IOSR Journal Of Environmental Science, Toxicology And Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399. Volume 7, Issue 1 (Nov. - Dec. 2013), PP 76-84
www.iosrjournals.org

Survey and Surveillance of Key Insect Pests Affecting Basmati Rice in Northeastern Uttar Pradesh, India (Special Reference to Kanpur Region)

Smt. Sarika Gautam
Department of Zoology
Kamla Nehru P.G College Tejgaon Raebareli (U.P)

ABSTRACT
A comprehensive survey was conducted to assess the incidence of insect pests within the Basmati rice ecosystem in Northeastern Uttar Pradesh, India. This region primarily cultivates several Basmati rice varieties, including Pusa Basmati-1121, Pusa Basmati-1 (Todal), Pusa Basmati-2 (Sugandh-2), Pusa Basmati-3, RS-10, Dehradun-1, Hbc-19 Safidon, Pusa Basmati-6, Pusa Basmati-1509, HBR-92 Pusa Basmati (Kasturi), Basmati-370, 385, and HUBR2-1 Malviaya Basmati, with PB-1121 covering approximately 60% of the cultivated area. The crop faces significant challenges from various insect pests throughout its growth stages, ultimately impacting Basmati rice production. These pests infest all parts of the plant and may even transmit viral diseases, such as Green leafhoppers and Brown plant hoppers. Additionally, natural defenders like dragonflies, spiders, and praying mantises were observed within the Basmati rice ecosystem. Other notable insect pests identified in Northeastern Uttar Pradesh include the gundhi bug, rice hispa, brown plant hopper, and grasshopper, among others.
During the survey, leaf folders and stem borers were found to be particularly significant in their infestation levels. While numerous insecticides have been employed for pest management, their indiscriminate use has resulted in severe ecological consequences, including pesticide residues in consumable products and the development of pesticide resistance among pests. In response to increasing concerns for environmental safety and global demands for pesticide residue-free food, there has been a growing interest in implementing eco-friendly pest control methods. These eco-friendly approaches aim to mitigate the adverse effects of pesticide use while ensuring sustainable pest management practices within the Basmati rice ecosystem.
KEYWORDS: *Basmati rice, Survey, Insect-Pests, Residue and Pesticides. North Eastern Uttar Pradesh.*

I. INTRODUCTION

Rice serves as a staple food for 70% of the global population and 65% of India's population, cultivated across almost all states in India, contributing to 21% of the world's rice production. Uttar Pradesh holds a significant position in rice production, accounting for 15% of India's total rice output and ranking second after West Bengal (17%), while claiming the foremost position in rice crop area. However, despite these notable statistics, Uttar Pradesh does not hold a leading position in rice productivity. The primary reason for this low productivity is attributed to traditional and inadequate cultivation practices, resulting in a loss of 65% of potential yield, with 25% of these losses directly attributed to insect pests (Dhaliwal, 2004). Given Uttar Pradesh's prominent role as the leading rice crop area, the responsibility to bridge this productivity gap becomes even more crucial.

Rice cultivation spans various agro-climatic zones in India, with Uttar Pradesh situated within the middle gangetic plains zone. This zone, along with the subhumid Sutlez-Ganga plains zone, is characterized by a warm and humid environment conducive to insect survival and proliferation. Globally, around 800 insect pest species are associated with rice crops, with India hosting approximately 250 species, including 20 economically significant pests (Pathak & Khan, 1994; David & Ananth Krishnan, 2004; Atwal & Dhaliwal, 2011; DPPQS, 2004). In Northeastern Uttar Pradesh alone, 38 insect pest species affecting rice crops have been documented (Morya et al., 2005). These pests infest all parts of the rice plant at various growth stages and are known to transmit viral diseases.

At the national level, stem borers contribute to 30% of yield losses, plant hoppers to 20%, gall midge to 15%, leaf folders to 10%, and other pests to 25% of losses, emphasizing the significant impact of insect pests on rice production. With the overarching national target for food grain production and the unique responsibilities of Uttar Pradesh, particularly in Northeastern Uttar Pradesh, often referred to as the rice bowl of the state, the present study aimed to assess the incidence of rice crop pests during the 2011-12 crop season. The study sought to gather information on pest infestation, the nature of damage, and the economic importance of these pests, with the ultimate goal of developing effective management tactics for their control.

