

Challenges of Snail Farming in Nigeria: A review

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Abstract

This review paper on the challenges of snail farming in Nigeria introduces the phylum Mollusca. In the introduction, the highlights of the importance of mollusks to man and the ecosystem were given. They include importance in medicine, as food of other organisms, as disease carriers, pest of farm crops and even inimical to aquatic means of propulsion. The paper noted that there is need to culture mollusks due to the dwindling feral populations, given their contribution to man's food needs. Challenges facing the farming of mollusks were enumerated. These include poaching, accommodation, tradition; take off income, education and feral population of snails. Based on these challenges of farming land snails, it was suggested that aquatic species common in our area should be considered for Aquaculture.

Keywords: Mollusks; Farming; Challenges; Nigeria; Gastropod; Farming Technology

1. Introduction

Mollusks are among the largest invertebrates. Among the terrestrial gastropods are three members that are farmed in Nigeria. They are in the menu of many communities all over the world. They are not only present in the menu; they are there as preferred part of the menu. However, Turkey [1] and some minor traditional communities in Nigeria forbid them as their food, such communities in Nigeria include Ukwuani land, some part of Ijaw land, Isolo South and North Local Governments and Ebendo [2]. They are recommended as healthy food items because they are said to be low in fat, have high concentration of protein which is rich in essential amino acids and high concentration of minerals [3;4;5;6]. They are rich in anti-oxidants [7;8].

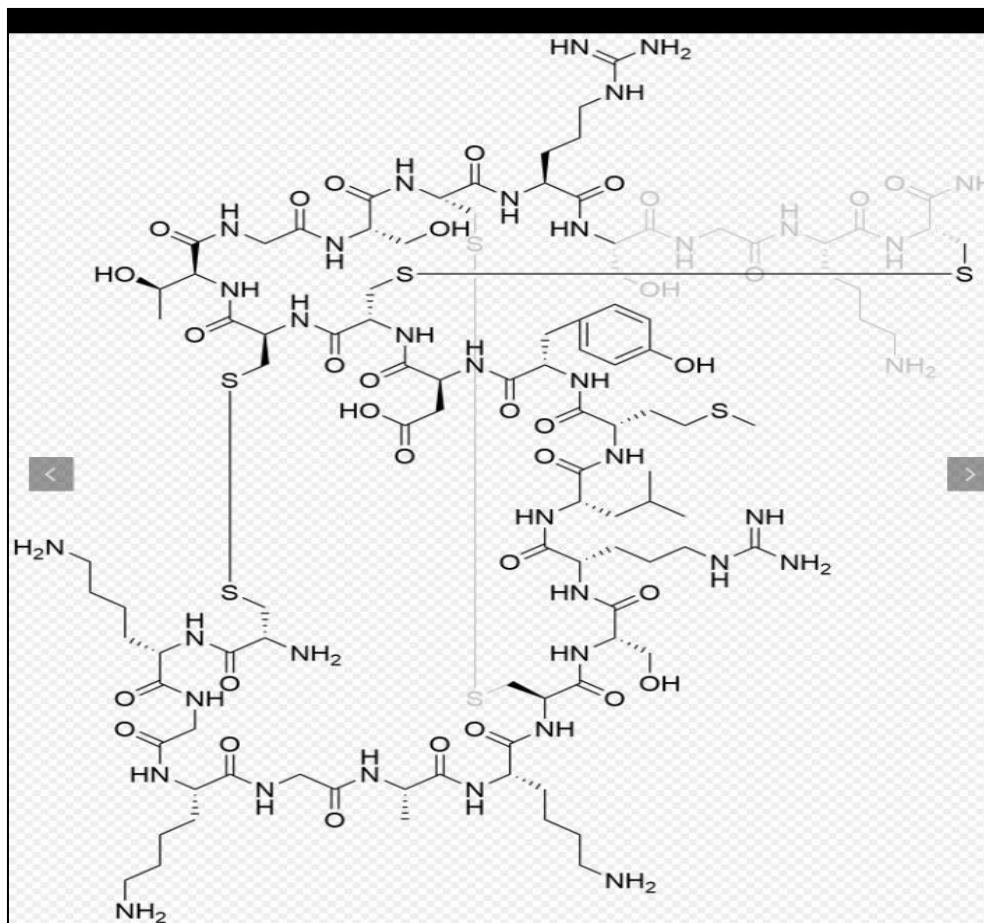
The slime of African land snails *Lisachatinina fulica* have anti-inflammatory properties in human [9]. In the study by Wrya and Siaenphet, it was observed that slime extract reduced malondialdehyde and increased superoxide dismutase in the granuloma tissues of induced rats. In Europe (Italy), snail slime is used in the cosmetic industry [10].

