



# Article

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## Three new species of semi-aquatic freshwater earthworms of the genus *Glyphidrilus* Horst, 1889 from Malaysia (Clitellata: Oligochaeta: Almidae)

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### Abstract

Three new species of semi-aquatic freshwater earthworms of the genus *Glyphidrilus* Horst, 1889 are described from Malaysia. *Glyphidrilus bisegmentus* **sp. n.** was collected from Air Banun Pandig, Perak, *Glyphidrilus kotatinggi* **sp. n.** from Kota Tinggi waterfall, Johor, and *Glyphidrilus peninsularis* **sp. n.** from Sungei Bantang, Johor. For comparison, type and non-type material of five morphologically similar species was reinvestigated. The descriptions of the new species include illustrations of the external and internal morphological characteristics.

**Key words:** Taxonomy, morphology, wing organ, Malay Peninsula, Annelida

### Introduction

Malaysia is located on South-east Asia's southernmost peninsula and offshore islands, and known as Peninsula Malaysia. It has land borders with Thailand in West Malaysia, and Indonesia and Brunei in East Malaysia. Malaysia is the only country with territory on both the Asian mainland and the Malay Archipelago. The two parts of Malaysia, separated from each other by the South China Sea, share a largely similar landscape in that both peninsula and East Malaysia feature coastal plains rising to hills and mountains. Malaysia is a megadiverse country with a high number of species and high levels of endemism. It is estimated to contain 20% of the world's animal species (Alexander 2006). High levels of endemism are found in the diverse forests of Borneo's mountains, as species are isolated from each other by lowland forest. During the last decades, the earthworms of Malaysia have been reviewed and 92 nominal species were reported (Blakemore 2006). Most of these earthworm species are in the family Megascolecidae. In the family Almidae, in contrast, only four species of semi-aquatic freshwater earthworms of the genus *Glyphidrilus* Horst, 1889 were recorded: *G. kukenthalii* Michaelsen, 1896 from Baram River, Sarawak, *G. malayanus* Michaelsen, 1902 from Lubok Paku, Pahang River, *G. horsti* Stephenson, 1930 from Pulau Berhala, and *G. gatesi* Shen & Yeo, 2005 from swamp forest, Sedili River, Johor (Horst 1889; Michaelsen 1896, 1902; Stephenson 1930; Shen & Yeo 2005). Our extensive surveys of *Glyphidrilus* suggested that it is highly threatened by human transformation of riparian habitats, including forests. *Glyphidrilus* is one of the genus in the family Almidae, with only 21 nominal species described (Jamieson 1968; Chen & Xu 1977; Shen & Yeo 2005; Chanabun *et al.* 2011). The localities are only in Asia and Africa. The animals are probably present in appropriate aquatic margin habitats throughout most of Burma, India, Ceylon, and the Malay Peninsula (Beddard 1895; Stephenson 1923; Brinkhurst & Jamieson 1971; Gates 1972). The aim of the present study is to report additional species diversity of the genus *Glyphidrilus* from Peninsula Malaysia, which we surveyed in May 2011.