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Source: Revue suisse de Zoologie, 126(1) : 53-59

Published By: Muséum d'histoire naturelle, Genève

URL: <https://doi.org/10.5281/zenodo.2619518>

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On the spider genus *Racata* Millidge, 1995, with the description of three new species (Araneae, Linyphiidae)

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Abstract: The linyphiid spider genus *Racata* Millidge, 1995 is re-diagnosed. Three species are described as new: *R. brevis* sp. nov. (male and female), *R. laxa* sp. nov. (female) and *R. sumatera* sp. nov. (male and female). The unknown female of *R. grata* Millidge, 1995 is described for the first time. The structure of the male palp of *R. grata* (the type species) is re-examined and illustrated. The taxonomic position of the genus among the linyphiid subfamilies is discussed. Most probably the genus *Racata* belongs to the subfamily Erigoninae, not to the Dubiaraneinae, and is closely related to *Aperturina* Tanasevitch, 2014b.

Keywords: Taxonomy - Erigoninae - Dubiaraneinae - Southeast Asia - Indonesia.

INTRODUCTION

The genus *Racata* Millidge, 1995 was originally described on the basis of a single male from Krakatoa Island, Indonesia, and placed in the subfamily Dubiaraneinae (Millidge, 1995). The description of the male does not contain the chaetotaxy formula, two very schematic drawings of the male palp do not reveal its detailed structure, and the absence of any corresponding females also makes the taxonomic placement of the genus unclear. New specimens of both sexes of *R. grata* from Java, Indonesia, kept at the Muséum d'histoire naturelle de Genève, Switzerland (MHNG), allowed me to re-examine the genitalia and chaetotaxy of the species. Beside that, a few other representatives of the genus from Indonesia were found in the collection of the MHNG. A re-diagnosis of the genus *Racata*, the first description of the female of *R. grata*, as well as the description of three new species from Sumatra, Indonesia, are the subject of this study.

MATERIAL AND METHODS

This paper is based on material collected in Indonesia and kept at the MHNG. Sample numbers are given in square brackets. Specimens preserved in 70% ethanol were studied using a MBS-9 stereomicroscope. A Levenhuk C-800 digital camera was used for photos. The terminology of copulatory organs mainly follows that of Merrett (1963), Millidge (1985), Hormiga (2000) and

Tanasevitch (1998, 2014b). The sequence of leg segment measurements is as follows: femur + patella + tibia + metatarsus + tarsus. All measurements are given in mm. Scale lines in the figures correspond to 0.1 mm unless indicated otherwise. Figure numbers are given above the scale lines, the alternative distance below.

Abbreviations

a.s.l.	above sea level
C	convector <i>sensu</i> Tanasevitch (1998) = plate, lamella <i>sensu</i> Millidge (1985)
D	duct
DSA	distal supratregular apophysis <i>sensu</i> Hormiga (2000)
E	embolus
MM	median membrane <i>sensu</i> Helsdingen (1965)
Mt	metatarsus
NP	national park
Re	receptacle
CD	copulatory duct
Ti	tibia
Tml	position of trichobothrium on metatarsus I

RESULTS

Racata Millidge, 1995

Type species: *Racata grata* Millidge, 1995, by original designation and monotypy.

Diagnosis: Members of the genus *Racata* can be easily recognised by the “micronetine”-like chaetotaxy, by the highly developed convector and by the presence of a panicle-shaped median membrane in the palpal organ. Females are distinguished by a distinct epigynal cavity, which is often surrounded by sclerotized swellings, and by mostly helical copulatory ducts.

The genus contains medium-sized spiders with a total length of 1.45-1.75, which are characterized by the following combination of somatic and genitalic characters:

- 1) Carapace unmodified in both sexes, eyes somewhat enlarged, cephalic pits (= sulci) absent.
- 2) Chaetotaxy formula: TiI: 2-1-1-0; II: 2-0-1-0, III-IV: 2-0-0-0; Mti-IV without spines; MtiV without trichobothrium; TmI 0.20-0.30.
- 3) Palpal tibia simple, unmodified.
- 4) Distal part of cymbium narrowed.
- 5) Convector highly developed and sclerotized.
- 6) Median membrane panicle-shaped.
- 7) Epigyne with distinct cavity, usually surrounded by sclerotized swellings.
- 8) Copulatory ducts mostly wide, helical.

