CHANGES IN THE COMPOSITION OF INSECT COMMUNITIES OF LADANG IN TANAH MERAH, EAST KALIMANTAN *)

by

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RINGKASAN

Penelitian mengenai segi-segi ekologi populasi serangga Indonesia yang sangat jarang telah mendorong dilakukannya penelitian ini. Kegiatan ini dilakukan pada sebidang tanah bekas ladang di Kalimantan Timur. Dua pengamatan dilakukan pada permulaan musim kemarau untuk menelusuri perubahan komposisi komunitas serangga selama masa pengamatan.

Komunitas serangga di daerah penelitian mengalami perubahan dengan meningkatnya jumlah individu dan jenis. Akan tetapi, kepadatan nisbi masing-masing jenis mengalami penurunan. Peningkatan keanekaragaman terjadi lebih cepat pada kelompok pemakan tumbuhan daripada dalam kelompok parasit dan pemangsa, yang munculnya lebih lambat. Dari sembilan ordo yang tercatat, tiga muncul pada pengamatan kedua, sedangkan satu lainnya menghilang.

SUMMARY

The scarcity of researches on population ecological aspects of Indonesian insects has stimulated the development of this study. A shifting-cultivated rice field in East Kalimantan was used as the area of study. Two observations at the beginning of dry season were done to trace the composition changes of the insect communities during the observation period.

The insect communities in the study area were changing by increase in number of individuals and species. However, the relative density of each species was in general decreased. The increase of diversity occured more rapidly in plant feeding groups than in the parasites and predators, whose appearance was mostly later. Out of nine ordines recorded, three appeared later, while another disappeared in the second observation.

INTRODUCTION

Researches on population ecology of Indonesian insects have not been done too often. Still rarer are those on grass plane or open areas. Only

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a limited endeavours had been done (Adisoemarto, 1974; BIOTROP, 1975). This situation is not very much different in other countries, although researches on that of tropical forests have been done (Elton, 1972; Golley, 1977). In support of promoting activities or efforts on ecological studies of Indonesian insects in general and those of grass plane and open areas in particular, a study on this aspect was done in East Kalimantan. This study was also conducted in conjuction with the Man and the Biosphere research activities in this area, covering the aspects of the impacts of human activities on the floristic and faunistic communities of tropical forests. One of the community types was "ladang" or shifting cultivated rice field.

The activities of this study were still limited. Limitation was shown in times of observations, area covered and aspects analyzed. Limited as it is, this study is still believed to have value in the contribution towards the improvement of knowledge in this particular field. In addition, within the framework of the Indonesian MAB Programme on East Kalimantan, the data obtained from the insect study will be complementary to those on the floristic communities (Kartawinata, 1977).

The choice of the results of ladang study to be forwarded among other types of community, has been mainly based on the fact that the ladang showed striking changes in floristic composition. After harvest, the rice stems were left to rot and dry, while wild plant species were growing uncontrolled, to let the entire area changed into "belukar" or shrubs. Adjusting to the vegetational changes, the insects inhabiting the area were also changing in composition. This phenomenon was considered here as an opportunity to conduct a research in population ecology on Indonesian insects, especially of the open areas. Therefore, observations were made in this ladang, in order to contribute to the effort in tracing the dynamics of the insect communities in this type of community.

MATERIALS AND METHODS

The ladang studied was a part of the resettlement area in Tanah Merah, East Kalimantan, which was slightly above sea level. From the housing complex, the ladang was situated approximately 1 km by straight line. Next to this ladang was a secondary forest. Between ladang and the housing complex there were effective rice paddy and some home gardens.

The observations were made during a short period within the dry season: the first was conducted in the period from the end of March to early April 1978; the second was in the mid July 1978. Within this short period, which was approximately 4 months, the vegetation changed rapidly. The change involved the expansion of the area covered as well as the number of species.

To conduct the observations, the master plot was made on two different types of terrain, *i.e.* a plane and a slope. There were stumps and trunks scattered in this plot. On the plane there were creeks and some pools. Some of these water bodies were included in the observation plot.

During the first observation, rice stems were still covering the plot on the plane, which was in general muddy. However, on the slope side the land was dry. Here, a mixture of rice stems and belukar species such as *Paspalum conjugatum*, *Macaranga hypoleuca*, *Melastoma* sp and occasionally alang-alang *(Imperata cylindrica)* was observed. During the second observation, the belukar was thicker and more varied covering the part of plot on the plane as well. During this time all of the rice stems were already gone, and the land was drier.

