Cyphophthalmid opilionids new to Madagascar: two new genera (Opiliones, Cyphophthalmi, ?Pettalidae)

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Summary

Cyphophthalmid opilionids are reported for the first time from the island of Madagascar, represented by two new species belonging to two new monotypic genera: *Manangotria taolanaro* and *Ankaratra franzi*. While clearly belonging to the clade Temperophthalmi, they are not easily placed in any of the three families (Sironidae, Pettalidae, Troglosironidae) in that clade. They appear closer to Australian genera than to those from South Africa.

Introduction

The cyphophthalmids of the African continent fall into two major clades (Shear, 1980). The Tropicophthalmi are typical of tropical regions in Africa, South America and South-east Asia and are represented in west Africa by the genera *Ogovea* Roewer (family Ogoveidae Shear) and *Paragovea* Hansen (family Neogoveidae Shear). The Temperophthalmi of Africa are concentrated in the Cape biogeographic province, where the family Pettalidae Shear includes the genera *Purcellia* Hansen & Sørensen, *Parapurcellia* Rosas Costa, and *Speleosiro* Lawrence. An enigmatic species, *Marwe coarctata* Shear, is known only from a cave in Kenya; it cannot at this time be assigned to a family (Shear, 1985). Other pettalid genera are known from Chile, Australia, New Zealand, and Sri Lanka (Juberthie, 1970; Shear, 1980). Of the two other families in Temperophthalmi, Sironidae Simon is found in the North Temperate Zone in North America, Europe and Japan, and Troglosironidae Shear is known only from the island of New Caledonia. Troglosironidae would appear to be the sister group of the two families Pettalidae and Sironidae taken together (Shear, 1993).

Cyphophthalmids have not been reported before from Madagascar. Indeed, the latest (and only) comprehensive work on Malagasy Opiliones (Lawrence, 1959) lists only representatives of the suborder Laniatores from the island, in contradistinction to the African continent, where Phalangioidea are well-represented (cf. Starega, 1984, 1992). Concerning cyphophthalmids, Lawrence (1959) states that "il parait à peu près certain que des espèces de ce sous-ordre n'ont pu échapper aux recherches à Madagascar et qu'elles y sont defaut", referring to his own work and to the researches of numerous entomologists (e.g. J. Millot, R. Paulian, P. Remy) on Madagascar.

It therefore came as a surprise to one of us (JG) in 1987 to find the cyphophthalmid material treated below, while perfunctorily sorting through a voluminous collection of soil animals transferred to the collections of the Naturhistorisches Museum from the former institute of Prof. H. Franz (Institut für Bodenforschung und Baugeologie, Universität für Bodenkultur, Wien). *Manangotria taolanaro*, n. sp. was mislabelled as "Ixodidae" and *Ankaratra franzi*, n. sp. as "Trombidiformes" in the roughly sorted material. A variety of circumstances, including grave doubts about the locality data, prevented JG from definitively describing this interesting material; attempts to confirm the data were unsuccessful. Finally, in 1992, JG sent the material to the first author (WAS) for further work. He was able to confirm the unusual nature of the specimens themselves, which added credence to the locality data. In April and May 1969, Prof. Franz collected extensively in central, southern, eastern and northern Madagascar; he covered numerous localities of which only two yielded cyphophthalmids. This indicates the localised occurrence of this suborder on the island. It may be no coincidence that material of the triaenobunine genus *Ankaratrix* Lawrence was also present from these localities; this genus is a possible indicator of relictual and faunally rich montane forest regions (Lawrence, 1959).

Other attempts to obtain independent confirmation proved unsuccessful. Because of the long-standing connections between France and Madagascar, we asked our colleague Dr A. Muñoz-Cuevas to examine the mite collection at the Muséum d'Histoire Naturelle, Paris. He found a few interesting cyphophthalmids (which have been returned to his care) but nothing from Madagascar. We also took note of a recent paper on Malagasy millipedes (Mauriès, 1994) which reported the order Chordeumatida from Madagascar for the first time. Methods used to collect these small soil millipedes would probably have also produced cyphophthalmids. Dr Mauriès was not aware of any cyphophthalmids taken by the same collector, and we were not able to make contact with the collector directly. We are grateful to Drs Muñoz-Cuevas and Mauriès for their efforts on our behalf. It is possible that Malagasy specimens are "hiding" in other collections, but we have not enquired after them. Thanks are also due to Prof. Franz and his former assistant, Dr Gabriele Haybach, for having arranged the donation and transfer of this whole rich collection to the Naturhistorisches Museum Wien.