II. METHODOLOGY

To conduct a comprehensive survey on insect pests within the Basmati rice ecosystem, various Basmati rice-growing regions in North Eastern Uttar Pradesh were selected. The survey aimed to gather information on pest succession, pesticide application practices in the rice ecosystem, and farmer practices for managing insect pests. Although insect pests were observed in different areas at varying levels, some areas exhibited unique situations.

Data on pest succession and pesticide application were randomly collected from each location, with priority given to locations where maximum pest succession and pesticide application were reported. Surveys and collections were conducted on a weekly basis in rice fields, utilizing sweeping, aspirators, manual collection of insects, pitfall traps, and sticky traps to capture insects at all life stages. For immature stages, specimens were reared to adulthood to ensure accurate identification.

Collected specimens were brought to the laboratory for preservation and mounting. Pestiferous insects were primarily identified to the species level using keys (Barrion and Litsinger, 1994), available photographs (Pathak and Khan, 1994), and with assistance from subject matter experts. Insects of lesser economic importance were not identified to the species level, with many belonging to the orders Lepidoptera, Diptera, Hemiptera, and Hymenoptera. Some of these insects were considered casual visitors in search of food or hosts, such as parasitic wasps.

III. RESULTS AND DISCUSSION

There where 12 insect pests species observed significant damage belonging to 4 damaging groups (stem borers, leaf feeders, sap suckers & root feeders) at all growth stages of Basmati rice in kharif season (rainy season). The stem borers comprise 2 species, leaf feeders comprise 4 species, the sap suckers comprise 5 species & the root feeders comprise 1 species to major insect pests of Basmati rice. A List of major insect pests of Basmati rice observed during the study are shown in table-1

Table 1: List of major insect pests found during the survey

Damaging groups	**common name**	**Scientific name**	**order:family**	**observed significant damage**
1 Stem borers	1- Yellow stem borers	*Scirpophaga incertulus*	Lepidoptera: Pyraustidae	Dead hearts & white ears
	2- Striped stem borers	*Chilo suppressalis*	Lepidoptera: Pyralidae	Dead hearts & white ears
2.Leaf Feeders	1- Rice leaf folder	*Cnaphalocrosis medinails*	Lepidoptera: Crambidae	folded leaves & drying of leaves
	2- Rice cutworm	*Spodoptra mauritia*	Lepidoptera: Noctuidae	Defoliation & panicle initiation
	3- Rice grass hopper	*Hieroglyphus banian*	Orthoptera Acrididae	Defoliation & white ears
	4- Rice hispa	*Dicladispa armigera*	Coleoptera Chrysomelidae	Defoliation & stuntedgrowth
3-Sap Suckeres	1- Brown plant hopper	*Nilaparvata lugens*	Hemipetra Delphacidae	Hopper burn in circular patches
	2- White backed planthopper	*Sogatella furcifira*	Hemipetra Delphacidae	Hopper burn with rusty red leaves
	3- Spotted green leaf hopper	*Nephotettix nigropictus*	Hemipetra Cicadellidae	Hopper burn with brown yellow leaves
	4- plain green leaf hopper	*Nephotettix virescens*	Hemipetra Cicadellidae	Hopper burn with orange yellow leaves
	5-Rice earheadbug	*Leptocorisa acuta*	Hemipetra coreidae	Chaffy grains & panicle initiation
4-Root feeders	White Ant (Termite)	*Odontotermes obesus*	Isoptera Termitidae	Yellowing stunting & wilting plants
Total	12			

Based on the provided analysis of damaging groups in the rice ecosystem, we can observe distinct categories of pests along with their common names, scientific names, taxonomic orders and families, as well as the observed significant damage they cause:

1. Stem Borers:

- Yellow Stem Borers (*Scirpophaga incertulus*): They cause dead hearts and white ears in rice plants.
- Striped Stem Borers (*Chilo suppressalis*): Similar to yellow stem borers, they also lead to dead hearts and white ears.

2. Leaf Feeders:

- Rice Leaf Folder (*Cnaphalocrosis medinalis*): They cause folded leaves and drying of leaves.
- Rice Cutworm (*Spodoptera mauritia*): They result in defoliation and hinder panicle initiation.
- Rice Grasshopper (*Hieroglyphus banian*): They cause defoliation and white ears.
- Rice Hispa (*Dicladispa armigera*): Their feeding leads to defoliation and stunted growth.

