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SYSTEMATIC STUDY ON THE BENEFICIAL INSECTS AND INSECT PEST ON THE REPRODUCTIVE PHASE OF RICE (*Oryza sativa*) PLANT GROWTH

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ABSTRACT

The agro ecosystem within the rice-based system presents great opportunities for improved nutrition within rural communities that comprised a rich mosaic of rapidly changing ecotones, harboring a rich biological diversity, maintained by rapid colonization as well as by rapid reproduction and growth of organisms.

Four species of insect pest from the family Alydidae, Nymphalidae, Cicadellidae and Pentatomidae that thrives during the reproductive phase were present on the agro- ecosystem and these insects pest were detrimental for they mostly feed on the panicle of the rice plant and leaf surface and their abundance on the field indicates that the Rice field is at risk for they can cause low yield. A total of seven (7) species of natural enemies were identified using morphological characters representing 7 families; Tettigoniidae, Coccinellidae, Coenagrionidae, Gryllidae, Sciomyzidae, Carabidae and Tetragnathidae that acts as bio control for the insect pest that helps in the mitigation of the insect pest that causes diseases and low yield on the rice fields.

Keywords: Systematic, Beneficial Insect, Insect pest, Reproductive phase, *Oryza sativa*

INTRODUCTION

There is growing evidence that traditional agro-ecosystems such as rice fields contribute to sustain the regional biodiversity of many invertebrate and vertebrate species [1]. The study of biodiversity associated with agro-ecosystems such as rice fields is of significance for agroecologists and conservation biologists, since maintenance of biological diversity is essential for productive agriculture, and ecologically sustainable agriculture is in turn essential for maintaining biological diversity [2].

The agro-biodiversity within the rice-based system presents great opportunities for improved nutrition within rural communities, increased farmer income through crop diversification, and the protection of a wealth of genetic resources for future generations [3].

Rice fields are very important because they are environmental buffers. They are a dynamic ecosystem that helps balance temperature and wind. They provide a moderating effect on the surroundings [4]. Irrigated rice fields, being temporary aquatic habitats with a generally predictable dry phase, can be scientifically defined as an agronomically managed temporary wetland ecosystem [5].

The physico-chemical composition of the floodwater changes accordingly. These changes are made more complex by agronomic practices such as application of fertilizer and biocides. As a whole, the ecology of rice fields is characterized by rapid physical, chemical and biological changes [5].

Rice fields, together with their contiguous aquatic habitats and dry land, comprise a rich mosaic of rapidly changing ecotones, harboring a rich biological diversity, maintained by rapid colonization as well as by rapid reproduction and growth of organisms [6, 7]. Although the species composition of terrestrial arthropod pests and natural enemies in rice fields throughout the world is relatively well documented, only a few studies have examined the overall biodiversity in rice fields [6].

In Nueva Ecija, farmers have difficulties in controlling pest in rice production. Among these difficulties are lack of knowledge in other pest control methods, resistances of some major pests in chemical pesticides, rapid pest resurgence, and unexpected incidence of pest occurrences due to climate change.

Biological control measures are developed as an agricultural pest control technology, and it is the application of ecology in ecosystem. The idea is to manage a pest by deliberate use of living organisms. In natural ecosystems, such events occur innumerable times and are a major component by which populations of an organism are regulated. In application to agriculture, the goal is to effectively manage populations of beneficial organisms and their ability to reduce the pests' activities within environmental, legal and economic constraints [8].

MATERIALS AND METHODS

COLLECTION SITES

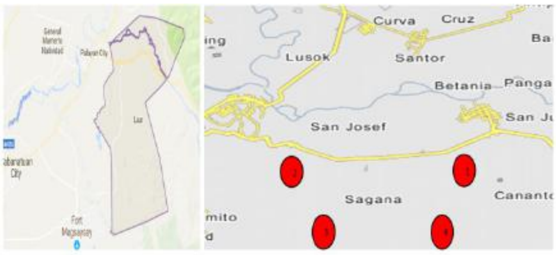

Figure 1: Collection site at Barangay Sagana, Laur, Nueva Ecija, Philippines

Four 1000 m^2 rice field were the sampling size of the study located from the North, East, South and western part of Barangay sagana, Laur, Nueva ecija. Figure 1 shows the map of Barangay Sagana, Laur, Nueva ecija, Philippines where the four collection areas were identified namely: Station 1: Purok1; Station 2: Purok 3; Station 3: Purok4 and Station 4: Purok 6.

COLLECTION OF SPECIMENS

Rice plants were on reproductive growth phases for the collection of the insect pests. Collection of insect pests was performed during morning, daylight sweeps taken between 6:00 and11:00 in the morning, since this is after the dew has burned off and before the midday rains begin in the rainy season. Sweeping was never done on days with morning rain.

