The phylum, **Mollusca** is the second most diverse phylum after **Arthropoda** with over *110,000* described species. The member of this phylum is called **Mollusks**.

The Phylum Mollusca consist of 8 classes:

1. Monoplacophora discovered in 1977
2. Aplacophora or solenogasters of the deep sea
3. Caudofoveata (worm-like)
4. Polyplacophora, or chitons
5. Pelecypoda or bivalves
6. Gastropoda or snails; Digestive tract inside the foot
7. Scaphopoda, or tusk shells; shovel like foot
8. Cephalopoda that include among others squid and the octopus.

Only the Gastropoda is important in veterinary and medical science, since they act as intermediate host of parasites.

Malacology derives from Greek *malakos* means soft, first used by Aristotle; and *logia* means study. Malacology is the branch of invertebrate zoology that deals with the study of the Mollusca (mollusks or molluscs). It is the second-largest phylum of animals in terms of described species after the arthropods.

Mollusks include snails and slugs, clams, octopus and squid, and numerous other kinds which have shells. One division of malacology is **Conchology** which is devoted to the study of mollusk shells.

- Field malacology research includes taxonomy, ecology and evolution.
- Applied malacology studies medical, veterinary, and agricultural applications, for example mollusks as vectors of disease, as in schistosomiasis.

Molluscs: They are the animals that belong to the phylum Mollusca (chitons, snails, clams, octopods, squid).

Terminology related to malacology

Head-Foot: It is the part of the molluscan body that contains the its head and a muscular foot.

Visceral Mass: It is the part of the molluscan body that contains all of the organs, with the exception of the animal's head and foot.

Conchiolin: A protein that makes up the periostracum.

Prismatic Layer: The middle layer of the molluscan shell and is composed of $CaCO_3$ and protein.

Anal pore: Opening in the mantle to allow waste elimination.

Aperture: The opening of a snail shell from which the snails soft body emerges, sometimes called the mouth.

Apex: The top end of a shell columella, opposite the umbilicus and furthest from the aperture.

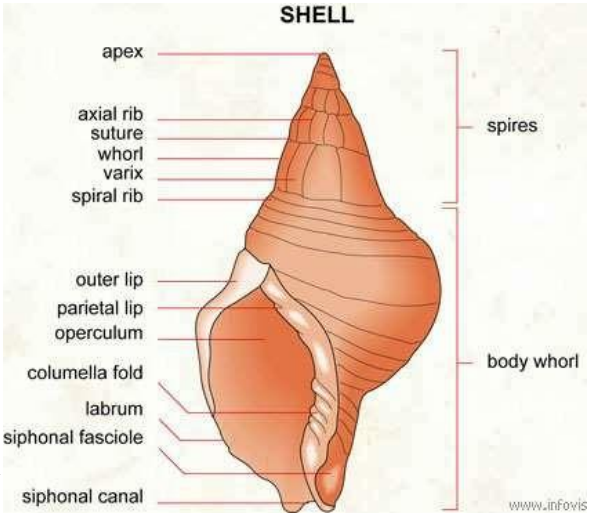
Axial: A direction parallel to a shell's columella.

Callus: A thickening in the shell wall.

Columella: The central, structural axis of revolution a snail shell. At the top of the columella is the shell's apex and at the bottom, the shell's umbilicus.

Denticle: A solid calcium carbonate deposit integral to a land snail shell, usually at the aperture or within the shell.

Whorl: Each one the complete rotations of the shell spiral/ each 360 revolution of a snail's shell, measured from the apex.



Body whorl: The largest whorl in which the main part of the visceral mass of the mollusk is found.

Sinistral: A direction meaning whorled to the left. A sinistral shell's aperture appears on the left to the observer when the shell is positioned with apex up and umbilicus down.

Dextral: A direction meaning whorled to the right. A dextral shell's aperture appears on the right to an observer when shell is positioned with apex up and umbilicus down and aperture toward the observer.

Torsion: Rotation of visceral mass, mantle and shell 180^{o} with respect to head and foot. It occurs in all Gastropods during development. The results of torsion bring mantle cavity and anus to the anterior position.

Factors

- Contraction of larval retractor muscles.
- Differential growth of the visceral mass.

Detorsion: Reversion of torsion is known as Detorsion. It is characteristic of Euthyneura.

- Incomplete detorsion - Opisthobranchia and Pulmonata
- Complete detorsion -typical Opisthobranchia

Genital pore: The opening to a land snail's reproductive organs, usually located on the right side of the head behind the right eye tentacle.

Impressed: A shell groove.

Iteroparous: Life history in which adult snails have more than one reproductive cycle.

Semelparous: Life history in which adult snails mate once and then die.

Mantle: The membrane like organ that builds the shell in shelled snails, found around the aperture. The mantle is also present in slugs, where it serves as a dorsal covering.

Mantle Cavity: The space between the mantle and the mollusc's body.

Odontophore: Cartilage structure in the mouth over which the radula is drawn to rasp food.

Operculum: A hardened cover that closes the aperture of a shell, or the trapdoor of the shell.

Pneumostome: An opening in the mantle to allow air passage.

Peristome: The part of the shell that is right around the aperture.

Periostracum: A thin layer of organic skin which forms the outer layer of the shell of many species.

Radula: A chitinous organ in the mouth of a snail, covered with series of tiny teeth that function to rasp food.

Spiral: A direction parallel to a shell's direction of whorl growth.

Spire: The part of a shell above the body whorl.

Sculpture: Ornamentation on the outer surface of a shell.

Suture: The junction between whorl of most gastropods.

Tentacle: One of two to four elongate, retractable sensory appendages at the snail's head; they are devoted to chemoreception and most have eyespots as well.

