

**A FIRST EPIGEAN SPECIES OF *STYGOPHRYNUS* KRAEPELIN
(AMBLYPYGI: CHARONTIDAE) FROM JAVA AND ADJACENT
ISLANDS, INDONESIA WITH NOTES ON *S. DAMMERMANI* ROEWER, 1928**

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ABSTRACT. – *Stygophrynus sunda*, new species, is described from Ujung Kulon National Park, Banten and adjacent island in the Sunda Strait based on male and female specimens. The only previously known species from the Sunda region, *Stygophrynus dammermani* Roewer, 1928, is reviewed and discussed with the new illustrations and diagnostic characters. The distribution of *S. dammermani* is found across western Java up to central part of Java and the Krakatau Islands. The distribution of *S. sunda* is recently only found in southern Sumatra and far-western Java.

KEYWORDS. – *Taxonomy, morphology, Asia, biodiversity.*

INTRODUCTION

The amblypygid genus *Stygophrynus* was first proposed by Kraepelin (1895) for *Charon cavernicola* Thorell, 1889, from Burma. Since then, seven additional species have been added to the genus, including *S. cerberus* Simon, 1901, from Burma, *S. brevispina* Weygoldt, 2002 from Thailand, *S. longispina* Gravely, 1915 and *S. berkeleyi* Gravely, 1915, from Malaysia, *S. moultoni* Gravely, 1915, and *S. dammermani* Roewer, 1928, from Indonesia, and *S. forsteri* Dunn, 1949, from the Solomon Islands.

The Indonesian species of *Stygophrynus* are poorly known. The first to be reported was *S. moultoni* based on a single male specimen collected from the summit of Klingkang Range in West Kalimantan. This species was subsequently reported from Sebesi Island situated in the Sunda Strait by Quintero (1986). The second was *S. dammermani*, from caves in western Java (Roewer, 1928). Whilst identifying specimens collected in a variety of locations in the Sunda region of Indonesia, an additional species was identified. The purpose of this paper is to describe the new species and provide new illustrations and a new diagnosis for *S. dammermani*.

MATERIALS AND METHODS

The specimens examined during the course of this study are deposited in the following institutions: Museum Zoologicum Bogoriense, Indonesia (MZB), the Western Australian Museum, Perth, Australia (WAM) and the Zoological Reference Collection, National University Singapore, Singapore (ZRC). The general terminology and the pedipalpal spination follow Weygoldt (2000) and the pedipalpal terminology follows Harvey & West (1998). The measurements were made with a standard ocular grid fitted within a binocular Olympus microscope and follow the system deployed by Quintero (1981). The genitalia were examined by lifting the genital operculum.

TAXONOMY

CHARONTIDAE Simon, 1892

Stygophrynus Kraepelin, 1895

Stygophrynus Kraepelin, 1895: 44; Kraepelin, 1899: 248; Pocock, 1900: 129; Gravely, 1915: 443; Mello-Leitão, 1931: 53; Werner, 1935: 471; Weygoldt, 2000: 25.

Type species. – *Charon cavernicola* Thorell, 1889, by original designation.

Diagnosis. – Principally having three or two major spines on the dorsal surface of the pedipalpal patella, a divided pedipalpal tarsus and at least three spinelets on the pedipalpal tibia both dorsally and ventrally (Kraepelin, 1895; Gravely, 1915; Dunn, 1949; Weygoldt, 2000).

Remarks. – *Stygophrynus* is a member of Charontidae which is characterized by the presence of a row of setae on the proximal edge of the cleaning organ on the pedipalpal tibia (Quintero, 1986; Harvey & West, 1998; Weygoldt, 1996, 2002). The only other genus of the family, *Charon* Karsch, 1879, is distinguished from *Stygophrynus* by the presence of only two major spines on the pedipalpal patella and an undivided pedipalpal tarsus (Harvey & West, 1998; Weygoldt, 2000). Dunn (1949) proposed the subgenus *Stygophrynus* (*Neocharon*) to accommodate *S. moultoni* from Kalimantan and *S. forsteri* from the Solomon Islands.

Stygophrynus sunda, new species

(Figs. 1, 3–12)

Material examined. – Holotype: male (MZB.Ambl. 109), INDONESIA: Banten: Air Panas Cibiuk [= Hot Water spring], under stones on small limestone area (06°47'08.3"S 105°31'22.6"E, alt. 81 m a.s.l.), Desa [= Village] Taman Jaya, Kecamatan [= District] Sumur, Kabupaten [= Regency] Lebak, coll. Sidiq Harjanto and Cahyo Rahmadi, 25 Feb.2007.

