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THE MEDICINAL VALUE OF LEECHES

MEENAKSHI PRIYA
M.Phil., Roll No.: 142145 Session-2014-15
Department of Zoology, B.R.A. Bihar University, Muzaffarpur, India
E-mail: priyameenakshi.1405@gmail.com

Abstract

In an era when many folk remedies are being rediscovered and the use of homeopathic and natural drugs is increasingly popular, it is not surprising to witness a revival of the use of leeches in medical practice. In the ancient world, leeches were used as one of several methods of bloodletting. The concept of removing vitiated blood in an attempt to restore health was a fundamental one, and instruments such as lancets, scarifiers and bleeding cups were in common use among apothecaries and surgeons. Tools for venesection were unearthed from archeological excavations of the Stone Age.' Leeches were used for bloodletting and were applied to congested or inflamed parts of the body in conditions of engorged hemorrhoids, swollen testicles, laryngitis, prolapsed rectum and inflamed vulva. Compared to venesection, the use of leeches was considered a less painful procedure, in which a limited amount of blood could be removed.

Keywords: Medicinal, Leeches

Introduction

In an era when many folk remedies are being rediscovered and the use of homeopathic and natural drugs is increasingly popular, it is not surprising to witness a revival of the use of leeches in medical practice. In the ancient world, leeches were used as one of several methods of bloodletting. The concept of removing vitiated blood in an attempt to restore health was a fundamental one, and instruments such as lancets, scarifiers and bleeding cups were in common use among apothecaries and surgeons. Tools for venesection were unearthed from archeological excavations of the Stone Age.' Leeches were used for bloodletting and were applied to congested or inflamed parts of the body in conditions of engorged hemorrhoids, swollen testicles, laryngitis, prolapsed rectum and inflamed vulva. Compared to venesection, the use of leeches was considered a less painful procedure, in which a limited amount of blood could be removed. Nicander of Colophon (200-130 BC) was probably the first medical practitioner to use leeches for therapeutic purposes, and leeching was described in a work of the celebrated 2nd-century physician, Galen. Early Chinese writings from the first century AD describe the use of leeches, a practice which is also mentioned in ancient Sanskrit, Persian and Arabic literature. The Old Testament mentions the leech in Proverbs 3.15, although not in connection with healing. The widely held view that leeches were important in therapy during the Middle Ages is probably incorrect. The word 'leech' is actually the Anglo-Saxon term for physician, and the 'leech books' of that era contained hardly any reference to the animal. On the whole, it looks as if the creature acquired the name from the doctor and not the other way around. In the 18th and 19th centuries, the popularity of leeching was at its height in Europe and leeches became a major item of international trade. It was calculated that Parisian hospitals used approximately 5-6 million leeches between 1829 and 1836 and that 84 150 kg of blood were removed annually from treated patients.' There is documentation testifying that 97 300 leeches were used in St Bartholomew's Hospital in London in 1832.' The demand for H. medicinalis in Europe was so great that the natural leech population became almost extinct and a $500 premium was offered in the USA to those who could breed leeches.' Leeches were used for practically every disease, from various local aches and inflammatory processes to nephritis, laryngitis, eye disorders, brain congestion and even obesity and mental illnesses. Stokes recommended the use of 2040 leeches for gastritis and Behrend reported a beneficial effect of 6-10 leeches in scarlet fever.' The Russian novelist Gogol was subjected to leeching in his nostrils4 and Napoleon was treated with leeches for his hemorrhoids. Leeches are segmented, hermaphroditic worms of the phylum Annelida. They are equipped with two suckers. Both