The master plot was 100 m x 100 m and divided into 100 subplots. The subplots where insects were collected were systematically determined, by alternate choice. Consequently, a total of 25 subplots were effective. Insects were collected by standardized sweeping for each subplots. There were some deviation in some difficult subplots, due to the condition of the terrain, which made it impossible to follow strictly the standardized method.

Discussion of the results was limited to the relative density and the degree of diversity of each group (order). Analyses of the collected materials were done towards the calculation of the relative density. The diversity was calculated by comparing the number of species within a group to the total number of species in each observation.

DISCUSSION

From the two observations, nine ordines of insects were recorded, consisting of 196 species. These orders were Neuroptera (1 species), Odonata (4), Lepidoptera (4), Hymenoptera (15), Hemiptera (49), Coleoptera (54), Diptera (21), Orthoptera (45) and Dermaptera (3). Detailed analysis based on time of observation shows that during the observation in March-April 1978, there were 90 species classified in 6 ordines, while in July 1978, the insect population showed a change in species number, that was 143 species grouped in 8 ordines. There was also increase in number of individuals, from 302 to 1073 (Table I). During the March-April 1978 observation, Neuroptera, Odonata and Lepidoptera were not represented, but during the July 1978 observation, only Dermaptera disappeared. Out of 196 species recorded during the two observations, 53 species or 27% were only found when the observation area was covered with grasses and rice stems, 106 species or 54% were found when there were more species of belukar present in the area, while 37 species or 19% were found all the time.

Table I. The composition of insects on an abandoned ladang in Tanah Merah, Lempake, East Kalimantan

Insect group	First observation		Second observation	
	Number of specimens	Rel. density	Number of specimen	Rel. density
1	2	3	4	5
I. NEUROPTERA				
Myrmeleontidae				
Myrmeleon sp.	—	—	1	0.19
II. ODONATA				
Libellulidae				
Pantala flavescens	—	—	1	0.09
Libellulidae sp. 1	—	—	1	0.09
Libellulidae sp. 2	—	—	2	0.18
Coenagriidae				
Coenagriidae sp. 1	—	—	1	0.09
III. LEPIDOPTERA				
Pyralidae				
Pyralidae sp. 1	—	—	1	0.09
,, sp. 2	—	—	3	0.28
,, sp. 3	—	—	1	0.09
,, sp. 4	—	—	3	0.28
IV. HYMENOPTERA				
Ichneumonidae				
Ichneumonidae sp. 1	1	0.33	1	0.09
,, sp. 2	—	—	2	0.18
Braconidae				
Braconidae sp. 1	—	—	1	0.09
Braconidae sp. 2	—	—	1	0.09
Chalcididae				
Chalcididae sp. 1	—	—	1	0.09
Trigonalidae				
Trigonalidae sp. 1	—	—	3	0.28
Trigonalidae sp. 2	—	—	1	0.09
Apidae				
Apidae sp. 1	—	—	1	0.09
Apidae sp. 2	—	—	1	0.09
Xylocopidae				
Xylocopa latipes	—	—	1	0.09

1	2	3	4	5
Sphecidae				
Isodartia sp.	—	—	1	0.09
Dasypactus sp.	—	—	2	0.18
Sphecidae sp. 1	—	—	1	0.09
Vespidae				
Rhopalidia sp.	1	0.33	—	—
Hymenoptera sp. 1	1	0.33	1	0.09
V. HEMIPTERA				
Reduviidae				
Epidaus pellax	1	0.33	—	—
Iegia pullata	1	0.33	—	—
Harpactor visinus	2	0.66	—	—
Velinus nigrigenu	5	1.65	4	0.37
Sycanus bividus	1	0.33	2	0.18
Euagoras sp.	9	2.97	14	1.30
Vesbius sp.	—	—	1	0.09
Nabidae				
Nabidae sp. 1	1	0.33	—	—
Nabidae sp. 2	1	0.33	—	—
Coreidae				
Hyalopeplus vitripennis	—	—	1	0.09
Leptocorixa sp.	1	0.33	—	—
Riptortus linearis	3	0.99	—	—
Mictus longicornis	1	0.33	—	—
Leptocorixa acuta	2	0.66	6	0.56
Narbo biplagiatus	—	—	1	0.09
Riptortus sp. 2	—	—	1	0.09
Malcus sp. 1	—	—	12	1.12
Malcus sp. 2	—	—	12	0.46
Malcus sp. 3	—	—	6	0.56
Rhinomiris sp.	—	—	4	0.37
Pentatomidae				
Amissus sp.	1	0.33	—	—
Delpada occulata	4	1.32	—	—
Plautia lunulata	—	—	1	0.09
Podops laportae	—	—	1	0.09
Brachyplatis sp.	—	—	1	0.09
Aradidae				
Mezira sp.	—	—	3	0.28
Miridae				
Miridae sp. 1	—	—	4	0.37

