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SIX-LEGGED SCIENCE IN NIGERIA AND ITS DEVELOPMENT

By A. E. Akingbohungbe

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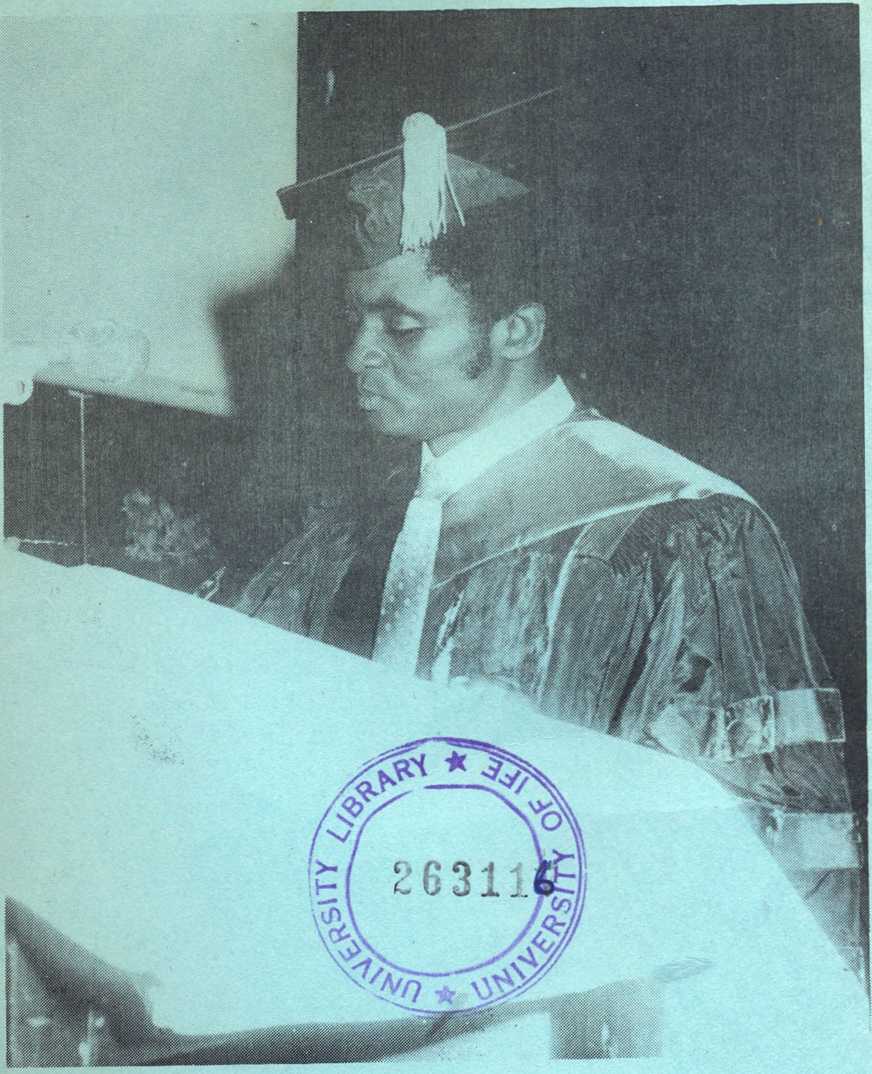

Professor A.E. Akingbohungbe

SIX-LEGGED SCIENCE IN NIGERIA AND ITS DEVELOPMENT

by

A. E. AKINGBOHUNGBE

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Ever since the topic, "Six-legged science in Nigeria and its development" sneaked into public view several months ago, many of you would have been wondering about which kind of science has six legs, and why I chose such a topic. I therefore consider it necessary to first answer these queries.

What to talk about on an occasion such as this is a sticky problem, especially when there are no rules as to what shall constitute an Inaugural lecture. It was even more sticky for me as Professor and Head, Department of Plant Science at such a period when our country is bedeviled with a crisis of food shortage. However, going by the meaning of the word, "inaugural" and my own conception of it, I have decided to limit myself to what my professional philosophy at Ife has been, why it has been so, and what dreams I have for the future. This I believe to be quite appropriate since plant science is multidisciplinary and my own area of specialization happens to be just a component, albeit a very important component of it.

What is "Six-legged Science" and what are its dimensions?

"Six-legged science" is a literal substitute for the more technical term, "entomology" which, put simply, is the study of insects. Insects are characterised by a number of features among which is the possession of six legs (a pair each per thoracic segment) (Fig. 1) and hence the substitute term, "six-legged science".

Traditionally, entomology had as its dimensions the following areas of specialization: insect morphology, insect taxonomy, insect physiology, insect ecology, medical and veterinary entomology, and agricultural entomology. The last two are also frequently integrated variously to give what is called, "economic entomology."

The hall-mark of today's science is the high degree of specialization evolved, and entomology has not been an exception. Thus, the traditional dimensions referred to previously have undergone fragmentation and regeneration to give rise to such more novel areas of specializations as: numerical

Fig. 1 – An adult beetle showing the six-legged feature of an insect.

taxonomy, phylogenetics, insect biophysics, insect biochemistry, insect ultrastructure, insecticide toxicology, insect pathology, biological control, pest management, insect population dynamics, extension and regulatory entomology, insect sociobiology etc. The list is indeed inexhaustible and the multifarious nature which entomology has assumed over the decades has been such that the University of California at Berkeley, U.S.A., has christened her Department of Entomology as Department of Entomological Sciences!