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suckers are used for clinging and crawling. The smaller anterior sucker houses the mouth. The mouth leads into the buccal cavity which houses three jaws each bearing a row of many denticles or 'teeth'. Leeches live in freshwater ponds and swim to their target within 25" of a wave source. They usually bite into a warm area of the skin and suck the host's blood by means of rhythmic contractions into the crop, where it is stored until digested. Strong muscles move the jaws back and forth, cutting rapidly and painlessly into the dermis. The lowered sensitivity to pain from a leech bite has been demonstrated by the tail-flick test and has been related to two complementary activities of leech saliva, each of which reduces kinin-like activity in the host's blood. These are (a) the inhibition of plasma kallikrein, determined by the inhibition of kininogenase activity and (b) kininase activity.5 Our earlier results on the heat-pain threshold point in the same direction but are inconclusive.6 A leech bite usually leaves a distinctive scar made by the three jaws, which is reminiscent of the Mercedes-Benz emblem. As it sucks, the leech secretes its saliva, rich in active materials, both into the wound and into the aspirated blood and thus maintains a continuous flow of blood. These materials include hyaluronidase, collagenase, coagulation and platelet aggregation inhibitors. Aeromonas hydrophila, the symbiotic bacterium in the intestine of H. medicinalis, plays a dominant role in the digestion of the blood. In one meal, which lasts approximately 2040 min, the leech removes about 5-l 5 ml of blood, which amounts to approximately ten times leech body-weight. This is regarded as one of the largest meals taken by any living creature relative to its own size. Satiated leeches are much less active and tend to hide for periods of 12-18 months, during which they digest their meal and do not bite.

ANTICOAGULANTS IN LEECH SALIVA

In the wake of quackery and with the advent of modern medicine, leeching fell into disrepute. However, limited interest in the medicinal use of leeches still persisted into the 20th century, mainly because it was already known that extracts of leech heads contain a powerful anticoagulant. Leeches were used for the treatment of post-operative thrombosis and even coronary thrombosis.' Hirudin, the principal anticoagulant in leech saliva, was discovered by Haycraft in 1884 and employed in blood transfusion in 1915.' More than 70 years elapsed from the discovery of hirudin until Markwardt isolated it and identified it as a polypeptide, a highly potent antiprotease with a strict specificity for thrombin.'j Hirudin has since been the subject of extensive research,'4-2' is now produced by recombinant DNA technology22-Z4 and is administered to patients undergoing coronary angioplasty, in the treatment of deep venous thrombosis and as a substitute for heparin in patients developing heparininduced

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thrombocytopenia. Interest in leeches and other hematophagous animals is growing, as attempts are being made to discover new biological compounds with therapeutic potential.

We found potent thrombin inhibitors in Poecilobdella granulosa (formerly named Hirudinaria granulosa)25 and in Limnatis nilotica (unpublished). Haemadin, a thrombin inhibitor of about 5 kDa, has been isolated from the Indian leech Haemadipsa sylvestris and has been sequenced and cloned.26 Two variants of theromin, specific thrombin inhibitors of molecular weight 14 and 9 kDa respectively, were isolated from the leech Theromyzon tessulatum. The 14 kDa variant, which has also been cloned, possesses 127 amino acids.Z7 Hirudin variants from Hirudinaria manillensis have been described in depth.28-3' Leeches also affect coagulation by other mechanisms: the saliva of Hirudo medicinalis was found to inhibit plasma kallikrein5 and to contain destabilase, which liquefies cross-linked fibrin and is antithrombotic in rats.32 Destabilase converted the DD fragment of cross-linked fibrin into the D monomer.j3 Antistasin, a 119-amino acid two-domain protein isolated from the salivary glands of the Mexican proboscisfeeding leech Haementeria ojj$cinalis is a potent inhibitor of coagulation Factor Xa(FXa). This protein was also found to exert an antimetastatic effect in animal tumor models.3e4' An FXa inhibitor was identified in the saliva of Hirudo medicinalis. This salivary inhibitor and a novel FXa inhibitor from an H. medicinalis complementary deoxyribonucleic acid (cDNA) library were recently cloned by BioTechnology General Ltd (Rehovot, Israel).43Aj The novel FXa inhibitor was shown to be an effective antithrombotic agent in animal models of arterial and venous thrombosis.

Literature Review

Islam, M.S., Roy, B.K., Rahman, M.A., and Islam, M.N. (2013). Water Quality Assessment of Ghurdaur Pond of Rajshahi University, Bangladesh. Journal of Environmental Science and Natural Resources, 6(1): 87-92. This study conducted an assessment of water quality parameters such as pH, dissolved oxygen, turbidity, and nutrient concentrations in Ghurdaur Pond and identified potential sources of pollution.

Khan, S.A., Ahmed, M., Ahmed, S., and Ahmed, Z. (2016). Ichthyofaunal diversity of Ghurdaur Pond, Rajshahi University campus, Bangladesh. International Journal of Fisheries and Aquatic Studies, 4(2): 452-456. This study documented the diversity of fish species in Ghurdaur Pond and identified potential threats to the fish population.

