Neotype Designation for Two Centipedes, *Scolopocryptops curtus* (Takakuwa, 1939) and *Cryptops nigropictus* Takakuwa, 1936, and A Review of Species of Scolopendromorpha (Chilopoda) in Taiwan

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Abstract. Takakuwa described six new species of Scolopendromorpha from Taiwan between 1934 and 1940, without designation of type specimens. We herein designate two neotypes, *Scolopocryptops curtus* (Takakuwa, 1939) and *Cryptops nigropictus* Takakuwa, 1936, and re-describe their morphological characters using new terms. Furthermore, based on both the analysis of published information and the morphological examination of Taiwanese specimens, we discuss the validity of three doubtful species. The following synonymies are new: *Otostigmus multispinosus* Takakuwa, 1937 is a new synonym of *O. aculeatus* Haase, 1887; *O. striatus* Takakuwa, 1940, a new synonym of *O. scaber* Porat, 1876; and *Rhysida yanagiharai* Takakuwa, 1935, a new synonym of *R. longipes longipes* (Newport, 1845). Keys to Taiwanese species of genera *Scolopocryptops* and *Cryptops* are provided.

Key words: Neotype, Scolopendromorpha centipedes, systematics, Taiwan.

INTRODUCTION

Yosioki Takakuwa (1872~1960), one of the early Asian scholars of myriapodology, described six new species of Scolopendromorpha from Taiwan, namely, *Rhysida longipes brevicornis* Takakuwa, 1934, *R. yanagiharai* Takakuwa, 1935, *Cryptops nigropictus* Takakuwa, 1936, *Otostigmus multispinosus* Takakuwa, 1937, *Scolopocryptops curtus* (Takakuwa, 1939), and *Otostigmus striatus* Takakuwa, 1940. However, there is no indication that he ever came to Taiwan to collect specimens himself, but he obtained all of the centipedes from U-Kijo Oo and Masayuki Yanagihara (Takakuwa, 1934, 1936, 1937). Most of Takakuwa's specimens were destroyed during an air-attack in World War II (Takashima, 1954). Takakuwa did not designate any types in his publication, intending to let his student, Dr. Yasunori Miyosi, carry out the work of type designation later (Takashima, 1954). However, we could not find those specimens, nor any other papers about them. The literature of myriapoda gathered by Takakuwa was in the late Miyosi's private library and then transferred to the laboratory of Dr. Nobuo Tsurusaki, Tottori University, Tottori, Japan. We asked Tsurusaki about these specimens. Unfortunately, we were told that he could find none of the specimens in Miyoshi's home after Dr. Miyoshi passed away. Therefore, it is apparent that Takakuwa's specimens were lost.

Yu-hsi Moltze Wang (1910~1968), the first Chinese scholar of myriapodology, studied Taiwanese myriapods from the 1950s to the 1960s. The list of Taiwanese centipedes he compiled (Wang, 1955, 1956, 1957, 1959, 1963) includes *Otostigmus aculeatus* Haase, 1887, but not *O. multispinosus* or *R. yanagiharai*. Chao and Chang (2003) discussed the list and recognized that *R. longipes brevicornis* Takakuwa, 1934 is clearly a junior synonym of *R. l. longipes* (Newport, 1845), and suggested that *O. multispinosus* Takakuwa, 1937 may be a junior synonym of *O. aculeatus* Haase, 1887; *O. striatus* Takakuwa, 1940 may be a junior synonym of *O. scaber* Porat, 1876; only

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Scolopocryptops curtus (Takakuwa, 1939) and *Cryptops nigropictus* Takakuwa 1936 are valid species.

Lewis (1981, 2003) discussed the taxonomic problems caused by regeneration in scolopendromorph centipedes, including the antennomere number, prefemoral spinulation of the ultimate legs, and the tarsal spurs of trunk legs. He suggested that regenerated antennae may have an abnormally high or low number of antennomeres; regeneration of lost ultimate legs frequently leads to irregular spinulation of prefemoral spines in scolopendrids; and regeneration of trunk legs might lead to the atypical presence or absence of a tarsal spur. He also noted that the longitudinal keels of tergites can change with age in the genus *Otostigmus*.

In the present study, based on both the analysis of published information and the morphological examination of Taiwanese specimens, we designate two neotypes for *S. curtus* and *C. nigropictus*, and re-describe their morphological characters with new terms suggested by Lewis *et al*. (2005). Furthermore, we discuss the validity of three doubtful species: *O. multispinosus*, *O. striatus* and *R. yanagiharai*. Keys to Taiwanese species of genera *Scolopocryptops* and *Cryptops* are provided.

MATERIALS AND METHODS

Extensive collections of centipedes, covering most parts of Taiwan, were made between 1991 and 2004, by hand-sorting soil and litter. Specimens were preserved in 70% ethanol. External characters were examined and drawn with a Leica MZ 16 stereomicroscope. Coloration of the specimens is described from fresh material. The material has been deposited in the collections of the Department of Biological Sciences, National Sun Yat-Sen University (NSYSUB), Kaohsiung, and the National Museum of Natural Science (NMNS), Taichung, Taiwan. All neotypes and paratypes are deposited at the NMNS.

TAXONOMY

Neotype designation

1. *Scolopocryptops curtus* (Takakuwa, 1939)
(Figs. 1, 2)

Otocryptops curtus Takakuwa, 1939: 698; 1940: 76. Miyoshi, 1982: 734. Chao and Chang, 2003: 2.

Type specimen: Neotype: 1 male, 50 mm (NMNS-5187-001), adult, Shihmen Mt., Taoyuan County (Co.), Taiwan, Oct. 25, 2002, Jeng-Di Lee.

Paratypes: 2 females, 48 and 44 mm (NMNS-5187-002), adult, Wufeng Township, Hsinchu Co., Sept. 22, 2005, Hong-Da Chu; 1 female, 38 mm (NMNS-5187-003), Chuyun Mt., Taitung Co., Sept. 16, 2001, Hsueh-Wen Chang; 1 male, 25 mm (NMNS-5187-004), Erwanping, Chiayi Co., Apr. 21, 2000, Jui-Lung Chao.

Description: Body dark red throughout (Fig. 1A). Antennae with 17 antennomeres, basal 3 with sparse long setae, 4th and subsequent ones with countless minute setae. Cephalic plate as long as wide, without ocelli or lateral limbus (Fig. 1B). Cephalic plate covered by 1st tergite. Anterior border of forcipular coxosternum with a tubercle on each side (Fig. 1C, D), and coxosternum with small puncti. Trochanteroprefemur of forcipule with a small inner tooth (Fig. 1C, D).

Tergites smooth with faint puncti, tergites 2~22 with complete longitudinal paramedian sutures (Fig. 1E). Lateral margination of tergites beginning on 6th tergite (Fig. 1E). Sternites with puncti and setae. Sternites 4~20 with a central sulcus. Sternite 23 with posteriorly converging sides and concave posterior border. Coxopleuron with a very short coxopleural process and a small coxopleural spine (Fig. 2A, B). Pores widely spread on coxopleuron, extending to edge of tergite 23, but not posterior (Fig. 2A, B).

Legs 1~19 with 2 tibial spurs, short one very close to joint and long one a bit farther from joint (Fig. 2C, D), legs 20 and 21 with 1 tibial spur (Fig. 2C). Legs 1~21 with a tarsal spur, trunk leg 22 and ultimate legs without tibial or tarsal spurs. Ultimate leg with a large prefemoral spinous process and a small lateral one.

Diagnosis. With a short coxopleural process and a small coxopleural spine. Coxopleural pores extending to edge of tergite 23. Cephalic plate without lateral limbus.

Remarks. In Takakuwa's (1939) original paper, based on a single specimen with most of the legs missing, *Scolopocryptops curtus* was described as leg 1 with 2 tibial and 1 tarsal spur, legs 10~13 with 1 tibial and 1 tarsal spur, leg 19 with 2 tibial and 1 tarsal spur, and legs 22 and 23 without tibial or tarsal spurs. Later, Miyoshi (1982) mentioned legs 1~19 as having 2 tibial spurs. Our

observations agree with Miyoshi's description. Lewis (2003) suggested that the regeneration of trunk legs might lead to the atypical presence or absence of a tarsal spur.