All material of the two new species described below has been deposited in the Naturhistorisches Museum Wien (NHMW), Wien, Austria.

Methods

Though the specimens had been allowed to dry up, they were unharmed, thanks to the typical heavy sclerotisation of this group. They were rehydrated using sodium triphosphate solution. Specimens were observed, measured, and drawn using a dissecting microscope. The right chelicera, pedipalp, first and fourth legs, and penis were then mounted in glycerine on a microscope slide

and examined with a compound microscope fitted with Nomarski Interference Contrast optics, and measured with an ocular micrometer. All measurements are in millimetres; in the descriptions, measurements of appendage segments are given in order from basal to distal (beginning with trochanter for pedipalps, femora for legs), lengths first, separated from widths by a diagonal stroke, and L/W ratios, if significant, follow in parentheses.

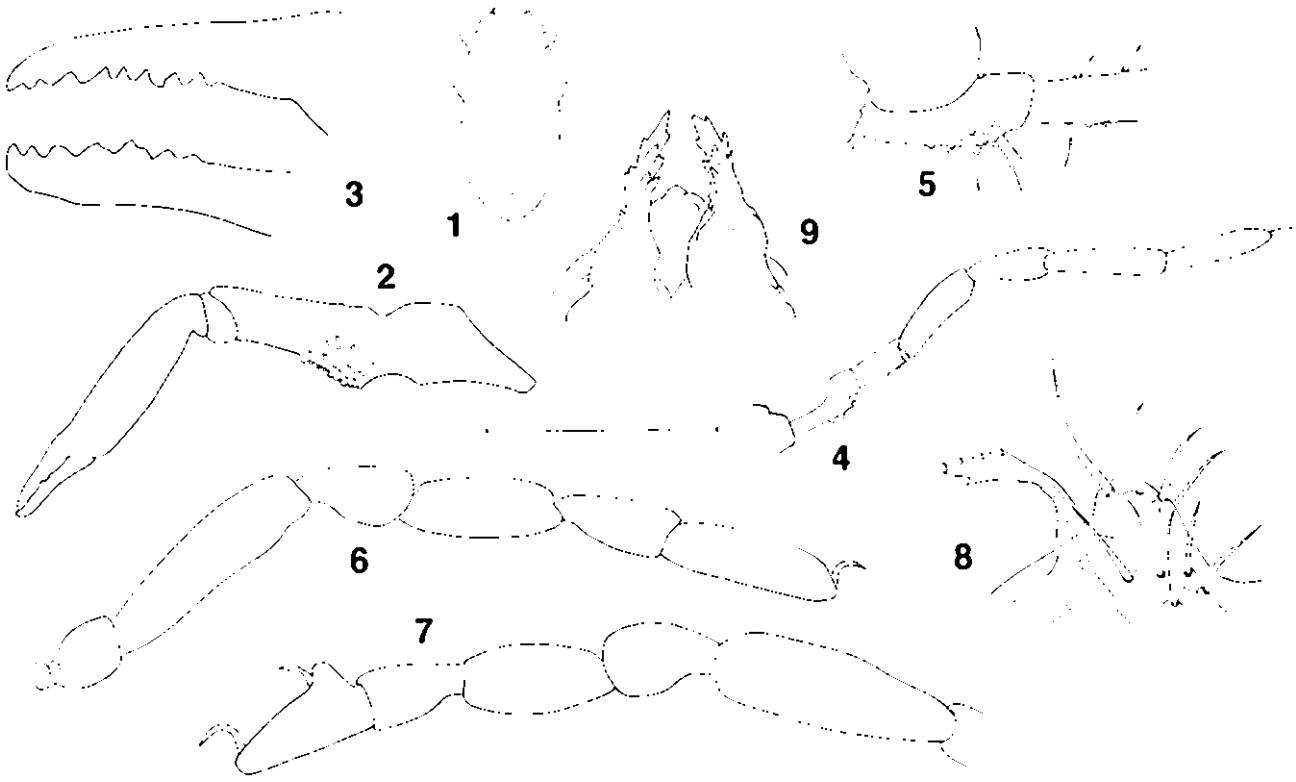
Systematics

Family Pettalidae Shear, 1980

While we have elected to place both of these new genera in the family Pettalidae, the evidence is ambiguous. In 1980, before additional genera were discovered, Shear characterised the separation of the families Sironidae and Pettalidae as "satisfyingly unequivocal." As recognised by Juberthie (1989), that is no longer the case. A new family had to be named for the New Caledonian *Troglosiro* Juberthie (Shear, 1993), *Marwe* Shear remains unassigned, and neither of the two genera below have all the diagnostic characters of the pettalids. *Manangotria taolanaro* qualifies as a pettalid because it has two kinds of teeth on the movable finger of the chelicera, a character regarded as very important by Juberthie (1989; Sironidae have a single type of large, regular cheliceral tooth); the male, however, entirely lacks the strong modifications of the anal region that occur in all other pettalids. *Ankaratra franzi*, on the other hand, has a single type of cheliceral tooth (though not the same type as in the