

Original Research Article

Survey of Spiders and Hoppers in Paddy Crop under Different Ecosystem

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ABSTRACT

The spiders are obligate carnivores and hold the unique position of being the only large part of the predatory arthropod fauna of paddy ecosystem and prey upon plant and leaf hopper, dipterans mainly whorl maggot and stem borer (Barrion and Litsinger, 1980; Pantua *et.al.*, 1980). There is increasing evidence that spiders play an important role in the suppression of insect density under field condition. Predacious arthropods, including insects and spiders, attack all stages of paddy insects. Spiders are abundant in paddy fields throughout the world. The first step in determining of the role of spiders in an agro-ecosystem is to identify the species present and determine their abundance and distributions. The biotic and abiotic factors of an environment often play an important role on the population buildup of spider. The survey was conducted nearby Jaunpur city during *kharif* 2003 and 2004 on rice varieties Sarju-52, NDR-359, Pant Dhan-4 and Sambha Mansoori at research field and on farmers fields. Population of spiders and paddy leaf hoppers and paddy plant hoppers observed through conducting sequential survey of paddy field transplanted with varieties Sarju-52, NDR-359, Plant Dhan-4 and Sambha Mansoori under irrigated, irrigated wet land and rainfed wet land ecosystem during *kharif* season 2003 and 2004. For the survey of paddy fields each of these varieties transplanted during first week of July were selected under different ecosystem nearby Jaunpur city during both the year. The observations were taken after plants appearing green to till the harvest of crop at 15 days interval. Observations were taken both by net-sweeping and quadrat method. The observations taken in net-sweeping method showed that the spider population in five sweeps varied from 0.90 to 3.00 during 2003 and 0.85 to 3.30 during 2004. The spiders population quadrat method observed range from 10.45 to 21.80 per sq m in 2003 and 11.00 to 23.20 per sq m during 2004. Following spider species were observed during studies viz., *Pardosa pseudoannulata* (Boes. and Strand), *Tetragnatha mandibulata* (Walk), *T. javana* (Thorell), *Hippasa holmerae* (Thorell), *Clubiona japonicola* (Boes. and Strand), *Araneus* spp., *Phidippus* spp. and *Neosconatheisi* (Walck). Amongst these *Pardosa pseudoannulata*, *Tetragnatha mandibulata* during *kharif* season.

Keywords

Spider survey,
spider

Introduction

Spiders play an important role in the suppression of insect density under field condition. Predacious arthropods including insects and spiders, attack all stages of rice insects. Spiders are abundant in rice fields throughout the world. Paddy (*oryza sativa*

L.) is one of the most important staple food crops of global importance. Rice helps to feeds almost half of the planet on a daily basis however at national level to feed the ever growing population and maintain our food security an additional two million tons

of rice needs to be produced annually with less water, land and against a number of biotic and abiotic stresses that limits rice production. Continuous research efforts are, therefore, needed to meet rice requirement of the country, which is estimated to be around 140 million tons by 2020 AD. Achieving this target in the next decade, without harming the environment would be a challenge. Spiders are obligate carnivores and hold the unique position of being the only large part of the predatory arthropod fauna of rice ecosystem and prey upon plant and leaf hoppers, dipterans mainly whorl maggot and stem borer (Barrion and Litsinger, 1980; Pantua *et al.*, 1980).

Among the Integrated Pest Management strategy, use of natural enemies viz., Parasitoids, Predators and Pathogens play an important role in regulating the population fluctuation level in rice crops. About 40–60% of the pests in rice are controlled by their natural enemies (Swaminathan and Siddiq, 1991). The predators were responsible to bring 95% mortality on plant hopper nymphs (Anonymous, 1979).

Spider one of the most important groups of predatory fauna in rice fields which has bio control agent play important role in regulation of insect pests. It reported that 80% of the total predatory community is represented by the spiders in the paddy fields (Wang, 1985). They are magical gift of nature to farmers for suppressing the insect-pest population in rice fields (Singh *et al.*, 2005). *Pardosa pseudoannulata* (Boes. and Strand), *Tetragnatha mandibulata* (Walk), *T. javana* (Thorell), *Hippasa holmerae* (Thorell), *Clubiona japonicola* (Boes. and Strand), *Araneus* spp., *Phidippus* spp. and *Neosconatheisi* (Walck). Amongst these *Pardosa pseudoannulata*, *Tetragnatha mandibulata* spider species were found during *kharif* season.

Materials and Methods

Survey experiment were conducted at experimental fields and different locations of farmers fields in district Jaunpur during *kharif* season 2003 and 2004. Observations were recorded by conducting the sequential survey of paddy fields transplanted with rice varieties Sarju-52, NDR-359, Pant Dhan-4 and Sambha Mansoori at research field and on farmers' fields under irrigated, irrigated wet land and rainfed wet land ecosystems. Incidence of spiders and paddy leaf hoppers and paddy plant hoppers were recorded after the plant at appearing green and continued to till the harvesting stage of crop at 15 days intervals. The observations were taken both through the net-sweeping and quadrat method at five spots in each each fields and by each methods. Net-sweeping methods were used to record the incidence of spiders and hoppers found in upper and middle parts of plants, whereas quadrat method used to record the incidence if spiders and insects, which were present on ground and lower parts of the plants. In net-sweeping method, spiders and hoppers incidence were recorded by taking five successive double stroke sweeps in each fields diagonally. In quadrat method, one square meter iron quadrat were thrown randomly at five spots while moving diagonally across the field. The number of spiders as well as hoppers fell inside the quadrat were counted. The spiders incidence, thus obtained, were subjected to statistical analysis to find out the correlation between the age of crop, incidence of hoppers and abiotic factors under different ecosystems.

