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Incidence and Population Dynamics of Various Associated Insect-pests of Late Direct Sown Paddy, *Oryza sativa* L. at Gajapati, Odisha

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ABSTRACT

Background: Rice is the most important staple food of the world. Rice production is now-a-days reduced due to insect pest attacking to the crop in various growing stages. There are more than 1400 pest species, which are cause great menace to the rice cultivation. Incidences and abundance of pests in rice is growing day by day due to climatic change and excess use of chemical pesticides. In late direct sown paddy is also facing the insect pest problems in different growing stages. The study aimed to layout the different pest's incidence and population dynamics as well, on various stages of direct sown paddy. The knowledge of incidence timing for various pests can be further utilized for the suitable management.

Methods: The present study has been conducted during the late *Kharif* seasons of 2021-22 for 11 most widely grown paddy cultivars of farmers field around the locality of MS Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha. The surveyed cultivars were Anjali, Arize 8433, BAM-6, Bhuban, Chandra, CR Dhan 100, Varsha Dhan, CR Dhan 306, Sumit, Luna Sankhi and Vandana, respectively. These cultivars were surveyed for the abundance of various associated insect-pests at two different crop growth stages.

Result: The results revealed that the incidence of various pests namely *Scirpophaga incertulus, Orseolia oryzae, Cnaphalocrocis medinalis, Parapoynx stagnalis, Dicladispa armigera, Leptocorisa acuta,* Grasshoppers, *Nezara virdula, Nephotettix virescens, Melantis leda* and *Mythimna separate* was found to be significant for both the growth stages. The maximum population on late direct sown rice was found to be of *Scirpophaga incertulus* (3.67) and *Orseolia oryzae* (2.67) at the vegetative stage of rice while pests such as *Cnaphalocrocis medinalis* (6.34), *Leptocorisa acuta* (7.34) and *Mythimna separate* (5.67) were recorded maximum during the milking stage of rice.

Key words: Direct sown rice, Incidence, Milking paddy, Paddy, Population dynamics, Rice leaf folder, Yellow stem borer.

INTRODUCTION

Rice (*Oryza sativa*) belonging to the family Gramineae, is one of the most important foods crops in India and worldwide as well. More than two billion people in Asia and hundred million in Africa and Latin America depend on rice as staple food (Kubo and Purevdorj, 2004; Muthayya *et al*., 2014; Bashir and Yuliana, 2019). India ranks first in area with 43.79 million hectares of land under rice cultivation and second after China in production of rice with a production of 112.91 million tonnes that shares 22.81 per cent of world rice production with an average productivity of 2578 kg/ha. It contributes to 65 per cent of the total population food requirements with 45 per cent cereal production of India and thereby, holds the key position to sustain food sufficiency in the country (Mahajan *et al*., 2017; Chauhan *et al*., 2017). It is grown under diverse soil and climatic conditions and the productivity level of rice is low compared to the productivity levels of many countries in the world. Rice is grown in both *Kharif* and *Rabi* season under diverse ecological and climatic conditions apart from socio-economic diversities of the state of Odisha. Rice is grown in 43 m ha area under varying moisture regimes and diverse ecological situations like rainfed upland (7.10 m ha), lowland (6.00 m ha)

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and deepwater (1.50 m ha). The unholy triple alliance of pests (insects, diseases and weeds) act as a great impediment in achieving desired level of rice production (Pathak and Khan, 1994, Pathak, 1968). In Gajapati, rice is mostly grown during *Rabi* and *Kharif* as well. In the present study, various fields of farmers, grown lately through direct sowing, were surveyed for various insect-pests at two different stages of crop growth *i.e.*, vegetative stage and milking stage for the estimation of various insect visitors.

