INTEGRATED MANAGEMENT OF PADDY PESTS BY THE SYSTEM OF RICE INTENSIFICATION (SRI): A CASE STUDY IN LUBOK CHINA MELAKA

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INTRODUCTION

- Integrated pest management (IPM) is an integrated ecological approach of crop management to solve ecological problems in agriculture that involves prevention, monitoring and intervention.

- The aim of IPM is to reduce significantly or eliminate the use of pesticides and other agrochemicals while managing pest problems and economic threshold levels to acceptable levels.
- In this regard, monitoring of the population abundance and diversity of biological control agents such as predators, parasites, parasitoids and competitors of the major pests of paddy constitutes a significant part of IPM in rice cultivation.

- This case study reports on the abundance and diversity of pest and non-pest insects in rice plots planted by the System of Rice Intensification (SRI) organic farming in Lubok China Melaka.

Rice cultivation is an economically important agricultural sector in Malaysia to ensure national food sufficiency and security.

The rice harvest can be improved by various modern and scientific techniques including the SRI organic farming which can increase the rice yield up to threefold per harvest.

SRI was developed 20 years ago in Madagascar by a French agronomist, Father Henri de Laulanié based on 20 years of working with farmers to improve their rice production without dependence on external inputs (Uphoff, 2004).

Since then, productivity of SRI method has been validated in 28 countries worldwide including Malaysia (Uphoff, 2004).

However, rice cultivation is still faced with many limitations that range from weather patterns, fertility and soil type to water supply, irrigation and pest problems.

