

A CHECKLIST OF PESTS AND VISITORS OF
APIS MELLIERA ADANSONII (HONEYBEE) IN THE
SIX STATES OF SOUTHWESTERN NIGERIA

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Abstract

This fieldwork involved quantitative data collection of pests, visitors, and parasites from nineteen selected bee farms at different locations of six states of south-western Nigeria located in the three main ecological zones (Lowland Rain Forest, Savannah and Mangrove forest). Twenty-three animal species representing sixteen families, twelve orders, five classes and three phyla were encountered. Most of the pests/visitors belonged to the class Hexapoda (Insecta) followed by Mammalia, Reptilia, Arachnida and Gastropoda, respectively. The species encountered include *Pheidole barbata*, *Crematogaster lineolata*, *Belongaster spp*, *Oecophylla smaragdina*, *Marcotermes nigeriense*, *Periplanata americana*, *Stagmomantis spp*, *Brachytrypes spp*, *Zonocerus variegatus*, *Aeshna spp*, *Aethina tumida*, *Acherontia atropos*, *Achoria grisella*, *Galleria mellonella*, Wax moth larvae, *Opiliones spp*, *Archachatina marginata*, Slug *Hemidactylus fasciatus* & *H. brookii*, *Agama agama*, snake and *Rattus rattus*

Parasitic mites and the definitive honeybee diseases were lacking in all the study sites.

Keywords : Checklists, Pests, Visitors, honeybees, South-western Nigeria.

Introduction

Honeybees are well represented in Africa being found almost throughout the continent and represented by ten different races [21]. *Apis mellifera adansonii* is about the most common that has been given due attention in Nigeria probably because of its beneficial attributes as a natural agent of pollination and as the most important of all insect pollinators [16], [19], [10], [11]

The contribution made by honeybees to maintaining and increasing biodiversity by virtual of pollination of flowering plants is poorly researched in Africa [8], [22]. *A. m. adansonii* is a source of good quality honey that is commonly harvested in the wild in Nigeria until recently [9], [18]. In addition, apicultural industries play an important role in generating employment opportunity and increasing family income in the rural areas of the world.

Honeybee colonies are subject to a number of natural stress inducers and enemies including weather, natural disasters, pests, predators, parasites, and diseases [17]. There have been many reports of attacks on honeybees by pests, parasites, predators, pathogens, and diseases from different parts of the world, but there has never been a comprehensive record from South-western Nigeria. Anderson and Trueman [1] Reported that ectoparasitic mite *Varroa destructor* is the most serious pest of managed honeybee *Apis mellifera* world wide. Therefore, we included a survey for this parasite in our study.

Beekeeping is becoming popular due to encouragement from the Nigeria government through the activities of National Directorate of Employment (NDE) and National Poverty Eradication Project on self-empowerment. Also encouragement from some Non Governmental Organisations such as Justice and Development of Peace

Commission has occurred by creating awareness and organising trainings and workshops for people through the Bee friendly Society of Nigeria (Ijebu Ode Chapter) and many more.

This study provides an inventory of the pests, parasites, and diseases that are associated with honeybees in southwestern Nigeria. Such information will be useful in good management of apiaries and possibly alert beekeepers for the preparation of control measures against the pests in their hives. This education will invariably increase the honey production and apicultural revenue.

Method and Materials

This study was carried out in nineteen locations within the six states of southwestern Nigeria located within latitude $6^{\circ} 34' N$ - $8^{\circ} 44' N$, longitude $3^{\circ} 18' E$ - $4^{\circ} 50' E$ and Elevation 39.4 - 330.0m. The bee farms used in this project were selected in all the six states in the southwestern Nigeria based on the three main ecological zones (Lowland Rainforest, Savannah and Mangrove forest). The study sites were located in Lagos, Oyo, Ogun, Ondo, Ekiti, and Osun States. In each a minimum of two and a maximum of six bee farms were selected for this study. Moreover, minimum of 11 colonies and maximum of 38 colonies were surveyed in each state, depending on the numbers of colonies at each bee farm. Fortnight visits were made to the bee farms in the company of the bee farm owners with structured apiary data sheets for data collection about each colony in all the selected bee farms. Samples of the honeybees, their pests and visitors found associated with the honeybee hive in each selected bee farms were collected and preserved in 70% alcohol. Video records were made of the activities of all pests and visitors. Still photographs and macrographs were taken to facilitate identification, enumeration and population estimates.

Laboratory Experiment

The taxonomic identification of all the samples was carried out at the Entomology Laboratory in Cocoa Research Institute of Nigeria (CRIN) and at the Department of Agricultural Biology University of Ibadan. The identification of non-arthropods visitors were carried out at the Zoological museum of Department of Plant Science and Applied Zoology, Olabisi Onabanjo University.

The honeybee samples were examined for both internal and external parasitic mites using the shaking methods described by [5]. This involves placing of about 200-300 honeybees in 70% alcohol and shaking for about 5 minutes. Ninety percent of the parasitic mites *Varroa jacobsoni* (now known as *V. destructor*) attached to honeybees are thereby dislodged. The mites are then separated from honeybee through mesh sieve. For the tracheal mites classical technique was used as described in the *Handbook for Diagnosis of Honeybee Diseases* [26]. Some preserved samples of honeybee were forwarded to the United States Department of Agriculture (USDA) Bee Research Laboratory for the following examinations: internal and external examinations of the honey bee samples for parasitic mites, and diagnosis for Nosema.

Statistical Analysis

The statistical package SPSS software was used in the analysis of the data.

