

Spiders of the *Clubiona corticalis* Group from Thailand, with Descriptions of Three New Species (Araneae: Clubionidae)

Pakawin Dankittipakul and Tippawan Singtripop*

Insect Endocrinology Research Laboratory, Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand

(Accepted February 19, 2008)

Pakawin Dankittipakul and Tippawan Singtripop (2008) Spiders of the *Clubiona corticalis* group from Thailand, with descriptions of three new species (Araneae: Clubionidae). *Zoological Studies* 47(5): 644-656. Four *Clubiona* species belonging to the *corticalis*-group were hitherto known to occur in Thailand. Three new species are described and assigned to the *corticalis*-group: *C. rama* sp. nov., *C. allotorta* sp. nov., and *C. alticola* sp. nov. The male palp of *C. parconcinna* Deeleman-Reinhold, 2001 is illustrated. Three species from southern China originally designated in *Paraclubiona* are placed in the *corticalis*-group.
<http://zoolstud.sinica.edu.tw/Journals/47.5/644.pdf>

Key words: *Paraclubiona*, New taxa, Biodiversity, Zoogeography.

Clubiona Latreille, established in 1804, is the largest genus of the sac spider family Clubionidae sensu lato. The genus comprises approximately 450 species distributed worldwide (Platnick 2007). *Clubiona* species are particularly diverse in the foliage layer of primary and secondary forests including agricultural ecosystems. The genus has been revised both regionally and on a worldwide scale. Unfortunately, the species descriptions are dispersed in the literature. Lohmander (1945) recognized the morphological diversity of *Clubiona* and subsequently established a new genus *Paraclubiona* for *C. corticalis* (Walckenaer). This classification was challenged by subsequent authors. Mikhailov (1995) divided *Clubiona* into 4 subgenera, and *Paraclubiona* was given a subgeneric status in his infrageneric revision of the Palaearctic species. Deeleman-Reinhold (2001) suppressed the subgeneric status, and *Paraclubiona* was reverted to a species-group. This has been followed in recent studies dealing with Thai fauna.

In general, members of the *corticalis*-group

can be recognized by the following combination of characters (see also Deeleman-Reinhold 2001): the lack of a color pattern on the opisthosoma; a narrow cephalic region, approximately 2/3 of the carapace width; relatively long legs; an expanded tegulum of the male palp; the female copulatory openings located anterior to enlarged posterior bursae; and spermathecae dorsally with a chitinous cylindrical appendage. Representatives of the *corticalis*-group known from Southeast Asia include *C. concinna* (Thorell, 1887) from Burma, *C. parconcinna* Deeleman-Reinhold, 2001 from Thailand, *C. stiligera* Deeleman-Reinhold, 2001 from Sumatra, *C. mikhailovi* Deeleman-Reinhold, 2001 from Java, and *C. hindu* Deeleman-Reinhold, 2001 from Bali. Three species from Yunnan Province, southern China were recently described and were originally attributed to *Paraclubiona*: *C. applanata* Liu et al., 2007; *C. altissimoides* Liu et al., 2007; *C. cylindrata* Liu et al., 2007. Three new species belonging to the *corticalis*-group are added here in the present study. Consequently, 15 *Clubiona* species are now known to occur in

*To whom correspondence and reprint requests should be addressed. Tel: 66-53-943346 ext. 1435. Fax: 66-53-892259.
E-mail: scboi020@chiangmai.ac.th

Thailand (Okuma 1968, Okuma and Wongsiri 1973, Deeleman-Reinhold 2001, Vungsilabutr 2001). The presently recognized species treated here are probably only a fraction of the actual fauna. From the relatively sparse records presented above, it is clear that much collecting for clubionid spiders still needs to be done, and further basic taxonomic and faunistic work is required.

MATERIALS AND METHODS

The external morphology was examined, measured, and drawn with an Olympus SZX-9 stereomicroscope and an Olympus BX-40 equipped with a drawing tube and photographic devices. Measurements of leg segments were taken from the dorsal side. All measurements are in millimeters. Epigynes were drawn in a natural and cleared state (after immersion in 90% lactic acid for 10-20 min). Illustrations are of specimens from Thailand, unless otherwise indicated. Leg measurements are shown as: total length (femur, patella and tibia, metatarsus, tarsus).

Type specimens and other voucher specimens will be deposited in collections of the Muséum d'histoire naturelle de la Ville de Genève, Switzerland (MHNG) and the Thailand Natural History Museum, National Science Museum, Pathumthani Province, Thailand (TNHM).

Abbreviations used in the text and in the figures are as follows: A, epigynal atrium; ALE, anterior lateral eyes; ALS, anterior lateral spinnerets; AME, anterior median eyes; BS, bursae; C, conductor; E, embolus; FD, fertilization duct; GO, genital orifice; ID, insemination duct; MOQ, median ocular quadrangle; PLE, posterior lateral eyes; PME, posterior median eyes; RTA, retrolateral tibial apophysis; SD, sperm duct; SH, spermathecal head; SP, spermathecae; VTA, ventral tegular apophysis.

TAXONOMY

Clubionidae Wagner, 1887

***Clubiona* Latreille, 1804**

Type species: *Clubiona pallidula* (Clerck, 1757)

***Clubiona parconcinna* Deeleman-Reinhold,**

2001

(Figs. 1-9)

Clubiona parconcinna Deeleman-Reinhold, 2001: 117, figs. 34-40 (description of ♂ and ♀).

New materials: 1 ♂, northeastern Thailand, Nakhorn Rachasrima Prov., Pak Chong Dist., Khao Yai NP, Khao Yai, forests behind park headquarters, 800 m, 20-30 July 2006, pitfall trap, P. Dankittipakul leg. [TNHM]; 1 ♂, 1-10 Aug. 2006, P. Dankittipakul leg. [MHNG].

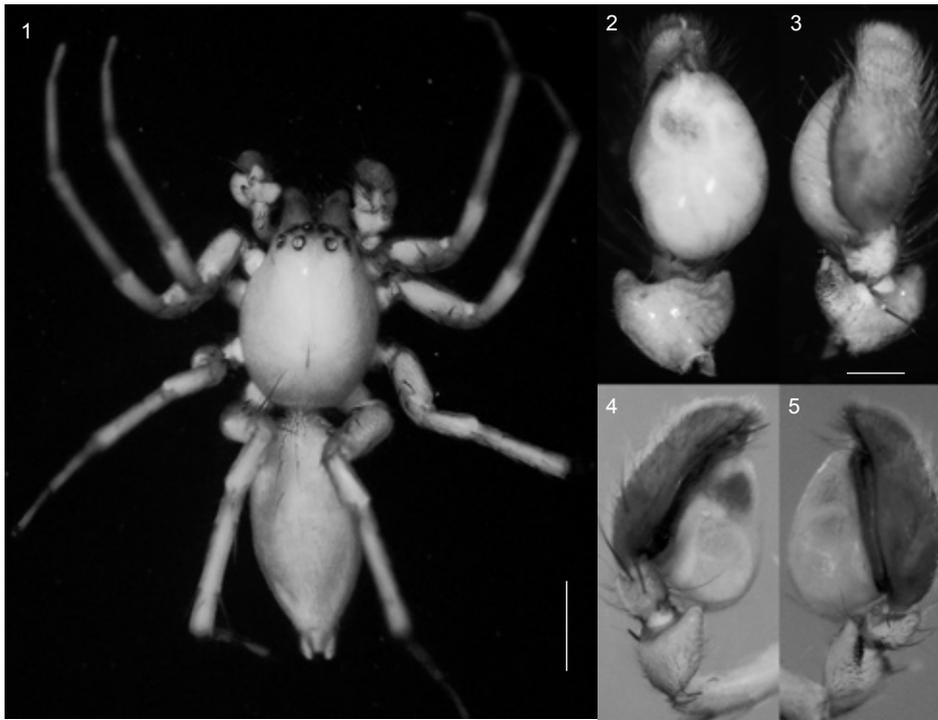
Taxonomic remarks: The male of *C. parconcinna* has 2 unique characters which separate it from all other species of the *corticalis*-group treated in this paper: the coiled sperm duct on the tegulum of the male palp is almost indistinct (Figs. 2, 3); and the male palpal patella and tibia are strongly modified, slightly enlarged prolaterally, and provided with numerous denticles retrolaterally (Figs. 2-7). Slightly larger denticles also appear on the dorsolateral side of the palpal tibia. *Clubiona parconcinna* is most similar to *C. concinna*, known from Burma, particularly in the general shape of the male palp which is spherical, and the short conical embolus and membranous conductor situated proapically (Figs. 1, 8, 9). Females can be distinguished from *C. allotorta* sp. nov. by the similar shape of the posterior bursae in which the median border is nearly parallel-sided, and the spermathecae which are ovoid. In *C. allotorta* sp. nov., the epigynal atrium is elongate-ovoid and the spermathecae are curved terminally.

