Benson Idahosa University
Academic Excellence with Godliness
Benin City

18th INAUGURAL LECTURE

"THE PARADOXICAL LIFE OF INSECTS: THE TESTIMONIALS OF AN ENTOMOLOGIST"

Delivered by

Professor Taidi Ekrakene

B. Tech. (Akure), M.Sc., Ph.D. (Benin), PGDE (BIU)

Professor of Stored Products and Forensic Entomology

March 28, 2023

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DEDICATION

I dedicate this work to my Lord and Saviour, Jesus Christ, who has given me eternal life and provided more than enough grace for my academic journey.

&

My both parents, Mr. Benson Ekrakene Taidi of blessed memory and Mrs. Ekaghwa Mary Taidi for their parentage in my life journey.

&

My immediate family, Rev. (Mrs.) Sarah I. Ekrakene, my wife of immeasurable value, Onome B. Ekrakene, Eseoghene R. Ekrakene, Ogheneruemu C. Ekrakene and Okeoghene F.D. Ekrakene, my beautiful jewels for their encouragement and peace in the home.

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PROTOCOL

President and Head of Cabinet, CGMI Global Rt. Rev. Dr. F.E.B. Idahosa
Members of the Governing Council of Benson Idahosa University present
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Esteemed Members of the Benson Idahosa University Senate
Principal Officers of other institutions
Members of Staff of Benson Idahosa University present
Colleagues from our sister universities present
Bishop of the Historic Miracle Centre Bishopric and Director of Ministry of CGMI and his amiable wife
Director of Administration, CGMI worldwide
Director of Finance, CGMI, worldwide
All members of the Clergy present
Members of CGMI, the Historic Miracle Centre Bishopric
Members of CGMI, Peniel Province
Family members present
Gentle men and women of the Press
Great BIU Students
Ladies and Gentlemen

1.0 PREAMBLES

Mr. Vice Chancellor Sir, I am very grateful to God who has made it possible for me to stand before everyone present to deliver this lecture. Indeed, it is all by His grace that I am alive and have attained this milestone of a professor, a noble milestone indeed, for which I am required by the creed of the profession, to justify why I am and continued to be called a professor. It is a call that the profession demands of me, and I am here to give effect to it, and to continue to savour every benefit that is attached thereto. Amund (2000) referring to the words of Former Vice Chancellor of the University of Lagos, Late Prof. Jelili Adebisi Omotola OON, SAN noted that a professor who did not deliver inaugural lecture is likened to a new-born child without a naming ceremony.

Today, I am here to announce on the rooftop of my voice, that on October 1, 2017, after painstaking internal and external processes of the University, was promoted to the rank of a Full Professor. In the University System, inaugural lecture is one of the avenues provided for Town and Gown to meet, among other goals intimate the public with research findings for the advancement of humanity. Today, I am immensely grateful to Mr. Vice Chancellor and Management for approving this date and deploying university resources for its actualization.

Mr. Vice Chancellor Sir, this being the third lecture from the Department of Biological Sciences and the fourth from the Faculty of Science, is the first to be delivered in the field of entomology (study of insects) in this university. I have done research work in six major research areas, and it would be near impossible for me to accommodate all in a one-hour lecture, hence this lecture will chronicle my research activities in three of the six areas namely – stored product pests, environmental ecology, and forensic entomology to the understanding and enjoinment of this audience. It is therefore my honour and pleasure to stand before this distinguished audience to deliver my Inaugural Lecture – the 18th in the series entitled "*the paradoxical life of insects: the testimonials of an entomologist*".

Mr. Vice Chancellor, Sir, insects exhibit a paradoxical lifestyle. This means that they have contrasting lifestyle depending on the types. They can be good and our friends or bad and our enemy. I am almost a hundred percent certain that everyone listening to me now can attest affirmatively to this. They are a good friend because without them perhaps life would cease to exist. They are bad and our enemy because they cause unquantifiable pain and damages to the existence of life itself.

2.0 INTRODUCTION

2.1 Insects

Insects are grouped with other animals sharing similar characteristics in the phylum Arthropoda. Arthropods, as they are known, are generally characterized as having their body divided into grooves to form segments and a well-developed covering, integument, which makes up the outer shell, or exoskeleton.

Some of the arthropod body segments possess one or more pairs of jointed appendages from which the phylum name was derived (from *arthro*, joint; *poda*, feet) (Pedigo and Rice, 2009). Specifically, insects belong to the class Hexapoda (formerly Insecta), constituting the most important category of Arthropoda. The class has some specific features that set its members apart from other arthropod classes. These features include:

- A body divided into three distinct regions: head, thorax, and abdomen.
- A middle region, the thorax, bearing three pairs of legs and, most often, two pairs of wings. Although, some insects are completely wingless.

- ❖ Lack internal skeleton, instead they are covered with external shell (exoskeleton) that protect internal organs.
- ❖ Insects have typical mouth parts a pair of lower jaws called maxillae and upper jaws called mandibles. There are variations however to this structure, as many moths and butterflies have tubular sucking mouthparts, many bugs, and other blood-sucking insects have sucked stabbing mouthparts and some adult insects simply do not have functional mouthparts.
- ❖ Insects have a pair of antennae located on their head.
- ❖ They have a breathing system composed of air tubes.

2.2 Types of Insects

Insects belong to the kingdom *Animalia* and are classified and grouped by their phylum (Arthropoda), class (Hexapoda formerly Insecta), order, and family. Then individual species of insects make up specific genera. This makes it easy to identify insects and know if they are dangerous or not. Erwin (1982) estimated about 30 million different species worldwide from which over 900,000 have been characterized. This huge number has been criticized by other scientists (May, 1988; Stork, 1988). Despite the inherent biases in methodology noted in the estimation of Gaston (1991), global insect species of 5 million is most accurate. Thus, only about 20% of the global insect fauna is probably known and named, so clearly a great deal of basic exploration is needed.

The classification of animals and plants is based primarily on the physical characteristics and relationships of the animals and plants. The order of classification follows pattern of kingdom, phylum, class, order, family, genus, and species. Pedigo and Rice (2009) have noted 31 insect orders and emphasized 7 as being the most diverse and account for the greatest share of our pest problems. Accordingly, an overall scheme of insect ordinal classification which many entomologists consider to be from the most primitive insects to the most highly evolved is presented below:

Class Hexapoda (formerly Insecta)

Subclass Apterygota – meaning wingless insects.

1. Proturan – proturans
2. Collembola – springtails
3. Dipluran – diplurans
4. Thysanuran – bristletails
5. Microcortphia – jumping bristletails.

Subclass Pterygota – winged and some wingless insects.

Division Exopterygota – simple body change during growth

6. Ephemeroptera mayflies
7. Odonatan – dragonflies and damselflies
8. Orthoptera - grasshoppers and crickets
9. Phasmatodea – walkingsticks
10. Grylloblattaria – rock crawlers
11. Mantophasmatodea – gladiators
12. Dermaptera – earwigs
13. Plecopteran – stoneflies
14. Embiidina – webspinners
15. Zoraptera – zorapterans
16. Isoptera – termites
17. Mantodean – mantids
18. Blattodea – cockroaches
19. Hemiptera – bugs, aphids, scale insects, hoppers, cicadas, psyllids, and whiteflies
20. Thysanoptera – thrips
21. Psocoptera – psocids
22. Phthirapteran – chewing lice and sucking lice

Division Endopterygota – complex body change during growth

23. Coleoptera – beetles
24. Neuroptera – alderflies, antlions, dobsonflies, fishflies,

lacewings, snakeflies, and owlflies

25. Hymenoptera – ants, bees, wasps, and sawflies
26. Trichoptera – caddisflies
27. Lepidoptera – butterflies and moths
28. Siphonaptera – fleas
29. Mecoptera – scorpionflies
30. Strepsiptera – twisted-winged parasites
31. Diptera – flies and mosquitoes

Source: Pedigo and Rice (2009)

2.3 Insects' abundance and success

Insects (hexapods – arthropods having six legs) are the most diverse group in contemporary animals in terms of biological niches, species diversities and richness. Biologically, their origins are highly debatable, primarily because of almost complete absence of fossils that connect them to other major arthropod groups (sub-phyla) including Crustacea, Myriapoda (centipede and millipedes), Chelicerata (scorpions and spiders) (Glenner *et al*., 2006). According to Grimaldi and Engel (2005), evolution begets diversity and insects are the most diverse organisms in the history of life, so insects should provide profound insight into the evolution.

They noted that by evolutionary success, insects are unmatched: in the longevity of their lineage, their species numbers, the diversity of their adaptations, their biomass, and their ecological impact. Finn *et al*., (2015), have mentioned that, excluding bacteria, insects represent more than half of the biodiversity in the world, and are thus considered the most evolutionary successful group of terrestrial organisms in the history of life. Advancing further, they mention that the remarkable explosion of different insect lifestyles is due to their ability to colonize highly diverse niches from those with exceptionally hot and arid conditions to others with temperatures far below zero.

The inability of insects to regulate their body temperatures has hinged their success on a series of adaptations for survival in the face of desiccation and freezing, including the accumulation of high levels of alcohols such as glycerol or sorbitol in specific organs (Finn *et al*., 2015). Insects' success is largely due to some of the following factors: possession of wings which enable them to move from one place to another, various adaptation tendencies, large reproductive rate, and ability to feed on array of foods.

2.4 Insects' paradoxical life

Mr. Vice Chancellor, Sir, every day, we see some amazing flying, crawling, swarming, buzzing and most times beautiful insects around us. The location notwithstanding, they are actively present, and they present to us the fantastic sites of nature. In most climes, insects are considered dangerous creatures because many research findings have been obtained from insects of medical importance such as malaria-causing mosquitoes. Medical entomology is considered the most popular branch of entomology mainly because of health implications of insects acting as disease vectors and disease agents.

This is followed closely by agricultural entomology due to the attention that pest insects have derived over the years in relation to food insecurity. Notwithstanding, however, insects are paradoxical in their behaviour. They are both beneficial or adversarial to man in the areas of medicine, agriculture, and the environment in so many ways.

2.4.1 Insects are beneficial to man

The activities of many insect species have positive effects on man and the environment in many ways. These include:

Source of food – insects represent a great reservoir of food and food production sources for both human and animals. Ramos-Elorduy (2009), has estimated 1000 -2000 numbers of edible insect species consumed globally. These species include 235 butterflies and moths, 344 beetles, 313 ants, bees, and wasps, 239 grasshoppers, crickets, and cockroaches, 39 termites, and 20 dragonflies, as well as cicadas (Ramos-Elorduy and Menzel, 1998). It is estimated that more than 2 billion people eat insects daily (Pap, 2018). Insects are nutrient-efficient compared to other meat sources. Some insects (e.g. crickets, mealworms) are a source of complete protein and provide similar essential amino acids levels as soybeans, though less than casein (Yi *et al*., 2018, FAO, 2019). They have dietary fibre, essential minerals, vitamins such as B12 (Schmidt *et al*., 2018), riboflavin and vitamin A, and include mostly unsaturated fat (FAO, 2019).