MATERIALS AND METHODS

The present study has been conducted during the *Kharif* season of the year 2021 and 2022 at Farmers Grown Rice of Gajapati, North Odisha. For the experiments, a total of 11 late direct sown rice cultivars have been selected for the estimation of population dynamics and incidence of various insect-pests at two different stages of rice growth. The following genotypes have been identified and utilized for this study: Anjali, Arize 8433, BAM-6, Bhuban, Chandra, CR Dhan 100, Varsha Dhan, CR Dhan 306, Sumit, Luna Sankhi and Vandana. The incidence and population dynamics of the insect pests were surveyed for the cultivars. Firstly, the estimation has been performed at the vegetative stage of rice growth followed by the second estimation at the milking stage. For the estimation of incidence and population dynamics, the total crop area of one genotype was divided into three uniform portions and five randomly selected tillers at the vegetative and milking stages of rice. The data was further analysed using RBD (randomized block design) for three replications. The immature stage of stem borers and gall midge were counted by splitting the rice stem of the selected tillers.

RESULTS AND DISCUSSION

Incidence and population dynamics of various insect-pests at the vegetative stage of 11 selected genotypes was shown in Table 1. The maximum incidence and population dynamics of *Scirpophaga incertulus* was recorded in Varsha Dhan and Luna Sankhi cultivars with 3.67 larvae/ tiller followed by Arize 8433 and Bhuban with 3.34 and Chandra with 3.00 larvae/ tiller of rice, respectively. The minimum incidence and population dynamics of *Scirpophaga incertulus* was recorded in BAM-6 with 2.00 and CR Dhan 306 with 2.34 larvae/tiller of rice, respectively. The maximum incidence and population dynamics of *Orseolia oryzae* was recorded in Chandra with 2.67 larvae/tiller followed by Sumit with 2.34 and CR Dhan 100, CR Dhan 306 and Luna Sankhi with 2.00 larvae/tiller of rice, respectively. The minimum incidence and population dynamics of *Orseolia oryzae* was recorded in BAM-6 with 0.67 larvae/tiller followed by Varsha Dhan, Bhuban and Anjali with 1.34 larvae/tiller of rice, respectively. The maximum incidence and population dynamics of *Nilaparvata lugens* was found to be non-significant for all of the selected cultivars, however, in case of *Sogatella frucifera,* low incidence was recorded in Varsha Dhan with 1.34 nymphs which stands maximum followed by Bhuban and Sumit with 0.67 and 0.34 nymphs/tiller, respectively.

The maximum incidence and population dynamics of *Cnaphalocrocis medinalis* was recorded in Bhuban cultivar with 5.34 larvae/tiller of rice followed by Chandra with 5.00 and Anjali with 4.34 larvae/tiller of rice. The minimum incidence was noted in case of Vandana with 2.67 larvae/ tiller of rice followed by Sumit 3.34 and CR Dhan 306 with 3.67 larvae/tiller of rice. The maximum incidence and population dynamics of *Parapoynx stagnalis* was recorded

Table 1: Incidence and population dynamics of various pests of paddy at the vegetative growth stages during *Kharif* season of 2021-22.

Name of cultivars	Average of population per tiller					
	*Scirpophaga incertulus**	*Orseolia oryzae**	*Nilaparvata lugens***	*Sogatella frucifera***	*Cnaphalocrocis medinalis**	*Parapoynx stagnalis**
Anjali	2.67	1.34	0.00	0.00	4.34	1.34
Arize 8433	3.34	1.67	0.00	0.00	4.00	2.67
BAM-6	2.00	0.67	0.00	0.00	4.34	2.00
Bhuban	3.34	1.34	0.00	0.67	5.34	1.34
Chandra	3.00	2.67	0.00	0.00	5.00	0.67
CR dhan 100	2.67	2.00	0.00	0.00	4.34	1.34
Varsha dhan	3.67	1.34	0.00	1.34	4.00	1.67
CR dhan 306	2.34	2.00	0.00	0.00	3.67	0.34
Sumit	2.67	2.34	0.00	0.34	3.34	2.00
Luna sankhi	3.67	2.00	0.00	0.00	4.34	2.34
Vandana	2.67	1.67	0.00	0.00	2.67	0.34
CD @ 0.05%	0.57	0.31	NS	NS	0.83	0.28
SEm±	0.21	0.13	-	-	0.29	0.11
CV	1.69	1.54	-	-	2.03	1.37

*Larval stage; **Nymph/Larvae and adults.

