

**Dolichopodidae from Papua New Guinea XII.
The genus *Mesorhaga* on the northern coast'**

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Contribution n° 316 of the Biological Station Leopold III on Laing Island.

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Summary

Two new species of Mesorhaga are described from the supralittoral zone of sandy beaches of the northern coast of Papua New Guinea. Two related species: M. stylata BECKER and M. dispar BECKER from Taiwan are re-described.

Key words: Diptera, Dolichopodidae, new species, Papua New Guinea.

Resume

Deux nouvelles especes du genre Mesorhaga sont decrites de la zone supralittorale de plages sablonneuses de la cote nord de la Papouasie Nouvelle Guinee. Deux especes voisines: M. stylata BECKER et M. dispar BECKER de Taiwan sont redecrites.

Introduction

The genus *Mesorhaga* SCHNER, 1868 is clearly redefined by BECKEL (1994) in his impressive monograph on the Sciapodinae of the Oriental and the Australasian regions. There, he describes no fewer than 35 new species of *Mesorhaga* from Australia.

In the present paper we describe another two new species from the northern coast of Papua New Guinea which is an indication that many new species are to be found and described. *M. stylata* BECKER, 1922 and

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M. dispar BECKER, 1922, two more or less related species from Taiwan are re-described.

The biology of *Mesorhaga* species is unknown. They seem to be adapted to a wide variety of biotopes. BICKEL (1994) finds them in the dry interior of Australia as well as in the monsoonal woodland and some species are even reported from dunes on the coast.

The two new species from Papua New Guinea are found in large numbers together with species of *Asyndetus* in the pioneer vegetation of the supralittoral zone of sandy beaches. They are often seen on the leaves of *Canavalia maritima*, a very common pioneer plant on tropical beaches. It is supposed that our *Mesorhaga* species are halophilic since they were restricted to the supralittoral of the beach and not found in the beach forest behind it nor in the swamp forest nearby. BICKEL (l.c.) reports that *M. wirthi* was collected at a crab-hole. Our species may also be associated with crabs, but we never observed them entering or leaving crab burrows like *Asyndetus* species do (GROOTAERT & VAN DE VELDE, 1993; GROOTAERT, 1994).

Material and methods

Material was collected with white pan traps on the beach of Awar and Condor Point, both beaches with black volcanic sand and on Laing I., a small island in Hansa Bay with only white coral sands. All sites are situated in the Madang province on the northern coast of Papua New Guinea. Details on the collection can be found in GROOTAERT & MEUFFELS (1993). All material is preserved in alcohol in the collections of the Royal Belgian Institute of Natural Sciences in Brussels.

Head formula: Total width of head (=10): width of frons at level of upper ocelli: width of face at level of antennae: smallest width of face below antennae.