The most potent analgesic ever produced, Zinocotide, is from the fish-eating marine snail *Conus magus*, found in shallow tropical areas of the ocean. This is a protein with the structural formula as displayed in Figure 1. This drug lacks ability to cross blood to its target organ, the brain. It is therefore not administered intra venous, intra muscular or orally. Its mode of administration is intrathecal only. This is a method of implanting the drug in the abdominal region to be gradually released to the spinal cord, where it blocks the transport of N-type Calcium channels across the synapses and prevent the release of glutamate and calcitonin from the brain. When correctly administered, it has advantages over opium related drugs in stopping pains. It has no problem of addiction or the need to increase the concentration over time to be effective. However, wrong or inappropriate modes of administration have too many perilous side effects

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including dizziness, confusion, ataxia, abnormal gait, and memory impairment as listed by McGiern [11] and Rauck *et al.*, [12].

Mollusks are very important in ecological studies where they are used for bio-monitoring. They satisfy the conditions to be used as environmental bio-indicator and environmental monitors. Organisms to be used as bio-indicator or bio-monitors according to Oehlmann and Schulte-Oehlmann [12] and Kang *et al.*, [13] should possess the following features: i) must have wide ecological distribution, ii) specimens must be large in size, iii) should be easy to be captured, iv) have poor ability to digest the pollutants, v) should not have ability to change diet



Source: Wikipedia, [41].

Figure 1 The structural formula of Zinocotide, a peptide produced by *Conus magus*

so fast vi) should have limited movement vii) have relatively long-life span, viii) have close contact with the environment for easy exchange of pollutants between organism and environment ix) should be easily identified with no complication in their taxonomy. All these attributes are seen in the gastropods especially.

In a study conducted by Ituen [13], it was reported that shells of mollusks, particularly clams, contain a high concentration of calcium carbonate; approximately twice the calcium content found in the calcium carbonate typically used for agricultural liming. Because of the high content of Calcium, it is recommended for incorporation into animal feeds as well as in liming to reduce acidity in fish ponds and farm lands.

Considering the farmed mollusks, (Genus Archatina), are good as culture-able species because they happen to be low in trophic level among animals in terms of their nutrition. Meaning that their feeds are less costly compared to carnivores. This could lead to low cost benefit ratio in the production of these animals [6;15;]. Zucaro *et al.* [6] even noted that the contribution to global warming in the process of producing mollusks meat is low due to low carbon emission compared to the production of other animal proteins such as beef, pork and poultry.

Some other importance of mollusks to man were enumerated by Ada [16] to include: i) their use in biological control as some have ability to attack specific plants and animals, ii) importance in disease transmission eg flukes, iii) their shells

are use as jewelries as shells of oysters have been used to make chains, pen, buttons and ear rings, iv) shell as cowries have been used as currency in Pacific Islands, v) aquatic transport and fishing vessel could be damaged by wood borers mainly bivalves, vi) shells could be used in carbon dating, vii) used as bait in fishing, ix) used as ink and dyeing materials, xi) important link in food chains and xii) they become cleaning agents when they feed on decomposing materials.

In spite of the ease with which mollusks can be captured and reared, the culture is plagued with several challenges that include: predation, land availability, funds, feed stuff, diseases, poaching, and seasonal variations in weather conditions as well as tradition and technology.

2. Predators

A major and number one hindrance of snail farming is the issue of predators. Of all these predators, it is the soldier ants that are the number one enemy. This belongs to a group of insects called the social insects because they live a social life-style. They are highly organized. Biologically, they belong to the order hymenoptera; Family Formicidae. A situation where concrete walls were erected and the gutter constructed round the snail house and containing condemned engine oil as described by Okon and Ibom [17] and (Ghosh, *et al* [18]; the soldier ant or other ants that attacked the snail were not supposed to cross this barrier. But soldier ants were able to attack the snail. Where did they come from? They emanated from the deep layer of the soil.

See what led to the generation of these ants. Note that in the months of December to April, the period of dry season is on. Once the *hamattan* period set in, the *Achatina* and other land snails produce a disc to cover themselves to prevent desiccation. This is a process of hibernation. Within this period, there is no growth in size or in number of snails. No quantity of water applied to the snail house could prevent the snails from hibernation due to dry air. Any attempt to increase watering to prevent desiccation only lead to generation of ants. The effects could rather enhanced production of endogenous soldier ants that may have also gone deeper into the soil for the same purpose of dryness. The snail has no mechanism of running from ants. Rather, they withdraw into the shells, carrying the ants into the shells with them. The remedy to soldier ant attack is not just the forming of gutter containing engine oil around the house. The house foundation must be placed on a concrete platform. Then the Damp proof course (DPC) of the building must be equal or more than 30 cm above the concrete platform. The base of the building (from where the building is resting on the concrete) must be perforated to allow exit of water. That is, from the concrete to the DPC should be 30 cm at least. Without this, the soil will become water log. Meanwhile, a waterlogged soil is not suitable for optimum living of land snails.

