

The *Hirudo medicinalis* species complex

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Abstract Recently, Hildebrandt and Lemke (Naturwissenschaften 98:995–1008, 2011) argued that the taxonomic status of the three European medicinal leeches, *Hirudo medicinalis* Linnaeus 1758, *Hirudo verbana* Carena 1820, and *Hirudo orientalis* Utevsky and Trontelj (Parasitol Res 98:61–66, 2005) is “questionable” since “all three species interbreed in the laboratory”. This statement is in conflict with data published by Elliott and Kutschera (Freshwater Reviews 4:21–41, 2011), indicating that these leeches, which are reciprocally copulating hermaphrodites, represent reproductively isolated biospecies. Here, I summarize evidence indicating that these three European taxa, plus the North African “dragon leech” (*Hirudo troctina* Johnson 1816), must be interpreted as a complex of closely related species, and that the economically most important taxon *H. verbana* is polymorphic.

Keywords *Hirudo medicinalis* · Species complex · Class Hirudinea · Leeches · *Hirudo verbana* · Biospecies

Fifty years ago, Mann (1962) gave a “fairly thorough description of *Hirudo medicinalis*” as a representative member of the class Hirudinea and remarked that the colour pattern of the medicinal leech “is very variable”, but “in Britain usually consists of a greenish background with a pair of longitudinal red stripes and a pattern of irregular black markings nearer the lateral margins”, with a ventral surface that is “usually black with white and grey markings”. This description applies to the

type species of the genus *H. medicinalis* (Fig. 1 a), the only blood-sucking member of the Gnathobdellidae (jawed leeches) found in the wild in England and Wales (Elliott and Kutschera 2011).

In his monograph on the biology and behaviour of leeches, Sawyer (1986) adopted Mann’s (1962) view that *H. medicinalis* is a “polymorphic taxon” and summarized different colour variants of these amphibious annelids under the species name “*H. medicinalis* Linnaeus 1758 (= *Hirudo officinalis* Savigny 1822)”. Based on the investigation of *Hirudo* specimens with an unpigmented (grey) ventral side collected in a small pond in Hungary, Neesemann and Neubert (1999) proposed that these European leeches must be assigned to the taxon *Hirudo verbana* Carena 1820 (syn. *H. officinalis* Savigny 1822), which they distinguished from Linnaeus’ type species. Five years later, *H. medicinalis* and *H. verbana* (Fig. 1b) were recognized as two separate biospecies that do not interbreed when groups of both types of leeches were cultivated together in freshwater aquaterraria (Kutschera 2004). This conclusion was corroborated by careful descriptions of the markings of both species and the determination of the DNA sequences of mitochondrial genes (Kutschera 2006, 2007a, b; Utevsky and Trontelj 2005; Siddall et al. 2007).

Three years ago, Petrauskiene et al. (2009) published a report on mating experiments, using three medicinal leeches, *H. medicinalis*, *H. verbana*, and *Hirudo orientalis*. Under laboratory conditions, pairs of mature *H. medicinalis* and *H. verbana*, which had been kept single for 1 month and thereafter been given the opportunity to copulate for a subsequent 4 weeks, were able to mate and to produce cocoons. However, the viability of the young generated by these forced laboratory crosses was drastically reduced. For instance, over a post-hatching period of 8 months, 100 % of the few descendents obtained from female *H. medicinalis* × male *H. verbana* crosses died, i.e. the mean number of adult

