RESEARCH ARTICLE

Population Dynamics of Rove beetle (Coleoptera: Staphylinidae), *Paederus fuscipes* (Curtis) in Rice Ecosystem during Rabi and Kharif Season

Jadhao MF and Shukla AK

Department of Zoology, S.N. Mor College, Tumsar, Dist: Bhandara, Maharashtra (India).
Email: mfjadhao@gmail.com

Manuscript details:

Available online on
http://www.ijlsci.in

ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Chavhan Arvind

Cite this article as:
Jadhao MF and Shukla AK (2016) Population Dynamics of Rove beetle (Coleoptera: Staphylinidae), *Paederus fuscipes* (Curtis) in Rice Ecosystem during Rabi and Kharif Season, *Int. J. of Life Sciences*, A6: 177-180.

ABSTRACT

A weekly survey at selected sites of rice growing area in Bhandara district was carried out regularly during rabi and kharif seasons of 2012 and 2013. The data collected on predatory beetle complex and population dynamics of rove beetle, *P. fuscipes* during the present study is summarized in the present paper. A survey carried out during kharif and rabi seasons revealed that 4 predatory beetles viz., lady bird beetle *Micraspis discolor* (Fb.) and *Hormonia octomaculata* (Fb.), ground beetle, *Ophionia indica* (Thum.) and rove beetle, *Paederus fuscipes* (Curtis) were active and effectively regulating the populations of all the four major pests of rice (*Scirpophaga incertulus, Cnaphalocrosis medinalis, Nilaparvata lugens* and *Sogatela furcifera*). Among the 4 predatory beetles, rove beetle, *P. fuscipes* was found to be abundantly predating on immature and mature stages of major and minor pests of rice. During rabi season the highest population of rove beetle, *P. fuscipes* was recorded in second week of March at 42 DAT. In kharif season, first appearance of rove beetles, P. fuscipes was noticed in third week of October at about 63 DAT and its highest population was recorded in second week of November (84 DAT). The data obtained of four seasons (2 kharif and 2 rabi) indicated that the abundance of rove beetle, *P. fuscipes* was more in rabi than in kharif season.

Keywords: Bhandara, Days After Transplantation (DAT), Population Dynamics, Rice, Rove beetle.

INTRODUCTION

Rice (Paddy), *Oryza sativa* is the staple food for over 55% population of India and is grown in almost all the states. Average productivity of rice in Maharashtra is poor as compared to other states. More than 50% of the total area under rice in the state is concentrated in low productivity group, which accounts for about 42% of total production in the state. Average productivity of the state is 1,480 kg/hectare, which is about 24% below the national biennial average productivity of 1,950 kg/hectare.

Bhandara district ('rice bowl' of state) belongs to low productivity group (yield 1,000 - 1,500 kg/ hectare). Though, Bhandara district occupies first

position in area and rice production in Maharashtra, per hectare yield of 1,304 kg is very low (ICAR, 2002). Among the various factors, the insect pests are the major one responsible for the lower yield of rice crop in Bhandara and other low productivity districts of our country. About 300 species of insects have been reported to attack rice crop in India out of which 20 have been found to be the major pests (Pathak, 1977, Arora and Dhaliwal, 1996) causing 21 to 51 percent yield loss (Singh and Dhaliwal, 1994). In India, rice is consuming largest amount of insecticides after cotton and even after such a heavy reliance on insecticides, the farmers are able to reduce only a small percentage of losses due to insects. Such injudicious use of insecticides has also been reported to eliminate predators and parasitoids which are able to check the pest population below economic injury level under natural conditions (Kenmore *et al*., 1984). The indiscriminate use of insecticides for pest control led to disturbances in natural ecosystem, leading to resurgence of pests such as yellow stem borer, *Scirpophaga incertulus*, leaf folder, *Cnaphalocrosis medinalis*, brown planthopper, *Nilaparvata lugens* and whitebacked planthopper, *Sogatella furcifera* (Anonymous, 1995). Again, the farmers are not aware with the succession of natural enemies which is the least studied subject in rice entomology. For rice crop, it is impossible to develop an IPM programme without understanding the role of predators and parasitoids. These "friends of the rice farmer" were associated with rice pests long before rice was cultivated in its present form (Shepard *et al.,* 1987). Ooi and Shepard (1987) concluded that predators and parasitoids in the rice fields of tropical south and Southeast Asia are essential for maintaining insect pest populations at low levels. Walker (1962) recorded about 100 species of natural enemies, including predators, parasites as well as diseases on the rice stem borers in Asia. The natural enemy fauna of *kharif* season is generally different from those found in *rabi* season. Panda *et al.* (1995) noted that the rove beetle, *P. fuscipes* constituted the major predatory arthropod complex of the plant hoppers during both *kharif* and *rabi* seasons. Rove beetle was found to be predaceous on *N. lugens* and *S. furcifera* (Natarajan and Mathur, 1981 and Ooi *et al*., 1980). Anis Joseph (2006) observed large number of rove beetles in the rice ecosystem in Kerala. Although some attempts have been made to study the occurrence of rice pests and their natural enemies in Andhra Pradesh (Rao and Ali, 1976), Punjab (Brar *et al*., 1994), Gujarat (Pandya *et al*., 1995), Karnataka (Naganagoud et *al*., 1999), Bihar (Rai *et al*., 2000) and Uttaranchal (Pushpakumari and Tiwari, 2005) in India, we do not have much information for Maharashtra, especially Bhandara district. Keeping in view the above mentioned facts, in the present work the attempts were made to study the occurrence and population dynamics of rove beetle, *Paederus fuscipes* (Curtis), one of the natural enemy of rice pests in the rice growing areas of Bhandara district. The present investigation contains two year (2013-2014) field study at selected sites.

