Journal of Research in Forestry, Wildlife & Environment Vol. 15(2) June, 2023
E-mail: *jrfwe2019@gmail.com; jfewr@yahoo.com*
http://www.ajol.info/index.php/jrfwe
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ISBN: 2141 – 1778
Oyewale and Makinde, 2023

A REVIEW OF THE IMPORTANCE AND UTILIZATION OF *Oryctes rhinoceros* LARVAE AS A SOURCE FOOD TO RURAL LIVELIHOOD

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ABSTRACT

Oryctes rhinoceros' larvae serve as a source of food which is highly nutritious and also as a means of livelihood but despite this importance, Oryctes rhinoceros and other insects have been neglected, especially as food and source of income. Insects are part of the forest ecosystem and are readily available in the forest in different varieties. The problem with exploiting the use of edible insects is due to the lack of social acceptance, nutritional knowledge, information and disbelief about delicacies of these insects that are abundantly available in our farms and forests. The income realized from sales of Oryctes rhinoceros' larvae increases the total income of the rural dwellers which leads to an improvement in the standard of their living. The major threat factors are deforestation and climate change. Due to the economic significance of Oryctes rhinoceroslarvae in this areas, the conservation of the host plant (Raphia palm) should be encouraged by the state government through the enforcement of legislation against bush burning and illegal felling of trees. As the population is increasing, there is a need for an increase in the level of productivity of food in other to meet the demand of the people. However, due to the increase rate of poverty, lack of employment and food insecurity, there is need for the population to shift their focus from the total dependence on government jobs to exploring areas of self- employment, one of which is marketability of insects. The potential of insects need to be more considered in food security and poverty alleviation.

Keywords: *Importance, utilization Oryctes rhinoceros, food, and rural livelihood*

Correct Citation of this Publication
Oyewale, O.O. and Makinde, K. D. (2023). A Review of the importance and Utilization of *Oryctes Rhinoceros* Larvae as a source Food to Rural Livelihood. *Journal of Research in Forestry, Wildlife & Environment* Vol. 15(2): 1 – 8.

INTRODUCTION

Insect refers to any group of the abundant arthropod animals of the class Insecta, having an adult stage characterized by three pairs of legs and a segmented body into head, thorax, and abdomen and usually having one or two pairs of wings. Insects include the flies, crickets, beetles, butterflies and bees. (Adeoye *et al.*, 2014). According to Ene (1963), Some species are often considered as devastators of harvests (grasshoppers, weevil), while others (winged termites, raphia weevil larvae, caterpillars, crickets, bees, maggots, butterflies) are significant sources of food. Insects make up more than half of the known species of animals. Insects are often considered as a nuisance to human beings and mere pests for crops and animals. Yet this is far from the truth. Insects provide food at low environmental cost, play an essential role in nature and contribute positively to livelihoods. However, these benefits are largely unknown to the public.

In contrary to popular belief, insects are not merely "famine foods" eaten in times of food scarcity or when purchasing and harvesting "conventional foods" becomes difficult; many people around the world eat insects based on choice largely because of the palatability of the insects and their established places in local food

cultures. (FAO, 2013). Edible insects inhabit a large variety of habitats, from aquatic ecosystems and farm land to forests. Until recently, insects were apparently an inexhaustible resource obtainable by harvesting from nature (Schabel, 2006). However, some edible insect species are now endangered due to a number of anthropogenic factors, such as overharvesting, pollution, wildfire and habitat degradation, which has contributed to a turn down in many edible insect populations. Climate change will likely affect the distribution and availability of edible insects in ways that are still relatively unknown (FAO, 2013). Increasing temperatures could cause certain populations to increase, although periods of extreme heat or drought could also lead to declines (Toms and Thagwana, 2005). The distribution of species may also be affected.