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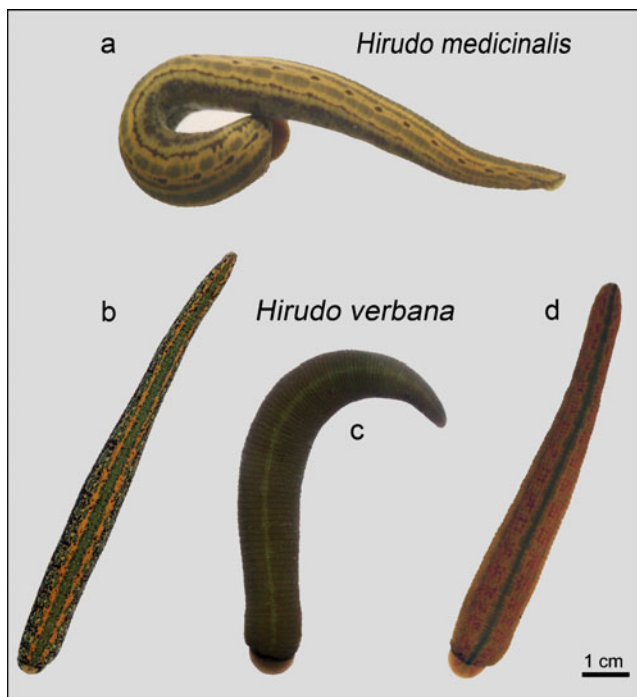


Fig. 1 Adult living specimen of the European medicinal leech *Hirudo medicinalis* L. 1758 (a). The large posterior sucker is used in crawling, whereas the smaller sucker at the head encloses the mouth, which has three jaws. Note the dark-pigmented ventral side of the annelid. Specimens of the Mediterranean medicinal leech *Hirudo verbana* Carena 1820 in dorsal views. Coloured variant *H. verbana* “var. *verbana*” (n nominate species) (b), dark pigmented form *H. verbana* “var. *nigra*” (c), and largely unpigmented variant *H. verbana* “var. *monostrigata*” (d). Although these three leeches look like different species, they all belong to the same polymorphic taxon

offspring was zero. In the control (female *H. medicinalis* × male *H. medicinalis*), about ten juveniles per leech survived to adulthood. In the other interspecies crosses (female *H. verbana* × male *H. orientalis* and female *H. orientalis* × male *H. medicinalis*), mortality of the hatched juveniles was likewise much higher than in the intraspecific controls.

Since all three “leech types” differ with respect to their chromosome numbers, and evidence for hybridization in nature is lacking (Petrauskienė et al. 2009), it follows that, in the wild, *H. medicinalis*, *H. verbana*, and *H. orientalis* represent reproductively isolated species that differ morphologically, as well as in their geographical distributions.

The species *H. verbana* (Fig. 1b) is characterized by a variety of colour variants. In large populations, dark-pigmented individuals were found (Fig. 1c) and described as *H. verbana* “var. *nigra*” (Kutschera 2007b). More recently, individuals that lack the species-specific dorsal pigmentation, and are characterized by one median dark line, were discovered and are described here as *H. verbana* “var. *monostrigata*” (Fig. 1d). The DNA sequence of the mitochondrial gene cytochrome *c* oxidase subunit I (CO-I) for the coloured nominate species *H. verbana* “var. *verbana*” (Fig. 1b) was determined

(Kutschera et al. 2007) and deposited in the GenBank database (no. EF125043). A DNA analysis revealed that the ca. 600-bp CO-I sequences of the colour variants shown in Fig. 1c, d are identical with GenBank acc. no. EF125043 (unpublished results). Hence, *H. verbana*, the leech used by Hildebrandt and Lemke (2011) for histological studies, is a polymorphic species. It should be emphasised that the “colour variants” described here (Fig. 1c, d) are of no taxonomic significance, i.e. the species name of this variable taxon is *H. verbana*.

The data summarized here show that, in accordance with Utevsky and Trontelj (2005), the following four well-defined taxa form a species complex: the European medicinal leech (m. l.) *H. medicinalis*, the Mediterranean m. l. *H. verbana*, the Caucasian m. l. *H. orientalis*, and the African m. l. *H. troctina*. Finally, it should be noted that the Asian m. l. *Hirudinaria mallinensis* Lesson 1878 and the North American m. l. *Macrobdeella decora* Say 1824 are also of considerable economic importance (Elliott and Kutschera 2011). However, these annelids represent more distantly related evolutionary lineages that are no members of the *H. medicinalis* species complex.

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