

Habitat and Life Cycle of Golden Apple Snail (*Pomacea canaliculata*): A Review

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ABSTRACT

In the 1980s, the golden snail was brought from its native South America to Taiwan for both commercial and human dietary uses. The Amazon River and the surrounding areas in Argentina are where this golden snail is native, but Asia is where it was first introduced. The golden snail prefers areas with slow water flow, clear water with lots of aquatic plants, poor drainage, and delayed drying times. Calcium and water are the two most crucial chemical components for the survival of all mollusks, including this particular species of snail. These animals experience a high death rate at temperatures exceeding 32 °C. Due to the fact that temperature has a significant impact on golden snails' growth, temperature has a fatal impact on the majority of components of their biology. The maturation stage of the golden snail relies on its dimension and minimal growing time. The golden snail is dioecious, or having separate male and female sexes. The sexual development of the golden snail is attained between the ages of 3 months and 2 years, depending on the local climate. The golden snail can live up to 4 years.

Keyword: anatomy, apple snail, mollusca, taxonomy, characteristic

1. INTRODUCTION

Pomacea canaliculata is known as the golden apple snail in English and in Indonesia it is known as "keong mas" or golden snail. This snail belongs to a type of freshwater snail that has a high appetite for aquatic plants such as lotus and rice. The golden snail was introduced from its native South America to Taiwan in the 1980s as a source of food for humans and also for commercial purposes. After that, this snail spread widely in the Asian region as an additional food source of protein and also helps in increasing income for people below the poverty line. In its development, these animals became major pests for various crops in Southeast Asia (especially rice) and Hawaii. This type of snail is also a serious threat to wetlands around the world, which contributes to potential habitat modification and competition with local snail species [1],[2].

The golden snail actually has a uniqueness that can be used as a guide in studying rainfall. If the golden snail lays its eggs rather low in the water, then the rainfall will be low, but if the golden snail lays its eggs rather high, for example 40 cm above the surface of the rice fields or waters, it means that the rainfall will be very high. This is done as a step to anticipate the golden snail for the condition of the eggs so they are not submerged in water. Continuous rain will cause the golden snail to take a long time to lay eggs. Another control system implemented by farmers in Simbang, for example, is to pay attention to cropping patterns. Farmers there consider that paddy should be planted when the rice fields are muddy or the water discharge is not high. This is because the golden snail that is still small will not be strong enough to survive in such conditions [3].

2. HABITAT

The area of origin of this golden snail is from around Argentina and the Amazon River while its introduction area is mostly in Asia including the Philippines, Japan, Taiwan, Vietnam, Cambodia, Thailand, Laos,

Korea, Sri Lanka, Indonesia, Malaysia, South China, Singapore besides that also found in Hawaii, Guam, Papua New Guinea, the Dominican Republic and America [1].

The golden snail lives in clear waters, ranging from shallow waters up to 3 meters deep, with a mud substrate with abundant aquatic plants. The golden snail likes places where the water flow is slow, the drainage is not good, and it doesn't dry quickly. The most important chemical elements for the life of molluscs including this type of snail in general are calcium and water. This is because these elements are the ingredients in the formation of shells, and therefore the golden snail likes waters with high carbonate levels and are always alkaline. The golden snail can survive up to 6 months in dry soil. These animals can live in water that has a pH of 5-8, and a temperature tolerance between 14-25°C [4],[5] and 18-28°C [6].

Golden snails at higher temperatures will eat, move and grow faster. At lower temperatures, the golden snail sinks into the mud and becomes inactive. At temperatures above 32°C these animals have a high mortality rate. Temperature has a lethal effect on most aspects of the biology of golden snails because their growth is highly dependent on temperature [4],[6].

3. REPRODUCTION

Unlike other types of snails in general, which are hermaphroditic (can be male and female at the same time), the golden snail has separate male and female sexes (dioecious). The opening (aperture) in male snails is more rounded than female snails due to the large penial complex. The male golden snail has a genital organ in the form of a penis that resembles an elongated antenna and is partially surrounded by a pouch that grows from the right end of the mantle [7].

The golden snail is a gonochoristic snail, but the possibility of changing sex has been discussed where this proves that the golden snail is also a protandric hermaphrodite. Although this has never happened in natural and laboratory populations of golden snails. Golden snails tend to show secondary sexual dimorphism in shell size, shape and weight [4].

Copulation and spawning of the golden snail are an activity that takes quite a long time. Sexual intercourse with the golden snail lasts up to 10-20 hours and storage of eggs lasts up to 5 hours. Collections of golden snail eggs are bright pink and kept well above the water line. Egg storage is usually done at night probably because of the lower risk of predation and drying of eggs at night. Known fecundity in laboratory golden snails ranged from 1326 to 10,869 eggs per female snail spread over 8 to 57 egg batches. Female snails can store sperm for up to 140 days and release 3000 eggs during this period [4].

The golden snail is known to have sexual intercourse based on size. Male snails prefer females that are larger in size as partners but female snails do not show any size selection. The size of the female snail is related to fecundity and also the size of the eggs, as a result choosing a large female snail will increase the number and quality of offspring obtained from each relationship. Sperm transferred after one insemination will be used by the female snail to lay eggs several times [4]. Golden snail mating can be done throughout the season. A golden snail is capable of producing around 1,000-1,200 eggs per month or 200-300 eggs per week. The most damaging stage is when the golden snail measures 10 mm (approximately the size of a corn kernel) to 40 mm (approximately the size of a ping pong ball) [6].

