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INAUGURAL LECTURE

"CONSIDER THE WAYS OF 'ANTS' AND BE WISE"

By

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My dear Students,
Ladies and Gentlemen,

Preamble

I give all glory and adoration to Almighty God who has kept, led, informed and enabled me to stand before this distinguished audience this day to deliver the 169th inaugural lecture of this great University, thirty-six years after my admission into this University as an undergraduate

student, twenty-seven years after my appointment as an Assistant Lecturer and five years after my appointment as a Professor in the same University.

Mr. Vice-Chancellor Sir, I so much appreciate this pinnacle privilege you have granted me because I am a true bred product of this great University having put in 36 years of continuous residency, including NYSC. Therefore I see myself today as representing an undiluted University of Ilorin product out to showcase the quality of our great University.

This inaugural lecture titled "CONSIDER THE WAYS OF 'ANTS' AND BE WISE" is the 6th from the Zoology unit of Biological Sciences, the 3rd from the Faculty of Life Sciences and 1st on Entomology, i.e. study of insects, in the Science Faculty.

I became a Zoologist by the prompting and encouragement of the Late Professor V. L. A. Yoloye, a mentor of inestimable value and wonderful teacher who met me for the first time and picked interest in me after the release of Harmattan Semester examination results of ZLY 201: Invertebrate Zoology. He insisted I was going to be a Zoologist against my wish, as I wanted to be a Medical Doctor. He subsequently pursued his wish vigorously by convincing, nurturing and encouraging me to the point of fruition. .I wish he was here to see his little boy 'crowing' today; May his gentle and kind soul continue to rest in perfect peace – Amen.

Introduction

Insects, i.e. the six legged animals, are the most abundant and diverse group of organisms. They constitute more than 75% of all animal species described with about

26 orders and 1.3 million species. Thus, the total number of insect types described is triple the total number of plant species, six times the total number of other invertebrates and fifteen times the total number of vertebrates described (Wilson, 1992). Indeed for every human individual on earth, there are about 200 million insects at a point in time (Sanways, 2005) and this ratio has continued to increase.

Human life is beset with inevitable associations with insects that have over the years influenced human destiny positively and negatively. Unfortunately, the negative influences, such as disease transmission, crop losses, food spoilage, economic losses and nuisance value caused by less than 5% of insect species, have been exaggerated by man. The more extensive positive influences of insects which include pollination of flowers, waste recycling, ecosystem sustenance activities, use as source of silk, shellac, cochineal, therapeutic agents, aesthetics, biological control agents and food source are however unappreciated and down-played.

Insects, by virtue of their dominance and abundance in the biosphere, have remained the centre of most of the interactions sustaining the biospheric ecosystem. All living organisms, including man, have numerous direct or indirect interactive relationships with insects. Hence, human beings are highly conscious of insects and concerned about their associations, especially the harmful and predominant ones. No wonder, naturalists and entomologists alike are familiar with insects.

Insects, being the most abundant, dominant, diverse, ubiquitous, assertive, prolific and industrious living creature, remain the most successful and influential group of organisms in the biosphere. These facts, in contemporary

times, are glaring, not open for debate and must have informed the biblical directive by King Solomon to the sluggard in Proverbs 6: 6: "**Go to the ant, thou sluggard; consider her ways, and be wise**" (KJV) and indeed has informed today's lecture, titled "CONSIDER THE WAYS OF 'ANTS' AND BE WISE".

The word 'ants' is used to describe a group of tiny relatively inconspicuous insects that bite. It is derived from the Middle English word "*ante"* whose original meaning is "the biter". 'Ants' are insects in the order Hymenoptera with biting property. They frequently exist as social group, comprising of numerous coexisting individuals with defined castes and each caste saddled with a unique functions, i.e. division of labour for the improved efficiency of the whole group.

The world of ants shares a lot of similarity with that of humans. Both comprise numerous individuals co-existing in the same environment with each entity saddled with daily survival tasks to be accomplished within the confines of the habitat. Some of these tasks include searching for food, mate and security. The ant world, however, is more organised and sustainable owing to their sociable attributes and industrious posture. Unlike humans, ants work independently, peacefully and diligently without supervision. They work harder than humans considering the burden of the load carried by their miniature size. More importantly, in contrast to the human world, ants have foresight that anticipates trouble season; thus they work collectively to secure an unknown future. Man therefore has a lot to learn from ants to get wise. In the context of this lecture therefore, 'ants' and 'insects' shall be used as synonym, and I will be sharing with you my modest

findings after considering the ways of some 'ants' to make us wise.

Mr Vice-Chancellor Sir, in the course of my thirty years sojourn as a doctoral student and subsequently a lecturer in this University, I have painstakingly considered several 'ants' by way of active research activities, but I will concentrate on three of these 'ants', namely: i) *'Mọ́nímọ́ní'*, ii) mosquitoes and iii) honey bees. My mission today is therefore quite tedious, as I must at the end of this lecture improve our collective wisdom and resolves to do things better using the ant's experience. This I intend to achieve by sharing my FINDINGS and twelve LESSONS I learnt with this distinguished audience and to do, this your rapt attention is required.

i. Mọ́nímọ́ní

'Mọ́nímọ́ní' is generally known by this name but various dialects have different local names for it. For example: "*Kaanni*" (Yoruba), "*suzza Mọ́nímọ́ní"* or "*suzza kadenyan*" (Hausa) and Awịgu (Igbo). The Nupes call it '*manni'* or '*Mọ́nímọ́ní*, It is particularly very prominent amongst the Yoruba and Nupe of Kwara and Niger States. Fasoranti and Ajiboye (1993) described it as an important and marketable food insect resource, as it features as an item of commerce in markets (Plate 1).

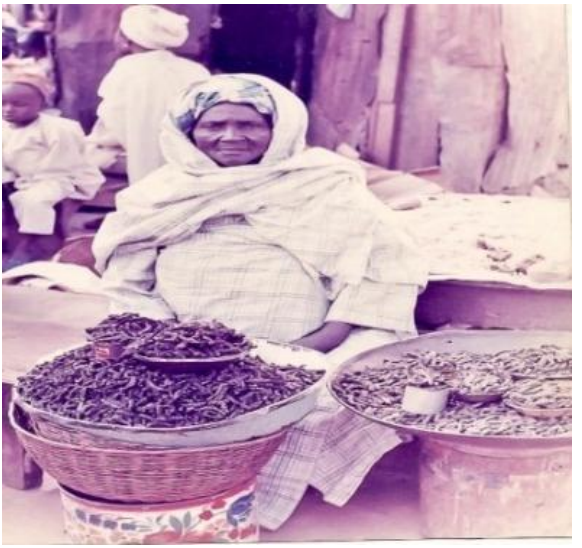


Plate 1: *'Mọ́nímọ́ní' on sale at Idi Ape market Ilorin*

About three decades ago, at a departmental postgraduate seminar, the same insect was referenced by a friend and senior colleague, Dr Zubair Folorunsho Erubu as 'caterpillar' or '*Mọ́nímọ́ní'*, as the scientific identity of the insect was obscure. This conspicuous and profound information gap aroused my curiosity as a doctoral student of the same Department interested in the physiology of another 'ant', i.e. grasshopper (*Zonocerus variegatus)*.. I therefore decided to commit some of my research time to unraveling the scientific name of '*Mọ́nímọ́ní'*.

