



Description of four new species of the genus *Ptilocerembia* Friederichs, 1923 (Embiopoda: Ptilocerembiidae) from Thailand

PISIT POOLPRASERT¹ & JANICE S. EDGERLY^{2,3}

¹Faculty of Science and Technology, Pibulsongkram Rajabhat University, Phitsanulok, 65000, Thailand.

E-mail: poolprasert_p@psru.ac.th

²Department of Biology, Santa Clara University, Santa Clara, 95053, CA, U.S.A. E-mail: jedgerlyrooks@scu.edu

³Corresponding author

Abstract

Four new species of webspinners in the genus *Ptilocerembia* Friederichs (Ptilocerembiidae) are described including *Ptilocerembia thaidina* sp. n., *P. senathami* sp. n., *P. catherinae* sp. n. and *P. rossi* sp. n. from Thailand. Illustrations of heads, genitalia and papilla of adult males, sternite pattern of adult females together with photographs of adult males, females and their galleries for each species are provided. Notes on field observations and egg mass structure are given for *P. catherinae* sp. n. A distribution map and a dichotomous key to the Thai species in the genus *Ptilocerembia* are also included.

Key words: Embiidina, Embiodes, taxonomy, Thailand, webspinner

Introduction

The webspinner family Ptilocerembiidae Miller and Edgerly, 2012 consists of only one Southeast Asian genus known to date, *Ptilocerembia* Friederichs, 1923, which was erected based on a single species from Indonesia (*Ptilocerembia roepkei* Friederichs, 1923). Nevertheless, the genus probably occurs throughout Thailand as well as in eastern Myanmar (Ross, 1963).

The recently established family Ptilocerembiidae is apparently related to *Oedemia* in the polyphyletic family Embiidae, designated as “Embiidae 3” in Miller *et al.* (2012). Three different analyses (Parsimony, Likelihood and Bayes) placed Ptilocerembiidae near the families Oligotomidae and Teratembiidae (Miller *et al.* 2012). Ross (1963) noted in his treatment of Australian embioiderans and his discussion of the Family Notoligotomidae (configured by Davis (1940b) to include *Ptilocerembia*) that the genus is a complex of many species occurring throughout Asia (Indonesia, Myanmar, and Thailand). Our collecting efforts in Thailand confirm Ross's assessment with the discovery of four new species. In this report, we describe and illustrate morphological characteristics of these new species. Distribution maps and a key to species of both sexes are also provided. Females with their nymphs are often the only stages encountered in the field and therefore the separate key to the nymph-like adult females is a helpful tool for field identification. Otherwise, colonies must be collected and reared to obtain adult males.

Material and methods

Webspinner specimens were collected from different localities in Thailand. Their morphological characteristics were examined and photographed with a handheld digital microscope (AM-413T-FVW Dino-Lite Pro White) and the DinoCapture Program for measurement. The head, genitalia and tarsi of males and sternite patterns of females were illustrated with the aid of a stereomicroscope with a drawing tube attachment. Photographic plates were generated with Adobe Photoshop CS5.

Morphological terminology follows that of Ross (2007), Poolprasert & Edgerly (2011), Poolprasert *et al.* (2011a, b) and Poolprasert (2014). The holotypes and paratypes are deposited in the collection of CUMNH: Chulalongkorn University Museum of Natural History, Bangkok, Thailand.

Results

Family Ptilocerembiidae Miller and Edgerly, 2012 Genus *Ptilocerembia* Friederichs, 1923

Ptilocerembia Friederichs, 1923: 24; 1934: 422; Davis, 1940a: 526; 1940b: 535; Ross, 1963: 123; Miller *et al.* 2012: 561.

Diagnosis. Males of *Ptilocerembia* (family Ptilocerembiidae) are readily distinguished from other embiopterans as follows: the antennae have long setae, the antennae are abruptly white distally, the anterior branch of the media (MA) is branched in the forewing and hindwing, the left tergal process (10LP) is short, the medial flap (MF) has a variable hook and the hind basitarsus has dense setae ventrally and only one papilla. Females are large, robust and variously pigmented. Distal antennal segments are commonly abruptly white and intersegmental areas of the thorax and abdomen are regularly pale in color. The hind basitarsus has one ventral papilla.

Type species. *Ptilocerembia roepkei* Friederichs, 1923: 24, figs. 6–8.

Distribution. Oriental region.

Ptilocerembia thaidina sp. n.

(Figs. 1A–1C, 6A, 7A–7D)

Diagnosis. Males of *P. thaidina* can be readily distinguished from congeners by the basal left cercus, excavated on the inner side in the basal half. The terminal left cercus, is short, subconical, the hemitergite of the tenth segment (10LP) is medially slightly expanded and terminally subacute and the medial flap (MF) has a dorsal hook curving forward. Females can be recognized by the abdomen mostly dark with white stripes on lateral plate and basal three abdominal terga blackish in contrast with the next four brown terga. Three terminal abdominal segments are dark brown. Coxae and trochanters are whitish, strongly contrasted by the dark femora, tibia and tarsi.

Material examined. Holotype male (CUMNH), Thailand, Chiang Mai province, Mueang district, Huay Kaeo Arboretum, 18°48.348'N 098°57.585'E, 336 m, 01.II.2008. Two paratype males and 23 paratype females: 3 females (CUMNH), same data as holotype; 2 females (CUMNH), Loei province, Phu Kradueng district, orchard, 16°53.315'N 101°53.140'E, 227 m, 26.II.2007; 12 females (CUMNH), Nong Bua Lam Phu province, Na Klang district, mixed deciduous forest, 17°25.044'N, 102°10.944'E, 376 m, 07.VII.2010; 1 female (CUMNH), Phetchabun Province, Lom Sak district, dry evergreen forest, 16°46.462'N, 101°14.323'E, 129 m, 04.IV.2008; 1 male (CUMNH), Phisanulok province, Nakhon Thai district, dry evergreen forest, 17°61.174'N, 100°50.156'E, 321 m, 14.III.2008; 1 male, 1 female (CUMNH), Tak province, Mae Ramat district, dry evergreen forest, 16°58.591'N, 98°31.012'E, 353 m, 20.III.2008; 2 females (CUMNH) Mae Sod district, hill evergreen forest, 16°45.837'N 98°54.533'E, 804 m, 26.VI.2009; 2 females (CUMNH), Mae Sod district, deciduous dipterocarp forest, 16°45.233'N 98°53.113'E, 213 m, 26.VI.2009.

Distribution: This species was collected from several localities in Thailand.

Etymology: The new species is named after the Thai people.

Description. Alate male (Fig. 1A) (n = 3), mean (range): Head width × length 1.8 (1.7–1.9) × 2.3 (2.1–2.4) mm, body length 15.3 (14.9–15.8) mm, width 2.2 (2.1–2.3) mm, forewing length 12.5 (12.1–13.2) mm, hind wing length 11.8 (10.5–12.3) mm.

Head capsule elongate-oval (longer than broad), sides convergent (Fig. 7A). Eyes entirely dark, large, prominent, subreniform. Submentum trapezoidal. Antennae 36-segmented, dark with long perpendicular hairs, six most apical segments white.