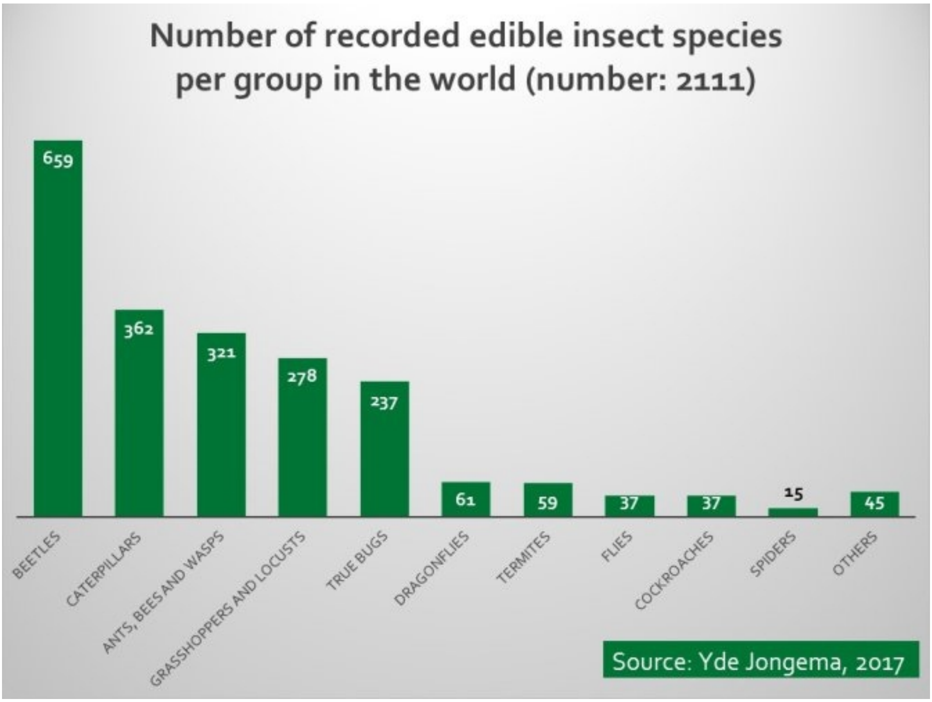


Fig.1: Number of recorded edible insect species worldwide

ii. **Source of Products** – a great number of insects produce certain substances which are beneficial to mankind. Some notable most valued primary resources insects produce today are silk, honey, wax, and their bodies for human consumption and experimentation. Perhaps, silk, which may be referred to as the *queen of fabrics* is a product woven from thread of fine strands secreted from the salivary glands of silkworm caterpillars of the moth *Bombyx mori*. Sericulture is the scientific management of production and marketing of natural silk from silkworms believed to have been developed in China as far back as 2500 B.C. (Pedigo and Rice, 2009). Raw silk is used in the manufacture of woven materials, knitted fabrics, and garments. It is also used in parachutes, parachute cords, fishing lines, sieves in flour mills, insulation coil for telephones and wireless receivers, and tires of racing cars.

Honey and wax are produced by the honeybee, *Apis mellifera*. Honeybees are social insects. They live as colonies and are active throughout the year. They feed on the pollen and nectar of flowers. Wild honeybee hives are believed to have been raided by humans as long ago as 7000 B.C., and management of the species to obtain honey and beeswax, called beekeeping or apiculture, has developed into a major agricultural industry in much of the world (Pedigo and Rice, 2009).

Honey is produced by worker bees that feed on minute quantities of nectar from flower blossoms. A honeybee colony is typically composed of three types of phenotypically distinct kinds of adults: a single queen, a few hundred drones (depending on the season), and tens of thousands of workers (Cervoni and Hartfelder, 2021). The honeybees collect nectar from various flowers and swallow them. Enzymatic action within the honeybee's stomach results in certain changes to the nectar. This is regurgitated and stored in chambers as honey. Honey has laxative, antiseptic, and sedative characteristics. It helps build up the hemoglobin in the blood. It prevents cough, cold, and fever. It cures ulcers on the tongue and alimentary canal. It is also used in the preparation of bread, cakes, and biscuits. As with honey, beeswax is gathered by humans for various purposes such as candle making, waterproofing, soap and cosmetics manufacturing, pharmaceuticals, art, furniture polish, and more (Conrad, 2016).

In addition, another important insect product is the raw material from lac scales (*Lucifer lacca*). Lac is one of the most versatile natural resinous materials with a unique combination of properties that render it useful in plastics, electrical, adhesive, leather, wood finishing, and other industries. In the electrical industry, it is used in the form of insulating varnishes and molded insulators. It possesses very good adhesion to mica. It is an ingredient of varnishes, polishes, and finishes wood used for protective and decorative purposes and is a principal ingredient of sealing wax. It is also used in the manufacture of glazed paper, printing and waterproof inks, nail polishes, dental plates, ammunition, bangles, wax crayons, and optical frames.

Insects as plant pollinators - Insects play an important role in the pollination of plants. Insect pollination constitutes an ecosystem service of global importance, providing significant economic and aesthetic benefits as well as cultural value to human society, alongside vital ecological processes in terrestrial ecosystems. Bees, wasps, ants, butterflies, beetles, and thrips render valuable service in pollination.

The services of honeybees are needed in the production of cultivated crops, such as apples, pears, plums, and vegetables. Cameron and Sadd (2020) make the case for the importance of bumble bees (*Bombus*) as pollinators in many biological communities, noting that, there are approximately 260 species of bumble bees worldwide that pollinate plants in natural ecosystems as well as in agriculture. Bees are a particularly important group of insect pollinators, responsible for pollinating 60–70% of the world's total flowering plant species, including nearly 900 food crops worldwide, such as apples, avocados, cucumbers, and squash. These crops comprise 15–30% of the world's food production, and bees are credited with $4.2 billion in annual crop productivity in California alone (Brauman and Daily, 2014).

Insects as natural enemies – some arthropods are natural enemies to other organisms in our environment. The use of these natural enemies to suppress pest species falls within the biological pest control system. These natural enemies could act against pests as predators in which case they eat up the pest or as parasitoids on or in the host pest thereby killing it. Natural enemies play an important role in limiting potential pest populations. Predatory insects feed on other insects. Ballew (2019) highlighted many different species of predatory insects with various feeding habits.

Some predators eat their prey whole while others suck out the bodily fluids of their prey. Many predatory insects are skilled fliers and/or runners which aids in catching prey. Some predators use intricate crypsis (camouflage) that allows them to ambush their prey. Others feed on slow, sedentary insect species; therefore, they do not require speed or stealth.

Parasitoids are insects that develop at the expense of a host insect, eventually killing it. Parasitoids live and develop either within their host (endoparasitic) or outside of it (ectoparasitic). In most endoparasitic species, adult parasitoid oviposits (lay or insert) an egg into the body of the host, where it grows while gaining nourishment from within the host's body. The host dies after the parasitoid emerges to pupate. In ectoparasitic species, adult parasitoids paralyze the host and oviposit an egg on the outside of the host's body Ballew (2019).

Parasitoids of Agricultural Importance

- *Trichogramma sp.* – egg parasitoid of sugarcane internode borer.
- *Chelonus Blackburn* – egg larval parasitoid of potato tuber moth
- *Bracon brevicornis* – Larva parasitoid of coconut black-headed caterpillar (BHC)
- *Parasierola nephantidis* – Larva parasitoid of coconut BHC

- *Eriborus trochanteratus* – Larva parasitoid of coconut BHC
- *Eucelatoria bryani* – Larval parasitoid of American bollworm *Helicoverpa armigera*
- *Sturmiopsis inference* – Larval parasitoid of sugarcane shoot borer.
- *Eucarcelia illota* – Larval pupal parasitoid of *H. armigera*
- *Trichospilus pupivora* – Pupal parasitoid of coconut BHC
- *Tetrastichus israeli* – Pupal parasitoid of coconut BHC

Insects as a scavenger - scavengers are animals that consumed dead organisms that have died from causes other than predation or have been killed by other predators (Tan, *et al*., 2011). They play important roles in the environment through the removal of decaying organisms, serving as a natural sanitation service (Ogada, *et al*., 2011). Some insects such as flies, termites, beetles, maggots, etc. feed upon waste material like the dead and decaying matter of animals and plants. By this action, they act as scavengers and remove dead and decaying materials from the environment thereby sanitizing the environment.

The decay of carrion, for example, brought about mainly by bacteria, is accelerated by the maggots of Dipterans. The activities of these larvae, which distribute and consume bacteria, are followed by those of moths and beetles, which break down hair and feathers. Through this process, they help to enrich the soil through nutrient recycling.

Other important benefits of insects include their use as experimental organisms, games, and employment avenues among many others.

2.5 The harmful effects of Insects

2.5.1 Transmission of Diseases

Insects bring about harmful effects by destroying tissues of their hosts, e.g., larvae of a fly *Dermatobia* burrow under the skin and cause cutaneous myiasis (Akunne *et al*., 2013). The larvae of a botfly, Gasterophilus enter the stomach of horses and cause inflectional myiasis. Some insects transmit disease-producing bacteria and protozoans.

The insect which carries the diseases organisms from one host to another is called a vector. A summary of insects that cause disease as outlined by (Ubachukwu, 2009) is given below.

Order Dictyoptera (Cockroaches and Mantids): Cockroaches spoil food and are intermediate hosts of some helminths of humans.

Order Hemiptera (Bugs, Bed bugs): These give irritating bites. Cone-nose bugs transmit Chagas disease. Order Phthiraptera (Anoplurans and Mallophagans) (Lice): they cause irritation and skin infections and are vectors of typhus, trench fever, and louse-borne relapsing fever.

Order Coleoptera (Beetles): invasion of the alimentary canal and intermediate hosts of helminths of man. Larvae can cause urticaria.

Order Lepidoptera (Butterflies and moths): Caterpillars found in the alimentary canal. Caterpillar hairs cause urticaria. Moths attack the eyes of cattle and suck blood.

Order Hymenoptera (Wasps, Bees, and Ants): they give venomous stings and bites.

Order Diptera (Flies, Mosquitoes, and Gnats): Different types of biting flies irritate. They transmit diseases e.g., malaria, dengue, yellow fever, filariasis, leishmaniasis, trypanosomiasis, etc. They cause tissue invasion called myiasis.

Order Siphonaptera (Fleas including Jigger or Chigoe fleas): They cause direct irritation and transmission of plague.

2.5.2 Household Pest

Pests in households flourished with the storage of dried organic material in houses, such as grains, flour, and dried dog food. Some common insect

pests in households include:
Carpet Beetles: these tiny insects are quite destructive in the larval stage on nearly anything organic. Heavily-infested food should be discarded. Lightly-infested food may be frozen for a few days and then used. Pantry shelves should be vacuumed and cleaned thoroughly. They also infest carpets.
Pantry Moths: several kinds of moths appear in pantries to feed on all kinds of stored foods, the Indian meal Moth perhaps being the most common. They may be controlled to some extent by using sticky trap boxes that contain pheromones as attractants.
Silverfish: these insects are wingless, primitive types that live in areas of moderate humidity and darkness. They are a particular threat to paper products, and the glue used in book and magazine production. Silverfish can extract nutrients from the cellulose fibers in paper products.
Cockroaches: there are thousands of cockroach species in the world, but only a handful is pests. Control measures commonly involve sprays or dust.
Termites: this group of insects is the least commonly seen of all the household pests. They infest wood and must rely on protozoa and bacteria in their guts to break down the cellulose of the wood. Recent studies indicate that termite digestion produces large quantities of methane gas (flatulence), which, because of the large numbers of termites affects world ecosystems.
Bedbugs: Though not very common in many countries currently, in earlier decades, these bloodsuckers were an annoying problem, and would also be found in the seats of trains, trolley cars, and theaters.
Carpenter Ants: The Black Carpenter Ant, *Camponotus pennosvlvanicus*, is a problem in many households. They originate from large nests in dead or dying trees and then enter houses to start secondary nests, usually in walls. Sometimes homeowners are alerted to their presence by the sight of small piles of sawdust. Blockage of entry places and the use of baits will usually control these large pests.
Cloth Moths: adults of this species do not feed, but damage to clothes is caused by the larvae, which avoid light and live inside silken cases or webs. Wool, hair, fur, and feathers are eaten. Dry cleaning kills the larvae,

and storage in airtight boxes or bags will protect clothes.

2.5.3 Injurious to Domestic Animals

Domestic animals are often seriously injured by insects. Many of them live as parasites either externally, such as fleas, lice, bugs, mosquitoes, and others, or internally such as larvae of botflies in sheep. The bird lice feeding upon the feathers of chicken cause irritation and loss of flesh. The blood-sucking horn fly is a serious pest to cattle. The grubs of ox warble-fly cut holes in the skin of cattle, thus causing damage to hide and flesh. The larvae of horse botflies sometimes cause serious disturbances in the stomach.

2.6 Insect pest and control

The early development of agriculture by humans led to the remodeling of the landscape significantly by encouraging some animals and plants to multiply and others to be displaced. This resulted in reduced biodiversity and as might be expected, a greater confrontation of humans with insects.

Humans were not only to contend with insects feeding on their bodies and transmitting diseases but, they had to also be concerned with insects competing for a very important resource which is limited, their crops. As the human population increased and, agriculture developed further, greater areas of land were utilized for farming, and pressure from insect populations and other pests such as weeds increased disproportionately, making pest control a major preoccupation (Pedigo and Rice, 2009).