Distribution. Taoyuan, Hsinchu, Chiayi, and Kaohsiung Counties, Taiwan. *Scolopocryptops curtus* is currently only found in the Ryukyu Islands (Ohmine, 2003) and Taiwan, and it is distributed in mountainous regions of Taiwan. It can be found in rather moist environments, under stones, decaying wood, and humus, rarely in dry or muddy places.

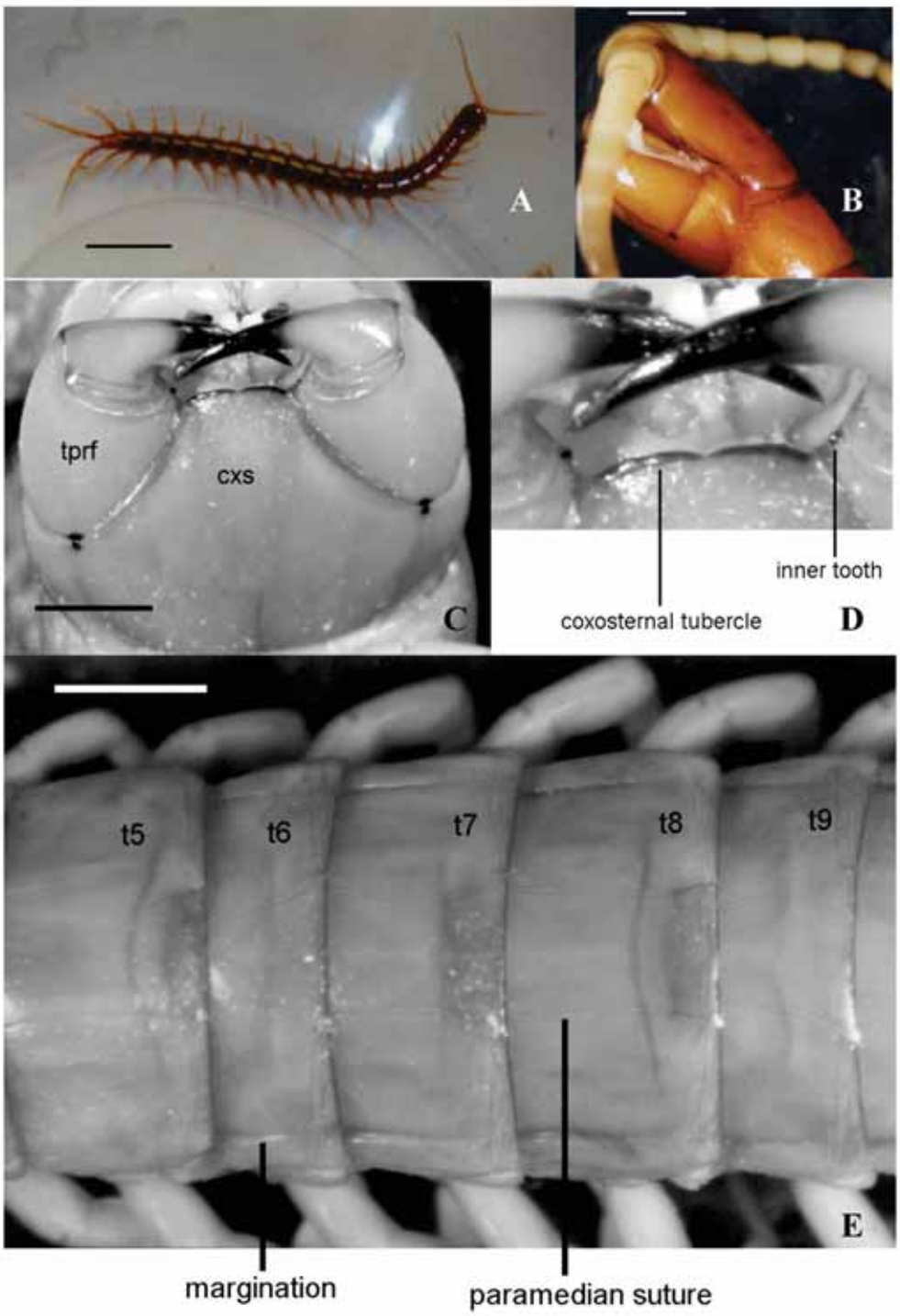

Fig. 1. *Scolopocryptops curtus*. A. body color dark red. bar = 10 mm. B. cephalic plate, without ocelli or lateral limbus. bar = 1 mm. C & D. forcipules and coxosternum, a tubercle on each side of coxosternum (cxs), and a small inner tooth on each trochanteroprefemur (tprf) of forcipule. E. tergites 5~9, with paramedian sutures, and lateral marginations beginning on 6th tergite. bar = 1 mm.

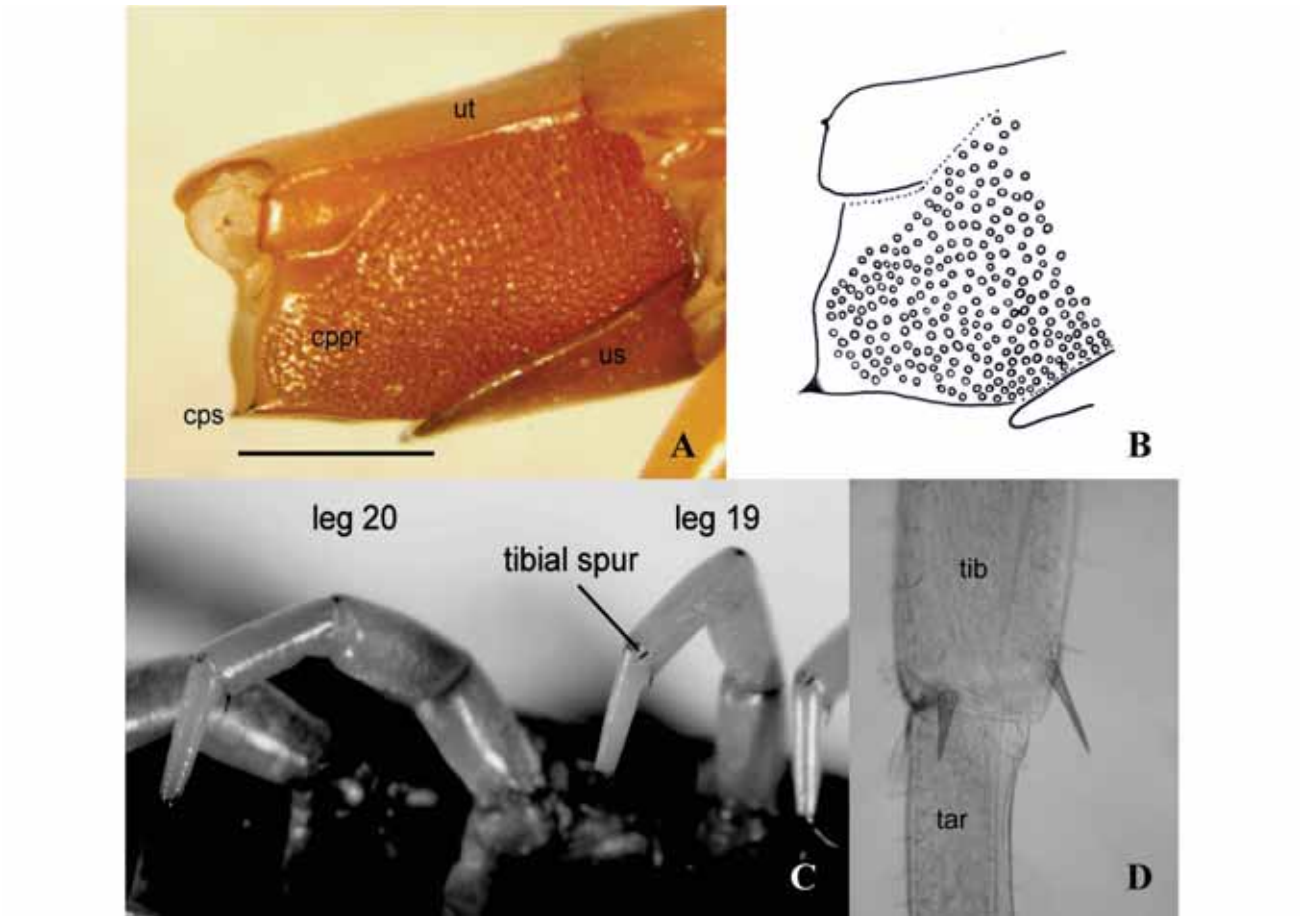

Fig. 2. *Scolopocryptops curtus*. A & B. coxopleuron with a very short coxopleural process (cppr) and a small coxopleural spine (cps). bar = 1 mm. C. leg 19 with two tibial spurs, and leg 20 with one tibial spur. D. tibial spurs of leg 17, short one very close to joint, long one farther to joint. tib - tibia; tar - tarsus; us - sternite 23; ut - tergite 23.