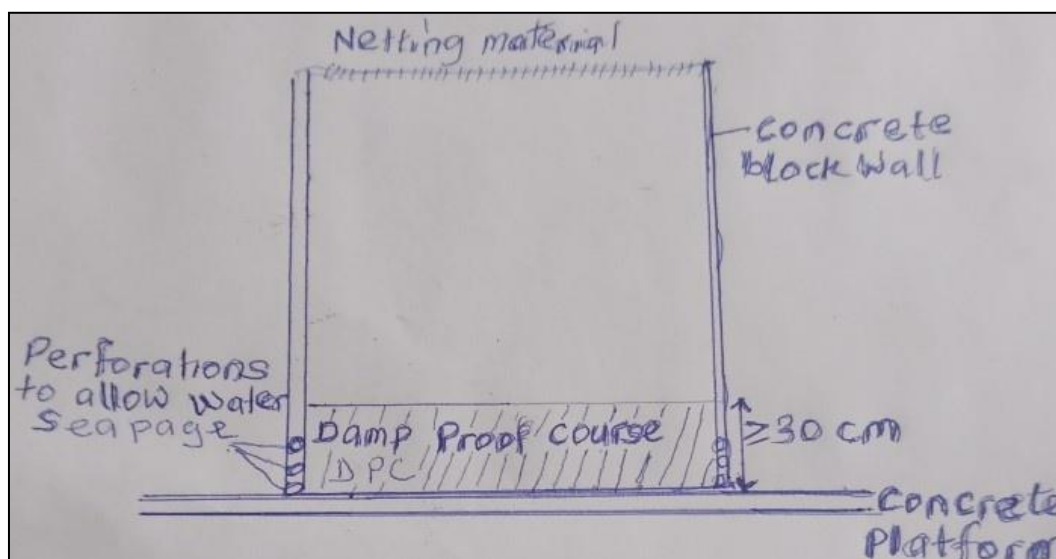
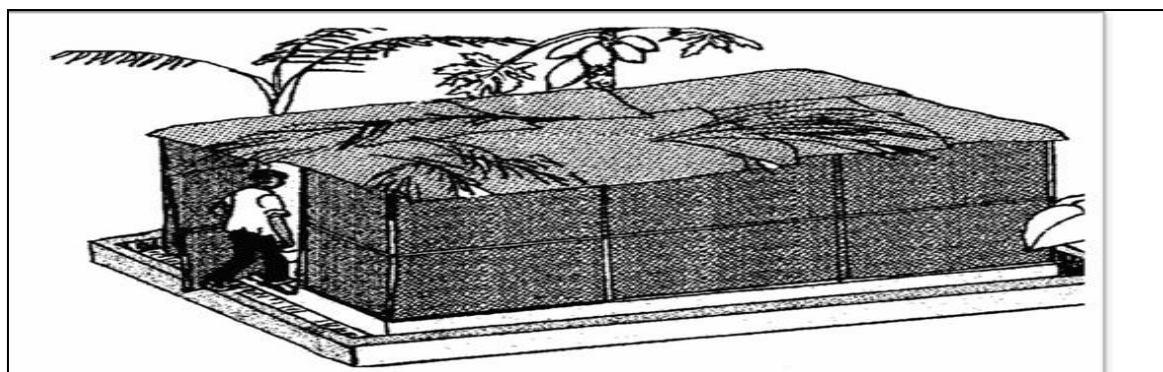


Figure 2. A Transverse section of a snail house showing an optimal design of a snail house



Source: Adopted from Scaglia and Karnwea,[19]

Figure 3 A drawing of a complete snail house

It was previously noted that three species of Gastropods belonging to the family *Helicidae* are commonly farmed in Nigeria. These are *Archachatina marginata*, *Achatina achatina* and *Achatina fulica*. *Archachatina marginata* is capable of growing up to 20 cm and can live for 10 years maximum. It reaches maturity for eggs production at age 8 to 9 months and can produce up to 45 eggs per year. *Achatina achatina* is the next in size to *Archachatina marginata* and is capable of producing 2,000 eggs per year with a juvenile survival rate of 30 to 50 %. The third preferred in terms of size of individual is the *Achatina fulica* also maturing for eggs production at the age of 6 to 7 months; with juvenile survival rate of 30 to 50 %. Eggs production in this species could be as high as 2,000 eggs per year. To evade the problems of land snail farming, it is also possible to choose to farm aquatic species. In aquatic environment, it is not possible for terrestrial arthropods to attack cultured species in aquatic environments.

