

ความหลากหลายของสัตว์ไม่มีกระดูกสันหลังในระบบนิเวศข้าวไร่ ที่อำเภอบ้านแฮด จังหวัดขอนแก่น

Diversity and community structure of arthropods in upland rice ecosystem of Ban Had District, Khon Kaen Province, Thailand

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บทคัดย่อ: การศึกษาประชากรของสัตว์ไม่มีกระดูกสันหลังในระบบนิเวศข้าวไร่ในพื้นที่เกษตรกรรม อ.บ้านแฮด จ.ขอนแก่น ภาคตะวันออกเฉียงเหนือของประเทศไทย ตั้งแต่เดือนพฤษภาคม ถึง ตุลาคม 2554 โดยเก็บตัวอย่างแมลงด้วยกับดักแสงไฟ กับดักกาวสีเหลือง สวิงโฉบ และ วิธีการสำรวจด้วยตาเปล่า ในการศึกษาครั้งนี้พบจำนวนสัตว์ไม่มีกระดูกสันหลังทั้งหมด 160 ชนิด 7,195 ตัว ซึ่งเป็นตัวอย่างที่ได้จากกับดักแสงไฟทั้งหมด 140 ชนิด กับดักกาวสีเหลือง 108 ชนิด สวิงโฉบ 58 ชนิด และวิธีการเดินสำรวจด้วยตาเปล่า 30 ชนิด จากการศึกษาพบประชากรของสัตว์ไม่มีกระดูกสันหลังประกอบด้วย 4 กลุ่มคือกลุ่มกินพืชเป็นอาหาร ตัวห้ำ ตัวเบียน และกินซากพืชซากสัตว์เป็นอาหาร โดยพบกลุ่มแมลงตัวห้ำมากที่สุด (60.93% ของจำนวนตัวรวม และ 47.17% ของจำนวนชนิดรวมทั้งหมด) กลุ่มกินพืชเป็นอาหาร (30.72% ของจำนวนตัวรวม และ 33.33% ของจำนวนชนิดรวมทั้งหมด), กลุ่มกินซากพืชซากสัตว์ (7.39% ของจำนวนตัวรวม และ 15.09% ของจำนวนชนิดรวมทั้งหมด) และกลุ่มตัวเบียน (0.95% ของจำนวนตัวรวม และ 4.40% ของจำนวนชนิดรวมทั้งหมด)ตามลำดับ ชนิดของสัตว์ไม่มีกระดูกสันหลังที่พบในระบบนิเวศข้าวไร่สูงสุด คือ กลุ่มที่ 1 อันดับ Coleoptera โดยเฉพาะอย่างยิ่งด้วงที่กินพืชเป็นอาหาร วงศ์ Scarabaeidae กลุ่มแมลงตัวห้ำ วงศ์ Staphylinidae Carabidae และ Coccinellidae กลุ่มที่ 2 อันดับ Homoptera และ Hemiptera พบแมลงศัตรูข้าวที่สำคัญได้แก่เพลี้ยกระโดดสีน้ำตาล วงศ์ Delphacidae และเพลี้ยจักจั่น วงศ์ Cicadellidae และกลุ่มแมลงตัวห้ำ วงศ์ Miridae กลุ่มที่ 3 อันดับ Hymenoptera ประกอบด้วย แมลงตัวเบียน และกลุ่มกินซากพืชซากสัตว์เป็นอาหาร โดยพบวงศ์ที่สำคัญได้แก่ วงศ์ Braconidae และ Formicidae ส่วนโครงสร้างประชากรของสัตว์ไม่มีกระดูกสันหลังของระยะการเจริญเติบโตของข้าวที่แตกต่างกันพบกลุ่มแมลงและจำนวนที่ต่างกัน ซึ่งกลุ่มตัวห้ำและกลุ่มกินพืชเป็นอาหารพบในระยะข้าวแตกกอมากกว่าระยะข้าวตั้งท้องและระยะข้าวสุกแก่ ดังนั้นสรุปได้ว่าความหลากหลายของสัตว์ไม่มีกระดูกสันหลังในระบบนิเวศข้าวไร่มีจำนวนชนิดและความหลากหลายของการอยู่ร่วมกันของแมลงตัวห้ำและกลุ่มแมลงกินพืชเป็นอาหารเป็นกลุ่มแมลงที่มีมากและเป็นตัวสำคัญของระบบนิเวศ

