Shear, W. A. 1977. The opilionid genus *Neogovea* Hinton, with a description of the first troglobitic cyphophthalmid from the Western Hemisphere (Opiliones, Cyphophthalmi). J. Arachnol. 3:165-175.

THE OPILIONID GENUS *NEOGOVEA* HINTON, WITH A DESCRIPTION OF THE FIRST TROGLOBITIC CYPHOPHTHALMID FROM THE WESTERN HEMISPHERE (OPILIONES, CYPHOPHTHALMI)

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ABSTRACT

The genus *Neogovea*, traditionally placed in the subfamily Stylocellinae of the family Sironidae, is surveyed, and two new species *N. kamakusa* and *N. mexasca*, are described. The latter is the first troglobitic cyphophthalmid to be reported from the Americas. Species of *Neogovea* are related to species of *Brasilogovea*, *Metasiro*, *Metagovea* and *Chileogovea*, in that order. The author does not formally recognize family and subfamily names in the Cyphophthalmi, believing that a complete reorganization of the group is warranted. The new term *eusternum* is coined to describe a median sternal sclerite found between the meso- and metasterna of *N. kamakusa*.

INTRODUCTION

The cyphophthalmids are peculiar, mite-like opilionids inhabiting forest litter and caves in tropical and temperate regions all over the world. Formerly thought to be rare, they are now known from abundant specimens, and many new species have recently been described. Hoffman (1963) has reviewed the history of the New World forms, and Martens (1969) has added a new species of *Metagovea*, and a monotypic new genus, *Brasilogovea*, both from Brazil.

The higher classification of the group has been reviewed by Rosas Costa (1950) and Juberthie (1969). Despite these efforts a number of problems remain to be solved. The lumping of all known cyphophthalmids into the single family Sironidae is extreme; at least three clearly defined family-level groups can be discerned in the world fauna. Further, the subdivision of this family into the subfamilies Sironinae and Stylocellinae on the basis of the degree of fusion of the second leg coxae is obviously artificial; I follow Hoffman (1963) in declining to use subfamily names until the entire group can be studied. Hoffman (1963) and Juberthie (1969) have independently pointed out a number of taxonomic characters not used by previous authors. Among these are the teeth of the chelicerae, position of the ozophores, ornamentations of the fourth male metatarsi, form of the penis and ovipositor, and form of the endites of the second and third leg coxae (mesosterna and metasterna of Hoffman). Traditionally used characters include the presence or absence of grooves between the abdominal tergites, form of the corona analis, and form and position of the adenostyles. Only the most recent work on cyphophthalmids includes descriptions and illustrations specifically designed to exploit all these characters, so the whole group will probably have to be restudied before a phylogenetic classification can be arrived at.

A few years ago, I began a revision of the North American species of cyphophthalmids, and recently decided to include the genus *Neogovea* because its known members seem to be rather closely related to species of *Metasiro* from the southern United States. When Dr. J. Mark Rowland of Texas Tech University kindly sent me a new troglobitic cyphophthalmid from Mexico, and it turned out to be a member of *Neogovea*, it seemed best not to delay publication of my work on this genus. The account that follows, plus the redescription of the type species, *N. immsi* Hinton, by Martens (1969) gives a complete picture of our knowledge of the genus up to the present.

My forthcoming revision of the North American fauna, with descriptions of several new species, will be the proper place to expand on my comments above concerning the families and subfamilies of cyphophthalmids.

Genus *Neogovea* Hinton

Neogovea Hinton 1938, Ann. Mag. Nat. Hist. 11(2):333; Rosas Costa, 1950, Arthropoda (Org. Asoc. Argent. Arthropodol.) 1(2-4):139; Hoffman, 1963, Senck. Biol. 44(2):137; Martens, 1969, Beitr. z. Neotrop. Fauna 6(2):110. *Sirula* Goodnight and Goodnight 1942, Amer. Mus. Nov. 1167:1.

Type Species.—Of *Neogovea*, *N. immsi* Hinton, by original designation and monotypy; of *Sirula*, *Siro kartabo* Davis, by original designation and monotypy.