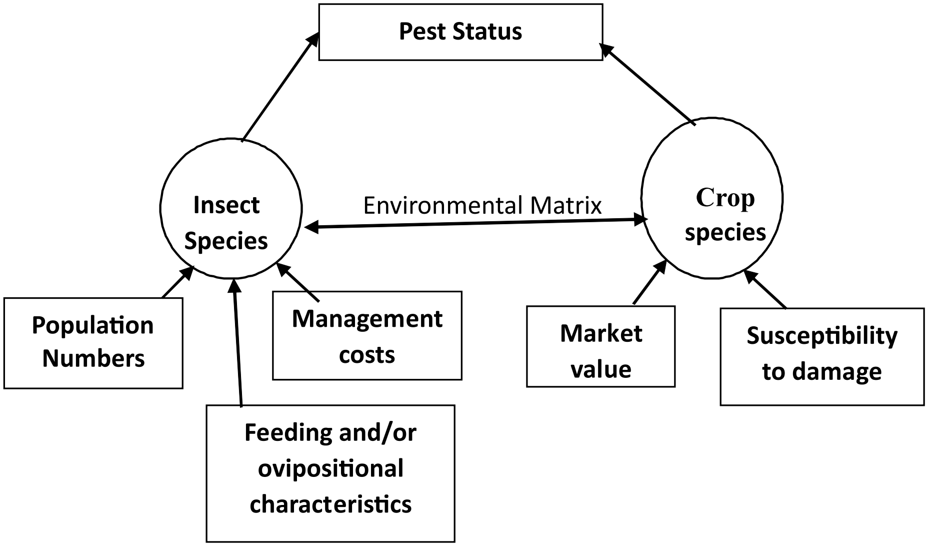


Fig. 2: Diagrammatic representation of the major factors contributing to pest status. Source: Pedigo and Rice (2009).

Over the years, humans have attempted various approaches to alleviate insect pest problems. The most popular in recent times is the pest management, also called Integrated Pest Management. It is a general approach to dealing with all kinds of pests which insects and other arthropods are key components to keep their population below economic injury level. The major objective of the integrated pest management strategy is to reduce losses from pest activities in ways that are effective, economically sound, and ecologically compatible.

According to the National Policy on Food and Nutrition in Nigeria (2001), the food distribution system in Nigeria remains largely inefficient, due to factors such as crop seasonality, inadequate storage technology and facilities, inadequate transport and distribution systems, and inadequate market information. All these result in considerable spatial and seasonal variation in food production and availability and are responsible for the considerable food price variations in the country. Another major problem affecting food availability, especially at the household level, is the inadequacy of food storage facilities at that level, resulting in significant storage losses. Losses of cereals such as maize, millet and sorghum, are estimated in the range of 25% to 30%; for root crops, from 50% to 70%, and approximately 70% for fruits and vegetables. The degree of losses is largely dependent on some inert characteristics specific to the grain type (Iloba and **Ekrakene**, 2008), and the mechanisms invading insect pests damage differ considerably (Whitteaker, 1971; Gupta and Kadyan, 1971). Additionally, due to lack of adequate storage facilities and economic pressures, farmers sell part of their produce soon after harvest at low and unremunerative prices, resulting in escalating food prices during the off-season period – often two to three times higher than prices immediately following the harvest.

Mr. Vice Chancellor Sir, in view of the humongous post-harvest losses usually encountered in storage, either directly or indirectly, resulting majorly from insect pest activities, I decided to join other researchers in finding alternative means of insect pest control methods that are effective, easy to use, cheap, biodegradable, safe, and have comparative results to the synthetic ones whose characteristics are highly detrimental even though they are effective. It was on this note that when it was time for me to choose one of three major project areas in Biology (hydrobiology, parasitology and entomology) at my first degree, I stunk with entomology to give me clearer understanding of the activities of insects and how they could be manipulated for the benefit of humanity, noting that the National Development Goals of Nigeria has food security as a cardinal requirement in the sustenance of our teeming population.

Mr. Vice Chancellor Sir, to a relative extent, I have understood the basics of insects – anatomy, biology, physiology, etc. and have therefore deplored that knowledge to manipulate insects to the advantage of man. I urge therefore you to come along with me as I intimate you with the testimonials of my research activities which constitute my modest contributions to knowledge in general and the study of entomology in three of six areas of my scientific involvement in the past 18 years.

3.0 MY TESTIMONIALS AND CONTRIBUTIONS TO KNOWLEDGE

3.1 Stored Products Entomology

Mr. Vice Chancellor Sir, my research activities started with my undergraduate project under the supervision of now late Mr. S.T. Arannilewa of the Food Storage Technology Programme, Department of Biology of the Federal University of Technology, Akure with the aim of using some commonly available plant materials to reduce/prevent the damages from stored product pests, especially *Callosobruchus maculatus* and *Sitophilus zeamais* that are notable insect pests of cowpea and maize respectively.

These two insect pests are notorious for the numerous damages they cause both on the field and in storage thereby fueling food insecurity. They are both fields to storage pests. *C. maculatus* infestation begins in the field while most damages occur during storage (Prevett 1961) causing over 90% yield reductions (Caswel 1981). The population of *Callosobruchus maculatus* can grow exponentially, leading to a significant loss in seed weight, germination viability, and the market value of the crop (Caswell, 1968; Singh, 1977; Southgate, 1979; Beck and Blumer, 2014). It is estimated that the economic losses caused due to *Callosobruchus maculatus* infestation in stored grain legumes are 35%, 7-13%, and 73% in Central America, South America, and Kenya, respectively (Nahdy, 1994 and Hu *et al*. 2009).

Legume seeds stored for six months can experience 70% seed infestation and about 30% yield loss, leaving them unacceptable for human consumption (Singh and Jackai 1985). It is also estimated that *S. zeamais* accounts for about 10 - 40% of the total damage to stored maize grains worldwide. Grain weight losses of 12 - 80% attributed to maize weevil have been documented in untreated grains stored in traditional structures in the tropics (Muzemu *et al*., 2013). These losses are among the motivation for my research drive in stored product entomology.

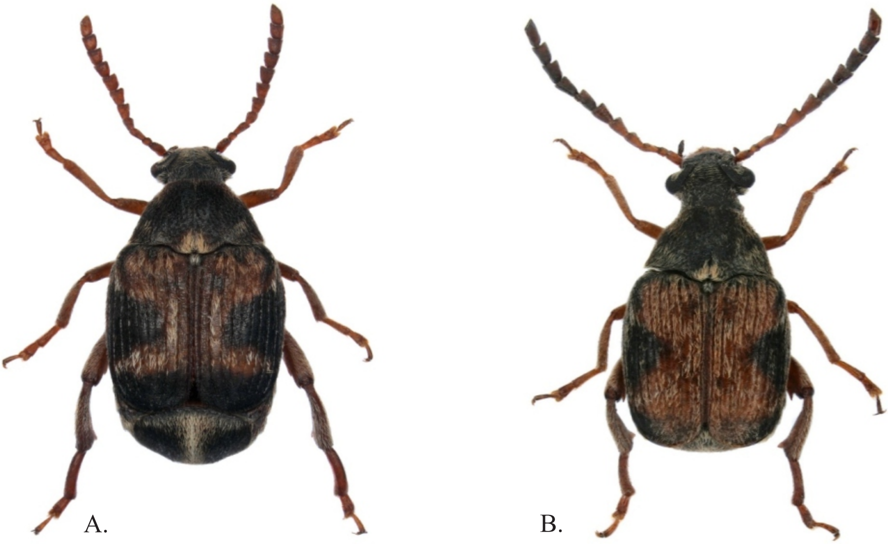
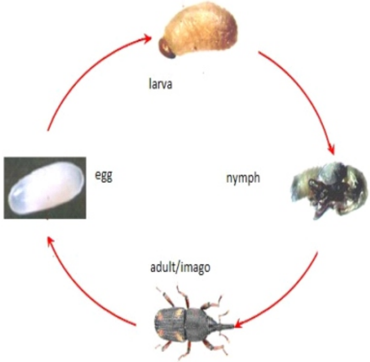


Plate 1: Cowpea weevil, *Callosobruchus maculatus*
A: Female B: Male

Plate 2: Maize weevil, *Sitophilus zeamais*



A

B

Plate 3: Life cycle of *Sitophilus zeamais*

Plate 4: Life cycle of *Callosobruchus maculatus*

Source: Meikle *et al*., (1999).

Accordingly, Arannilewa, **Ekrakene** and Akinneye (2006) studied four medicinal plants (*Aristolochia ringens* (Vahl), *Allium sativum* (L), *Ficus exasperata* (L), *Garcina kola* (H)) as protectants against the maize weevil, *Sitophilus zeamais* (Mots) in the laboratory at 0.5, 1.0 and 1.5% (w/v) concentrations to assess adult mortality, adult emergence, grain damage effect and weevil perforation index.

The results revealed increased adult mortality with days of exposure in all concentrations. *Ar. ringens and A. sativum* recorded 100% and 85% adult mortality respectively and both effectively prevented significantly, adult emergence as well as exerting better grain protection with highly reduced weevil perforation indices. These findings corroborated Adedire and Ajayi (1996), who reported the insecticidal ability of *Ar. ringens*, *Al. sativum* and other plant types and noted that, the strong choky odour they produce may have exerted a toxic effect by disrupting normal respiratory activity of the weevils, thereby resulting in asphyxiation and subsequent death. Richards (1978) reported that essential oils of plant origin are highly lipophilic; and therefore, could penetrate the cuticle of insects. This may be another reason for the potency of the extracts. By this method, the plant material apart from its odour may have also acted as a contact poison. We also found out that, the oil extract, on application, covered the outer layer (testa) of the grains (thereby serving as food poison to the adult's insects); while some of them penetrated the endosperm and germ layers (thereby suppressing oviposition and larval development) (Arranilewa *et al*., 2006). The study revealed that *Ar. ringens* and *A. sativum* could be potent bioinsecticides for protecting maize grains from *S. zeamais* infestation and damage thereby prolonging storability and grain security. The results of this study, besides adding to the literature database of stored product entomology, provided a baseline for us to consider assessing more commonly available plant materials in a manner that simplifies processing and application methodology, especially for non-scientific minded peasant farmers who do not have competency in science and technology.

Table 1: Effect of plant extract on adult weevils – *Sitophilus zeamais*

Plants	Conc. (%, v/w)	Mean mortality (±S.D) (%) at 1 - 4 days post treatment			
		1	2	3	4
Ar. ringens	0.50	13.33±0.54[a]	38.33±0.00[bc]	55.33±0.00[c]	79.33±0.
	1.00	45.00±0.47[bc]	72.67±0.94[d]	85.00±0.72[d]	94.33±0.
	1.50	60.33±0.27[c]	98.00±0.94[e]	100.00±0.00[e]	100.00±0
Al. sativum	0.50	0.00±0.00[a]	2.67±0.27[a]	12.00±0.00[a]	33.33±0.
	1.00	1.67±0.27[a]	18.33±0.27[b]	30.33±0.00[b]	45.00±0.
	1.50	8.33±0.54[a]	39.33±0.82[bc]	65.00±0.27[d]	85.00±0.
G. kola	0.50	0.00±0.00[a]	1.67±0.27[a]	3.33±0.00[a]	6.67±0.
	1.00	0.00±0.00[a]	3.33±0.27[a]	5.33±0.27[a]	10.00±0.
	1.50	0.00±0.00[a]	10.00±1.25[a]	31.67±0.94[bc]	50.00±0.
F. exasperata	0.50	0.00±0.00[a]	0.00±0.00[a]	1.67±0.27[a]	4.33±0.
	1.00	1.67±0.00[a]	3.33±0.27[a]	5.00±0.27[a]	12.67±0.
	1.50	1.67±0.27[a]	8.33±0.27[a]	13.33±0.00[a]	20.00±0.
Control (solvent-treated)	0.00	0.00±0.00[a]	0.00±0.00[a]	0.00±0.00[a]	0.00±0.

Each value is the mean of four replicates. Means followed by the same letters are not significantly different (P<0.05) from each other, using the New Duncan's Multiple Range Test.