Mọ́nímọ́ní is particularly well known to the elderly folks in the Nigerian society but there were quite a number of conflicting information on its biology and indeed its developmental stages, including the adult stage that is required for the recovery of a scientific name. This

revelation spurred me, at that point in time, to believe that *Mọ̀nímọ̀ní* may not have a scientific name after all; I thought that I could be on the verge of becoming a renowned Zoologist, like the late Professor Afolabi Toye, the 3rd Vice Chancellor of this University who had an animal named after him.

Mr Vice-Chancellor Sir, that we may consider the ways of '*Mọ̀nímọ̀ní*' and be wise, I initiated a full study directed at updating the public knowledge with valid information on the grey areas of the biology of *Mọ̀nímọ̀ní*' using laboratory and field experimental guides under the able supervision and encouragement of an erudite entomologist, Prof J. O. Fasoranti.

The search for living specimen of *Mọ̀nímọ̀ní* began in 1987. At that time, I was a complete novice who had neither set eyes on the living or dead sample nor tasted it. I was only able to find *Mọ̀nímọ̀ní*; a largely misconceived insect that some describe as a spirit that comes into season arbitrarily and its advent portends good luck for the community that has it, the subsequent season, when new consignment of processed form was supplied from Niger State. During the waiting period, questionnaire based studies directed at confirming the level of public awareness and understanding of *Mọ̀nímọ̀ní* amidst Nigerians revealed that more than 80% of the elderly and less than 36% of the young respondents knew or have or utilized *Mọ̀nímọ̀ní* as food. However, 63.4% of these respondents were unable to correctly identify its host food plant and 72.2% unable to describe what becomes of the caterpillar. These findings confirmed that the public, particularly the elderly, were quite aware of *Mọ̀nímọ̀ní* and its seasonality but a dearth of knowledge exists regarding its biology. This was despite

the fact that Yoruba language has several terms and even songs that describe the resultant burrowing activity of the caterpillar. For example the appellation "*Kàànì wọlẹ̀*", means "burrowing kànnì"; the phrase "*kànì wọlẹ̀ tọmútọmú*" ("ọmú" being the prolegs) describe its burrowing activity as wholesome, and a tune translated below:

Mọ̀nímọ̀ní wọlẹ̀ lọ	'Manimani' burrows into the ground
Wọ́n ní kó má wọlẹ̀ lọ	People pleaded it should not
Ó káwọ́ lórí ò n sunkún	It started shedding mournful tears
O lóun ó dá burú	It threatened to cause havoc
Wọ́n ni kó má da burú	People pleaded it should not cause havoc
Ó kawọ́ lórí ó n sunkún	It became more aggrieved and shed more tears

Consideration of the ways of *Mọ̀nímọ̀ní* to unravel its biology began in earnest in 1989 when an intimidating population of *Mọ̀nímọ̀ní* was encountered by chance between kilometre 107 and 108 along Mokwa-Bida highway. The spot was contiguous to Wuya Kanti settlement, Lavun LGA, Niger state. It was confirmed to be *Mọ̀nímọ̀ní* by a fellow elderly female Nupe commuter, sample was collected, transported to Ilorin and reared on cut twigs of sheabutter plants in the laboratory and on the field in restricted screen cages, located in a remote bush that now houses the administrative building and the Vice-Chancellor and other principal officers' car park. The *Mọ̀nímọ̀ní* was monitored closely for resulting developmental stages; and a detailed description of each stage as it showed up, life history and cycle, behaviour and habits were undertaken. The series of experiments ran for two seasons and quite a number of staggering revelations were made. These include:

i. **Life cycle**: *Mọ̀nímọ̀ní* is a holometabolous (insect with complete metamorphosis) lepidopteran (moth) with four distinct developmental stages, i.e. caterpillar or larva

with five or six instars, pupa and adult or imago moth and egg (Ande and Fasoranti, 1995;1996).

ii. **Naming Ceremony**: On the 29th of January, 1990 precisely 30 months after the investigation started, came the first and only identification report of the numerous requisitions sent out. The prolonged moments of subtle anxiety and hopeful suspense, wishing that the insect had not been named was sadly truncated. The report came from CAB International Institute of Entomology, British Museum of Natural History. It identified *Mọ̀nímọ̀ní* to be ***Cirina forda*** Westwood (Lepidoptera: Saturniidae). The *Cirina forda* sample in the museum was picked from Nigeria and kept in the British Museum by a Briton, Mr Golding in 1929. Unfortunately this important information was not available to Nigerian Entomologists and we can derive a pertinent lesson thereof:

LESSON 1: As Africans and indeed Nigerian Biologists and Naturalists, it is an unpardonable disservice to be oblivious of the identity and record of our animals, only to fall back on our colonial masters 50 years after independence. At the very least and as a matter of urgency we need to establish a Nigerian museum that correctly identifies and stock Nigerian insects. Biologists should also note that strange specimens should never be assumed to be new until after confirming with international museums.

iii. External Morphology: The descriptive morphological details of each of the developmental stages, i.e. egg,

larva (caterpillar), pupa and imago of *Cirina forda* are as summarized below:

Egg: Oval, longer (X = 1.68 ±0.07mm, n = 50) than broad (X = 1.38 ± 0.04 mm, n = 50) with a white to whitish grey hard and shiny, unsculptured chorion and average weight of 0.0013 ± 0.0002g/egg (n = 50). A dark spot of different shapes may occur on each egg and when it does, it occurs on every egg in the clutch (Plate 2).

Plate 2: *C. forda* egg mass

Larva: Eruciform with prominently sclerotised head and anal plate, highly setaceous body with a thorax bearing three pairs of true legs and a ten segmented abdomen carrying a pair of prominent prolegs ventrally on A_3, A_4, A_5, A_6 A_{10} and a pair of spiracular openings each on A_1 to A_8. *C. forda* has five readily distinguishable instar stages and

occasionally a six instar that is not readily distinguishable (Ande and Fasoranti, 1995). As expected the instars differ conspicuously in terms of body dimension, weights and colour outlay as shown in Plates 3 to 8. Generally the prominent yellow body colour gave way to black while the head capsule went from brown to black with age.