2. *Cryptops nigropictus* Takakuwa, 1936
(Figs. 3, 4)

Cryptops nigropictus Takakuwa, 1936: 238; 1940b: 66. Wang, 1956: 159; Chao and Chang, 2003: 2.

Type specimen: Neotype: 1 male, 18 mm (NMNS-5187-005), adult, Yuanli Township, Miaoli Co., Taiwan, Mar. 21, 2006, Jui-Lung Chao.

Paratypes: 3 males and 2 females, 11 , 12 , 14 , 14 , and 16 mm (NMNS-5187-006), same data as for neotype.

Description: Head red, tergites yellowish-white with a characteristic black symmetrical pattern (Fig. 3A, B). Entire body and legs with numerous long setae.

Antennae with 17 antennomeres, basal 3 with scattered long setae, 4th and subsequent ones with countless minute setae. Cephalic plate as long as wide, with 2 short faint lateral oblique sulci, covered by 1st tergite. Band of 6 clypeal setae in front of labrum (Fig. 3C).

Tooth plates of forcipular coxosternum absent. Forcipular coxosternum with 2 + 2 fine setae behind virtually straight anterior border (Fig. 3D).

Tergites 1 and 2 with a faint central longitudinal sulcus. Tergites 3~20 with paramedian longitudinal sutures and 2 lateral crescentic sulci (Fig. 3E). Sternites 1~20 with a crisscrossed sulcus, composed of a median longitudinal and a curved transverse sulcus (Fig. 3F). Sternite 21 with posteriorly converging sides and rounded posterior border.

Legs 1~19 with undivided tarsi (Fig. 4A). Tarsi of leg 20 and ultimate leg divided into tarsi 1 and 2 (Fig. 4B). Claws of legs 1~20 each with a single long accessory spur (Fig. 4A), ultimate leg without accessory spur.

Coxopleuron with 10~13 large pores, spread only on antero-ventral surface of coxopleuron,

without coxopleural process or spines (Fig. 4C, D). Femur of ultimate legs without sawteeth. Tibia of ultimate leg with a row of 5 or 6 saw teeth, tarsus with a row of 3 or 4 saw teeth (Fig. 4B).

Diagnosis: Tergites with a characteristic black symmetrical pattern. Sternites 1 and 2 with median longitudinal and transverse sulci, coxopleurite with about 13 pores spread on antero-ventral coxopleuron. Femur of ultimate legs without saw teeth.

Remarks: *Cryptops nigropictus* is easily distinguished from *C. japonicus* Takakuwa, 1934, which has 30 or more coxopleural pores (Fig. 9E), a saw tooth on the ultimate leg femur, and clypeus with 6 fine setae in front of labrum (Fig. 9F, G).

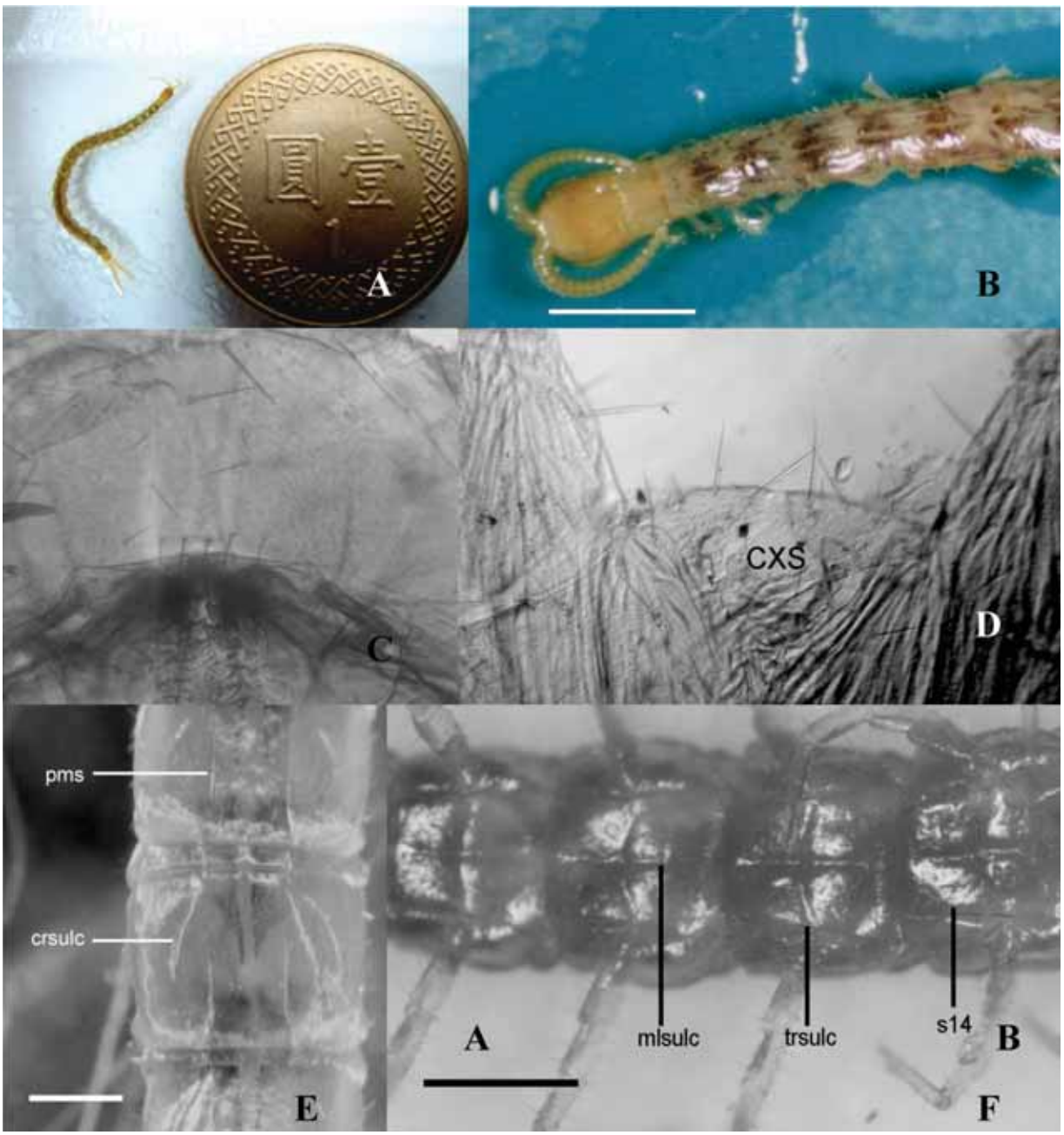

Fig. 3. *Cryptops nigropictus*. A. size of an adult, the diameter of the coin is 20 mm. B. tergites with a characteristic black symmetrical pattern. bar = 1 mm. C. clypeus with a band of six clypeal setae in front of labrum. D. anterior border of coxosternum (cxs) with four fine setae. E. Tergites 6~8 with paramedian suture (pms) and crescentic sulcus (crsulc). bar = 0.3 mm. F. sternites 14~17, with a median longitudinal sulcus (mlsulc) and a transverse sulcus (trsulc). s14- sternite 14. bar = 0.5 mm.