Diagnosis.—In *Metagovea* species, the mesosternal and metasternal elements are usually fused, and show sexual dimorphism, and the adenostyle does not end in a brush of setae; in *Brasilogovea* (which may be a synonym of *Neogovea*) the penis is not apically flattened; in *Metasiro* species the fourth coxae meet broadly anterior to the gonostome, not narrowly as in *Neogovea.*

Description.—Medium sized to large cyphophthalmids of typical appearance. Grooves between abdominal tergites and median groove present or absent. Ozophores removed from margin of scute but not fully dorsal; openings terminal or ventral. Eyes absent. Anterior margin of scute with square emargination above chelicerae, laterally prolonged as squared flange on either side of cheliceral insertions. Claws of legs III and IV toothed in all species, of legs I and II in all species except *N. mexasca.* Cheliceral teeth blunt, small, irregular. Mesosterna always present, arcuate, anterior portion broadest; metasterna absent or present, small if present; eusternal sclerite sometimes present. Gonostomal lobes of fourth coxae meeting narrowly anterior to gonostome. Genital lobe of first abdominal sternite distinct. Dorsum smooth or pebbled, with few setae; legs heavily pebbled. Fourth metatarsus of male not divided; adenostyles ending in brush of setae; metatarsi completely ornamented. Anal glands not detected. Penis as in Figs. 9 and 15. Ovipositor of the usual type, sensillae as setose knobs on apical lobes. No sexual dimorphism in ventral thoracic complex.

Remarks.—1. Useful taxonomic characters. The form of the penis links all species for which males are known. Interspecific variation is concentrated in the setation and the form of the distal structures (cf. Figs. 9 and 15). The form of the mesosterna and metasterna and the presence or absence of a eusternal sclerite (*eusternum*: ventral remnant of a true thoracic sternite ventrally exposed between the mesosterna and metasterna. The dorsal wall of the gonostome is formed from the thoracic sternite, and this wall is continuous with the small triangular eusternal sclerite exposed in *N. kamakusa*) is also important, as are the shapes of the lobes from the fourth coxae forming the anterior and

lateral walls of the gonostome. In *Siro*, *Rakaia* and other cyphophthalmids, there is sexual dimorphism in the ventral thoracic complex and gonostome, but this does not appear to be the case in *Neogovea*.

Hinton (1938) has already remarked, in describing the genus, that the first coxae of *N. immsi* are only "slightly movable." Since the mobility of the coxae is a prime (indeed virtually the only) distinction between the nominate subfamilies Sironinae and Stylocellinae, it is of interest to note that in *N. mexasca* coxa I is entirely free and easily pulled off with the leg. In *N. kartabo* and *N. kamakusa*, the first coxa is immobile and fused to the second coxa as well as the dorsum.

The importance of toothed vs. smooth claws is not yet fully understood, but the character is not consistently distributed between the subfamilies.

The position and form of the adenostyle has been accorded great significance in the cyphophthalmids, probably because it is easy to observe. All *Neogovea* species are related by having the adenostyle end in a brush of setae, as in *Metasiro* and *Brasilogovea*. The form of the adenostyle is of importance, but its relative position on the tarsus is only of species-level significance.

2. Relationships. *Neogovea* species are closest to *Brasilogovea microphaga* Martens, from near Manaus, Brazil (Martens, 1969). *Brasilogovea microphaga* (which I have not seen) was evidently placed in a new genus because of the slightly different form of the penis and adenostyle, which is removed about half the length of the tarsus from its base. The penis is still of the same general form as that found in species of *Neogovea*, and *N. kamakusa* has the adenostyle distant from the base of the tarsus. Perhaps *Brasilogovea* could be synonymized with *Neogovea* at some future time, when generic taxa are better understood. Unfortunately, Martens (1969) does not clearly illustrate the ventral thoracic complex of *B. microphaga*.

Juberthie (1969) placed *Metasiro americanus*, from Florida, USA, in the Sironinae. *Neogovea* species are traditionally considered stylocellines, but there are some very clear relationships between the two genera, such as the form of the metasterna, the position and form of the adenostyle, and the toothed claws. The penis of *M. americanus* is not of the usual sironine type, especially as concerns the setation, in which it resembles species of *Chileogovea* and possibly *Neogovea*. The discovery of males of *N. mexasca* might help to solve this problem.

Metagovea is a genus of two species from South America. The adenostyle of *M. oviformis* Martens is as in *M. disparunguis* Rosas Costa, the generotype, but the latter has all the sternal elements fused together, while the former has distinct mesosterna and metasterna (Martens, 1969). More than one genus may be included in *Metagovea*.

Chileogovea oedipus Roewer has been redescribed in detail by Juberthie and Muñoz-Cuevas (1970). The ozophores are more dorsal than in any of the foregoing, but the penis is quite like that of *Metasiro americanus* and also similar to that of *Metagovea oviformis*. The ventral thoracic complex in much like *Neogovea kamakusa*, but the adenostyle is likewise closer to the form found in *Metagovea*. The claws are not toothed.