Thorax dark throughout. Wings with MA forked, brown with hyaline inter-veinal lines. All legs dark. Hind basitarsus elongate with only one papilla, plantar setae long (Fig. 7D).

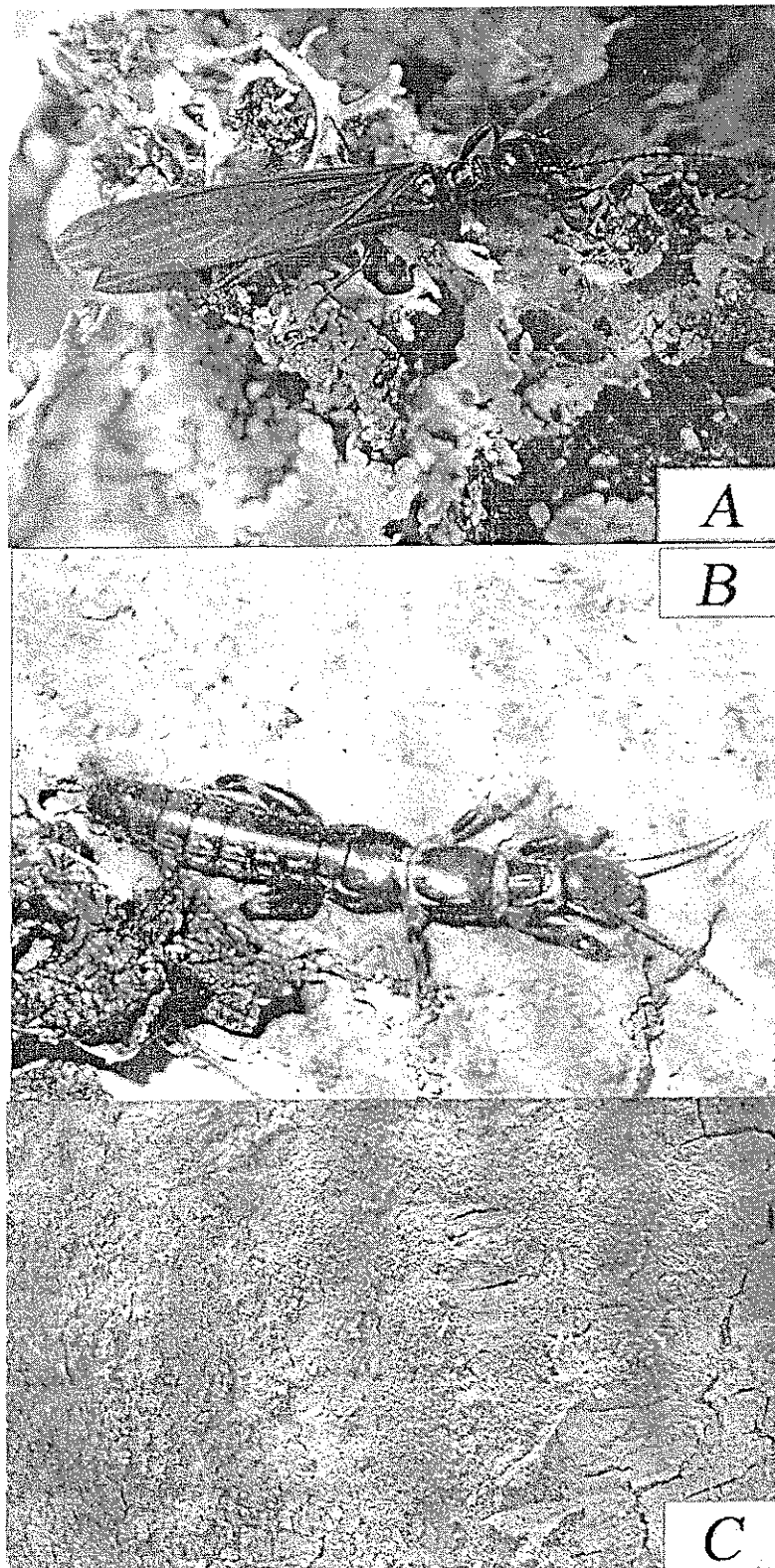


FIGURE 1. *Ptilocerambia thaidina* sp. n. (A) male, (B) female and (C) a silk gallery showing the silk camouflaged by gathered materials, including frass, stitched onto its surface by the occupants. The white silk is barely visible. Sizes of these adults and others shown in subsequent photographs are provided in the text descriptions.

Abdomen very dark brown, paler ventrally. Terminalia with tenth abdominal tergite completely cleft, hemitergites separated basally by a trapezoidal plate; 10R transverse, inner margin ending posteriorly in a blunt 10RP, anteriorly in a dorsal hook curving forward; 10L with inner margin produced backward to an elongate 10LP, medially slightly expanded, terminally subacute. LPPT broad, sclerotized, slightly arched leftward (Fig. 7B). Right cercus with two subcylindrical segments (RC_1 and RC_2) (Figs. 7B–7C). LC_1 excavated on inner side in basal half, dilated terminally with a finely echinulated nodule. LC_2 shorter, subconical, firmly set in first segment outside and inner dilation distally (Figs. 7B–7C).

Apterous female (Fig. 1B) ($n = 23$, mean [range] $\pm$ SD): Head width $\times$ length $1.9 (1.7\text{--}2.0) \pm 1.32 \times 2.3 (2.0\text{--}2.5) \pm 0.11$ mm, body length $17.4 (14.5\text{--}19.9) \pm 0.43$ mm, width $2.2 (2.0\text{--}2.4) \pm 0.51$ mm.

Head capsule as broad as long, sides short, parallel, broadly arcuated caudally, dark. Eyes dark, smaller and less kidney-shaped than in male. Submentum trapezoidal. Antennae 34-segmented, entirely black except six most distal segments white.

Thorax dark throughout. All legs concolorous with thorax except coxae and trochanters whitish, strongly contrasted by the dark femora, tibia, and tarsi.

Abdomen mostly dark with white-striped lateral plate, basal three abdominal terga blackish in contrast with the next four brown terga; three terminal three abdominal segments dark brown. Cerci medium brown.

Ptilocerembia senatham sp. n.

(Figs. 2A–2C, 6B, 7E–7H)

Material examined. Holotype male (CUMNH), Thailand, Ratchaburi province, Pak Tho district, mixed deciduous forest, $13^\circ 16.628'N$ $99^\circ 29.800'E$, 483 m, 04.II.2010. One paratype male, 32 paratype females (CUMNH), same data as holotype.

Distribution. This species is known only from Pak Tho district, Ratchaburi province, Thailand.

Etymology. The new species is named to honor Mr. Yu Senatham, an environmentalist and the chief of Kao Ang Rue Nai Wildlife Sanctuary, Chachoengsao, Thailand.

Description. Alate male (Fig. 2A) ($n = 2$, mean (range)): Head width $\times$ length $1.7 (1.6\text{--}1.8) \times 1.8 (1.7\text{--}1.9)$ mm; body length $12.5 (12.3\text{--}12.9)$ mm, width $2.2 (2.1\text{--}2.3)$ mm; forewing length $8.8 (8.8\text{--}8.9)$ mm; hindwing length $8.1 (7.8\text{--}8.3)$ mm.

