ON SOME METHODS 0F COLLECTING INSECTS IN THE FIELD (A.B.U. BOTANICAL GARDEN)

By

JOHNSON ALIMOEME ILEGAR

B.Sc(Ed.) A.B.U. 1980

A thesis submitted to the Postgraduate School, Ahmadu Bello University, in partial fulfilment of the requirements for the Degree of Master of Science (Educational Biology).

Department of Biological Sciences,

Faculty of Science,

Ahamdu Bello University, Zaria.

October, 198$

E. J. Asimeng
(Supervisor)
Lecturer in Entomology,
Department of Biological Sciences,
Ahmadu Bello University,
Samaru - Zaria.

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THESIS APPROVAL

This thesis by ILEGAR, Johnson Alimoeme meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University and is approved for its contribution to scientific knowledge.

Mr. E.J. Asimeng
Supervisor/Internal
Examiner, Department of
Biological Sciences
Ahmadu Bello University
Zaria, Nigeria.

Dr. J.A. Ajayi
External Examiner
Department of Zoology
University of Jos
Jos, Nigeria.

Dr. J.O.D. Adegboye
Internal Examiner
Department of Biological
Sciences, Ahmadu Bello
University
Zaria, Nigeria.

Dr. M.M. Kapu
Internal Examiner
Department of Biological
Sciences, Ahmadu Bello
University
Zaria, Nigeria.

Dr. C.G. Vajime
Internal Examiner
Department of Biological
Sciences, Ahmadu Bello
University
Zaria, Nigeria.

DECLARATION

I declare that this work is wholly the author's and has not been part of any presentation for any other qualification.

Signed by the author

J.A. Ilegar

ILEGAR, JOHNSON ALIMOEME

DATE: 31st October, 1983

D E D I C A T I O N

This work is dedicated to
Johnny, Adiza and Francis.

ACKNOWLEDGEMENTS

I would like to thank Mr. E.J. Asimeng, Lecturer, Department of Biological Sciences, for his guidance and Supervision of this work.

I am grateful to Dr. C.G. Vajimme, Lecturer in Entomology, Department of Biological Sciences, for suggesting the topic of research. His assistance and suggestions during the research were very valuable.

I am thankful to Prof. B.J. Harris, Professor of Botany, for making available to me the map of the Botanical Garden.

Messrs M. Chori and M.C. Dike of the Department of Crop Protection, Institute of Agricultural Research, helped in identifying most of the insects collected. To them, I am much obliged.

I am equally grateful to the staff of the Meteorological Unit, Institute of Agricultural Research, for assisting me in collecting the weather records for Zaria Area.

I must not fail to mention the valuable material and financial contributions of Mr. J.I. Aigbudume of the Department of Chemical Engineering, Mrs. G. Oyati of Ahmadu Bello University Hospital; Alhaji S.A. Afegbua of Kashim Ibrahim Library, Mr. I.O. Iwenekhai of Durbar Hotel, Kaduna, Mr. L. Ilogho of West African Examinations Council, Kaduna, and Mr. A.S. Agekamhe of the Department of Nigerian and African Languages, Ahmadu Bello University, Zaria. I am very much indebted to them.

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ABSTRACT

Ten method Is were used for the collection of insects at the Botanical garden, Ahmadu Bello University, Zaria- The methods were Hand picking, Sweepnet, Pitfall-trap, Water-trap, Bait-trap, Beating, Suction (aspiration), Digging (escavation) Barking and Light-trap.

The relative efficiency (RE) of each method was determined. Light-trap with a score of RE = 16.3% was highest. This was followed by the Sweepnet method RE = 14.3%. Suction method has the least value of RE = 2.0%.

Twelve orders of insects were collected by the various methods. These were Odonata, Orthoptera, Phasmida, Dermaptefa, Dictyoptera, Isoptera, Hymerioptera, Hemipter, Neuroptera, Lepidoptera, Coleoptera and Diptera,

The relative abundance (RA) for each order was determined. Hymenoptera scored RA = 35.7%, the highest. This was followed by the Isoptera RA = 15.71/2. The least score of RA = 0.6% was recorded for Odonata and Phasmida.

CHAPTER ONE

INTRODUCTION

Insects and their relatives e.g. ticks, scorpions, spiders, millipedes and centipedes, are widely distributed. They are found in varied ecological niches e.g. on land, in fresh and sea waters, and as well as in the air. They have a remarkable power of survival under various environmental conditions like high temperatures, frost, low or high humidity, and long period of dessication.

Their ubiquitous distribution and high success of survival have been attributed to their small size, possession of wings, hard exoskeleton and good respiratory system.

For general biological studies, the biologist is interested among other things, in the great diversity of form which occurs in the class INSECTA.

A systematic study of insects usually entails collection for which various methods are employed. The methods include the use of sweepnets, various traps, baits, handpicking, chemical spraying and suction. The choice of a particular method is influenced by a number of factors such as, the type of insects, the habit and habitat.

1.1 Objective of the Study

This work primarily aims at evaluating some methods available for collecting insects in the field. The study also involves identification and preservation of the insects collected from the study area.

1.2. Description of the Study Area

The investigation was carried out in the Botanical Garden of the Department of Biological Sciences, Ahmadu Bello University, Zaria. This garden is situated opposite the Staff School Playground.

It is divided into two main sections by an avenue lined on both sides with mango trees. The northern part of the garden has tall trees of the genera Gmelina, Cassia, Neem, Albezia and Parkia. Nursery beds are also located in this area.

The vegetation of the most southernly part of the garden consists mainly of savanna grass.

The garden floor has small undergrowth of shrubs and herbs.

The soil, which appears brown in colour, is a mixture of clay and sand (See Fig. 1).

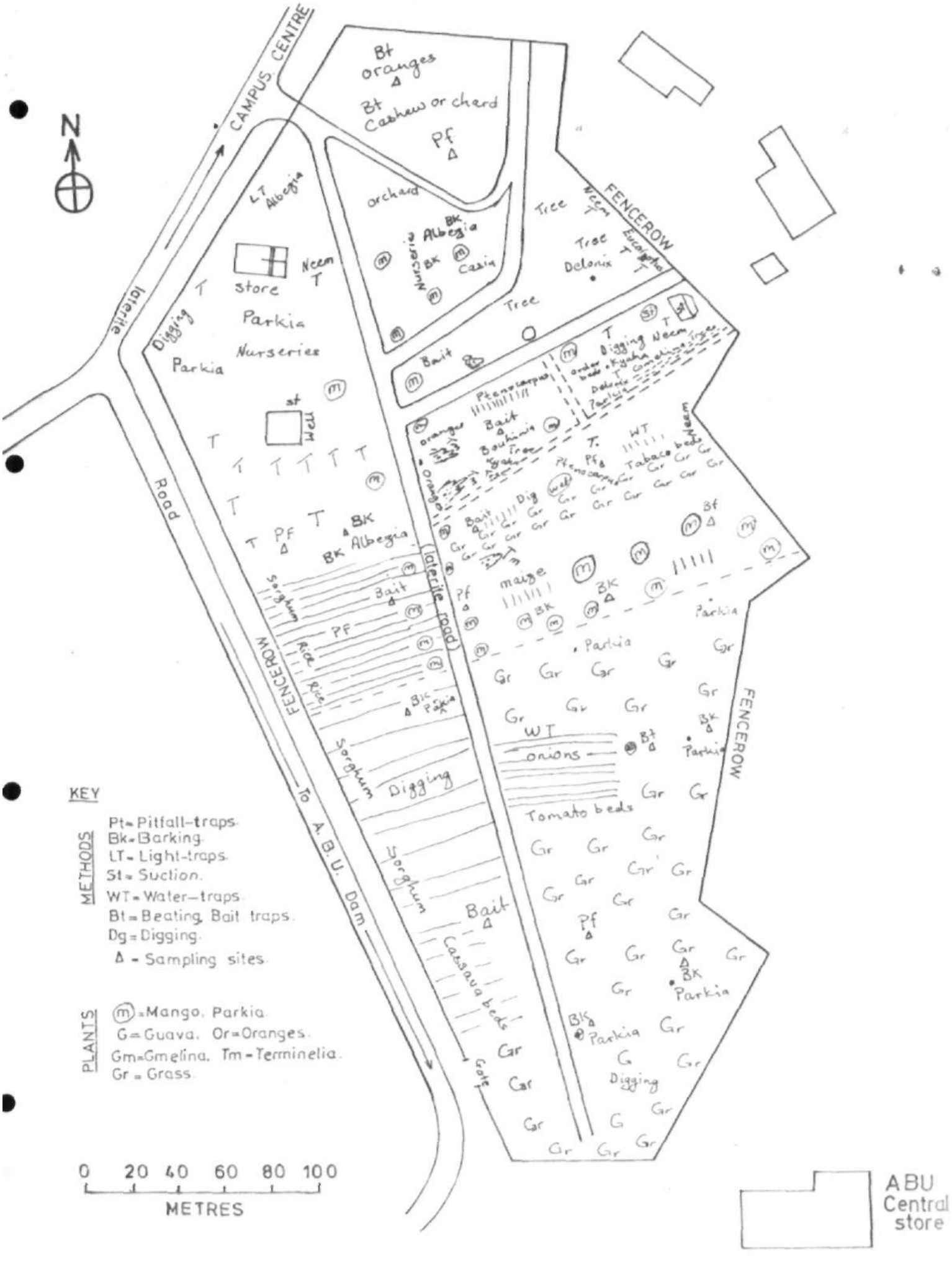


Fig 1. Map of A B U botanical garden showing sampling sites.

