Biological Forum – An International Journal 13(4): 406-410(2021)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Population of Major Insect Pests of Rice Influenced Under Different Weather Parameters of Eastern Uttar Pradesh Conditions

Gyan Prakash Morya* and Rajnish Kumar
Department of Entomology, B.R.D.P.G. College, Deoria, (Uttar Pradesh), India.

(Corresponding author: Gyan Prakash Morya)*
(Received 01 September 2021, Accepted 26 October, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Weather factors have always been found to be important for insect pests survival, growth, development, fecundity and reproduction. An investigation was undertaken to study the population of major insect pests of rice influenced under different weather parameters in rice field ecosystem of Eastern Uttar Pradesh, India for two consecutive years, 2014 and 2015. The population of major insect pests of rice were observed under particular weather parameters, *i.e.*, temperature maximum, temperature minimum, relative humidity, and rainfall in different growth stages of rice. The influence of weather parameters on population of major insect pests of rice were inferenced by correlation coefficient. Of the total observed population of rice insect pests under damaging groups in all growth stages of rice under temperature maximum, temperature minimum, relative humidity, and rainfall, the correlation coefficients were - 0.669, - 0.649, - 0.564, and 0.821 for stem borers; 0.859, 0.846, 0.784, and - 0.953 for leaf feeders; 0.191, 0.217, 0.321, and 0.037 for sap feeders; 0.587, 0.565, 0.474, and - 0.756 for root feeders respectively. The all-correlation coefficients were inferenced non-significant between damaging groups of rice insect pests and particular weather parameters in all growth stages of rice except between rainfall was inferenced significant. The population of most of the major insect pests of rice were highly decreased with highly increasing temperature maximum, temperature minimum, and relative humidity and decreasing rainfall in seedling stage; highly increased with moderately decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in transplanting stage; and moderately decreased with highly decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in flowering stage. The population of Rice cutworm (*Spodoptera mauritia* Boisduval) in nursery stage and Rice earhead bug (*Leptocorisa acuta* Thunberg) in flowering stage were highly increased under influence of weather parameters respectively.

Keywords: Major insect pests of rice, Weather parameters, Population influence, Eastern Uttar Pradesh, India.

INTRODUCTION

Rice is one of the most important staple foods of the world (70% of the population) as well as India (65% of the population). About 90% of the world's rice is produced and consumed in the Asian region and most staple food of South East Asia. More than 110 countries grow rice on one fifth of the world food grain crop area. The rice fragrance spreads to the entire world. It provides livelihood and food security to the about, 56% of the world population (7.46 billion) as well as 65% of the India population (1.32 billion). Rice is cultivated in India since Indus valley civilization and worshipped for wealth prosperity. More than 60% of India population living in rural areas, where agriculture is the major concerns of rural economy, that is the backbone of Indian economy (Pathak and Khan, 1994; Maclean *et al*., 2002; Viraktamath, 2013; Heinrichs and Muniappan, 2017; Pathak *et al*., 2018; DAC&FW, 2018; FAOSTAT, 2019).

About 800 insect pest species associated with rice crop over world. Among them about 250 insect pest species associated with rice crop in India and about 20 of them are major economic significance. Out of 20 major insect pests of rice, 12 of national significance and 08 of regional significance have been recognized respectively. The insect pests of rice infest all parts of the plant at all growth stages and transmit few viral diseases of rice. In India national level, stem borers accounted for 30% yield loss, while plant hoppers (20%), gall midge (15%), leaf folders (10%), and other insect pests (25%) respectively (Pathak and Khan, 1994; Shepard *et al.*, 1995; Matteson, 2000; David and Ananthakrishnan,2004; Bentur, 2011; Prakash *et al.*, 2014; Singh *et al.*, 2016; Heinrichs and Muniappan, 2017; Krishnaiah and Varma, 2018).

Rice is grown under wide range of climatic conditions. The warm humid environment is congenial for rice production and conductive to the survival and proliferation of insect pest biodiversity. Environment is the key factor of insect pest population dynamics. The weather factors have always been found to be important for insect pests survival, growth, development, fecundity and reproduction. The population of insect pests are mostly influenced by different weather factors, *i.e.,* temperature maximum, temperature minimum, relative humidity, and rainfall. Chakraborty and Deb (2012), studied the incidence of rice hispa influenced by agroclimatic conditions of northern parts of West Bengal for monsoon rice. Sulagitti *et al*. (2017) has been observed the incidence of yellow stem borer and leaf folder were highest at vegetative phase and showed a positive significant correlation with evening and average humidity Bisen *et al*. (2019) has been reported that, the population of army worm were observed increase after drought followed by heavy rains.