Why study insects?

For most uninitiated people, the immediate reaction will probably be to kill an insect on first encounter, or alternatively, avoid the 'nuissance' entirely. However, to us entomologists, the study of insects has become something akin to an article of faith to which we would like to see everybody subscribe. The reason for this will be apparent shortly.

The early naturalists studied insects because of their amazing degree of evolutionary diversity, and their aesthetic values. Insects generally show a wonderful array of colours ranging from the obscure and the variegated to the strongly aposematic forms. They also vary widely in shapes and sizes, and these frequently confer on them, unique evolutionary/adaptive attributes. For example, the Nigerian fauna consists of forms ranging from strongly microscopic (Fig. 2), to the 'giant' African goliath beetle, *Goliathus goliatus* Linnaeus,

Fig. 2 – *Myiomma albicoxa* Smith.

which with a body dimension of about 10 cm x 4.9 cm, clearly approximates some small mammals (Fig. 3). It also

Fig. 3 – The African goliath beetle, *Goliathus goliatus* Linnaeus.

consists of twig-like forms such as members of the Phasmida (stick and leaf insects) (Fig. 4). These variations in colour and size among other attributes, coupled with the following more fundamental enabling mechanisms:[1]

(a) tracheal system
(b) impermeable exocuticle
(c) flight wings
(d) pupal stage in life history

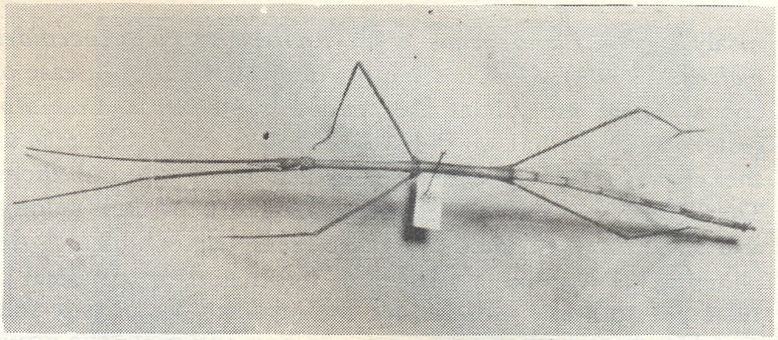

Fig. 4 — A stick insect (Order Phasmida).

have made insects the most abundant and successful group of animals. It is known that insects alone constitute three-fourths of all described species of animals; leaving us, human beings to share with all other animals, the remaining one-fourth. Even right here in this hall, if suitable insect collection techniques were to be applied now, we might record some hundreds! It is therefore not surprising that some of my colleagues 'bugsmen' have taunted *Homo sapiens* with the remark that insects are the landlords on earth while we human beings are their tenants! It is needless to emphasize that a tenant must study and understand his landlord properly in order to avoid ejection.

I have in the preceding paragraph shown, albeit in a nutshell, the biological success of insects as a compelling reason for their study. There is however a second reason which I believe endears us to the study of insects. Insects, their life and ways of doing things, are so fascinating that their study is regularly a vitalising and, refreshing exercise. A few interesting phenomena will suffice to illustrate this point. I will start with my first encounter with the profession some nineteen years ago. I was then an Agricultural Assistant at the Cocoa Research Institute of Nigeria, and I was charged, along with another colleague, with the responsibility of carrying out some field experiment. The experiment involved the

Fig. 5 — A praying mantis camouflaging in the tassel of Maize for unsuspecting prey to walk into its grip.

This ensures that insects visiting the tassel for pollen can walk into its grip unsuspecting, and be used as prey. The assasin bugs, *Phonoctonus* spp. achieve a similar objective on their prey (the cotton stainers, *Dysdercus* spp.) by adopting their colour pattern. Thus, they can stay within a population of cotton stainers undetected, and subsequently seize some individuals as prey. On the other hand, the diadem butterfly, *Hypolimnas misippus* Linnaeus has to solve the problem of being eaten by predators. This it does by ensuring that the females closely resemble the monarch butterfly (*Danaus chrysippus* Linnaeus), which being distasteful, is usually avoided by predators.

The third and final reason which I like to give for studying insects is what has frequently been given by most people as virtually the only justification for entomology. This is the economic importance of insects. Within the context of Nigeria, this can be viewed from the following standpoints:

- crop pests
- medical pests
- veterinary pests
- beneficial insects

Again, time will not permit a comprehensive treatment of the importance of insects in Nigerian economy. I am however sure that the depradation caused by mosquitos as vectors of the malarial parasite is very well known to everyone here present. So also is the transmission/dissemination by various flies, of other debilitating diseases such as diarrhoea, sleeping sickness, river blindness etc. I am also certain that many of us would have taken honey from the honey-bees or eaten some delicacies made from insects such as termites, larvae of the palm weevil, *Rhynchophorus phoenicis* (Fabricius) and the caterpilars of the African silkworms, *Anaphe* spp. These represent some of the beneficial aspects of insects. I will however like to dwell a little bit more on the role of insects as crop pests since I am a plant scientist.