Plate 3: First Instar larva of *C. forda*

Plate 4: Second Instar Larva *C. Forda*

Plate 5: Third Instar Larva *C. forda*

Plate 6: Fourth Instar larva of *C. forda*

Plate 7: Fifth Instar Larva *C. forda*

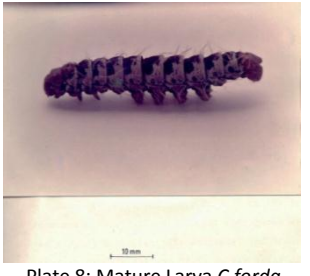
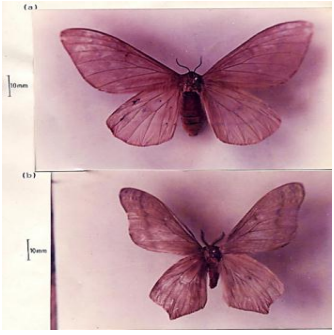


Plate 8: Mature Larva *C.forda*

For taxonomic reasons in-depth morphological descriptions and chaetotaxy, i.e. the description of the seatae on the head and body of the first and the mature larvae were undertaken and reported (Ande and Fasoranti, 1996). To enhance precise recognition of the edible mature larva of *C. forda* (Plate 8*)* and avoid numerous cases of poisoning occasioned by wrong identity, a detailed descriptive expression of the fifth instar was undertaken; again these were summarised lucidly with free hand, labeled zoological drawings of the various views of the general externals and reported in Ande and Fasoranti (1996)

Pupa: Obtectae, adecticous, highly scelerotised, smooth bodied, brownish black with a stout profile (Plate 9) and mean total body length of 31.38 ± 3.17 mm (n = 60). It is however sexually dimorphic with females recording significant (P >0.05) higher total body lengths, body widths, body heights and weights. The general body structural outlay were illustrated lucidly and reported in Ande and Fasoranti (1996).

Plate 9: Three *C. forda* pupae



Plates 10 Mounted adults of *C. forda* (a) female (b) male

Adults: Mr. Vice-Chancellor Sir, getting the imago developmental stage that was the most sought after for

taxonomic reasons was ridden with anxious moments expecting the unknown with daily surveillance and subtle prayers. Alas the 'child was born' after 9 months when all hopes were almost lost and the news heralding the arrival of an elusive and evasive spiritual being went round the Department of Biological Sciences. The imago is a large, bisexual, shiny light brown to rusty brown single colored moth (Plates 10 a & b). The moths are sexually dimorphic with females recording significant ($P > 0.05$) higher total body length, body width, body height and weight. The lucid free hand zoological drawings of the gross structure as well as all appendages were also published in the same paper, i.e. Ande and Fasoranti (1996)

Mr. Vice Chancellor Sir, the very incisive descriptive zoological details of the external morphology of each of the developmental stages of *Cirina forda* was done for the very first time, primarily to enhance unequivocal identification and nomenclature and secondarily to fill the gap of information and ease its recognition by would be consumers. For these reasons all the information were reported in a single paper titled "Description of the life stages of *Cirina forda* Westwood (Lepidoptera: Saturniidae)" and was published in Nigerian Journal of Entomology, a publication of the Entomological Society of Nigeria. This to me was the most appropriate thing to do and the most plausible outlet for the Nigerian society to benefit maximally from an indigenous item. Unfortunately the same paper, despite the volume of information and the far reaching fundamental findings in it, is today assessed as a national publication and rated lower than less incisive and informing articles published outside the shores of Nigeria where the organism may not be known. I therefore do not

agree less with one of my supervisors and a notable scholar of repute who opined that it is absolutely absurd and academically primitive to judge a scientific publication by where it was published rather than by the quality, merit and beneficial values of its contents (Edungbola, Pers. Comm.). Two pronged lessons can readily be picked from this experience and these are:

LESSON 2: *The first likely lesson is for the researchers to opt for publishing same quantum of information in numerous papers outside the shores of the country. This will satisfy the theory of numbers that is currently reigning in our great citadel of knowledge. This option is personal, selfish and lazy. It also does not enable an inbuilt mechanism of researching our products and releasing same information through journal media we established for the same purpose: thereby discouraging the growth, development and relevance of our publishing outlets.*
The second lesson, which an 'ant' would have proffered, is for the researcher to remain resolute and publish the rich pertinent information in scientific journal publications within the country and consequently promote the referencing of indigenous scientific journal outlets. For this to be the case, institutions within the country, including our own, should stop rating our publishing outlets low, rather we should fall back to the correct mode of validating intellectual contributions of each paper by experts.

iv. Life-cycle, History and Period of Occurrence

C. forda is univoltine, i.e. occurs once in a year (Ande and Fasoranti, 1997a). Fertile eggs laid in May hatches after an incubation period of 30 – 34 days (X =31.8 ± 2.1 days; n = 50) into an active and voraciously feeding larval stage lasting between 42 and 50 days (June/August). The mature larva burrows into the soil in August/September to transform to a prepupa that lasts 6 – 7 days after which it metamorphoses into pupa that remains subterranean for nine months (261 - 296 days; X = 267.5 ± 21.5days), i.e. August to May/June the subsequent year the next year. Adults emerge subsequently and live for a maximum of only 72 hours. A few adults emerge by February/March but never survived. Majority of the adults emerges from the soil in May/June, lay eggs within 72 hours and die. The rather short life span of *C. forda* adult, i.e. Less than 3 days in a year, is strange but very pleasing to the insect and it is one of the major reasons for the relative inconspicuous nature of the insect.

***C. forda* Habits and Behaviors**

Feeding: The only developmental stage of *C. forda* that feeds is the larval stage and their sole host plant is the sheabutter tree, *Vitellaria paradoxa*; the only savannah species of the family Sapotaceae in Nigeria. Being a deciduous plant, the host plant sheds its leaves by November and new leaves begin to sprout by February (Keay, *et al*, 1964). A high synchrony exist between the periods of occurrence of *C. forda* larval and *V. paradoxa* foliage and this could be responsible the univoltine nature of *C. forda*. Golding (1929) described *C. forda* as a severe pest of *V. paradoxa,* but its pest action is more tolerable to

man, as it indirectly offers dietary use for *V. paradoxa* foliage.

