

Incidence of Pest on Different Cultivars of Paddy under Various Cultivation Methods in Relation to Weather Parameters

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Abstract

The field experiment, "Studies on effect of different paddy cultivars with various cultivation methods of paddy in relation to weather parameters." was carried out during *kharif*, 2018 at Agricultural Research Station Farm, Vadgaon Maval, Tal. Maval, Dist. Pune. It was laid out in split plot design with three replications. There were sixteen treatment combinations comprising of four varieties *viz.*, VDN-3-51-18 (*Indrayani*), VDN-99-29 (*Phule Samruddhi*), IET-13549 (*Bhogawati*) and RDN-99-1 (*Phule Radha*) and four cultivation methods *viz.*, M₁ : Four Point Agro Technique (Char Sutri Method), M₂ : Drilling at 22.5 cm, M₃ : Saguna Rice Technique (SRT) and M₄ : Modified Direct Seeded Rice Technique (MDSRT). The lower pest population was observed in paddy variety VDN-99-29 (*Phule Samruddhi*) followed VDN-3-51-18 (*Indrayani*) and higher incidence with IET-13549 (*Bhogawati*) and RDN-99-1 (*Phule Radha*). Pest incidence was more with drilling at 22.5 cm and lower with Modified Direct Seeded Rice Technique (MDSRT). There was positive correlation between maximum temperature, morning relative humidity, BSS, growing degree day and canopy temperature with incidence of leaf folder and brown plant hopper but negative correlation with minimum temperature, evening relative humidity. Therefore, it would be suggested to Farmers to go for adopt VDN-99-29 (*Phule Samruddhi*) variety, sowing with Modified Direct Seeded Rice Technique (MDSRT) for minimum attack of rice pest.

Key words : Paddy, Cultivation Methods, Varieties, Pest, Correlation.

Rice (*Oryza sativa* L.) is one of the most ancient crops being cultivated in 117 countries, hence called as "Global Grain In India, it is being cultivated in 44.6 million hectare with a production of about 109.5 million tonnes. In Maharashtra, rice is the second important crop of the people, which is grown over an area of 14.99 lakh hectares with an annual rough rice production of 32.37 lakh tonnes. The average productivity of the state is 2.01 t ha⁻¹. Maharashtra ranks 13th place in rice production in country. Large number of paddy varieties have been released for cultivation by private and government sector to enhance its productivity. Hence, it is essential to compare the productivity of these high yielding varieties under agro-climatic condition of rice growing belt of the state. The weather condition is warm and

humid. This climatic condition is beneficial for the development of various pests. It is a major problem in increasing rice production here. Considering these facts, the present experiment has been carried out to study the major insect pest incidence on rice ecosystem during *kharif* season.

Materials and Methods

The field experiment, "Studies on effect of different paddy cultivars with various cultivation methods of paddy in relation to weather parameters." was carried out during *kharif*, 2018 at Agricultural Research Station Farm, Vadgaon Maval, Tal. Maval, Dist. Pune. There were sixteen treatment combinations comprising of four varieties *viz.*, VDN-3-51-18 (*Indrayani*), VDN-99-29 (*Phule Samruddhi*), IET-13549 (*Bhogawati*) and RDN-99-1 (*Phule Radha*) and four cultivation methods *viz.*, M₁ : Four Point

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Agro Technique (Char Sutri Method), M_2 : Drilling at 22.5 cm, M_3 : Saguna Rice Technique (SRT) and M_4 : Modified Direct Seeded Rice Technique (MDSRT). The gross plot size was 3.40 m x 3.40 m. The other details of cultivation methods were as below.

1) Four point agro technique(Char Sutri method) : 1) Use of paddy crop residues containing silicon for recycling (Black grey rice hull ash @ 0.5 to 1.0 Kg sq.m.⁻¹ to rice seedlings and paddy straw @ 2 tonnes ha⁻¹ at the time of transplanting. 2) Application of Glyricidea as green manure @ 3 tonnes ha⁻¹ at the time of transplanting. 3) Controlled transplanting of improved varieties at the spacing of 15-25 x 15-25 cm. 4) Use of Urea DAP briquettes (175 Kg ha⁻¹). N and P through Urea DAP briquettes (60:30:0)+ 50 kg K₂O ha⁻¹.

2) Drilling at 22.5 cm : This method is followed in traditional areas of Western Maharashtra where medium to deep soil are observed. For drilling of rice seed drill is used. Distance between two plants is 22.5 cm. Dose-100:50:50 kg NPK ha⁻¹.