CHAPTER TWO

REVIEW OF LITERATURE

Many ecological studies on insects require population estimates, which involve collection of insects in the field. Various collecting methods are devised and constructed, each method being based upon various factors such as the type of insect species, the habit and habitat.

Morris (1955); Oldroyd (1958); Southwood (1966) and Varley, Gradwell and Hassell (1973) have presented excellent reviews on collecting and sampling insect populations. Both Morris (1955) and Southwood (1966) recognized three major types of population sampling: absolute (or direct), indirect, and population index. Absolute sampling entails directly counting every individuals in a unit area of the earth's surface. Indirect sampling utilizes some techniques such as mark-recapture so that not all insects need to be counted. Population index sampling involves measurement of some factors related to density.

Sweepnet, suctioning, digging, beating, pitfall traps, baiting traps, light traps, barking and water-traps are population indices that can be used for collecting and estimating the insect populations of a particular area. (Southwood, 1966).

Evaluation of the efficiency of some of the collecting methods have been reported by several workers (Morris, 1955; Shepard, Carner and Turnipseeds, 1974; and Cantelo, Goodenough, Baumhover, Smith, Stanldy and Henneberry, 1974).

It has generally been conceded that insect sweepnet catches are not directly quantitative although calibrations are possible to convert such catches to density estimates. Pruess, Saxena and Koinzan (1977) estimated the insect population from reduction in catches in successive sweep samples taken from the same area. They developed a model which assumes that the probability of collecting an insect may change with successive samples.

Ruesink and Haynes (1973), developed two interrelated models to predict cereal leafbeetle density from sweepnet catch, and found that catches were affected by sweepnet diameter, length of sweep, the proportion of the insect population that is in the net's path, and the probability of capture given that the insect is in the net's path.

Burrage (1963) used potatoes as baits to estimate seasonal feeding of wireworms economically important in the Canadian prairies. Punjabi, Berozo, Mortan, and Bierl (1974), working on trapping of Lymantra obtuscata Walker, with "disparlure" as bait, reported that with increasing bait concentration, the number of insects that are attracted and caught equally increased.

Apablaza, Keaster, and Ward, (1977) assessed the attractancy of various types of baits in the laboratory of species of wireworms occuring on the Midwestern United States, whereas the efficiency of different baiting techniques in the field in Missouri was evaluated by Ward and Keaster (1977).

Schoenly(1981) described a 12-sided carrion bait trap which permitted omnidirectional sampling of arthropods and

found that it could be used to collect a wide variety of number of arthropod orders in the field.

In determining the arthropods in Grape Vineyards (Jubb and Masteller, 1977) used pitfall traps, vine beating, sticky cup-traps, sweep net and the D-vac vacuum (suction) insect net and found that the efficiency of each method was dependent upon the density of insects and height of traps.

Simonet, Pienkowsk, Martinez and Blakeslee (1979) evaluated four techniques of sampling potato leafhopper adults on alfalfa. The techniques were:

(1) D-vac vacuum insect collector (suction);

(2) 38-m standard sweepnet;

(3) Trash can emergency trap and

(4) A plexiglas drop-trap.

Their results showed that D-vac vacuum insects collector and drop-trap collected the highest numbers of ($P < 0.05$); and the emergency trap collected the least adults on eadh date.

Trumble, Cartwright, and Kok (1981), determined the efficiency of suction sampling for Rhinocyllus conicus and a comparison of suction and visual sampling techniques. They found that the efficiency and reliability of a suction device for assessing R. conicus population were less at a height in excess of 1m even though the density of population was high enough. Also, Garcia, Gonzalez and Leigh, (1982), used a visual examination of plants, a modified berlese-funnel method, and whole-plant collection in cloth bags for sampling arthropod numbers on California cotton. Comparison by number of arthropods collected by each method was made.

They found no significant differences in the number collected by the three methods when arthropod populations were at low densities.

Climatic conditions affect the physiology and behaviour of insects. Day-length and temperature have important effects on the insect endocrine system which can act as a switch and determine whether the insect is active or goes into diapause (Varley, Gradwell and Hassell, 1973).

Howard and Fiske (1911) observed that weather acted as a catastrophic agent (density independent) killing a very variable proportion of insects from time to time. Andrewwartha and Birch (1954) have also emphasized that variable weather determines population change of insects.

Delong and Smith (1966) reported on some problems they encountered in the estimation of insect populations by sweeping method. These included temperature, humidity, wind, plant size and condition. They also observed that the proportion of the population of insects caught varied with these weather parameters.

Romney (1945) studied the effect of physical factors on sweepnet catch of the beetle leafhoppers on Russian thistle in New Mexico and found that plant host height, cloud cover, host plant density, time of day and humidity have no effect on catch. He reported, however, that the catch was directly proportional to temperature and inversely proportional to wind speed.

In a study of a chloropidfly in wheat, Hughes (1955) found wind to be the only significant factor affecting

sweepnet catch, with temperatures, humidity, and solar radiation having negligible effects.

Locusts, which live in semi-desert country, where the amount of rain is significantly variable, are especially affected by weather. However, their uneven distribution and their migratory behaviour make a meaningful census extremely difficult (Uvarov, 1931). Baron (1972) observed that the thousand-mile migrations of Schistocerca gregaria in 1967 and 1968 were determined by wind direction, which normally blows towards the intertropical convergence zone which is a semi-permanent but mobile frontal system where rain is most likely to be falling.

Hardwick (1971) gave the peak dates for the capture of various common moths at light traps between July and September months.

A direct demonstration that temperature and humidity affect the reproductive rate (and also the survival of an insect is provided by the work of Buxton and Lewis (1934), on the tsetse-fly Glossina tachineides in West Africa. They found that temperature and humidity in the field were often far from optimum for the species and indeed approached close to the lethal limits of 30.C/65% relative humidity.

Thus, in many places, the seasonal, cyclical and other variations of weather exert a profound influence on the rates of change of insect number (Clark, Gevie, Hughes and Morris, 1967).

Our knowledge of the insect fauna of the Botanical Garden of Ahmadu Bello University, Zaria, is scanty.

Silas (1980), examined the use of pitfall traps in sampling insects in the garden. He found that only insects that crawl on ground surface were collected.

In surveying the general arthropod fauna of the garden, (Abubakar, 1982) observed that sweepnet method was the most efficient of five methods employed for collecting insects.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Collection and Sampling Techniques

Intensive periodic sampling was conducted in several locations on mid-weekly basis, from 2nd February to 27th April, 1983, at the Botanical Garden of the Department of Biological Sciences, Ahmadu Bello University, Zaria.

Sampling involved the following methods:

(a) Hand-picking,
(b) Sweepnets,
(c) Pitfall-traps,
(d) Bait-traps,
(e) Beating,
(f) Suction (Aspiration),
(g) Barking,
(h) Digging (escavation),
(i) Water-traps and
(j) Light-traps.

The hand-picking method involved collecting large insects from the surface of the ground, tree trunks and various vegetations. The insects which were so collected were immediately killed using 40% v/w formaldehyde fumes in killing bottles.

Pitfall-traps were made from 210 ml glass jars, 6-cm wide x 10 cm tall, having metal screw-top lids. Each jar carried a metal funnel measuring 145-mm wide, which was soldered to an opening cut in the jar lid (Fig. 2).

The funnels with attached jars wer placed flush with the ground surface. Each jar contained 50ml of 70% ethel alcohol as preservative. The traps were inspected periodically to remove insects and replace the preservative. Six traps were distributed at various locations in the garden.

For the beating method, a 1m x 1.2m cloth was placed on the ground below the tree branches. The branches were then beaten vigorously using a stick for 10 sec. to dislodge the attached insects. Those which fell onto the cloth were collected and recorded. Fast moving insects were removed first to reduce the possibility of their escaping.

Sweepnets used were the standard 38.1-cm sweepnets. Several sweeps were taken at each sampling station. In most cases, individual insects were aimed at and an average of 3-sweeps were made before catching could be accomplished. This conformed with Menhinick (1963) range of 2.3 to 10.8, depending on the species and the weather. Sweepnet collections were carried out in dry grassy areas around the cultivated beds of tomatoes, maize and tobacco, and under the canopies of Gmelina, Neem, Guava and Mango trees.

