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Heliculture - A Future Source of Food

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Abstract

Food is a basic human need, and access to an adequate quantity and quality of food is essential for survival and good health. Food security and nutritive food are vital for individual health, economic development, social stability, and global cooperation. Promoting food security and nutritive food production in a sustainable manner helps protect the environment by encouraging responsible agricultural practices, reducing waste, and conserving natural resources. Heliculture in enhancing food security depends on various factors, including proper farming techniques, market access, and cultural acceptance of snail meat as a food source. Additionally, efforts to promote snail farming should be integrated into broader food security and nutrition programs to have a meaningful impact on improving access to nutritious food for vulnerable populations.

1. Introduction

Worldwide the number of people not having access to sufficient food has reached 795 million, out of which Asia and Pacific share almost 62%. More specifically, India alone is home to the maximum number of undernourished people-194.6 million-who make up nearly 15% of the nation's current population (Anonymous, 2018). Human existence and well-being depend on having access to a sufficient and nutritious food supply, overall growth and wellbeing. Food security is a serious issue in India due to its large and expanding population. It is a significant task to meet the dietary demands of more than 1.3 billion individuals. For economic growth, social cohesion, personal and national security, food security is essential. Due to India's vast population and reliance on agriculture, guaranteeing food security is a difficult problem that necessitates long-term, comprehensive solutions. Currently, it seems more feasible and practical to concentrate on nutritional security rather

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than food security because both the quantity and quality of the nutrients in food matters.

Livestock rearing is often a vital aspect of inclusive agriculture that can further enhance a farmer's income. The animal-based food products could be utilized to combat the mild to moderate protein malnutrition widespread throughout the developing world, including India. But in contrast to meats like beef, chicken, pork, and veal, snail meat has high protein content, low bad cholesterol content requires fewer farming inputs and takes up less space for farming. Hence, the snail meat can be used as a future tool to overcome malnutrition and to meet nutritional requirements of the ever-increasing population (Neumann et al., 2022).

Snail farming, also known as heliculture, is the practice of raising land snails for human consumption, both as food (edible escargot or caviar made from snail eggs), medicine, or cosmetics utilizing snail slime (Figure 1 and 2). The phrase "Snail is frail but does not fail to assail every nail on its trail" describes how vulnerable and slow the snail is, having a wet and delectable tongue, it can safely navigate its way through thorns and thistles (Amusan et al., 1999). The yearly consumption of snails in Europe exceeds 100,000 tons, although present production only fills 60–70% of this demand. Other notable users include France (about 40,000 tons year^{-1}) and Italy (about 6,000 tons year^{-1}) (Ghosh et al., 2016).

2. History

Since ancient times, people have depended on snails as a food source for thousands of years. In the circum-Mediterranean region, archaeological sites from the late Pleistocene to the early to mid-Holocene era include evidence of land snail ingestion, indicating that they were a component of prehistoric diets. Additionally, instruments used to remove the soft parts of land snails from their shells by making purposeful holes in them have been found in North African villages that date back 12,000 years (Schoeninger and Peebles, 1981).

Figure 1: Snail slime

Figure.2 Snail eggs

3. Species of Edible Land and Fresh Water Snails

Different species of edible fresh water and edible land snails are furnished below

Sl. No.	Edible freshwater snails	Edible land snails
1.	Golden apple snail (*Pomacea canaliculata*)	Brown Garden snail (*Helix aspera*)
2.	Banded Pond snail (*Bellamya bengalensis*)	Turkish snail (*Helix lucorum*)
3.	The red-rimmed Melania (*Melania tuberculata*)	Roman snail (*Helix pomatia*)
4.	West African apple snail (*Lanistes varicus*)	Giant African snail (*Achatina marginata*)
5.	Common apple snail (*Pila globosa*)	Giant African snail (*Acatina fulica*)

4. Global Scenario of Snail Farming

In Midnapore district of West Bengal's Lodha tribe's dietary customs include a "secondary food system" consisting of various snail species with common names like "shamuk," "jal geri" and "jhinuk." The French word "escargot," which refers to a dish cooked with snails. It is very well-liked in France and is also well favoured throughout many other European countries. French "escargot" are imported from a number of nations since there is a huge market for them in the United States (Ghosh et al., 2016).

The top importers of snails were France, Portugal, and Bosnia and Herzegovina, while Morocco was the main exporter, followed by Romania and Bulgaria. Regarding the Greek market, snail exports in 2018 was around 280 tons, showing growth for the second year in a row following two years of decline. From an economic standpoint, snail exports increased to 1.5 million $. Exports reached their highest level of 2.3 million $ in

2015, but from 2016 through 2019, they declined. The top three countries that Greece exports snails to are Spain, Italy, and Turkey. The greatest provider of snails to Greece, with an import value of almost 400 tonnes, was Bulgaria. Germany was the third-largest provider, followed by Hungary and Latvia (Anonymous, 2018).

India snails were sold for between US$1.98 and US$1.63 per kilogram (148.58 rupees per kg) in 2022. Nearly 1450 species of snails and slugs have been identified in India, with the north-eastern states of the country (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tamil Nadu, Sikkim, and Tripura) and the Western Ghats having the highest diversity.

5. Nutritive Value of Snails

Snails, regardless of where they come from, provide a comparable amount of protein (varying from 10.8 to 25.6%) to other meat sources including cattle, pork, and chicken (21, 22, and 24%, respectively). Snail meat contains low content of fat (0.6-1.5%, mostly polyunsaturated), high content of proteins rich in important amino acids, such as leucine and lysine (12.9%) and low content of minerals (approximately 2.4 g of Ca, Fe, P, and Cu per 100 g) (Maria et al., 2021). Most edible molluscs have between 10 to 140 g of carotenoids per 100 g of their raw edible component, and some of these carotenoids are converted by the human body to vitamin A (Kantha, 1989).