MATERIALS AND METHODS

The rice insect pests complex was observed under rice fields of Eastern Uttar Pradesh conditions for two consecutive years (2014 and 2015) to surveillance their incidence. The observation was surveyed in all 10 districts of 03 administrative divisions of Eastern Uttar Pradesh, *i.e*., Gorakhpur (Gorakhpur, Deoria, Kushinagar, and Maharajganj), Basti (Basti, Santkabirnagar, and Siddharthnagar) and Azamgarh (Azamgarh, Mau, and Ballia) under 03 growth stages of rice, *i.e.,* seedling, transplanting, and flowering. The samples were taken randomly for concerned districts of all 03 divisions for each growth stage of rice for consecutively two years. There was each field selected at each division per growing stages for each year. There were 5 samples collected per field at the plot size of 100 m^2. Therefore, during the entire crop period a total of 90 samples ($3 \times 3 = 9 \times 5 = 45 \times 2 = 90$) collected from 3 divisions for consecutive two years respectively. All 90 samples were converted average total of 18 samples ($3 \times 3 = 9 \times 2 = 18$) of all 03 divisions for two years. Samples were taken 03 times at interval of 20 days after sowing (20 DAS) for seedling stage, 30 days after transplanting (30 DAT) for transplanting stage and 60 DAT for flowering stage respectively. Each plot was selected 5 spots (4 in the corner at least 60 cm inside the border and one in the centre) to collect samples at 0.25m^2/spot for seedling stage and at 01 hill/spot for transplanting and flowering stage to observe abundance of insect pests and their infestation. There were also at each plot, 05 net sweeps made randomly at every 05 steps to observe abundance of insect pests for all 03 growth stages of rice. The size of sweep net were 25 cm diameter and 70 cm handle and made up of nylon. The timing of sampling was 9.30 A.M. to 12.30 P.M. respectively. Each observation was recorded abundance of insect pest species concerned to screen major insect pest species for significant damage above 10 % infestation and recognize among them most serious insect pests of rice from previous reports. The observation was also calculated correlation with meteorological factors at different rice growth stages. The meteorological recording was coordinates with Gorakhpur meteorological station concerning tutiempo and time and date web portal regarding maximum and minimum temperature, relative humidity, and rainfall of months, *i.e.,* August, September, October, and December for years, 2014 and 2015 respectively. Taxonomic identification was verified with texts of reference, *i.e*., Dale (1994); Barrion and Litsinger (1994); Pathak and Khan (1994); David and Ananthakrishnan (2004); Rice knowledge management portal (RKMP); and Subject experts respectively. The statistical inferences were verified with texts of reference, *i.e*., Chandel (1999); Dhamu and Ramamoorthy (2007); Rangaswamy, (2010).

RESULTS AND DISCUSSION

The population of rice insect pests under damaging groups were influenced by particular weather parameters, *i.e.* temperature maximum, temperature minimum, relative humidity, and rainfall. Population of different damaging groups of insect pests under different growth stages of rice were influenced by particular weather parameters accordingly. The influence of weather parameters on population of damaging groups of rice insect pests were inferenced by correlation coefficient. Of the total observed population of rice insect pests under damaging groups in all growth stages of rice under temperature maximum, temperature minimum, relative humidity, and rainfall for sum of both the years 2014 and 2015, the correlation coefficients were - 0.669, - 0.649, - 0.564, and 0.821 for stem borers; 0.859, 0.846, 0.784, and - 0.953 for leaf feeders; 0.191, 0.217, 0.321, and 0.037 for sap feeders; 0.587, 0.565, 0.474, and - 0.756 for root feeders; and 0.982, 0.977, 0.949, and - 0.999 for total population of all damaging groups respectively. The all-correlation coefficients were inferenced non-significant between damaging groups of rice insect pests and particular weather parameters in all growth stages of rice except between rainfall and total population of all damaging groups were inferenced significant.

