NOTE

Anadeninus parvipenis (Pulmonata: Anadenidae), a Newly Recorded Species from Taiwan

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ABSTRACT: *Anadeninus parvipenis* Wiktor, Chen *et* Wu (Anadenidae), an endangered species in China Species Red List, is recorded for the first time in Lalashan Forest Reserve, Taiwan. The spermatheca of this species is elongated, penis is small and epiphallus is long and thick. In this study, a description of this newly recorded species is given and the colored photographs of specimens, SEM images of radula and jaw and dissection of genitalia are also provided for aid of identification of this species.

KEY WORD: Anadenidae, *Anadeninus parvipenis*, genitalia, New record, Taiwan.

INTRODUCTION

Anadenidae is a taxonomic family of air-breathing land slugs in the superfamily Arionidea. Wiktor et al. (2000) raised the Anadeninae to a family rank and reported seven species of *Anadenus* from China. Kuzminykh and Schileyko (2005) reassigned seven China *Anadenus* species to the genus *Anadeninus*. Currently, the Family Anadenidae consists of two genera (*Anadenus* and *Anadeninus*) and 20 nominal species that distribute from northern India to Kashmir and Pakistan, Nepal and southern China (Gupta and Oli, 1998; Kuzminykh and Schileyko, 2005).

Recently, in our faunal survey of nature reserve, we collected *Anadeninus* species in Lalashan Forest Reserve (24°42'37.68" N, 121°26'15.78" E). In the past investigation, the species of Anadenidae had never been reported from Taiwan. By making a detail comparison of external characters, genitalia, jaw and radula, this species was identified as *Anadeninus parvipenis* Wiktor, Chen *et* Wu, an endangered species in China Species Red List (Wang and Xie, 2005).

In this study, taxonomic external features with color photographs, SEM images of radula and jaw, and the result of genitalia dissection were studied and provided.

MATERIALS AND METHODS

Seventeen specimens were collected from the Lalashan Forest Reserve. Specimens were drowned in water overnight and then fixed and preserved in 70% ethanol. The slugs were identified mainly based on their external features and genital morphology. The size of preserved specimens was measured and external characters were photographed in dorsal, ventral and right side of views with a digital camera (Canon 20D). Dissections were done under a Leica Wild MZ12.5 binocular dissecting microscope (Leica Microscopy and Scientific Instruments Group, Heerburg, Switzerland). Drawings were made with the aid of a camera lucida attached to the microscope. Both the jaw and radula were separated, cleaned, observed and photographed with a Hitachi scanning microscope (model 3000N, Tokyo, Japan).

TAXONOMIC TREATMENT

Family **Anadenidae** Pilsbry, 1948
Genus ***Anadeninus*** Simroth, 1912

Anadeninus parvipenis Wiktor, Chen et Wu, 2000.
Figs. 1-5

Specimens: *NMNS-6656-001*: National Science Museum, Taichung, Taiwan, 2 specimens; *ESRI-MOL-10-382*: Taiwan Endemic Species Research Institute, 15 specimens.

Locality: Lalashan Forest Reserve, Taoyaun County, Taiwan (24° 42' 37.68" N, 121° 26' 15.78" E), 17 specimens.

Body length (specimens preserved in 70% ethanol) 29 mm; mantle length 14 mm; sole width 13 mm. Body coloration creamy or yellowish-brown (Fig. 1). Mantle slightly darker, sides with indistinct spots connects into barely visible streaks. Sides generally darker than dorsum. Sides separated from dorsum by two dark

