



Research Article

SOME ENTOMOFAUNA HERBIVORES SPECIES RELATED WITH FIG TREES IN BAMBILI (NORTH-WEST REGION-CAMEROON)

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ABSTRACT

This work was undertaken from March to June 2019 in the Bambili locality to assess the diverse insect species visiting ficus plants. Direct observations on the tree were done three times per week for daily periods: 7-10am, 11am-2pm, 3-5pm. *Ficus arboretum*, *Ficus carica*, *Ficus infectoria*, *Ficus maxima*, *Ficus sur* and *Ficus virens* were identified. Seven arthropod species belonging to five Orders were recorded. Out of these, two species (ants, wasps) belonged to Hymenoptera (74.89%), two others species (Moth, butterfly) belong to Lepidoptera (4.53%); 21.27%, Mecoptera (3.05%) and Coleoptera (0.62%) are represented each by aphids, beetles and scorpion flies respectively.

Keywords: Bambili, Diversity, *Ficus* spp, Insect species.

INTRODUCTION

The plant genus *Ficus* (Linnaeus, 1758) is one of 40 genera in the family Moraceae, and it is distributed mainly in tropical and subtropical regions of the world and is used extensively as medicinal plants by indigenous people (Rhaman and Khanom, 2013). The genus includes a large number of species (600 -2000) (Crisosto *et al.*, 2011) with 105 species in Africa (Berg & Corner, 2005). They vary widely in their growth form that can range from tall trees above ten meters in height to shrubby plant less than a few meters that can be found in a variety of habitats such as tropical forest to desert (Berg and Wiebes, 1992). The specific identification of many of the species can be difficult, but figs as a group are relatively easy to recognize (Berg & Corner, 2005). Many have aerial roots and a distinctive shape or habit, and their fruits distinguish them from other plants (Compton *et al.*, 2010). As state by the Editors of Encyclopedia Britannica, most *Ficus* species are evergreen; the leaves are usually simple and waxy, and

most exude white or yellow latex when broken. The unusual fruit structure, known as a syconium, is hollow, enclosing an inflorescence with tiny male and female flowers lining the inside. Depending on the species, each fruit can contain up to several hundred to several thousand seeds. (Van Noort & Van Harten, 2006). We have information of *Ficus* species as cultural, social and symbolic plants (Gautier, 1996) in Cameroon. Much information exists in other countries for the species of figs as medicinal plant (Kirtikar & Basu, 1999; Shukia *et al.*, 2000; Khare, 2004; Gregory *et al.*, 2009; Abotsi *et al.*, 2010; Shamkant *et al.*, 2014; Zaid *et al.*, 2021). Some works have documented the entomofauna associated with *Ficus* in Malta (Sammuto, 2000; Mifsud, 2008; Mifsud & Knížek, 2009; Lo verde & Porcelli, 2010; Mifsud *et al.*, 2012); In Italy (Longo *et al.*, 1998; Lo verde *et al.*, 2007), in Ukraine (Sosnovsky, 2013). In Cameroon information on *Ficus* insect diversity is still lacking and no previous researches have been done on the relationship between the plant and its anthophilous insects. This study was therefore

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carried out to assess the diverse insect species visiting fig plants in Bambili area. The information from this research will enable ecologist to develop strategic management plans for the preservation of the species in the Bambili environment.

MATERIALS AND METHODS

This study was conducted from 31st of March, 2019 to 20th of June, 2019 in Bambili. The locality is found in Tubah sub-Division, Mezam division, North West Region of Cameroon. It is situated in the Afromontane forest belt, which currently lies 1800 to 2800 m above sea level. It is located in latitude 05° 56' 11.9 N and longitude 10° 14' 31.6 E. Bambili lies under the influence of the African monsoon system and characterized by two seasons: a rainy season (mid-March to mid-November) and a dry season (mid-November to mid-March) (Neba & Eze, 2004). The annual average precipitation ranges from 1770 mm to 2824 mm with a maximum in July through September; the mean annual temperature is 20°C and at the altitude, mean monthly temperature does not exceed 18°C while the mean annual relative humidity is above 85% (Abdoul Aziz *et al.*, 2008). Mists are frequent during the rainy seasons, and frost is very rare (Suchel, 1988).

