

Population dynamics of insect pests and their natural enemies in rice seed bed ecosystem

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As a general principle, natural enemies consume the insect pests to sustain. Though the population densities of both the pests and natural enemies always vary, their proportional representation is generally sufficiently balanced in nature to make natural enemies as successful bio-control agents. Insecticides tend to disturb the natural equilibrium over a relatively long time (Anon., 1999). Being the staple food for more than 65% of the population, increased and sustained production of rice is fundamental to food security in India (Gour *et al.*, 2003; Katti, 2008). Losses in grain yields due to insect pests have been estimated at 10-15 % (Krishnaiah *et al.*, 2008). In several instances, a rich diversity of natural enemies has been reported in rice ecosystem. These natural enemies play an important role in keeping the population levels of major pests under EP (Equilibrium point) under normal conditions. Therefore, to avoid indiscriminate use of pesticides as well as associated residue problems, the natural prevalence of parasites and predators in rice seed bed should be encouraged towards eco-friendly pest management programme. Keeping this background in mind, the present investigation was undertaken to enumerate the role of naturally occurring parasites and predators in rice seed bed *vis-à-vis* their impact on BIPM (Bio-intensive pest management).

The investigation was conducted during *kharif*, 2008 to study the population dynamics of insect pests and their natural enemies in rice seed bed. The experimental site was located at the Rice Research Station, Chinsurah, Hooghly, West Bengal, situated at 88°24' E longitude and 22°52' N latitude with an altitude of 8.62 m above msl. Variety Swarna (MTU 7029) was sown during June 30, 2008 in the seedbed. Sweeping method was followed to collect and records insects, predators and parasites. A sweep net was used to sweep through rice herbage and each sweeping was completed with strokes. The collected insects on sweep net were transferred to killing bathe containing ethyl acetate ($C_4H_8O_2$) solution and kept for 30 minutes to kill them (Shrivastava, 2001). The killed insects thus collected were put on killing tray

and separated for identification *viz.* pests, predators and parasites. Population densities of individual group were recorded at weekly interval initiating from first week of July till first week of August. In total, five rounds of sweeping were made during the period of observation. Population ratio of pest : predator, pest : parasite and pest : natural enemy were worked out. Meteorological data pertaining to the period of observation were also recorded (Table 1).

Pest population

It can be seen from Table-2 that a total number of 199.50 pests belonging to 13 different types was recorded, of which rice thrips (*Baliothrips biformis* Bagnall) and grass hopper (*Heiroglyphus banian* Fabr.) were dominant. The highest of population (88.50) of rice thrips was followed by grasshopper (33.41) and white leaf hopper (30.60). Total population load of all the three pests was more during first week of July (53.00) and it gradually declined with the progress of time, which may be due to progressive build up of natural enemies.

Natural enemy population

It appeared that, in total, 113.67 numbers of predators were recorded belonging to 12 different groups (Table 3). Out of these, the populations of dominant predators *viz.* lynx spider (*Oxyopes* sp.), damsel fly (*Agriocnemis pygmaea* Rambur) and water bag (*Mesovelia vittigera* Horvath) were found 27.67, 19.33, 17.50, respectively. Highest (34.67) predator population was recorded during third week of July, followed by first week of August (25.50) and it was minimum during second week of July (15.50). So far parasite population is concerned, seven different types were recorded (26.83). Out of these, *Telenomus rowani* Gahan (10.50) and *Tetrasticus schoenobii* Ferriere (11.33) were found to be dominant (Table 4). Total parasite population was recorded maximum (10.00) during fourth week of July, followed by first week of August (25.50) while it was minimum (1.00) during first week of July. The findings of present authors are in conformity of the findings of Pasalu (2007) who also narrated the possibilities of native natural enemies in pest management.

Population ratio

Population ratio of pest: predator, pest : parasite and pest : natural enemy were 1.76: 1.00, 7.44: 1.00 and 1.00: 1.21, respectively. Katti (2007) advocated for regular scouting to observe the presence of common natural enemies like spiders, dragon flies, damsel flies, coccinellids, ground beetles and their numbers *vis-à-vis* pest population, and suggested an optimum ratio of 2 : 1 while taking up any pest management decisions.

The results, thus, inflicted an idea regarding the population ratio of pests and their naturally occurring bio-control agents (parasites and predators), which would be meaningful to chalk out a successful eco-friendly pest management programme in the rice seed bed.