Table 2: Effect of plant extracts on Sitophilus zeamais adult emergence (7weeks post-treatment)

Plants	Conc (%, v/w)	Mean number of emerged adults (±S.D)
Ar. ringens	0.50	10.33 ± 1.28^{b}
	1.00	$7.00 \pm 1.19^{a`}$
	1.50	1.00 ± 0.00^{a}
Al. sativum	0.50	18.00 ± 2.76^{b}
	1.00	12.33 ± 1.19^{b}
	1.50	9.67 ± 1.19^{b}
G. kola	0.50	27.67 ± 1.28^{c}
	1.00	11.00 ± 1.19^{b}
	1.50	10.33 ± 0.00^{b}
F. exasperata	0.50	56.33 ± 3.33^{d}
	1.00	52.67 ± 1.19^{d}
	1.50	50.00 ± 1.28^{d}
Control (Solvent-treated)	0.00	82.67 ± 1.28^{e}

Each value is the mean of four replicates. Means followed by th e same letters are not significantly different ($P<0.05$) from each other, using the New Duncan's Multiple Range Test.

Table 3: Effect of extracts on grain damage

Plants	Conc. %, v/w)	Total No. of grains	No of perforated grains	Unperforated grains	% grain damage	*WPI
A. ringens	0.50	244	11	233	4.51	10.65
	1.00	236	9	227	3.81	9.15
	1.50	238	1	237	0.42	1.10
A. sativum	0.50	249	20	229	8.03	17.51
	1.00	238	10	228	4.20	10.00
	1.50	249	7	242	2.81	6.91
G. kola	0.50	242	27	215	11.16	22.78
	1.00	234	10	224	4.27	10.14
	1.50	237	10	227	4.22	10.04
F. exasperata	0.50	224	58	166	25.89	40.64
	1.00	134	50	84	37.31	50.00
	1.50	229	50	141	21.83	36.60
Control (solvent- reated)	0.00	238	90	148	37.81	50

*Weevil Perforation Index (WPI). A value above 50 is an indication of negative protectant ability.

Hence, Iloba and **Ekrakene** (2006) studied comparatively the insecticidal effects of the powders of the leaves of *Azadirachta indica*, *Hyptis suaveolens,* and *Ocimum gratissimum*, which are readily available plant materials at 1.5, 2.5 and 3.5/80g maize grain and cowpea seeds against *Sitophilus zeamais* and *Callosobruchus maculatus*, the notorious insect pests of stored maize (*Zea mays*) and cowpea (*Vigna unguiculata*) respectively aimed at comparing their effectiveness in controlling the pests. The results obtained revealed that the three plant powders exerted better adult mortality effect ranging from 83% to 96% against *Callosobruchus maculatus* compared to 13% to 50% adult mortality recorded against *Sitophilus zeamais*.

The plant types and concentrations perform better than the controls (0-33% mortality for *C. maculatus* and 0-3% for *S. zeamais*) within the 7 days post treatment. From the results obtained, despite the adult mortality recorded, new emergences were recorded, and the number of emergences was a characteristic of the different plant used. The results of the bioassays of Arannilewa **Ekrakene** and Akinneye (2006) and Iloba and **Ekrakene** (2006) corroborated other researchers who had searched for and found them positive, locally available plant materials that have grain protectant ability (Odeyemi, 1993; Ivbijaro, 1983; Ofuya, 1986; Lale, 1992, 1995; Ivbijaro and Agbaje, 1986; Arannilewa et al., 2002; Arannilewa, 2002; Adedire and Lajide, 1999; Ajayi and Adedire, 2003; Adedire and Akinneye, 2003; Akinkurolere et al., 2006).

Furthermore, Iloba and **Ekrakene** (2006a), studied the daily mortality responses of *C. maculatus* and *S. zeamais* to changes in the concentrations of *A. indica*, *O. gratissimum* and *H. suaveolens* to ascertain the most effective time of exposure for maximum mortality effect and to provide baseline duration of exposure. The results revealed daily mortality of *S. zeamais* was dependent on concentration and peaked on day 3 of exposure. This however contrasted the mortality pattern exhibited by *C. maculatus* which was independent of concentration and peaked on day 2 post-treatment.

Mr. Vice Chancellor Sir, the ability of these plant materials to kill these pests is inherent in the plant themselves. Sallam (1999), Bell *et al*., (1990), and KeAOEta *et al*., (2000) among other researchers had reported that secondary compounds also called phytochemicals present in plants that do not have known functions in photosynthesis, growth or other aspects of plant physiology give plant materials or their extracts their anti-insect activity. The secondary compounds include alkaloids, terpenoids, saponin, phenolics, flavonoids, and other minor chemicals. About this, **Ekrakene** and Ogunsede (2015) evaluated phytochemicals (saponins, flavonoids, and alkaloids) from lemon (*Cymbopogon citratus*) and curry (*Murraya koeinigi*) leaves as potential protectants against the bean weevil, *C. maculatus* at 0.2g, 0.4g and 0.6g/ml concentration per 100 grains of cowpea and to explain the mechanisms of action they exhibit against the pests. The results revealed increased mortality with an increase in concentrations of phytochemicals irrespective of plant type and were most effective in the first 3 days of treatment, agreeing with our earlier submission as reported by Iloba and **Ekrakene** (2006a). Saponins from both plant types were most potent in killing adult *C. maculatus* acting as a fumigant whereas, flavonoids and alkaloids showed better ovicidal potency in preventing new *C. maculatus* emergence.

Mr. Vice Chancellor, Sir, following our investigation of plant materials as possible protectants against these two notorious fields to store insect pests of *Sitophilus zeamais* and *Callosobruchus maculatus*, we submit that *field to store losses being encountered agriculturally, which usually fuel food insecurity could be reduced significantly, if locally sourced plant materials in the forms of extracts, powders or purified phytochemicals are readily available and systematically applied to maize grains and cowpeas in the appropriate proportion.*

3.2 Environmental Entomology

Mr. Vice Chancellor Sir, my research journey was not and is not restricted to stored product entomology. It also includes a critical assessment of the soil ecosystem and how it regains biodiversity when subjected to human activities which have far-reaching effects, resulting in the degradation of the environment. According to Williams (1999), Soil can be referred to as a world of its own life and biodiversity, consisting of various forms of life in an endless series of interlinked caves with lots of food and stable environmental conditions like a rainforest.

The human activities of agriculture, urbanization, industrialization, etc. have resulted in the release of waste products into the environment with their attendant consequences. Though, the use of pesticides in the last 50 years has greatly increased the quantity and quality of food for our growing global population (Olufade e*t al*., 2014; Adeyeye and Osinbanjo, 1999), the widespread usage of these pesticides in the agro and non-agro ecosystem have resulted in the presence of their residue in the various environmental matrices such as soil, water, and air (Aktar *et al*., 2009; Ortelli *et al*., 2004). The resultant consequences are the death of fish and reproductive and organ failures in humans among others. Motohashi *et al*., (1996) reported that an estimated amount of less than 0.1% of the pesticides applied to crops reach the target pests, and the rest enter the environment, contaminating soil, water, and air as well as poison or adversely affecting non-target organisms.

Mr. Vice Chancellor Sir, soil microarthropods are among the non-target organisms in the soil that are adversely affected by human activities from agriculture, industrialization, urbanization, and the like. The soil environment is habitable to 3 groups of soil organisms (water film dwellers – protozoans, rotifers, tardigrades; soil pore dwellers – microarthropods and other microfauna species; real soil dwellers – earthworms and microarthropods). Soil arthropods are a vital link in the food chain, as decomposers, and without these organisms, nature would have no way of recycling organic materials on its own (Trombetti and Williams, 1999). Mr. Vice Chancellor, Sir, on the basis of the vital role these soil dwellers (soil fauna) play in the food chain/food web, biogeochemical cycles of nature, and maintaining ecosystem balance, I had wondered what was the fate of these organisms whenever there was willful or accidental discharges from vehicles and industrial wastes, agricultural applications such as fertilizers, herbicides, and other pesticides which have the ability to reduce or eliminate these biodiversities.

My curiosity was satisfied by a few findings arising from our investigations:
Iloba and **Ekrakene** (2008) studied soil micro arthropods associated with the workshop soil in relation to the effect of petroleum and carbide wastes present. The results revealed a total number of 268 soil microarthropods sampled between May and July, from eight families (Collembola, Coleoptera, Isoptera, Hymenoptera, Acarina, Myriapoda, Crustacea, and Arachnida), obtained from petroleum polluted, carbide polluted, and controlled stations accounting for 10%, 20%, and 70% of the total sampled microarthropods respectively.

The presence of these contaminants reduced the soil microarthropods within the workshop soils with carbide having a stronger effect on the arthropods compared to petroleum waste. The abundance of the soil microarthropods correlated positively with moisture content and total hydrocarbons. Collembola, Coleopterans and Acarina were more abundant (Iloba and **Ekrakene**, 2008). The results of this work prompted a need to find an answer to how the soil microarthropods would re-colonize soil when different pesticides were applied.
Badejo (1982), and Badejo and Akintola (2006) emphasized that most soil fauna especially the orbited mites enjoy a better conducive microenvironment within the top 5 cm of soil. When insecticides are used

on agricultural crops, most of them sip into the soil. What they do to the soil fauna and how they recover from them is very important because it has implications for the ability of the soil to support food production. Iloba (2016) noted that a clear understanding of this would be very useful in designing bioremediation programmes for such soils. Iloba and **Ekrakene** (2008a, 2009, 2010, and 2011), studied soils treated with dichlorov (an organophosphate pesticide) and endosulfan (an organochlorine pesticide) at single and double dosage applications for a five-month period (April – August), aimed at understanding the recovery rate of soil microarthropods at 0-10 cm depth. The mean number of sampled soil arthropods was significantly different (P>0.05), based on the pesticide concentration compared with the control. There was an initial decrease in the arthropod population because of the lethal effect of the insecticide irrespective of concentration. Acarina, Collembola, and Coleopterans were more in abundance and recovered fastest while Crustacea and Arachnida were least in number and lowest in their ability to recover. There was a generally observed decrease in sampled arthropods from April to June, followed by a resurgence from July to August. However, the resurgence was observed to be dependent on the dosage of pesticide applied.

Table 4: Monthly mean number of microarthropods sampled at different concentrations.

Sampling Months	Conc. (pesticide vol. per 20L of water)	Mean numbers of arthropod sampled (±S.D)
April	.00	19.57±5.77[a]
	.25	14.00±5.16[b]
	.75	9.71±4.75[c]
May	.00	20.86±5.93[a]
	.25	8.29±2.98[b]
	.75	3.14±2.91[c]
June	.00	23.86±7.36[a]
	.25	5.43±2.57[b]
	.75	1.00±1.41[c]
July	.00	26.71±7.93[a]
	.25	13.14±6.23[b]
	.75	8.71±6.42[c]
August	.00	26.43±7.37[a]
	.25	13.29±6.05[b]
	.75	9.29±5.38[c]

Each value is the mean of four replicates. Means followed by the same letters are not significantly different (P<0.05) from each other, using the New Duncan's Multiple Range Test.

Table 5: Mean number of microarthropods sampled at different concentrations.

Soil microarthropod groups	Conc. (pesticide vol. per 20L of water)	Mean numbers of arthropod sampled (±S.D)
Collembola	.00	29.00±3.39[a]
	.25	12.60±4.72[b]
	.75	8.20±5.17[c]
Coleoptera	.00	26.20±3.35[a]
	.25	12.00±6.78[b]
	.75	6.40±4.72[c]
Isoptera	.00	16.60±1.67[a]
	.25	7.80±3.27[b]
	.75	5.40±3.32[c]
Hymenoptera	.00	26.60±3.65[a]
	.25	9.60±2.88[b]
	.75	5.40±4.28[c]
Acarina	.00	30.20±6.34[a]
	.25	17.60±8.32[b]
	.75	14.00±7.75[c]
Myriapoda	.00	27.60±4.62[a]
	.25	10.80±1.92[b]
	.75	4.60±3.71[c]
Crustacea	.00	13.20±3.35[a]
	.25	5.40±1.67[b]
	.75	2.00±1.58[c]

Each value is the mean of four replicates. Means followed by the same letters are not significantly different (P<0.05) from each other, using the New Duncan's Multiple Range Test.