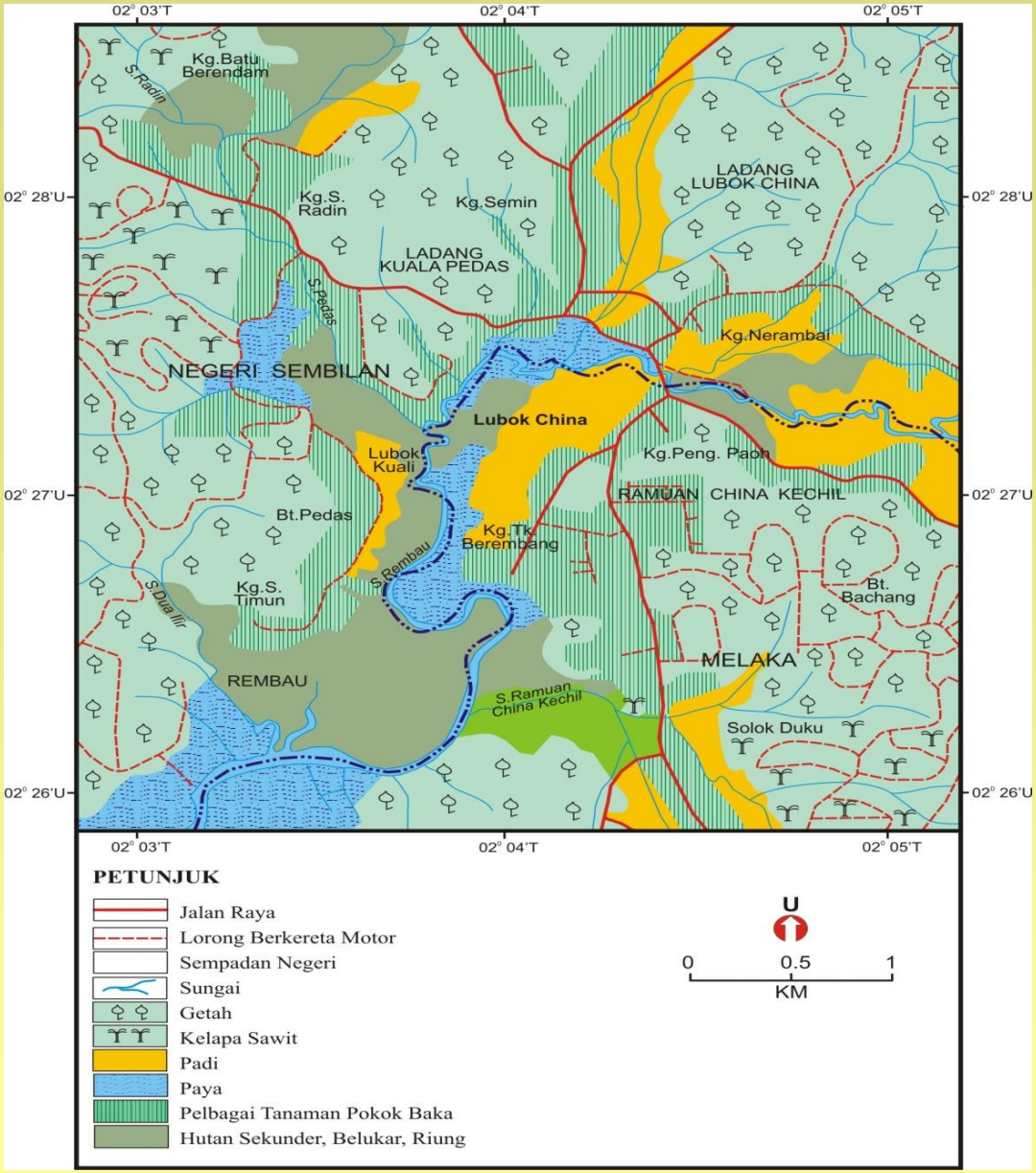

Figure 1: Study site of the organic rice field (SRI) in Lubok China, Melak (Location: 2° 25' 26" N, 102° 04' 44" E)

MATERIALS AND METHOD

A total of eight sampling visits were made:

From 18th Sept. to 1st Oct. 2009 (early stage); from 18th July to 21st August 2009 (growing stage); from 28th August to 4th Sept. 2009 (flowering stage); and from 11th Sept. to 1st Oct. 2009 (ripening stage).

Five sampling methods were used:

- light trap
- Pitfall Trap (8x15 cm)
- sticky trap (10x10 cm)
- Yellow Pan Trap (10x5 cm)
- Sweeping Method (100 sweeps per plot)

Net for flying insects





Techniques for sampling arthropods: contd.

Traps placed randomly within each plot and left for 48 hours.

Each pitfall & yellow pan trap contained a colourless and odorless detergent to drown the insects.

Abiotic factors measured were relative humidity and air temperature, percentage soil water and humus content.




RESULTS AND DISCUSSION:

Distribution and diversity of orders and families of insects in the SRI rice plots of Lubok China Melaka

- A total of total of 1008 individuals representing 8 orders, 21 families and 34 species of arthropods were successfully sampled in the study area, comprising:
- Homoptera (2 families; 220 individuals),
- Hymenoptera (2 families; 122 individuals),
- Coleoptera (2 families; 132 individuals),
- Orthoptera (4 families; 231 individuals),
- Odonata (2 families, 55 individuals),
- Hemiptera (1 family; 85 individuals),
- Lepidoptera (5 families; 140 individuals),
- Diptera (2 families; 23 individuals).

Order	Family	Number Of Species	Number Of Individual (%)	Population abundance (mean ± SE)
Orthoptera	Tettigoniidae	3	98	
	Acrididae	1	41	
	Grillidae	1	83	
	Gryllotaplidae	1	9	
		6	231 (22.9%)	28.9 ± 2.29
Homoptera	Pentatomidae	2	152	
	Coridae	2	68	
		4	220 (21.8%)	27.5 ± 2.66
Lepidoptera	Noctuidae	1	6	
	Satryidae	1	1	
	Arctiidae	1	43	
	Pyralidae	4	77	
	Lymantriidae	1	13	
		8	140 (13.9)	17.5 ± 2.38
Coleoptera	Coccinellidae	2	104	
	Scarabaeidae	2	28	
		4	132 (13.1%)	16.5 ± 1.58
Hymenoptera	Braconidae	1	27	
	Formicidae	1	10	
	Ichneumonidae	2	85	
		4	122 (12.1%)	15.3 ± 1.92
Hemiptera	Belostomatidae	2	85	
		2	85 (8.4%)	10.6 ± 1.05
Odonata	Libelluidae	3	36	
	Agrionidae	1	19	
		4	55 (5.5%)	6.9 ± 1.62
Diptera	Hesperidae	1	9	
	Muscidae	1	14	
		2	23 (2.3%)	2.9 ± 0.64