Sironidae!), and a modified anal region; but unlike any pettalids, sternites 8 and 9 and tergite 9 are fused to form a ring around the anal operculum, which is typical of sironids. The somewhat irregular, large cheliceral teeth of one type that are found in this latter species also occur in troglosironids (Shear, 1993), but the species lacks the ventral midline glands of the males of troglosironids and the penes are completely different.

Clearly a reassessment of the clade Sironidae+Pettalidae+Troglosironidae is required, but is beyond the scope of this study. Genera also must be re-evaluated. Shear (1980) placed *Neosiro* Newell in the synonymy of *Siro* Latreille because the only character separating the two was the division of the fourth tarsus of the male in *Neosiro*, and *Siro sonomae* Shear, with a partially divided tarsus, had been described (Shear, 1980). Juberthie (1989), however, decided to leave the genera *Rakaia* and *Neopurcellia* Forster separate despite finding a species (*Rakaia daviesae* Juberthie) intermediate between the two genera, including an incompletely divided male fourth tarsus.

It is also of some interest that the two new Malagasy species may have closer affinities to Australian forms than to those found in South Africa. At first glance, there are some biogeographic similarities between Madagascar and Australia which are based mainly on negative evidence, such as the total or preponderant absence of certain "progressive" groups, e.g. large, modern mammals, certain bird groups such as vultures and woodpeckers, Gymnophiona among the amphibians, most "primary fresh-water fishes", and solpugid



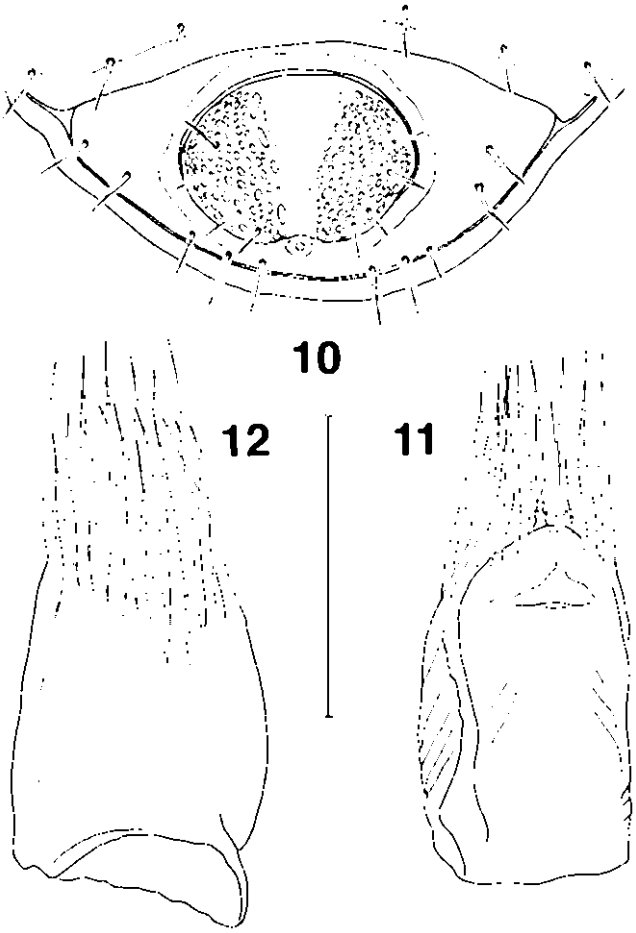
Figs. 1–9: *Ankaratra franzi*, n. sp., male. **1** Body, dorsal view; **2** Chelicera; **3** Cheliceral teeth, movable finger beneath; **4** Palpus; **5** Palpal trochanter; **6** Leg I; **7** Leg IV; **8** Adenostyle; **9** Movable fingers of penis. Scale line=2.0 mm (Fig. 1), 0.6 mm (Figs. 2, 4, 6, 7), 0.3 mm (Fig. 5), 0.15 mm (Figs. 3, 8), 0.06 mm (Fig. 9).