Head capsule as broad as long, sides short, parallel, broadly arcuate caudally (Fig. 7E), dorsally dark. Eyes lavender black, narrowly outlined with dark amber. Submentum trapezoidal. Antennae 36-segmented, dark brown with six white antennal segments apically.

Prothorax basically chestnut brown but with dark mahogany pattern. Pterothorax pale tan dorsally, clouded with mahogany brown. All legs various shades of dark brown. Wing with MA forked, medium brown with metallic purple luster. All legs entirely blackish. Hind basitarsus elongate with only one papilla, plantar setae long (Fig. 7H).

Abdomen mottled dark purple; terminalia more darkly mottled over a basic color of chestnut brown; apices of cerci tan. 10L slightly vaulted, the vaulted area setose but basally and apically non-setose. 10LP slender; apex abruptly pointed and rugose. 10R with a strong inner margin, the medial portion (MF) bearing blunt sickle-shaped hook (EP), nodule elevated. LPPT produced as a sclerotized, sharp LPPT-P extended to LC_1 (Fig. 7F). LC_1 medium long, gradually lobed, entire inner surface coarsely echinulated. LC_2 shorter, subconical, line of fusion with LC_1 membranous, diagonal (Figs. 7F–7G).

Apterous female (Fig. 2B) ($n = 32$, mean [range] $\pm$ SD): Head width $\times$ length $1.5 (1.4\text{--}1.6) \pm 2.23 \times 1.6 (1.4\text{--}1.7) \pm 1.03$ mm; body length $14.0 (13.8\text{--}16.7) \pm 1.43$ mm, width $1.9 (1.8\text{--}2.3) \pm 0.73$ mm.

Head capsule about as long as broad, caudal margin broadly arcuate; sides short, parallel, glossy piceous dorsally with faint pattern; ventrally chestnut brown. Mandibles dark chestnut brown with piceous margins; other mouthparts various shades of chestnut brown. Submentum trapezoidal. Antennae 29-segmented, dark with long perpendicular hairs, five most apical segments pure white.

Thorax yellowish with two longitudinal brown bars. Coxae and trochanters of all legs concolorous with thorax; femora and tibia blackish brown except for short basal and terminal yellow area.

Abdomen dark purplish brown, paler at sides and ventrally; cerci brownish but with apical segment becoming yellowish at apex. Basal two abdominal terga dark brown, tergum 3 brownish yellow region on posterior half, terga 4–6 yellowish, terga 7–10 dark brown.

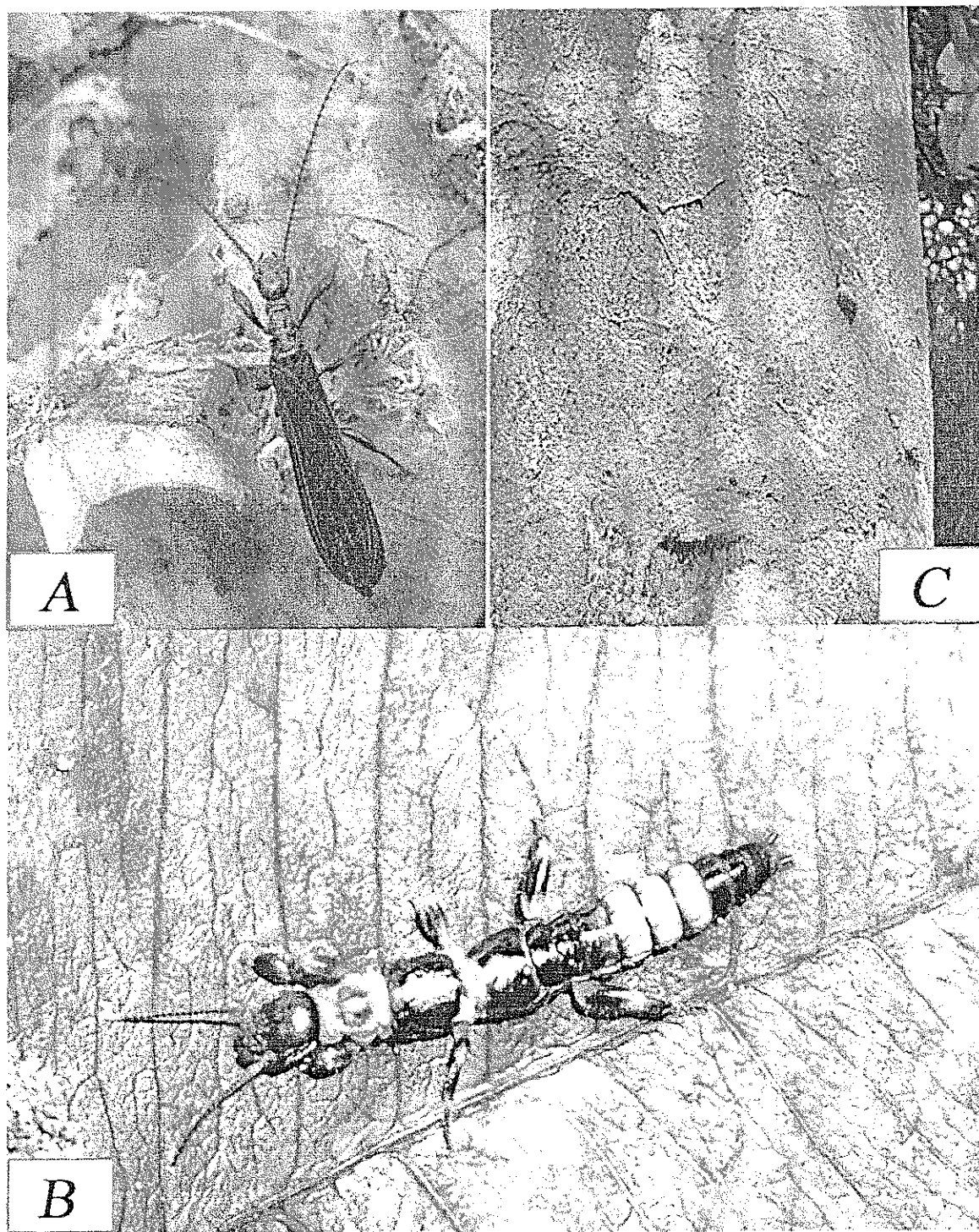


FIGURE 2. *Ptilocerembia senathami* sp. n. (A) male, (B) female and (C) silk gallery. Silk is as described for Fig. 1.

