

Research Article

The Acceptability and Knowledgeability of *Rhynchophorus Phoenicis* (Coleoptera: Curculionidae) Grub As Food in Bayelsa State, Nigeria

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Abstract: This study was aimed at evaluating the knowledgeability and acceptability of the African red palm weevil (*Rhynchophorus phoenicis*) as food in Bayelsa State owing to its nutritive and medicinal properties. The study employed the use of sample survey method engaging the distribution of 120 and retrieval of 100 open ended questionnaires. The respondents were males and females of age brackets 20-60 years. The findings revealed general knowledge, acceptability as food and nutritional awareness of *R. phoenicis* at 63, 91 and 61 respectively. Also 84 respondents had eaten various delicacies prepared with the grub, 74 were well aware of palm trees as the breeding sites, 39 recognized the adult beetle as emergent of the grub, 41 asserted to eating the larvae as food rids the chest of hang overs, 50 attested to the fact that pregnant women actually gave birth to healthy babies upon inclusion of the grubs in their diets. 60 individuals called for mass rearing the larvae to meet the nutritive needs of the populace thus forming a basis for its incorporation in entomophagy, as the larvae are considered high in unsaturated fat and the third most proteinous food after chicken and termites. The results of the present study showed that *R. phoenicis* larva is mostly consumed and widely accepted as food by the people. However, there is the clarion call for domestication and mass rearing of the larvae for food and commerce rather than continuous reliance on harvesting natural population/wild collection occasioned by low yield and seasonality problems.

Keywords: *Rhynchophorus phoenicis*, Domestication, Mass rearing, Entomophagy, Acceptability.

INTRODUCTION

The palm weevil larvae also known as ‘grubs’ are harvested from palm trees infested by the adult palm weevil, which lays her eggs in the tree via natural openings or injuries. The eggs hatch into the larval stage which molts thrice, then the pupa and adult emergence, thus exhibiting complete metamorphosis (Alrouechidi, 2003). All the life stages are eaten by different people.

Insects have played important part in the history of human nutrition in Africa, Asia and Latin America (Bodenheimer, 1951, Defoliart, 1992) and several species have been used as human food (Defoliart, 1988). *Rhynchophorus phoenicis* commonly called Red palm weevil is one of the species of edible insects that are generally accepted, considered most important and widely marketed edible insect in the Niger Delta region and Bayelsa State specifically. The

larva is cherished as food among the many communities in Nigeria and around the world, especially in those places where palms (Oil, Raffia and coconut) are cultivated on commercial basis Okaraonye and Ikewuchi, (2008).

Among the various ethnic nationalities in Nigeria, it is associated with different local names such as *Orhu* or *Okhin* in Edo, *Nten* in Ibibios, *eruru*, *akwangwo* or *nza* in Igbo, *eko-ali* in Idoma, *awon* or *ekuku* Yoruba, *odo*, *Ikolo*, *edon* by the Isokos, Itsekiris and the Urhobos respectively (Okaraonye and Ikewuchi, 2008). The Ijaws in Bayelsa State call the insect *dun* or *okoko* Thomas and Briyai, (2019).

In Nigeria, these insects are fried in their own oil, salted for snacks and eaten as special local delicacies (Antonio and Isoun, 1982). In Bayelsa State, the insects, especially the larval stage serves as special

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delicacies to both the rural and city dwellers (Omotoso and Adedire, 2007). Banjo *et al.*, (2005) stated that the grubs and adults are used as food in South Western Nigeria. Processed grubs are dressed on skewers for a certain amount/price and are sold in local markets, motor parks and by the sides of major roads leading into and outside. Upon harvesting, the grubs are either eaten raw (fresh) or cooked. Other processing/preparation methods include roasting, frying, smoking, stewing, and so on. In the Niger Delta area and Eastern States of Nigeria, this larva is often a cherished delicacy and can be sold along major roads and markets in Edo and Delta States of Nigeria, from Sapele where it is called 'edible worm' or 'Maggot' to Warri where it is called 'diet', down to Bayelsa where it is called 'Bayelsa Suya' and in Rivers it is called 'chafer' (Lale, 1996). In Cross River, Akwa Ibom and all the Eastern States of Nigeria, it is widely consumed either raw, boiled, fried, smoked or sometimes used in the preparation of stews and soups as part of a meal or as a complete meal Okaraonye and Ikwuchi (2008).

