

## First Record of Blood-Feeding Terrestrial Leech, *Haemadipsa rjukjuana* Oka, 1910 (Hirudinida: Arhynchobdellida: Haemadipsidae) in Korea

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## 국내 미기록인 흡혈성 산거머리 *Haemadipsa rjukjuana* Oka, 1910 보고

서홍열 · 은 예 · 박태서 · 김기경 · 원소현<sup>1</sup> · 김백준<sup>1</sup> · 김혜원<sup>1</sup> · 채준석<sup>1</sup> · Takafumi Nakano<sup>2,\*</sup>  
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### ABSTRACT

The terrestrial leeches from the peripheral island of the Korean Peninsula were identified as *Haemadipsa rjukjuana* Oka, 1910. The arhynchobdellid family Haemadipsidae and *H. rjukjuana* are newly added into the Korean leech fauna. This species is blood-feeding leech that attacks birds and medium or large sized mammals primarily, including human. The sequence of mitochondrial cytochrome c subunit I (COI), and the additional biology for this species are presented. This is the first study of terrestrial blood-feeding leeches in Korea.

**Key words :** Hirudinida, Haemadipsidae, Terrestrial leech, *Haemadipsa rjukjuana*, First record, Korea

### INTRODUCTION

Leeches are carnivorous animals of clitellates with a constant number of somite and two characteristic suckers for locomotion (Sawyer, 1986). With a great diversity of morphology, habitats and diets, there are about 680 nominal species in the world (Sket and Trontelj, 2008) and 17 species in Korea (KSSZ, 1997; Nakano and Seo, 2012).

The majority of leeches inhabit in freshwater environments, but also reside in terrestrial environments. They are generally classified into two orders: Rhynchobdellida (leeches with a proboscis) and Arhynchobdellida (without a proboscis). In arhynchobdellid leeches, the suborder Hirudiniformes is known as a group mainly consisted of jawed leeches. Jawed leeches are known for blood-feeding habits and can be found in terrestrial

and aquatic environments. Blanchard (1896) established Haemadipsidae to distinguish blood-feeding terrestrial leeches from their aquatic sanguivorous and carnivorous counterparts belonging to Hirudinidae (Borda *et al.*, 2008). At present, blood-feeding terrestrial leeches are classified into two families, Haemadipsidae and Xerobdellidae (Sket and Trontelj, 2008) based on the phylogenetic analyses (Trontelj *et al.*, 1999; Borda and Siddall, 2004; Kutschera *et al.*, 2007; Borda *et al.*, 2008).

Haemadipsid species are truly terrestrial haematophagous leeches with high biodiversity in tropical regions with high humidity, such as the damp jungles and forests of South Asia, Southeast Asia and Australia. The trignathous haemadipsid genus *Haemadipsa* is mostly found in Southeast Asia (Ngamprasertwong *et al.*, 2007). The Japanese Archipelago has been considered as the northern distribution limit of the genus *Haemadipsa* (Borda and Siddall, 2011). Two species are known from the archipelago: *Haemadipsa japonica* Whitman, 1886 and *Haemadipsa rjukjuana* Oka, 1910. *Haemadipsa japonica* was

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described based on the specimens collected from Honshu island, Japan (Whitman, 1886). At present, this species is known from Japan (Honshu, Kyushu, and Yakushima islands) as well as the continental China (Yang, 1996; Tani and Ishikawa, 2005). Another species *H. rjukjuana* was described based on the leeches from Ishigakijima island, Ryukyu islands, Japan (Oka, 1910), and is distributed in the Ryukyu Islands Taiwan (Itoh, 2003; Lai *et al.*, 2011). In Japan, the number and areas of habitats of land leech have been rapidly expanded since 1970s and many leeches attack forest workers, hikers and residents during May to September (Tani and Ishikawa, 2005). As a result of climate change, same situation can be reproduced in Korean Peninsula. However, there was neither record of *Haemadipsa* leeches nor study in regarding the taxonomy and biology of blood-feeding terrestrial leeches in Korea. We firstly report the occurrence of blood-feeding land leeches, their behavior on human being and distribution in Korea. Also, the sequence of cytochrome c subunit I (COI) in mitochondria obtained from the Korean specimen is herein presented.

## MATERIALS AND METHODS

Leeches were newly collected from Gageodo island, Korea (Fig. 1) along a mountain trail. Altitudes and coordinates for localities were obtained using a Garmin eTrex® GPS unit. For



Fig. 1. Collection site in Mt. Doksilsan, Gageodo island (red circle).