Of the total observed population of rice insect pests under damaging groups for sum of both the years 2014 and 2015, the population of most of the damaging groups were highly increased with increasing temperature maximum, temperature minimum, and relative humidity and decreasing rainfall in seedling stage, and highly decreased with decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall, while moderately decreased with decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in transplanting and flowering stage respectively. There have been several research workers reported similar results. Our findings are in accordance to that of Pathak and Khan (1994); Shepard *et al.,* (1995); Chakraborty and Deb (2012); Prakash *et al.* (2014); Gangwar *et al.* (2015); Saini *et al*. (2015); Singh *et al.*, (2016); Krishnaiah and Varma (2018); Bisen *et al.*, (2019); Deshwal *et al*., (2019), who have been reported similar trends of results (Table 1 & Fig. 1).

Table 1: Insect Pests Population under Weather Parameters (Sum of 2014 & 15).

Influence of Insect Pests Population under Weather Parameters								
Damaging Groups	**Growth Stages of Rice**			**Weather Parameters**				
	Seedling	**Transplanting**	**Flowering**	**Correlation Coefficient**				
	34.10	32.40	30.10	Observations	**Temperature Maximum(°C)**			
	25.20	21.60	16.25			**Temperature Minimum(°C)**		
	78.70	75.85	69.40				**Relative Humidity(%)**	
	1000.60	1007.70	1011.95					**Rainfall (mm)**
Stem borers (885)	168	384	333	Population	- 0.669	- 0.649	- 0.564	0.821
Leaf feeders (3442)	3097	298	47		0.859	0.846	0.784	- 0.953
Sap feeders (4327)	1198	2042	1087		0.191	0.217	0.321	0.037
Root feeders (74)	43	10	21		0.587	0.565	0.474	- 0.756
Total (8728)	**4506**	**2734**	**1488**		**0.982**	**0.977**	**0.949**	**- 0.999 ***

***** Significant at 5% level of significance.

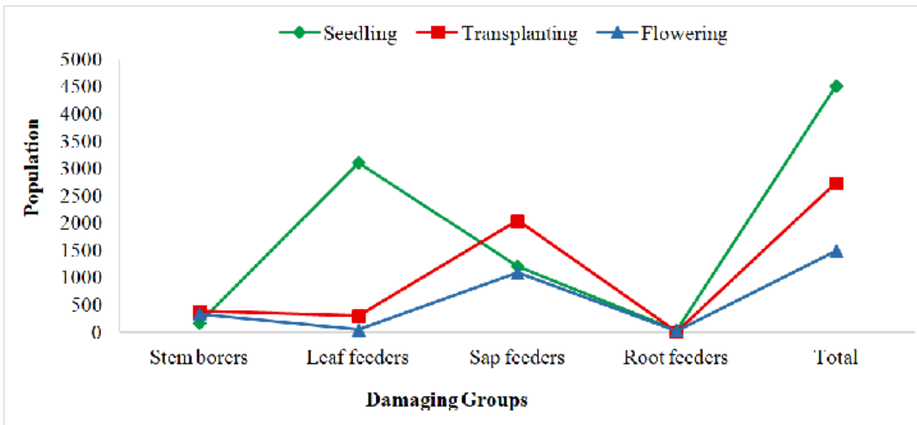

Fig. 1. Insect Pests Population under Weather Parameters (Sum of 2014 & 15).

The population of major insect pests of rice were also influenced by weather parameters. Of the total observed population of major insect pests in all growth stages of rice under temperature maximum, temperature minimum, relative humidity, and rainfall for sum of both the years 2014 and 2015, the correlation coefficients were 0.852, 0.838, 0.774, and - 0.949 for Rice cutworm (*Spodoptera mauritia* Boisduval); 0.244, 0.219, 0.113, and - 0.459 for Common termite (*Odontotermes obesus* Rambur); - 0.447, - 0.424, - 0.324, and 0.640 for Plain green leafhopper (*Nephotettix virescens* Distant); - 0.420, - 0.396, - 0.295, and 0.616 for Spotted green leafhopper (*Nephotettix nigropictus* Stal); - 0.385, -0.361, - 0.259, and 0.586 for Whitebacked planthopper (*Sogatella furcifera* Horvath); 0.086, 0.112, 0.118, and 0.143 for Rice hispa (*Dicladispa armigera* Oliver); - 0.905, - 0.916, - 0.954, and 0.785 for Rice earhead bug (*Leptocorisa acuta* Thunberg); 0.805, 0.820, 0.877, and - 0.648 for Rice grasshopper (*Hieroglyphus banian* Fabricius); - 0.758, - 0.741, - 0.665, and 0.887 for Yellow stemborer (*Scirpophaga incertulus* Walker); - 0.670, - 0.651, - 0.566, and 0.822 for Striped stemborer (*Chilo suppressalis* Walker); - 0.019, 0.007, 0.418, and 0.246 for Brown planthopper (*Nilaparvata lugens* Stal); - 0.103, - 0.077, 0.029, and 0.327 for Common rice leaffolder (*Cnaphalocrosis medinalis* Guenee) respectively. The all-correlation coefficients between major insect pests of rice and particular weather parameters in all growth stages of rice were inferenced non-significant.