Suction (Aspiration) involved the use of wide-bore glass of 23cm whose two ends were drawn into small tubings. One end was inserted into a rubber tube and a piece of gauze placed over the tube to which suction was applied. This kept the insects in the wide tube, and prevented them getting into the mouth. At the other end of the rubber

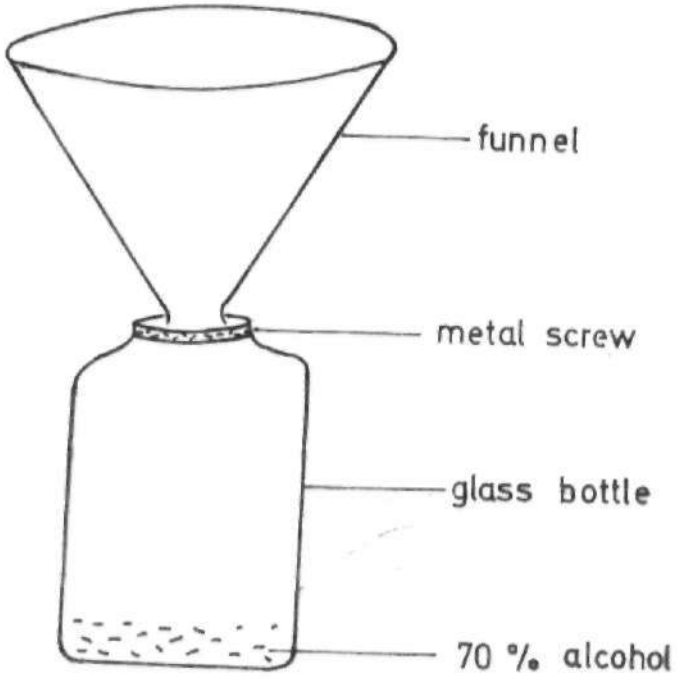


Fig 2, Pitfall–trap

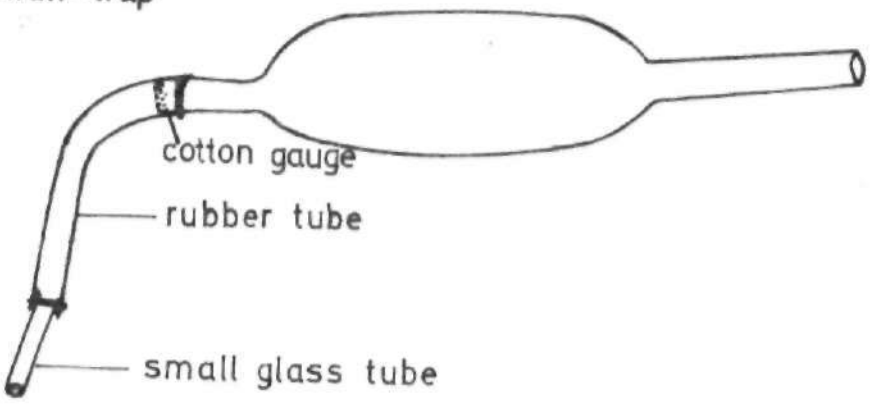


Fig 3, Suction-trap

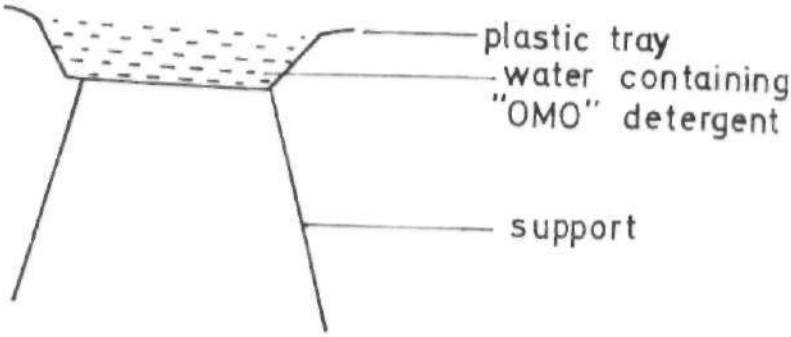


Fig 4, Water–trap

tubing was inserted a small glass tube through which suction was applied (Fig. 3). Aspiration was directed at tunnels, wells and surfaces of tree trunks and leaves. Insects aspirated were killed in 40% V/w Formaldehyde fumes and transferred to vials containing 70% ethyl alcohol.

The water-traps consisted of shallow trays measuring 6cm deep x 25cm wide and filled with water. A small quantity of "Omo" detergent were added to the water in order to break the surface tension, so that insects could be easily drowned. These were set up at crop level on a wooden support (Fig. 4).

Four sites were selected for sampling using the digging method. Several escavations, 3 - 5cm deep were made. The insects found were removed by hand, killed and preserved in 70% ethyl alcohol.

Barking collection consisted of removing the barks of large trees and collecting insects from the debarked wood. Few trees such as Mango, Neem and Parkia species provided sufficient and productive barking materials. Fallen trees and logs were found equally resourceful for this exercise.

Insects were attracted to baits of over-riped fruits of pawpaw, banana and pineapple, that were placed in shallow cups in five different locations. Simple hand-nets were used to collect insects found resting on these baits.

Light-traps consisted of a "Rothansted" model which has a 5.5V. 3A bulb with a funsgstein element (Lewis and Taylor, 1969). The traps were set up at night for 4 hours (7.00 to 11.00 p.m.) on each collecting day. Insects attracted to

the light were sprayed on using insecticidal aerosol (mobiltox). This killed some of the insects instantly. Larger ones were collected with hand and hand-nets around the traps. Others that entered the light trap box were killed by fumes of Potassuim cyanide in a small bottle placed at one corner of the box. Traps were operated at fencerows and around the nursery beds area at the northernly portion of the garden.

3.2 Preservation and Identification of Specimens

Large and hard integumented insects were pinned up dry in insect boxes. Preservation was effected by Naphthalene Moth Flakes in small envelope placed at one corner in each box (Plate 1).

The soft bodied insects were placed in small insect bottles containing 70% alcohol.

The identification and classification of the insects were done with the aid of the following taxonomic texts:

(i) A General Textbook of Entomology, (including the Anatomy, Physiology, Development and Classification of Insects) by A.D. Imms; (1957) and

(ii) Classification of Insects by Brues, Melander, and Carpenter (1954).

The specimens were later sent to the Entomoligical Section of the Crop Protection Department, Institute of Agricultural Research, Ahmadu Bello University, Zaria, for further identification and certification.

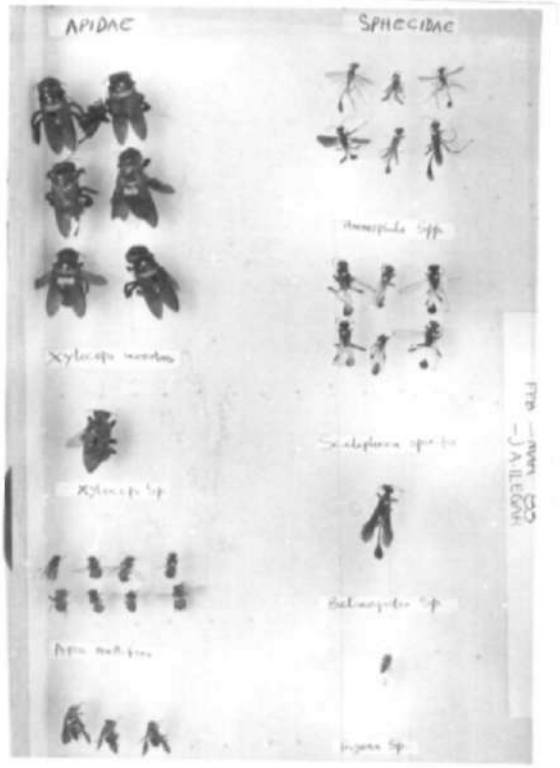


PLATE I = Preserved insects.

3.3 Meteorological Records

Daily weather reports were obtained from the Meteorological Research Unit, Institute of Agricultural Research, Ahmadu Bello University, Zaria, for the months of February, March and April, 1983 (See Appendix 1).

CHAPTER FOUR

RESULTS

The insects collected represented twelve different orders. This is made up of sixty-three identified families and one hundred and thirty six species (Appendix 3). The numbers and orders of daily collections of insects from the various locations in the Botanical Garden are summarized in Appendix 2.

The orders, Orthoptera, Lepidoptera, Hymenoptera, Coleoptera and Diptera were encountered throughout the sampling period. In all, a total of 1,284 insects were collected. The orders, families, genera and species and numbers of individual insect are shown in the Appendix 4.