All the Neotropical cyphophthalmids, plus *Metasiro americanus*, are not surprisingly related to a greater or lesser degree, but their relationships to the New Zealand and South African forms remains to be clarified. Juberthie and Muñoz-Cuevas (1970) see definite relationships between the Chilean *Chileogovea oedipus* and the New Zealand species of *Rakaia*.

KEY TO SPECIES OF *NEOGOVEA*

1a. Troglobitic; legs long and attenuate (Figs. 22, 23); color medium brown; dorsum of abdomen without conspicuous transverse grooves (Fig. 16); claws of legs I and II smooth; Oaxaca, Mexico . . . . . *mexasca* n. sp.

1b. Not troglobitic; legs typically short and stout (Fig. 8); color very dark brown to black; dorsum of abdomen with conspicuous transverse grooves (Fig. 1); claws of legs I and II with small teeth 2

2a(1b). Length of adult male about 4.5 mm; adenostyle not at base of tarsus IV (Fig. 12); penis as in Fig. 15; Guyana . . . . . *kamakusa* n. sp.

2b. Length 3.0-3.5 mm or less; adenostyle at base of tarsus or slightly removed (fig. 8); penis as in Fig. 9 or as in Martens' (1969) Fig. 5 3

3a(2b). Adenostyle at base of tarsus (Fig. 8); penis with distal prongs at first converging (Fig. 9); Guyana . . . . . *kartabo* (Davis)

3b. Adenostyle slightly removed from base of tarsus; penis with distal prongs diverging at an acute angle; Pará, Brazil . . . . . *immsi* Hinton

Neogovea immsi Hinton

Neogovea immsi Hinton 1938, Ann. Mag. Nat. Hist. 11(2):334-338, Figs. 1-16; Martens, 1969, Beitr. z. Neotrop. Fauna 6(2):110-111, Figs. 1-8.

The excellent original description by Hinton (1938) and the supplementary one by Martens (1969) require no amplification here. The types are from Punta dos Indio, state of Pará, Brazil, and were collected under logs in a moist forest; they are deposited in the British Museum (Natural History).

Neogovea kartabo (Davis)
Figs. 1-9

Siro kartabo Davis, 1937, J. N. Y. Ent. Soc. 45:133, Figs. 1-12.

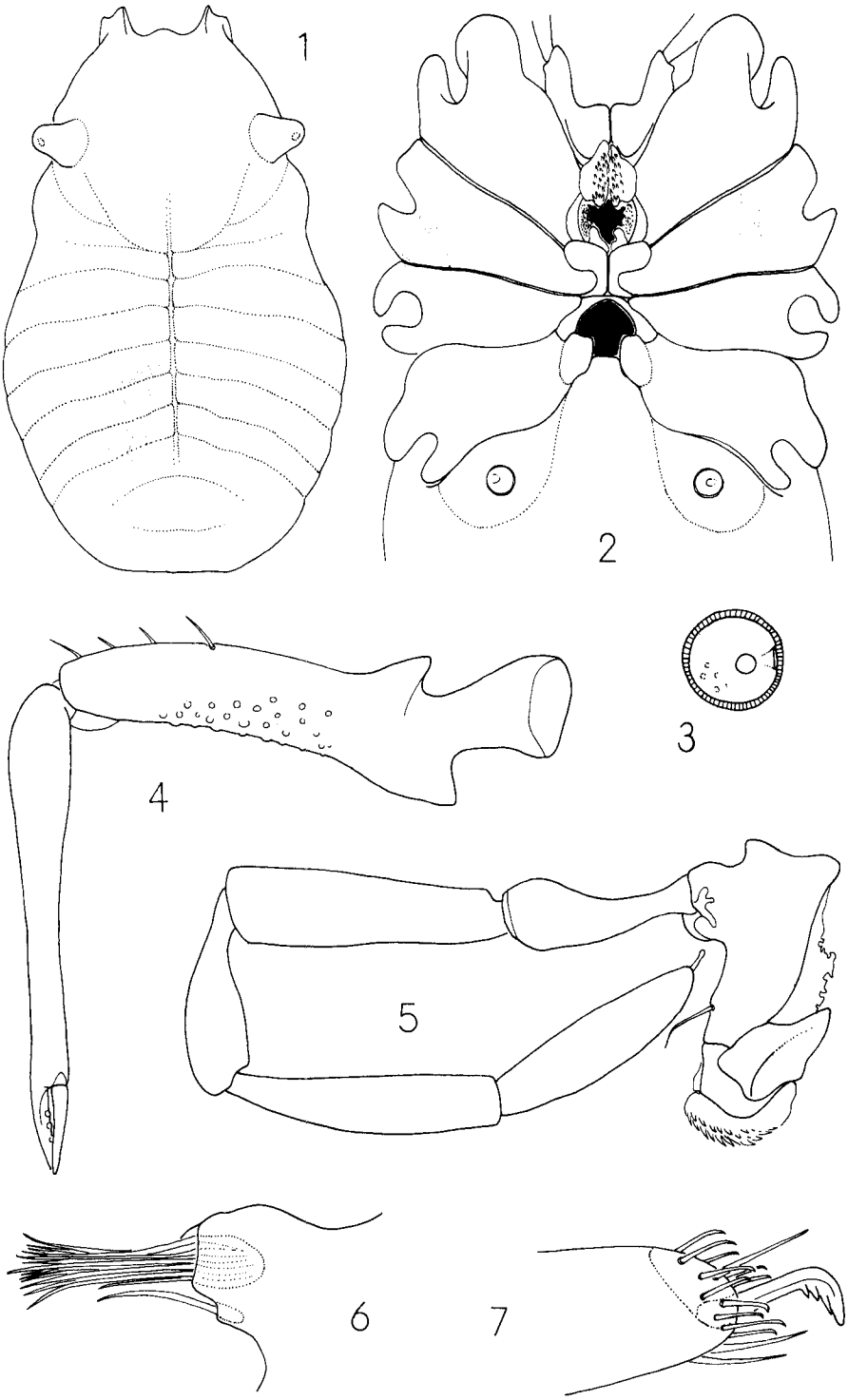
Sirula kartabo, Goodnight and Goodnight, 1942 (in part), Amer. Mus. Nov. 1167:1, no Figs. Record from Kamakusa refers to *N. kamakusa*, n. sp.