Of the total observed population of major insect pests of rice for sum of both the years 2014 and 2015, the population of most of the major insect pests of rice were highly decreased with highly increasing temperature maximum, temperature minimum, and relative humidity and decreasing rainfall in seedling stage; highly increased with moderately decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in transplanting stage; and moderately decreased with highly decreasing temperature maximum, temperature minimum, and relative humidity and increasing rainfall in flowering stage, except the population of Rice cutworm (*Spodoptera mauritia* Boisduval) and Rice earhead bug (*Leptocorisa acuta* Thunberg) were highly increased under influence of weather parameters, relevance to the nursery stage and flowering stage respectively. Similar findings have also been reported by Pathak and Khan (1994); Shepard *et al.*, (1995); Chakraborty and Deb (2012); Prakash *et al.* (2014); Gangwar *et al.* (2015), Saini *et al.* (2015); Singh *et al.* (2016), Krishnaiah and Varma (2018), Bisen *et al.* (2019); Deshwal *et al*. (2019) (Table 2 & Fig. 2).

Table 2: Major Insect Pests Population under Weather Parameters (Sum of 2014 & 15).

	Influence of Major Insect Pests Population under Weather Parameters								
Sr. No.	Major Insect Pests of Rice	Growth Stages of Rice			Weather Parameters				
		Seedling	Transplanting	Flowering	Correlation Coefficient				
		34.10	32.40	30.10	Observations	Temperature Maximum(°C)			
		25.20	21.60	16.25			Temperature Minimum(°C)		
		78.70	75.85	69.40				Relative Humidity(%)	
		1000.60	1007.70	1011.95					Rainfall(mm)
1.	Rice cutworm	112	13	6	Population	0.852	0.838	0.774	- 0.949
2.	Common termite	5	2	4		0.244	0.219	0.113	- 0 .459
3.	Plain green leafhopper	0	428	224		- 0.447	- 0.424	- 0.324	0.640
4.	Spotted green leafhopper	0	654	325		- 0.420	- 0.396	- 0.295	0.616
5.	Whitebacked planthopper	0	112	52		- 0.385	- 0.361	- 0.259	0.586
6.	Rice hispa	0	27	0		0.086	0.112	0.218	0.143
7.	Rice earhead bug	0	0	389		- 0.905	- 0.916	- 0.954	0.785
8.	Rice grasshopper	26	32	3		0.805	0.820	0.877	- 0.648
9.	Yellow stemborer	78	179	168		- 0.758	- 0.741	- 0.665	0.887
10.	Striped stemborer	32	79	68		- 0.670	- 0.651	- 0.566	0.822
11.	Brown planthopper	0	382	44		- 0.019	0.007	0.418	0.246
12.	Common rice leaffolder	0	30	6		- 0.103	- 0.077	0.029	0.327

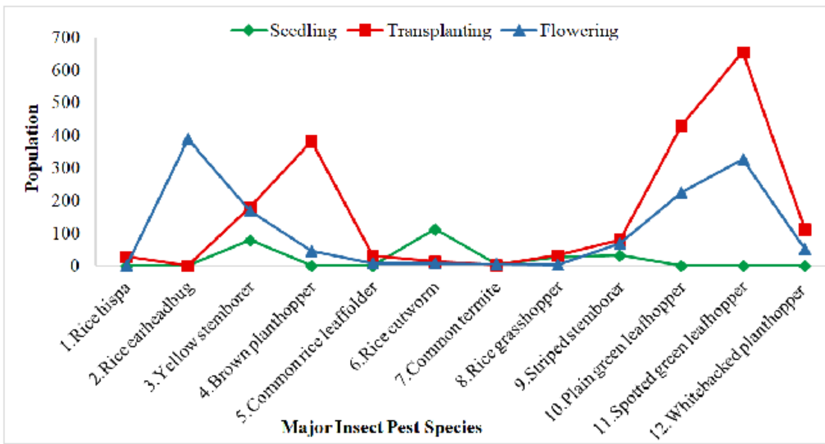

Fig. 2. Major Insect Pests Population under Weather Parameters (Sum of 2014 & 15).