arachnids. A positive and highly visible example is of course the baobabs (*Adansonia*) which have their centre of diversity in Madagascar, but also occur in Africa.

Paulian (1961) has discussed aspects of austral elements in the Malagasy fauna, but many of these include Africa and South America, as well as Australia. Only three of his examples seem to point to special Malagasy–Australian links, those taken from Curculionidae, Diplura and, significantly for us, Opiliones (Starega, 1989).

A few other examples may be mentioned: paramigine spiders (Main, 1991), gallieniellid spiders (Platnick, 1990) and the pseudoscorpion genera *Feaella* and *Indohya* (Harvey, 1989, 1993); these examples also implicate other southern continents, including peninsular India. Paleogeographical grounds make relations between India and Madagascar plausible, and they share sphaeriotheriid millipedes (Jeekel, 1974), and Mauriès (1994) placed his new Malagasy chordeumatid genus *Betscheuma* in the Pygmaeosomatidae, a family previously known only from southern peninsular India. However, no cyphophthalmids are known from peninsular India; the sparse and preliminary records from north-eastern (Himalayan) India are insufficiently known (Shear, 1993, after Martens, 1980; Bastawade, 1992) and probably represent South-east Asian elements, i.e. species of *Stylocellus*. The genus *Pettalus*, known only from Sri Lanka, shows strong sexual dimorphism; the penis has not yet been described.

In conclusion, one can state that Madagascar and Australia–New Zealand share elements of a general austral or Gondwanan character, partly implicating other southern or southern-derived continents or micro-continents. Exclusive relations are scarce. Here one can mention the triaenonychid opilionid genus *Ankaratrix* Lawrence 1959, which Lawrence placed in the subfamily Triaenobuninae*, heretofore known only from the Australian–New Zealand region; this form co-occurs with both new cyphophthalmid species.



Figs. 10–12: *Ankaratra franzi*, n. sp., male. **10** Anal region; **11** Penis, ventral view; **12** Penis, dorsal view. Scale line = 0.3 mm (Fig. 10), 0.15 mm (Figs. 11, 12).

Genus *Ankaratra*, new genus

Type species: *Ankaratra franzi*, new species, described below.

Etymology: The name is derived from the locality, the Ankaratra Massif, where the type species was collected. It is feminine in gender.

Diagnosis: Differing from other pettalid genera in having only one kind of tooth (large and irregular) on the cheliceral movable finger, and with a fused corona analis including sternites 8 and 9 and tergite 9.

Description: Coxae I, II free, III, IV fused. Eyes absent. Ozophores type 2. Chelicerae (Fig. 2) robust, dorsal crest low. Cheliceral fingers with large, irregular teeth only (Fig. 3). Abdominal sternites 8, 9, tergite 9 fused to form corona analis. Tarsus IV entire; legs with pebbled ornamentation on all segments except tarsi. Male secondary sexual modifications: adenostyle lamellar, gently curved, arising from base of swollen area on dorsal surface of tarsus (Figs. 7, 8); anal region with prominent midline gland pore on tergite 9; anal operculum with median furrow (Fig. 10). Penis (Figs. 9, 11, 12) of *Siro* type.

Distribution: Known only from the Ankaratra Massif, Malagasy Republic.