3. Land availability/accessibility

Land is an important factor of production anywhere in the World. Land in Nigeria is owned by communities. Though individuals could own land by inheritance, leasehold, gifting, purchase or by tenancy. How land owners go about this in Nigeria is documented in the land use act of 1978 [20]. It therefore means that it is not every one who has the will to go into snail farming that has access to land, yet, snail farm cannot be sited in air. Snail farming can be undertaken by both males and females. However, in most rural communities in Nigeria, land is owned by the male gender. It may be the reason why (Adesida *et al.* [20] found a 5% higher participation of males in snail farming compared to females in Nigeria. Though access to land is a challenge for many farmers, Zucaro, *et al.* [6] noted that production of snail meat requires less land than to produce an equivalent amount of animal proteins such as beef, pork and poultry. These workers came to this conclusion when they took into consideration several factors including space for snail housing and space for the production of food for the snails compared to other animals. As simple as it may look, one may be found in a location where he/she cannot practice because he/she does not have access to any portion of land for any agricultural engagement. It is possible to have space and access to a named land; it is not all available spaces that may be suitable for snail farming. Features of lands that could be used for snail farming. These include: loamy soils with neutral to slight alkaline pH, temperature of 25 to 28°C and humidity of 80 per cent and above [17].

4. Funds

Many observers and investigators have pointed that availability of funds is crucial to the startup of and continuous running and even making progress in any agricultural venture. Mbutor, Ochu and Okafor [21] linked the effect of funding to snail production when they said that product output is directly related to the extent of financing. Loan facilities to snail farmers is not attractive due to the short tenure. When loans are given, the sum is usually not enough to obtain expensive amenities for snail farming [22]. Many interested farmers cannot even access the fund because of the challenges of collateral. Expansion of farm is big problem due to dwindling capital. When a farmer manages to produce, there comes the problem of marketing. A loan scheme may be instituted. The approval and disbursement process can become hindrance. There are bottle necks such that government provides the loan to beneficiaries. But agents whose functions are to make sure the loan was not diverted to other directions apart from which the loan was approved become the wrong manipulators. The Nigerian factor set in such that these agents only become interested on what they can get from the loan. Whatever balance get to the beneficiary cannot help to achieve the intended purpose. The Nigerian Agricultural funding system is therefore faulty and not likely going to encourage snail farming in the near future.

5. Feeds

Feral food sources are declining. Habitats for feral food items are disappearing at a time we need more food. The graphs of food need by man and other organisms on one hand, and that of food supply from the feral source on the other, are moving in opposite directions. With the disappearance of the habitats of food items of animals, selective care becomes inevitable. That means the artificial production of feed for any organisms of one's interest. In many organisms of agricultural importance, it is calculated that feeding components make 60 to 70 per cent of production cost [23;24]. In the ruminants, as in mollusks, this may not be the case because their food items are low in trophic pyramid. For the snails, their food can be made of egg shells, including old shells of the snails themselves, pawpaw fruits, leaves, leaves of *Telanium triagularae* (water leaf plant) and kitchen wastes. Problem of feeding will center on the proportions of the combination of the items, the regularity of feeding and rate in order not to contaminate the snail house.

6. Profitability from Achatiniculture

All businesses are established with the sole aim of making profits. In this business, profit making is encouraging due to the minimal financial input required [25]. Baba and Adeleke [26] observed a profit of N1.36 for every one Naira spent in the business of snail farming. These workers still emphasized that the major input in Achatiniculture is labour. It cost a hunter less to obtain the same level of income from hunting than the farmer who spend money and time caring for the snail, or even pay for labour. However, presently, the feral source still permits the primitive style of Agriculture, which was hunting. Most of the snails displayed in our markets for sell today are from the feral source. It is every one's knowledge that such feral supplies are not forever, especially as natural habitats are disappearing. If our younger generation must continue to consume snails in future, then, there is urgent need to promote Achatiniculture (snail farming) with emphasis.

6.1. Diseases

Like other cultured organisms, snails are also vulnerable to attack by disease organisms. As we know, diseases are caused by environmental condition deviations as well as by organisms that seek relationship with other organisms. Among organisms that cause diseases in snails are fungi. The major cause of fungal disease in snail is *Fusarium sp.* The disease this species causes is called pink eggs disease [26]. The affected eggs turn to red to reddish brown. To prevent this disease from occurring, one has to keep the farm clean.