CONCLUSION

The population of stem borers and leaf feeders was highly correlated with rainfall, but the stem borers were correlated positively and leaf feeders was correlated negatively. Whereas, the sum of population of damaging groups showed highly significant negative correlation with rainfall. The population of Rice cutworm (*Spodoptera mauritia* Boisduval), Yellow stemborer (*Scirpophaga incertulus* Walker), and Striped stemborer (*Chilo suppressalis* Walker) were highly correlated with rainfall where Rice cutworm was correlated negatively and the Yellow stemborer and Striped stemborer were correlated positively. Similarly, the Rice earhead bug (*Leptocorisa acuta* Thunberg) and Rice grasshopper (*Hieroglyphus banian* Fabricius) were highly correlated with temperature maximum, temperature minimum, and relative humidity, but the relationship was negative with Rice earhead bug and positive with the Rice grasshopper. The correlation between rainfall Rice earhead bug and Rice grasshopper were moderately positive and negative respectively with rainfall.

REFERENCES

Barrion, A.T., & Litsinger, J. A. (1994). Taxonomy of rice insect pests and their arthropod parasites and predators. In: *Biology and Management of Rice Insects*, E.A. Heinrichs (ed.). Wiley Eastern, New Delhi, India. pp. 13-359.

Bisen, D., Bisen, U., & Bisen, S. (2019). Studies on major insect pests of rice crop (*Oryza sativa*) at Balaghat district of Madhya Pradesh. *Journal of Entomology and Zoology Studies*, *7*(2): 625-629.

Chakraborty, K., & Deb, D. C. (2012). Incidence of rice hispa, *Dicladispa armigera* (Coleoptera: Chrysomelidae) on Kharif paddy in the agroclimatic conditions of the northern parts of West Bengal, India. *Global Journal of Science Frontier Research Biological Sciences*, *12*:7(1): 53-61.

Chakraborty, K., Moitra, M. N., Sanyal, A. K., & Rath, P. C. (2016). Important natural enemies of paddy insect pests in the Upper Gangetic plains of West Bengal, India. *International Journal of Plant, Animal and Environmental Sciences, 6*(1): 35-40.

Chandel, S. R. S. (1999). A handbook of agricultural statistics. Achal Prakashan Mandir, Kanpur, India. 547 pp.

DAC & FW (2018). Agricultural statistics at a glance 2018. Department of Agriculture, Cooperation & Farmers Welfare, Government of India, New Delhi, India. 468 pp.

Dale, D. (1994). Insect pests of the rice plant-their biology and ecology. In: *Biology and management of rice insects*, E.A. Heinrichs (ed.), Wiley Eastern, New Delhi, India. pp. 363-485.

David. B.V. and Ananthkrishnan, T.N. (2004). General and applied entomology, 2nd Edition. McGraw Hill Publication (India) Pvt. Ltd., New Delhi, India. 1184 pp.

Deshwal, R., Sachan, S. K., Singh, G., Singh, D. V., Singh, G., & Chand, P. (2019). Seasonal abundance of insect pests associated with paddy crop in western plain zone of Uttar Pradesh. *Journal of Entomology and Zoology Studies*, *7*(3): 1347-1350.

Dhamu, K. P., & Ramamoorthy, K. (2007). Statistical methods. Agrobios (India), Jodhpur, India. 359 pp.

FAOSTAT (2019). Statistical data of world rice production. In: Data. Retrieved from http://www. fao.org/faostat/en3/#data/QC (Accessed on 11 March 2019).

Gangwar, R. K., Javeria, S., Yadav, K. Tyagi, S., & Singh, R. (2015). Survey and surveillance of major insect pests of basmati rice in western Uttar Pradesh (India). *International Journal of Research in Applied, Natural and Social Sciences*, *3*(3): 1-8.

Heinrichs, E. A., & Muniappan, R. (2017). IPM for tropical crops: rice. *CAB Reviews*, *12*(30): 1-31.