Ptilocerambia catherinae sp. n.
(Fig. 3A–3C, 4A–4B, 6C, 7I–7L)

Material examined. Holotype male (CUMNH), Thailand, Tak province, Mae Ramat district, dry evergreen forest, 16°58.591'N, 98°31.012'E, 363 m, 20.III.2008. Seven paratype males and 15 paratype females: 1 male, 2 females (CUMNH), same data as holotype; 2 females (CUMNH), Mae Sod district, hill evergreen forest, 16°45.377'N, 98°31.012'E, 811 m, 20.III.2008; 1 female (CUMNH), Mae Sod district, coniferous forest, 16°45.370'N, 98°57.056'E, 518 m 27.VI.2009; 1 female (CUMNH), Mae Sod district, coniferous forest, 16°45.241'N, 98°56.124'E, 443 m, 13.VIII.2009; 1 male, 1 female (CUMNH), Chiang Mai province, Sanpatong district, hill evergreen forest, 18°32.608'N, 98°31.521'E, 1237 m, 02.III.2008; 2 males, 3 females (CUMNH), Fang district, mixed deciduous forest, 20°04.499'N 99°14.616'E, 615 m, 31.III.2008; 3 males, 4 females (CUMNH), Mae Taeng district, hill evergreen forest, 19°18.917'N, 98°36.348'E, 1597 m, 31.III.2008; 1 female (CUMNH), Nan province, Wiang Sa district, dry evergreen forest, 18°10.803'N, 100°58.928'E, 417 m, 22.XII.2009.

Distribution. This species is known from northern Thailand.

Etymology: The new species is named after Catherine Craig, an important and creative scientist who researches the evolution of silk and works to conserve nature by promoting local economies based on silks produced by native insects.

Description. Alate male (Fig. 3A) ($n = 8$, mean (range) $\pm$ SD): Head width $\times$ length $2.0 (1.9\text{--}2.3) \pm 0.15 \times 1.8 (1.6\text{--}1.9) \pm 0.11$ mm; body length $16.6 (15.7\text{--}17.5) \pm 0.64$ mm, width $2.2 (2.0\text{--}2.4) \pm 0.12$ mm; forewing length $5.6 (4.8\text{--}6.1) \pm 0.34$ mm; hind winglength $10.5 (10.2\text{--}11.5) \pm 0.32$ mm.

Head capsule as broad as long (Fig. 7I), blackish brown. Eyes grayish purple, paler than cranium. Preclypeal and labral membranes lavender, sclerites dark brown; mandibles dark amber, sclerotized portions of the other mouthparts dark purple, appearing concolorous to the naked eye. Molar angles of mandibles deeply pitched. Submentum trapezoidal. Antennae 30-segmented, black from base through segment 26, segments 27 to 30 white.

Thorax blackish throughout. Wings with MA forked, black with purple iridescence except for narrow, white interveinal stripes; margins of costa, radial vein and cross-veins pink. All legs entirely blackish. Hind basitarsus elongate with only one papilla, plantar setae long (Fig. 7L).

Abdomen dark throughout, terminalia with 10 LP, broad, separate from 10R, 10LP broad basally, gradually arched leftward, evenly tapered to apex. 10R transverse, inner margin ending posteriorly in a blunt 10RP, anteriorly in a dorsal sharp hook backward. Media area of inner side of 10RP with a microspicule next to a protruding hook; EP process long, narrow, overlapping apex of an echinulated projection; LPPT somewhat long, sclerotized (Fig. 7J). Right cercus with two subcylindrical segments (RC₁ and RC₂) (Figs. 7J–7K). LC₁ very short, distally echinulate, expanded and lobed; LC₂ shorter, subconical, fused to LC₁ (Figs. 7J–7K).

Apterous female (Fig. 3B) ($n = 15$, mean (range) $\pm$ SD): Head width $\times$ length $2.1 (2.0\text{--}2.3) \pm 0.19 \times 1.9 (1.8\text{--}2.0) \pm 0.07$ mm; body length $17.8 (16.5\text{--}18.3) \pm 0.33$ mm, width $2.3 (2.1\text{--}2.4) \pm 0.53$ mm.

Head capsule mostly blackish brown, faintly transversely clouded reddish brown between eyes. Submentum trapezoidal. Antennae 26-segmented, with basal three antennal segments golden, all other segments dark brown except distal five segments white.

Prothorax dorsally glossy dark brown, legs mostly dark brown except for entirely golden brown tibia; meso- and metathorax and their legs similar in color but tarsi are only partially medium yellowish; membranous areas between thoracic segments tan.

Abdominal terga almost all black, faintly clouded medially with golden brown; pleura creamy white forming a lateral band on each side of the abdomen; cerci entirely black; membranous areas of venter of prothorax creamy white; venter of meso- and meta-thorax and abdomen mottled dark brown; genital sternites glossy black.

Biology. Adult females were found hiding within leaf litter on the ground during the dry season in March 2008. Freshly spun silk tubes appeared pinkish rather than white, the typical color of embiopteran silk. Older silk appeared white but was usually coated with gathered materials, such as in the arboreal colony shown in Fig. 3C. The silk tubes in the litter, each holding one insect, fit tightly. These tubes may function as hibernacula, as if the females were aestivating until the rains began. None of the dozens of females found in leaf litter had eggs or nymphs with them. When disturbed by our collecting attempts, they would scurry rapidly into underground retreats. These tactics may provide safety against predators that dig in leaf litter. In areas near creeks or irrigated

lawns, colonies were found on tree bark. These colonies appeared to be groups of nymphs, each group perhaps from one family. An egg mass uncovered in a lab colony (Fig. 4) revealed the typical style of egg clustering associated with egg-guarding and subsociality in webspinners (Edgerly 1997). The configuration of the egg mass suggests that siblings emerge together and readily form colonies. One particularly large field colony of *P. catherinae* at Doi Inthanon was sequestered within a tree-hole; the silk tubes leading from this retreat to epiphytic lichens indicated that they periodically ventured forth via these tubes to graze. The behavior of this colony suggested to us that they travel back and forth from foraging sites. Further research is warranted to determine whether they cooperate to find fresh food and how they interact with colony-mates.