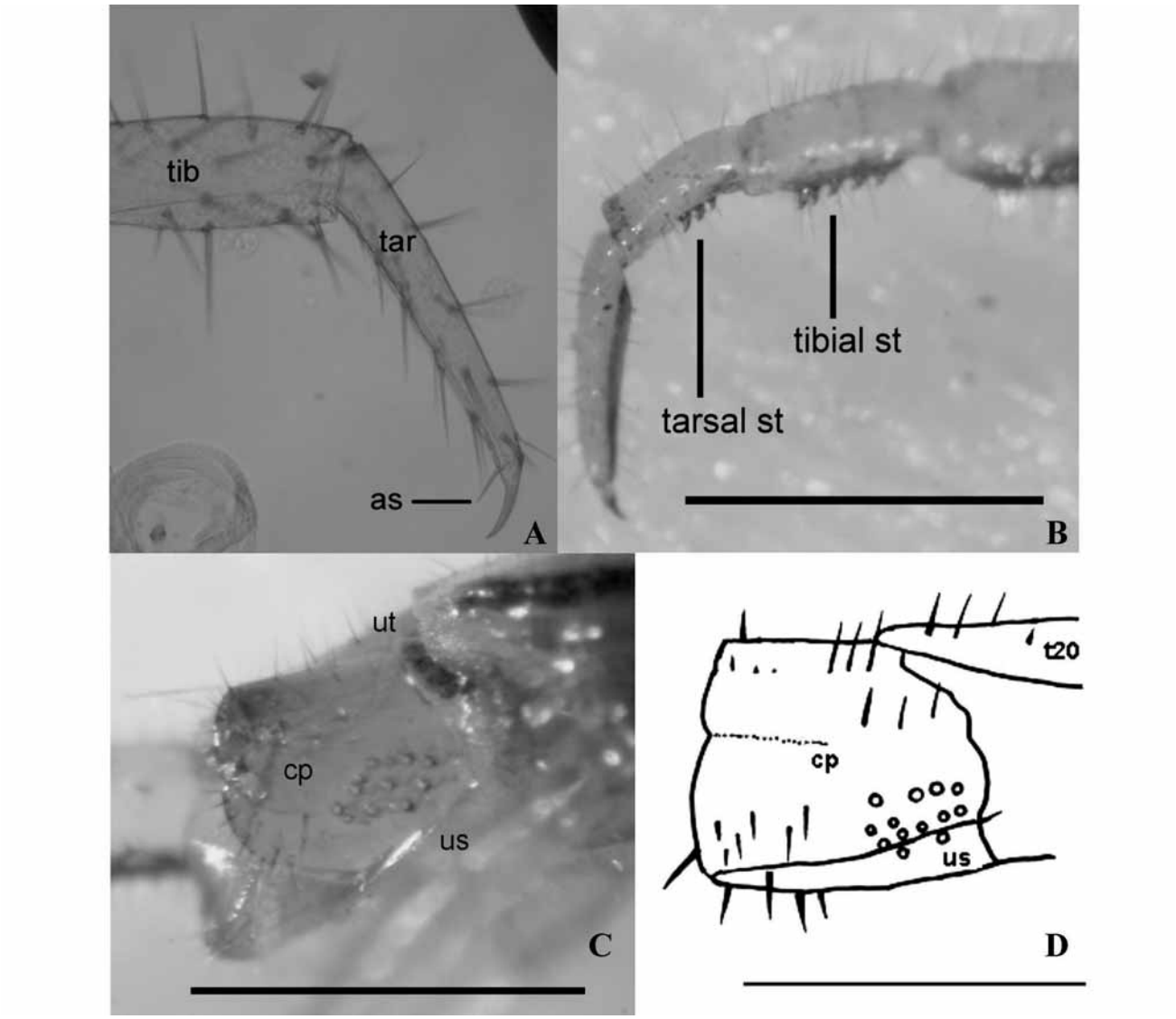

Fig. 4. *Cryptops nigropictus*. A. leg 7 with undivided tarsi (tar) and a single accessory spur (as). B. ultimate leg extended, with 5~6 tibial saw teeth (tibial st) and 3~4 tarsal saw teeth (tarsal st). C & D. anterior coxopleuron (cp) with about 13 pores. t20 - tergite 20; us - sternite 21; ut - tergite 21. bar = 1mm

Distribution: Changhua, Taichung, Hualien, and Miaoli Counties, Taiwan. *Cryptops nigropictus* is only found in the Ryukyu Islands (Ohmine, 2003) and Taiwan, and is distributed over the lowlands of central and eastern Taiwan. It prefers a sandy habitat under dead leaves, in a rather dry environment.

Review of three doubtful species

We discuss the validity of 3 doubtful species after examining their taxonomic characters. The following synonymies are new: O. *multispinosus* Takakuwa, 1937 = *O. aculeatus* Haase, 1887; *O. striatus* Takakuwa, 1940 = *O. scaber* Porat, 1876; and *R. yanagiharai* Takakuwa, 1935 = *R. longipes longipes* (Newport, 1845).

1. *Otostigmus multispinosus* Takakuwa, 1937

Otostigmus multispinosus Takakuwa, 1937: 105; 1940b: 44.

Otostigmus aculeatus Haase, 1887: 71; Attems, 1930: 148; Lewis, 2001: 28-31; Chao and Chang, 2003: 8-9.

Remarks: Takakuwa (1937) suggested that this species was very similar to *O. aculeatus* Haase, 1887. He compared *O. multispinosus* with Attems' (1930) description of *O. aculeatus*, then suggested 5 diagnostic characters of *O. multispinosus*: 4+4 coxosternal teeth, coxopleuron with 1~3 dorsal coxopleural spines (ds), ultimate leg with no dorsomedial prefemoral spines (dps) or corner spine (cs), and variation of tarsal spurs on legs 1~20 (Table 1).

Lewis (2001) described *O. aculeatus* with 8 specimens from Vietnam and 10 specimens from China. These *O. aculeatus* had 4+4 coxosternal teeth (as in *O. multispinosus*); a coxopleural process with dorsal spines (also as in *O. multispinosus*); the ultimate leg with dorsal prefemoral spines and a corner spine (as in Attems, 1930); and the ultimate leg with 5 rows of prefemoral spines: 2 rows of ventrolateral prefemoral spines (vlps), 1 row of ventromedials (vmps), 1 row of medials (mps), and 1 row of dorsomedials (dps). However, he observed 1 regenerated leg without dorsomedial prefemoral spines and 2 without a corner spine (as in *O. multispinosus*).

Otostigmus aculeatus is widespread in Taiwan. We re-examined 72 specimens and compared the morphological characters with the description of those of *O. aculeatus* and *O. multispinosus*. There are many similar characters between the prefemoral spinulation of the ultimate legs of *O. aculeatus* and *O. multispinosus* (Table 1). The prefemur of both has a mid-ventral longitudinal strip without spines, which separates the vlps from the vmps (Takakuwa, 1937; Lewis, 2001). We suggest using this non-spine strip (nss) as a datum line. In most Taiwanese specimens, the ultimate leg has 2 rows of outside spines (vlps), and 3 rows of inside spines (vmps + mps + dps) (Fig. 5A, B). But in a few Taiwanese specimens, the ultimate leg has 3 rows of outside spines, and 4 or more rows of inside spines (Fig. 5C). In 1 specimen, a regenerated ultimate leg has 5 corner spines and 2 rows of dorsal spines (Fig. 5D, E). Therefore, differences in the prefemoral spinulation of the ultimate leg of *O. multispinosus* are only individual variations.

Since there are no distinct characters separating *O. multispinosus* from *O. aculeatus*, we recognize here that *O. multispinosus* Takakuwa, 1937 is as a junior synonym of *O. aculeatus* Haase, 1887.