C. forda young larva is unable to initiate feeding individually and they do not feed on the leaf veins further confirming lack of strength. Older larvae (third to sixth instars) are more powerful and capable of consuming veins and solitarious feeding activity, hence could independently search for foliage. Due to the gregarious habit of *C. forda* larvae, sheabutter plant defoliation are frequently total. Larval maturity and readiness to pupate are depicted by feeding cessation and descend from host plant canopy.

Growth

The larval stage of *C. forda* is the only growing developmental stage and it attains maturity in six weeks after feeding continually on the foliage of the sheabutter plants. Its absolute biomass growth rate (911.67%) and pattern is quite commendable.

Pupal habits

Ande (2004) reported that *C. forda* larvae preparing to pupate stops feeding, burrows to a convenient depth around the base of the host plant, contracts to about 55% of its length and loses its sharp coloration to form a prepupa. Mature larvae burrow into all soil types. They however, show significant higher ($P<0.05$) preference for loamy and sometimes clayey soil In the loamy and clayed soils majority of the prepupae occur between 20 cm and 30 cm depth, No prepupae form beyond 40 cm depth. Mature prepupae (5 or 6 day old) metamorphose into an obtectae pupa within 24 hours. The only noticeable movement on the

subterranean pupa is the jerking of the terminal abdominal region.

Imago Habits

The imago crawls quietly out of the soil between 7.00 pm and 1.00 am. The newly emerged adult climbs any available substrate which is usually the stem of the host plant. It subsequently settles down to commence wing pumping activity and thereafter assumes a resting position. *C. forda* imago is nocturnal but flies later than most moths. Generally, they become very active between 1.00 am and 5.00 am and less active between 6.00 pm and 9.00 pm. The activity pattern is sexually dimorphic. Males are more active and take to flight more often and after about 3 to 4 hours of rest, i.e. between 1.00 am and 3.00 am.

Like most other holometabolous moths, *C. forda* has restricted its reproductive activities, i.e. courtship, mating and oviposition to its adult developmental stage. The stage however is not supported by feeding, as it lacks a mouth part hence it is short-lived (<72 hours) and its activity restricted to the late nights (nocturnal). The bisexual moth is therefore inconspicuous and cryptic with highly restricted activity centered around its host plant; hence its latency and anonymity. Thus *C. forda* leaves us with a copy able lesson: LESSON 3: *Quality and prolonged living is better put in the immature youthful age than in adulthood, a situation where adults enjoy prolonged living and recycling as the case is in our political life, at the expense of impoverished youth is problematic. Let us give our children and youths the opportunity to learn and excel. Rather than compete with them, they should be given special assignments that*

will engage them. This will no doubt reflect in the quality of life they will express as adults.

Reproductive Habits

Courtship: The males patrol for a female, locate it and alight next to it. My observation did not show that the females produced pheromones, i.e. chemical cue frequently utilized by males in the search of females. I however noticed and confirmed that the males precisely located their female counterparts over long distances in the dark and thereafter resolves to remain around the vicinity of the female. The female also elevates its terminal abdominal portion slightly, an indication of a posture for pheromone production. The courting male makes a contact with the female. Successful courtship is achieved when the male stays attached to a less resentful female. Active *C. forda* males approach numerous females thus enhancing the chance of encountering a receptive female (Ande and Fasoranti, 1997b).

Mating in *C. forda*, entails the male flexing and apposing its terminal abdominal genitalia onto the female to accomplish a union. When this is achieved the pair remains in copula for 20 to 40 minutes. A successful union terminates when the female shakes off the male and moves away rapidly. Once mated, a female *C. forda* is non-receptive to other males, but the males can mate many times.

Oviposition commences 2 to 4 hours after mating. The mated female moves to a favoured location which is usually at the terminal ends of small twigs where leaves radiate.

They accumulate eggs in a single oval cluster glued together and to the substratum. A single female lays an average of 327 ± 128 (n = 50) eggs with mean hatchability rate of 98%. Oviposition lasts several hours, continuous day and night and the females die ovipositing. The 72 hour old adult male undertakes a suicidal acrobatic activity of somersaulting and banging self against the floor, loosing wing scales and shape until it dies. *C. forda* mortality records were quite low and indeed, lower in captivity, as most natural predatory agents were precluded. It is therefore a rear able resource.

LESSON 4: C. forda *is a highly prolific and productive moth that parades encouraging growth potential thus qualifying as livestock worthy of agricultural production. Agriculturists stand to benefit and should consider taping from the encouraging biomass acquisition rate, short duration of six weeks, low or close to zero capital input, prolific and gregarious habit, low mortality records in captivity, none requirement of intensive care and many more production benefits of adopting* C. forda *caterpillar as a rear able agricultural resource.*

Standing against the production of *C. forda* as a food insect round the year and its efficient utilization as a food resource is the 9-month pupa period within a year. Attempts to uncover the exact physiological state of *C. forda* pupa and to seek the possibility of breaking it, is being undertaken by one of my PhD students, Mr Bamidele Oriolowo with emerging success. We tried to monitor the respiratory rates and biochemical food reserves situations of the pupa progressively and significantly lower values have been observed in the months of December to April

indicating that the pupa diapauses. Attempts to break the diapauses also yielded some interesting results. The prolonged pupal duration can be shortened by chemical intervention at will. A major issue that is yet to be tackled if pupal duration is shortened is the alternative food for the resulting larvae that are likely to show up when *V. paradoxa* leaves are naturally unavailable.

Defensive Behaviour

C. forda is particularly highly vulnerable and hence getting rare. Only the larval stage exhibits two types of feeble defensive mechanisms when perturbed (Ande and Fasoranti, 1998) both of these do not deter predators including man. The fierce looking hairy disposition of the mature larvae also provides some passive protection, especially against individuals that are not used to them. For the same vulnerability reason, *C. forda* has quite a number of natural biotic decimating agents documented against all its developmental stages. Mallam Mohammed Izom, one of my PhD students uncovered the reasons behind the growing rareness of *C. forda* on the field in a study of its population dynamics in Niger State between 2010 and 2014. He confirmed that its dwindling status is informed chiefly by biotic and other specific ecological issues contrary to the popular cultural belief that *C. forda* is a spiritual insect and it chooses to appear and disappear on fields. Mohammed and Ande (2014) reported the absence of *C. forda* from locations that had thriving populations with only six of the twenty-one LGAs of Niger State having pockets of them. Mohammed (2017) reported about 18 biotic agents that adversely affect the various developmental stages of *C. forda*. He also went ahead to quantify their effects and to

suggest strategies and tactics to avert the imminent extinction of this highly valued food resource.