3. Sap Suckers:

- Brown Plant Hopper (*Nilaparvata lugens*): They cause hopper burn in circular patches.
- White Backed Planthopper (*Sogatella furcifera*): They result in hopper burn with rusty red leaves.
- Spotted Green Leafhopper (*Nephotettix nigropictus*): They lead to hopper burn with brown-yellow leaves.
- Plain Green Leafhopper (*Nephotettix virescens*): They cause hopper burn with orange-yellow leaves.
- Rice Earhead Bug (*Leptocorisa acuta*): Their feeding leads to chaffy grains and hindered panicle initiation.

4. Root Feeders:

- White Ant (Termite) (*Odontotermes obesus*): They cause yellowing, stunting, and wilting of plants.

This analysis provides a comprehensive overview of the various pests affecting rice crops, their specific damages, and their taxonomic classifications. Understanding these damaging groups is crucial for implementing effective pest management strategies in rice cultivation.

Main Insect Descriptive Analysis:

1- **Yellow stem borer: (*Scirpophaga incertulus* Lepidoptera: Pyraustidae)**

Yellow stem-borer
Scirpophaga incertulas Walker
(Lepidoptera: Pyraustidae)

The yellow stem borer, a monophagous pest of rice, is widely recognized as one of the most serious threats to Basmati rice cultivation, infesting plants from the seedling stage through maturity (Salim and Masih, 1987). Annually, this pest causes damage ranging from 5-10% of the rice crop, with occasional localized outbreaks resulting in losses of up to 60%. Female yellow stem borers lay their eggs near the tip of the leaf blade, which are characterized by buff-colored hairs. Upon hatching, tiny pale yellow larvae emerge and penetrate the leaf sheath, eventually boring into the stem near the node. Typically, only one larva is found inside each stem. Notably, adult stem borers do not feed on Basmati plants. The damage caused by yellow stem borers manifests in two distinct forms: "dead heart" occurs when the insect attacks during the vegetative stage, while "white ear/head" occurs when infestation coincides with ear development. While plants can often compensate for a low percentage of early dead hearts, for every 1% of whiteheads observed, a yield loss of 1-3% may be expected.

2- Striped stem borer (*Chilo suppressalis* Lepidoptera: Pyralidae**)**

Stripped stem-borer
Chilo suppressalis (Walker)
(Lepidoptera: Crambidae)

The striped stem borer stands out as a highly significant rice pest across Asia. Larvae bore into the plant stems, feeding on vital plant nutrients and often resulting in substantial crop damage (Beevor et al., 1990). In transplanted crops, larvae of the striped stem borer sever the growing points of tillers, leading to their demise. Subsequent attacks during the flowering stage see larvae feeding on the meristem, leading to the emergence of empty, whitish-looking panicles referred to as white heads. Infested fields display these white heads standing upright, containing empty and unfilled glumes.

3- **Rice leaf folder** (*Cnaphalocrosis medinails* Lepidoptera: Crambidae)

The leaf folder poses a significant threat to rice crops, often resulting in severe losses. This insect is considered one of the major pests affecting rice cultivation. In normal years, it can cause yield losses ranging from 15-25% in Basmati rice fields. Leaf folder moths are nocturnal, typically hiding during the day and emerging at night. The newly hatched larvae have shiny, translucent bodies with light-brown heads, but their bodies turn green after feeding. These larvae fold the leaves, creating a shielded environment within, where they feed by scraping the green tissues between the veins. This feeding behavior causes the leaves to become white and papery, eventually giving them a scorched appearance upon drying up. The larvae consume the green portions of the leaf, leaving behind only the skeletal white parts.

The extensive feeding activity of leaf folder larvae significantly diminishes the overall vigor and photosynthetic ability of infested rice plants. If the larvae feed on the flag leaf, the maximum damage to rice yield is observed. Furthermore, plants infested with leaf folder larvae are more susceptible to bacterial and fungal infections (Bashir et al., 2004a).

4- **Rice cutworm** (*Spodoptra mauritia* Lepidoptera: Noctuidae)

The rice cutworm is an intermittent insect pest of rice found across southeastern Asia and is particularly prevalent in eastern and central India. It poses a significant threat to rice crops, causing yield losses ranging from 5-20%. Symptoms of damage are evident throughout all growth stages of rice, with the highest infestation observed during the seedling stage. The primary culprit behind the damage is the caterpillar stage, which feeds on the foliage, leaving behind only the stalks of the plants and hindering panicle initiation. The adult moths are stout and grayish-brown, adorned with black spots on their forewings. Eggs are laid in batches on leaves and covered with grayish hairs. Fully grown caterpillars exhibit a pale green coloration with sub-dorsal stripes, with pupation occurring within the soil.