The plant material used in the study consisted of six different species of fig trees present in the study site: *Ficus arboretum*, *Ficus carica*, *Ficus infectoria*, *Ficus maxima*, *Ficus sur*, and *Ficus virens*. The identification of these Ficus trees was done with the help of Prof. Njouonkou Andre, a botanist in the Faculty of Science at The University of Bamenda and the Cameroon National Herbarium. The animal material here is represented by insect species which are naturally present in around the experimental site.

Methodology

The present work was undertaken from March, 2019 to June 2019 in the Bambili locality. Numerous visits were made to identified Ficus trees present in the study area. After which the selected fig trees were observed three times a week between the periods; 7-10am, 11am-2pm, and 3-5pm. Only arthropods that are associated with Ficus were included in the study. These included all species which directly feed on Ficus (at least in their larval stages) and as a consequence of this spend most of their life cycle on the mentioned hosts. Visual inspection of the entire tree, including syconia, leaves, branches and trunk was done. Collection of insects was done using an aspirator and insect net. In a slow walk along all trees, the identity of all insects that visited each species of fig tree was recorded. For each insect species, at most two specimens were captured. Sampled insects were stored in 70% ethanol for subsequent taxonomy determination except for Lepidoptera which were conserved in wrapper following Borror & White (1991) recommendations. All insects encountered on the entire tree were registered and the cumulated results expressed in number of visits to determine their relative frequency in the entomofauna of fig trees. Another device

that was used in collecting small insects was a pooter. A digital camera was also used to snap some irregular structures caused by insects on ficus trees. Data was analyzed using descriptive statistics using Microsoft Excel 2016 and results were presented in tables and pictures.

RESULTS AND DISCUSSION

Six species of ficus are found in the study area. They are *F. arboretum*, *F. carica*, *F. infectoria*, *F. maxima*, *F. sur* and *F. virens*. These ficus species attract a wide variety of insect species. Among which, *F. carica*, *F. sur*, *F. virens* are associated with five insect species while *F. arboretum*, *F. infectoria* and *F. maxima* attract six insect species. *F. carica* attracts more individual's visitors (18.98 %) followed by *F. virens* (17.12 %), *F. infectoria* (16.79 %), *F. arboretum* (16.74 %) and *F. sur* (15.45 %). *F. maxima* attract fewer individuals (14.93 %). This result is in accordance with many others studies on the diversity of ficus species and their related arthropods. We have for example the works of Misfud *et al.* (2012) in the Maltese islands, Basset & Novotny (1999) in Papua New Guinea, Van Noort & Rasplus (2010) in the United Arab Emirates, Rasplus *et al.* (2003) in the Mont Nimba. Insects were mostly found on the syconia, leaves and trunk of fig trees. Of the six (6) species of fig trees found in the study area, about 90% of the insects were found on the leaves and syconia and only 20% were found on the trunk.

