

## Description of a new *Cladolasma* (Opiliones: Nemastomatidae: Ortholasmatinae) species from China

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### Abstract

The harvestmen genus *Cladolasma* Suzuki, 1963, previously known only from Japan and Thailand, is here reported from China for the first time. A new species, *Cladolasma damingshan* sp. nov., is described on the basis of a single male specimen collected from Daming Mountain, Guangxi, China. The new species is distinct from *C. parvulum* Suzuki, 1963 and *C. angka* (Schwendinger & Gruber, 1992) in lacking keels around the eyes; and from the known males of *C. parvulum* in the arrangement of large spines on the penial glans. The finding also represents the first record of Nemastomatidae and Ortholasmatinae for China.

**Key words:** harvestmen, taxonomy, *Dendrolasma*, Daming Mountain

### Introduction

The nemastomatid harvestmen subfamily Ortholasmatinae Shear and Gruber, 1983 currently contains five genera and 19 species in Southeast and East Asia, North and Central America (Schönhofen 2013; Shear 2006, 2010; Shear & Gruber 1983). Four of its genera (*Dendrolasma* Banks, 1894; *Martensolasma* Shear, 2006; *Ortholasma* Banks, 1894; and *Trilasma* Goodnight & Goodnight, 1942) are distributed in North America (Canada, the United States, Mexico and Honduras). Only *Cladolasma* Suzuki, 1963 is found exclusively in Asia (Japan and Thailand).

*Cladolasma* was originally considered monotypic, established on the type species *C. parvula* Suzuki, 1963 (subadult specimens) from Japan. After Suzuki (1974) re-examined further adult specimens of both sexes, he synonymised *C. parvulum* with *Dendrolasma*. Subsequently a second Asian *Dendrolasma*, *D. angka* Schwendinger and Gruber, 1992 (female holotype and juveniles), was described from northern Thailand (Schwendinger & Gruber 1992). The genus *Cladolasma* eventually was reinstated for the two currently known Asian species (Shear 2010).

Asiatic and American Ortholasmatinae appear quite different, not only because of their geographic separation. Also many morphological characters are distinct, especially regarding penis morphology. For example, the Asiatic representatives have a relatively stout penis shaft, a compressed glans and a short, slender, pointed stylus; whereas the American species have a long, thin shaft, a flattened glans and a contorted stylus (Suzuki 1974, Schwendinger & Gruber 1992, Shear 2010). Since the male of *C. angka* remains unknown, only the distinctive penis of *C. parvulum* can serve to establish these characters for the genus *Cladolasma*.

When collecting harvestmen in the mountains of Guangxi Zhuang Autonomous Region, China, a new *Cladolasma* species was found which is described here as *Cladolasma damingshan* sp. nov. The presence of a male of this new species allows us to revisit the characters of the genus *Cladolasma* and the relationship between the known species.

## Material and methods

The specimen was preserved in 75% ethanol, and examined and drawn under a Leica M165c stereomicroscope with a drawing tube. Further details were studied using a compound microscope (Nikon YS100). Morphological terminology mostly followed Gruber (2007), Schwendinger and Gruber (1992), Shear and Gruber (1983), and Suzuki (1974). All measurements followed Shear (2010) and are given in millimeters (mm). Shapes of cross-sections of truncus and glans penis refer to Martens (1978). Terminology for genitalic structures followed Shear and Gruber (1983) and Macías-Ordóñez *et al.* (2010). The holotype is deposited in the Museum of Hebei University, Baoding, China (MHBU).

## Taxonomy

### Nemastomatidae Simon, 1872

### Ortholasmatinae Shear and Gruber, 1983

### *Cladolasma* Suzuki, 1963

*Cladolasma* Suzuki, 1963: 40–41; Shear 2010: 17–18 (reinstated *Cladolasma*); Schönhofer 2013: 24.

*Dendrolasma*: Suzuki 1974: 121–122 (synonymised *Cladolasma*); Shear & Gruber 1983: 51; Schwendinger & Gruber 1992: 57.

**Type species:** *Cladolasma parvula* Suzuki, 1963, by monotypy and original designation.

**Diagnosis.** Carapace with only one forward-projecting lateral conical process on either side of ocularium; metapeltidium free from abdominal scutum. Penis with short and compact shaft. Glans with large and small spines. Stylus short and pointed, without torsion, but apical part of stylus slightly bent.

