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BIO DIVERSITY OF INSECTS AND THEIR DISTRIBUTION PATTERN IN MIYAWAKI PLANTATION OF COIMBATORE, TAMIL NADU

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ABSTRACT
In the present investigation is an attempt to assess the relative abundance of insects indifferent planting system of forest of study site in Anna University, Coimbatore zone during 2017-19. The main objective of the study was to identify the composition of insect's fauna at genus level in Miyawaki plantation and also to study the diversity and distribution of insects. Miyawaki method is the random and dense plantation of native species. Studies regarding diversity of insects available on miyawaki forest are very few. Totally182 species of insects which it belongs to 21 insect families in Miyawaki plantation were observed. Among all insect families Alydidae having more number of distribution percentage (20.88) followed by Membracidae (18.68), Nymphalidae (14.84) and Monophelbidae (7.69).In normal forest planting 109 insect species which it belongs 13 insect families was observed. Comparison of both system of forests different diversity indices *viz.*,Simpson's diversity index (*SDI*), Shannon-WienerIndex (*H'*), Margalef Index (α) and Pielou's EvennessIndex (*E1*) was calculated. In all the indices shows that diversity of insects were high in miyawaki forest plantation than the normal forest.

KEY WORDS: Miyawaki, Insects, Distribution, Forest, Diversity indices.

INTRODUCTION

Miyawaki method of plantation is denoting dense plantation of trees and shrubs. It was named after the Japanese scientist Dr. Akira Miyawaki, this methodology has been extremely successful with over 17 million trees planted in 1700 locations. Such forests are multi-layered forests and mimic the densest parts of a native undisturbed forest. The simplest definition of the Miyawaki method is the random and dense plantation of native species. The native trees of the region are identified and divided into four layers- shrub, sub-tree, tree, and canopy (Miyawaki,1975). The quality of soil is analysed and biomass which would help enhance the perforation capacity, water retention capacity, and nutrients in it, is mixed with it.A mound is built with the soil and the seeds are planted at a very high density- three to five saplings per square meter. The ground is covered with a thick layer of mulch. This kind of plantation useful for lack some qualities of natural forests, such as medicinal properties and the ability to bring rain. Fast-growing plantations are actually wood lots (a parcel of a woodland or forest capable of small-scale production of forest products (such as wood fuel, sap for maple syrup, sawlogs, and pulpwood) as well as recreational uses like bird watching, bushwalking, and wildflower appreciation) and cannot be termed as forests (Padilla and Pugnaire, 2006). Since, its a new plantation system of planting and diversity of insect organisms in this miyawaki plantation study is needful.

METHODOLOGY

Collection of insects

The field survey was carried out in the Anna University, Coimbatore zone miyawaki plantation with interval of two weeks. The sweep net method was used for field survey to estimate the insect population.The sweep net employed for collecting was essentially similar to an ordinary insect net with 673 mm mouth dia and a 1076mm long aluminium handle. The frame can be fitted to one end of the handle. This facilitates easy separation of the frame. The long handle allows the net to be used as far as possible making the sweeping easier and effective. The net bag was made up of thin cotton cloth. It measures about 600 mm in length and has a well- rounded bottom. The top of the bag which fits around the frame was made up of a canvas. The canvas was folded over the frame and sewed in position.

Method of collection

Sweeping of vegetation was as random as possible from ground level to the height of the crop. Sweeping was done in early morning and late evening hours for about half an hour per day which involved 30 sweeps. One to and fro motion of the sweep net was considered as one sweep.

Identification of specimens

The insects thus collected from miyawaki plantations were preserved in70% ethyl alcohol, later dried, mounted on triangularcards and identified using taxonomic keys under a Stemi(Zeiss) 2000-C and photographed under Leica M205Astereo zoom microscopes. These identified specimenswere deposited in the Insect Biosystematics Laboratory,bTamil Nadu Agricultural University, Coimbatore.

Diversity indices

Thediversity indices *viz*., relative Density (%) = (No. ofindividuals of one species /no. of individuals of allspecies) x 100; and alpha diversity quantifed usingSimpson's diversity index (*SDI*), Shannon-WienerIndex (*H'*), Margalef Index (*α*) and Pielou's EvennessIndex (*E1*).