Umbilicus: The depression at the base of a snail shell, leading into the interior space of the columella. The space may be open; perforate, very tiny or closed, covered by shell material.

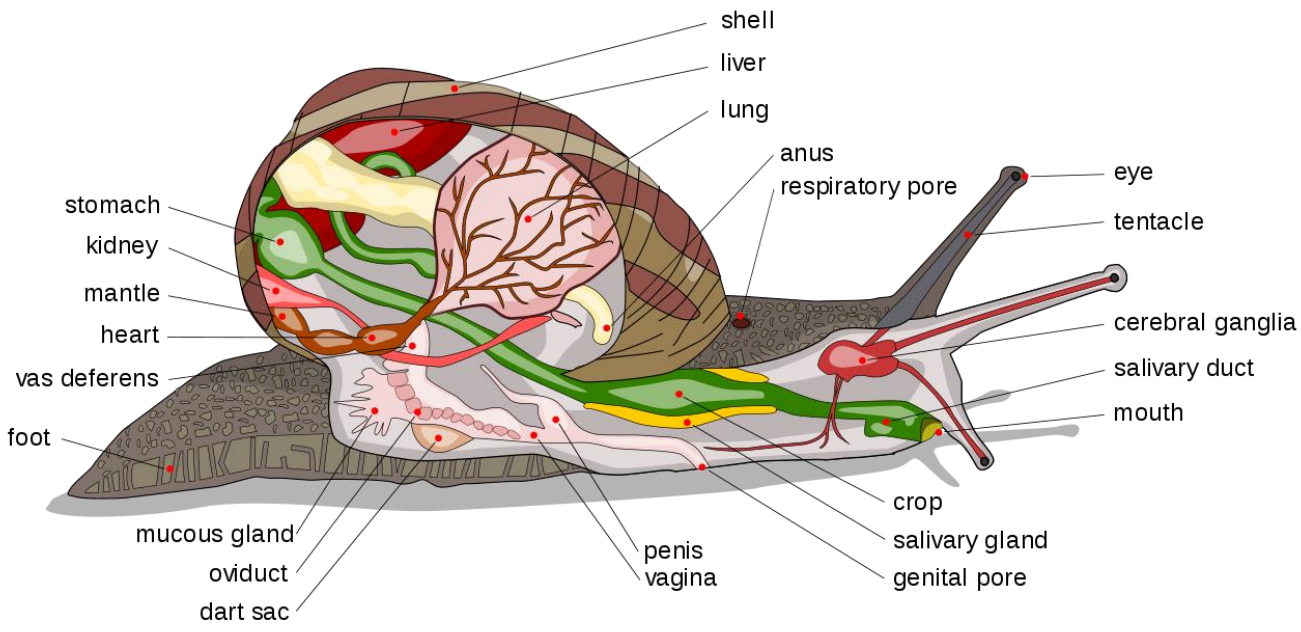


Fig: Different parts of a snail

General Anatomy of Gastropoda snail

Gastropods are characterized by the possession of a single (often coiled) shell, although this is lost in some slug groups, and a body that has undergone torsion so that the mantle cavity faces forwards.

Major structures are **shell** and **internal organs**. Shell is composed of **conchiolin infiltrated with calcium carbonate**. Shell has protective layer 'epidermis' or 'periostracum' composed of horny substances. Much of the surface markings are present on the periostracum. This is secreted by mantle edges and inner calcareous is secreted by dorsal surface of the mantle layer.

Internal organ consists of a **head-foot**, **mantle region** and **visceral mass**. The head and foot are united to form a head-foot region which bears eyes and a pair of tentacles (cephalic tentacles) and a muscular foot used for "creeping" in most species while in some it is modified for swimming or burrowing. The foot typically bears an operculum that seals the shell opening (aperture) when the head-foot is retracted into the shell. While this structure is present in all gastropod veliger larvae, it is absent in the embryos of some direct developing taxa and in the juveniles and adults of many heterobranchs.

The digestive system begins through a mouth which opens at the anterior of the head. The mouth leads to a buccal cavity into which salivary glands opens. In order to break down their food, most snails have thousands of microscopic tooth-like structures located on a ribbon-like tongue called a **radula**. The radula works like a file, ripping the food into small pieces for the hungry snail. The buccal cavity leads to the tubular oesophagus followed by a thin walled enlarged stomach and an intestine opening through anus into the mantle cavity. An accessory digestive gland 'liver' is situated in the mid gut and is connected with the stomach. This organ secrets enzymes, and acts as an organ of absorption, phagocytosis, nutrient storage and excretion.

Gastropods breath through lungs or gills which are filamentous or tuftlike. The nervous and circulatory systems are well developed with the concentration of nerve ganglia being a common evolutionary theme. Reproductive system is variable, **prosobranches are dioicous** whereas the **pulmonates are monocious**. The male and female genital tract open through common opening, in some may open separately.

The shell is typically coiled, usually dextrally, the axis of coiling being around a central columella to which a large retractor muscle is attached. The opening of the shell (aperture), into which the animal can typically retract, is often sealed with a horny (sometimes calcareous) operculum. The uppermost part of the shell is formed from the larval shell (the protoconch). The shell is partly or entirely lost in the juveniles or adults of some groups - with total loss occurring in several groups of land slugs and sea slugs (nudibranchs).

Externally, gastropods appear to be bilaterally symmetrical. However, they are one of the most successful clades of asymmetric organisms known. The ancestral state of this group is clearly bilateral symmetry (e.g., chitons, cephalopods, bivalves), but gastropod molluscs twist their organ systems into figure-eights, differentially develop or lose organs on either side of their midline, and generate shells that coil to the right or left. The best documented source of gastropod asymmetry is the developmental process known as torsion.