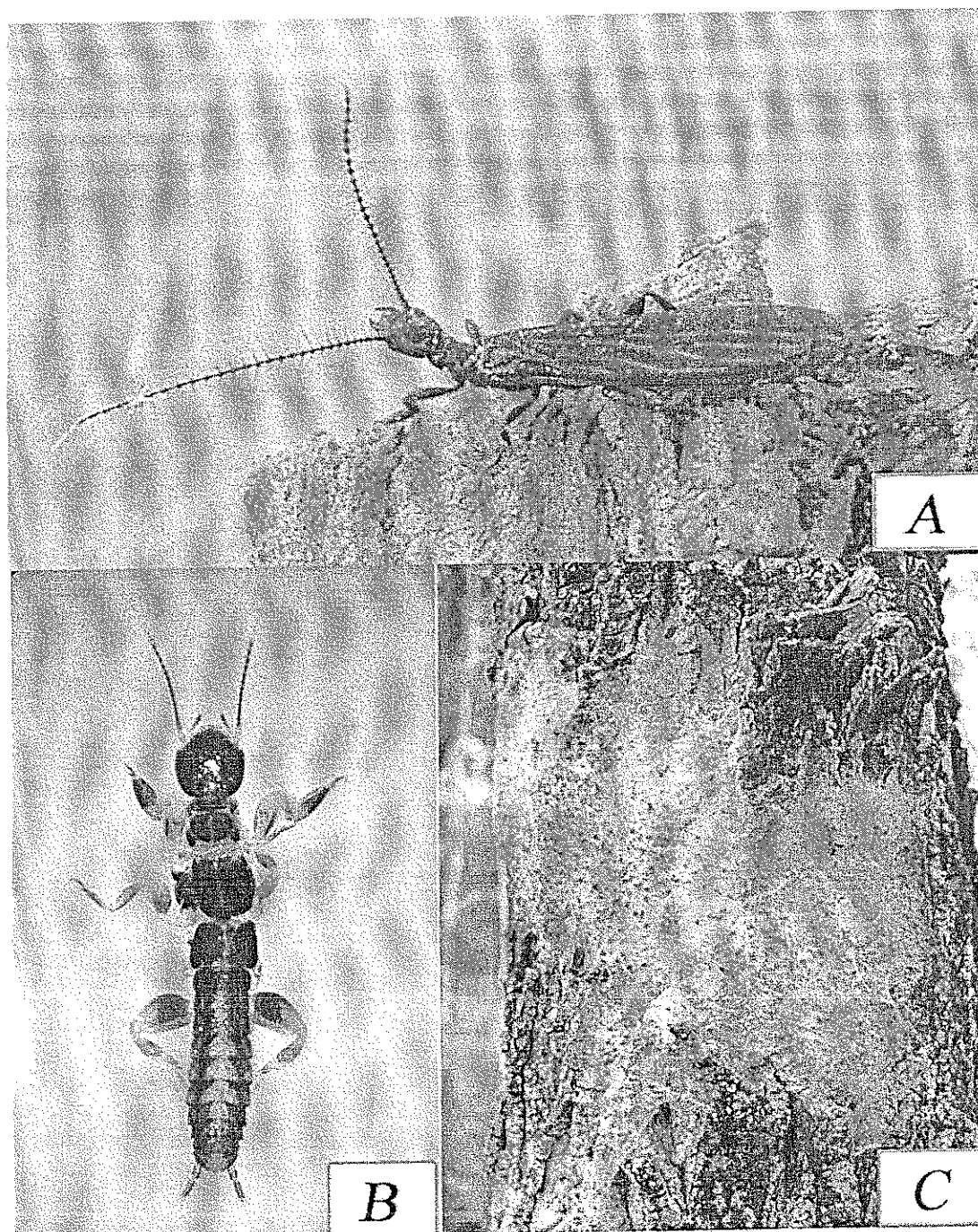


FIGURE 3. *Ptilocerembia catherinae* sp. n. (A) male, (B) female and (C) silk gallery. Silk is as described for Fig. 1.

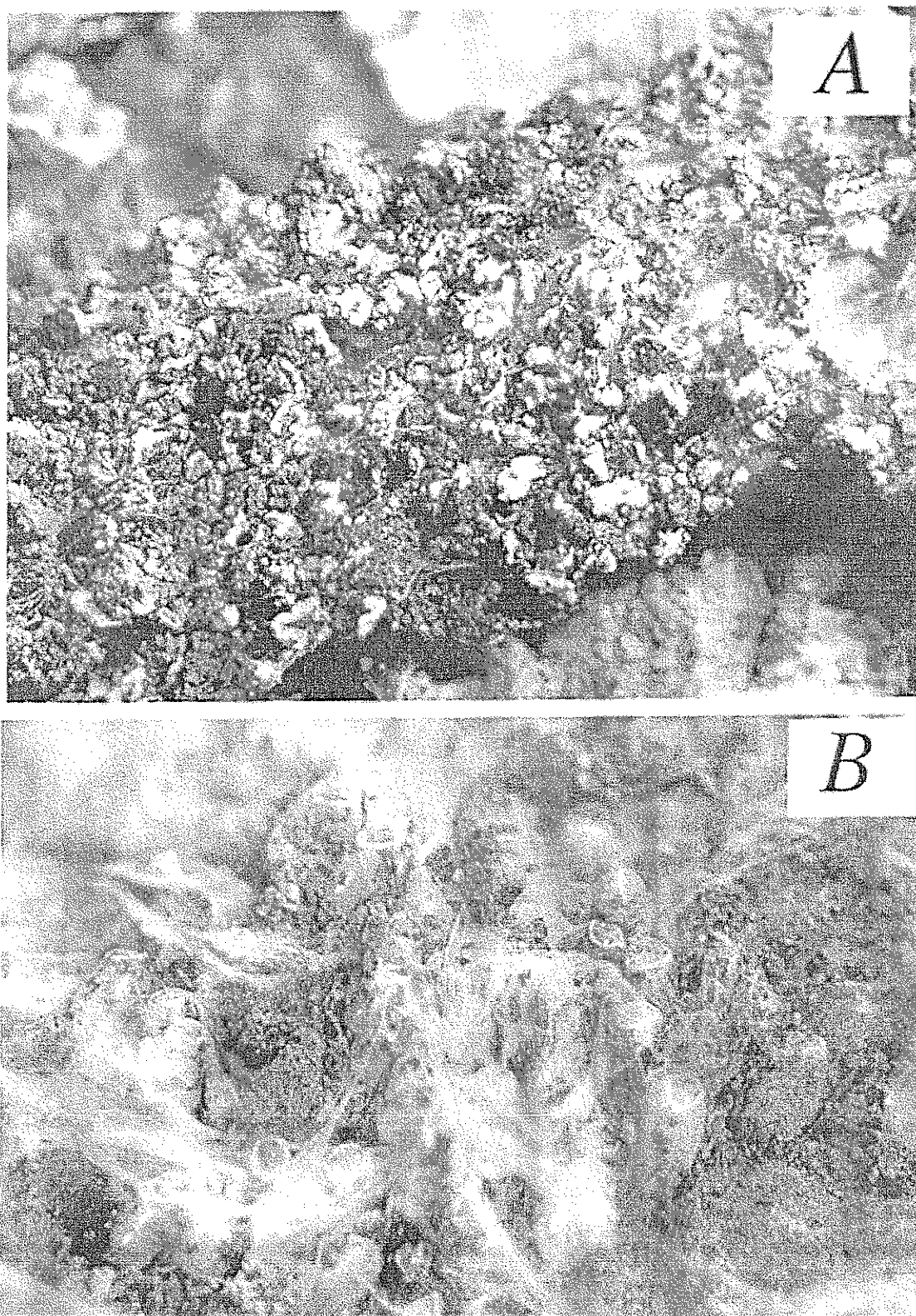


FIGURE 4. Eggs of *Ptilocerembia catherinae* sp. n. (A) coating of gathered materials stitched onto silk covering above an egg mass in a laboratory colony, (B) eggs beneath the coating shown in A, reflecting a type of egg-clustering often displayed by egg-guarding females in this order.