Ankaratra franzi, new species (Figs. 1–12)

Types: Holotype male (NHMW 17.317) from Ankaratra, Malagasy Republic, Madagascar (sample Mg 9), 14 April 1969, coll. H. Franz.

Etymology: The species epithet honours Prof. H. Franz, the collector.

Description: *Male*: Total length 1.8, greatest width 1.0, L/W = 2.3. Body (Fig. 1) broadly oval, widest across laterally bulging posterior part of cephalothorax, dorsum in lateral view nearly level. Dorsum with dull matt appearance, with very fine pebbled microsculpture. Ozophores removed from carapace margin by about one diameter (Type 2). Cephalothoracic sulcus indistinct; abdominal sulci nearly obsolete. Posterior end of body evenly rounded. Sternites 8 and 9 and tergite 9 fused; prominent posterior midline gland pore. Anal operculum with shallow median furrow lacking microsculpture of operculum (Fig. 10). First cheliceral segment (Fig. 2) 0.89 long, 0.22 wide, dorsal crest low, smooth; ventral

*There are some reservations; Starega (1992) placed the genus in the Triaenonychinae, but without explicit justification.

tubercle with numerous warts. Second cheliceral segment 0.82 long, 0.15 wide, straight, evenly tapered, fixed finger 0.26 long, 32% length of second cheliceral segment. Cheliceral teeth (Fig. 3) of movable finger all similar, irregularly shaped, large. Palpal segments (Figs. 4, 5) 0.20, 0.40/0.08, 0.20, 0.32/0.07, 0.29. Legs robust, with small pebbled ornamentation complete on all segments except tarsi. Leg I (Fig. 6) segments 0.65/0.17 (3.82), 0.31/0.17, 0.43/0.16 (2.69), 0.33/0.13, 0.46/0.13. Leg IV (Fig. 7) segments 0.64/0.21 (3.05), 0.30/0.18, 0.38/0.18 (2.11), 0.27/0.15, 0.37/0.16. Adenostyle (Fig. 8) narrow, lamellar with apical incisions, arising beside prominent swelling on mesodorsal surface of tarsus, cluster of macrosetae at base. Penis in ventral view (Fig. 11) with 6 marginal setae well separated, situated proximal of margin; single ventral setae on large tubercle; in dorsal view (Fig. 12) 12 dorsal setae closely set. Gonopore margins with two robust, curved fingers set with irregular projections (Fig. 9).

Female: Unknown.

Distribution: The Ankaratra Massif is located in the centre of the island, south-west of Tananarive, covering about 2000 km^2. Its highest peak is Tsiafajavona, 2638 m. Prof. Franz's field notes concerning the collection number Mg 9 read as follows: "Ankaratra: Abstieg vom Gipfel zum Parkplatz und weiter bis zur Waldgrenze, 14 April 1969 (Ankaratra, descent from summit [presumably Tsiafajavona] towards parking lot, and further on as far as the [upper] limit of the forest)". Two further collection localities are noted: Mg 7: "Tsiafajavona, summit, 2643 m, sifted from turf, under stones . . ."; Mg 8: "Col de Manontongana, 2000 m, upper limit of forest, sifted from litter . . .". Locality Mg 9 would seem to lie between these two spots, therefore about 2000–2600 m elevation. Franz (1979) states that the vegetational cover of Ankaratra is more degraded by fire and grazing than that of other high mountains in Madagascar. The ericaceous shrub zone which normally occurs above the tree line (about 2000 m) is largely replaced by secondary grassland, which, however, contains an interesting soil fauna. In this connection, Franz (1979), cites a hypothesis put forward by Paulian (1961), who found high altitude grasslands on Malagasy mountains to have species-rich, endemic faunas, and therefore supposed that there may be primary montane grasslands on the island. Putting these observations and ideas together, we surmise that *Ankaratra franzi* came from secondary grassland probably above 2000 m elevation.