Habitat and biology of snail

The snail is a small to medium sized mollusk that is generally split into three groups on the basis of ecology which are land snails, sea snails and freshwater snails. On the basis of respiration, gastropoda are of two types:

1. **Pectinate** who have a **filamentous gill** and
2. **Pulmonate** who have lost their gills, and developed a **vascularised lung** from the mantle cavity.

But the classification depends on the shell, internal anatomy and physiology and biochemical characteristics as described below:

1. The size, shape, external and internal structure, sculpturing and coloration.
2. The form and number of teeth.
3. The reproductive organ: eg. Vergo, broad pouch, size and shape of egg mass
4. The physiology/biochemistry and ecology of the snail.

There are nearly 1,000 different species of snail that are spread throughout the world's continents. The snail is found on every continent on Earth with the possible exception of Antarctica, although it is thought that there are a number of marine snail species inhabiting the chilly waters that surround the South Pole. In the land, snails inhabit places ranging from sunny urban gardens to remote mountainous regions with cold climates. So, the snails can thrive successfully in many habitats with different temperatures and conditions.

Snails are distinctive animals due to the fact that they have a hard, coiled outer shell when they reach adulthood. All true snails are known to have large protective shells that they are able to retract their bodies into for protection. Snails that do not have a shell are not snails, but slugs.

Snails are generally herbivores, primarily eating vegetation such as leaves, stems and flowers. Some larger snail species however, are known to be more predatory animals either being omnivores or, in some cases, full-on carnivores. Due to their relatively small size, and slow-paced movement, snails are preyed upon by numerous animal species all around the world. Rodents, birds and amphibians such as frogs and toads are some of the snail's main predators, and also fish for those snails that are inhabiting marine environments.

Despite being hermaphrodites (meaning that they possess both male and female reproductive organs), snails have to mate with another snail in order to fertilise their eggs. Up to a month after mating, the snails lay small white eggs into a burrow in the ground or on a covered leaf, which hatch after a couple of weeks. Baby snails can take up to two years to reach full adulthood. Today, snails are thriving in some areas of the world but are suffering in others. This can be for a number of reasons which include pollution, habitat loss or changes to the native food chain.

Ecology of Snails:

Snails serve an important role in the ecosystem. They eat very low on the food web, as most land snails will consume rotting vegetation like moist leaf litter, and also fungi and sometimes eat soil directly. So, their ecology depends on the following factor:

1. Snail habitat:
    a. Snail differs in their choice of habitat. e.g.:
        i. Pulmonate snails require low water current, minimal pollution, aquatic vegetation and low salinity.
        ii. Pectinate snails prefer shaded or moist ground, edges of streams in low, flat alluvial plains suitable for low land farming and a fluctuating water level.
2. pH and Temperature of water:
    a. Plays an important role in the activity of snails.
    b. Survive under the water for several weeks and prefer to live on the edges of water.
    c. Don't move in a definite direction and don't always leave the water.
    d. Some creeping along the edges of water and others in and out of the water.
3. Soil:
    a. Burrow in the mud to protect themselves against desiccation and associated with hibernation.
    b. Hibernation occurs when---
        i. Lack of water sources.
        ii. Fall of temp below 23˚C.
        iii. Nutrient is not available.
4. Growth:
    a. Growth rate in snails is greatly influenced by the supply and availability of food as influences size and time of maturity.
    b. Attain maturity within 2-12 months.
    c. Die within a few weeks of cercarial release; some may survive up to 2 years.
5. Physiology:
    a. Oxygen is required for normal functioning of all snails, their activity regarding reproduction and shedding of cercariae is influenced by oxygen tension, temperature and light.
    b. Anaerobic conditions reduce shedding cercariae.
    c. Snail produce 30 to 200000 eggs in her life time and these hatch within 3 weeks to 3 months.

Biological classification of snail

Kingdom: Animalia**; Phylum:** Mollusca**; Class:** Gastropoda**; Subclass:** Pulmonata

Order	**Superfamily**	**Family**	**Genus**	**Species**
Basommatophora	Lymnaeoidae	Lymnaeidae (Fresh water snail)	*Lymnaea*	*Lymnaea auricularia*
				Lymnaea luteola
				Lymnaea stagnalis
				Lymnaea truncatula
			Fossaria	*Fossaria parva/ F. truncatula*
Basommatophora	Planorboidea	Planorbidae	*Planorbis*	*Planorbis planorbis*
			Indoplanorbis	*Indoplanorbis exustus*
			Bulinus	*Bulinus globosus*
			Segmentina	*Segmentina nitida*
			Hippeutis	*Hippeutis complanatus*
			Helisoma	*Helisoma trivolvis*
		Physidae	*Physa*	*Physa* sp.
Architaenioglossa	Ampullarioidea	Pilidae	*Pila*	*Pila virens*
		Ampullariidae	*Ampullaria*	*Ampullaria globosa*
Metagastropoda	Viviparoidea	Viviparidae	*Viviparus*	*Viviparus viviparous*
			Bellamya	*Hetisoma dissimilis*
Sorbeoconcha	Cerithioidea	Thiaridae	*Thiaria*	*Thiaria plicaria*
			Brotia	*Brotia costula*
			Melanoides	*Melanoides tuberculate*
Neotaenioglossa	Rissooidea	Amnicolidae	*Amnicola*	*Amnicola dalli*
		Bithyniidae	*Bithynia*	*Bithynia tentaculata*
		Potamidae	*Pirnella*	*Pinella* spp.