Paratypes. – INDONESIA: Banten: 1 female (MZB. Ambl. 110), 4 juveniles (MZB. Ambl. 111–114), same locality data as holotype; 1 male (MZB.Ambl.021), 2 females

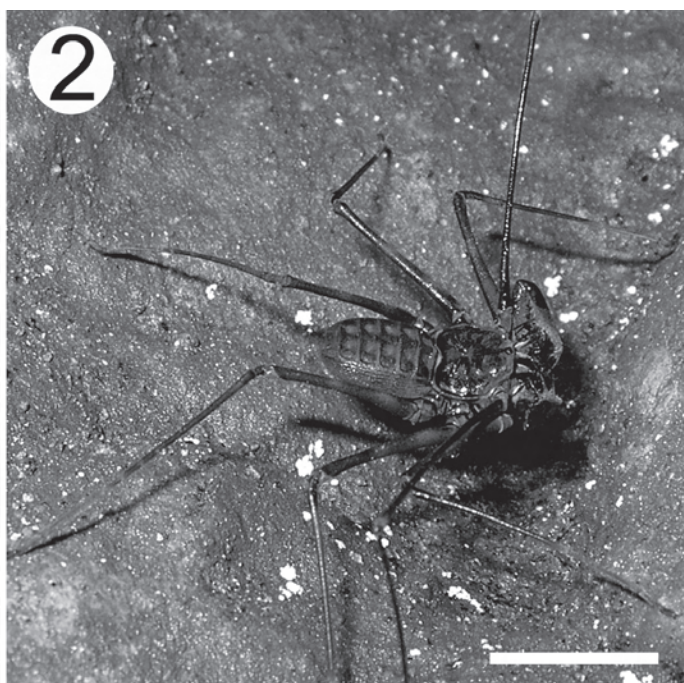
(MZB. Ambl.022–023) (1 female with an egg sac on ventral abdomen) and 1 juvenile (MZB.Ambl. 023), Ujung Kulon, Ujung Kulon National Park, coll. Team Oxford (Christopher Stewart), Aug.1993; 7 females (MZB.Ambl. 025–031), Pulau Legundi (no specific location, presumably located on Lampung Bay), coll. unknown, 21 May 1955.

Specimens for comparison. – 1 male and 1 female *Stygophrynus berkeleyi* (ZRC.ARA.529: 2 ex.) MALAYSIA: Kedah, Baling, Limestone cave. coll. H. D. Collings. Apr.–May 1935. Identified by E.A.M. Speijer. All specimens of *Stygophrynus dammermani*.

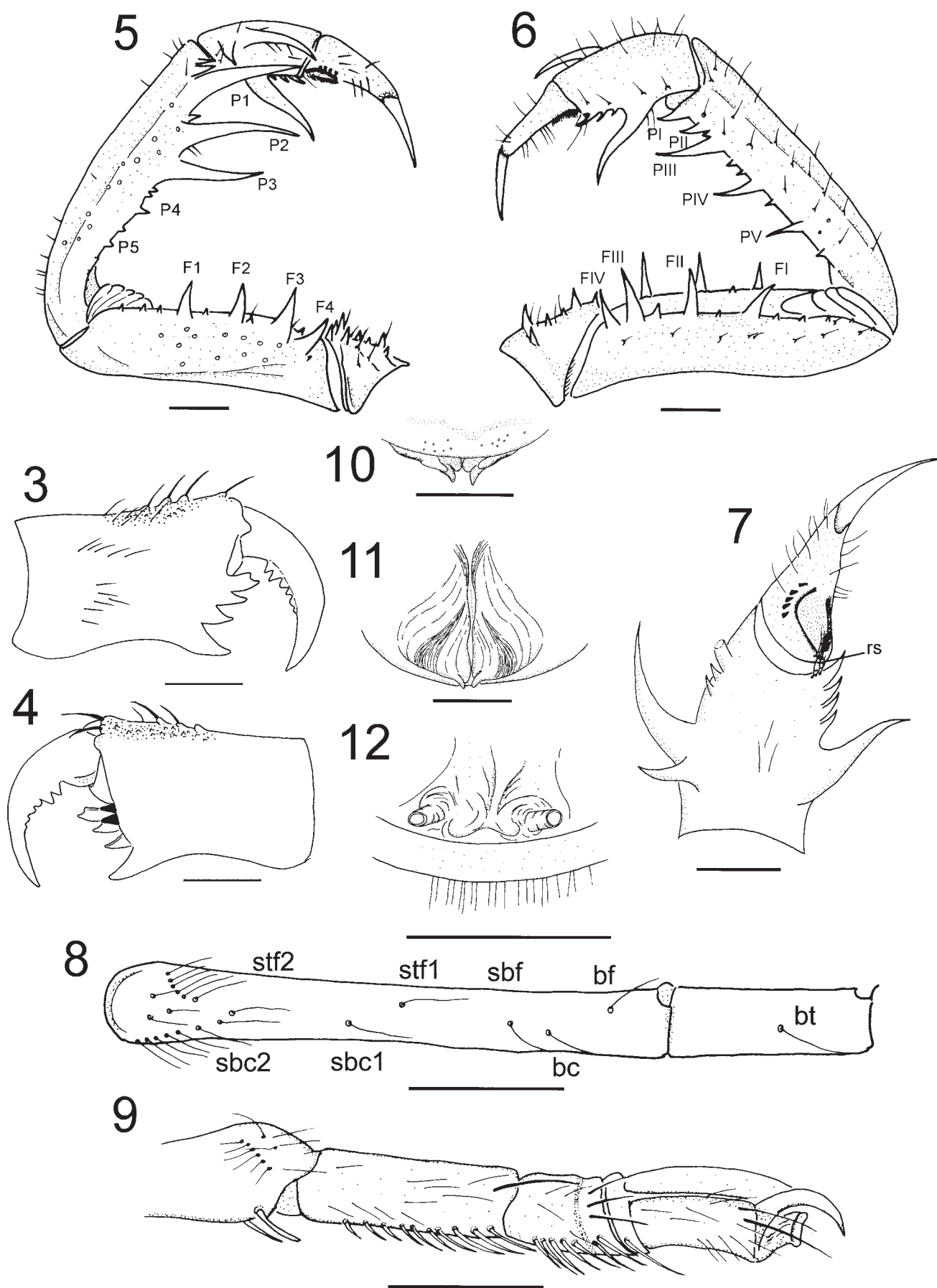
Diagnosis. – Can be easily distinguished from other species of the genus by the following combination of characters: two teeth on the external face of the basal cheliceral segment; six teeth on the movable finger with the 2 dorsalmost teeth about equal in size, the remaining teeth decreasing in size distally; the dorsal surface of the chelicera roughened with small denticles.