1	2	3	4	5
Jassidae				
Tettigoniella sp. 2	1	0.33	—	—
Tettigoniella ferruginea	27	9.91	62	5.78
Jassidae sp. 1	1	0.33	7	0.65
Jassidae sp. 2	1	0.33	1	0.09
Nisia sp.	1	0.33	1	0.09
Jassidae sp. 3	—	—	1	0.09
Jassidae sp. 4	—	—	1	0.09
Nephotettix sp.	—	—	6	0.56
Kolia bataviae	—	—	3	0.28
Fulgoridae				
Fulgoridae sp. 1	1	0.33	—	—
Fulgoridae sp. 2	2	0.66	—	—
Fulgoridae sp. 3	2	0.66	—	—
Dictyophara pallida	12	2.96	16	0.50
Delphacodes sp.	—	—	2	0.18
Tingidae				
Tingidae sp. 1	1	0.33	—	—
Tingidae sp. 2	1	0.33	—	—
Camspeuta sp	2	0.66	—	—
Corixidae				
Corixidae sp. 1	—	—	5	0.45
Flattidae				
Lawana candida	—	—	1	0.09
Membracidae				
Leptocentrus sp.	—	—	1	0.09
Membracidae sp. 1	—	—	1	0.09
VI. COLEOPTERA				
Chrysomelidae				
Hyphasis sp	2	0.66	—	—
Ceratia similis	1	0.33	—	—
Ceratia bicolor	1	0.33	—	—
Ceratia sp. 1	1	0.33	—	—
Ceratia coffeae	3	0.99	2	0.18
Theopea sp.	5	1.65	8	0.75
Psylliodes sp.	5	1.65	16	1.50
Chrysomelidae sp. 1	1	0.33	10	0.93
Calosposoma sp.	—	—	1	0.09
Ceratia sp. 2	—	—	1	0.09

1	2	3	4	5
Nodina sp.	—	—	27	2.51
Longitarsus sp. 1	—	—	2	0.18
Longitarsus sp. 2	—	—	5	0.47
Chrysomelidae sp. 2	—	—	2	0.18
Chrysomelidae sp. 3	—	—	2	0.18
Meloidae				
Epicauta ruficeps	5	1.65	—	—
Languridae				
Anadustus filiformis	5	1.65	—	—
Coccinellidae				
Epilachna sp. 1	2	0.66	—	—
Coccinella sp. 1	1	0.33	—	—
Elateridae				
Elateridae sp. 1	1	0.33	—	—
Aceloderma sp.	—	—	2	0.18
Heteroderes sp.	—	—	1	0.09
Malaianus sp.	—	—	—	—
Colleidae				
Colleidae sp. 1	1	0.33	—	—
Lampyridae				
Lampyridae sp. 1	1	0.33	—	—
Erotylidae				
Erotylidae sp. 1	1	0.33	—	—
Amblyopus sp.	—	—	1	0.09
Nitidulidae				
Nitidulidae sp. 1	1	0.33	9	0.83
Mordellidae				
Mordellidae sp. 1	—	—	1	0.09
Scolytidae				
Xyleborus sp.	—	—	2	0.18
Lysidae				
Coleoptera sp. 1	1	0.33	—	—
Bulenides sp.	—	—	1	0.09
Xylobanus sp.	—	—	3	0.28
Cerambycidae				
Demonax elongatus	1	0.33	—	—
Euryphagus lundi	1	0.33	—	—
Cerambycidae sp. 1	1	0.33	—	—
Cerambycidae sp. 2	1	0.33	—	—
Chlorophorus sp.	1	0.33	1	0.09
Astates japonica	—	—	1	0.09