Important snails act as intermediate host for Parasites:

Snail species	Parasites
Planorbis planorbis	*Paramphistomum cervi, P. microbothrium, Echinostoma* spp.
Planorbis corneus	*Bilharziella polonica, Prosthogonimus ovatus, Syngamus*
Indoplanorbis exustus	*Schistosoma indicum, S. spindale, S. nasalis, Paramphistomum* spp. *Cotylophoron cotylophorum*
Gyraulus parvus	*Gigantobilharzia* sp., *Haematoloechus* spp.
Bulinus spp.	*P. microbothrium, Schistosoma* spp., *Cotylophoron cotylophorum, P. cervi*
Hippeutis spp., *Segmentina* spp.	*Fasciolopsis buski*
Thiaria sp., *Melanoides* spp.	*Paragonimus westermanii, Clonorchis sinensis*
Viviparous spp.	*Opisthorchis* sp., *Echinochasmus elongatus*
Lymnaea auricularia, L. luteola, L. truncatula. L. stagnalis	*Fasciola gigantica, Fasciola hepatica, F. magna, F. buski Schistosoma incognitum, S. nasalis Echinostoma* sp.,
Fossaria spp.	*Fascioloides magna, Echinostoma* spp.
Physa spp.	*Echinostomum* spp., *Notocotylus* spp., *Trichobilharzia* sp.
Amnicola spp.	*Prosthogonimus ovatus*
Bithynia spp.	*Opisthorchis tenuicollis, O. felineus, Prosthogonims ovatus, Syngamus trachea, Echinostoma revulotum*

Snail Host of Trematodes of veterinary and medical Important are recorded given below:

Parasite	Intermediate host/ snails	Location
Fasciola gigantica	*Lymnaea auricularia var rufescens*	Bile duct of ruminant
Fasciolopsis buski	*Planorbis, Hippeutis*	Small intestine (man, pig)
Dicrocoelium dentricum	1st *Zebrina detrila* 2nd *Formica regina* (Ant)	Bile duct
Platynosum fastomum (Lizard poisoning fluke)	*Bulina* sp. (land snail)	Gall bladder/ Bile duct
Cotylophoron cotylophorum	*Bulinus* spp.	Rumen, reticulum
Paramphistomum cervi	*Planorbis planorbis, Indoplanorbis exuastus*	Rumen, reticulum, Immature in duodenum
Schistosoma mansoni, *S. haematobium,* *S. japonicum*	*Planorbis planorbis* *Indoplanorbis exutus* *Lymnaea auricularia*	Blood vessel
S. suis, S. nasalis	*Lymnaea luteola/ L. accuminata*	Blood vessel
Opisthorchis sinensis *O. tenuicolis /* *Clonorchis tenuicolis* *C. sinensis*	1st snail *Bithynia* spp. 2nd fish *Hydrobidae* spp.	Bile duct
Prosthogonimus ovatus	*Bithynia leachi/ Aminocola* sp.	Oviduct
Paragonimus westermani (Lung fluke)	*Thiaria* spp. *Melanoides tuberculata*	Lung
Echinostoma sp.	*Physa* spp./ *L. acuminata*	Small intestine
Heterophyses heterophyses	*Pirnella* spp.	

Economic importance and different aspects of Mollusk

Positive impact

Mollusks and humans have a close and mostly productive relationship, at least from the human perspective.

- Species within each of the major classes, Gastropoda, Bivalvia, and Cephalopoda, are major sources of human food.
- Mollusks can also be used as indicators of environmental health (Bio-indicator). Species of bivalves are often used as gauges to detect pollution levels in aquatic environments. As they filter feed, they accumulate any toxins or heavy metals that are present in high concentrations in the water.
- Culturally, mollusks have played an important role in the jewelry and art worlds. When a sharp piece of sediment or debris becomes stuck inside of an oyster, the mantle secretes the same material it normally uses to generate inner layers of the shell in order to smooth over the rough edges of the sediment and prevent it from tearing up the inner tissues of the animal. In this way, oysters produce highly valued pearls.
- Pearl is used as medicine. Seed pearls are used in the preparation of ayurvedic medicine called **Mukta Bashma**. Molluscs are also used in the preparation of Ayurvedic and homeopathic medicines in the form of extracts of oyster shell, cowry shell and operculum of Pugilina. A new antibiotic has been isolated from the eggs of ***Nassarius* sp.**
- Skin creams derived from ***Helix aspersa*** snails are sold for use on wrinkles, scars, dry skin, and acne. A research study suggested that secretions produced under stress by *Helix aspersa* might facilitate regeneration of wounded tissue.
- Mollusks have also made significant contributions to our understanding of the process of evolution. The rich mollusk fossil record, preserved so well due to their hard shells, has made them an important focus of paleontology research.
- The hard shell is an excellent source of calcium which is used in animal and poultry feed industry.
- Certain varieties of snails, notably the family Muricidae, produce a secretion that is a color-fast natural dye. The ancient Tyrian purple was made in this way as were other purple and blue dyes.

Negative impact

Despite the numerous positive roles played by mollusks in human society, they have also had some negative impacts.

- Certain species of terrestrial slugs are harmful to agricultural crops.
- Mollusks are also intermediate hosts for many parasitic flatworm species. As part of the complex life cycle of these parasites, an intermediate host is required for several stages of their development.
- Most mollusks pose no threat to humans as predators, but a few octopi have poison that could kill someone if they bit them.
- Some people are highly allergic to shellfish, and, in this way, mollusks can also be deadly to humans.

