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## On the First American Spiders of the Subfamily Sternodinae (Araneae, Malkaridae)

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### ABSTRACT

A new genus, *Chilenodes*, is described for a new Chilean species, *C. australis*, that is closely related to the Australian and Tasmanian genera *Sternodes* Butler and *Carathea* Moran. These three genera are hypothesized to represent the sister-group of the Malkarinae, known only from Australia and

New Zealand, and the family Sternodidae Moran is therefore relegated to subfamilial status within the Malkaridae. The enlarged Malkaridae is tentatively treated as the sister-group of the Mime-tidae, but could prove to represent only a highly autapomorphic subgroup of that family.

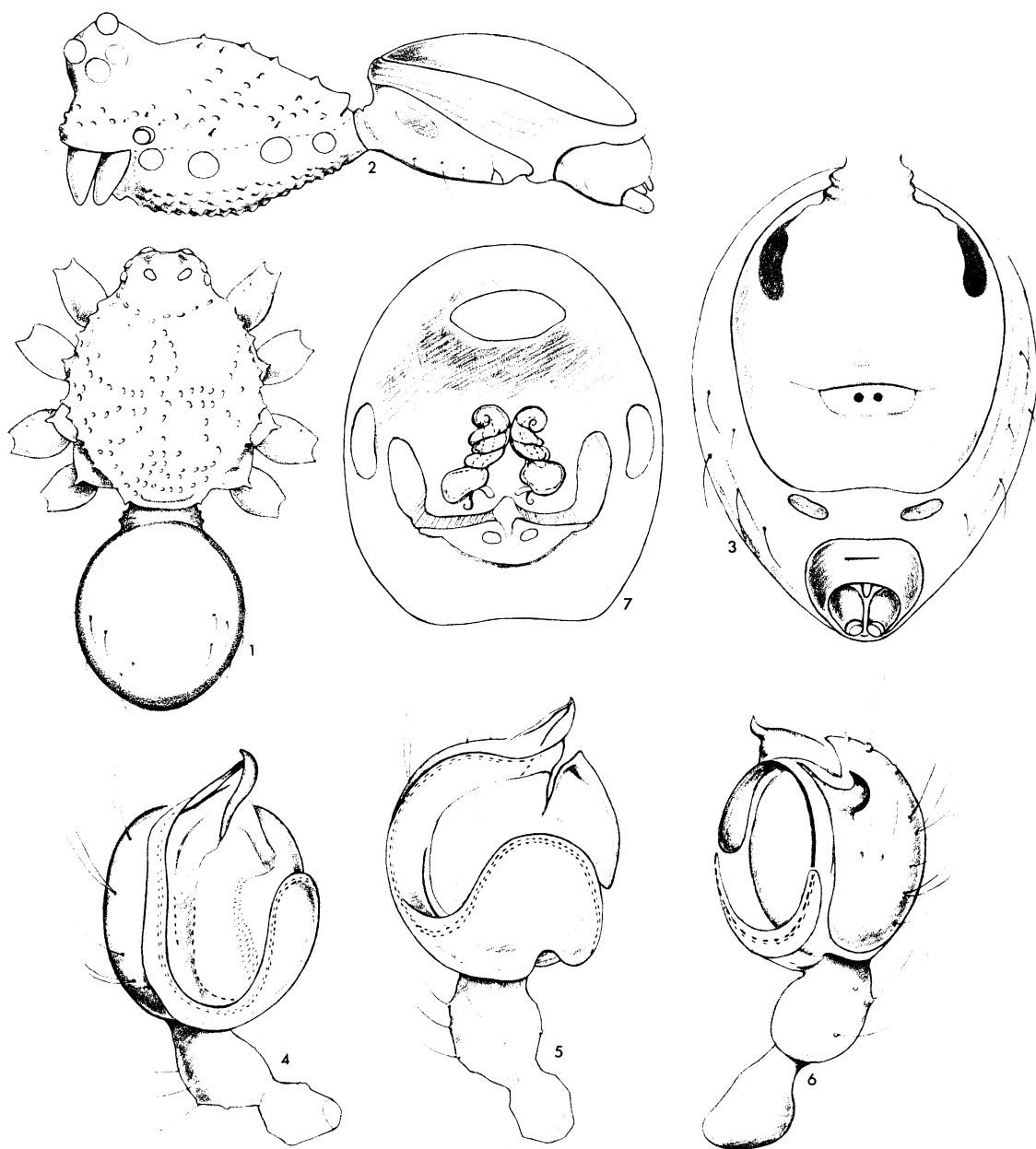
### INTRODUCTION

The spider family Sternodidae was recently established by Moran (1986) for two genera, the eastern Australian genus *Sternodes* Butler (which had previously been misplaced by various authors in the Palpimanidae or Zodariidae) and a new Tasmanian genus, *Carathea* Moran. Moran pointed out the distinctive features of the group, including the presence of a pair of deep sulci on the carapace margin between the palpi and first legs

(figs. 12, 13), and the occurrence of a greatly enlarged flange on the male palpal conductor that wraps around the palpal bulb and supports the embolus for most of its considerable length (figs. 4–6). Moran also commented on the similarities of these spiders to members of a number of araneomorph families, including the Theridiidae, Linyphiidae, Hadrotarsidae, Cyatholipidae, Metidae, Nesticiidae, and Malkaridae (this last group was