Statistical analysis

Simpson's diversity index D = Σ*n (n-1)/ N(N-1)*where *n* = total number of organisms of a particularspecies and *N* = total number of organisms of all species(Simpson 1949). Subtracting the value of Simpson'sdiversity index from 1, gives Simpson's Index ofDiversity (SID). The value of the index ranges from 0 to1, the greater the value the greater the sample diversity.Shannon-Wiener index Shannon-Wiener index *H'*= – Σ*Pi* ln(*Pi*), where *Pi* = *S / N*; *S* =number of individuals ofone species, *N* = total number of all individuals in thesample, *ln* = logarithm to base e (Shannon & Wiener1949). Margalef index α = *(S – 1) /ln (N); S* = totalnumber of species, *N* = total number of individuals inthe sample (Margalef 1958). Pielou's evenness index*E1=H'/ ln(S)*; *H'*= Shannon-Wiener diversity index, *S*= total number of species in the sample (Magurran, 1988). Beta diversity, the most widely usedbeing Jaccard Index (JI) (Jaccard, 1912)- JI (for twosites) = *j / (a+b-j)*, where *j* = the number of speciescommon to both sites A and B, *a* = the number of speciesin site A and *b* = the number of species in site B. It isassumed the data to be normally distributed and adoptedparametric statistics for comparing the normal and miyawaki plantation methods.All these statistical analyses were done in MS-Excel 2016 version.

RESULTS AND DISCUSSION

In the present study, there was huge number of different insect species were collected from miyawaki plantation forest comparing to the normal plantation. Totally we were collected around 182 species of insects which it belongs to 21 insect families *viz.*, Gryllidae, Chrysopidae, Alydidae, Eurybrachidae, Fulgoroidea, Membracidae, Reduviidae, Monophelbidae, Ricanidae, Chalcididae, Halictidae, Buprestidae, Rhipiphoridae, Chrysomelidae, Curculionidae, Tephritidae, Dolichopodidae, Calliphoridae, Nymphalidae, Pieridae and Psychididae(Fig 2). Among all insect families Alydidae having more number of distribution percentage (20.88) followed by Membracidae (18.68), Nymphalidae (14.84) and Monophelbidae (7.69). In least number of species were observed in Chrysomelidae, Rhipiphoridae and Chalcididae having 0.55 per cent distribution in miyawaki forest.