Also, soil $_{P}$H and moisture content showed positive correlation with increased micro arthropods sampled. This corroborated with Jones and Hopkin (1998), Badejo *et al*., (2002), Badejo and Akinwole (2006), when they studied the relationship between moisture and density of micro arthropods within the 0-5 cm soil litter. However, soil temperature and hydrocarbon content (THC) exhibited negative correlation with number of soil arthropods sampled.

This implies that soil micro arthropods abundance is dependent on concentrations of pesticides applied and when not indiscriminate, the organisms have the tendency to re-colonize the soil. These observations have been confirmed by Erhunmwunse and Iloba (2011) and Erhumwunse *et al*., (2012) when they studied carbofuran, and carbamates-treated soil.
In view of the findings, we submit that *everything being equal, nature has*

a natural pathway of re-colonization/balancing process of the ecosystem. The application of pesticides for the benefit of humanity would always aim at depopulating the 'enemy of our interest'. Micro arthropods reduction is with time and re-colonization after a period is imminent. Pesticide applications must therefore be done with a clear understanding of the nature of the pesticides, the tolerable application level, and the need to shift from conventional pesticides to biopesticides. Whereas many conventional pesticides are non-biodegradable, they can persist in the soil for a long time thereby causing harm to soil fauna. Biopesticides are products of living organisms and can easily be degraded in the soil after their actions against target pest insects.

3.3 Forensic Entomology

Mr. Vice Chancellor Sir, I am a dancing entomologist. As an entomologist, my focus has been to study insects and use them to the benefit of humanity. From this lecture, I am sure you are convinced that insects are paradoxical in their lifestyle, meaning they can be good and our friends or bad and our enemies. I have manipulated insects in stored products and environmental entomology by introducing agents that could reduce/eliminate their population to ensure food security for humanity. As a dancing entomologist, I have also studied insects in relation to the role they play in the dead-decaying animal matter.

This is within the field of science called forensic entomology. This aimed among others, to establish a baseline forensic entomology reference database for other uses in Nigeria and the world at large. Mr. Vice Chancellor Sir, I must note here that my interest in forensic entomology was triggered by Prof. (Mrs.) B.N. Iloba in 2005 prior to my enrollment for the Ph.D. programme in entomology at the University of Benin. On our first meeting, she told me that there was a relatively new area in entomology where I could make some good research impact, and quickly too if I was not going to be deterred by the offensive smell during the research work. On my inquiry of what could be the possible area, she told me about forensic entomology, and I was expected to observe the decomposition of some animals and note the role insects play in the entire process. My simple answer to her was, to *give me some time, and I would get back*. I got back 21 days later and was subjected to a 3-hour interrogation to gauge how much information I had been able to get and how ready and prepared I was.

Without sounding immodest Mr. Vice Chancellor, my performance at the interaction totally convinced her that I was properly ready for the job. She urged me to immediately write up my Ph.D. proposal. On receiving my Ph.D. admission in June 2006, I was ready with my Pre-Data seminar presentation in July same year. This feat was highly commended by the Department of Animal and Environmental Biology, University of Benin. This is how my research interest expanded to forensic entomology. On record, my Ph.D. thesis titled "*Successional pattern of insects fauna on pig carcasses with varied death agents*" successfully defended in November 2008 was the first Ph.D. in the field of forensic entomology in the entire Nigerian University system. Many more have since been done based on my interactions with other entomologists at conferences, and through our publication networks.

Mr. Vice Chancellor Sir, it is on this ground, as a dancing entomologist that the testimonials of my research in the field of forensic entomology are highlighted. Anderson (1998) defined forensic entomology in its broadest sense as the study of insects involved in any legal action and can include urban and stored products entomology. The American Board of Forensic Entomology (1997), refers to it as the science of using insect evidence to uncover circumstances of interest to the law, often related to a crime. Byrd

(1997) regards forensic entomology as the use of insects, and their arthropod relatives that inhabit decomposing remains to aid legal investigations. Collins (2001) reported that forensic entomology uses insects to help law enforcement determine the cause, location, and time of death of a human being. Aggarwal (2005), noted that insects' life cycles act as precise clocks, which begin within minutes of death. They can be used to closely determine the time of death when other methods are useless.

They can also show if a body has been moved after death (Catts and Haskell, 1990). Although, Hall and Doisy (1993) referred to forensic entomology as the name given to any aspect of the study of insects and their arthropod counterparts that interacts with legal matters. Lord and Stevenson (1986) divided it into three components which include urban entomology, stored products entomology and medicolegal entomology, which is often termed "forensic medical entomology," and in reality "medico criminal entomology" (because of its focus on violent crime).
It relates primarily among other things to the following.

I. Determination of the time of death (postmortem interval).
II. Site or places of death as regional information of insects vary from place to place.
III. Mode of death (Anderson, 1997).
IV. Larvae can give information on how long children or elderly people were neglected by their relatives or nursing personnel (Lord, 1990).
V. Drugs that cannot be detected in severely decomposed tissue of a corpse may still be found in the insects that did feed on the corpse.
VI. To answer the question as to whether a corpse was killed and/or brought outside (a) at night or during the day and/or (b) while it was raining or not can be examined (Smith, 1996; Nuorteva, 1977).

The use of insect evidence to resolve disputes was reported first in a documented case in 1235 AD in China, where the knowledge of a fly's attraction to blood was used in the aid of solving a murder investigation (Goff, 2000; Benecke, 2001). The potential for contributions of entomology to legal investigations has been known for at least 700 years, but only within the last two decades or so has entomology been defined as a discrete field of Forensic science (Aggarwal, 2005).

He also highlighted that most recently within the last 30 to 40 years, the science of entomology in criminal areas, using various techniques of data analyses founded through agriculture and forestry is being revived. Anderson (1998) on his part stated that, in the last 15years, forensic entomology has become more and more common in police investigations. Forensic entomology is a growing field of study, incorporating entomology's expertise in insects including their identification, life cycles and habitats, with an arm of law enforcement (Aggarwal, 2005).

Despite this great potential, however, forensic entomology remains untapped in Nigeria, largely because of dearth of awareness of the benefits that may accrue from its application. According to Ekanem and Usua (1997) full-blown forensic entomology work did not start in Nigeria until 1988. Though Usua (2007) noted that forensic entomology is at its infancy stage in Nigeria and highlighted the possibilities of establishing the PMI of homicide cases with some certainty.

If adequate concern is shown in this regard, our nation will stand to gain intelligible answers to such questions as time and place of death, cause of death; when burial occurred; whether the body was mutilated after death, among others using forensic entomological techniques. Forensic entomological techniques involve the examination of the insects involved in the decay of corpses, the collection of insects' evidence, and its use in predicting the post-mortem interval (Aggarwal, 2005).

Mr. Vice Chancellor, Sir, perhaps our most profound testimonial and contribution to the field of forensic entomology is embedded in our article titled "*one death, many insects species yet one insect's generation*" published in the Journal of Entomology in 2011 authored by **Ekrakene** and Iloba (2011). It was a critical scientific excerpt from my Ph.D. research work aimed at determining the number of cycles of insects' generations obtainable from decaying carriers arising from different death agents over a two-year period, observing two cycles of rainy and dry seasons. The results of our investigation revealed a consistent pattern of insect invasion in both the dry and wet seasons, regardless of the killing agents.

The consistent insects from the earliest to the latest arrival are *Lucilia sericata*; *Chrysomya rufifacies*, *Musca domestica*, *Sarcophaga carnaria*, *Hermetia illucens,* and *Ophyra aenescens* from the order Diptera; *Dermestis maculatus* and *Necrobia rufipes* from the order Coleoptera. The other insect order, Hymenoptera was represented by members of the Formicidae (ants) family which were opportunistic. This result is consistent with those reported by other researchers including Payne (1965), Smith (1985), Lord (1990), Catts and Goff (1992), Anderson (2000), and Aggarwal (2005), among others, who reported insects from members of the orders Diptera, Coleoptera, and Hymenoptera as most predominant insect groups.

Mr. Vice Chancellor, Sir, important and worthy of note in this investigation is that the insects' species that bred (*Lucilia sericata*, *Chrysomya rufifacies*, *Musca domestica*, *Sarcophaga carnaria*, *Hermetia illucens*, *Ophyra aenescens,* and *Dermestis maculatus*) within the decomposition process in both seasons, all had one complete generation (egg, larva, pupa, and adult or larva, pupa, and adult). *No emerged adult from the process initiated and completed another cycle. This suggests that the phenomenon of decomposition of animals is predictable from insect evidence since carrion insects seem to be decomposition-stage dependent, with only one generation of such insect species guaranteed, except where unpredictable circumstances present themselves*.

We, therefore, submit that a *clear understanding of the phenomenon of one death, many insect's species yet one insect's generation would enhance the global acceptability and applicability of testimonies from entomological data.*

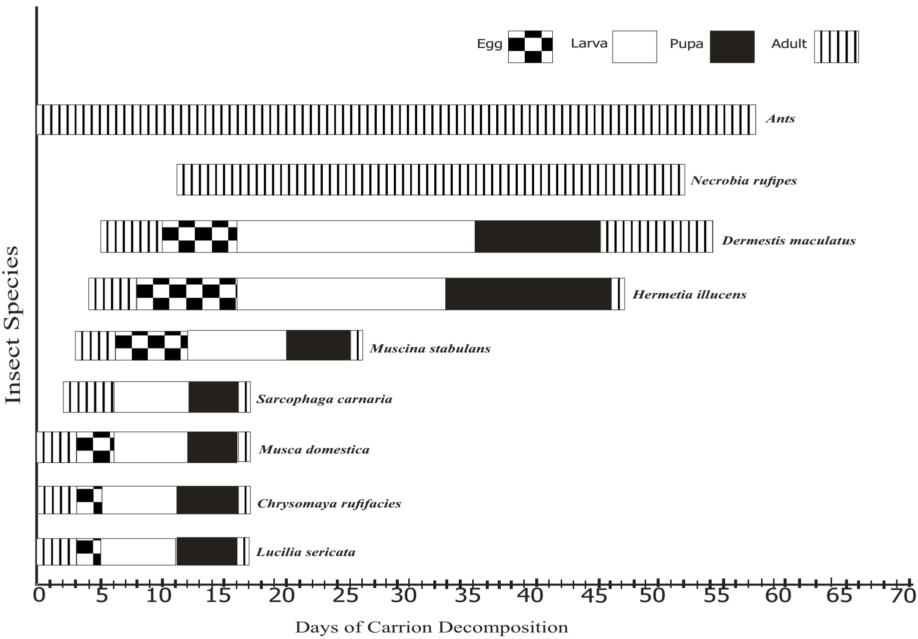


Fig. 3: Insects successional profile on slaughtered carrion - dry season of 2006.
Source: **Ekrakene** (2014)

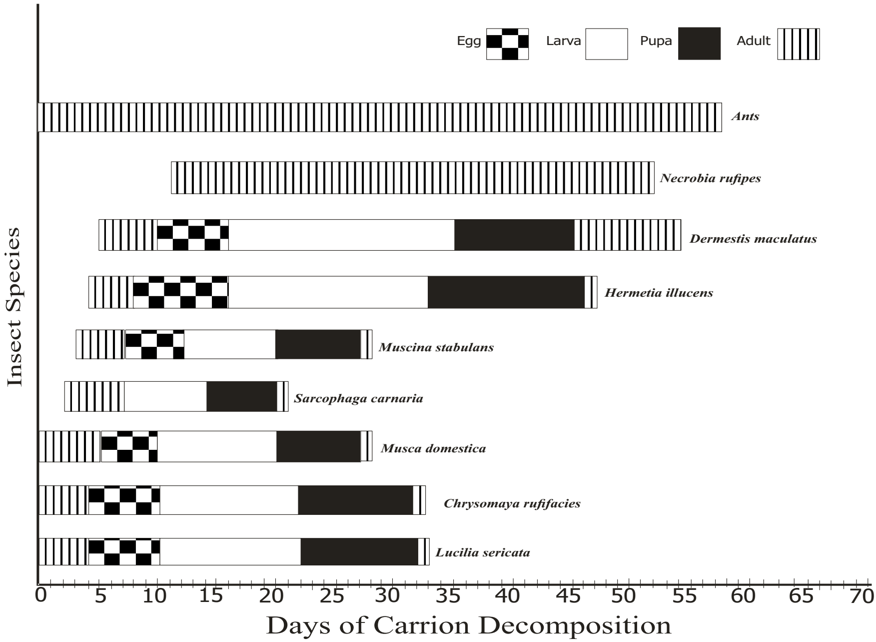


Fig. 4: Insects successional profile on monocrotophos-poisoned carrions - dry season of 2006.
Source: **Ekrakene** (2014)