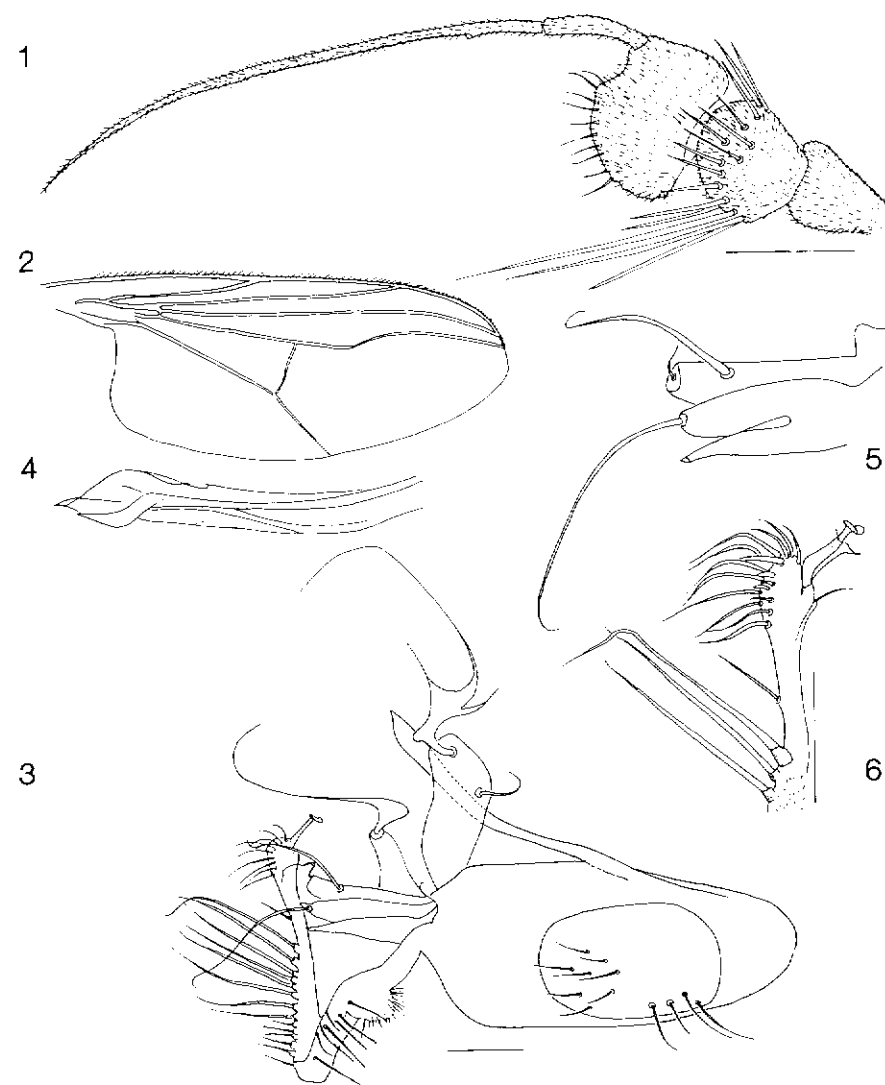
acr: acrostichals; ad: anterodorsals; av: anteroventrals; dc: dorsocentrals; pd: posterodorsals; pv: posteroventrals.

Taxonomic account

Mesorhaga litoralis sp. nov. (Figs 1-6)

Material examined: Holotype male: Papua New Guinea, Madang province, Bogia district, Condor Point, beach, 10-14.V.1993. Paratypes 8♂, 9♀ with same data as holotype; Condor Point, beach 19.III.1992, 2♂; 1-3.IV.1994, 4♂, 10♀ (leg. P. GROOTAERT).

Diagnosis: A medium-sized species with long, black sickle-shaped cerci bearing a comb of long yellow bristles on the distal part and very long forked bristles on the surstyli and epandrial lobes. Fore coxa with white hairs. Hind coxa with a white bristle.



Figs 1-6. *Mesorhaga litoralis* sp. nov. male. 1: antenna; 2: wing (holotype); 3: hypopygium (paratype); 4: tip aedeagus; 5: surstyli; 6: tip cercus. Scale 0.1 mm.

♂

Length body: 2.9-3.2 mm (average 3.1 mm; without hypopygium); wing: 2.4-2.7 mm (average 2.6 mm).

Head. Formula 10 : 4 : 3 : 0.75. Frons and face with shining green metallic ground-colour. Face narrowing downwards. Palpi small, blackish, bearing short black hairs and bristlets and one small black apical bristle.

Rostrum short, brown. Occiput with shining green metallic ground-colour. Eyes bare, without enlarged facets. 2 large ocellars, pointing upwards, diverging; 2 equally strong orbitals, pointing forwards; 8 postocellars, the longest of which are more than half as long as the ocellars, but much less strong; 2 verticals, slightly stronger and longer than uppermost postocular setae, and almost in line with them; no postverticals. Upper postocular setae long, bristle-like, black; lateral postocular cilia very short, dark; lower postocular cilia somewhat longer, pluriseriate, white.

Antennae (Fig. 1) short, black. First segment bare; second segment nearly as long as deep, with a circlet of bristles, short dorsally, longer ventrally, including several long ventral bristles. Third segment slightly deeper than long, shortly pubescent. Arista dorsal (inserted on upper angle), about twice as long as antenna, bare; basal segment a little longer than third antennal segment.

Thorax and scutellum with dark metallic green ground-colour, shining. Acr irregularly biseriate, about 4 pairs, well developed but not long. 5 dc, increasing in length to the rear; 1 humeral, 2 notopleurals, 1 sutural, 2 supra-alars, 1 post-alar. Propleurae bare. Scutellum with 2 not very strong marginals and at each side with a thin hairlike bristle, less than half as long as the marginals.