About 80% of trees and plants are pollinated by insects, many species of forest trees reproduce through wind pollination. Many types of ants play an important role in spreading seeds and fruit from herbaceous plants. Leaf and needle eating insects are referred to as regulators of nutrient and sources of energy. The plant material which is being eaten by the larva enters the soil that is already well broken down in the form of excrement from the animals. This excrement is rapidly occupied and mineralized by micro-organisms leading to a rapid availability of nutrients for plant growth. In the natural functioning of a forest there are always dying trees and this could be because of the tree age, a lightning strike, storms, forest fires, drought, insect infestation, or pathogens. The decomposition of wood is more difficult for micro-organisms than that of leaves or herbaceous plants. The nutrients and energy which are stored in the bark have to be made available to the soil. The bark is difficult to colonize and the underlying body of wood is protected by it from decomposition by fungi. Freshly dead wood is colonized by a multitude of specialized pioneer insects. They drill holes into the bark or down into the wood and make this substrate accessible to other wood and bark eating insects and fungi. The resulting chippings and excrements can be decomposed by micro-organisms much easier than the hard wood. The decomposition of a tree trunk by microbes alone would take twice as long without the help of wood eating insects.

Insects function as food for various groups of animals. Regular insect feeders among birds are woodpeckers, tits, warblers, sparrows and cuckoos. More insect eating vertebrates are mice, shrews, bats, salamanders, frogs, toads and lizards. Many insects also live as predators or parasites off other insects at the same time. They can play a major role in regulating outbreaks of pest insects. In habitat creation, the killing of single trees and the decomposition of wood by insects creates new habitats. Insect-killed trees allow light into the forest so that various herbaceous plants and pioneer wood can thrive and heat loving species of open terrain insects and other animals can find new breeding, eating and living grounds. The elimination of dead wood and the decomposition of wood by insects provide new habitats for other organisms (waldwissen.net).

Benefits of insect consumption

The consumption of insects seems to be culturally universal, varying with location, insect populations and ethnic group. Insects offer exacting benefits to those who want to lessen their ecological footprint, because they are particularly efficient in converting what they eat into tissue that can be consumed by others. Insect utilization may also help to reduce the adverse environmental impacts of livestock production as insect rearing requires far less space and generates less pollution.

As a food source, insects are highly nutritious; many insect species contain as much or more protein as meat or fish. Some insects, especially in the larva stage, are also rich in fat and most insects contain important percentages of amino acids and essential vitamins and minerals.

Insects collected from forest areas are generally clean and free of chemicals, and in some areas are even considered to be “healthy foods”. Some insect species are also assumed to have beneficial medicinal properties. With movement in some locations toward insect farming or collection of insects from the wild in larger numbers, however, concerns arise regarding management and

processing practices, hygiene and overall food safety. To assure increasingly sophisticated and health-conscious consumers of the nutritional quality and safety of insect foods new efforts and standards will be required (Durst and Shono, 2010).

Reason for insect consumption

There are three main reasons why insect consumption is being promoted:

Environmental purpose:

i. Insects are very efficient at converting feed into protein because they are cold-blooded.
ii. Insect rearing is not necessarily a land-based activity and does not require land clearing to expand production. Feed is the major requirement for land.
iii. The ammonia emissions related to insect rearing are also far lower than those linked to conventional livestock, such as pigs
iv. Insects can be fed on organic waste streams.

Livelihoods (economic and social purpose)

i. Insect rearing can be low-tech or very sophisticated, depending on the level of investment (FAO, 2013).
ii. Insect harvesting/rearing is a low-tech, low-capital investment option that offers entry even to the poorest sections of society, such as women and the landless.
iii. Mini-livestock offer livelihood opportunities for both urban and rural people

Health purpose

i. Many insects are rich in protein and good fats and high in calcium, iron and zinc.
ii. Insects already form a traditional part of many regional and national diets
iii. Insects are healthy, nutritious alternatives to conventional foods such as chicken, pork, beef and even fish from ocean catch (FAO, 2013).

Palm tree and its uses

Raphia palms have played a very important role in the history of mankind; the purpose for its cultivation includes serving as food source, shelter, firewood and for aesthetic purposes such as landscaping. Raphia is the largest palm in Africa and it is one of the most useful economically (Obahiagbon and Osagie, 2007). Raphia palm grows in the swampy and semi-swampy areas of the equatorial rainforest or derived savanna (Ugwu and Igboeli, 2009).

Palm Tree Insects

Description of*Oryctes rhinoceros*

Oryctes rhinoceros belongs to the order Coleoptera and family Scarabaeidae. Newly hatched larvae are 7.5 mm long (Lever, 1979). "The large (60 to 105 mm long, white mature larva is C-shaped, with a brown head capsule and legs. The posterior part of the abdomen is a bluish-grey colour" (Giblin-Davis, 2001).