คำสำคัญ: สัตว์ไม่มีกระดูกสันหลัง ระบบนิเวศข้าวไร่ โครงสร้างประชากร ความหลากหลาย

ABSTRACT: The research studies an arthropod community in upland rice ecosystem at farmers' field in Ban Had District, Khon Kaen Province, Northeast Thailand, was conducted during May to October 2011. Samples were collected using light traps, yellow sticky traps, sweep nets and visual observation methods. A total of 7,195 individual arthropods from 160 species were recorded in this study. Among the sampling methods, 140 species were recorded using light trap, followed by 108, 58 and 30 species collected by using yellow sticky trap, sweep net and visual observation, respectively. The arthropod community of this studies constituted of four guilds as phytophagous, predator, parasitoid and scavenger. The predator (60.93 % of total individuals and 47.17% of total species) was the most abundant group followed by phytophagous (30.72 % of total individuals and 33.33% of total species),

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scavenger (7.39 % of total individuals and 15.09% of total species) and parasitoids (0.95% total individuals and 4.40% of total species). Among the arthropod species diversity found in upland rice ecosystem, the highest number of insect species belonged to order Coleoptera, especially dominated by phytophagous beetles in family Scarabaeidae and predator in families Staphylinidae, Carabidae and Coccinellidae. The second highest insect recorded belonged to orders Homoptera and Hemiptera of phytophagous dominated by rice pest leafhoppers and planthoppers in the families Cicadellidae, Delphacidae and predators in family Miridae. The third insect group was order Hymenoptera consisting parasitoid and scavenger groups, dominated by families Braconidae and Formicidae. In terms of community structure of different rice growth stage, higher number of predators and phytophagous were recorded at vegetative stage than reproductive and ripening stage of crop growth. In conclusion, arthropods diversity in upland rice field ecosystem had diverse taxonomic groups and functional groups of predators and phytophagous insects were the most abundant and predominant guild in this study.

Keywords: Arthropods, Upland Rice Ecosystem, Community Structure, Diversity

Introduction

Undulating area of Northeast Thailand occupied 1,600 square kilometers in 5 districts of 2 provinces, Muang, Ban Phai and Ban Had (in Khon Kaen province), and Kudrung and Kosumpisai (in Mahasarakam province). In this area, upland rice was grown in a two-year crop cycle cropping system with sugarcane and cassava as main crop. Upland rice varieties, Daw Sahyan (local variety) and Sakon Nakhon (SKN) were selected as popular varieties for this region. There are numerous taxa of insects - phytophagous (insect pests), parasitoids, predators, and scavengers which mostly constitute the arthropod community in the rice ecosystems. Arthropod abundance and diversity in rice field ecosystems had been demonstrated to be the function of host plant (Crawley, 1983), geographical sites, surrounding environment (Hendrix et al., 1988), and agronomic practices such as irrigation, and management practices (Edirisinghe and Bambaradeniya, 2006). Moreover, the composition of the arthropod species diversity is known to change with the growth stage of the rice crop (Heong et al., 1991). The diversity of upland rice environments gives rise to a more heterogeneous

insect fauna compared with the homogeneous lowlands. (Listsinger et al., 2007). However, no attempts have been made to document the community structure and arthropod diversity in upland rice ecosystem in Khon Kaen Province, Northeast Thailand. Therefore, the present study was to determine the population abundance and diversity of arthropods species in upland rice ecosystem, and compare the arthropod diversity and community structure in different growth stages of rice. This will be useful information for development of rice's pest control program.

Materials and Methods

Two field trials were conducted in upland rice condition at the farmers' field in Wang war villages of Ban Had District in Khon Kaen Province, Northeast Thailand in May - October 2011. The size of the experimental plot at each household was about 1 rai (40m x 40m) grown with Sakon Nakhon variety of glutinous rice. The various arthropod species in the experimental plot area was biweekly monitored by four sampling methods; light trap, yellow sticky trap, sweep net and visual observation on rice hills from the seedling to harvesting stage.

Per one experimental field, a total of ten yellow sticky traps with the size of 10.5 cm x 28.5 cm were placed in two rows in the field. One row contains 5 sticky traps and trap distance was 5 m. All sticky traps were collected and replaced biweekly. Light traps with black light (18 W) was placed at the middle of rice field plot at night from 6 - 8 PM or 7 - 9 PM. Sweep net sampling was carried out at the experimental plot. A total of twenty sweeps per rice field plot was done as the standard. For the visual sampling, a total of 20 hills per rai was monitored for insect species by systematic random sampling with diagonal method. All insects were collected and kept in glass tube containing 70% alcohol. Collected samples were sorted out and identified to the species level based on previously published keys. Arthropod species were grouped into one of four guilds: phytophagous, predators, parasitoids and scavengers.

