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The Aradidae of New Zealand (Hemiptera, Heteroptera)
III—The Aradinae and Calisiinae

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Abstract

Aradus australis Erichson is redescribed and the first New Zealand species of *Calisius* is described.

A GENERAL introduction to this series of papers is given in Part I (Pendergrast, 1965a). In Part I and Part II (Pendergrast, 1965b) abbreviations for the names of institutions housing the specimens are listed. I add the following: P.D.D., Plant Diseases Division, D.S.I.R., Auckland; U.Q., Entomology Department, University of Queensland. The help of institutions and persons has been acknowledged in the earlier parts. I also wish to thank Mr G. Monteith of the University of Queensland for the loan of specimens of Australian Aradinae. I am grateful to Miss M. Barclay for help with Figs. 2-5.

Subfamily ARADINAE Amyot and Serville

1843. *Hist. Nat. Ins.*, Hémiptères, 307.

Usinger and Matsuda (1959) place the Aradinae amongst the subfamilies with genae not produced on either side of the clypeus and with glabrous areas on the dorsal surface of the abdomen as follows: two in the connexival area of each segment from 3 to 7, one near these on the abdominal disc and one on either side of the mid-line. The base of the rostrum is bordered by well developed bucculae and there are no distinct metapleural scent gland openings. Aradinae can be distinguished from Calisiinae by the size of the scutellum which is very large in the latter subfamily.

The chief features of the Aradinae are:

Clypeus bulbous, juga unrecognisable, genal plates absent. Rostrum with well developed bucculae.

Hemelytra usually complete, the clavus, corium and membrane well differentiated; corial veins usually distinct, R + M submarginal, Cu most prominent, corial disc with ill-defined cross veins forming irregular cells; membrane with several prominent veins enclosing irregular cells; hemelytra sometimes brachypterous or stenopterous.

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Tergites of abdominal segments 1 and 2 more or less fused; pattern of glabrous areas 2:1:1 above, 2:2:1 below; in female abdominal segment 8 forms a distinct tergal plate with postero-lateral lobes (paratergal lobes) bearing spiracles on their margins; in male segment 8 well developed, forming a cup-like receptacle completely enclosing genital capsule below, spiracle-bearing postero-lateral lobes arise beyond genital segment.

Undersurface traversed by median longitudinal sulcus; metapleuron with a small hole in front of hind coxae but without evaporating areas.

Legs with trochanters difficult to distinguish and partially fused to femora; claws without arolia and with only short bristles.