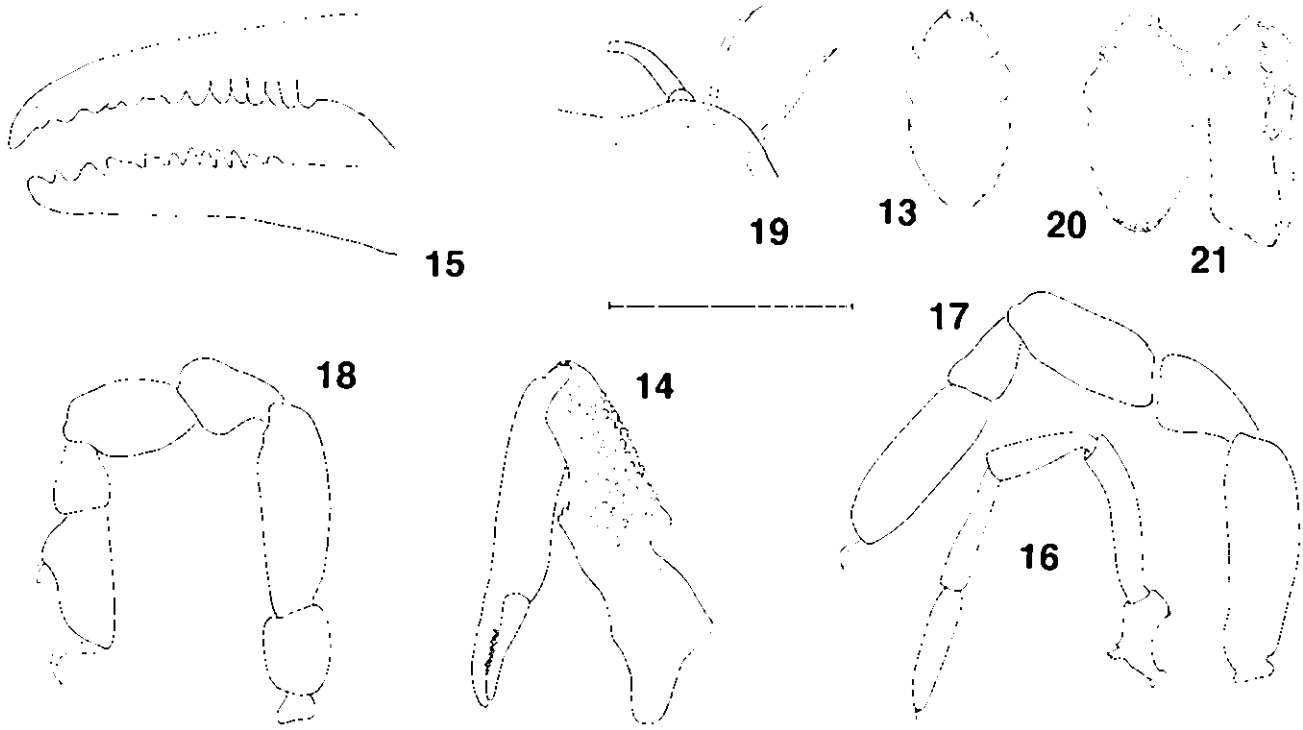
Notes: The chelicerae have only one kind of tooth, but it is difficult to tell from the single individual whether this is due to wear during its lifetime.

Genus *Manangotria*, new genus

Type species: *Manangotria taolanaro*, new species, described below.

Etymology: The name is derived from the locality, Col de Manangotry, where the type species was collected. It is feminine in gender.

Diagnosis: Differing from other pettalid genera in lacking any modifications of the male anal region, and from most of the African genera of the family except *Parapurcellia* and *Ankaratra* in having type 2 ozophores (see Juberthie, 1970, 1989; Shear, 1980). An autapomorphy is the unique sexual dimorphism in which the female abdominal dorsum slopes sharply down behind tergite 5 (Fig. 21); the male profile is uniformly depressed.



Figs. 13–21: *Manangotria taolanaro*, n. sp. **13–19** Male. **13** Body, dorsal view; **14** Chelicera; **15** Cheliceral teeth, movable finger beneath; **16** Palpus; **17** Leg I; **18** Leg IV; **19** Adenostyle. **20, 21** Female body. **20** Dorsal view; **21** Lateral view. Scale line=2.0 mm (Figs. 13, 20, 21), 0.6 mm (Figs. 14, 16–18), 0.15 mm (Figs. 15, 19).

