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Influence of weather parameters on the incidence of natural enemies in rice ecosystem

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Abstract
A field experiment were undertaken at S. K. College of Agriculture and Research Station, Kawardha, during *Kharif* 2018 to assess the influence of weather parameters on the incidence of natural enemies *viz*., staphylinid beetle, rove beetle, earwig, ladybird beetle, ground beetle and mirid bug through light trap catches in rice ecosystem. Light trap catches were recorded at weekly interval during 27th Standard Meteorological Week (SMW) to 48th Standard Meteorological Week (SMW) and the data were correlated with the weather parameters which, indicates that September to November is the period of maximum activity of major rice natural enemies. Staphylinid beetle showed significant positive correlation with RH-II and rove beetle showed significant positive correlation with sunshine hours with r value of 0.606 and 0.563, while, staphylinid beetle showed significant negative correlation with sunshine hours and rove beetle with minimum temperature with r value of -0.448 and -0.810, respectively. Ear wig, ground beetle and mired bug showed significant positive correlation with Sunshine hours with r value 0.453, 0.491 and 0.587, respectively, however, ear wig and ground beetle showed significant negative correlation with minimum temperature with r value of -0.756 and -0.853, respectively. Rove beetle and mirid bug showed significant negative correlation with minimum temperature with r value of -0.810 and -0.853, respectively. All the recorded weather parameters (*viz* Maximum temperature, minimum temperature, rainfall, RH-I, RH-II and sunshine) and the population of predator lady bird beetle showed non-significant correlation in the light trap.

Keywords: Light trap, Weather parameters, Natural enemies, Rice

Introduction
Rice is the main food of the largest population of the World. About 90% rice in the world is grown and consumed by the population of the Asian countries. Weather parameters e.g., temperature, rainfall, humidity, sunshine hours are the key factors for development of any rice insect pests and their natural enemies. In addition, each ecosystem depends on and influences by non-living abiotic environment e.g., soil, water, climate, and micro-climate (e.g. rainfall, temperature, sunshine, radiation) etc. Climate change along with other intervention such as crop diversity, variety, irrigation, cropping intensity, fertilization/imbalance use and other management practices (e.g. indiscriminate use of insecticide) in rice production systems affect the intensity and severity of pests and natural enemies in the ecosystem. Use of light trap is one of the oldest, traditional and Indigenous technology of pest control for sustainable agriculture. Light traps are mainly used at night in the field to collect a various phototactic diversity of insects like moths, beneficial insects such as parasites and predators, coleopteran predators, Hemipteran bugs and other crop insects species etc. Light trap is an adequate indicator of the ecological effects of climate change on insects (Hufnagel *et al*., 2008) [3]. Although a lot of information is available on attracting the crop pest species in light trap, but very few reports of work done on light trap collection of natural enemies is available (Atwal *et al*. (1969) [1], De bach (1974) [2], Upadhyay *et al*. (2000) [12] and Sharma *et al*. (2010) [10]. Therefore, present study discusses the influence of abiotic parameters (temperature, rainfall, relative humidity and sunshine hours) on the incidence of natural enemies (staphylinid beetle, rove beetle, ear wig, lady bird beetle, ground beetle and mirid bug) in rice ecocsystem.

2. Materials and Methods
Present study was carried out at the research farm of S. K. College of Agriculture & Research Station, Kawardha (Kabirdham), Chhattisgarh during *kharif* 2018. Kawardha (Kabirdham) is situated in Chhattisgarh plain region and lies between 21.32 to 21.35º North latitude and 80.48 to 81.28º East longitude with an altitude of 353 meters above from the mean sea level.

During the crop growth period range of prevailing weather parameters were 29.5 to 34.4 ºC for maximum temperature and 14 to 25ºC for minimum temperature, the rainfall ranged from 0.00 to 25.8 mm, the average RH-I was 71 to 92 per cent and RH-II was 66 to 92 per cent and sunshine hours were observed 3.0 to 10.4 hours per day.