Type specimens.—Male holotype and male and female paratypes from Kartabo, Bartice District, Guyana, collected by A. E. Miller, no date given, deposited in American Museum of Natural History, examined.

Diagnosis.—The adenostyle is close to the base of the tarsus and metasterna are apparently absent. *Neogovea kamakusa*, also from Guyana, is one-third larger.

Description.—Male holotype. Length, 2.87 mm, width over tips of ozophores, 1.40 mm, maximum width 1.62 mm. Dorsum as in Fig. 1; ozophore openings ventral. Ventral thoracic complex: endites of coxae I long, narrow. Mesosterna arcuate, anterior lobe wider. Metasterna absent, mesosterna in contact with anterior wall of gonostome formed from lobes of coxae IV. Gonostome about as wide as long; distinct anterior and lateral marginal elements from coxae IV; ventral element from abdominal sternite I distinctly

Figs. 1-7.—Anatomy of male *Neogovea kartabo*: 1, body, dorsal view; 2, thorax, ventral view; 3, left spiracle, ventral view; 4, left chelicera, lateral view; 5, right palpus, mesal view; 6, left adenostyle, mesal view; 7, tip of tarsus of left leg IV, lateral view.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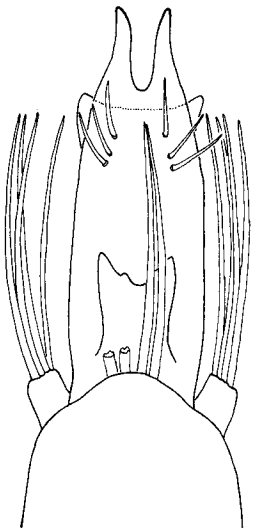

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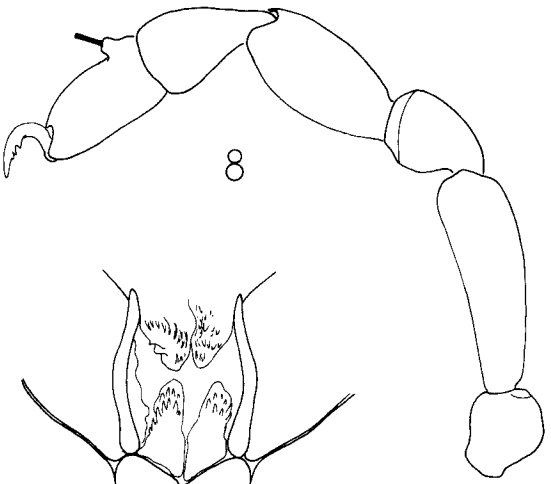