Proximate and chemical analysis of these grubs revealed the presence of protein, carbohydrates, saturated and unsaturated oil and fatty acids at about 31- 61% wet weight. Minerals found include sodium, zinc, iron, copper, manganese, potassium, calcium, phosphorus and magnesium in low, moderate and high content levels Okaraonye and Ikwuchi, (2008). The larvae are proven to contain the richest source of animal fat and high energy value of 234.9KJ/100g of larvae (Oliveria *et al.*, (1976). According to Chaney, (2006a), the crude protein content of *R. phoenicis* larvae is higher than those found in cow milk, eggs, termites and beef, implying that this larval meal can contribute significantly to the daily human protein requirements of about 23-53g. It is also rich in essential amino acids such as histidine, methionine and phenylalanine (McGilvery and Goldstein, 1983; FAO/WHO/UNU, 1991). Its high content of unsaturated fatty acids is an indicator that the oil is safe for consumption by individuals prone to dyslipidemia, diabetes mellitus and cardiovascular diseases since its intake reduces the risk of these attacks Martirosyan, *et al.*, (2007). Vitamins found in high amount include thiamine and riboflavin (Thomas and Briyai, 2019).

Ene, (1963) noted that insects directly or indirectly provide man with good quality food since processed proteins could be manufactured from insect tissues, therefore insects could add to the world's meager supply of proteins and fats. Defoliart, (1989, 1991a, 2002) stated that indigenous population in many third world countries where animal protein is scarce, use about 30 species of insects or more since insects are many times higher in protein and fat content than the plants which they fed upon. Accordingly, Clastres, (1972), viewed the palm larvae as more than food gathered by chance in the forest, rather they are the product of some sort of cultivation Fasoranti and

Ajboye, (1993) reported the use of palm weevil grub as food by many Nigerians especially rural dwellers as major protein supplement. They stated that it was easier manufacturing proteins from insects than other plant tissues, thereby advocating the need for the development of mass rearing methods of the insects for food and commerce.

Bayelsans in Bayelsa State eat the palm weevil larva as meat amidst varieties of meat from different species of animals for reasons ranging from its nutty flavour, oily/fatty nature, nutrient content, taste, tender meat nature, among many others. This study was conducted to determine the knowledgeability and acceptability level of the grub by the populace of Bayelsa State and the inclusion of palm weevil larva in their choice of variety of meat in the locality

METHODOLOGY

Study Area

The study was conducted in Bayelsa State, which is one of the Six (6) States in South-South Geopolitical Zones of Nigeria, located in the Niger Delta Region lying between latitudes 4'15°N and 5'23°N and longitudes 5'22°E and 6'45°E of the Equator. The study area covered five communities including Akenfa, Agudama, Edepie, Biogbolo and Yenezue-gene, all in Yenagoa metropolis.

MATERIALS AND METHODS

Employing the sample survey method by Nodu *et al.*, (2013), primary data was collected using well-structured, open-ended descriptive questionnaires. A total of one hundred and twenty questionnaires bound on the 'Acceptability' and 'knowledgeability' of Red Palm Weevils (*R. phoenicis*) as food in Bayelsa State were distributed between males and females within the age bracket of 20-60 years in the research area under study. Respondents were shown pictures of *R. phoenicis* larvae and adults. Filled questionnaires were retrieved after a period of three days to a week from the respondents.

STATISTICAL ANALYSIS

The data generated from the studies were analyzed by simple percentages while the charts were plotted using Microsoft excel.