Species included: *Racata brevis* sp. nov., *R. sumatera* sp. nov. (Indonesia: Sumatra), *R. grata* Millidge, 1995 (Indonesia: Krakatoa, Java and Belitung) and *R. laxa* sp. nov. (Indonesia: Sumatra; Thailand: Ko Chang).

Taxonomic remarks: The genus *Racata* was established from a male and placed into the subfamily Dubiaraneinae (Millidge, 1995) on the basis of the structure of its embolic division. Due to the same reason Millidge (1995) also placed the following Southeast Asian genera into the Dubiaraneinae: *Kenocymbium* Millidge & Russell-Smith, 1992, *Ketambea* Millidge & Russell-Smith, 1992, *Prosoponoides* Millidge & Russell-Smith, 1992 and *Thainetes* Millidge, 1995. The subfamily Dubiaraneinae is defined by only a single character of the vulva, i.e.: “... the seminal [= copulatory] duct of the epigynum running along the margins of a lamina, as in the Mynogleninae; in the majority of the species, the lamina is coiled into a short, almost planar helix, the axis of which is more or less perpendicular to the plane of the epigynum...” (Millidge, 1993). However, as pointed out by Millidge & Russell-Smith (1992), the epigyne in all above mentioned genera (including *Racata*) is of the linyphiine type and is quite different from that of *Dubiaranea* Mello-Leitão, 1943, the type genus of the Dubiaraneinae. At present it is premature to discuss the position of these genera in the system of subfamilies in the Linyphiidae until the subfamily Dubiaraneinae is clearly diagnosed. In the meantime I provisionally consider the genus *Racata* as belonging to the Erigoninae. The small size and erigonine-like general appearance, and the structure of the genitalia, which are similar to that of some Southeast

Asian erigonines, i.e., *Asiagone* Tanasevitch, 2014a, *Houshenzinus* Tanasevitch, 2006, *Laogone* Tanasevitch, 2014a, *Nasoona* Locket, 1982, *Oedothorax* Bertkau in Förster & Bertkau, 1883, etc., support the preliminary inclusion of *Racata* in the Erigoninae. The only problem I see here is in the chaetotaxy formula, which is absolutely not characteristic for the subfamily, but rather for the Micronetinae or Linyphiinae.

The genus is closely related to *Aperturina* Tanasevitch, 2014b, known from Thailand and West Malaysia (Tanasevitch, 2014b).

Distribution: So far known only from Indonesia and Thailand.