Control of snail borne parasitic infection

A. **Managemental method:** The important managemental methods of controlling of snail are:
    a. To prevent snail habitats by regular clearing of drainage/channels as vegetation provides suitable sites for snail development.
    b. To keep livestock away from pastures contaminated with metacercariae. This may only be possible when number of animals involved is small.
    c. Establish proper watering facilities to prevent animals from drinking from lakes, ponds and streams.
    d. Animals should be grazed in high land.
B. **Biological method**:
    a. Snails and slugs favor seedlings on plants with succulent foliage, planting molluscicidal trees and shrubs along streams and irrigation channels can reduce the number of snails in a population. *eg.* Phytolaccaceae, Phytolacca, Euphorbiaceae, Solanaceae,
    b. The introduction of large numbers of ducks into rice fields after harvest has been used to reduce the snail population.
    c. Natural Enemies: Snails and slugs have many natural enemies including ground beetles, pathogen, snakes, toads, turtles and birds.
C. **Chemical method**: The use of molluscicides for the control of snail I/H is a potential tool for control of fluke infection.

    Before considering chemical control of snails it should be noted that:
    a. Many habitats are topographically unsuitable for the use of molluscicides and it is often very difficult to apply them effectively.
    b. They are toxic to the environment.
    c. Cooperation between neighboring properties is required for effective cover.
    d. Regular application is required because rapid repopulation of snail may occur.
    e. They are expensive.

    Some commonly used molluscicide, repellents
        i. Copper sulphate solution (30 ppm)
        ii. Copper sulphate powder with sand @ 10-35kg/hectre of land
        iii. Niclosamide 70% powder
        iv. Sodium pentachorophenate @ 5-10 ppm
        v. N-tritylomorpholine (highly effective) @ 0.45kg in 680 litre/hectre

    Caution:
    - Animals should not be allowed to graze on treated pasture until next rainfall.
    - Toxic to fish.

Control by other ways

Handpicking:

- ✓ Handpicking can be effective if done thoroughly on a regular basis.
- ✓ At first, we should look for snails and slugs daily, paying careful attention to potential hiding places.
- ✓ Wear thick gloves and gumboots to remove any old wooden boards and other garden rubbish.
- ✓ After the population has noticeable declined, a weekly handpicking can be sufficient.
- ✓ The best time is 2 hours after sunset by torchlight.

Traps/Baits:

- ✓ We can trap snails and slugs beneath boards or upside-down flower pots, dark-colored plastic sheeting that we position throughout the garden scrape off the accumulated snails and slugs daily and destroy them; crushing is the most common method.
- ✓ Don't use salt to destroy snails and slugs, since it will increase soil salinity.

Barriers:

- ✓ Several types of barrier will keep them out of planting beds.
- ✓ The easiest to maintain are those made with copper flashing and screen.
- ✓ It is believed that copper barriers are effective because the copper reacts with the slime that snails and slugs secrete, causing a disruption in their nervous system similar to an electric shock.
- ✓ When erecting vertical copper screens, it is best to use ones that are at least 4 inches tall, so we can bury a portion of it a few inches below the soil to prevent slugs from crawling beneath the barrier.
- ✓ Commercial garlic sprays are strong enough to kill slugs and young snails.
- ✓ Copper foil wrapped around planting boxes, headers or trunks will repel snail for years.

Baits:

- ✓ Baits containing the active ingredient metaldehyde are most common; however, metaldehyde baits are poisonous to dogs and cats.
- ✓ Metaldehyde baits containing 4% active ingredient are more effecting than 2%.
- ✓ Placing baits repeatedly in the same areas to maximize control, because mollusks tend to return to food source sites.
- ✓ Thick, liquid baits might persist better when it is rainy or in areas that receive sprinkler irrigation.
- ✓ Irrigate before applying a bait to promote snail activity, and apply the bait in the late afternoon or evening.
- ✓ Sprinkle bait around sprinklers, close to walls and fences or in other moist and protected locations, or scatter it along areas that snails and slugs cross to get from sheltered areas to the garden.

Family: Lymnaeidae (Dextral)
Genus: *Lymnaea*, **Species**: *Lymnaea auricularia*
English name: Pond snail, **Local name**: Shamuk

Description:

- Shell thin, roundly ovate and very inflated, such that the body whorl comprises 90% of its volume.
- The shell has a rounded and spire is broad, conic and small compared with body whorl.
- The whorls are convex, inflated, smooth and rapidly increasing.
- The peristome is thin and sharp and the sutures are deeply impressed.
- The color of the shell is yellow, sometimes tan.
- The ear-shaped aperture, which has no operculum, is around 5 times higher that spire.
- The mantle is pigmented with a line of dark spots along its edge, irregular spots which show through the shell.
- The head is broad and auriculated.
- Have large, flat, lobate, triangular tentacle those are wider than they are high.
- Size: average shell length & width, aperture length & width are 30, 25, 18 and 14 mm.

Habits:

- This species feeds on such items as detritus, *Cladophora* spp., algae and sand grains.
- It is a hermaphroditic and oviparous snail.
- Eggs are laid in a gelatinous and cylindrical mass on waterweeds.

Habitat:

- It is a widely spread species inhabiting in small puddles, pools, lakes, reservoirs, brooks, irrigation canals, water field, brackish lakes and spas.
- They can also live in water fields with deficient oxygen and 6-9 pH.

Distribution:

- Common all over Bangladesh. Elsewhere in India, Afghanistan, Moldova, Oman, Russia and Ukraine. This species is also introduced in the United States.

Economic importance:

- Meat may be used as a fish bait and poultry feed.
- Used as food by tribal people and workers of tea gardens of Bangladesh and west Bengal.
- The shell is used for decoration and lime production.
- I/H of some Helminth like *Fasciola gigantica, Echinostoma revolutum, Echinoparyphium recurvatum*.