RESULTS

A total of a hundred questionnaires were retrieved from the respondents. These were compiled and used for the computation of the results. The results showed that majority of the respondents were well aware of the larvae of *R. phoenicis*. Figure 1 shows the number of respondents who indicated knowledge of the *R. phoenicis* larvae as 91. Among the respondents, 45 (49.5%) were male and 46 (50.5%) were females respectively. Amongst the male respondents, 25 were within the ages of 20-40 years and 20 within 41-60 years of age. For the female respondents, 34 were

within 20-40 years and 12 within 40-60 years respectively (fig.1).

A total of 84 respondents, claimed to have eaten the grub. From the number 41 (48.81%) were males while the females were 43 (51.19%). Among the males 21 were within the age of 20-40 years and 20 were 41-60 years. Also, 31 female respondents fell within the age bracket of 20-40 and 12 within 41-60 years of age respectively (fig. 2).

The response to mass rearing and domestication of *R. phoenicis* was supported by 60 respondents. 32 (53.3%) were males and 28 (46.7%) were females. A total of 19 and 13 of them were within the age brackets of 20-40 and 41- 60 years respectively for male, while, 19 within the age of 20-40 years and 9 within 41-60 years of age were females (fig. 3).

The graph on figure 4 gives the outcome of respondents who reported awareness of palms as breeding site for *R. phoenicis* beetle as 74. Males were 41 (55.4%) while females were 33 (44.6%). From the sum, 24 males were within the age of 20-40 and 17 within the age bracket of 41-60 years. Also, 21 females were ranked 20-40 years and 12 within 41-60 years old.

A total of 61 respondents believed that the consumption of *R. phoenicis* beetle and grub as delicacy was nutritious and had medicinal value. Among the number, 32 (52.5%) were male respondents while females were 29 (47.5%). From the number given, 16 respondents between the age of 20-40 and another 16 within 41-60 years respectively were males while 17 within the age of 20-40 years and 12 within age 41-60 years were females (fig. 5).

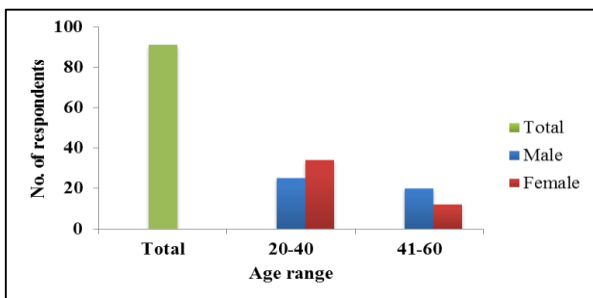


Fig 1: Number of respondents that were knowledgeable of *R. phoenicis* grub

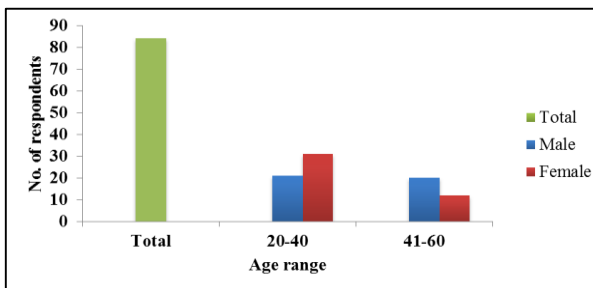


Fig. 2: Number of respondents who preferred eating *R. phoenicis* grub as food

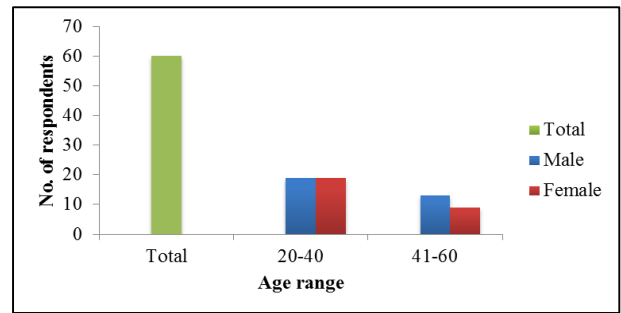


Fig. 3: Number of respondents that called for mass rearing and domestication of *R. phoenicis*