Legs. Coxae, trochanters and femora black, with a blackish-green metallic gloss, especially on fore legs (but fore trochanters somewhat brownish). Extreme tips of fore and mid femora, and whole of fore and mid tibiae yellow. Fore and mid tarsi yellow, progressively darkened from tip of first segments onwards. Hind tibia and tarsus entirely brownish.

Fore leg. Coxa anteriorly with rather long white hairs, without bristles. Trochanter bare. Femur posteriorly with a row of brownish bristle-like hairs, slightly longer than diameter of femur; posteroventrally a row of whitish hairs, growing longer towards base of femur; anteroventrally on basal half a row of short whitish hairs. Tibia shorter than femur, without bristles even at tip. Last four tarsal segments very short. Length ratio of tibia and tarsal segments of fore leg (in mm): 0.65 : 0.35 : 0.09 : 0.05 : 0.05 : 0.08.

Middle leg. Coxa anteriorly with rather long white hairs; exteriorly a weak, bent black bristle. Trochanter with a strong black bristle. Femur anteroventrally and posteriorly on apical half with strong but not long black bristle-like hairs; ventrally a double row of white hairs, almost as long as depth of femur. Tibia about as long as femur; one well developed ad at basal fourth; 1-3 minute pd on basal half; at tip some small bristles, two of which are nearly as strong as the ad. Length ratio of tibia and tarsal segments of middle leg (in mm): 0.9 : 0.53 : 0.25 : 0.15 : 0.07 : 0.08.

Hind leg. Coxa exteriorly with a white bristle. Trochanter with 1-2 tiny hairlets. Femur anteroventrally near tip with a few short bristle-like hairs; posteriorly, just in front of tip, a very small bristle. Tibia without real

bristles on shaft; only 2-4 of the dorsal hairs lengthened and bristle-like; at tip a few weak bristles or bristle-like hairs. Basal tarsal segment shorter than second segment, somewhat narrowed and bent at very base and bearing there a small remarkable tooth, pointing backward to tip of tibia. Length ratio of tibia and tarsal segments of hind leg: 0.95 : 0.4 : 0.45 : 0.26 : 0.15 : 0.08.

Wing (Fig. 2) hyaline; veins blackish, but yellowish at base of wing. Costa apparently "broken" just in front of humeral cross vein, bearing there two longer bristles. Mediastinal vein ending in subcosta. m1+2 with a smooth bend before middle of its apical part. tp straight, only slightly shorter than apical part of m3+4. Anal vein represented only by a fold. Squamae dirty white with long black margin; long white cilia present. Halter yellow with most of stem dark brown.

Abdomen with 6 visible segments (apart from hypopygium), with shining dark metallic green ground-colour. First tergum with rather long black bristles, especially so at sides; other terga with short black bristles (longer only on fifth tergum). All hairs on terga black. Venter with very short pale hairs. *Hypopygium* black, oblong, with rather short appendages. Cerci very long, black, squarish bent, ventrally in basal half with several long black bristles; in apical half with long yellow bristles. Tip of cercus hardly enlarged, subapically with two peculiar bristles with a cup-shaped tip. Surstyli and epandrial lobes with long, forked, partly flattened, pale hairs.

♀

Body length 2.0-3.3 mm (average 3.0 mm); wing length 2.4-2.6 mm (average 2.5 mm).

Head. Formula 10: 4: 3: 1.

Legs. Fore femur with posterior row of short bristle-like hairs much shorter than diameter of femur; posteroventrally very short whitish hairs. Middle femur with anteroventral and posterior bristle-like hairs all much shorter than with the ♂.

Abdomen with 5 visible segments (apart from oviscapt). Terga with short black hairs and short black marginal bristles, not much longer on first tergum. *Oviscapt* with 4 small spatulate spines.

Derivatio nominis; The name *litoralis* refers to the habitat of the species.

Discussion. Having seen a male specimen of the type series of *M. dispar* BECKER, 1922, we can confirm that *M. litoralis* n.sp. is a different species. Main differences are: BECKER's species has hind tibiae and metatarsi yellow, squamae yellow without black margins, basal tarsal segment of hind leg longer than second segment, apical segment of vein m3+4 much longer than tp, and a differently shaped hypopygium.

M. litoralis belongs to the *M. geoscopa*-group.

Mesorhaga stylatoides sp. nov. (Figs 7-11)

Material examined: Holotype male: Papua New Guinea, Madang province, Bogia district, Laing I., beach, white pan traps, 2-4.III.1992. Paratypes: Laing I., 2-4.III.1992, 1♂; Condor Point, beach, 19.III.1992, 2♂; 10-14.IV.1993, 115♂, 9♀ (leg. P. GROOTAERT).

