EFFECTS OF ISOLATION ON TEMPORAL DYNAMIC OF INSECT COMMUNITY STRUCTURE AND PARASITIC HYMENOPTERA DIVERSITY IN CACAO AGROFORESTRY SYSTEMS AT THE MARGIN OF LORE LINDU NATIONAL PARK, CENTRAL SULAWESI

BANDUNG SAHARI

GRADUATE SCHOOL
BOGOR AGRICULTURAL UNIVERSITY
BOGOR
2004
ABSTRACT


Effects of isolation on insect community structure as well as diversity and abundance of parasitic Hymenoptera in cacao agroforestry systems were studied between February 2003 and April 2003. The research focused on two main aspects: (Chapter IV) effects of isolation of agroforestry systems from remaining forest on temporal dynamic of insect communities in general, (Chapter V) temporal and spatial dynamic of parasitic Hymenoptera of cacao agroforestry system.

The research was conducted at the eastern margin of the Lore Lindu National Park in Palolo Valley (Donggala District, Central Sulawesi). Samplings were conducted at 16 sites belonging to two different habitat types (cacao agroforestry systems, natural forest sites). The 12 sampled cacao agroforestry systems were situated in different distances to the forest margin (10 to 2200 m). The cacao plantations were located in the vicinity of the villages Berdikari, Sintuwu and Nopu. Two additional cacao agroforestry system were situated inside the forest margin shaded by a cover of remaining natural forest trees. Two further sampled sites were selected inside the natural forest. Insects were sampled by treating single cacao tree crowns with a knock-down insecticide (Matador). At each study site 5 randomly selected trees were sampled. After spraying all individuals were collected from a large plastic sheet spread under the treated canopy. Individuals were transferred to plastic containers containing 70% alcohol before sorting and identification took place in the laboratory.

A total of 119,536 insect specimens were collected by spraying single cacao trees. Results showed that the most abundant orders were Hymenoptera, Collembolla, Homoptera, Diptera, and Coleoptera. Insect communities on cacao trees changed significantly with artificial disturbance by insecticide on cacao habitats. Increasing isolation of small blocks of cacao plantation from nearest forest did not have effects on insect communities. While a strong temporal effects was found. Samples within spraying periods proved to be more to each other than samples belonging to different spraying periods.

On a small temporal scale, we found significant differences of abundance and species richness of parasitic Hymenoptera between samples form June and August 2001 indicating that the re-colonization of the sprayed cacao trees was still in process after 2 months. No differences in abundance and species richness were found between samples after a re-sampling of the same trees 1.5 years later. However, a significant difference with respect to the species composition indicated a pronounced temporal species turnover. Due to the long recovery period of communities of parasitic Hymenoptera the treatment of cacao trees with insecticides can significantly decrease the effectiveness of these important parasitoids to control herbivores in cacao agroforestry systems.
Habitat corridors that connect isolated cacao plantations can be recommended to increase the abundance and diversity of species within those cacao plantations through increases in rates of immigration.

Keywords: parasitic Hymenoptera, insect communities, diversity, habitat isolation, temporal dynamic
ABSTRAK


Pengaruh isolasi habitat terhadap struktur komunitas serangga serta keanekearagaman dan kelimpahan Hymenoptera parasitika pada sistem agroforestri tanaman kakao diteliti antara bulan Februari 2003 dan April 2004. Penelitian dikonsentrasi pada dua aspek, yaitu (Bab IV) pengaruh isolasi sistem agroforestri tanaman kakao dari hutan pada komunitas serangga dalam konteks waktu, dan (Bab V) dinamika Hymenoptera parasitika dalam konteks waktu dan ruang pad agroforestri tanaman kakao.


Secara keseluruhan dikoleksi sebanyak 119,536 spesimen serangga. Hasil penelitian ini menunjukkan bahwa Hymenoptera, Collembollae, Homoptera, Diptera, and Coleoptera merupakan ordo yang paling melimpah. Aplikasi pestisida yang biasa dianggap sebagai gangguan buatan ternyata sangat mempengaruhi struktur komunitas serangga secara umum. Isolasi plot-plot perkebunan kakao dari hutan tidak mempengaruhi struktur komunitas serangga. Struktur komunitas serangga akan berubah sesuai dengan perbedaan waktu sampling.

Pengambilan contoh yang dilakukan pada jarak waktu yang sempit (6 minggu) sudah memberikan pengaruh yang signifikan pada kelimpahan dan kekayaan spesies Hymenoptera parasitika, yang berarti bahwa rekolonisasi masih berlangsung dalam waktu tersebut. Tidak terdapat perbedaan yang signifikan dalam kelimpahan dan kekayaan spesies pada pengambilan contoh dengan tenggang waktu 1,5 tahun pada pohon yang sama. Perbedaan waktu pengambilan contoh memberikan implikasi pada perubahan komposisi spesies yang menunjukkan adanya temporal species turnover. Aplikasi insektisida dengan tenggang waktu yang sempit akan menyebabkan penurunan jumlah spesies,
sehingga dapat berimplikasi pada keefektifan parasitoid dalam mengendalikan serangga herbivora di perkebunan kakao.

Habitat yang berfungsi sebagai koridor yang menghubungkan perkebunan kakao dengan hutan dapat disarankan untuk meningkatkan kekayaan spesies Hymenoptera parasitika melalui peningkatan laju migrasi.