in Arize 8433 with 2.67 larvae/tiller of rice followed by Luna Sankhi with 2.34 and BAM-6 and Sumit 2.00 larvae/tiller of rice. The incidence and population dynamics of *Scirpophaga incertulus, Orseolia oryzae, Cnaphalocrocis medinalis, Parapoynx stagnalis* was found to be significant in almost all of the selected cultivars but a few of them showed greater favourable response against these pests which was likely due to late sowing of the rice in this region. This result was also slightly similar to previous work (Graf *et al*., 1992; Karuppaiah and Sujayanad, 2012; Kraker *et al*., 1999). The incidence of various sucking pests was non-significant in case of *Nilaparvata lugens*, however, in case of *Sogatella frucifera,* low incidence has been recorded inVarsha Dhan with a very negligible population count which was in agreement with previous reports of Cohen *et al.* (1994); Raju *et al.* (2021) and Verma *et al.* (2021). The direct sown rice appears to be bit more convenient for pests to seek shelter and feed on compared to the transplanted rice which took more time to establish in the fields (Lamba and Dono, 2021; Zhao *et al*., 2021).

The data presented in the Table 2 show the maximum incidence of *Dicladispa armigera* (Grub and adults) was recorded in BAM-6 and CR Dhan 306 with 2.67 followed by Bhuban and Sumit with 2.00 and Arize 8433 with 1.34 larvae/ tiller of rice, respectively. The maximum incidence and population dynamics of *Leptocorisa acuta* (nymph and adults) was recorded in CR Dhan 100 with 5.34 followed by Arize 8433, CR Dhan 306 with 5.00 and Chandra, Vandana with 4.67 nymph and adults *Leptocorisa acuta*per tiller of rice, respectively. The maximum incidence and population dynamics of various Grasshoppers (Nymph and adults) were recorded in CR Dhan 100 with 7.34 followed by Chandra, Vandana with 6.67 and Anjali with 6.34 grasshoppers per tiller while the minimum population of grasshoppers were recorded in CR Dhan 306 with 4.00 followed Sumit, Varsha Dhan, BAM-6 with 5.34 grasshoppers per tiller of rice.

The distribution of pests like *Dicladispa armigera* and *Melantis leda* was sporadic in nature and the incidence was reported to be very low from various assessed fields, which majorly depends on topography and climatic conditions of the given area (Nagdev *et al.,* 2022; Das *et al*., 2021; Verma *et al*., 2021; Morya and Kumar, 2021; Askary and Ahmad, 2021; Xu *et al*., 2022 and Nam *et al*., 2020).

The incidence and population dynamics of various insect-pests at the milking stage of rice during *Kharif* 2021 was shown in Table 3. The maximum incidence and population dynamics of *Scirpophaga incertulus* at the milking stage in various farmers shown cultivars were found in Chandra with 2.67 larvae/tiller followed by Luna Sankhi, Varsha Dhan and Bhuban with 2.34 larvae/tiller. The minimum values of *Scirpophaga incertulus* infestation at milking stage in various farmers shown cultivars were recorded in Anjali, BAM-6, CR Dhan 100 and Vandana with 1.34 larvae/tiller.

The incidence and population dynamics of *Orseolia oryzae* in various farmer shown rice cultivars shown in Table 3 in which, the maximum incidence and population dynamics of *Orseolia oryzae* were recorded in Luna Sankhi, CR Dhan 100 and Anjali with 2.67 larvae/tiller followed by Vandana with 2.34 larvae/tiller, while minimum values were seen in BAM-6 with 1.34 larvae/tiller followed by Bhuban, Varsha Dhan with 1.67 larvae/tiller. The incidence and population dynamics of *Cnaphalocrocis medinalis* in various farmer shown rice cultivars is presented in Table 3, in which maximum incidence and population dynamics of *Cnaphalocrocis medinalis* was recorded in Bhuban with 6.34 larvae/tiller followed by the Anjali with 5.67 and Luna Sankhi, Varsha Dhan with 5.34 larvae/tiller while minimum values were recorded in Vandana with 3.67 larvae/tiller followed by Sumit with 4.00 and Arize 8433 with 4.34 larvae/tiller. The milking stage of rice growth attract much more pests in compared to the vegetative stage due to high amount of

Table 2: Incidence and population dynamics of various pests of paddy at the vegetative growth stages during *Kharif* season of 2021-22.