Results and Discussion

Abundance and diversity of arthropods in upland rice ecosystem

The upland rice ecosystem in Khon Kaen Province, Thailand harbors a diverse taxonomic range of arthropods species. The total number of arthropod insects recorded and identified from this study consisted of 7,195 individuals from 160 species using the four sampling methods, light

trap, yellow sticky trap, sweep net and visual observation. Of those, 33.33% (53 species), 4.40% (7 species), 47.17% (75 species) and 15.09% (24 species) were recorded as phytophagous, parasitoids, predators and scavengers, respectively. It was noted that the arthropod insect species recorded during the present study is lower than that documented by Heong et al., (1991) from rice fields in the Philippines where a total of 212 species were recorded. That may be due to the agricultural practices of farmers such as application of insecticide in surrounding area and different sampling methods.

Among the sampling methods, the light trap method can collect the highest arthropod species of 89.37% (143 species), followed by using sticky trap, sweep net and visual observation methods collected species of 67.50% (108 species), 36.25% (58 species) and about 18.75% (30 species), respectively.

Predators group was the highest number and individual collected by using light trap, sticky trap and visual observation methods of which 52.44% (75 species), 54.63% (59 species) and 33.59% (38 species), respectively. Whereas phytophagous group was the highest number and individual of 36.20% (21 species) collected by using sweep net (**Figure 1**).

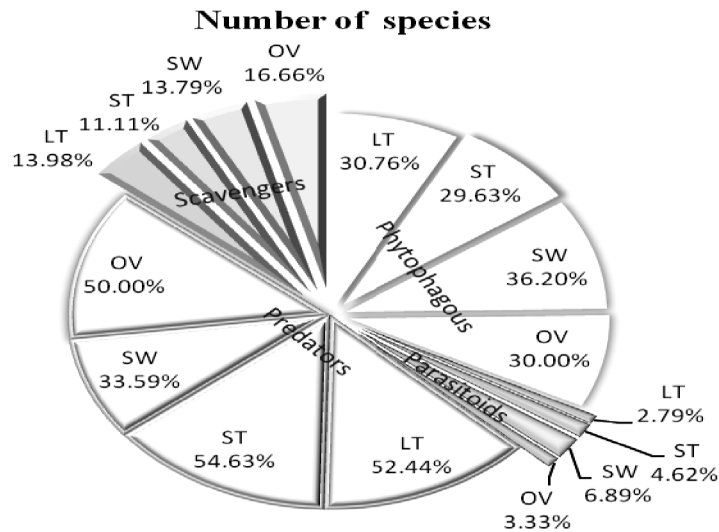


Figure 1 Number of arthropod species abundant in upland rice ecosystem at Ban Had District, Khon Kaen Province, Northeast Thailand collected from May to October 2011 (Remark: LT= Light trap; ST= Sticky trap; SW= Sweep net; OV= Visual observation)

Functional groups of arthropod diversity in upland rice ecosystem

Arthropod diversity in upland rice field according to four functional groups was as details:

1) Phytophagous: The phytophagous comprising of 7 orders were the most prevalent accounting for approximately 33.33 and 30.72 percent of species and individuals from all arthropod sampled and ranked second in abundance in this study. The dominant families were Scarabaeidae, Pentatomidae, Cicadellidae, Delphacidae and Pyralidae

2) Parasitoids: The parasitoids group belonging to orders Hymenoptera and Diptera was the least number of fauna group found from this study. It constituted about 4.40 and 0.95 percent of species and individuals from all

arthropods sampled. The dominant families were Braconidae and Ichneumonidae.

3) Predators: The predators group was the highest group recorded from this study. It represented by 19 families belonging to 7 orders ranked in first in abundance in this study and constituted about 47.17 and 60.93 percent of species and individuals from all arthropods sampled. The dominant orders were Coleoptera, Hemiptera and Diptera. The dominant families were Staphylinidae, Carabidae and Coccinellidae.

4) Scavengers: The scavengers belonging to orders Hymenoptera, Orthoptera, Diptera, Coleoptera were recorded and made up about 15.09 and 7.39 of species and individuals, respectively. The most abundant were Chironomidae and Formicidae.

Arthropod diversity and community structure in different stage of rice growth

Arthropod species diversity collected in upland rice field at different stages of rice growth was shown in **Figure 2**. A total of 5,079 individuals arthropods from 112 species was the highest recorded at vegetative stage of crop (55 days after planting, DAP). Among them, 65.49 % (3,326 individuals from 61 species) were predator, 28 % (1,422 individuals from 33 species) were phytophagous, 6.01 % (305 individuals from 13 species) were scavengers and 0.51 % (26 individuals from 5 species) were parasitoids.