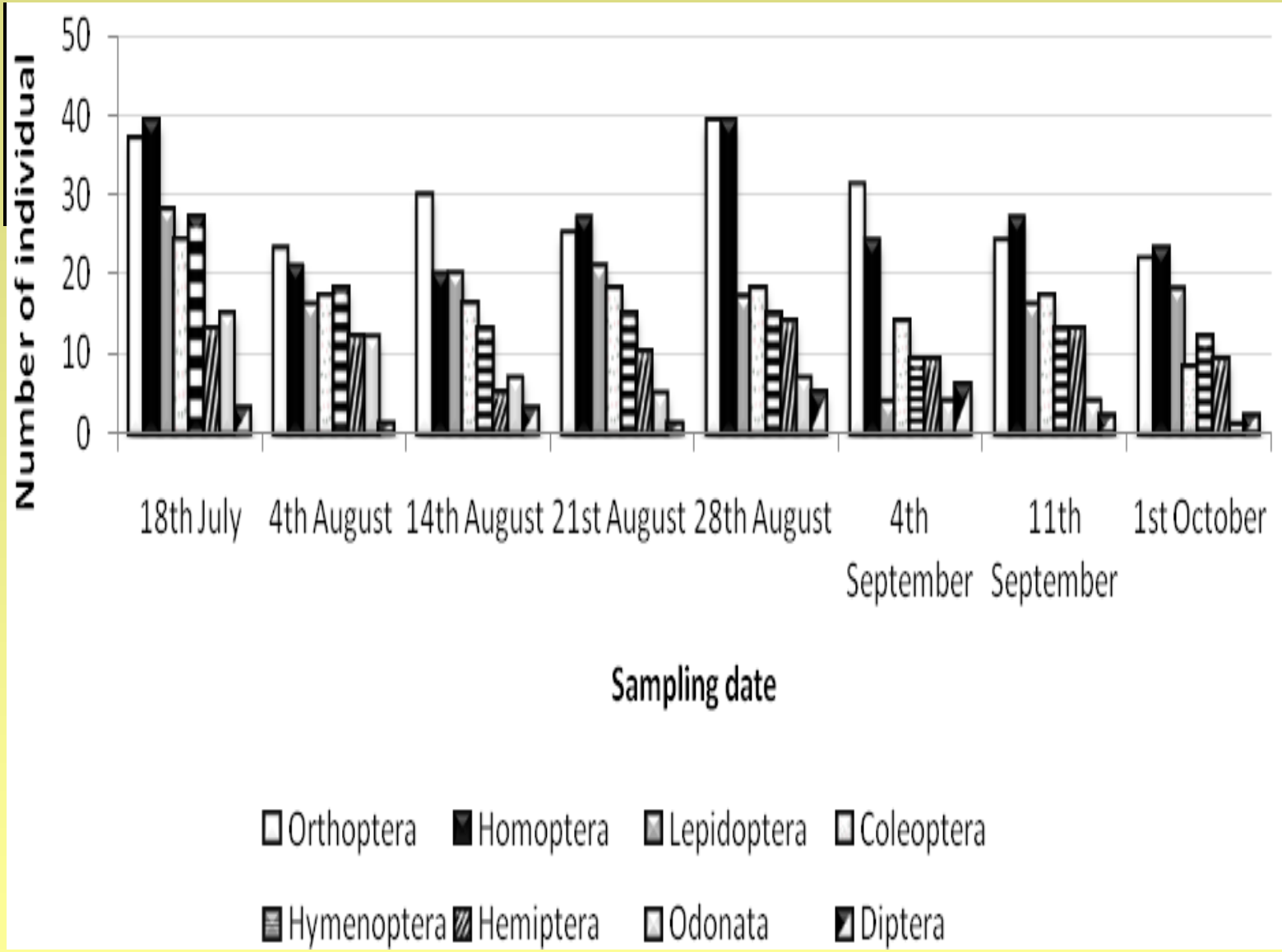

Figure 2. Abundance of insect orders collected from the SRI rice field in Lubok China, Melaka

Results and Discussion: contd.