LESSON 5: C. forda *populations is dwindling and could be classified as a threatened biological resource. There is therefore an urgent need for a conservation programme aimed at the sustenance of this important food resource.*

Nutritional Qualities

I undertook biochemical and nutritional studies of *C. forda* caterpillar and observed that even the processed *C. forda* caterpillar that has the lowest proximate composition rates has encouraging crude protein and lipid composition of 64.49% and 21.45% (dry weight basis), respectively. Its organic matter and energy values, i.e. 92.41% and 479.61KJ/g, respectively were equally good. All of which constitute desirable qualities that attest to the possibility of *C. forda* caterpillar having qualities that can readily qualify it as a human diet.

The earlier findings enthused me so much that I wanted a post doctoral research opportunity to investigate the nutritional qualities of *C, forda* and see the possibility of pushing some lines of utilisation that will help the nutritional status of impoverished Nigerians. Topmost on my mind was the possibility of administering powder *C. forda* caterpillar to children's diet, extracting amino acids components and utilising same as additives to carbohydrate diets since such proteins are likely to be cheaper and more readily available than those sourced from popular conventional sources. And for individuals, especially the elites, that would mind utilising the caterpillar whole, I want

to see to the possibility of crushing and repackaging into cubes forms.

Unfortunately, securing a fellowship in this regard dragged unsuccessfully for years and was received with discouraging and embarrassing comments from the so called "advanced world'. A notable example of such was the comment from a nutritionist in USA that said "Dr Ande, this day when amino acids are synthesized in the laboratory for nutritional purposes, it is astonishing to note that you are still in the age of sourcing it from insects". Though discouraged, I was undaunted and thank God by 1996 I got a TWAS-CSIR fellowship to undertake the same research line at the Central Food Technology Research Institute (CFTRI) Mysore, India. At the institute, I had the privilege of training in the Nutritional Biochemistry Laboratory with Drs S. B. Baskaran and John Pereira as my guides. The studies revealed the following:

Protein and amino acids

All amino acids except tryptophan that was not determined were present and 44.53% of these were essential. Lysine, Tyrosine, Leucine, Phenylalanine and Valine are encouragingly high but the Sulphur bearing ones, i.e. Methionine and Cysteine, are most limiting and hence the low chemical score of 56.70 (Ande, 2003a). The rat feeding trial results show that *C. forda* performed dismally when compared with skimmed milk control. Reasonably high digestibility value (72.31) and biological value (47.11) are recorded and 95.02% protein available is utilised. Attempt to score *C. forda* caterpillar as a human diet with reference to the most demanding age group in terms of essential amino acid requirements and using the digestibility

value obtained from rats show *C. forda* to be a good and adequate source of Isoleucine, phenl-tyrosine, threonine and valine. Histidine, leusine and lysine are inadequate but adequate for other human age groups (Ande, 2003a).

Lipid and Fatty Acid Profile

The lipid quality and fitness for human dietary intake was also elucidated and reported by Ande (2003b). *C. forda* caterpillar has phospholipid, cholesterol and triglyceride values of 554.96mg/100g, 201.01mg/100g and 244.03mg/10g, respectively. *C. forda* is richer in unsaturates than all other animals' sources and palm oil. As a source of polyunsaturates, *C. forda* surpasses all except soya bean. It is therefore a very rich source of essential fatty acids, especially linolenic acid (33.84%). Arachidonic acid is, however, absent. *C. forda* therefore is confirmed to be a good source of unsaturated fatty acid, particularly linolenic (33.84%), linoleic (7.81%) and oleic (12.93%) acids.

Mineral composition

All eleven elements investigated, i.e. Ca, Cu Fe, K, Mg, Mn, Na, P, S, Se, Zn were found in *C. forda* caterpillar (Ande, 2003c). Se (<0.1 µg/g) was the least of them and K, S, P, Ca and Mg were particularly abundant and in thousands of µg/g with Na in hundreds of µg/g of the *C. forda* caterpillar sample, therefore, is a better source of mineral elements than most other food sources.

C. forda caterpillar no doubt possess the qualities of a desirable insect food, as the quality of amino acids, fatty acids and mineral salts meet the human requirement to a large extent. This may have informed the common Yoruba

chorus chanted to encourage the consumption of *C. forda* caterpillar (manimani) by our fore fathers, i.e.

Mọ̀nímọ̀ní ṣeun abẹ̀ẹ̀gbẹ́ ròdò rodo	Thanks to manimani with a robust trunk
Kòkòrò tó ní n má jẹ́kà lásán	The insect that forbids me never to eat without meat
Mọ̀nímọ̀ní ṣeun abẹ̀ẹ̀gbẹ́ ròdò rodo	Thank you for your robust trunk

is valid and indeed "*Mọ̀nímọ̀ní*" should be appreciated.

Unfortunately *Mọ̀nímọ̀ní* is no longer commonly utilized as food owing to aversion for assimilation of western values and lack of information. These nutritional understandings of *C. forda* caterpillar have proved thus:

LESSON 6: *Let it be known that Mọ̀nímọ̀ní is a fantastic and cheap protein, lipid and mineral salt source that is quite agreeable with human dietary requirements. Its caterpillar offers cheap, and adequate amino acids that could be readily tapped to enhance dietary protein intake among Nigerians. It may however, require some supplementation with Sulphur bearing amino acids. It also offers impressive amounts of essential fatty acids and mineral salts. It is waiting and begging for utilisation by all, especially the literate in our society.*

C. forda harvest Technique

The edible stages, i.e. mature larva and prepupa form the harvest target, especially the prepupae that are more mature, robust tasty and more costly. Ande (2002) noted that three techniques are in use. These include:

(i) **Direct Aerial Technique**: The mature larvae are handpicked from the leaves of host plants while they are still feeding. Gathering them and restricting them in containers take some extra effort, as they are still in the wondering stage Collections are subsequently confined, starved and allowed time to egest frass before processing.

(ii) **Indirect Aerial Technique:** The mature and descending larvae are intercepted around the trunk base of the host plant at night using basins lined with some soil. The prepupa prone individuals find it convenient to remain in the container attempting to burrow while the immature larvae soon exited the basin.

(iii) **Subterranean Technique:** This entails carefully digging up soil surrounding a host plant trunk and examining same for prepupae within 3 days after burrowing. Though quite strenuous, this technique has several advantages namely the recovery of prepupae; making restriction and starvation before processing unnecessary; the reduction of critical timing range to 72 hours; and the practicability during the day. It must also be stated that the chances of *C. forda* population depletion are remote, as some pupae will definitely go unnoticed. This method is also frequently used by the Nupes.