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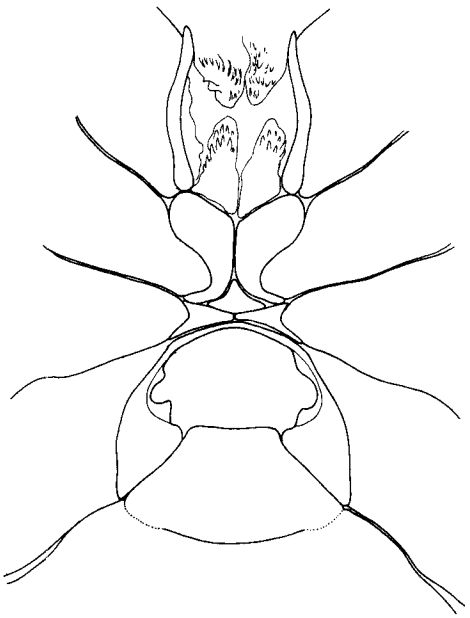

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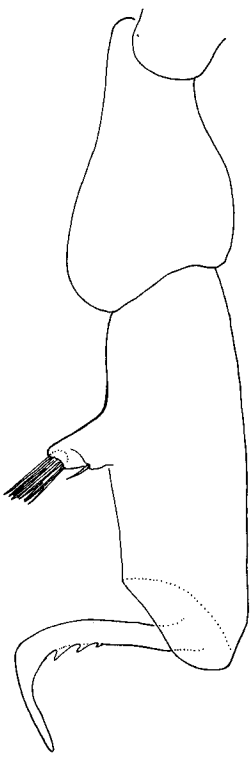

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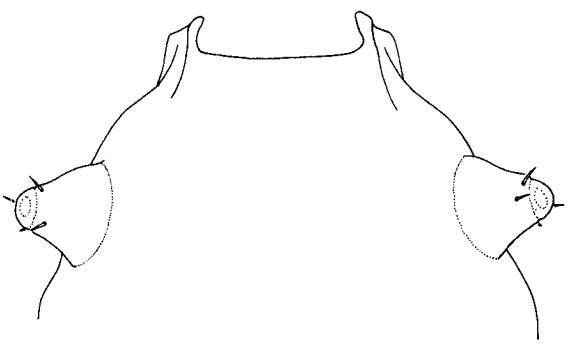

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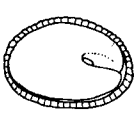

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narrowed between coxae IV. Spiracular grooves present, spiracles as in Fig. 3. Chelicerae typical of genus, as in Fig. 4; first article 1.11 mm long, 0.21 mm wide, second article 1.23 mm long, 0.15 mm wide. Pedipalp as in Fig. 5; trochanter lacks ventral processes, measurements given below. Legs densely covered with pebbled cuticular pattern, including all metatarsi; setation typical, becoming very dense on tarsi. Leg formula 1423. Tarsus of leg I basally swollen, heavily set with sensory (?) hairs ventrally, claws with 2 or 3 minute teeth. Leg IV (Fig. 8) with metatarsus completely pebbled; tarsus with adenostyle near base; claw with lateral rows of three teeth (Fig. 7). Adenostyle with brush of apical setae, and subterminal accessory seta; distal part not set off by groove. Anal glands not detected. Penis in dorsal view as in Fig. 9. Color dark brown, nearly black. Measurements of legs and palpus as follows:

	palpus	I	II	III	IV
trochanter	0.34	0.38	0.38	0.36	0.43
femur	0.48	1.06	0.86	0.77	0.85
patella	0.37	0.51	0.43	0.43	0.51
tibia	0.45	0.81	0.64	0.51	0.68
metatarsus	–––	0.38	0.37	0.37	0.49
tarsus	0.43	0.68	0.60	0.55	0.64

Female paratype. Structure as in male except for sexual differences. Total length, 3.00 mm, width across tips of ozophores, 1.30 mm, maximum width, 1.50 mm. Chelicerae: First article 1.05 mm long, 0.20 mm wide, second article 1.22 mm long, 0.15 mm wide. Ovipositor typical, apical sensillae setose knobs. Measurements of legs and palpus as follows:

	palpus	I	II	III	IV
trochanter	0.38	0.36	0.32	0.37	0.43
femur	0.52	0.98	0.81	0.68	0.87
patella	0.34	0.51	0.43	0.39	0.51
tibia	0.44	0.72	0.55	0.49	0.68
metatarsus	–––	0.42	0.41	0.34	0.47
tarsus	0.36	0.60	0.49	0.42	0.51

Distribution.–Known only from the type locality.

Remarks.–Perhaps the absence of metasterna mark *N. kartabo* as the most highly evolved member of the genus.

Neogovea kamakusa n. sp.
Figs. 10-15

Sirula kartabo, Goodnight and Goodnight, 1942 (in part, not *S. kartabo* (Davis). Only the record from Kamakusa refers to this species, the juvenile from Tukeit is a *Neogovea* but cannot be placed as to species.

