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Status of insect pests in direct seeded and transplanted rice

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Abstract

Rice is the one of most important cereal food crops in India. In this view, CR Dhan 200, CR Dhan 201, CR Dhan 202, CR Dhan 203, CR Dhan 204, CR Dhan 205, CR Dhan 206, CR Dhan 207, CR Dhan 209 rice varieties were sown in experimental plots of Faculty of Agriculture, Annamalai University, Chidambaram. The experiment was laid out in Randomized block design with three replications. In India rice was mainly grown by direct-seeded and transplanted rice. To monitor the pest population by using net sweeping and method was used. The results showed that the vegetative stage maximum number of yellow stem borer was observed in the transplanted rice variety of CR Dhan 209 (5.00) and leaf folder population was maximum in transplanted rice variety of CR Dhan 204 (6.00). The peak population of the grasshopper was observed in the direct and transplanted rice variety of CR Dhan 204 (6.66) and green leafhopper was recorded in the maximum number of population in the transplanted rice variety of CR Dhan 204 (6.66). It's evident from the data reproductive stage that the population of the grasshopper was the maximum number observed in the direct-seeded rice variety of CR Dhan 200 (11.33). The highest number of plant bug population was recorded in the transplanted rice variety of CR Dhan 204 (7.00). The peak population of Green leafhopper was recorded in the direct-seeded rice variety of CR Dhan 204 (8.00), whereas the maximum number of plant bugs was recorded in the direct-seeded rice variety of CR Dhan 204 (15.00). In the ripening stage, the appearance of stem borer adult was the maximum number observed in the transplanted rice variety of CR Dhan 209 (7.33). The peak population of the leaf folder was recorded in the direct-seeded rice variety of CR Dhan 203 (7.33). The lowest number of green leafhopper population was recorded in the transplanted rice variety of CR Dhan 204 (0.33). The highest number of plant bug population was recorded in the variety of CR Dhan 200 (11.00). The peak population of the grasshopper was recorded in the variety of CR Dhan 209 (10.66). In the population of pollenfeeder was the maximum number observed in the direct-seeded rice variety of CR Dhan 209 (11.00).

Keywords: Direct seeded rice, transplanted rice, insect pests, net sweeping

Introduction

Rice is one of the cereal food crop half of the population of the world, it is an important target crop to provide food and livelihoods for millions. Rice is mainly grown by direct-seeded rice and transplanted rice. The recent years both the methods of sowing were scarce, expensive and less profitable coupled with excessive use of nitrogenous fertilizers and abuse of agrochemicals have further aggravated the pest menace in transplanted conditions. All these factors demanded a major shift from Transplanted Rice (TR) production to Direct Seeded Rice (DSR) in irrigated and assured or high rainfall areas (Edirisinghe, J. P. and Bambaradeniya, C. N. B. 2006) [2]. Direct seeded rice technique is becoming popular nowadays because of its low-input demanding nature. This method has become inevitable for tail-end farmers who receive less amount of irrigation water. Numerous guilds of insect pests attacked by Paddy crop in the field, but few cause significant losses. Losses caused by insect pests are the main constraints in achieving a high yield of rice (Rai *et al.*, 2000) [8]. The rice plant is subject to attack by more than 100 species of insects and 20 of them can cause economic damage (Pathak, M. D, and Khan, Z. R, 1994) [7]. Among the major insect pests attacking rice are rice leaf folder, *Cnaphalocrocis medinalis* (Guenee), brown planthopper, *Nilaparvata lugens* (Stal), white-backed planthopper, *Sogatella furcifera* (Horvath) and yellow stem borer, *Scirpophaga incertulas* (Walker). The loss due to yellow stem borer ranged from 3 to 65 percent (Muralidharan and Pasalu, 2005) [5] and leaf folder reported to the extent of 5 to 39 percent (Shanmugam *et al.*, 2006) [9]. A change from transplanting to direct seeding may affect the status of various pests. The main factors that influence pest status are exposure of very young

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seedlings to pests, longer plant duration in the field and increasing plant density. Among the major insect pests attacking rice are yellow stem borer, leaf folder, green leafhopper, grasshopper, earhead bug, white leafhopper. The average yield loss in rice have been accounted for 30% loss in stem borers, while plant hoppers 20%, gall midge 15%, leaf folder 10% and other pests 25%, respectively (Krishnaiah and Varma, 2015) ^[4]. This study describes possible changes in pest status in direct-seeded rice fields. It is felt that a complex and rich web of general and specific insect pests of direct-seeded rice (DSR) ecosystem was studied.