The monthly collection of the insects varied with,

(i) the species of insect concerned,

(ii) the method of collection,

(iii) the sample locations, and

(iv) the prevailing weather conditions.

The total percentage monthly collections and average monthly weather records are shown in Table 1. There was no incidence of rainfall during the period. The wind velocity was generally high, reaching its peak in the month of March. Greater number of insects were collected during the month of February than during either March or April. Temperatures and solar radiation records

Table 1

Comparison of Percentage Monthly Collections in relations to the Climatic Variables recorded for February, March and April.

Months	% Total Insects	°C Rel. Temp.	Av. % R.H.	Km/day Windrum	cal/Cm^3/min.
February	39.4	25.1	9.0	193.15	20.8
March	33.9	25.5	17.3	243.62	19.6
April	26.3	29.0	12.6	174.98	23.0

were generally high. The humidity was low in February and April, but high in March. In the months taken, the climatic conditions had no apparent bearing on the insect numbers.

Hymenopteral species were the most abundant insects collected from the garden. This showed a relative abundance (RA) of 35.2%. The Isoptera, Diptera, Coleoptera and Lepidoptera showed RA 15.7%, 11.8%, 10.2% and 7.9% respectively. Odonata and Phasmida showed the least RA scores of 0.6% each. This relationship is shown in Fig. 5.

Fig. 6 shows the numbers of orders collected by each method. It reveals the relative efficiency (RE) of each method. This was determined by calculating the numbers of orders collected by each method divided by the total number of orders and then multiplying by one hundred.

The most efficient method was the light-trap which has a score of RE = 16.3%. The traps collected eight different orders which included Neuroptera, Coleoptera, Hemiptera, Diptera, Lepidoptera, Orthoptera, Hymenoptera and Dictyoptera. This was followed by the sweepnet method with RE = 14.3%. Swept-netted insects included members of the orders, Lepidoptera, Hymenoptera, Odonata, Neuroptera, Diptera, Hemiptera and Orthoptera.

Handpicking, pitfall trapping, water trapping, barking, beating and bait-trapping have equal efficiency in collecting and trapping insects. They each had a score of RE = 10.2%. The number of orders collected by each

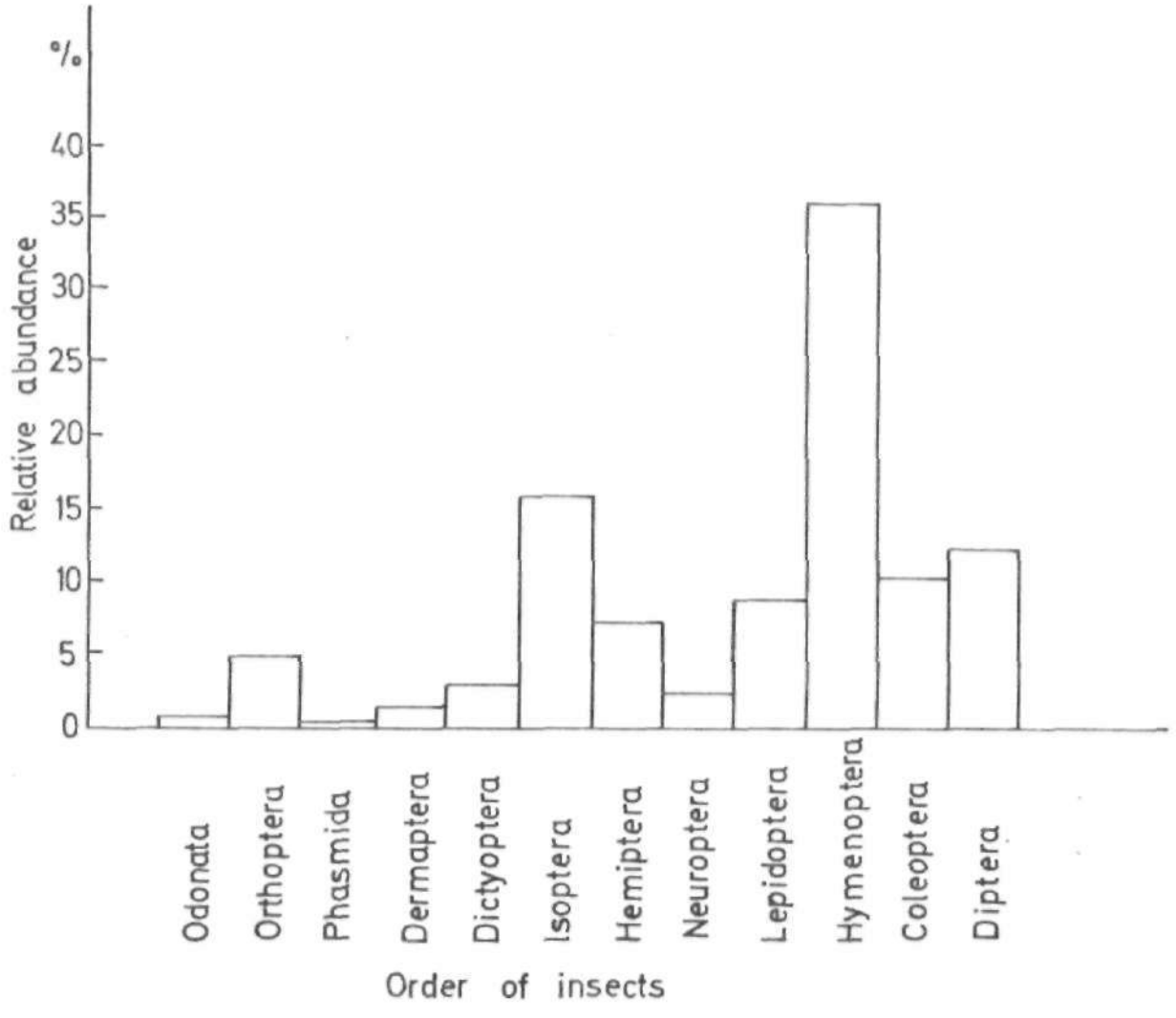


Fig 5, Relative abundance (R.A.) of the orders collected in the garden.

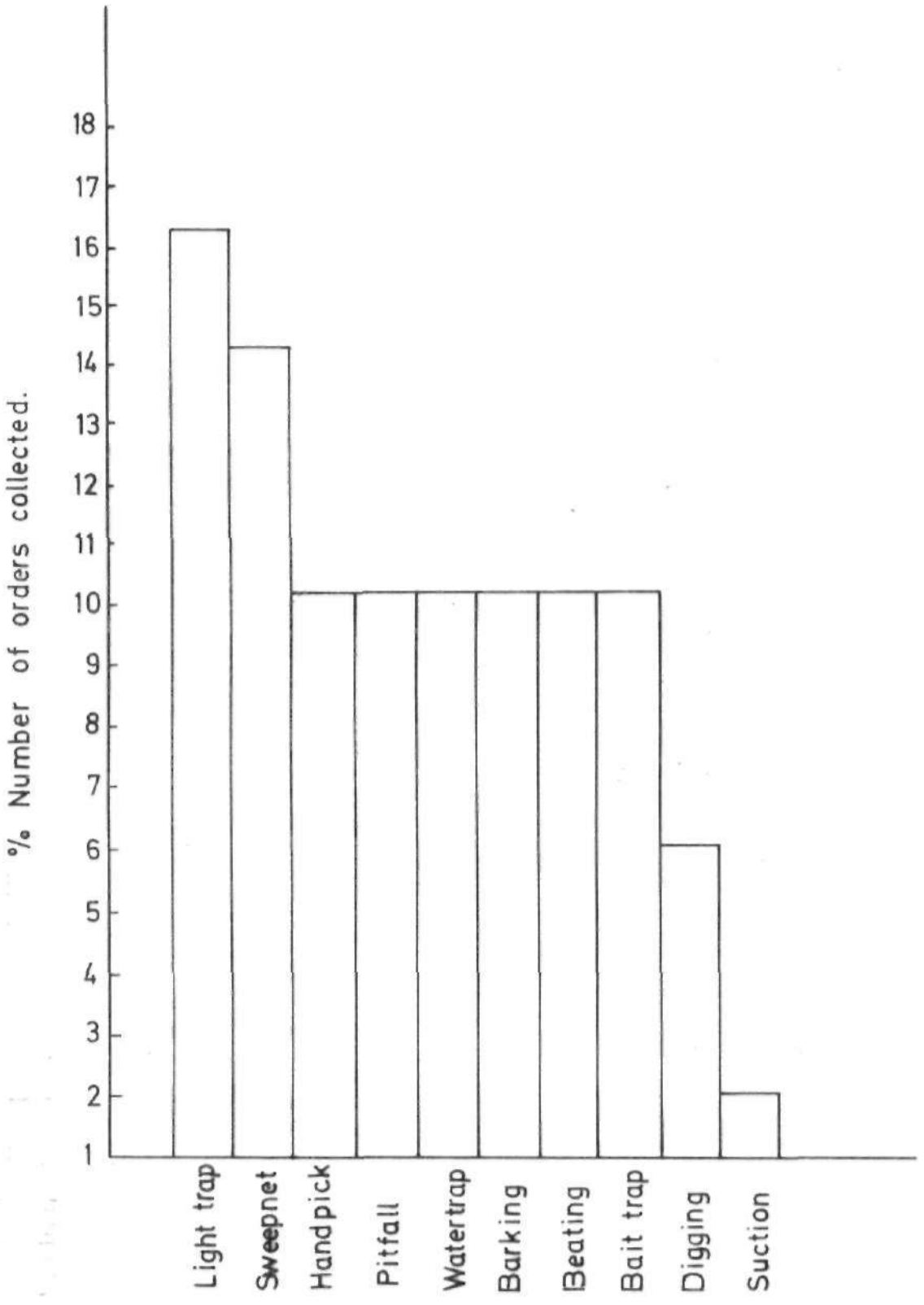


Fig. 6, Relative efficiency (R.E.) of methods.

