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Taxa composition of Insects in Peat Agricultural area Kalampangan sub-district Central Kalimantan Indonesia

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***Abstract*— Insects are one of taxa within Animal. Despite of their high adaptability, this group also cover vast areas. Nevertheless, they are played an ecological role. This is suggest, that this taxa having a sizable proportion over animal kingdom. Data from agricultural area, their existence most often reported as pest. However, less study has been conducted regarding their ecological role, especially in peat land, as in Kalampangan. The research was aimed to study the insects' abundance within Kalampangan peat agricultural area, as well as their ecological role. Research is quantitative descriptive, using survey method. Data was collected from Dec 2017 to July 2018. Insects was collected usingPitfall trap, Yellow trap, Light trap and Sweep Net, within two differ locations. Time factor as effort was recorded. Density approximation was using CPUE. All trapped insects, was transported to Zoology Laboratory, PMIPA-FKIP UPR for identification. Their unique characteristic at family taxa was documented. The data described that the taxa was consisted of 10 orders, 24 families, with a total 847 individual. Acrididae was found dominant on sweep net, while I sotomidae (pitfall trap), Coccinellidae (yellow trap) and Formicidae (light trap), respectively. To conclude, herbivore was highly dominated ecological role among trapped insects.)**

Keywords—Insects; Peatland; CPUE; Kalampangan.

I. INTRODUCTION

Peatlandis a wetland ecosystem that is formed by the accumulation of organic matter through times, whereas water is becoming a determining factor. Water prevents the organic decomposition processes. This ecosystem has a unique property compared to other ecosystems which have acidic pH, poor nutrient and thick organic matter. Its unique characteristics is generally accepted that it is home of biodiversity in Indonesia [1], [2].

According to [3], insects are one of the most dominating taxa in peat ecosystem. Insects are an important order in the class of arthropods, used as an indicator of the balance and health of an ecosystem. The ecological roles of the order are very important, especially in terms of animal-plant interactions, including its relationshipwith humans [4]. It is suggest to monitor the diversity of insects, one need to have information on abundance and their role in an ecosystem [5]. The abundance of insects is very much determined by their reproductive activities which are supported by a suitable environment and the need for food sources.Kalampangan is one of the peat ecosystem, on which has been processess for agricultural purpose. This study was aimed to study the insects' abundance within Kalampangan peat agricultural area, as well as their ecological role.

II. METHODS

A. Time and Location

Data was collected from Dec 2017 to July 2018, in peat agricultural area, Kalampangan sub-district, Central Kalimantan (Fig 1). Location was divided into two distinct locations, based-on distance along the peat forest, and crops being planted. Table 1 describes the GPS position of each location.

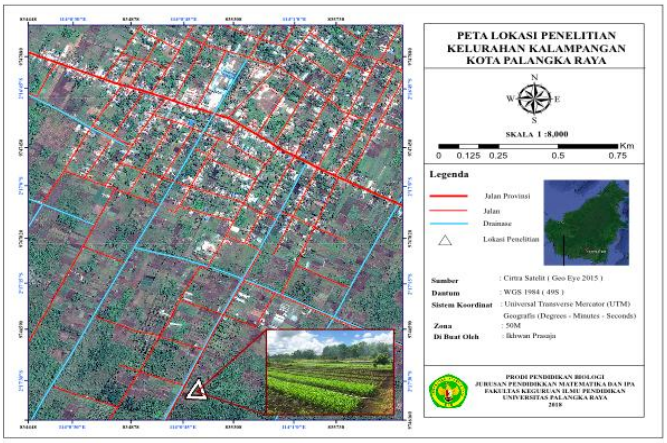

Fig. 1. Map of Kalampangan district *(inset: sampling location)*

TABLE I. GPS COORDINATES OF TWO SAMPLING LOCATIONS

No.	site	asl	Coordinates
1.	I	17-18	Point 1 : 114º0'44,51" BT, 2º17'33,67" LS Point 2 : 114º0'43,92" BT, 2º17'35,00" LS
2.	II	18	Point 1 : 114º0'42,63" BT, 2º17'32,89" LS Point 2 : 114º0'42,15" BT, 2º17'34,25" LS

B. Data collection

Assuming that all trapped insects are insecticide free, we did sample purposively. Within each location, we use four (4) different traps, which were pitfall trap, yellow trap, light trap and sweep net. Sweep-net was conducted along diagonal basis, while other traps, were randomly positioned within intervals (Fig 2). The selection of 4 traps is based on the time of catching the insects, where the insects that are captured are noctural and diurnal.