Racata grata Millidge, 1995

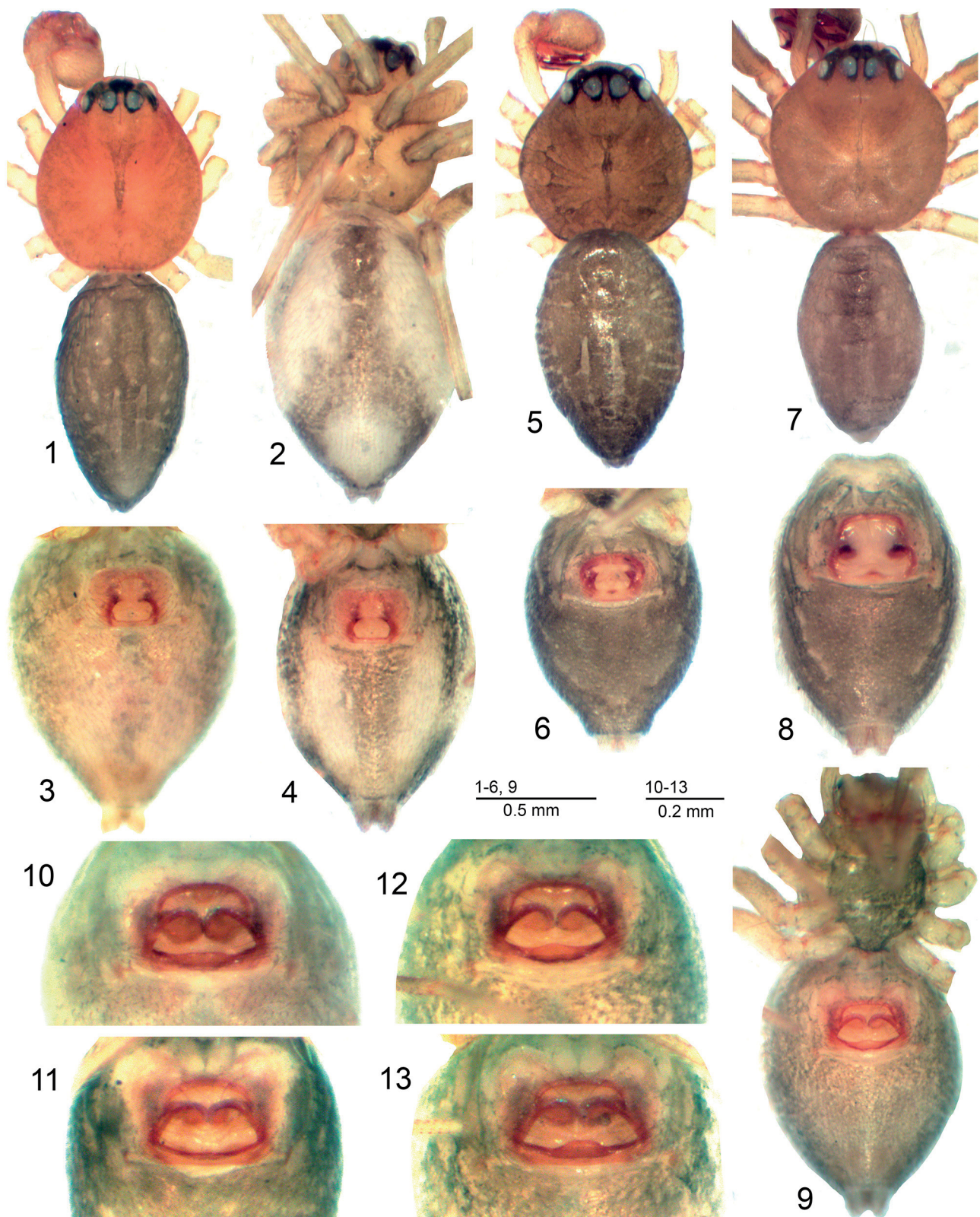
Figs 1-4, 14-15, 20, 23

Racata grata Millidge, 1995: 49, figs 62-63 (description of male).

Material examined: 1 female [Sar-87/11]; INDONESIA, Java, Bogor, Botanical Garden, soil sample between buttresses of large trees near two lakes, ca 260 m a.s.l.; 24.XI.1987; leg. B. Hauser. – 1 male [Sar-87/30]; Botanical Garden of Bogor, in nursery part, under flower pots and especially under paving slabs of the trail between greenhouses, 260 m a.s.l.; 28.XI.1987; leg. B. Hauser. – 5 males, 15 females [AS-05/11]; Java, Mt Gede - Pangrango NP, near Cibodas, 6°47'0"S, 107°01'0"E, 1450-1600 m a.s.l.; 4.-11.V.2005; leg. A. Schulz. – 1 female [IND-08/02], Belitung Island, Mt Tajam, near Gurok Beraye Waterfall, 2°47'01"S 107°51'47"E, primary forest, 150 m a.s.l.; 20.IX.2008; leg. P. Schwendinger. All new localities.

Remarks: The male holotype of *R. grata* (not examined) was described by Millidge (1995). A re-description of the male and the first description of the female are given below.