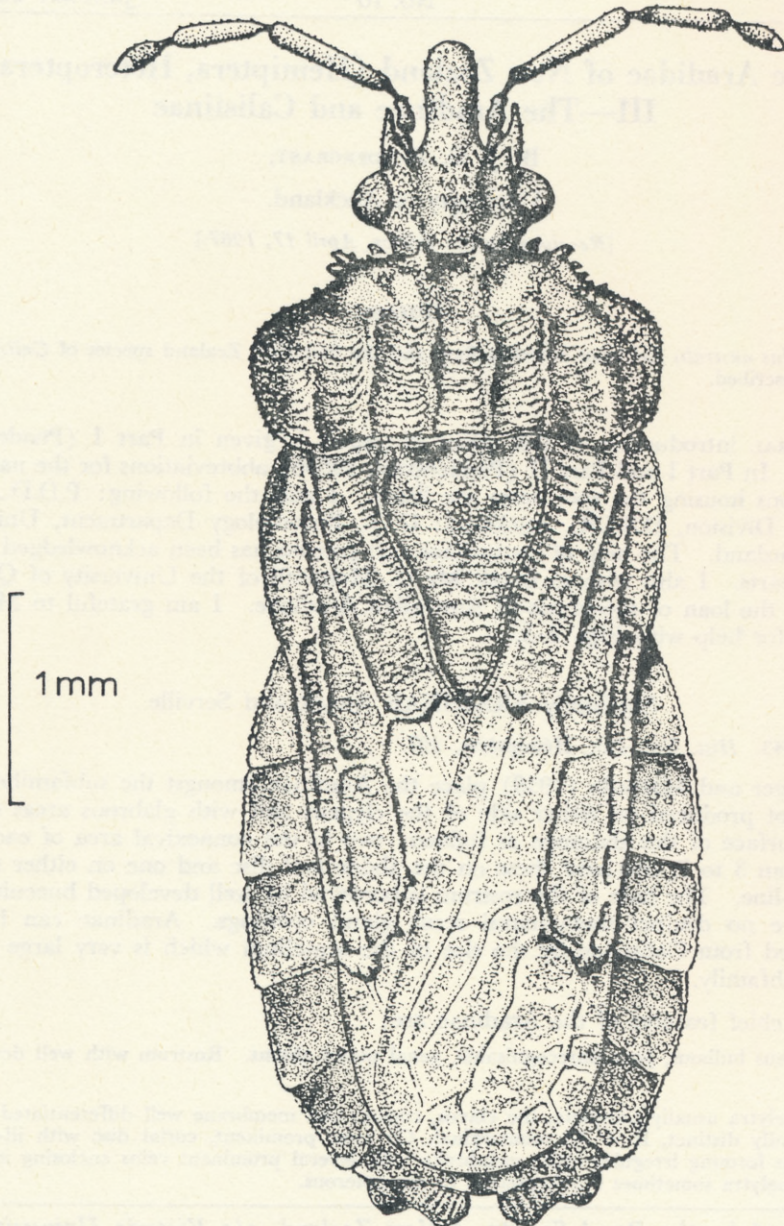


FIG. 1.—*Aradus australis* Erichson.

Genus ARADUS Fabricius

Aradus Fabricius, 1802, *Systema Rhyngotorum*: 116.

Usinger and Matsuda (1959) should be consulted for the description of the genus and for a comprehensive catalogue of species and synonymy.

Aradus australis Erichson. (Figs. 1-5).*Aradus australis* Erichson, 1842, *Arch. Naturgesch.* 8(1): 281.

REDESCRIPTION

Head about as long as wide (across the eyes); interocular space about three times width of one eye, mean (10 specimens) 2.9, range 2.6-3.2. Eyes prominent, globular. Antenniferous tubercles divergent, reaching more than half the distance between anterior margin of eye and apex of head, almost reaching apical third of first antennal segment; sub-acute; lateral margins rounded in apical third, straight proximally; inner margin strongly dilated in proximal half for insertion of antenna; head width: antenniferous tubercle length (outer edge from tip to front margin of eye) = 3.3:1 (mean, 10 specimens). Base of antenniferous tubercle with a prominent vertical spine near eye margin. Surface of head coarsely granulate; granules tall, pointed, especially at centre of disc and near inner margins of eyes; between these areas disc smooth, depressed; from near the middle of the lateral margins of the eyes a pair of narrow smooth white or buff bands run inwards and backwards to meet in the mid-line near the pronotal border. Ventrally, head coarsely granulate; rostrum reaching on to mesosternum.

Antennal length about 1.7 times width of head; relative lengths of segments 1-4 = 5.1:18.5:10.6:8.6 (mean, 10 specimens). First segment urn shaped, expanded in basal half, basal margin rounded and with a distinct oblique peduncle; maximum width: total length = 1:2. Second segment elongate semi-cylindrical, widest apically and with a distinct oblique peduncle; maximum width: length = 1:6. Third segment elongate pyriform with a peduncle; maximum width: length = 1:3. Fourth segment fusiform, apex closely invested with pale hairs; maximum width: length = 1:2.5.

Pronotum slightly more than twice as broad as long, length: width = 2.07:1 (mean, 10 specimens); anterior margin slightly concave except on each side of mid-line at the projecting apices of median carinae; antero-lateral angles acutely produced laterally; lateral margins flattened and irregularly tuberculate, in anterior half strongly sinuate and laterally produced, in posterior half broadly rounded; basal margin widely and shallowly cut into. Surface of pronotum with transverse wrinkles in posterior two-thirds, coarsely granulate anteriorly except on a pair of antero-lateral callosities. Longitudinal carinae conspicuous, almost equally spaced, tuberculate; middle pair traversing length of pronotum, somewhat eroded in anterior third to a series of tubercles, apical tubercle massive; intermediate carinae about two-thirds length of middle pair; outer pair about half length of middle pair.

Scutellum triangular, one and a half times as long as wide; lateral margins feebly bisinuate, strongly raised; apex narrowly rounded; apical two-thirds of disc transversely wrinkled, basal third slightly elevated and irregularly granulate with a faint carina in the mid-line. Hemelytra reaching or almost reaching end of body; embolium margin slightly rounded, raised about 60° to surface, tuberculate; lateral margin of remainder of corium straight, elevated, tuberculate; clavus transversely wrinkled; corium irregularly wrinkled; veins of corium strongly elevated, tuberculate; membrane mottled, partly opaque, partly transparent; veins elevated. Ventrally thorax coarsely granulate.