Table 1. Morphological characters of *Otostigmus aculeatus*, *O. multispinosus*, and Taiwanese specimens of *O. aculeatus*.

	O. aculeatus Haase, 1887			*O. multispinosus*
	Attems, 1930	Lewis, 2001	Taiwanese specimens	Takakuwa, 1937
Number of antennomeres	17	17	17	17
Glabrous antennomeres	3	3 or 4	3	3
Coxosternal teeth	3+3	4+4	4+4	4+4
Tergite lateral margination (from)	tergite 13	tergite 10, 11, 12, 14, or 15	tergite 10, 11, 12, or 13	tergite 13
Tergite paramedian sutures (from)	tergite 4 or 5	tergite 4, 5, or 6	tergite 4 or 5	tergite 4 or 5
Sternite paramedian sutures	long (1~19)	long (2 or 3~19)	long (1~19)	long (1~19)
Coxopleural spines	5~7 aps + 2 ls	5 aps + 1~4 ls + 1~3 ds	4 aps + 2 ls + 2 or 3 ds	2~4 aps + 2 or 3 ls + 1~3 ds
Prefemoral spines of ultimate leg	4 rows (2 (2~6) vlps + 6~7 vmps + 3~4 dps) cs: 1	5 rows ((4~6 + 5~9) vlps + 4~8 vmps + 6~8 mps +3~5 dps) cs: 0 or 1	5 or 6 rows 2 or 3 (6~9) vlps + 5~9 vmps + 5~7 mps + 4~5 dps) cs: 0 or 1	4 rows (2 (5~9) vlps +5~9 vmps + 5 mps) cs: 0
Tarsal spur of trunk legs	2: legs 1 and 2 1: legs 3~19	2: legs 1~5 or 6 1: legs 6 or 7~19	2: legs 1~9 1: legs 10~19	2: legs 1~8 1: legs 9~19

aps, apical spine; cs, corner spine; dps, dorsal prefemoral spine; ds, dorsal spine; ls, lateral spine; lsubaps, lateral subapical spine; mps, median prefemoral spine; vlps, ventrolateral prefemoral spine; vmps, ventromedial prefemoral spine.

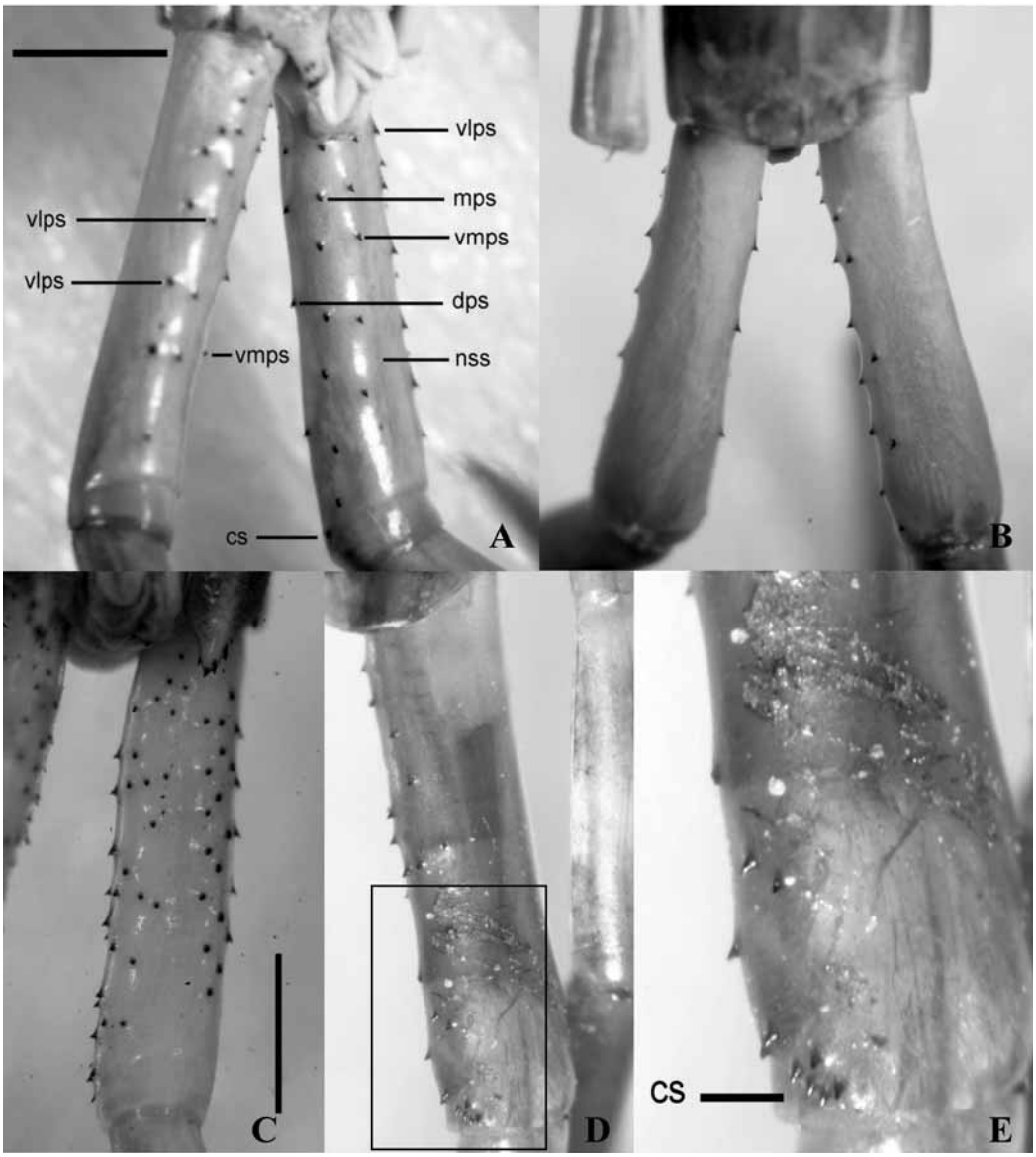

Fig. 5. The ultimate leg of *Otostigmus aculeatus*. A & B. typical prefemoral spination. A. Ventral view of prefemur: (14 vlps in 2 rows) +(nss) + (5 vmps + 7 mps + 4 dps). B. dorsal view: 4 dps + 1 cs. C, D & E. abnormal prefemoral spination. C. ventral view: (22 vlps in 3 rows) + (nss) + (16 vmps (in 2 rows) + 7 mps + 7 dps). D. dorsal view: 2 (dps) + 5 cs. E. five corner spines (cs). dps - dorsal prefemoral spine; mps - medial prefemoral spine; nss - non-spine strip; vlps - ventrolateral prefemoral spine; vmps - ventromedial prefemoral spine. bar = 1 mm.

2. *Otostigmus striatus* Takakuwa, 1940

Otostigmus striatus Takakuwa, 1940a: 209; 1940b: 50.

Otostigmus striatus porteri Dobroruka, 1960: 61.

Otostigmus scaber Porat, 1876:10; Attems, 1930: 153; Lewis, 2001: 27; Chao and Chang, 2003: 8.

Remarks: Takakuwa (1940a, b) suggested that *O. striatus* resembles *O. scaber*. There are 2 diagnostic characters of *O. striatus*: the number of antennomeres (17) and the spinulation of the prefemur of the ultimate legs (10 dorsomedial spines and 2 corner spines).

Dobroruka (1960) described a new subspecies of Taiwanese centipede, *O. striatus porteri* Dobroruka, 1960. He suggested 2 diagnostic characters based a single specimen: tergite lateral margination from tergite 5 (tergite 7 or 8 in *O. striatus*), and sternite paramedian sutures distinct from sternite 3 (posterior sternites in *O. striatus*). There are no detailed data about spinulation of the prefemur of ultimate legs in Dobroruka's description.

