INSECT POLLINATORS/VISITORS OF THREE SELECTED TREES SPECIES AT NGEL NYAKI MOTANE FOREST ,MAMBILA PLATEAU, TARABA STATE NIGERIA

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Abstract

The study on insects' pollinators of three selected trees: *Eugenia*, *Deinbollia* and *Anthonotha* were conducted between the months of November2007 to January 2008 to document visitors and the role and contribution of insects to a stable ecosystem. Of all the visitors recorded Bees were the highest (61%) followed by Butterflies (14.5%). *Eugenia* sp was found to be visited/pollinated mainly by Bees (*Apis mellifera* L) (94.6%) in contrast to *Deinbollia* sp with (42.5%). *Anthonotha* sp which had seven insect pollinators had butterflies recording the highest visitors (43%). The high visitation of bees pollinators to Eugenia plant may pose treat to the existence of the tree in the forest, since the forest Ngel Nyaki was faced with danger of crude harvesting of honey. This will consequently lead to a decline in bird's population of the area as the tree is a major food source to birds in the forest.

Key words**: Pollinators, Ecosystem, specialization, extinction**.

Introduction

The diversity of tropical forest ecosystem is known to be high, however, tropical forest are being deforested at an alarming rate. Deforestation has been described as the earth's most significant environmental and economic problem (FAO, 2001) As human populations continues to grow land use intensity increases and the negative effects of deforestation are likely to worsen (Chazdan,2003).

Ngel Nyaki forest reserve is one of the most species diverse forests on Mambila Plateau (Chapman and Chapman, 2001). The field station attracts scholars on conservation issues from many parts of the world hence an important research centre because of its many animals species and a large diversity of over 146 Vascular plants species that comprises trees that are near endemic to t

gion (White,1983). Four tree species in the forest are red data listed and several others, such as

Anthonotha nolddii are new to West Africa and others new to Nigeria (Chapman and Chapman, 2001). With the significance of the forest there is the need to document all aspects that are critical to the existence of the forests ecosystem.

Pollination activity is known to be one of such activity that is mostly neglected when it has to do with stability of an ecosystem. This could be due to its complex nature. Technology so far, have not yet explored this aspect to a point of finding its subtitue, thereby confirming the potential risk associated with pollination should there is problem in any of the pollinator agents.

Pollination interactions that truly are mutualistic are beneficial to plants and animals. The mutualism also directly benefits humanity through crop productivity and indirectly through ecosystem health. Hence pollination is an important ecosystem service (Costanza *et al*, 1997) and cannot be replaced to any appreciable degree by technology. Many authors put it that, there is or soon could be a pollination crisis in natural ecosystems hence the need for conservation of pollinators (Steffan-Dewenter *et al.*, 2005).The evidence that some pollinators population {most clearly of exotic honey bees Ghazoul (2005a)} have experienced dramatic declines in recent decades is a signal.

According to (Ghazoul,2005) little is known about the pollinators of rare plants and that, one of the best books on British rare plants fail to address this issue. Plants of the temperate regions tend to have a generalised pollinator fauna (Memmott, 1999). These pollinators tend to be generalists themselves, feeding on and or pollinating a range of different plant species. It follows that rare plant population will probably be linked to other plant species in a community via shared pollinators (Waser,and Prince, 1983).

Much is known about species diversity within West African Montane forest but, very little is known about the plant- animal interaction with scarce literature on the investigation of mutualistic webs. Stork and Lyal, (1993) put it that such information will help us understand the evolution of mutualisms in a community context which is vital when working to restore damaged ecosystem.

It is based on this fact that this work tries to lay a foundation for any possible study of pollination network in Ngel Nyaki forest aim at documenting the Insects Pollinators /Visitors of trees species in the area, with the specific objective of finding

out the most common insects visitors of these area and the strong affiliation of insects with a particular tree species.

Materials and methods

The study was carried out at Ngel Nyaki a Montane forest on the Mambilla Plateau in a remote South- East corner of Taraba State. Ngel Nyaki is located between longitude 11 00^{11} and 11 30^{11} East and latitude 6 30^{11} and 7 15^{11} North, On the Plateau. The rainy season last for an average of 250 days, from March to October .The mean annual rainfall is 1,780mm and is highest in the months of June and July. The mean daily temperature does not exceed 30^{oc}

Ngel Nyaki forest is of International interest because of its rich bird species diversity and is also home to a rich flora. The Reserve comprises of approximately $46km^2$ of impressive submontane to mid – altitude forest lying between 1400--1500 in altitude.

Observations.

The insects'pollinators/visitors from the three selected trees (*Eugenia gilgii, Anthonotha noldeae* and *Deinbollia pinnata*) were recorded for four months. For each tree species three flowering individuals, from the Fragments and the Main forest was identified and mark for observation. Observation of pollinators in a particular tree was carried out twice a day between the hours of 7-11 am and 2-5 pm. One individual tree from each of the three different tree species was observed each day for a total of 160 minutes for each tree. The four observation periods of 40 minutes each alternating in 40 minutes period between trees were made. Within each 40 minutes period, 10 flowers were observed through either binocular or telescope for pollinator visitation. During each observation period records was made of: 1) each pollinator specie; 2) the number of flowers each specie visits, and 3) the time each visitor spends on each flower, was recorded on a data sheet according to the method of (Kelly *et al*, 2004)

All insects were identified to the generic and species level where possible. Insects that cannot be identified at the field were given a 'code name' for later identification at the insects Museum of Ahmadu Bello University Zaria. From this the relative frequency of the different pollinators was determined.