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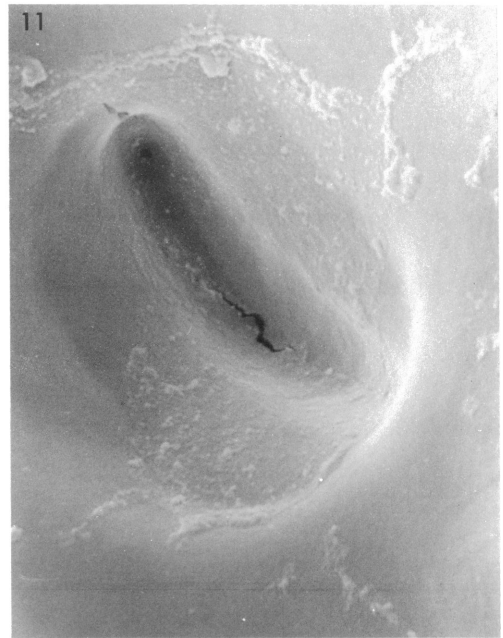
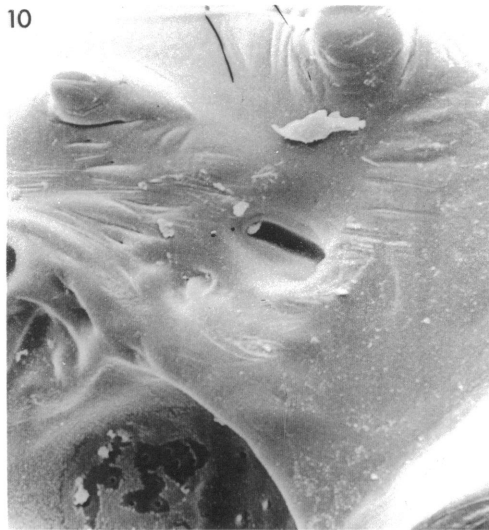
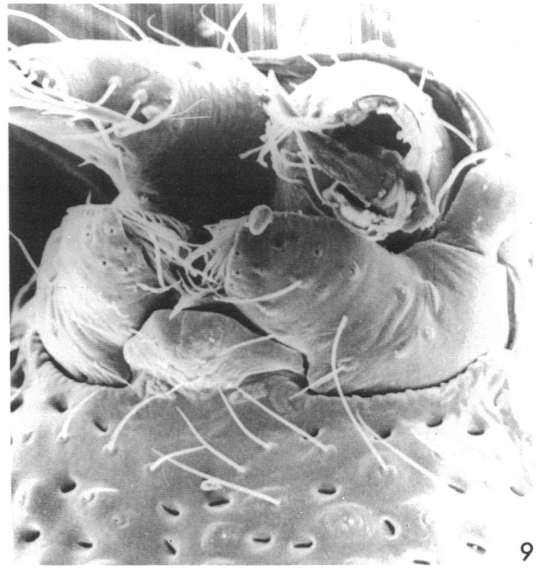
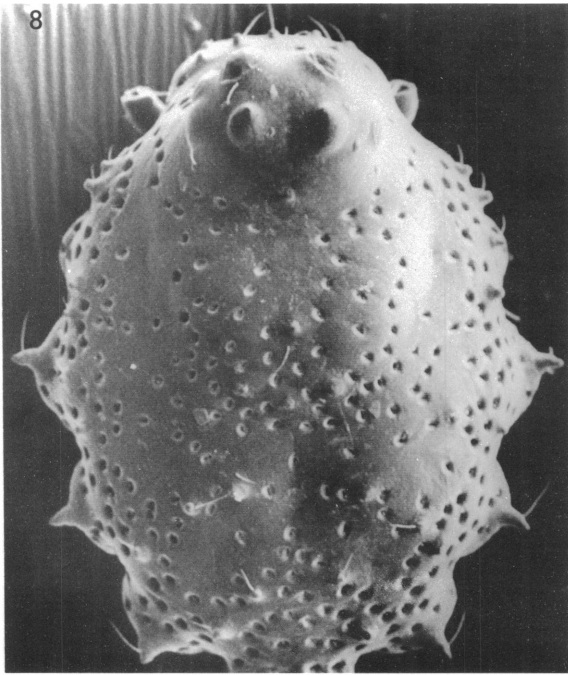


Figs. 1-7. *Chilenodes australis*, new species. 1. Male, carapace and abdomen, dorsal view. 2. Same, lateral view. 3. Same, abdomen, ventral view. 4. Left male palp, prolateral view. 5. Same, ventral view. 6. Same, retrolateral view. 7. Female genital and anterior respiratory systems, dorsal view.

recently elevated from its previous status as a subfamily of Araneidae by Wunderlich, 1986). Moran was unable, however, to specify a sister-group for the Sternodidae.

Moran's excellent illustrations and de-

scriptions of *Sternodes* and *Carathea* have allowed the placement of a Chilean species that seems to have been collected only over the past decade, presumably because of the recent emphasis, by several collectors, on the