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Barua, A., and Rashid, H. (2018). Limnological studies of a freshwater pond at Sylhet Agricultural University, Bangladesh. International Journal of Fisheries and Aquatic Studies, 6(6): 369-374. This study conducted a limnological analysis of a freshwater pond in Bangladesh and provided insights into the physical and chemical characteristics of the pond.

"The Diversity of Fishes: Biology, Evolution, and Ecology" (2020) by Gene Helfman, Bruce B. Collette, Douglas E. Facey, and Brian W. Bowen. This comprehensive textbook provides a detailed overview of the biology, evolution, and ecology of fishes, which are the most diverse group of vertebrates. The authors cover topics such as fish anatomy, physiology, behavior, and classification, as well as their roles in ecosystems and their conservation.

Research Methodology

Location

In Maharashtra, district Parbhani lies between 18°45’ to 20°. 10’ North latitude and 76'13’ to 77 39’ East Longitude. It is located South-East of Maharashtra State. The neighbouring districts to Parbhani are Nanded, Hingoli to East, Latur to south, Beed and Jalna to West, Buldhana 8s Washim to North.

Area and Population

The Parbhani district has an area of 6511 sq km and population 14, 91109 (census 2011), out of which there are 761937 males and 729172 females. 9 taluka in Parbhani district are Jintur, Pathri, Parbhani, Gangakhed, Puma, Palam, Selu, Sonpeth and Manwat District Parbhani, is surrounded by Buldhana and Hingoli districts to its North, Nanded and Hingoli district to the East, Latur district to the South, Beed district to the South West and Jalna district to the West.

Rivers:

Parbhani district is largely supported with network of rivers which are tributaries of Godavari, the main river in the region; Dudhana, Puma and Masoli are other important rivers. Besides these, other rivers are Karpara and Indrayni. The district as a whole has Godavari drainage system. The river Puma and Dudhana are tributaries of Godavari. The several minor streams

of the district the more important are the Wan, Bori, Borwand, Masoli, Lendi, Italasi, Galati, and Dhondi River, all these are the direct tributaries of river Godavari. Godavari River flows from West to East direction through Pathri, Sonpeth, Gangakhed, Palam and Puma talukas of Parbhani district. The length of river Godavari is about 79 kilometers in the district as it enters before in Nanded district. Dudhana River flows through Selu, Jintur, Parbhani and Puma taluka before entering into Hingoli district. On the river Puma, Yeldari Dam is constructed in the taluka Jintur.

DATA NALYSIS

The data of distribution of the leech species Asiaticobdella birmanica in the different 09 taluka in varied number of habitats reveals that, maximum 40 number of habitats were present in Parbhani taluka where the possibility of occurrence of the leech species was observed, the search possibility of occurrence of the leech was based on the experience of leech collector for the collection of this leech species since last ten years. The number of pastures around Parbhani city was high hence the number of buffalo grazing are more and the Pingalgadh spring and other small isolated ponds in the area high in this taluka as compared to other taluka places. In other taluka of the district less number of habitats was in Sonpeth taluka and occurrence of the leech species was also less in this Taluka as compared to other Taluka in the district. On an average, the % of occurrence of the leech species A. birmanica in the district Parbhani was 56.0 %; maximum was 72.5 % in Parbhani taluka and minimum was 33.3 % in Jintur and Sonpeth Taluka. Such lype of distributional data on the occurrence of the leech species A. birmanica is not available in the literature on the leech studies from this region. Kondekar and Kulkami (2005) has reported. the presence of the leech species from this region but the reports are only about the name of the habitats and not for the method of collection, % of occurrence and number of habitats they searched in the region were only around Parbhani city but not in the all 9 Taluka of the district. Kondekar and Kulkami (2005) searched on 06 habitats as compared to 263 different habits search, in this investigation; they have not reported the details of the distribution of this species in the selected study area. Nasemann and Sharma (2001) reported the occurrence of this leech species from Nepal and Bihar state of India during their study for the leech species of Nepal and North India, they have also not reported the distribution of A. birmanica in each habitat as it has been done in this investigation. The study of H. Nasemann was concentrated on the characteristics of the leech species they collected.