**Distribution.** China, Thailand, Japan.

### Key to species of *Cladolasma*

- |   |   |                               |
|---|---|-------------------------------|
| 1 | Ocularium without circumocular keels; abdominal scutum without enlarged, dorsad-directed tubercles . . . . .                            | <i>C. damingshan</i> sp. nov. |
| - | Ocularium with circumocular keels; abdominal scutum with enlarged, dorsad-directed tubercles . . . . .                                  | 2                             |
| 2 | Area I–IV each with a pair of enlarged, dorsad-directed tubercles . . . . .   | <i>C. parvulum</i>            |
| - | Area I without enlarged tubercles, area II with two, area III with four, area IV with six enlarged, dorsad-directed tubercles . . . . . | <i>C. angka</i>               |

### *Cladolasma damingshan* sp. nov.

(Figs 1–24)

**Type material.** Male holotype; CHINA, Guangxi Zhuang Autonomous Region, Wuming County, Damingshan National Nature Reserve (23°30'N, 108°26'E), elevation 1231 m, 18. July 2012, C. Zhang leg. (MHBU-Opi-12ZC030).

**Diagnosis.** Base of penis dorsoventrally compressed, truncus penis bent to ventral after proximal third (Fig. 20). Glans with eight small spines and six large spines: small ones arranged around base of stylus; large ones situated on dorsal, lateral, and ventral side at the central and basal part of the glans (Figs 22–24). Ocularium (Figs 3, 5–6) without circumocular keels (see Suzuki 1974: 123, fig. 1 for *C. parvulum*; Schwendinger & Gruber 1992: 58, fig. 2 for *C. angka*). The eyes at the highest part of the ocularium and the hood projections sloping slightly to ventral (Fig. 6; in comparison to Suzuki 1974: 123, fig. 1; Schwendinger & Gruber 1992: 58, fig. 3). Abdominal scutum (Fig. 6) without enlarged, dorsad-directed tubercles (compare Schwendinger & Gruber 1992: 58, fig. 3 for *C. angka*).

**Etymology.** The species epithet is a noun in apposition, referring to the type locality.

**Description.** Male (holotype) habitus as in Figs 1–2 and 4–6. Coloration in alcohol generally dark brown with yellow background color: dorsum with yellowish brown background (Figs 1–2). Propeltidium with two brown lateral areas. Eye rings black, hood pale brown to yellow (Fig. 3). Meso- and metapeltidium with a lighter median area in the center. Most of the opisthosomal scutum brown, only area V yellowish brown posteriorly, where thinning into tubercle structures. Venter dark brown, slightly lighter in ventral midline (Fig. 4). Chelicerae dark brown. Pedipalpi pale brown except for dark brown trochanter. Legs yellowish brown except for dark brown trochanters, metatarsi and tarsi; femora of legs I, III and IV banded brown (base and center) and yellow.

Dorsum (Figs 1–2, 5). Entire body strongly sclerotized. Metapeltidium clearly separated from carapace and abdominal scutum (Figs 2, 5). Free tergites not visible from above. Surface covered with a network of interconnected anvil-shaped tubercles. Anterior border of carapace with one lateral conical process on each side of ocularium; central portion of carapace with four longitudinal rows of anvil-shaped tubercles connected with each other by transverse bridges; lateral margin of carapace smooth, without anvil-shaped tubercles. Metapeltidium with a transverse row of anvil-shaped tubercles (Figs 2, 5). Abdominal scutum with intricate lattice of interconnected anvil-shaped tubercles, its posterior margin with a fence-like row of 6 enlarged, posteriad-directed digitiform tubercles. Free tergites on caudal surface of body with low keels in transverse rows (Figs 4, 6).



**FIGURES 1–4.** *Cladolasma damingshan* sp. nov. Photographs of holotype male. 1. Entire animal, dorsal view. 2. Body and parts of appendages, dorsal view. 3. Hood, dorsal view. 4. Body and parts of appendages, ventral view. Scale bars: 2 mm (Fig. 1); 0.5 mm (Figs 2, 4); 0.2 mm (Fig. 3).

Hood (Figs 3, 5–6) highly arched, with one median, unpaired and 4 lateral, paired digitiform tubercles, decreasing in length toward base of the hood; these digitiform tubercles usually with small basal cross-bars and decreasing in diameter from base to tip. Basal stem of the hood very short in comparison to other species, and hood projecting ventral and not bent in central part. Eyes thus located relatively high, not below the level of the hood if seen from lateral. No circumocular keels or lace-like elevations present.

Venter (Fig. 4). Coxae with small wart-bearing setae on ventral surfaces and with dorso-distal rows of anvil-shaped tubercles; a row of anvil-shaped tubercles along anterior and posterior margins of coxae II, III and IV; coxae I and II with distal digitiform processes retrolaterally; coxa IV with similar process prolaterally. Genital operculum short and tongue-shaped, surface with tubercles. Sternites with transverse rows of low keels, these reduced at the midline.