MATERIAL AND METHODS

Bhandara is known for its large production of rice, located at 21°10'N 79°39'E 21.17°N79.65°E.Weekly survey was conducted at different sites (farmers' fields) in Tumsar tahsil and adjoining rice growing areas of the Bhandara District for monitoring the predation and population fluctuation of rove beetle, *Paederus fuscipes*. The investigation was carried out regularly for two *rabi* and two *kharif* seasons from early to mature grain stage of rice crop during 2012 and 2013. The rice insect pests in the form of eggs, larvae and adults were observed at weekly interval for their predation by rove beetles. Whenever the predatory beetles predating pests were noticed, they were collected by hand or insect collecting net and were further provided with different pest species to confirm their predatory behaviour. The predators noticed and collected in this way were killed and preserved in 70 per cent alcohol. The population of predatory rove beetles was recorded visually as well as hand and net collection in 1x1 m quadrate sample from five randomly selected spots.

RESULTS AND DISCUSSION

In both *kharif* and *rabi* seasons, four predatory beetles, viz., lady bird beetle *Micraspis discolor* (Fb.) and *Hormonia octomaculata* (Fb.), ground beetle, *Ophionia indica* (Thum.) and rove beetle, *Paederus fuscipes* (Curtis) were prominently recorded in the field predating on various stages of insect pests. Of these four species of predatory beetles, *P. fuscipes* was found to be the most dominant predator during present investigation. Rove beetle, *P. fuscipes* is characterized by having extremely short elytra, which covered only the central part of the body and were metallic green.

The body is orange brown and the tip of the abdomen and head are black. It measures about 7 mm in length. The beetles were often found running actively up and down the rice leaves in search for prey. It is a carnivorous beetle. Both grubs and adults of *P. fuscipes* are predatory in nature. After citing the prey, the predator grabs it by inserting its mandibles and devours it within seconds. The food of rove beetle consists of eggs and first instar larvae of stem borers and leaf folder and hopper nymphs as well as adults.