Name of cultivars	Average of population per tiller						
	*Dicladispa armigera***	*Leptocorisa acuta***	Grass hopper (s)**	*Nezara virdula***	*Nephotettix virescens***	*Melantis leda**	*Mythimna separata**
Anjali	0.67	4.34	6.34	1.34	8.33	1.34	4.34
Arize 8433	1.34	5.00	6.00	0.67	7.00	0.67	3.00
BAM-6	2.67	4.34	5.34	1.34	7.34	1.34	4.67
Bhuban	2.00	3.00	6.00	1.67	6.67	2.67	5.34
Chandra	1.34	4.67	6.67	0.34	5.34	2.00	4.34
CR dhan 100	0.67	5.34	7.34	1.34	8.67	1.34	5.00
Varsha dhan	1.34	4.34	5.34	0.67	6.34	1.34	4.34
CR dhan 306	2.67	5.00	4.00	2.00	7.00	0.67	3.00
Sumit	2.00	4.34	5.34	1.67	8.34	1.34	4.67
Luna sankhi	1.34	4.00	6.00	2.00	7.34	2.67	5.34
Vandana	0.67	4.67	6.67	1.34	6.67	2.00	4.34
CD @ 0.05%	0.31	0.97	1.03	0.64	1.17	0.23	0.59
SEm±	0.12	0.35	0.36	0.23	0.41	0.09	0.21
CV	1.26	2.43	2.83	1.14	3.17	1.21	2.68

fragrance and other stimuli produced by various portions of crop plants (Bisen *et al.,* 2019; Mohanta *et al.,* 2020; Chou *et al.,* 2022; Han *et al.,* 2018). The larval population of various pests like *Scirpophaga incertulus, Orseolia oryzae, Cnaphalocrocis medinalis, Parapoynx stagnalis* increases with the increase of vegetations. The growth of hosts is directly proportional to the population of various phytophagy (Mandloi *et al.,* 2018; Nasrullah and Rafsanjani, 2022 and Khanpara *et al.,* 2020).

The incidence and population dynamics of various insect-pests at the milking stage of rice during *Kharif* 2021 is shown in Table 4. The incidence and population dynamics of *Dicladispa armigera* which were recorded maximum in the CR Dhan 306, BAM-6 with 3.34 grub and adults/tiller followed by Sumit, Bhuban with 2.67 grub and adults/tiller. The minimum values of incidence and population dynamics were seen in Anjali, CR Dhan 100, Luna Sankhi and Vandana with 1.67 grub and adults/tiller. The incidence and population dynamics of *Leptocorisa acuta*, which were recorded maximum in CR Dhan 306, BAM-6Arize 8433 with 3.34 nymphs and adults/tiller followed by CR Dhan 100, Anjali with 6.67 nymphs and adults/tiller. The minimum incidence and population dynamics values were recorded in BAM-6, Chandra, Varsha Dhan, Vandana with 5.34 nymphs and adults/tiller.

The incidence and population dynamics of *Nephotettix virescens*, shown in Table 4 and was recorded maximum in CR Dhan 306, Bhuban with 8.34 nymphs and adults/tiller followed by Vandana, Varsha Dhan, Anjali with 7.67 nymphs and adults/tiller. The incidence and population dynamics of *Melantis leda*, which were recorded maximum in the Luna Sankhi,Varsha Dhan with 8.34 larvae and pupae/tiller

Table 3: Incidence and population dynamics of various pests of paddy at milking stages during *Kharif* 2021-22.