Distribution: Thailand. Although mentioned in Deeleman-Reinhold (2001: 117), she did not include a male *Clubiona* obtained by canopy fogging from Borneo (NHML) in the original description of *C. parconcinna* because of the apparent variability in palpal patella and tibia. Platnick (2007), however, included Borneo in the distribution range of *C. parconcinna* in his catalog.

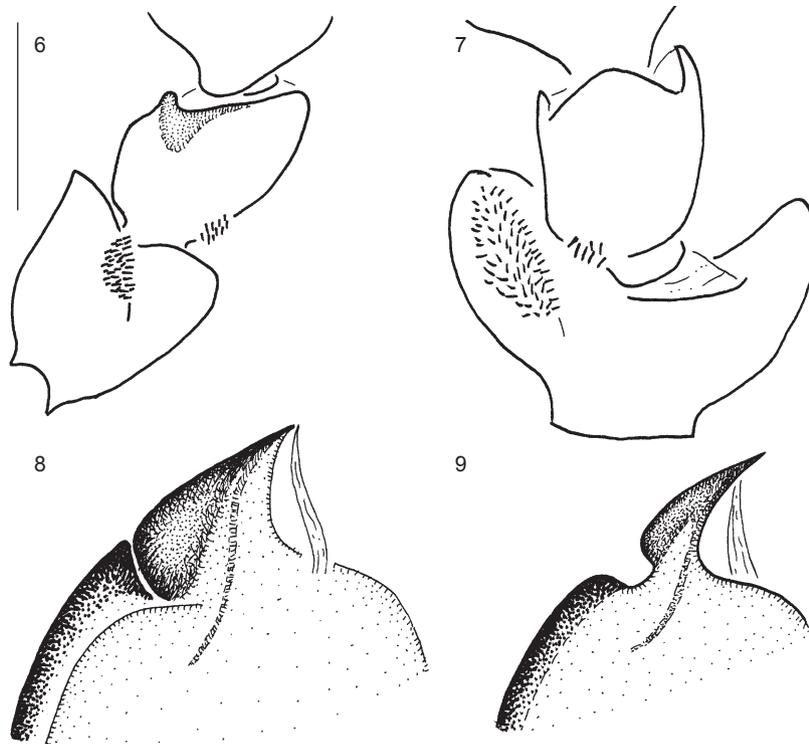
***Clubiona rama* sp. nov.**

(Figs. 10-23)

Diagnosis: *Clubiona rama* sp. nov. is placed in the *corticalis*-group because of its elongate, posteriorly expanded tegulum of the male palp (Figs. 12-14, 18-20), genital orifices located anteriorly on the epigyne (Fig. 21), and spermathecae situated anterior to the distinctly enlarged posterior bursae (Figs. 15, 22). It can be easily recognized by the apically indented retrolateral tibial apophysis (Figs. 14, 20), the presence of a median longitudinal furrow on the epigyne (Fig. 21), and the V-shaped insemination ducts (Fig. 22). *Clubiona rama* sp. nov. resembles *C. cylindrata* in many respects but is distinguished by the more-elongate posteriorly expanded



Figs. 1-5. *Clubiona parconcinna* Deeleman-Reinhold, 2001. Specimen from the type locality, Khao Yai National Park. **1.** Habitus, dorsal view; Scale bar = 1.0 mm. **2.** Left male palp, ventral view. **3.** Ditto, dorsal view. **4.** Ditto, prolateral view. **5.** Ditto, retrolateral view. Scale bars = 0.25 mm (2-5).