Abdomen oval, widest between 4th and 5th segments, width slightly greater than pronotum, maximum abdominal width: maximum pronotal width = 1.15:1 (mean, 10 specimens); surface concave. Disc extremely finely granulate, connexivum granulate. Ventrally median sulcus prominent; connexivum closely tuberculate, in posterior segments tubercles bear extremely short pale apical bristles visible at 150× magnification; disc finely granulate with widely spaced flattened tubercles; posterior borders segments 3-5 with hind margin angulate and strongly emarginate, straight on either side of middle.

Female: Paratergites of 8th segment prominent, bilobed; inner lobe larger with inner margin rounded, apex sub-acute or rounded, outer margin straight or rounded; outer lobe triangular, apex sub-acute or rounded, spiracle borne on edge and not visible from above or below; paratergite separated from 7th segment connexivum by slight but distinct gap; outer lobe granulate, inner lobe radially striated. Ventrally spiracles placed near inner connexival margins; segment 6 hind border strongly emarginate, straight on each side of mid-line; first valvifers with outer margin about two-thirds length of paratergite of segment 8; valvifers tuberculate, tubercles with extremely short apical bristles.

Male: Lateral margins connexival segments 3–7 sinuate, slightly so in anterior segments, more strongly posteriorly. Paratergites of 8th segment prominent, bilobed but not strongly so; inner lobe broadly rounded; outer lobe with an almost straight long outer margin, apex rounded. Ventrally spiracles placed near lateral margins in anterior segments, more distant from margins posteriorly; posterior margins segments 6 and 7 angulate, strongly emarginate, straight on either side of middle; segment 8 with disc evenly swollen.

Colour: Dorsally and ventrally black or very dark brown; postero-lateral angles of connexival segments marked with white or buff. Dorsally head with pair of light lines described above.

LENGTH: Females: 5.8mm (mean, 8 specimens); range, 5.2–6.2mm.

Males: 4.7mm (mean, 2 specimens); range, 4.6–4.8mm.

SPECIMENS EXAMINED: Unfortunately, I have not recorded all the data on the labels of the specimens I examined in the British Museum (Nat. Hist.). I include them here, however, because I have, at least, made notes of the localities.

New Zealand: 1 ♀, bush, Cape Reinga, 30.1.62, B. M. May (P.D.D.); 1 ♀, Mangere, Auckland, 20.4.50, K. P. Lamb (P.D.D.); 1 ♀, Timaru, 2.3.42, D. Spiller (P.D.D.); 1 ♀, Tokaanu, 29.12.40, K. Harrow (P.D.D.); 1 ♂, no data (Bergroth Collection, H.M.); 1 – (abdomen missing), Whangarei, 18–20.3.31, E. S. Gourlay (E.D.); 1 ♀, 67a (no other data) (E.D.); 1 ♀, Tyndall's Bay, Whangaparaoa Peninsula, 22.3.65, K. Somerfield (A.U.); 1 ♀, Tyndall's Bay, 5.2.66, J. Robb (A.U.); 1 ♀, Ross, Westland, 27.1.64, D. Cowley (A.U.); 1 ♀, Port Waikato, D. Cowley (A.U.); Ohakune, J. G. Myers (B.M.); Wellington City (window), J. G. Myers (B.M.).

Australia: Mt. Wellington, Tasmania (B.M.); Launceston, Tasmania (B.M.); Hobart, Tasmania (B.M.); Hobart, Tasmania, M. Lea (B.M.); Tasmania, J. W. Evans (B.M.); 1 ♀, Brisbane, 15.10.59 (U.Q.); 1 ♂, F. W. Lake, 10ml N of Rocky R., Via Coen, N. Qld., 17.12.64, G. Monteith (U.Q.).