Analysis of variance (ANOVA) to assess the scoring for incidence and the severity of pest in the study areas.

Results

Twenty-three (23) species representing sixteen (16) families, twelve (12) orders, five (5) classes and three (3) phyla were encountered (Table 1). In the class Insecta, there were seven different orders, eleven families and fifteen different species (Plates: 1-18). In class Arachnida there was only one order, one family, and one species (Plate 19). In Class Gastropoda there was only one order, one family, and one species (Plates: 20-22) and unidentified (slug). In class Reptilia there was one order, two families and three different species (Plates: 23-25), and an unidentified snake. Class Mammalian was represented by one order, one family and one species (Plate 26).

TABLE 1: LIST OF ALL PEST/VISITORS FOUND ASSOCIATED WITH HONEYBEE HIVE IN THE STUDY AREAS, THEIR CLASSIFICATION AND FREQUENCY OF RECOVERY

PHYLUM	CLASS	ORDER	FAMILY	GENUS/SPECIES	STAGE	FREQUENCY OF RECOVERY	RELATIVE FREQUENCY
UNIRAMIA	INSECTA	HYMENOPTERA	Formicidae	<i>Pheidole barbata</i>	Adult	74	0.05208
			Formicidae	<i>Crematogaster lineolata</i>	Adult	136	0.09571
			Cynipidae	<i>Belongaster spp</i>	Adult	20	0.01407
			Formicidae	<i>Oecophylla smargadina</i>	Adult	46	0.03237
		ISOPTERA	Termitidae	<i>Marcotermes nigeriense</i>	Adult	59	0.04152
		BLATTARIA	Blattidae	<i>Periplaneta americana</i>	Adult	2	0.00141
		MANTODAE	Mantidae	<i>Stagmomantis spp</i>	Adult	12	0.00844
		ORTHOPTERA	Gryllidae	<i>Brachytrypes spp</i>	Adult	11	0.00774
			Pyrgomorhidae	<i>Zonocerus variegatus</i>	Adult	24	0.01689
		ODONATA	Aeshnidae	<i>Aeshna spp</i>	Adult	1	0.0007
		COLEOPTERA	Nutidulidae	<i>Aethina tumida</i>	Adult	576	0.40535
				<i>Aethina tumida</i>	Larvae	136	0.09571
		LEPIDOPTERA	Sphingidae	<i>Acherontia atropos</i>	Adult	10	0.00704
			Pyrallidae	<i>Achoria grisella</i>	Adult	45	0.03167
			Pyrallidae	<i>Galleria mellonella</i>	Adult	83	0.05841
			Pyrallidae	Wax moth larvae	Larvae	143	0.10063
	ARACHNIDA	OPILIONES	Pholadidae	<i>Opiliones spp</i>	Adult	5	0.00352
MOLLUSCA	GASTROPODA	PULMONATA	Achatinidae	<i>Archachatina marginata</i>	Adult	1	0.0007
				Slug (unidentified)	Adult	2	0.00141

CHORDATA	REPTILIA	SQUAMATA	Gekkonidae	<i>Hemidactylus fasciatus</i> & <i>H. brookii</i>	Adult	4	0.00281
			Agamidae	<i>Agama agama</i>	Adult	1	0.0007
				Snake (unidentified)	Adult	1	0.0007
	MAMMALIA	RODENTIA	Muridae	<i>Rattus rattus</i>	Adult&young ones	29	0.02041
				TOTAL		1421	1

The frequency distribution of the Pests/Visitors found associated with beehives in the study areas (Fig 1) *Aethina tumida* (adult) was the most frequent followed by wax moth larvae, *Crematogaster lineolata*, *Aethina tumida* (larvae) and *Galleria mellonella*. The least frequent are snake and *Agama agama*. The photographs of the pests/visitors encountered during the study are shown in Plates 1-26d. Highest frequency of pests/visitors was recorded in Oyo, Ekiti, Ogun, Lagos, Osun and Ondo states respectively. The number of individual pest/visitors was higher in Oyo state and the lowest in Ondo state (Table 2). Pests/visitors were found to be more frequent in Savannah followed by Lowland Rain forest and Mangrove forest (Table 3). Among the insect order found Coleoptera was the most frequent followed by Hymenoptera, Lepidoptera and the least are Odonata and Blattaria (Fig 2). In the Non insect group Mammalia was the most frequent and the least is Arachnida (Fig 3). Figs. 4-9 shows the pattern of distribution of individual pests/visitors in order Hymenoptera, Lepidoptera, Coleoptera, Orthoptera, Class Reptilia and Mollusca.