Results and Discussion

Irrigated condition

The observations on survey of spiders were started from 20 days after transplanting

(DAT) to till the harvest at 15 days intervals in *kharif* crop during 2003 and 2004. The observations recorded during survey on the incidence of spiders and hoppers are given in Table-1. The observations by net sweeping method that the spiders incidence in 5 sweeps range from 0.90 to 3.00 during 2003 and 0.85 to 3.30 during 2004. The spiders incidence in quadrat method range from 10.45 to 21.80 per sq m in 2003 and 11.00 to 23.20 per sq m during 2004. Incidence of spider at 20 DAT under net sweeping method was 0.90 and 0.85 per 5 sweeps with 0.75, 0.28, 0.50 and 0.65, 0.18, 0.43 of WBPH, BPH and GLH in the same numbers of sweeps during 2003 and 2004, respectively. In quadrat method, at this stage of crop the incidence of spiders at 20 DAT was 10.45 and 11.00 per sq m with 5.20, 7.50, 4.80 and 4.80, 7.10, 4.40 per sq m WBPH, BPH and GLH during 2003 and 2004.

Irrigated wet-land condition

The observations on survey of spiders were started from 20 DAT to till the harvest at 15 days intervals in *kharif* crop during 2003 and 2004. The observations recorded during survey on the incidence of spiders and hoppers are given in Table-2. The observations by net sweeping method that the spiders incidence in 5 sweeps range from 1.00 to 3.60 during 2003 and 1.15 to 4.40 during 2004. The spiders incidence in quadrat method range from 10.50 to 21.70 per sq m in 2003 and 10.95 to 23.00 per sq m during 2004.

Incidence of spider at 20 DAT under net-sweeping method per five sweeps was 1.00 with 1.05, 0.30, 0.60 incidence of WBPH, BPH and GLH during 2003, whereas it was 1.15 with 0.95, 0.25 and 0.50 incidence of WBPH, BPH and GLH during 2004. In quadrat method, the incidence of spiders

was 10.50 with 6.00, 8.30, 5.60 and 10.95 with 5.60, 7.90, 5.20 incidence of WBPH, BPH and GLH during 2003 and 2004.

Rainfed wet-land condition

The observations on survey of spiders were started from 20 DAT to till the harvest at 15 days intervals in *kharif* crop during 2003 and 2004. The observations recorded during survey on the incidence of spiders and hoppers are given in Table-3. The observations by net sweeping method that the spiders incidence in 5 sweeps range from 1.25 to 4.10 during 2003 and 1.49 to 5.42 during 2004. The spiders incidence in quadrat method range from 9.60 to 19.50 per sq m in 2003 and 11.55 to 21.60 per sq m during 2004. Incidence of spiders at 20 DAT under net-sweeping method per five sweeps was 1.25 with 0.85, 0.35, 0.58 incidence of WBPH, BPH and GLH during 2003, whereas it was 1.49 with 0.75, 0.28 and 0.50 incidence of WBPH, BPH and GLH during 2004. In quadrat method, the incidence of spiders was 9.60 with 6.80, 9.10, 6.40 and 11.55 with 6.40, 8.70, 6.00 incidence of WBPH, BPH and GLH during 2003 and 2004.

The incidence fluctuation under the study of survey of spiders and hoppers in different paddy ecosystem have been studied. The result obtained from different paddy ecosystem (Irrigated, Irrigated wet-land and Rainfed wet-land) indicate that the spiders incidence increased with increase in crop age and hoppers (WBPH, BPH and GLH) incidence in all the paddy ecosystem under both methods of study during 2003 and 2004. A regular and sequential survey of spiders carried out at fortnight interval in relation to crop age. The spiders has been rated to be the most important group of predators in the nature and agricultural ecosystem.

Table.1 Survey of spiders and hoppers average incidence in irrigated paddy field during *kharif* season 2003 & 2004