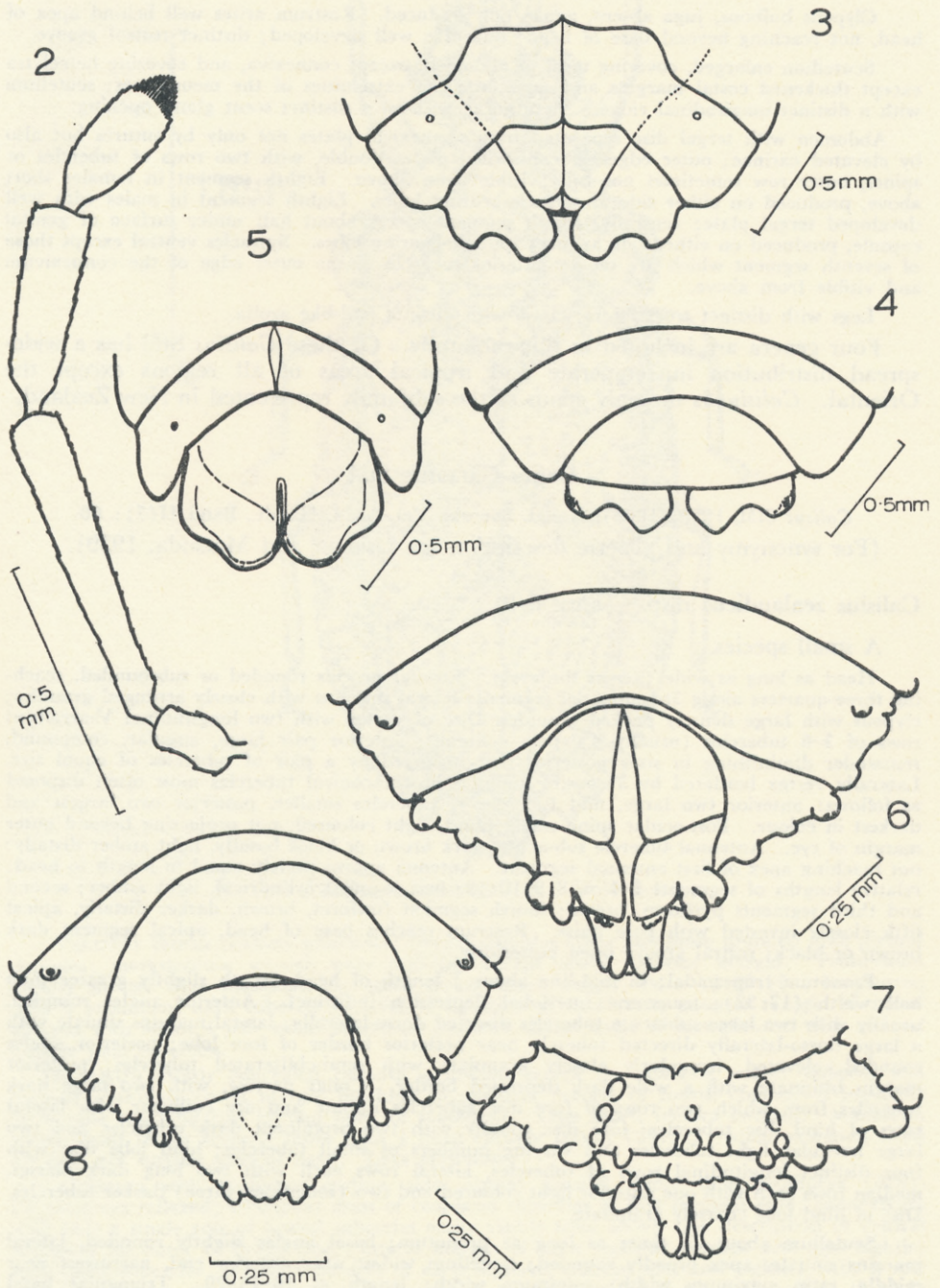
This species has been recorded from Australia, Tasmania, New Zealand and the Chatham Islands. I have concluded from measurements of the parts, especially the antennal segments, and from other characters that the Australian and New Zealand specimens belong to the same species. There is some diversity in the antennal segment ratios of the specimens examined but the range of variability among the New Zealand insects is not significantly different from that found amongst the Australian. One feature of interest which deserves further investigation when more specimens are available is the extent of erosion of the median carinae of the pronotum. In New Zealand specimens each carina is reduced in the anterior third to a row of small tubercles; in the Queensland specimens there is a single high narrow tubercle. When a greater range is studied, however, it is possible that wide variability in this feature will become apparent.

This species does not seem to have been found in colonies, the specimens collected usually being solitary individuals. It has often been taken on the sides of buildings and on windows; apparently it is a good flier. Myers (1926) records observations on its habits.

Subfamily CALISIINAE Stål, 1873, Kongl.

Svenska Vet.-Akad. Handl., Band II(2): 138.