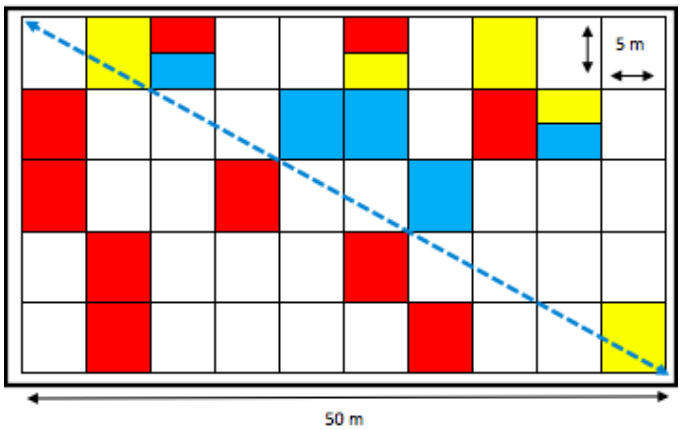

Fig. 2. The designation on position of each trap within location (red: Pitfall; yellow : yellow trap; blue : light trap)

We were run data collection, for seven day, simultaneously, started at 6.00 a.m. to 6.a.m. However, every 12 hours, all trapped insects collected, counted and stored within sample bottle contains 1% formalin. By doing so, we were able to calculated catchment per unit effort (CPUE); number of insects trapped per unit time All trapped insects, were transported to zoology laboratorium, for further identification processes. We were also measure the air temperature, soil pH and humidity, for seven consecutive day.

Identification for taxa aimed for species, but when there is any inconsistency, we only aimed for family. All descriptions after [6] except for authenticity we provided the photograph of each representatives taxa. Although we mainly focus on taxa composition, we also provide the information on their ecological role, related to the specific characteristic such as nostril type.

III. Result and Discussion

A. Number of Family per location as per trap

In general, in both locations, we have identified 10 orders, 24 families, with a total 847 individual (Table II).

TABLE II. Number of Taxa Family Within Each Location As Per Trap

Order	Family	I	II	I	II	I	II	I	II	I	II
		Sweep Net		***Pitfall Trap***		***Light Trap***		***Yellow Trap***		***Total Indivi-dual***	
Hemiptera	Pentatomidae	29	17	0	0	0	0	5	3	34	20
	Reduviidae	3	6	1	0	0	0	0	1	4	7
	Coreidae	1	1	0	0	0	0	2	2	3	3
	Tingidae	1	0	0	0	0	0	0	0	1	0
	Gerridae	0	0	0	0	4	13	0	0	4	13
	Cydnidae	0	0	0	0	5	1	0	0	5	1
Coleoptera	Chrysomelidae	28	17	1	0	1	0	9	4	39	21
	Coccinellidae	7	6	0	0	0	0	9	9	16	15
	Cicindellidae	0	1	12	4	7	3	0	2	19	10
	Carabidae	0	0	10	2	18	5	0	0	28	7
	Scolytidae	0	0	0	0	0	0	2	1	2	1
Hymenop-tera	Ichneumonidae	18	9	0	0	0	0	0	0	18	9
	Vespidae	8	4	0	0	0	0	0	0	8	4
	Formicidae	0	0	37	17	35	29	0	0	72	46
Homoptera	Membracidae	5	2	0	0	0	0	5	2	10	4
	Cicadellidae	9	6	0	0	0	0	6	6	15	12
Orthoptera	Acrididae	36	25	12	3	10	4	0	0	62	32
	Gryllotalpidae	0	0	3	0	0	0	0	0	3	0
	Gryllidae	0	0	56	22	32	23	0	0	78	45
Lepidoptera	Pyralidae	19	14	0	0	0	0	0	0	0	14
Dermaptera	Carcinophoridae	0	0	6	0	0	0	0	0	0	0
Collembola	Isotomidae	0	0	65	46	46	0	0	0	0	46
Isoptera	Termitidae	0	0	16	16	9	0	0	0	0	9
Blattaria	Blattidae	0	0	1	1	0	0	0	0	0	0
Total per trap		164	108	220	103	112	78	38	30	528	319