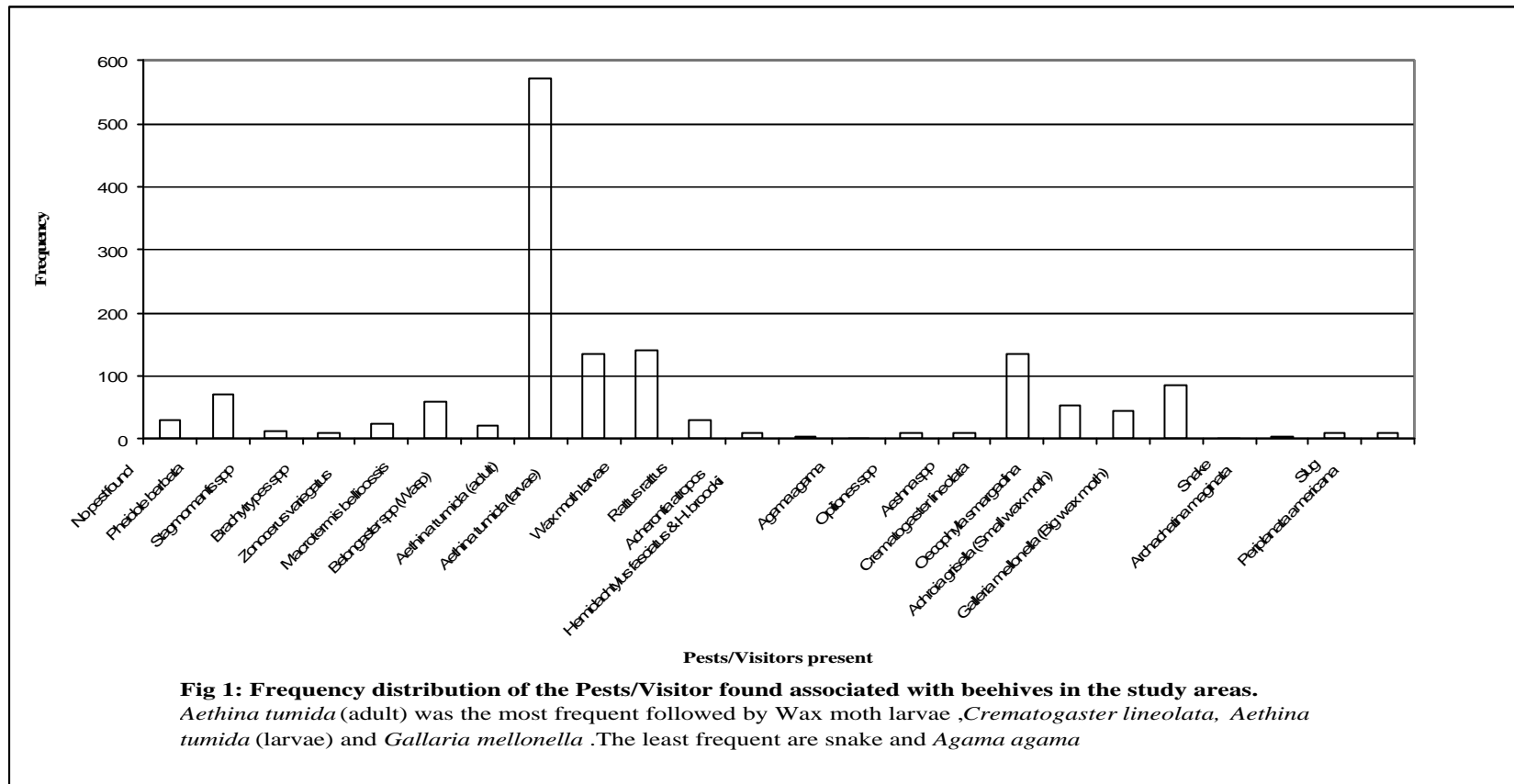


Table 2: Frequency distribution of pests/visitors found associated with beehive in all the six states

Pests/visitors present	states					
	Oyo	Ogun	Ekiti	Osun	Lagos	Ondo
<i>Pheidole barbata</i>	23	32	15	1	1	0
<i>Crematogaster lineolata</i>	57	32	45	0	2	0
<i>Belongaster spp</i>	12	3	4	0	0	1
<i>Oecophylla smaragdina</i>	18	11	21	1	3	0
<i>Macrotermes nigeriense</i>	4	9	13	28	3	2
<i>Periplanata americana</i>	0	1	0	0	0	0
<i>Stagmomantis spp</i>	5	5	0	0	2	0
<i>Brachytrypes spp</i>	11	0	0	0	0	0
<i>Zonocerus variegatus</i>	0	1	23	0	0	0
<i>Aeshna spp</i>	0	0	0	0	1	0
<i>Aethina tumida</i> (adult)	129	107	116	60	89	70
<i>Aethina tumida</i> (larvae)	57	25	51	2	1	0
<i>Acherontia atropos</i>	5	0	0	0	4	1
<i>Achoria grisella</i>	31	5	5	1	3	0
<i>Galleria mallonella</i>	50	19	12	2	2	0
Wax moth larvae	50	21	52	3	11	4
Opiliones spp	2	3	0	0	0	0
<i>Archachatina maginata</i>	0	1	0	0	0	0
Slug	0	2	0	0	0	0
<i>Hemidachtylus fasciatus</i> & <i>H. broockii</i>	2	1	1	0	0	0
<i>Agama agama</i>	1	0	0	0	0	0
Snake	0	1	0	0	0	0
<i>Rattus rattus</i>	4	15	1	0	8	1
No pest found	23	2	0	0	0	4
Total	484	296	359	98	130	83

Table 3: Frequency distribution of pests/visitors found associated with beehives in Different Ecotypes