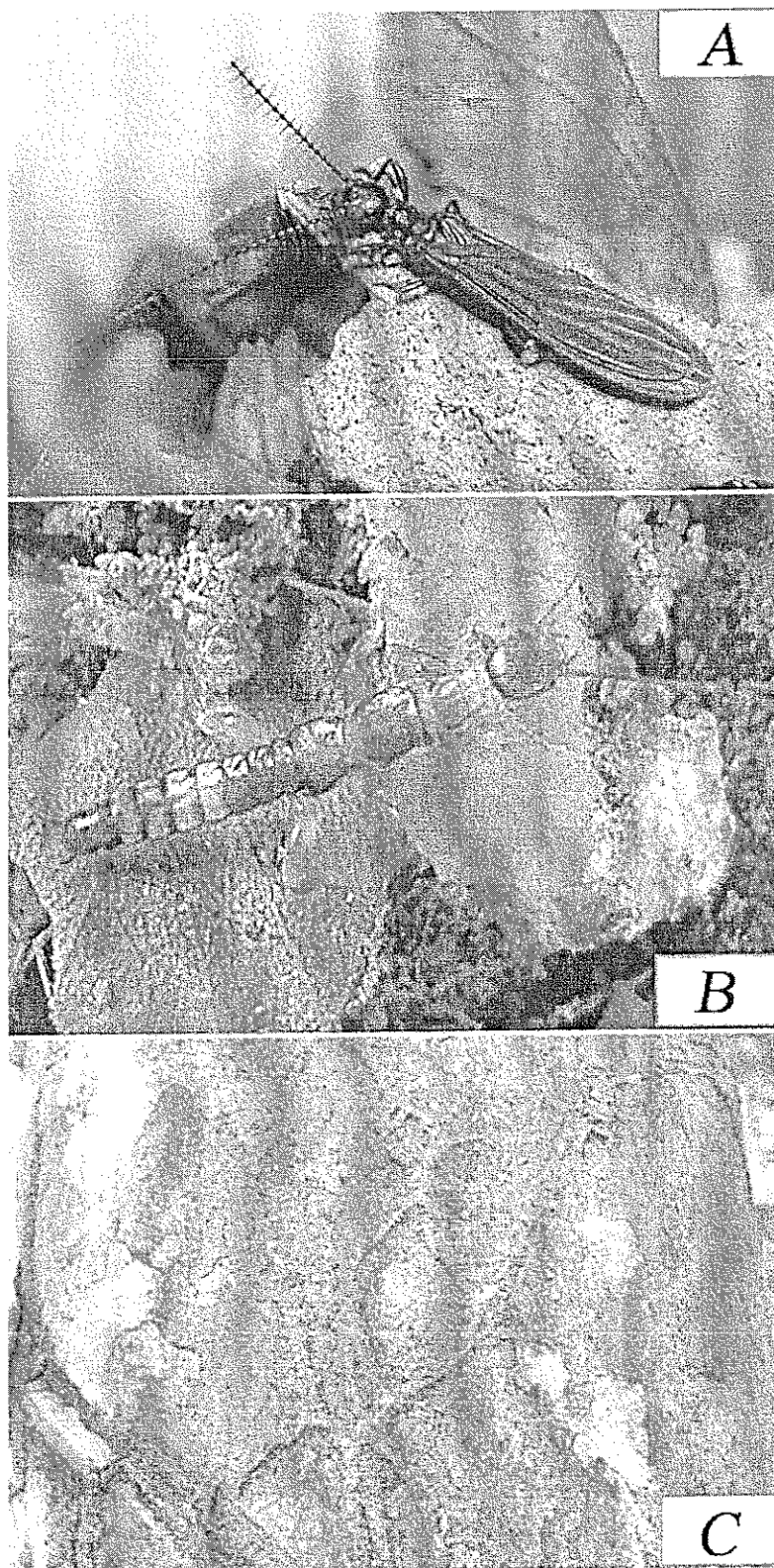


FIGURE 5. *Ptilocerembia rossi* sp. n. (A) male, (B) female and (C) silk gallery. Silk is as described for Fig. 1.

Genus *Ptilocerembia* (Adult females)

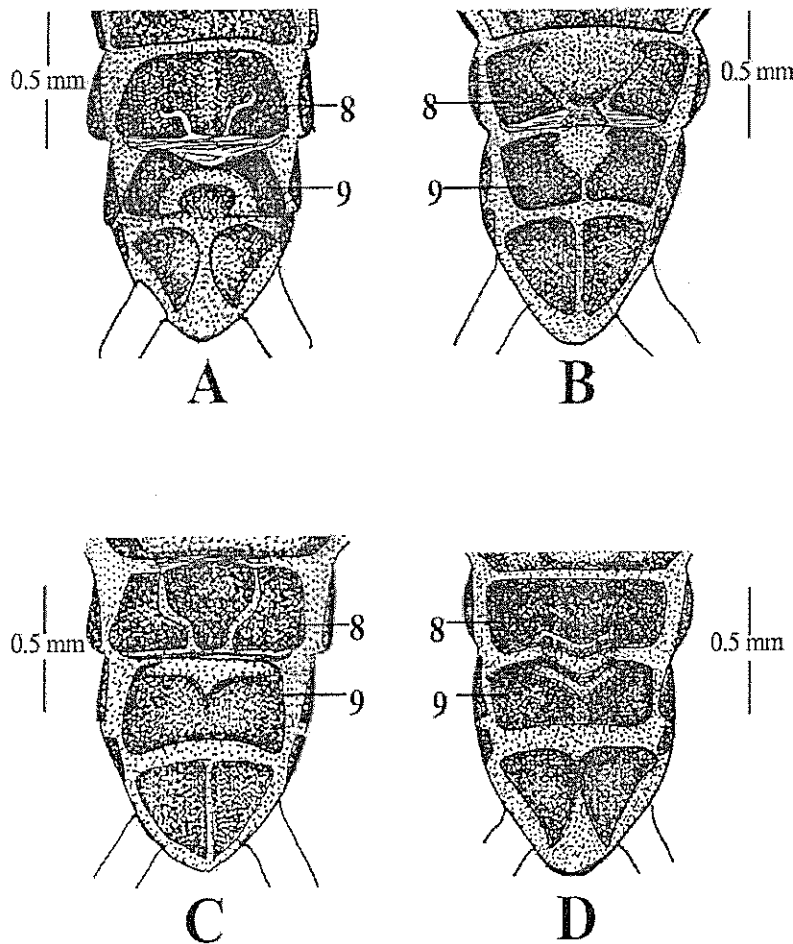


FIGURE 6. Illustrations of sternites, especially on 8th and 9th abdominal segments of female *Ptilocerembia thaidina* sp. n. (A), *P. senathami* sp. n. (B), *P. catherinae* sp. n. (C) and *P. rossi* sp. n. (D)

Ptilocerembia rossi sp. n.