Krishnaiah, K., & Varma, N. R. G. (2018). Changing insect pest scenario in the rice ecosystem- A national prospective. Retrieved from *http://rkmp.co.in* (Accessed on 2 August 2018).

Maclean, J. L., Dawe, D. C., Hardy, B., & Hettel, G. P. (2002). Importance of rice. In: *Rice almanac*, *3rd Edition- Source book for the most important economic activity on earth*, J. L. Maclean, D. C. Dawe, B. Hardy, and G. P. Hettel (eds.). *International Rice Research Institute, Manila*, Philippines. pp. 1-9.

Matteson, P. C. (2000). Insect pest management in tropical Asian irrigated rice. *Annual Review of Entomology*, *45*: 549-574.

Ooi, P.A.C., & hepard, B.M. (1994). Predators and parasitoids of rice insect pests. In: *Biology and management of rice insects*, E.A. Heinrichs (ed.), Wiley Eastern, New Delhi, India. pp. 585-612.

Pathak, H., Samal, P., & Sahid, M. (2018). Revitalizing rice systems for enhancing productivity, profitability and climate resilience. In: *Rice research for enhancing productivity, profitability and climate resilience*, H. Pathak, A.K. Nayak, M. Jena, O.N. Singh, P. Samal and S.G. Sharma (eds.). ICAR-National Rice Research Institute, Cuttack, India. pp. 1-17.

Pathak, M. D., & Khan, Z. R. (1994). Insect pests of rice. International Rice Research Institute, Manila, Philippines. 89 pp.

Prakash, A., Bentur, J. S., Prasad, M. S., Tanwar, R. K., Sharma, O. P., Bhagat, S., Sehgal, M., Singh, S. P., Singh, M., Chattopadhyay, C., Sushil, S. N., Sinha, A. K., Asre, R., Kapoor, K. S., Satyagopal, K., & Jeyakumar, P. (2014). Integrated pest management for rice. National Centre for Integrated Pest Management, New Delhi, India. 43 pp.

Prasad, R., Prabhu, S. T., & Balikai, R. A. (2010). Incidence of whitebacked planthopper on rice and its predators under rainfed ecosystem and their correlation with weather parameters. *Research Journal of Agricultural sciences*, *1*(4): 322-326.

Rangaswamy, R. (2010). A textbook of agricultural statistics, 2nd edition. New Age International (P) Limited, Publishers, New Delhi, India. 531 pp.

Rao, C.S. (2019). Ecological sustainable strategies for pest management. *Extension Digest*, *3*(1), 26 pp.

Saini, U.P., Sachan, S. K., Pratap, A., Singh, B., & Kumar, K. (2015). Insect pests associated with basmati rice in western plain zone of Uttar Pradesh, India. *Plant Archives*, *15*(2): 775-777.

Shepard, B. M., Barrion. A. T., & Litsinger, J. A. (1995). Rice-feeding insects of tropical Asia. International Rice Research Institute, Manila, Philippines. 228 pp.

Singh, K., Prasad, V., Dixit, S., & Verma, S. (2016). Pest scenario in rice in eastern Uttar Pradesh. *International Journal of Plant Protection, 9*(1): 297-300.

Sulagitti, A., Raghuraman, M., Reddy, M. S. S., & Sathua, S. K. (2017). Seasonal variation in major insect pests incidence on rice and impact of various abiotic factors on their incidence under Varanasi conditions. *Journal of Entomology and Zoology Studies*, *5*(3): 1060-1063.

Timeanddate (2019). Weather in India. Retrieved from https://www.timeanddate.com/weather/india (Accessed on 10 March 2019).

Timeanddate (2019). *Weather in India*. Retrieved from *https://www.timeanddate.com/weather/india* (Accessed on 10 March 2019).

Tutiempo (2019). *Climate India*. Retrieved from *https://www. tutiempo.net/amp-en/climate/india* (Accessed on 10 March 2019).

Viraktamath, B. C. (2013). Key research inputs and technologies production in rice production in pre and post green revolution era. In: *Innovations in rice production*, P.K, Shetty, M.R. Hedge and M. Mahadevappa (eds.). National Institute of Advanced Studies, IISc Campus, Bangalore, India. pp. 1-17.

How to cite this article: Morya, G.P. and Kumar, R. (2021). Population of Major Insect Pests of Rice Influenced Under Different Weather Parameters of Eastern Uttar Pradesh Conditions. *Biological Forum – An International Journal, 13*(4): 406-410.