The herbivores species associated with the Ficus species identified in Bambili area are diverse. Seven (7) species of insect belonging to five Orders visiting the ficus trees were recorded during the studied period. Out of these, two species (ants and wasps) belonged to Hymenoptera (74.89%) and two others species (Moth and butterfly) belong to Lepidoptera (4.53%); Coleoptera (0.62%), Hemiptera (21.27%) and Mecoptera (3.05%) had one species each represented by beetles, aphids and scorpion flies respectively. Basset & Novotny (1999) found 779 species of insect herbivores on 15 species of ficus in rainforest and coastal habitats in the Madang area, in Papua New Guinea. Rasplus *et al.* (2003) found 113 insect species on 31 species of ficus on the Mont Nimba in Guinea with the Order Hymenoptera being the most represented. Misfud *et al.* (2012) found 39 arthropod species on different ficus trees in the Maltese Islands. The phytophagous insect community includes Orthoptera, Coleoptera, Lepidoptera Thysanoptera and Auchenorrhyncha. Sosnovsky (2013) in Ukraine recorded 22 insect species represented by Hemiptera, Thysanoptera and Arachnida. It has been established that the abundance and diversity of insect fauna of a plant species vary over time (Elfawalet *et al.*, 1976; Tchuenguem, 2005) and depend on the Regions (Tchuenguem, 2005, Michener; 2007; Gallai *et al.*, 2009). Among the insects Order recorded, the hymenopterans were the most frequent. This result is in accordance with the work of some previously cited authors (Basset & Novotny 1999, Rasplus *et al.*, 2003; Misfud *et al.*, 2012). The insects of this Order found on fig trees in Bambili area are the ants and the wasps. It was observed that the insects which belong to Orders Hemiptera, Hymenoptera and

Lepidoptera were seen on all the species of ficus trees as indicated in table 1. Insects of Order Coleoptera were found

on *F. arboretum* and *F. maxima* while insects of Order Mecoptera were found only on *F. infectoria*.

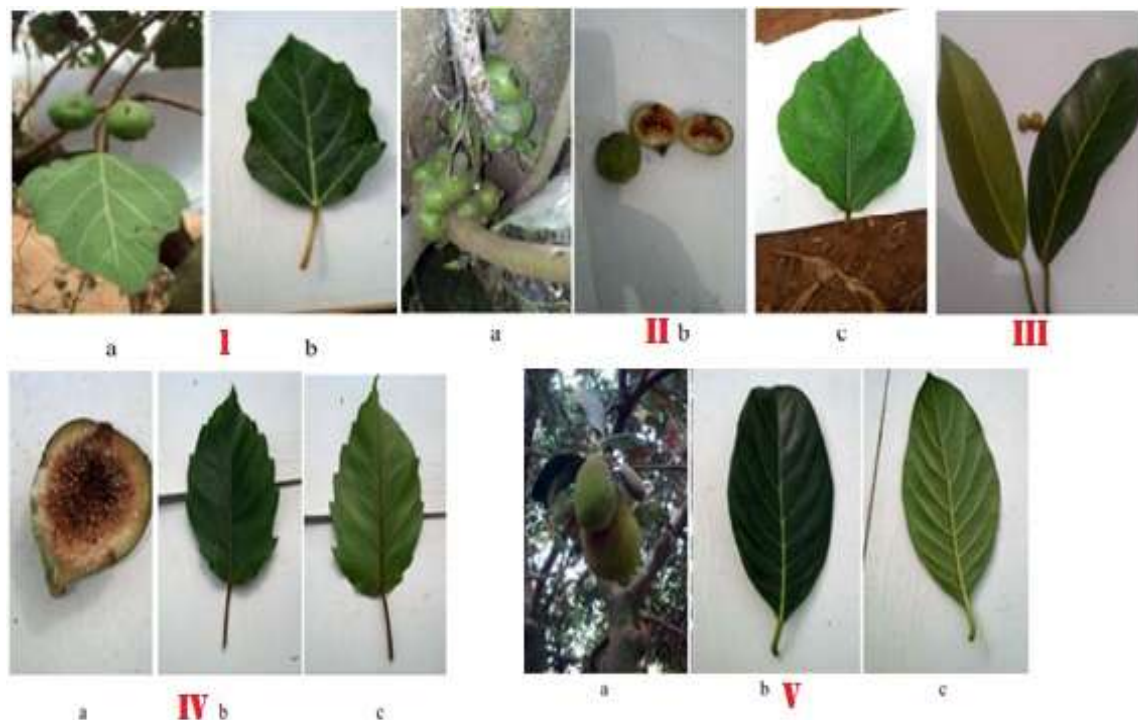


Figure 1. Some Fig parts visited by insects in Bambili. I: Syconia (a) and leaves (b) of *Ficus arboretum*; II Syconia (a, b) and leaf (c) of *Ficus carica*; III : Leaves and syconia of *Ficus virens*; IV: Cross section of a syconium (a) and leaves (b, c) of *Ficus sur*; V: Syconia (a) and leaves (b, c) of *Ficus maxima*.