Description. – Male holotype: Colour of living holotype specimens: carapace, pedipalpal femur dark black, pedipalpal tibia and tarsi reddish, pedal tibiae reddish, abdominal tergites greenish; colour in alcohol: carapace, pedipalps and legs brown; tergites yellowish-brown; femur of legs without annulations. All setae acicular.

Carapace (Fig. 1): anterior margin nearly straight, with 12 setiferous tubercles, eye tubercle black, large and high with two setiferous tubercles on dorsal surface, eyes slightly directed to anterolateral margin, surface with numerous small tubercles lacking setae especially on frontal margin, several setiferous tubercles, central sulcus deep and radiating; frontal process triangular, tip visible from above.



Figs. 1–2. *Stygophrynus* from Java: 1, Male holotype of *Stygophrynus sunda* new species collected from Ujung Kulon National Park. 2, *Stygophrynus dammermani*, female from Buniayu Cave (MZB.Ambl.118). (Photo. C. Rahmadi). Scale bars: 1 = 4 mm; 2 = 7 mm.



Figs. 3–12. *Stygophrynus sunda*, paratype male (MZB.Ambl.021): 3, left chelicera, internal view; 4, left chelicera, external view. Holotype male (MZB.Ambl.109): 5, left pedipalp, dorsal view; 6, left pedipalp, ventral view; 7, left pedipalpal tibia; 8, left leg IV showing trichobothria; 9, left leg IV, tarsal segments; 10, male genitalia, ventral view; 11, male genitalia, dorsal view. Paratype female (MZB.Ambl.022): 12, female genitalia. Scale bars = 1mm.

Chelicera (Figs. 3–4): dorsal surface with 7 large and 7 small setiferous tubercles; antero-dorsal surface of basal segment with 2 setiferous tubercles on outer margin and 1 setiferous tubercle on inner margin, basal segment with 4 teeth on internal margin (Fig. 3), the upper-most tooth bicuspid, with lower cusp larger than upper cusp, the lower-most the largest, external margin with 2 teeth on common base (Fig. 4), movable finger with 6 teeth, the 2 proximal teeth about equal in size, teeth 3 to 6 decreasing in size distally.

Sternum: anterior sternite of tritosternum elongate, median and posterior sternites rounded; anterior sternite with 2 apical setae and 2 intermediate setae; median sternite with 3 small setae and 2 large setae, posterior sternite with 2 large setae.

