Evaluation of Local, Improved and Hybrid Rice Varieties against Insect Pests in District Rewa (M. P.), India

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Abstract- The field studies were carried out for evaluation of local, improved and hybrid varieties of rice for insect pest complex in rewa region. Study of insect pest complex was done from 2006-07 to 2007- 08. To study the incidence of various pests 16 rice cultivars five were local cultivars namely Dehula, Newari, Bhataphool, Loachai & Lohindi & six were improved varieties viz Pusabasmati, IR-36, IR-64, Vandana, IR-20 & Pusa Sugandha and five were hybrid varieties i.e. PA-6201, KRH-2, PRH-10, JRH-4 & JRH-5. The observations were made regarding the incidence of insect pests, their spread, type and extent of damage.

Index Terms- Insect pests complex, *Oryza sativa*, India

I. INTRODUCTION

Rice (*Oryza sativa* Linn.) is a basic food crop for a large proportion of the world's population. Consequently, it is receiving major attention in the current efforts to improve the world food situation. Rice continues to remain as the staple food for more than 65 per cent Indian population and with largest area of 44.6 million hectares and with second largest milled rice production of 93.3 million tones (2006-2007). Rice cultivation extends from 8^{O} to 35^{O}N latitudes across diverse ecosystems such as irrigated (52.6%), upland (12%), rain fed low land (32.4%), semi deep water and deep water (3%) as well as coastal saline regions. Based on the water availability rice is taken up as a single crop or as high as three crops in a year. [1]

Rice is a major food grain crop of the country and it is widely grown in north-eastern parts of Madhya Pradesh comprising Rewa district. In modern agriculture, high yielding rice varieties are extensively grown with the use of fertilizers and manures. Such cultivation pattern of rice accidentally or inadvertently offers infestation of a large number of insect pests, which results in to severe loss in crop yields. [2]

Insects are major constraint to rice production. Most of the rice plant parts are vulnerable to insect feeding from the time of sowing till harvesting. Both the mature and immature stages of insects injure rice plants by chewing leaf and root tissues, boring and tunneling into stems, or sucking fluid sap from stems and grains. The injury from feeding leads to damage showing symptoms of skeletonized and defoliated leaves, dead hearts, whiteheads, stunted and wilted plants and unfilled or pecky grains. Ultimately insect damage affects the plant physiology leading to reduction in measurable yield, utility or economic return. As the insect pests cause damage to rice plants and are one of the reasons of total annual yield loss of rice, it is important to study the rice insect pests, especially their seasonal abundance and incidence, to evaluate the control measures. [3]

The present investigation was evaluated local, improved and hybrid rice varieties against insect pests.

II. MATERIALS AND METHODS

The present study was done in Kuthulia farm of Agriculture College of District Rewa. The study was conducted in the seasons of 2006-07 and 2007-08. During this time period average temperature was 30.4 ^{0}C (maximum) and 15.61 ^{0}C (minimum). During 2007 the monsoon was received on 16th June whereas in 2008 it was on 12th June. Rainfall was adequate in 2007 (669.5mm) in 41 rainy days but the year 2008 it was comparatively high ranging up to 672.6mm.

In order to study the incidence of various pests 16 rice cultivars were tested during years 2006-07 and 2007- 08. Among the tested cultivars, five were local cultivars namely Dehula, Newari, Bhataphool, Loachai & Lohindi & six were improved varieties viz Pusabasmati, IR-36, IR-64, Vandana, IR-20 & Pusa Sugandha and five were hybrid varieties i.e. PA-6201, KRH-2, PRH-10, JRH-4 & JRH-5.

The observations were made regarding the incidence of insect pests, their spread, population and nature, type and extent of damage. Ten spots in the selected rice fields were marked at diagonal line with the help of a quadrate of 0.5m x 0.5m size. This area was marked by using a quadrate by fixing bamboo sticks at the seedling stage of the crop. These marked areas were used for counting the number of insects without disturbing the crop plant in *situ*. As various insect pests damage the rice crop at various stages starting from the early seedling stage to maturity of crop different methodologies were adopted for counting their numbers. Light trap method was used in insect pest complex study. [4]

III. RESULTS AND DISCUSSION

Rice, the staple diet of over half of the world's population, is grown on over 145 million ha in more than 110 countries, and occupies almost one-fifth of the total world cropland under cereals [5]. John (1981) reported that inadequate crop protection in India causes annual losses more than 36 percent by insects alone. [6]

In the present study during both 2006-07 and 2007-08 seasons, a pest complex of about 5 insect pests were recorded. The common and scientific names have been given in Table 1. The study of insect population on different rice varieties at

various growth stages was studied in 2006-07 & 2007-08. The mean of population has been calculated for both the years are shown in Table No. 2 to 6.

