



Review Article

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A REVIEW ON LEECH BREEDING

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ABSTRACT

Hirudo therapy or Leech therapy is a very popular technique of phlebotomy and bloodletting which has been popular across the world since ancient time. Leech therapy was previously widely practiced in all systems of medicine, for anything in everything concerning from head to toe, for bloodletting with limited trouble. Due to irrational exploitation of Leeches and other reasons like climatic variations and changes in food chain, leeches are getting scarcer in their population. The leech species began to face a drastic decline in their population, and this has led to their categorization as 'near threatened' species in IUCN red list in 2025. The waning in the leech species, and augmented price has led to a decline in leech therapy. Later in 1980 nearly 100 chemical substances in leech saliva were detected, and this has led to a return in leech therapy in the name of hirudo-therapy. Further in 2004 the US FDA (food and drug administration) approved leech therapy as a 'Medical Device' used as an adjuvant for reconstructive flap surgery. This has further increased the demand of leech therapy. Along with the extensive research on, application of leeches in newer and newer health conditions, we shall also find means to replenish this natural resource, for sustainable development. Various methods of leech breeding have been adopted and practiced globally. This paper summarizes all those techniques to an easily adoptable pattern.

Keywords: Hirudo therapy, leech, leech- breeding, jalauka

INTRODUCTION

The usage of medicinal leeches for treatment purposes has its ancient references dating back to antiquity with references in the ancient Indian Ayurveda classics, Egyptian Tomb decorations, Greek Medicine, Arabs, Iranian, Chinese medicine, Russian, Ireland, and UK etc. Leech therapy was once used for anything in everything concerning from head to toe, and bloodletting without much trouble was its major attraction. This has given a lucrative market in international trade for leeches in the 18th and early 19th century for medicinal purposes. With the indiscriminate utilisation of an extensive Leech application, the leech species began to decline and led to their categorization as 'near endangered' species in IUCN red list. By the 19th century the discrediting of bloodletting for all diseases from Hysteria to syphilis marked an end to this practice of utilisation of leeches for medicinal purposes. By 1884 with the discovery of hirudin, an anticoagulant, the scenario had changed further. The decline in the number of leech species, tendency of bleeding and increased price has led to a decline in leech therapy.

Later in 1980 with the discovery of nearly 100 chemical substances in leech saliva, there was a comeback in leech therapy in the name of 'hirudo-therapy', but with their increased demand, declining number and increase in the prices leech farming attempts were started, although many had failed. There were references of a Welsh merchant who had successfully farmed leeches and sold it commercially in 1812. Later for the first time leeches were bred in captivity, in the London Zoo for the first time as a part of a long-term project. The average life span of leeches is maximum of up to 10 years.¹

Further in 2004 with the approval of leech therapy by the US FDA (food and drug administration) as an adjuvant for reconstructive flap surgery the further demand of leeches increased. China is now a leading leech producer and makes leech farming as a source of income for many farmers. It has a long history of leech farming. There is huge potential for novel substances and these could be future therapeutics.²

The Taxonomic Position of Leeches

The taxonomic position of leeches are as follows

| | |
|----------|--------------------|
| Kingdom | - Animalia |
| Phylum | - Annelida |
| Class | - Clitellata |
| Subclass | - Hirudinea |
| Order | - Arhynchobdellida |
| Family | - Hirudinidae |
| Genus | - Hirudo |
| Species | - medicinalis |

Morphology

Leeches belong to the phylum Annelida. Leeches are cylindrical and dorsoventrally flattened with slender leaflike structure. Unlike other annelids, they lack setae (chaetae), Para podia or appendages bristle like structure for locomotion. The leech attaches to the surface with two suckers a large posterior sucker and a small anterior sucker. Leeches absorb blood either through their proboscis which is used to puncture the skin or by bite.³ The leeches have 34-36 segments in body and 102 annuli. A classic leech body consists of many segments divided as two preoral, nonmetameric segments, and 32 post-oral metameres (somite).⁴ They lack hard exoskeleton but has a thin, flexible cuticle. This thin cuticle makes leeches dry out quickly, so they are always

placed closely associated with water. The coelomic space of Leeches is largely filled with mesenchyme tissue, with which, they move by contraction of its circular muscles, after attaching the posterior sucker to the substratum. The suckers are actually the modified groups of terminal segments of each end. The average size of leech ranges from 10 to 15 cm long. Large specimen may range from 30 to 35 cm long. The dorsal surface is olive green, dark brown or greenish with several longitudinal rows of black stripes and spots. The ventral surface is comparatively darker and there is a yellowish orange band laterally on either side. They have five pairs of eyes anterolaterally. The clitellar region extending between ten to twelve segments contain the male and female genital openings which produce the egg cocoons. Leeches have 17 pairs of nephridia, which forms the excretory organ. The circulatory system of leeches has six blood sinuses, with no distinct blood vessels. The two lateral sinuses have a muscular wall which function as heart to circulate the blood in leeches.