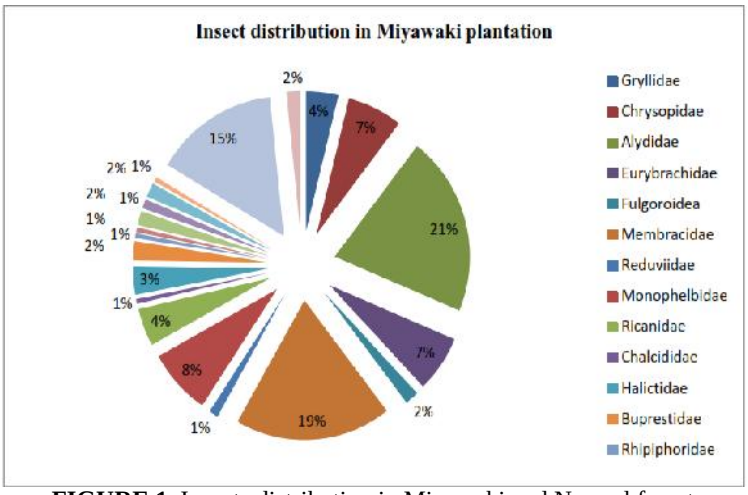


FIGURE 1. Insects distribution in Miyawaki and Normal forest

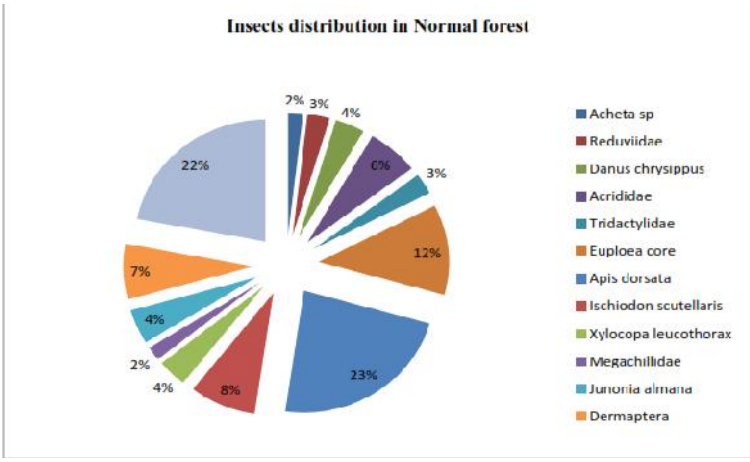


FIGURE 2. Insect diversity in miyawaki method of plantation

The structure of vegetation between the different plantations could be affecting the existing of insect diversity (Abdullah and Sina, 2009). This insects collected from miyawaki plantation were compared with normal forest insect diversity. In normal we were observed 109 insect species which it belongs 13 insect families(Fig 3).In this *Apis dorsata*populations were high which it is having 22.94% distributionfollowed by common red ant, *Oecopylla smaragdina* (22. 02%). Comparing to the miyawaki forest Grass hopper,*Acrididae* population were high in normal forest (6.42%).The dominance of Coleoptera and Leptoptera in our study areas is indicated by the exceptionally higher abundance (Sawada and Hirowatari, 2002 and Sorensson, 2003)Table 1 and 2 reveals that insect diversity and distributions was high in miyawaki plantation forest comparing to the normal forest. The species compositionamong different plantations can indicate how communitystructure changes with biotic and abiotic environmentalpressures (Shmida and Wilson 1985; Condit *et al*., 2002).Studies on the effect of species diversityof taxa such as spiders (Sebastian *et al*., 2005), moths(Axmacher and Fiedler, 2008) and ants (Smith *et al.*, 2014) reported that species diversity decreased with increase the dense of the plantation.

TABLE 1. Insect diversity in miyawaki method of plantation

S.No	Family	No.of species	Percent distribution
1	Gryllidae	7	3.85
2	Chrysopidae	12	6.59
3	Alydidae	38	20.88
4	Eurybrachidae	12	6.59
5	Fulgoroidea	3	1.65
6	Membracidae	34	18.68
7	Reduviidae	2	1.10
8	Monophelbidae	14	7.69
9	Ricanidae	8	4.40
10	Chalcididae	1	0.55
11	Halictidae	6	3.30
12	Buprestidae	4	2.20
13	Rhipiphoridae	1	0.55
14	Chrysomelidae	1	0.55
15	Curculionidae	3	1.65
16	Tephritidae	2	1.10
17	Dolichopodidae	3	1.65
18	Calliphoridae	1	0.55
19	Nymphalidae	27	14.84
20	Pieridae	3	1.65
21	Psychididae	1	0.55

TABLE 2. Insect diversity in normal method of plantation

S.No	Family	No.of species	Percent distribution
1	*Acheta* sp	2	1.83
2	Reduviidae	3	2.75
3	*Danus chrysippus*	4	3.67
4	Acrididae	7	6.42
5	Tridactylidae	3	2.75
6	*Euploea core*	13	11.93
7	*Apis dorsata*	25	22.94
8	*Ischiodon scutellaris*	9	8.26
9	*Xylocopa leucothorax*	4	3.67
10	Megachillidae	2	1.83
11	*Junonia almana*	5	4.59
12	Dermaptera	8	7.34
13	*Oecopylla smaragdina*	24	22.02

TABLE 3. Insect Diversity indices in miyawaki method of plantation

1	Simpson index	0.1306
2	Shanon index	2.2625
3	Menhinick index	1.848
4	Berger parker dominance index	0.2077
5	Margalef richness index	4.607
6	Pielou eveness index	0.4525

TABLE 4. Insect Diversity indices in normal method of plantation

1	Simpson index	0.1011
2	Shanon index	2.227
3	Menhinick index	1.245
4	Berger parker dominance index	0.2294
5	Margalef richness index	2.558
6	Pielou eveness index	0.6177