B. Visual

As for authentic proof, we take photograph for each taxa representatives. It is taken dorsal and ventral, or else only lateral part (Fig. 3).

a **b**

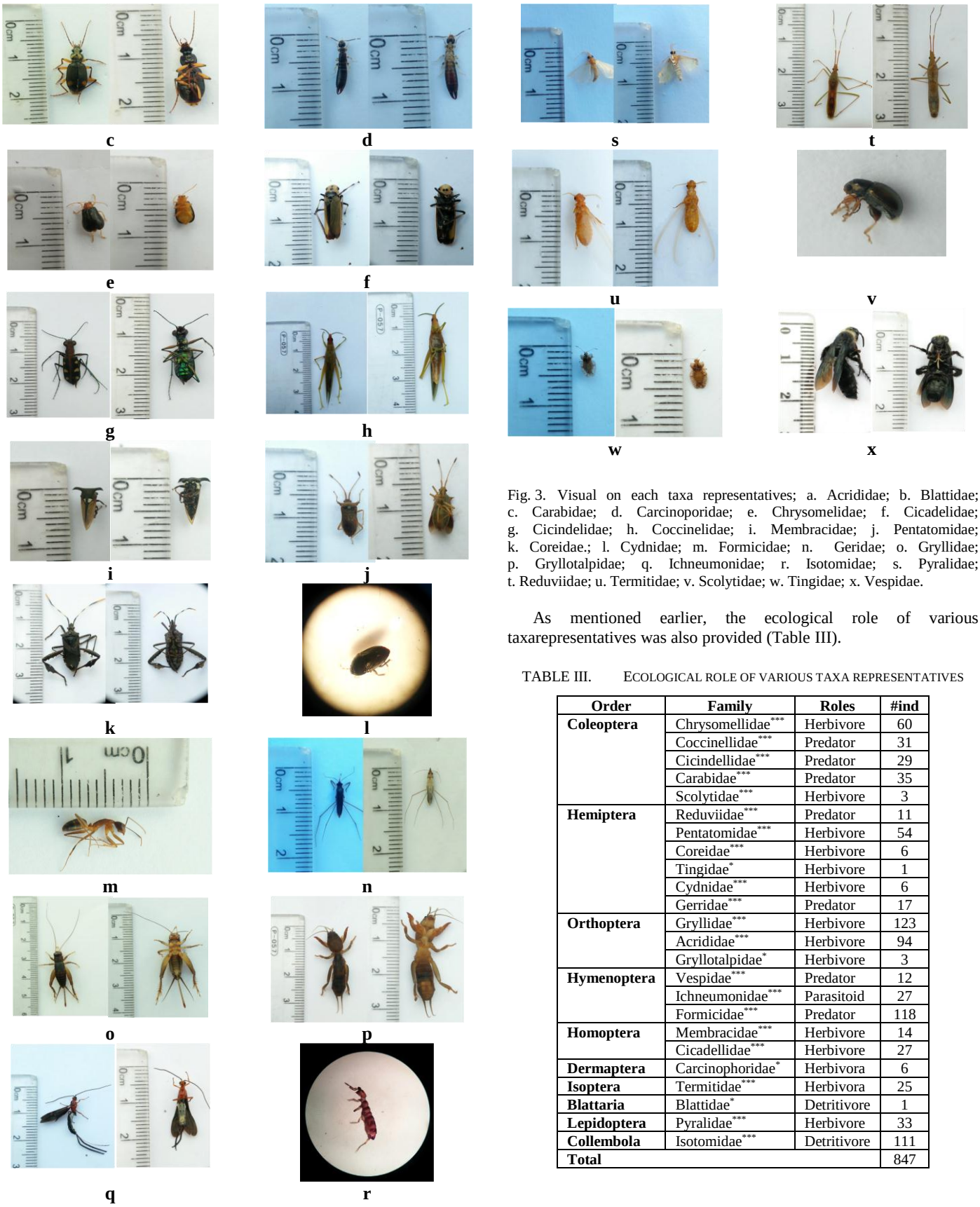

Fig. 3. Visual on each taxa representatives; a. Acrididae; b. Blattidae; c. Carabidae; d. Carcinoporidae; e. Chrysomelidae; f. Cicadelidae; g. Cicindelidae; h. Coccinelidae; i. Membracidae; j. Pentatomidae; k. Coreidae.; l. Cydnidae; m. Formicidae; n. Geridae; o. Gryllidae; p. Gryllotalpidae; q. Ichneumonidae; r. Isotomidae; s. Pyralidae; t. Reduviidae; u. Termitidae; v. Scolytidae; w. Tingidae; x. Vespidae.