Pests/visitors present	Ecotypes		
	Lowland Rain forest	Savannah	Mangrove forest
<i>Pheidole barbata</i>	36	22	1
<i>Crematogaster lineolata</i>	43	18	2
<i>Belongaster spp</i>	4	12	0
<i>Oecophylla smaragdina</i>	17	0	3
<i>Macrotermes nigeriense</i>	11	32	3
<i>Periplanata americana</i>	1	0	0
<i>Stagmomantis spp</i>	5	5	0
<i>Brachytrypes spp</i>	0	11	0
<i>Zonocerus variegatus</i>	1	0	0
<i>Aeshna spp</i>	0	0	10
<i>Aethina tumida</i> (adult)	248	178	89
<i>Aethina tumida</i> (larvae)	29	55	1
<i>Acherontia atropos</i>	3	3	4
<i>Achoria grisella</i>	6	31	3
<i>Galleria mallonella</i>	21	50	2
Wax moth larvae	37	49	11
Opiliones spp	4	1	0
<i>Archachatina maginata</i>	1	0	0
Slug	2	0	0
<i>Hemidachtylus fasciatus</i> & <i>H. broockii</i>	2	1	0
<i>Agama agama</i>	0	1	0
Snake	1	0	0
<i>Rattus rattus</i>	17	4	8
No pest found	6	23	0
Total	495	551	130

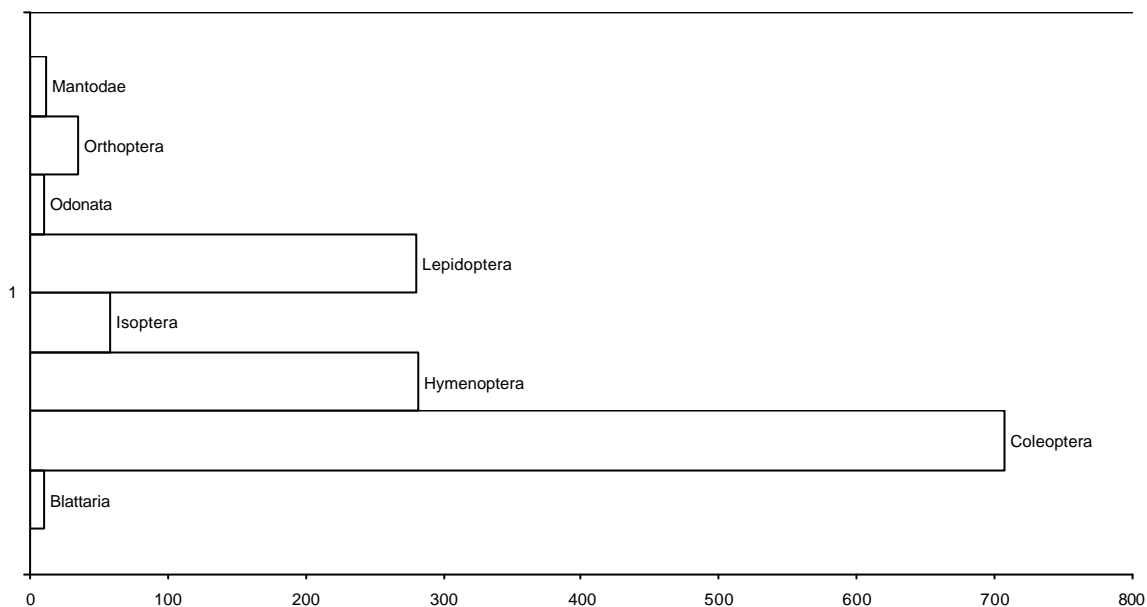


Fig 2: Frequency of the insect orders associated with the beehive in the study areas.

Coleoptera was the most frequent insect order followed by Lepidoptera and Hymenoptera the less frequent were Odonata and Blattaria

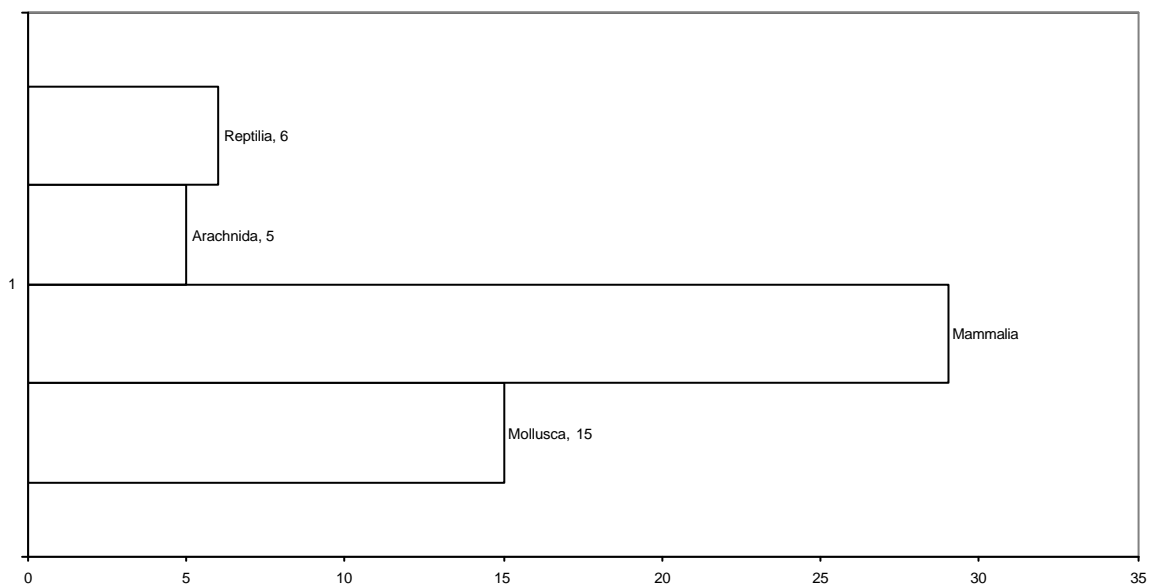


Fig 3: Frequency of Non - insects pests/visitor associated with beehives in the study area.

