

Constructing and Using a Light Trap Harvester: Rural Technology for Mass Collection of Agoro Termites (*Macrotermes subhyllanus*)

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Abstract: Entomophagy is now a growing industry in many parts of the world especially in the developing countries. Entrepreneurs in several parts of the world are making edible insects both palatable and marketable for income generation. The traditional use of insects as food continues to be widespread in tropical and subtropical countries and to provide significant nutritional, economic and ecological benefits for rural communities. Consumption of insects is considered to be a more efficient use of the world's resources to feed the growing population. Insect consumption is growing in many parts of the world and the winged termite in particular is consumed widely in various part of East Africa especially in the western part of Kenya. The traditional methods of collecting these termites vary considerably from one region to another. This paper highlights the indigenous ways of collecting *Macrotermes subhyllanus* locally known as *Agoro* in the Lake Victoria region. The method was developed by integrating modern technology and the indigenous technological knowledge. The variation in the yield of the sample of *Agoro* mounds selected and the traps used are presented and discussed.

Key words: Agoro, harvesters, indigenous knowledge, termites, yields

INTRODUCTION

It is reported that more than 2.5 billion people mainly in Africa and Asia, eating insects is a common dietary habit and collecting edible insects is a potential income generating activity for many women and youth in the rural areas (FAO, 2010). Entomophagy is indeed a growing industry of the world especially in the developing nations in Africa and Asia continents. FAO is therefore drawing the world's attention to this valuable protein food source. As reported by many researchers, eating edible insects is not a new thing. Entomophagy is only finding its rightful position in the world community where the practice is moving from a former position of a 'backward practice' to a healthy commendable eating habit. In Kenya, almost all the edible insects are collected from their natural habitat using traditional traps. Collectors simply lay wait the insects and collect them one by one as they emerge from their habitats in the wild. One most seasonally collected edible insect in western Kenya is termites. There are several species of termites that are regularly collected. However, there are certain species which are not collected for human feeding (Nyeko and Olubayo, 2005). Eggleton (2000) reports that there are over 2600 species of termites worldwide and Africa is the richest continent in termite diversity with over 660 species. Termites have been collected for many decades by means of unimproved

technology because of the less importance research initiatives placed on entomophagy. With the current emphasis placed on forest products by FAO, entomophagy is gaining ground. This paper is a step towards improving technology for mass collection of these valuable edible insects.

Method of termite collection varies from species to species in different parts of the world. In the western Kenya, termites are collected during the rainy season. They are prepared by blanching in boiling water then sun drying, shallow fried in own fat, or simply eaten raw directly from the emergence hole (Christensen *et al.*, 2006; Ayieko *et al.*, 2010). Edible termites form an important part of the food culture in the Lake Victoria region of East Africa (DeFoliart 1999; Ayieko, 2007). In many households termites are a delicacy enjoyed by almost all ethnic communities in western Kenya, particularly the Luo, Luhya and Kalenjins of western Kenya. The large alate termite (*Macrotermes subhyllanus*) locally known as *Agoro* by the Luo community and *Chiswa* (*Tsitswa*) by Luhya language is a gregarious insect mostly common during the first long rains between March and May. This specie of termite tends to emerge in the month of March or April during the onset of the long rainy season; but this emergence pattern is changing with the climate changes. These alates are dark brown fatty and are the largest of all types of the winged termites

normally collected for human consumption. At the onset of a rainy season, the winged reproductive fly off from their nest in large numbers during which they are collected for domestic consumption. It is during this flight, known as the nuptial flight, virgin queens pair up with males in the air for mating and then land to start a new colony.

In Lake Victoria region, these termites emerge with the first rains at the ends of the dry season when crop yields have not been realized and during heightened food insecurity in the villages. The *Agoro* termites emerge in dense numbers at night and are eagerly collected by the villagers. The villagers do this at night by introducing a light source inside a bucket lined with wet slippery banana leaves, placed near an active mound. Other rural technology include placing a bowl of water under a light source, attracted to the light the insects fall into the water bowl and thus cannot fly away. In other communities, large shiny or white materials are placed on the ground where the termites get attracted and simply drop and pile on the sheet. Some of these methods have posed dangers to the harvesters because a collector is likely to come in contact with other dangerous predators such as snakes which also come to feast on the readily available catch.

As mentioned earlier, there are different types of edible termites which are normally collected for human consumption within the lake region. Some emerge only at night while others come out between mid mornings to late afternoon, while others emerge early evenings. Further still some species only emerge when it is raining making it difficult for predators to prey on them.

