

**Insect Diversity in Rajamangala University of Technology Isan,
Roi Et Campus at Tung Kula Rong Hai**

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Abstract

This current research aimed to determine the insect diversity at various land-use types in Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai. Three main land-use types i.e. rice paddy fields, vegetables and pastures as representatives of this study. Insects were caught using sweeping net at 20 times/sampling plot in July 2018. All samples were identified based on external morphology. The result of this study found that 39 insect species, 25 families obtained were representative of 9 orders. Rice paddy fields had the highest diversity (31 species) followed by pastures (24 species) and vegetables (15 species) respectively. The number of insect species and individual significantly differed among land-use types ($p < 0.01$). Herein, Shannon-wiener Index (H') for all insect of all land-use types was considered relatively high (2.15). Additionally, the insect pests, *Nilaparvata lugens*, *Edwardsiama hergmanni* and *Hydrellia philippin* were dominant species. Whereas, *Micraspis discolor*, *Coccinella transversalis* and *Agriocnemis pygmaea* were mainly exhibited. For relationship between physical factors and insects, relative humidity and temperature were highly significant positive correlated with the number of insect ($p < 0.01$).

Keywords: Insect diversity, Shannon-wiener Index, Tung Kula Rong Hai

Introduction

Global diversity is currently to be about 10 million species; however, insects comprise more than half of earth's diversity of species [1]. Healthy biological communities depend on insects as pollinators, seed dispersers, herbivores, predators and prey. Within the ecological communities, insects comprise a large proportion of the biomass and are critical conduits of energy through the ecosystem [2]. Disappearance of insects could lead to extinction of earth's animals because of the disappearance of so much plant life. Today insects are by far the planet's most diverse, abundant and successful species [3,4]. The roles (positive or negative) insects play in nature require proper understanding on how they interact with living and non-living environment and their diversity [3]. This study aims to investigate insect diversity and its relationship with environmental factors especially humidity and temperature. To address the aim, we conducted a field study in an organic agroecosystem was conducted during the planting season in July 2018. The results can be used as a insect checklist and as database for a proper insects conservation and management in the future.

Materials and methods

Study area

The study was conducted at various land-use types in Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai. It is located in Suwannaphum, Roi Et province which is one part of Tung Kula Rong Hai in northeastern Thailand. Tung Kula Rong Hai, Roi Et is one of the main export jasmine rice products. It is the most famous premium rice which has a unique sweet scented aroma, softness, and tender texture.

Three main land-use types i.e. rice paddy fields, vegetables and pastures as representatives of this study.