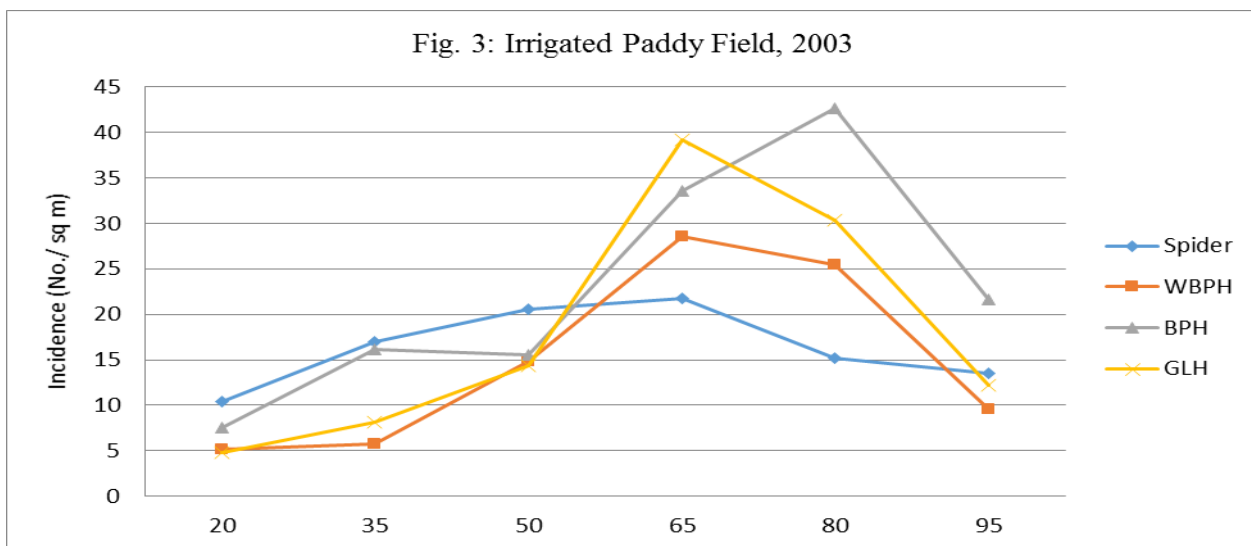
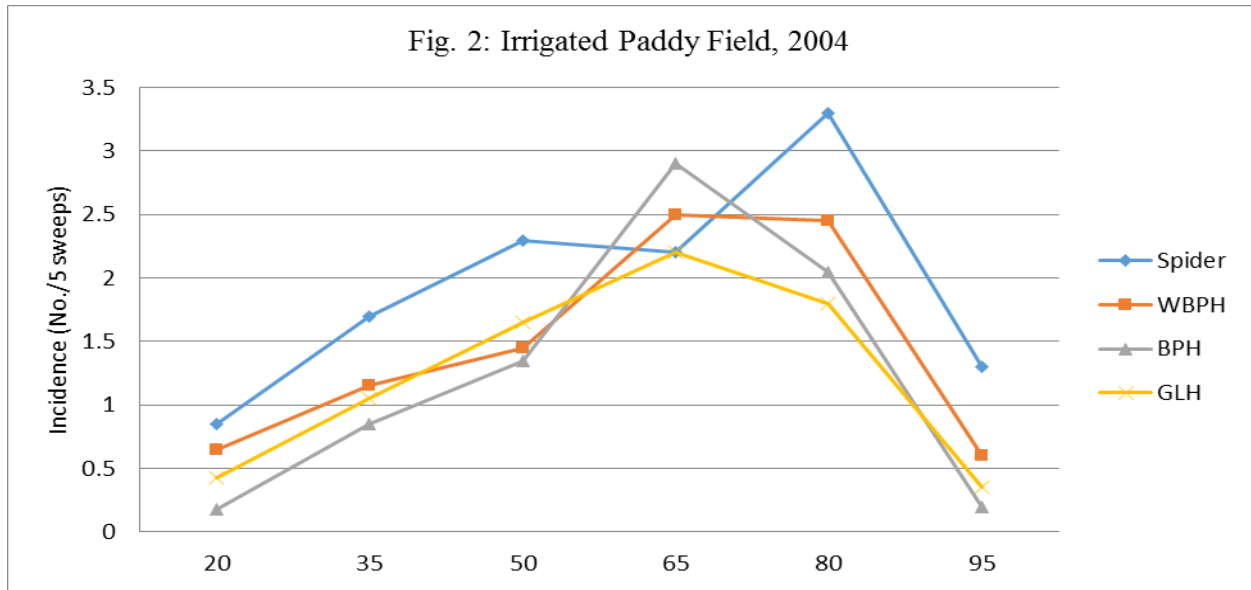
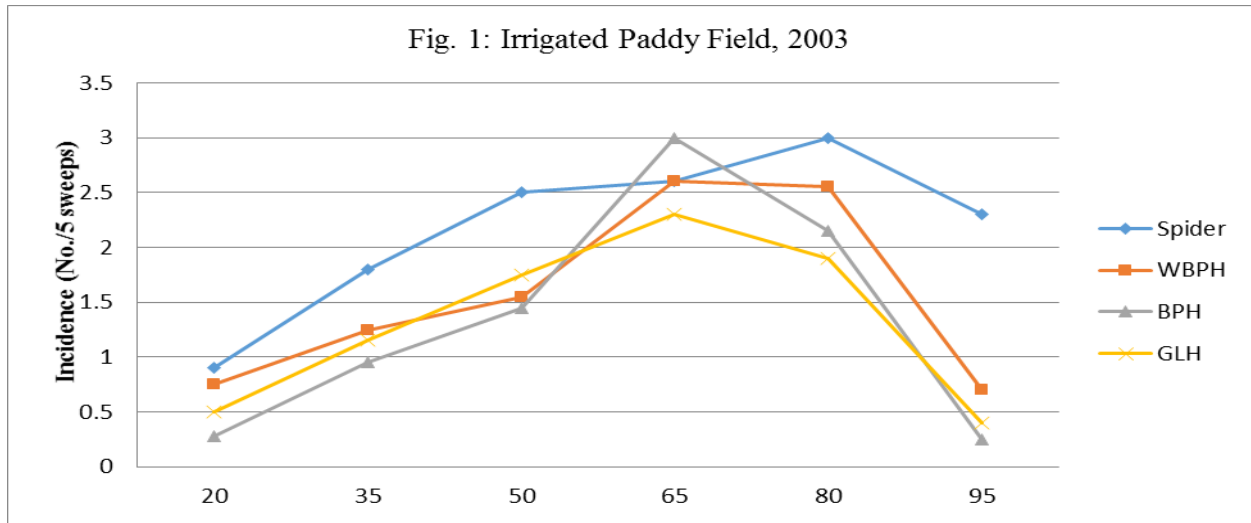
Crop age (DAT)	Incidence per five sweeps								Incidence per square meter							
	Spiders		WBPH		BPH		GLH		Spiders		WBPH		BPH		GLH	
2003&04	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
20	0.90	0.85	0.75	0.65	0.28	0.18	0.50	0.43	10.45	11.00	5.20	4.80	7.50	7.10	4.80	4.40
35	1.80	1.70	1.25	1.15	0.95	0.85	1.15	1.05	17.00	17.40	5.80	5.40	16.20	15.80	8.20	7.80
50	2.50	2.30	1.55	1.45	1.45	1.35	1.75	1.65	20.60	21.70	14.80	14.40	15.60	15.20	14.40	14.00
65	2.60	2.20	2.60	2.50	3.00	2.90	2.30	2.20	21.80	23.20	28.60	28.20	33.60	33.20	39.20	38.80
80	3.00	3.30	2.55	2.45	2.15	2.05	1.90	1.80	15.20	16.40	25.40	25.00	42.60	42.20	30.40	30.00
95	2.30	1.30	0.70	0.60	0.25	0.20	0.40	0.35	13.50	14.70	9.60	9.20	21.60	21.20	12.20	11.80