Chelicerae (Figs 7–9). Basal segment without glandular area and dorsomedial tooth, only ventrally and dorsally with a few setae. Second segment with one basal, prodorsal tooth (Fig. 7) and many long dorsal setae, and rows of short setae at base of fixed finger (Figs 7, 9). Fingers short, with diaphanous teeth and dark subapical teeth: one dark tooth on movable finger, two dark teeth on fixed finger.

Pedipalpi (Figs 10–12). Coxae with one ventral setiferous tubercle. Trochanters with two ventral setiferous tubercles. Femora with few clavate hairs. Patellae medially with many clavate hairs and laterally with few clavate hairs. Tibiae and tarsi densely covered with clavate hairs.

Legs (Figs 13–18). All trochanters prodorsally and retrodorsally with one enlarged tubercle. Femora, patellae and tibiae without pseudoarticulations, with distinctive microsculpture as shown in Fig. 18, composed of broad, thick, conical, slightly inclined denticles. Metatarsi and tarsi without annulations and microsculpture, only with setae. Tarsal segments I–IV: 4 (2+2), 5 (3+2), 6 (2+2+2), 6 (2+2+2).

Penis (Figs 19–24) slender; no clear distinction between shaft, glans and stylus. Shaft with nearly parallel sides for most of its length (seen from dorsal and ventral), then tapering distally; in proximal portion dorsoventrally compressed and ventrally flattened (best seen from lateral), in median portion elliptical and wider than long in cross-section, in distal portion elliptical and longer than wide in cross-section, close to glans almost circular. Base of truncus drawn out in two large lobe-like roots, containing the muscles. Glans strongly bulged ventrally and slightly bulged dorsally (Fig. 20); distal part of glans with eight small spines at the base of the stylus and basal part with six large spines, the latter arranged as follows: two dorsal, two lateral, and two ventral (Figs 22–24). Stylus simple, straight, slightly inclined towards dorsal side, without torsion; tip of stylus slightly bent towards ventral side.

Female. Unknown.

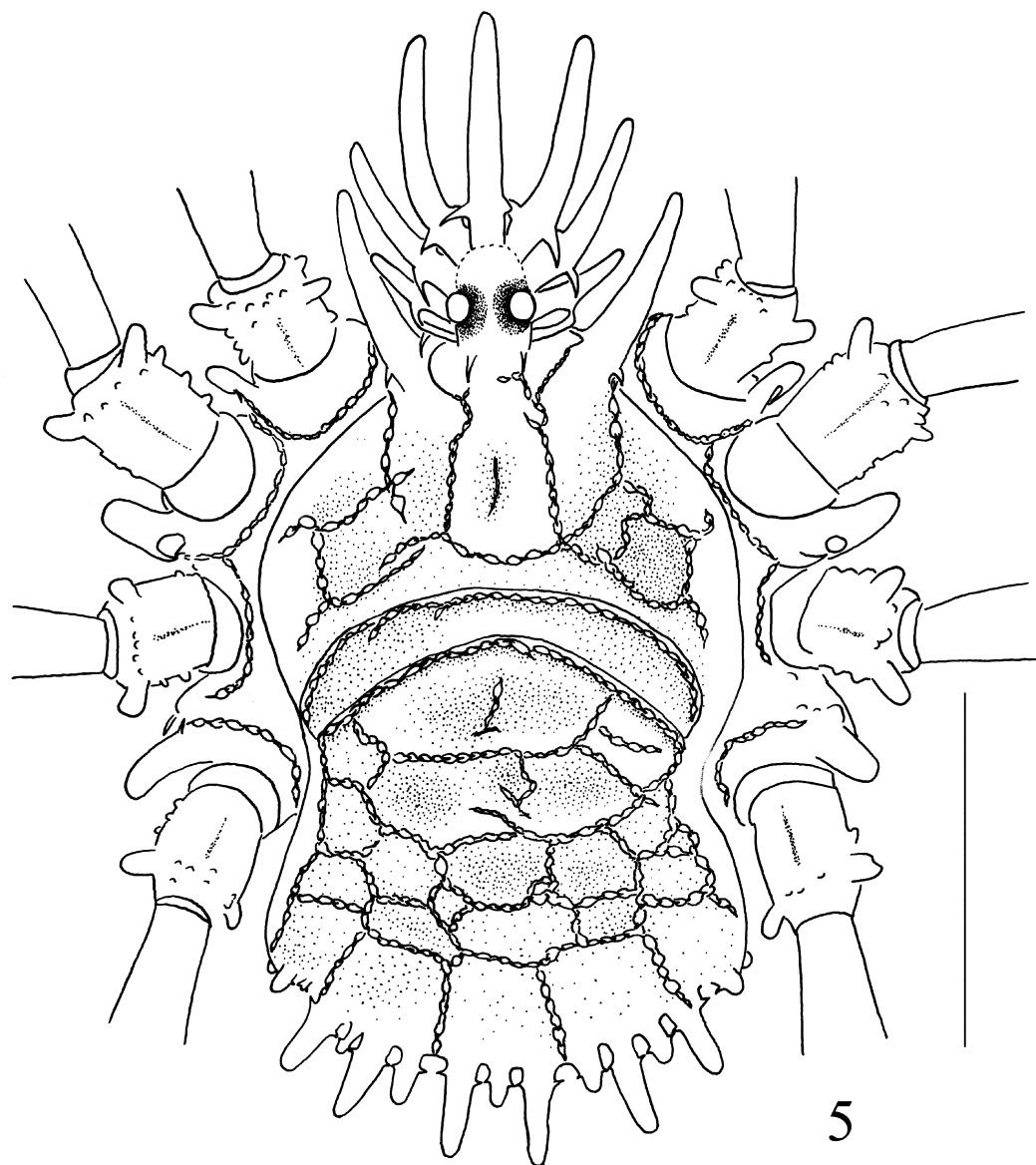
**Measurements.** Male holotype: Total length (including hood and posterior tubercles) 3.15. Prosoma 0.75 long, 1.35 wide. Opisthosoma 1.23 long, 1.31 wide. Median hood process 1.00 long, 0.82 wide. Basal segment of chelicerae 0.55 long, 0.22 wide; second segment of chelicerae 0.60 long, 0.18 wide. Measurements of left pedipalpus and right legs as in Table 1.