Figs. 5A–5C, 6D, 7M–7P

Material examined. Holotype male (CUMNH), Thailand, Prachuap Khiri Khan province, Ban Saphan district, Rubber plantation, 11°19.124'N 99°24.422'E, 105 m, 16. IV.2009; 4 paratype males, 29 paratype females, 2 additional females (CUMNH), same data as holotype. Four females (CUMNH), Ban Saphan District, Rubber plantation, 11°19.342'N 99°24.536'E, 78 m, 03.IX.2009; 5 females (CUMNH), Chantaburi province, Soi Dao district, tropical rain forest, 13°06.184'N, 102°11.496'E, 113 m, 08.VIII.2009; 1 female (CUMNH), Klung district, rubber plantation, 12°30.742'N 102°10.562'E, 50 m, 28.XI.2009; 3 males, 5 females (CUMNH), Nakhon Si Thammarat province, Thung Song district, rubber plantation, 08°10.340'N 99°44.505'E, 103 m, 06.II.2010; 1 male (CUMNH), 01.V.2008; 4 females (CUMNH), 25.VI.2008, 7 females (CUMNH), Satun province, La-ngu district, beach forest, 06°32.502'N 099°16.411'E, 3 m, 21.X.2008; 1 female (CUMNH), Trang province, Mueang district, tropical rain forest, 07°33.423'N, 099°36.653'E, 34 m, 02. XII. 2010.

Distribution. This species was collected at several localities in Thailand.

Etymology: The new species is named after Dr. Edward Ross, the renowned Embioptera specialist.

Description. Alate male (Fig. 5A) ($n = 5$, mean (range) $\pm$ SD): head width $\times$ length 1.4 (1.2–1.5) $\pm$ 0.25 $\times$ 1.6

(1.4–1.7) $\pm$ 0.42 mm; body length 12.5 (12.3–15.5) $\pm$ 0.41 mm, width 1.9 (1.8–2.1) $\pm$ 0.03 mm; forewing length 9.2 (9.1–9.5) $\pm$ 0.73 mm; hind wing length 8.8 (8.5–9.0) $\pm$ 0.16 mm.

Head capsule about as broad as long, sides behind eyes strongly convergent and round caudally (Fig. 7 M); eyes rather large. Molar area of mandibles sharply pointed. Antennae 29-segmented, uniformly brown except for five white distal antennal segments.

Thorax dark brown but more darkly patterned with mahogany. Wing with MA forked, medium brown with metallic purple luster. All legs concolorous with thorax. Hind basitarsus elongate with only one papilla, plantar setae long (Fig. 7P).

Abdomen dark brown then caudally darker. Terminalia with 10L broad and vaulted; 10LP slender and constricted basally then tapered distally, pointed; MF a long sickle-shaped hook, with raised nodule; LPPT limited to a dark, sclerotized caudal rim; sharp LPPT-P, curved leftward, pointed to LC₁. Basal portion of left cercus (LC₁) tubular, elongated, half the length of the cercus, its echinulate lobe rather small, its caudal width gradually constricting to equal that of atrophied base of LC₂ (Figs 7N–7O).

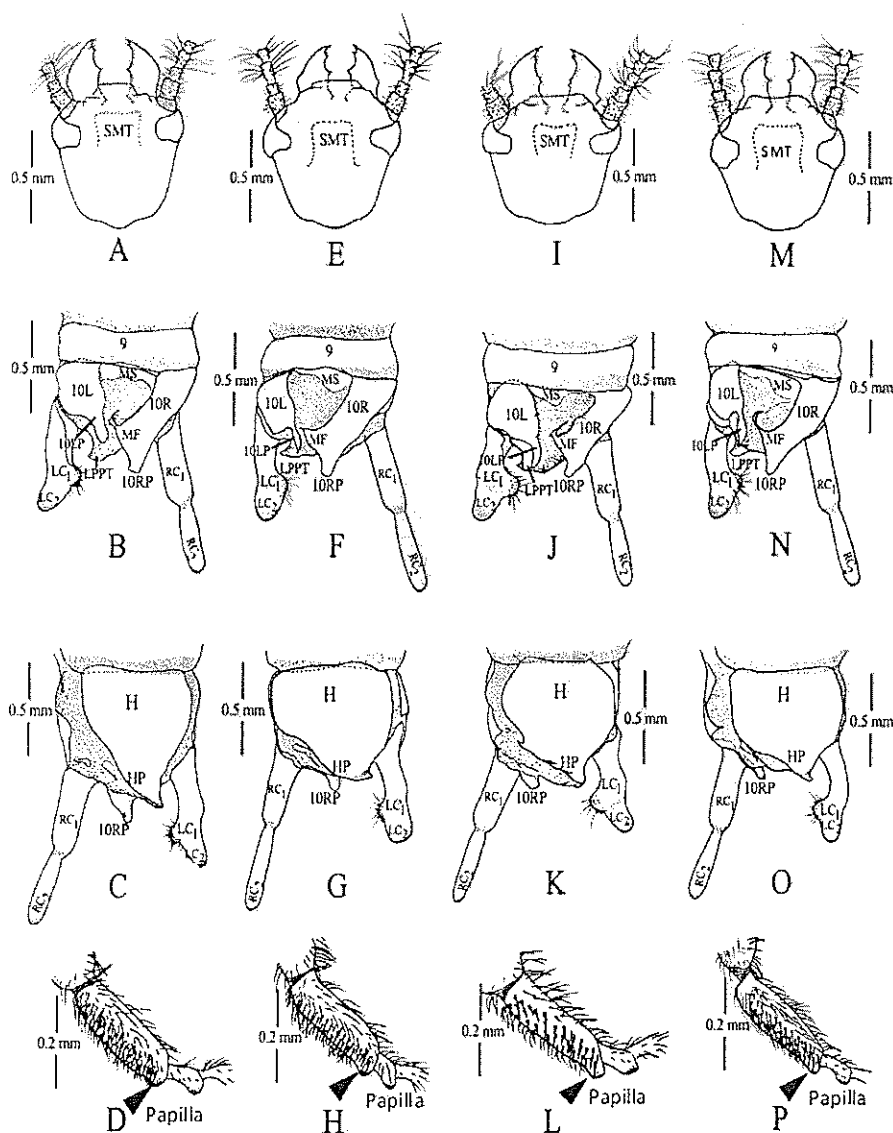


FIGURE 7. Important characters of male *Ptilocerambia thaidina* sp. n. (A–D), *P. senathami* sp. n. (E–H) *P. catherinae* sp. n. (I–L) and *P. rossi* sp. n. (M–P). A, E, I, M) Head. (B, F, J, N) Dorsal views of terminalia. (C, G, K, O) Ventral views of terminalia. (D, H, L, P) Hind basitarsus.