Materials and Methods

The field experiment was conducted during 2018-19 at Annamalai University Experimental farm, Chidambaram, under the direct-seeded and transplanted rice and the variety CR Dhan 200, CR Dhan 201, CR Dhan 202, CR Dhan 203, CR Dhan 204, CR Dhan 205, CR Dhan 206, CR Dhan 207, CR Dhan 209 was sown. The Experimental design was laid out in Randomized Block Design with three replications. The size of the individual plot was 5 m × 4 m (20 m²) and spacing 20x10cm.

Collection methods for insect pests by using net sweeping

A Sweep net is the best-suited method for the collection of a large number of species in a shorter period (Noyes and Valentine, 1989) ^[6]. The observations on the occurrence of major insect pests were recorded. One sample consists of 25 sweeps at each plot of the ecosystem. The insect collected while sampling was counted and collected and then transferred to a transparent polythene bag which was returned to the laboratory for identification. All the samples were collected near the center of the ecosystem.

Experimental details

Specification of sweep net - 30 cm diameter and 65 cm depth
 Number of sweep in each sampling - 25 Sweeps
 Time of sampling - Morning or late evening
 Stages of the collection - Vegetative stage, Reproductive stage, Ripening stage

Results and Discussion

Yellow stem borer

Data revealed that, in the different stages of the collection of rice insect pests, maximum yellow stem borer adult population was recorded in the ripening stage of the transplanted rice variety of CR Dhan 209 (7.33) followed by direct-seeded rice variety of CR Dhan 209 (6.33) were as the minimum number of stem borer was recorded in the vegetative stage of the transplanted rice variety of CR Dhan 201 (0.00) followed by the direct-seeded rice variety of CR Dhan 203 (0.33)

Leaf folder

The population of leaf folder was maximum observed in the ripening stage of the transplanted rice variety of CR Dhan 204 (7.33) followed by the vegetative stage of the transplanted

rice variety of CR Dhan 204 (6.00) were as the minimum number of leaf folder was observed in the vegetative stage of the direct-seeded rice variety of CR Dhan 201 (0.33) followed by CR Dhan 203 (0.66).

Green leafhopper

The highest number of green leafhopper population was recorded in the reproductive and ripening stage of transplanted and direct-seeded rice variety of CR Dhan 204 and CR Dhan 209 (8.00) followed by the ripening stage of the direct-seeded rice variety of CR Dhan 204 (7.33) DR. (2012) opined that rice leaf folder damage was more in DSR than the Puddled transplanted rice, whereas the lowest number of population was recorded in the ripening stage of the transplanted rice variety of CR Dhan 204 (0.33) followed by the vegetative stage of the direct-seeded rice variety of CR Dhan 202 (0.66).

Grasshopper

The peak population of the grasshopper was recorded in the vegetative stage of the direct-seeded rice variety of CR Dhan 204 (16.00) followed by CR Dhan 209 (15.00), whereas the lowest number of population was observed in the reproductive stage of the direct-seeded rice variety of CR Dhan 206 (0.66) followed by CR Dhan 205 (1.00) and transplanted rice variety of CR Dhan 206 (1.00).

Plant bug

The lowest number of plant bug population was recorded in the reproductive stage of the direct-seeded rice variety of CR Dhan 207 (0.66) followed by transplanted rice variety of CR Dhan 207 (1.00) were as the maximum number of plant bugs was recorded in the ripening stage of the transplanted rice variety of CR Dhan 200 (11.00) followed by the direct-seeded rice variety of CR Dhan 209 (10.66).

White leafhopper

In the population of white leafhopper was maximum number observed in the vegetative stage of the direct-seeded rice variety of CR Dhan 209 (7.33) followed by CR Dhan 203 (6.00), were as the minimum number of white leafhopper was observed in the vegetative stage of the transplanted rice variety of CR Dhan 202 (0.33) followed by CR Dhan 205 (1.00).

