS- Days after sowing

Table 2 : Per cent dead hearts (DH) and white ears (WH) incidence in aerobic rice variety Rasi by *Scirphophaga incertulas* during Rabi season

Date of sowing	Per cent dead heart					WH (%) prior harvest	Combined mean per cent of DH and WH	Grain yield (q/ha)
	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS			
30 th September	0.46 (4.20) ^a	0.80 (5.11) ^b	6.5 (14.77) ^a	7.13 (15.47) ^a	5.5 (13.30) ^b	5.30 (13.30) ^b	4.29 (11.95) ^b	19.81 ^{cd}
15 th October	0.72 (4.85) ^a	1.63 (7.3) ^a	6.75 (15.05) ^a	9.40 (17.85) ^a	6.40 (14.6) ^a	7.40 (15.78) ^a	5.37 (13.37) ^a	16.60 ^c
30 th October	0.20 (4.06) ^b	0.76 (5.07) ^b	5.45 (13.49) ^b	5.93 (14.07) ^{ab}	4.05 (11.51) ^b	3.05 (10.04) ^c	3.16 (10.24) ^c	37.96 ^b
15 th November	0.3 (4.15) ^b	0.81 (5.15) ^b	5.133.07 ^b	6.45 (14.71) ^a	4.57 (12.25) ^{ab}	4.20 (11.81) ^b	3.60 (10.88) ^{bc}	22.16 ^c
30 th November	0.05 (4.06) ^b	0.20 (4.06) ^c	0.70 (4.78) ^c	1.55 (7.20) ^c	1.45 (6.69) ^c	0.82 (5.17) ^d	0.75 (4.92) ^d	49.86 ^a
15 th December	0.13 (4.06) ^b	0.41 (4.06) ^c	2.08 (9.37) ^c	5.40 (13.41) ^b	3.75 (11.1) ^b	1.60 (7.25) ^c	2.25 (8.60) ^c	47.89 ^a
S.Em ±	0.21	0.24	0.33	0.35	0.98	0.54	0.42	1.29
C.D. (P=0.05)	0.64	0.72	1.0	1.04	2.95	1.64	1.26	3.89
C.V. (%)	10.11	9.95	5.18	5.60	16.91	9.97	8.39	7.98

Figures in parentheses are arc sin transformed values. Means showing similar alphabet in the columns are on par. DAS- Days after sowing.

and Saxena (1988) reported that few larvae survived on younger rice plants (10 to 28 days old) than the older ones (30 to 40 days) and survival then declined progressively on 46 and 60 days old plants. These results indicated the importance of the stage of the crop in escaping from the damage in spite of more number of moths.

Rabi paddy :

During the Rabi season (Table 2) the per cent DH infestation in aerobic rice was least in 30th November sowing with 0.05, 0.20, 0.70, 1.55 and 1.45 per cent at 30, 45, 60, 75 and 90 DAS, respectively and per cent WH of 0.82 prior to harvest with higher yield of 49.86 q/ha followed by 15th December, 30th October, 15th November and 30th September sown crop with yield of 47.89, 37.96, 22.16 and 19.81 q/ha, respectively with decreased order in incidence. Whereas, the infestation was highest in 15th October sown crop (with per cent DH of 0.72, 1.63, 6.75, 9.40 and 6.4 at 30, 45, 60, 75 and 90 DAS, respectively and per cent of WH of 7.4 prior to harvest) with lowest yield of 16.60 q/ha. These results were in agreement with Krsihnamurthy and Ramasubbaiah (1987) who recorded lowest stem borer incidences at all the periods of observation in the 15th December planting and were lowest (0.60 and 0.48 per cent, respectively) at both 30 and 50 DAT and the incidence was significantly lower than 1st December planting (5%) at 30 DAT and 15th November and 1st January plantings at 50 DAT, and they also recorded the lowest white ear (1.2%) in the 15th December planting.

During Kharif season in aerobic rice, peak activity was noticed at 60 DAS in all the dates of sowing with 2.13, 3.85, 6.23, 7.97, 9.94 and 12.03 per cent DH (Table 1). During Rabi season, peak activity was noticed at 75 DAS in all the dates of sowing with 7.13, 9.40, 5.93, 6.45, 1.55 and 5.40 per cent DH (Table 2). These are in agreement with Dutt and Kundu (1984) who reported that dead heart incidence reached its peak around

45 DAT in case of Amani paddy and around 60 DAT in case of Boro paddy.

Conclusion :

During Kharif season peak activity was noticed at 60 DAS in all the dates of sowing and was least with percentage of dead hearts and white ear heads were lower in the crop sown earlier on 30th May and was higher on crop sown later on 15th August sowing. This showed that the incidence gradually increased as the date of sowing advanced. During Rabi season, 30th November sown crop yielded higher with lower infestation. Whereas, higher incidence of the pest and lower yield was observed when the crop was sown on 30th and 15th October.

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