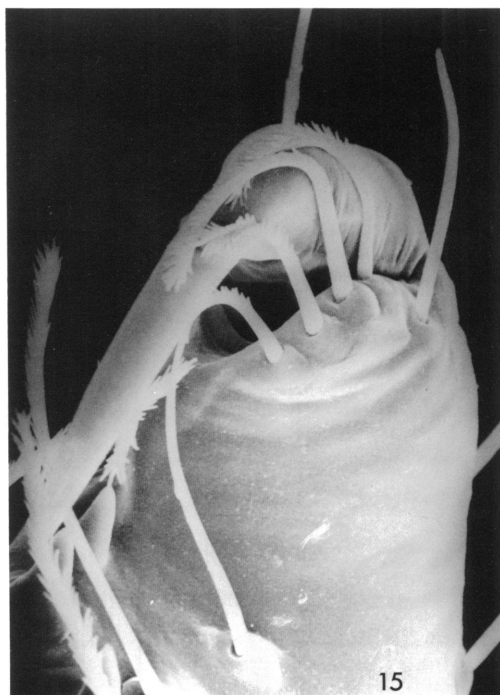
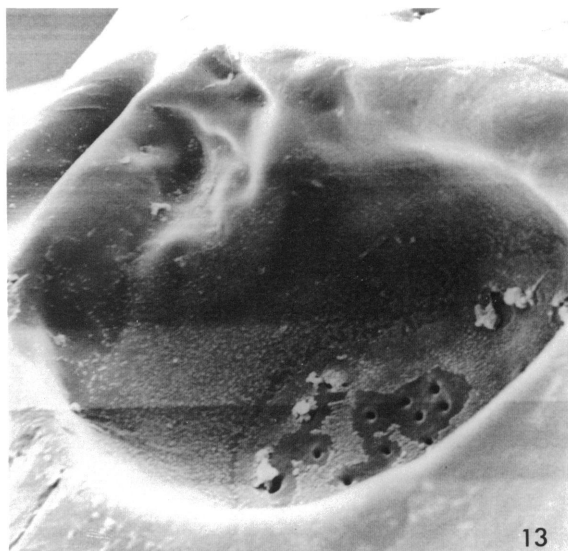
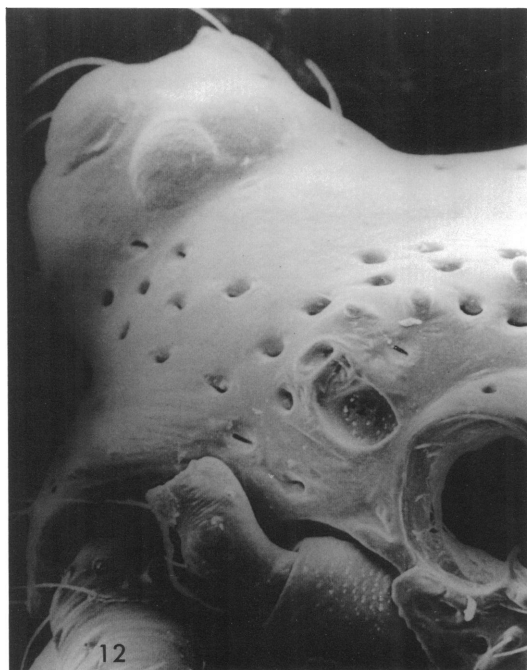


Figs. 8–11. *Chilenodes australis*, new species. 8. Female, carapace, dorsal view, showing alveolations and tubercles. 9. Male, mouthparts and anterior portion of sternum, oblique ventral view; note sternal alveolations. 10. Male, anterior portion of carapace, lateral view, showing portion of sulcus, two tubercles, and one alveolation. 11. Male, one alveolation of carapace, dorsal view, showing pore at one end.

fascinating litter fauna of Chilean forests, and the adoption of specialized collecting techniques, including variously modified pitfall traps and Berlese sampling of concentrated litter. Studies of similar New Zealand spiders

in preparation by the second author have also made it possible to suggest a sister-group for *Sternodes* and its relatives.

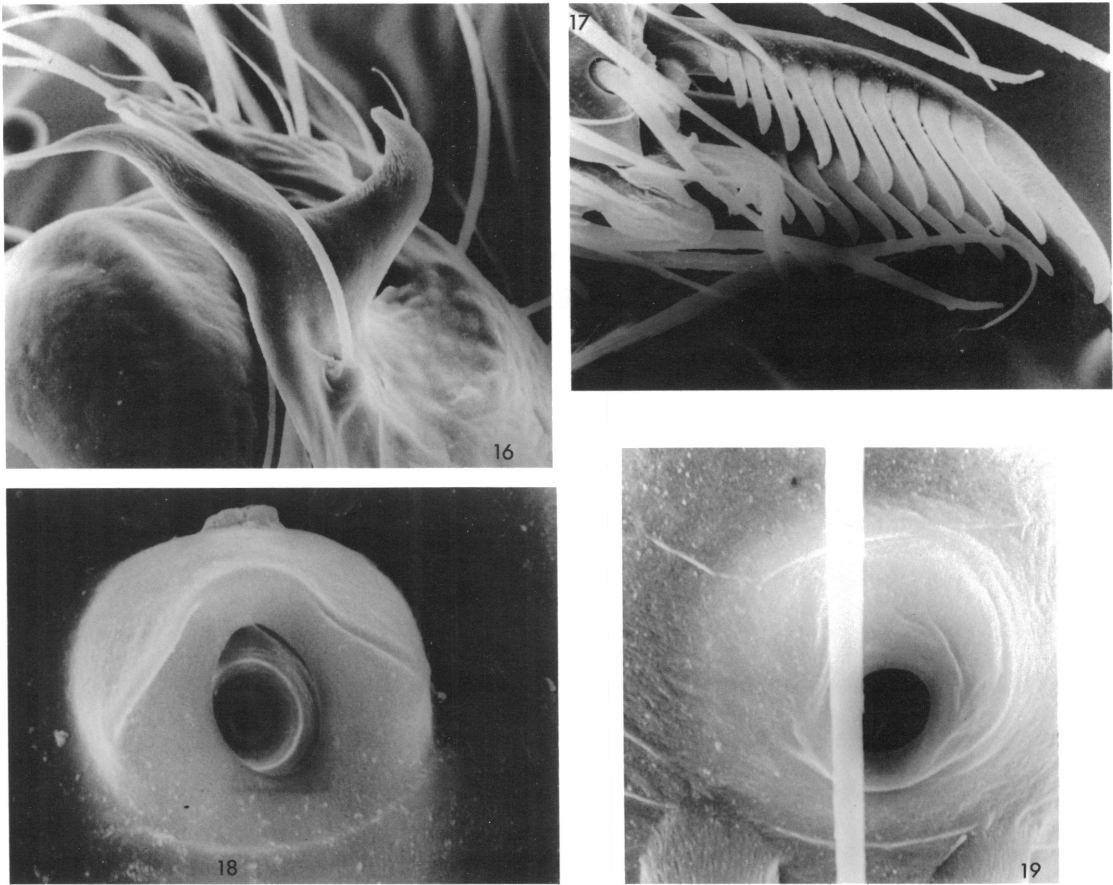
The illustrations (figs. 1–7) are by Ms. Patricia Altman. Drs. V. T. Davies, R. J. Mor-