Pollen feeder

The maximum number of pollen feeder population was recorded in the reproductive stage of the direct-seeded rice variety of CR Dhan 204 (15.00) followed by CR Dhan 209 (13.33), whereas the lowest number of plant bugs was recorded in the ripening stage of the transplanted rice variety of CR Dhan 207 (1.00) followed by CR Dhan 206 (1.33). The present findings are in conformation with Hegde and Nagappa (2011), who reported that the leafhopper population was significantly higher in puddled transplanted rice than aerobic methods.

Table 1: The Succession of rice insect pests in different varieties of direct seeded and transplanted rice through the sweeping net during the vegetative stage (2018-2019).

Rice Entry	YSB Moths (No./sweep)		LF Moths (No./sweep)		GLH		Grasshopper		Plant bugs		WLH	
	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted
CR Dhan 200	1.33 (1.52) ^{bc}	1 (1.41) ^{bc}	1.33 (1.52) ^{bc}	2 (1.62) ^{bc}	5 (2.44) ^e	6 (2.64) ^d	5 (2.44) ^a	5.66 (2.58) ^{cd}	4.66 (2.50) ^{cde}	3.66 (2.12) ^{bc}	5 (2.44) ^{cde}	1.66 (1.62) ^{bc}
CR Dhan 201	2 (1.62) ^c	0 (1.00) ^a	0.33 (1.13) ^a	2 (1.52) ^{abc}	2 (1.73) ^{bcd}	1.66 (1.62) ^{ab}	9.33 (3.20) ^{bc}	3 (2.00) ^b	3.33 (2.02) ^{abc}	2 (1.71) ^{ab}	3.66 (2.09) ^{bcd}	1 (1.41) ^{ab}
CR Dhan 202	1 (1.41) ^{cd}	0.66 (1.27) ^{ab}	1.66 (1.62) ^{cd}	1 (1.41) ^{ab}	1 (1.41) ^{ab}	0.66 (1.27) ^a	11 (3.45) ^{bcd}	4.33 (2.30) ^c	3.66 (1.98) ^{abc}	3 (1.97) ^{ab}	4.66 (2.36) ^{cde}	0.33 (1.13) ^a
CR Dhan 203	0.33 (1.13) ^a	1.66 (1.62) ^{cd}	0.66 (1.91) ^{de}	1.66 (1.82) ^{cd}	3 (1.98) ^d	3 (1.98) ^c	12.33 (3.65) ^{cde}	5.66 (2.57) ^{cd}	4 (2.17) ^{bcd}	2.33 (1.80) ^{ab}	6 (2.64) ^{de}	1.33 (1.52) ^{bc}
CR Dhan 204	3.66 (1.73) ^{cd}	0.66 (1.27) ^{ab}	4.33 (2.30) ^f	6 (2.64) ^e	6.66 (2.75) ^e	6.66 (2.76) ^d	16 (3.87) ^{de}	6 (2.64) ^d	2 (1.73) ^{ab}	7.66 (2.92) ^d	5.66 (2.57) ^{de}	3 (2.00) ^d
CR Dhan 205	0.66 (1.24) ^{ab}	2 (1.71) ^{cde}	2.66 (1.27) ^{ab}	3 (1.71) ^{bcd}	0.66 (1.27) ^a	1 (1.41) ^a	8.33 (3.02) ^b	1 (1.41) ^a	7.33 (2.88) ^e	7 (2.82) ^d	1 (1.41) ^a	2 (1.71) ^{bcd}
CR Dhan 206	1.66 (2.15) ^{ef}	3 (2.00) ^{ef}	1.33 (1.52) ^{bc}	0.66 (1.27) ^a	1.33 (1.52) ^{abc}	1.66 (1.62) ^{ab}	5 (2.44) ^a	2.33 (1.82) ^b	1.33 (1.52) ^a	1.33 (1.52) ^a	2.66 (1.82) ^{abc}	2.33 (1.79) ^{cd}
CR Dhan 207	3 (2.00) ^{de}	2.33 (1.82) ^{de}	2.33 (2.07) ^{ef}	1.33 (2.00) ^d	2.66 (1.91) ^{cd}	2.33 (1.82) ^{bc}	10.33 (3.34) ^{bc}	1.33 (1.52) ^a	2 (1.73) ^{ab}	2 (1.73) ^{ab}	1.66 (1.62) ^{ab}	2 (1.73) ^{bcd}
CR Dhan 209	5 (2.44) ^f	4.33 (2.30) ^f	3.33 (1.82) ^{cde}	2.33 (1.73) ^{cd}	5.33 (2.50) ^f	6 (2.63) ^d	15 (3.99) ^e	7 (2.81) ^d	6.33 (2.70) ^{de}	5.66 (2.57) ^{cd}	7.33 (2.88) ^e	2.33 (1.82) ^{cd}
C.D (0.05)	0.34	0.30	0.30	0.30	0.40	0.35	0.46	0.28	0.59	0.52	0.63	0.37

*Mean of 3 replications Values in parenthesis are square root transformed Values with various alphabets differ significantly

Table 2: The Succession of rice insect pests in different varieties of direct seeded and transplanted rice through the sweeping net during the Reproductive stage (2018-2019).