Mammalia were the most frequent non-insect visitors to beehive

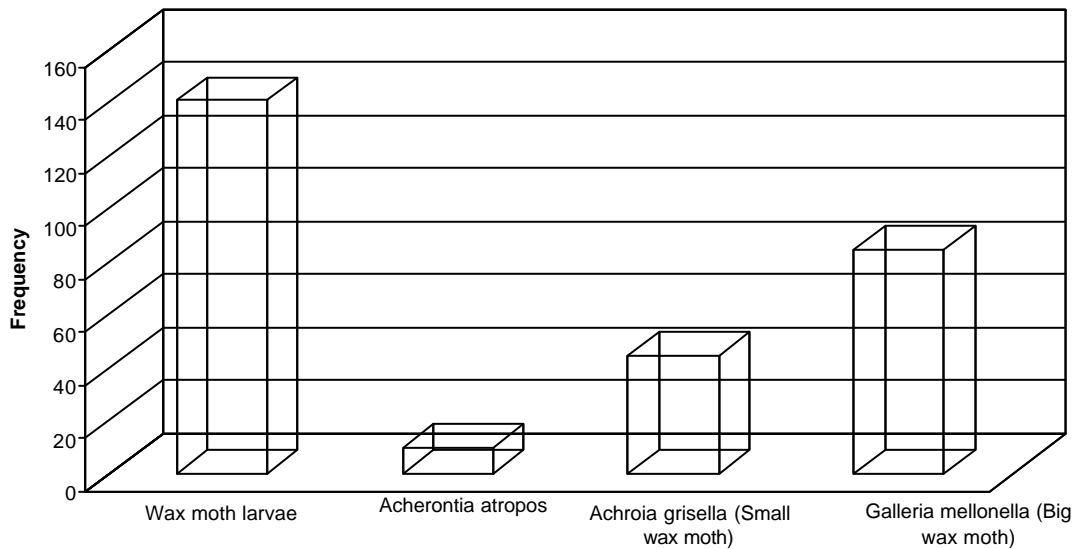
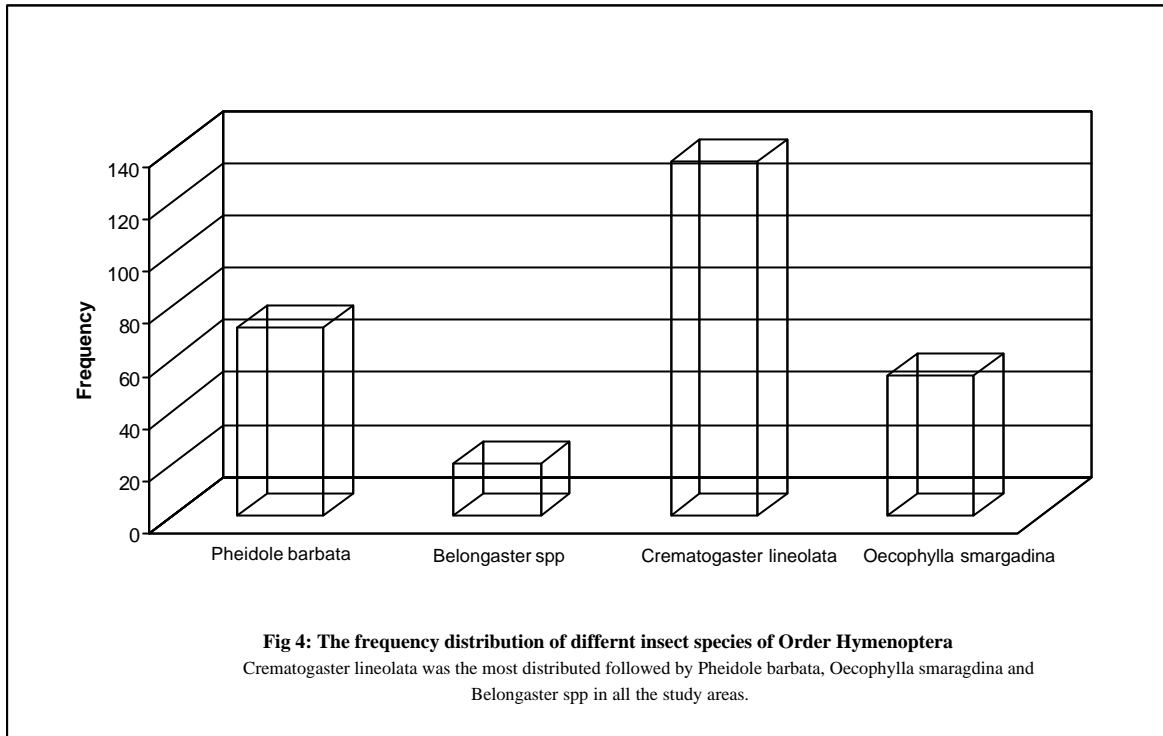


Fig 5: The frequency distribution of different species of Order Lepidoptera
 Wax moth larvae were the most distributed followed by Galleria mellonella, Achroia grisella and Acherontia atropos among the the order Lepidoptera