**TABLE 1.** Pedipalpus and legs measurements of the *Cladolasma damingshan* sp. nov. holotype; length/width given for femora.

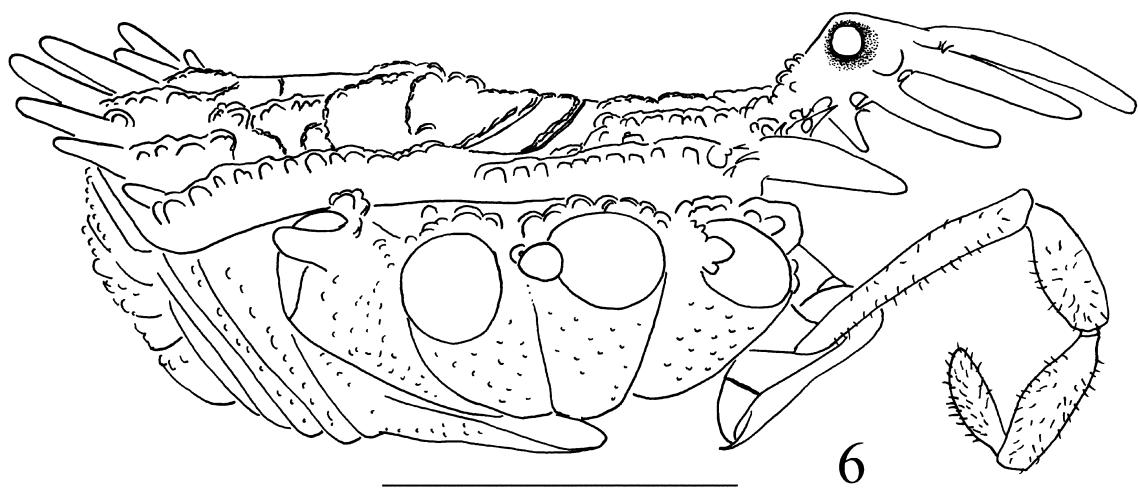
	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
Pedipalpus	0.37	0.70/0.10	0.38	0.48		0.32	2.25
Leg I	0.34	1.27/0.23	0.55	0.96	0.33	0.60	4.05
Leg II	0.40	3.00/0.18	1.00	2.50	1.30	1.48	9.68
Leg III	0.34	1.40/0.23	0.55	1.03	0.32	0.65	4.29
Leg IV	0.34	1.85/0.23	0.65	1.72	0.40	0.70	5.66

**Habitat.** The single specimen was collected by sieving leaf litter in a sub-tropical evergreen broad-leaved forest.

**Distribution.** This species is so far known only from the type locality, the Damingshan National Natural Reserve in Guangxi Province, China.