Classification

Leech breeding is mainly done in 3 ways⁵

- Leech Breeding in laboratory conditions
- Intensive Leech breeding in artificial ponds
- Semi intensive Leech breeding in natural ponds

The main principle of leech breeding is to create a suitable environment or Habitat for leeches to thrive and reproduce. This can be done in laboratory conditions under controlled environmental factors, or in intensive artificial ponds or in semi-intensive natural ponds.

Leech breeding in laboratory conditions

It is the best way to breed leeches hygienically for therapeutic use. It requires careful and continuous monitoring and control to sustain the optimal conditions of Breeding. It involves construction of a controlled environment with adequate temperature, pH and other facilities. The food source shall be available in plenty. Temperature of 20-28 °Celsius shall be maintained in the tank. The temperature shall not fall below 18 °Celsius. A temperature too low and too high are not suitable for leech breeding. At extreme warm temperatures of about 30 °Celsius the leeches may not survive in the laboratory. For commercial breeding a temperature of 25 to 28 °Celsius is the most appropriate temperature zone. But for the natural environment the egg hatches at a little lower temperature.

The pH of the water tank should be of the range 5 to 6. Total dissolved solids range -50 PPM TDS is the desirable optimum level for leech farming. The water should have sufficient aeration for oxygen supply. The water level shall not fluctuate frequently. There should not be any disinfectant in the water nor shall it be chlorinated water. Chemicals like doxycycline shall not be present.

Adequate food shall be provided in the form of small snails and mussels. Insufficient food can lead to leech loss. Fresh blood is the recommended food source for commercial breeding.

Lighting shall also be minimum leeches and are light sensitive. Temperature, light intensity PH and diet place a major impact in the reproductive efficiency of leeches. Laboratory breeding is more suitable in cold conditions since leeches show more adaptability to warm environments. Usually, leeches breed once during an annual season in the month of March- April.⁶

The following requirements are needed for leech farming

1. Air conditioner
2. Plastic pans
3. Water purifying system
4. TDS meter
5. PH metre
6. Pump fittings
7. Aquarium
8. Nets for Prevention of leech escaping
9. Heating cooling and humidifying system
10. Natural or artificial pond

Intensive breeding in artificial ponds

Hair and artificial environment are created in adequate water temperature pH lighting and other amenities to save the growth environment of leeches. Adequate foot shall be provided to prevent leech loss. This kind of leech breeding method involves the following steps.

Breeding pool preparation: Build the breeding pool in a clean environment free from pollution with adequate wind and sunlight but devoid of direct scorching rays. There should be proper supply of water service drainage and irrigation of the water from the tank. The water level shall be maintained at 0.5 m deep and 1-metre-wide area the tank is filled initially with a lot of small snails and mussels as food for the leech and planktons shall be planted.

Selection and stocking of leeches: Active leeches of about 25-to-30-gram weight and 2 years old are selected. They should shrink when touched with the finger. These leeches are first disinfected before being introduced into the pond. This can be done by treating them with bleaching powder for 20 minutes. About 40 to 50 leech seeds shall be placed in each square metre area of the tank. Leeches are planted in the early or mid-April.

The volume of leech storage pans should be more than 50 litres-100 litres and the pan should be totally free of contamination. The platform soil is Sandy Loam rich in humus. Changing of water as and when required is an important step in leech farming. In the storage tank the temperature at the upper part of the water level is more than the lower part. Leeches should not be exposed to too much temperature fluctuations. Therefore, it is not recommended to move leeches from upper part to lower part or vice versa as it can harm their life. In the cocooning season mosquito net bands should be used to restrict the entry of mosquitoes to feed the cocoons. The temperature shall be 18 to 30 °Celsius for growth and breeding purposes. 25 to 26 °Celsius room temperature of water is favourable for reproduction. Another important factor is the measure of TDS or total dissolved solids. This corresponds with the total solid suspended in water. 50 PPM TDS is the desirable optimum level for leech farming. TDS about 400 PPM is not suitable for leech Breeding. Water specific gravity should be 1008.58. Minimum 1000 and maximum of 1020. Water pH should be between 6-9.

Semi intensive Breeding in natural ponds

Semi intensive Breeding in natural ponds is the cheapest method in which leeches are bred in natural Ponds.⁷ In such conditions, leeches require water ponds with a wide variety of natural food, especially amphibians, where they interact mutually and survive under natural conditions of water temperature, humidity and other environmental factors. They feed on the natural fresh blood from the co-habitants there. Here the total feed and environmental control is attained naturally, whereas in intensive Breeding the full manual control of food and environment is essential for breeding in the system. Here everything like the water, temperature, soil, moisture, humidity, aeration, nutrition, mud

shade, planktons, algae, greenery etc shall be available sufficiently to breed and survive.