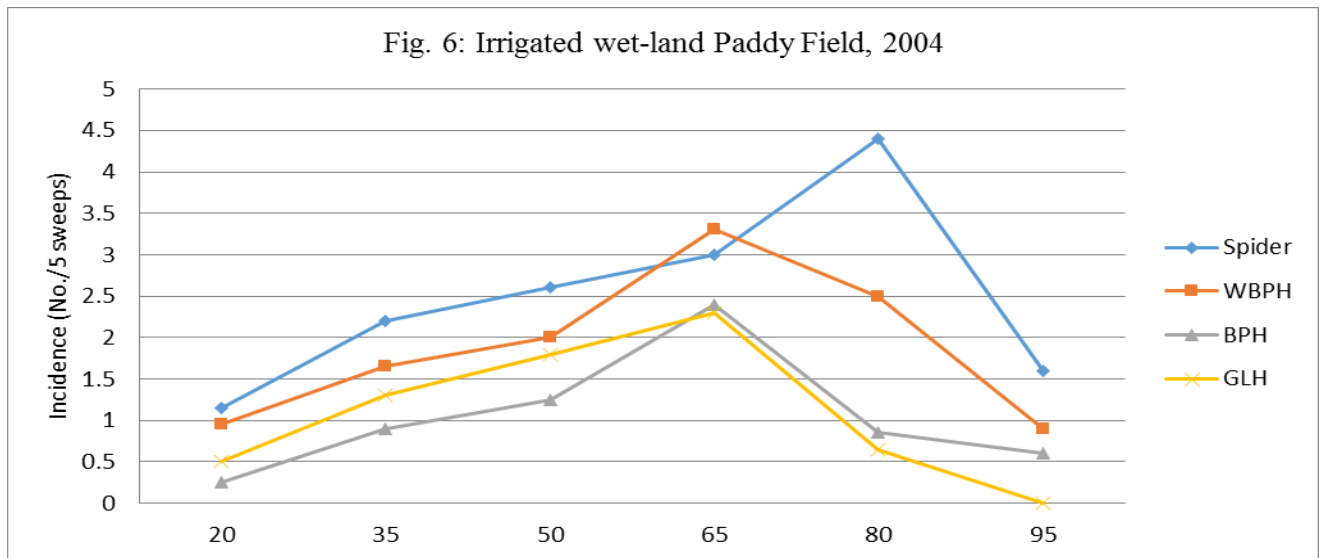
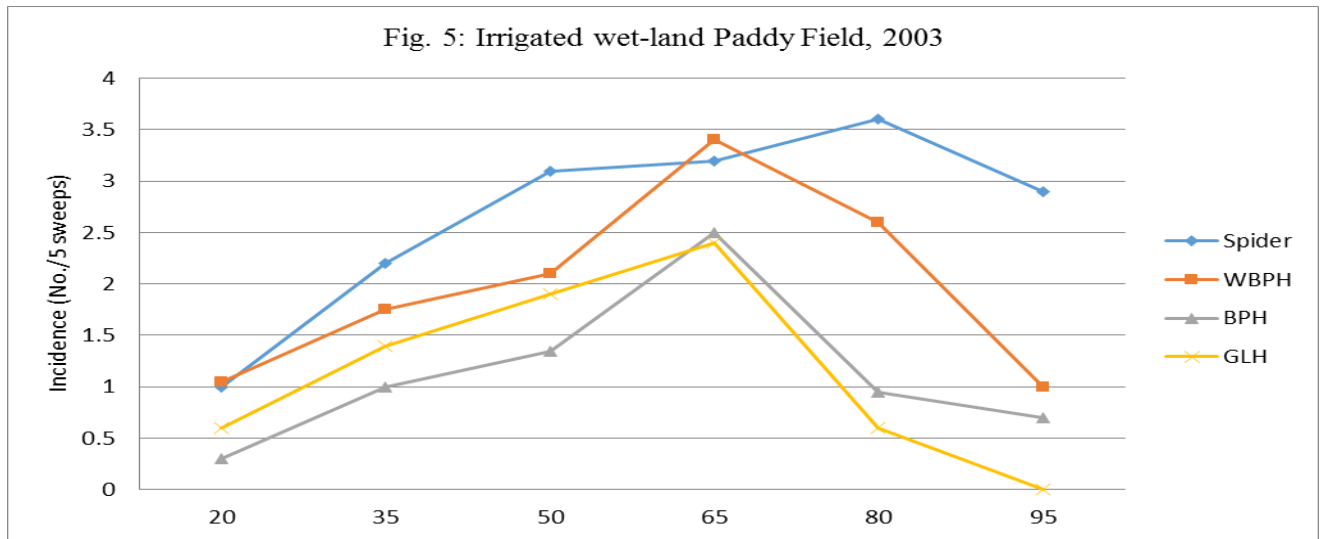
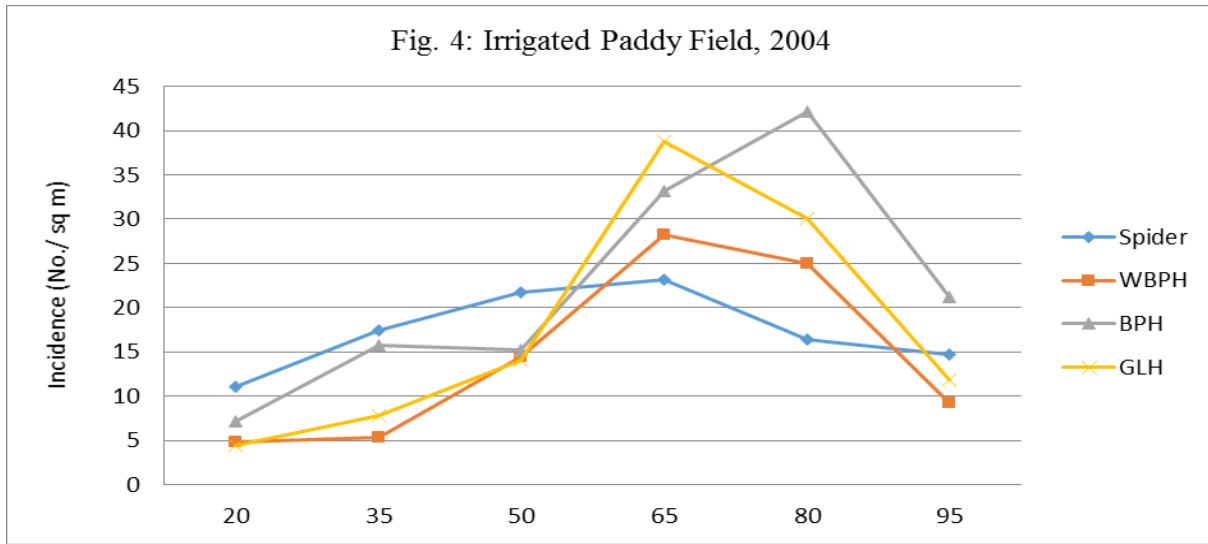
Table: 2. Survey of spiders and hoppers average incidence in irrigated wet-land paddy field during *kharif* season 2003 & 2004.