Insects affect crop and ornamental plants in various ways, and they constitute a major biological constraint in their production. In Nigeria, there are those that feed on the roots thus impairing the important function of anchorage as well as absorption of nutrients and water from the soil, e.g. termites and the banana root weevil, *Cosmopolites sordidus* (Germar). On the stem, there are those that cause ring-barking, which involves a painstaking removal of the external tissue layers, leaving the plant canopy on a weak central support (Fig. 6). Eventually, such a canopy is toppled over by the wind (Fig. 7) e.g. *Tragocephala castnia Thomson* on

Fig. 6 – Stem of cashew ring-barked by the stem girdler, *Analeptes trifasciata* Fabricius.

Fig. 7 – Cashew plant toppled over by wind following stem girdler damage.

cocoa, *Voetia* = (*Phosphorus*) ***virescens*** (*Oliver*) on kola, and *Analeptes trifasciata* Fabricius on cashew. Others bore directly within the stem, destroying the strengthening tissues and/or the conducting elements of the plant. These include such pests as the lepidopterous stem borers, *Busseola fusca* (*Fuller*), *Sessamia* spp. and *Eldana saccharina* Walker, which cause dead heart in cereal crops (Fig. 8); as well as the weevils, *Gasteroclisus rhomboidalis* (Boheman) and *Lixus cameru-*

Fig. 8 – Maize plant showing damage caused by *Busseola fusca* (Fuller) larva. The damage eventually leads to "dead" heart.

nensis Kolbe which respectively cause dead hearts in the bitter leaf *(Vernonia amygdalina)* (Fig. 9) and *Amaranthus* spp. The foliage, flowers and fruit of plants are similarly affected by various insects. Active consumption may take place, as usually observed for insects with mandibulate mouth parts. For example, the notorious variegated grass-hopper, *Zonocerus variegatus* Linnaeus defoliates several crop plants during the dry season in S. Nigeria (Fig. 10).

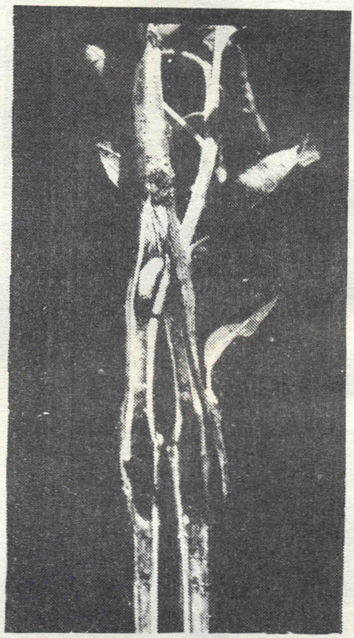

Fig. 9 – Dead heart of bitter leaf shoot caused by *Lixus camerunensis* Kolbe.

Cowpea flowers are consumed by pollen beetles, *Mylabris* spp. (Fig. 11) while leafy vegetables like Okra, Curcubits and *Cochorus olitorus* (Ewedu) are respectively defoliated by *Copa occidentalis* Weise, *Aulacophora* spp., and *Acraea eponina* Cramer , (Figs. 12 & 13). Damage may also result from the depletion of assimilates through sap removal as usually occurs in the case of insects with piercing and sucking mouth parts. This group of insects frequently causes varying

Fig. 10 – Citrus stand virtually defoliated by *Zonocerus variegatus*.

Fig. 11 – *Mylabris bifasciata* feeding on cowpea flower.

Fig. 12 – Okra seedling severely defoliated by *Copa occidentalis.*

Fig. 13 – *Cochorus olitorus* (ewedu) being defoliated by caterpillars of *Acraea eponina.*

degrees of malformations or distortions, as well as discolouration or even necrosis resulting from enzymatic breakdown or injection of toxin in affected tissues. They may also transmit various plant diseases. For example, sap-sucking by the mirid, *Chamopsis* sp. on young shoot of Indian Almond, *Terminalia catapa* is accompanied by rapid enzymatic breakdown of cells, leading to dark necrotic lesions. On maize, *Zea mays* L., similar feeding activity by the leafhoppers, *Cicadulina* spp. is followed by the transmission of streak virus disease (Fig. 14).

Fig. 14 – Streak virus disease of Maize transmitted by *Cicadulina* spp. (note uninfected plant in the centre).

What have I been doing with insects?

Having adduced various reasons for the necessity to study insects, I will now highlight some of the work done, or being done in my laboratory.

My work over the past fifteen years has been in two main areas of entomology viz: systematic entomology and agricultural entomology (or crop protection entomology). Systematics has been defined as the scientific study of the kinds and diversity of organisms, and their relevance to some specified kinds of relationships thought to exist among them[5]. It involves species recognition, description, classification and inference of phylogenetic relationships. According to Confucius, "The beginning of wisdom is calling things by their proper names." Hence when a new baby is born in human culture, it is soon given a name to serve as a reference. This is also one principal aim of systematic entomology. When a new insect is discovered, it is described in sufficient details to enable other biologists to recognize it whenever other specimens are found. It is also given a universal name so that it can be referred to, and classified taking into consideration its relationships with other insects at various levels of universality.

Systematics, in providing universal names for organisms, serves as the key to the entire literature relating to any species. All biological research begins with accurate identification of the organisms to be studied, and obtaining base line data from their classification. Sadly however, as will be shown later on, systematic entomology is a virtually neglected area of research in Nigeria. My research efforts in this respect have centred on the family Miridae.