Pedipalp (Figs. 5–6): trochanter with 8 spines and 11 setiferous tubercles on anterodorsal margin, spines with basal setae, with 7 anteroventral spines, and many setiferous tubercles; femur with 4 major spines and many small denticles on anterodorsal margin, **F3** the longest, **F3** > **F2** > **F4** > **F1**, 1 small spine between **F1–F2**, **F2–F3** and **F3–F4** (Fig. 5), 4 major spines and 4 small spines on anteroventral margin, **FIII** > **FII** > **FI** > **FIV**, with several small spines between **FI** and distal margin, 1 small spine between **FI–FII**; **FIII** and **FIV** situated close together on proximal margin (Fig. 6); patella with 3 major spines about equal size and 2 small spines on anterodorsal margin, with 2 small spines between **P1** and distal margin, with 1 small spine between **P1–P2** and **P4–P5**, and with 3 small spines between **P5** and proximal margin (Fig. 5); with 5 major spines and 6 small spines on anteroventral margin, **PIII** > **PIV** > **PV** > **PI** > **PII** (Fig. 6); tibia with 1 large submedial spine on anterodorsal margin, which has a subsidiary basal spine, with 3 contiguous spinelets on distal margin, the most distal the largest, this 3 small spinelets decreasing in size proximally, anteroventral margin with 1 large submedial spine and, with 4 spinelets distal ones (the most distal largest and three other decreasing in size proximally); tarsus with 5 denticles dorsal to cleaning organ, about three setae on proximal edge of cleaning organ; cleaning organ with row of short dorsal setae and 29 long setae ventrally; tarsus completely divided, apotele present (Fig. 7).

Legs (Figs. 8, 9): femora I, II, III and IV with small tubercles lacking setae. Right tibiae I with 25 segments, right tarsus I with 43 segments, left leg I is missing; tibiae II and III with 2 segments; tibiae IV with 5 segments; fourth segment with 1 trichobothrium, bt (0.48); fifth segment (distitibia) with 22 trichobothria (Fig. 8), bf (0.10), sbf (0.27), stf 1 (0.35), stf2 (0.75), bc (0.21), sbc1 (0.55), sbc2 (0.75), distitibia II and III with same number and arrangement of trichobothria (Fig. 8); tarsi II, III, IV with 4 segments, segment 2 with light transverse line, fourth segment without oblique slit; pulvilli present (Fig. 9).

Genitalia (Figs. 10–12): Male: Ventral surface with genital operculum cover the genitalia, the distal part with darker colour. Two limbs are present on ventral which is shorter than dorsal one (Fig. 10), dorsal surface with two black striations

(Fig. 11). Female: Gonopods is soft and tube-like, with setae on margin of genital operculum (Fig. 12).

Dimensions (mm), male holotype (female paratype MZB. Ambl.110): Body length (excluding chelicera) 13.00 (13.00). Carapace: median length 4.75 (4.50), width 7.00 (7.00); median eyes to anterior margin 0.15 (0.15), lateral eyes to lateral eyes 2.75 (2.40), to anterior margin 0.50 (0.50), lateral margin 0.50 (0.50). Pedipalps: trochanter length 1.75 (1.75), width 1.00 (1.00), femur length 5.00 (4.50), width 1.50 (1.50), patella length 5.50 (5.00), width 1.25 (1.25), tibia length 2.50 (2.00), width 1.25 (1.25), tarsus length 2.25 (2.40). Leg I: femur 13.75 (13.00), patella 1.00 (1.00), tibia 23.15 (22.50), tarsus 23.75 (25.00). Leg II: femur 8.25 (7.75), patella 1.25 (1.00), basitibia 7.50 (7.00), distitibia 3.50 (3.25), metatarsus and tarsus 2.75 (2.50). Leg III: femur 9.00 (8.75), patella 1.25 (1.00), basitibia 8.75 (8.25), distitibia 3.75 (3.75), metatarsus and tarsus 2.75 (2.50). Leg IV: femur 8.50 (8.00), patella 1.25 (1.00), basitibia 9.50 (9.00), distitibia 3.25 (3.00), metatarsus and tarsus 3.00 (2.75).

Etymology. – The specific epithet refers to the presence of this species on Sunda Strait. It is to be treated as a noun in apposition.

Remarks. – *Stygophrynus sunda* is most similar to *S. dammermani* but the new species is much smaller than the latter, can also be separated by the dentition of the external margin of the basal segment of the chelicera and the dentition of the movable cheliceral finger. The number of trichobothria and their arrangement is also quite different, as *S. dammermani* has 21 trichobothria (Fig. 16) and *S. sunda* has 23 (Fig. 8).

Natural history. – *S. sunda* is found live under stones in limestone forest in Ujung Kulon National Park. The habitat in Legundi Island is uncertain since no specific information on specimens examined. The distribution of this species is only known from Pulau Legundi located in the Sunda Strait and on the western ridge of Gunung Hondje near Cibiuk Hotspring, Ujung Kulon in western Java (Fig. 21).