The Calisiinae are placed by Usinger and Matsuda (1959) near the Aradinae (see p 81 above). They are to be distinguished from that subfamily by the greatly enlarged scutellum which covers almost all the abdominal dorsum except the connexiva.



FIGS. 2-5.—*Aradus australis* Erichson. Fig. 2.—Antenna. Fig. 3.—Female terminal segments, ventral view. Fig. 4.—Same, dorsal view. Fig. 5.—Male terminal segments, ventral view. FIGS. 6-8.—*Calisius zealandicus* n.sp. Fig. 6.—Female, terminal segments, ventral view. Fig. 7.—Same, dorsal view. Fig. 8.—Male terminal segments, ventral view.

The chief features of the Calisiinae are:

Clypeus bulbous, juga absent, genae not produced. Rostrum arises well behind apex of head, not reaching beyond base of head; bucculae well developed; distinct rostral groove.

Scutellum enlarged, covering most of abdomen, except connexiva, and covering hemelytra except thickened costal margins and sometimes the extremities of the membranes; scutellum with a distinct longitudinal ridge. Metathorax without a distinct scent gland opening.

Abdomen with tergal disc separated from connexival plates not only by sutures but also by elevated carinae; outer edges of connexival plates double, with two rows of tubercles or spines, outer row sometimes not fully visible from above. Eighth segment in females short above, produced on either side as spiracle-bearing lobes. Eighth segment in males with well developed tergal plate; ventrally, eighth segment covers about half under surface of genital capsule, produced on either side as short spiracle-bearing lobes. Spiracles ventral except those of seventh segment which are on an anterior tubercle of the outer edge of the connexivum and visible from above.

Legs with distinct trochanters; claws with distinct pad-like arolia.

Four genera are included in this subfamily. Of these *Calisius* Stål has a wide-spread distribution in temperate and tropical areas of all regions except the Oriental. *Calisius* is the only genus of the subfamily represented in New Zealand.

Genus CALISIUS Stål

Calisus Stål, 1858 (1860), Kongl. Svenska Vet.-Akad. Handl., Band II(7): 68.

(For synonymy and generic description see Usinger and Matsuda, 1959).

Calisius zealandicus n.sp. (Figs. 6-9).

A small species.

Head as long as wide (across the eyes). Frontal process rounded or subrounded, reaching three-quarters along 3rd antennal segment; lateral margins with closely arranged granules; clypeus with large densely packed granules. Disc of vertex with two longitudinal V-arranged rows of 3-6 tubercles (usually 4), pale ochreous; anterior pair large, angular, compound, remainder diminishing in size; posterior pair bordered by a pair of tubercles of equal size. Laterally vertex bordered by a row of about 5 brown conical tubercles most often disposed as follows: anterior two large, mid tubercle or tubercles smaller, posterior two largest and darkest in colour. Post-ocular spine small, blunt, light coloured, not projecting beyond outer margin of eye. Antennal tubercle sub-acute, dark brown or black basally, light amber distally; not reaching apex of first antennal segment. Antenna approximately equal in length to head; relative lengths of segments 1-4 = 8:9:10:19; first segment cylindrical, light amber; second and third segments pyriform, brown; fourth segment fusiform, brown, darker distally, apical fifth closely invested with pale hairs. Rostrum reaches base of head, apical segment dark brown or black; rostral groove open posteriorly.

Pronotum trapezoidal; in mid-line about $\frac{7}{8}$ length of head, length slightly greater than half width (17:32); transverse interlobal depression indistinct. Anterior angles rounded, usually with two large sub-acute tubercles directed dorso-laterally; lateral margins sinuate with a large dorso-laterally directed tubercle near posterior border of fore lobe; posterior angles rounded, elevated, irregularly closely granulate with semi-obliterated tubercles; posterior margin bisinuate with a wide dark depressed border. Collar narrow, with two large dark tubercles from which two rows of fore disc tubercles radiate and are collinear with lateral rows of hind disc tubercles; fore disc usually with two prominent dark tubercles and two large irregular light tubercles and varying numbers of small tubercles; hind lobe disc with four distinct longitudinal rows of tubercles, lateral rows each with two long dark masses, median rows each with one anterior light coloured and two (sometimes three) darker tubercles. Disc of hind lobe coarsely granulate.