6. By Products of Heliculture

Sl. No.	By products	Use
1.	Eggs	Water content 85%, protein >40% and very little fat.
2.	Snail dung/ droppings	Organic manure
3.	Snail slime	Cosmetic and pharmaceutical products (Tsoutsos et al., 2009)
4.	Snail shell	Different products buttons, rings, bracelets, pendants, jewelry, and ornaments, fine powder in feed mills, bagged, and sold to the industries that make fish and poultry feed.
5.	Snail protein	Antibacterial and antifungal activities (Selvakumari and Hak, 2018)

7. Snails Breeding (Rearing) Methods

Snails can be maintained in a variety of ways when it comes to breeding techniques. Different cattle breeds require various breeding techniques. In the same way that snails can be bred using various techniques.

7.1. Car tyres

Snail farming is primarily practiced in this way on an experimental basis. Typically, 4 to 5 tires are utilized, stacked on top of one another. The first two tires are stuffed with humus or loamy dirt. The third and fourth tires are then positioned on top. The top is then coated with nylon or wire mesh. The top-weighted fifth tire, which has been reinforced with stones, is used to press the wire mesh down. At least twice a week, the tires must have water drained from them. But snails in tires function poorly during the rainy season and the growth rate may be slowed down since the system appears packed. Perhaps the snails don't feed as well.

7.2. Drums

The plastic or metal drum's bottom and sides are perforated for drainage and aeration. Additionally, the holes are small so that hatchlings cannot easily escape. Loamy dirt is poured into the drum to a depth of 20 to 30 cm and covers the snails with banana, and cocoa leaves. Drum is covered with a mosquito net or nylon mesh to keep the snails from escaping.

7.3. Cages/boxes/ hutch boxes

Cage around 2 m (7 feet) long, 1 m (3 feet) broad and 60 cm high. It is composed of wood and has a lid, door, or cover with a mosquito net and nylon mesh netting. To allow extra water to drain away, the floor is perforated. The cage is said to have high stands or legs that are between 15 and 30 cm long. For a hatchery or nursery for fresh hatchlings, cages or boxes work well.

7.4. Trench

Trench pens are adjacent snail pens that range in size from 0.6 m x 0.6 m to 1 m x 1 m. They can be raised 40–50 cm from the ground or excavated into the earth and depth of 10 to 15 cm, the pens are filled with suitable soil and snail a place to hide, spread out some chopped, semi-dry banana leaves inside the pens. It is appropriate for semi-intensive to intense snail farming operations.

7.5. Mini paddock

Mini-paddock pens are constructed with bamboo, nylon mesh, or wood, chicken wire, and nylon mesh with 20

cm underground and 50 cm high. To keep snails from escaping, wooden frames coated in mesh are fastened to the tops of the walls (stretched inward). Prior to the release of the snails, plants that provide shelter and/or food are planted in the pens. With rectangular pens, the farmer has easier access to the entire space without having to enter the pens themselves. Additionally, mini-paddock pens can be built above ground, with an entirely enclosed structure, and even with a roof.

7.6. Free-range pens

Free-range pens are essentially big mini-paddock pens: a fenced area up to 10 to 20 m filled with vegetation that offers food and protection from the wind, sun, and rain. To keep snails from escaping, the vertical fence must be pushed inside, just like in a little paddock pen. The fence needs to be buried at least 20 cm into ground. There's even a chance that the free-range pen will be entirely fenced and covered.

7.7. Curtain method of snail farming

The curtain breeding system, which touchstone employs in all of its units for producing snails, has many benefits, many of which can be attributed to improved cleanliness and breeding management. The snail's surroundings are always kept clean by the curtain system, which allows the snails' waste to fall to the ground immediately. Additionally, there is consistently good ventilation, preventing the spread of disease. The curtain method makes it simpler to identify the dead snails, which need to be removed every day (Cobbinah et al., 2008 and Tebson, 2020).

8. Recommended Food Items

Leaves: cassava, okra, eggplant, loofa, cocoyam, kola, paw paw, centrosema, cabbage and lettuce. *Fruits*: eggplant, pear, oil palm, paw paw, mango, banana, fig, tomato and cucumber. *Tubers*: yam, sweet potato, cocoyam, cassava and plantain. *Flowers*: oprono (*Mansonia altissima*), odwuma (*Musanga cecropoides*) and paw paw. *Household waste*: peels of fruit and tuber, like banana, plantain, pineapple, yam and especially paw paw, and leftovers like cooked rice, beans, fufu and eko. *Caution*: household waste should not contain salt. *Supplementary vitamins*: It is recommended to include additional dietary plants that are known to have small concentrations of vitamins D, E, and K. Some examples include sunflower and copra cake (vitamin D), wheat germ, lettuce, and other vegetables (vitamin E), and cabbage and African spinach (vitamin K). *Supplementary calcium*: Supplemental calcium will be required if the soil is low in calcium; this can be given by sprinkling ground limestone, powdered oyster or snail shells on green vegetables. *Supplementary minerals*: Other minerals can be provided by placing licking stones containing the minerals in the pen. *Water*: The snails should always have access to clean water.

9. Conclusion

Snail farming holds significant promise as a sustainable source of meat protein, having the potential to transform the livelihoods of forest dependent populations. Due to the comparatively low labour and capital costs and high returns on both food production and money generation, the establishment of snail farms is therefore essential for reducing this danger. Snail farming possesses the potential to increase employment opportunities in low-income nations and also contribute to the future supply of meat.

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