Journal of Agriculture and Natural Resources (2019) 2(1): 238-243
ISSN: 2661-6270 (Print), ISSN: 2661-6289 (Online)
DOI: https://doi.org/10.3126/janr.v2i1.26081

Research Article

Diversity and abundance of insect pest of low land rice field in Lamahi, Dang district of Nepal

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Received: August 05; Accepted: October 12; Published: October 25, 2019

ABSTRACT

A study on diversity and abundance of insects in rice field was conducted at farmer field of Lamahi, Dang during July to October in 2019. Insects were collected using sweep net and light trap. Overall, 414 insect specimen representing 11 families and 8 orders were collected during the period. Grasshopper (23.98%) with including all species was the most abundance insect found in rice field as it followed by brown plant hopper (16.62%). Among the eight insect orders captured Orthoptera (29.16%) was the most abundance insect order followed by Homoptera (16.62%). As the diversity of insect pest in this area may responsible economic losses was found which will be useful to adapt appropriate management practices to keep them at normal area. The presence of natural enemies should conserve to enhance the natural biological control of insect pests.

Keywords: Low Land Rice, Insect, diversity, Abundance

Correct citation: Gyawali A., Regmi, B., Pudasaini, R., & Acharya, N. (2019). Diversity and abundance of insect pest of low land rice field in Lamahi, Dang .*Journal of Agriculture and Natural Resources*, *2*(1), 238-243. DOI: https://doi.org/10.3126/janr.v2i1.26081

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INTRODUCTION

Rice (*Oryza sativa* L.) is the one of the staple food for one third of the world population after maize and wheat. It is widely grown in tropical and subtropical regions. Nepal is rich in rice diversity and more than 1, 700 rice landraces are reported in Nepal growing from 60 to 3050 m altitude (Mallick, 1981; Adhikari *et al.,* 2018). Rice occupies first position in terms of area, production and productivity with net area of cultivation 15, 52,469 ha, production 52, 30,327 metric ton (t) and productivity 3.369 t/ha respectively in Nepal (MOAD, 2017). Cultivation of rice is practiced in about 46% cereal cultivated area and accounts for 55% of production share in Nepal (CBS, 2011). Agriculture contributes 27.03% to national GDP in FY 2017/18 in Nepal, while rice alone contributes to 20.75% to AGDP in Nepal (MOAD, 2016). Rice only accounts for more than 50% of the total calories of Nepalese people (Kharel *et al*., 2018: Gadal *et al*., 2019). To feed ever increasing population, rice production in Nepal has to be increased over 6.0 million tons by 2020 to meet the growing demand of ever increasing population (Kharel *et al*., 2018). Insects are major constraint to rice production. The insect pest infestation is one of the major limiting factors on rice production. Most of the rice plant parts are vulnerable to insect feeding from the time of sowing till harvesting. The rice plant is subject to attack by more than 100 species of insects; 20 of them can cause economic damage (Pathak & Khan, 1994). Warm and humid environment make congenial condition for proliferation of different species of insect pest in rice field (Edirisinghe & Bambaradeniya, 2006; Pathak & Khan, 1994). Additionally heavily fertilized, high tillering, variety of growth stages in short time period favour the build-up of pest populations. As a result of that average rice yield loss due to various insect pests was estimated to be 31.5% in Asia and 21 % in North and Central America (Pathak & Khan, 1994). Farmers in Lamjung, Nepal also reported as the insect pest are the serious constraint in rice production with rice gundi bug followed by yellow stem borer as the major devastating insects in standing crop (Adhikari *et al*., 2018). Since the introduction of high-yielding varieties, distinct changes have occurred in the insect pest complex of rice in Asia. Several species, which once were considered minor pests, are now considered major. To apply appropriate control measure for insect pest in rice field it is necessary to assess the diversity of insect pest in field. But there is no any study in present study areas or similar weather condition. Hence, this study was conducted to assess the abundance and diversity of insect pests and natural enemies in low land rice habitats and to gather information in order to develop elements of an integrated control program against insect pests of rice for use by the farmers in the local cropping system.

MATERIALS AND METHODS

Experimental location

The experiment was conducted in farmer field in Lamahi Municipality, Ward No. 2, Dang district, province 5 during July to October, 2018. Geographically, it is located at 27.8771° N, 82.5727° E, with 250 masl. The experimental location lies in Terai region and is situated in the sub-tropical climatic zone of Nepal. The area has sub- humid type of weather condition with cold winter, hot summer and distinct rainy season (Bartaula *et al.*, 2019). The experiment was conducted at farmer field of Lamahi, Dang during July to October in 2019.