Table 1 Data of distribution of leech species Asiaticobdetla birmanica in Parbhani district during the study period (2009-2010)

Sr. No	Taluka places	No. of available habitats searched	presence of *A. birmanica* in then searched habitats	Absence of *A. birmanica* In the searched habitats	% of presence	% of absence
1	Parbhani	**40**	29	11	**72.5**	**27.5**
2	Gangakhed	33	16	17	48.4	51,5
3	Pathri	19	9	10	47.3	52.6
4	Palam	37	14	23	37.8	62.1
5	Purna	38	14	24	36.8	63.1
6	Manwat	19	7	12	36.8	63.1
7	Selu	20	7	13	35.0	65.0
8	Jintur	42	14	28	**33.3**	**66.6**
9	Sonpeth	**15**	5	10	**33.3**	**66.6**

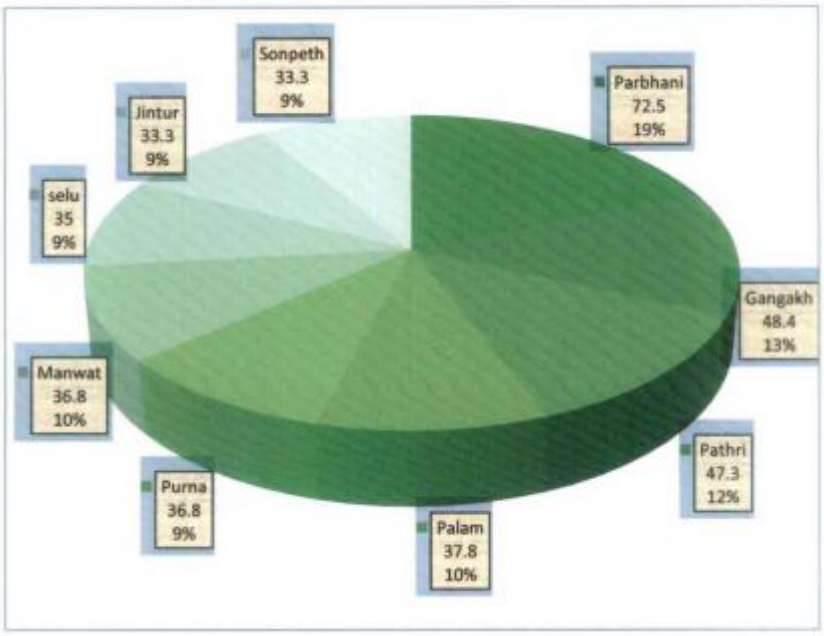

Figure 1 Percentage distribution of the leech species Asiaticobdella birmanica in nine different taluka of district Parbhani of Maharashtra

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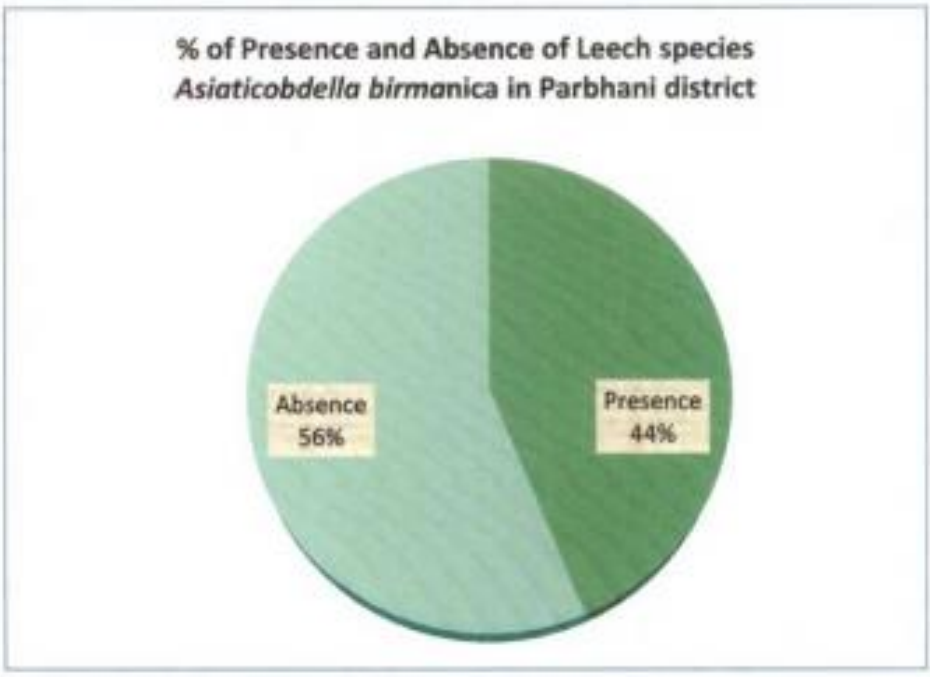