The Miridae belong in the Order Hemiptera. They are commonly known as "plant bugs", and they include a number of economically important pests as well as numerous species that play a significant role in the maintenance of natural balance. The celebrated capsid pests of cocoa in Nigeria (viz:– *Sahlbergella singularis* Haglund, *Distantiella theobroma* (Distant) and *Helopeltis bergrothi* Reuter), which have been rightly called "jorí-jorí" by the Yoruba because of the 'die-back' syndrome caused on cocoa, belong to the family. This partly explains my early sentimental attachment to the family. *Cyrtorhinus* spp. which are known to be important predators of some key pests in rice ecosystem, also belong in the family.

According to the world catalogue published between 1957 and 1959 by Carvalho[6], the African mirid fauna comprised 240 genera which represented about 30.0% of the known world genera by then. Of these African records, only 9 (representing 0.04%) were known from Nigeria. The situation has changed fairly over the last two decades with at least some 52 new genera recorded in Africa[7,8]. If this analysis were done at the species level, the findings would no doubt be even more startling! I have attempted to correct this 'black box' which the dearth of knowledge of Nigerian mirid fauna represents. Though progress has been slow, I like to report that we now have in our collection at Ife several determined species distributed over 100 genera. A number of these have been described as new to science by me.[9,10,11,12]. The types of these species are also deposited in our collection which has now gained recognition as a reference centre for African Miridae. Apart from this, several thousand specimens, many of which undoubtedly represent previously undescribed taxa, have been collected from different parts of Nigeria; and they are currently being studied. The studies carried out so far on these specimens have revealed some interesting features. For example, the members of the Hyaliodini which were previously known only from the Neotropics, with some two species of the nominotypic genus from North America have been described from Nigeria, Ghana, Ivory Coast and Central Africa.[10] All these African hyaliodines differ from the neotropical species in possessing a wing-edge stridulatory mechanism. The evolutionary significance of this will no doubt be subject of future investigation. Similarly, new species of the genus *Fingulus* Distant which was previously known only from the Palearctic, Oriental and Australian regions, have been described from Nigeria, Ghana and the Ivory Coast.[12] I have also observed considerable affinity between our fauna and those of the Oriental region at the generic level. This makes the description of new taxa very risky unless an extensive study of the zoogeographical limits of taxa is carried out. I will illustrate this point with my current work on the subfamily Isometopinae.

The Isometopinae are predaceous mirids which have been shown to be important regulators of the populations of scale insects[13]. Unlike most other mirids, they are generally characterized by the possession of ocelli, two-segmented tarsi in the adult stage, a strongly vertical head with very large compound eyes occupying most of it and a distinctly cryptic habitus. They also have a generally reduced femoral trichobothrial number. Up to 1959, eleven species belonging to four genera were described from Africa. Only two of these – *Isometopus peltatus* McAtee and Malloch and *Ptisca blattiformis* McAtee and Malloch were described respectively from Togo and Cameroon in W. Africa. Smith added twelve new species from Ghana; assigning two of them to a new genus, *Magnocellus* Smith, one to *Letaba* Hesse and the remainder to *Myiomma* Puton.[14] Slater and Schuh described seven new species from South Africa and the Congo, including three in *Magnocellus* and two in *Letaba.*[15] Recently, I reviewed the genus *Magnocellus*, and described five new species from Ghana and Nigeria.[16] I also drew attention to the presence within the genus of two species-groups viz:— *wacriensis*-group and *ghanaiensis*-group. The puzzle that this represents is now being cleared in my current revision of the sub-family covering African, Palearctic (Europe and Mediterranean), Oriental and Australian faunal regions. Apparently, the *wacriensis*-group (Figs. 15 & 16) belongs to a different genus – *Jehania* described by Distant from India.[17] Members of this genus are widely distributed across the African, Oriental and Palearctic regions with a preponderance in Africa; whereas the *ghanaiensis* group (Fig. 17), constitutes a genus that appears endemic to Africa. A similar situation as that of *Magnocellus*, arises in respect of *Letaba* which has had to go through sinking and resuscitation from synonymy. The type of *Letaba* is undoubtedly congeneric with *Paloniella* described from Burma by Poppius[18]; and members of the genus

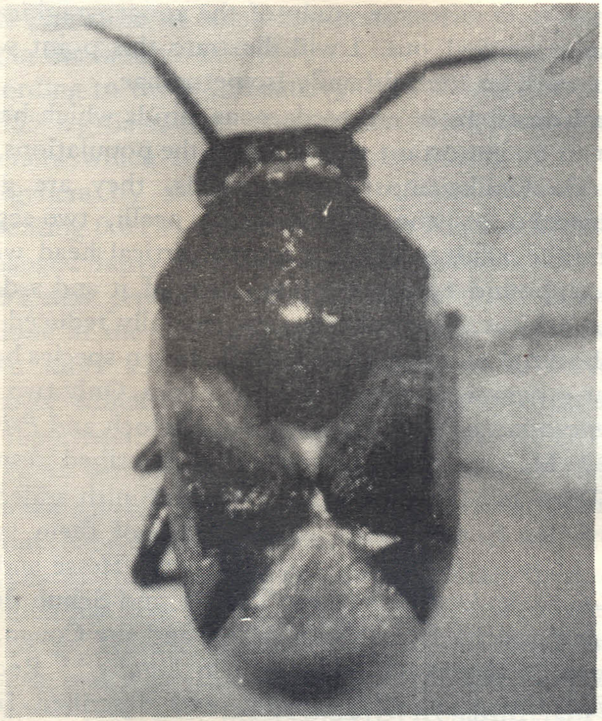

Fig. 15 – Male *Jehania wacriensis* (Smith), a typical member of *wacriensis* - group of *Magnocellus* Smith.

are distributed across Africa and the Orient, with a preponderance in Africa.