♂

Diagnosis: A smaller species with dark sickle shaped cerci. Fore coxa with black hairs. Hind coxa with a black bristle.

Length body: (without hypopygium) 1.8-2.7 mm (average 2.3); wing: 1.7-2.4 mm (average 2.0).

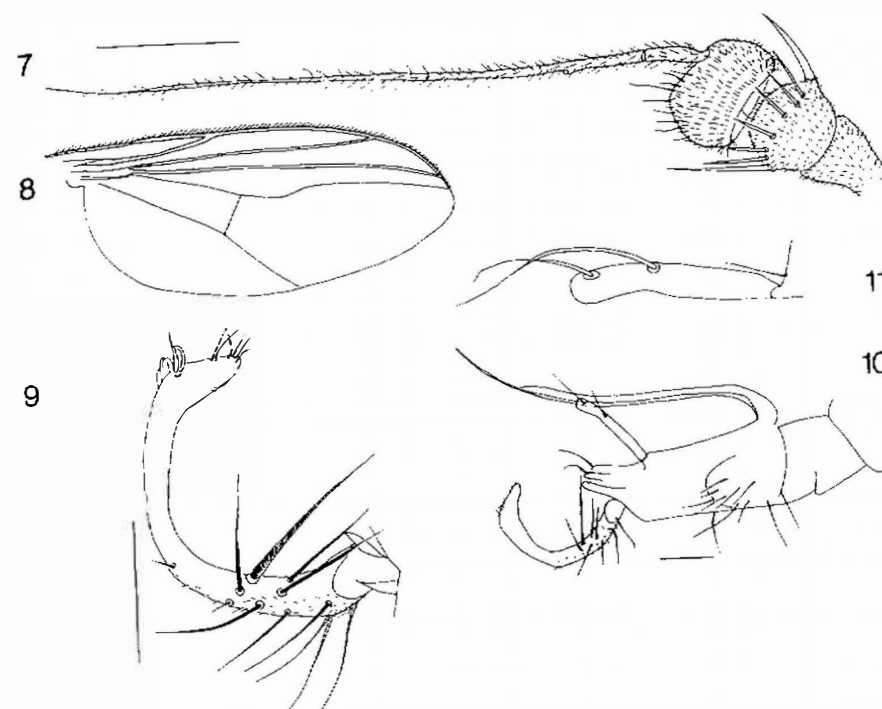
Head. Formula 10 : 3.25 : 3 : 1. Frons and face with shining metallic green ground-colour. Palpi small, brownish black, bearing very short dark hairs and one short black apical bristle. Rostrum short, brown. Occiput with shining metallic green ground-colour. Eyes bare, without enlarged facets. 2 large ocellars, pointing upwards, diverging; 2 less strong orbitals, pointing forwards; 4 small postocellars; 2 verticals, shorter and less strong than orbitals, but much stronger and longer than nearest postocular setae, converging and crossing at tips. No postverticals. Uppermost postocular setae rather long, few (2-3), black; lateral postocular cilia very short, black; lower postocular cilia longer, uniseriate, yellowish.

Antennae (Fig. 7) short, black (third segment brownish black). First segment bare; second segment slightly deeper than long, with a circlet of short black bristles, the ventral bristles hardly longer than the dorsal ones. Third segment about as long as deep, rounded, very shortly pubescent. Arista dorsal, a little more than twice as long as antenna, very shortly pubescent (almost appearing bare); basal segment shorter than third antennal segment.

Thorax and scutellum with shining dark metallic green ground-colour. Acr irregularly biseriate, 3-4 pairs, well developed but short; 5 dc, increasing in length to the rear; 1 humeral; 2 notopleurals; 1 sutural; 2 supra-alars, 1 post-alar. Propleurae bare. Scutellum with 2 large marginals and at either side a hair, much less than half as long as the marginals.

Legs. Fore coxa blackish brown; other coxae black. Trochanters I and II largely yellow, III dark brown. Femora black; fore and middle femora with yellow tips. Fore and middle tibiae and tarsi yellow, tarsi progressively browned from tip of first segments onwards; hind tibiae brown or dark brown, hind tarsus dark brown.