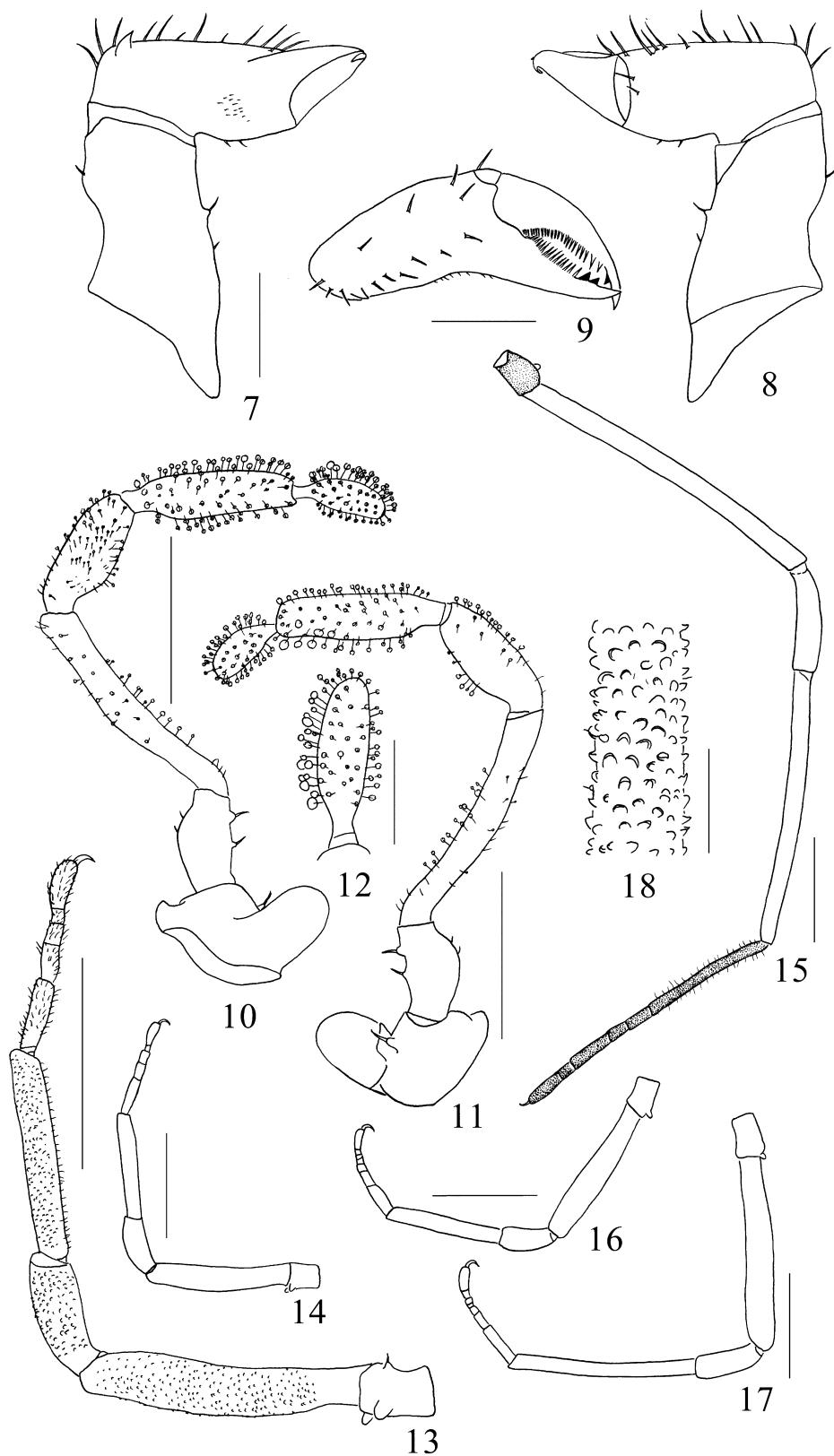


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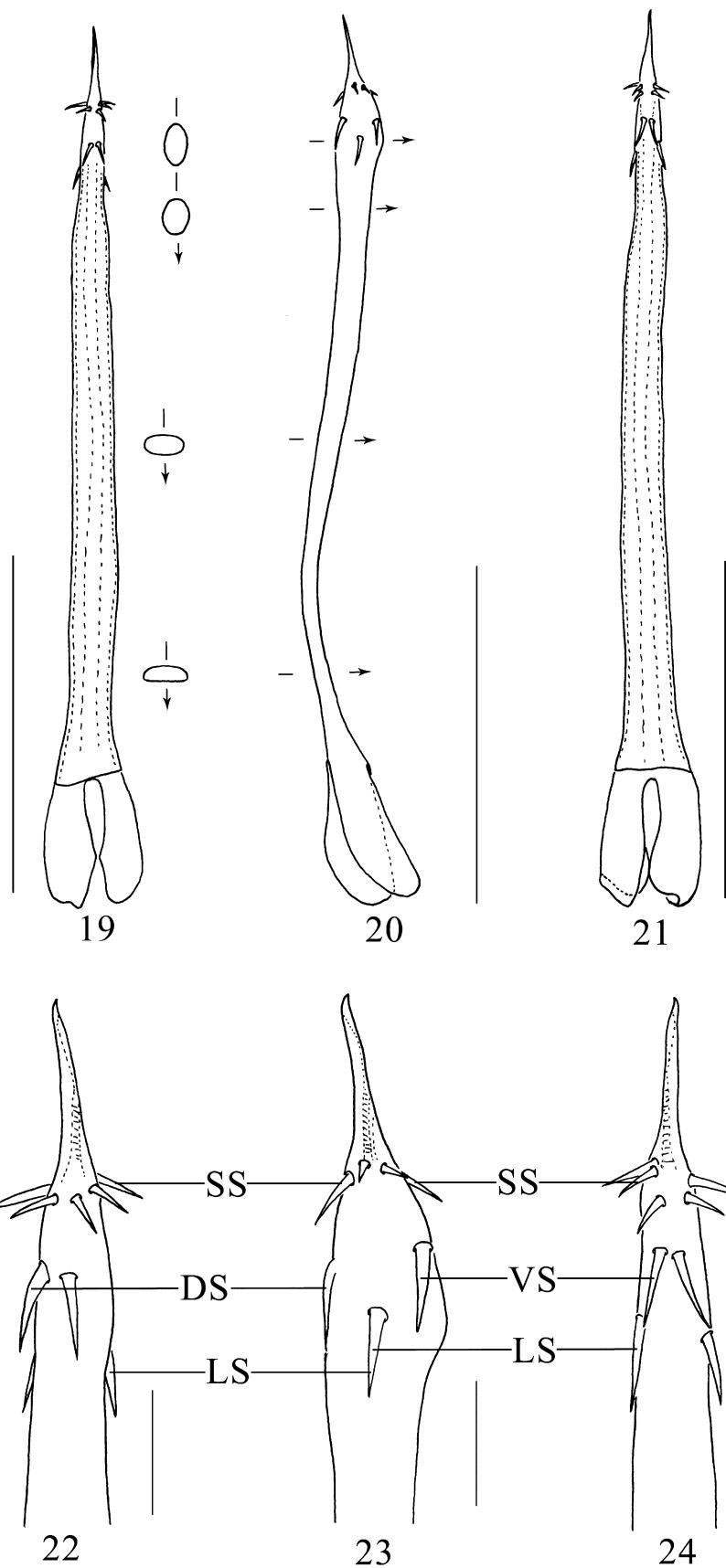


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