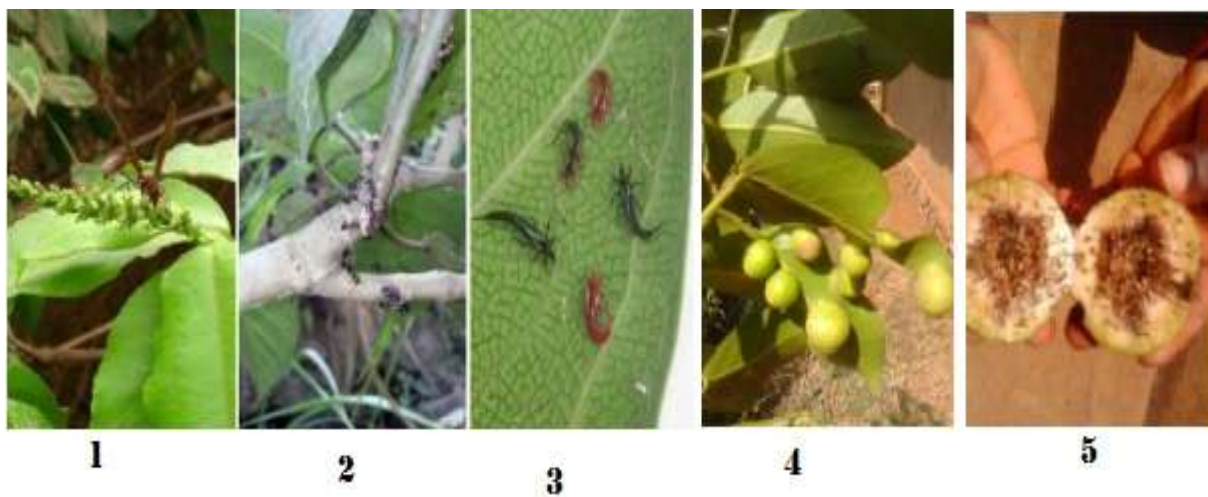


Figure 2. Some insects associated with figs (collected at Bambili). (1): wasp; (2) ants; (3): scorpion flies; (4): Galls on *Ficus virens* leaves caused by tiny wasps; (5): cross section of *Ficus arboretum* with many tiny wasps.

The ants were found in great number at all times on the plant during the experiment. They moved up and down linearly to all parts of the fig tree for feeding (Bronstein, 2001). Probably what attract them to these figs are the secretions produced by the fig plant. These substances are identified as a waste product of the fig tree. The ants are

attracted to this substance because they contained sugary secretions (Klein *et al.*, 2007). The wasps recorded were present in all the six ficus species. These wasps utilize the ficus trees as their main source of food, at least during their larval development (Misfud *et al.*, 2012). Some wasps were observed to be landing on the leaves and stems of figs and

particularly around the petiole of leaves were they feed on the sugary secretions produced by the fig plant (Klein *et al.*, 2007). This is not somehow strange as the ants belonging to the same order as the wasps exhibited this characteristic. Besides feeding, wasps also visited the fig tree for pollinating sake and for the sake of their reproduction (Bronstein, 2001). Another order of insect that is associated with ficus in Bambili is the Order Lepidoptera. On several occasions, moths and butterfly could be seen hovering and landing on the leaves of fig trees. The leaves of figs provide a suitable environment on which these insects lay their eggs (Bain *et al.*, 2012). The lepidopteran larvae use Ficus as their host plant because they spend most of their immature stage development on and utilize ficus trees as their main source of food. When the syconium of *F. maxima* and *F. arboretum* are opened, beetles (Coleoptera) are found in