The second aspect of my research endeavour as indicated previously involves crop protection in which I have concentrated on pests of cowpea. Cowpea (commonly called erèé or ẹ̀wà by the Yoruba, or beans by most educated Nigerians), is a well adapted, and easily the most popular grain legume crop in Nigeria. It is important as a major source of protein in the diet of many people; and it has been estimated that Nigeria devotes about 4.0 million hectares of cultivated land to cowpeas, with an overly low annual production of 0.85 million tonnes.[19]

Fig. 16 — Female *Jehania slateri* (Akingbohungbe), a member of the *wacriensis* - group

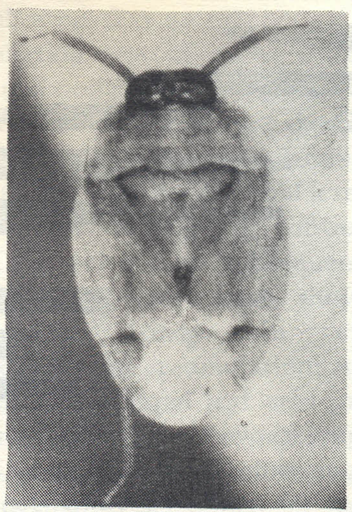

Fig. 17 — A typical member of the *ghanaiensis* - group of *Magnocellus* Smith.

Efficient cowpea production in Nigeria is handicapped by a number of biological constraints, the most important of which are the insect pest problems. Extensive lists have been prepared showing that the crop is attacked at virtually every stage of development by several species of insects.[20,21,22] A schematic representation of the incidence of these pests in relation to the crop phenology, is shown in Fig. 18. When these insects are controlled, yield increases up to six-fold have been recorded.[23,24] As many as six insecticidal sprays were considered necessary for effective control and optimum **yield realisation.** This was the state of affairs when I made my debut on cowpea entomology in 1973.

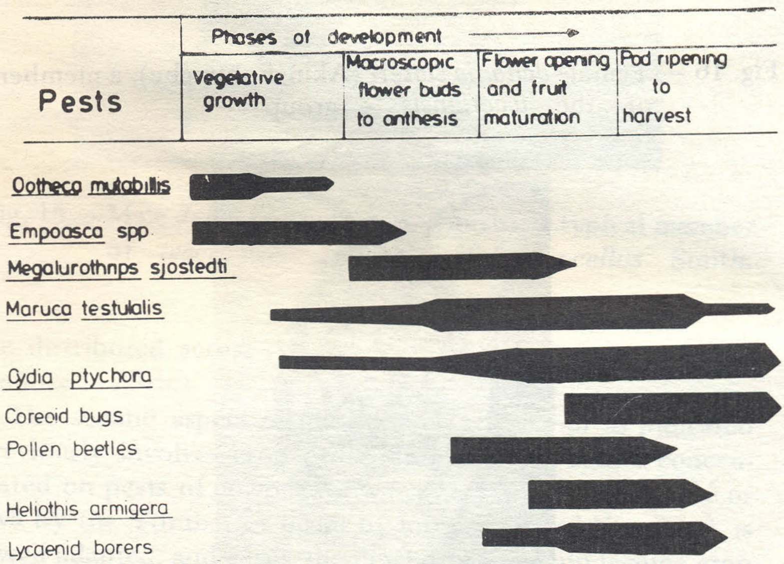

Fig. 18 – Diagrammatic representation of the incidence of pests in relation to cowpea phenology.

Conscious of the environmental problems associated with intensive use of insecticides, and the fact that Nigerian peasant farmers hardly use insecticides to protect their crops (partly because they cannot afford the cost and partly because of ignorance of such technology), I have geared my efforts over the years towards the development of an integrated pest management programme that would involve a much less reduced spray schedule than the six sprays referred to previously. Conventionally, cowpea pests in Nigeria have been classified broadly into (a) pre-flowering, (b) flowering and (c) post-flowering pests. The first group includes the flea beetle, *Ootheca mutabilis* (Sahlberg) as a major constituent for which at least one insecticidal spray is recommended. The damage by this beetle occurs principally in the seedling stage, and is usually so striking (Fig. 19) that no farmer seeing it would not be afraid of a serious yield loss. However, application of insecticide to control the beetle hardly improves yield. The riddle that this represents was resolved by me in two successive studies.[25,26] The first study involved a quantitative assessment of damage by *O. mutabilis* on Ife Brown cowpea; and it showed that an infestation level resulting in up to 30% defoliation was tolerated without any adverse effect on flower and pod production. In the second study, an attempt was made to simulate insect damage by artificially removing varying proportions of the laminae of Ife Brown cowpea leaflets, to give varying nominal levels of defoliation. These were done either as single or continuous defoliation treatments, and the effects on subsequent crop performance were observed. The results again showed that cowpea tends to produce foliage in excess of its requirement for dry matter accumulation; and that with only about 50–70% of its potential leaf area present during the first three weeks of growth, a cowpea crop could still produce satisfactory yield. I have therefore suggested the replacement of the single spray scheduled for the flea beetle and other foliage feeders of cowpea, with occasional treatment

Fig. 19 – Cowpea seedling severely damaged by the flea beetle, *Ootheca mutabilis*.

such as when an epiphytotic of Cowpea Yellow Mosaic Virus (CYMV), is imminent.