Type specimen.–Male holotype from Kamakusa, Essequibo District, Guyana, collected January, 1923, by H. Lang, deposited in American Museum of Natural History. The

Figs. 8-13.–Anatomy of male *N. kartabo* and male *N. kamakusa*: 8, 9, *N. kartabo*: 8, left leg IV, posterior view; 9, penis, dorsal view; 10-13, *N. kamakusa*: 10, thorax, ventral view; 11, anterior part of body, dorsal view; 12, left leg IV, tarsus and metatarsus, mesal view; 13, left spiracle, ventral view.

species epithet refers to the type locality. Despite the great difference in size between *N. kamakusa* and *N. kartabo*, Goodnight and Goodnight (1942) failed to recognize the type specimen as representing an undescribed species.

Diagnosis.—The large size, 4.5 mm in length, separates this species from all the others.

Description.—Male holotype. Total length, 4.50 mm, width across tips of ozophores, 2.30 mm, maximum width, 2.55 mm. Dorsum much as in *kartabo*, cuticle smooth but with mat surface faintly irridescent; ozophores somewhat more lateral than in *kartabo*, openings ventral (Fig. 11). Ventral complex: As in Fig. 10. Mesosterna with anterior lobes broader than in *kartabo*; metasterna small and subtriangular; posterior lobes of mesosterna separated by small, triangular eusternal sclerite. Gonostome somewhat wider than long, anterior and lateral walls formed by lobes of coxae IV, lateral and anterior portions not distinct as in *kartabo*, edges of lateral lobes irregular. Posterior wall formed by extension from first abdominal sternite set off by definite groove. Spiracular grooves present, spiracle as in Fig. 13. Chelicerae typical; first article 1.92 mm long, 0.33 mm wide, second article 1.88 mm long, 0.27 mm wide. Palp as in *kartabo*, measurements given below. Legs densely covered with pebbled cuticular pattern. Adenostyle nearly half length of tarsus from base of tarsus (Fig. 12), apical portion set off by definite groove above accessory seta; hairs of brush somewhat modified (Fig. 14). Anal glands not detected. Penis in dorsal view as in Fig. 15. Color dark brown, nearly black, appearing black without magnification. Measurements of legs and palpus as follows:

	palpus	I	II	III	IV
trochanter	0.53	0.57	0.45	0.53	0.56
femur	0.87	1.50	1.20	1.05	1.28
patella	0.48	0.75	0.60	0.45	0.65
tibia	0.72	1.17	0.75	0.75	0.90
metatarsus	———	0.60	0.90	0.68	0.68
tarsus	0.53	0.98	0.90	0.83	0.98

Female unknown.

Distribution.—Known only from the type locality.

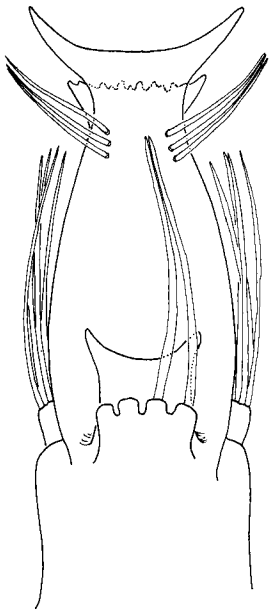
Remarks.—*Neogovea kamakusa* is a very large cyphophthalmid, certainly the largest new world form.

Neogovea mexasca n. sp.
Figs. 16-24

Type specimens.—Female holotype and paratype from Cueva del Nacimiento del Río San Antonio, 10 km SSW of Acatlán, Oaxaca, México, collected 31 December 1973 by James Reddell, William Elliott and Roy Jameson, deposited in the American Museum of Natural History. The species epithet is a neologism referring to the Association for Mexican Cave Studies.

Diagnosis.—The light color and long, thin legs (Figs. 22, 23) set *N. mexasca* off from all other species. It is also the only cyphophthalmid known from the region between Florida and Guyana.

Figs. 14-20.—Anatomy of male *N. kamakusa* and female *N. mexasca*: 14, 15, *N. kamakusa*: 14, left adenostyle, mesal view, enlargements show specialized setae; 15, penis, dorsal view; 16-20, *N. mexasca*: 16, body, dorsal view; 17, thorax, ventral view; 18, left chelicera, lateral view; 19, claw of leg III; 20, claw of leg IV.