At the reproductive stage (55 - 98 DAP), a total of 1,083 individuals from 107 species were recorded, out of which 52.63 % (570 individuals from 54 species) were predator followed by phytophagous 29.92 % comprising of 324 individuals from 35 species, 14.31 % (155 individuals from 14 species) were scavengers and 3.14 %

(34 individuals from 4 species) were parasitoids. At the ripening stage (98 -128 DAP), a total of 768 individuals from 55 species was recorded, 35.81 % (275 individuals from 26 species) were predators, 48.31 % (371 individuals from 18 species) were phytophagous, 13.54% (104 individuals from 7 species) were scavengers and the rest 2.34 % (18 individuals from 4 species) were parasitoids species. It was noticed phytophagous individuals were the most abundant in vegetative stage than reproductive stage and ripening stage. It is because sap suckers (Cicadellidae and Delphacidae) and leaf feeding insects (Pyralidae and Chrosomelidae) flourish during the vegetative stage of rice growth. At the reproductive stage, when the rice leaves are no longer attractive feedstuffs to the insects because of its lower succulence, grain suckers belonging to families Pentatomidae and Alydidae were abundant.

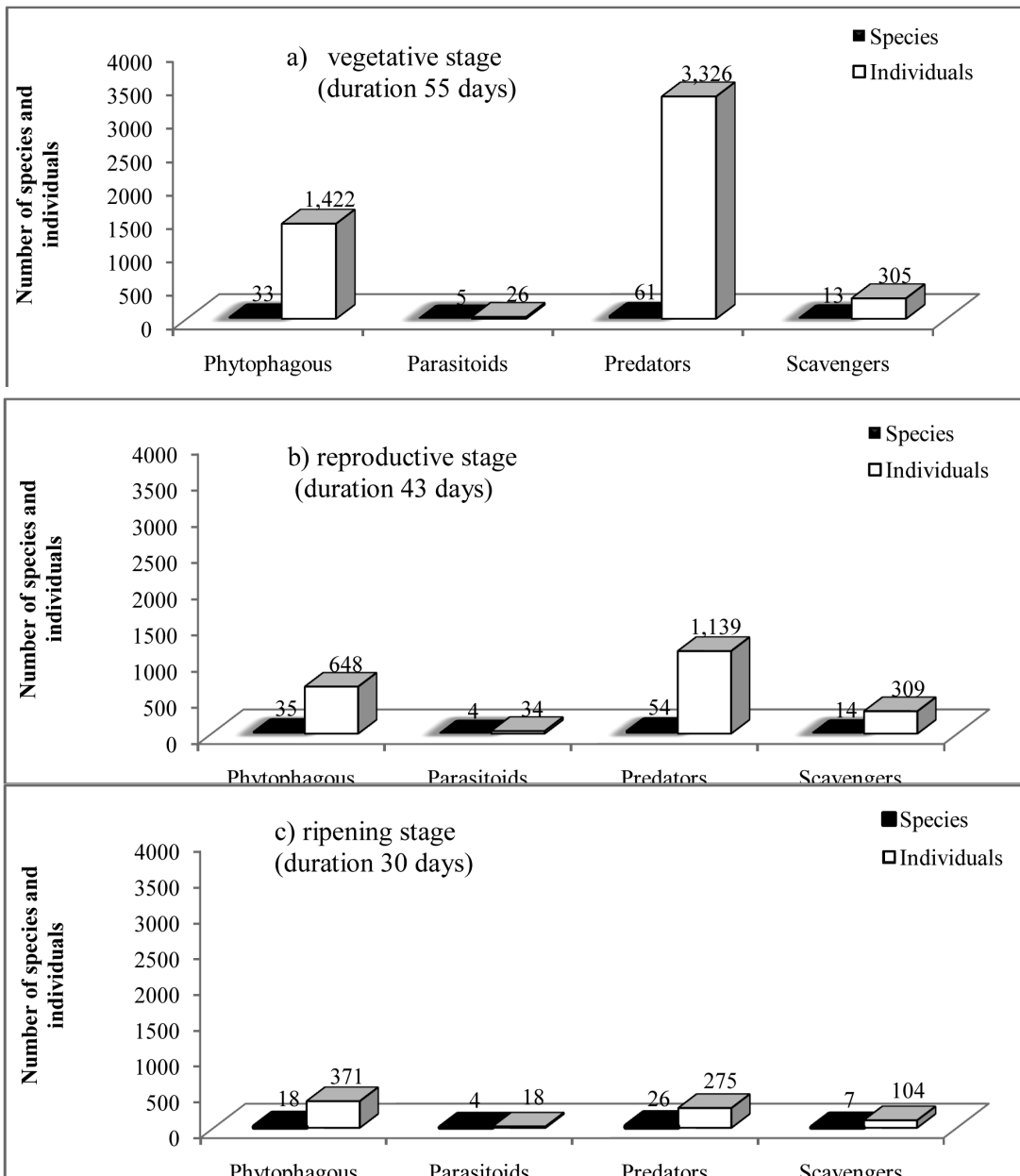


Figure 2 Arthropod diversity in different stages of rice growth, a) vegetative stage b) reproductive stage and c) ripening stage.

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