Ecological role:

- This snail helps in maintaining the ecosystem as a consumer of green and semi decayed aquatic vegetation as well as serving as a host to many helminth parasites. Thus, this is an excellent eco-friend of the fresh water.

Genus: *Lymnaea*, **Species**: *Lymnaea trancatula*
English name: Dwarf Pond snail, **Local name**: Shamuk

It is the vector mainly involved in human fascioliasis.

Description:

- Thin shell thin, roundly ovate and very inflated, the last whorl comprises mostly of its volume.
- The rounded and broad spire short, conic, very small compared with the body whorl.
- The whorls are convex, stepped, smooth and rapidly increasing.
- The columella is folded and sutures are deeply impressed.
- The color of the shell is yellow, beige or tan.
- The ear-shaped aperture, which contains no operculum and peristome is thin and sharp.
- The mantle is pigmented with a line of dark spots along its edge, irregular spots which show through the shell.
- Tentacles are large, flat, lobate, triangular and wider than height.
- Mantle roof shows larger unpigmented whitish spots giving a pale appearance to the shell of living specimens by transparency. The first bilateral teeth are tricuspid in radula.
- Size: average shell length & width, aperture length & width are 9, 6, 7 and 6 mm.

Habits:

- Mainly herbivore, hermaphroditic and oviparous snail (usually 2-15 eggs in cluster).
- Remains attached or floats upside down to the surface film of water the foot glides.
- Eggs are laid in a gelatinous and cylindrical mass on waterweeds.

Habitat:

- It is found in stagnant water bodies.
- In Europe, it has usually 2 generations per year and snails can live up to 2 years.
- During very wet years, the species can produce occasionally 3 generations per year.

Distribution:

- It is believed to be native to Europe and America, but it has been introduced in other parts of world.

Economic importance:

- It is an edible freshwater gastropod, used as a food by the tribal people.
- Meat may be used as a fish bait and poultry feed.
- The shell is used for decoration and lime production.
- It is intermediate host of parasites *Fasciola hepatica*.

Ecological role:

- Helps in maintaining the ecosystem as a consumer of semi decayed aquatic vegetation.

Genus: *Lymnaea*, **Species**: *Lymnaea stagnalis*
English name: Stagnant pond snail, **Local name**: Lomba Shmauk

Description:

- Shell thin, horny, ovate and high.
- Body whorl large, expanded outwards with a ovate aperture.
- Columellar callus well expanded, umbilicus closed.
- Head with one pair of flattened, non-invaginable, triangular tentacles with eyes at the base.
- Whorl 4-6.
- Color: exterior golden-greenish to creamy.

Habits:

- Spawns in colorless gelatinous masses on stones and aquatic weeds.
- Has the habit of crowding.
- It may be carnivorous and eat meat and dead fish during scarcity of food.
- It is hermaphroditic and oviparous.

Distribution:

- Common all over Bangladesh. Elsewhere India, Pakistan, Myanmar and Sri Lanka.

Economic importance:

- It also acts as an I/H of monostome and Furcocercous cercariae.

Genus: *Lymnaea*, **Species**: *Lymnaea acuminata*
English name: Pond snail, **Local name**: Patla Shamuk

Description:

- Shell very thin, ovate, rather slender and delicate, narrow with a blunt apex, the outer lip very much expanded and convex in outline, spire short, acuminate, last whorl much inflated.
- Whorl 4-6, tentacles flattened and triangular.
- Color: exterior light brown, peristome dark-brown, inside same as outside.

Habitat:

- Found attaching in all types of freshwater bodies.
- Dominant in the habitats containing water from household drainage.

Distribution:

- Common all over Bangladesh, India, Myanmar and Pakistan. Worldwide in distribution.

Economic importance:

- It has been recorded as the I/H of *Fasicola gigantica*, *F. Hepatica*, *Schistosoma indicum, S. nasalis, S. spindalis* etc.

Genus: *Lymnaea*, **Species**: *Lymnaea luteola*
English name: Lymneid snail, **Local name**: Shamuk

Description:

- Small aquatic mollusk with round foot.
- Shell not very pointed, ovate, spire distinct, conoid, not very pointed.
- Aperture ovate, less expanded.
- Shell dextral.
- Operculum absent.
- Central tooth of the radula unicuspid.
- Whorls 4-5.
- Size: average shell length & width, aperture length & width are 19, 10, 13 and 7 mm.

Habits:

- Mainly herbivore.
- Remains attached or floats upside down to the surface film of water the foot glides.
- It is a hermaphroditic and oviparous snail.
- Eggs are laid in a gelatinous and cylindrical mass on waterweeds.

Habitat:

- Occurs in the littoral regions of shallow water bodies like ponds, ditches, stagnant and temporary water bodies with aquatic vegetation.

Distribution:

- Common all over Bangladesh. Widely distribute in all low land areas.

Economic importance:

- Serving as an I/H of some helminth parasites of cattle, pig and dog.
- Meat may be used as fish and poultry feed.
- It is also considered as a pest of paddy.

Ecological role:

- Decaying plants and detrital remains of macrophytes are important diet of the snail.
- Thus, *L. luteola* is an excellent eco-friend of the freshwater biome.

Family: Planorbidae (Sinistral)
Genus: *Indoplanorbis*, **Species**: *Indoplanorbis exustus*
English name: Ram's Horn snail, **Local name**: Chapta Pechano Shamuk

Description:


Indoplanorbis exustus

- Shell moderately large, thick, sinistral, depressedly coiled, whorls 3, rounded, apex shunken, last whorl large, rounded at the periphery, suture deeply impressed.
- Aperture is ear-shaped; Relatively broad, short and leaf shaped; posteriorly pointed branchial process lobed.
- In newly hatched offspring, the width is greater than the length. But after 7 to 10 days, width and length of the snail become equal.
- Color: exterior golden with creamy spiral bands, golden color gradually turns greenish from the aperture to the apex.
- Size: average shell length & width, aperture length & width are 16, 8, 4 and 6 mm.