Its presence was not seen at 30DAS and thereafter its infestation increased severely at 45 to 105 DAS, growth stages. Again, its infestation declined till 105 DAS. The incidence of gundhi bug was recorded earliest in Dehula, Lohnadi, Vandana and IR-201 in 45 DAS and it remained latest upto 105 DAS on Bhataphool, Lochai, Pusabasmati IR-36, IR-64, Pusa sugandha, PA 6201, KRH – 2 and PRH – 10. On 45 DAS the severity of their incidence was highest on Vandana (4.2/m^2) and lowest on Dehula (2.4/m^2). After 60 DAS the severity of their incidence was highest i.e. 17.25/m^2 on Vandana and 1.05/m^2 on JRH-4 the lowest. After 75 DAS Pusabasmati was recorded to be the highest infested variety i.e. 15.2/m^2 and PRH-10 having 3.95/m^2, being the lowest infected one. After 90 DAS Pusabasmati remained with highest incidence as 29.85/m^2 and JRH-4 as 3.2/m^2 as of the lowest incidence. After 105 DAS the highest incidence remained on Pusabasmati as 17.95/m^2 but the least occurrence was recorded on PA 6201 as 4.1/m^2 (Table 2). Durge *et al*, 1972 [7] have been reported gundhi bug from all the rice growing areas and cause economic damage to the crop.

It is evident from the data that the presence of WBPH was seen first time form early stage (30DAS) and then successively increased till 75 DAS.WBPH was recorded on 30 DAS, the severity of its incidence was highest on Pusabasmati (7.45/m^2) and lowest on PRH-10 (1.45/m^2). After 45 DAS the severity of its incidence was highest i.e. 23.35/m^2 on Pusabasmati and 5.55/m^2 on PRH-10, the lowest. After 60 DAS Pusabasmati was recorded to be the highest infested variety i.e. 8.6/m^2 and JRH-5 i.e. 2.2/m^2, the lowest infested one. After 75 DAS Pusabasmati remained with highest incidence as 3.4/m^2 and PA 6201 having 0.45/m^2 occurence as of the lowest incidence variety (Table 3). The Similar studies were done by Pathak 1975 [8].

Mean number of caterpillars/m^2 of rice case worm on different rice varieties at various growth stages during the years 2007-2008 at experimental site are given in Table 4. It is evident from the data that the occurrence of this pest was increased at 30DAS growth stage and then declined gradually till 75 DAS. Case worm was recorded on 30 DAS. The severity of its incidence was highest on Pusabasmati (5.35/m^2) and lowest on JRH-4 (0.6/m^2). After 45 DAS the severity of their incidence was highest i.e. 8.75/m^2 on Pusabasmati and 1.85/m^2 on JRH-4, the lowest. After 60 DAS Pusabasmati was recorded to be the highest infested variety i.e. 2.3/m^2 and KRH-2 and JRH-4 having 0.15. /m^2 became lowest infested ones. Ramasubbaiah *et al*, 1978 [9] have reported crop damage due to rice case worm.

Leaf folder was recorded on 30 DAS the severity of their incidence was highest on Pusabasmati (7.3/m^2) and lowest on JRH-4 (1.45/m^2). After 45 DAS the severity of their incidence was highest i.e. 16.2/m^2 on Pusabasmati and 4.75/m^2 on JRH-5, the lowest. After 60 DAS Pusabasmati was recorded to be the highest infested variety i.e. 8.75 and JRH-4 i.e. 1.8/m^2, the lowest infested one. After 75 DAS Pusabasmati remained with highest incidence as 3.2/m^2 and JRH-4 as 0.5/m^2, as having the lowest incidence (Table 5). Mishra and Kulshrestha 1971 have been described leaf folder is a more serious problem in high fertiliser responsive semidwarf varieties. [10]

It as evident from the data the damage by stem borer was observed in the crop from very early stage i.e. (30 DAS) which gradually increased till 75 DAS. Thereafter, a little reduction in the damage was noted at 90 DAS. On 30 DAS the severity of the incidence of stem borer was highest on Pusabasmati (2.55/m^2) and lowest on JRH-5 (0.15/m^2). After 45 DAS the severity of its incidence was highest i.e. 3.55/m^2 on Pusabasmati and 0.4% on PA6201 and KRH-2, the lowest. After 60 DAS Pusabasmati was recorded to be the highest infested variety having. 5.3/m^2 and PA6201 having 1.4/m^2 incidence, being the lowest infested one. After 75 DAS Pusabasmati remained with highest incidence as 2.55/m^2 and PA6201 as 0.1/m^2, the lowest incidence. After 90 DAS the highest incidence remained on Pusabasmati as 0.5/m^2 but least occurrence was recorded on Lochai and IR-64 as 0.05/m^2 (Table 6). Murthy and Chiranjeevi 1996 [11] have showed similar results. Pandya, *et al* 1987 have been described crop damage due to yellow stem borer. [12]