In both culture and natural snail populations, a worm called *Alluauihella flavicornis* lays 20 to 40 eggs inside the shell of the snail. The eggs take up to one week to hatch into larvae that start feeding on the snail tissues. This trophic relationship continues until the snail turns to a putrefied mass. It takes 10 days for the larvae to turn to adult and move out of the snail shell, by the time which the snail is no more

Attacking the snails are also bacteria. Principal among them is *Pseudomonas aeroginosae* that infest the digestive systems of the snails. Symptom is the appearance of leukodromic lesion in the head. It causes the snail to grow too slowly [27].

Inappropriate feeding where some nutrients are lacking can cause deformities and sometimes abnormal shell formation. Where feeds are grossly inadequate, the snails can fall to cannibalism. The larger snails eat up the smaller and younger ones to make for the nutrients they lack.

6.2. Poaching/stealing

Here, we are referring to the illegal harvesting of agricultural produce by non-owners as a form of stealing. It is a major cause of slow or no growth in many agro-businesses in Nigeria. Stealing has forced many small and large scale agro-businesses to shut down in Nigeria. This is even more frustrating where a business owner may have obtained loan to establish the business. A situation where the thief who sits idle becomes the one to reap the products of farming discourages the farmers from establishing a business. This plays well in snailery because of the nature of the animals. They do not make noise when they are being captured. They do not run from the thieves due to their slow nature of movement.

Poaching could be reduced in Heliciculture if the farm is carried out within fenced enclosures like residential houses. However, in rural dwellings, the numbers of compounds that are fenced are basically lacking. In the cities, many occupants of the fenced apartment are there on rental basis and therefore are not allowed to raise structures to house snail farms.

Many communities have somehow legalized stealing from rich members of the society especially from their farms. This is practiced more where the farmer is not a local. In such communities, syndicates are formed, which go about harvesting crops from established farms. There is a notion that if the thieves are not allowed to steal from those large farms, the alternative will be to steal from or burgle houses of individuals of the community. The question I ask always here is, 'were these people born, breed and trained in these communities to steal only'? By encouraging this, we are stunting economic growth of our societies by discouraging establishment of agro-business in general and snail farming in particular.

6.3. Seasonal variation in weather conditions

This is a very important factor to consider if one wants to succeed in farming snails. Snails thrive in warm humid condition. In west Africa, there is annual variation in rain regimes. The period from November to May is characterized by dry season. The remaining part of the year, June to October is wet with more rains. At the onset of the dry period; the snails form a cap and cover themselves to prevent desiccation [29]. Within this period, there is neither feeding nor growth. In an attempt to moisten the snail house by applying water leads to rejuvenation of soldier ants from the deeper layers of the soil (personal observation). That is why a deep concrete layer is recommended in the construction of the house (see Figs 1 and 2). As far as we continue to capture wild snails for culture, there is no promise that this problem can be solved. It may be possible to breed species that may not practice this aestivation if given appropriate weather conditions. We are therefore recommending that stocking materials should be sourced from verified strains.

6.4. Tradition/technology

Products or food items that have no indigenous technology suffer the same fate of low adaptation by local people. For instance, similar observation was earlier made in fish farming [7;24;27;30] that culturing of fish in Nigeria is exogenous. It is only in 1944 that fish farming started in Nigeria [24]. However, today, fish farming has attended accelerated speed of growth [32;33] because of its long-time introduction to Nigeria and Africa as a whole [34]. It is therefore hoped that snail farming is going to be more popular than it is today. There are several pieces of evidence to show that snail farming is not indigenous to Nigeria. For instance, it was [15;36;37;38;39] noted in separate studies that the farming practice is dominated by literate people with higher than secondary school certificates. This group of Nigerians may have copied the practice recently from books and learning institutions. However, snail farming was invoked in Greece since the first century A.D. [40]. Such crops or animals that have no indigenous technology take time to undergo wide spread farming practice. Conversely, in situations where a crop is produced endogenously, as in the example of ground nut, yam and cassava, tiny outputs from several citizens collect to form the bulk to a point that such produce are thought of being exported. Other item like domestic fowl though not being exported, is produced in high quantity because it has an age-long practice in Nigeria

7. Conclusion

There are a lot of uses and other importance of members of the molluscan phylum to man. These benefits, notwithstanding, there are challenges of making these animals at enhanced quantity for man's use. These challenges were enumerated. Since this phylum includes a wide range of members, it behooves on us to look into aquatic specimens including both fresh water and marine water specimens to be included in mollusks farming in Nigeria.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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