Light and strong insect net (32 cm diameter) with fairly open mesh for easily sweeping and an insect can be seen through it were used for catching the insects. Insect net was used for catching the flying and jumping insects in the rice fields. Sampling was done by sweep netting in established plots during the reproductive phase of rice growth, horizontal pattern with twenty (20) sweeping strokes of insect nets were performed in the rice field plots as randomly selected were used as the standard.

KILLING OF INSECTS

Killing jar/zip lock composed of potassium cyanide and saw dust with 1:2ratio were used for the quick killing of the insects to avoid unnecessary contact to each other for them to be easily separate from each other. Sweeping nets with insects were placed on the killing jar/ zip lock for 5 minutes and wait until all the insects were died.

RELAXING SPECIMENS

Dried specimens can be relaxed by placing them in humid atmosphere for a few days. Cover the bottom of the jar with wet sand and add sodium hypochlorite to prevent molds. Insects were placed in small open boxes or envelopes and tightly closed the jar. In this manner the specimens were became flexible for easy mounting and pinning.

SPECIMENS PINNING

Hard-bodied insects are normally preserved by pinning to retain their shape when dry. Insects should be pinned with insect pins (insect pins no. 1, 2 and 3) made especially for this purpose, which can be bought from supply house. Pinning block were used to mount the insect about an inch up on the pin. Large-bodied insects should be enough of the pin above the insect to permit easy handling.

STORAGE OF THE SPECIMENS

Pinned insects should be kept in boxes or sealed glass containers having a soft material in the bottom to permit easily pinning. Labels were placed at a uniform position on the insect. Proper labeling was followed by proper data labels from respective entomologist.

SPECIES RICHNESS

Species richness is a measure of the number of species found in a sample. Since the larger the sample, the more species we would expect to find, the number of species is divided by the square root of the number of individuals in the sample. This particular measure of species richness is known as D, the Menhinick's index.

$$\mathbf{D = s/\sqrt{N} * 100}$$

Where**s** equals the number of different species represented in your sample, and **N** equals the total number of individual organisms in your sample.

RESULTS AND DISCUSSION

In the early stages of the rice crop, several common insects can cause highly visible damage symptoms. In most cases, insecticides applied in rice fields during the early crop stages to insect pest are unlikely to benefit farmers economically. Instead, they can cause an imbalance in the natural insect population that may lead to pest outbreaks. FAO's Integrated Pest Management programs advocate minimizing the application of broad spectrum of chemical and natural pesticides and allowing some pests to live in the field which serves as food or host for natural enemies.

The study yielded 4 species of insect pest that thrives during the reproductive phase of rice growth namely Rice Bug (*Leptocorisaoratorius)* (Thunberg), Rice Butterfly (*Melanitis ledaismene),* Green leaf hopper (*Nephotettix virescens)* and Rice black bug (*Scotino pharacoarctata)* and a total of seven (7) natural enemies were identified representing two classes, five orders, seven families and seven genera namely: *Conocephalus longipennis* (De Haan), *Micraspis crocea* (Mulsant), *Agriocnemis femina femina* (Brauer), *Metioche vittaticolis, Sepedon* sp., *Ophionea nigrofasciata* (Schmidt-Goebel), and *Tetragnatha maxillosa* Thorell.

The Species richness graph tells us the measure of the number of species found in a sample. The number of species is divided by the square root of the number of individuals in the sample. We can see that Station 1 with 34.95% which is located at Purok 1 has the highest Species richness that explains the diversity of insects thriving during the reproductive phase on the growth of rice plant followed by Station 2 with 34.55%, Station 4 with 29.73% and lastly Station 3 with 28.36 %.

Station 1 and Station 2 yielded the highest Species richness index maybe because these stations were nearby the passage road and harvesting phase rice field that leaves no other choice for the insect pest to look for their host plant which was on its reproductive phase where they can feed for survival. Rice bugs (*L. oratorius)* damage rice by sucking out the contents of developing grains from pre-flowering spikelet to soft dough stage, therefore causing unfilled or empty grains and discoloration. Immature and adult rice bugs both feed on rice grains. Rice butterfly (*Melanitis ledaismene)* larvae rest on the undersides of leaves, parallel to the midrib, and feed on the leaves mostly at night. Green leaf hoppers (*Nephotettix virescens*) are the most common leafhoppers in rice fields and are primarily critical because they spread the viral disease tungro. Both nymphs and adults feed by extracting plant sap with their needle-shaped mouthparts.