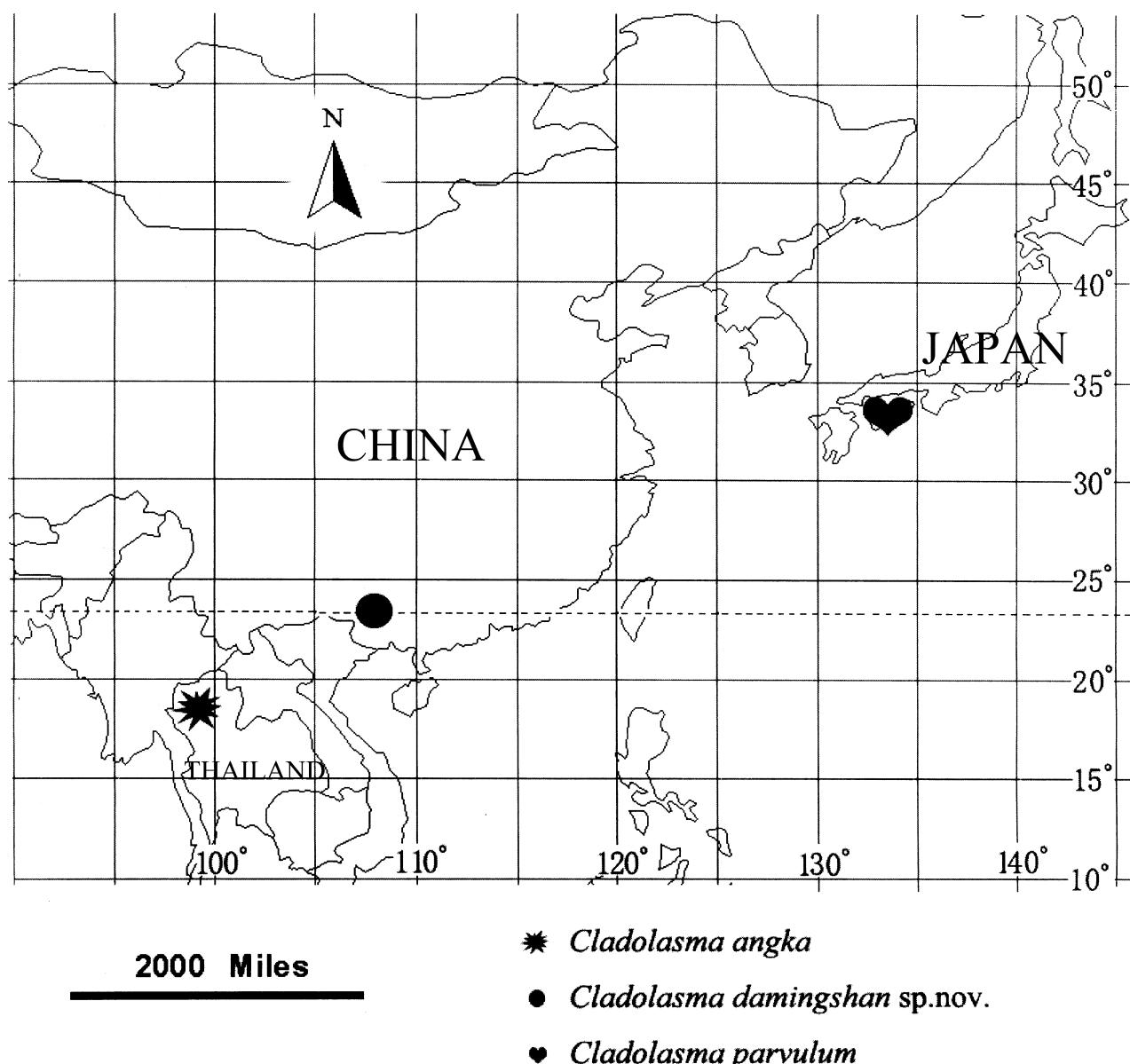
**FIGURES 5–6.** *Cladolasma damingshan* sp. nov. Holotype male, drawings. 5. Body, dorsal view. 6. Body, lateral view. Scale bars: 1 mm.



