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STATUS OF EGG PARASITISATION OF BROWN PLANTHOPPER *NILAPARVATA LUGENS* (STAL) IN RICE DIFFERENTIAL VARIETIES, CARRYING DIFFERENT BPH RESISTANCE GENE

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ABSTRACT

The present investigation entitled "Status of egg parasitisation of brown planthopper *Nilaparvatalugens* (Stal) in ricedifferential varieties, carrying different BPH resistance gene."Was carried out in the Glass House, Department of Entomology, College of Agriculture, IGKV, Raipur (C.G.) during 2013-2014.The functional responses of *Anagrus* sp. and *Oligosita* sp., egg parasitoids of the brown planthopper, *Nilaparvata lugens*, were studied under the laboratory conditions. The egg parasitisation was observed for set of twenty rice differentials, *Anagrus*sp., *Oligosita*sp. were found present in the bph egg mass. Level of eggparasiti sationvaried from 0 % to 89.48 %. Maximum egg parasitisation was observed in genotype Ptb 33 (89.48%) by *Anagrus*sp., *Oligosita*sp. Secondmaximum egg parasitisation was observed in Rathu Heenati (ACC 11730) (83.88%), followed by RP 2068-18-3-5 (52.95%) and Swarnalatha (ACC 33964) (48.55%). The minimum egg parasitisation was observed in TN1 (PHSS10) which was3.94% mostly by *Anagrus*sp.

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INTRODUCTION

Rice is one of the important cereal crops of the world and forms the staple food formore than 50 per cent of population. Even though, there are many constraints inrice production, insects, pests remain a constant problem in all the rice growing regions (ManikandanNarayanasamy *et al.,* 2014). Rice is the dominant staple food in Asia. About 175 species of insect feed on rice only 20 are considering as major pests including Brown Planthopper (BPH). The Brown Planthopper (BPH) *Nilaparvata lugens* (Stal) has become a number one threat to tropical rice production in many parts of Asia in the last three decades.In most cases, the numerous predators, egg and nymphalparasitoids, pathogens and nematodes can maintain BPH populations below damaging densities (Kenmore *et al.*, 1984). Attempts to control brown planthopper with chemical pesticides have given rise to many problems, including elimination of natural predators,environmental pollution, resurgence and outbreak (Balakrishna and Satyanarayana, 2013). Biological control, complemented by host plant resistance, is now seen as the basis of management of BPH (Way and Heong, 1994). IPM programmes emphasize that the routine use of insecticides should be avoided (Gallagher *et al.*, 1994). Wide-scale observations of low populations of BPH in farmer's fields, even with BPH-susceptible rice, suggest that more emphasis be put on biological control (Way and Heong, 1994; Schoenly *et al.*, 1996).

Several natural enemies havebeen listed attacking the various stagesof brown planthopper (BPH), *Nilaparvata lugens*, a serious pest of rice. Amongst the egg parasitoids, the mymarid, *Anagrus* sp. and the trichogrammaid, *Oligosita* sp. were common species found (Tan, 1981).The brown planthopper (BPH) [*Nilaparvata lugens* (Stal) (Hemiptera: Delphacidae)] is a typical piercing-sucking insect pest of rice (*Oryza sativa* L.; Poaceae), which feeds on phloem sap and thus affects the growth of rice and results in 'hopperburn' in rice fields (Watanabe and Kitagawa, 2000). Furthermore, BPH also transmits viruses, such as the ragged stunt virus and grassy stunt virus, and associated diseases to rice plants (Khush and Brar, 1991; Jena *et al.*,2006). Outbreaks of BPH are very frequent in tropical Asia and have caused heavy rice yield losses in recent years (Normile, 2008). To control this pest, the application of chemical insecticides has not been a satisfactory tactic in practical rice production, because insecticides can cause BPH resurgence and may play a major role in inducing outbreaks (Heinrichs *et al.*, 1982; Tanaka *et al.*, 2000).

Egg parasitoid has been reported at significant levels in various rice growing region. Claridge *et al.* (1999) monitoring the field parasitism of BPH eggs by wasp of the genera *Anagrus* (Mymaridae) and *Oligosita* (Trichogrammatidae) over 6-year period and their technique was to place rice plants previously infested with BPH eggs in the field for 5 days. Their result show that eggs parasitism varied between 29% to 91%. Mortality of BPH eggs in plant collected in field in the Philippines varied between 21 and 42% (Kenmore *et al.*, 1984) and in Sri Lanka egg parasitism varying from 0% to 54% (Fowler *et al.*,1991).The study of egg parasitoids of rice hoppers is made difficult by the extremely small sized of the parasitoids and by the nature of hopper oviposition. The delicate host eggs are inserted inside the plant material and cannot be identified or counted without dissection of the rice plant.