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Setting of light trap

Light trap with a 100W filament bulb was installed at the site for trapping nocturnal insects. It was installed after 20 days of rice seedlings transplanting which was operated from dusk (6 pm) of previous day to dawn (6 AM) of next day. It was installed in about middle of field, standing alone without any provision for shade. Light trap was operated once in a week and altogether twelve data were taken throughout the study period. The bulb was switched on at night and trapped insects were observed early in the morning. All the collected insects were killed using formalin, kept in plastic container and brought back to laboratory for identification and counting.

Sweep net

The swept net was swung about 180^0 arc 10 sweeps in one time and trapped insect was collected and used for further study. Each 180^0 arc was considered as a sweep. The swept net sampling was done three times a day at 8:00 am in the morning, 12 noon in afternoon and 4:00 pm in the evening. All the collected insects were killed using formalin, kept in plastic container and brought back to laboratory for identification and counting.

Insect identification

Collected insects were identified by using dichotomous key observed in microscope. Similarly; references available in web were also used to identify them.

RESULTS AND DISCUSSION

Insect captured in swept net

Highest number of Grasshoppers (40%) was tapped in sweep net followed by Dragonflies (25%) and least honeybee (2%) during day as shown in Figure 1.

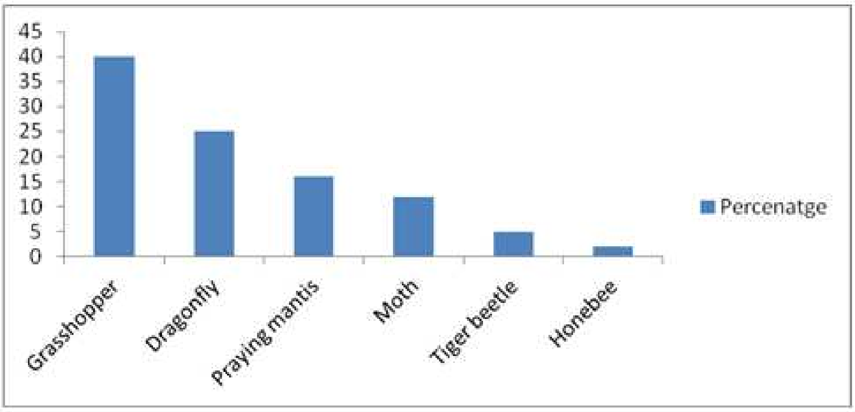

Figure 1.Trapped insects in swept net during day in rice field at Lamahi, Dang, 2018

Insect captured in light trap

According to the Figure 2 highest number of insects trapped was Brown plant hopper (23%) followed by different species of moth (22%), grasshopper (17%).

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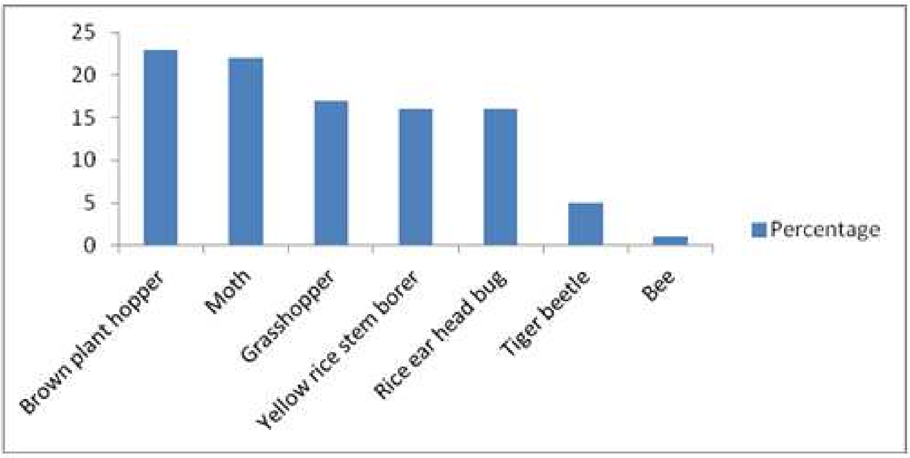

Figure 2. Trapped insect in light trap in rice field at Lamhi, Dang, 2018

Relative Abundance of Insects

As presented in Table 1, Grasshopper (23.98%) with including all species was the most abundance insect found in rice field as it followed by brown plant hopper (16.62) and different species of moth (11.62%). Among the eight insect orders captured Orthoptera (29.16%) was the most abundance insect order followed by Homoptera (16.62%), Lepidoptera (15.25%), Hemiptera (14.53%), Odonata (11.42%) Dictyoptera (7.00%), Coleoptera (4.58%) and least Hymenoptera (1.44%). Overall, 414 insect specimen representing 11 families and 8 orders were collected during the period.