Figs. 12–15. *Chilenodes australis*, new species, male. 12. Anterior portion of carapace, lateral view; note slight indication of horn on anterior edge of posterior median eye and large sulcus just anterior of foramen of coxa I. 13. Sulcus, lateral view, showing pores. 14. Cheliceral gland mound, oblique medial view. 15. Chelicera, anterior view, showing seta-bearing lobe near fang.

an, and R. J. Raven provided helpful comments on a draft of the manuscript. Unless

otherwise indicated, all specimens mentioned are in the collection of the American



Figs. 16–19. *Chilenodes australis*, new species, male. 16. Paracymbium of left palp, retrolateral view. 17. Claws of leg I, lateral view. 18. Trichobothrial base from metatarsus III, dorsal view. 19. Tarsal organ from leg III, dorsal view.

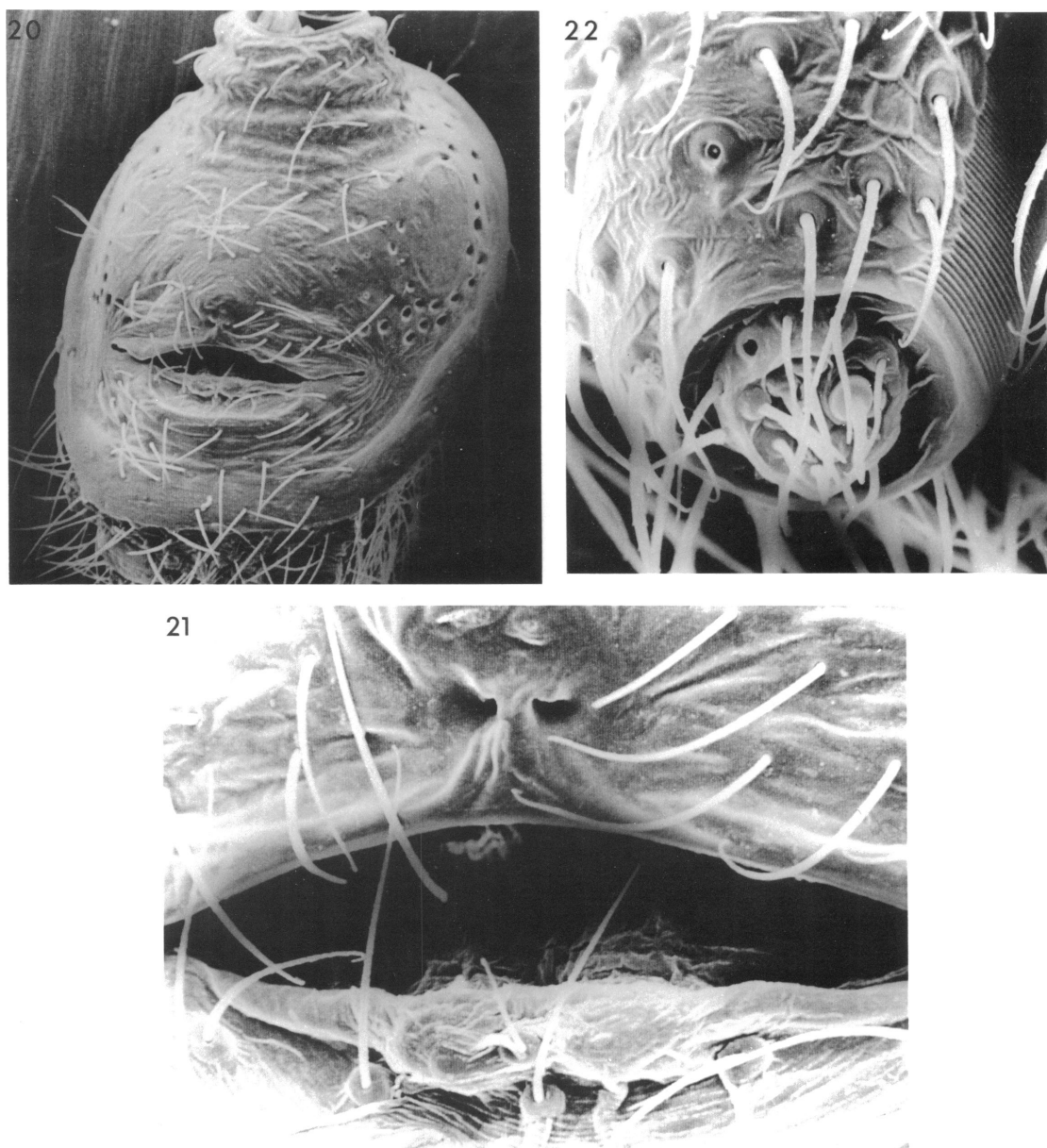
Museum of Natural History (AMNH). All measurements are in millimeters; the abbreviations used for eye pattern description are standard for the Araneae. This work was supported by National Science Foundation grants BSR-8312611 and BSR-8406225.

## RELATIONSHIPS

Moran (1986) suggested three synapomorphies for *Sternodes* and *Carathea*: the carapace sulci and palpal conductor flange mentioned above, and the presence of a “crook-shaped, mid-ectal paracymbium” on the male palp. The first two characters are also found in the Chilean species described below as *Chilenodes australis*; the paracymbium of that

species agrees in general shape and in being mid-ectally situated, but has a longer ventral prong (figs. 6, 16). Representatives of a closely related but undescribed genus from New South Wales, Australia (AMNH), have the paracymbium reduced in size and very different in nature, but still similarly positioned; hence it is the mid-ectal position, rather than the details of the shape, of the paracymbium that seems informative in this context.