Fore leg. Coxa anteriorly with dark hairs and short and weak dark bristles (appearing yellowish in some aspects). Trochanter bare. Femur posteriorly and posteroventrally with longish hairs, becoming bristle-like towards tip of femur. Tibia about as long as femur, without bristles. Length ratio of fore tibia and tarsal segments (in mm): 0.55 : 0.34 : 0.15 : 0.07 : 0.05 : 0.07.



Figs 7-11. *Mesorhaga stylatoides* sp. nov. male. 7: antenna; 8: wing (holotype); 9: cercus; 10: hypopygium (paratype); 11: epandrial lobe. Scale 0.1 mm.

Middle leg. Coxa anteriorly set with dark hairs, some of which are bristle-like. Trochanter with a strong black bristle. Femur anteroventrally with short black bristly hairs. Tibia about as long as femur; on basal half two short and weak ad and two very small pd; at tip two short bristles. Length ratio of middle tibia and tarsal segments: 0.75 : 0.45 : 0.2 : 0.15 : 0.1 : 0.07.

Hind leg. Coxa with a black exterior bristle. Trochanter with a small dorsal bristle. Femur ventrally with a double row of thin pale hairs, hardly longer than half a diameter of femur. Tibia a little longer than femur, without real bristles even at tip; dorsal hairs and some hairs at tip slightly lengthened, some of them somewhat stronger. Basal segment of tarsus shorter than second segment. Length ratio of hind tibia and tarsal segments: 0.84 : 0.26 : 0.3 : 0.21 : 0.15 : 0.07. Second tarsal segment with a basal tooth-like projection.

Wing (Fig. 8) hyaline with black veins. Costa appearing "broken" just in front of humeral cross-vein, bearing there two short bristles. Mediastinal vein ending in subcosta. m1+2 with a smooth bend before middle of its apical part. Tp straight, shorter than apical part of m3+4 (5 : 11). Anal

vein indicated only by a fold. Squamae yellow, with long yellowish cilia appearing black from some points of view. Halteres black.

Abdomen with 6 visible segments (apart from hypopygium), with shining dark metallic green ground-colour. First tergum with rather long black bristles, especially at sides; other terga with short black bristles. All hairs on terga black. Venter brown, with short black hairs. **Hypopygium** (Figs 9-11) black, oblong. Cerci brownish to black, curved like a sickle, with several long black hairs exteriorly on proximal half.

♀

Length body: 2.0-3.0 mm (average 2.4); wing 1.8-2.4 mm (average 2.0).

Head. Formula 10: 4: 3: 1.25. Head and antennae was with the ♂.

Legs. Fore femur only posteroventrally with a row of short hairs, growing slightly longer towards tip of femur. Middle femur ventrally with only very short hairs. Hind femur ventrally without thin pale hairs. Hind tibia with two small apical bristles.

Abdomen. First tergum having marginal bristles longer than those on following terga; at sides the bristles are not nearly as long as with the ♂.

Oviscapr without spatulate spines.

Derivatio nominis: This species is named *stylatoides* because of its resemblances to *M. stylata* BECKER.

Discussion. This species is much like *Mesorhaga stylata* BECKER, 1922, but BECKER's species is a trifle larger, has a slightly longer basal arisal segment, fewer acr, and hairs flanking marginal bristles on scutellum shorter; its legs are differently coloured; apical part of m1+2 with strong bents; ratio of tp and apical part of m3+4 7:9 (in *stylatoides* 5:11); cerci of hypopygium with broad base and without long black ventral hairs. (See the re-description of *Mesorhaga stylata* BECKER, 1922!).