Macrosiagon bipunctuata

Tephritidae

Catopsilia pomona pomona

Buprestidae

Miochira sp

Reduviidae

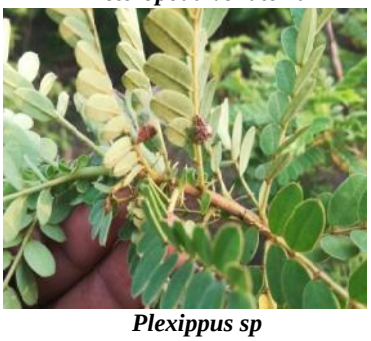
FIGURE 2. Insect diversity in miyawaki method of plantation

Gasteracantha geminata

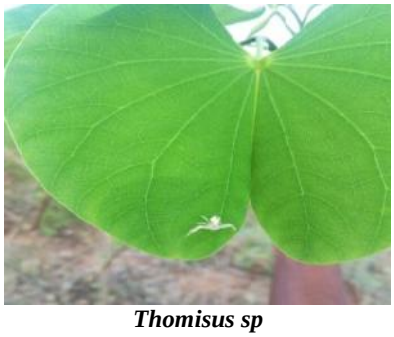
Heteropoda venatoria

Oxyopes lineatipes

Plexippus paykulli



Plexippus sp



Thomisus sp

FIGURE 3. Spider species in miyawaki method of plantation

Normally diversity indices provide important information about rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure. Diversity indices were analysed for both miyawaki and normal forest of insects species (Table 3 and 4). Simpson's index of diversity is highestfor miyawaki (0.1306) and in normal (0.1011).

A similar trend was observed in Shannon-Wiener index also with 2.2625 in miyawaki plantation and 2.227 in normal plantation. Menhinick index, Berger parker dominance index and Margalef richness index were calculated for the miyawaki plantations 1.848, 0.2077 and 4.607 which it is higher than normal forest insect diversity. On comparing the species similarities using the pielou eveness index in between two planting system shows that miyawaki having more diversity and distribution of insects (4.607) than normal forest (0.6177).

CONCLUSION

A survey was conducted to relative abundance of insects in different planting system of forest of study site in Anna University, Coimbatore zone shows that there were significant difference in the relative abundance of insects between taxa and micro invertebrate ofthe miyawaki and normal forest. Miyawaki plantation are having more diversity of insect species and also having good distribution of insects. Which its clearly shows that the dense of the forest will increases at the same time diversity of the insects also will increase.

REFERENCES

Abdullah, F. Sina, I. (2009) Rove Beetles (Coleoptera: Staphylinidae) ofLanjak Entimau, Sarawak, East Malaysia. Int. J. Zool. Res. 5(3):126-135

Jaccard, P. (1912) The distribution of the fora in the alpine zone. NewPhytologist 11: 37-50.

Magurran, E.A. (1988) Ecological Diversity and its Measurement. CroomHelm, Australia. 215 pp

Margalef, R. (1958) Temporal succession and spatial heterogeneity inphytoplankton, Perspectives in Marine Biology. University ofCalifornia Press, Berkeley. pp. 323-347.

Miyawaki, A. (1975) Entwicklung der Umweltschtz-Pflanzungen undAnsaaten in Japan. In: Tu¨xen R (ed) Sukuzessionsforschung Berichte U ber Internationales Symposium der Internationalen Vereinigung fu¨r Vegetationskunde. J. Cramer, Vaduz, pp 237–254

Padilla, F.M., Pugnaire, F.I. (2006) The role of nurse plants in the restoration of degraded environments. *Front Ecol Environ*, 4(4):196–202.

Sawada, Y., Hirowatari, T. (2002) A revision of the genus Acrotrichis Motschulsky(Coleoptera: Ptiliidae) in Japan. *Entomological Science* 5:77-101

Shannon, C.E., Wiener, W. (1949) The mathematical theory ofcommunication. Urbana, University of Illinois Press. 177 pp

Simpson, E.H. (1949) Measurement of species diversity. Nature 163: 688

Sörensson, M. (2003) New records of feather wing beetles (Coleoptera: Ptiliidae) inNorth America. Coleopterists Bulletin 57:369e381