Rice black bug (*Scotinophara coarctata)* removes the sap of the plant. They can cause browning of leaves, dead heart and bug burn. Their damage also causes stunting in plants, reduced tiller number, and formation of whiteheads. On severe cases, black bugs weaken the plant preventing them from producing seeds. While the species richness of the Beneficial insect yielded 28.07% on station 1 which has the highest value for species richness followed by Site 2 (24.72%), Site 4 (24.56%) and Site 3 (22.65%).

Mainly the reason for the highest species richness in Site 1 is that it is situated near the main road and surrounded by other rice fields on harvesting phase leaving no options for the natural enemies but thrive in the site wherein insect pests are also abundant for consumption.

Table 1: Species richness of beneficial insects and insect pest

		Site 1	Site 2	Site 3	Site 4
Species Richness	**Beneficial Insects**	**28.07 %**	**24.72 %**	**22.65 %**	**24.56 %**
	Insect Pest	**34.95 %**	**34.55 %**	**28.36 %**	**29.73 %**

Inrelation to the rice crop, the fauna and flora in rice fields include pests, their natural enemies (predators and parasitoids) and neutral forms. Long standing cultivation of rice over several millennia have enabled organisms to become adapted to the rice field aquatic system [9]. However, the marsh, pond, and stream-dwelling organisms colonize and survive in rice fields due to their ability to tolerate drastic changes in the rice field ecosystem and the ready availability of colonizers in contiguous aquatic habitats [7].

Previous studies on the biodiversity of rice fields deal mainly with agronomic aspects, where the rice pests, their natural enemies and weeds have been surveyed extensively. Comprehensive studies on the ecology and biodiversity of rice fields are scanty. A preliminary study on fauna and flora of a rice field in Sri Lanka has documented 77 species of invertebrates, 45 species of vertebrates and 34 species of plants [5].

When cultural control practices double as desirable agronomic practices, the farmers usually adopt them readily. However, when the cultural control practices are poor agronomic practices, adoption can be difficult. Some cultural practices offer direct benefits to the farmer if carried out at the farm level. However, some others require community-wide action to be effective. Depending on the scale of adoption required to derive pest suppression benefits, important cultural control practices are divided into two categories: Single field cultural practices and Community-wide cultural practices [10].

CONCLUSION

The physical and biological components of our environment are all interrelated. When one component is damaged, sooner or later the other components will also be affected from the tiniest organism to the biggest of animals.

Four species of insect pest from the family Alydidae, Nymphalidae, Cicadellidae and Pentatomidae that thrives during the reproductive phase were present on the agro-ecosystem and these insects pest were detrimental for they mostly feed on the panicle of the rice plant and leaf surface and their abundance on the field indicates that the Rice field is at risk for they can cause low yield.

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REFERENCES

[1] Lawler S.P. 2001. Rice fields as temporary wetlands: a review. Israel Journal of Zoology 7: 513–528.

[2] Pimental D., Stachow U., Takacs D., Brubaker H.W., Dumas A.R., Meaney J.J. et al., 1992. Conserving biological diversity in agricultural/ forestry systems. BioScience 42: 354–362.

[3] International Year of Rice (2004. Rice and Agro-Biodiversity. - FAO 2004.http://www.Fao.Org/Ag/Irc/Default.html

[4] Rogel Marie C.J.G. (2004): The Richness of Philippine Rice Fields. — A Public Education Series of the Asia Rice Foundation, September 2004 **1** (3): 1-4.

[5] Bambaradeniya C.N.B. 2000. Ecology and biodiversity in an irrigated rice field ecosystem in Sri Lanka. Ph.D. Thesis, University of Peradeniya, Sri Lanka, 525 pp.

[6] Fernando C.H. 1995. Rice fields are aquatic, semi-aquatic, terrestrial and agricultural: a complex and questionable limnology. In: Timotius K.H. and Goltenboth F. (eds) Tropical Limnology 1: 121–148.

[7] Fernando C.H. 1996. Ecology of rice fields and its bearing on fisheries and fish culture. In: de Silva S.S.(ed) Perspectives in Asian Fisheries. Asian Fisheries Society, Manila, Philippines, pp. 217–237.

[8] Vincent C., Goettel M.S. and Lazarovits G., 2007 Biological Control: A Global Perspective.

[9] Heckman, I. (1979). "Sample selection bias as a specification error." Econometrica. 47 (1): 153-61. Doi.10.2307/1912352

[10] Litsinger, J. A., 1994. *Cultural*, mechanical and physical control of rice insects. Pp. 549-584 In: EA Heinrichs (ed.) *Biology and Management of Rice Insects*. International Rice Research Institute, Philippines.