Many people in the area love eating *Agoro* but fear going out at night to collect them. Technically there are only two options for getting *Agoro*. One has to collect them as they emerge at night or wait till the morning after emergence to pick them up one by one after they have shade off their wings. Waking up early in the morning to collect entails competing with other predators for *Agoro* that are already burrowing down in the soil to form new colonies. The burrowing *Agoro* are normally found nesting in pairs or more under loose covers on the ground such as stones, pebbles, fallen leaves, and dry woody materials. In such a case, the collectors have to unearth them from these temporary nests or tunnels in their early stages of forming colonies. The catch in this stage is tedious, slow and not ideal for collecting sizeable amounts to make a meal. Thus the need for improved technology. Constructing the light trap also ensures a risk free and efficient method for collection. The light trap is designed specifically for collecting *Agoro* at night based on the insects' behavior and characteristics. The objective of this project was therefore to demonstrate the construction of a light trap and a receptor to facilitate mass collection of

Macrotermes subhylanus for increased food security among the communities practicing entomophagy.

METHODOLOGY

Three traps for *Agoro* (*Macrotermes subhylanus*) collection were made and used in three selected areas. Each trap had three major parts: the trap stand, a light source to attract the insects, and a receptacle basin for collecting the attracted insects. The design of the trap was based on scientific and indigenous knowledge on *Macrotermes subhylanus*. The actual construction was done by sourcing the services of a local skilled labor commonly known in Kiswahili as *jua kali* (or *fundi*) with metal welding facilities. The project team chose to use the *fundis* in the village to promote ownership among the stakeholders. The skilled labor was provided with instructions on how to construct the stand for supporting the receptacle and the light source. The light source was suspended slightly above the collection point and the receptacle was raised some 2 feet above the ground so that the trap may stand without toppling over. The receptacle was raised above the ground to prevent rain water from splashing grit and soil into the receptacle and also to prevent crawling predators such as ants, lizards and snakes from entering the trap. Light but strong metal rods were used to construct the stand to ensure that the trap could stand the weight of hyenas and wild cats that may overturn it down when also looking for termites at night. The light attractor consisted of a solar light bought from the local market (any bright source of light could do). The rechargeable solar light was used since it doesn't require monitoring when the trap is securely placed in position. The solar lighting was preferred because it has no chances of causing accidental fire outbreak when left unattended. It was ensured that the solar equipment produce (7-8) adequate hours of light to be placed out as early as 7.00 pm till midnight, period between which the insects would normally emerge.

The receptacle consisted of a large deep plastic basin also bought from the local market. Small holes were punched at the bottom of the basin to discourage theft and also to drain off any rain water should it rain at night. A large 2 ft deep plastic basin was used to provide maximum capacity for collection and also to prevent the insects from flying away after landing in. Punching small holes at the base of the receptacle basin ensured that the termites do not drench in the rain water at night. The basin was then fastened on the metal stand such that the open end of the basin faced upwards and the solar light secured in place as described and illustrated on Fig. 1. Stability of the trap was ensured by the strong metal rod used to construct the trap and also securely positioning of the harvester stand on the ground. As the termites collect in the basin, they add weight to the base of the trap and this reinforced the needed stability.



Fig. 1: The Agoro Harvester showing light, receptor basin and stand

Sitting the traps in the villages: Three sites in three different areas within the Maseno division in Kisumu County were selected based on the availability of active termite mounds. The information was provided by the selected stakeholders and the local community who know the potential active mounds in the area. The purposive and convenient sample selection was used to identify the locations and the stakeholders. The field assistants who were also part of the stakeholders were trained on how to use the traps and how to charge and operate the solar light. The stakeholders were also trained on how to read the weather for a potential day of termite emergence. A complete trap was issued to each person. The lead researcher escorted the selected stakeholders in order to confirm the pre-identified collection points in the village. The field assistants were also encouraged to share the information with their neighbors to solicit the villagers' corporation in the study, promote ownership, and of course, to minimize vandalism or obstruction by children. The field assistants also had to confirm that there were no other visible traditional traps placed near the trial project sites. It was however mentioned that some villagers may have secretly placed smaller traditional traps in their homes due to the high demand of Agoro.

RESULTS

A total of four and one half kilogram (4.5 kg) of live clean *Macrotermes subhyllanus* was collected by the three collectors from three different places. All the three collections were made in the month of May, about 6 weeks after the onset of the long rainy season. Normally the rains set in April but due to the experienced poor onset of the long rains, the insects were affected and their emergence was delayed. During the months of April and May, the period during which Agoro emerges, inadequate rainfall was recorded in the area.

After the collection, the yield was removed from the trap and placed in clean airy containers and weighed. One of the trap yielded 2 kg of fresh Agoro (*Macrotermes subhyllanus*) while the other two traps yielded 1.5 kg and 1kg respectively. It was reported that all of the insects that emerged at site were not trapped in the basins, a lot others flew away. It is hope that the lot that escaped in the night went to form new colonies. Few were still crawling around in the surrounding area when the field assistants went to pick the harvest in the morning. Some other termites had already shed off their wings, paired up, and burrowed in the ground in readiness to found new colonies for sustainability of the specie in the area.