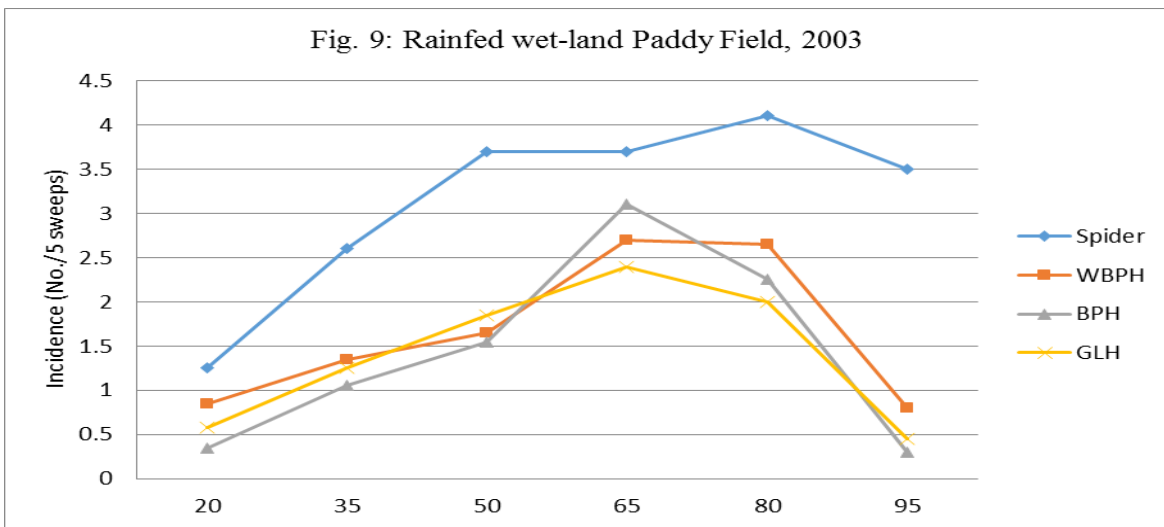
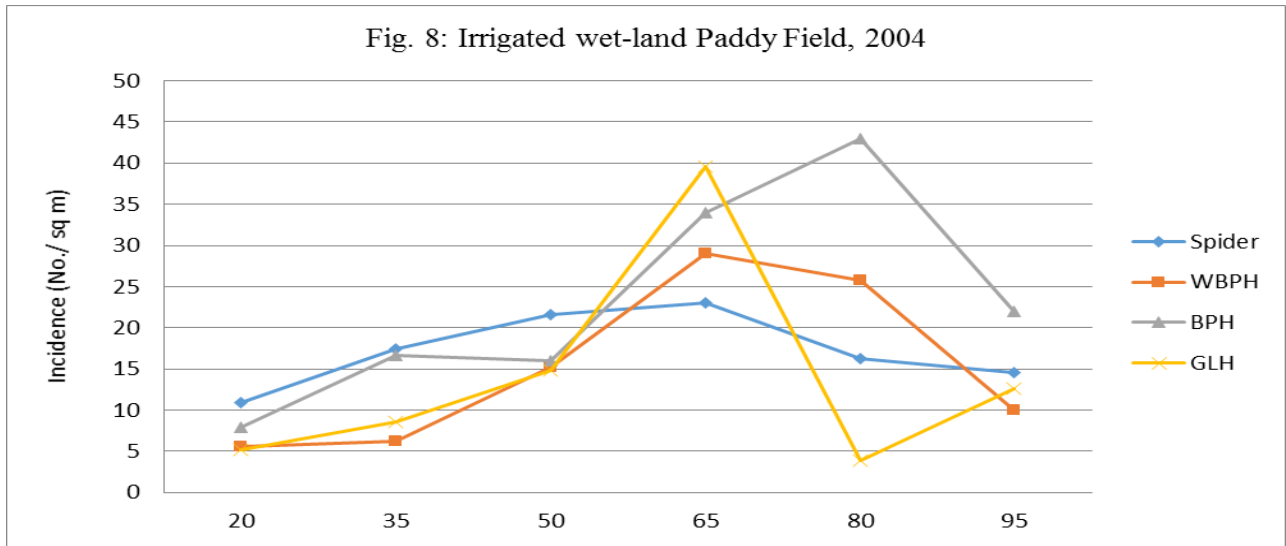
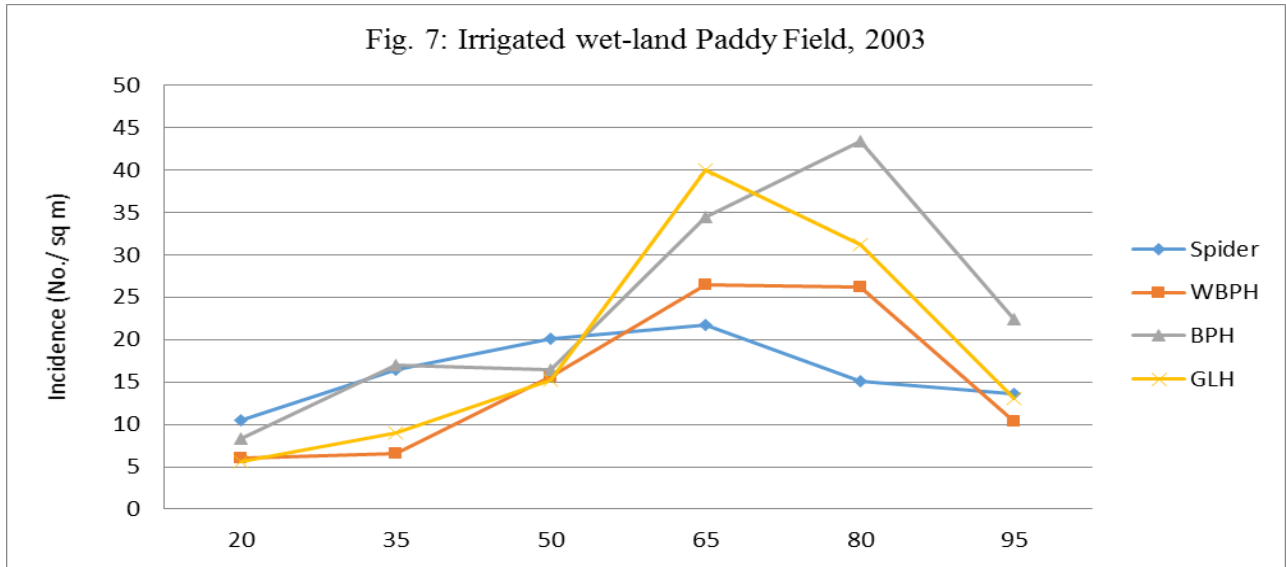
Crop age (DAT)	Incidence per five sweeps								Incidence per square meter							
	Spiders		WBPH		BPH		GLH		Spiders		WBPH		BPH		GLH	
2003&04	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
20	1.00	1.15	1.05	0.95	0.30	0.25	0.60	0.50	10.50	10.95	6.00	5.60	8.30	7.90	5.60	5.20
35	2.20	2.20	1.75	1.65	1.00	0.90	1.40	1.30	16.40	17.40	6.60	6.20	17.00	16.60	9.00	8.60
50	3.10	2.60	2.10	2.00	1.35	1.25	1.90	1.80	20.10	21.60	15.60	15.20	16.40	16.00	15.20	14.80
65	3.20	3.00	3.40	3.30	2.50	2.40	2.40	2.30	21.70	23.00	26.40	29.00	34.40	34.00	40.00	39.60
80	3.60	4.40	2.60	2.50	0.95	0.85	0.60	0.65	15.10	16.20	26.20	25.80	43.40	43.00	31.20	3.80
95	2.90	1.60	1.00	0.90	0.70	0.60	0.00	0.00	13.60	14.50	10.40	10.00	22.40	22.00	13.00	12.60