The light trap captured significantly more insects compared to the sweeping net and the other sampling methods ($p>0.5$).

The most abundant of insects in the SRI paddy plots were from the order Orthoptera (22.9% of total collected).

Lepidoptera recorded the highest number of species (8 species) or 13.8% of the total 34 species successfully identified.

In terms of feeding habits, herbivorous insects were the most abundant (62.86%), followed by carnivores (25.71%) and omnivores (8%).

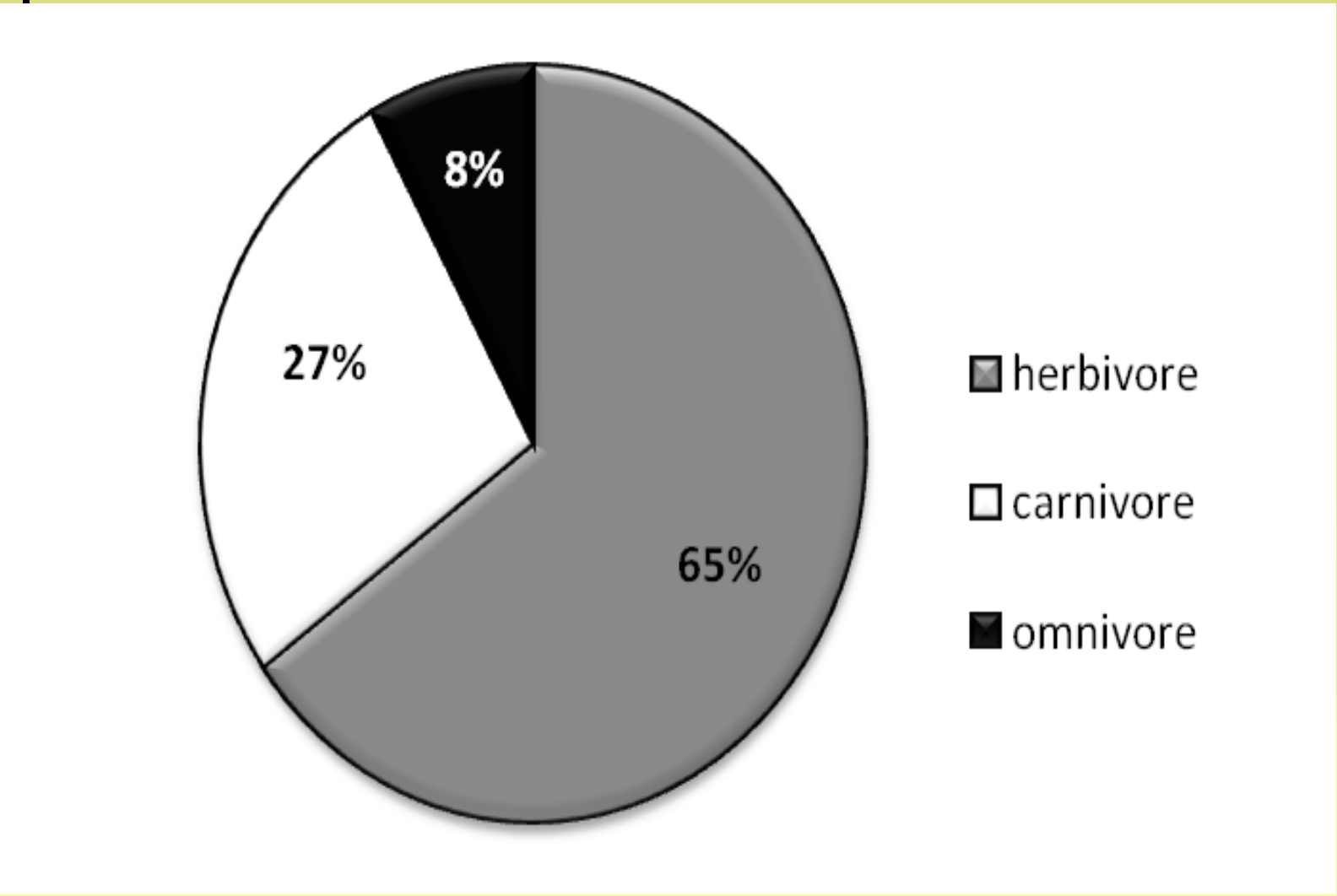

Figure 4. Percentage of herbivorous, carnivorous and omnivorous insects in the SRI plots.

No.	Family	Species	No. of individuals	Percentage (%)
1	Grillidae	*Metioche vittaticollis*	83	**8.23**
2	Pentatomidae	*Nezara viridula*	81	**8.04**
3	Coreidae	*Lepticorisa oratorius*	73	**7.24**
4	Pentatomidae	*Scotinophora coarctata*	71	**7.04**
5	Braconidae	*Opius sp.*	67	**6.65**
6	Coccinellidae	*Micrapis disclor*	57	**5.65**
7	Coccinellidae	*Lemnia biplagiata*	**47**	**4.66**
8	Coreidae	*Riptortus linearis*	**47**	**4.66**
9	Arctiidae	*Creatonotus gangis*	**43**	**4.27**
10	Tettigoniidae	*Atractomopha crenulata*	**42**	**4.17**
