Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 20(3), September-December, 2022]

Pantnagar Journal of Research

(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)

G.B. Pant University of Agriculture & Technology, Pantnagar

PANTNAGAR JOURNAL OF RESEARCH

Vol. 20(3) September-December, 2022

CONTENTS

Major insect pest abundance diversity in the Nainital foothill rice Agro-ecosystem

SHIVENDRA NATH TIWARI* and PRAMOD MALL

Department of Entomology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar-263145 (U.S. Nagar Uttarakhand)
**Corresponding author's email id: snt.chandan@gmail.com*

ABSTRACT: A field trial was conducted for the study of insect pests and associated natural enemies in foothill basmati rice during the *kharif* season of 2020 and 2021 at Kotabagh Block in Nainital District, Uttarakhand. Eleven insect species belonging to six different orders, including Homoptera (white-backed plant hopper, green leaf hopper and brown plant hopper), Lepidoptera (leaf folder, yellow stem borer), Coleoptera (rice hispa), Orthoptera and Hemiptera (heteroptera) rice gundhi bug and rice grass-hopper were revealed during the study period to be associated with basmati rice in this Kotabagh block District Nainital, Uttarakhand region. Coccinellids, Hemipterans, Coleopterans, damsel flies, dragon flies and carabid beetles were identified as natural enemies in the rice agro-ecosystem.

Key words: Basmati rice, foot hill region, insect pests, Lepidopterans, natural enemies

Rice is typically cultivated widely all over the world since it is the main cash crop and the staple food crop for more than half of the global population, prominently in eastern countries. Major producers of rice include China, India, Thailand, Bangladesh, Pakistan, USA, Philippines, Korea, Indonesia and Vietnam. China and India produce half of the world's rice (Wasim, 2002). The area under rice cultivation has increased to 158 ha, with 90% of the crop produced in developing nations (Poolprasert and Jongjitvimol, 2014).

Other species have always found rice fields to be particularly alluring because to the enormous area of land that is covered in vegetation, warm and humid climate, tropical and dynamic environment and the variety of growth phases that occur promptly (Edirisinghe and Bambaradeniya, 2010). It is inhabited by a variety of invertebrate species that live in rice ecosystems' soil, water and vegetation areas. The majority of the soil inhabiting arthropod community consists of spiders and insects. Rice pest natural enemies as well as non-rice pest Terrestrial arthropod insects are the only insects that enter rice habitats for other purposes (Thongphak *et al*., 2012). Worldwide, more than 800 different species of scurvy critters have been identified in rice biological systems (Ehrlich, 1992). Our nation's basmati rice is grown in the States of Uttarakhand, Punjab, Uttar Pradesh, Haryana and Jammu and Kashmir. The attack of numerous insect pests severely deducts the yield and quality of the basmati rice crop. From the time rice crop was planted in the nursery until it was harvested, as many 100 species of insects have reportedly attacked the crop. In different rice ecosystems, the estimated average yield loss from insect pests is about 25% (Saini *et al*., 2015).

The biodiversity productivity hypothesis states that biodiversity is essential to sustaining sustainable agronomic systems. Conserving diversity in agricultural systems is essential for achieving fruitful results. Threats to the biodiversity connected to the rice farming system include monoculture, poor farming methods, grazing and excessive use of pesticides, etc. (Muhammad *et al*., 2013).

The study has been taken as there is vast forest and agriculture area which makes this prone area for the abundance diversity of different insects.

MATERIALS AND METHODS

The current study was carried out in the *kharif* of 2020 and 2021 on a farmer's field in Bhatlani village, Kotabagh block, district Nainital, Uttarakhand. After transplanting until crop harvest, the natural enemies of the rice insect pest were monitored at weekly interval. Three locations from each 6 plot were

chosen at random for observations and sampling. Arthropods were collected through Arial net, yellow pan trap & aspirator and bring in Bee disease Diagnostic laboratory in Department of Entomology, College of Agriculture, G. B. pant University of Agriculture & Technology Pantnagar to categorized and identification (Khan, 2013). To evaluate the economic status of the pest, the type and degree of damage caused by different insect pests was also documented.

RESULTS AND DISCUSSION

Ten insect species from six different orders and nine distinct families were identified on basmati rice over the course of this experiment. Yellow stem borer (*Scirpophaga incertulas* Walker) and brown plant hopper (*Nilaparvata lugens* Stal.), kharif grasshopper (*Hieroglyphus banian* Fab) were found as major pests. Leaf folder (*Cnaphalocrocis medinalis* Guenee), rice gundhi bug (*Leptocorisa acuta* Thunb) and white backed plant hopper (*Sogatella furcifera* Horvath) were found moderately damaging the crop. Whorl Maggot *Hydrellia prosternalis*, rice hispa *Dicladispa armigera,* rice gall midge *Orseolia oryzae* are less significant, and the damage's scope resulted in less loss of revenue (Table 1).