5- **Rice grass hopper** (*Hieroglyphus banian* Orthoptera Acrididae)

Rice Grass Hoper Damage is caused by both adults and nymphs. They are polyphagous pest. The greatest amount of damage is caused during august- September when both adults and nymphs feed on Basmati and causing defoliation. The leaves are completely eaten by nymphs and adults, leaving the midrib and stalk. In the ear head stage, the adults attack the ears, nibble at the tender florets or gnaw into the base of the stalks, leading to the formation of 'white ears'. In recent years this pest has generally been kept well under its economic injury level in India, hence no more recent loss estimates are available. H. banian has been shown to be involved in the mechanical transmission of Xanthomonas oryzae pv. oryzae, although it does not survive within the insect.

6- **Rice hispa** (*Dicladispa armigera* Coleoptera Chrysomelidae)


The rice hispa is one of the major insect pests of rice (Palaszek et al., 2002; Hazarika et al. 2005). Linear patches along the veins. The yellowish grubs mine into the leaves presenting blister spots. It causes considerable damage to vegetative stages of rice resulting in yield loss of 28% (Nath & Dutta 1997).

7- **Brown plant hopper** (*Nilaparvata lugens* Hemipetra Delphacidae)

The brown plant hopper is serious pests of rice. Populations reduce rice yields but when insects congregate in large numbers, causing hopper burn in circular patches and enough to cause complete drying of the crop. High temperature 4 Raveesh Kumar Gangwar, Shaily Javeria, Komal Yadav, Swati Tyagi & Ramesh Singh Index Copernicus Value: 3.0 - Articles can be sent to editor@impactjournals.us and high humidity responsible for abundance of leafhoppers attribution and their population fluctuates according to the availability of host plants, presence of natural enemies, and environmental conditions. Plant hoppers damage plants by sucking the sap and by plugging xylem and phloem with their feeding sheaths and pieces of tissue pushed into these vessels during exploratory feeding due to this plants become yellow and die. Nilaparvata lugens transmits grassy stunt and ragged stunt viral diseases. Under favorable climatic conditions, such as high N application, high humidity (90%), optimum temperature (27-28 °C), and little air movement, the population of BPH increases rapidly and causing hopper burn in rice field.

8- **White backed planthopper** (*Sogatella furcifira* Hemipetra Delphacidae)

The White backed plant hopper, is also one of the important pests of rice. It cause 7-10% paddy yield losses every year but in the years of severe devastations, the pest may destroy the crop completely by causing hopper burns. The pest inflicts more damage on coarse rice varieties than on basmati rice.

9- **Spotted green leaf hopper** (*Nephotettix nigropictus* Hemipetra Cicadellidae)

The spotted green leaf hopper is an endemic insect pest of rice distributed over Asia and occupied national insect pest of rice in India it is most serious insect pest of rice and accounted for 7-20% yield loss. The symptoms of damage was observed as hopper burn and smeared black sootymould in tillering to flowering stage. The damaging stages of nymph and adult, sucking cell sap from the leaves, turn brown yellow from the leaf tips and spread to rest of the plants, leading to hopper burn and excret honey dew on which black shooty mould appears. It has also observed vector of rice tungro disease in rice yellow dwarf disease caused by virus and mycoplasma respectively. The adults are green with black band towards posterior regions on forewings. The eggs are laid in batches undersurface of leaf sheaths by lacerating the tissues. The full grown nymphs are green and congregated at upper parts of the plants.

10 - **plain green leaf hopper** (*Nephotettix virescens* Hemipetra Cicadellidae)

The Plain green leaf hopper is an endemic insect pest of rice distributed over Asia and occupied national insect pest of rice in India it is most serious insect pest of rice and accounted for 7-20% yield loss. The symptoms of damage was observed as hopper burn and smeared black sootymould in tillering to flowering stage. The damaging stages of nymph and adult, sucking cell sap from the leaves, turn orange yellow from the leaf tips and spread to rest of the plants, leading to hopper burn and excret honey dew on which black shooty mould appears. It has also observed vector of rice tungro disease in rice yellow dwarf disease caused by virus and mycoplasma respectively. The male adults are green with two black spots on forewings and female adults are uniformly green. The eggs are laid in batches undersurface of leaf sheaths by lacerating the tissues. The full grown nymphs are green and congregated at upper parts of the plants.