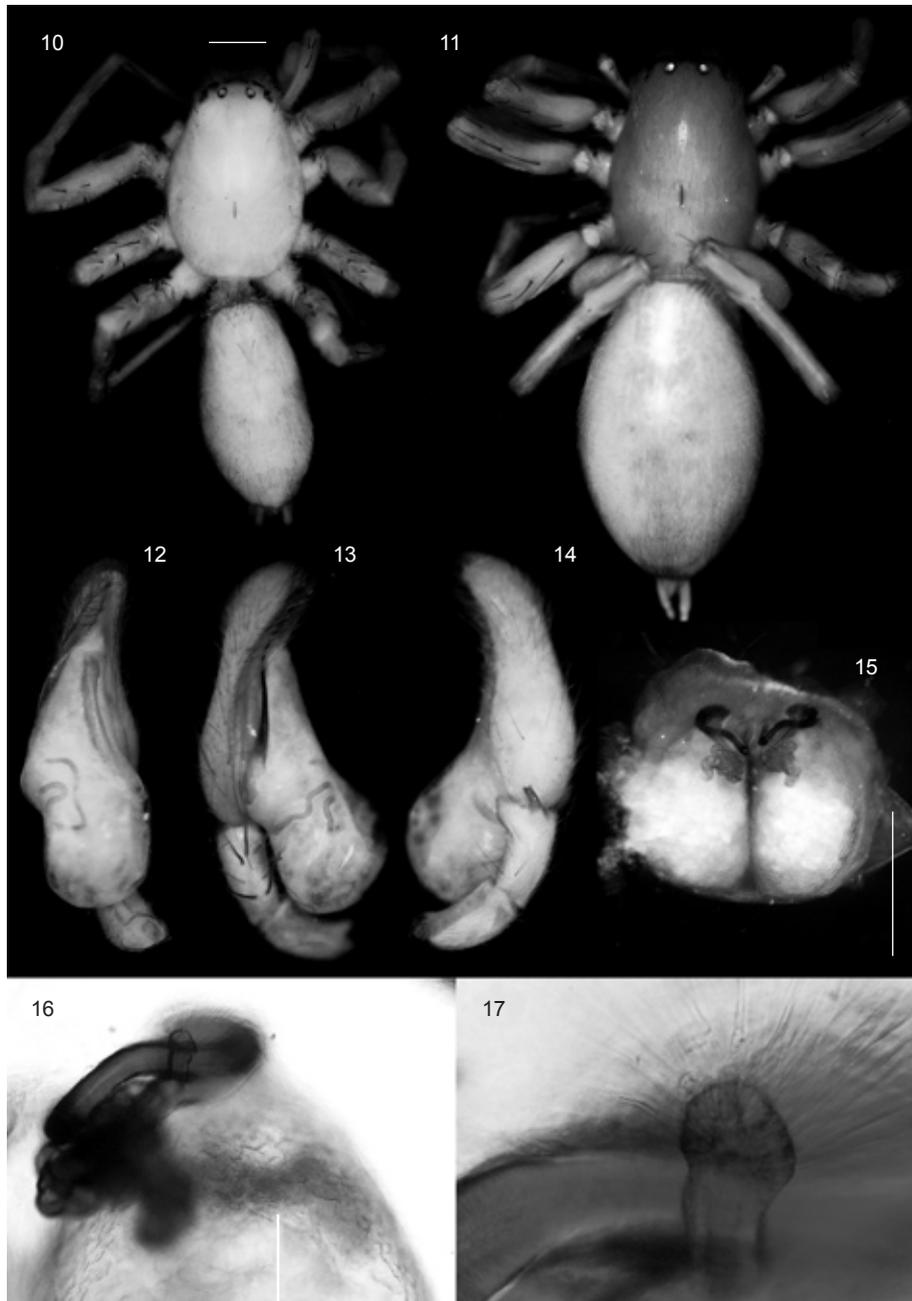


Figs. 6-9. *Clubiona parconcinna* Deeleman-Reinhold, 2001. Specimen from type locality, Khao Yai National Park. **6.** Left palpal patella and tibia, retrolateral view. **7.** Ditto, dorsal view. **8.** Apical portion of male bulb showing embolus and conductor, proventral view. **9.** Ditto, prolateral view. Scale bars = 1.0 mm (6, 7).

tegulum (reaching the palpal patella but only the palpal tibia in the latter species), the membranous apical conductor (Fig. 18), the more-elongate longitudinal furrow on the epigyne (Fig. 21), and the V-shaped insemination ducts (Figs. 15, 22). In most species a ventral tibial apophysis is apparent, although it generally appears as a small tubercle (Figs. 32, 44), but it is relatively larger and more

heavily sclerotized (Fig. 20) in *C. rama* sp. nov.

Etymology: The specific epithet is established in honor of His Majesty King Bhumibol Adulyadej the Great of Thailand, King Rama IX of the Royal House of Charkri, to pay tribute to His Majesty's achievements and enduring dedication to developing and industriously uplifting the living conditions of the Thai people throughout his 60 yr



Figs. 10-17. *Clubiona rama* sp. nov., male holotype (10, 12-14) and female paratype (11, 15-17). **10.** Male habitus, dorsal view. **11.** Female habitus, dorsal view. **12.** Left male palp, ventral view. **13.** Ditto, prolateral view. **14.** Ditto, retrolateral view. **15.** Vulva in lactic acid, dorsal view. **16.** Anterior part of vulva showing insemination ducts, dorsal view. **17.** Spermathecal heads, dorsal view. Scale bars = 1.0 mm (10, 11); 0.5 mm (12-14); 0.25 mm (15).

reign.

Type material: *Holotype*: ♂, central Thailand, Phitsanulok Prov., Wang Thong Dist., Thung Salaeng Luang NP, Thung Nang Paya, sweeping in grass meadow interspersed with pine trees, 200 m, 15 Nov. 2006, P. Dankittipakul leg. [MHNG]. *Paratype*: 1 ♂, 2 ♀♀, data same as for holotype [TNHM, MHNG].

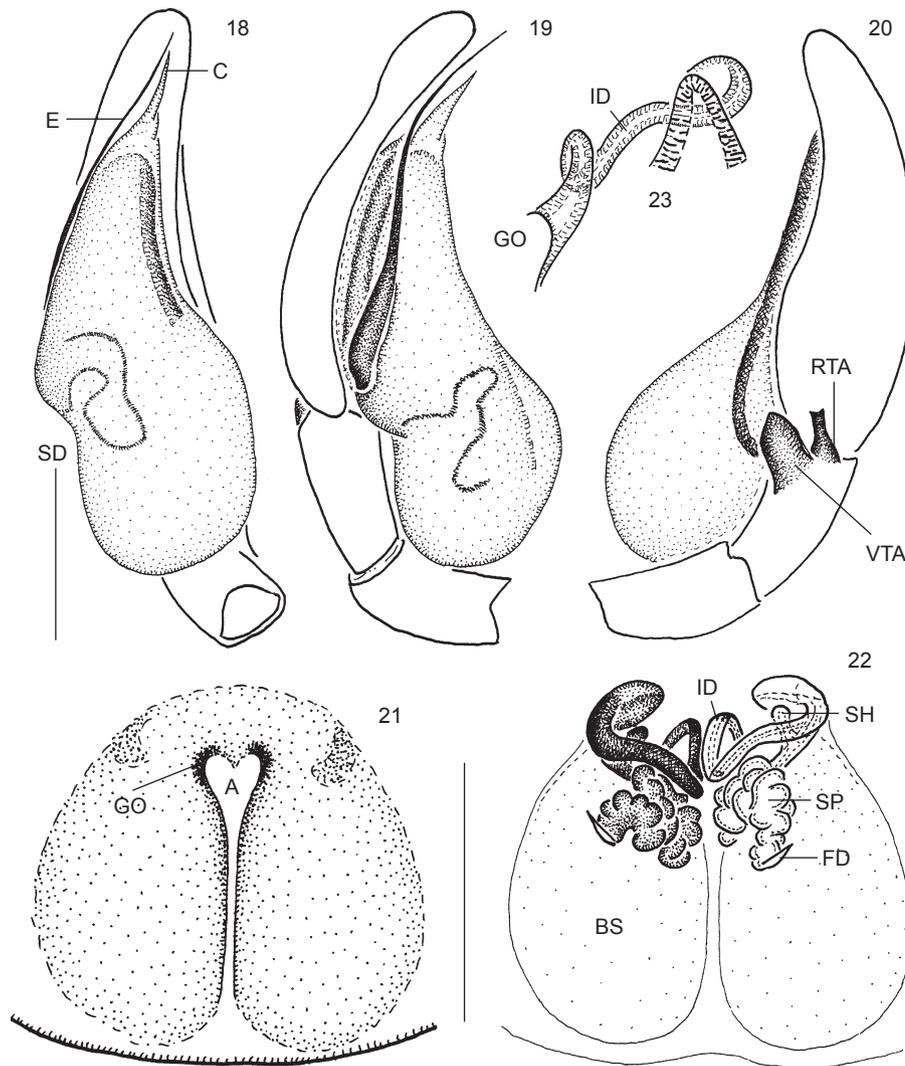
Description: *Male (holotype)*. Total length 6.2. Prosoma 2.7 long, 2.2 wide; opisthosoma 3.5 long, 1.9 wide.

Prosoma widest between coxae II and III; in profile highest just behind ocular region, gradually sloping to pars thoracica; tegument clothed with short fine hairs. Carapace pale yellow. Fovea

deep, longitudinal, red. Chelicerae yellow, dorsal surface covered with long hairs. Labium and endites yellowish-brown, serrula reddish-brown. Sternum pale yellow, margin with yellowish-brown extensions fitting intercoxal concavities.

Eye sizes and interdistances: AME 0.13, ALE 0.18, PME 0.11, PLE 0.16, AME-AME 0.15, AME-ALE 0.11, PME-PME 0.31, PME-PLE 0.23; MOQ: 0.41 long, 0.40 anterior width, 0.57 posterior width.

Legs pale yellow. Spination: femur with 1-1 proapical spines and 1-1-1 dorsal spines; posterior femur with 1 additional retrolateral spine; tibia with 2 pairs of elongate ventral and 1 pair of short apical spines; metatarsus with 1 pair of large proximal spines on ventral side, several shorter



Figs. 18-23. *Clubiona rama* sp. nov., male holotype (18-20) and female paratype (21-23). 18. Left male palp, ventral view. 19. Ditto, prolateral view. 20. Ditto, retrolateral view. 21. Epigyne, ventral view. 22. Vulva, dorsal view, right side showing internal duct system. 23. Epigyne in lactic acid showing insemination ducts, ventral view. Scale bars = 0.5 mm (18-22).

spines on dorsal and lateral sides. Leg formula 2 = 413. Leg measurements: I 8.6 (2.5, 3.5, 1.7, 0.9), II 9.8 (2.7, 3.9, 2.1, 1.1), III 7.6 (2.0, 2.7, 2.1, 0.8), IV 9.8 (2.5, 3.4, 3.0, 0.9).