We collected and re-examined 32 specimens of *O. scaber* from Taiwan, and compared the

morphological characters of these specimens with the description of *O. scaber* by Attems (1930) and Lewis (2001), *O. striatus* by Takakuwa (1940a, b), and *O. striatus porteri* by Dobroruka (1960) (Table 2). We found no Taiwanese specimens that have both 17 antennomeres and the ultimate legs with 10 dorsomedial prefemoral spines and 2 corner spines. We consider that in *O. striatus*, the ultimate leg, with 2 cs, 9 vlps, and 10 dps, is regenerated as are the antennae. In addition, the 3 apical coxopleural spines of *O. striatus* and *O. scaber* described by the original authors (Table 2), are actually 2 apical spines and 1 subapical spine (Lewis, 2001) (Fig. 6A). The tergites of *O. scaber* with 7~9 longitudinal keels are clear from tergite 3 in juveniles, but from tergite 8 or subsequently in adults (Fig. 6B, C). This variation supports Lewis's (2003) suggestion that the number of tergites with longitudinal keels changes with age in *Otostigmus*.

We found that the sternite paramedian sutures of Taiwanese *O. scaber* are also from sternite 3 (as in *O. striatus porteri*), and the sutures are short (< 20% of sternite) (Fig. 6D). In subsequent sternites, the length of the sternite paramedian sutures increases, and they are relatively long (33%~50% of sternite) from sternite 9 or 10 (as in Attems, 1930; Takakuwa, 1940a, b; Lewis, 2001) (Fig. 6E). The tergite lateral margination of Taiwanese *O. scaber* is from tergite 5, 6, or 7 (as in *O. striatus* and *O. striatus* porteri). Based on the above-mentioned comparison, we consider that *O. striatus* Takakuwa, 1940 and *O. striatus porteri* Dobroruka, 1960 are both junior synonyms of *O. scaber* Porat, 1876.

3. *Rhysida yanagiharai* Takakuwa, 1935

Rhysida yanagiharai Takakuwa, 1935: 340; 1940b: 55.

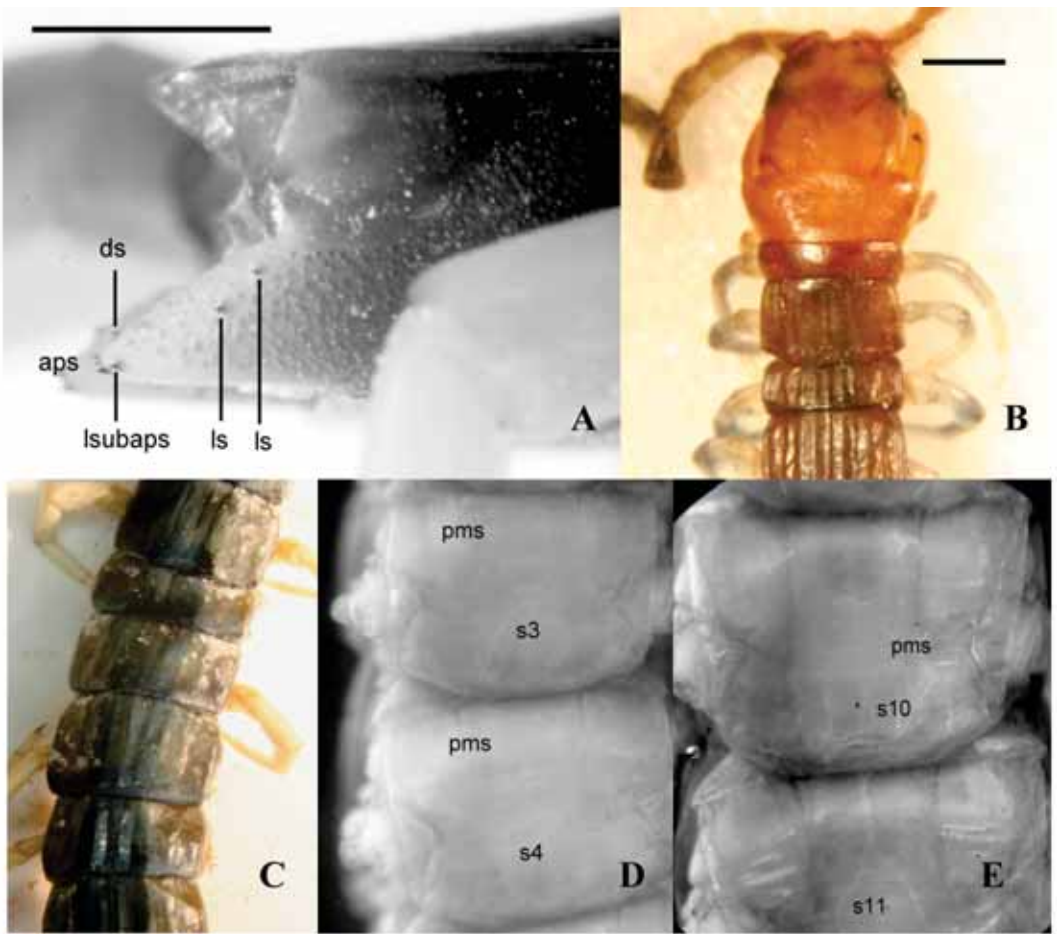

Fig. 6. *Otostigmus scaber*. A. coxopleural spination, 2 aps + 1 lsubaps + 2 ls + 1 ds. B. tergites with 7-9 keels from tergite 3 in juvenile. bar = 1 mm. C. tergites 5-10 in adult, tergites with 7 - 9 keels from tergite 8. D. sternites 3 and 4 in adult, length of paramedian sutures<20% of sternite. E. sternites 10 and 11 in adult, length of paramedian sutures>33% of sternite. aps - apical spine; ds - dorsal spine; ls - lateral spine; lsubaps - lateral sub-apical spine; s3 - sternite 3; pms - paramedian suture.

Branchiostoma longipes Newport, 1845: 411.
Rhysida longipes longipes Attems, 1930: 193; Lewis, 2002: 86; Chao and Chang, 2003: 8.

Remarks: Takakuwa's (1935, 1940b) description of *R. yanagiharai* was based on a very small specimen (body length 22 mm). Its morphological characters described by Takakuwa are very similar to those of *R. longipes* except for 2 diagnostic characters (Table 3): tergites 1~20 with complete longitudinal paramedian sutures and sternites 2~20 with complete longitudinal paramedian sutures or sulci (German: ganz durchlaufende Langsfurchen).

Lewis *et al*. (2005) suggested that 'sutures'

Table 2. Morphological characters of *Otostigmus scaber*, *O. stratus*, and Taiwanese specimens of *O. scaber*.

	O. scaber Porat, 1876			*O. striatus*	*O. s. porteri*
	Attems 1930	Lewis 2001	Taiwanese specimens	Takakuwa, 1940	Dobroruka, 1960
Number of antennomeres	21	20	21 or 20 (rare)	17	no data (damaged)
Glabrous antennomeres	2.5	2.14	2 or 2.2	2	2.5
Coxosternal teeth	4+4	4+4	4+4	4+4	no data
Tergite lateral margination (from)	tergite 5 or 6	tergite 6	tergite 5, 6, or 7	tergite 7 or 8	tergite 5
Tergite with 7~9 keels (from)	tergite 5	tergite 9	tergite 3 (juvenile), 7, 8, or 9 (adult)	tergite 5 or 6	tergite 5
Tergite paramedian sutures (from)	no data	tergite 6	tergite 4 or 5	tergite 7	no data
Sternite paramedian sutures (length: % of sternite), (from)	(33%~50%), (no data)	(33%~50%), (middle or posterior sternites)	(20%), (sternite 3); (33%~50%), (sternite 9 or 10)	(short), (posterior sternites)	(short), (sternite 3)
Coxopleural spines	3 aps + 2 ls + 1 ds	2 aps + 1 lsubaps + 2 ls + 1 ds	2 aps + 1 lsubaps + 2 ls + 1 ds	3 aps + 2 ls + 1 ds	3 aps + 2 ls + 1 ds
Prefemoral spines of ultimate leg	4 rows: (4 vlps + 2 vmps + 1 mps + 2~3dps) cs: 1	3 rows (4 vlps + 1~2 vmps + 1~2 dps) cs: 1	4 rows (4 vlps + 3~4 vmps + 2~3 mps + 2 dps) cs: 1	4 rows (9 vlps + 5~6 vmps + 4 mps + 10 dps+ 10 dps cs: 2	*same as O. striatus* (no detailed data)
Tarsal spur of trunk legs	2: legs 1~6 or 7 1: legs 7 or 8~19	2: legs 1~4 1: legs 5~19	2: legs 1~12, 15, or 16 1: legs 13, 16, or 17~19 or 20	2: legs 1~8 1: legs 9~19	*same as O. striatus* (no detailed data)

aps, apical spine; cs, corner spine; dps, dorsal prefemoral spine; ds, dorsal spine; ls, lateral spine; lsubaps, lateral subapical spine; mps, median prefemoral spine; vlps, ventrolateral prefemoral spine; vmps, ventromedial prefemoral spine.