Description: *Male from near Cibodas.* Total length 1.50. Carapace unmodified, as shown in Fig. 1, 0.65 long, 0.60 wide, pale reddish brown. Chelicerae 0.30 long, mastidion absent. Chaetotaxy: TiI: 2-1-1-0; II: 2-0-1-0, III-IV: 2-0-0-0; Mti-IV without spines. Length of spines 1.5-2 diameters of corresponding leg segment. TmI 0.29. Palp (Figs 14-15, 20): Tibia short, simple. Distal half of cymbium narrowed. Narrow distal part of paracymbium longer than shown in original description (see Millidge, 1995: fig. 62 cf. Fig. 14). Distal supratégular apophysis, called tegular apophysis by Millidge (1995), large, claw-shaped. Median membrane, not mentioned in original description, panicle-shaped. Convector (called radical part [of embolus] in *op. cit.*), massive, forming a hook anteriorly. Embolus developed as a narrow long stripe, forming a loop, abruptly narrowing apically. Radix small, rounded. Abdomen



Figs 1-13. *Racata grata* Millidge, 1995 (1-4), *R. brevis* sp. nov., male holotype (5) and female paratype (6); *R. sumatera* sp. nov., male holotype (7) and female paratype (8); *R. laxa* sp. nov., female paratypes (9-13). (1, 5, 7) Male body, dorsal view. (2, 9) Female body, dorsal and ventral view, respectively. (3-4, 6, 8) Female abdomen, ventral view. (10-13) Epigyne, ventral view. Specimens from: near Cibodas (1-4), Mt Kerinci (5-6), Mt Sibayak (7-8), Bukittinggi (9, 12), Padangpanjang (10), Padangsidempuan (11), Taman Hutan Raya Bung Hatta (13).

0.80 long, 0.43 wide, uniformly grey (Fig. 1) or with a dorsal pattern similar to that in female (Fig. 2).

Female from near Cibodas. Total length 1.60. Carapace 0.63 long, 0.53 wide, unmodified, pale greyish yellow, with indistinct grey radial stripes and a narrow grey margin. Chelicerae 0.28 long. Legs yellow, its segments slightly darkened distally. Leg I 2.79 long (0.75+0.18+0.73+0.63+0.50), IV 2.51 long (0.70+0.15+0.63+0.60+0.43). TmI 0.34. Metatarsi IV without trichobothrium. Abdomen 0.95 long, 0.75 wide, dorsally grey, or cream-coloured with a grey pattern (Fig. 2). Epigyne (Figs 3-4, 23): Cavity slightly wider than long, with a rounded depression anterior to it. Copulatory ducts wide, helical; receptacles narrow, bent.

Taxonomic remarks: The male clearly differs from those of known congeners by the shape of its embolus: it is considerably thinner and longer than in *R. brevis* (Fig. 15 cf. Fig. 17); it is three times shorter than in *R. sumatera* (Fig. 15 cf. Fig. 19). The epigyne is similar to that of *R. brevis*, but differs by a larger depression anterior to the cavity (Figs 3-4 cf. Fig. 6), as well as by the shape of the helical copulatory ducts (Fig. 23 cf. Fig. 24).

Distribution: Known from the Indonesian islands of Krakatoa (type locality), Java and Belitung.

***Racata brevis* sp. nov.**

Figs 5-6, 16-17, 24

Holotype: Male [Sum-00/12]; INDONESIA, Sumatra, Jambi Province, Mt Kerinci, footpath to summit, NW of Kersik Tua, 1°44'12"S, 101°15'35"E, evergreen hill forest, sifting, 1800-1980 m a.s.l.; 16.II.2000; leg. P. Schwendinger.

Paratype: 1 female; collected together with the holotype.

Diagnosis: The species is characterized by possessing the widest and shortest embolus among all known congeners, as well as the shortest copulatory ducts.

Etymology: The specific epithet is a Latin adjective meaning "short" referring to the relatively short embolus of the male.

Description: *Male holotype.* Total length 1.45. Carapace 0.70 long, 0.63 wide, rounded (Fig. 5), pale greyish brown. Head part slightly elevated and protruded distad. Eyes enlarged, anterior median eyes much smaller than others. Chelicerae 0.30 long, mastidion absent. Legs pale greyish yellow, its segments slightly darkened distally. Leg I 2.60 long (0.75+0.15+0.65+0.67+0.38), IV 2.47 long (0.68+0.13+0.63+0.63+0.40). Chaetotaxy: TiI: 2-1-1-0; II: 2-0-1-0, III-IV: 2-0-0-0; Mtl-IV without spines. Length of spines 1.5-2 diameters of corresponding leg segment. TmI 0.24. Metatarsi IV without

trichobothrium. Palp (Figs 16-17): Tibia short, simple. Distal half of cymbium narrowed. Proximal part of paracymbium wide, distal part L-shaped. Tegulum weakly sclerotized, light in colour. Distal suprategular apophysis very small. Median membrane panicle-shaped. Convector large, strongly sclerotized, covering base of embolus. Embolus very wide proximally, abruptly narrowing distally, its distal part relatively long and narrow. Abdomen (Fig. 5) 0.85 long, 0.53 wide, grey.