Description: Coxae I, II free, III, IV fused. Eyes absent. Ozophores type 2. Chelicerae (Fig. 14) robust, dorsally crested. Cheliceral fingers with both large and small teeth (Fig. 15). Abdominal sternites 8, 9 free, tergite 9 free (Fig. 25). Tarsus IV entire. Metatarsi I–II with basal microsculpture only; III–IV with microsculpture complete. Male secondary sexual modifications: adenostyle tubular, gently curved, arising from swollen area on dorsal surface of tarsus (Figs. 18, 19); anal region without glands or modifications. Penis (Figs. 22–24) of *Siro* type.

Distribution: Known only from the vicinity of Taolanaro, Malagasy Republic.

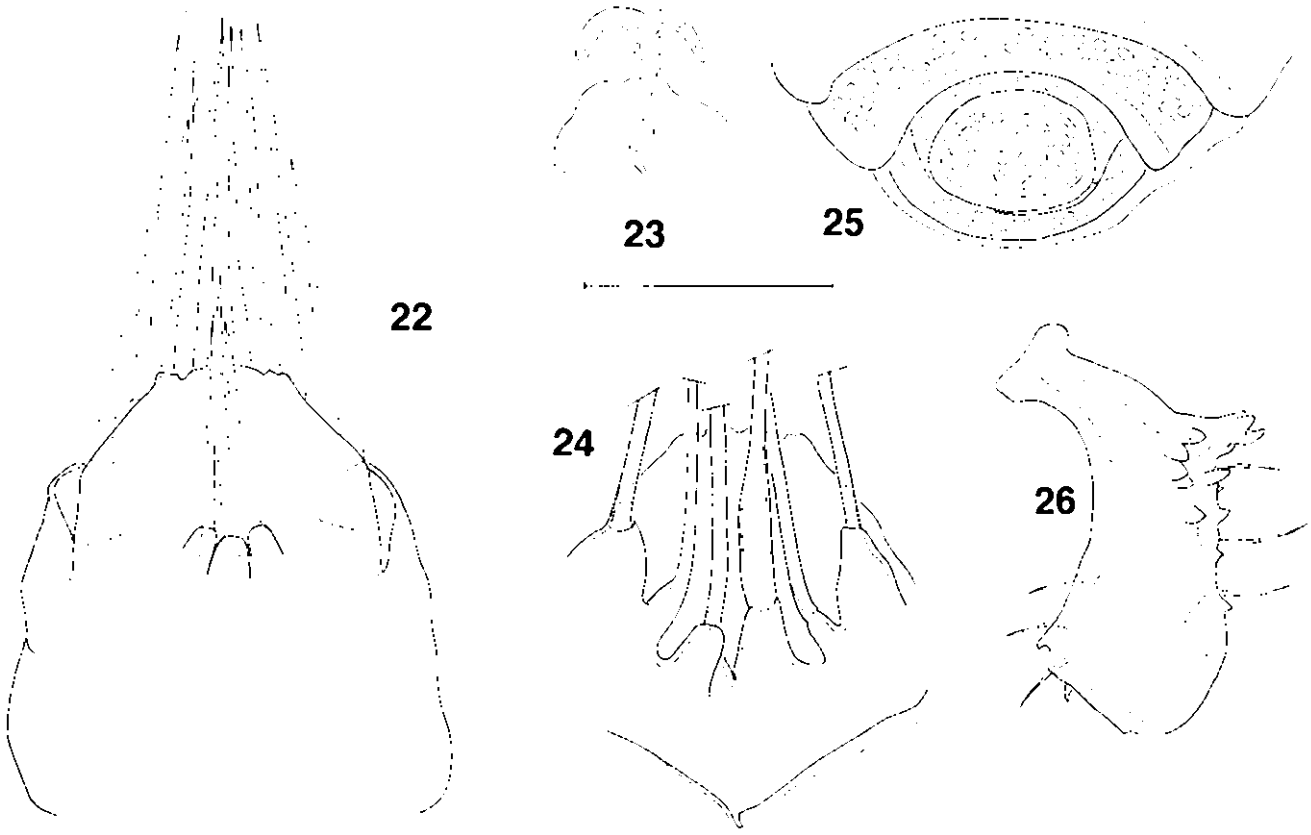
Manangotria taolanaro, new species (Figs. 13–26)

Types: Holotype male, two paratype females (NHMW 17.318) from 630 m elevation, Col de Manangotry, near Taolanaro, Malagasy Republic, Madagascar (sample Mg 45), 4 May 1969, coll. H. Franz.