Complete dissection of the plants allowed us to determine the status of the egg parasitisation in different donar differentials.Egg parasitism has the potential to play an important role in the control of BPH population.

MATERIALS AND METHODS

The experiment was carried out in the Glass House, Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during 2013-2014. PHSS (Planthopper Special Screening) entries provided by DRR under AICRIP programme were tested (table no.1). A parasitoid is an organism that feeds on a single host organism. Parasitoids of rice insect pests are insects, which are parasitic only in their immature stages. The adult parasitoid is usually free living and may feed on nectar, honeydew, or body fluids of the host insect. In the life cycle of a typical egg parasitoid, the egg, larva, and pupa stages are spent inside the host egg. The adult parasitoid emerges from the host egg and mates, and then the female parasitoid lays eggs inside other host egg. The study of egg parasitoids of rice hoppers is made difficult by the extremely small sized of the parasitoids and by the nature of hopper oviposition. The delicate host eggs are inserted inside the plant material and cannot be identified or counted without dissection of the rice plant. Complete dissection of the plants allowed us to determine the status of the egg parasitisation in different donar differentials. Studies on egg parasites were carried out using individual rice seedling (40-45 days old). Two gravid females of BPH were confined to individual rice seedlings of twenty varieties of Plant hopper Special Screening trial (PHSS) for 24 hrs. for oviposition. After 9 to 10 days plants were dissected to count numbers of egg parasites. Oviposited stalks/stems have a whitish patch from which they can be identified. Cut stems and dissect them under a microscope for observing parasitized eggs. Unparasitised eggs are creamy white while parasitised eggs are lemon yellow or orange red in colour based on the species of parasitoid.

RESULTS AND DISCUSSION

The egg parasitisation was observed for set of twenty rice differentials, *Anagru* sp., *Oligosita* sp. were found present in the bph egg mass. Level of egg parasitisationvaried from 0 % to 89.48 %. Maximum egg parasitisation was observed in

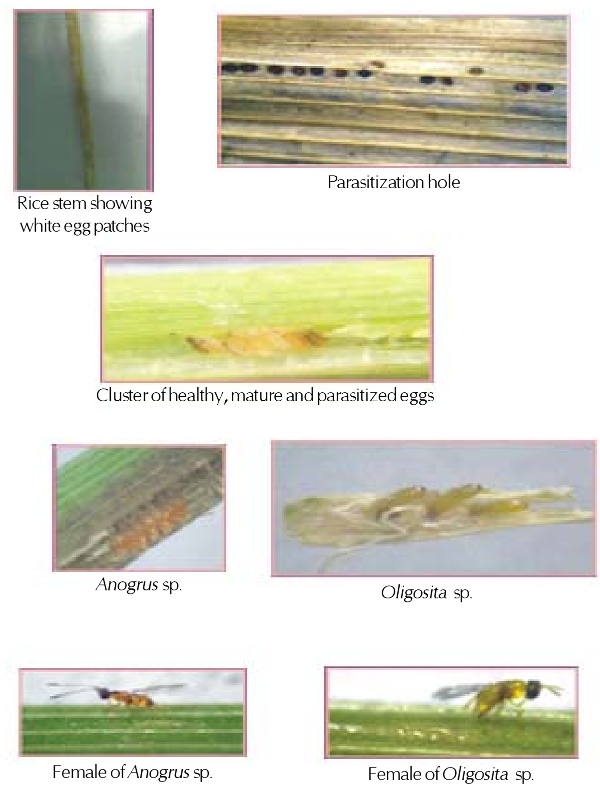

Figure 1: Egg parasitization of BPH on set of rice differential

Table 1: List of differential varieties carrying different BPH resistant gene:

PHSSEntries	R Gene	List of differential varieties Designation	Cross
1	bph2	ASD 7 (ACC 6303)	Karsamba Red
2	Bph3+Bph17	RathuHeenati (ACC 11730)	RathuHeenati
3	bph4	Babawee (ACC 8978)	-
4	?	Milyang 63	Tongil/IR 946-33-2-2-2//YR675-131-2
5		TN1	S.Check
6	Bph6	Swarnalatha (ACC 33964)	-
7	bph7	T 12 (ACC 56989)	-
8	bph8	Chinsaba (ACC 33016)	-
9	bph9	Pokkali	-
10		TN1	S.Check
11	Bph1+	IR 64	IR 5657-33-2-1/IR 2061-465-1-5-5
12	Bph18	IR 65482-7-216-1-2-B	IR 31917-45-3-2-2*3/*O.australiensis*
13	bph2	IR 36	IR1561-228//4*IR661-1-140-3-117/*O.nivara*///CR 94-13
14	?	MUT NS 1	-
15		TN1	S.Check
16	?	OM 4498	IR 64/OMCS 2000//IR 64
17	?	RP 2068-18-3-5	
18	bph2+Bph3+	Ptb33	
19	BPH20/21	IR71033-121-15	
20		TN1	S.Check

Table 2: Status of BPH egg parasitisation in rice differential varieties carrying different resistance gene

PHSS Entries	Designation	Unparasitized egg %	Parasitized egg % *Anagrus* sp.	*Oligosita* sp.	Total egg parasitisation %
1	ASD 7 (ACC 6303)	84.61	15.39	0.00	15.39
2	RathuHeenati (ACC 11730)	16.12	83.88	0.00	83.88
3	Babawee(ACC 8978)	96.07	3.93	0.00	3.93
4	Milyang 63	81.36	18.64	0.00	18.64
5	TN1	93.54	6.46	0.00	6.46
6	Swarnalatha(ACC 33964)	51.45	48.55	0.00	48.55
7	T 12 (ACC 56989)	57.61	42.39	0.00	42.39
8	Chinsaba (ACC 33016)	76.92	23.08	0.00	23.08
9	Pokkali	85.48	14.52	0.00	14.52
10	TN1	96.06	3.94	0.00	3.94
11	IR 64	55.55	44.45	0.00	44.45
12	IR 65482-7-216-1-2-B	77.81	22.19	0.00	22.19
13	IR 36	80.00	20.00	0.00	20.00
14	MUT NS 1	78.14	21.86	0.00	21.86
15	TN1	95.08	4.92	0.00	4.92
16	OM 4498	89.96	10.04	0.00	10.04
17	RP 2068-18-3-5	47.05	52.95	0.00	52.95
18	Ptb33	10.52	31.58	57.90	89.48
19	IR71033-121-15	87.18	12.82	0.00	12.82
20	TN1	100.00	0.00	0.00	0.00

genotype Ptb 33 (89.48%) by *Anagrus* sp., *Oligosita* sp. Second maximum egg parasitisation was observed in RathuHeenati (ACC 11730) (83.88%), followed by RP 2068-18-3-5 (52.95 %) and Swarnalatha (ACC 33964) (48.55 %). The minimum egg parasitisation was observed in TN1 (PHSS10) which was 3.94% mostly by *Anagrus* sp. (Table 2 and Fig.).

Similar findings were reported by Fowler *et al.* (1991) on the rice plants infested with eggs of *Nilaparvata lugens* (Stal.) or *Nephotettix* spp. In laboratory cultures, were used to trap egg parasitoids in rice fields at two sites over a period of four days in Sri Lanka. Levels of egg parasitism in per plant varied from 0 to 54% in *Nilaparvata lugens* and 45 to 100% in *Nephotettix* spp. *Nilaparvata lugens* eggs were parasitized by *Anagrus* sp., *A. optabilis*(Perkins)(Hymenoptera: Mymaridae) and *Oligosita* sp. (Hymenoptera: Trichogrammatidae).

Atmaja*et al.*, (2000) studied that egg parasitoids of BPH have good potential to reduce BPH populations; these are: *Anagrus* sp., *Oligosita* sp. Parasitism caused by these parasitoids in the field was 64 and 55% respectively. Lam (2002) found that *Anagrus* was the most common egg parasitoid at Tien Giang in the 1977-1978 survey with its parasitization fluctuating between 20 and 30%. Lan *et al.* (2000) found that *Anagrus* sp. was the main egg parasitoid of brown planthopper with less *Oligosita* sp.

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REFERENCES

Atmaja, W. R. and Laba, I. W. 2000. Parasitoid used to manage the brown planthopper *Nilaparvatalugens* (Stal.) (Homoptera: Delphacidae). *J. Penelitian and Pengembangan Pertanian*. **19(1):** 1-8.

Balakrishna, B. and Satyanarayana, P. V. 2013. Genetics of brown planthopper (*NilaparvatalugensStal.*) resistance in elite donors of rice (oryzasativa L.). *The Bioscan*. **8(4):** 1413-1416.