Female. Total length 1.50. Carapace 0.60 long, 0.50 wide, unmodified, pale greyish yellow. Chelicerae 0.25 long. Legs yellow, its segments darkened distally. Leg I 2.67 long (0.70+0.18+0.68+0.63+0.48), IV 2.24 long (0.65+0.18+0.60+0.43+0.38). Chaetotaxy as in male. Length of spines 2-2.5 diameters of corresponding leg segment. TmI 0.26. Metatarsi IV without trichobothrium. Abdomen 0.85 long, 0.63 wide, grey. Epigyne (Figs 6, 24): Cavity relatively small, depression anterior to it narrow. Copulatory ducts very wide, forming half a loop. Receptacles curved, beanlike.

Taxonomic remarks: The male can be easily distinguished by its boat-shaped convector and by the bent, thick embolus with a narrow, rapier-like distal part. The epigyne of *R. brevis* slightly resembles that of *R. grata*, but the depression anterior to the cavity is narrow instead of rounded, almost the same size as the cavity (Fig. 6 cf. Figs 3-4).

Distribution: Known only from the type locality on the densely forested southern slopes of the highest mountain of Sumatra, Indonesia.

***Racata sumatera* sp. nov.**

Figs 7-8, 18-19, 21-22, 25

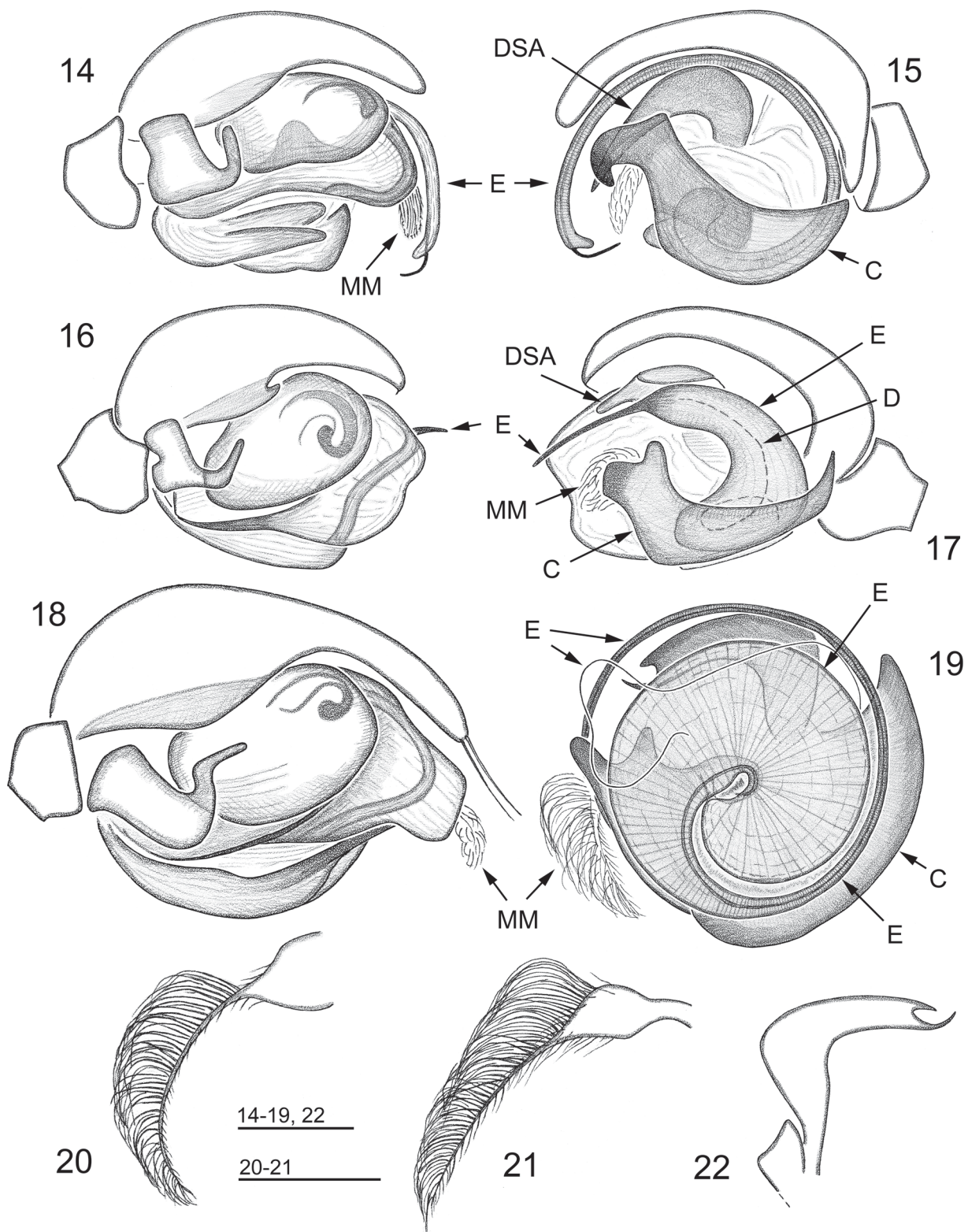
Holotype: Male [Sum-06/33]; INDONESIA, Sumatra, North Sumatra Province, Mt Sibayak, 4 km N of Brastagi, 3°13'16"N, 98°29'50"E, primary forest, 1600-1650 m a.s.l.; 6.-7.VII.2006; leg. P. Schwendinger.