1	2	3	4	5
Scarabaeidae				
Onthophagus liliputans	—	—	1	0.09
Cetonidae				
Cetonidae sp. 1	—	—	1	0.09
Staphylinidae				
Staphylinidae sp. 1	—	—	1	0.09
Staphylinidae sp. 2	—	—	1	0.09
Tenebrionidae				
Tenebrionidae sp. 1	—	—	2	0.18
Scotaeus corallipes	—	—	1	0.09
Curculionidae				
Lixus javanicus	1	0.33	—	0.09
Alcides reticulatus	2	0.66	—	—
Lixus sp. 1	1	—	1	0.09
Metialma sp.	—	—	2	0.09
Curculionidae sp. 1	—	—	1	0.09
Curculionidae sp. 2	—	—	1	0.09
Curculionidae sp.3	—	—	1	0.09
Curculionidae sp. 4	—	—	1	0.09
Brenthidae				
Brenthidae sp. 1	5	1.65	1	0.09
Brenthidae sp. 2	—	—	1	0.09
VII. DIPTERA				
Asilidae				
Laphria sp.	3	0.99	1	0.09
Celyphidae sp.	1	0.33	—	—
Tephritidae sp.	1	0.33	—	—
Tabanidae				
Chrysops fissisima	—	—	—	—
Sarcophagidae				
Sarcophagidae sp. 1	—	—	1	0.09
Syrphidae				
Syrphidae sp. 1	—	—	1	0.09
Syrphidae sp. 2	—	—	1	0.09
Tachynidae				
Tachynidae sp. 1	—	—	10	0.93
Tachynidae sp. 2	—	—	1	0.09
Muscidae				
Muscidae sp. 1	—	—	2	0.18
Muscidae sp. 2	—	—	1	0.09

1	2	3	4	5
Trypetidae				
Trypetidae sp. 1	—	—	1	0.09
Drosophilidae				
Drosophila melanogaster	—	—	17	1.58
Culicidae				
Culex sp. 1	—	—	2	0.18
Culex sp. 2	—	—	1	0.09
Mansonia sp.	—	—	3	0.28
Empididae				
Empididae sp. 1	—	—	1	0.09
Tipulidae				
Tipulidae sp. 1	—	—	1	0.09
Stratyomyiidae				
Microchryza sp.	—	—	1	0.09
Diptera sp. 1	—	—	1	0.09
Diptera sp. 2	—	—	1	0.09
VIII. ORTHOPTERA				
Gryllidae				
Pteroneurobius sp.	2	0.66	—	—
Neurobius sp.	2	0.66	19	1.37
Nisitra pyalina	27	8.91	56	5.21
Gryllidae sp. 1	6	1.98	1	0.09
Gryllidae sp. 2	1	0.33	1	0.09
Gryllidae sp. 3	1	0.33	1	0.09
Gryllidae sp. 4	—	—	1	0.09
Gryllidae sp. 5	—	—	9	0.83
Gryllidae sp. 6	—	—	2	0.18
Gryllidae sp. 7	—	—	2	0.18
Tetrigidae				
Tetrigidae sp. 1	1	0.33	—	—
Acridiidae				
Caryandra spuria	4	1.32	—	—
Catantops humilis	6	1.98	—	—
Valanga nigricornis	1	0.33	—	—
Oxya chinensis	7	2.31	—	—
Acridiidae sp. 1	1	0.33	—	—
Atractomorpha crenaticeps	7	2.31	8	0.75
Oxyrhepes obtusa	2	0.66	18	1.68

1	2	3	4	5
Catantops angustifrons	1	0.33	9	0.84
Phloeoba artenata	4	1.32	10	0.93
Oxya minuta	4	1.32	40	3.73
Acridiidae sp. 2	1	0.33	13	1.21
Acridiidae sp. 3	—	—	1	0.09
Acridiidae sp. 4	—	—	3	0.28
Arcidiidae sp. 5	—	—	2	0.18
Acridiidae sp. 6	—	—	14	1.3
Acridiidae sp. 7	—	—	3	0.28
Tettigonidae				
Elimaea signata	1	0.33	—	—
Ducetia thymifolia	2	0.66	—	—
Ducetia japonica	1	0.33	4	0.37
Xiphidion maculatus	52	17.16	408	38.0
Tettigonidae sp. 1	1	0.33	8	0.75
Tettigonidae sp. 2	1	0.33	6	0.56
Tettigonidae sp. 3	—	—	3	0.28
Tettigonidae sp. 4	—	—	6	0.56
Tettigonidae sp. 5	—	—	1	0.09
Liotrachella hyalima	—	—	1	0.09
Hexacentrus unicolor	—	—	7	0.65
Blattidae				
Periplaneta australasiae	1	0.33	—	—
Periplaneta sp.	1	0.33	—	—
Phyllodroma germanica	6	1.98	10	0.93
Phasmidae				
Ephierodula sp.	—	—	3	0.28
Gryllacridiidae				
Gryllacridiidae sp. 1	6	1.98	26	2.42
Gryllacridiidae sp. 2	—	—	1	0.09
IX. DERMAPTERA				
Forficulidae				
Forficula sp.	1	0.33	—	—
Dermaptera sp. 1	1	0.33	—	—
Dermaptera sp. 2	1	0.33	—	—