11	Acrididae	*Oxyca chinensis*	**41**	**4.07**
12	Tettigonidae	*Phaneroptera gracilis*	32	**3.17**
13	Pyralidae	*Chilo supressalis*	31	**3.08**
14	Ichneumonidae	*Stenobracon nicevillei*	27	**2.68**
15	Scarabidae	*Anomalia pallida*	26	**2.58**
16	Tettigonidae	*Conocephalus longipennis*	24	**2.08**
17	Belostomatidae	*Pachybracius pallicornis*	21	**2.08**
18	Libellulidae	*Acisoma panorpoides*	20	**1.98**
19	Agrionidae	*Agriocnemis pygmaea*	19	**1.88**
20	Ichneumonidae	*Temelucha philippinensis*	18	**1.79**
21	Pyralidae	*Sesamia inferens*	18	**1.79**
22	Muscidae	*Musca domestica*	14	**1.39**
23	Pyralidae	*Herpetograma licarsisalis*	14	**1.39**
24	Pyralidae	*Scirpophaga incertulas*	14	**1.39**
25	Lymantriidae	*Laelia suffuse*	13	**1.29**
26	Belostomatidae	*Lepthocerus indicus*	12	**1.19**
27	Libellulidae	*Orthetrum sabina*	11	**1.09**
28	Formicidae	*Componotus sp.*	10	**0.99**
29	Grillotalpidae	*Gryllotalpidae orientalis*	9	**0.89**
30	Hesperidae	*Argyrophylax nigrotibialis*	9	**0.89**
31	Noctuidae	*Spodoptera mauritia*	6	**0.60**
32	Libellulidae	*Diplacodes trivialis*	5	**0.50**
33	Scarabidae	*Oryctes rhinoceros*	2	**0.20**
34	Satyridae	*Melanitis leda*	1	**0.10**