Kata kunci: Hymenoptera parasitika, komunitas serangga, keanekaragaman, isolasi habitat, dinamika waktu.
SURAT PERNYATAAN

Dengan ini, saya menyatakan bahwa tesis saya yang berjudul "Effects of Isolation on Temporal Dynamic of Insect Community Structure and Parasitic Hymenoptera Diversity in Cacao Agroforestry Systems at the Margin of Lore Lindu National Park, Central Sulawesi" merupakan gagasan atau hasil penelitian saya sendiri dan belum diajukan dalam bentuk apapun kepada perguruan tinggi manapun. Semua data dan informasi yang digunakan telah dinyatakan dengan jelas dan diperiksa kebenarannya.

Bogor, October 2004

[Signature]

Bandung Sahari
NRP A425010031
EFFECTS OF ISOLATION ON TEMPORAL DYNAMIC OF INSECT COMMUNITY STRUCTURE AND PARASITIC HYMENOPTERA DIVERSITY IN CACAO AGROFORESTRY SYSTEMS AT THE MARGIN OF LORE LINDU NATIONAL PARK, CENTRAL SULAWESI

BANDUNG SAHARI

A Thesis
Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science
At the Graduate School, Bogor Agricultural University
Study Program Entomology/Phytopathology

GRADUATE SCHOOL
BOGOR AGRICULTURAL UNIVERSITY
BOGOR
2004
Title of Thesis: Effects of Isolation on Temporal Dynamic of Insect Community Structure and Parasitic Hymenoptera Diversity in Cacao Agroforestry Systems at the Margin of Lore Lindu National Park, Central Sulawesi

Name: Bandung Sahari

Student Registration Number: A 425010031

Study Program: Entomology/Phytopathology

Approved by:

Advisory Committee

Dr. Ir. Damayanti Buchori, M.Sc.
Chairman

Drs. Rosic on Ubaidillah, DIC, M.Phil.
Member

Dr. Christian Hansjoachim Schulze
Member

Acknowledged by:

Chairman of Study Program
Entomology/Phytopathology

Date of Examination: October 8th, 2004
Date of Graduation: 1 DEC 2004
BIOGRAPHICAL SKETCH

Bandung Sahari was born in Surakarta, Central Java on March 25, 1974 as the seventh of eight children of Slamet Sutarso (Alm) and Sri Sumiyarti. He finished his senior high school program in 1993 at SMA Negeri 2 Surakarta, Central Jawa and was accepted as undergraduate student at Bogor Agricultural University (IPB) in 1994. One year later, he was then accepted as a student of the Department of Plant Pest and Diseases, Faculty of Agriculture. During the study period, he actively involved in student activities at local (Plant Protection Student Association) and national level (Indonesia Plant Protection Student Association). Between 1997-1999, he was a General Secretary of 2nd region of Indonesia Plant Protection Student Association. In 1999 he finished his Bachelor degree and also was accepted as staff member of the Center for Conservation and Insect Studies (CCIS/ Yayasan Peka Indonesia). Additional experience, he collated through his one-year work (2000-2001) as technical staff of the Center for Integrated Pest Management. Currently he is research coordinator of CCIS.

In 2001, he was accepted as a student of the Study Program of Entomology-Phytopathology, Graduate Program. At the same year, he married Lu’lu Agustina SP and blessed with a two-year old son (born in Bogor on October, 16, 2002), named Muhammad Islam Al-Ghifari.
Foreword

Many thanks to Allah SWT for blessing me to finish this thesis “Effects of isolation on temporal dynamic of insect community structure and parasitic Hymenoptera in cacao agroforestry systems at the margin of Lore Lindu National Park, Central Sulawesi”. This thesis based on the research under the supervision of Dr. Damayanti Buchori, chairman of the advisory committee, Drs. Rosichon Ubaidillah, DIC. Mphil and Dr. Christian H Schulze, both are members of the advisory committee. Many thanks are expressed to all of them for their support of my MSc research, their valuable advice and many fruitfull discussion.

I am grateful to Faculty of Agriculture, and the Head of the Plant Pest and Disease Department, Bogor Agricultural University (IPB), Dr. Damayanti Buchori. They gave me the opportunity to perform my study and to use the department’s facilities. I also like to thank all lecturers of IPB for sharing their knowledge and experience.

I am also thankful to Prof. Dr. Teja Tscharntke, head of the Institute of Agroecology, University of Göttingen, Germany, for giving me the opportunity to join the STORMA’s research. Special thanks to Dr. Christian H. Schulze and Drs. Rosichon Ubaidillah DIC MPhil for many fruitful discussions, supports, and the close collaboration over the whole time during my MSc project.

Special thanks are extended to Peka Indonesia and Wildlife Trust which have given me a fellowship for attending the Graduate School, Director of Balai Taman Nasional Lore Lindu, Palu -University of Tadulako - STORMA Which gave me facilities to perform my research in Palu. I would like to say many thanks to Dr Tukirin who gave me more information related to my research topic, to all Storma’s drivers, Ibu Rina, and to all my best friends (Mbak Adha, Hertab, Jalu, Nina, Dina, Ai, Ari, Atiek, Nita, Rahma, Shinta etc) who assisted and encouraged me to finish this research.

Finally, I would love to express my lovely thanks to my wife Lulu’ Agustina-Gifa for their love, support, understanding, and patience as well as all of my families and friends. To my son Gifa for his missing in love during the time I conducted my research in Bogor and Palu.