The populations of hourly overnight collections of rice natural enemies through light trap were recorded at weekly interval during the rice crop season. Daily weather data was collected from Agro-meteorological observatory of S. K. College of Agriculture & Research Station, Kawardha (Kabirdham), Chhattisgarh. The experimental field was free from insecticide sprays. Weekly average data of weather parameters and hourly catches of natural enemies were calculated from the daily collected data. The succession of major rice natural enemies was correlated with the weather parameters like Maximum temperature, Minimum temperature, rainfall, relative humidity (I & II) and sunshine hours, for the instantaneous impact of light trap catches studied on the fluctuation of natural enemies population.

3. Results and Discussion

The observation of hourly overnight catches through light trap of important rice natural enemies were recorded during 27th Standard Meteorological Week (SMW) to 48th Standard Meteorological Week (SMW) and the data were correlated with the weather parameters (Table 1 & 2 and Fig. 1).

Table 1: Observation of hourly overnight catches of rice natural enemies and weather parameters during *Kharif*-2018.

SMW	DATE	SB	RB	EW	LBB	GB	MB	Temperature (ºC)		Rainfall (mm)	RH (%)		Sunshine (Hours)
								Max.	Min.		I	II	
27	02/07/2018	5	0	0	4	0	0	30.3	23	0	92	66	5.7
28	09/07/2018	10	0	0	6	0	0	32	25	0	77	85	4.2
29	16/07/2018	10	0	0	8	0	0	34	24	25.8	92	78	0
30	23/07/2018	7	0	2	16	0	0	30.1	20	79	91	86	0
31	30/07/2018	12	0	0	13	0	0	31	23	0	92	78	3.4
32	06/08/2018	8	0	1	20	0	0	31	23	0	92	84	6
33	13/08/2018	2	2	2	104	0	0	31	25	0	78	67	0
34	20/08/2018	3	11	1	224	0	0	34	24	4.3	90	81	3
35	27/08/2018	51	51	36	372	0	0	29.5	23	10.2	88	91	0
36	03/09/2018	15	6	11	214	0	0	32	22.2	0	92	88	0
37	10/09/2018	23	10	11	174	0	0	33	24	0	92	85	4.6
38	17/09/2018	0	34	0	117	0	6	33	18	0	84	77	9.1
39	24/09/2018	0	21	21	52	2	26	34	24	0	71	72	10.1
40	01/10/2018	3	23	10	59	10	2	34.4	24	0	78	85	10.3
41	08/10/2018	16	52	18	129	10	1	35	22	0	83	92	9.7
42	15/10/2018	9	71	22	118	3	8	34	25	0	76	77	9.4
43	22/10/2018	5	9	0	121	3	0	33.5	23	0	77	77	9.5
44	29/10/2018	2	100	30	102	66	9	33	16	0	71	72	10.4
45	05/11/2018	4	166	52	137	98	9	35	20	0	73	74	10.2
46	12/11/2018	6	170	61	144	117	4	33	15	0	76	71	9.3
47	19/11/2018	2	182	74	158	141	9	33.1	15	0	88	77	9.1
48	26/11/2018	6	193	79	177	157	13	32	14	0	78	78	9.8

SB = Staphylinid beetle, RB = Rove beetle, EW = Earwig, LBB = Lady bird beetle, GB = Ground beetle, MB = Mirid bug