DNA extraction, botryoidal tissue was taken from the posterior part of the body around the caudal sucker of one specimen, which had been fixed and preserved in 99% ethanol. DNA barcode region was analyzed by conventional PCR and sequencer ABI 3730 XL targeting cytochrome c subunit I (COI). All of the other specimens were preserved in 70% ethanol. Four measurements were taken: body length from the anterior margin of the oral sucker to the posterior margin of the caudal sucker, maximum body width, length and width of the ventral surface of the caudal sucker. Examination, dissection, and drawings of the specimens were accomplished under a stereoscopic microscope equipped with a drawing tube (Leica M125). Specimens used in this study have been deposited in National Institute of Biological Institute (NIBR) and the Zoological Collection of Kyoto University (KUZ).

## DESCRIPTION AND BIOLOGY

Taxonomic accounts

Class Clitellata

Subclass Hirudinida

Order Arhynchobdellida

Suborder Hirudiniformes

Family Haemadipsidae 산거머리과 (신칭)

Genus *Haemadipsa* Tennent, 1859 산거머리속 (신칭)

Species *Haemadipsa rjukjuana* Oka, 1910

독실산거머리 (신칭)

**Description.** Body length 14.2-35.4 mm, Body width 2.2-4.3 mm (Fig. 2). Caudal sucker ventral, ellipsoid or circle, its length 2.5-5.0 mm, its width 2.5-4.2 mm, with 71 or 72 friction rays on its ventral surface; prehensile lobe present (Fig. 3B). Somites I completely merged with prostomium (Fig. 3A). Somites II-IV uniannulate (Fig. 3A). Somite V biannulate, (a1 + a2), a3 (Fig. 3A). Somite VI triannulate, a1, a2, a3 dorsally (Fig. 3A); frequently ventrally biannulate, a1, (a2+a3). Somite VII triannulate. Somite VIII quadrannulate, a1, a2, b5, b6. Somites IX-XXII quinquannulate, b1, b2, a3, b5, b6 (Fig. 3C). Somite XXIII quadrannulate. Somite XXIV triannulate. Somite XXV biannulate. Somites XXVI and XXVII uniannulate. Anus behind XXVII with no post-anal annulus. Respiratory auricles in one pair, trilobed, formed along with both lateral margin of XXV to XXVI; middle lobe (second annulus of XXV) smaller than other two lobes (first annulus of XXV, and XXVI, respectively). Eyes in five pairs, first pair on II, second pair on III,



Fig. 2. *Haemadipsa rjukjuana* Oka, 1910, Korea, KUZZ217; dorsal view (A), and ventral view (B).