Moran noted that a similar conductor flange occurs in the Malkarinae, among other groups, and examination of a series of undescribed malkarine species from New Zealand and Australia suggests that there are at least two other characters that seem to be synapomorphic for both the malkarines, on one hand, and *Sternodes* and its close relatives, on the

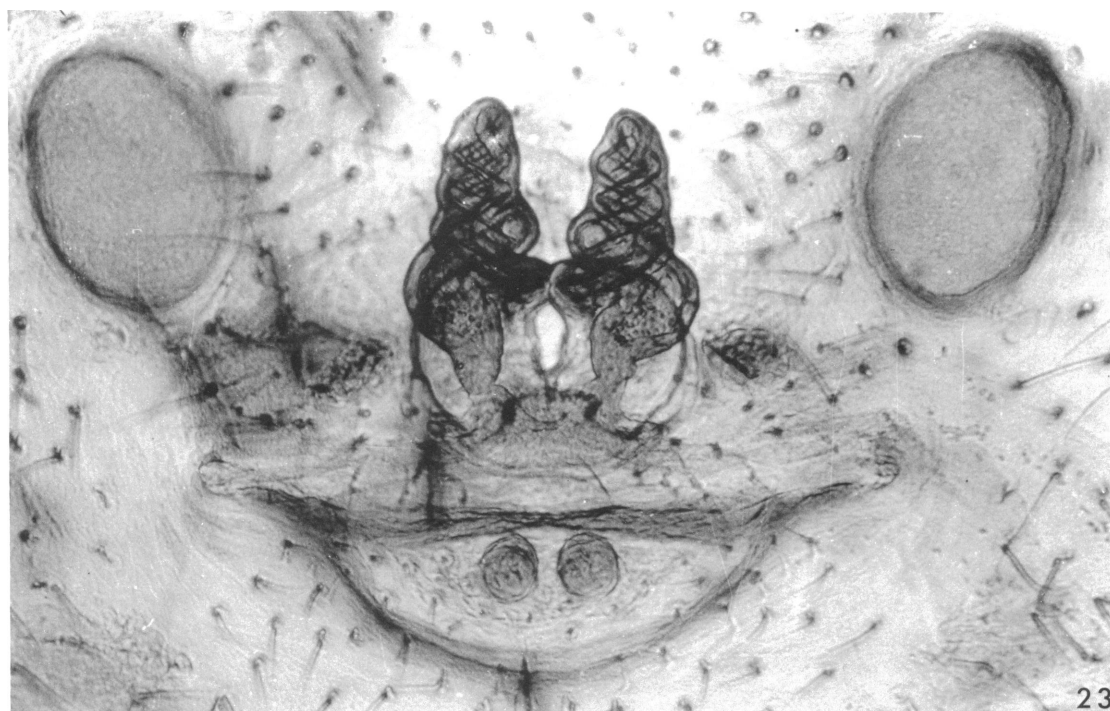


Figs. 20–22. *Chilenodes australis*, new species. 20. Female, anterior abdominal scutum, oblique ventral view, showing epigynal openings and soft area immediately behind epigastric furrow. 21. Same, enlargement of epigynal openings and two oval sclerotizations within soft area. 22. Male, anterior median spinneret, oblique ventral view, showing medial series of ridges.

other. The first is the presence of numerous deep alveolations on the carapace (figs. 8, 10; cf. Moran, 1986, figs. 5, 6) and often the margins of the sternum as well (fig. 9); in *Chilenodes* and at least some New Zealand malakarines, these alveolations have a basal pore

(fig. 11) and thus presumably have a secretory function. The second character is the presence of a small, oval unsclerotized area situated just behind the epigastric furrow, enclosed within the anterior abdominal scutum and containing one or two small, round to

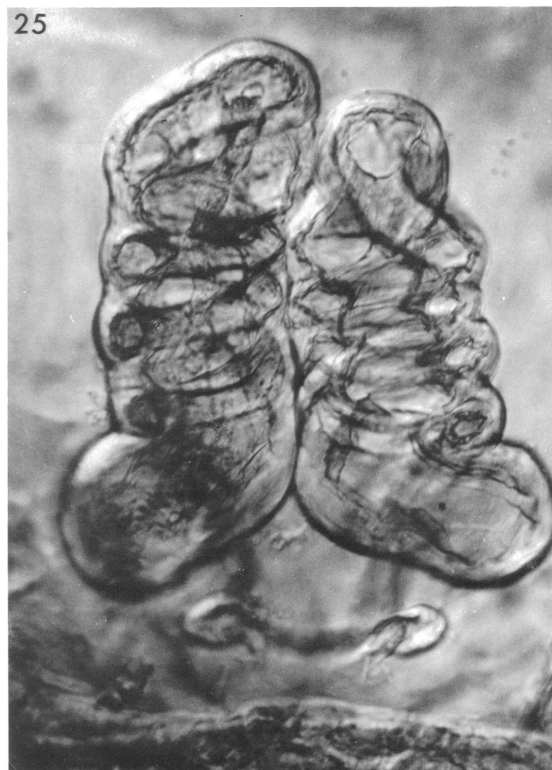




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Figs. 23–25. Female genitalic and anterior respiratory systems of Malkaridae, dorsal views. 23. Undescribed species of Malkarinae from New Zealand; note anteriorly directed, ledge-shaped medial enlargement of transverse duct connecting book-lungs. 24–25. *Chilenodes australis*, new species. 24. View showing posteriorly directed, cone-shaped medial extension of transverse duct connecting book-lungs. 25. Detail of spermathecae.

oval, internally protruding sclerites (figs. 3, 7, 20, 23) that probably serve as muscle attachment points. Hence it seems likely that *Sternodes* and its close relatives represent the sister-group of the malkarines, and the family Sternodidae Moran is therefore treated here as a subfamily of Malkaridae.