Claridge, M. F., Morgan, J. C., Steenkiste, A. E., Iman, M. and Damayanti, D. 1999. Seasonal patterns of egg parasitism and natural biological control of rice brown planthopper in Indonesia. *Agricultural and Forest Entomology*. **1:** 297-304.

Fowler, S. V., Claridge, M. F., Morgan, J. C., Peries, I. D.R. and Nugaliyadde, L. 1991. Egg mortality of the brown planthopper,*Nilaparvata lugens* (Homoptera :Delphacidae) green leafhopper, Nephotettix *spp.* (Homoptera: Cicadellidae) on rice in Sri Lanka. *Bulletin of Entomological Reasearch*. **81:** 161-167.

Gallagher, K. D., Kenmore, P. E. and Sogawa, K. 1994. Judicial use of insecticides deter planthopper outbreaks and extend the role of resistant varieties in Southeast Asian Rice. In Deno, R.F. &Perfect , T.J.(Eds) *Planthopper, their ecology and management,* London. Chapman and Hall. pp. 559-614.

Heinrichs, E. A., Aquino, G .B. and Chelliah, S. 1982. Resurgence of *Nilaparvata lugens* (Stal) populations as influenced by method and timing of insecticide applications in lowland rice. *Environmental Entomology*. **11:** 78-84.

Jena, K. K., Jeung, J. U., Lee, J. H., Choi, H. C. and Brar, D. S. 2006. High resolution mapping of a new brown planthopper (BPH) resistance gene, Bph18(t), and marker-assisted selection for BPH resistance in rice (*Oryza sativa* L.). *Theoretical and Applied Genetics*. **112:** 288-297.

Kenmore, P. E., Carino, F. G., Perez, C. A., Dyck, V. A. and Gutierrez, A. P. 1984. Population regulation of the rice brown planthopper (*Nilaparvata lugens* Stal) within rice fields in the Philippines. *Journal of Plant Protection in the Tropics*. **1:** 19-37.

Khush, G. S. and Brar, D. S. 1991. Genetics of resistance to insects in crop plants. *Advances in Agronomy*. **45:** 223-274.

Lan, L. P., Huyen, N. P. D., Cam, N. V., Heong, K. L. and Schoenly, K. G. 2005. Species composition of arthropods in the rice field and its neighbouring botanical ecosystems. *Fifth National Conference in Entomology, Ha Noi,* pp. 93-101.

Lam, P. V. 2002. *Natural Enemies of Insect Pests: Research and Application-Book I, NongNghiep Publ. house, Ha Noi*, pp. 7-99.

Manikandan Narayanasamy, John Samuel, K. and Geethalakshmi, V. 2014. Life History And Population Dynamics Of Rice Leaf folder at Different Temperatures. *The Ecoscan*. **8(3&4):** 315-320.

Normile, D. 2008. Reinventing rice to feed the world. *Science*. **321:** 330-333.

Qian, M. R., Xiang, G. D., Zhang, G. R. and Zhang, W. Q. 2002. Preliminary investigation on structure and dynamics of egg parasitoid community on the brown planthopper in rice field. *Acta Entomologica Sinica*. **45(3):** 408-412.

Schoenly, K., Cohen, J. E., Heong, K. L., Arida, G., Barrion, A. T. and Litsinger, J. A. 1996. Quantifying the impact of insecticides on food web structure of rice arthropod population in Phillipine farmer's irrigated fields in Polis, G. A. and Wiremiller, K. (Eds) *food webs; integration of patterns and dynamics,* London, Chapman and Hall.

Tan, C. L. 1981. Natural enemies of the major insect pests of ricc in Peninsular Malaysia.*Crop Protection Branch Information Leaflet No. 1,* p. 22.

Tanaka, K., Endo, S. and Kazana, H. 2000. Toxicity of insecticides to predators of rice planthoppers: spiders, the mirid bug and the dryinid wasp. *Applied Entomology and Zoology*. **35:** 177-187.

Watanabe, T. and Kitagawa, H. 2000. Photosynthesis and translocation of assimilates in rice plants followingphloem feeding by planthopper *Nilaparvata lugens* (Homoptera: Delphacidae). *J. Economic Entomology*. **93:** 1192-1198.

Way, M. J. and Heong, K. L. 1994. The role of biodiversity in the dynamics and management of insect pests of tropical irrigated rice- a review. *Bulletin of Entomological Research*. **84:** 567-587.