3) Saguna Rice Technique (SRT) : Raised beds of 1m breadth with 8-10cm height. Rack of 1m x 1m is placed on bed having iron pegs at 25 cm distance is placed on bed and pressed to make holes. Three seeds per hole are placed and covered carefully. Dose-100:50:50kg NPK ha⁻¹.

4) Modified Direct Seeded Rice Technique (MDSRT) : Raised beds of 1 m breadth with 8-10 cm height. Marking are made with help of rope and wooden rod at distance of 15-25 x 15-25 cm. Two seeds per hole are dibbled and covered carefully. Then Urea DAP briquettes placed in the square of 15-15 cm. N and P applied through Urea DAP briquettes (60:30:0)+ 50 kg K₂O ha⁻¹.

The pest observations were taken in proper scale.

Leaf folder (*Cnaphalocrosis medinalis*) : Larvae consume the leaf tissue except the epidermis, causing typical white streaks. They create a leaf tube during later stages of feeding. Used the following scale on the basis of the percentage of damaged leaves on a 0-9 scale.

Scale	0	1	3	5	7	9
Damage (%)	No damage	1-10%	11-20%	21-35%	36-50%	51-100%

The observations were recorded a tillering, stem elongation, booting, heading, milk stage and dough stages.

Stem Borer (*Scirpophagain certulas*) : The observations for stem borer were recorded at tillering, stem elongation and booting (Dead hearts), and dough stage and grain mature stages (Whiteheads).

Scale for stem borer (Dead hearts) :

Scale	0	1	3	5	7	9
Damage (%)	No damage	1-10%	11-20%	21-30%	31-60%	61%-above

Scale for stem borer (White heads) :

Scale	0	1	3	5	7	9
Damage (%)	No damage	1-5%	6-10%	11-15%	16-25%	26%-above

Brown plant hopper (*Nilaparvata lugens*) : Partial to pronounced yellowing of plant with increased severity of stunting. Extreme signs are wilting to death of plants. Infested areas in the field may be patchy. The observations were recorded at tillering, stem elongation, booting, heading, milk stage, dough stage and mature grain stages. The scale for brown plant hopper is

0 - No damage , 1 - Very slight damage , 3 - First and 2nd leaves of most plants partially yellowing, 5 - Pronounced yellowing and stunting or about 10 to 25% of the plants wilting or dead and remaining plants severely stunted or dying, 7- More than half of the plants, 9- All plants dead.

Results and Discussion

Correlation between weather parameters and incidence of pests

Correlation analysis of weather parameters and incidence of pests on paddy is given in Table 1 to 4.

On variety *Indrayani*

a) Incidence of Leaf folder : Correlation of incidence of leaf folder with weather parameters at different varieties is presented in Table 1. Correlation of incidence of leaf folder with weather parameters at 30,45,60,75,90 DAS and at harvest revealed significant positive correlation with maximum temperature ($r = 0.798^*$), RH-I($r = 0.634^*$),BSS ($r = 0.895^{**}$) and canopy temperature ($r = 0.899^{**}$) indicating increase in maximum temperature, RH-I, canopy temperature and BSS increased infestation of leaf folder. Significant negative correlation with minimum temperature($r = -0.463$) and RH-II ($r = -0.451$) indicated increase in Tmin and RH-II, decreased infestation of leaf

folder. Incidence of leaf folder having positive correlation with Tmax, RH-I, BSS and canopy temperature having negative correlation with Tmin and RH-II. Similar results were observed by Kumar *et al.* (1996).

b) Incidence of brown plant hopper :

Correlation of incidence of brown plant hopper with weather parameters at different varieties is presented in Table 1. Correlation of incidence of brown plant hopper with weather parameters at 30, 45, 60, 75, 90 DAS and at harvest significant positive correlation with maximum temperature ($r = 0.572$), RH-I ($r = 0.478$) and BSS ($r = 0.438$), canopy temperature ($r = 0.467$) indicated increase in maximum temperature, RH-I, canopy temperature and BSS increased in infestation of brown plant hopper. On the other hand significant negative correlation was observed with minimum temperature ($r = -0.632^*$) and RH-II ($r = -0.783^*$) indicated increase in these meteorological element decreased infestation of brown plant hopper. Incidence of BHP having positive correlation with Tmax, RH-I, BSS and canopy temperature while having negative correlation with Tmin and RH-II similar results was observed by Heong *et al.* (1995).