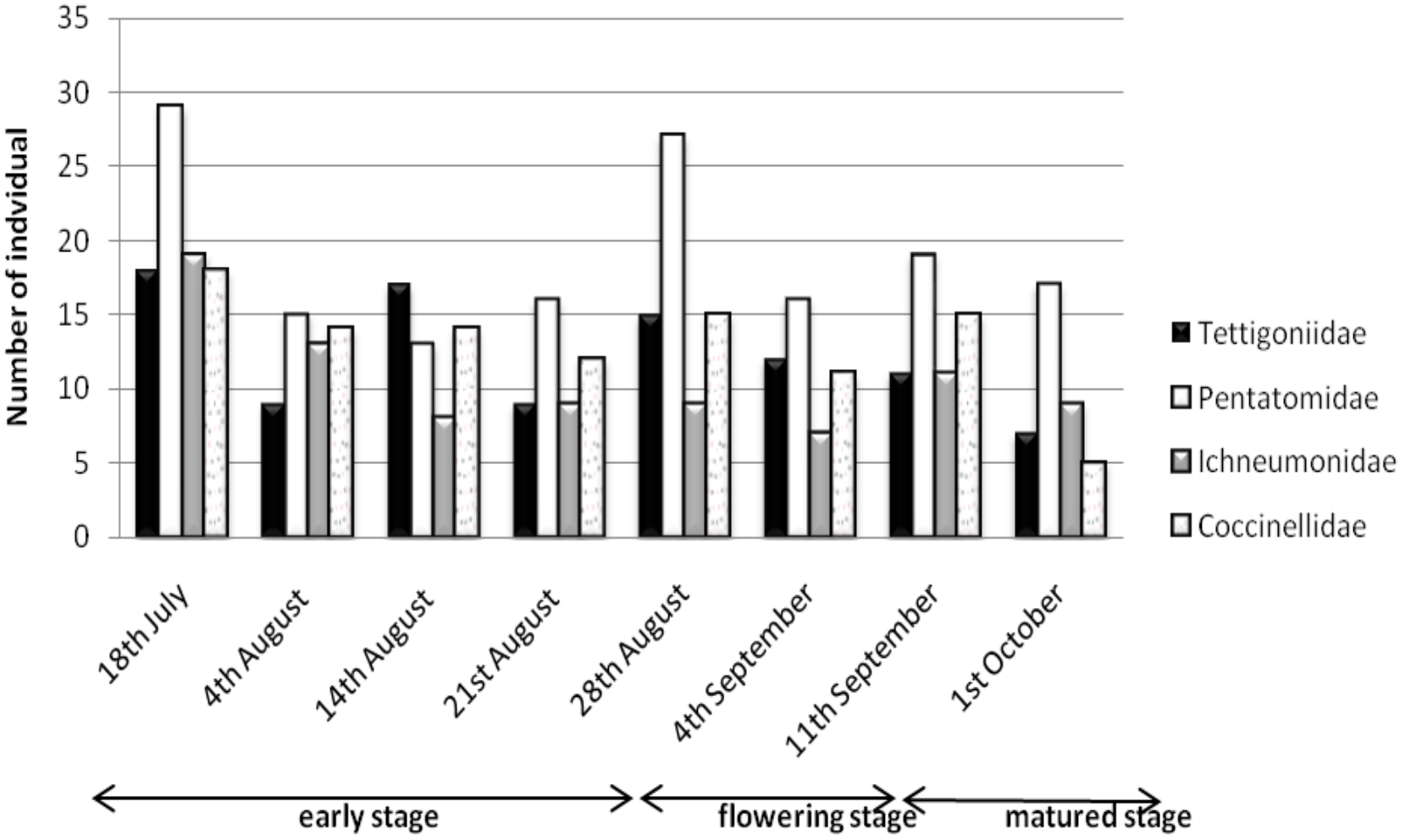

Figure 3. Abundance of four dominant insect families during the growing stages of the rice plants

Results and Discussion: contd.

For the total sampling period, the Shannon Weiner diversity index (H') is 3.23,

- Shannon Weiner evenness index (E') is 2.10

- Margalef richness index (R') is 4.77.

The insect population abundance increased with increasing development of the paddy plants, however, statistical test by one-way ANOVA showed no significant differences between the sampling visits. ($p<0.05$).

Results and Discussion: contd.