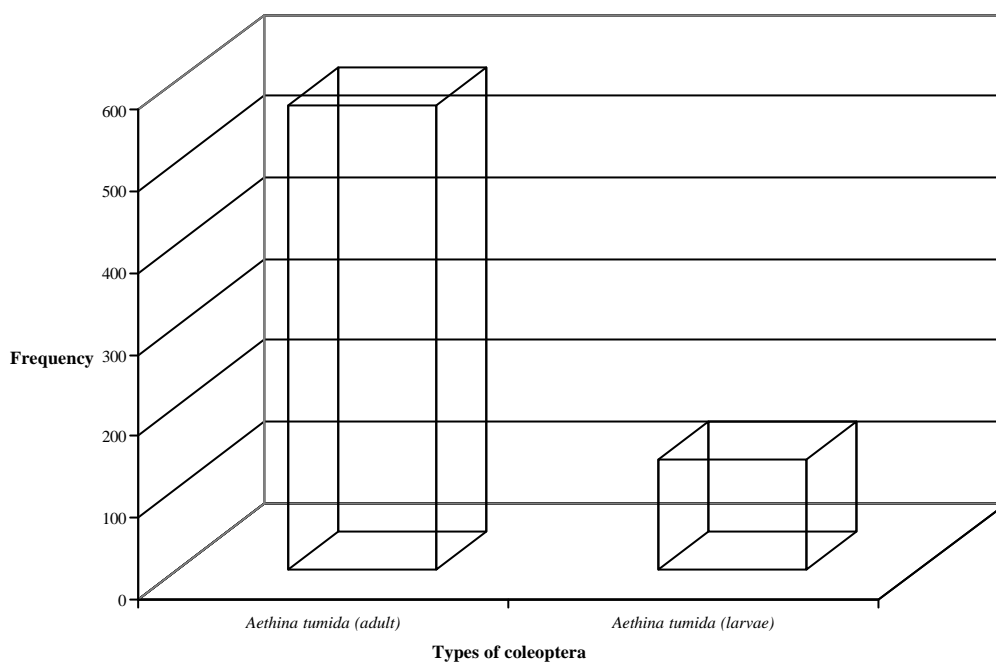


Fig 6: The abundance of order coleoptera associated with beehives
Aethina tumida was the only found Coleoptera both the adult and the larvae but the number of adult was more than the larvae.

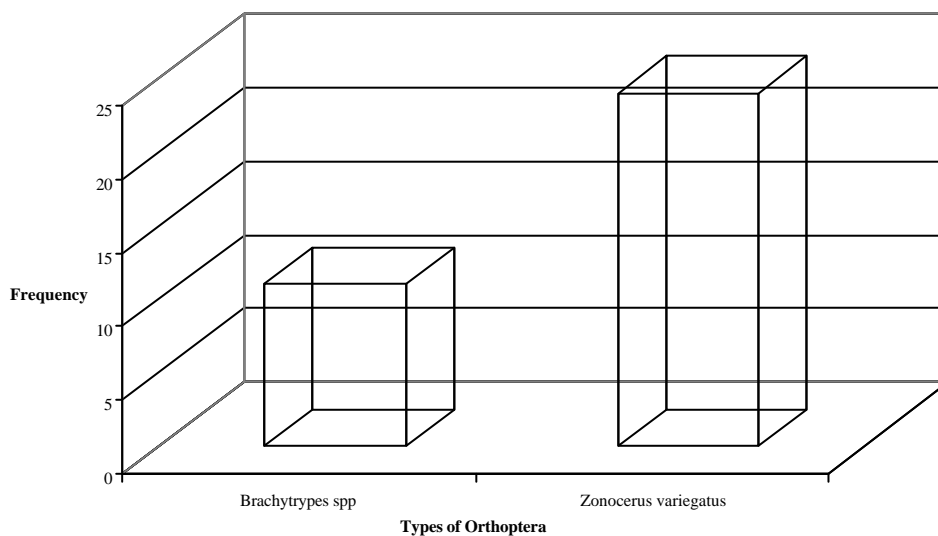


Fig 7: Frequency of different types of order Orthoptera associated with beehives.
Zonocerus variegatus was the most frequent among the species of order Orthoptera found in the study areas

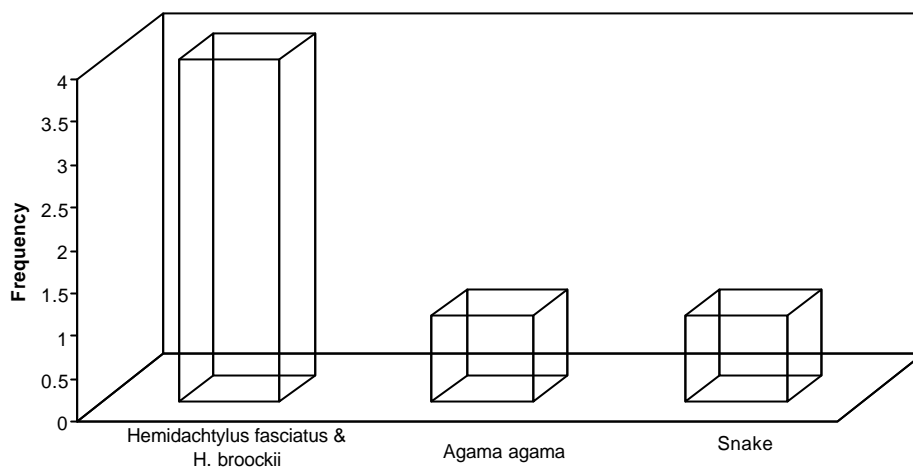


Fig 8: Frequency distribution of Class Reptilia found associated with the beehives.
Hemidachtylus fasciatus & H. brookii, were found to be most distributed followed by Snake & *Agama agama*.