Habits:

- *Indoplanorbis exustus* lives shallow freshwater bodies containing different kinds of aquatic vegetation.
- It prefers weeds.
- It is hermaphroditic.

Habitat:

- Commonly found in stagnant waters throughout Bangladesh; abundant in ponds, ditches, canals and paddy fields.

Distribution:

- Common to fresh water bodies of Bangladesh; elsewhere Iran, India, Pakistan, Myanmar, Malaysia, Vietnam, Thailand, Java and Sumatra.

Economic importance:

- It is one of the most important snails from the medical and veterinary points of view as the trematode parasites of horse, goat, sheep, camel, dog, buffalo and livestock develop to the cercarial stage in this snail, which serves as the I/H.

Ecological role:

- This snail helps in maintaining the ecosystem as a consumer of green and semi decayed aquatic vegetation as well as serving as a host to many helminth parasites.

Note:

- *Planorbis* has smooth shell surface where *Indoplanorbis* is rough shelled. Except shell surface and as I/H, all characteristics are quite similar.

Genus: *Gyraulus*, **Species**: *Gyraulus convexiusculus*
English name: Horn snail, **Local name**: Choto Pechano Shamuk

Description:

- Shell small, thin, flattened discoidally, greatly depressed, pale translucent or semi- transparent, with 4-5 whorls, without strong transverse ribs.
- Periostracum with or without short hair-like projections, peripheral keel, lip simple.
- Color: Yellowish-brown.
- Size: shell length, width, aperture length and width 4, 5, 3 and 2 mm, respectively.

Habits:

- Feeds on detritus, algae, semi-decayed debris, zooplankton etc.
- it is hermaphroditic and the right tentacle of the male acts as the penis.
- It breeds twice a year and is viviparous.

Habitat:

- Herbivore remains attached or floats upside down to the surface film of water and foot glides, as if moving along a sheet of glass.
- During summer, when ponds, ditches, tanks and paddy fields dry up, it buries itself in the muddy bottom.
- Spawns in colorless gelatinous masses on stones and aquatic weeds.
- But in the rainy season when ponds become over-flooded, it migrates towards canals and temporary water bodies.

Distribution:

- Indo-Pacific, from India, Pakistan, Sri Lanka, Thailand, Myanmar, Malaysia, Vietnam, west Bengal and almost all northern districts of Bangladesh.

Economic importance:

- Intermediate host of various types of digenetic trematodes of freshwater bodies.
- It is used as poultry feed.

Economic role:

- It helps in controlling aquatic environment pollution by feeding on detritus.

Family: Thiaridae (Dextral)
Genus: *Melanoides*, **Species**: *Melanoides tuberculata*
English name: Screw snail, **Local snail**: Pachano Shamuk

Description:

- Shell with high spire, narrowly rounded with a moderately large body whorl.
- Whorls are moderately convex, evenly rounded with dark or brown dots and flames either irregularly distributed arranged on the shell surface.
- Shell surface sculptured with vertical ribs and spiral striae, distinct and raised on the upper whorls.
- Color: dark brown with red brown dots, flames and bands.
- Size: average shell length & width, aperture length & width are 35, 9, 7 and 5 mm respectively.

Habitat:

- Stagnant and slow-moving water source like streams, river, irrigation canals and often extending brackish water habitat near sea.
- It occurs in abundance in muddy drains, sedimented lakes, ponds and poorly throughout the year including the summer with very little water flows.
- In temporary water bodies, it burrows in the semi-dry substratum during the dry season to overcome the unfavorable situation.
- It remains nocturnal and during the day hides in the gravel and continues the search for food there, sexes are separate.

Distribution:

- All most all the districts of Bangladesh with wide and varied range from freshwater ponds to hill streams. Widely distributed throughout Asia, Africa, Central and South America etc.

Economic importance:

- Eaten by the tribal people.
- A number of fluke cercariae have been recorded from *M. tuberculata* which serves as an I/H host.

Ecological role:

- It plays a vital role in maintaining the balance of the aquatic ecosystem by stirring up gravel, which prevents clogging and also eating food remains, that would otherwise decay and pollute the water.

Genus: *Brotia*, **Species**: *Brotia costula* (Synonyms: *Melania costula*)
English name: Brotia snail, **Local name**: Lomba Shamuk

Description:

- Shell elongate, conoid, large, very thick, rough, and turreted.
- Spire somewhat convex, elongated suture impressed, apex decollated.
- Whorls 12-14, regularly increasing, each sculptured with vertically arranged curved ridges, prominent axial ribs with spines.
- Shell dextral and decollated.
- Inner lip thick, smooth, regular.
- Operculum oval, thin and concave on the outer surface, with a basal nucleus.
- Color: generally, brick red or dark brown, aperture purple, inner lip yellowish.
- Size: average shell length, width, aperture length and width are 154, 19, 17 and 13 mm.

Habit:

- Mainly herbivore remains attached to the submerged plants or on the bottom in the littoral region of water.
- Unisexual and oviparous snail.
- Fertilization internal, occurs almost throughout the year.

Habitat:

- Occurs in muddy, sandy bottoms of freshwater like rivers, canals, streams and also stagnant waters.
- Clean water with lime offers suitable habitat for *B. costula*.
- It is mostly found in ponds and flowering streams.