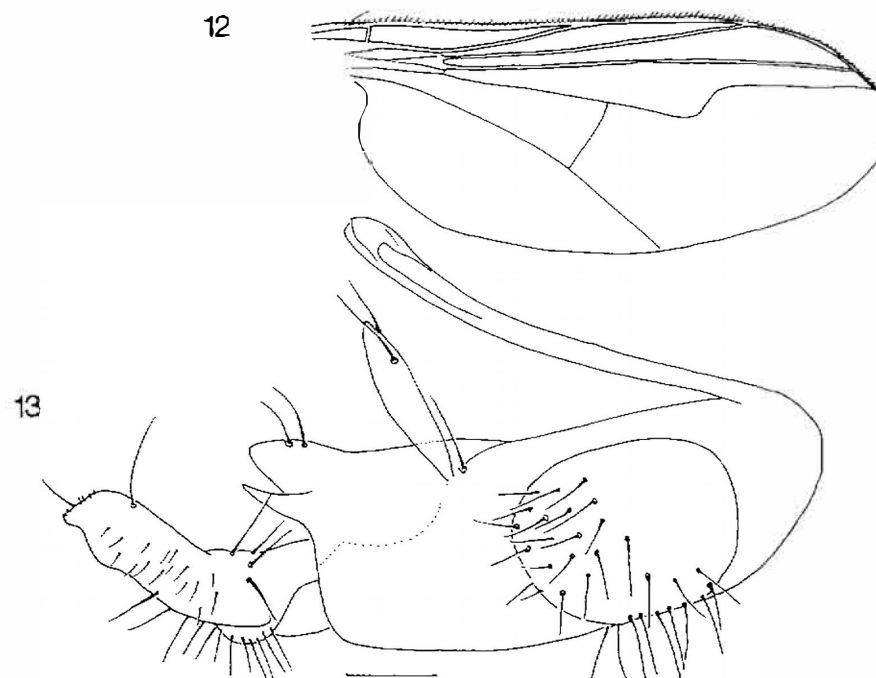
***Mesorhaga dispar* BECKER, 1922 (Figs 12-13)**

Mesorhaga dispar BECKER, 1922: 232.

Material examined: Redescription after 1♂ from the type series of BECKER. Labels: Anping Formosa Sauter V. 1992 / *M. dispar* Beck., det. Becker / [red label] Typus / Zool. Mus. Berlin.

The type series should consist of 3♂, 2♀ from Anping (Formosa) conserved in DEI (Berlin) and a specimen from Takoa (Formosa) conserved in the Hungarian National Museum (Budapest). We only studied the above mentioned specimen. BICKEL (1994) did not see the types.

Diagnosis: A small species with the fore coxa bearing white hairs; hind coxa with a white exterior bristle; hind tibiae yellowish-brown.



Figs 12-13. *Mesorhaga stylata* BECKER, 1922 male from type series (Anping). 12: wing; 13: hypopygium. Scale 0.1 mm.

♂

Length body: 2.25 mm (without hypopygium); wing: 2.4 mm.

Head. Formula 10 : 5 : 3.2 : 1.5. Frons shining metallic green with purplish reflections; greyish dust beneath the ocellar callus. Face with shining purplish-green ground-colour, covered by a greyish dust. Palpi small, dark brown, bearing short hairs and a short apical bristle. Rostrum short, brownish yellow. Occiput dark metallic green, with a slight greyish-brown dusting. 2 diverging ocellars, 2 less strong orbitals, 4 relatively long postocellars, 2 verticals (about as strong as orbitals and uppermost postocellars, and almost in line with the latter). Two uppermost postocellars long and bristle-like, black; the following upper postocellars short, black; lateral postocellars short, yellow; lower postocellars longer, yellowish-white indistinctly pluriseriate. **Antenna** short, dark brown. First segment bare; second segment with a circlet of bristles, longest on ventral side. Third segment rounded, slightly higher than long, pubescent. Arista inserted at upper corner of third antennal segment, one and a half times as long as antenna, practically bare; basal arisal segment shorter than third antennal segment.

Thorax and scutellum with shining metallic green ground-colour, with bluish and purplish reflections. Mesonotum and scutellum with a shifting brownish-grey dusting. Pleurae with a shifting greyish dusting. Acr irregularly biseriate. 5 dc, increasing in length to the rear; 1 humeral, 2 notopleurals, 1 sutural, 2 supra-alars, 1 postalar. Scutellum with 2 strong marginals and 2 bristle-like hairs, less than half as long as the marginal bristles. Propleura bare.

Legs. [N.B.: colours faded]. Fore coxa concolorous with the pleurae; middle and hind coxae black according to BECKER, faded to a brownish yellow colour. Trochanters yellowish. Femora dark, with metallic green gloss. Tips of fore and middle femora yellowish. Tibiae yellow. Tarsi dark; with yellow metatarsi.

Fore leg. Coxa anteriorly set with white bristly hairs, becoming longer towards apex of coxa. Trochanter bare. Femur ventrally and posteriorly with rows of short pale hairs. Tibia about as long as femur, without bristles. Length of tibia and tarsal segments: 0.65 : 0.35 : 0.18 : 0.075 : 0.075 : 0.1.