It is consumed at the larva stage. It is so called because of its similarity to the rhino; it is primarily a pest of coconut in most part of the world, especially in Southern Asia, but in Africa, Nigeria in particular. It lives and feeds mostly on oil and raphia palms. While the adults attack the palm tree, the larvae are harmless, feeding only on decaying organic matter such as decaying palm logs, manure, debris etc. Usually, when left to decay, old stems of coconut, raphia and oil palms, provide excellent breeding sites or grounds for *Oryctes rhinoceros*. It is either eaten raw, boiled, smoked or fried. It may be consumed as part of a meal or as a complete meal (Okaraonye and Ikewuchi, 2009).

Description of *Rhynchophorus phoenicis*

*Rhynchophorus phoenicis*is a species of insects belonging to the order Coleoptera and family Curculionidae. The insect can reach a body length of 25mm (Wikipedia). The larva of the beetle *Rhynchophoru sphoenicis*(F)popularly known as "Edible worm" is a delicacy in many parts of Nigeria and other countries in Africa where it is found. The larva is known by various names by the different ethnic groups in Nigeria, they strongly believe it to have high nutritive as well as certain pharmaceutical potentials. The mode of preparing it for eating differs from one geographical locality to another. In some places, it is boiled while others smoke, fry or simply eat it raw (Ibibio's in AkwaIbom State, and Ibos in Anambra state) It may be consumed as part of a meal or as a complete meal with Tapioca or bread

(Urhobo's in Delta state,) The use of the larva of *Rhynchophorusphoenicis*is believed to extend beyond the nutritional value (Ekpoand Onigbinde,2005).Some tribes (Urhobo's and Isoko's, both in Delta state) strongly recommend it to their pregnant women, probably as a source of essential nutrients (Ekpo, 2003).

Ecology and biology of *Oryctes rhinoceros*

The life cycle of *Oryctes rhinoceros* can range from 4 to 9 months. When in a favorable condition, more than one generation can occur per year. Eggs are laid in manure, rotten wood, decaying vegetation found in coconut/palm plantations, or other organic matter, Females lay between 70 and 140 eggs, after laying the egg, they cover them with the chewed material (Giblin-Davis, 2001; Schmaedick, 2005). Trees damaged by typhoons can serve as breeding sites and dead standing palms are the most preferred (Moore, 2007; Bedford, 1976). The male *Oryctes rhinoceros* usually arrive after the females lay their eggs and stay longer in the breeding site to prepare the wood for the larvae (Zelazny and Alfiler, 1991; Alfiler, 1999).

The eggs are hatched in about 12 days and the larvae can be found in decaying or dead standing palms (Giblin-Davis, 2001) and eat rotten organic matter (Muniappan, 2002). Zelazny and Alifiler (1987) described four phases of the adult life of *Oryctes rhinoceros* in the Philippines which are: the immature phase, the first feeding, the breeding phase, and the late life feeding. The last two phases occurred simultaneously. In late life feeding, the beetles will occasionally make additional visits to palms (reviewed in Alfiler, 1999). They may be found feeding in the trunks of living palms, but this is only when the tree is already seriously injured by the adult or other means (Gressitt, 1953). In Guam, a significant number of *O. rhinoceros* have been found to complete their entire life cycle in the crowns of coconut palms with larvae feeding on decaying detritus caught between the petioles (Moore, 2012). Crowns are only damaged by adults as they bore into folded, emerging fronds to feed on sap.

Larvae seems to prefer areas with high moisture content, with more larvae being found in decaying trunks of palms where moisture content was 80 to 100% (Kamarudin*et al*., 2005). They develop fully in 72 to 130 days (Giblin-Davis, 2001) going through three instars (Gressitt, 1953; Hinckley, 1973). Once mature, larvae go through a non-feeding pre-pupae stage lasting 8 to 13 days before pupation occurs (Schmaedick, 2005). Pupation lasts about 20 days, after which the adult remains in the cocoons after pupation is complete for about 11 to 20 days (Giblin-Davis, 2001). This is done to allow the exoskeleton time to darken and harden (Hinckley, 1973).

After emergence, adults remain mostly around the breeding sites (Giblin-Davis, 2001). Adults can fly to the crowns of host plants to feed, flying between dusk and dawn (Catley, 1969). The depth of burrows made by adults can range from 2 to 50 cm.