Opisthosoma ovoid; anteriorly with conspicuous tuft of brown hairs. Dorsum of opisthosoma pale yellow, without a color pattern; venter pale, without markings. Spinnerets white.

Male palp (Figs. 12-14, 18-20). Ventral tibial apophysis large and broad. Heavily sclerotized retrolateral tibial apophysis tubular, broader at base, apically indented. Cymbium longer than wide, slightly excavated dorsoapically. Tegulum elongate, strongly bulging, expanded posteriorly, reaching palpal patella. Embolus filiform, slender. Conductor membranous, situated apically. Sperm duct originating retrolaterally, sinuate prolaterally.

Female (paratype). Total length 7.7. Prosoma 3.5 long, 2.4 wide; opisthosoma 4.2 long, 3.0 wide.

Prosoma ovoid; widest between coxae II and III; in profile slightly higher between ocular area and fovea; tegument clothed with short fine hairs and interspersed with long erect hairs. Carapace orange-brown; slightly darker anteriorly. Fovea deep, longitudinal, reddish-brown. Chelicerae dark brown. Labium and endites brown, anteriorly with yellow margin, serrula black.

Eye sizes and interdistances: AME 0.16, ALE 0.20, PME 0.15, PLE 0.18, AME-AME 0.15, AME-ALE 0.08, PME-PME 0.40, PME-PLE 0.26; MOQ: 0.46 long, 0.48 anterior width, 0.70 posterior width.

Legs yellowish-brown, posterior legs slightly paler; tibia yellow proximally, brown distally. Spination: femur with 1 proapical and 1-1-1 dorsal spines; posterior femur with an additional retrolateral spine; anterior metatarsus with 2-2 elongate ventral spines and 1 pair of short apical spines, posteriorly with several spines not arranged in row. Leg formula 4213. Leg measurements: I 6.7 (1.9, 2.7, 1.3, 0.8), II 7.5 (2.2, 3.0, 1.5, 0.8), III 5.9 (1.8, 2.0, 1.5, 0.6), IV 9.2 (2.6, 3.2, 2.6, 0.8).

Opisthosoma ovoid; sparsely covered with short hairs; a pair of ovoid muscle depressions situated mid-ventrally. Dorsum of opisthosoma without distinctive coloration pattern. Venter pale. Spinnerets yellow.

Epigyne and vulva (Figs. 15-17, 21-23). Atrium anteriorly cordiform, posteriorly elongate-narrowed, extending to epigastric furrow. Genital orifices situated laterally on epigynal atrium, leading to parallel insemination ducts which move posteriorly then ascend obliquely, forming an arch and descending posteriorly.

Spermathecae strongly convoluted, situated posterior to insemination ducts. Fertilization ducts short and curved. Bursae ovoid, relatively large, semitransparent.

Natural history: *Clubiona rama* sp. nov. inhabits grasslands. The type locality, Thung Salaeng Luang NP, consists of several limestone hills ranging 300-1000 m in elevation. The main mountain range stretches along a north-south direction on the western border of the park. The pristine forests were previously almost completely destroyed. The meadows including Thung Nang Paya, where specimens were obtained, are located in the southern part of the park.

Distribution: Known only from the type locality, Phitsanulok Prov., central Thailand.

***Clubiona allotorta* sp. nov.**

(Figs. 24-36)

Diagnosis: *Clubiona allotorta* sp. nov. is most similar to *C. mikhailovi* from which it can be distinguished by the anterior hood of the epigyne being heavily sclerotized (Figs. 28, 34) and the membranous, triangular bursae being much larger and well-developed than that in *C. mikhailovi* (Fig. 35). The male palp closely resembles that of *C. applanata* in the general shape of the tegulum, and the presence of an apical embolus and retrolateral conductor. However, they are separable by the smaller triangular retrolateral tibial apophysis in the latter species. Males of the new species can be recognized by the following combination of characters: the palpal tibia provided with a minute basolateral tubercle and a more-or-less triangular retrolateral apophysis (Figs. 24, 26, 31, 32); the heavily sclerotized embolus excavated basoprolaterally (Figs. 31, 33); and the conductor broad at the base, gradually tapering toward its apex, abruptly bending inward at half its length (Figs 24, 31).

Etymology: The specific epithet, *allotorta*, means another tortuous species and refers to the convoluted vulva of females. It is derived from *allos* (Greek, *ἄλλος* = another, different) and *tortus* (Latin, *tortus* = twisted).

Type material: **Holotype:** ♂, northern Thailand, Chiang Mai Prov., Chomthong Dist., evergreen hill forest, 1600-1680 m, sweeping, 10 Sept. 2005, P. Dankittipakul leg. [MHNG]. **Paratype:** 1 ♂, 2 ♀♀, data same as for holotype [MHNG]; 2 ♂♂, 2 ♀♀, Chiang Mai Prov. and Dist., Doi Suthep-Pui NP, Doi Pui, 1200 m, forests

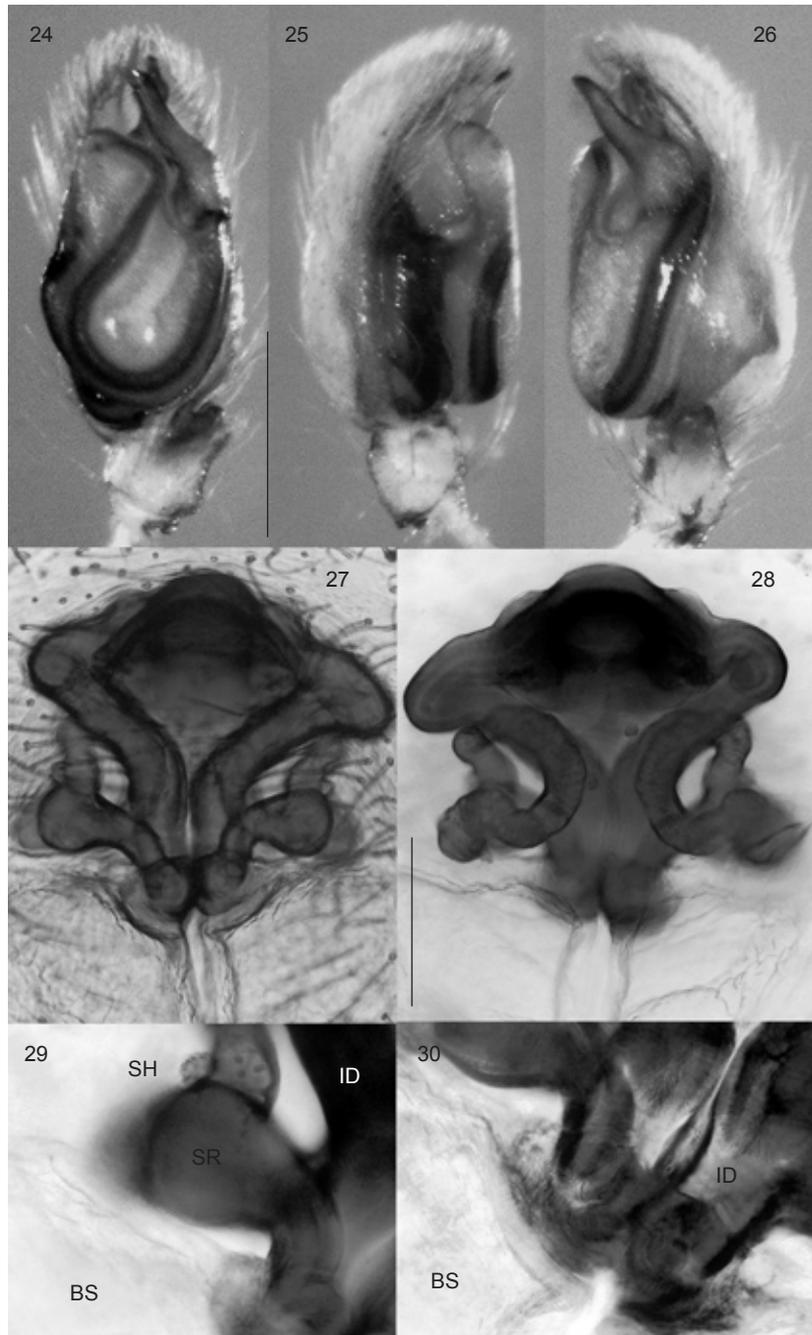
near Chang Kein Hmong Village, 15 Oct. 2002, P. Dankittipakul leg. [TNHM].