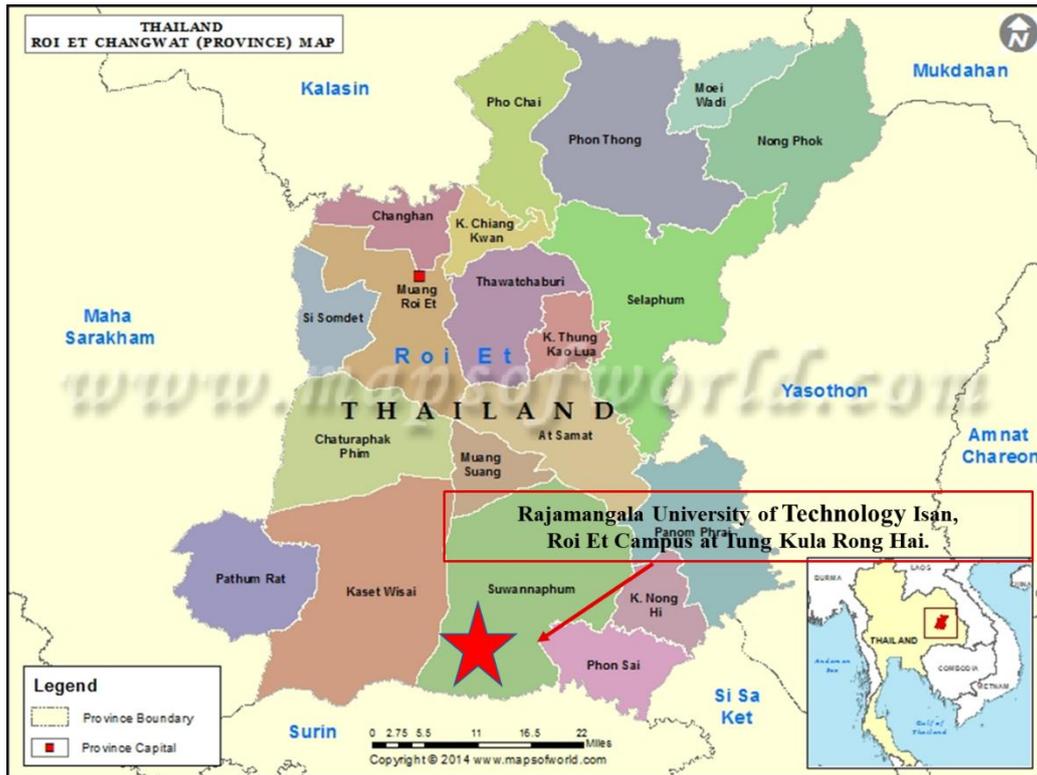


Fig. 1. Location of Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai

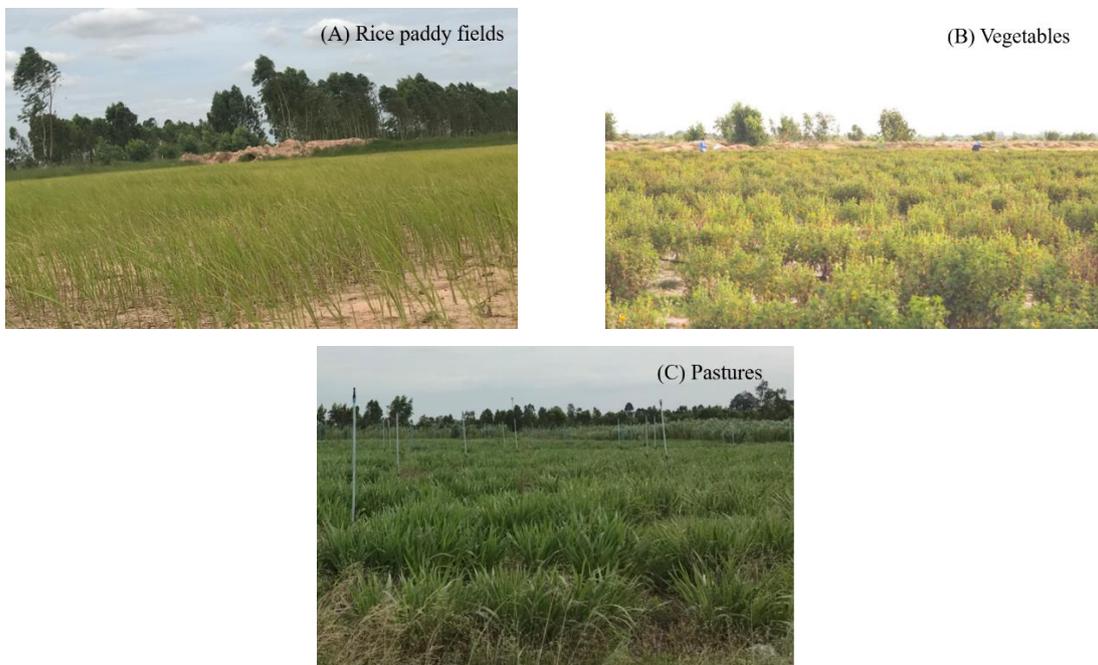


Fig. 2. Study sites in Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai

Insect collection: Insects were sampled using hand picking and sweep net method. Small sucking pest like aphids and mealy bugs and large sized caterpillars were handpicked. Whereas in sweep net method each quadrat was swept several times (10 sweeps were performed each time and new 10 sweeps was repeated after a gap of 10 minutes) [5]. For storage and preservation, the killing jars with ethyl acetate were used to killed large insects. The small insects were preserved in glass vials consisting of 70-90% ethyl alcohol. Identification and labelling were done in the laboratory using the keys available in standard taxonomic literature and standard manuals [6,7].

Data analysis

Shannon-Weiner index [8] were calculated from insect data of each site using Species Diversity and Richness version 4.1.2. Difference among sites were tested by using one-way analysis of variance (ANOVA). Relationship between environmental factors and insect diversity by using Spearman rank correlation.