As mentioned earlier, the ecological role of various taxarepresentatives was also provided (Table III).

TABLE III. ECOLOGICAL ROLE OF VARIOUS TAXA REPRESENTATIVES

Order	Family	Roles	#ind
Coleoptera	Chrysomellidae***	Herbivore	60
	Coccinellidae***	Predator	31
	Cicindellidae***	Predator	29
	Carabidae***	Predator	35
	Scolytidae***	Herbivore	3
Hemiptera	Reduviidae***	Predator	11
	Pentatomidae***	Herbivore	54
	Coreidae***	Herbivore	6
	Tingidae*	Herbivore	1
	Cydnidae***	Herbivore	6
	Gerridae***	Predator	17
Orthoptera	Gryllidae***	Herbivore	123
	Acrididae***	Herbivore	94
	Gryllotalpidae*	Herbivore	3
Hymenoptera	Vespidae***	Predator	12
	Ichneumonidae***	Parasitoid	27
	Formicidae***	Predator	118
Homoptera	Membracidae***	Herbivore	14
	Cicadellidae***	Herbivore	27
Dermaptera	Carcinophoridae*	Herbivora	6
Isoptera	Termitidae***	Herbivora	25
Blattaria	Blattidae*	Detritivore	1
Lepidoptera	Pyralidae***	Herbivore	33
Collembola	Isotomidae***	Detritivore	111
Total			847

IV. Conclusion

We have obtained 847 individuals, 24 families and 10 insects order, which are Hemiptera, Coleoptera, Hymenoptera, Orthoptera, Homoptera, Lepidoptera, Dermaptera, Collembola, Isoptera and Blattaria.

The comparisons between two sites, clearly showed difference among sites, both in total individual, as well as insect taxa (Table 2). The table has showed no encounter on Carcinophoridae, Tingidae, Blattidae and Gryllotalpidae, in location 2. This is due to different characteristics such as temperature, humidity, pH and type of vegetation of the two sites. Location I has a temperature ranging from 26-28°C, soil pH 5.6 and soil moisture of 65%, while in location II it is ranging from 27-29°C, soil pH of 4.4 and soil moisture 50% respectively.

The abundance of insect families with sweep net is Acrididae which is found in site 1 as well as site 2. Acrididae at site 1 reached 1.50 Ind / hour, while at site 2 Acrididae reached 1.04 Ind / hour. This is due to the several environmental factors, such as air temperature, pH and humidity. The diversity of Acrididae according to [7] is influenced by ecological factors namely temperature, rainfall patterns, humidity, soil types, predators and vegetation. Based on observations that the temperature at location 1 was lower than location 2, while humidity and pH were higher at location 1 than location 2.Acrididae is widely found at site 1, since the pH is 4.4 and lack of food sources. In contrast, pH at site 1 is equal to 5.6, less acidic. There is also various of crops in both location. According to [8] soil pH will affect the proliferation of Acrididae so that Acrididae is unable to adapt, in addition to pH there is also a food source, where according to [9] food is a source of nutrition needed by insects to live and thrive, if food available with suitable quality and sufficient quantity, the insect population will rapidly increase.

Insects that are found in pitfall traps were 12 families, while the most frequent taxa isIsotomidae (Collembola). Its family member was found dense in location 1 (0.49 ind/hour) compared with location 2 (0.35 Ind/hr). This is due to this taxa survive in various habitats and conditions. In addition, Isotomidae is also tolerant of environmental conditions affected by pollution from both agriculture and industry [10]. With regards to environmental factors, it is suggested that soil humidity play an important role for Isotomidae. Furthermore, they live on the soil surface and acquired their feeding from litter. The more litter produced, the higher the foraging activity by Isotomidae.

The same pattern was also found in yellow trap. This technique yielded 6 taxa families, with the most frequent member of Coccinellidae and Chrysomelidae, both with 0.19 Ind / hr. Coccinellidae can reproduce well at a temperature of 25-31°C. This is suggesting perfect match with the observation result, whereas both sites, the temperatures ranging from 26-29°C. This is due to the presence of member of Isotomidae. Nevertheless, Chrysomelidae was also found at both locations, density index is 0.19 Ind/hr. It is revealed that standing crops, play an important as source of food for Chrysomelidae.