Total number of competitors and enemies of the various types of insects is in natural equilibrium, where reduced usage of pesticides and agrochemicals under SRI cultivation has facilitated the adaptive balance between the herbivorous, carnivorous and omnivorus insect groups that is crucial in controlling pestilence and pest outbreaks in the agricultural area (Uphoff, 2004).

Among the herbivorous insects are members of Homoptera, Orthoptera, Hymenoptera, Lepidoptera, Hemiptera and Coleoptera, that constitute the main pests of rice, particularly the sap feeders, which also act as vectors and carriers of viral diseases of rice (Kalshoven, 1891; Kirk-Springs, 1990).

Results & Discussion:

Kepinding hijau or Southern green stink bug, *Nezara viridula* (Pentatomidae, Hemiptera), Kesing or Rice bug, *Lepticorisa oratorius* (Coreidae, Hemiptera) and Kepinding tanah/Kutu bruang or Black rice bug, *Scotinophora coarctata* (Pentatomidae, Hemiptera), are the main sap feeders of vegetative and early flowering stages (Table 2).

N. viridula (81 indiv, 8.04%)
L. oratorius (73 indiv, 7.24%)
S.coarctata (71 indiv, 7.04%)

Carnivorous insects or natural enemies of rice pests comprised members of Hymenoptera, Coleoptera and Diptera.

The cricket *Metioche vittaticollis* (Orthoptera: Gryllidae), is the most abundant predator of rice insect pests collected in the SRI study plots (83 indiv, 8.23%). This predator feeds on eggs, small larvae, and adult rice hoppers.

Nezara viridula

Metioche vittaticollis

Lepticorisa oratorius

Scotinophora coarctata

Results and Discussion: contd.

From early stage till flowering stage (18th July to 21st Aug), Pentatomidae recorded the highest population followed by Coccinellidae, Tettigonidae and Ichneumonidae (Fig.3). in the SRI study plots.

Scotinophora coarctata is the dominant pentatomid pest species in rice fields, with high adaptive capacity (Adalla & Alzona, 2007).

In Philippines adults & larvae incurred serious damage with net yield loss of 15-20% (Joshi *et al*. 2007),
Nezara viridula (Pentatomid pest, sucks sap, stunts paddy growth, causes yellowing of stems and leaves.

However, both accounted for only 1% of infestations in Malaysia

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Results and Discussion: contd.

- Results of this study indicate that the rice intensification system (SRI) has ensured a good balance between
- the populations of pests;
- beneficial insects (predators and parasitoids);
- as well as other insects in the rice field community during the various phases of paddy growth from planting stage until the rice grains have ripened and are ready for harvest, without any appreciable loss in yield.
- However, there were no signif. correlations between abiotic factors (air temp, & humidity, soil water & organic content) and abundance of insects in the study area ($p>0.05$).

Spodoptera litura

Plutella xylostella

Crocidolomia binotalis

Spodoptera exigua

Phyllotreta striolata

Scotinophora coarctata


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CONCLUSION

The US-EPA has a useful set of IPM Principles :

1. Acceptable pest levels: The emphasis is on control, not eradication.

2. Preventive cultural practices: Select varieties best for local growing conditions and maintain healthy crops.

Implement plant quarantine and cultural techniques such as crop sanitation (e.g. removal of diseased plants to prevent spread of infection).

3. Monitoring: regular visual inspection and accurate pest identification, keep record of pest life cycles.

CONCLUSION

The US-EPA has a useful set of IPM Principles contd.

4. Mechanical controls: e.g. hand-picking, erecting insect barriers, using traps, vacuuming, and tillage to disrupt breeding.

5. Biological controls: beneficial insects, biocides, (e.g. Bt, entomopathogenic fungi and entomopathogenic nematodes).

6. Responsible Pesticide Use: natural compounds e.g. nicotine, pyrethrum and insect juvenile hormone analogues, pheromones, environmentally-friendly pesticides.

Reliance on knowledge especially local wisdom, experience, observation, and integration of multiple techniques makes IPM most fitting for organic farming for rice as well as other crops.



THANK YOU