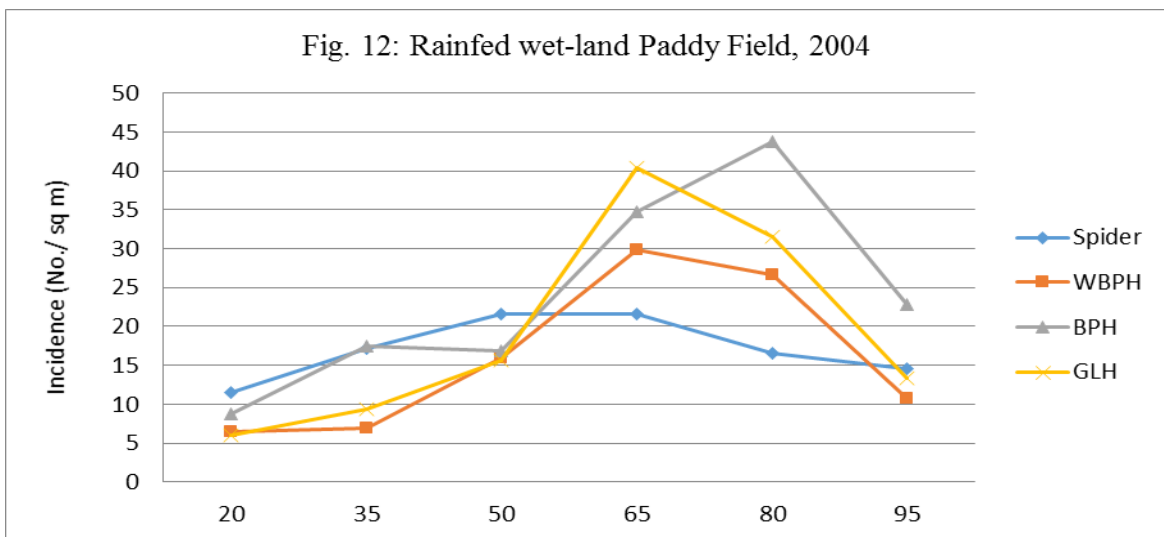
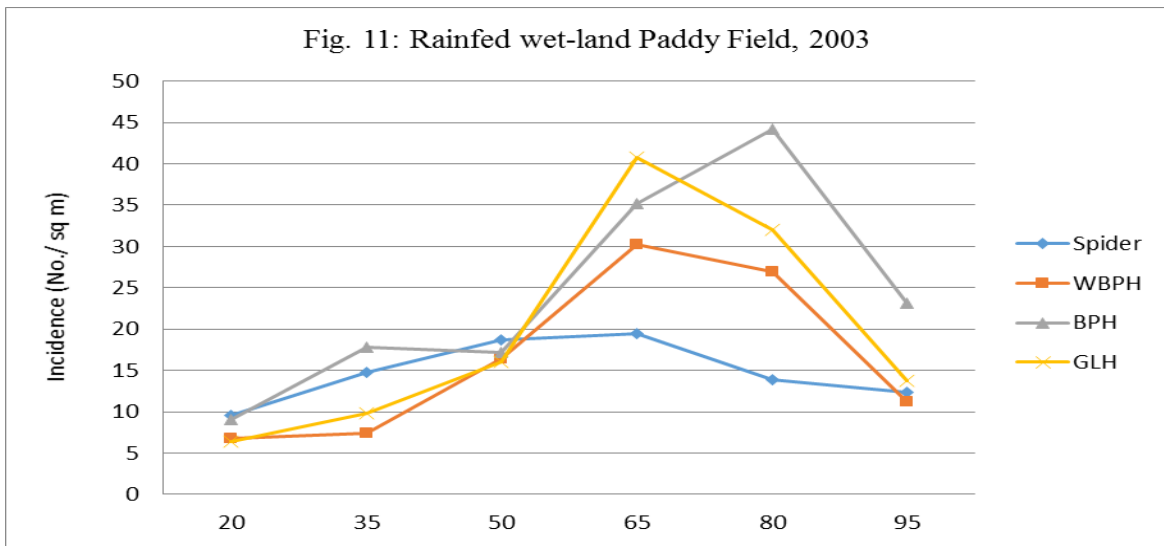
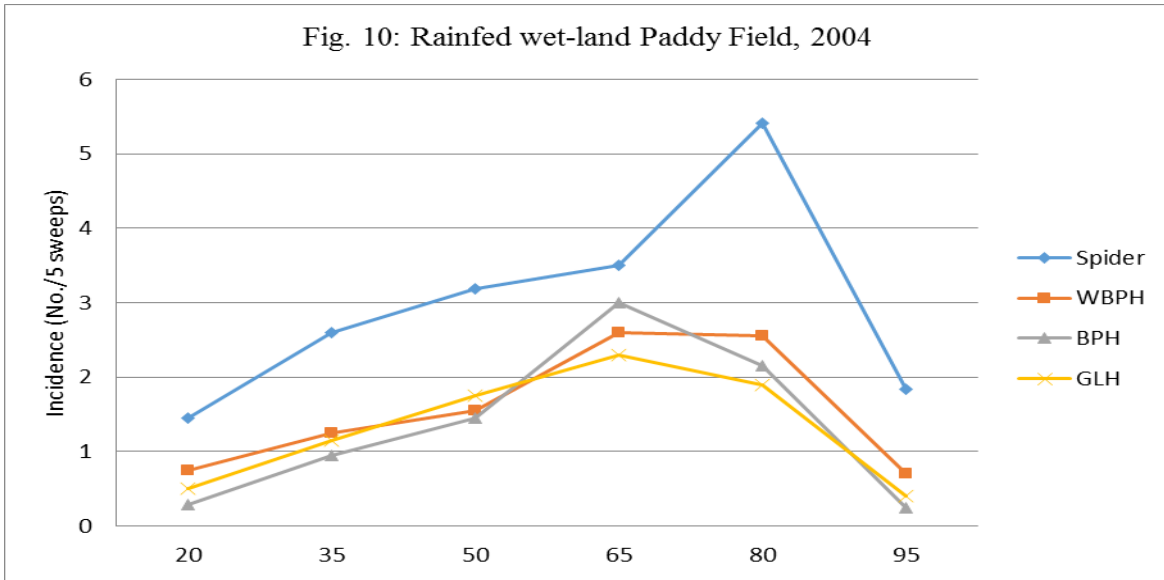
Table: 3. Survey of spiders and hoppers average incidence in rainfed wet-land paddy field during *kharif* season 2003 & 2004.