Figure 2 Percentage presence and absence of Asiaticobdella birmanica in Parbhani district of Maharashtra

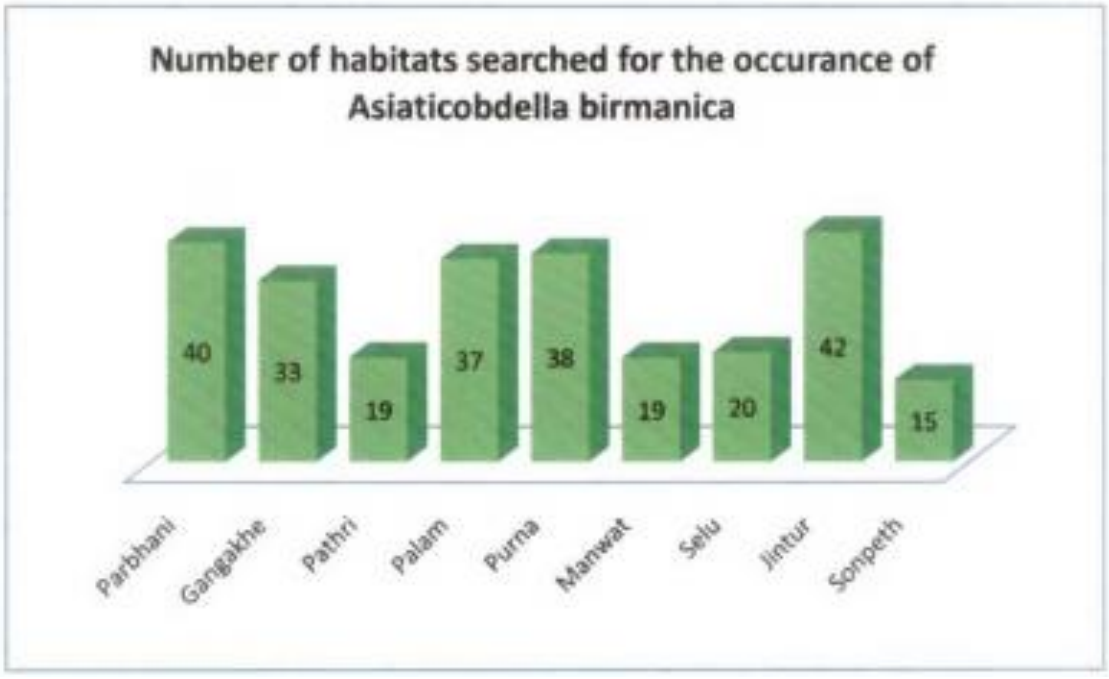

Figure 3 Total number of habitats searched for the occurrence of leech Asiaticobdella birmanica in Nine different taluka of District Parbhani, Maharashtra

Meenakshi Priya*, *University Department of Education: B.R.A. Bihar University, Muzaffarpur*

CONCLUSION

The treasure of annelid biodiversity in Marathwada represented by medicinal leeches of species PoicilobdeUa granulosa, PoicilobdeUa manilensis, Asiaticobdella birmanica, PoicilobdeUa viridis are firstly taken into consideration in this work from their ecological study point of view, especially for A. Birmanica. After going through the literature it was observed that, in such a detail the ecological behavioral and distributional study including the medicinal application of Asiaticobdella brimanica is firstly being studied in this research work. The study conducted has elaborately given an idea about the status of this important leech species. Earlier work by Kondekar and Kulkarni (2000) was very scanty, hafazardous and random. In the region studied for the occurrence of the leech species Asiaticobdella birmanica in Parbhani District, it is more prominent in the region where there are parmanent water pools and the host animal- buffalo enters in the habitat water, these kind of habitats are more in number in Parbhani Taluka. around the Pingalgad nala. Due to presence of pastures and available drinking water at easy in the isolated ponds like ITI Pond, Ambedkar nagar Pond, Sant Gadge baba nagar Pond, Pool in the stream at village Balsa near Marathwada Agriculture University, Parbhani were rich in the Asiaticobdella birmanica population. .A. birmanica was the dominant leech species found in the region, other species are PoicilobdeUa granulosa, poicilobdella viridis and P. manilensis to some extent.

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