Indian Medicinal Leeches: Historical Use, Ecology, and Conservation

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Abstract:
Medicinal leeches and their historical use in phlebotomy (blood-letting) and contemporary use in neurobiology and medicine are summarised. Leeches require warm-water ponds with a range of suitable hosts, especially amphibians, to survive and prosper. Medicinal leeches can persist with a low minimum viable population size, which may be typical of rare freshwater invertebrates in isolated habitats, especially species limited by high temperature requirements and specialised food sources. The type species, H. medicinalis, was once abundant in Europe but is now rare and on the endangered list in several countries. The major factor in the decline of medicinal leech populations has been the general loss of wetlands, especially ponds and marshes throughout India. Destruction of these water bodies has also led to a decline in amphibians that are an important source of blood-meals for the leeches and are crucial for the survival of their juveniles. More quantitative information is required on H. medicinalis, to facilitate their conservation and management, and to prevent them becoming extinct in the wild.

Keywords: *Indian leeches, Medicinal values ,conservation*

Introduction:

Although there is general agreement on the position of leeches in the classification of invertebrates, opinions differ on some of the finer points of their placement. Leeches belong to the Phylum Annelida, the segmented worms. The name, introduced by Grube (1850), is derived from the Latin annelus or annellus (diminutive of anulus), meaning 'little ring' and referring to the external ringed appearance of the worms. Leeches are also placed in the Class Hirudinea (from Latin for leech, Hirudo) in the Sub-Phylum Clitellata, together with the Class Oligochaeta (earthworms and other detritus feeders).It occurs in ponds, waters that dry up periodically, floodplain pools and small lakes. Other ecological requirements include abundant hosts (frogs, cattle and horses), silty water bottoms, dense submerged and emergent vegetation and gently sloping banks favourable for laying cocoons. Among the currently ca. 14 000 accepted species of Annelida (segmented worms) found worldwide in freshwater, marine and terrestrial ecosystems.

During subsequent decades, notably when the use of leeches in phlebotomy (bloodletting) became very popular throughout Europe (ca. 1850), numerous "varieties" of "*H.medicinalis*" were distinguished by naturalists as well as practitioners (Herter 1936, 1937).

The clinical use of leeches was revived by Derganc and Zdravic(1960) to relieve post-operative venous congestion in patients recovering from tissue flap and replantation surgery. Their application in this regard proved so successful that European medicinal leeches were approved by the US Food and Drug Administration in June, 2004 as a medical device due to their mechanically relieving venous congestion and delivering anti-coagulants. Rados c 2004. The powerful anti-coagulants in leech salivary secretions have been of interest since the anti-thrombin, hirudin, was purified Prikle ,Markland 1985. The first human dialysis treatment accomplished by Haas1924 was only possible in light of the newly available purified hirudin, though it would later be supplanted by widely available and less expensive heparin.

Large numbers of *H.medicinalis* were obtained from the wild in the 18th and early 19th centuries, and towards the end of this period, they were already scarce in many countries. This demand for medicinal leeches was not restricted to Europe. *Hirudomedicinalis* does not occur naturally in North America, and large numbers were imported from Europe into the United States in the 18th and 19th

centuries. Several attempts were made to rear this species in the US, without positive results (Elliott and Kutschera 2011). As medicinal leeches became more difficult to find in the 19th century, the indigenous supply was supplemented by importations of other species of medicinal leeches from outside Western Europe. There was also the development of 'leech farms', especially in France and Germany. As late as 1890, a leech farm near Hildesheim in Germany was breeding between three and four million individuals per year (Herter 1968). Leech farms still exist today but, unfortunately, they often rely on imported leeches from Southeastern Europe and Turkey. These imports are often not *H.medicinalis*, but the closely-related species, *H.verbana*, which has been confused with the 'true' medicinal leech (Michalsen and Roth 2006). A number of explanations have been proposed for the loss of many populations of *H.medicinalis* in Northern Europe, and these should all be considered in combination. Extensive over-collecting for blood-letting in the nineteenth century is frequently blamed, but used leeches were regularly discarded into the nearest pond or stream and thus may have enabled the survival of this species in the countryside. Contemporary collecting for experimental biology, medical use and pharmaceutical needs is probably a serious threat because the leeches are destroyed, often in large numbers (Shain 2009). Although leech farms offer an obvious solution, this only works if the commercial suppliers actually rear leeches, rather than importing them and thereby reducing populations in the wild (Michalsen and Roth 2006).In the present article describction on the morphology of juvenile and adult Indian *H.medicinalis*-individuals, the behaviour, ecology and distribution of this endangered species.

Material and Methods:

Adult and juvenile leeches (H.medicinalis) were collected from local area . The leeches were kept in aqua-terraria (90 x 40 x 60 cm, depth of the pond water ca. 10 cm; temperature 22 to 26 °C), and observed alive. Specimens of *H.medicinalis* were killed by adding 80 % ethanol to the water, so that the animals were preserved in their non-contracted, natural shape for study.