**FIGURES 7–18.** *Cladolasma damingshan* sp. nov. Holotype male. 7. Left chelicera, prolateral view. 8. Ditto, retrolateral view. 9. Second and third segment of chelicera, dorsal view. 10. Left pedipalp, prolateral view. 11. Ditto, retrolateral view. 12. Tarsus of pedipalpus, prolateral view. 13. Right leg I, retrolateral view, showing distribution of ornamentation. 14–17. Right legs, retrolateral view. 14. Leg I. 15. Leg II. 16. Leg III. 17. Leg IV. 18. Microsculpture of femur leg II. Scale bars: 0.2 mm (Figs 7–9, 12, 18); 0.5 mm (Figs 10–11); 1 mm (Figs 13–17).



**FIGURES 19–24.** *Cladolasma damingshan* sp. nov. Holotype male, penis. 19. Dorsal view. 20. Lateral view. 21. Ventral view. 22. Penis tip, dorsal view. 23. Ditto, lateral view. 24. Ditto, ventral view. DS, dorsal spines; LS, lateral spines; SS, small spines; VS, ventral spines. Scale bars: 0.5 mm (Figs 19–21); 0.05 mm (Figs 22–24).



**FIGURE 25.** Map of East and Southeast Asia showing the known localities for *Cladolasma* species.

## Discussion

According to the diagnosis of the Ortholasmatinae (Shear 2010), *Cladolasma damingshan* sp. nov. clearly belongs to this subfamily. We place the new species in *Cladolasma* based on the short, pointed stylus without torsion (Figs 19–24). Additional characters support this placement, as the length of the lateral conical processes is about two-thirds that of median hood process (Figs 3, 5) and leg femoral microsculpture is composed of broad denticles (Fig. 18). However, the new species has some characters inconsistent with the current diagnosis of *Cladolasma*, i.e. the dorsum has large keel cells instead of small ones (Fig. 5; Suzuki 1974: 123, fig. 1; Schwendinger & Gruber 1992: 58, fig. 1), but a contrast that is also found in the two species of *Dendrolasma* (Shear & Gruber 1983). The penial glans shows a pair of large spines ventrally, laterally and dorsally instead of two having lateral rows of large spines as in *C. parvulum* (Figs 22–24; Suzuki 1974: 124, fig. 2–O; Shear & Gruber 1983: 62, figs 207, 208). These characters and differences are to be considered in the definition of *Cladolasma*. Yet, further changes are likely as additional species can be expected.

The new species and *C. parvulum* share similar external morphological characters, e.g., the basal digitiform tubercles of the hood are the shortest; the femora of the pedipalpi have clavate hairs (Figs 3, 5; Suzuki 1974: 123, fig. 1). *C. angka* differs from *C. parvulum* and the new species in the ocularium having a pair of extended digitiform tubercles proximally (Schwendinger & Gruber 1992: 58, fig. 2), *C. angka* also can be distinguished from the new species by the leg femora dorso-distally and patellae retrodorsally with lateral processes or lobes (Figs 10–11, 13–17; Schwendinger & Gruber 1992: 59, fig. 5, 7). Still, this assumes that these characters are monomorphic in both sexes.