of these methods was five. For instance, the pitfall trapped the Coleoptera, Orthoptera, Dictyoptera, Hymenoptera and Hemiptera. Digging method has RE = 6.1% and the least efficient method is the suction which has RE = 2.0% . The suction collected one order, the Diptera.

CHAPTER FIVE

DISCUSSION

The population density of insects in the Botanical Garden is of interest when viewed against the background of its location in the university. The garden is almost surrounded by residential houses and school playing-ground. This probably influenced the type and number of insects found. However, there is a great indication that the garden is rich in insect population, judging from the diversity of forms collected.

The occurrence here of at least twelve different orders of insects is of significance for both general biological and agricultural studies. In general, it gives some indication of the composition of orders and population of insects existing in the garden. The presence of some species of Coleoptera and Hemiptera is of agricultural interest because they are potential pests of crops and stored products.

The ten methods employed in this investigation could be used to estimate populations of many insects. The methods presented here, though unsatisfactory for collecting some insects, nonetheless, provided better methods of population estimation in all cases. Sweepnet, light-traps, handpick, bait-traps, pitfall traps and beating, indicated satisfactory performance.

The daily variability in catches of insects in different orders was analysed with respect to the methods employed. The results substantiated field observations that the

larger and more obvious the insects are, the more are they easily catchable by many methods. The performance of several methods for the collection of members of the Hymenoptera, Hemiptera, Dictyoptera, Orthoptera, Coleoptera and Diptera supports this claim.

The abundance of the species of Hymenoptera and Isoptera in the garden (see Fig. 5) is also worth-noting. This may be explained by the fact that the family formicidae is particularly urbiquitous and easily lends itself for collection. The prolonged drought also rendered the soil so loose and dry and termite nests became abound everywhere in the garden.

The difference observed in the population densities of the Lepidoptera and Orthoptera, particularly the moths and crickets, is essentially related to the life-cycles. Moth larvae were more available than the adults. Thus, the light-traps collected more larvae suspected to be moths than adult moths. Also, among the butterflies, food availability in terms of attraction to flowers nectar was low as the vegetation was predominantly dry. In the Orthoptera, the mole crickets were not found because the breeding period was delayed due to lack of rain to moisten the soil for the preparation of their burrows.

The daily variations in populations of the different orders are probably indicative of the extent to which climatic and other environmental factors influence their distribution and availability in this area. Wind velocity and humidity may, for instance, influence emergence of the butterflies during the day (Higgins and Riley, 1970).

Also temperature (heat) may have even more adverse affects on their survival and life-history (Cloudsley-Thompson, 1965 and Wigglesworth, 1964), as observed by the many carcasses of the Orthoptera, Coleoptera and Dictyoptera in the garden. These findings are also in accord with Trojan (1958) who noted that the temporary interruption of solar radiation though not significantly affecting temperature results in decreased flight activity.

Observations in the field indicated that in attracting insects by the baits repeatedly to a given location, various predators become habituated to these sites. Thus, it seems likely that the indirect effect of trapping, i.e. causing insects to congregate near the trap sites, where they are vulnerable to predators, may play an important role in suppressing these species.

Light-traps seem to be most effective in collecting any life stage of insects in the field. This is so because many insects at various stages of development are nocturnal in habit. The trap's efficiency is judged here by the diversity and number of insects collected.

The sweepnet is efficient in collecting most insects in flight. This is influenced among other factors by the density of the population of insects involved (Ruesink and Haynes, 1973 and Pruess, Saxena and Kaiuman, 1977). The observation supported their views that the efficiency of sweepnet for catching insects in terms of number decreases as the population of the insects decreases.

The suction method is observed to be most effective for collecting small insects of the Dipteran Order. Simonent, Pienkowsk, Martinez and Blakeslee, 1979, confirmed this when they found that D-vac suction was more effective for small leafhopper adults on alfalfa. The mouth operated suction is observed to be limited in performance by the fact that it cannot be operated for a long time at one location or site without substantially disturbing and scaring the insects. But Trumble, Cartwright, and Kok,(1981) confirmed that the efficiency and reliability of a suction device for assessing Rhinocyllus cenicus populations were less because of the small size of the device.

Barking also provided means of assessing the nature of the habit and habitat of some insects. Barked insects are observed to be of flat streamlined shape capable of manoeavering through crevices in plant barks. The Dermaptera, Reduviidae (Hemiptera) and some Coleoptera are particularly note-worthy.

CHAPTER SIX

SUMMARY

The investigation was carried out at the Botanical Garden of the Department of Biological Sciences, Ahmadu Bello University, Zaria.

Human activities in the garden are high. There are ridges for cultivation of crops as well as frequent cutting and clearing of the vegetation.

Ten methods were designed and employed in sampling the insects of the garden. All of them were found to be valuable in insect population estimation.

However, the light-trap appeared to be most efficient in attracting, trapping and collecting insects. This is probably so because most insects are nocturnal.

The suction method appeared to be the least efficient in sampling insects in the field. This is probably due to the difficulty in its operation.

The richness of the garden in insect population is shown in the number and diversity of insects collected during the period of investigation. Twelves orders, out of twenty-nine in the INSECTA (Youdeowei, 1977) were collected. The Hemiptera, Orthoptera, Isoptera, Lepidoptera, Coleoptera, Hymenoptera and Diptera are particularly note-worthy.

Physical and climatic conditions affecting the types and number of the insect population included the soil type, vegetation cover, rainfall, wind velocity, humidity, temperature and solar radiation.

The investigation was conducted in February, March and April, being the dry season in this part of the country. More work in this area is recommended during the wet season to determine the type of insects in the garden. This will also help to elucidate the effects of the various climatic conditions on the insect population. Finally, this will help to determine the efficiency or otherwise of the various methods employed in collecting insect in the field.

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APPENDIX 1

Records of Weather Reports for the collecting days in February, March and April, 1983 for Zaria Area.

DAYS	RAINFALL mm.	TEMP. % Max.	Min.	WINDRUN Km/day	AV.RH %	SOL.RAD. Cal/Cm^3/min
Feb.2	0.0	27	$16^{26.5}$	204.32	15.0	18.3
" 9	0.0	33	$19^{26.0}$	188.53	7.5	19.5
" 16	0.0	36	$18^{27.0}$	163.35	6.0	23.7
" 23	0.0	23	$19^{21.0}$	216.40	7.5	21.2
Mar.2	0.0	32	$15^{23.5}$	191.09	8.5	21.0
" 9	0.0	30	$16^{23.0}$	264.87	10.0	23.0
" 16	0.0	32	$17^{28.5}$	376.51	12.0	20.9
" 23	0.0	33	$18^{26.0}$	181.15	10.0	21.0
" 30	0.0	31	$22^{26.5}$	204.52	46.0	12.0
Apr.6	0.0	38	$18^{28.0}$	107.87	16.0	23.4
" 13	0.0	35	$20^{22.5}$	182.53	10.0	23.7
" 20	0.0	39	$23^{36.0}$	242.18	10.0	22.8
" 27	0.0	38	$21^{29.5}$	167.33	24.5	22.2

APPENDIX 2

The Distribution of Daily Collections of Insects per order from the Botanical Garden