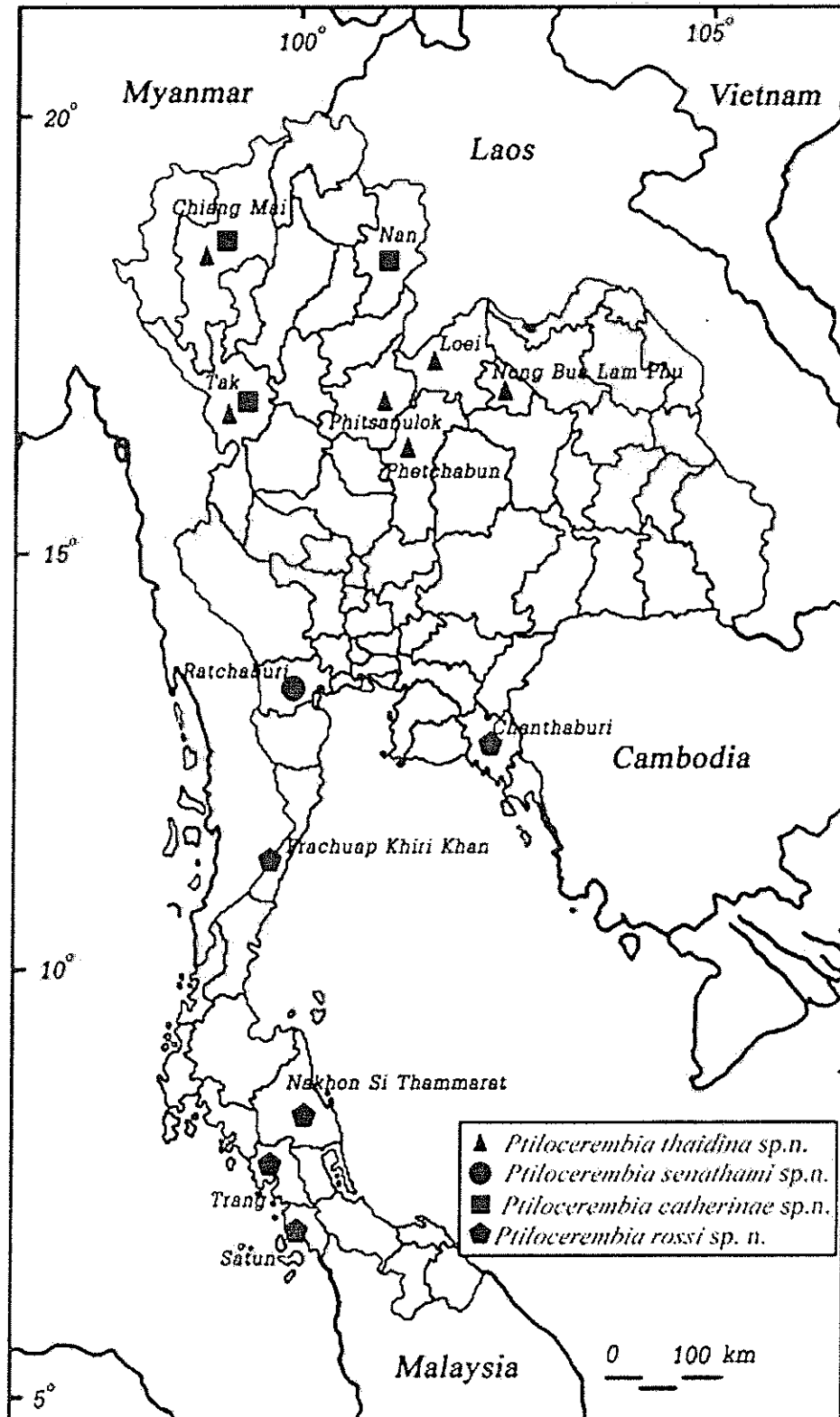


FIGURE 8. Map distribution of the genus *Ptilocerembia* (F. Ptilocerembiidae) found in Thailand.

Apterous female (Fig. 5B) ($n = 29$, mean (range) $\pm$ SD): Head width $\times$ length $1.5 (1.3\text{--}1.6) \pm 0.11 \times 1.7 (1.3\text{--}1.8) \pm 0.81$ mm; body length $14.6 (14.2\text{--}17.1) \pm 0.23$ mm, width $2.1 (1.9\text{--}2.5) \pm 0.46$ mm.

Head capsule medium brown. Eyes dark brown, less kidney-shaped than in male. Antennae 35-segmented, darker except for eight white distal segments.

Prothorax and acrotergite yellowish, mottled with medium brown. Meso- and meta-tergites and pleurites blackish brown. All legs pale yellow.

Basal three abdominal terga blackish brown in sharp contrast with the next four golden terga (mottled with medium brown); terminal three abdominal segments and cerci medium brown.

Key to species of *Ptilocerembia* (adult males)

1. Median area of inner side of 10RP with a microspiculate promontory near a projecting hook; LC_1 short, distally large echinulate nodule expanded and lobed; LC_2 shorter, subconical, fused to LC_1 ; 10LP gradually arched leftward, evenly tapering to apex; MF with a sharp hook *Ptilocerembia catherinae* sp. n. 2
- Media area of inner side of 10RP without a microspiculate promontory near a projecting hook. 2
2. LC_1 subcylindrical. 3
- LC_1 clavate. 4
3. LC_1 basally subcylindrical, distally expanded and lobed; LC_2 long, subconical; 10LP broad, medially constricted then distally expanded; MF with a short sharp hook. *P. roepkei*
- LC_1 excavated on inner side of basal half, dilated terminally; LC_2 short, subconical; 10LP medially slightly expanded, terminally subacute; MF with a dorsal hook curving forward *P. thaidina* sp. n.
4. MF with a long sickle-shaped hook, elevated nodule; 10LP slender constricted basally then tapered distally; Basal portion of left cercus tubular, elongated, half the length of the cercus, its echinulate lobe rather small, its caudal width gradually constricting to equal that of atrophied base of LC_2 *P. rossi* sp. n.
- MF with a short sickle-shaped hook, elevated nodule; 10LP slender, apex abruptly pointed; basal portion of left cercus subcylindrical, gradually lobed distally, entire inner face coarsely echinulated; LC_2 shorter, subconical *P. senathami* sp. n.

Key to Thai species of *Ptilocerembia* (adult females)

1. Head and prothorax unicolorous. 2
- Head clearly darker than prothorax. 3
2. Head and thorax blackish; abdomen mostly dark with white stripe on lateral plate, basal three abdominal terga blackish in contrast with the next four brown terga; terminal three abdominal segments dark brown; coxae and trochanters whitish, strongly contrasted by the dark femora tibia and tarsi. *P. thaidina* sp. n.
- Head and thorax dark. Abdomen with white stripe lateral on plate and conspicuous pale longitudinal mark on a dark background; tibia and tarsi darker than other part of legs *P. catherinae* sp. n.
3. Head light brown; prothorax yellowish; meso- and metathorax brown to dark; legs largely yellow; abdominal terga 1–3 dark, terga 4–7 yellowish, and terga 8–10 dark brown *P. rossi* sp. n.
- Head brown to dark; prothorax yellowish with two longitudinal brown bars; coxae and trochanters yellowish; femora and tibia, except for short basal and terminal yellow area, as darkly colored as tarsi; abdominal terga 1 and 2 dark, tergum 3 with wide pale colored patch on a dark background, terga 4–6 yellowish, terga 7–10 dark brown *P. senathami* sp. n.

Comments. Four new webspinner species in the genus *Ptilocerembia* were recorded in several localities of Thailand (Fig. 8). These species are from a variety of habitats, including dry dipterocarp, dry evergreen, hill evergreen coniferous and tropical rain forests and rubber plantation. The species are most readily distinguished by adult female coloration. Mature males also have combinations of good morphological characteristics, particularly in the head and terminalia. The results from this study expand our knowledge of webspinners in southeastern Asia. It is certain many additional species will be discovered as this major region is more fully surveyed for Embioptera.

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