Middle leg. Coxa anteriorly with pale bristle-like hairs. Trochanter with a black bristle. Femur with an antero- and a posteroventral row of short, pale bristly hairs, all shorter than half a diameter of femur. Tibia slightly longer than femur; no bristles on shaft; at apex a few pale bristles of unequal length. Length of tibia and tarsal segments: 0.8 : 0.5 : 0.2 : 0.15 : 0.06 : 0.08.

Hind leg. Coxa with a white exterior bristle. Trochanter with a few tiny black hairlets. Femur with only posteroventrally near tip a very small bristle. Tibia slightly longer than femur, with a coarse hairiness, without real bristles; even at tip only a few, slightly longer, bristly hairs. First tarsal segment longer than second segment. Length of tibia and tarsal segments: 1.0 : 0.4 : 0.25 : 0.2 : 0.14 : 0.1.

Wing (Fig. 12) hyaline. m1+2 with two strong bents before middle of its apical part; from there parallel to r4+5, and ending well above wing tip. Tp straight, shorter than apical part of m3+4 (2:3). Anal vein indicated by a fold. Squamae yellow, with long yellow cilia. Halteres yellow.

Abdomen shining metallic green, with a shifting, vague, brownish pollen. On sides of first tergum some rather long, pale, hairlike bristles, on the other terga the marginal bristles are very small, hardly longer than the hairs. All hairs on terga short, yellowish. **Hypopygium** dark brown, oblong, large. Cerci rather stout and short.

Mesorhaga stylata BECKER, 1922 (Figs 14-16)

Mesorhaga stylata BECKER, 1922: 233.

Material examined: Redescription after 1♂ from the type series of BECKER. Labels: Formosa, Sauter / *M. stylata* Beck., det. Becker / [red label] Typus / Zool. Mus. Berlin.

M. stylata was described from 5♂, 9♀ from Tainan, Mai 1912 (Formosa) and the types should be deposited in the Hungarian national Museum. Bickel (1994) mentions that the types are lost, but apparently at least one specimen was retained in BECKER's collection in Berlin.

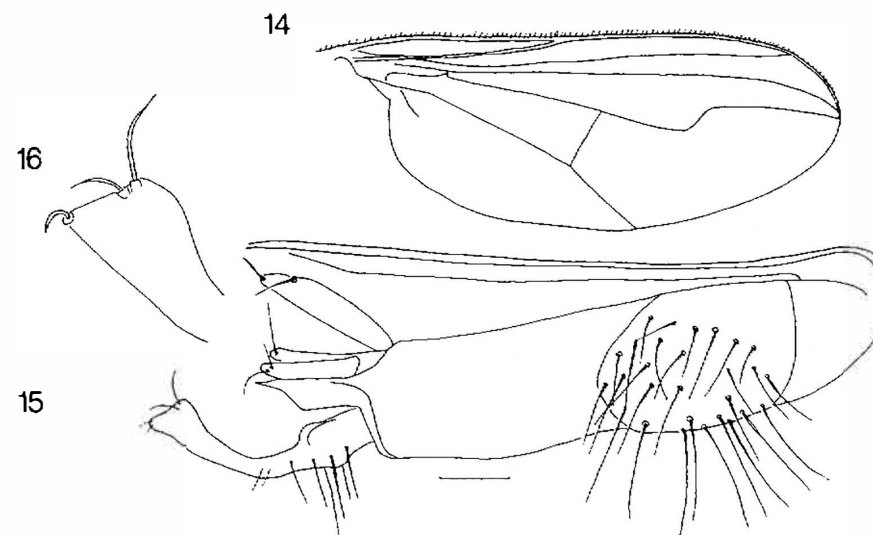
Diagnosis: A medium-sized species with fore coxae covered by yellow hairs. Hind coxa with a black exterior bristle. Hind tibiae yellow.

Length (without hypopygium) 3 mm; wing: 3 mm.

Head. Formula 10 : 4 : 3 : 1.5. Frons and face shining metallic green, seen obliquely from above with a slight greyish brown dusting. Palpi small, brownish black, with short hairs and one short, black apical bristle. Rostrum short, brown. Occiput metallic green. 2 ocellars, 2 orbitals (broken off), 4 small postocellars; no postverticals; 2 small verticals. Uppermost postoculars black, rather long. Lower postoculars pluriserial, brownish yellow.