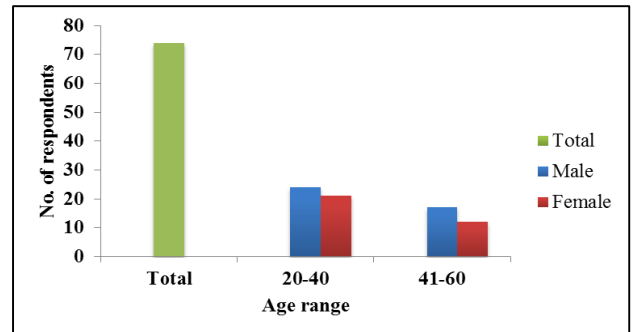


Fig. 4: Number of respondents that indicated awareness of palms as breeding ground for *R. phoenicis*

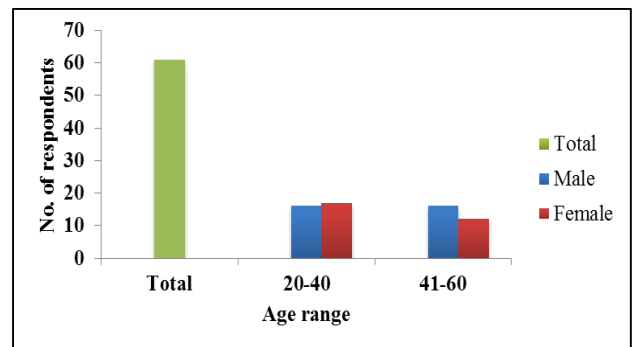


Fig. 5: Medicinal and nutritional importance of *R. phoenicis* as food.

Figure six shows that 50 respondents believed that pregnant women who consumed these grubs were likely to birth healthy and chubby children. About 28 (56.0%) respondents in support of this motive were male respondents while females were 22 (44.0%). Amongst the males, 15 fell within the age brackets of 20-40 while 13 were within 41-60 years. Likewise, the female respondents had 14 within 20-40 and 8 within 41-60 years.

A total of 39 respondents claimed recognition of the adult beetle as part of *R. phoenicis* grub. 22 (56.4%) were males while, 17 (43.6%) were females. Among the males, 12 were within 20-40 years and 10 within 41-60 years. For the female respondents, 11 were within 20-40 and 6 within 41- 60 years of age respectively as presented on figure 7

The total numbers of respondents who believed that these grubs when eaten could clear the chest region and help those suffering from “hang-overs” were 41. From the number, 24 (58.5%) were males and 17 (41.5%) were females. Male respondents had 14 within 20-40 and 10 within 41-60 years. Also, regarding the female respondents, 12 were within ages 20-40 and 5 within 41- 60 years of age respectively (fig. 8).

As represented on figure nine below, a total of 63 respondents accepted the grubs as food. Males were 42 (66.7%) and females 21 (33.3%). 20 males fell within ages 20-40 and 22 within 41-60 years respectively. The number of females were 10 which fell within ages 20-40 and 12 within ages 41-60 years of age accordingly

A total of 33 respondents reported knowledge of *R. phoenicis* beetle as the primary pest for the destruction of raphia and oil palms. From the above value, 18 (54.5%) were males and 15 (45.5%) were females. Among the males, 5 were within age brackets 20-40 and 13 within 41-60 years. For the females, 3 were within the ages of 20-40 and 12 within 41-60 years of age respectively (fig 10).