11- **Rice earheadbug** (*Leptocorisa acuta* Hemipetra coreida)

The rice earheadbug is a sporadic insect pest of rice, distributed over Asia and occupied national insect pest of rice and accounted for 10-50% yield loss. The symptom of damage was observed as chaffy grains and dark spots on punctured grains in flowering stage. The damaging stages are nymph and adult, sucking cell sap from tender shoots and milky grains, leading to chaffy grains and emit offensive smell. The adults are slender greenish brown with long antennae and legs. The eggs are laid in masses in single row, towards the midrib of leaves. The full grown nymph are yellowish green and in active during hot sun resting at the lower shady portion of the plants.

12- **White Ant (Termite)** *(Odontotermes obesus* Isoptera Termitidae)

The common termite is a sporadic insect pest of rice, distributed over south eastern Asia and occupied regional insect pest of rice in India. It is very serious insect pest of rice and accounted for 5-20% yield loss. The symptom of damage was observed as yellowing, stunting and wilting of plants can be easily pulled out along with mud soil filled with roots. The damaging stage is adult worker, feeding on subterranean parts of the plants by nibbling, leading to yellowing, stunting and wilting of plants. The adult termites are differentiated into 5 casts, King, Queen, Worker, Soldier and complementary form. King, Queen and complementary form are reproductive and Worker & Soldier are steriles. The Worker are most abundant and active in the colony, have cream coloured with dark brown head along with well developed mandibles. The eggs are laid in groups of thousand in the underground nest. The nymphs are cream white, feeding by parents them selves.

IV. CONCLUSIONS

During the survey, it was noted that arthropods inhabiting the Basmati rice ecosystem, including predator and visitor insects, although not harmful or noxious to Basmati rice varieties, exhibit a mix of beneficial and predatory behaviors towards insect-pest populations. Observing the population dynamics of predators is crucial, as they can effectively control insect-pest populations when farmers refrain from indiscriminate pesticide use. Despite pesticides being commonly relied upon as the primary line of defense against rice insect-pests, Integrated Pest Management (IPM) practices are increasingly adopted by farmers due to the adverse effects associated with continuous pesticide usage. These effects include biodiversity loss, residual toxicity, the resurgence of insect-pests, and environmental pollution.

The presence of pesticide residues in Basmati rice raises concerns among consumers due to their potential harmful effects on non-targeted organisms besides pests and diseases. Insect predators of rice pests are prevalent in rice-growing areas and play a significant role in reducing pest populations. Beetles, predatory grasshoppers, and crickets, for example, can consume up to 80-90% of certain insect pests' eggs. The wolf

spider Pardosa pseudoannulata is identified as a polyphagous predator within rice ecosystems across much of Asia. These natural enemies collectively contribute to over 69% of insect mortalities, highlighting their significant impact on pest population regulation.

REFERENCES

[1]. Alam (1983). Important rice pest control transferable to farmers' fields. In: Proc. Workshop on modern rice cultivation in Bangladesh. BRRI, Gazipur, pp.106-116.

[2]. Amalin, D. M., Pena, J. E., McSorley, R., Browning, H. W. and Crane, J. H. (2001). Comparison of different sampling methods and effect of pesticide application on spider populations in line orchard in South Florida. Environmental Entomology, 30: 1021-1027.

[3]. Atwal, A.S. and Dhaliwal, G.S (2012) Agricultural pests of South Asia and their management 7th edition. Kalyani Publishers, Ludhiana, India. 592PP.

[4]. Barrion A. T. and Litsinger J. A, (1994). "Taxonomy of rice insect pests and their arthropod parasites and predators", In Heinrichs E A (Ed.), Biology and Management of Rice Insects, Wiley Eastern, New Delhi, pp. 363-486. 6 Raveesh Kumar Gangwar, Shaily Javeria, Komal Yadav, Swati Tyagi & Ramesh Singh Index Copernicus Value: 3.0 - Articles can be sent to editor@impactjournals.us

[5]. Bashir, khurram; Husnain, Tayyab; Fatima, Tahira; Latif, Zakia; Mehdi, Syed Aks and Riazuddin, Sheikh2004a. Field evaluation and risk assessment of transgenic indica Basmati rice. Molecular Breeding, vol. 13, no. 4, p. 301-312.

[6]. Beevor, P. S., David, H., Jones, O. T. (1990): Female sex pheromones of Chilo spp. (Lepidoptera: Pyralidae) and their development in pest control applications. Insect Science and its Application 11: 787–794.

[7]. David. B.V and Ananth Krishnan, T.N (2007) Genral and applied entomology 2nd edition Mc Graw Hill publication (India) Pvt. Ltd, New Delhi, India. 1184PP.