While the preceding studies were on, I was also involved with finding a solution to another pest of cowpea – the black flower thrips, *Megalurothrips sjostedti* (Trybom). As at 1973, it was hoped that the development and release of day-neutral varieties with acceptable seed quality such as Ife Brown, will prevent the problem of a flush crop occupying a piece of land for months without or with very poor flower, and consequently pod production. This hope was dashed by the flower thrips (Fig. 20) which causes dark red lesions on the growth points of floral buds, leading to their abscission when infestation is heavy (Fig. 21). Cowpea is characterized by an amazing degree of diversity of form. My approach to this pest therefore involved locating sources of resistance from the very large germplasm with which cowpea is endowed. Thus, in April 1974, I carried out a field screening trial involving 10 varieties. I had reasoned in my mind that with-

Fig. 20 – Adult cowpea flower thrips, *Megalurothrips sjostedti.*

Fig. 21 – Cowpea flower bud severely damaged by *Megalurothrips sjostedti.*

out any insecticide protection, susceptible varieties will flower very poorly while resistant or tolerant varieties will flower normally. To my surprise, all ten varieties flowered normally; and I mused to myself that it was simply unimaginable to have 10 resistant varieties within one cycle of field screening! I subsequently realised that I had broken the golden rule for effective pest control, which is having adequate biological knowledge of the pest before attempting to control it. This is a small lesson for people who have always quipped at us with such phrases as, "We see more of the science than the plants." The job of the entomologist in pest control can be likened to that of a General in the prosecution of a war. He must have a fair knowledge of the enemy movements in order to mount a successful campaign against it. What went wrong in the field screening work, was simply that I had planted at a time of the year when the population of thrips was at a threshold that could not affect the flowering potential of the different varieties much. Secondly, the prevailing weather conditions during the period of crop growth, were such that could not predispose the plants to full expression of susceptibility.

Arising from the above, I decided to embark on a formal classification of the gamut of cowpea pests along accepted pest management line (i.e. key pest, occasional pest and potential pest). This was an ambitious decision which would require several years and substantial resources (human and material), to implement. Since these requirements could only barely be met under our own setting, I chose a relatively simple approach. This involved several monthly plantings of four cowpea varieties from 1974 to 1976 in replicated plots which were either sprayed with insecticide (to control pests) or left unsprayed. A combination of intuitive judgement of pest population and quantitative assessment of damage were used to evaluate the roles of the various pests as related to crop performance, during the different plantings. The massive data obtained from this work were eventually published in 1982.[27] The findings could be summarized thus:

1. Flowering, podding and seed yield tend to decrease over the season in cowpeas planted from April to September.
2. There is a definite pattern of pest succession on cowpea over the season, with two peak periods of pest activity (viz: April to July and October to December), during which unprotected plots are severely damaged (Fig. 22).

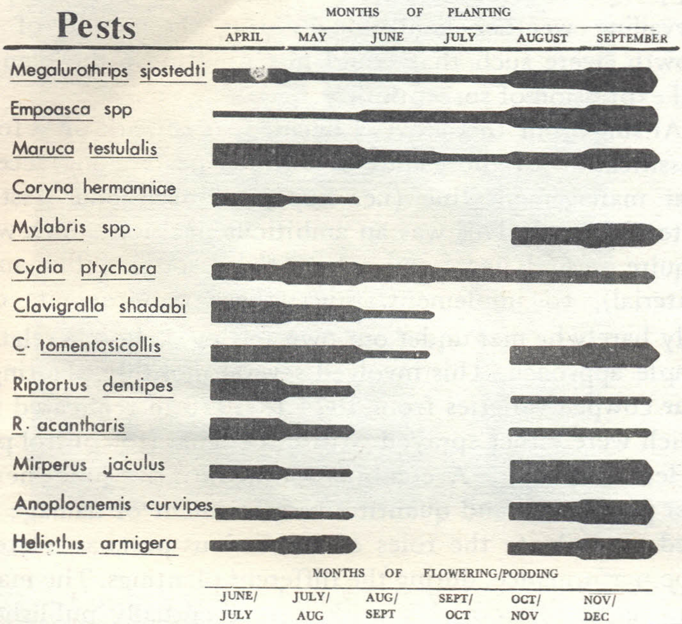

Fig. 22 – Relative activity of cowpea pests at different periods of the cropping season at Ile-Ife.

3. Planting cowpea in June or July usually led to an escape from several major pests, but the cool night temperatures and the incidence of overcasts which such crops experience seem to preclude optimal reproductive performance.
4. Only thirteen species could be considered major pests in Southern Nigeria while others such as *Ootheca mutabilis, Medythia quaterna* Fairmaire, *Ophiomyia phaseoli* Tryon, *Nezara viridula* Linnaeus etc., constitute potential pests.
5. Of the thirteen species considered as major pests, two – the flower and pod borer *Maruca testulalis* (Geyer) and the black cowpea moth, *Cydia ptychora* (Meyrick), are key pests while the remainder are occasional major pests.