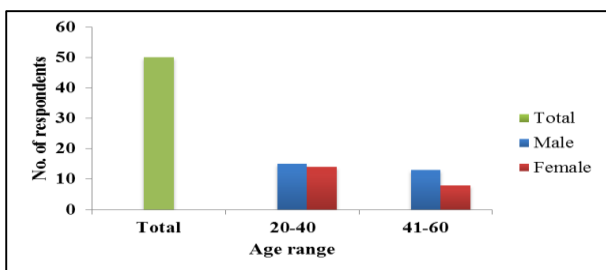


Fig. 6: Number of respondents who believed that the consumption of *R. phoenicis* grubs by pregnant women enables them to give birth to healthy babies

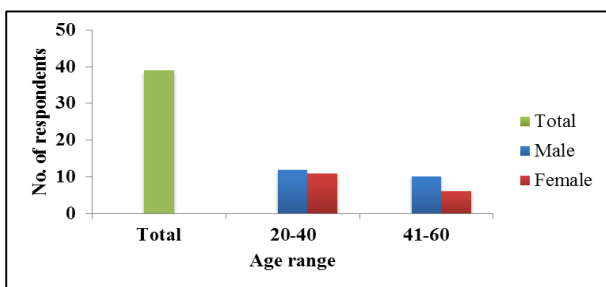


Fig.7: Number of respondents who recognized the adult beetle as a life stage of *R. phoenicis*

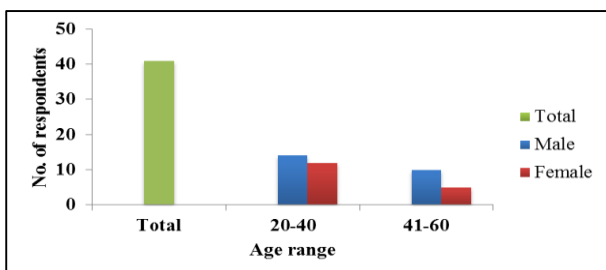


Fig.8: Number of respondents who believed that consumption of *R. phoenicis* grubs act as cure or hang-overs

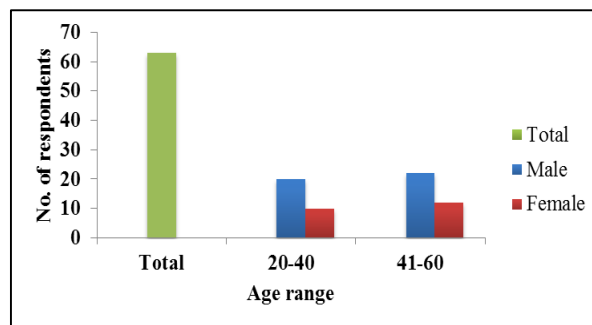


Fig. 9: Number of respondents who accepted *R. phoenicis* grubs as food.

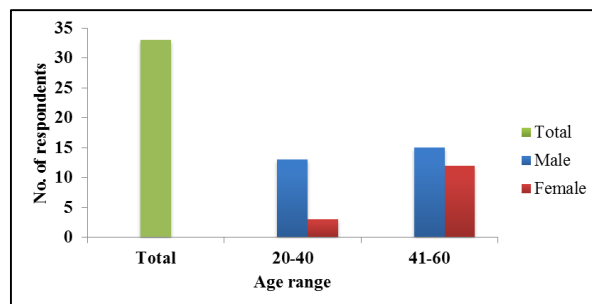


Fig. 10: Number of respondents who reported that the infestation of palms by *R. phoenicis* led to their destruction

DISCUSSION

The larval stage of *R. phoenicis* is well known to the indigenes and non-indigenes of Bayelsa State who strongly believe that the ‘grubs’ have high nutritional and medicinal potentials. The respondents had favourable perceptions regarding the larvae as food which positively influenced their level of acceptance at sixty three (63) out of a hundred indicating a high acceptance at that. This finding is in support of earlier report of Thomas and Briyai, (2019), who reported total acceptance of the larvae as food by the people of Bayelsa state specifically and Niger Delta region in general.