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Table 1. Meteorological data pertaining to the period of experimentation

Week	Temperature($^{\circ}$ C)		Rainfall (mm)	Relative humidity (%)		Sunshine hours	
	Max.	Min.		7.00 LMT	14.00		
				LMT	LMT		
July 1 st wk.	31.2	26.6	10.0	95.0	87.0	0.833	
July 2 nd wk.	30.5	26.3	11.7	95.3	83.8	3.675	
July 3 rd wk.	31.7	25.6	10.7	95.6	84.8	1.225	
July 4 th wk.	32.3	26.8	6.8	94.8	79.1	3.667	
Aug. 1 st wk.	32.4	26.3	3.8	93.7	77.7	7.365	

Table 2. Pest population in rice seed bed during *kharif* (2008) at Chinsurah, West Bengal

Week	YSB	WM	RH	LF	CW	RT	SB	RB	WLH	GLH	ZLH	BPH	GH
July 1 st wk.	2	0.00	0.00	0.00	0.00	35.0	0.0	0.00	2.0	7.00	0.00	0.00	7.00
July 2 nd wk.	1	0.50	0.50	0.50	0.50	31.0	1.5	0.00	5.0	3.00	0.00	1.00	5.00
July 3 rd wk.	0	2.00	0.00	0.33	0.00	20.0	2.0	0.00	6.6	0.33	0.33	1.66	9.66
July 4 th wk.	0	4.25	0.25	0.00	0.25	2.5	0.0	0.25	13.5	4.00	1.50	0.25	6.25
Aug. 1 st wk.	1	2.00	0.00	1.00	0.00	0.0	0.0	1.00	3.5	4.50	2.50	0.50	5.50
Total	4	8.75	0.75	1.83	0.75	88.5	3.5	1.25	30.6	18.83	4.33	3.41	33.41

YSB: Yellow stem borer (*Scirpophaga incertulas*);RH : Rice hispa (*Dicladispa armigera*);CW: Cut worm (*Mythimna separate*);SB: Seed bug (*Scotinophora* sp.);WLH: White leaf hopper (*Cofona spectra*);ZLH: Zig-zag leaf hopper (*Recelia dorsalis*);GH: Grass hopper (*Heiroglyphus banian*).WM: Whorl maggot (*Hydrellia* sp.);LF: Leaf folder (*Cnaphalocrocis medinalis*);RT: Rice thrips (*Baliothrips biformis*);

RB: Red bug; .

GLH: Green leaf hopper (*Nephrotettix* sp.).BPH: Brown plant hopper (*Nilaparvata lugens*);**Table 3. Parasite population in rice seedbed during *kharif* (2008) at Chinsurah, West Bengal**

Week	TS	TR	CM	IP	CH	XP	OP	Total
July 1 st wk.	0.00	1.0	0.0	0.0	0.0	0.0	0.0	1.00
July 2 nd wk.	3.00	1.5	0.5	0.0	0.0	0.0	0.0	4.50
July 3 rd wk.	4.33	3.0	1.0	0.0	0.0	0.0	0.0	8.33
July 4 th wk.	2.50	3.5	2.0	0.5	0.5	0.5	0.5	10.00
Aug. 1 st wk.	1.50	1.5	0.0	0.0	0.0	0.0	0.0	3.00
Total	11.33	10.5	3.5	0.5	0.5	0.5	0.5	26.83

TS: *Tetrastichus schoenobii*;TR: *Telenomus rowani*;CM: *Copidosmopsis nacoleiae*;IP: *Itoplectis narangae*;CH: *Charops brachypterum*;XP: *Xanthopimpla flavolimeata*; OP: *Opium* sp.**Table 4. Predator population in rice seedbed during *kharif* (2008) at Chinsurah, West Bengal**

Week	LB	GB	CR	LHG	WB	DF	WS	LS	JS	DS	OS	LJS	Total
July 1 st wk.	0.00	2.00	0.00	2.00	6.0	3.00	1.00	2.00	0.0	0.00	0.0	2.0	18.00
July 2 nd wk.	1.50	2.50	0.50	2.00	1.5	3.00	0.00	2.50	0.0	0.00	0.0	1.5	15.50
July 3 rd wk.	2.33	1.67	1.33	1.33	7.0	1.33	4.33	10.67	1.0	1.67	0.0	2.0	34.67
July 4 th wk.	0.00	0.50	1.50	1.00	0.0	6.50	3.00	5.50	0.5	0.00	0.5	1.0	20.00
Aug. 1 st wk.	3.50	1.50	0.50	2.00	3.0	5.50	2.50	7.00	0.0	0.50	0.0	0.0	25.50
Total	7.33	8.17	3.83	8.33	17.5	19.33	10.83	27.67	2.0	2.17	0.5	6.5	113.67

LB: Lady bird beetle (*Micraspis* sp.);GB: Ground beetle or bottle insect (*Ophionia nigrofasciata*);CR: Cricket (*Meticche vittatellallis*);LHG: Long-horned grasshopper (*Conocephalus longipennis*);WB: Water bug (*Mesovelia vittigera*);DF: Damsel fly (*Agriocnemis pygmaea*);WS: Wolf spider (*Lycosa pseudoannulata*);LS: Lynx spider (*Oxyopes* sp.);JS: Jumping spider (*Phidippus* sp.);DS: Dwarf spider (*Atypena formosana*);OS: Orb spider (*Argiope* sp.);LJS: Long-jawed spider (*Tetragnatha maxillosa*).