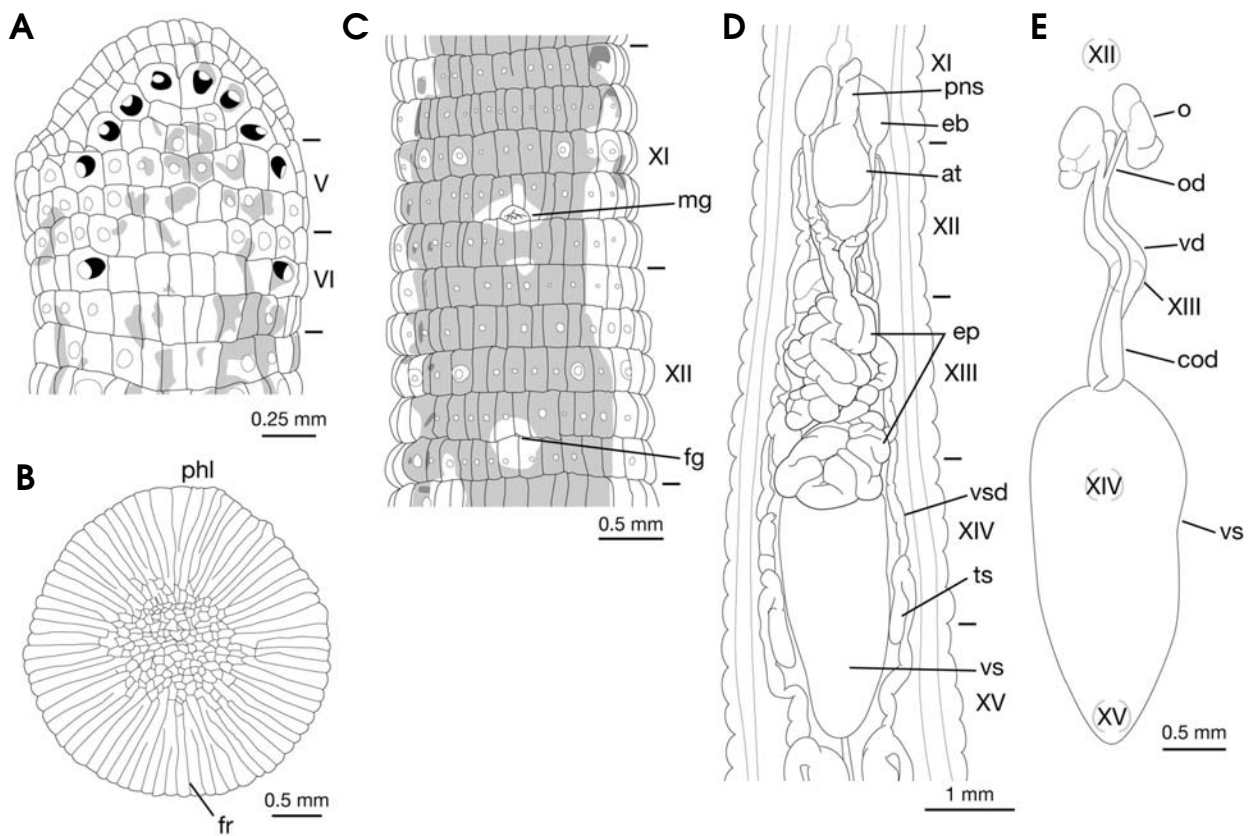


Fig. 3. *Haemadipsa rjukjuana* Oka, 1910, KUZZ217 (A, C-E), Z219 (B); dorsal view of somites I-VI (A), ventral view of caudal sucker (B), ventral view of somites XI and XII (C), dorsal view of reproductive system (D), and dorsal view of female reproductive system showing position of ganglia XII-XV (E). Abbreviations: at, atrium; cod, common oviduct; eb, ejaculatory bulb; ep, epididymis; fg, female gonopore; fr, friction ray; mg, male gonopore; o, ovisac; od, oviduct; phl, prehensile lobe; pns, penis sheath; ts, testis; vd, vaginal duct; vs, vaginal sac; vsd, vas deferens.

third pair IV, fourth pair on V (a1+a2), fifth pair on VI a2 (Fig. 3A). Nephridiopores in 16 pairs in VIII-XXIII, situated laterally in VIII a1/a2, and b2/a2 of each somite of IX-XXIII. Tri-

gnathous, monostichodont jaws. Pharynx reaching to VIII/IX. Crop reaching to XX a2; crop ceca in eleven pairs, first-tenth pairs globular, first pair in IX b6 and X b1, second pair in X

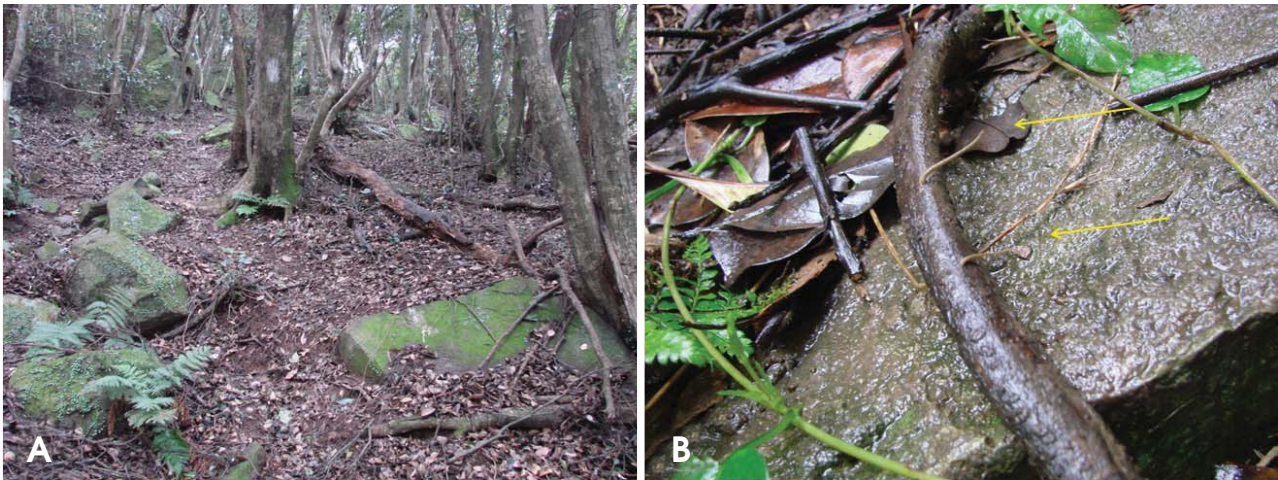
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b6 and XI b1, third pair in XI b5 and b6, fourth pair in XII b5 and b6, fifth pair in XIII a2 and b5, sixth pair in XIV b2-b5, seventh pair in XV b2-b5, eighth pair in XVI b2-b5, ninth pair