Following these findings, I then directed my energy towards identifying sources of resistance to the two key pests. This has been pursued vigorously in collaboration with a core of dedicated undergraduate and postgraduate students, notable among whom are:

1. Dr. Julius Ipadeola Olaifa whose work culminated in an M.Phil. thesis on the biology of *C. ptychora.*
2. Dr. Thomas Inomisan Ofuya whose work culminated in a Ph.D. thesis on cowpea varietal resistance to *C. ptychora.*
3. Mr. Thank-God Nnamdi Echendu whose Ph.D. thesis is now being written on cowpea varietal resistance to *M. testulalis.*

Our various studies have shown that promising levels of resistance to *C. ptychora*, exist in seven varieties – EW/1, ER-7, BPL-3-1, TVx 3236 O/G, Vita 5, TVu 2994 and TVu 3709. Three of these varieties – ER-7, BPL-3-1 and EW/1 also showed relatively low damage under reduced insecticide dosage; they are therefore good materials for integrated control. Different mechanisms were also found to govern the observed resistance in these varieties. For example, antixenosis with respect to oviposition was found in varieties that were not strongly vegetative;[28] while antibiosis was implied in varieties like BPL-3-1 and TVu 2994.

In addition to the above, the study on the biology of *C. ptychora* revealed that fourteen hymenopterous parasites and three predators contribute to the regulation of its population.[29] One of the parasites, *Bracon hancocki* Wilkinson was shown to be a major parasite which caused up to 25.0% mortality in the field during the late cropping season, and much greater in the dry season.[30] Current work on this parasite has indicated that its action could be enhanced by a more judicious application of insecticides. Moreover, we now know that the resistance to *C. ptychora* shown by BPL-3-1 is in part due to the higher incidence of parasitism by *B. hancocki* on it.

The cowpea breeder in the Department of Plant Science is now busy looking at how to combine the sources of resistance to insect pests identified by us with other desirable attributes like disease resistance in a standard variety. Such a variety would be utilized in integrating its resistance with reduced insecticide application, to take advantage of parasitism by *B. hancocki*. This should be of tremendous benefit in boosting cowpea production by Nigerian farmers.

What is the hope for the future?

A former British prime minister, Sir Winston Churchill once said that opening a quarrel between the past and the present makes us lose the future. Since history only repeats itself if its lessons are ignored, I like to approach the question of my hope for the future by first making a brief historical review of the development of entomology in Nigeria.

The development of entomology as a profession in Nigeria has been largely influenced by Nigeria's colonial history. Even though records show that in the early part of the 19th century, missionary explorers of the West Coast of Africa have been making collections of fascinating insects[31], these were primarily for leisure, rather than for study. With the colonisation of Nigeria firmly established by 1900, attention of the British colonialists was focussed on raw materials for use in commerce and industry. The prospects for raw materials appeared considerable with the discovery by the colonial administrators that a great potential existed for cultivating several cash crops (e.g. cocoa, kola and cotton). Thus, by 1909, positive efforts were already being made to encourage commercial agriculture through the activities of the Agricultural Department of the southern provinces. These activities inevitably included the work of entomologists, as it was soon discovered that insect pests constituted a great limitation to agricultural production. From 1909–1911, C. W. Jemmett served as entomologist for the southern provinces; and it would appear that entomology as a profession in Nigeria started with his pioneering observations on insect pests of crops, especially the attack on yams near Afikpo in Eastern Nigeria by some large 'Melolonthid' beetles.

The effective colonisation of Nigeria by the British was also accompanied by an influx of British settlers. One major problem encountered by these settlers and their horses involved insect bites and insect-transmitted diseases. Notable in this respect was the plague which mosquitos and tsetse flies constituted and which had much earlier earned the entire West Coast of Africa, the appellation – "Whiteman's grave." Therefore, almost concurrently with the agricultural activities, attention was focussed on insects of medical and veterinary importance. In 1910–1911, M. M. Graham (then Director of Medical Research Institute, Lagos), carried out a survey of insects associated with native water receptacles in Lagos Island, Iddo and Ebute Metta. He reported 18 different species, out of which six were mosquitos; and showed one of the mosquitos – *Culex tigripes* var *fusca* Theobald to be predaceous on other mosquito larvae. In another study, he also showed a fish in the family Cyprinodontidae (*Haplochilus grahami* Boulenger) to be an active predator of mosquito larvae.

By 1910, the entomological problems of British colonies in Africa assumed such an importance that an Entomological

Research Committee was formed to co-ordinate the research activities in the colonies. The committee produced the Bulletin of Entomological Research in which agricultural and medical pest problems of the colonies were published; and in addition, the lists of insect specimens received from the various colonies. The Entomological Research Committee eventually became the Imperial Bureau of Entomology, now known as the Commonwealth Institute of Entomology. In 1910–1911, the committee commissioned J. J. Simpson to carry out a study tour of the protectorates of Nigeria. A comprehensive account of his findings was published in 1912, and it included all known records of blood-sucking insects and other arthropods in the protectorates. It also included the first record of the rat flea (a potential vector of plague), *Xenopsylla cheopis* Rothschild. Simpson's work and the studies by Graham apparently marked the beginning of organised medical and veterinary entomological research activities in Nigeria.

The preceding account clearly shows that entomology as a profession in Nigeria evolved primarily as an applied discipline, with the sorely needed fundamental knowledge in areas such as taxonomy being provided by the Imperial Bureau of Entomology in London. This dependence syndrome very regrettably has persisted till today. It has been actively encouraged by various government functionaries who in the typical parlance of the 'Payer of the Piper' dictating the tune, have shown interest in funding only perceptibly applied work. The result of this has been the development of what, I fear, amounts to some phobia and anti-intellectualism in respect of fundamental areas of entomology, even by Nigerian entomologists!