LESSON 7: *In view of the findings that the prepupae stage of development is more nutritious and has biomass advantage, the second and third harvest techniques therefore are preferable and recommended, more so because they ensure sustenance of* C. forda *resource on the field.*

ii. Mosquitoes

These are a group of 'ants' that as far as humans are concerned are popular, most abhorred and detested, unavoidable neighbour; it is however, the most dependable ally of human blood pathogens and least understood. They are keen associate that man often claps for in a bid to eliminate. Unfortunately, the clapping and other approaches aimed at eliminating them have made mosquitoes stronger. The clapping gesture therefore has turned to a seeming eulogy for an 'ant' that can best be described as '*Kòkúmọ́*' (refused to die).

Mosquitoes have influenced man negatively and inordinately in respect of disease transmission, bloodletting, loss of sleep and skin damage. Man therefore, sees all mosquitoes as guilty. Man also deliberately misconstrues mosquitoes' role and frequently describes them as causing the diseases they transmit: a case of calling a dog a bad name to nail it, when in the actual sense the mosquitoes are equally sick but inadvertently and unwillingly convey pathogens that are the real causal agents of these diseases.

The human – mosquito compulsory interaction is informed by the obligatory need for the female to provide its developing eggs some special proteins obtainable from human blood. Without these proteins embryo development will be defective and the survival of the mosquito progenies is compromised. Thus, a mature female mosquito is forced to undertake a 'suicide mission' in its bid to provide for its unborn children. Unfortunately too, the blood source must be of good quality, as a wrong blood choice has no immediate resourcing opportunity, hence cannot be corrected. The female mosquito therefore needs to sample the best human blood which unfortunately resides in a man

who is more active and who is a better mosquito 'murderer'. Thus quite a high percentage of prospective human blood sucking adult female mosquitoes are killed in the process, but the few that successfully maintain the trail ensure the sustenance of the mosquito population. The female mosquitoes therefore can be described as an example of a true mother (*Abiamọ tòótọ́*) and a good lesson can be drawn from this.

LESSON 8: *Adult female mosquitoes have exceptional value for child raising hence the level of commitment and risk they take on the mission that entails a decision between life and death. The aftereffect of this commitment is a well thought out plan that forestalls most of the factors may stand in the way of raising good children. I am sure most human females will not take comparable decision in the face of similar attendant risks. It is however certain that children borne after well thought out and risky conditions are better posited for quality living than those produced carelessly. For the human race to improve our dear ladies must view child bearing as a serious business that requires fortified planning aimed at providing and ensuring quality living and survival of our offspring. This will drastically reduce the incidences of unwanted pregnancies, street children and will surely checkmate population explosion constructively.*

Female mosquitoes, as a result of their unparalleled success in accessing human blood despite human opposition, are employed by pathogenic parasites for efficient transmission between human hosts. Unfortunately the mosquito assumes a culpable stance because of its role

in further developing the pathogen to an infective stage and for being actively involved in the infective cycle by introducing it to man. However such mosquitoes no doubt are sick and therefore are unwilling but unable to help the situation, as they get infected as a result of the consumption of an infected human blood.

Man has always believed in his subconscious that an eradicatory approach to solving mosquito problem is the key to the challenge they constitute. Unfortunately all the approaches developed in this direction have brought us nearer a cataclysmic pestilence envisaged by Ene (1963). The most preferred but abused approach is the chemical mode in which insecticides are employed and every one of us here is guilty. This mode has over the years culminated in persistently high levels of insecticides in our environment and has forced mosquitoes to develop resistance against the insecticides. Thus mosquitoes no longer respond as expected to insecticide use in contemporary times.

At various times, we at the individual and family levels have been confronted with peculiar environmental and biological challenges. Some of these challenges are so pertinent that they could form distinct and independent evolutionary lineages, if they remain persistent. Examples of such challenges include: nutritional peculiarities or inadequacies that may over time identify clans, families and individuals as ecologically distinguishing. Such factors do not kill but with prolonged exposure will necessitate adaptive responses and over many generations, and the survivors would acquire ingenious solutions that are impressed in the genetic constitution of the linage as a solution to the challenge. Such individuals are in essence

better capable of surviving than unexposed lines and the trait will be selected naturally.

Unfortunately, unlike the ants, the human race uses its intellectual capacity to remove such challenges and hence disallow the opportunity to independently evolve along different lines. Thus the natural solution of developing a trait as a lasting and sustainable solution to a challenge is disrupted, basis for natural selection is removed and genetic variability is reduced drastically. 'Ants' do not have such intellectual backing, hence they face and tolerate insecticide challenges and the few that survive it over several generations develop a resistant feature that is sustained and naturally selected. Consequently, the mosquitoes have left a lesson for man, who has the same capability but has refused to muster similar power to invent a lasting solution to biological and environmental challenges confronting him.

LESSON 9: *Mosquitoes face environmental challenges confronting them squarely and eventually develop biologically sustainable solutions to the challenge and this is gradually manifested in subsequent generations. Man with a more viable biological sustenance instrument does not face challenges long enough to acquire a permanent and sustainable solution. Instead he will work actively to stop such lines of development; the results that all humans are forced to evolve along the same line and there is no variance to pick on by way of survival of the fittest as proposed by Darwin. Unfortunately too, individual manifested traits are worked by humans towards a common direction thus confusing the selection processes further. A good example is the situation where young men wish to*

select for a hairy lady, i.e. a lady with requisite genes for being hairy. Unfortunately his choice is confused, as all ladies today have become "hairy" courtesy of making up for what they do not have. The God ordained variability in terms of hairiness is therefore masked and sampling men are faced with a univariate choice. This certainly is never the case with ants.

Our environments (terrestrial and aquatic) have suddenly become laden with insecticides owing to its unguarded use for agricultural and medical purposes and its residual retentive properties. Mosquitoes are therefore not spared from insecticides as flying adults and juveniles and this has quietly lead to the development of insecticide resistant strains of mosquitoes, rendered insecticides less effective and has lead to further pumping of insecticides into the environment. A notable example of this comes to mind in an almost concluded doctoral study investigating the resistance status of *Anopheles* mosquitoes in Adamawa State, Nigeria. In this study, Mr Jasini Wahedi, one of my PhD students, observed that *Anopheles* mosquitoes within the State have developed resistance to all the four categories of insecticides. Thus our dear Adamawa State is not only beset with terrorist insurgence but is also facing insidious threats of terrorist strains of mosquitoes. The preponderance of insecticides and its aggravation over time remains a source of serious concern to all especially the environmentalists. The reaction and status of the mosquitoes that are the target, if understood, should be read appropriately to teach man another lesson.