The malkarines were recently placed by Wunderlich (1986) as the sister-group of the Mimetidae. Hypothesizing a closer malkarine-sternodine relationship, as here advocated, requires the assumption that the characteristic series of interspersed long and short prolateral spines on the anterior tibiae and metatarsi that is found in mimetids and some malkarines has been lost in the sternodines. Various undescribed New Zealand malkarines vary widely in this character, however; some (usually larger) species have the full, typical mimetid pattern, whereas others have (like *Malkara* itself) lost the short spines, or have all the spines reduced to bristles, or even show no trace of the character at all. A similar, independent loss in the sternodines is not unexpected, since they (like the malkarines) are litter-dwelling forms whose predatory behavior is probably quite different from that of the foliage-climbing mimetids. Genitalic and other similarities between malkarines and mimetids make it seem likely that the presence of the mimetid spine pattern is nonetheless plesiomorphic for the Malkaridae, that the pattern has independently been reduced in the Sternodinae and some Malkarinae, and that the malkarids (as here delimited) are indeed close relatives of the Mimetidae. Wunderlich (1986) united malkarines and mimetids on the basis of a second character (loss of web-building habits) as well, but the accuracy of that assessment depends crucially on whether the entire complex belongs to the Araneoidea (as classically assumed, and argued by Wunderlich) or the Palpimanoidea (as suggested by Forster and Platnick, 1984). For the time being, we accept Wunderlich's suggestion of a sister-group relationship between Mimetidae and (the now enlarged) Malkaridae. However, much descriptive and revisionary work on both groups (and especially on *Arkys*, which was added to the Mimetidae by Heimer, 1984, and Wunderlich, 1986) is needed before the monophyly of the Mimetidae can be regarded as

clearly established; the possibility remains that the Malkaridae may represent only a highly autapomorphic subgroup of mimetids.

## MORPHOLOGY

The internal female genitalia of *Sternodes*, *Carathea*, and *Chilenodes* are all similarly constructed, having a pair of coiled ducts that travel forward from the bursa, widen anteriorly, and then extend back posteriorly within the coils of the anteriorly directed portion (fig. 25), much as in many Mynogleninae (Linyphiidae). Interestingly, female genitalia of this general type also occur in some undescribed New Zealand malkarines (fig. 23), although other New Zealand species have less elaborate female genitalia more similar to that of *Malkara* itself (cf. Davies, 1980, figs. 12–14).

Of special interest is the presence in both male and female *Chilenodes* of a peculiar, cone-shaped, medially situated structure that appears to originate on, and extend posteriorly from, the transverse duct that links the book-lungs (figs. 7, 24). This curious structure, which may have a secretory function, seems not to have been reported in any other spiders, although some other araneomorphs, including the New Zealand malkarines, have a slightly expanded flap in this position on the transverse duct (fig. 23). The presence of such a flap is indicated in some of the illustrations of sternodine female internal genitalia provided by Moran (1986, figs. 34–37, 39), but the extensive development of the structure, its posterior orientation, and its apparent acquisition of a new function seem to be autapomorphic in *Chilenodes*.

The anterior spinnerets of both sexes of *Chilenodes* bear on their medial surface a patch of closely spaced ridges (fig. 22) resembling a stridulatory file; they may rub against each other, or even contact setae on leg IV as silk is pulled from the spigots. Similar patches of ridges occur in at least *Hadrotarsus* (Hickman, 1943), *Guaraniella* (Baert, 1984a), *Yoroa* (Baert, 1984b), and *Euryopis* (Wunderlich, 1978). One New Zealand malkarine examined with scanning electron microscopy lacks the ridges.

Also of interest is the variation shown by *Chilenodes* in the morphology of the eye re-



gion. Moran (1986) distinguished the eastern Australian *Sternodes* from the Tasmanian *Carathea* by the presence, in the former genus, of a pair of odd, hornlike processes in front of the posterior median eyes (Moran, 1986, figs. 1, 5, 13, 19–21, 23–26). Most specimens of *Chilenodes australis* show no trace of such horns, but some males have slight horns similar to those found in *Sternodes arkanus* Moran (1986, fig. 21). No genitalic differences have been found that otherwise separate those males from specimens with no horns; specimens with distinct and with no horns have been collected together, and other specimens show intermediate degrees of elevation of the anterior edge of the posterior median eyes (figs. 8, 12).

## SYSTEMATICS

### SUBFAMILY STERNODINAE MORAN, NEW RANK

**DIAGNOSIS:** Sternodines resemble malkarines in having deep alveolations on the carapace (figs. 10, 11) and a greatly elaborated flange on the male palpal conductor (figs. 4–6), but can be distinguished by the presence of a pair of sulci (figs. 12, 13) on the carapace margin between the palpi and first legs (similar to, but situated more posteriorly than, that typical of the Anapidae; see Platnick and Forster, 1986, figs. 1–4), a greatly elevated ocular area (figs. 2, 12), a mid-ectally rather than basally situated paracymbium (fig. 6), a long embolus that loops around the palpal bulb (figs. 4–6) distally, proximally, and then distally again (rather than in a single coil), and a dorsal abdominal scutum in males (figs. 1, 2).

**DESCRIPTION:** See Moran (1986).

### *Chilenodes*, new genus

**TYPE SPECIES:** *Chilenodes australis*, new species.

**ETYMOLOGY:** The generic name is a contraction of Chilean *Sternodes* and is masculine in gender.

**DIAGNOSIS:** Specimens of *Chilenodes* can be distinguished from those of *Sternodes* and *Carathea* by the presence of enlarged tubercles protruding from the carapace margin over

coxae II–IV (figs. 1, 8; cf. Moran, 1986, fig. 5), the absence of a series of oval to square sclerites on the sides of the abdomen (fig. 2; cf. Moran, 1986, figs. 19–26), and by the elongated ventral prong of the male paracymbium (figs. 6, 16; cf. Moran, 1986, fig. 15).