Results

The following insects orders were found to be the major pollinators of the three selected trees : Diptera , Coleoptera, Lepidoptera and Hymenoptera. Visitations were more in the morning hours in *Euginea* than afternoon hours while *Anthonotha* and *Deinbollia* recorded more visitors in the afternoon than the morning hours.

Out of all the nine insects species that visited all the three Trees species,(55.6%) were Bees followed by the Butterflies(13.2%,) and the list was common wasp (0.6%) as in table 1

The *Euginea* plant was visited by 317 insects from only three insect's species. Out of which bees were the most dominant visitors representing 94% followed by House flies 3.8% and the least was butterflies with only 1.6% appearance as in table 1

On the other hand the *Deinbollia* plant were visited by eight different species of insects totalling 287. Out of this number, the bees represented the highest percentage of 42.5% followed by the ants with 18% and the least was RBF with 0.7%

Anthonotha nollddii on the other hand was visited by seven different insect species totalling 239. Out of this number, the butterflies recorded a highest number of 43.1% followed by House flies with 20.5% and the least was common wasp with 2.0%

Insect visitors

Of all the nine insect visitors recorded bees were the highest with 469 species followed by the butterflies with 111 species and the least was common wasp with 5 species.

The bees recorded the highest occurrence in all the plants with 63% in *Eugenia* plant and the least in *Anthonotha* plant with 10% while the butterflies were the most common (92.7%) in visiting *Anthonotha* plant and the least in *Deinbolia* plant with 2.7% as in table 11

Of the total houseflies recorded 59.7% were associated with *Anthonotha* plant . While *Euginea* recorded the least visit of 14.6%.

Out of the total number of butterlies recorded (111) 92.7% were found visiting *Anthonotha* plant while 2.7% *Deinbollia*.

The ants' visitors were also more common on *Deinbolia* 74% and least observed in *Anthonotha* 25.7% there was generally a poor visitors of wasp as only five were cited. *Eugenia* and *Deinbollia* plants recorded the highest visitation of bees *Apis mellifera L.* Were as *Anthonotha* recorded more visitation of butterflies (*Choraxes abudensis).*

Table 1 Over all Insects' species Visitors to the Three selected Plants species.

Plt/pol	AT	%	BE	%	BF	%	BBF	%	CW	%	HF	%	GSB	%	RBF	%	YSB	%
Eugenia	-	0	300	63.9	5	4.5	-	0	-	0	12	14	-	0	-	0	-	0
Deinbollia	52	74	122	26	3	2.7	42	82	-	0	21	25	18	100	2	20	27	100
Anthonotha	18	25	47	10	103	92.7	9	17	5	100	49	59	-	0	8	80	-	0
Total	70		469		111		51		5		82		18		10		27	

Table 2: Overall Insects species Visitors to each Plants species .

pol/plt	Eugenia	%	Deinbollia	%	Anthonotha	%
AT	-	0	52	18	18	7.5
BE	300	94.6	122	*42.5*	*47*	*19.6*
BF	5	1.6	3	1.0	103	43
BBF	-	0	42	14.6	9	3.8
CW	-	0	-	0	5	2.0
HF	12	3.8	21	7.3	49	20.5

GSB	-	0	18	6.3	-
0					
RBF	-	0	2	0.7	8
3.3					
YSB	-	0	27	9.4	-
0					
Total	317		287		239

Table 3: Identified insect species that were coded.

code	order	family	species
AT	Hymenoptera	formicidae	*componotus sp nr perrisi*
BE	Hymenoptera	apidae	*apis mellifera L*
BF	Lepidoptera	nymphalidae	*choraxes abudensis*
BBF	Coleoptera	carabacidae	*plaenorrhina*
ubangianuspreis			
CW	Diptera	asilidae	*Lophopeltis sp*
HF	Diptera	calliphoridae	*chysomyia albiseps wied*
GSB	Lepidoptera	papillonoidae	*mylothris sulphoee*
RBF	Coleoptera	carabacidae	*sephanorrhinagulta oliver*
YSB	Coleoptera	scarabacidae	*charadronota-4-signata*

Key : ant , Anthonotha. den: Deinbollia . eug: Eugenia plants.

Discussion

The most active insect visitors in the forest and its fragments were the bees with over 55% dominance. This result has agree with the work of Appanah, (1990) and Momose *et al*,(1998) who reported that bees are the predominant group of flowering visiting insects likely good pollinators in both Old and New world tropical forest. This finding also agrees with the name of the forest " Ngel Nyaki" which means land of bees in fulfulde. The high predominance of bees in the forest could be due to the availability of flowering plants in the forest all year round because of the large diversity of plant species that flower at different time which

produce scent to attract them for nectar. Also there were patches of bee hives' keepers at the fragments, these may contribute to their abundance in the forest.