Experimental Model

The present study was carried out on *Poecilobdellaviridis* (Blanchard) weighing about 2.5 to 3 gms. Leeches were collected locally.Leeches were kept in the laboratory without food at 20 ^{0}C in the dark avoiding direct sunlight. They were kept in suitable containers with sufficient dechlorinated tap water. The water was changed every other day. Water temperature was upto 45^0 F. Sudden changes in temperature were avoided when transferring leeches from one container to another. Since leeches are amphibious and like to crawl about, a lid over container is essential. Leeches are small. The elastic leech body is capable of going through remarkable small opening. The cloth was covered tightly secured with string, rubber band or tape. Not more than twenty leeches were kept in a two gallon container.

Result and Discussion:

Leeches are animals with an organization akin to that of earthworms, but having certain modifications associated with a predatory or parasitic mode of life. The limitation of the number of body segments facilitates a greater degree of agility than would be the case if the body was as long as that of most earthworms. The segments are each subdivided into a number of annuli. Externally, the annuli look much alike, and there is little indication of segmentation. Perhaps the best guide is the pattern of colouring, which often repeats itself once per segment. The size of the suckers relative to the body varies according to the mode of life of the leech species. Weight gain by leeches and Time duration taken.

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America, and large numbers were imported from Europe into the United States in the 18th and 19th centuries. Several attempts were made to rear this species in the US, without positive results (Elliott and Kutschera 2011). As medicinal leeches became more difficult to find in the 19th century, the indigenous supply was supplemented by importations of other species of medicinal leeches from outside Western Europe. There was also the development of 'leech farms', especially in France and Germany.These imports are often not *H.medicinalis*, but the closely-related species, *H.verbana*, which has been confused with the 'true' medicinal leech (Michalsen and Roth 2006). The typical natural habitat of leeches in India is a eutrophic pond with a muddy substratum, littoral vegetation, and a high summer temperature. It should also be a breeding site for amphibians (frogs, toads and newts). Although *Poecilobdellaviridis* (Blanchard) are reported as feeding almost exclusively on the blood of mammals (cattle, horses, deer, humans), they will also suck the blood of fish, water birds, and especially amphibians, both the adults and their larvae.

The size of the suckers relative to the body varies according to the mode of life of the leech species and, in*Poecilobdellaviridis*, the anterior sucker is quite small. The buccal cavity is lined by muscular ridges surmounted by cuticular teeth, and the mouth is a wide aperture occupying the whole of the anterior sucker. Following the pharynx is a region of the alimentary canal, the crop, which is dilated for the storage of food. In the sanguivorous, it is drawn out into lateral arms referred to as diverticula. The clitellum is situated towards the anterior of the body. The male reproductive aperture is median and unpaired. There are two internal ducts leading to it but these unite to form a single genital atrium with one external gonopore and a 'tube-like' malecopulatory organ. The female pore is likewise median and unpaired, and is posterior to the male pore.laboratory studies showed that the preferred temperature of *Poecilobdellaviridis* in a gradient of 7 to 43 °C was 21 °C a value midway between the 50 % and 90 % active leeches, as documented. Optimum temperature ranges for growth (22 to 25 °C) and breeding (25.5 to 27.5 °C) in the laboratory were similar to predicted values for maximum activity in the field. At 39 to 43.5 °C, the upper lethal range is remarkably high for this species. These high temperature requirements have important implications for the survival of Leeches in the wild: the leeches were unable to reproduce and survive in many water bodies simply because of the low water temperatures.

Table. 1- Weight gain by leeches and Time duration

Sr. No.	Initial Weight of Leech (g)	Weight of Leech After complete Meal (g)	Time Duration (min)	Temperature (degree)
1	2.5	9.5	40	21
2	3.0	10.0	50	25
3	2.7	9.5	45	23
4	3.0	11.5	55	28
5	3.0	11.0	60	25
6	3.0	9.8	35	26

Conclusion:

A reduction in the availability of suitable vertebrate hosts is another possible reason for the decline in countries where troughs are now used instead of ponds for the watering of cattle and horses. Changes in land use not only caused the loss of ponds but also isolation of the remaining freshwater ecosystems, even to wild animals, and this may have contributed to a reduction in blood meals from this source. The declining abundance of field populations of the Indian medicinal leech could be the result of lower available energy for growth, reflecting leeches now feeding predominantly on amphibian

blood of lower energetic value than mammalian blood.The slow growth of the leeches could be partially caused by the scarcity of mammalian blood in their diet. Water temperature will also affect the growth of *H.medicinalis*. Fast-growing leeches that attained maturity after only 289 days were kept at a constant 20 °C . The high temperature requirements of medicinal leeches (*H.medicinalis* and *H.verbana*) impose limitations on their distribution and occurrence. Therefore, the absence of these species from many water bodies may be due partially to the relatively high temperatures required for swimming activity, feeding, growth and breeding, as well as the scarcity of mammalian hosts. It should be noted that there has been a loss of many small, shallow ponds throughout India, and these are often the ideal habitat for medicinal leeches, especially if they contain amphibian species and water birds. one of the most popular known annelids, the unique phenotype of this beautiful "annelid with character" is still widely unknown, even among biologists.

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