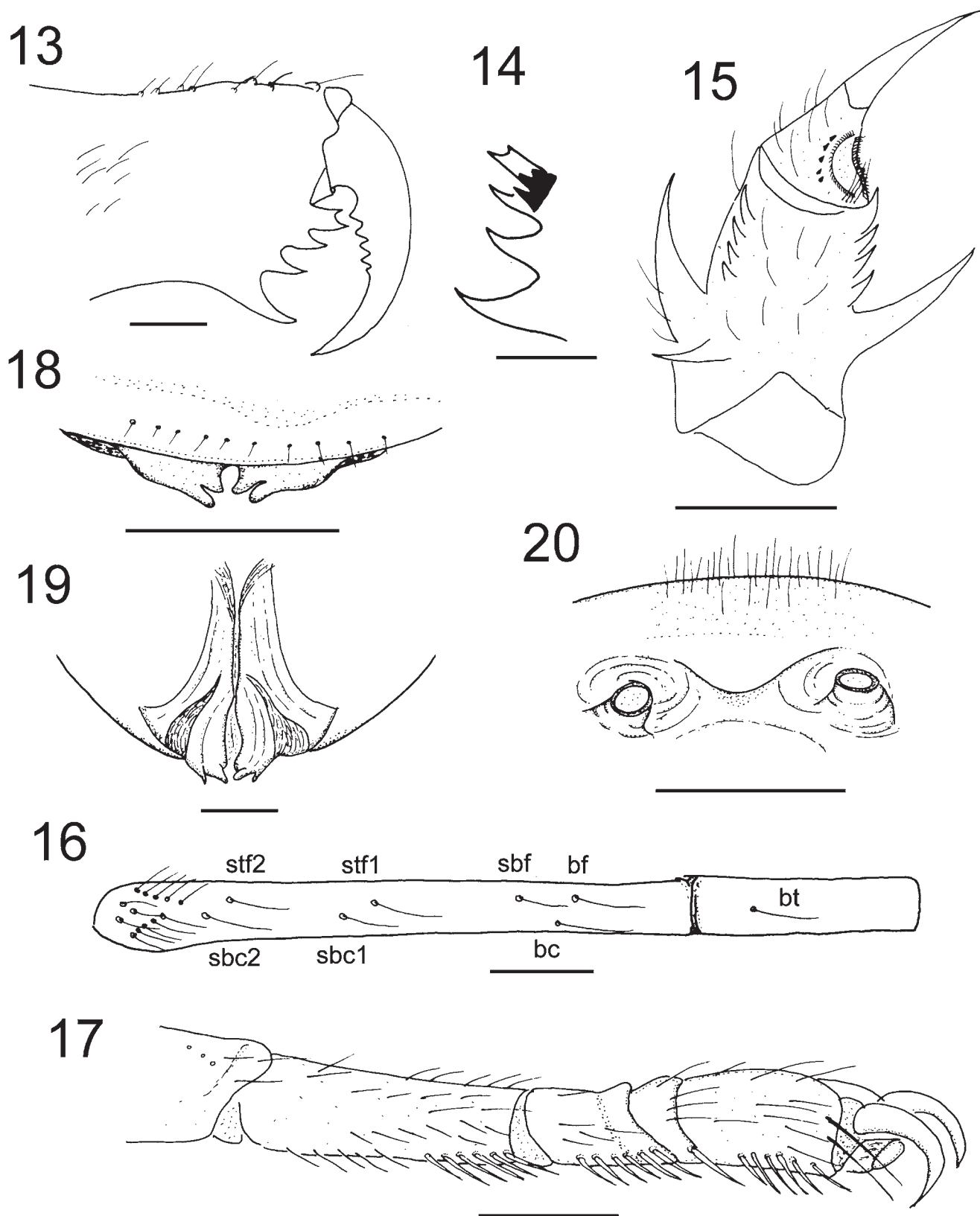
Stygophrynus dammermani Roewer, 1928

(Figs. 2, 13–20)

Stygophrynus dammermani Roewer 1928: 15–21, Figs. 1–6; Giltay 1931: 24–25; Mello-Leitao 1931: 54; Roewer 1932: Fig. 3; Werner 1935: Fig. 1; Dammerman 1948: 49; Dunn 1949: 11. *Stygophrynus (Stygophrynus) dammermani* – Harvey 2003: 10–11.

Type locality. – Goeha [= Cave] Koeda, Buitenzorg [= Bogor].