Damage is caused at the adult stage, specifically young adults that bore into the crowns of healthy palms. Adults can penetrate 10 to 50 cm down close to the center of the spear cluster. Adults bite through the tightly packed unopened leaves in the central bud. The beetle feeds on juice produced by host tissue after entering the palm. While in the developing stage mature fronds will often have patches of missing foliage if attacked (Giblin-Davis, 2001).

Plate 1: Larvae of *Oryctes rhinoceros*

Plate 2: Adult female of *Oryctes rhinoceros*

Plate 3: Adult male of *Oryctes rhinoceros*

Demand and consumption of *Oryctes rhinoceros*

Since sufficient food to meet the needs of all citizens is not available at the national level, and food security remains one of the most fundamental challenges for human welfare and economic growth in most African countries, (Benson 2004). Their delicious flavour (Cerda*et al.*, 2001) is credited by some to their elevated fat content (Fasoranti and Ajiboye, 1993).In the tropics, the insects are found all year-round where their hosts can be found. Often these hosts are trees under stress; that is, trees previously damaged by other insects, notably *rhinoceros'* beetles (*Oryctes*spp.) or by the local traditional tapping for palm wine (FasorantiandAjiboye, 1993). Fallen palms can serve as breeding sites and support hundreds of larvae; for this reason, palms are often felled intentionally.

Oryctes rhinoceros' larva is valued as food in many communities in Nigeria and around the world the larvae are typically collected particularly in areas where palm tree is abundant, they are washed and fried for consumption (Fasoranti and Ajiboye, 1993). It is unusual to add oil because the larvae are high in fat and exude oil during the frying process. Common condiments include onion, pepper and salt. Barbecuing the larvae is also a common practice (FAO, 2013).

In Nigeria, adults discourage children from eating palm weevil larvae. It is thought that this is done to prevent children from felling palm trees, which can increase breeding sites for the available stock of number of larvae to be harvested in the short term but would cause irrevocable long-term damage to host trees (Fasoranti and Ajiboye, 1993). Protecting palm trees is considered essential to communities, who depend on them for other key products, including palm oil, palm kernels and palm wine.

Socio economic Importance of Insect

Food and Nutrition

Insects are traditional foods in most cultures, playing an important role in human nutrition and have much nutrient to offer. People in Africa, Asia and Latin America eat insects as regular parts of their diets. They may do so not only because conventional meats such as beef, fish and

chicken are unavailable and insects therefore are vital sources of protein, but also because insects are considered important food items, often delicacies (FAO, 2013). The consumption of edible insects has a long history for many cultures. According to Banjo *et al.*, (2006), the consumption of non-toxic insects therefore, should be encouraged.

Employment and Income Generation

The capturing, processing, transporting and marketing of forest insects provide income and livelihood opportunities for some people around the world (Durst and Shono, 2010).

They are not only a source of nutrition but a source of income for economically marginal rural population. Edible insect are food resources that continue to be tapped extensively by population in the third world (De foliart, 1990; 2002; Latham, 2001). In several areas of Zimbabwe, South Africa, Zambia and Nigeria, many families make fairly good living from selling insects. Trade in edible insects is a major source of income in some places and what is collected is not always fully consumed directly by the collectors themselves. Insects offer important livelihood opportunities for many people in developing countries, including some of the poorest segments of society and particularly women and children. "Greening" the economy with forestry – including edible insects – can help redress the social, economic and regional asymmetries and inequalities that still prevailing many parts of the world (FAO, 2012d).

CONCLUSION

Based on this study, the following conclusions can be made: *Oryctes rhinoceros*l arvae is economically significant as it contributes to the socio-economic life of the people. The sales of the insect also contributes to the income earning of the rural people. The utilization of *Oryctes rhinoceros*larvae as food can lead to as an increase in the protein intake of the rural people. The major threat of the insect is deforestation and climate change will affect the insect in ways not known yet. The collection and sales of *Oryctes rhinoceros'* larvae is mainly by women.

RECOMMENDATIONS

Due to the economic significance of *Oryctes rhinoceros*larvae in this areas, the conservation of the host plant (Raphia palm) should be encouraged by the state government through the enforcement of legislation against bush burning and illegal felling of trees. Establishment of plantations should also be promoted to enhance the production of this insect for heavy marketing. More attention should also be given to domestication of the insect.

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