Although four predatory beetles of rice insect pests were recorded, only rove beetle, *P. fuscipes* being important in regulation of major rice pests viz., *Scirpophaga incertulus, Cnaphalocrosis medinalis, Nilaparvata lugens and Sogatela furcifera* was considered for study of population dynamics and counted during weekly survey. The population fluctuations of rove beetle in the field during *Rabi* and *Kharif* are presented in Table 1 and depicted graphically in Figure 1. During Rabi 2012 rove beetle, *P. fuscipes* first noticed in 1st week of February (7 DAT) and thereafter observed up to harvesting stage. The highest population with its mean 9.4 beetles/m^2 was recorded in 2nd week of March (42 DAT). During Kharif 2012 *P. fuscipes* first appeared in the 3rd week of October (at 63 DAT) when its count was 3.4 beetles/m^2 after which they were present throughout the season with highest population (22.6 beetles/m^2) in 3rd week of November. The minimum number (3.2 beetles/m^2) was recorded in 3rd week of October (63 DAT). During Rabi 2013, *P. fuscipes* was recorded throughout the crop growth and its population was high in 3rd (42 DAT) and last week of March (56 DAT). Its population varied from 0.6 to 56 beetles/m^2. During Kharif 2013, the populations of rove beetle, *P. fuscipes* was negligible with peak densities of 0.6 beetles/m^2.The average populations of two *rabi* seasons was 17.36/ m^2 and that of two *kharif* seasons was 5.32 / m^2 (Table 1). Therefore, the incidence of rove beetle was found to be more in Rabi season than Kharif. The data obtained on the number of rove beetles in the rice field during *rabi* and *kharif* seasons of 2012 and 2013 exhibited the increase in their population densities with the infestation of all the four major insect pests and the absences or low number of predators in the rice ecosystem favoured the population build up of all the four major pests and damaging the crop substantially. This indicates that the predatory beetle complex present in the rice ecosystem of Bhandara district was active and

Table 1: Population Dynamics of Rove beetle, *P. fuscipes* in Rice Ecosystem.

DAT	Rabi 2012	Kharif 2012	Rabi 2013	Kharif 2013
7	0.4	0	0.6	0
14	0	0	0.6	0
21	0	0	21.4	0
28	0	0	32.6	0
35	6.4	0	46.6	0
42	9.4	0	56	0
49	2.6	0	48.4	0.6
56	0.2	0	55	0
63	0	3.4	22.2	0
70	1.4	3.2	16.2	0
77	4.8	17.6	15	0
84	3.6	21.8	13	0
91	5.2	22.6	14.2	0
98	0	0	23.6	0
105	0	0	11.8	0
Average Population of *P. fuscipes* during two seasons Kharif, 2012-13: **5.32,** Rabi, 2012-13: **17.36**				

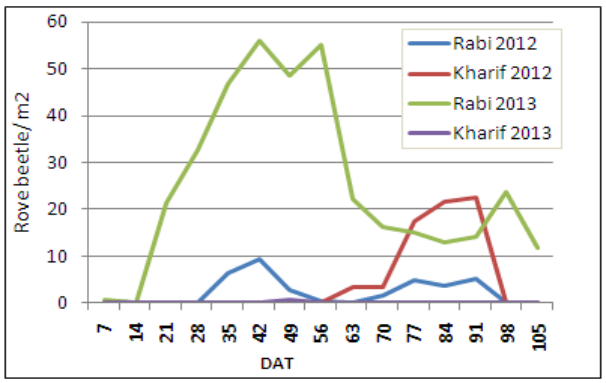

Figure 1. Population fluctuations of Rove beetle during Rabi and Kharif season.

DAT- Days After Transplantation

regulating the populations of both major and miner insect pests effectively. Shen and Pang (1989) described the predation of *P. fuscipes* on the eggs of *C. medinalis* and concluded that they are the important predators of *C. medinalis* eggs. Luo *et al.* (1990) reported that the males and females of *P. fuscipes* consumed a mean number of 4.2 and 6.1 adults of *S. furcifera* per day, respectively. Mun and Yuen (1982) showed that *P. fuscipes* also predate on the larvae of *C. medinalis*. They also observed that *P. fuscipes* was found to prey upon *N. lugens*, *S. furcifera and N. virescens.* Rajendran and Gopalan (1988) estimated that an adult *P. fuscipes* can consumes 8.7 adults of *N.*

lugens, 8.3 adults of *S. furcifera* and 8.4 adults of *N. virescens* in a day and the predator move in very large numbers to nearby vegetation when crop is harvested. Komala Devi (2003) showed that the *P. fuscipes* has quite good feeding potential, prey range and longer adult longevity.

Thus, it is concluded that the populations of all the four major pests were effectively regulated by a large number of rove beetles. Hence if predatory beetle complex such as rove beetle, ground beetle and lady bird beetle of rice-ecosystem is conserved with a judicious use of insecticides particularly at the time of pest resurgence, the major rice pests can be kept under check at sub economic level.

REFERENCES

Anis Joseph R (2006) Role of predators and parasites in rice-ecosystem. *Agrobios Newsletter*, 4 (9): 17.