Description: *Male (holotype)*. Total length 3.3. Prosoma 1.6 long, 1.2 wide; opisthosoma 1.7 long, 0.9 wide.

Prosoma in profile highest in front of fovea; tegument clothed with short fine hairs. Carapace

white. Fovea deep, longitudinal. Chelicerae yellow. Labium and endites yellow. Sternum pale yellow.

Eye sizes and interdistances: AME 0.05, ALE 0.11, PME 0.10, PLE 0.10, AME-AME 0.03, AME-ALE 0.03, PME-PME 0.13, PME-PLE 0.08; MOQ: 0.25 long, 0.16 anterior width, 0.31 posterior width.



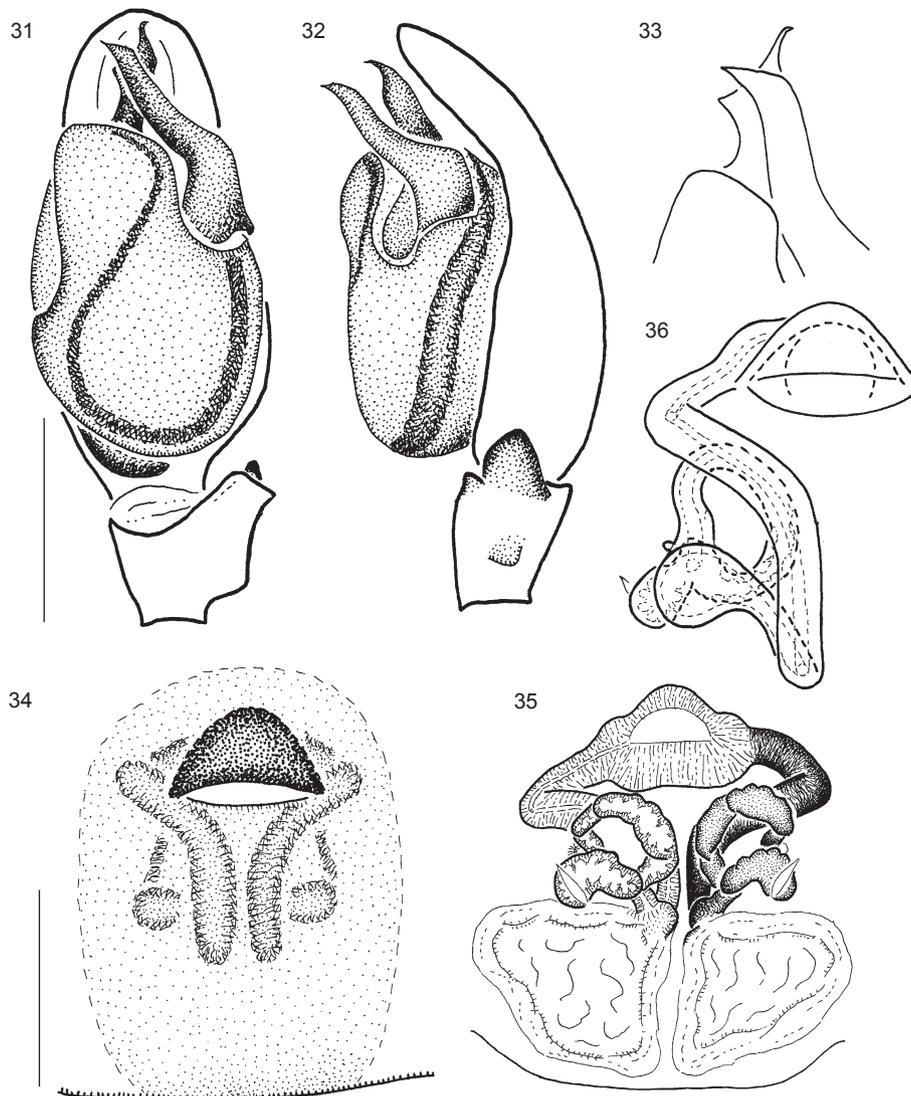
Figs. 24-30. *Clubiona allotorta* sp. nov., male holotype (24-26) and female paratype (27-30). **24.** Left male palp, ventral view. **25.** Ditto, prolateral view. **26.** Ditto, retrolateral view. **27.** Epigyne in lactic acid, ventral view. **28.** Vulva, dorsal view. **29.** Seminal receptacle of vulva, dorsal, oblique view. **30.** Vulva showing distal part of insemination ducts and bursae, dorsal, oblique view. Scale bars = 0.25 mm (24-26); 0.1 mm (27, 28).

Legs pale yellow, metatarsus and tarsus yellowish-brown. Spination: femur with 1 weak proapical and 1-1-1 dorsal spines, posteriorly with 1 additional retrolateral spine; metatarsus I and II with 2-2-2 long erect spines, spines on posterior metatarsus distinctly shorter but relatively stout, not arranged in a row, apically provided with a metatarsal preening brush. Leg formula 4213. Leg measurements: I 3.8 (1.0, 1.7, 0.8, 0.3), II 4.2 (1.2, 1.9, 0.8, 0.3), III 3.4 (1.0, 1.3, 0.8, 0.3), IV 4.8 (1.5, 1.5, 1.3, 0.5).

Opisthosoma ovoid, pale, sparsely clothed with short fine hairs. Dorsum of opisthosoma

without color markings. Venter pale. Spinnerets white.

Male palp (Figs. 24-26, 31-33). Palpal tibia with small triangular basolateral tubercle. Retrolateral tibial apophysis rhomboidal, partly hidden in ventral view. Ventral tibial apophysis triangular, lightly sclerotized. Bulb with conspicuous proapical and retroapical excavations on tegulum; sperm duct sigmoid-shaped, clearly visible. Conductor broad at base, abruptly bent inward, with sharply pointed apex. Apical embolus heavily sclerotized, distinctly excavated on prolateral side, with hook-shaped apex, sharply



Figs. 31-36. *Clubiona allotorta* sp. nov., male holotype (31-33) and female paratype (34-36). **31.** Left male palp, ventral view. **32.** Ditto, retrolateral view. **33.** Apical portion of bulb showing embolus and tip of conductor, proventral view. **34.** Epigyne, ventral view. **35.** Vulva, dorsal view, left side showing internal duct system. **36.** Schematic diagram of female duct system, dorsal view. Scale bars = 0.25 mm (31, 32); 0.1 mm (34, 35).

pointed, directed downward.