Paratypes: 3 females, collected together with the holotype.

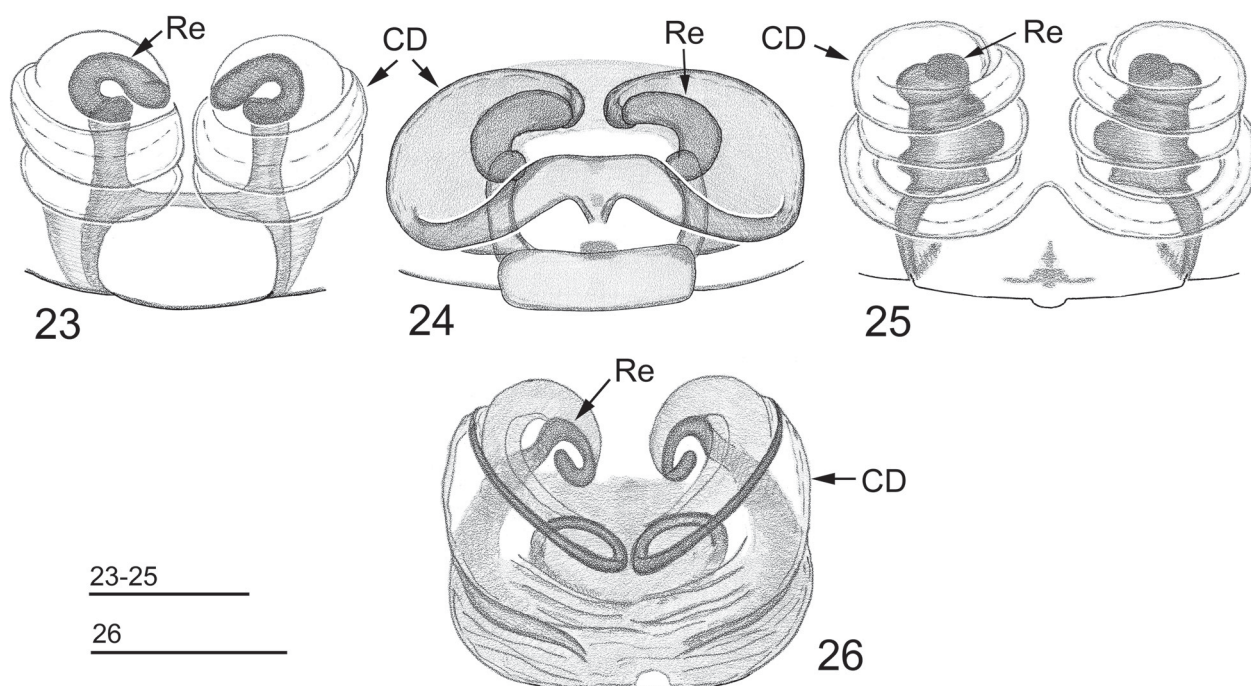
Diagnosis: The male can be easily distinguished from those of all known congeners by its very long, helical, gradually narrowing embolus; the female can be recognized by the wide anterior part of their epigyne, which is surrounded by slightly sclerotized swellings.