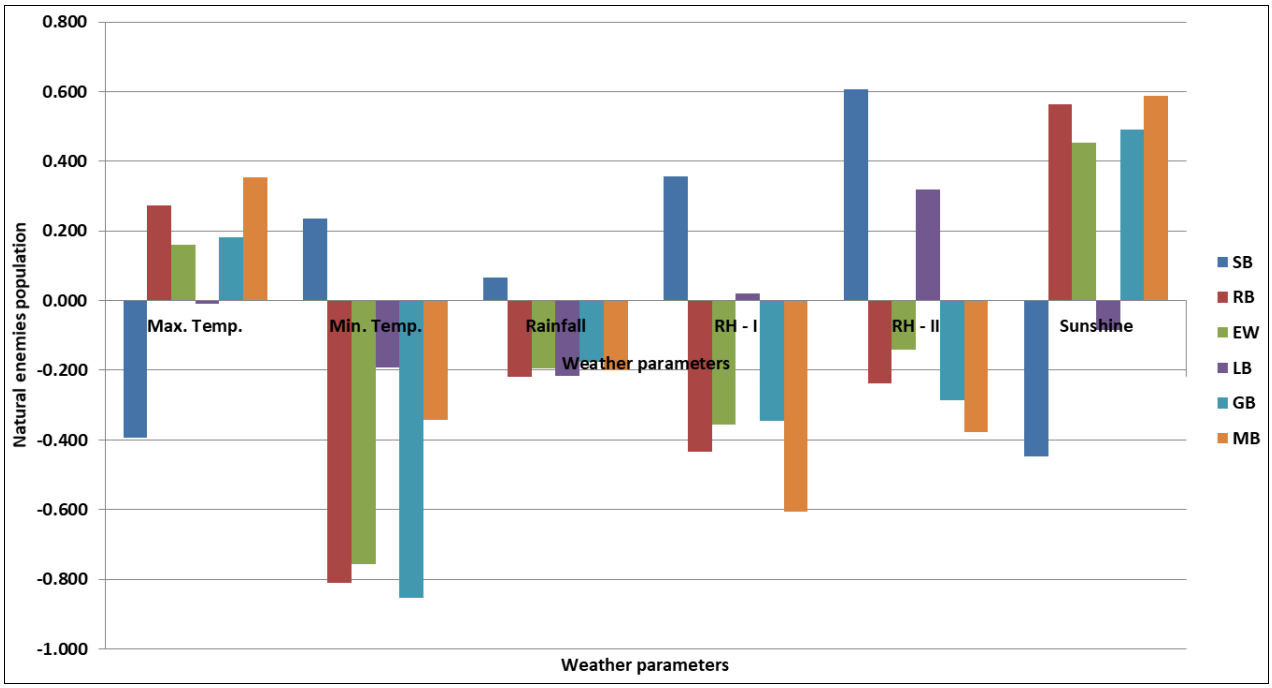

Fig 1: Correlation coefficient (r) between natural enemy's population and weather parameters

Table 2: Correlation coefficient (r) between rice natural enemies and weather parameters

Natural Enemies	Weather Parameters					
	Max. Temp. (ºC)	Min. Temp. (ºC)	Rainfall (mm)	RH – I (%)	RH – II (%)	Sunshine (hrs.)
SB	-0.393	0.236	0.066	0.356	0.606**	-0.448*
RB	0.273	-0.810**	-0.220	-0.434*	-0.239	0.563**
EW	0.159	-0.756**	-0.195	-0.357	-0.142	0.453*
LB	-0.009	-0.193	-0.217	0.019	0.320	-0.084
GB	0.183	-0.853**	-0.175	-0.346	-0.287	0.491*
MB	0.354	-0.342	-0.201	-0.606**	-0.377	0.587**

*Significant at 5% level of significance,
**Significant at 1% level of significance
SB = Staphylinid beetle, RB = Rove beetle, EW = Earwig, LBB = Lady bird beetle, GB = Ground beetle, MB = Mirid bug.

3.1 Staphylinid beetle (SB)
Highest population of Staphylinid beetle (51) was observed during 35th SMW. SB showed significant positive correlation with RH-II at 1% level of significance with r value of 0.606 while, the significant negative correlation with sunshine hours at 5% level with r value of - 0.448 were observed. Parasappa *et al*. (2017) [7] found that the population of yellow stem borer showed significantly positively correlated to Staphylinids in rice agro-ecosystem.

3.2 Rove beetle (RB)
The peak population of RB (193) was observed during 48th SMW and the second peak population(182) was observed during 47th SMW however, the natural enemy RB was not observed during 27th to 32nd SMW. RB showed significant positive correlation with sunshine hours while, minimum temperature showed significant negative correlation with RB at 1% level of significance with r value of 0.563, -0.810, respectively whereas, significant negative correlation was observed between RH-1 and RB with r value - 0.434 at 5% level. from Maharashtra was reported as RB is one of the important natural enemies of rice ecosystem. Kumar *et al.* (2008) [4] from Pantnagar amd Madhukar (2011) [5].

3.3 Earwig (EW)
Data revealed that the maximum population of natural enemy earwig was found during 48th SMW (79) followed by 47th (74) and 46th (61) SMW. The population of this natural enemy was not observed during 27th to 29th, 31st, 38th and 43rd SMW in light trap. Sunshine hours showed significant positive correlation with EW at 5% level with r value 0.453 however, minimum temperature showed significant negative correlation at 1% level of significance with r value -0.756.