**DESCRIPTION:** See species description.

### *Chilenodes australis*, new species

Figures 1–22, 24, 25

**TYPE:** Male holotype from a Berlese sample of concentrated litter taken at an elevation of 60 m in a disturbed forest 8 km west of Ancud, Isla de Chiloé, Provincia de Chiloé, Region de los Lagos (X), Chile (Feb. 1, 1985; N. I. Platnick and O. F. Francke), deposited in AMNH.

**ETYMOLOGY:** The specific name refers to the distribution of the species in southern Chile.

**DIAGNOSIS:** With the characters of the genus, palpi as in figures 4–6, and internal female genitalia as in figures 7, 24, and 25.

**MALE:** Total length 2.11. Carapace 1.04 long, 0.89 wide (at coxae II, where widest, including protruding tubercles), 0.37 high (at PME, where highest), deep red (in fully sclerotized specimens), oval but with elevated ocular area protruding beyond clypeus in dorsal view, bearing numerous deep pore-bearing alveolations (figs. 10, 11) concentrated at rear of pars cephalica and of pars thoracica, scattered small, submarginal tubercles, and greatly enlarged marginal tubercles protruding over coxae II–IV (figs. 1, 8); posterior margin with broad, elevated ridge (figs. 1, 2); lateral margins with pair of deep, oval sulci closer to coxae I than to palpal trochanter origin (figs. 12, 13); thoracic groove a dark, longitudinal line occupying one-seventh of carapace length, situated back four-sevenths of carapace length, pars thoracica evenly sloped; clypeus slightly concave, height three times AME diameter. AME dark, circular, slightly larger than other light, oval, subequal eyes, separated by almost their diameter, by less than their radius from ALE; lateral eyes of each side contiguous; PME separated by more than their diameter, slightly closer to PLE; MOQ wider in front than in back, wider than long; from above, both eye

rows recurved; from front, both rows procurved. Sternum with ventral portion longer than wide, but with sides extending around coxae and fused with carapace; surface with alveolations (fig. 9) and rounded tubercles except on small smooth area near middle; posterior margin narrow, not elevated. Endites convergent, truncated distally, each with anteromedian scopula and anterolateral serrula. Labium almost twice as wide as long, fused to sternum; labrum unmodified. Chelicerae thin, greatly narrowed distally, with one promarginal and two retromarginal teeth; cheliceral gland openings on wide, low mound (fig. 14); peg teeth absent; narrowed distal portion of paturon with promarginal seta-bearing mound (fig. 15). Leg formula 4123, coxae originating from narrowed extensions; legs without spines or scopulae, with bristles (densest on metatarsi); one or two trichobothria on tibiae, one subdistal on metatarsi, none on tarsi; superior claws elongated, with numerous teeth (fig. 17); trichobothrial bases with elevated ridge (fig. 18); tarsal organ capitate (fig. 19). Abdomen with anterior scutum surrounding pedicel, bearing two or three elevated rings anteriorly, extending to half of abdomen height dorsally, to more than half of abdomen length ventrally (fig. 2), incorporating dark, oval, lateral patches and transverse, median, oval, unsclerotized area situated behind epigastric area and extending laterally as narrow unsclerotized slit to book-lung openings; oval unsclerotized area contains pair of small, round to oval, internally protruding sclerites just behind epigastric furrow (fig. 3); anterior scutum followed posteriorly by two small, triangular sclerites at about three-fourths of venter length; oval dorsal scutum occupying about three-fourths of dorsum length; posterior scutum encircling spinnerets, incorporating broad posterior spiracle separated from spinnerets by about length of colulus; unsclerotized areas of abdomen slightly ridged, setose, setae originating from tiny round sclerotizations but distinct series of elongated sclerites of *Sternodes* and *Carathea* lacking; anterior pair of spinnerets with medial ridges (fig. 22), median pair tiny, probably nonfunctional; posterior spiracle leading to four simple tracheal tubes sharing common base; book-lungs connected by transverse duct expanded at middle (figs.

7, 24) into cone-shaped process (possibly secretory in nature). Palp with proximal segments unmodified; paracymbium mid-ectal, bifid, with long ventral and shorter, dorsally directed dorsal prongs (fig. 16); embolus originating retrodistally, coiling around to venter of bulb, looping distally, proximally, then distally again, supported by large, translucent flange of conductor; conductor tip hooked (figs. 4–6).

**FEMALE:** As in male, except as follows. Total length 3.07. Carapace 1.15 long, 0.98 wide, 0.48 high. Anterior abdominal scutum smaller, reaching only about half of abdomen length ventrally; triangular postscutal sclerites further from posterior edge of anterior scutum, preceded by pair of smaller, more laterally situated, oval sclerites; dorsal abdominal scutum lacking; median spinnerets larger, possibly functional. Palp with unusually long, finely dentate claw. Epigynal openings posteriorly situated, inconspicuous (figs. 20, 21); conformation of ducts and receptacula as in figure 7, coiling of ducts as in figure 25.

**OTHER MATERIAL EXAMINED: CHILE: Region del Bio-Bío (VIII): Concepción:** Cerro Caracol, Concepción, Apr. 10, 1977, Berlese (T. Cekalovic K.), 1♂; 6 km S San Pedro, Dec. 12, 1982–Jan. 2, 1983, elev. 360 m, window trap, pine forest (A. Newton, M. Thayer), 2♂. **Arauco:** 16 km N Tres Piños, Dec. 12, 1982, elev. 170 m, Berlese, forest leaf and log litter (A. Newton, M. Thayer), 1♂. **Region de la Araucanía (IX): Malleco:** 6 km W Curacautín, Dec. 12, 1984–Feb. 16, 1985, elev. 750 m, carrion trap, grazed beech forest (S. and J. Peck), 2♂, 2♀; 6.5 km E Malalcahuello, Dec. 13–31, 1982, elev. 1080 m, window trap, baited pitfall trap, beech forest (A. Newton, M. Thayer), 3♂, 18♀; 12 km E Malalcahuello, Dec. 13–31, 1982, elev. 1350 m, baited pitfall trap, beech-araucarian forest (A. Newton, M. Thayer), 1♂. **Cautín:** Bellavista, N shore, Lago Villarrica, Dec. 15–30, 1982, elev. 310 m, Berlese, leaf and log litter, valdivian rainforest (A. Newton, M. Thayer), 1♀, Jan. 28, 1985, elev. 350 m, Berlese, native forest litter (N. I. Platnick, O. F. Francke), 1♀; Flor del Lago, 15 km NE Villarrica, Dec. 14, 1984–Feb. 10, 1985, elev. 300 m, carrion and flight intercept traps, beech forest (S. and J. Peck), 4♂; Lago Caburga, 21 km NE Pucón, Dec. 15, 1984–Feb. 10, 1985, elev. 600 m, flight in-