Etymology: The specific epithet is a name in apposition referring to the "terra typica"; "Sumatera" is the Indonesian name for "Sumatra".

Description: *Male (holotype).* Total length 1.75. Carapace 0.85 long, 0.75 wide, rounded as shown in Fig. 7, greyish yellow, with a narrow dark margin. Head part slightly elevated and protruded distad. Clypeus



Figs 14-22. Details of male palp structure of *Racata grata* Millidge, 1995, specimen from near Cibodas (14-15, 20); *R. brevis* sp. nov., holotype from Mt Kerinci (16-17); *R. sumatera* sp. nov., holotype from Mt Sibayak (18-19, 21-22). (14, 16, 18) Right palp, retrolateral view. (15, 17, 19) Right palp, prolateral view. (20-21) Median membrane. (22) Distal suprategular apophysis.



Figs 23-26. Vulva structure (dorsal view) of *Racata grata* Millidge, 1995, specimen from near Cibodas (23); *R. brevis* sp. nov., paratype from Mt Kerinci (24); *R. sumatera* sp. nov., paratype from Mt Sibayak (25); *R. laxa* sp. nov., paratype from Bukittinggi (26).

sparsely covered with long hairs. Eyes enlarged, anterior median eyes considerably smaller than others. Chelicerae 0.33 long, mastidion absent. Legs pale greyish yellow, its segments slightly darkened distally. Leg I 4.14 long ($1.00+0.23+1.15+1.08+0.68$), IV 3.46 long ($0.93+0.20+0.90+0.90+0.53$). Chaetotaxy: spines mostly lost, presumably as in female (see below). TmI 0.36. Metatarsi IV without trichobothrium. Palp (Figs 18-19, 21-22): Tibia short, simple. Distal part of cymbium narrowed. Proximal part of paracymbium wide, distal part narrow, S-shaped. Tegulum distinctly protruded distad, light in colour. Distal suprategular apophysis long, bifurcated apically. Median membrane panicle-shaped (Fig. 21). Convector massive, narrow, gradually curving. Embolus very long, forming three loops; very wide at base, gradually narrowing and in third loop becoming whip-shaped. Abdomen (Fig. 7) 1.00 long, 0.53 wide, grey.

Female. Total length 1.60. Carapace 0.65 long, 0.58 wide, unmodified, pale yellow, with a narrow grey margin. Chelicerae 0.25 long. Legs pale yellow, its segments darkened distally. Leg I 3.23 long ($0.85+0.18+0.85+0.80+0.55$), IV 2.98 long ($0.85+0.18+0.75+0.75+0.45$). TmI 0.31. Chaetotaxy: TiI: 2-1-1-0; II: 2-0-1-0, III-IV: 2-0-0-0; MtI-IV without spines. Length of spines 1.5-2 diameters of corresponding leg segment. TmI 0.36. Metatarsi IV without trichobothrium. Abdomen 1.00 long, 0.63 wide, grey. Epigyne (Figs 8, 25) relatively large; anterior part

of epigynal cavity surrounded by slightly sclerotized swellings. Copulatory ducts very wide, forming three loops. Receptacles small, indistinct.

Taxonomic remarks: The male clearly differs from those of all known congeners by its long embolus forming three loops, whereas in *R. grata* it forms one loop and in *R. brevis* only half a loop. The female is distinguished by its large epigynal cavity, the anterior part of which is surrounded by slightly sclerotized swellings.