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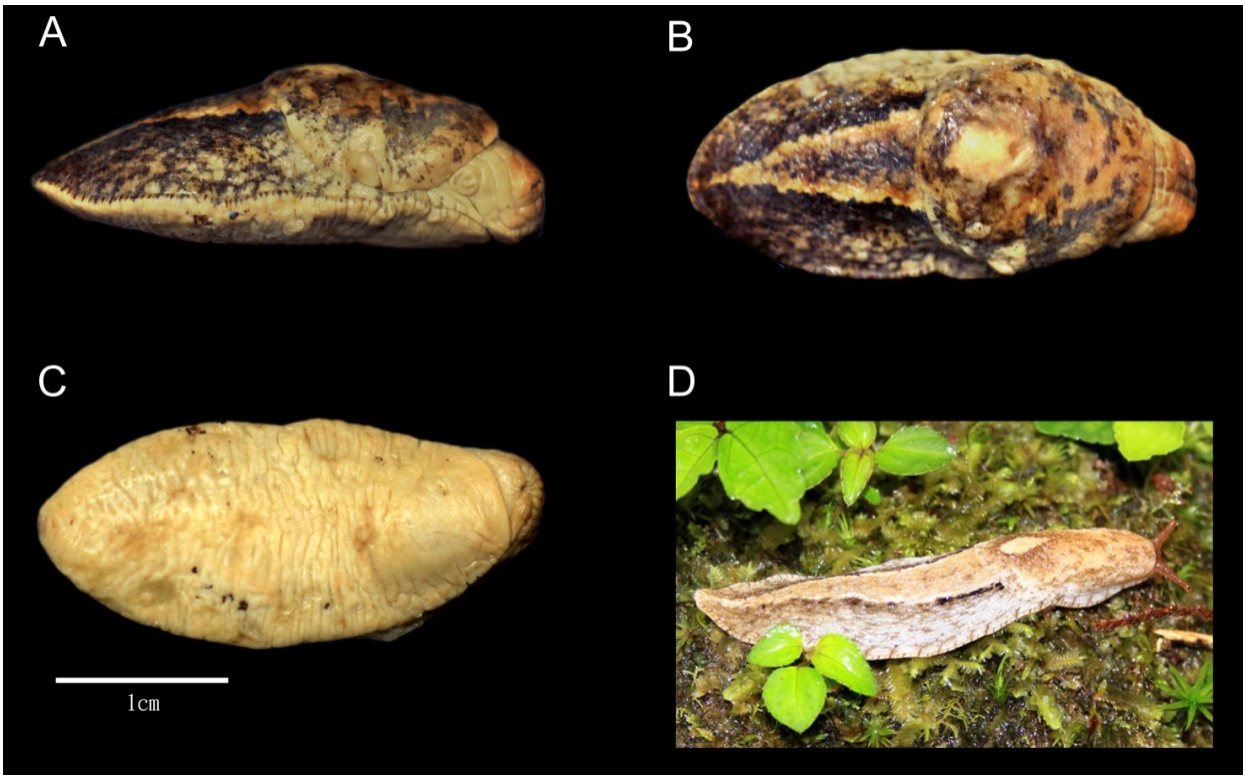


Fig. 1. *Anadeninus parvipenis*. Scale bar = 1 cm. A: Right-side. B: Dorsal view. C: Ventral view. D: Living individual.



Fig. 2. Jaw of *Anadeninus parvipenis*.

longitudinal bands with frayed edges, which are more sharply contrasting towards the dorsum than towards the sides. Sole creamy in color.

Jaw (Fig. 2) aulacognathic, arcuate with about 16 fused plates. Radula length 6 mm, width 2.4 mm, 140 transverse rows. Each transverse row has a central tooth and 48 lateral and marginal teeth on both side of central tooth. The central tooth (Fig. 3) has a pointed cusp with a slit on both sides; lateral teeth with an elongated triangular cusp medially and with a slit laterally of which increase in depth giving an appearance as separate denticles. The further away from the center, the triangular cusp of laterals becomes smaller and more narrowly pointed and its denticle also becomes smaller and finally disappear (Fig. 4).

Genitalia (Fig. 5): Ovotestis (Ot) of moderate size, about 3 mm in diameter and 6 mm length; hermaphroditic duct (Hd) moderate in length (about 15 mm); spermoviduct (Spov) long, about 9 mm long; free oviduct long, about 7 mm in length; duct of spermatheca (Sd) nearly spherical, about 2 mm wide; spermatheca (Sp) elongated, about 5 mm; vas deferens (Vd) thin and long (about 16 mm); epiphallus (E) long about 10 mm long and coiled at its proximal end; penis (P) elongated conical shape with tongue-shaped internal ligula, about 3 mm long; atrium (A) small, spherical, about l mm. Genital pore (Gp) located at 1/6 body length from the anterior end.

General distribution: Known only from the type locality Luding County, Sichuan Province, China (Wiktor et al., 2000).

Distribution in Taiwan: Lalashan Forest Reserve.

Remarks: *Anadenus parvipenis* is now listed as an endangered species in China Species Red List. Mt. Lalashan is the orchard area of honey peach in Taiwan.

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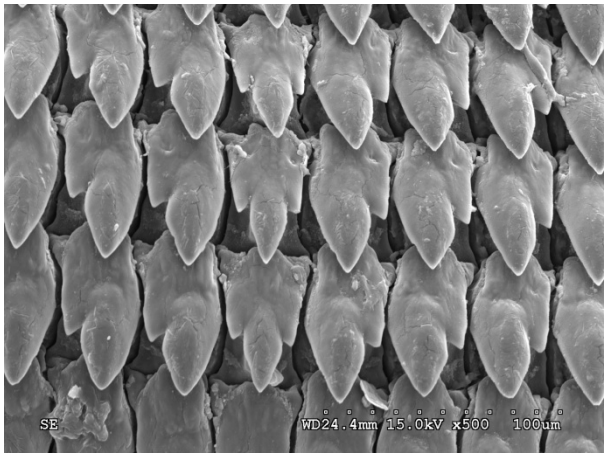


Fig. 3. Radula of *Anadeninus parvipenis*, showing the central tooth (4th tooth from the left side) and 1st to 3rd lateral teeth.