3.4 Lady bird beetle (LBB)
The predator LBB population was observed throughout the crop growth season. Present findings revealed that the highest population of LBB (372) was observed during 35th SMW and lowest population (4) of this natural enemy was observed during 27th SMW. All the recorded weather parameters (*viz* Maximum temperature, minimum temperature, rainfall, RH-I, RH-II and sunshine) and the population of predator LBB showed non-significant correlation at 1% and 5% level of significance in the light trap. However, maximum temperature, minimum temperature, rainfall and sunshine hours showed negative non- significant relationship with the population of LBB.

3.5 Ground beetle (GB)
Data revealed that the highest population of GB was observed during 48th SMW and the second highest population was observed during 47th SMW. Minimum temperature showed significant negative correlation with GB at 1% level while, sunshine hours showed significant positive correlation with this natural enemy at 5% level with r value -0.853 and 0.491, respectively, Mukharjee and Khan (2017) [6] reported the highest abundance of ground beetle (28.80) at seedling stage of rice.

3.6 Mirid bug (MB)
Present investigation revealed that no population of MB was observed from 27th SMW to 39th SMW and highest population of this natural enemy (13) was observed during 48th SMW. Sunshine hours showed significant positive correlation with MB while RH-I showed significant negative correlation at 1% level with r value of 0.587 and -0.606, respectively. Maximum temp., minimum temp., rainfall and RH-II showed non-significant correlation with the population of MB. Prasad *et al.*, (2010) [8] reported that the WBPH predating mirid bug population reached maximum during the month of November. The correlation studies revealed negative and significant relationship with maximum temperature, while, positive and significant relationship with minimum temperature, morning and evening relative humidity.

References

1. Atwal AS, Choudhary JP, Ramjan M. Studies on the seasonal abundance on insects on light trap at Ludhiana J Res. Agric. Univ. 1969; (6):186-196.
2. De bach P. Biological control by Natural enemies. Cambridge University Press, 1974, 323.
3. Hufnagel *et al.* Klímaváltozás, biodiverzitás és közösségökológiai folyamatok kölcsönhatásai. In Zs. Harnos, L. Csete, (eds.). Klímaváltozás környezet – kockázat – társadalom. Budapest Szaktudás Kiadó Ház, 2008, 229-266.
4. Kumar *et al.* Biodiversity of natural enemies in paddy ecosystem and their seasonal dominance. Annals of Plant Protection Science. 2008; 16(2):381-383.
5. Madhukar FJ. A preliminary study of the predatory natural enemy complex of rice ecosystem in Vidarbha region of Maharashtra, India. International Referred Research Journal Vol. 2011; 2(22):25-27.
6. Mukherjee P, Khan MMH. Abundance of arthropod insect pests and natural enemies in rice field as influenced by rice growth stages. Bangladesh J Agril. Res. June 2017; 42(2):309-319.
7. Parasappa HH, Narasa RG, Neelakanth D. Rice insect pests and their natural enemies complex in different rice ecosystem of Cauvery command areas of Karnataka, India. Journal of Entomology and Zoology Studies. 2017; 5(5):335-338.

8. Prasad R, Prabhu ST, Balikai RA. Incidence of White Backed Planthopper on Rice and its Predators under Rainfed Ecosystems an their Correlation with Weather Parameters. Research Journal of Agricultural Sciences. 2010; 1(4):322-326.
9. Samanta *et al.* Pest surveillance in lcc and non-lcc rice plots by participatory rural folk appraisal. The Ecoscan. 2014; 8(3-4):211-213.
10. Sharma AK, Barche S, Mishra PK. Pest and predatory insect species inhabiting paddy ecosystem in Jabalpur, Madhya Pradesh collected with the help of light traps. Pest Manag. Econ. Zool. 2010; 18(12):125-133.
11. Singh *et al.* Taxonomic analysis of phototactic beneficial insects as biocontrol agents (Predators and parasites) collected in light trap in rice ecosystem at Jabalpur. Journal of Entomology and Zoology Studies. 2018; 6(3):850-853.
12. Upadhyay RN, Dubey OP, Vaishampayan SM. Studies on the common predatory and parasitic species of insects collected on light trap. JNKVV Res. J. 2000; 33(1/2):50-57.