Table -1: A Qualitative Composition of Insect Pests Complex of Rice Ecosystem (2007-2008)

S. No.	Common Name	Scientific Name
1.	Rice bug/ gundhi bug	*Leptocorisa varicornis* (Fabricius)
2.	Whitebacked Planthopper (WBPH)	*Sogatella furcifera* (Horvath)
3.	Rice case worm, case bearer	*Nymphula depunctalis* (Guenee)
4.	Rice leaf folder, rice leaf roller	*Cnaphalocrocis medinalis* (Guenee)
5.	Yellow stem borer (YSB)	*Scirpophaga incertulas* (Walker).

Table – 2: Mean numbers of nymph/adults of gundhi bug/m^2 on different rice varieties at various growth stages during the year (2007-2008).

Variety	Crop Growth Stages DAS Gundhi bug						
	15	30	45	60	75	90	105
Dehula	0.0	0.0	2.4	14.65	9.65	0.0	0.0
Newari	0.0	0.0	0.0	3.55	12.0	6.1	0.0
Bhantaphool	0.0	0.0	0.0	0.0	11.6	24.05	11.95
Lochai	0.0	0.0	0.0	0.0	8.05	18.45	10.45
Lohnadi	0.0	0.0	2.55	10.45	4.1	0.0	0.0
Pusabasmati	0.0	0.0	0.0	0.0	15.2	29.85	17.95
IR – 36	0.0	0.0	0.0	0.0	12.25	26.2	13.25
IR - 64	0.0	0.0	0.0	0.0	13.1	27.1	14.6
Vandana	0.0	0.0	4.2	17.25	14.25	0.0	0.0
IR – 201	0.0	0.0	3.8	14.7	9.75	0.0	0.0
Pusa sugandha	0.0	0.0	0.0	0.0	13.2	25.6	11.5
PA 6201	0.0	0.0	0.0	0.0	4.3	8.4	4.1
KRH – 2	0.0	0.0	0.0	0.0	4.15	7.45	4.7

PRH – 10	0.0	0.0	0.0	0.0	3.95	7.05	4.7
JRH – 4	0.0	0.0	0.0	1.05	5.2	3.2	0.0
JRH – 5	0.0	0.0	0.0	1.55	5.25	3.8	0.0

Table – 3: Mean population of wbph/m2 on different rice variety at various growth stage of crop during the year (2007-2008)

Variety	Crop Growth Stages DAS. WBPH						
	15	30	45	60	75	90	105
Dehula	0.0	3.2	10.25	3.7	1.65	0.0	0.0
Newari	0.0	3.25	9.6	3.75	1.35	0.0	0.0
Bhantaphool	0.0	2.95	10.55	3.7	1.6	0.0	0.0
Lochai	0.0	3.05	10.65	4.3	1.6	0.0	0.0
Lohnadi	0.0	3.2	11.6	4.3	1.4	0.0	0.0
Pusabasmati	0.0	7.45	23.35	8.6	3.4	0.0	0.0
IR – 36	0.0	4.8	20.6	6.1	2.2	0.0	0.0
IR - 64	0.0	5.7	20.3	5.7	2.25	0.0	0.0
Vandana	0.0	5.45	21.0	7.2	2.15	0.0	0.0
IR – 201	0.0	5.1	19.95	6.55	2.3	0.0	0.0
Pusa sugandha	0.0	5.7	20.8	6.75	2.05	0.0	0.0
PA 6201	0.0	1.5	5.7	2.7	0.45	0.0	0.0
KRH – 2	0.0	1.7	6.25	2.75	0.7	0.0	0.0
PRH – 10	0.0	1.45	5.55	2.5	0.7	0.0	0.0
JRH – 4	0.0	1.55	6.45	2.95	0.6	0.0	0.0
JRH – 5	0.0	1.55	5.6	2.2	0.7	0.0	0.0

Table-4: Mean number of caterpillars/m^2 of rice case worm on different rice variety at various growth stages during the year (2007-2008)