Female (paratype). Total length 3.5. Prosoma 1.7 long, 1.2 wide; opisthosoma 1.8 long, 1.1 wide.

Resembling male but slightly larger in size. Prosoma distinctly narrowed in ocular area; fovea deep, longitudinal, situated more or less posteriorly; tegument clothed with short fine hairs. Carapace yellow, slightly darker anteriorly. Chelicerae, labium, and endites yellow. Sternum pale yellow, margin yellowish-brown.

Eye sizes and interdistances: AME 0.06, ALE 0.08, PME 0.08, PLE 0.10, AME-AME 0.05, AME-ALE 0.03, PME-PME 0.15, PME-PLE 0.10; MOQ: 0.20 long, 0.18 anterior width, 0.33 posterior width.

Legs pale yellow, metatarsus and tarsus dark yellowish-brown. Spination: femur with 1 proapical and 1-1-1 dorsal spines, posteriorly with an additional retrolateral spine; metatarsus I and II with 2-2-2 very long spines ventrally, posteriorly shorter and not arranged in a row, metatarsal preening brush present. Leg formula 4231. Leg measurements: I 2.9 (0.9, 1.2, 0.5, 0.3), II 3.6 (1.0, 1.5, 0.7, 0.4), III 3.3 (1.0, 1.0, 0.9, 0.4), IV 4.5 (1.3, 1.5, 1.2, 0.5).

Opisthosoma pale yellow, covered with numerous short fine hairs. Dorsum of opisthosoma without distinct color pattern. Venter pale yellow. Spinnerets white.

Epigyne and vulva (Figs. 27-30, 34-36). Epigynal plate lightly sclerotized. Semicircular anterior epigynal atrium situated posterior to heavily sclerotized hood; genital orifices located on basolateral sides of atrial margin. Proximal part of insemination ducts thick-walled, forming V-shaped tubular structures; distal part descending downward, arranged in parallel lines, running longitudinally, connecting to triangular membranous bursae then ascending to anteriorly located seminal receptacles. A pair of enlarged receptacles connected to convoluted spermathecae and small spermathecal heads. Spermathecae forming a complete loop; carrying thin fertilization ducts on terminal ends.

Natural history: *Clubiona allotorta* sp. nov. inhabits evergreen hill forests at relatively high elevations (1200-1680 m) of Doi Suthep and Doi Inthanon, northern Thailand.

Distribution: Chiang Mai Province, northern Thailand.

***Clubiona alticola* sp. nov.**

(Figs. 37-46)

Diagnosis: *Clubiona alticola* sp. nov. is close to *C. applanata* but is consistently separable by its distinctive lanceolate conductor (Figs. 37, 43). The only difference between this new species and *C. applanata* appears to be the shape of the conductor and embolus.

Etymology: The specific epithet, *alticola*, means dweller in the heights and refers to the evergreen hill evergreen forests situated at high elevations of Doi Inthanon, which this new species inhabits. It is derived from *altus* (Latin = high) and *icola* (Latin = dweller, inhabitant).

Type material: *Holotype*: ♂, northern Thailand, Chiang Mai Prov., Chomthong Dist., Doi Inthanon NP, Doi Inthanon, evergreen hill forests, 1750 m, sifting leaf and decomposing organic litter, 15 Mar. 2000, P. Dankittipakul leg. [MHNG]. *Paratype*: 2 ♂♂, data same as for holotype [TNMH]; moist evergreen hill forests near summit of Doi Inthanon, 2500-2540 m: 1 ♀, 29 July 2006, P. Dankittipakul leg. [TNHM]; 2 ♀♀, 9 Aug. 2006, P. Dankittipakul leg. [MHNG]; 2 ♀♀, 16 Aug. 2006, P. Dankittipakul leg. [MHNG]; 2 ♀♀, 6-13 Oct. 2006, P. Dankittipakul leg. [TNHM]; 2 ♀♀, 13-21 Sept. 2006, P. Dankittipakul leg. [TNHM].

Description: Male (holotype). Total length 3.6. Prosoma 3.1 long, 2.1 wide; opisthosoma 3.5 long, 1.8 wide.

Prosoma widest in pars thoracica; in profile highest just in front fovea; tegument smooth, clothed with short fine hairs. Carapace orange, distinctly yellowish-brown anteriorly. Fovea deep, longitudinal, red. Chelicerae orange-brown. Labium and endites yellowish-brown, anterior margin pale yellow. Sternum yellow, lateral margin with yellowish-brown extensions fitting intercoxal concavities.

Eye sizes and interdistances: AME 0.11, ALE 0.16, PME 0.15, PLE 0.13, AME-AME 0.11, AME-ALE 0.06, PME-PME 0.28, PME-PLE 0.16; MOQ: 0.35 long, 0.40 anterior width, 0.58 posterior width.

Legs pale yellow except for dark-brown metatarsus and tarsus I. Spination: femur with 1 prolateral, 1-1-1 dorsal, and 1 retrolateral spines; tibia with very long 2-2 ventral spines; anterior metatarsus with a pair of very long apicoventral spines, spines on posterior metatarsus distinctly shorter, arranged in a ring. Leg formula 2413. Leg measurements: I 8.3 (2.4, 3.3, 1.8, 8.3), II 12.5 (3.4, 5.0, 2.9, 1.2), III 7.6 (2.1, 2.9, 2.0, 0.6), IV 10.2 (3.0, 3.5, 3.0, 0.7).

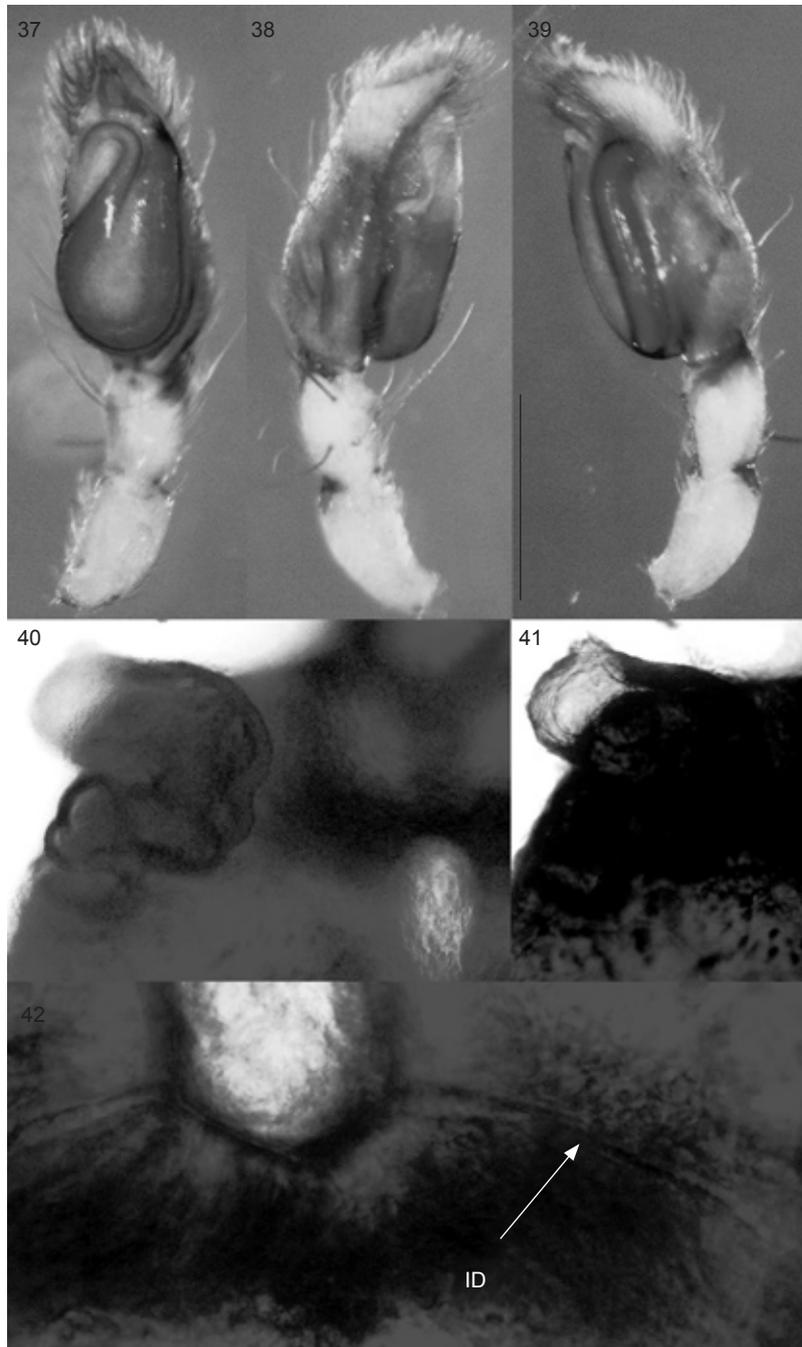
Opisthosoma elongate-ovoid; anteriorly with thick tuft of long hairs, long erect bristles sparsely