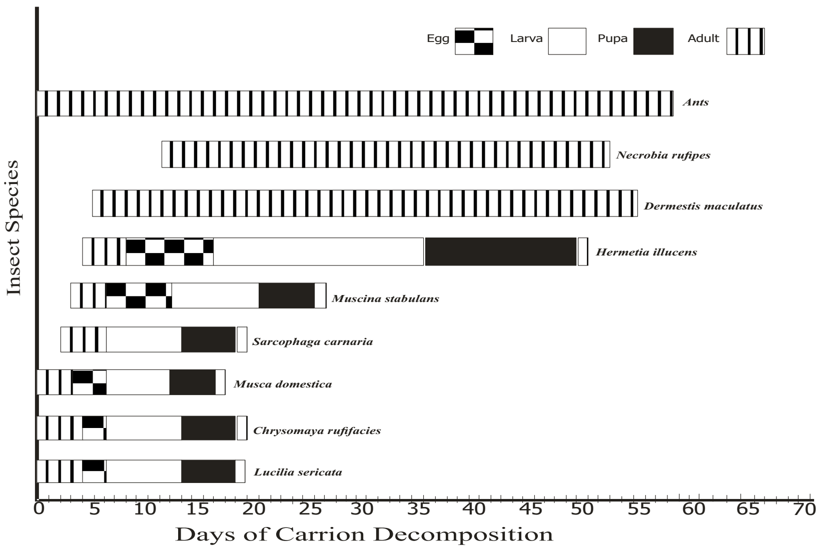


Fig. 5: Insects successional profile on slaughtered carrions - wet season of 2006.
Source: **Ekrakene** (2014)

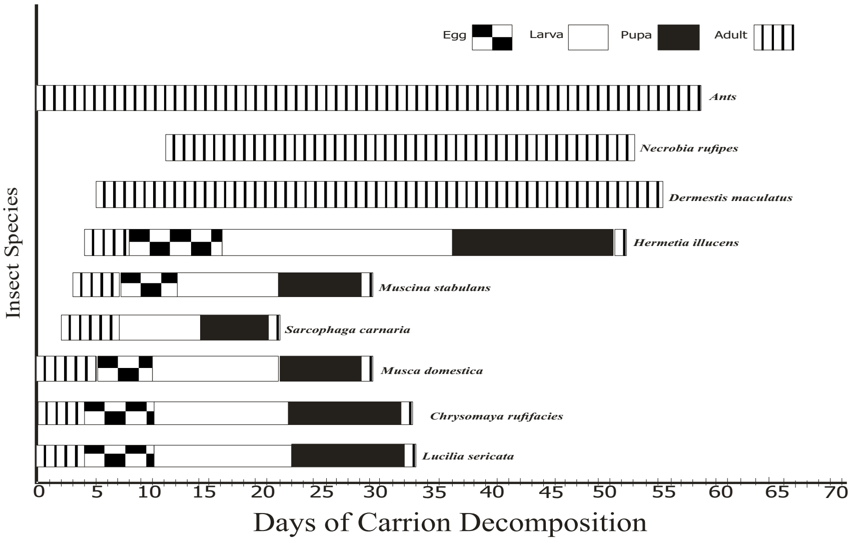


Fig. 6: Insects successional profile on monocrotophos-poisoned carrions – wet season of 2006.
Source: **Ekrakene** (2014)

Spurred by these findings, **Ekrakene** (2012) studied puparia cases and adults bred from monocrotophos poisoned carrions using high performance liquid chromatographic (HPLC) method by trying to detect the toxicant or its subsequent metabolites from the afar mentioned insect stages. The results revealed that puparia cases were better component in detecting the toxicant or its component metabolites compared to the adult flies. This is a valuable piece of information as puparia are always in abundance even when carrion is completely skeletonized in the late stages of decomposition compared to maggots and adults which have limited time and are soon transformed or fly away.

Hence, in the absence of classical methods of determining PMI, *standard operating procedures for collecting entomological evidence at death/crime scene involving heavily decomposed remains should focus on collecting puparia, as they could be the only link to cause of death, especially when foul play by poisoning is suspected* (**Ekrakene**, 2012).

Wolff *et al*., (2004) reported that HPLC was used to determine and quantify parathion in insects collected from decomposing rabbits previously injected with commercial methyl parathion. Rahat *et al*., (2005) and Arun *et al*., (2005) respectively reported agrochemicals and overdose of medicine in India and extensive use of organophosphate which have been implicated in suicides or homicides.

Table 6: Summary of some insects' succession on carrions at different season.

Insects	Earliest arrival time	Decomposition stage of arrival	Significant insect state on carrion	Estimated period on carrio Wet season	 Dry seas
Lucilia sericata	5-15 min	Fresh	All Stages beginning with adults laying eggs	13-16 day	10-14 da
Chrysomya rufifacies	5-15 min	Fresh	All Stages beginning with adults laying eggs	13-16 day	10-14 da
Musca domestica	5-15 min	Fresh	All Stages beginning with adults laying eggs	10-15 day	9-13 day
Sarcophaga carnaria	2-4 days	Bloated	All stages beginning with adults deposing 1st instar larvae	10-15 day	8-10 day
Ophyra aenescens	3-5 days	Bloated	All stages	23-35 day	23-34 da
Hermetia illucens	4-7 days	Bloated	All Stages beginning with adults laying eggs	45-55 day	42-50 da
Dermestis maculatus	5-10 days	Wet Decay	All Stages beginning with adults laying eggs	47-52 day	45-50 da
Necrobia rufipes	2-3 weeks	Wet Decay	Only adult	Not defined	Not defir
Ants	5-10 min	Fresh	Only adult	Not defined	Not defir

Source**: Ekrakene** and Iloba (2011)

Furthermore, **Ekrakene** (2012a, 2014) studied how different death agents affect egg laying and hatching time by carrion insects, and the insect fauna succession resulting from the different killing methods respectively. The results consistently revealed *Lucilia sericata* and *Chrysomya rufifacies* as the two blow flies that laid and hatched eggs in the wet and dry seasons.

It revealed that both insects laid eggs on slaughtered and oxygen-deprived carrions at an average oviposition time of 1.0-3.5 hours which agreed with the submissions of Anderson and Vanlaerhoven (1996) and Shean *et al*., (1993) who reported oviposition time on carcasses to be 1-3 hours but contrary to Pillay (2004) and Aggarwal (2005) that reported oviposition time of 18-36 hours after death in spring, summer, rainy and autumn. Average egg hatching period of 24-36 hours were also recorded for both seasons which corroborated Aggarwal (2005), Kulshreshtha and Chandra (1987), Adelson (1972) and Fisher (1980) who reported 19-24 hours egg hatching time after death. However, monocrotophos carrions recorded average oviposition time of 7-12 hours and 6-14 hours respectively for wet and dry seasons with average egg hatching time of 12-14 days which agrees with Patrican and Vaidyanathan (1995) when they studied arthropod succession in rats euthanized in different ways. They found out that chemicals like sodium pentobarbital delayed the oviposition of calliphorids by 7 days and rat carrion took twice as long to decompose. The maggot mass sampled was significantly different ($P>0.05$) on account of the killing agents with monocrotophos recording zero maggot mass.

Table 7: Maggot mass production and density in carrion of pigs killed using four different methods.

Killing Method	Maggots' density (Mean Cumulative No. of maggots/Carrion)
Slaughtered	75.50 ± 16.07^{a}
Oxygen-deprived	71.94 ± 14.39^{a}
Aluminum phosphide-poisoned	48.68 ± 15.23^{b}
Monocrotophos-poisoned	0.00 ± 0.00^{c}

Each value is the mean of four (4) replicates. Means followed by the same letter are not significantly different ($P < 0.05$) from each other, using New Duncan Multiple Range Test

Table 8: Maggot mass temperature at selected sites on carrion in relation to rate of decomposition in the wet and dry seasons of 2006-2008.

Killing Method	Dry season					Wet season				
	Mean maggot mass temperature (^{0}C) at indicated region of carrion					Mean maggot mass temperature (^{0}C) at indicated region of carrion				
	Stomach	Mouth	Anus	Neck	Duration of active decomposition (Days)	Stomach	Mouth	Anus	Neck	Duration of active decomposition (Days)
Slaughtered	41.0	36.8	37.7	41.0	3 – 5	29.0	37.1	38.0	39.5	4 – 6
Oxygen- deprived	36.1	35.9	36.2	-	4 – 6	38.1	38.1	36.2	-	5 – 7
Monocrotophos	-	-	-	-	25 - 30	-	-	-	-	25 - 35

Arising from the results, *we conclude that, due to the physiological effect of the killing agents on carrion insects, time of oviposition and egg hatching could be affected and when this happens, it could cause rate differences in carrion decomposition and carrion insects' development period. Forensic entomological data must therefore be applied with these variables in mind to minimize or eradicate application errors.*

In addition, **Ekrakene** and Iloba (2015, 2017) and **Ekrakene** and Odo (2017) respectively surveyed arthropod profile on poisoned and preserved carrions on African giant rat (*Crycetomys gambianus*) killed from phostoxin poison for 30 days, and insect succession data on rabbit carrions from Warri in Delta State. While the results obtained were consistent with the insect succession profile already reported (Abell *et al*., 1982; Blackit and Blackit 1990; **Ekrakene** and Iloba, 2011; Okiwelu *et al*., 2013; Abajue *et al*., 2014; Ewuim and Abajue 2016), they provided a baseline insect succession data for the Warri metropolis of Delta State.

Mr. Vice Chancellor, Sir, I did dance further in the field of forensic entomology. In our quest to ensure that the baseline forensic entomology data from Nigeria are robust and comparable to others from other parts of the globe, we attempted to provide scientific evidence that is based on empirically verifiable data. **Ekrakene** *et al*., (2016); **Ekrakene** and Odo (2017b, 2017c) studied the body lengths, weights and developmental rate of the blowfly larvae, *Lucilia sericata* (Diptera: Calliphoridae) reared on rabbit carrions killed by the injection of varying dosages of tramadol hydrochloride (an opioid) 150ml (50ml/mg) (½LD_{50}), 300ml (LD_{50}), 600ml (2LD_{50}) and control (no tramadol). These dosages are the same as those that are normally observed in homicide and abusive cases involving tramadol hydrochloride injection overdose. The results revealed mean maximum body lengths and weights reached 17.50mm and 0.093g for 2LD_{50} at 96hrs; 14.13mm and 0.081g for LD_{50} at 96hrs; 13.13mm and 0.051g for ½LD_{50} at 108hrs larvae reared on the rabbits injected with tramadol hydrochloride compared to the control which attained 11.38mm and 0.050g at 108hrs.