On variety *Phule Samruddhi*

a) Incidence of leaf folder : Correlation of incidence of leaf folder with weather

Table 1. Correlation between weather parameters and pests of paddy on variety *Indrayani*

Weather parameter	Leaf folder						Brown plant hopper					
	Days after sowing / transplanting											
	30	45	60	75	90	At harvest	30	45	60	75	90	At harvest
Tmax	0.798*	0.902**	0.532	0.856**	0.753*	0.673*	0.572	0.905**	0.423	0.956**	0.845**	0.868**
Tmin	-0.463	-0.453	-0.462	-0.921**	-0.531	-0.572	-0.632*	-0.561	-0.483	-0.356	-0.654*	-0.548
RH-I	0.634*	0.452	0.289	0.482	0.561	0.345	0.478	0.782*	0.542	0.423	0.634**	0.573
RH-II	-0.451	-0.353	-0.760*	-0.521	-0.896**	-0.643*	-0.783*	-0.364	-0.467	-0.453	-0.766*	-0.432
BSS	0.895**	0.536	0.675*	0.487	0.478	0.587	0.438	0.465	0.463	0.678*	0.249	0.896**
Canopy temp	0.899**	0.679*	0.654*	0.581	0.542	0.642*	0.467	0.591	0.742*	0.432	0.675*	0.562

parameters at different varieties is presented in Table 2. Correlation of incidence of leaf folder with weather parameters at 30,45,60,75,90 DAS and at harvest revealed significant positive correlation with Tmax ($r = 0.943^{**}$), RH-I ($r = 0.654^*$), BSS ($r = 0.453$) and canopy temperature ($r = 0.573$) indicated increase in Tmax, RH-I, canopy temperature and BSS increased infestation of leaf folder. On the other hand significant negative correlation was noticed with, Tmin ($r = -0.542$) and RH-II ($r = -0.643^*$) indicated increase in these parameters resulted in decreased infestation of leaf folder. Incidence of leaf folder having positive correlation with Tmax, RH-I, BSS and canopy temperature was highest at grain filling stage and having negative correlation with Tmin and RH-II similar results were observed by Sakia and Parameswaran (1999).

b) Incidence of brown plant hopper :

Correlation of incidence of brown plant hopper with weather parameters at different varieties is presented in Table 2. Correlation analysis of incidence of brown plant hopper with weather parameters at 30,45,60,75,90 DAS and at harvest revealed significant positive correlation with Tmax ($r = 0.652^*$), RH-I ($r = 0.673^*$), BSS ($r = 0.583$) and canopy temperature ($r = 0.214$) indicated increase in Tmax, RH-I, canopy temperature and BSS increased infestation of brown plant hopper and significant negative

correlation with Tmin ($r = -0.478$) and RH-II ($r = -0.901^{**}$) indicated increase in Tmin and RH-II decreased infestation of brown plant hopper. Incidence of BHP having positive correlation with Tmax, RH-I, BSS and canopy temperature while having negative correlation with Tmin and RH-II similar results were observed by Dycket *et al.* (1997).

On variety *Bhogawati*

a) Incidence of leaf folder : Correlation of incidence of leaf folder with weather parameters at different varieties is presented in Table 3. Correlation of incidence of leaf folder with weather parameters at 30,45,60,75,90 DAS and at harvest revealed significant positive correlation with Tmax ($r = 0.935^{**}$), RH-I ($r = 0.475$), BSS ($r = 0.937^{**}$) and canopy temperature ($r = 0.467$) indicated increase in Tmax, RH-I, canopy temperature and BSS increased infestation of leaf folder. However, significant negative correlation of leaf folder incidence was noticed with Tmin ($r = -0.703^*$) and RH-II ($r = -0.475$) indicated increase in these parameters decreased infestation of leaf folder. Incidence of leaf folder having positive correlation with Tmax, RH-I, BSS and canopy temperature and having negative correlation with Tmin and RH-II. Similar results were observed by Mishra *et al.* (2001).