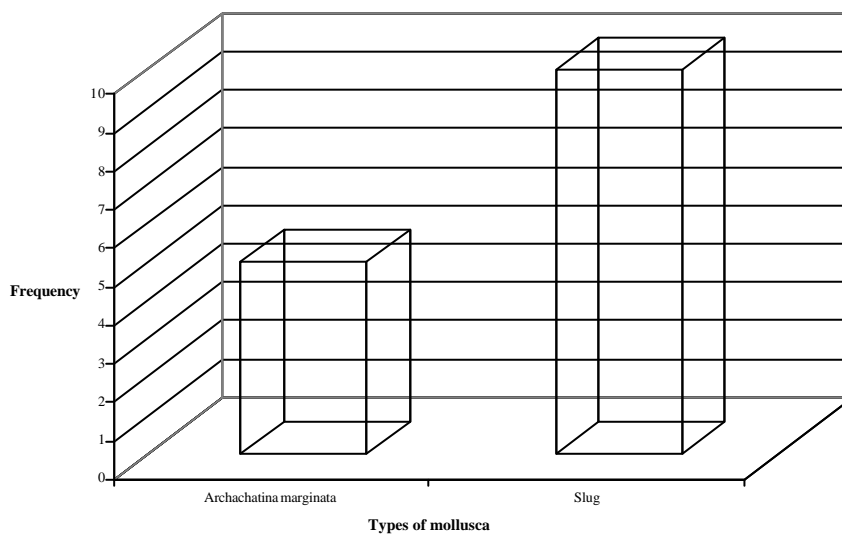


Fig 9: Frequency of the types of Mollusca associated with beehives
 Slug was more frequent than the *Archachatina marginata* in the study areas.

Table 4: Result of internal and external examinations for the presences of parasitic mites and disease diagnosis in Honeybee sample from all the study areas.

Honeybee code	Location	Presence of parasitic mites and diseases		
		Varroa mite	Tracheal mites	Diseases
HB:IJ	Ijebu-ode / Ogun State	NO	NO	NO
HB:IK	Ikangba / Ogun State	NO	NO	NO
HB:AW	Awa / Ogun State	NO	NO	NO
HB:AB	Abeokuta / Ogun State	NO	NO	NO
HB:OD	Odoepo / Ogun State	NO	NO	NO
HB:EP	Epe / Lagos State	NO	NO	NO
HB:BA	Badagry / Lagos State	NO	NO	NO
HB:IKR	Ikorodu / Lagos State	NO	NO	NO
HB:SA	Saki / Oyo State	NO	NO	NO
HB:IB	Ibadan / Oyo State	NO	NO	NO
HB:ABJ	Abaja / Oyo State	NO	NO	NO
HB:OGB	Ogbomoso / Oyo State	NO	NO	NO
HB: EK	Ido Ekiti / Ekiti State	NO	NO	NO
HB : EKOM	OmuoEkiti/ Ekiti State	NO	NO	NO
HB: OS	Osogbo / Osun State	NO	NO	NO
HB: IL / EJI	Ilawo / Osun State	NO	NO	NO
HB: AK	Akure / Ondo State	NO	NO	NO
HB: ON	Ondo / Ondo State	NO	NO	NO

DISCUSSION

The Pest and Visitors

The list of pests/visitors encountered associated with honeybee during this study (Table 1) agrees with the findings of [19], [23], [29], [26]. The insect pests found in this study include the greater wax moth *Galleria mellonella*, lesser wax moth *Acthoria grisella*, (Lepidoptera: Pyralidae), deathhead hawkmoth *Acherontia atropos* (Lepidoptera: Sphingidae). The most common pest was the small hive beetle *Aethina tumida* (Coleoptera: Nitidulidae). Other enemies of bees include ants, snakes, lizard, bee-eater bird, mice, honey badger, robberflies, mantids, yellow jackets and other wasps and perhaps termites which damage bee hives.

The Absence of Parasitic Mites

We found no varroa or tracheal mites in the sampled apiaries during this investigation, which was in sharp contrast to previous findings that more than 40 species of mite (Acari) have been reported to be associated with honeybees [6]. The presence of mites have been confirmed in Asia [26] and many other countries and regions [7], [14], [15] including Scotland [2], China, [28], Ireland [3], Europe, Americas, Africa, and Australia, [4], [20], but not in this study areas of southwestern Nigeria.

The Most Frequent Pests /Visitors

Among the pests/visitors encountered, the results revealed that *Aethina tumida* (adult) was the most frequent followed by *Aethina tumida* (larva), *Crematogaster lineolata* and wax moth larvae. This agrees with the previous work done [29] that *Aethina tumida* is a native of southern Africa and found in associated with honeybee colonies. Massive aggregation of *Aethina tumida* and heavy comb infestation leads to absconding in African honeybees [8]. The larvae of *Aethina tumida* causes further severe damage to the honeycomb [13], [24]. The larvae also eat live brood and defecate on the honey which causes fermentation [27]. The result of this study showed that *Aethina tumida* (adult) was most widely spread in Oyo, Osun, Ekiti, Ondo, Ogun and Lagos states respectively. [29] Reported that its spread is very rapid, enhanced by migratory beekeeper, due to the migratory pollination demand within the United States. But the practice of modern beekeeping in the study areas of Nigeria is still at its infancy. This could be interpreted that *A. tumida* is already ubiquitous in apiaries independent of the level of technology practiced.

The association of *Crematogaster lineolata* with honeybee discovered in this study is a confirmation of the previous work done [19], [25]. Wax moth larvae were found as one of the most frequent pests/visitors encountered in this study. They have been observed as a serious

pest that causes loss of colonies, damages to hives and combs. Our result supports the findings of [25] and [12] that wax moth larvae cause damage to wooden hives, stored honeycombs, and pollen.