These findings are in line with Goff and Lord (1991), Goff *et al*., (1999), and Goff *et al*., (1993) who reported respectively that heroin, methamphetamine, and amitriptyline accelerated the rapid developments of various larvae weights and lengths. However, the total developmental period appreciated immensely with increased injected dosages and ranged from 362.15hrs (15.09 days) in the 2LD_{50}, 345.15hrs (14.38 days) in the LD_{50}, and 309.46hrs (12.89 days) in the ½LD_{50} compared to the control mean developmental period of 280.25hrs (11.68 days). There were significant differences in the mean body length ($H = 0.174$, $P>0.05$) and the mean larval body weight ($H = 0.055$, $P>0.05$) using the non-parametric Kruskal Wallis analysis. **This study revealed an error in the estimation of the PMI to be between 29.21 and 81.90 hours depending on the amount of dosage of the death agent involve.**

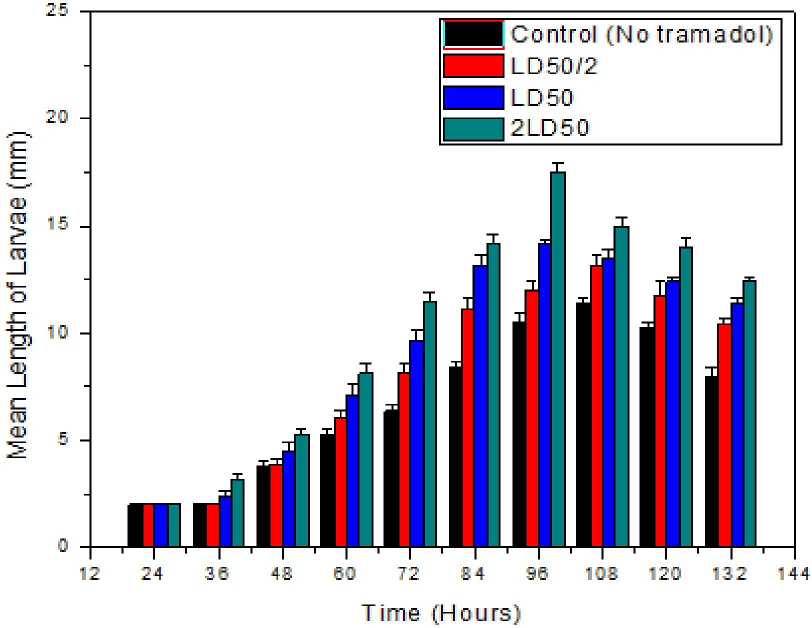


Fig. 7: Mean length of larvae bred from carrions intoxicated with different concentrations of tramadol

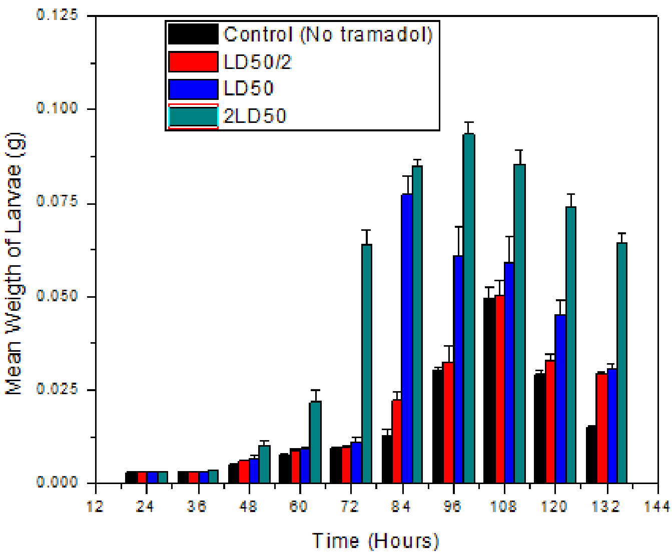


Fig. 8: Mean weight of larvae bred from carrions intoxicated with different concentrations of tramadol

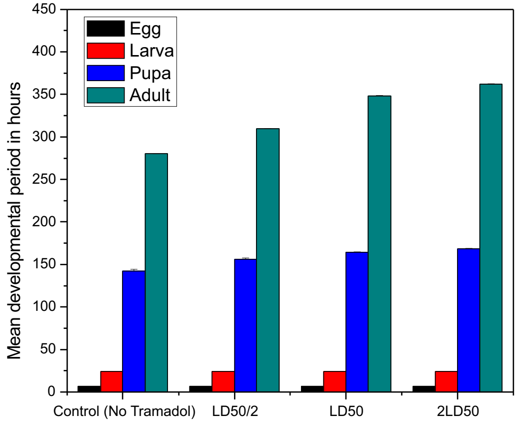


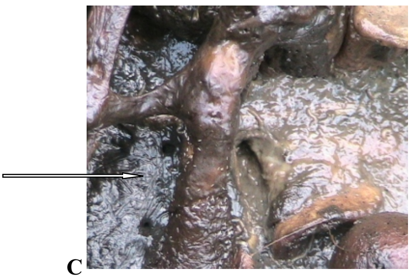
Fig. 9: Mean developmental periods of the different stages of Dipteran flies at different concentrations of tramadol

A

B

Plate 5: A: Sample of pig carrion killed by slaughtering method at 36 hours after deposition with arrow showing the cut region.

Plate 6: B: Sample of pig carrion killed by injecting with 5ml of monocrotophos at 36 hours after deposition.



C

D

Plate 7: C: Decomposition stage when *Hermetia illucens* is sampled with arrows pointing to region of *Hermetia illucens* concentration.

Plate 8: D: Skeletonized monocrotophos killed carrion at 7weeks during the wet season.

In a related study, Ekrakene and Odo (2017a), investigated the effects of varying dosages of cypermethrin pesticide on *chrysomya albicep* reared on rabbit carrions. The results revealed the mean minimum body lengths and weights, i.e., 0.0045g and 03.95mm for 12 ml; 0.0053g and 05.77mm for 6ml, and 0.0074g and 06.56mm for 3ml were attained at 108 h after eggs were laid compared to the control group that recorded 0.0123g and 11.13mm at the same time. The mean total developmental periods were reached at 450.22 h (18.76days), 401.05 h (16.71days), 380.28 h (15.85days) and 281.24 h (11.42days) respectively for 12ml, 6ml, 3ml groups, and the control respectively.

Accordingly, **the result revealed PMI estimation errors of 7.34 days, 5.29 days, and 4.43 days respectively in cases where 12ml, 6ml and 3ml dosages of cypermethrin pesticide are involved compared with the control group**. Absolute care must be employed in the calculation, interpretation, and usage of insects' data in forensic entomology, when and where toxins and drugs may be involved in the investigation. The outcome of the developmental period of *C. albiceps* from the egg to adult under the same physical conditions revealed that the presence of cypermethrin affected the developmental period and was dependent on the volume of the pesticides used. *This result would imply that the estimation of Postmortem Interval (PMI) without the full knowledge and consideration of the possible effects of toxins or drugs on the insects could lead to an error when insects' data are the only possible evidence in the medicolegal investigation*.

This buttressed Goff and Lord (1994) who reviewed various studies in forensic entomology and concluded that entomotoxicological testing was very important to the exact forensic entomology conclusion. Hence, data indicating the presence of drugs allow for corrections to the data in cases where drugs affect insects' development. The findings of this research revealed that cypermethrin ingestion retarded the body mass indices and development period of *C. albiceps* larvae that colonize the carrions and could results in a PMI error of 4 to 7 days depending on the volume of the cypermethrin used. *It is therefore imperative, to be cautious in applying insect data as tenable evidence in the medicolegal investigation.*

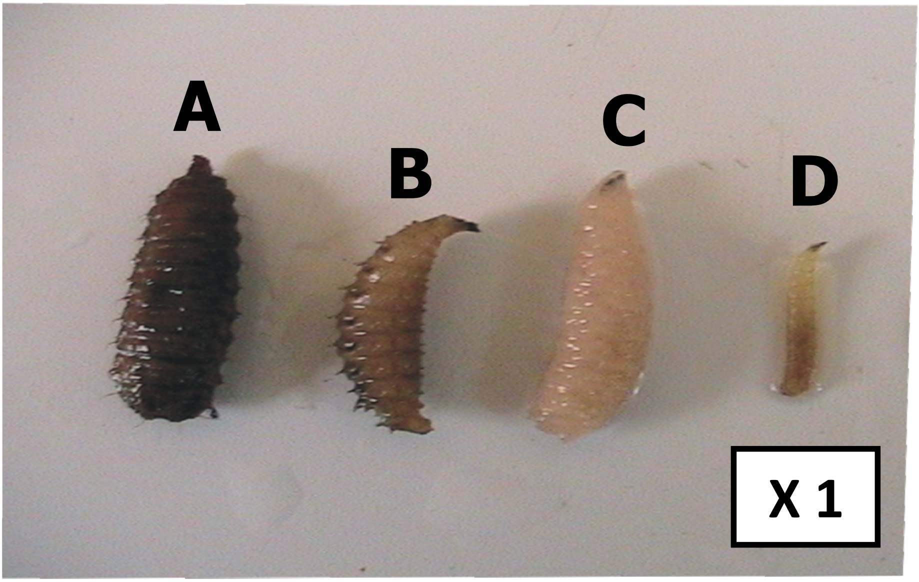


Plate 9: Larvae of some forensically important insects consistent in the decomposition process.

A: Larva of *Hermetia illucens*;

B: Larva of *Chrysomya rufifacies*

C: Larva *of Lucilia sericata;*

D: Larva of *Ophyra aenescens*

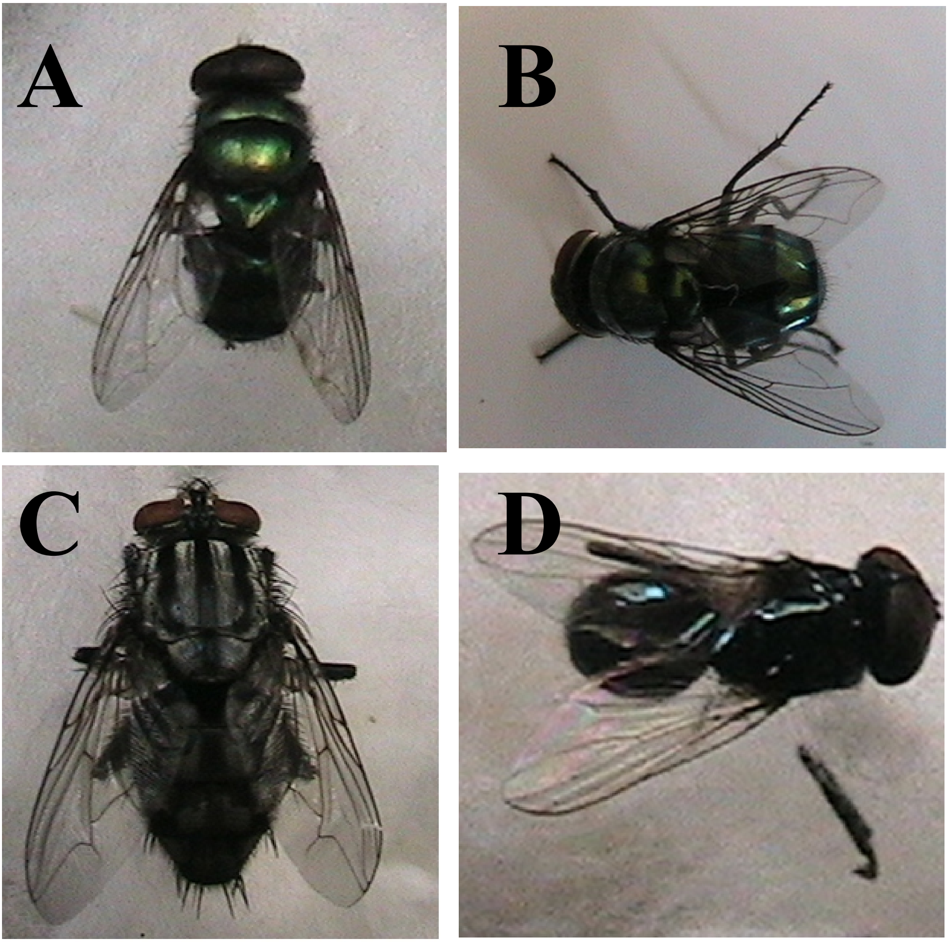


Plate 10: Dipterans bred from the laboratory during the investigation of pig carcasses decomposition.

A: Adult of *Lucilia sericata*

B: Adult of *Chrysomya rufifacies*

C: Adult of *Sarcophaga carnaria*

D: Adult of *Ophyra aenescens*

4.0 RECOMMENDATIONS/SUGGESTIONS

Arising from this lecture where the paradoxical life of insects was highlighted and the testimonials of my involvement in manipulating insects for the advantage of man are presented, the following recommendations/suggestions have become necessary:

1. There is an urgent need for a legislation that would ensure a mandatory periodic interface between Town and Gown to ensure research findings are duly incorporated into the national policy framework for implementation which could help to drive the National Development Goal.
2. Ministries, Departments, and Agencies of Government in charge of Agriculture, both at the National and sub-national, should integrate as part of their ethos, an Annual Strategic Conference, as an avenue to address the perennial post-harvest losses to ensure food security for all.
3. There is a need for regular monitoring and surveillance of our terrestrial ecosystem by an agency of government, especially regarding the use of pesticides in view of their ecological and public health hazards.
4. Safe limits and standards for pesticides should be integrated into Government programmes to protect the terrestrial fauna.
5. There is a need for security agents to abreast themselves with the incredible proof forensic entomological data could bring into the investigation, especially in homicides and abandonment cases.
6. There should be a deliberate attempt by the Judiciary to incorporate forensic entomological data in our legal jurisprudence. This would help provide intelligible evidence when classical methods of evidence gathering are not feasible, especially in homicide cases.
7. There is a need for Forensic Entomologists of Nigeria to develop protocols for data collection, interpretation, and analysis precursor to application.