The butterflies were seen as the next abundant insects' visitor which agrees with the work of Martina, *et al*, 2006 who also record a high number of butterflies and moths in a forest study in Spain. The high presences of the butterflies could be due to the ever presences nature of flowers in the forest which also attract them for scent and nectar. Also, the undisturbed nature of the forest by wild fire could also be a contributing factor since the place is conducive for breeding.

This work also recorded a high occurrence of Ants which is in variance with the work of Martina, *et al*,(2006) who recorded five while this work recorded over 70 species . The high difference could not be explained. The high occurrence of ants to *Deinbllia* Plant 74% could be due to the fact that the plant does grow very tall and the flower has strong scent and sugary which could possibly attract the ants.

The wasp were the least recorded in this study five just like the work of Martina *et al*, (2006) who recorded nine reasons could not be explained.

Deinbollia and *Anthonotha* plants have an extended flowering period, this may serve as a long-term resources which allows the presence of a constant population of pollinators (Waser and Real 1979,Dobkin, 1984). The presence of extended flowering period attracts more pollinators when alternatives are scarce. This is particularly true as observed in this study as seen in the high number of insect's visitors in *Deinbollia* and *Anthonotha* plant.

There was high visitation in the morning hours in *Euginea* than in the afternoon, while the reverse in both *Anthonotha* and *Deinbolia* Plant reason can be that In addition to the scents produce by the flowers, The Eugenia plant has scent that last just few days and only more pronounced in the morning hours. In Deinbollia the scent last throughout the day, hence more pollinators at all the sessions as observed in this study. However, the *Anthonotha* plant lack sharp scent yet experience visitors more in the afternoon. Reason could not be explained.

The strong link of bees to *Euginea* plant 63% and ants to *Deinbollia* plant 74% while *Anthonotha* to butterflies 92.7% need further research to find out the reason for this strong affiliation this is very important because it

may explain the mystery of a " living dead plant"

Recommendation

There is the need to guide jealously our biodiversity in its totality since pollination activities is one which the world technology are yet to proper solution to it

The practice of bee hives keeping should be encouraged to the farmers at the area to help them earn their living and also see reasons for promoting conservation activities.

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Reference

Appanah, S (1990) Plant Pollinator interactions in the Malaysian rainforest 457-474 in Bawa KS and Hadley, M (eds) Reproductive ecology of tropical forest plant UNESCO the parthernan publishing group, paris

Costanza R, R.O Arge, R. De Groot, S. Farber, M. Grasso, B.Hannan, K.Limburvella, R.G.Raskin, P.Sutton, and M.vanden Belt (1997). Thevalue of the Worlds ecosystem service and natural capital. *Nature* **387**: 253-260. .Dobkin D.S (1984) Flowering patterns of long lived Heliconia inflorescence: Implication forvisiting and resident nectarivores *oecologia***64**:245-254.

Ghazoul, J.(2005a) Buzziness as usual ? questioning the global pollination crisis. *Trend in Ecology and Evolution***20**: 367-373.

Gibson R.H, Nelson I.L, Hopkin G .W,Hamlett B.J ,Memmott J.(2006) Pollination web plant communitiesand the conservation of rare plant arable weeds as case study. *Journal of Applied Ecology* **43**:246-257.

Kearns C.A, and Inouye D.S (1997) Pollinators, flowering plants and conservation biology: Much remains to be learned about pollinators and plants *Bioscience***47:**297-307

Martina Stang , Peter G.L. klinkchamar and Eddy Vander Meijdan (2006) Size constrains and flower abundance determine the number of interactions

in a plant –flower visitor web. OIKOS 112-121.

Memmott J. (1999).The structure of a plant-pollinator food web *Ecology letters***2**: 276-280.

Momose,K. ,Yumoto, T. ,Nagamitsu, T. ,Kato, M., Nagamasu, H. ,Sakai, S., Harrison, RD. ,Itioka, T. Hamid, A.A.,and Inoue, T.(1998). Pollination biology in a low land dipterocarp forest. *American journal of Botany***85**: 1477-1501.

Steffan-Dewenter, I.,Potts, S.G. andParker,L (2005) Pollinator diversity and crop pollination services are at risk. *Trend in ecology and evolution***20**: 651-652

Stork,E.N., and Lyal, C.H.(1993). Extinction or Co-extinction rates. *Nature***366**: 307-307.

Waser,N.M.and Real, L.A.(1979). Effective mutualism between sequentially flowering plants species . *Nature***281**:670-672.

Waser,N.M.and M.V. Price (1983). Optimal and actual out crossing in plants and the nature of plant-pollinator interaction. Pp341-359 in C.E. Jones and R.J. Little (eds) Hand book of experimental biology. Van Nostrand Reinhold, NewYork.

Wilson, E.O (1992). The diversity of life. Belknap press of Harward University press Cambridge MA.