Table 3. Morphological characters of *Rhysida longipes longipes*, *R. yanagiharai*, and Taiwanese specimens of *R. l. longipes*.

	R. l. longipes (Newport, 1845)			*R. yanagiharai*
	Attems, 1930	Lewis, 2002	Taiwanese specimens	Takakuwa, 1935
Glabrous antennomeres	2 + dorsal 3	2 + dorsal 3	2 + dorsal 3	2 + dorsal 3
Antennal length (reaching)	tergite 6	tergites 3~5	tergites 4~6	tergite 4
Coxosternal teeth	4+4	4+4	4+4	4+4
Basal sulci of toothplates (angle)	almost rectangular (118°)	obtuse (104°~109°)	obtuse (108°~138°)	obtuse
Tergite lateral margination (from)	tergite 6, 7, or 15 (seldom)	tergite 8 or 9	tergite 4 or 5 (juvenile), 8 or 9 (adult)	tergite 1, but anterior tergites unclear
Tergite paramedian sutures (from)	tergite 5	tergite 4 or 5	tergite 4 or 5	tergite 1
Sternite paramedian sutures	short sutures	short sutures	short sutures	long sulci
Coxopleural spines	3 aps + 1 ls	2 aps + 1 lsubaps + 1 ls	2 aps + 1 lsubaps + 1 ls	2 aps + 2 ls
Prefemoral spines of ultimate leg	3 rows (3 or 4 vlps + 1~3 vmps + 2 or 3 dps) 1 cs	3 rows (3~5 vlps + 3 or 4 vmps + 2 or 3 dps) 1 cs	3 rows (3 or 4 vlps + 3 or 4 vmps + 2 or 3 dps) 1 cs	3 rows (3 vlps + 2 vmps + 3 mps) 0 cs
Tarsal spur of trunk legs	2: legs 1~7, 8, 9, 10, 11, or 12 1: legs 8, 9, 10, 11, 12, or 13~19	2: legs 1~6 or 7 1: legs 7 or 8~18 or 19	2: legs 1~6, 7, or 8 1: legs 7, 8, or 9~19	2: legs 1~9 1: legs 10~19

aps, apical spine; cs, corner spine; dps, dorsal prefemoral spine; ls, lateral spine; lsubaps, lateral subapical spine; mps, median prefemoral spine; vlps, ventrolateral prefemoral spine; vmps, ventromedian prefemoral spine.

should be used to describe the fine lines and 'sulci' for the grooves of tergites and sternites. The German: 'Furchen' had previously been used for both structures. We found no specimens of Taiwanese *Rhysida* with sternites possessing long paramedian sutures, but 2 long paramedian sulci are present in two larvae (body lengths of 9 and 14 mm) (Fig. 7C) and eight juveniles (body length of about 30 mm) of *R. l. longipes*, and their paramedian sutures begin on tergite 4. Furthermore, the coxosternal toothplates and teeth of *R. yanagiharai* described by Takakuwa (1935) are the same as those of the larva of *R. longipes* (Fig. 7A, B), not the adult of *R. longipes* (Fig. 8). The coxopleural spinulation of the larva of *R. longipes* have 2 apical, 1 lateral subapical, and 1 lateral spine (2 aps + 1 lsubaps + 1 ls) (Fig. 7D). We consider that this lateral subapical spine was identified as a lateral spine by Takakuwa, so that *R. yanagiharai* was described as having 2 apical and 2 lateral spines (2 aps + 2 ls) (Table 3), because he never used the term, lateral subapical spine. In addition, the ultimate legs of *R. yanagiharai* have 3 medial prefemoral spines (mps), but no dorsal prefemoral spines (dps) or corner spines (cs). We consider these 3 mps actually represent 2 dps and 1 cs, the error in interpretation being due to the angle at which the specimen was viewed. Based on the above reasons, we consider that *R. yanagiharai* described is actually a larva or juvenile of *R. l. longipes*, and hence a junior synonym of that species.

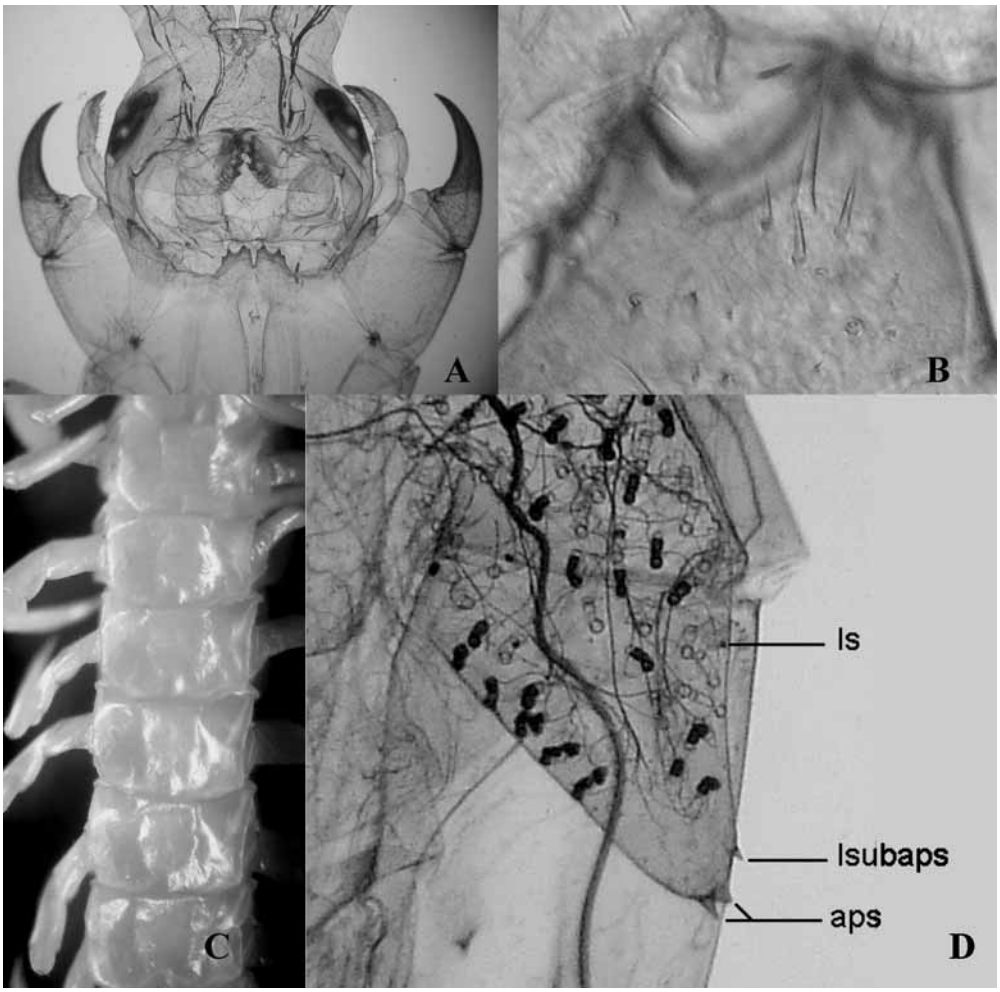

Fig. 7. The larva of *Rhysida longipes* (three weeks old, body length 14 mm). A&B. coxosternal toothplates and teeth, their forms are the same as the ones of *Rhysida yanagiharai* which ventral toothplate with one large and three small setae. C. sternites 4 - 9 with two long paramedian sulci. D. spination of coxopleuron, 2 aps + 1 lsubaps + 1 ls, this lsubaps was identified as a ls by Takakuwa (1935). aps - apical spine; ls - lateral spine; lsubaps - lateral sub-apical spine.