	ORDERS	FEBRUARY				MARCH					APRIL				TOTAL
		2	9	16	23	2	9	16	23	30	6	13	20	27	
1.	Odonata	1	1	2	-	-	-	2	-	-	-	-	1	1	8
2.	Orthoptera	6	11	4	4	5	4	5	7	2	2	2	1	3	56
3.	Phasmida	-	-	-	1	0	-	-	-	1	-	-	-	-	2
4.	Dermaptera	3	3	-	-	-	-	-	2	-	4	6	-	-	18
5.	Dictyoptera	1	-	5	3	2	2	1	-	3	13	1	6	1	37
6.	Isoptera	35	-	27	32	0	18	-	-	37	16	-	16	20	201
7.	Hemiptera	1	18	1	10	3	11	2	1	4	1	10	14	5	81
8.	Neuroptera	5	5	3	3	-	5	-	7	-	-	-	1	2	31
9.	Lepidoptera	9	12	11	10	11	10	10	4	6	3	5	3	8	102
10.	Hymenoptera	65	57	38	3	16	25	47	59	31	56	21	32	9	459
11.	Coleoptera	10	18	20	12	17	3	4	3	5	8	12	8	11	131
12.	Diptera	9	24	7	20	4	10	16	7	25	10	16	2	8	158
	TOTAL	145	149	118	98	58	87	87	90	114	113	73	84	68	1,284

APPENDIX 3

Families and Number of Species collected

Families	No.of Spp.	Families	No.of Spp.
Danaidae	1	Emesiidae	1
Pieridae	6	Lygaeidae	3
Papihonidae	1	Delphaeidae	1
Satyridae	1	Alydidae	1
Arctiidae	1	Pentatomidae	3
Saturniidae	1	Cicadellidae	2
Brahmeidae	1	Cassidinae	1
Sphingidae	1	Eurybrachidae	1
Aeridiidae	5	Flatidae	1
Pyralidae	1	Coreidae	1
Tetrigidae	1	Myrmeleonidae	2
Gryllidae	1	Chrysopidae	1
Pompilidae	5	Scarabaeidae	3
Apidae	6	Melyridae	1
Formicidae	5	Tenebrionidae	4
Sphecidae	4	Rutelidae	3
Eumenidae	2	Bruchidae	2
Vespidae	4	Chrysomelidae	1
Tiphiidae	1	Nitidalidae	2
Crabronidae	1	Curculionidae	2
Ichneumonidae	1	Carabidae	3
Evaniidae	1	Buprestidae	1
Libellulidae	3	Calliphoridae	2
Chlorocyphidae	1	Culicidae	1
Zygoptera	1	Asilidae	2

Families	No.of Spp.	Families	No.of Spp.
Phasmatidae	1	Tachinidae	2
Forficulidae	2	Milichiidae	1
Mantidae	3	Muscidae	3
Blattidae	2	Syrphidae	3
Termitidae	1	Bombyliidae	2
Reduviidae	9	Cerambycidae	1
Pyrrhocoridae	1		

APPENDIX 4

Identification and classification of insects collected on daily basis.

2 February, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Lipidoptera	Danaidae	Danaus chrysipes	9
	"	Pieridae	Anaphaeis auruta	1
	"	Papilionidae	Graphium pylades	1
	"	Pieridae	Eyrema brigitta	1
	"	"	Eronia loba	1
	Orthoptera	Acrididae	Acrotylus patruelis	2
	"	"	Aiolopus thalassinus	2
	"	"	Catantops axillaris	2
	Hymenoptera	Pompilidae	Hemipepsis vindex	1
	"	Apidae	Megacluta cineta	1
	Odonata	Libellutidae	Wilsoni pinhey	1
	Neuroptera	Myrmeleonidae	Nemaleon sp.	2
Handpick	Coleoptera	Scarabaeidae	Stenddinodes sp.	1
	"	"	Heronychus lucas	3
	"	Melyridae	Melyris abdominalis	1
Pitfall	Coleoptera	Tenebrionidae	Zophosis sp.	2
	"	Scarabaeidae	Heronychus lacas	2
Water-traps	Hymenoptera	Formicidae	Camponotus maculatus	8
	"	"	Camponotus sp.	7
Barking	Dermaptera	Forficulidae	Forficula senegalensis	3
	Hymenoptera	Formicidae	Camponotus sp.	10
Beating	Dictyoptera	Mantidae	Sphedromantis lineola	1
	Hymenoptera	Formicidae	Oecophylla sp. (Weaver Ants)	18

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Baiting	Hymenoptera	Formicididae	Camponotus maculatus	10
	Diptera	Calliphoridae	?	3
Digging	Isoptera	Termitidae	Termites	35
	Hymenoptera	Formicidae	Camponotus sp.	10
Suction	Diptera	Culicidae	Aedes sp.	4
Light-traps	Neuroptera	Chrysopidae	?	3
	Hemiptera	?	Dysdercus superstitiosus	1
	Coleoptera	Rutalidae	Anomala sp.	2
	"	Scarabaeidae	Heronychus licas	1

9 February, 1983

Sweepnets	Lepidoptera	Danaidae	Danaus chrysipes	3
	Orthoptera	Acrididae	Short-horn grasshoppers	10
	Hymenoptera	Sphecidae	Ammophila sp.	1
	"	Pompilidae	Dichragenia sp.	1
	"	Eumenidae	Eurmenas maxillosa	1
	Odanata	Chlorocyphidae	Curta sp.	1
	Diptera	Asilidae	Nidophondus sp.	1
Pitfall-traps	Orthoptera	Tetrigidae	Phloenotus sp.	1
	Coleoptera	Tenebrionidae	Zophosis sp.	2
	"	"	Adesmiini sp.	1
	"	"	Gonocephalum simplex	1
Handpick	Coleoptera	Scarabaeidae	Coenodiilus maurus	2
	Hymenoptera	Formicidae	Messor galla	7

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Water-traps	Hymenoptera	Vespidae	Synagric sp.	1
	"	Formicidae	Campenatus sp.	10
	"	"	Camponatus maculatus	7
	Coleoptera	Meloidae	Coryna chevrolati	1
	Hemiptera	Reduviidae	Raphidosoma sp.	2
Barking	Hemiptera	Reduviidae	Acanthaspis sulcipes	1
	"	"	Reduvinus minutus	1
	"	Pyrrhoeoridae	Scantius clavimanus	3
	Dermaptera	Forficulidae	Forficula senegalensis	3
Beating	Lepidoptera	?	Moth larvae	2
	Hymenoptera	Formicidae	Oecophylla smaraydina	9
Baiting	Diptera	Tachinidae	Caliata sp.	5
	Hymenoptera	Formicidae	Dorylus sp.	8
Digging	Neuroptera	Chrysopidae	Ant-Lion Larvae	5
	Hymenoptera	Formicidae	Camponatus sp.	12
Suction	Diptera	Culicidae	Aedes sp.	2
	"	Milichiidae	Pholeomyia sp.	13
Light-traps	Hemiptera	Emesiidae	Lopodytes sp.	3
	"	Lygaeidae	?	4
	Coleoptera	Rutelidae	Anomala sp.	1
	"	Tenebrionidae	Palorus sp.	2
	"	Scarabaeidae	Heronychus licas	2
	"	Bruchidae	Bruchidius sp.	2
	"	"	Caryedon pallidus	4
	Hemiptera	Delphacidae	Perkinsiella sp.	3

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Light-traps	Lepidoptera	Moths	Moth larvae	5
	Hemiptera	Reduviidae	Lasiosomia sp.	1
	Lepidoptera	?	Ypthima ironia	2
	Diptera	Muscidae	Lesserflies	2
16 February, 1983				
Sweepnet	Hymenoptera	Apidae	Xylocopa sp.	2
	"	"	Xylocapa insconstans	1
	"	Sphecidae	Sceliphron spirifex	1
	"	Eumenidae	Eumenes maxillosus	2
	"	Apidae	Thyreus sp.	1
	"	Vespidae	Polistis fastidiosus	1
	Odonata	Zygoptera	Pseudagrion glaucescens	2
	Orthoptera	Acrididae	Short-horn grasshoppers	2
	Lepidoptera	Danaidae	Danaus chrysippes	1
	"	Pieridae	Belenois calypso	1
Hand-pick	Coleoptera	Rutelidae	Anomala sp.	2
	"	Tenebrionidae	Gonocephalum simplex	1
	"	"	Zophosis sp.	?
Pitfall-traps	Dictyoptera	Blattidae	Nynph (periplaneta sp.)	1
	Coleoptera	Tenebrionidae	Gonocephalum simplex	3
	"	"	Curimosphena epitragioides	1
	Hymenoptera	Formicidae	Camponatus sp.	6
Water-traps	Diptera	Syrphidae	Allograpta aegyptrum	4
	Hymenoptera	Sphecidae	Pison carinatum	4
	Orthoptera	Acridadae	Scalata sp.	1