Name of cultivars	Average of population per tiller					
	Scirpophaga incertulus	*Orseolia oryzae*	*Nilaparvata lugens*	*Sogatella frucifera*	*Cnaphalocrocis medinalis*	*Parapoynx stagnalis*
Anjali	1.34	2.67	0.00	0.00	5.67	2.34
Arize 8433	2.00	2.34	0.00	0.00	4.34	3.34
BAM-6	1.34	1.34	0.00	0.00	4.67	2.67
Bhuban	2.34	1.67	0.00	0.00	6.34	2.00
Chandra	2.67	2.34	0.00	0.00	4.67	1.67
CR dhan 100	1.34	2.67	0.00	0.00	4.67	1.67
Varsha dhan	2.34	1.67	0.00	0.00	5.34	2.34
CR dhan 306	1.67	2.34	0.00	0.00	4.67	1.34
Sumit	1.67	2.34	0.00	0.00	4.00	2.67
Luna sankhi	2.34	2.67	0.00	0.00	5.34	2.67
Vandana	1.34	2.34	0.00	0.00	3.67	1.34
CD @ 0.05%	0.41	0.73	NS	NS	1.08	0.37
SEm±	0.15	0.26	-	-	0.38	0.14
CV	1.97	1.43	-	-	2.57	1.44

Table 4: Incidence and population dynamics of various pests of paddy at milking stages during *Kharif* 2021-22.

Name of cultivars	Average of population per tiller						
	Dicladispa armigera	*Leptocorisa acuta*	Grasshopper (s)	*Nezara virdula*	*Nephotettix virescens*	*Melantis leda*	*Mythimna separata*
Anjali	1.67	6.67	7.67	3.67	7.67	1.67	5.67
Arize 8433	2.34	7.34	6.34	2.67	7.34	0.00	4.34
BAM-6	3.34	5.34	6.67	2.34	6.67	1.67	5.34
Bhuban	2.67	5.67	6.34	2.34	8.34	1.34	4.67
Chandra	2.34	5.34	5.34	1.67	6.34	0.67	4.67
CR dhan 100	1.67	6.67	8.34	2.67	7.34	1.67	5.34
Varsha dhan	2.34	5.34	7.67	2.34	7.67	2.34	5.34
CR dhan 306	3.34	5.67	5.34	1.67	8.34	0.34	4.67
Sumit	2.67	6.34	6.67	2.34	6.67	1.67	5.34
Luna sankhi	1.67	5.67	6.67	2.67	7.34	2.34	4.67
Vandana	1.67	5.34	7.67	1.67	7.67	1.67	5.34
CD @ 0.05%	0.74	1.17	1.29	0.57	1.24	0.28	1.38
SEm±	0.26	0.41	0.44	0.08	0.44	0.11	0.48
CV	1.59	2.76	2.91	1.57	3.14	1.28	2.08

followed by Bhuban with 1.34 larvae and pupae/tiller. The incidence and population dynamics of *Mythimna separata*, was recorded maximum in Anjali with 5.67 larvae/tiller followed by Vandana, Sumit, Varsha Dhan, CR Dhan 100, BAM-6 with 5.34 larvae/tiller. The minimum incidence and population dynamics values were seen in Arize 8433 with 4.34 larvae/tiller followed by Bhuban, Chandra with 4.67 larvae/tiller. Pests like *Leptocorisa acuta* and *Nezara virdula* showed more incidences during the flowering and milking stages as they prefer to feed mainly on the milking grains (Budiarti *et al*., 2022; Darmiati *et al*., 2018; Rahayu *et al*., 2018 and Siregar, 2021). Grasshoppers and *Mythimna separate* are considered to be foliage feeders of rice and can be found all over the rice fields during all the stages (Sugiarto, 2018; Mahesh *et al*., 2016; Cui *et al*., 2019 and Hussain *et al*., 2017).

CONCLUSION

Mono-cropping of rice invites many pests to live and breed on it. Monophagous pests like yellow stem borer required rice to feed and grow. Monocropping was the major cause, which trigger their activities throughout the year. Several pests require hot and humid climate to infest the crops and this was the main reason for the higher incidence and population dynamics of pests in crops grown during *Kharif* compared to *Rabi*. Pests like *Scirpophaga incertulus, Orseolia oryzae, Cnaphalocrocis medinalis, Parapoynx stagnalis, Leptocorisa acuta,* Grasshoppers, *Nezara virdula* etc were at their peak in case of the population dynamics at the milking stage. It was also seen that pest infestation in case of *Kharif* rice is more at the milking stage in comparison with the vegetative stage.

Conflict of interest

There is no conflict of interest among authors.

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