Distribution:

- All over Bangladesh in slow-flowering waters. Elsewhere, India, Myanmar, Malay Archipelago and Indonesia.

Economic importance:

- *B. Costula* is an edible freshwater gastropod, used as a food by the tribal people of Bangladesh.
- Meat may be used as a fish bait and poultry feed.
- The shell is used for decoration and lime production.
- It is also a host of the helminth parasite.

Ecological role:

- Helps in cleansing the suspended particles of water. So, it may be considered as a bio-filter of the slow-running waters.

Family: Pilidae (Apple-snail) (Dextral)
Genus: Pila; **Species**: *Pila globosa*
English name: Common Apple snail; **Local name**: Bara Shamuk

Description: (*Pila globosa*)

- Shell is large, thin, elongated, dextral with thick globose, spacious and hollow cone spirally coiled round a central axis.
- Operculated, suture is not deep, spire depressed, apex rounded at the tip.
- Aperture large, expanded, whorls 5 in number.
- Surface smooth, upper surface of the whorl obliquely flattened, umbilicus open.
- Head prolonged into two sides, labial palps or anterior tentacles.
- Mouth narrow, eyes arising on the outer side of the base of the tentacles.
- Color: Shell lemon-yellow, brownish or even blackish.
- Size: shell length is 43 mm, width 37, aperture length and width 21 and 9 mm.

Description: (*Pila virens*)

- Shell large, ovoid, semi-globose.
- Operculated snail.
- Suture deeply impressed canaliculated with a distinct carination of the whorls on the outside.
- Spire elevated, prominent and conical.
- Color: shell, variable, generally green or olive brown.
- Size: shell length is 45mm, width 41, aperture length and width 35 and 25 mm.

Habitat:

- Abundant in ponds, tanks and submerged rice fields, but also be found in freshwater streams, river and even in brackish water of low salinity in rainy seasons.

Habit:

- It is herbivorous, amphibious, oviparous and sexes separate.

Distribution:

- Bangladesh, India, Pakistan, Sri Lanka, Thailand, Myanmar, Vietnam and Indonesia etc.

Economic importance:

- It may be used as shrimp and poultry feed as well as lime production.
- It is also eaten by some tribal people.
- I/H of various digenetic trematodes available in fresh water bodies of Bangladesh.

Ecological role:

- It helps in controlling the aquatic environment pollution by consuming detritus.

Family: Viviparidae (Dextral)
Genus: Bellamya; **Species:** *Bellamya bengalensis, B. crassa, B. dissimilis*
English name: Banded pond/ River snail; **Local name:** Guli Shamuk

Description:
Bellamya bengalensis may be confused with *B. dissimils*

- Shell medium, thin, ovately conoid, more or less smooth with acuminate spire.
- Distinct dark spiral bands.
- Strongly inflated whorls, last whorls broader than high.
- Shell blackish brown with yellowish brown.
- Aperture semicircular, shell delicate and thin in the embryonic stage.
- Size: Shell length is 25 nm; width 14 mm, aperture length and width 12 and 10 mm respectively.

Bellamya bengalensis

For *Bellamya crassa*

- Shell small, thicker, globose with fine transverse striation.
- Umbilicus perforate, spire short and blunt.
- Umbilical opening prominent, generally impressed.
- Anterior margin almost straight, upper lip arched.
- Outer surface sculptured with fine wavy spiral lines.
- Aperture sub-oval.
- Uniform color without any bands.
- Color: olive brown or yellowish green.
- Size: shell length is 23 mm, width 18 mm, aperture length and width 14 and 12 mm respectively.

Bellamya crassa

Habitats:

- Prefers soft and clay bottom stagnant water with aquatic vegetation.
- Abundant in permanent and temporary water bodies, in the littoral zones of the ponds canal and paddy fields.
- For *Bellamya crassa*, found burrowing in mud or sand in shallow waters, often in groups, throughout the year but in rainy season it also moves in temporary water bodies, irrigated paddy fields and canals.

Habits/Feed:

- Feeds on detritus algae and minute particles of vegetables matter which are rasped off from the surface of submerged plants, stones, decaying vegetable matter, by the radula.
- Sexes are separate, the right tentacles of the male acts as the penis.
- It breeds twice in a year and is viviparous.

Distribution:

- Found almost all districts of Bangladesh. Elsewhere, Malaysia, Myanmar, India, Pakistan and Sri Lanka, Australia, Europe and North America.

Economic importance:

- It is a common I/H of various types of digenetic trematodes available in the fresh water bodies of Bangladesh.
- It is widely used as a poultry feed.
- Tribal people also eat its flesh as a delicacy.

Ecological role:

- It helps in controlling the aquatic environment pollution by consuming detritus and debris.
- Also serves as an agent of the bio-geochemical cycle as well as the host of various larval trematodes parasites of Vertebrates.

*Bellamya dissimilis***:**

Habits:

- Feeds on detritus algae, semi-decayed and zoo planktons. Adults are usually found on the muddy bottom of the bonds, ditches, canals and rivers.
- It is bisexual and the right tentacles act as a penis.
- It breeds twice in a year and it gives birth to live offspring.

Bellamya dissimilis

Snail Facts

Diet:	Herbivore
Size (L):	0.5cm - 80cm (0.2in - 32in)
Weight:	0.01kg - 18kg (0.02lbs - 40lbs)
Average Lifespan:	1 - 20 years
Colour:	Black. Brown, Yellow, Tan
Favourite Food:	Leaves
Habitat:	Well-vegetated areas
Average Litter Size:	200
Main Prey:	Leaves, Fruits, Stems
Predators:	Rodents, Frogs, Birds