
SHORT COMMUNICATIONS

Cannibalism in a Population of the Medicinal Leech (*Hirudo medicinalis* L.)¹

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Abstract—Medicinal leeches (*Hirudo medicinalis* L.) were maintained in large ponds in a commercial leech farm at Biebertal, Germany. The feeding of hungry adult leeches was performed on representative individuals that were placed on cloth soaked with mammalian blood obtained from a local butchery (pig, *Sus scrofa*). In a second set of experiments, cane toads (*Bufo marinus*) were used as host organisms. The leeches rapidly attached to the toads, explored the body and sucked blood. After feeding, the fully engorged leeches were placed into the pond or an aquarium. In this artificial habitat, the satiated leeches were attacked by hungry conspecifics, sucked off, and killed. This observation demonstrates that *H. medicinalis* must be classified as a cannibalistic annelid.

In the classical literature on the behavior of animals, cannibalism (intraspecific predation) has been regarded as abnormal and of little ecological relevance (Lorenz, 1966). However, more recent studies have shown that the killing and consumption of conspecifics is a behavioral trait observed throughout the kingdom Animalia, although many descriptions of this behavior are anecdotal or based on laboratory observations (Fox, 1975; Polis, 1981).

Cannibalism can occur in a variety of contexts, including oophagy, infanticide, mating, competitive interactions, and gerontophagy. In the last monograph on this subject, the taxonomic distribution of cannibalism was summarized (Elgar, Crespi, 1992). This behavior is documented in many species, from lower eukaryotes to higher primates. In addition, there is evidence to suggest that cannibalism may have been common in ancient humans (Pennisi, 2003).

The question whether or not intraspecific predation occurs in leeches (Hirudinea) is a matter of debate (Kutschera, 2003). Elgar and Crespi (1992) did not refer to any publications on the occurrence of cannibalism in the Clitellata (Oligochaeta, Hirudinea).

The medicinal leech (*Hirudo medicinalis* L.), one of the few members of the Phylum Annelida cultivated by man, feeds on mammals and other vertebrates (fish, amphibians, birds) (Herter, 1968; Mann, 1962; Sawyer, 1986; Elliott, Tullett, 1992). Here we document that in leech populations maintained in ponds cannibalism is a common behavior.

MATERIALS AND METHODS

Medicinal leeches (*Hirudo medicinalis* L.), collected in Turkey, were purchased from a commercial leech supplier (Sudak, Tr-59560 Murefte Tekirdag, Turkey). The observations and experiments were carried out at two localities: a commercial leech farm (Biebertaler Blutegelzucht, 35444 Biebertal/Gießen), where large breeding *H. medicinalis* populations (ca. 500 individuals each) are maintained in artificial ponds in glass-houses (Roth, 2002), and on representative sub-populations (8–10 individuals) that were kept in aquaria (Laboratories, Biology Department, University of Kassel). At Biebertal the aerated leech ponds (2 × 6 m; depth of the water, ca. 0.5 m) are filled with rain water and contain many aquatic plants (*Stratiotes*, *Potamogeton*, *Elodea*). In the laboratory, the aquaria (20–40 l) were equipped with pond water, hiding stones and *Elodea canadensis* strands.

In one set of experiments, adult leeches (body mass 3–4 g) were fed on fresh mammalian blood obtained from a local butchery (*Sus scrofa*). Single individuals were placed on blood-soaked cloth, observed during feeding, and thereafter placed into the pond. The behavior of the leeches was observed and documented.

In another series of observations, adult hungry leeches were added to glass aquaria in which a single host organism—cane toad (*Bufo marinus*) was present. The amphibians were obtained from stocks kept in the Department of Neurobiology at the University of Kassel. Avoidance reactions of the host (Ewert, Traud, 1979), feeding strategies of the ectoparasite and intraspecific predation were documented by photographs.

¹ The text was submitted by the authors in English.



Fig. 1. A medicinal leech (*Hirudo medicinalis*) (arrow) attached to an adult cane toad (*Bufo marinus*) in the process of feeding. Bar = 1 cm. (For Figs. 1–2).

All observations and experiments were carried out at least three times on different occasions with a new set of animals. Representative pictures are reproduced to document the most important findings of this study.

RESULTS

Over the past ten years, at the leech farm in Biebertal it was frequently observed that a satiated *H. medicinalis*, fed on mammalian blood obtained from pigs, was attacked by conspecifics. In all cases, the leech was killed as a result of loss of all the ingested blood.

We further explored this cannibalistic behavior in our *H. medicinalis* population as follows. Large hungry leeches were selected and fed on mammalian blood provided through a piece of cloth. Thereafter, one fully satiated leech was placed into a pond where numerous hungry *H. medicinalis* were kept. The well-fed leech alerted its conspecifics, which swam toward the satiated *H. medicinalis*. We suggest that the hungry conspecifics are attracted by traces of blood that are attached to the body of the satiated leech. Upon contact with the body, 5–8 hungry leeches would bite and suck the blood from the victim within less than one hour. In all trials performed the satiated leech was killed by its attackers.