Neuroptera was represented by one species of *Myrmeleon*, the dragonflies by four species, and Lepidoptera by four species. These three groups were in very low density and only observed during the second observation. These groups were not regular inhabitants of the observation area. Therefore, they were in low density level. Their presence in the observation area

was only occasional visits and probably due to their foraging behaviour. The limited appearance during the second observation only was caused by the situation of the observation area, when preys and flowers were abundant only during the second observation period. However, the presence of the pyralid moths was not entirely due to food attraction to the adults. These species might have used the surroundings of the area of observation as breeding ground as well, since the food materials for the larva, such as corns and other agricultural secondary crops were being grown.

Hymenoptera were represented by three species or 3.33% diversity, consisting of one species of ichneumonid wasps, a predator *Rhopalidia* sp and an unidentified hymenopteron. The total density was 0.99%. The presence of the parasitic species was probably as the remnants of the parasitic population of rice pests. *Rhopalidia* was hanging around in the area for obtaining remnants of rice caterpilars (Kalshoven, 1951). The hymenopteran population was more diversified (9.70%) in the second observation, to be represented by 14 species and with higher relative density (1.65%). The increase in diversity and density was due to the more diversified plant as well as insect population found in the area, that might be the source of food for these bees and wasps. This was shown by the more diversified habits of the insects, including predators and flower visitors. The parasites were relatively decreased in density, from 0.66% to 0.56%, but the absolute number increased three times. One of these species was constituting one of the two species that were found in both observations.

In the first observation, Hemiptera were constituting 28.14% density of the population and in the second observation relatively decreased to 16.3%. However, in absolute count, the bugs increased more than twice, from 85 to 175. *Sycanus bividus*, *Velinus nigrigenu* and *Eugoras* sp were the predaceous Hemiptera that were always present in the observation area. Three others, *i.e. Epidaus pellax*, *Iegia pullata* and *Harpactor visinus* were found only in the first observation, while *Vesbius* sp only in the second observation. Therefore, in total, the number of predaceous species lowered from 6 to 4. In general, the relative density of these predators was decreased from 6.27% to 1.95%. This is mainly due to the unproportional increase of other groups of insects in the area of observation. The other Hemiptera showed increase in species number, from 20 to 26, while the bugs in general increased in diversity from 26 to 31, but still decreased in relative diversity from 28.14% to 16.23%. The other bugs that were found in both observations were *Leptocorixa acuta*, *Tettigoniella ferruginea*, two other species of Jassidae and *Dictyophara pallida*. They showed absolute increase in number of individuals, from 44 to 93, but relatively less densed, from 14.52% to 8.67%, except one of the species of Jassidae, which increased from 0.33% to 0.65%. The species that were present only in the first observation were mostly in low

density, ranging from 0.33% to 0.67%. However, *Delpada occulata* constituted 1.33%. In the second observation, the density range was wider, from 0.09% to 1.12%.

The beetles showed almost entirely of plant feeders during the first observation. It is worth noted that 1.65% was occupied by wood-boring species of Cerambycidae. These might be present in the area of observation as visitors. This was possible since in the neighbouring environment provided plant species as the hosts of the larval stages. Out of the entire population of the beetles in the first observation, 37.5% was of the chrysomelids. More *Ceratia* species appeared earlier, but one species, *C. coffeae* was found in both observations. Three other species of this family were found in both observations. Most of the chrysomelids found in the first observation were leaf feeders of Solanaceae species, which were present in the area from the end of the rice cultivation and more frequent subsequently. However, the population of the chrysomelids in the first observation was replaced by other species in the second observation. The rest of the species, except *Epicauta ruficeps*, *Anadustus filiformis* and a species of Brenthidae in the first observation, and a species of Nitidulidae in the second observation, were in low density. *Epicauta* is polyphagous, therefore,its abudance could be due to this character. The larva of *Anadastus filiformis* is a rice stem borer, a character that would explain the abundance of the adults in the second observation.