distributed. Dorsum of opisthosoma pale yellow, without color markings. Venter pale. Spinnerets white, except ALS brown.

Male palp (Figs. 37-39, 43, 44). Lightly sclerotized, triangular ventral tibial apophysis short and minute. Retrolateral tibial apophysis flat, forming a short ridge with broad base; dark reddish-brown. Bulb with elongate-ovoid

tegulum; proapical portion membranous; sperm duct sigmoid-shaped. Embolus truncate; with sharply pointed apex, distinctly slender than basal portion. Conductor lanceolate-shaped, originating retroapically, directed inward.

Female (paratype). Total length 6.5. Prosoma 3.0 long, 2.2 wide; opisthosoma 3.5 long, 2.3 wide.



Figs. 37-42. *Clubiona alticola* sp. nov., male holotype (37-39) and female paratype (40-42). **37.** Left male palp, ventral view. **38.** Ditto, prolateral view. **39.** Ditto, retrolateral view. **40.** Vulva showing spermathecae, dorsal view. **41.** Vulva showing spermathecal head, dorsal view. **42.** Part of vulva showing insemination ducts, dorsal view. Scale bars = 0.5 mm (37-39).

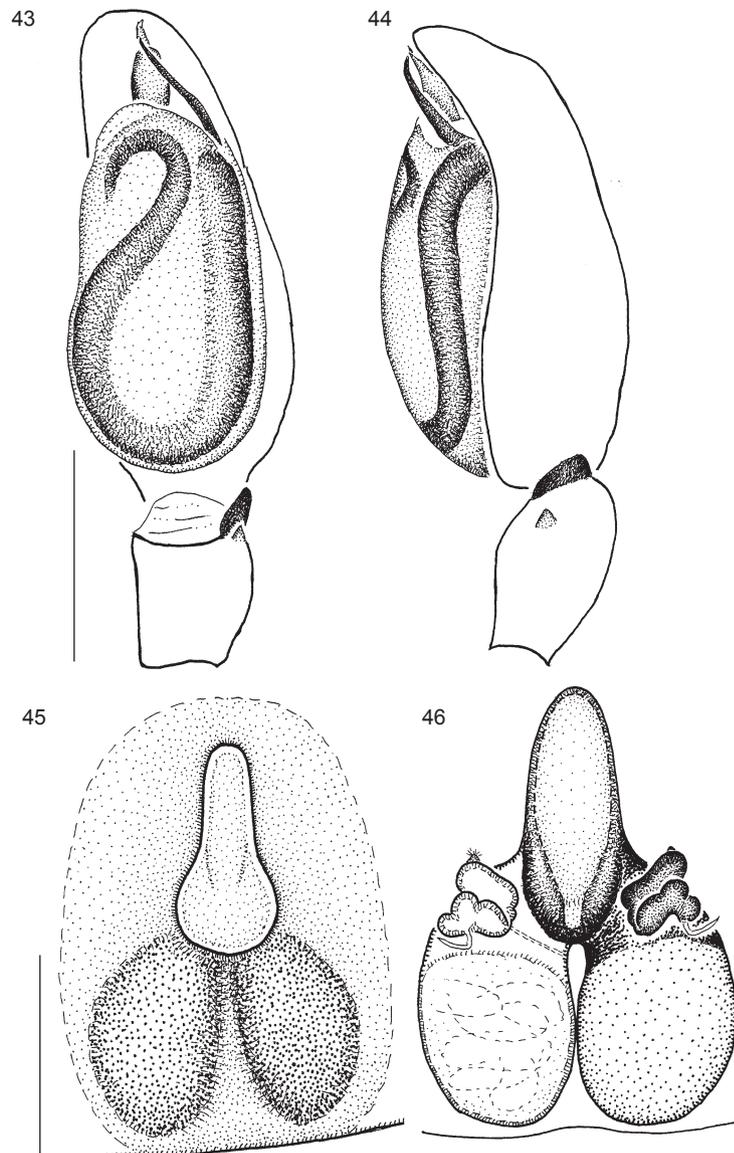
Resembling male but slightly larger in size. Prosoma widest in pars thoracica; pars cephalica relatively broad; in profile slightly higher in pars cephalica, highest just in front of fovea; tegument smooth, clothed with short fine hairs. Carapace orange, anteriorly dark yellowish-brown. Fovea deep, longitudinal, red. Chelicerae orange-brown. Labium and endites yellowish-brown. Sternum orange, lateral margin with orange-brown extensions fitting intercoxal concavities.

Eye sizes and interdistances: AME 0.13, ALE 0.16, PME 0.13, PLE 0.13, AME-AME 0.11, AME-ALE 0.10, PME-PME 0.28, PME-PLP 0.21; MOQ:

0.33 long, 0.38 anterior width, 0.56 posterior width.

Legs yellow, except for yellowish-brown tibia, metatarsus, and tarsus. Spination: femur with 1 prolateral and 1-1-1 dorsal; tibia with very long 1-1 ventral spines; anterior metatarsus with a pair of very long apicoventral spines, spines on posterior metatarsus distinctly shorter, arranged in a ring. Legs curled in all females persevered in ethanol. Leg formula 4213. Leg measurements: I 6.5 (2.0, 2.5, 1.2, 0.8), II 7.6 (2.2, 3.0, 1.5, 0.9), III 5.8 (2.0, 2.0, 1.3, 0.5), IV 9.3 (2.5, 3.5, 2.5, 0.8).

Opisthosoma elongate-ovoid; covered with fine pubescence, long erect bristles sparsely



Figs. 43-46. *Clubiona alticola* sp. nov., male holotype (43, 44) and female paratype (45, 46). **43.** Left male palp, ventral view. **44.** Ditto, retrolateral view. **45.** Epigyne, ventral view. **46.** Vulva, dorsal view, left side showing internal duct system. Scale bars = 0.5 mm (43-46).

distributed; 2 pairs of muscle depressions situated on its anterior half. Dorsum of opisthosoma pale yellow, without color markings. Venter pale. Spinnerets white.

Epigyne and vulva (Figs. 40-42, 45, 46). Epigynal plate ovoid, heavily sclerotized, dark reddish-brown. Epigynal atrium elongate-columnar, running mid-longitudinally, posteriorly enlarged, rounded. Genital orifices situated on basolateral margins of epigynal atrium, leading to thin and elongate insemination ducts. Spermathecae convoluted; proximal part reniform, distal part curved; anteriorly situated spermathecal heads small. Fertilization ducts short and curved. Bursae large, ovoid, located posteriorly.