Distribution: Known only from the type locality on the densely forested slopes of a volcano in northern Sumatra, Indonesia.

Racata laxa sp. nov.

Figs 9-13, 26

Holotype: Female [Sum-06/05]; INDONESIA, Sumatra, West Sumatra Province, Batang Palupuh Rafflesia Sanctuary, 12 km N of Bukittinggi, $0^{\circ}14'32''\text{S}$, $100^{\circ}21'10''\text{E}$, 900-1100 m a.s.l., primary forest; 2.-3. VI.2006; leg. P. Schwendinger.

Paratypes: 5 females [Sum-06/01]; collected together with the holotype. – 3 females; West Sumatra Province, old secondary forest above Taman Hutan Raya Bung Hatta, near road from Padang to Lubuksulasih, $0^{\circ}56'45''\text{S}$, $100^{\circ}32'37''\text{E}$, 1100 m

a.s.l.; 29.-30.V.2006; leg. P. Schwendinger. – 1 female [Sum-06/03]; Anai Valley, 6 km S of Padangpanjang, 0°28'38"S, 100°21'14"E, primary forest, 500 m a.s.l.; 1.VI.2006; leg. P. Schwendinger. – 5 females [Sum-06/20]; disturbed primary forest near road from Lubuksikaping to Bonjol, ca 10 km S of Lubuksikaping, 0°03'16"N, 100°12'33"E, 500 m a.s.l.; 12.VI.2006; leg. P. Schwendinger. – 1 female; Mt Singalang (= Mt Singgalang), Anai Valley, 400-520 m a.s.l., secondary forest, leaf litter; 9.-24.VI.1994; leg. S. Djojosedharmo. – 2 females [Sum-06/22]; North Sumatra Province, Sipirok, Dolok Sipirok NP, near hot springs, about 30 km N of Padangsidempuan, 1°33'55"N, 99°17'03"E, disturbed hill forest, 1000 m a.s.l.; 16.VI.2006; leg. P. Schwendinger. – 1 female [AS-TH06/4]; THAILAND, Trat Province, Ko Chang, northern side, forest 3 km E of White Sand Beach, 50-200 m a.s.l., 12.02527°N, 102.308333°E; 7.XI.2006; leg. A. Schulz.

Etymology: The specific name is a Latin adjective, meaning “wide, spacious”, referring the large epigynal cavity.

Diagnosis: The female of the new species is characterised by the specific shape of its large epigyne, namely, by the two loops of the copulatory ducts, which are visible through the translucent bottom the epigynal cavity.

Description: *Female paratype from Anai Valley.* Total length 1.58. Carapace 0.63 long, 0.55 wide, pale yellow, with indistinct radial stripes and narrow grey margin. Chelicerae 0.25 long. Legs pale yellow, almost white. Leg I 2.74 long (0.75+0.18+0.73+0.65+0.43), IV 2.51 long (0.73+0.15+0.65+0.58+0.0). TmI 0.28. Chaetotaxy: TiI: 2-1-1-0; II: 2-0-1-0, III-IV: 2-0-0-0; MtI-IV without spines. TmI 0.36. Length of spines 1.5-2 diameters of corresponding leg segment. Metatarsi IV without trichobothrium. Abdomen 0.95 long, 0.70 wide, pale grey, almost white. Epigyne (Figs 9-13, 26) with a large cavity surrounded by a sclerotized swelling; a pair of loops of the copulatory ducts, which are visible through the translucent cavity bottom.

Variability: The shape of the epigyne is slightly variable, see Figs 10-13.

Taxonomic remarks: The species is only known by females but can be easily recognized by its very large epigynal cavity surrounded by a sclerotized swelling, and by a pair of loops of the copulatory ducts that can be seen through the translucent cavity bottom.

Distribution: Known from several localities on Sumatra, Indonesia and from a locality on an island off the coast of eastern Thailand.

ACKNOWLEDGEMENTS

I am deeply grateful to Peter Schwendinger (MHNG) for the opportunity to work on arachnological collections under his care and for editing this paper. Thanks also go to Peter van Helsdingen (Leiden, Netherlands) who kindly reviewed the manuscript.

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