Table 2. Correlation between weather parameters and pests of paddy on variety PhuleSamruddhi

Weather parameter	Leaf folder						Brown plant hopper					
	Days after sowing / transplanting											
	30	45	60	75	90	At harvest	30	45	60	75	90	At harvest
Tmax	0.943**	0.987**	0.657*	0.784*	0.923**	0.974**	0.652*	0.967**	0.452	0.643*	0.769*	0.874**
Tmin	-0.542	-0.532	-0.687*	-0.435	-0.534	-0.489	-0.478	-0.974**	-0.638*	-0.753*	-0.254	-0.368
RH-I	0.663*	0.654*	0.534	0.635*	0.564	0.683*	0.673*	0.879**	0.546	0.634*	0.462	0.578
RH-II	-0.643*	-0.602	-0.396	-0.465	-0.913**	-0.572	-0.901**	-0.587	-0.365	-0.923**	-0.451	-0.782*
BSS	0.476	0.453	0.978**	0.563	0.435	0.468	0.583	0.465	0.542	0.578	0.756*	0.912**
Canopy temp.	0.573	0.875**	0.512	0.936**	0.456	0.582	0.214	0.576	0.587	0.564	0.523	0.890**

b) Incidence of brown plant hopper :

Correlation analysis of incidence of brown plant hopper with weather parameters at different varieties is presented in Table 3. Correlation of incidence of brown plant hopper with weather parameters at 30, 45, 60, 75, 90 DAS and at harvest revealed significant positive correlation with T max ($r = 0.434$), RH-I ($r = 0.543$), BSS ($r = 0.783^*$) and canopy temperature ($r = 0.544$) indicated increase in T max, RH-I, canopy temperature and BSS increased infestation of brown plant hopper. Further, significant negative correlation was observed with Tmin ($r = -0.689^*$) and RH-II ($r = -0.264$) indicated increase in Tmin and RH-II decreased infestation of brown plant hopper. Incidence of BHP having positive correlation with Tmax, RH-I, BSS and

canopy temperature while having negative correlation with Tmin and RH-II similar results was observed by Ashrith *et. al.* (2016).

On variety Phule Radha

a) Incidence of leaf folder : Correlation analysis of incidence of leaf folder with weather parameters at different varieties is presented in Table 4. Correlation of incidence of leaf folder with weather parameters at 30,45,60,75,90 DAS and at harvest revealed significant positive correlation with T max ($r = 0.988^{**}$), RH-I ($r = 0.463^{**}$), BSS ($r = 0.640^*$) and canopy temperature ($r=0.673^*$) indicated increase in Tmax, RH-I, BSS, canopy temperature increased infestation of leaf folder. However, significant negative correlation was noticed with

Table 3. Correlation between weather parameters and pests of paddy on variety *Bhogawati*

Weather parameter	Leaf folder						Brown plant hopper					
	Days after sowing / transplanting											
	30	45	60	75	90	At harvest	30	45	60	75	90	At harvest
Tmax	0.935**	0.596	0.758*	0.689*	0.516	0.856**	0.434	0.904**	0.969**	0.823**	0.783*	0.743*
Tmin	-0.703*	-0.552	-0.640*	-0.953**	-0.451	-0.995**	-0.689*	-0.387	-0.537	-0.465	-0.583	-0.537
RH-I	0.475	0.298	0.567	0.383	0.732*	0.612	0.543	0.987**	0.463	0.722*	0.934**	0.531
RH-II	-0.475	-0.564	-0.342	-0.562	-0.601	-0.321	-0.264	-0.567	-0.472	-0.538	-0.413	-0.579
BSS	0.937**	0.564	0.476	0.478	0.497	0.689*	0.783*	0.650*	0.835**	0.465	0.523	0.414
Canopy temp.	0.467	0.532	0.453	0.684*	0.745*	0.875**	0.544	0.565	0.750*	0.574	0.547	0.903**

Table 4. Correlation between weather parameters and pests of paddy on variety *PhuleRadha*

Weather parameter	Leaf folder						Brown plant hopper					
	Days after sowing / transplanting											
	30	45	60	75	90	At harvest	30	45	60	75	90	At harvest
Tmax	0.988**	0.678*	0.574	0.932**	0.463	0.731*	0.541	0.834**	0.763*	0.550	0.842**	0.921**
Tmin	-0.653*	-0.462	-0.461	-0.342	-0.452	-0.730*	-0.809*	-0.342	-0.435	-0.574	-0.534	-0.684*
RH-I	0.463	0.548	0.563	0.614*	0.523	0.731*	0.687*	0.901**	0.327	0.457	0.573	0.713*
RH-II	-0.452	-0.782*	-0.738*	-0.508	-0.534	-0.541	-0.451	-0.673*	-0.681*	-0.577	-0.674*	-0.923**
BSS	0.640*	0.429	0.653*	0.654*	0.542	0.749*	0.913**	0.564	0.649*	0.555	0.470	0.933**
Canopy temp.	0.673*	0.960**	0.673*	0.570	0.689*	0.445	0.540	0.463	0.399	0.587	0.955**	0.698*