Material examined. – INDONESIA: Jawa Barat: Syntypes – 1 female (MZB.Ambl.002). Labeled: “(Typus ♀), Dammerman leg, 11.XI.1924, Java: Panoembangan Djampang, Roewer det. 1928 No. 5499; 1 male (MZB.Ambl. 032), Labeled: Guha Kuda by Loeloet, Btz. 20.XII.1923, coll. Dammerman (Original label is lost); 1 male (MZB.Ambl.001), Labeled: “1 ♂, Dammerman leg, Java: Tjiampea, Buitenzorg [= Bogor], 9.III.24, Roewer det 1928 No. 5499a”; three



Figs. 13–20. *Stygophrynus dammermani*, male (MZB.Ambl. 052): 13, cheliceral dentition, internal view; 14, cheliceral dentition, external view. Syntype female (MZB.Ambl.002): 15, pedipalpal tibia of left pedipalp. Male (MZB.Ambl.104): 16, left leg IV showing trichobothria; 17, left tarsus IV; 18, ventral view of male genitalia; 19, dorsal view. Female (MZB.Ambl.101): 20, dorsal view female genitalia. Scale bars = 1 mm.

Table 1. Comparison between *Stygophrynus dammermani* Roewer, 1928, *S. berkeleyi* Gravely, 1915, and *S. sunda* new species

	<i>S. dammermani</i>	<i>S. berkeleyi</i>	<i>S. sunda</i>
Colouration	black	brown-yellowish	brown
Cheliceral external teeth	two teeth with dorsal teeth bicuspid	Two teeth with dorsal teeth bicuspid	two teeth
Dorsal surface of chelicera	smooth	Roughened with small tubercles	Roughened with small tubercles
Number of teeth on movable finger	five teeth	five teeth	six teeth with two dorsal most about equal in size
Spines between P1 and distal margin	two spines	three spines	two spines
Number of trichobotria on distibia Leg IV	21	22	23
Habitat	caves and epigean	caves	epigean

juveniles (MZB.Ambl. 003–005) Labeled: “3 pulli, Eingeborener leg. I.24, Java: Goeha Gadjah, Kelapa Nunggal, Roewer det. 1928. No. 5499b”; 1 male (MZB.Ambl. 006) Labeled: “1♂, 26.XII.23, Dammerman leg., Java: Goeha Koeda bei Loeloet (Buitenzorg) [= Bogor], Roewer det. 1928 No. 5497”.

Other material. – INDONESIA: Jawa Barat: 1 male (MZB. Ambl. 017), 1 female (MZB. Ambl. 018), Panoembangan Djampang Tengah, coll. M.A. Lieftnik, 28 Apr.19??; 2 males (MZB. Ambl. 49–50), Gua Cikaray, Bogor, coll. C. Rahmadi, 8 Sep.2004; 1 male (MZB.Ambl.104), 1 female (MZB.Ambl.105), Gua Garunggang, Bogor, coll. C. Rahmadi, 15 Oct.2005; 1 female (MZB.Ambl. 118), Gua Buniayu, Nyalindung, Sukabumi, coll. C. Rahmadi, 18 Feb.2007; Banten: 1 male (MZB.Ambl. 115), 2 females (MZB. Ambl. 116–117), Gua Cilalay, Sawarna Village, Bayah, Lebak, coll. Sidiq Harjanto and C. Rahmadi, 25 Feb.2007; Jawa Tengah: 1 male (MZB. Ambl. 038), 1 female (MZB.Ambl. 039), 1 juvenile (MZB.Ambl. 040), Petruk Cave, Karang Bolong, Gombong, coll. Yayuk R.S. et al., 18 Aug.2000; 2 males (MZB.Ambl. 051–052), Petruk Cave, Gombong Selatan Karst, Kebumen, coll. C. Rahmadi, 12 Sep.2003; 1 male (MZB.Ambl.054), Ratu Cave, Nusakambangan Island, coll. C. Rahmadi, 3 May 2003 1 female (MZB. Ambl. 044), Merah Cave, Nusakambangan Island, coll. C. Rahmadi, 3 May 2003; 1 male (MZB.Ambl. 046), Maria Cave, Nusakambangan Island, coll. C. Rahmadi, 08 May 2003, 1 juvenile (MZB.Ambl.045), Lawa Cave, Nusakambangan Island, coll. C. Rahmadi, 6 May 2003; 2 males (MZB. Ambl. 099–100), 3 females (MZB. Ambl. 101– 103), Kiskendo Cave, Menoreh Karst, Yogyakarta, coll. Mufti S., 7 Jun.2005; INDONESIA: Lampung: 2 males (WAM 247-KA, WAM 247-JA), 1 juvenile (WAM 247-IB), 1 juvenile (WAM 247-JA), Sertung Island, under logs, coll. M.S. Harvey, 6 juveniles (WAM 121-BP, 121-I, 121-SA, 121-SA, 121-SA), 2 male juveniles (WAM 172-AD, 172-E), Rakata, Zwarte Hoek, coll. M.S. Harvey.