Nocturnal taxa family, yielded from light trap, account for 8 families, where the most frequent taxa is formicidae. The density index site 1 (0.45 Ind/hr) is higher that site 2 (0.19 Ind/hr). As mentioned above, the temperature observed was ranging from 26-29°C, which allows Formicidae to live in these ecosystems. According to [11] the optimal temperature range for Formicidae is 25-35°C. Temperature affects the activity of insects because temperature will determine the level of decomposition of soil organic matter. Soil pH also affected the abundance of Formicidae.

The difference on abundance on taxa among trap equipment is mainly due several factors such as external factors and internal factors. In one hand, internal factors, for instance form of breeding ability, self-defense, life cycle, and sex ratio. While in the other hand, external factors such as temperature, humidity, food and predatory.

Table III provides the role of various taxa representatives. Herbivore is the most ecological role-played by all identified taxa. Moreover, it is also gives information on predator, detrivore as well as parasitoid. Gryllidae is the most common herbivore, while Formicidae as predator, Isotomidae as detrivore and Ichneumonidae as parasitoid, respectively. Aside from being predators, Formicidae is suggest as bioindicators. Many predators and parasitoids on peatlands in agricultural areas need control so that other insect families such as Isotomidae can survive, because Isotomidae is important for remodeling soil organic matter.

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References

[1] S.L. Nijayati, Muslihat and I.N.N. Suryadiputra, “Panduan Pengelolaan Lahan Gambut untuk Pertanian Berkelanjutan. Project Climate Change, Forests and Peatland In Indonesia, Wetland International-Indonesia Programme and Wildlife Habitat Canada,” Bogor, 2005.

[2] A. Rizali and D. Buchori, “Lahan Gambut dan Keanekaragaman Hayati: IPN Toolbox Tema C Subtema C1,” [Online]. Available: www.cifor.org/ipn-toolbox. [Accessed: 20-Jul-2018].

[3] Arief, Hutan dan Kehutanan, Jakarta: Kanisius, 2001.

[4] A. Panda, and Y.E. Gunawan, “Komposisi takson tingkat suku serangga yang terperangkap dalam kantung *Nepenthes* spp. di Taman Nasional Sebangau,” J. Biotrop, vol. 5, pp. 6-43, 2017.

[5] S. Kahono, L. Pungki, Erniwati, and N. Hari, “Potensi Pemanfaatan Serangga Penyerbuk untuk Meningkatkan Produksi Kelapa Sawit di Perkebunan Kelapa Sawit desa Api-api, kecamatan Waru, Kabupaten Panajam Paser Utara, Kalimantan Timur,” J. Bid. Zool., vol. 21, pp. 23-34, 2012.

[6] D.J. Borror, F.J. Norman, A.P. Charles, “Pengenalan Pelajaran Serangga,” Yogyakarta : Gadjah Mada University Press, 1996.

[7] A.K. Ghosh, Q.H. baqri, and I. Prakash, Faunal Diversity in the Thar Desert: Gaps in Research, Jodhpur: Scientific Publisher, 1996.

[8] I. Falahudin, E.M. Delima, A.P.R Indah, “Diversitas Serangga Ordo Orthoptera pada Lahan Gambut di kecamatan Lalan Kabupaten Musi Banyuasin,” J. Bioilm., vol. 1, no. 1, pp. 1-7, August 2015.

[9] Jumar, Entomologi Serangga, Jakarta : PT. Rineka Cipta, 2000.

[10] B. Gudleifsson, and B. Bjarnadottir, "Springtail (Collembola) populations in hayfields and pastures in Northern Iceland," J. Icel. Agric. Sci., vol. 21, pp. 49–59, 2008.

[11] S. Mugerwa, M. Nyangito, D. Mpairwe, and J. Nderitu, "Effect of biotic and abiotic factors on composition and foraging intensity of subterranean termites," J. Environ. Sci. Technol., vol. 5, pp. 579-588, 2011.

[12] Riyanto, "Kepadatan, Pola Distribusi dan Peranan Semut pada Tanaman di Sekitar Lingkungan Tempat Tinggal," J. Penelit. Sains. vol. 10, pp. 241-253, 2007.