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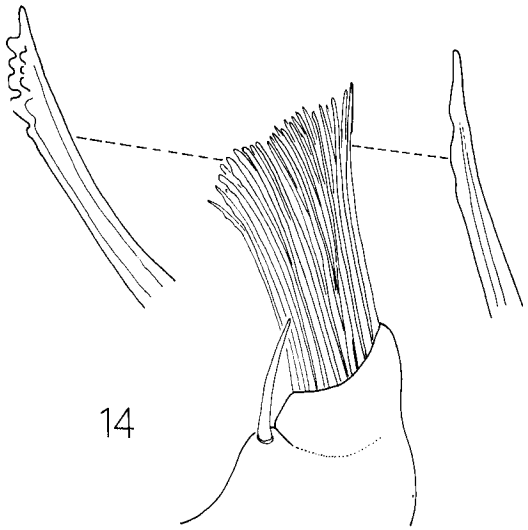

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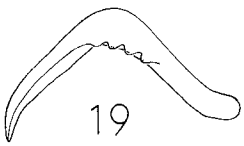

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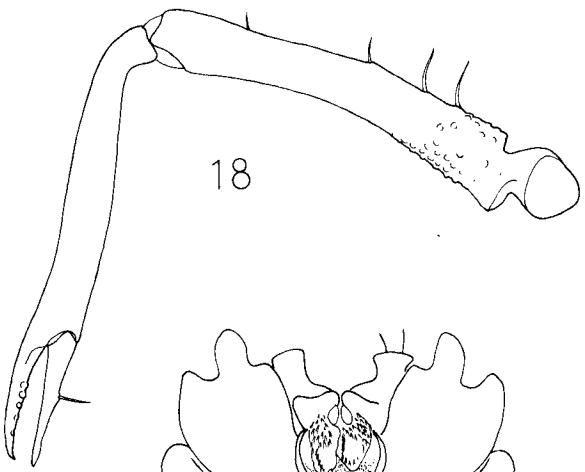

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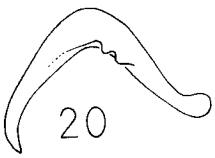

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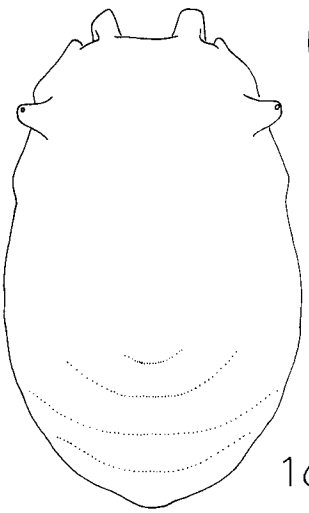

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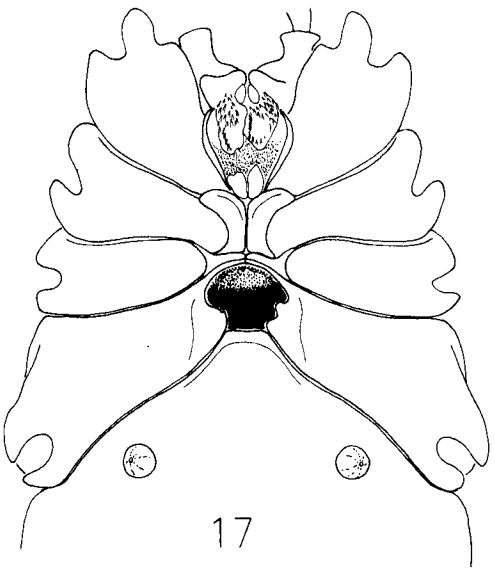