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In my academic sojourn, I have benefitted very immensely from spiritual, intellectual, moral, and financial support from individuals and groups, and would not fail to acknowledge them as much as possible.
First and foremost, and above all else, my special gratitude goes to God Almighty, the Father of my Lord and personal Saviour Jesus Christ, who loved me the way He met me and made me His righteousness. I am truly grateful for the wisdom, strength, commitment and favour He bestowed on me through the thick and thin. Indeed, according to the scriptures – "It is of the Lord's mercies that we are not consumed, because His compassions fail not (Lamentations 3:22)". Grateful Lord and all glory to you alone.

I remember my beloved father, Mr. Benson Ekrakene Taidi of blessed memory, who had so great a confidence in me even though I was not his first son neither the second, but he would always tell his friends, this my son (Taidi) would make me proud and by him, people around the world would hear about him. He was a huge pillar of support and encouragement in ensuring that my formative years in academics were solid. He always encouraged me with these words, and I quote "if pepper no pepper, the seed go pepper" meaning, he might have not been impactful, but his seed (offspring) would. I acknowledge my dear mother, Mrs. Ekaghwa Mary Taidi who defied all odds to take up the challenge of seeing me through school because my father passed when I was at 100 level.

When it was clear I needed to continue in school, she said to me, my son "if it would require, I hawk to see you through school, I would do it". To God be the glory, the rest is history. Mama, I am truly grateful. I am also grateful to all my brothers and sisters – Omotoyoma, Ibeji, Comfort, Andrew, Sunday, Onoriode, and Oghenefegor as well as Odibo, Ejiro, and Omotowho of blessed memory for their support and encouragement. I sincerely appreciate my in-laws – the entire Ivbiedo Imolega family for their support and encouragement.

I heartwarmingly pay tributes to the Founder, Visioner, and the first Archbishop of CGMI, His Grace, Most Rev. Prof. Benson Andrew Idahosa for obeying the voice of God to establish this institution. My very special appreciation and heartfelt gratitude go to the Jewel of world evangelism, our own Chancellor of Benson Idahosa University and Archbishop, CGMI Worldwide, His Grace, Dr. Margaret E. Benson Idahosa, *JP, OON*, the President, of Benson Idahosa University and Head of Cabinet, CGMI, Worldwide, Rt. Rev. Dr. Faith Emmanuel Benson-Idahosa II and his amiable wife, Rev. (Mrs.) Laurie Idahosa for the opportunity given to me to work at Benson Idahosa University and to serve the Lord in the Church. I cannot say thank you enough. Truly, I am grateful.

I also acknowledge all those who at one time or another pastored, taught, and nurtured me in my Christian walk. They include but are not exhaustive – Bishop Wale Ajayi, Bishop of the Historic Miracle Centre Bishopric, and his beautiful wife, Rev. (Mrs.) Freda Ajayi, Rev. Prof. I. A. Ogboghodo, Rev. Prof. Martins Aisien, and Bishop Imafidon among others. Thank you so much for your spiritual imprint on my life.

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I am sincerely grateful to our amiable Vice Chancellor and Chairman of the Senate of Benson Idahosa University, Prof. Sam Guobadia for the privilege given to me to deliver the 18th Inaugural Lecture. Sir, I will cherish this honour and opportunity for a long time while the memories of your goodwill and support will remain indelible in my heart. Similarly, I sincerely acknowledge the support and encouragement I have received from other Principal Officers – Prof. Olajide Johnson Oyedeji, the Deputy Vice-Chancellor. He was the first to appoint me as his Assistant Dean in 2009 when he was Dean of the Faculty of Basic and Applied Sciences, now the Faculty of Science; Mr. Vinton-Okoedo Itoya, the Registrar and Secretary to Council, a man of wisdom and an astute administrator from whom I have savoured a lot of goodwill; Dr. Gladday O. Igweagbara, the Bursar and Chief Financial Officer, and Dr. (Mrs.) Rosemary Odiachi, the Ag. University Librarian. Thank you sincerely.

Let me seize this opportunity with deep gratitude in my heart to acknowledge the role the former Vice Chancellors and other Principal Officers of this great university have played in my appointment and academic journey, especially Prof. Ernest B. Izevbigie who reposed so much confidence in me and assigned duties that help toughened me on the job. I thank you all.

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6.0 CONCLUSION

Mr. Vice Chancellor Sir, I have during this lecture tried to highlight the different ways the pest insect population of stored products can be manipulated for sustainable management of agricultural produce, especially maize, and cowpea for food security for our teeming population.

I have also shown that pesticide application and other agricultural and industrial wastes to the environment have implication in distorting the soil fauna balance which may however resurge if application is not indiscriminate. Thus, engineering the natural cycle which would promote agricultural productivity and food security.

The lecture has also focused on the possibility of using entomological data as a biological clock in the determination of Postmortem Interval (PMI) alternative to known classical methods of PMI determination, especially in a situation when insect data could be the only link to cause. The caution requisite to the full application of insect data was highlighted for accuracy and general acceptability.

Finally, may I seize this opportunity to remind this distinguished audience that, though insects are paradoxical in their tendency, they will always enhance the existence of life for the benefit of humanity if we agree to work with them. On behalf of Entomologists the world over, I invite you to come and let us work with them. This is my Testimonial.

Thank you for your attention. God bless eternally.

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8.0 BENSON IDAHOSA UNIVERSITY INAUGURAL S ERIES

S/N	NAME OF LECTURER	LECTURE TOPIC	DATE
1	Professor Johnson Olajide Oyedeji	Bricks with Little Straws: How efficient are the meat and egg-type chickens?	27 July 2010
2	Professor R. A. Masagbor	Language: A Complementarity of Being	17 April 2012
3	Professor A. A. Borokini	Female Genital Mutilation: The Nexus between Anthropology, Law and Medicine	19 May 2015
4	Professor Ernest B. Izevbigie	From Growth Biology to HIV associated Neuropathy to the Discovery of Anti-Cancer Agents: Economic Implications	8 December 2015
5	Professor Andrew O. Oronsaye	The Anatomy of Nigeria Federalism and the Physiological Imperatives for Sustainable Development	22 March 2016
6	Professor Rex O. Aruofor	Economic Systems Engineering-Poverty, Unemployment, and Underdevelopment: A Quest for Solution and Imperatives for Developing the Nigerian Economy	6 March 2017
7	Professor Sam Guobadia	It's The Environment	19 October 2017
8	Professor (Mrs.) Clara Leyibo Igeleke	Microbes The Good and The Bad, and The Fascinating: Man, the Effective Manager"	26 November 2019
9	Professor (Mrs.) Nora Omoregie	Educational Administration and Quality of Products of the school system	2 April, 2021

9	Professor (Mrs.) Nora Omoregie	Educational Administration and Quality of Products of the school system	2 April, 2021
10	Professor Duze Chinelo Ogoamaka	Nigeria's Legacy in Education, Nigeria's Education System and Sustainable National Development: Thought for Food	13 July 2022
11	Professor Theresa Uzoamaka Akpoghome	Taming the Beast: IHL in a Bleeding Environment	26 July 2022
12	Professor Alexandra Esimaje	Because War is much too serious to be left to the Military, Corpus Linguistic is a thing and it is a very Useful Thing too.	18 October 2022
13	Professor Mark Osamagbe Ighile	The Poet Prophetic Voice in the Wilderness of our Time: An Oral, Literary and Biblical Prognosis	8 November 2022
14	Professor Augustine E. Akhidime	Financial Gatekeepers, Watchdogs and Bloodhounds in the Eyes of the Storm of Public Trust; and the House that is Divided Against Itself	22 November 2022
15	Professor Ehimen Pius Ebhomielen	Take Responsibility: Comprehensive Accountability Culture is mandatory for all and sundry!	13 December 2022
16	Professor Kingsley Osamianmionmwan Obahiagbon	From Medieval to Modernity: Odyssey of an Information Scientist (informatics)	17 January 2023
17	Professor Fredrick Omonkhegbe Joseph Oboh	Exploration and Modification for better Utilization: Adding Value to Plant based Resources for Nutritional, Medicinal, and Industrial Applications	21 February 2023

ABOUT THE AUTHOR

Prof. Taidi Ekrakene is a Professor of Stored Products and Forensic Entomology in the Department of Biological Sciences, Faculty of Science, Benson Idahosa University, and is currently the Director of Pre-degree Programmes at the University. He was born over 52 years ago to the family of Mr. Benson Ekrakene Taidi of blessed memory and Mrs. Ekaghwa Mary Taidi of Uwheru Kingdom, Ughelli North Local Govt. Area, of Delta State, Nigeria. His early education started at Udu Primary School, Uwheru, and then at Ighiwiyisi Primary School, Ogba, Benin City, from where he obtained the Primary School Leaving Certificate in 1985, after a series of interruptions occasioned by frequent parental movement. He began his secondary school education at Iyekogba Grammar School, Ebo, Benin City from 1985-1988, and Edo College, Benin City from 1988-1991 where he obtained his Senior School Certificate in 1991. He attended the Federal University of Technology, Akure in 1995, and graduated with a B.Tech. (Hons.) (Upper Division) (Biology – Storage Technology) in the 1999/2000 academic session. He is the recipient of the Departmental prize for the best-graduating student in Storage Technology and the Mr. E.O. Fashuyi prize for the best graduating student in Storage Technology, of the Federal University of Technology, Akure, in the 1999/2000 academic session. His quest for further knowledge buoyed him to earn M.Sc. and Ph.D. degrees in 2004 and 2008 respectively from the University of Benin, Benin City, and a PGD in Education with Distinction in 2007 from Benson Idahosa University, Benin City.

Before joining the services of Benson Idahosa University, Benin City, in 2005, he was the Principal and Head of General Administration of the now default Independence College, Benin City from January 2001 to August 2005. He joined the service of Benson Idahosa University as an Assistant Lecturer in September 2005, and for his commitment, hard work, and God's favour, he rose through the ranks expeditiously to become a full professor in October 2017. He has over thirty (30) peer-reviewed published articles in local, national, and foreign reputable journals, in the areas of stored product entomology, environmental entomology, forensic entomology, and general microbiology among others.

Prof. Taidi Ekrakene has served Benson Idahosa University at various times and in different capacities- Ag. Dean and Assistant Dean, Faculty of Basic and Applied Sciences, as Ag. HOD, Basic Sciences; as present or past Chairman of many university committees - University Ceremonials Committee, Cafeteria and Utilities Management Committee, University Admissions Board, Senate Business Committee, University Staff Placement Committee (Non-Academic), Committee on Archbishop Benson Idahosa Memorial Committee, Faculty of Science Relocation Committee; as member of different committees from the Department to the University level, Committee on the review of the Regulation Governing the Service of Staff (including staff scheme of service), Benson Idahosa University Management team, Benson Idahosa University Senate, Deputy Chairman, University Admissions Board, Senate Business Committee, Staff Disciplinary Committee, University Pre-Accreditation Committee among many more others.

Prof. Taidi Ekrakene has taught and supervised students at both the undergraduate and postgraduate levels and External Examiner at the postgraduate level to Kaduna State University and Examiner to the National Open University of Nigeria. He is a member of the Entomological Society of Nigeria and the Zoological Society of Nigeria. He has served as a member of the National Universities Commission Accreditation Panels to some Nigerian universities including Kogi State University, Anyangba, and the Cross River University of Technology, Calabar. He is also an editor and member of the editorial board of some journals.

Prof. Ekrakene is a firm believer in the LORD JESUS CHRIST and has served in various leadership positions in the Body of CHRIST. He is currently the Provincial Pastor of Church of God Mission International, Peniel Province. He is happily married to Rev. Mrs. Sarah Imoisemen Ekrakene (Nee Imonlega) and is blessed with four beautiful daughters: Onome, Eseoghene, Ogheneruemu, and Okeoghene.