Unlike in the traditional methods of collection of termites by making holes in the wet ground, the yield from the trap was clean and free from ants, soil and other foreign materials. Almost all of the termite yields from the traps were still alive and active by the following morning, and free from dampness. Only few of the termites at the bottom of the receptor basin were smashed by being compacted at the bottom of the basin. To remove all the traces of soil and grit that came with the insects, the collection was washed with plenty of water, thoroughly drained in a colander and stored frozen to retain quality.

DISCUSSION

The winged Agoro termites tend to emerge early evenings. They are normally attracted to sources of illumination at night and have a tendency to swarm near a light source (Kaider, 2009). Due to their characteristics of being lured by light, solar lamps were used to attract them. As they emerge they fly and hit their body against the lamps, and become dizzy. This makes them fall down in swarms and collect into a basin placed below the lighting. Agoro termites normally have little energy reserved in their fat bodies. Hence they cannot fly away easily once they fall into the receptacles. The smooth slippery surface of the plastic basin helped to keep the insects sliding back to the bottom whenever they tried to crawl or fly out. Also their nature to compact when they collect together also prevents them from flying away, thus ensuring maximum retention of the catch in the basin.

Depending on how the trap is constructed, it is not unusual to find other predators such as snakes and lizards (not intended for collection) compete for the same source of food item. Thus, care must be observed when harnessing the termites at ground levels or from the traditional harvesters with holes dug in the ground. This challenge was overcome by raising the trap 2 feet above the ground and using a 2 feet deep basin. As such, only the termites that fall on the ground during flight are left for the crawling animals to feed on at the ground. The raising of the receptacles also eliminated collection of the wingless termite soldiers and workers that normally

accompany the reproductive termites to the emergence hole during the nuptial flight. The small perforations at the bottom of the basin not only minimized collection of rain water but also allowed circulation of air in the trap to keep the insects alive for long. Of course the perforations were small enough not to allow the insects to pass through the holes.

Due to the scope of this study, it was not feasible to estimate the age of each mound used for the three collection trials. The variation in weight of the collected insects from the three sites indicated that mounds from different regions produces different amounts of yield in terms of weight. The villagers reported that some mounds are more active than others and thus may yield up to 4 kg per emergence. It was thus concluded that termite yields vary from one mound to the other. The traps under trial were all placed in different geographical area to facilitate mound variation for comparison, but failed to capture this information. From indigenous knowledge collected in the villages, there are significant variations in the mound of *Agoro* from each mound in different the village. This is an area still needing research to promote sustainable harvesting of the forest products. It is unclear whether harvesting per se or habitat damage is the main threat to termites in the biodiversity. Habitat damage may be associated with decreasing insect harvesting but more so is the destructive human activities such as logging and grazing and indiscriminate use of organ-phosphorus herbicides in the villages. The risk of variability in insect numbers could be reduced by the development and adoption of closed production systems at the local levels for sustainable termite collection (Yen, 2009; Yen and Alan, 2009; Ayieko, 2006; Luo, 1997).

CONCLUSION AND RECOMMENDATION

As much as the traditional methods have since been employed in the collection of *Agoro* termite in the Lake Victoria region, the various methods have proved to be ineffective and inefficient. The methods employed by the local community of the Lake Victoria region have posed health risks in some way or the other to the people collecting the *Agoro*. The concept of indigenous technical knowledge has gained in prominence in recent years and may come up with effective and efficient tools and equipment in harnessing termites. There is need to adopt modern technology in the harvesting process. This therefore begs for a strategy that combines the skills and indigenous technical knowledge of the local community with modern scientific knowledge. The materials used in the construction of the traps should be easily available and the community living within the Lake region should be taught how to make and use such traps in order to maximize collection. Understanding the emergence pattern of the *Agoro* termite cannot be overlooked by those people intending to collect these termites. This

means identifying potential active mound for maximum collection.

Mass collection of termites calls for understanding of the various species of termite activities, the changing environmental situations, and integration of the indigenous technological knowledge with modern science. The yield exhibited by the termite traps used for collecting the *Agoro* termite in this case in deed calls for further research into characteristics exhibited by these termite species and why there is a variation in the mound yields. According to Sileshi *et al.* (2009), it would be important to integrate ethno-ecological and scientific knowledge of termites for sustainable management in Africa. Could there be an indication of *Agoro* extinction in some mounds due to the high demand of this termite specie? This paper therefore advocates for sustainable use of improved technology for harvesting termites and commercially development of the same for food security and economic development in rural villages. The primary step would be improving the available traditional harvesting technologies found in the villages.

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