Natural history: *Clubiona alticola* sp. nov. inhabits high elevational zones of Doi Inthanon (1750-2500 m); the male type specimens were collected from a remnant patch of evergreen hill forest at about 1750 m in elevation, while those of the female paratypes were obtained only from the summit area. *Clubiona alticola* sp. nov. forages openly on the surface of the ground. It was common in Winkler bag samples of leaf litter. Mature females were collected between June and Sept. (the rainy season); males were found in the dry season (Mar.).

Distribution: Known only from Doi Inthanon, Chiang Mai Province, northern Thailand.

DISCUSSION

The infrageneric classification of *Clubiona* proposed by Mikhailov (1995) was defined on the basis of Palaearctic fauna. A synopsis of the taxonomic history and its component species was outlined in Deeleman-Reinhold (2001), with a discussion of species-group limits and relationships on a regional scale emphasizing Oriental species. *Clubiona* was further divided into 6 main groups (5 species-groups and a cluster of species that cannot be assigned to any particular groups). No cladistic analysis has been published to resolve this debate; therefore, the wider concept of the *corticalis*-group (sensu Deeleman-Reinhold) is retained in this paper.

In a previous classification (Mikhailov 1995: 42), members of the *Paraclubiona* share the following combination of characters: tegulum of the male palp enlarged and protruded (Figs. 2-5, 12-14); retrolateral and ventral tibial apophyses simple, poorly developed (Figs. 26, 32, 39, 44); genital orifices situated on anterior part of epigyne

(Figs. 21, 27, 28, 35, 46). European species, represented by *C. corticalis*, seem to be closely related to *C. concinna* and several undescribed species from South and Southeast Asia (Ono 1986; Deeleman-Reinhold 2001: 120, map 4). Additional character states shared among the Asian species are recognized (Deeleman-Reinhold 2001): prosoma distinctly narrowed, pars cephalica approximately $\leq 2/3$ of prosoma width (Fig. 1); opisthosoma pale yellow, lacking coloration pattern (Fig. 1); legs relatively long; male palp without clearly visible contour of convoluted sperm duct (Fig. 2); genital orifices situated anterior to conspicuously enlarged posterior bursae (Figs. 15, 35, 46); and spermathecae dorsally with chitinous cylindrical appendage (Fig. 28).

The 3 recently described species from southern China (*C. applanata*, *C. altissimoides*, and *C. cylindrata*) were originally placed in *Paraclubiona* (Liu et al. 2007). These taxa, together with the 3 new species treated here, and other *Clubiona* species previously placed in *Paraclubiona* at present are being placed in the *corticalis*-group. The addition of the 3 new species has improved our knowledge of variations of character states in this species-group. The poorly delimited contour of the sperm duct is present in all species treated by Deeleman-Reinhold (2001) (Figs. 2-5). However, this structure is clearly visible, appearing as a tortuous, sigmoid-shaped duct in Chinese and the new species treated here (Figs. 24-26, 37-39; see also Liu et al. 2007). The presence of 2 tibial apophyses on the male palp can be found in all males, and is still valid for the *corticalis*-group, although this character state is greatly modified in some species (enlarged, dorsally expanded to cover a part of the cymbium in *C. parconcinna* (Figs. 2-7) and *C. hindu*). The female genital structure conforms well with the diagnosis of the species-group in having anteriorly situated genital orifices and spermathecae anterior to distinctly enlarged posterior bursae (Figs. 15, 21, 22, 34, 35, 45, 46). The vulva of the female genitalia is strongly convoluted and difficult to see without proper investigation (preferably using a compound microscope). Deeleman-Reinhold (2001) included the presence of a chitinous cylindrical appendage on the dorsal side of the spermathecae as one of the diagnostic characters shared among females of the *corticalis*-group. The female of *C. stiligera* closely resembles that of *C. allotorta* sp. nov. in possessing a 'cylindrical appendage' dorsally on the spermathecae. This character state is of interest and deserves special

attention. In *C. allotorta* sp. nov., the genital orifices are located on the basolateral sides of the epigynal atrium and directly connect to the insemination ducts of the vulva (Figs. 27, 28, 35, 36). The insemination ducts descend downward to join the posterior membranous bursae (Figs. 27, 30, 35, 36) then ascend upward (Figs. 27, 36), forming small receptacles (Figs. 27, 29, 30, 36) which connect to the strongly convoluted spermathecae (Figs. 27-29, 35). The convoluted spermathecae referred to here are regarded as the 'cylindrical appendage' of Deeleman-Reinhold (2001). Spermathecal heads generally arise on the proximal part of the spermathecae, and there are numerous minute pores on the apical portion (Figs. 16, 17, 22, 27, 29, 41, 46). Terminal parts of the spermathecae carry short and curved fertilization ducts (Figs. 22, 35, 46).

Acknowledgments: We are grateful to Dr. P.J. Schwendinger (MHNG) for providing specimens from his private collection and for a loan of specimens from MHNG. The Graduate School and Faculty of Science of Chiang Mai Univ. (Chiang Mai) supported P. Dankittipakul during his study. The Royal Forest Department (Bangkok) gave permission to collect specimens in national parks and other protected areas. P. Dankittipakul wishes to thank the following people for their generous support: Dr. Angoon Lewvanich (The Royal Academy of Thailand, Bangkok); and Donglin Li and Dr. Yayun Xu (Univ. of Auckland, Auckland, New Zealand).

REFERENCES

- Clerck C. 1757. Svenska spindlar, uti sina hufvud-slägter indelte samt under några och sextio särskildte arter beskrefne och med illuminerade figurer uplyste. Stockholm: 1-154.
- Deeleman-Reinhold CL. 2001. Forest spiders of South East Asia: with a revision of the sac and ground spiders (Araneae: Clubionidae, Corinnidae, Liocranidae, Gnaphosidae, Prodidomidae and Trochanterriidae [sic]). Leiden, The Netherlands: Brill.
- Liu P, HM Yan, C Griswold, D Ubick. 2007. Three new species of the genus *Clubiona* from China (Araneae: Clubionidae). *Zootaxa* **1456**: 63-68.
- Lohmander H. 1945. Vorläufige Spinnen-Notizen. *Arkiv. Zool.* **35**: 1-21.
- Mikhailov KG. 1995. Erection of infrageneric groupings within the genus *Clubiona* Latreille 1804 (Aranei: Clubionidae). *Arthropoda Selecta* **4**: 33-48.
- Okuma C. 1968. Preliminary survey on the spider-fauna of the paddy fields in Thailand. *Mushi* **42**: 89-118.
- Okuma C, T Wongsiri. 1973. Second report on the spider-fauna of the paddy fields in Thailand. *Mushi* **47**: 1-17.
- Ono H. 1986. A new spider of the group of *Clubiona corticalis* (Araneae, Clubionidae) found in Japan. In Uéno, SI. ed. Entomological papers presented to Yoshihiko Kurosawa on the occasion of his retirement. Tokyo: Coleopterists' Association of Japan, Special issue, pp. 19-25.
- Platnick NI. 2007. The world spider catalog, vers. 8.0. American Museum of Natural History. Available at <http://research.amnh.org/entomology/spiders/catalog/index.html>
- Thorell T. 1887. Viaggio di L. Fea in Birmania e regioni vicine. II. Primo saggio sui ragni birmani. *Ann. Mus. civico storia nat. Genova* **25**: 5-417.
- Vungsilabutr S. 2001. Spider fauna in citrus orchards in Thailand. Bangkok: Entomology and Zoology Division, Ministry of Agriculture.