Traditionally, many claimed that the larva content extends beyond nutritional to medicinal properties. A total of sixty one (61) out of the 100 respondents believed that *R. phoenicis* larvae contained medicinal and nutritional properties hence its acceptability. This result supports the report by Solomon *et al.*, 2008, who stated that as long as protein-energy malnutrition prevails in developing countries, the search for low cost, nutritious and easy to prepare locally available complementary foods will continue. The protein content of *R. phoenicis* larva compares with those from most conventional protein sources (Pyke, 1979). The high protein content of the larva is suggestive of the potential of the larva being used in combating protein deficiency if the larva is dehydrated and defatted. A relatively high cash value is observed for the larva, when compared with the reported values for meats, meat products and poultry (Watt and Merrill, 1963). *R. phoenicis* grubs have been proven by

researchers to be good source of protein and other nutrient supplements, thus mass production of its larvae and those of other edible insects using advance scientific procedures and cultivation will drastically decrease the excessive reliance on conventional protein source Ifie and Emeruwa, (2011). FAO/WHO/UNU, (1991) reported that the high protein content of these grub meal can contribute significantly to the daily human protein requirements of about 23-56g.

These insects are known to be rich sources of various macro and trace elements/ minerals such as sodium, potassium, calcium, magnesium, iron, manganese, phosphorus, zinc and copper Abdel-Moniem *et al.*, (2017). They further stated that the copper content of the larva can supply the recommended minimum daily requiremen of human while the sodium content is also very high. These elements are probably accumulated for future use in adult exoskeletal and connective tissue synthesis. According to Defoliart, (1991b), Okaraonye and Ikewuchi, (2008) *R. phoenicis* larva contain fatty acids similar to those found in poultry and fish in their degree of utilization but higher in unsaturation. They also reported that the larvae oils are safe and low in cholesterol content but the oils should be stored at low temperature, protected from light and oxygen to avoid peroxidative changes. Stedman, (1996), remarked that fat gotten from palm grubs can be used in the manufacture of excellent butter. Abdel-Moniem *et al.*, (2017), McGilvery and Goldstein, (1983) also confirmed that the grubs contained about eighteen known amino acids that are essential to the wellbeing of humans in trace to high amounts such as alanine, lysine, valine, leucine, methionine, phenylalanine, histidine and several others.

About seventy four (74) of the respondents claimed awareness of palm trees as the actual breeding sites of *R. phoenicis*. This is indicative of the fact that a lot above average of the respondents were totally conversant that the insects are polyphagous with females that are usually attracted by palm volatiles and thus lay several eggs in dying or damaged parts of palms, although undamaged palms could also be attacked and that palms indeed are the natural breeding sites of the insect (Thomas, 2003).

About thirty nine (39) recognized the adult beetle as an emergent of the larvae and thus a stage of its developmental cycle. Most of the respondents only knew the larval stage while some knew the adult beetle but never speculated it to be an emergent stage of the larva and a few others claimed never to have seen the adult stage prior to the time of the research. This can be attributed to the fact that palm plantations are located in forests far away from residential areas and the insect is crepuscular and seldomly flies to areas inhabited by the populace.

Furthermore, forty one (41) of respondents believed that eating the larvae as food rids the chest of hang overs. Those who believed this fact attested to it been used by them or some friends that experienced hangovers due excessive intake of alcohol. They claimed it calmed the thoracic region thereby ridding them of all symptoms of hang overs. This result is in agreement with that of David, (2015) who stated that eating greasy grubs after hangovers do actually get rid of the tired-headachy-nauseated feeling. This is also buttressed by Buddy, (2019) who reported that taking food that can replace the salt and potassium lost during a drinking binge can help cure hang overs. Hence, since the grub is proven to contain relatively high amounts of sodium (460mg) and potassium (45mg) per 100mg its consumption is proven as cure for hangovers.