Rice Entry	Grasshopper		Plant bugs		Green leaf hopper		Pollen feeders	
	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted
CR Dhan 200	5.33 (2.50) ^{de}	11.33 (3.51) ^f	4 (2.22) ^{de}	4.33 (2.30) ^{de}	6 (2.64) ^e	6 (2.64) ^e	8 (2.95) ^c	6.66 (2.70) ^e
CR Dhan 201	3 (1.98) ^{bc}	4.66 (2.44) ^d	2 (1.71) ^{bc}	3 (1.98) ^{cd}	3.33 (2.15) ^d	4 (2.23) ^d	5 (2.39) ^{abc}	3.66 (2.15) ^d
CR Dhan 202	3.66 (2.15) ^{cd}	3 (2.00) ^c	2.33 (1.62) ^{abc}	2 (1.73) ^{bc}	1.66 (1.62) ^{ab}	2 (1.71) ^{abc}	4 (2.23) ^{ab}	1.66 (1.62) ^{bc}
CR Dhan 203	1.33 (1.52) ^{ab}	2 (1.73) ^c	1 (1.41) ^{ab}	1.33 (1.52) ^{ab}	2 (1.71) ^b	2.33 (1.82) ^{bc}	6 (2.64) ^{bc}	2 (1.73) ^c
CR Dhan 204	9 (3.15) ^f	8.66 (3.10) ^e	6.66 (2.75) ^f	7 (2.81) ^f	6 (2.82) ^e	8 (2.99) ^f	15 (3.99) ^d	7 (2.82) ^e
CR Dhan 205	1 (1.41) ^a	4.66 (2.37) ^d	3 (2.00) ^{cd}	2.66 (1.91) ^c	2 (1.73) ^b	2.66 (1.90) ^{cd}	2.66 (1.90) ^a	2 (1.73) ^c
CR Dhan 206	0.66 (1.27) ^a	1 (1.41) ^a	2 (1.71) ^{bc}	1.66 (1.60) ^{abc}	1.33 (1.52) ^{ab}	1 (1.41) ^a	3.66 (2.15) ^{ab}	1.33 (1.52) ^{ab}
CR Dhan 207	2 (1.73) ^{abc}	1.66 (1.52) ^a	0.66 (1.27) ^a	1 (1.41) ^a	1 (1.41) ^a	1.33 (1.52) ^{ab}	4.66 (2.33) ^{abc}	1 (1.41) ^a
CR Dhan 209	8.33 (3.01) ^{ef}	3 (2.00) ^c	5 (2.44) ^{ef}	5.66 (2.56) ^{ef}	5.66 (2.64) ^e	7 (2.82) ^{ef}	13.33 (3.77) ^d	6 (2.64) ^e
C.D (0.05)	0.51	0.19	0.39	0.38	0.28	0.33	0.63	0.20

*Mean of 3 replications Values in parenthesis are square root transformed Values with various alphabets differ significantly

Table 3: The Succession of rice insect pests in different varieties of direct seeded and transplanted rice through the sweeping net during the ripening stage (2018-2019).