Results and discussion

A total of 107 insect samples were collected in July, 2018. Altogether 39 species were identified belonging to 25 families under 9 orders (Tables 1). According to the total number of species, the dominant order was Hymenoptera (8 species), followed by Odonata (6 species) and the least was Lepidoptera (2 species). Additionally, The three common arthropod groups as pests, predators and parasites found were 1) pests: *Nilaparvata lugens*, *Diuraphis armigera* and *Hydrellia philippina* 2) Predators: *Micraspis discolor*, *Coccinella transversalis* and *Agriocnemis pygmaea* and 3) parasites: *Trichogramma* sp., *Opius* sp., and *Apanteles* sp.

In the present study predatory insects, parasitic hymenoptera and other beneficial insect populations were more abundant than phytophagous insects in organic field. This finding is supported by earlier studies by several ecologists. Gabriel *et al.* [9] have reported that organic farms supported more insects especially more butterflies compared to chemical farms. According to Letourneau and Bothwell [10] have compared the biodiversity of natural enemies and phytophagous insects between organic and chemical

farming systems in the Sacramento Valley. They found that carnivorous insect (predators and parasitoids) richness was higher (37) in organic samples compared to chemical field samples (21).

Table 1. Insect species in Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai.

Order	Family	Scientific name	Status
Odonata	Coenagrionidae	<i>Ischnura aurora aurora</i> Brauer	NE
		<i>Ischnura senegalensis</i> Rambur	NE
		<i>Agriocnemis pygmaea</i> Rambur	NE
		<i>Ceriagrion coromandelianum</i> Fabricius	NE
	Libellulidae	<i>Crocothemis servilia</i> Drury	NE
<i>Pantala Flavescens</i> Fabricius		NE	
Orthoptera	Acrididae	<i>Oxya Japonica</i> Thunberg	PT
	Tettigoniidae	<i>Conocephalus longipennis</i> de Haan	NE
	Gryllidae	<i>Metioche vittaticolis</i> Stal	NE
Hemiptera	Pentatomidae	<i>Scotinophara</i> sp.	PT
	Alydidae	<i>Leptoconsa oratonus</i> Fabricius	PT
	Miridae	<i>Cyrtorhinus lividipennis</i> Reuter	NE
		<i>Tytthus chinensis</i> Stal	NE
Homoptera	Reduviidae	<i>Polytoxus</i> sp.	NE
	Cicadellidae	<i>Nephotettix virescens</i> Distant	PT
		<i>Nephotettix nigropictus</i> Stal	PT
	Delphacidae	<i>Sogatella Furcifera</i> Hoevath	PT
		<i>Nilaparvata lugens</i> Stal	PT
Thysanoptera	Thripidae	<i>Stenchaetothrips biformis</i> Bagnall	PT
Coleoptera	Chrysomelidae	<i>Dicladispa armigera</i> Olivier	PT
	Carabidae	<i>Ophionea</i> sp.	NE
	Coccinellidae	<i>Micraspis crocea</i> Mulsant	NE
		<i>Micraspis discolor</i> Fabricius	NE
Diptera	Ephydriidae	<i>Ochthera</i> sp.	PT
		<i>Hydrellia</i> sp.	PT
	Cecidomyiidae	<i>Orseolia oryzae</i> Wood-mason	PT
	Pipunculidae	<i>Pipunculus</i> sp.	NE
	Lepidoptera	Pyralidae	<i>Nymphula depunctalis</i> Guenee
Nymphalidae		<i>Melanitis leda</i> Linnaeus	PT
Hymenoptera	Braconidae	<i>Opius</i> sp.	NE
		<i>Dacnusa</i> sp.	NE
		<i>Cotesia</i> sp.	NE
		<i>Apanteles</i> sp.	NE
	Platygasteridae	<i>Platygaster</i> sp.	NE
	Scelionidae	<i>Telenomus</i> sp.	NE
	Trichogrammatidae	<i>Trichogramma</i> sp.	NE
	Formicidae	<i>Odontoponera transversa</i> Smith	NE

NE = natural enemy, PT = pest

The result of this study found that 39 insect species, 25 families obtained were representative of 9 orders. Rice paddy fields had the highest diversity (31 species) followed by pastures (24 species) and vegetables (15 species) respectively (Table 2). The species diversity index calculated using the Shannon-Weiner equation (H') is shown in Table 2. The Maximum value was observed in rice paddy fields ($H'=2.09$) and the lowest in vegetables ($H'= 0.95$). The number of insect species and individual significantly differed among land-use types ($p<0.01$).