Anonymous (1995) Directorate of Plant Protection, Quarantine and Storage, Ministry of Agriculture, Govt. of India, N. H. IV, Faridabad,-121001

Anonymous (1998) Plant protection schedule, Government of Maharashtra, Pune.

Arora R and Dhaliwal GS (1996) Agro- ecological changes and insect pest problems in Indian agriculture. Indian J. Ecol., 23: 109-122.

Brar DS Shenhmar M, Mahal MS, Singh R and Singh R (1994) Egg parasitoids of YSB, *S. incertulus* (Lep: Pyralidae) in Punjab. *Journal of insect science*, 7: 61-63.

Indian Council of Agricultural Research (ICAR) (2002) Rice in India. Status paper, 4. htm. (1-11-2002).

Kenmore PE, Carino FD, Perez C A, Dyck DA and Guiterrez AP (1984) Population regulation of the rice brown planthopper (*Nilaparvata lugens* Stal) within rice fields in the Philippines. *J. Plant Prot. Tropics,* 1: 19-37.

Komala Devi P, Yadav DN and Jha (2003) Predatory behaviour and feeding potential of *Paederus fuscipes*. *Indian J. Ent*., 65 (3): 319-323.

Komala Devi P, Yadav DN and Jha A (2003) Seasonal occurrence and association of *Paederus fuscipes* with different host plants at Anand, Gujarat. Indian J.Ent.,65 (1) : 77-75.

Luo XH, Zhuo WX and Wang YM (1990) Studies on *Paederus fuscipes* Curtis. Insect knowledge, 27 (2): 77-79.

Mun YP and Yuen PM (1982) Short notes on the biology and natural enemies of *Cnaphalocrosis medinalis* (Guenee). MAPPS Newsletter, 6(2): 4-5.

Naganagoud A, Patil BV and Sreenivas AG (1999) Studies on the light trap catches of major pests of rice in Tungabhandra project area. *Karnataka journal of Agricultural Sciences*, 12: 191-194.

Natarajan K and Mathur KC (1981) New records of predaceous beetles on brown plant hopper in India. *Current Science*, 50 (5): 239.

Ooi PAC, Saleh AR and Haut YG (1980 Outbreak of the white backed planthopper in the Muda irrigation scheme and its control. *Malaysian Agril. J*., 52 (3): 315-331.

Ooi PAC and Shepard BM (1987) Predators and Parasitoids of rice insect pests. In "Biology and Management of rice insects". (E.A. Heinrichs, ed.) Wiley, New Delhi, India, PP. 585-612.

Pathak M D (1977) Insect Pest of Rice. International Rice Research Institute, Los Banos, 77 pp.

Pandya SK, Senapati B and Samalo AP (1995) Field efficacy of some insecticide against rice planthoppers and their predators. *Pestology*, 19 (8): 15-19.

Pushpakumari AS and Tiwari SN (2005) Incidence and population dynamics of rice pests and their natural enemies in Uttaranchal. *Pestology*, 29 (2): 9-13.

Rai AK Sinha RBP and Singh AK (2000) Effect of abiotic factors on the population of rice leaf folder, *Cnaphalocrosis medinalis* (Gn.).*Annals of Plant Protection Science*, 8: 154-158.

Rajendran R and Gopalan M (1988) Staphylinid beetle, *Paederus fuscipes* Curtis - a potential biocontrol agent in rice. *Current Science,* 58 (1): 40-41.

Rao PK and Ali MH (1976) Some natural enemies of rice and *Sorghum* stem borers in Andhra Pradesh. Indian *Journal of Entomology*, 38: 191-193.

Shen BB and Pang XF (1989) Studies on predation of carabid and rove beetles to egg of rice leaf roller. Natural Enemies of Insects, 11 (4): 156-163.

Shepard BM, Barrion AT and LitsingerHA (1987 Friends of the rice farmer. Helpful insects, spiders, and pathogens. International Rice Research Institute, Los Banos.

Singh J and Dhaliwal GS (1994) Insect Pest Management in Rice; A perspective, In: G. S. Dhaliwal and Ramesh Arora (eds.) Trends in Agricultural Pest Management. Common- Wealth Publisher, New Delhi. Pp. 56-112.

Walker HG (1962) Preliminary list of insects and mites recorded on paddy rice. Mimeograph. Food Agr. Organ. UN. (Rome 66 pp.).