Rice Entry	YSB Moths (No./sweep)		LF Moths (No./sweep)		GLH		Plant bug		Pollen feeder	
	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted	Direct sown	Transplanted
CR Dhan 200	2 (1.71) ^b	0.66 (1.24) ^a	0.33 (1.13) ^a	0.33 (1.13) ^a	2.33 (1.82) ^{abc}	3.33 (2.06) ^{cde}	4 (2.22) ^a	11 (3.44) ^d	5.33 (2.51) ^{ab}	6 (2.64) ^c
CR Dhan 201	1 (1.41) ^{ab}	1 (1.41) ^a	1 (1.41) ^{abc}	1 (1.41) ^{ab}	3.66 (2.13) ^{cd}	4 (2.23) ^{cde}	6 (2.64) ^{ab}	8.66 (3.02) ^{cd}	3.66 (2.13) ^a	4 (2.23) ^{abc}
CR Dhan 202	21.33 (1.52) ^{ab}	1.33 (1.27) ^a	2 (1.52) ^{abc}	1 (1.38) ^{ab}	1.66 (1.62) ^{bc}	3.66 (2.13) ^{cde}	3 (2.00) ^a	5 (2.44) ^{abc}	6 (2.63) ^{abc}	3.66 (2.15) ^{abc}
CR Dhan 203	0.66 (1.24) ^a	1.66 (1.62) ^{ab}	1.66 (1.73) ^c	2 (1.62) ^b	4.66 (2.35) ^{cd}	5 (2.44) ^a	6.33 (2.68) ^{ab}	2.33 (1.74) ^a	4.33 (2.29) ^{ab}	3 (2.00) ^{abc}
CR Dhan 204	2 (1.71) ^b	2 (1.71) ^{ab}	2.33 (2.87) ^d	7.33 (2.87) ^c	7.33 (2.87) ^{de}	0.33 (1.13) ^a	3.33 (2.06) ^a	4 (2.21) ^{abc}	5.66 (2.57) ^{abc}	2.33 (1.79) ^{ab}
CR Dhan 205	1.33 (1.62) ^{ab}	1.33 (1.62) ^{ab}	0.66 (1.24) ^{ab}	0.66 (1.24) ^{ab}	1.33 (1.52) ^a	4.33 (2.30) ^{de}	2.33 (1.79) ^a	6.33 (2.70) ^{bcd}	6 (2.64) ^{abc}	2 (1.73) ^{ab}
CR Dhan	4	4	1.66	1.66	3	2.66	5.66	4	8.66	1.33

206	(2.22) ^c	(2.22) ^{bc}	(1.62) ^{bc}	(1.38) ^{ab}	(2.00) ^{abc}	(1.91) ^{bcd}	(2.52) ^{ab}	(2.07) ^{bcd}	(3.05) ^{bc}	(1.52) ^a
CR Dhan 207	1.66 (1.82) ^{bc}	1.66 (1.82) ^{ab}	1.33 (1.82) ^c	1.33 (1.71) ^b	3.33 (2.03) ^{abc}	2.33 (1.82) ^{bc}	4.33 (2.15) ^a	5.33 (2.49) ^{abc}	2.66 (1.91) ^a	1 (1.41) ^a
CR Dhan 209	6.33 (2.69) ^d	7.33 (2.87) ^c	2 (1.71) ^c	1 (1.52) ^{ab}	8 (2.99) ^e	1.33 (1.52) ^{ab}	10.66 (3.41) ^b	10.66 (2.95) ^{bcd}	11 (3.44) ^c	5 (2.44) ^{bc}
C.D (0.05)	0.45	0.66	0.43	0.47	0.57	0.41	0.82	0.91	0.87	0.82

*Mean of 3 replications Values in parenthesis are square root transformed Values with various alphabets differ significantly

Conclusions

Based on the results yellow stem borer population emerged more from stubbles in transplanted rice as compared to direct-seeded rice. These stubbles leftover in previously cultivated fields, which serves as an alternate host for yellow stem borer infestation. The incidence of leaf folder green leafhoppers and plant bugs were found to be more in transplanted as compared to direct-seeded rice. The population of white leafhoppers and pollen feeders were more in the direct-seeded rice. In general, at the vegetative stage, among the varieties, CR Dhan 209 followed by and CR Dhan 204 recorded the maximum number of insects. However the minimum number of infestations was observed in the varieties of CR Dhan 201. However the minimum number of infestations was not very specific to any particular variety and it varied with the type of insect pests. The reproductive stage, Among the varieties, CR Dhan 204 followed by CR Dhan 209 recorded the maximum number of insects. However the minimum number of infestations was observed in the varieties of CR Dhan 206. Its evident from that the ripening stage, among the varieties, CR Dhan 209 and CR Dhan 201 recorded the maximum number of insects. However the minimum number of infestations was observed in the varieties of CR Dhan 207.

Among both the rice ecosystems more insect pests and crop damage were noticed in direct-seeded rice than the transplanted rice ecosystems.

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