Diagnosis. – Can be distinguished from *S. sunda* by the dentition of the external margin of the basal segment of the chelicera: *S. sunda* has two teeth on the external margin (Fig. 4), whereas *S. dammermani* has two teeth with dorsal teeth bicuspid (Table 1; Figs. 13–14). It also differs from *S. cerberus* by the presence of four spines on the dorsal margin of the pedipalpal femur, whereas *S. cerberus* has five such spines (see Gravely 1915; Roewer 1928). *Stygophrynus dammermani* also differs from *S. longispina*, *S. berkeleyi* and *S. cavernicola* by the presence two small spines on the pedipalpal patella between P1 and the distal margin; *S. longispina*, *S. berkeleyi* and *S. cavernicola* bear 3 small spines (see Gravely, 1915;). *Stygophrynus dammermani*

differs from males *S. brevispina* by the number of pedipalpal patella: males *S. brevispina* have two major spines pedipalpal patella with the P3 reduce to a tubercle during postembryonic growth (see Weygoldt, 2002: Fig.1), external margin of chelicerae equipped with one blunt-tooth and *S. dammermani* has three major spines on pedipalpal patella. *Stygophrynus dammermani* differs from *S. moultوني* by the number of spines on pedipalpal tibia: *S. moultوني* have two spines on antero dorsal and one spine opposite the distal of dorsal one (see Gravely, 1915, Pl. XXXI: 9) and *S. forsteri* have only one ventral pedipalpal tibia spinelet distal of the large ventral spine (See Dunn, 1949: Fig. 6; Weygoldt, 2002), whereas *S. dammermani* have four pedipalpal tibia spinelets on both dorsally and ventrally (Fig. 15). *Stygophrynus moultوني* and *S. forsteri* have dorsal bicuspid tooth on internal margin of chelicera with the upper cusp larger than the lower-cusp (see Dunn, 1949: Fig. 5), and *S. dammermani* with the upper cusp smaller than the lower (Figs. 13–14).

Remarks. – We provided new illustrations for *S. dammermani* to facilitate the new diagnostic characters and to add new illustrations that not provided by Roewer (1928) such as male and female genitalia, distibia of leg IV and pedipalpal tibia. We make a correction on illustration of tarsus leg IV that Roewer (1928) showed five segments (see Roewer 1928: Fig.6) that actually only four segments (Fig. 17). The left distibial segment on leg IV with 21 trichobothria (Fig. 16) and the tarsus of left leg IV with 4 segments, segment 2 with light transverse line, fourth segment without oblique slit; pulvilli present (Fig.17). The male genitalia with black striation on dorsal view and some setae on genital operculum margin (Figs. 18–19). The female genitalia with gonopods tube-like (Fig. 20).

Natural history. – *Stygophrynus dammermani* was first described from caves in the Bogor region of western Java (Roewer, 1928) and was later found in epigean habitats in the Krakatau Islands by Dammerman (1948). The species was also found to be eaten by monitor lizards (*Varanus salvator*) based on specimens found amongst stomach contents (Dammerman, 1948). This species is found in the Krakatau Islands, caves in western Java, Nusakambangan Island, caves in Gombong Selatan (Central Java) and a small karst area in Menoreh (Central Java) (Fig. 21). *Stygophrynus dammermani*

has not been found in eastern Java and may be restricted to the western and central portions of the island. Lives in caves and also found on epigeal habitat in Krakatau Islands.

DISCUSSION

Specimens of *Stygophrynus* were first reported from Java by Gravely (1915) and Roewer (1928), and additional specimens were recorded in the Sunda Strait by Dammerman (1948) and Quintero (1986). *Stygophrynus moultoni* Gravely, 1915 was reported on Sebesi Island by Quintero (1986) who provided an image of the pedipalpal tibia (see Quintero 1986, Fig. 8). We feel that this identification is likely to be incorrect. As the pedipalpal tibia does not resemble the morphology of *S. moultoni* which has been found only from Banjaran Klingkang (see Gravely, 1915; Harvey, 2003) and in caves in the Sangkulirang karst, Kalimantan (unpublished data). The number of spines on dorsal pedipalpal tibia of *S. moultoni* has two spines with distal spine longer than proximal one and one spine on ventral part (Gravely, 1915) in contrast in *S. sunda* has one spine and one subsidiary basal spine on dorsal pedipalpal tibia and one large sub-medial spine on ventral with four pedipalpal tibia spinelets (Fig. 7).

We have found that *S. dammermani* occurs on the islands of the Krakatau group such as Sertung Island and Rakata Island, as well as in caves in western and central Java (Fig. 21). The fauna of Krakatau was thought to have been extinguished by the cataclysmic eruption of 1883 and the modern fauna derived by colonization from elsewhere (e.g. Dammerman 1922, 1948; Thornton & New, 1988; Thornton & Rosengren,

1988; Gathorne-Hardy et al., 2000; Thornton et al., 2002; Zabka & Nentwig, 2002; Yukawa et al., 2000). The Krakatau butterflies are thought to have been derived from Java rather than Sumatra even though two islands providing stepping-stones exist between Krakatau and Sumatra (Yakawa et al., 2000). Zabka & Nentwig (2002) suggested that Sumatra and Java were the most important faunistic sources for the Krakatau spider fauna. The discovery of the Javanese species *S. dammermani* on Krakatau suggests that this species is derived from Java.