tercept trap, mixed forest remnant (S. and J. Peck), 2♂; Parque Nacional Villarrica, 9 km S Pucón, Dec. 15, 1984–Feb. 10, 1985, elev. 900 m, carrion trap, beech grove on volcanic ash (S. and J. Peck), 8♂, 3♀; Volcán Villarrica, Dec. 15–29, 1982, elev. 1250 m, window trap, baited pitfall trap, beech forest (A. Newton, M. Thayer), 3♀. **Region de los Lagos (X): Valdivia:** 34 km WNW La Unión, Dec. 17, 1984–Feb. 7, 1985, elev. 700 m, carrion trap, mixed evergreen forest (S. and J. Peck), 2♂; Lago Calafquen, Feb. 18, 1977, Berlese (T. Cekalovic K.), 2♂. **Osorno:** 4.1 km W Anticura, Parque Nacional Puyehue, Dec. 19–25, 1982, elev. 270 m, window trap, forest floor litter, dung and squid trap, valdivian rainforest (A. Newton, M. Thayer), 2♂, 1♀, Dec. 19–26, 1982, elev. 430 m, window trap, valdivian rainforest (A. Newton, M. Thayer), 1♂; Antillanca Road, Parque Nacional Puyehue, Dec. 18–24, 1982, elev. 720 m, window trap, beech forest (A. Newton, M. Thayer), 1♂; Derumbes Forest Trail, Aguas Calientes, Parque Nacional Puyehue, Dec. 20, 1984–Feb. 8, 1985, elev. 500 m, flight intercept trap (S. and J. Peck), 4♂, 6♀; 13 km W Entre Lagos, Dec. 21, 1984–Feb. 8, 1985, elev. 200 m, carrion trap, forest remnant (S. and J. Peck), 4♂, 5♀; Piñero Forest Trail, Aguas Calientes, Parque Nacional Puyehue, Dec. 20, 1984–Feb. 6, 1985, elev. 500 m, carrion trap (S. and J. Peck), 1♀; Repucura Forest Trail, Anticura, Parque Nacional Puyehue, Dec. 19, 1984–Feb. 6, 1985, elev. 500 m, carrion trap, forest litter (S. and J. Peck), 5♂, 1♀; 1 km E Termas de Puyehue, Parque Nacional Puyehue, Jan. 31, 1985, elev. 305 m, Berlese, wet forest litter (N. I. Platnick, O. F. Francke), 1♂. **Llanquihue:** Frutillar Bajo, Dec. 22, 1984–Feb. 2, 1985, elev. 100 m, carrion trap, mixed forest (S. and J. Peck), 1♀; Lago Chapo, 11.7 km E Correntoso, Dec. 16–27, 1982, elev. 320 m, baited pitfall trap, disturbed valdivian rainforest (A. Newton, M. Thayer), 1♂; Lago Chapo, 13.5 km E Correntoso, Dec. 16–27, 1982, elev. 310 m, window trap, valdivian rainforest (A. Newton, M. Thayer), 1♀; Lago Chapo, 34 km E Puerto Montt, Dec. 24, 1984–Feb. 2, 1985, elev. 300 m, flight intercept trap, second growth beech forest (S. and J. Peck), 5♂, 2♀; Salto Petrohue, Parque Nacional V. Perez, Dec. 23, 1984–Feb. 4, 1985, elev. 150 m, flight intercept trap, carrion trap, mixed

moist forest (S. and J. Peck), 2♂. **Chiloé:** 11 km NW Castro, Isla de Chiloé, Dec. 27, 1984–Feb. 1, 1985, elev. 200 m, carrion trap, second growth forest in ravine (S. and J. Peck), 3♂. **Palena:** 28.5 km W Futaleufú, Jan. 16, 1986, elev. 90 m, dry forest (N. I. Platnick, P. A. Goloboff, R. T. Schuh), 1♂. **Region de Aisén (XI): Aisén:** 15 km S Las Juntas, 30 km N Puyuhuapi, Dec. 30, 1984–Jan. 29, 1985, elev. 100 m, flight intercept trap, beech forest (S. and J. Peck), 5♂; Río Grande, 16 km NW Cisnes Medio, Dec. 30, 1984–Jan. 28, 1985, elev. 200 m, carrion trap, mature beech forest (S. and J. Peck), 1♀; San Sebastian, 34 km W Puerto Aisén, Jan. 24, 1985, elev. 150 m, mixed forest and bamboo litter at cliff base (S. and J. Peck), 1♂. **Coihaique:** Reserva Nacional Río Simpson, 33 km E Puerto Aisén, Dec. 31, 1984–Jan. 26, 1985, elev. 70 m, carrion trap, selectively cut forest (S. and J. Peck), 2♂; Reserva Nacional Río Simpson, 37 km W Coihaique, Jan. 20, 1986, elev. 20 m, sifting litter, Berlese, moss from wet forest (N. I. Platnick, P. A. Goloboff, R. T. Schuh), 3♂.

**DISTRIBUTION:** Known only from southern Chile (Concepción to Coihaique).

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