* Significant at 5% level, ** Significant at 1% level

T min($r = -0.653^*$) and RH-II ($r = -0.452$) indicated increase in these parameters decreased infestation of leaf folder. Incidence of leaf folder having positive correlation with Tmax, RH-I, BSS and canopy temperature having negative correlation with Tmin and RH-II similar results were observed by Singh *et al.* (2003).

b) Incidence of brown plant hopper :

Correlation analysis of incidence of brown plant hopper with weather parameters at different varieties presented in Table 4. Correlation of incidence of brown plant hopper with weather parameters 30, 45, 60, 75, 90 DAS and at harvest revealed significant positive correlation with Tmax ($r = 0.541$), RH-I ($r = 0.687$), BSS ($r = 0.913^{**}$) and canopy temperature ($r = 0.467$) indicated increase in Tmax, RH-I, BSS and canopy temperature increased infestation of brown plant hopper. Further, significant negative correlation was observed with Tmin ($r = -0.809^{**}$) and RH-II ($r = -0.451$), and indicated increase in Tmin and RH-II decreased infestation of brown plant hopper. Incidence of BHP having positive correlation with Tmax, RH-I, BSS and canopy temperature while having negative correlation with Tmin and RH-II similar results was observed by Nair *et al.* (1980).

Conclusions

From data it was revealed that the pest population was lower in paddy variety VDN-99-29 (Phule Samruddhi) followed VDN-3-51-18 (Indrayani) and higher incidence with IET-13549 (Bhogawati) and RDN-99-1 (Phule Radha). Pest incidence was more with drilling at 22.5 cm and lower with Modified Direct Seeded Rice Technique (MDSRT). There was positive correlation between maximum temperature, morning relative humidity, BSS, growing degree day and canopy temperature with incidence of

leaf folder and brown plant hopper but negative correlation with minimum temperature, evening relative humidity. Stem borer incidence was not observed during the period of investigation. Therefore, It would be suggested to Farmers to go for adopt VDN-99-29 (Phule Samruddhi) variety, sowing with Modified Direct Seeded Rice Technique (MDSRT) for minimum attack of rice pest with high yield.

References

- Ashrith, K. N., Sreenivas, A. G., Guruprasad, G. S., Hanchinal, S. G. and Krishnamurthy, D. 2016. Status of insect pests and natural enemies of direct seeded and transplanted rice. *International Journal of Agriculture Sciences*. 8(52): 2472-2476.
- Dyck, V. A., Misra, B. C., Alam, S., Chen, C. N., Hsieh, C. Y. and Rejesus, R. S. 1997. Ecology of the brown plant hopper in the tropics. Los Baños (Philippines): International Rice Research Institute. 1(5): 61-98.
- Heong, K. L., Song, Y. H., Pimsamarn, S., Zhang, R. and Bae, S. D. 1995. Global Warming and Rice Arthropod Communities in Climate Change and Rice. Springer publications, Berlin. 5(8): 327-335.
- Kumar, B., Sonboir H. L., Kumar, S. and Singh, S. 2017. Influences of Spacing and Weed Management Practices on Growth Parameters and Weed Dynamics of Wet Direct Seeded Rice. *International Journal of Current Microbiology and Applied Sciences*. 6 (6): 3044-3050.
- Mishra, B. K., Senapati, B. and Mishra, P. R. 2001. Antixenosis of some rice varieties to rice leaf folders. *Annual Plant Protection Science*. 9(2):179-183.
- Nair, K. P. V., Mammen, K. V., Pillai, K. B. and Nair, S.S. 1980. Influence of climatic factors on population of the brown plant hopper in Kuttanand. *Agricultural Research Journal (Kerala)*. 18(1): 55-60.
- Sakia, P. and Parameswaran, S. 1999. Assessment of yield losses at different growth stages of rice due to rice leaf folder. *Annual Plant Protection Science*. 7(4):135-138.
- Singh, H. M., Srivastva, R. K. S., Rizvi, M. A., Elazegul, F. A., Castilla, N. P. and Savary, S. 2003. Yield reduction due to brown spot and leaf folder injuries at varying levels of fertilizers and water supply to rice crop. *Annual Plant Protection Science*. 11:16-19.