Antenna short, brownish black. Second segment with a circlet of short marginals. third segment higher than long, rounded. Arista inserted at upper corner of third antennal segment, about twice as long as antenna; basal arista segment as long as third antennal segment.

Thorax and scutellum shining metallic green, with a bluish gloss on scutellum. Seen from above, humeri and anterior slope of mesonotum brownish-grey dusted. Pleurae with a slight brownish-grey dusting, seen from certain directions. Acr biseriate (only two pairs visible), of unequal length. 5 dc, increasing in length to the rear; 1 humeral, 2 notopleurals, 1 sutural, 2



Figs 14-16. *Mesorhaga dispar* BECKER, 1922 male. 14: wing; 15: hypopygium; 16: tip cercus. Scale 0.1 mm.

supra-alars, 1 postalar. Scutellum with two long marginals and two small hairs near basal corners. Propleura bare.

Legs. [N.B.: colours faded!]. Coxae dark. Fore trochanters yellow, middle and hind trochanters darker. Legs yellow. According to BECKER basal third of fore femur and basal half of middle femur black. Hind femur black.

Fore leg. Coxa anteriorly with short yellow hairs, growing longer downwards; near apex of coxa two or three weak bristles. Trochanter bare. Femur posteroventrally with a row of hairs, some of which are longer than half a diameter of femur; three of the near apex of femur bristle-like. Tibia about as long as femur, without bristles. Length of tibia and tarsal segments: 0.8 : 0.5 : 0.25 : 0.15 : 0.1 : 0.1.

Middle leg. Coxa anteriorly with bristle-like hairs. Trochanter with a strong ventral bristle. Femur ventrally with two rows of hairs, nearly as long as diameter of femur. Tibia about as long as femur; anterodorsally a row of short hairs, with 3 slightly longer ad; 2 apicals. Length of tibia and tarsal segments: 1.05 : 0.75 : 0.4 : 0.25 : 0.15 : 0.1.

Hind leg: Coxa with a black exterior bristle. Trochanter with a small posterodorsal bristle. Femur ventrally with two rows of hairs, shorter than diameter of femur. Tibia somewhat longer than femur, without real bristles; some of the hairs on dorsal side slightly longer; no real apical bristles. Length of tibia and tarsal segments: 1.3 : 0.5 : 0.55 : 0.25 : 0.15 : 0.1.

Wing (Fig. 14) hyaline. Costa apparently "broken" in front of humeral cross vein. m1+2 with two bends before middle of its apical part. Tp straight, slightly shorter than apical part of m3+4 (7:9). Anal vein indicated by a fold. Squamae yellow, with long yellow cilia. Halteres yellow.

Abdomen shining metallic green, coppery at the incisures between the terga. First tergum with long black bristles at sides; other terga with short marginals; hairs on terga black. Venter brown, with short hairs. *Hypopygium* (Fig. 15) brownish black, slender. Cerci noded, very narrow on the bend, slightly broadening from there to tip; at proximal part, before the bend, with rather long dark hairs.

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References

- BECKER, Th., 1992. - Dipterologische Studien. Dolichopodinae der Indo-Australischen Region. *Capita zoologica*, 1(4): 3-247.
BICKEL, D., 1994. - The Australian Sciapodinae (Diptera: Dolichopodidae), with a Review of the Oriental and Australasian Faunas, and a World

Conspectus of the Subfamily. *Records of the Australian Museum*, Suppl. 21: 394 pp.

GROOTAERT, P., 1994. - Ecology and geographical distribution of marine empidoids in South-East Asia and Melanesia (Empidoidea: Dolichopodidae, Hybotidae, Microphoridae). Third International Congress of Dipterology, Guelph, Abstracts: 81-82.

GROOTAERT, P. & MEUFFELS, H.J.G., 1993. - Dolichopodidae (Diptera) from Papua New Guinea X. Description of new species of the marine genus *Cymatopus* KERTÉSZ. *Invertebrate Taxonomy*, 7: 1575-1588.

GROOTAERT, P. & VAN DE VELDE, I., 1993. - Empidoid flies (Insecta, Diptera) associated with crab burrows (Crustacea, Decapoda): opportunism or commensalism? *Belgian Journal of Zoology*, 123(1): 30-31.