The pattern of development of entomological manpower, the various kinds of entomological studies being conducted and the entomological content of the curricula of higher institutions in Nigeria bear testimony to the above observation. According to the last edition of the Directory of Nigerian Entomology published by the Entomological Society of

Nigeria, there were 99 professional entomologists in Nigeria up to 1978. Adjusting this for growth between then and now, one can estimate about 150 professional entomologists today. Admittedly, this figure is extremely low when set against the magnitude of entomological problems in the country. It is however worse when the figure is broken down in qualitative terms. There are for example, only three qualified personnel engaged in insect taxonomy, three in insect physiology and one each in insect pathology and pesticide toxicology while most others are engaged in pest biology and control. A careful analysis of the bibliography compiled by Olukemi Toye[32] on entomological works done in Nigeria between 1900–1973 similarly points to a strong bias for pest control. 33.35% of the items listed were on medical and veterinary pests; 49.52% on pests of crops and stored produce; and only 17.12% on fundamental aspects of entomology including taxonomy, morphology, physiology etc. The pattern from 1974 till present has not changed for the better, as the British experts, who did the little recorded for these neglected areas between 1900–1973, have virtually faded out of the scene.

The above pathetic picture has undoubtedly arisen mainly because entomology has been taught, and researches in it conducted in a sandwich manner in Nigeria. As aptly described by Toye, "teaching and research in Entomology in Nigeria is left to the fortuitous occurrence of individuals, themselves products of circumstances, in departments and institutes which are committed to multipurpose objectives grudgingly accommodating entomology."[33] This in my view, is a crippling legacy that must be reversed. The history of insect pests and their control in different parts of the world teaches us one simple lesson that entomologists must first understand insects as living organisms. Then, the by-products of the understanding could be exploited in various ways including efficient pest control. Failure to learn from this lesson could be, and has been very expensive on many occasions in the past. Time will not permit a review of startling casehistories in this respect. Nonetheless, I like to mention two recent experiences in Nigeria. The first is the cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero. The outbreak of this pest on cassava, was first reported in 1979[34], and since then, it has become a major pest attracting national attention. It was suggested that it might have been accidentally introduced from the East or Central African countries into Nigeria possibly through passive transport on infested cassava planting material. If this were so, it is very unfortunate because if Nigeria had an insect taxonomist with expertise on mealybugs working with an efficient quarantine service, the millions of naira now being spent to control this pest could have been saved through a timely interception at our border posts. The second experience deals with a pest problem that could arise from endemic fauna. Rice has now become such a major staple food crop in Nigeria that its cultivation is being actively encouraged by the various governments. In 1982, at the International Workshop on the Biotaxonomy of Auchenorrhyncha of economic importance, I drew attention to the fact that species in genera such as *Nilaparvata* Distant, *Sogatodes* Fennah and *Nephotettix* Matsumura have been recorded in Nigeria even though not incriminated as pests.[35] Judging by what was known of celebrated pests of rice in Asia which include *Nilaparvata lugens* Stal, *Nephotettix virescens* (Distant) and *N. nigropictus* (Stal), I warned that the Nigerian species are potential pests that must be kept in view. Subsequently, at the International Institute of Tropical Agriculture (IITA) in Ibadan, 16 rice cultivars which were among plant introductions being screened for resistance to another insect pest, *Diopsis thoracica* Westwood, showed serious hopper burn due to *Nilaparvata meander* Fennah.[36] The implications of this are quite clear and need no further amplification. I will only point out that if by commission or omission, *N. meander* establishes as a pest in this country, we have neither the expertise nor the facilities to face the kinds of problems with which Asia has been confronted by

N. lugens in terms of proper species distinction and separation of individual variations, biotypes, morphs etc.

One point however gives me optimism for the future on the possibility of our being able to correct the dearth both in quantitative and qualitative terms of the entomological capability of Nigeria. Our Department of Plant Science has been pursuing a staff development programme that will enable her to face up to the challenges of training the required manpower. Even though our effort in this direction is at its infancy, I am happy to say that we now have five entomologists, each with expertise in insect taxonomy, insect biology/ecology, pesticide toxicology, insect physiology/biochemistry and insect pathology/biological control. I am not aware of any other University in Nigeria nor indeed in West Africa that has this nucleus of entomology teachers. What now needs to be done is to capitalize on this nucleus and strengthen its capability such that it can become a full-fledged Department of Entomology. The University of Ife has been known for her premier position in the development of disciplines on which there are glaring deficiencies in Nigeria. We shall only now be adding another feather to our cap by ensuring the realisation of this goal. I sincerely hope that we will not let this opportunity slip, in our next quinquenium.

The Nobel Laureate, Albert Einstein, on being requested for a mathematical formula for success, was credited with saying that if a represents success, then $a = x+y+z$, where x is work, y is play and z is keeping your mouth shut. I believe I have within the last hour or so, laboured with you all to show the involvements of 'six-legged science', and the magnitude of the entomological problems in Nigeria. I will now keep my mouth shut, so that we can go and play. However as we go to play, let us all reflect in our minds on the salient points of this inaugural address and resolve to support the cause of the insect scientist, even by joining their crusade as amateur entomologists.

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