them. These insects enter through the ostiole of the fruit which enables them to feed on the juicy secretions of the fruit. The insects of the Order Mecoptera that was found associated with fig trees in Bambili were the scorpion flies. These insects were linked with *F. infectoria*. These insects lay their eggs on the leaves of this plant such that when they hatch, the insect larva continue to hebetate the leaves until when they are mature and can fly (Kerdelhue & Rasplus, 1996a; Cook & Segar, 2010). The main insects of Order Hemiptera associated with figs in Bambili are the aphids. They are phytophagous insects which mostly visit the fig stems and leaves and use their proboscis to suck out a sugar containing substance from the phloem vessels of the fig plant which is in line with Basset & Vojtech (1999). They were seen gathering in clusters on stems and the undersides of leaves when they are feeding.

Table 1. Numbers and percentages of visits of different insects on Ficus species from March to June 2019 at Bambili.

Ficus species	Insects							Total	%
	Hymenoptera		Lepidoptera		Coleoptera	Hemiptera	Mecoptera		
	ants	wasps	butterflies	moths	beetles	aphids	Scorpion-flies		
<i>F. arboretum</i>	123	113	8	4	5	71		324	15.45
<i>F. carica</i>	210	88	15	5		80		398	18.98
<i>F. infectoria</i>	120	93	9	6		60	64	352	16.79
<i>F. maxima</i>	125	80	10	5	8	85		313	14.93
<i>F. sur</i>	172	85	12	4		78		351	16.74
<i>F. virens</i>	160	110	11	6		72		359	17.12
Total (n)	910	569	65	30	13	446	64	2097	100
P (%)	43.40	27.13	3.10	1.43	0.62	21.27	3.05		

Keys: n: number of visits in 4 months; P: percentage of visits; $p = (n / 2097) \times 100$.

The different insect species found on ficus trees were grouped according to their different ecological regimes with respect to their host-plants, Ficus spp (Figure 2). It was noticed that the ants (43.40%) and the wasps (27.13%) were the most numerous insects found on the ficus species. They were present on the trunk, the leaves, and the syconia of all the six species of figs that were studied. The moths and the butterflies were found on the leaves of the fig trees and the aphids were found on the trunks. The beetle associated only with *F. arboretum* and *F. maxima* were seen on the syconia. The scorpions like flies were observed on the leaves of *F. infectoria*. Our finding is in accordance with Misfud *et al.* (2012). On the other hand, tiny wasps were responsible for causing swellings known as galls on *F. virens*. Galls are special products of co-evolution between insects and host plants with unique ecological significance. These galls harbor the insect larvae until they are mature after which an opening will form on the gall enabling the insects to escape (Wawrzynski *et al.*, 2005). The ants and the wasps were found to all the ficus trees in Bambili while the scorpion flies were only associated with *Ficus infectoria*. Within the fruit of *Ficus arboretum* are so many tiny wasps emerging from it which will subsequently

migrate through the ostiole when the fruit is fully mature (5).

CONCLUSION

Six different species of fig trees were found in Bambili. They are *F. arboretum*, *F. carica*, *F. infectoria*, *F. maxima*, *F. sur* and *F. virens*. These species attract a wide variety of insect community. A total of 7 arthropod species belonging to five Orders (Hymenoptera (74.89%) Lepidoptera (4.53%); Hemiptera (21.27%), Coleoptera (0.62%), Hemiptera (21.27%) and Mecoptera) The insects recorded were attracted to the leaves, stems and syconium of the fig trees mainly for their reproduction and feeding. According to their different ecological regimes with respect to their host-plants, it appears that ants, aphids, wasps were linked with the stem; the syconium has as host ants, beetle and wasps while the leaves are associated with ants, butterflies, moths, scorpions-flies, wasps. The gall makers are concerned by only wasps. This work therefore indicated that the insects associated to ficus should enable ecologist to develop management plans that could preserve the plant species in the Bambili environment.

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