Least Frequent Pests / visitors and Enemies

The least frequently pests/visitors encountered were *Periplaneta americana*, *Aeshna spp*, *Opiliones spp*, *Archachatina marginata*, Slug, *Agama agama* and a snake. Moreover *P.americana* and the snake were found in desolated hives. *A marginata* and a slug were found under the roof but on top of the hive bars, probably only seeking for shelter. *Aeshna spp* was only found in the hives kept near a stream. It is probable that the closeness to the stream created local high relative humidity that facilitated the thriving of that insect into those hives. *A. agama* was few in number but feeding on the honeybees. This observation agrees with the findings of [19] that reported other enemies of bees include ants, snakes, lizards, bee-eaters, mice, honey badgers and perhaps termites which damage bee hives. Shimanuki [25] reported that in Florida several other insects attack honeybee colonies such as ants, robberflies, mantids, yellow-jackets and wasps.

In this study, wax moth larvae were observed to cause great damage to honeycombs and wooden hive materials as reported in [12]

Absence of Varroa mite and Tracheal Mites

The joint absence of the varroa and tracheal and bee diseases are noteworthy. The absence of these mites and other disease in honeybee samples could be as a result of low level of modern technology in beekeeping in south-western Nigeria, which has no migratory beekeeping as is done in developed countries. The local practice here may not encourage transmission of mites.

Conclusion and Recommendation

Apiculture provides many valuable contributions in development of agricultural activities, especially in the pollination of crops, which cannot be quantified without a detailed study. Honey production contributes greatly to the economic support of the rural people and at the national and international levels. It improves diet and mean of getting cash to the beekeepers and is employed in much of the traditional medicine used by rural people against certain diseases.

There is every need for us to protect our honeybees through good hive management and to look for ways to develop control measures for the existing honeybee pests. For these reasons, further impact assessment of these honeybee pest/visitors is required. Furthermore, friendly control measures appropriate to field use should be developed along with how to prevent the infestation of parasitic mites and outbreak of honeybee diseases in south-western Nigeria.

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APPENDIX: A

PICTURES OF PESTS AND VISITORS ENCOUNTERED

(The Photographs taken by Lawal, O.A)

Class: Insecta



Plate 1: *Pheidole barbata*



Plate 3: *Balongaster* spp



Plate 2: *Crematogaster lineolata*



Plate 4: *Oecophylla smaragdina*

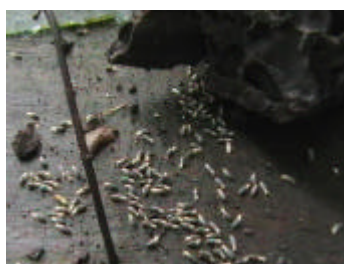


Plate 5: *Marcotermes nigeriense*



Plate 6: *Periplaneta Americana*



Plate 5b: Termitarium attached to the stand of Beehive stand



Plate 7: *Stagmomantis* spp



Plate 8: *Aethina tumida* (Adult)



Plate 9: *Aethina tumida* (Larvae)



Plate 10: *Acherontia atropos*



Plate 11: *Acherontia atropos* attached to a portion of the honeycomb)



Plate 12: *Achoria grisella*



Plate 14: Wax moth larvae

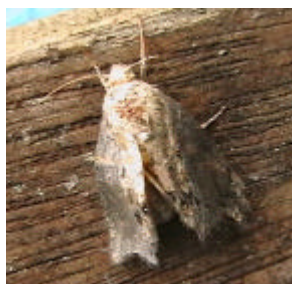


Plate 13: *Galleria mellonella*



Plate 15: Wax moth larvae infestation on honeycomb



Plate 16: Wax moth larvae infestation in beehive (webbing and cocoons)



Plate 18: Wax moth larvae in their cocoon attached to the hive



Plate 17: Damaged done by Wax moth larvae to the beehive

Class Arachnida



Plate 19: *Opiliones spp*

Class: Gastropoda



Plate 21: Slug

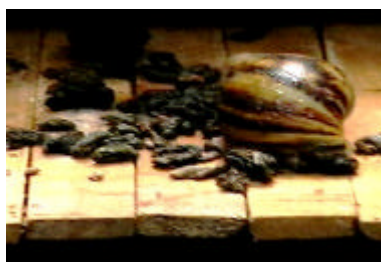


Plate 20: *Archachatina marginata*



Plate 22: Slug

Class: Reptilia

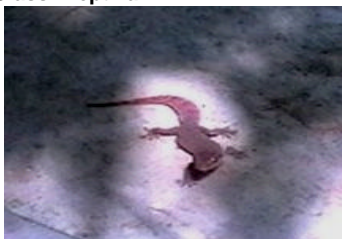


Plate 23: *Hemidactylus brookii*



Plate 25: *Agama agama*



Plate 24: *Hemidactylus fasciatus*

Class: Mammalian

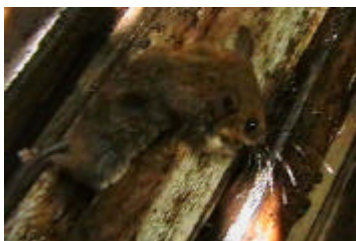


Plate 26: *Rattus rattus*



Plate 26c: The rat's faecal pellets on the floor of the beehive



Plate 26b: Rat nesting materials.



Plate 26d: Damage done by the rat on the beehive