Reproduction and Life Cycle of Leeches

Leeches are hermaphrodites. They have both the male and female sex organs in the same organism. They usually mate in this spring season from June to August. They have a clitellum, a region of thickened skin which is obvious only during the reproductive period. Meeting involves intervening of bodies where each deposits sperm in the other's clitellar area. The mating or fertilization usually occurs in the morning with their head and tail end direction contrary and their ventral aspect of the body close together. When the respective male organ faces the corresponding female organ then the thin line shaped penis stretches out and inserts into the female reproductive organ on the other side. This mating process continues for 1- 2 hours and a quiet and peaceful

surrounding is required for that. With the deposition of sperms in the clitellum, it moves into the ovaries for fertilization to take place. The clitella then secrete a gelatinous 'Silk cocoon' which contains nutrients and it is in this that the eggs are deposited. The leeches then shrug itself free of the cocoon sealing it as it passes over. The cocoon is either buried or attached to a rock, log or leaf and dries to form a foamy crust. Cocoons are naturally hatched in 15 to 25 days under 20-25 °Celsius. Leeches die after 1 or 2 bouts of reproduction.

This reproductive habit of leech is called hermaphroditism, or allogamy or internal fertilization where Gametogenesis organs are present concurrently or simultaneously in the same organism. They have the sex Reversal phenomenon where their sex role is exchanged mutually during mating. A leech can be at a time a father and mother at different times in their life cycle.

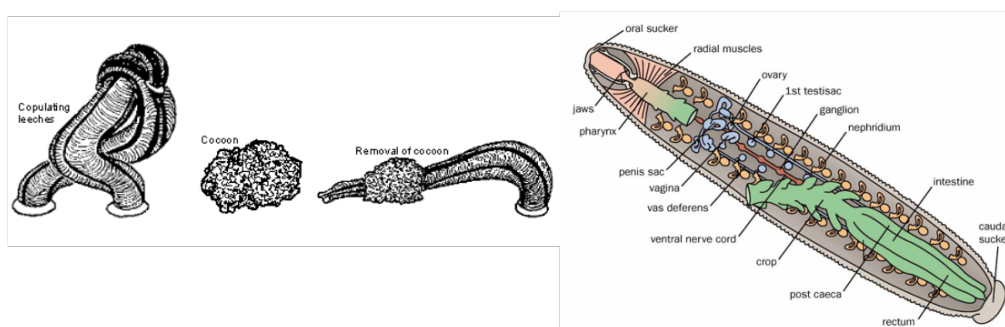


Figure 1: Cross fertilization and deposition of cocoon in leeches

According to the age and size leeches are divided into ⁸

1. Larvae 1 to 2 cm
2. Needle 2 to 4 cm
3. Match 5 to 6 cm
4. Medical 6 to 8 cm

Lifespan of a leech is about 10 years; it can cocoon for up to 5 years. High Cocooning ability is seen in the first 3 years. The identification of young and old productive leeches is not recognizable.

Based on the habitat leeches can be broadly divided into 3

1. Freshwater leeches
2. Marine leeches
3. Terrestrial leeches

Freshwater leeches are found in Shallow water. It is abundantly seen in ponds, streams, lakes and rivers. The medicinal Leech *Hirudo Medicinalis* is a freshwater leech. These leeches have saliva containing anaesthetic, anticoagulant and the inflammatory properties which keeps blood flowing painlessly from the patient. Marine leeches feed on aquatic life and it dwells in Ocean depth. They feed on Bony or cartilaginous fish. Terrestrial leeches are found on land. Highly humid environment is needed for such leeches to survive. They are found in the moist rainforests of Asia, Africa and South America. Such natures are adapted to live on land but they can survive submerged in water for a shorter period of time. In dry conditions Leeches can also borrow in mud and aestivate there until moisture revives them.

CONCLUSION

Leeches are extensively used in treating various diseases such as migraine, thrombophlebitis, hypertension, varicose ulcer, skin and musculoskeletal diseases etc. Ayurveda refers to it as one

among the panchakarma (the five main purificatory for treatment of diseases). Leech therapy is mentioned as raktamokshana (Bloodletting therapy) since the time of Acharya Sushruta. A whole chapter of Sushruta Samhita is dedicated to the description of leech therapy (Jaloukaavcharana sutra sthana chapter 13). Raktamokshana is considered as chikitsa ardha (half of treatment) because of its greater therapeutic effect. It provides an easy and non-invasive bloodletting therapy applied in a wide variety of conditions. Sushruta mentions leech culture techniques in earthen mud pots, filled with algae, mosses etc and in which water is changed every 7th day. But leech breeding references are absent in the context. A wide range of suitable hosts, especially amphibians are required by leeches, to survive and prosper. Even with a low minimum viable population size, medicinal leeches can survive, as typical of rare freshwater invertebrates in isolated habitats, with species limited by high temperature needs and specialised nutrition sources. The leech species are on the endangered list in several countries, with the current IUCN list shows near threatened for *Hirudo verbena*, in 2025. The decline of medicinal leech populations has been attributed to many causes viz. the over-utilization for medicinal purposes, climatic variation and general decline of wetlands, especially ponds and marshes which eventually led to a decline in the amphibians that are a vital source of blood-meals for the leeches and are critical for the survival of their juveniles. To enable their conservation and management, and to avert them from becoming extinct in the wild, further quantitative and qualitative data is required on leeches and their cultivation and therapeutic use. Hence, leech agrobusiness should be encouraged in different habitats under adequate climatic conditions. As leech therapy demand escalates every day and to adequately meet the demand medicinal leeches are required in large quantities, leech farming can make a low cost start up with high return.

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