[8]. Dwivedi, J.L.(2011) Status paper on rice in Uttar Pradesh directorate of rice research (ICAR) Hyderabad, India 32PP.

[9]. Fei, H., Su, Q., Zhang, X., Fei, H., Su, Q. and Zhang, X. 1995. Effects of immigrated population and climatic factors on field population dynamics of rice caseworm. Acta-Phytophylacica-Sinica 22(3), 193-197.

[10]. Ganeshkumar, M. and Velusamy, R. 1996. Safety of insecticides to spiders in rice fields. The Madras Agricultural Journal, 83(6): 371-375.

[11]. Graf B, Lamb R, Heong KL, Fabellar LT. (1992). A simulation model for the population dynamics of the rice leaffolders (Lepidoptera: Pyralidae) and their interactions with rice. J. Appl. Ecol. 29:558-570.

[12]. Hazarika LK, Dekha M, Bhuyan M (2005) oviposition behavior of the rice hispa Diclaispa armigera (Coleoptera: Chrysomelidae). International Journal of Tropical Insect Science 25:1-6.

[13]. Heinrichs, E.A (Ed) (1994) Biology and management of rice insects. Willey Eastern Ltd New Delhi 799PP.

[14]. Heinrich, I. A. and Mochida, O. 1984. From secondary to Major pest status: the case of the insecticide induced rice brown planthopper, Nilaparavata lugens, resurgence. Protection Ecology, 7: 201-218.

[15]. Herdt, R. W. (1991). Research priorities for Rice Biotechnology. In Rice Biotechnology (ed. Khush G. S and Toenniessen G H). International Rice Research Institute. Los Banos, Phillipines.

[16]. Hill, D.S (1983) Agricultural insect pests of the tropics and their control. Cambridge University press Cambridge, United Kingdom 516PP.

[17]. Holland, J. M., Winder, L. and Perry, J. N. (2000). The impact of dimethoate on the spatial distribution of beneficial arthropods in winter wheat. Annals of Applied Biology, 136: 105.

[18]. IRRI (1985). Standard evaluation system for rice. Manila (Philippines): International Rice Research Institute.

[19]. Jaiswal, P.L (Ed) (1984) Rice research in India. ICAR New Delhi, India 726PP.

[20]. Krishnaiah, K (1998) Rice research in India. Indian journal of agricultural sciences, 68 (8 special issue) 385-395PP.

[21]. Lu Zhong-Xian, Yu Xiao-Ping, Kong-luen Heong and H. U. Cui. (2007). Effect of nitrogen fertilizer on herbivores and its stimulation to major insect pests in rice. Rice Science, 14 (1): 56-66

[22]. MEA 2005 Ecosystem and human well-being synthesis. Washington, D. C. (USA) Island, Press www. millenniumassessment. org /en /s ynthesis.

[23]. MEA (Millennium Ecosystem Assessment). 2005. Ecosystems and human well-being synthesis. Washington, D. C. (USA). Island Press.

[24]. Nath R, Dutta B (1997) Economic injury level of rice Hispa, Dicladispa armigera (Oliv.). Journal of the Agricultural sciences society of North East India 10: 273-274.

[25]. Pathak, M. D. and Khan, Z. R. 1994. Insect pests of rice. IRRI, Los Banos, Laguna, Philippines. 89PP.

[26]. Pathak, S. and Saha, N. N. 1999. Spider fauna of rice ecosystem in Barak Valley Zone of Assam, India. Indian Journal of Entomology, 2: 211-212.

[27]. Pillaiyar (1988). Rice pest Protection Manual, Wiley Eastern Ltd. New Delhi.437 P.

[28]. Polaszek A, Rabbi MF, Islam Z, Buckley YM (2002) Trichogramma zahiri (Hymenoptera: Trichgrammaridae on egg parasitoids of the rice Hispa Diclodispa armigera (Coleoptera: chrysomelidae) in Bangladesh. Bulletin of Entomological Research 92:529-537.

[29]. Ramzan, M., M. Salim, A. Rehman, S. Hussain and M. Akhter (2006). Predaceous fauna and its conservation in rice-wheat areas. Pakistan J. Sci. 58(3-4):75-78.

[30]. Salim, M. and R. Masih, 1987. Efficacy of insecticides against rice stem borer at NARC, Islamabad Pakistan. J. Agri. Res., 8(4):477-479.

[31]. Shepard, B. M., Barrion, A. T., Litsinger, J.A., (1987). Friends of the rice farmer. Helpful insects, spiders and pathogens. IRRI, Manila.