LESSON 10: The efficacy of insecticides with reference to prompt and evident killing action as well as ease of application is no doubt readily noticeable and pleasing. Unfortunately the war against mosquitoes despite the colossal cost remains largely unworn due to the unguarded use of the insecticide arsenal. Instead it has empowered the few mosquito survivors to become resistant and make nonsense of the various mosquito management programmes. The only wise way forward therefore is to use the insecticide arsenal sensibly. Avoid the use of insecticides prophylactically, instead use it therapeutically. Its use should also be restricted to professionals, i.e. entomologists, who have been trained along the same line and are familiar with therapeutic application and understand the 'ants'.

Mr. Vice-Chancellor Sir, the simplistic application, promptness and assurance of the insecticidal mode of attacking 'ants' prompted its acceptability and use but it is certainly not a natural mode for handling competitors like 'ants' in the ecosystem. This is because it is barbaric, costly, unsafe, and residual. Furthermore, it must be repeated frequently and it has negative effects on non target organisms including man itself. Other natural modes though less effective could also be developed especially to redeem our dear ecosystem which is 'the only one we have' (Oladele, 2003). It will however require better understanding of the behaviour, transmission indices, and limitations of the mosquito. This informed my sojourn in the area of Bio-ecology and behavioral study of mosquitoes along with another PhD student, Dr I. K. Olayemi (now an associate professor) and my other academic grandchildren.

That we may understand the 'ways' of mosquitoes we started with uncovering the species composition and seasonal abundance of mosquitoes in Offa and Ilorin, Kwara State (Ande and Olayemi 2008; Olayemi and Ande, 2008a). All the various types of water bodies and collections supported 3 or more of the mosquito species encountered round the year. Domestic containers, i.e. abandoned tires, cans, bottles, storage containers, etc. and temporary ground pools, i.e. puddles, tire tracks, ditches, domestic runoffs, pools etc, raised all the types of mosquitoes. Unfortunately, the listed water collection forms feature prominently and characterise our urban environments in Nigeria.

A mission to understand the biting behaviour af Anopheline mosquitoes encountered in Ilorin (Olayemi and Ande, 2008c) revealed that the peak biting time is around midnight with *An. gambiae* featuring slightly after midnight, Biting in all were, however, initiated as early as 5.00 pm. Although malaria is endemic throughout Nigeria, the actual anopheline vectors, as well as, the potential of each differ with location. Attempts to uncover the situation in Ilorin showed a mean annual sporozoite rates of 4.95%, 1.71% and 1.31% for *An. gambiae*, *An funestus* and *An nili*, respectively (Olayemi and Ande, 2009). The temporal distribution of the infective mosquitoes in Ilorin ensured sustained malarial transmission cycle, high transmission intensity and perhaps suggests that Ilorin may be one of Africa's malarial holoendemic localities. The same trend of results was observed from similar studies carried out at Gaa bolorundoro, Kwara State and Adamawa State.

iii. Honey Bees

Bees are the group of 'ants' that produce the popular sweetener, honey (aka *Oyin*). The same group of 'ants' are particularly more popular for their stinging ability. Honey is the sweet and highly nutritious processed product synthesized by the bee and meant for its brood and adults. Hence, the naming of a human adult female child "*Oyin*" in Yoruba land is apt and quite meaningful. The production of this product by the bees is a necessity, as the developing brood is confined and incapacitated in a bee cell. They therefore rely solely on the honey as their sole source of food supply. Therefore the reserved food (honey) is expected to be a balanced diet that provides complete nutrition and must have a prolonged shelf life and produced in excess of the broods' requirements. Honey bees being a social group of 'ants' dwell as a colony that require to protect this desirable food product to ensure sustainability and collective security. The bee therefore developed the ability to sting any identified threat to their survival: thus leaving an understanding that bees can be sweet and can sting and a lesson for the men folk and young men in particular:

LESSON 11: The beautiful 'Oyin' (lady) is sweet and nice but will sting if threatened or treated badly. So always take good care of her and make her happy!

Bees, sting as a last resort because it has a cost that is ultimate, i.e. the demise of the stinger; thus it is a suicidal mission but for a good purpose which is the survival or protection of the colony thereafter. The action is comparable to that of a human terrorist suicide bomber;

however, the acclaimed basis for the latter, i.e. to have 10 virgins to oneself in *aljanah*, is futuristic, mundane and personal, not like the case with bees. Hence, it should be discontinued forthwith, more so when the bomber himself or herself is a believer and the Qur'an, *Sūratu Nnisā'* Chapter 4 Verse 93, cautions thus:

وَمَن يَقْتُلْ مُؤْمِنًا مُّتَعَمِّدًا فَجَزَآؤُهُۥ جَهَنَّمُ خَٰلِدًا فِيهَا
وَغَضِبَ ٱللَّهُ عَلَيْهِ وَلَعَنَهُۥ وَأَعَدَّ لَهُۥ عَذَابًا عَظِيمًا ﴿٩٣﴾

> And whoever kills a believer intentionally, His punishment is hell; he shall abide in it, and Allah will send His wrath on him and curse him and prepare him a painful chastisement.

Humans, having discovered the goodness of honey and the fact that smokes from burning flames render the bees weak and confused, have resorted to the use of smoke and fire (arson) to prosecute forceful harvest, hence committing an action comparable to an armed robbery exercise. Consequently maiming, killing, expelling bees and destroying the hive to prosecute honey harvest is frequently carried out by local honey hunters. Bee hunters also care less about the quality of the products, i.e. honey, since like all armed robbers, all they have invested in the business is the risk and any level of gain is profitable. This practice over the decades has affected the quality and quantity of honey available and the life system of the ecosystem adversely, as the bee's role in pollination has

been heavily compromised. To forestall these drawbacks, honey bee farming (Apiculture) is encouraged. Today, apiculture has been simplified and it is quite practicable and profitable. It is therefore the right time to put in place bee hunting restrictions and everyone, including honey bee hunters granted financial support and training on modern apicultural practice. This no doubt is the correct direction to go, as it will improve honey quality and production, provide job opportunities, enhance bee presence in the ecosystem, enhance pollination, and improve crop production: all of which are highly desirable and required qualities for our ailing ecosystem.

Mr. Vice-Chancellor Sir, that we may consider the ways of the bees and be wise I along with my graduate students decided to find out some of the difficulties of cultivating bees. Our team, comprising of myself, Dr Akeem Abolade (my former graduate student and currently a Senior Lecturer at University of Abuja and coordinator of the STEP B honey bee project), Mr. M.N. Jubril and Mr. Yisa Solomon, looked into apiculture practice in Kwara State and the physicochemical properties of honey produced at University of Ilorin apiary.