The most dangerous and prominent insect pest of rice crops in the area was found to be the yellow stem borer, *Scirpophaga incertulas* Walker (Pyralidae: Lepidoptera). Early July marks the first appearance of this pest, which is present the entire crop season. The central shoot's "dead heart" during the stage of vegetation and "white ear head" during the stage of reproduction both perished as a result of damage by larvae of the insect, feeding internally in the stem from the growing point. The result was chaffy grains. It was simple to get rid of the damaged plants. Between the start of July and the end of September, this pest significantly harmed the environment. Damage to rice crops caused by yellow stem borer has also been documented by Patil (2004). Leaf folder, *Canaphalocrocis medinalis* Guenee (Pyralidae: Lepidoptera), It used to be considered a minor pest of foliage-eating insects, but today it is recognised as a serious crop pest of basmati rice from the month of August to September. The larvae in their first instar stage ended up eating fragile, unfolded leaves. The second instar larvae adhere to the longitudinal expansion of the leaves for accommodation and gorge themselves on green foliage, producing papery, dried leaves. Feeding significantly reduced an infested plant's overall vigour and photosynthetic ability.

The occurrence of the green leaf hopper, *Nephotettix virescens* (Cicadellidae: Homoptera), whose nymphs and adults sucked plant sap from the plant's leaves and delicate portions and were most noticeable between August and September when their colour began to change yellow. They might also spread a virus to the plant. It was determined that this insect is a minor pest in this area.

Another prominent pest is brown plant hopper, *Nilaparvata lugens* Stal. (Delphacidae: Homoptera). Between the middle of August and the last week of September, it was found to be infested. Plants turn yellow and dry up quickly as a result of feeding by both nymphs and adults at the base of the tillers. Early infestation rounds produced yellow patches, which quickly turned brownish as the plants dried out. Hopper burn is the term used to describe this. In serious cases, the crop became entirely disoriented.

The white-backed plant hopper, *Sogatella furcifera* Horvath (Delphacidae: Homoptera), observed as a minor pest in this area from mid of August and the last week of September. It turned tender leaves yellow by sucking the sap out of them. Mold grows on the honeydew the hoppers produce, which acts as a food source. Rice crops have reportedly been harmed by brown plant hopper, green hopper and white backed plant hopper, according to several workers Deshwal *et al*. (2019) and Verma *et al*. (2021).

Rice gundhi bug, *Leptocorisa actua* thumb. (Coreidae: Hetroptera) has been identified being a significant pest infesting rice of Kotabagh region. Adults as well as the nymphs drained the sap from the grains while they were in the milky stage, turning

Table 1: Insects that affected basmati rice (kharif 2020-21)

Common Name	Scientific name	Family	Order	Destructive stage of crop pest	Severity of the pest
Whorl Maggot	*Hydrellia philippina* (Ferino)	Ephydridae	Diptera	Larva	Low
Yellow Stem borer	*Scirpophaga incertulas* (Walker)	Crambidae	Lepidoptera	Larva	Severe
Brown Planthopper	*Nilaparvata lugens* (Stal.)	Delphacidae	Homoptera	Nymph and adult	Severe
White backed plant hopper	*Sogatella furcifera* (Horvath)	Delphacidae	Hemiptera	Nymph and adult	Moderate
Short horned grasshopper	*Hieroglyphus banian* (Fab.)	Acrididae	Orthoptera	Nymph and adult	Severe
Long horned grasshopper	Tettigoniidae spp	Tettigoniidae	Orthoptera	Nymph and adult	Moderate
Rice Gundhi Bug	*Leptocorisa acuta* (Thumb.)	Alydidae	Hemiptera	Nymph and adult	Moderate
Rice hispa	*Dicladispa armigera* (Oliver)	Chrysomelidae	Coleoptera	Grub and adult	Low
Gall midge	*Orseolia oryzae* (Wood-mesion)	Cecidomyiidae	Diptera	Maggot and adult	Low
Termite	*Odontotermes obesus* Romb	Termitidae	Isoptera	Adult	Low

Table 2: Natural enemies of crop pest of basmati rice (2021-21)

Scientific name	Family	Order	Host
Cerigrion sp.	Conagrionidae	Odonata	Common predator
Apanteles sp.	Braconidae	Hymenoptera	Larval and pupal
Lycosa pseudoannulata	Lycosidae	Arachnida	General predator
Cyrtorhinus lividipennis	Miridae	Hemiptera	Nymphal and adult parasitoids
Coccinella transversalis	Coccinellidae	Coleoptera	Common predator
Coccinella septempunctata	Coccinellidae	Coleoptera	Common predator
Anisoptera sp.	Anisoptera	Odonata	
Trichogramma japonicum	Trichogrammatidae	Hymenoptera	Egg parasitoids

them into chaffy grains. Under severe infestation, the panicle's entire colour changes to white. It occurred between September and October, according to records (Adhikari *et al*., 2021).