Nearctic Ortholasmatines are limited to western North and Central America, and they are generally associated with coastal forests or high elevations (Gruber 2007, Shear 2010). Species from México and Central America, south of the Tropic of Cancer, also occur either at relatively high elevations or in caves. In Asia *Cladolasma parvulum* is restricted to the mountains of Shikoku (Japan), where a sub-tropical monsoon climate prevails and *C. angka* occurs only near the summit of Doi Inthanon (2500 m) in tropical Thailand. *C. damingshan sp. nov.* is present on Mt. Daming of Guangxi (China), which is located near the Tropic of Cancer, at the transition between the tropical and the sub-tropical zones (Fig. 25).

Schwendinger & Gruber (1992) mentioned *C. angka* may have a low population density or live in deep soil layers from which the species is not easily recovered. This also may be true for *Cladolasma damingshan sp. nov.*. During our survey on harvestmen in Guangxi, only this single specimen of the new species was found by sifting leaf litter and hand-sorting humus. Although only one specimen, this nemastomatid confirms the predictions of Schwendinger & Gruber (1992) and Shear (2010) that ortholasmatine nemastomatids would be more widespread in Asia and present in China. The new opilionid *Cladolasma damingshan sp. nov.* is thereby the first representatives of the family Nemastomatidae and subfamily Ortholasmatinae to be discovered and recorded for China.

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## References

- Banks, N. (1894) The Nemastomatidae and Trogulidae of the United States.-I. *Psyche*, 7 (213), 11–12.  
<http://dx.doi.org/10.1155/1894/37947>
- Goodnight, C.J. & Goodnight, M.L. (1942) Phalangida from Mexico. *American Museum Novitates*, 1211, 1–18.  
<http://dx.doi.org/10.5962/bhl.title.3244>
- Gruber, J. (2007) Nemastomatidae Simon, 1872. In: Pinto-da-Rocha, R., Machado, G. & Giribet, G. (Eds.), *Harvestmen: The Biology of Opiliones*. Harvard University Press, Cambridge, Massachusetts, pp. 148–151.
- Macías-Ordóñez, R., Machado, G., Pérez-González, A. & Shultz, J. (2010) Genitalic Evolution in Opiliones. In: Leonard, J. & Córdoba-Aguilar, A. (Eds.), *The Evolution of Primary Sexual Characters in Animals*. Oxford University Press, New York, pp. 285–306.
- Martens, J. (1978) Spinnentiere, Arachnida - Webspinnen, Opiliones. *Die Tierwelt Deutschlands*, 64, 1–464.
- Schönhofer, A.L. (2013) A taxonomic catalogue of the Dyspnoi Hansen and Sørensen, 1904 (Arachnida: Opiliones). *Zootaxa*, 3679, 1–68.  
<http://dx.doi.org/10.11646/zootaxa.3679.1.1>
- Schwendinger, P.J. & Gruber, J. (1992) A new *Dendrolasma* (Opiliones, Nemastomatidae) from Thailand. *Bulletin of the British Arachnological Society*, 9 (2), 57–60.
- Shear, W.A. (2006) *Martensolasma jocheni*, a new genus and species of harvestman from Mexico (Opiliones: Nemastomatidae: Ortholasmatinae). *Zootaxa*, 1325, 191–198.

- Shear, W.A. (2010) New species and records of ortholasmatine harvestmen from México, Honduras, and the western United States (Opiliones, Nemastomatidae, Ortholasmatinae). *ZooKeys*, 52, 9–45.  
<http://dx.doi.org/10.3897/zookeys.52.471>
- Shear, W.A. & Gruber, J. (1983) The opilionid subfamily Ortholasmatinae (Opiliones, Troguloidea, Nemastomatidae). *American Museum Novitates*, 2757, 1–65.
- Simon, E. (1872) Notices sur les arachnides cavernicoles et hypogés. *Annales de la Société Entomologique de France, série 5*, 2, 215–244.
- Suzuki, S. (1963) *Cladolasma parvula* gen. et sp. n. (Trogulidae: Opiliones) from Japan. *Annotationes Zoologicae Japonenses*, 36 (1), 40–44.
- Suzuki, S. (1974) Redescription of *Dendrolasma parvula* (Suzuki) from Japan (Arachnida, Opiliones, Dyspnoi). *Journal of Science of the Hiroshima University*, 25 (1), 121–128.