The Diptera were relatively rare during the first observation. Only 3 species were present in this period. Among these three, a species of *Laphria*, which is a predator, was found in the other observation. The relative density of the Diptera jumped from 1.65% to 4.84%. This jump was most probably due to the more diversified vegetation and enhancement of spore formation through fermentation of some rotten fruits or decaying matter, which enabled *Drosophila melanogaster* to flourish by forming 1.58% density, and other insect species to frequent the area. In turn, this development, and of other insect groups, made possible the development of parasitic Diptera such as the tachinids, which formed 0.93% of the population.

The orthoptera were nearly constant in density, 59.40% in the first, and 65.2% in the second observation. This ordines was the dominant group of insects during the observations. This is understandable since the environment renders it possible. This is probably a general situation for the grasshoppers and allies, as it was also found in the forest community (Adisoemarto, 1974). Although the density was constant, the composition showed some changes. During the second observation the absolute number showed five times increase compared to the number in the first observation. This increase was almost certainly due to the more abundant food materials. Out of 45 recorded species, 17 species or 37.8% were always present, consisting

of five species of Gryllidae, six of Acridiidae, four of Tettigonidae, one of each of Blattidae and Gryllacridiidae. In this community changes, a slight indication of the increase of diversity of plant feeders was shown, followed by the decrease of scavengers and the following appearance of predators. This development is in accordance with the community development as a whole.

The earwigs were represented by three species, *i.e.* a species of *Forficula* and two other species of Dermaptera. They were present only during the first observation. The absence from the second obseravtion was probably due to the thicker vegetation of the surroundings, enabling this group to escape from sampling.

CONCLUSIONS

The relative density of each species was 1.1% represented by 3.3 specimens in the first observation, but decreased to 0.69% represented by 7.5 specimens. The decrease in relative density with the increase in number of specimens representing is the sign of increase of diversity. This increase is understandable since the more diversified vegetation attracts more plant feeders, which in turn serve more predators and parasites.

Only four ordines formed highly ranked groups, which contained species with relative density above the average. These four were Hemiptera, Coleoptera, Diptera and Orthoptera. The "failure" of the Hymenoptera in joining the big four, although always present in both observations, was due to the slow developing parasites as shown by the parasitic groups (Chalcididae, Braconidae and Ichneumonidae) and the scarcity of the flower visitors. The latter were rare due to the scarcity of flowers, as proven also by the low density of the butterflies in the area.

In the first observation it was found that five species of Hemiptera were occupying the level above the average density. These were *Velinus nigrigenu*, *Euagoras* sp, *Delpada occulata*, *Tettigoniella feruginea* and *Dactyophora pallida*. The first two species are predators while the rest plant sap feeders. Apparently, among the assassin bugs, the species *Euagoras* in the observation area was the dominant one, which might be accounted for its very versatile movement. This species was, in fact, the only one of it groups that maintained the big relative density. For the rest of Hemiptera, except for Tingidae, Aradidae, Miridae, Corixidae, Flattidae, Membracidae and Nabidae, there seemed to be succession within the families. Nabidae, being a predatory group, lost its ground by competition with Reduviidae, which cointained dominant species. The other five families of plant sap feeders were later appearing groups, which might compensate the disappearance of Tingidae.

In the order Coleoptera, five species occupied the above-average position in the first observation, namely *Theopea* sp, *Psylliodes* sp, *Epicauta ruficeps*, *Anadastus filiformis* and a species of Brenthidae. However, none of these maintained their position in the second observation. Instead, three other species, *i.e. Nodina* sp, another species of Chrysomelidae and a species of Nitidulidae, took over the position. The nitidulid species, as being sap feeder, would appear in larger population as the food plants was available in more amount.

Two species of Diptera were present in the above-average-density level. These two appeared only in the second observation. The later appearance was understood since the parasitic Tachinidae needed hosts before they could develop a population. The drosophilids too needed some fermented organic matter, which was available later, for their appearance.

Orthoptera were the most dominant group. Among their members, 11 species in the first observation and 14 species in the second observation occupied the level above the average density. Out of these, seven species were always in high density. This situation showed that ladang and shrubs were the habitat most suitable for the grasshoppers and the related groups, such as the crickets and the cockroaches.

Based on the role of the insects in the environment, it was shown that the predators and parasites decreased in their relative density, from 8.36% to 5.5%. Their development seemed to be slower than that of the plant feeders. However, further observations were necessary to follow the dynamics of the following generations.

This study will be of much importance and having high application value, as knowledge on this aspect will be required in the management of agricultural area as a whole and understanding the population properties of predators and parasites. The need is also called for the analysis of the mechanism of diversity. This has been shown by the fact that the number of species increased (from 11.1% to 18.9%) at the expense of their relative density. This type of studies awaits more attention.

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