Over 800 species of insect in rice fields have been reported worldwide. Furthermore, about 100 species attack rice and the rest are friendly insects [11]. However, due to more than 20 predacious and parasitoid insect species (natural enemies) in this sampling sites, only 14 insect pests were found. This indicated that the ability of natural enemies could suppress insect pests to be under the economic threshold level (ETL) or economic injury level (EIL) in study sites [12].

Table 2. Total number of individual and species of insects in Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai.

Land-use types	species	individuals	Shannon-wiener Index (H')
Rice paddy fields	31	59	2.09
Pastures	25	31	1.73
Vegetables	9	17	0.95
Total	39	107	2.15

For relationship between physical factors and insects, relative humidity and temperature were highly significant positive correlated with the number of insect ($p < 0.01$) (Table 3). This result is consistent with Young [13] and Pollard *et al.* [14]. They reported that physical factors were significantly related to the total number on individuals and species richness. High temperature and relative humidity also facilitate oviposition, courtship behavior, and larval development.

Table 3. The Spearman rank correlation between physical factors and insects.

	Temperature	Relative Humidity
No. Species	0.118**	0.248**
No. Individual	0.241**	0.327**

** Highly significant at $p < 0.01$

Conclusions

The result of this study found that 39 insect species, 25 families obtained were representative of 9 orders. These three land-use types, there were no outbreaks of insect pests because natural enemies that can control the amount of insect pests. This also shows that the ecological balance in Rajamangala University of Technology Isan, Roi Et Campus at Tung Kula Rong Hai and beneficial insects can still grow and control insect pests.

The study period was relatively short for an analysis of trends which may affect their conservation status. Longer term monitoring is needed to identify significant changes in biological diversity, permitting the timely adjustment of management activities to reverse or prevent undesired trends.

Acknowledgements

This study has been done by the financial support from Rajamangala University of Technology Isan. We also would like to thank all our friends for all the help and suggestions.

References

- [1] Groombridge, B. *Global Biodiversity: Status of the Earth's Living Resources*. Report compiled by the World Conservation Monitoring Centre. Chapman and Hall, London. 1992.
- [2] Battist, A. Phytophagous insect in the energy flow of an artificial stand of *Pinus nigra* Arnold in northern Italy. *Redia*. 1988; 71(1): 139-160.

- [3] Miller GT. Environmental science, working with earth. 10th Edition, Brooks Cole Thompson, Nelson. 2006; 5-25.
- [4] Zrzavy J. Four chapters about the monophyly of insect ‘Orders’: A review of recent phylogenetic contributions. *Acta Entomologica Musei Nationalis Pragae*. 2008; 48(2): 217-232.
- [5] Price, P.W., *Insect Ecology*, John Wiley & Sons, New York. 1975, 514 p.
- [6] Pathak, M. D., and Khan, Z. R. *Insect Pests of Rice*. Phillippines, Manila: IRRI. 1994, 89 p.
- [7] Asahina, S. *A List of Odonata from Thailand*. Bosco Offset, Bangkok. 1993, 106 p.
- [8] Ludwig, J.A. and Reynolds, J.F. *Statistical Ecology*, John Wiley & Sons, New York. 1988, 337 p.
- [9] Gabriel, D.S., M. Sait, J.A. Hodgson, U. Schmutz, W.E. and Kunin, Benton, T.G. Scale matters: the impact of organic farming on biodiversity at different spatial scales. *Ecology Letters*. 2010; 13(7): 858-869.
- [10] Letourneau, D.K. and Bothwell, S.G. Comparison of organic and conventional farms: challenging ecologists to make biodiversity functional. *Front.Ecol. Environ..* 2008; 6(8): 430-438.
- [11] M. D. Pathak, “Insect pests of rice and their control,” in IRRI. (ed.). *Rice Production Manual*. Los Baños: University of the Philippines, College of Agriculture in cooperation with the International Rice Research Institute. 1970, p. 171–198.
- [12] P. Jaroenpol, *Integrated Pest Management*. Nakhon Ratchasrima province: Agriculture Department, Huai Tha-land district. (in Thai). 2008.
- [13] Young, A. M. *Population Biology of Tropical Insects*. Plenum Press, London. 1982, p. 289-377.
- [14] Pollard, E., van Swaay, C.A.M. and Yates T.J. Changes in butterfly numbers in Britain and The Netherlands, 1990–91. *Ecol. Entomol.* 1993; 18, 93–94.