The maturity level of the golden snail depends on its size and minimum growth time. Under uniform temperature conditions, the long growth of the golden snail takes place continuously and constantly until it matures and then decreases thereafter. The golden snail reproduces continuously in the tropics, in contrast to the golden snail in temperate climates which generally stop growing temporarily during the winter. The intensity of golden snail reproduction is associated with an increase in temperature, but the absolute temperature threshold is unknown [4].

[8] stated that *P. canaliculata* living in temperate climates is iteroparous (has more than one reproductive period throughout its life) and those living in more tropical conditions are semelparous (has only one reproductive period). At a high constant temperature, the growth rate of the golden snail will increase, the age at maturity and peak age will be lower and reproduction will take place continuously. All events in the life cycle of the golden snail have a tendency to take place at a shorter survival time at a constant high temperature. In addition to temperature, the unavailability of water in an area will also inhibit the spread of golden snails [4].

4. GOLDEN APPLE SNAIL'S EGG

Golden snail eggs are pink in color and clustered like mulberries. In one cluster there are tens and sometimes even hundreds of eggs. The shell contains a lot of calcium needed for growth and prevention of osteoporosis. In addition, high protein is needed by the body as a builder substance. In the midst of the high cost of

various basic needs including chicken eggs and the spread of fears of bird flu infection in poultry eggs, golden snail eggs can be used as an alternative to meet the family's animal protein needs [9].

The female snail will deposit a collection of bright pink eggs attached to a solid surface (stones, walls, logs, plants emerging from the surface of the water, garbage) to a height of 50 cm above the water surface. The eggs usually hatch in 7-15 days, but it can take longer depending on the ambient temperature. Reproductive output in a clutch of eggs can be enormous. A clutch of eggs may produce 1000 eggs but generally has an average of 200-300 eggs. Golden snail eggs are released every few weeks [1].



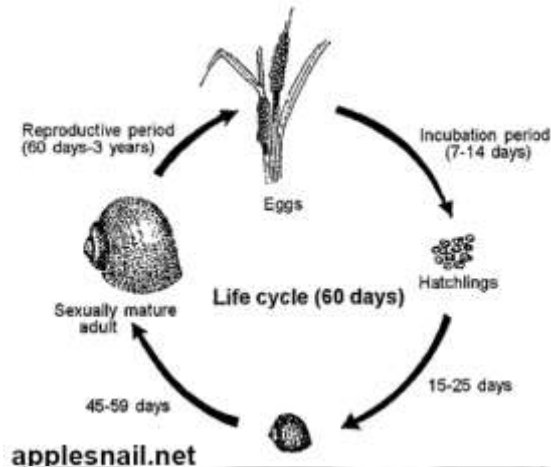
Figure 7. Golden snail eggs
Source: [10]

5. LIFE CYCLE

The golden snail can reach the age of 4 years where the reproductive maturity of the golden snail is reached at the age of 3 months to 2 years depending on the environmental temperature in the area [1]. At the beginning of its life cycle, the golden snail parent lays its eggs on plants, banks and other items such as twigs and water at night. The eggs hatch after 7-14 days. Young golden snails that have just hatched from an egg measuring 1.7-2.2 mm immediately leave the egg shell and enter the water. Two days later, the snail shell became hard.

Young golden snails measuring 2-5 mm have eaten algae and soft plant parts. Initial growth lasts 15-25 days. At the age of 26-59 days, the golden snail is very greedy to consume food, whereas after 60 days, the golden snail is ready to breed. The golden snail needs about 3-4 hours when holding a marriage in an area that always gets water throughout the year. Adult golden snails have a shell that is about 4 centimeters in diameter and weighs 10-20 grams. Shell growth is influenced by the availability of calcium as a shell forming material. In addition, an environment rich in nutrients will form a larger, thicker and stronger shell. The golden snail can live between 2 and 6 years with high fertility. The most damaging stage is when the cochlea reaches a size of 10 mm (approximately the size of a corn kernel) to 40 mm (approximately the size of a ping pong ball) [9].

Female snails grow larger than male snails and, in some cases, also have a higher growth rate. The difference in biomass indicates that female snails are heavier than male snails of the same size. In a laboratory experiment, both sexes would reach the same size at the start of reproductive activity, but male snail growth stopped after that and the female snail continued to grow throughout her life. Male snails show a high survival rate compared to female snails. This shows that the large size of female snails in natural populations is not due to a better survival rate, but only because of the faster growth rate of female snails [4].

Figure 8. The golden snail life cycle¹

6. CONCLUSION

The golden apple snail, or *Pomacea canaliculata*, is a species of freshwater snail with a voracious appetite for aquatic vegetation. The golden snail inhabits crystal-clear waters that can be up to three meters deep and have a mud substrate rich in aquatic vegetation. Higher temperatures cause golden snails to feed, move, and develop more quickly. The golden snail becomes dormant and burrows into the mud at cooler temperatures. The golden snail is a gonochoristic snail, but because of discussions over the possibility of changing sex, it has also been shown to be a protandric hermaphrodite. The pink eggs of the golden snail are grouped together like mulberries. There are tens, and occasionally even hundreds, of eggs in a cluster. The parent of the golden snail deposits its eggs at the onset of its life cycle at night on plants, banks, and other objects like twigs and water. Within 7–14 days, the eggs will hatch. Golden snail eggs range in size from 1.7 to 2.2 mm, and when an egg hatches, the young snails instantly abandon the egg shell and dive into the water. The shell of the snail hardened two days later.

7. REFERENCES

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