

# Description of a New Species of Branchiobdellida (Annelida: Clitellata) and Comparison with Other *Cirrodrilus* Species in Northern Honshu, Japan

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A new species of ectosymbiotic branchiobdellidan, *Cirrodrilus iwakiensis* sp. nov., is described from *Cambaroides japonicus* (de Haan, 1849), the endemic freshwater Japanese crayfish, collected in Aomori Prefecture, northern Honshu Island, Japan. The anatomical features used to identify *C. iwakiensis* are compared with those of its closest congener, *C. nipponicus* (Yamaguchi, 1932), as well as *C. aomorenensis* (Yamaguchi, 1934) and *C. tsugarensis* Gelder and Ohtaka, 2000 distributed in the same region.

**Key Words:** Annelida, Clitellata, branchiobdellidan, taxonomy, ectosymbiont, crayfish, Japan.

## Introduction

In East Asia, Branchiobdellida (Annelida: Clitellata) have been reported as ectosymbionts on freshwater crayfish and shrimp in China, southeastern Russia, the Korean Peninsula, and Japan (Ohtaka *et al.* 2012). Although *Cirrodrilus* is found across northern East Asia, there is no evidence to suggest any endemic species has been translocated between the Asian mainland and Japan. Japan's only indigenous crayfish, *Cambaroides japonicus* (de Haan, 1849), is distributed across Hokkaido and northern Honshu Islands and has been reported to carry 11 species of *Cirrodrilus* (Yamaguchi 1934; Gelder and Ohtaka 2000, 2002; Ohtaka 2010). Additional species reported from museum collections of *Cambaroides japonicus* include *Cirrodrilus japonicus* (Pierantoni, 1912) (*q.v.*), which Yamaguchi (1935) could not authenticate and doubted the species validity, and *Branchiobdella digitata* Pierantoni, 1906 (*q.v.*), which Timm (1991) regarded as *incertae sedis*. Each island has its own *Cirrodrilus* species, with nine in Hokkaido and *Cirrodrilus aomorenensis* (Yamaguchi, 1934) and *C. tsugarensis* Gelder and Ohtaka, 2000 in northern Honshu. Only one translocation is known to have occurred between these islands, when Japanese crayfish were introduced from Hokkaido to Akita Prefecture, northern Honshu. These hosts carried *C. inukaii* (Yamaguchi, 1934) and *C. uchidai* (Yamaguchi, 1932) and soon both crayfish and branchiobdellidans established viable populations which have remained restricted to the translocated area (Gelder and Ohtaka 2000).

During a distributional study of *C. japonicus* in Aomori Prefecture from 1997 to 1999, the senior author (AO) and his colleagues found two undescribed species of branchiob-

dellidan. *Cirrodrilus tsugarensis* was described soon after the survey had finished, but specimens of the second species appeared to lack reproductive organs in segments 5 and 6. Without details of the male anatomy, their generic affiliation remained indeterminate and the species description could not be completed. After 17 years of additional collecting, specimens with recognizable genital organs were finally obtained. This has resulted in the completion of the new species description presented here and also permitted an anatomical comparison with other Japanese species.

## Materials and Methods

Live *Cambaroides japonicus* were collected from 1997 to 2014 at 21 sites on 30 occasions in Aomori Prefecture (Table 1) and taken to Hirosaki University for examination. Branchiobdellidans were removed from their hosts and preserved in 10% formalin or 70% ethanol solutions. Specimens were dehydrated in a graded series of ethanol and water solutions, and either prepared for mounting whole (cleared in methyl salicylate, infiltrated with Canada balsam, and slide-mounted) or for wax sectioning (8 µm thick, haematoxylin-eosin-stained and slide-mounted), then examined on a compound microscope using bright-field and differential interference contrast (DIC) illumination. Mounted specimens have been deposited in the Zoological Institute, Faculty of Science, Hokkaido University (ZIHU), Sapporo, Japan; the National Museum of Natural History, Smithsonian Institution (USNM), Suitland, MD, USA, and the New Brunswick Museum (NBM), Saint John, NB, Canada. Anatomical terminology used in this paper follows that described in Gelder and Williams (2015), where “ectal” means