Our study revealed that apicultural practice in Kwara State dates back to year 2000 and it is still at low ebb in spite of the great potentials of the State. (Oyerinde and Ande, 2006). Honey bee pests distribution and impacts on bee colony establishment revealed a correlation between abscondment and occurrence of the various pests. *Achina tumida*, *Campanotus pennsyloasius* and *Gelloria mellonella* largely informed abscondments (Oyerinde and Ande , 2009). The comparative efficacies of six commonly used baiting materials (Ande *et al*., 2008a) and different hive

types (Ande *et al.*, 2008b) for bee colony establishment revealed that Keyan Top bar and Clay pot hives preformed significantly better. Colony establishment rates were generally low despite the use of baits and the order of efficacy was Bee Wax = Hayaki > Lovenda = Pine apple fruit juice>Fresh Cow dung =Locust bean.

The University of Ilorin in its characteristic way of living up to its responsibility and championing the course of good living came up with a signed Memorandum of Understanding with the NYSC apicultural unit in 2001 with laudable objectives and I had the opportunity of being involved. This understanding has today matured into the establishment of the Unilorin Apiary Unit that has a pen.

Unilorin established its apiary in 2003 and honey production and sales commenced thereafter. Fortunately, the University has enjoyed the confidence of the consumers. An attempt was, however, made to ascertain and compare the honey produced from various units scattered round the campus with those reported from renowned apiaries and international standards (Ande, Oyerinde, Adeyemi and Job, 2010). The honey produced from various units of Unilorin apiary were of high quality that is comparable with international standards. The quality of honey is known to be informed by type of bee, pollen source, season and location (Ikediobi, et. al 1985).

Thank God for the unrelenting efforts of the bee despite the discouragement put up by man and honey bee pests. Bees have ensured the continued production of honey in the face of arsonists that parade themselves as local hunters, ignorant human beings amidst us that will kill bees on sighting them even when the bees were attracted to the fragrance worn by them which the bee mistook for food

source. The advent of electromagnetic confusion instituted by mobile telephony, indiscriminate use of pesticides, etc, have also not helped matters. The bees are however complaining and driving home a lesson:

LESSON 12: *The seeming open cheque in respect of honey production from which man has drawn this ingenious resource, i.e. honey, is fast draining out and is on the verge of exhaustion. A deliberate attempt to revamp the resource is required through the adoption of apiculture and reorientation of our inclination to a production line for economic gain and sustainable cum quality production of honey. The same approach will encourage the bee and enhance its immense positive contribution to productivity in our dear ecosystem.*

Conclusion and Recommendations

Mr. Vice-chancellor Sir and distinguished guests, it is quite true that I wanted to be a medical practitioner for personal reasons that included offering prognosis that would allow me open up other human beings, like was done to me several times when I underwent surgical procedures on my left hind limb without achieving correction. I then made up my mind to dissect consenting individuals too to give them a better life; a chance that medical practitioners enjoy with so much honour. I however thank God for granting me an alternative of dissecting cockroaches, grasshopper, rats, etc. with the aim of considering their ways and making mankind wiser as a Zoologist. This grace has brought me this far and I feel better and most fulfilled that I stand before you today to share the information obtained from this grace, knowing fully well and with all sense of modesty that I command more honour going by the quantum of greetings I receive

daily and more importantly that we are all indeed collectively wiser as a result of the few lessons we have drawn from my experience and the ways of the few 'ants' we considered in this lecture.

You will all agree with me that one of the least understood issue in the world today is the animal component of our system. Unfortunately, Zoology has been relegated in contemporary times and we the supposed practitioners, i.e. Zoologists are largely responsible and misinformed. This failure has become so endemic that it affects the quality of students, young lecturers and the entire educational system of our nation. Therefore, rather than make recommendations for the nation, as it is the practice with inaugural lectures, I will make general recommendations to first encourage my discipline (A) and second to enhance judicious livelihood as a wise member of the ecosystem (B). These recommendations include:

Ai. Biologists, especially Zoologists should endeavor to familiarise themselves with scientific names of animals and pass same down the generation. This will encourage enhanced interest in taxonomy (a Zoology discipline that lacks experts), improve knowledge about animals and generate interest, protection and discovery of unknown individuals.

Aii. Zoology specimens, i.e. animals, are so enormously diverse and as it requires some basic techniques. Therefore zoology students face the herculean task of attempting to cover zoology curriculum with good grades. To encourage these lucky students and at the same time enhance their interest and performance, I recommend the following:

a) Improvement of the Zoology curriculum to enable better focus on organisms that feature prominently around us
b) Encouragement of practical classes that enable the demonstration of zoological techniques, diagrammatic expression which Zoology is renowned for and inventing modes for examining zoological techniques.

Aiii. The University of Ilorin is better placed for the study of Zoology. Let me use this opportunity to thank the University for establishing the Unilorin Zoo and for funding and developing it so well. I must also thank the Vice-Chancellor for giving me the opportunity to Chair the Unilorin Zoo Mangement Board (UZMB) between 2012 and 2014. Zoologists are expected to be the foster 'parents' of the animals in the Zoo and should be familiar with their needs and their health status. Committing the Zoo to veterinary doctors is like a parent (Zoologist) yielding over his children to family doctor for their welfare. I therefore recommend as follows:

a) All Zoologists should contribute meaningfully to the well being of all animals in the Zoo by visiting the Zoo and seeing to the well being and upkeep of the animals. It is our laboratory.
b) All members of the University community should see the survival of all the animals in the zoo as a collective responsibility. Thus I recommend that everyone should make it expedient to visit the Zoo at least once a year and help advertise the Zoo to enable better upkeep of the animals.

Bi. Insects are begging to be utilised as food, more so when this is a wiser way of putting them in check. Our fore father, John the Baptist (Mat 3:4b) and biblical instruction (Leviticus 11: 22) did and they did not regret it. Therefore to live long and have the right, cheap and healthy proteins, fatty acids and mineral nutrients for your body, everyone should consume insects.

Bii. Mosquitoes have proved to us over the years that they are our friends and allies and whether we like them or not they will exist and continue to source blood from us. Unfortunately our lack of understanding and intolerance has been largely responsible for the use of ungodly methods to handle them. The wise way out is to get more friendly with them and use ecologically compatible methods against them. My advice is stop killing mosquitoes; they are friends and they deserve to be properly managed.

Biii. The bee remains a glowing example of insects that should be copied. It produces a valuable product without being referenced and the product is stolen by a terrorist; yet it does not complain. The world would be a better place for us all, if we could act like the honey bee. I therefore recommend that if you cannot act like the honey bee, then do not mess up the honey bee.

Biv. The need for the establishment of an insect museum in the University of Ilorin is long overdue, as we need one to curate insect species in the middle belt region of Nigeria

Bv. “For every insect you kill, put aside 5 or 10 Naira for the studies of insects and for the establishment of a museum. You will be surprised that all of us will remain wise.

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