A polyphagous social insect known as a termite, *Odontotermes obesus* Romb (Termitidae: Isoptera), this insect caused harm to the crop by consuming roots. Leaving the sprouting shoots wilted, perished and damaged. The injured plants in the plant groove were easy to remove. Throughout the crop season, this pest's prevalence was seen. Such manner of effect has earlier observed on different crop by Behera *et al*. (2013).

Rice Grasshopper, *Hieroglyphus banian* Fab. (Acrididae: Orthoptera) were earlier reported in this area attacking basmati rice. They were active all through the growing season. Both grasshopper nymphs and adults consumed leaves by poking holes in them. Nymphs and adults completely consume the leaves in cases of severe infestation, only leaving the stalk and the midrib behind. Pest grasshopper of the polyphagous species have earlier been documented by Gangwar *et al*. (2015) on paddy crop. The mirids and spiders were the eminent natural enemies whereas spiders and Odonata were recognised as general predators of rice insect pest. The population of dragonflies among the Odonata was higher than that of damselflies. Mirid bugs, *Cytorhinus lividipennis* (Reuter) were observed as effective predators of the white-backed plant hopper and the brown plant hopper.

Coccinellides were also observed on the ridges of flowering plants and in rice fields also. The specimens that were gathered were classified as predatory. Other significant natural adversaries of rice pest insects include parasitoids, which are members of the hymenoptera order. The parasitoids found among the documented hymenopterans were classified as Trichogrammatidae species, Ichneumonidae species, and Braconideae (leaf folder's larval and pupal parasitoids) (Table 2), similar observations were documented by Gangwar *et al.* (2015) and Patil (2004). Predators such dragonflies, damselflies, spiders, mirid bugs, coccinellids, cicindellids and carabids were

consistently seen during the whole crop-growing season in the current research. However, during in the vegetative stage of the crop dragonflies, spiders, damselflies, and coccinellids were more prevalent, whereas coccinellids and mirids were more prevalent during the reproductive stage of the rice crop. It is known that the populations of all known predators and their prey are directly related. These observations are also reported by Parasappa *et al*. (2017).

CONCLUSION

This research identified several insect species that are associated to the rice crop, indicating a possible threat to rice production. However, the habitat around rice has also been home to several natural enemy species, including parasitoids and predators. The population of their prey is known to be closely correlated with every observed predator. According to this, significant biological control agents may be used to manage the main insect pest of rice.

REFERENCES

Adhikari, B., Bhusal, P., Kafle, K. and KC, R. (2021). Effects of different weather parameters on insect pest incidence in paddy in Sundarbazar Lamjung. *TAEC*, 2(2): 82-86.

Behera, K. S., Jena, M., Dhua, U. and Prakash, A. (2013). Emerging insect pests and diseases of rice under various rice ecosystems. *Innovations in Rice Production*, 93-103.

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

Edirisinghe, J. P. and Bambaradeniya, C. N. (2010). Rice fields: an ecosystem rich in biodiversity. *Journal of the National Science Foundation of Sri Lanka*, 34(2):57-59.

Ehrlich, P. R. (1992). Population biology of checkerspot butterflies and the preservation of global biodiversity. *Oikos*, 6-12.

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

Khan, M. M. H. (2013). Abundance and diversity of insect pests and natural enemies in coastal rice habitat. *Bangladesh Journal of Entomology*, 23(1):89-104.

Muhammad, A., Muhammad, A., Muhammad, F., Anju m, S. and Arshad, M. S. (2013). A survey of rice farmersâ€™ farming practices posing threats to insect biodiversity of rice crop in the Punjab, Pakistan. *International Journal of Biodiversity and Conservation*, 5(10): 647-654.

Parasappa, H. H. (2017). Rice insect pests and their natural enemies complex in different rice ecosystem of Cauvery command areas of Karnataka. *Journal of Entomology and Zoology Studies*, 5(5): 335-338.

Patil, B. V. (2004). Insect pest fauna to rice in Tungabhadra Project area of Karnataka, during kharif season. *Karnataka Journal of Agricultural Sciences*, 17(3):580-581.

Poolprasert, P. and Jongjitvimol, T. (2014). Arthropod communities inhabiting organic rice agroecosystem. *Measurement*, 29(30): 1-5.

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

Thongphak, D. U. A. N. G. R. A. T., Promdeesan, K. H. W. U. N. C. H. A. N. O. K. and Hanlaoedrit, C. H. O. N. L. A. D. A. (2012). Diversity and community structure of terrestrial invertebrates in an irrigated rice ecosystem. *International Journal of Environmental and Rural Development*, 3(1): 68-71.

Verma, A. P., Singh, H., Singh, G., Singh, D. V., Singh, R. and Tomar, A. (2021). Influence of weather parameters on population dynamics of major insect pests of basmati rice. *J. Exp. Zool. India,* 24: 1275-1280.

DoID: https://connectjournals.com/03895.2021.24.1275

Wasim, M. P. (2002). A study of rice in the major growing countries of the world: their growth instability and world share. *Pakistan Economic and Social Review*, 153-183.

Received: October 11, 2022
Accepted: December 7, 2022