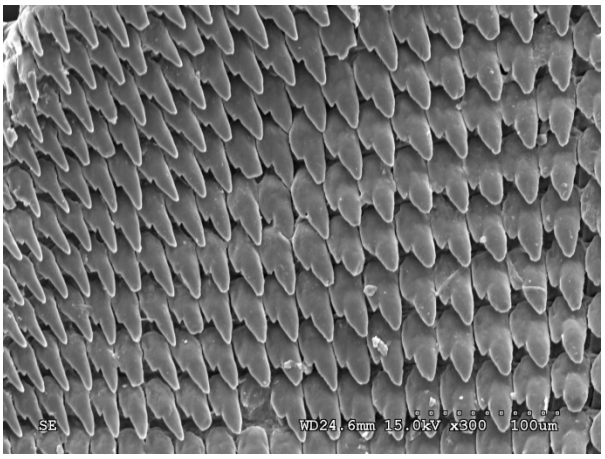


Fig. 4. Radula of *Anadeninus parvipenis* showing the left side of marginal teeth.

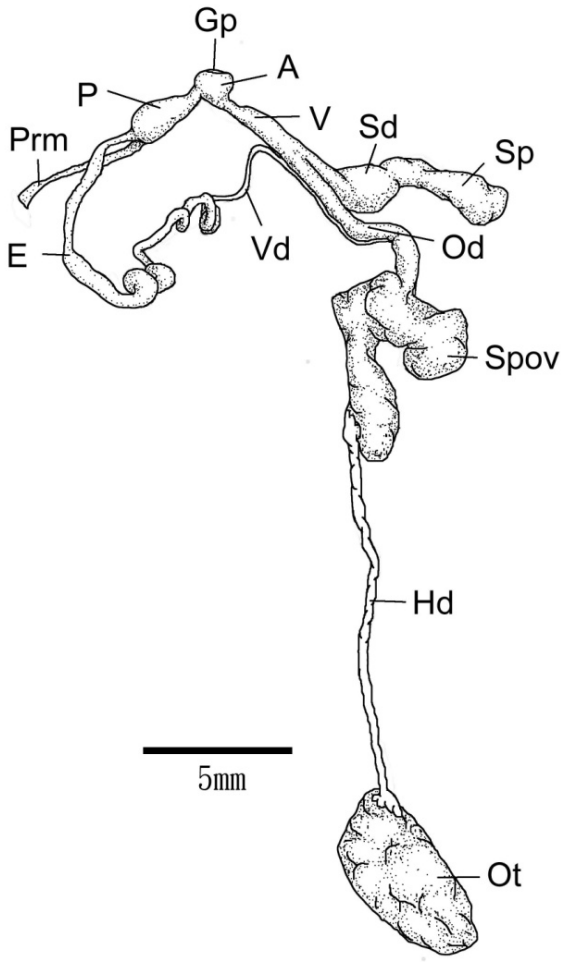


Fig. 5. Genitalia of *Anadeninus parvipenis*. A, atrium; E, epiphallus; Gp, genital pore; Hd, hermaphroditic duct; Od, oviduct; Ot, ovotestis; P, penis; Prm, penial retractor muscle; Sd, spermathecal duct; Sp, spermatheca; Spov, spermoviduct; V, vagina; Vd, vas deferens.

The nursery stock or seeds are frequently introduced in the low temperature from overseas for fruit cultivation. It infers that *A. parvipenis* was introduced to Mt. Lalashan through the transportation of nursery stock or seeds by low temperature device.

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LITERATURE CITED

Gupta, P. K. and B. P. Oli. 1998. The life cycle and growth of the slug, *Anadenus altivagus* (Theobald) from Kumaon Himalayan forests, India. J. Moll. Stud. **64**: 250-253.

Kuzminykh, A. A. and A. A. Schileyko. 2005. Slugs of the family Anadenidae Pilsbry, 1948 (Gastropoda, Pulmonata) with descriptions of two new subgenera and three new species. Ruthenica **15**: 109-118.

Pilsbry, H. A. 1948. Land Mollusca of North America (North of Mexico), Volume II, No. 2, Academy of Natural Sciences of Philadelphia, U.S.A.

Simroth, H. 1912. Mollusca (Weichtiere). In: Dr. H.G. Bronn's Klassen und Ordnungen des Tier-Reichs. 3. Band, 2 Abteilung: Gastropda. Buch: Pulmonata, Lieferung **122-138**: 417-608.

Wang, S. and Y. Xie. 2005. China species red list, Vol. III invertebrates. Higher Education Press, Beijing.

Wiktor, A., D.-W. Chen and M. Wu. 2000. Stylommatophoran slugs of China (Gastropoda: Pulmonata): prodromus. Folia Malacologica **8**: 3-35.

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摘要：等陽高山蛞蝓為中國紅皮書所列瀕危的蛞蝓，本種在臺灣拉拉山自然保護留區首次被採集記錄到。本種主要特徵為儲精囊長條形、陰莖短與陰莖鞘長且厚。本文描述此一新紀錄種蛞蝓，並提供標本彩色照片、齒舌與上頷電子顯微鏡照片及生殖腺解剖圖以供物種鑑定參考。

關鍵詞：高山蛞蝓科、等陽高山蛞蝓、生殖腺、新記錄、臺灣。

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