It has been reported that in nature the medicinal leech feeds not exclusively on mammals but also on amphibians (Wilkin, 1989). In order to elucidate whether cannibalism also occurs after the consumption of blood from non-mammalian hosts the following experiment was carried out. Large individuals of *H. medicinalis* were fed on a cane toad (Fig. 1). Immediately after the leech had dropped from the toad the satiated individual was placed into an aquarium where 3–5 hungry conspecifics were cultivated. The alerted leeches explored the body of the well-fed *H. medicinalis* and, within 24 h, sucked the blood from the conspecific (Figs. 2a, 2b). The attack was not as rapid as in the pond trials reported above, but finally the body of the dead leech was a limp, empty piece of skin (Fig. 2c). Hence, in our population, leeches fed on mammalian and amphibian blood are regularly killed by hungry conspecifics.

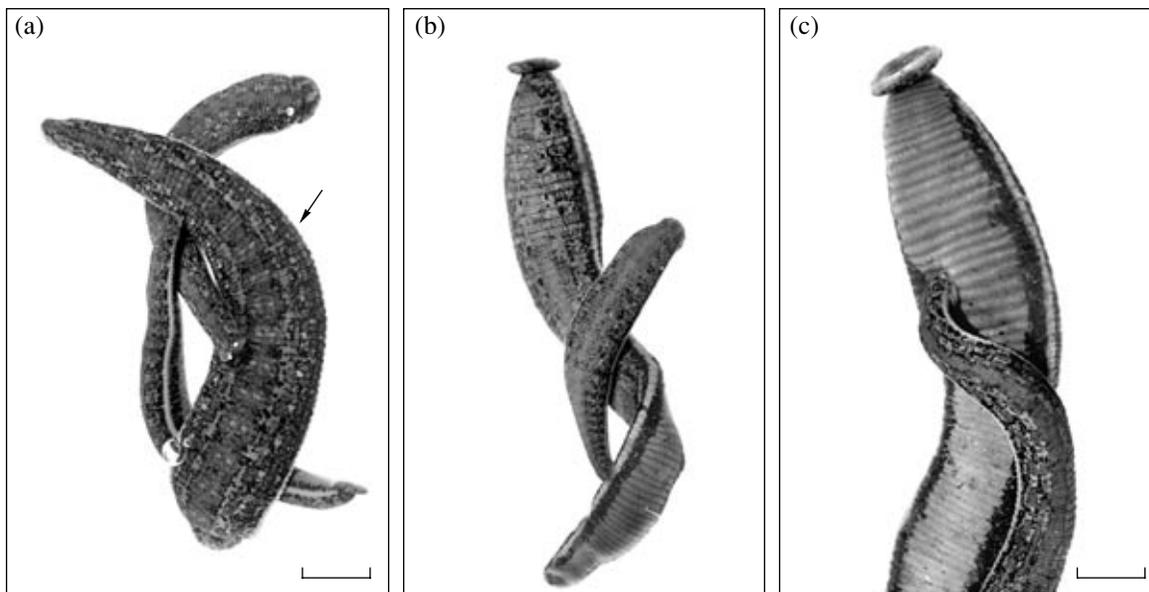


Fig. 2. Cannibalism in a population of *Hirudo medicinalis*. A large, satiated leech (arrow) was placed into an aquarium where hungry conspecifics of medium size were present (a). Hungry leeches attacked the satiated *H. medicinalis* and sucked the ingested blood from its body (b). After 24 h the host was emptied and a limp leech skin was left over (c).

DISCUSSION

A unexpected finding of this study was the observation that the *H. medicinalis* population under investigation was cannibalistic. Sawyer (1986) briefly mentioned intraspecific predation in the medicinal leech, but no data were provided. Anecdotal evidence indicates that some members of the Hirudinea, such as *Haemopsis sanguisuga* or *Erpobedella octoculata*, are cannibalistic annelids (Elliot, Mann, 1979). However, more recent studies into the life histories of these species revealed no intraspecific predation (Kutschera, Wirtz, 2001; Kutschera, 2003), with the exception of the well-known feeding on foreign (fresh) cocoons in populations of *E. octoculata* (Kutschera, 1983).

In the most recent monograph on cannibalism among diverse animal taxa, the phylum Annelida is not mentioned (Elgar, Crespi, 1992). Our results demonstrate that at least one well-known species, *H. medicinalis*, must be added to the list of cannibalistic taxa.

The relationships between cannibal and victim can be classified as follows: adults (A) cannibalizing adults (AA), juveniles (AJ) or eggs (AE); juveniles cannibalizing juveniles (JJ) or eggs (JE) (Elgar, Crespi, 1992). In the present study only the case AA was observed, i.e., adult medicinal leeches attacked, killed, and consumed the blood from conspecifics of similar size (Figs. 2a–2c). The question whether or not the other versions of cannibalism listed above occur in populations of *H. medicinalis* is unanswered.

According to Elgar and Crespi (1992) the most ubiquitous ecological factor that may cause cannibalism is low availability of alternative food at high density of population. It is obvious that in our observations and experiments with *H. medicinalis* this factor is of central importance. Some authors have suggested that cannibalism is an artifact of laboratory conditions (Fox, 1975). In our studies the satiated leech did not have a chance to escape from hungry individuals. The following questions are open: Is it possible that satiated leeches hide in the wild? Could they show other behavioral defence reactions that were not possible under the laboratory conditions? Is it common under natural conditions to find many hungry leeches together with one satiated leech? Or would they all have had a good chance to feed on the same vertebrate? The answers to these questions will determine the importance of cannibalism in natural populations of *Hirudo medicinalis*.

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