Crop age (DAT)	Incidence per five sweeps								Incidence per square meter							
	Spiders		WBPH		BPH		GLH		Spiders		WBPH		BPH		GLH	
2003&04	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
20	1.25	1.45	0.85	0.75	0.35	0.28	0.58	0.50	9.60	11.55	6.80	6.40	9.10	8.70	6.40	6.00
35	2.60	2.60	1.35	1.25	1.05	0.95	1.25	1.15	14.80	17.20	7.40	7.00	17.80	17.40	9.80	9.40
50	3.70	3.18	1.65	1.55	1.55	1.45	1.85	1.75	18.70	21.60	16.40	16.00	17.20	16.80	16.00	15.60
65	3.70	3.50	2.70	2.60	3.10	3.00	2.40	2.30	19.50	21.60	30.20	29.80	35.20	34.80	40.80	40.40
80	4.10	5.42	2.65	2.55	2.25	2.15	2.00	1.90	13.90	16.50	27.00	26.60	44.20	43.80	32.00	31.60
95	3.50	1.84	0.80	0.70	0.30	0.25	0.45	0.40	12.30	14.50	11.20	10.80	23.20	22.80	13.80	13.40









The survey revealed that the spiders incidence increased with the increase in crop age and hoppers incidence. The results also showed that from initial stage of crop establishment the spiders incidence increased due to complexity of its host range and even the individuals of its own species. During studies in both the year was observed the different species of spiders and hoppers identified during the survey at farmers field and experimental fields were name of hoppers, white backed plant hopper, brown plant hopper and green leaf hopper while spiders species i.e. *Tetragnatha mandibulata* (Walck), *Clubiona japonicola* (Boes. and Str.), *Pardosa pseudoannulata* (Boes. and Str.), *T. Javana* (Thorell), *Hippasa holmerae* (Rhorell), *Araneus inustus* (Clkoch), *Pardosa birmanica* (Simon), *Atypena* spp., *Cupa* spp., *Oxyopes* spp., *Runsinia* spp., *Phidippus* spp., *Neoscona theisi* (walck) and *Thomisus* spp. spider were found prominent in paddy grown area of Jaunpur district.

References

Anonymous, 1979. Annual report 1978 Los Banos, Philippines, 478.

- Barrion, A.T., Litsinger, J.A., 1980. Taxonomy and bionomics of spider in Philippine rice agro ecosystem: foundations future biological concept effort. Paper presented at the 11th annual conference of the pest control council of Philippine Cebu city, Philippines, April 23–26, 1980.
- Pantua, P., Litsinger, J.A., 1980. Comparison of insect pest and natural enemy abundance in weekly and biannual rice cropping systems. IRRI Saturday Seminar, May 31, 1980. Los Banos, Philippines, 21.
- Singh, R.B., 2005. Prevalance and composisions of different spiders and of land rice ecosystems. *J. Plant Prot. Environ Journal of Plant Protection and Environment* 2(1), 41–45.
- Swaminathan, M.S., Siddiq, E.A., 1991. Rice pest management in India. *Shell Agriculture* 10, 30–33.
- Wang, J.G., 1985. A preliminary investigation of spiders in paddy fields in Shoanxi. *Natural Enemies insects*, 7(4), 189–91 (c.f. *Rice Abstracts* 10(6): 273, 1987).