Table 1. Relative abundance of insect recorded on rice field in Lamahi, Dang, 2018

S. N.	Common Name	Scientific Name	Family	Order	Relative abundance (%)
1	Grasshopper	*Hieroglyphus* sps	Acrididae	Orthoptera	21.36
2	Brown plant hopper	*Nilaparvata lugens*	Delphhacidae	Homoptera	16.62
3	Moth	*Cnaphalocrocis medinalis*	Pyralidae	Lepidoptera	11.62
4	Dragonfly			Odonata	11.42
5	Rice ear head bug	*Leptocorisa oratorius*	Alydidae	Hemiptera	7.8
6	Praying mantis	*Mantis religiosa*	Mantidae	Dictaoptera	7.0
7	Tiger beetle	*Cicindela sps*	Carabidae	Coleoptera	4.58
8	Leaf hopper		Cicadellidae	Hemiptera	3.63
9	Yellow stem borer	*Scirpophaga incertula*	Pyralidae	Lepidoptera	3.63
10	Stink bug	*Halyomorpha halys*	Pentatomidae	Hemiptera	3.1
11	Field Cricket	*Gryllus bimaculatus*	Gryllidae	Orthoptera	2.6
12	Grasshopper	*Oxya* spp	Acrididae	Orthoptera	2.6
13	Mole Cricket	*Gryllatalpa Africana*	Gryllatalpidae	Orthoptera	2.6
14	Honeybee	*Apis mellifera*	Apidae	Hymenoptera	1.44
	Total			100	100

Beneficial Harmful insect Ratio

According to the Figure 3, the less number of beneficial insect were recorded as 24.44 % as compared to 75.56% to harmful insects study rice field.

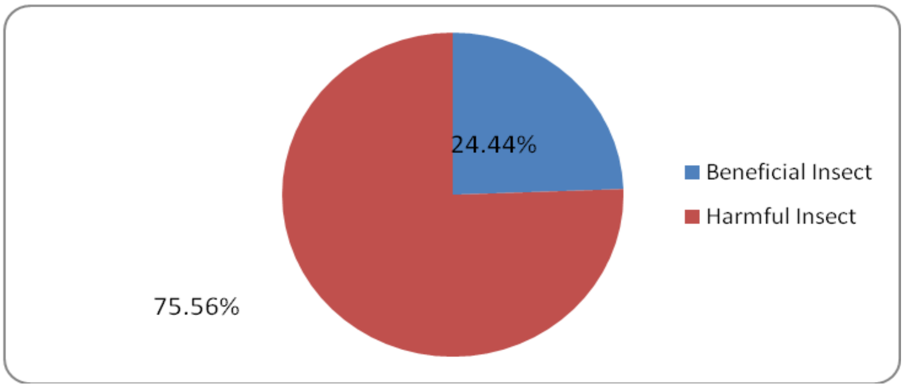

Figure 3. Ratio of beneficial and harmful insects recorded at Lamahi, Dang, 2018

Nasiruddin and Roy (2012) reported that Hemiptera as the most abundance order followed by Orthoptera, Lepidoptera and Coleoptera where as in this present study Orthoptera was the most abundance order. This may be due to climatic and geographical variation in these two study areas. Basmati Rice ecosystems in India also reported predators of rice pests included dragonfly, and praying mantis (Ane & Hussain, 2016) and our finding also report dragonfly as most abundance predator of rice. Similarly, 49 phytophagous and 34 predators insect were reported in China (Zhang *et al.*, 2013) which is similar to our finding as more number of pests as 75.56% followed by less predators as 24.44%. A report in Bangladesh was reported 13 insect families with 30 genera (Nasiruddin & Roy, 2012) and present study found that 11 families with 13 genera. A study in China reported Orthoptera, Lepidoptera, Hemiptera, Coleoptera insect order as most abundance order according to Chen *et al.* (2011) which is similar to present findings. Uttar Pradesh, India also reported grasshoppers as most abundance insect found in rice field (Ane & Hussian, 2016). Present finding is supported by research report presented by Singh *et al.* (2014) in India as the major insect pest of rice field were Grasshopper, mole cricket, stem borers, hopper complex, rice ear head bug.

CONCLUSION

Greatest diversity of rice insect pests was seen rice field. Grasshopper and Brown plant hopper was more abundant insect in rice field. As the diversity of insect pest in this area may responsible economic losses was found which will be useful to adapt appropriate management practices to keep them at normal area. The presence of natural enemies should conserve to enhance the natural biological control of insect pests.

ACKNOWLEDGEMENT

The authors are grateful to Prithu Technical College, Dang for providing every support during experiments period.

Authors contributions

B Regmi and A Gyawali designed and performed the experiments analyzed data and wrote the paper. R Pudasaini and N. Acharya helped in data recording of the experiments.

Conflict of interest

The authors declare no conflicts of interest regarding publication of this manuscript.

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