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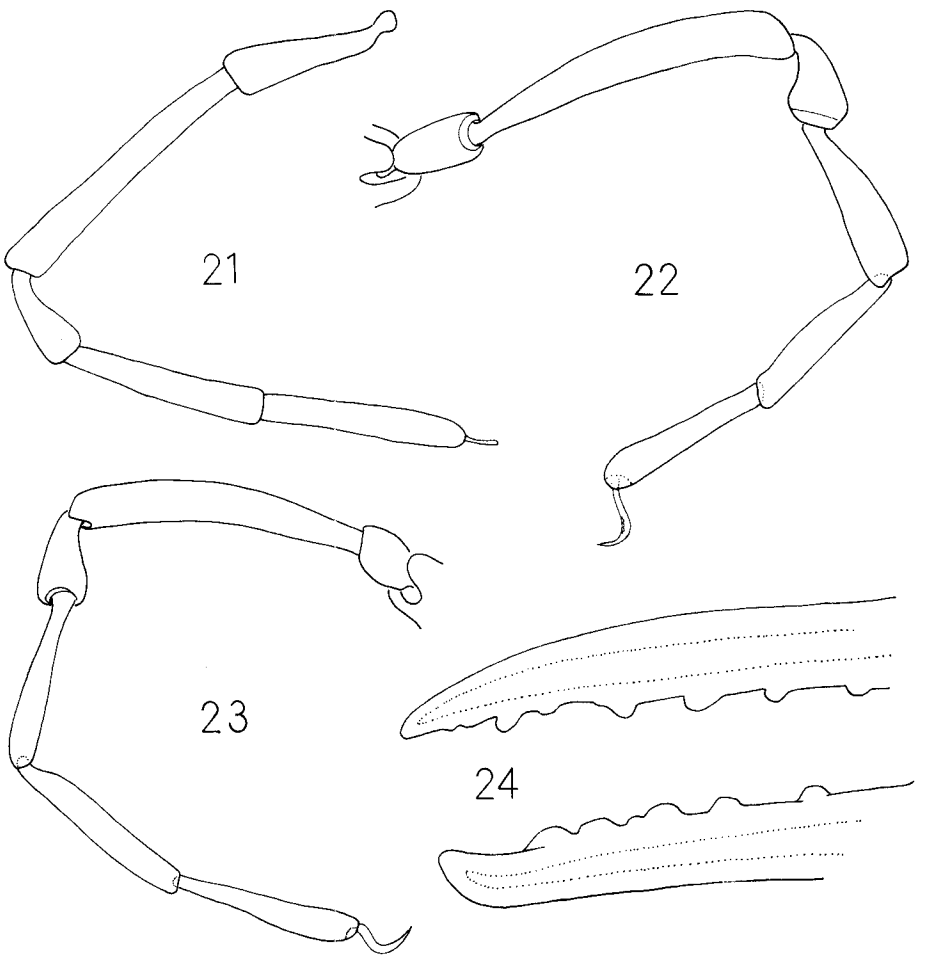
Description.—Female paratype. Length, 2.10 mm. Width across tips of ozophores, 1.02 mm, greatest width 1.21 mm. Dorsum as in Fig. 16; median groove lacking, abdominal segmental grooves faintly detectable only on posterior part of body. Cuticle of dorsum with dense pebbled pattern slightly finer than that found on legs. Ozophore openings terminal. Ventral complex (Fig. 17): Much as in *N. kamakusa*, with small but distinct metasterna present, no eusternal sclerite. Gonostome about as wide as long, wall formed by lobes of coxae IV not as distinct as in other species. Posterior wall rebordered, lobe of abdominal sternite not set off by groove. Spiracular grooves absent. Chelicerae (Fig. 18) typical, but basal article narrower than in surface species, 1.19 mm long, 0.16 mm wide, distal article 1.07 mm long, 0.12 mm wide. Teeth as in Fig. 24 (movable finger below). Palpus attentuate, trochanter without process (Fig. 21). Legs attenuate, heavily pebbled as in other species, scattered setae longer, denser, becoming very dense on tarsi. Tarsus of leg I not basally swollen (Fig. 23). Claws of legs I and II apparently smooth, of III and IV toothed (Figs. 19, 20). Leg IV as in Fig. 22. Ovipositor typical of family, apical sensillae



Figs. 21-24.—Anatomy of female *N. mexasca*: 21, left palpus, lateral view; 22, left leg IV, anterior view; 23, left leg I, posterior view; 24, fingers of chelicera, anterolateral view.

as setose knobs; typical seminal receptacles present. Color medium golden brown, slightly lighter on legs. Measurements of legs and palpus as follows:

	palpus	I	II	III	IV
trochanter	0.31	0.30	0.32	0.29	0.34
femur	0.60	1.12	1.19	0.89	1.06
patella	0.23	0.38	0.38	0.34	0.38
tibia	0.47	0.72	0.68	0.51	0.60
metatarsus	——	0.64	0.65	0.55	0.55
tarsus	0.47	0.72	0.72	0.55	0.65

Male unknown.

Distribution.–Known only from the type locality.

Remarks.–*Neogovea mexasca* is the first western hemisphere cyphophthalmid showing troglobitic adaptations: light color, reduced sclerotization, and much lengthened appendages. The general appearance of the animal suggests intermediacy between *Metasiro americanus* and the other species of *Neogovea*, and a new generic name may be warranted when males are discovered. Material is rare at the type locality (Reddell, Pers. Comm.). Only a few troglobitic cyphophthalmids have been found, including species of *Speleosiro* from South Africa and *Tranteeva* from central Europe. *Neogovea mexasca* does not appear at this time to show relationship to either genus.

ACKNOWLEDGEMENTS

I thank Dr. J. Mark Rowland and other members of the Association for Mexican Cave Studies, Lubbock, Texas, for allowing me to examine the material of *Neogovea* in their collections, and Dr. Norman I. Platnick of the American Museum of Natural History for the loan of the types of *N. kartabo*, and the heretofore unrecognized species described above as *N. kamakusa*.

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