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Barking	Dictyoptera	Blattidae	Nymphs (*periplaneta* sp.)	4
	Coleoptera	Tenebrionidae	*Gonocephalum simplex*	3
	"	Scarabaeidae	*Stenodinodes* sp.	1
Beating	Hemiptera	Alydidae	*Stenocoris elegans*	1
	Hymenoptera	Formicidae	*Oecophylla smaragdina*	11
Bait-traps	Hymenoptera	Apidae	*Apis mellifera*	1
	"	Formicidae	*Camponotus* sp.	3
Digging	Isoptera	Termitidae	Workers	27
	Hymenoptera	Formicidae	*Camponotus* sp.	5
Suction	Diptera	Culicidae	*Aedes* sp.	3
Light-traps	Lepidoptera	Arctiidae	*Utetheisa pulchella*	1
	"	?	Moths	5
	"	?	Moth Larvae	3
	Orthoptera	Gryllidae	*Gryllopsis* sp.	1
	Neuroptera	Chrysopidae	?	3
	Coleoptera	Scarabaeidae	*Heronychus licas*	3
	"	"	*Adoretus* sp.	2
	Hemiptera	Reduviidae	*R. Funcatum*	2

23 February, 1983

Sweepnet	Lepidoptera	Danaidae	*Danuas chrysippes*	1
	Diptera	Bombyliidae	*Petrorossia phthinoxantha*	1
	Hemiptera	Reduviidae	*Raphidosoma funcatum*	2
	Hymenoptera	Apidae	*Xylocopa* sp,	1
	Orthopera	Acrididae	Short-horn Grasshoppers	2
Handpick	Coleoptera	Tenebrionidae	*Gonocephalum simplex*	1
	"	Scarabaeidae	*Heronychus licas*	1
	Hemiptera	Pentatomidae	*Glypus crubescens*	1

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Pitfall-traps	Coleoptera	Tenebrionidae	Gonocephalum simplex	1
	"	Scarabaeidae	Stenodinodes sp.	5
	Orthoptera	Acrididae	?	2
Water-traps	Diptera	Syrphidae	Allograpta aegyptrum	2
	Hymenoptera	Sphecidae	Pison carinatum	1
	"	Vespidae	Polistes spilophorus	1
Barking	Dictyoptera	Blattidae	Nymph(Periplaneta sp.)	1
	"	"	Periplaneta sp.	2
	Coleoptera	Scarabaeidae	Stenodinodes sp.	2
	Hemiptera	Cassidinae	Aspidomorpha quinque-fasciatum	1
	"	Carambycidae	Exocentrus sp.	1
Beating	Hemiptera	Reduriidae	Raphidosoma funcatum	1
	"	"	Raphidosoma sp.	2
	"	Cicadellidae	Hecalus sp.	1
	Phasmida	Phasmatidae	Ramulus sp.	1
Bait-traps	-	-	-	-
Digging	Isoptera	Termitidae	Workers	32
	Neuroptera	Chrysopidae	Ant-lion Larvae	3
Suction	Diptera	Milichiidae	Pholeomyia sp.	13
	"	Culicidae	Aedes sp.	4
Light-traps	Lepidoptera	Arctiidae	Utetheisis pulchelta	1
	"	?	Moths	8
	Hemiptera	Cicadellidae	Hecalus sp.	2
	"	Reduviidae	R. Funcatum	1

2 March, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Lepidoptera	Danaide	Danaus chrysippus	1
	"	Pieridae	Belonois calypso	2
	"	"	Colotis danae	1
	"	"	Hamanunida daedilus	1
	Hymenoptera	Apidae	Xylocopa sp.	1
	Diptera	Syrphidae	Mesembrus sp.	1
	Orthoptera	Acrididae	Short-horn grasshoppers	5
Handpick	Coleoptera	Tenebrionidae	Gonocephalum simplex	1
Pitfall-traps	Coleoptera	Tenebrionidae	Zophosis sp.	6
	Dictyoptera	Blattidae	Nymph(Periplaneta sp.)	1
	Hemiptera	Pentatomidae	Euryaspsis sp.	1
Water-traps	Diptera	Syrphidae	Allograpta aegyptrum	2
	"	Bombyliidae	?	1
	Hymenoptera	Pompilidae	Homonotus sp.	1
Barking	Coleoptera	Chrysomelidae	Hattica sp.	3
	"	Nitidalidae	Carpophilus sp.	3
	Hemiptera	Pantatomidae	Eysarcoiris sp.	2
Beating	Dictyoptera	Manttidae	Miomantis sp.	1
	Hymenoptera	Formicidae	Oecophylla sp.	6
Bait-traps	Hymenoptera	Formicidae	Camponatus sp.	8
Digging	-	-	-	-
Suction	-	-	-	-
Light-traps	Coleoptera	Curculionidae	Sitophilus sp.	4
	Lepidoptera	Brahmeidae	Moths	6.

9 March, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Lepidoptera	Danaidae	Danaus chrysippus	4
	"	Pieridae	Belonis calypso	1
	Orthoptera	Acrididae	Short-horn grasshoppers	4
	Hymenoptera	Pompilidae	Pseudogenia sp.	1
Handpick	Hemiptera	Cessidinae	Aspidomorphia quinque-fasciata	1
Pitfall-traps	Coleoptera	Tenebrionidae	Gonocephalum simplex	1
	"	"	Zophosis sp.	1
	"	Carabidae	Drachaetochilus vagans	1
Water-traps	Diptera	Bombyllidae	?	3
Beating	-	-	-	-
Bait-traps	Hemiptera	Pentatomidae	Agonoscelis sp.	2
	Hymenoptera	Formicidae	Camponotus sp.	12
Barking	Hemiptera	Reduviidae	Ectonocoris crucigar	1
	"	"	Parates ochropus	1
	"	"	?	2
	Dictyoptera	Blattidae	Periplanata sp.(Nymph)	1
Digging	Isoptera	Termitidae	Workers	18
	Hymenoptera	Famicidae	Camponotus sp.	12
	Neuroptera	Chrysopidae	Nymphs (Larvae)	5
Suction	Diptera	Milichiidae	Pholeomyia sp.	7
Light-traps	Lepidoptera	?	Moths	3
	Hemiptera	Delphacidae	Perkinsiella sp.	4
	Lepidoptera	?	Moth Larvae	2

16 March, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Lepidoptera	Danaidae	Danaus chrysippus	2
	"	Sytyridae	Precis sophia	1
	Orthoptera	Acrididae	Grasshoppers	5
	Odonata	Zygoptera	Bendagrion glaucescens	2
	Hymenoptera	Tiphiidae	Elis sp.	1
Handpick	Hymenoptera	Formicidae	Decophylla sp. (Weaver Ants)	24
Pitfall-traps	Coleoptera	Tenebrionidae	Adesmia variolaris	1
	"	Carabidae	Dichaetochitus vagons	1
	"	Scarabaeida	Metacatharsius sp.	1
Water-traps	Hymenoptera	Crabronidae	Oxybelus sp.	1
	"	Sphecidae	Ammophila tenuis	1
	"	Apidae	Apis melifera	2
	"	"	Halictus sp.	1
Barking	Dictyoptera	Blattidae	Periplaneta sp.(Nymph)	1
	Hemiptera	Pentatomidae	Agonoscelis sp.	1
	"	Cassidinae	Aspidomorphia quinquie-fasciata	1
	Coleoptera	Buprestidae	Chrysobathris Wilkinsoni	1
Beating	-	-	-	-
Bait-traps	Lepidoptera	Pieridae	Colotis evippe	2
	Hymenoptera	Apidae	Apis meliferra	2
	Diptera	Calliphoridae	?	12
Digging	Hymenoptera	Famicidae	Camponotus sp.	3
	"	"	Camponotus maculatus	12
Suction	Diptera	Milichiidae	Pholeomyia sp.	4
Light-traps	Lepidoptera	?	Moth Larvae	2
	"	Sphingidae	Moths	3

23 March, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Lepidoptera	Danaidae	Danaus chrysippus	3
	Orthoptera	Acrididae	Grasshoppers	7
	Lepidoptera	Pieridae	Anaphaeis sp.	1
	Hemiptera	Reduviidae	R. funcatum	1
	Diptera	Asilidae	Neolophonatus sp.	1
	"	Bombyliidae	?	1
	Hymenoptera	Vespidae	Tricarinodynerus sp.	1
Handpick	-	-	-	-
Pitfall-traps	Hymenoptera	Formicidae	Camponatus sp.	14
	"	"	Messor galla	13
Water-traps	Hymenoptera	Sphecidae	Bembecinus sp.	3
	"	"	Annophila sp.	1
	"	"	Trigona sp.	1
Barking	Diptera	Forficulidae	Forficula senegalensis	2
	Coleoptera	Chrysomelidae	Haltica sp.	3
Beating	Hymenoptera	Formicidae	Occophylla sp.	26
Baiting	-	-	-	-
Digging	Neuroptera	Chrysopidae	Larvae (Ant-lions)	7
Suction	Diptera	Milichiidae	Pholeomyia sp.	5
Light-traps	-	-	-	-