Variety	Crop Growth Stages DAS case worm						
	15	30	45	60	75	90	105
Dehula	0.0	1.75	4.1	0.7	0.0	0.0	0.0
Newari	0.0	1.95	3.45	0.8	0.0	0.0	0.0
Bhantaphool	0.0	2.35	3.65	0.8	0.0	0.0	0.0
Lochai	0.0	2.55	3.9	1.3	0.0	0.0	0.0
Lohnadi	0.0	2.15	3.5	0.55	0.0	0.0	0.0
Pusabasmati	0.0	5.35	8.75	2.3	0.0	0.0	0.0
IR – 36	0.0	3.5	6.7	1.5	0.0	0.0	0.0
IR - 64	0.0	3.75	6.75	1.25	0.0	0.0	0.0
Vandana	0.0	4.05	7.9	1.4	0.0	0.0	0.0
IR – 201	0.0	3.4	5.95	1.4	0.0	0.0	0.0
Pusa sugandha	0.0	3.55	7.7	1.6	0.0	0.0	0.0
PA 6201	0.0	0.75	2.0	0.2	0.0	0.0	0.0
KRH – 2	0.0	0.8	2.0	0.15	0.0	0.0	0.0
PRH – 10	0.0	0.75	2.3	0.55	0.0	0.0	0.0
JRH – 4	0.0	0.6	1.85	0.15	0.0	0.0	0.0
JRH – 5	0.0	0.7	1.95	0.0	0.0	0.0	0.0

Table: 5Mean population of rice leaf folder/m2 different rice variety at various growth stages of crop during the year (2007-2008)

Variety	Crop Growth Stages DAS. Leaf Folder						
	15	30	45	60	75	90	105
Dehula	0.0	3.85	8.2	5.05	1.4	0.0	0.0
Newari	0.0	3.7	8.4	4.65	1.55	0.0	0.0
Bhantaphool	0.0	4.9	10.2	5.7	1.7	0.0	0.0
Lochai	0.0	3.8	9.5	5.3	1.5	0.0	0.0
Lohnadi	0.0	4.3	9.35	5.4	1.2	0.0	0.0
Pusabasmati	0.0	7.3	16.2	8.75	3.2	0.0	0.0
IR – 36	0.0	5.4	12.5	7.1	2.35	0.0	0.0
IR - 64	0.0	5.75	11.9	6.9	2.2	0.0	0.0
Vandana	0.0	5.9	12.4	7.55	2.6	0.0	0.0
IR – 201	0.0	5.35	11.75	6.8	2.3	0.0	0.0
Pusa sugandha	0.0	5.8	13.1	7.3	2.8	0.0	0.0
PA 6201	0.0	1.65	5.1	2.8	0.85	0.0	0.0
KRH – 2	0.0	1.7	5.15	2.8	0.8	0.0	0.0
PRH – 10	0.0	2.4	4.8	2.05	0.7	0.0	0.0
JRH – 4	0.0	1.45	4.85	1.8	0.5	0.0	0.0
JRH – 5	0.0	1.4	4.75	2.0	0.9	0.0	0.0

Table- 6: Mean number of damaged shoots (dead hard/white earhead)/m2 yellow stem borer on different rice variety at various growth stages during the year (2007-2008).

Variety	Crop Growth Stages DAS stem borer						
	15	30	45	60	75	90	105
Dehula	0.0	0.5	1.75	1.9	0.95	0.0	0.0
Newari	0.0	0.8	1.65	2.25	0.45	0.0	0.0
Bhantaphool	0.0	0.6	1.5	2.2	0.75	0.15	0.0
Lochai	0.0	0.7	1.3	1.6	0.8	0.05	0.0
Lohnadi	0.0	0.9	1.65	2.15	0.4	0.0	0.0
Pusabasmati	0.0	2.55	3.55	5.3	2.55	0.5	0.0
IR – 36	0.0	1.6	2.65	3.6	1.85	0.2	0.0
IR - 64	0.0	1.55	2.4	3.45	1.8	0.05	0.0
Vandana	0.0	1.95	2.65	3.4	2.05	0.0	0.0
IR – 201	0.0	1.85	2.25	3.65	1.8	0.0	0.0
Pusa sugandha	0.0	2.15	2.85	4.05	2.2	0.25	0.0
PA 6201	0.0	0.2	0.55	1.4	0.1	0.0	0.0
KRH – 2	0.0	0.3	0.04	1.6	0.2	0.0	0.0
PRH – 10	0.0	0.25	0.6	1.5	0.0	0.0	0.0
JRH – 4	0.0	0.2	0.6	1.5	0.0	0.0	0.0
JRH – 5	0.0	0.15	0.6	1.6	0.2	0.0	0.0

IV. CONCLUSION

In the present course of investigation, we have to explore the evaluation of Local, Improved and Hybrid Rice Varieties against Insect Pests. It is more than knowing that when a rice insect pest is present it should be controlled. It then requires adequate knowledge about all the factors responsible for the pest population reaching economic threshold levels. Considering the

pest and disease constraints affecting the productivity of rice in different agro-climatic condition/zones various strategies have been evolved to improve and sustain the productivity of rice.

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