Etymology: The species epithet refers to the town of Taolanaro, near the type locality. The French name for this place was Ft. Dauphin.

Description: *Male*: Total length 1.58, greatest width 0.9, L/W = 1.76. Body (Fig. 13) generally egg-shaped, widest across laterally bulging posterior part of cephalothorax, dorsum in lateral view nearly level. Dorsum shining, with heavily pebbled microsculpture. Ozophores removed from carapace margin by about one diameter (Type 2). Cephalothoracic sulcus distinct laterally, less so near midline; abdominal sulci very indistinct. Posterior end of body evenly rounded. Sternites 8 and 9 and tergite 9 free, unmodified, without gland pores. Anal operculum unmodified (Fig. 25). First cheliceral segment (Fig. 14) 0.93 long, 0.26 wide, strong dorsal crest present, heavily pebbled. Second cheliceral segment 0.83 long, 0.15 wide, straight, evenly tapered, fixed finger 0.28 long, 34% length of second cheliceral segment. Cheliceral teeth (Fig. 15) of movable finger of two kinds, distal teeth large, irregular; proximal teeth smaller, crowded, regular. Palpal segments (Fig. 16) 0.22, 0.43/0.07, 0.28, 0.31/0.05, 0.31; palpal trochanter with strong, nodulose ventral projection (Fig. 26). Legs robust, with heavily pebbled ornamentation; metatarsi I and II with basal ornamentation only, pebbling complete on III and IV. Leg I (Fig. 17) segments 0.56/0.18 (3.11), 0.31/0.18, 0.40/0.18 (2/22), 0.21/0.14, 0.46/0.16. Leg IV (Fig. 18) segments 0.52/0.18 (2.89), 0.26/0.20, 0.30/0.19 (1.58), 0.18/0.13, 0.31/0.21. Adenostyle (Fig. 19) tubular, arising from swollen mesodorsal surface of tarsus. Penis in ventral view (Fig. 22) with three ventral setae closely grouped on distinct individual tubercles, four apical setae on apical margin of dorsal plate, two lateral setae well separated from dorsal plate; in dorsal view (Fig. 24) six dorsal setae well separated, mesal seta of each side more slender than others; gonopore margins with two robust, acute, curved fingers (Fig. 23).

Female: (Figs. 20, 21): Total length 1.7, greatest width 1.0. Closely resembling male in nonsexual characters, but seen in lateral view dorsum is level to fifth abdominal tergite, then sloping sharply to posterior end.



Figs. 22–26: *Manangotria taolanaro*, n. sp., male. **22** Penis, ventral view; **23** Movable fingers of penis; **24** Bases of dorsal setae of penis; **25** Anal region; **26** Palpal trochanter. Scale line = 0.3 mm (Fig. 25), 0.15 mm (Fig. 26), 0.06 mm (Figs. 22–24).

Distribution: The town of Taolanaro (Ft. Dauphin) is at the south end of the island, on the Indian Ocean coast. Inland north and west is the Col de Manangotry in the Beampingaratra Mountains. Prof. Franz's field notes for locality Mg 45 are as follows: "Col de Manangotry, bei Fort Dauphin, ca. 630 m, 4 May 1969; Gesiebe im Wald auf der Nord- und Südseite, Laubstreu und morsches Holz; hier sehr reiche Ausbeute mit sehr interresanten Bodentieren (Col de Manangotry, near Fort Dauphin, about 630 m elevation, 4 May 1969; sifted from leaf litter and rotten wood in the forest on the northern and southern slopes; a very rich catch here with very interesting soil animals)". Franz (1986) mentions Col de Manangotry as a locality for 16 species of scydmaenid beetles.

Notes: In its setation and its curved movable fingers, the penis of *Manangotria taolanaro* is similar to that found in species of *Rakaia, Austropurcellia, Chileogovea* and other austral pettalids, but it differs from these in its lack of modifications of the male anal region.

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