30 March, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Lepidoptera	Pieridae	Colotis vesfa	1
	Hymenoptera	Sphecidae	Sceliphron spirifex	3
	"	"	Belonogaster sp.	1
	"	Apidae	Thyreus sp.	1
	"	Pompilidae	Batozonellus sp.	1
	Diptera	Asilidae	Podagricus sp.	3
Handpick	Coleoptera	Rutelinae	Anomala sp.	2
	"	"	Adoretus sp.	1
	Hemiptera	Reduviidae	Reaphidosoma sp.	1
	Phasmida	Phasmatidae	Ramulus sp.	1
Pitfall-traps	Coleoptera	Carabidae	Dichaetochilus vagans	1
	Dictyoptera	Blattidae	Periplaneta sp.(Nymph)	1
	Orthoptera	Gryllidae	Gryllopsis sp.	1
	Hemiptera	Reduviidae	Lopodytes sp.	1
	Orthoptera	Acrididae	Scalata sp.	1
Water-traps	Hymenoptera	Sphecidae	Ammophila sp.	1
Barking	Dictyoptera	Blattidae	Nymph (Periplaneta sp.)	2
	Hemiptera	Lygaeidae	Dieuches sp.	1
Beating	-	-	-	-
Bait-traps	Diptera	Calliphoridae	Chloropyga sp.	7
	"	"	Schoemani sp.	5
Digging	Hymenoptera	Formicidae	Camponatus sp.	23
	Isoptera	Termitidae	Workers	37
Suction	Diptera	Culicidae	Aedes sp.	2
	"	Milichiidae	Pholeomyia sp.	6
Light-traps	Coleoptera	Retulinae	Anomala sp.	1
	Hymenoptera	Formicidae	Dorylus sp.	1
	Hemiptera	Reduviidae	Lopodytes sp.	1
	Diptera	Calliphoridae	?	2
	Lepidoptera	?	Moths	3
	Lepidoptera	Saturniidae	Pseudobunaea metaii	2

6 April, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Hymenoptera	Apidae	Xylocopa sp.	1
	"	"	Thyreus sp.	1
	"	Pompilidae	Didiragenia sp.	1
	"	Eumenidae	Delta occidentale	1
	Diptera	Asilidae	Epiblepharis sp.	1
Handpick	Hymenoptera	Formicidae	Pheidole sp.	10
	Coleoptera	Rutelinae	Anomala sp.	2
	"	Scarabaeidae	Heronychus licas	1
Pitfall-traps	Dictyoptera	Blattidae	Periplaneta sp.(Nymph)	2
	"	"	Periplaneta sp.(Adults)	2
	Coleoptera	Tenebrionidae	Gonocephalum simplix	2
Water-traps	Hymenoptera	Apidae	Apis mellifera	2
	"	Pompilidae	Hormopogonius sp.	2
	"	Vespidae	Antodynerus bellatulus	1
	Diptera	Calliphoridae	Chrysomyia albiceps	1
Barking	Coleoptera	Chrysomalidae	Hattica sp.	1
	Dictyoptera	Blattidae	Periplaneta sp.(Nymph)	3
	Dermaptera	Forficulidae	Hypurgus poecilocaus	4
Beating	Hymenoptera	Formicidae	Oecophylla sp.	26
Bait-traps	Dictyoptera	Blattidae	Periplaneta sp.(Adults)	4
	"	"	Periplaneta sp.(Nymphs)	2
Digging	Isoptera	?	Termites (workers)	16
	Hymenoptera	Formicidae	Camponatus sp.	11
Suction	Diptera	Milichiidae	Pholeomyia sp.	8
Light-traps	Orthoptera	Gryllidae	Gryllopsis sp.	2
	Hemiptera	Eurybrachidae	Paropioxys sp.	1
	Lepidoptera	?	Moths	3
	Coleoptera	Bruchiidae	Callosobruchus sp.	2

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Diptera	Asilidae	Epiblepharis sp.	2
	Hymenoptera	Siphecidae	Ammophida tenius	2
	Hemiptera	Cicadellidae	Loba limbaticollis	1
Handpick	Hemiptera	Lygaeidae	Balchuthambila	1
	"	Flatidae	Flatoides sp.	1
	Coleoptera	Rutelinae	Anomala sp.	1
	Hemiptera	Reduviidae	Lopodytes.sp.	1
Pitfall-traps	Orthoptera	Acrididae	Scalata sp.	1
	Coleoptera	Tenebrionidae	Gonocephalum simplex	3
Barking	Hemiptera	Reduviidae	Ectomocoris crucifer	1.
	"	Lygaeidae	Dieuches sp.	3
	Orthoptera	Gryllidae	Gryllopsis sp.	1
	Dictyoptera	Blattidae	Periplaneta sp.	1
	Coleoptera	Chrysomelidae	Haltica sp.	6
	Dermaptera	Forficulidae	Hypurgus poecilocerus	3
	"	"	Forficular senegalensis	3
Water-traps	Diptera	Calliphoridae	Sarcophaga sp.	5
	Hymenoptera	Ichneumonidae	Stenarella sp.	1
	"	Evaniidae	Gasteruption sp.	1
Beating	Hymenoptera	Formicidae	Oecophylla sp. (Weaver Ants)	17
Bait-traps	Diptera	Calliphoridae	?	8
Digging	-	-	-	-
Suction	-	-	-	-
Light-traps	Coleoptera	Scarabaeidae	Anomala sp.	2
	Lepidoptera	?	Moths	5
	Hemiptera	Reduviidae	Lopodytes sp.	2

20 April, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Hymenoptera	Apidae	Xylocapa inconstans	2
	"	Sphecidae	Sceliphron spirifex	1
	Odonata	Libellulidae	Polleni unitata	1
	Neuroptera	Myrmeleonidae	Morter obscurus	1
	Hemiptera	Reduviidae	Lopodytes sp.	6
Handpick	Coleoptera	Tenebrionidae	Zophosus sp.	1
	Hymenoptera	Formicidae	Camponatus sp.	5
Pitfall-traps	Dyctyoptera	Blattidae	Periplaneta sp.(Nymph)	2
	"	"	Periplaneta sp.(Adults)	2
	Coleoptera	Tenebrionidae	Zophosis sp.	1
	"	"	Alphitobius laevigatus	3
Water-traps	-	-	-	-
Barking	Dictyoptera	Blattidae	Periplaneta sp.	1
	Orthoptera	Gryllidae	Gryllopsis sp.	1
	Coleoptera	Curculionidae	Neodeonus sp.	1
	"	Tenebrionidae	Mesomorphus setosus	1
Beating	Hemiptera	Reduviidae	Lopodytes sp.	6
Bait-traps	Hymenoptera	Formicidae	Doryhis sp.	5
	"	"	Camponotus sp.	11
Digging	Isoptera	?	Termites (workers)	16
	Hymenoptera	Formicidae	Camponotus sp.	8
Suction	-	-	-	-
Light-traps	Hymeptera	Reduviidae	Lopodytes sp.	2
	Lepidoptera	Pyralidae	Moths	3
	Coleoptera	Tenebrionidae	Hoplonyx sp.	1
	Diptera	Calliphoridae	Chrysomyia sp.	2
	Dictyoptera	Manttidae	Mantis religiosa (Nymph)	1

27 April, 1983

METHODS	ORDERS	FAMILIES	SPECIES	NO.
Sweepnet	Hymenoptera	Sphecidae	Sceliphron Spirifex	1
	"	Eumenidae	Eumenes maxillosus	1
	"	Sphecidae	Annophita sp.	1
	Orthoptera	Acrididae	Short-horn grasshoppers	2
	Odonata	Libellulidae	Coronata flavifrons	1
Handpick	Coleoptera	Scarabaeidae	Trochalus crampelena	1
	"	"	Anomala sp.	1
	"	Chrysomelidae	Puchytoma sp.	1
	"	Scarabaeidae	Coenochilus ventricosus	1
	"	"	Pachnoda cordata	2
	Dictyoptera	Mantidae	Entella sp.	1
	Hemiptera	Coreidae	Cletus notatus	1
Pitfall-traps	Coleoptera	Tenebrionidae	Goneceph alum simplex	3
	"	"	Derosphaerus sp.	1
Water-traps	-	-	-	-
Barking	Hemiptera	Reduviidae	Ectomocoris cruciger	1
	"	Lygaeidae	Lygaeus rivularis	1
	"	"	Distadieches sp.	1
	Coleoptera	Tenebrionidae	Mesomorphus sectosus	1
	Orthoptera	Gryllidae	Gryllopsis sp.	1
Beating	Hymenoptera	Formicidae	Camponotus maculatus	4
Bait-traps	Hymenoptera	Apidae	Apis mellifera	2
	Diptera	Calliphoridae	Chrysomyia albiceps	2
	"	"	Sarcophaga fibialis	2
	"	Muscidae	Lispe afra	4