Fig. 8. The coxosternal toothplates and teeth of an adult *Rhysida longipes longipes*.

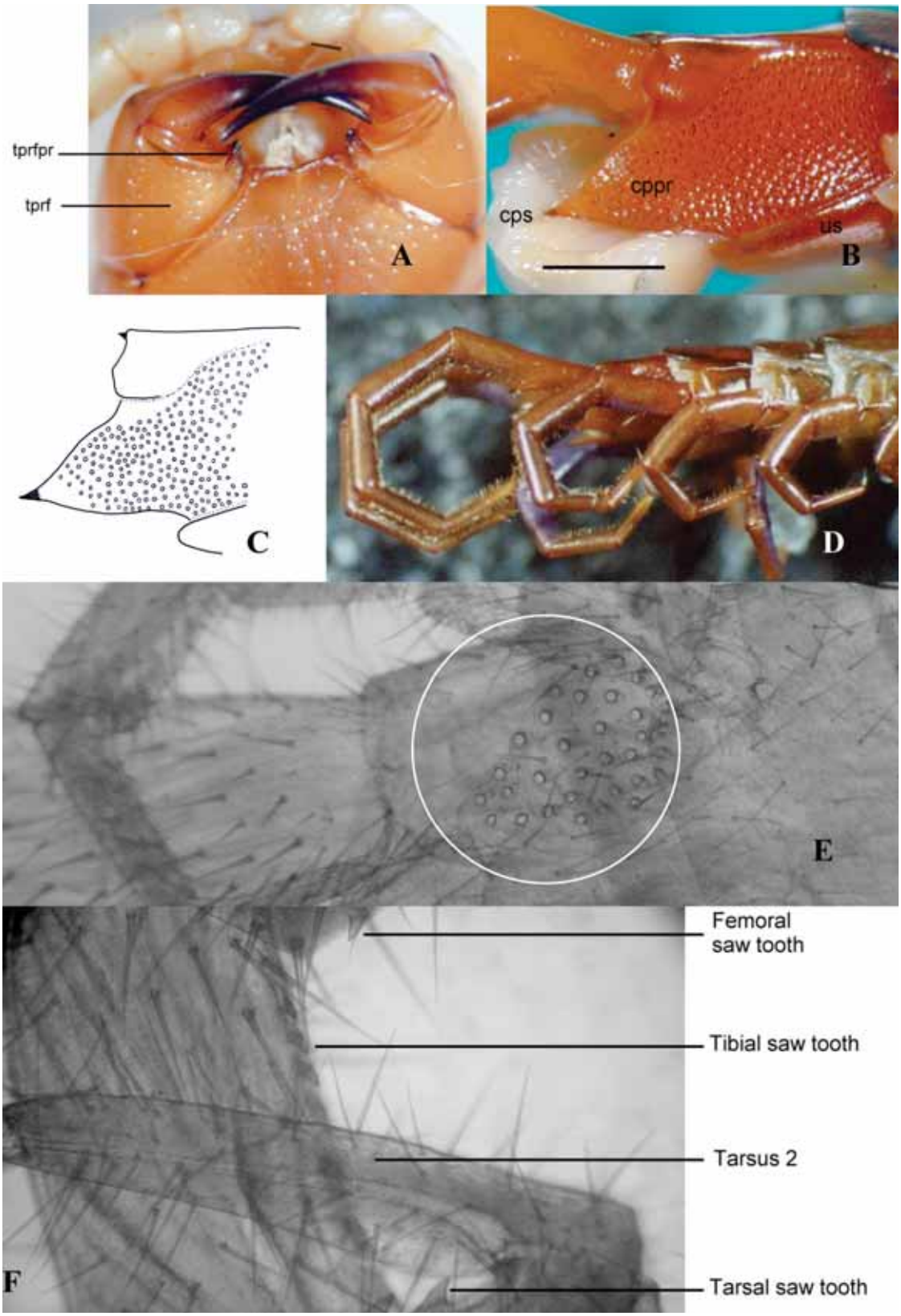

Fig. 9. A. forcipules of *Scolopocryptops melanostomus*, trochanteroprefemur (tprf) of forcipule with a process (tprfpr). B &C. S. *rubiginosus*, with a long coxopleural process and a large coxopleural spine. D. *Scolopocryptops capillipedatus*, femur, tibia and tarsus of ultimate legs with numerous long, clustered hairs . cppr- coxopleural process; cps- coxopleural spine; us- sternite 23; ut- tergite 23. bar = 1 mm. E & F. *Cryptops japonicus*, E. coxopleuron of with thirty or more pores. F. femur of ultimate leg with a saw tooth.

DISCUSSION

This investigation has demonstrated that detailed descriptions, accurate illustrations, and careful preservation of specimens are essential for species recognition; also a number of specimens of each species should be examined in detail. Proper preservation facilitates future re-examination. We consider that morphological studies are still valuable in taxonomy and systematics.

Key to species of *Scolopocryptops* in Taiwan

1. Trochanteroprefemur of forcipule with a small inner tooth (Fig. 1D) 2
   Trochanteroprefemur of forcipule without a small inner tooth, but a trochanteroprefemoral process with inner teeth (Fig. 9A).....*S. melanostomus* (Newport, 1845)
2. Coxopleuron with a very short coxopleural process, and a small coxopleural spine (Fig. 2A, B).....*S. curtus* (Takakuwa, 1939)
   Coxopleuron with a long coxopleural process, and a large coxopleural spine (Fig. 9B, C).....3
3. Tergites with 2 paramedian sutures.....*S. rubiginosus* (L. Koch, 1878)
   Tergites without 2 paramedian sutures 4
4. Femur, tibia, and tarsus of ultimate legs with numerous long hairs (Fig. 9D).....*S. capillipedatus* (Takakuwa, 1938)
   Femur, tibia, and tarsus of ultimate legs glabrous.....*S. sexspinosus* (Say, 1821)

Key to species of *Cryptops* in Taiwan

1. Coxopleuron with about 13 pores spread on anteroventral surface of coxopleuron; femur of ultimate leg without a saw tooth.....*C. nigropictus* Takakuwa, 1936
   Coxopleuron with 30 or more pores (Fig. 9E); femur of ultimate leg with a saw tooth .....*C. japonicus* Takakuwa, 1934

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兩種蜈蚣*Scolopocryptops curtus* (Takakuwa, 1939)、*Cryptops nigropictus* Takakuwa, 1936的新模式標本指定及檢討臺灣蜈蚣目物種

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高桑良興在1934到1940年，發表六種臺灣產的蜈蚣，但未指定模式標本。本文指定其中兩種蜈蚣*Scolopocryptops curtus* (Takakuwa, 1939)和*Cryptops nigropictus* Takakuwa, 1936的新模式標本，並重新描述其形態特徵。此外，也檢討了三個存疑的物種的有效性，指出：*Otostigmus multispinosus* Takakuwa, 1937是*O. aculeatus* Haase, 1887的同種異名；*O. striatus* Takakuwa, 1940是*O. scaber* Porat, 1876的同種異名；*Rhysida yanagiharai* Takakuwa, 1935是*R. longipes longipes* (Newport, 1845)的同種異名。並提出臺灣的*Scolopocryptops*屬與*Cryptops*屬的檢索表。

關鍵詞：新模式標本，蜈蚣目，系統分類學，臺灣。