In contrast, *S. sunda* is currently known from Ujung Kulon and Pulau Legundi in Lampung Bay of southern Sumatra and absent in the Krakatau group (Fig. 21). This species is also apparently absent from the east of Hondje Ridge to eastern Java, which may be related to the physiography of western Java, especially Ujung Kulon and Hondje Ridge. Bemmelen (1970) stated that the western-most regions of Java have, in some respects, more affinities with the Sunda Strait and Sumatra than with Java. During the Pliocene, Hondje Ridge and Ujung Kulon was separated by the sea from Java and formed the south-eastern end of the Barisan Range of Sumatra. Further study on the distribution of this species is required, especially on the other islands in the Sunda Strait (Sebesi, Sebuku and Panjang) and also Sumatra, to fully document the distribution of *S. sunda*.

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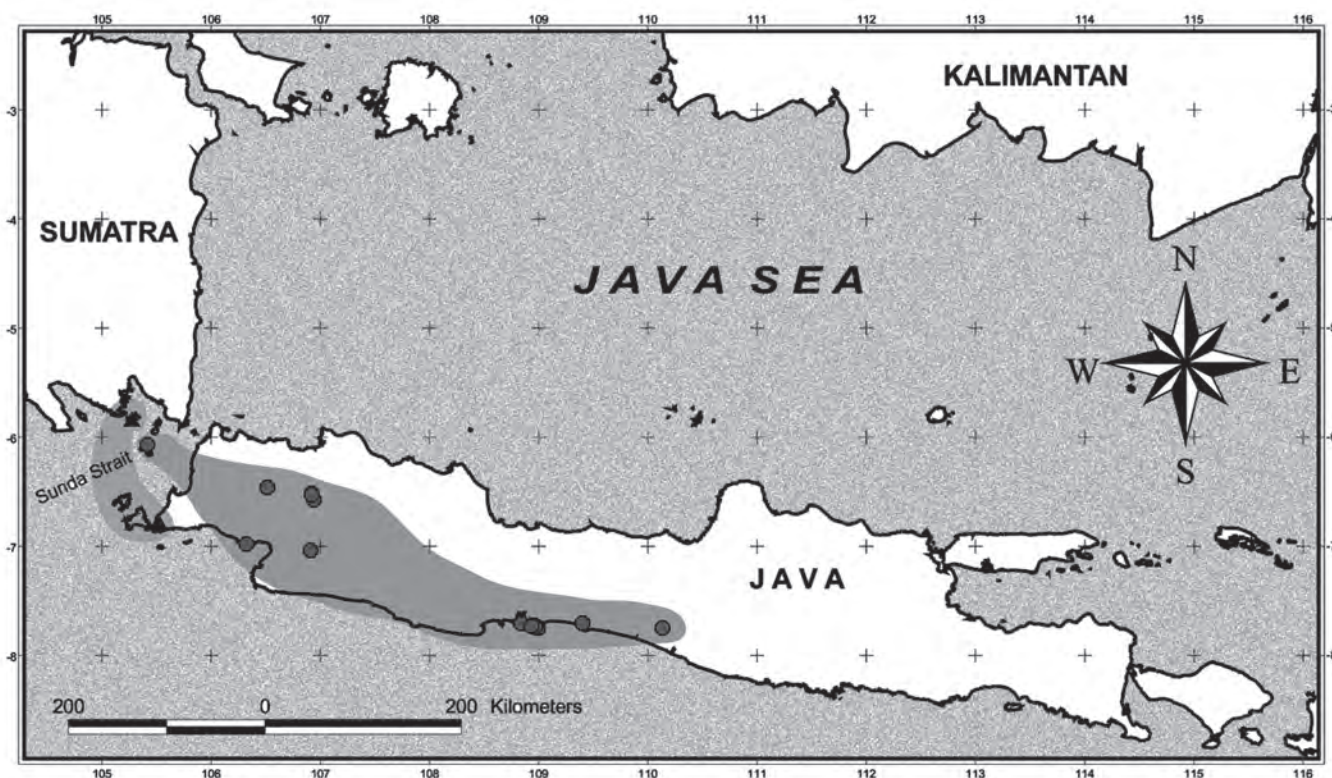


Fig. 21. Distributions of *Stygophrynus* species in Java and the Sunda Strait. (Note: circles : *Stygophrynus dammermani*, triangles = *Stygophrynus sunda*).

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