Fifty (50) respondents attested to the fact that pregnant women actually gave birth to healthy babies upon inclusion of the grubs in their diets which is an average of the total number of respondents.. This is also supportive of the statement by Bodenheimer, (1951), that palm beetles are reportedly eaten as protection against sterility. Saris *et al.*, (2000), Abdel-Moniem *et al.*, (2017) disclosed that iron deficiency has been a major problem in women's diet in the developing world particularly among pregnant women and most especially in Africa but that these grubs are rich source of iron. They stated that the iron content of *R. phoenicis* larvae was 99.0mg/100g larvae and is a good source of minerals for young, pregnant and lactating mothers and for the proper development and functioning of the body system. According to Chaney, (2006b) the larva can also supplement the daily iron requirement of man since iron is a component of hemoglobin, myoglobin, cytochromes and myelo peroxidases.

A total of sixty (60) respondents called for the domestication and mass rearing of the grub for commercial purposes. This is in agreement with the statement of Ebenebe *et al.*, 2016, who reported that the unsustainable practice of wild collection of the larvae has been characterized by low yield and seasonality problems and thus calls for alternate means of culturing the insect outside its natural habitat with the purpose of ensuring year round supply. Also, Fasoranti and Ajboye, (1993), stated that it was easier manufacturing proteins from palm grubs than other plant tissues, thereby advocating the need for the development of mass rearing methods of the insects for food and commerce.

Eighty four (84) respondents claimed to have eaten delicacies prepared using the grub while about ninety one (91) of the individuals affirmed they were well knowledgeable of the insect and its use as food, making the aim of this research a huge success. This is in conformity with the observations of Anthonio and Isoun, (1982), Banjo *et al.*, (2005), Omotoso and Adedire, (2007), Okaraonye and Ikewuchi (2008),

Thomas and Briyai, (2019) who having worked independently, variously stated that the grubs are widely enjoyed and consumed in large amounts, either eaten raw (fresh) or cooked, fried in their own oil, salted for snacks and cherished as special delicacies after been roasted, fried, smoked or stewed.

Finally, palm larvae should be viewed according to Clastres, (1972), as more than just a food gathered by chance in the forest, but rather as the product of some sort of cultivation. Chagnon, (1968), disclosed that the people of Yanomamo in Colombia in attempt to exploit the production of palm larvae for food and commerce practiced insect domestication by cutting down the palm trees thus providing fodder for the insects. According to Sutton, (1986), Indians in Western North America have expended much organization and effort in harvesting food insects which they saw as equally important resource. Insects have played important part in the history of human nutrition in Africa, Asia and Latin America (Bodenheimer, 1951).

CONCLUSION

R. phoenicis grub commonly called 'Bayelsa suya' in Bayelsa State is generally accepted as special treat and delicacy amongst the people. The larvae (nymphs or grubs) are fried in their own oil and sold on sticks along roads, parks, streets and market places. Grubs are eaten raw or in combination with garri (dried or soaked), used for preparation of stew, jollof rice, pepper soup, drinking of beer, palm wine and other soft drinks and lavishly eaten by all and sundry: men, women, youths and children including the aged. The grub has been revealed to have high nutrient content particularly in unsaturated fatty acids such as oleic and linoleic acids, proteins, amino acids, oils, vitamins and minerals which researchers confirmed can provide adequately the required daily intake needed by man. This also makes it suitable as replacement for fish/ meal in fish feeds. With regards to the knowledge generated by this research work, the grub should be domesticated and mass reared to meet the nutritive demand, reduce and or solve the problems of protein and micronutrient deficiency in humans and livestock of Bayelsa State owing to the fact that the people greatly like, accept and appreciate it as food, hence the clarion call for the practice of entomophagy in Bayelsa State.

RECOMMENDATION

With the level of knowledgeability, acceptability and all the positive nutritional benefits associated with *R. phoenicis* as food insect, we thereby recommend that mass rearing and domestication of this larva be encouraged for optimum use as food/feed resources for production of insect proteins for human consumption, animal husbandry and commerce rather than continuous reliance on harvesting natural population/wild collection occasioned by low yield and seasonality problems.

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