**Fig. 4.** *Haemadipsa rjukjuana* Oka, 1910, on rock.

in XVII b2-b6, tenth pair in XVIII b2-b6, last pair, post-crop caecum, tubular, elongated, in XIX a2-XXIII/XXIV. Intestine tubular, acecate reaching to XXIII b2/a2. Rectum tubular, thin-walled. Male gonopore in XI b5/b6 (Fig. 3C). Female gonopore in XII b5/b6 (Fig. 3C). Gonopores separated by five annuli (Fig. 3C). Testisacs in ten pairs, globular, thin-walled, situated in XIII/XIV-XXII/XXIII (Fig. 3D). Vasa deferentia reaching to middle of XII, then arching caudad to join epididymides (Fig. 3D). Epididymides folded, right epididymis in XII to XIV a1, left epididymis in XII to XIII b5/b6 (Fig. 3D). Ejaculatory bulbs ellipsoid in XI a2-b6 (Fig. 3D). Ejaculatory ducts thin-walled, joining with atrium in posterior part of XI. Atrium pyriform, in XI b5-XII a2 (Fig. 3D). Penis and Penis sheath present (Fig. 3D). One pair of ovisacs globular occupying approximate two annuli, situated in middle of XII to anterior of XIII (Fig. 3E). Oviducts thin-walled, right oviduct crossing ventrally beneath nerve cord, both oviducts converging into common oviduct in XII/XIII to XIII b2 (Fig. 3E). Common oviduct reaching caudad, joining with vaginal sac in XIII/XIV to XIV b2 (Fig. 3E).



**Fig. 5.** Habitat environment (A) and *Haemadipsa rjukjuana* Oka, 1910, waiting for prey (B).



**Fig. 6.** Blood feeding in *Haemadipsa rjukjuana* Oka, 1910; beginning of feeding (A), after 30 minutes of feeding (B), and the prolongation of bleeding after the stop of feeding (C).

Vaginal sac developed, situated in XIII/XIV-XIV b2 to XVa2/b5-XVII b2/a2 (Fig. 3E). Vaginal duct tubular, in XII b6 to XIII/XIV-XIV b2 (Fig. 3E).

**Material examined.** 14 specimens collected from Mt. Dok-silsan, Gageodo island, Sinan-gun, Jeollanam-do, Korea (34° 04'54"N, 125° 06'22"E, alt. 473 m), by Hong-yul Seo: 10 specimens, NIBR IV0000282429-37, KUZ Z216, Z217, on 7 July, 2011; 4 specimens, NIBR IV0000282438, KUZ Z218-Z220, on 24 August, 2011. KUZ Z217, Z219, dissected.

**Coloration.** In life, dorsal and lateral surface yellowish brown, with irregularly scattered dark brown pattern, ventral surface brownish black (Fig. 4). In preservative, color faded, but blown or black parts of the body surface discernible (Fig. 2).

**Habitats.** Discovered widely in mountain trails of Gageodo island (Fig. 1). Commonly in the bottom of moist forests. Attaching on the litters, grasses and bushes on the ground (Fig. 5A).

**Behavior.** Blood-feeding. Feeding time about 30 minutes (Fig. 6). Move fast and actively. Attach on grasses, rocks or litters by caudal suckers, stretch heads to the air and wait for prey. Detect the presence of preys and orient towards preys by sensing the vibration and heating. Inchworm crawling as the primary movement most of time (Fig. 5B).

**COI sequence of *Haemadipsa rjukjuana* :** Total 649 base (KC524508) COI showing 94.6% (614/649 bp) similarity to the reference sequence of the *H. rjukjuana* L00115A (from Taiwan, HQ322343).

actttatattttttggccttgatcatctatagtagtactggaataagtactatcattcga  
attgaactatctcaaccaggcactactagtgatgataaatctataataacttttagtact  
gctcatggccttattataattttttgtagtaatacctatttaattggtgggttggaaattga  
ctaattcaccataaattggctcccctgatagcattcccagactaaataactaagattt  
tgattactactcctcaatagttatattattatctctctatagtagaggggtgttggga  
acagggtgaacaatctaccaccactgcagataataggtcactcagggttattctgtag  
atatagctattttctcattacatttagctggagcctcatcaatttaggtctttaaatttattac  
tactattttaataacgatggcctggaataagattagatcgaattcctttattttgtctg  
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aactgaccgtaataataacttctttctttgaccctattggtgggtggatcctattctcttc  
aac

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