Scutellum about $2\frac{1}{2}$ times as long as pronotum; basal angles slightly rounded, lateral margins sinuate, apex broadly rounded; scutellum widest near anterior end, narrowest near middle. ratio maximum width: minimum width: length = 16:13:29. Triangular basal elevation with four conspicuous basal tubercles; lateral pair flattened, light coloured; median pair rounded, darker; smaller intervening tubercles variable in number and position; disc and lateral margins and apex of elevation with many tubercles, variable in number, position and size. Median carina low with about 10 spaced tubercles, diminishing in size posteriorly. Lateral margin with about 8 tubercles in region of hemelytron costal margin, diminishing posteriorly. Disc with deep and broad punctures.

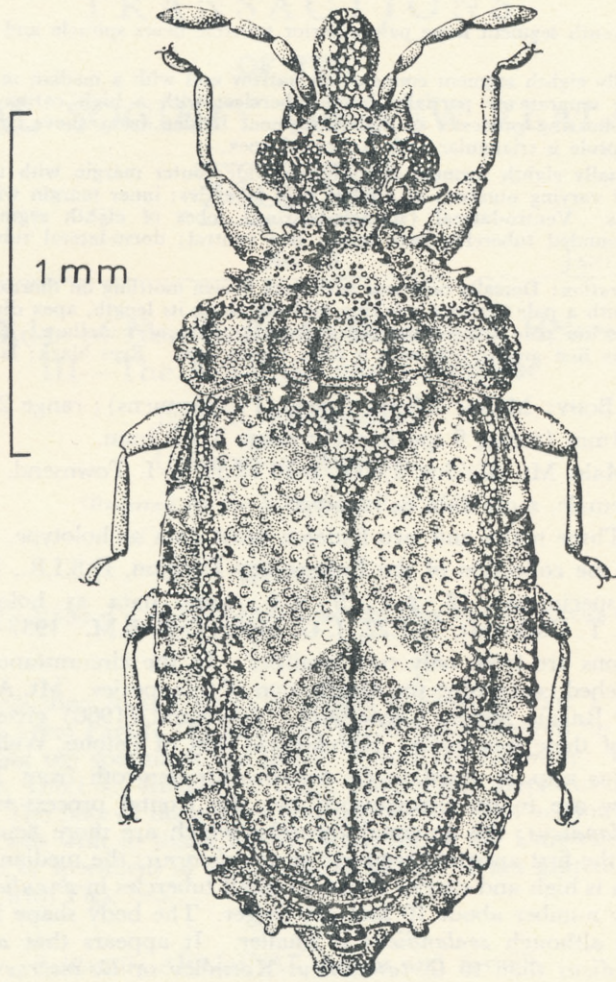


FIG. 9.—*Calisius zealandicus* n.sp. Male holotype.

Ventrally thorax coarsely granulate; sternal granules lower and more rounded than pleural granules; metasternum smooth near mid-line except along anterior margin. Prosternum slightly shorter than mesosternum, metasternum much longer, ratio 18:20:29. Propleuron with a prominent dark tubercle at level of insertion of mid coxa; anterior margin of mesopleuron with about 4 pale small tubercles; posterior dorsal angle of metapleuron with at least 2 large pale tubercles.

Hemelytra mostly concealed beneath scutellum except for elongate widely reflexed and coarsely granulate costal margin reaching to posterior margin of fourth connexival segment; membrane reaching just beyond apex of scutellum. Legs short, femora swollen. Maximum length front femur scarcely more than $\frac{1}{2}$ head capsule length (29:52); when extended front leg does not surpass apex of head. Legs granulate.

Abdomen with U-shaped outline, sides almost parallel, wider than prothorax (9:8). Connexivum reflexed; triangular mass of coalesced tubercles of first segment pale; connexivum with only a single row of lateral tubercles easily visible from above (see description of ventral abdomen for outer or lower row); lateral margin of each segment (except first and eighth) with three tubercles; posterior borders of each segment (except first and eighth) with a row of pale tubercles, small separate and obscure in second segment, large coalesced in third to sixth segments, obscure in seventh segment; inner border of connexivum raised with a row of closely placed granules generally small and dark but with two or three larger pale tubercles near the intersegmental borders between the second to sixth segments. Ventrally abdomen smoothly granulate in middle, lateral parts coarsely granulate; fourth to seventh segments with an irregular row of large tubercles mesad of the spiracles; lateral margin with row of somewhat obliterated tubercles (= outer or lower row of lateral connexival tubercles in most

Calisiinae); in seventh segment large pale anterior tubercle bears spiracle and is easily visible from above.

Male: Dorsally eighth segment connexivum narrow and with a median mass of coalesced tubercles or three separate or partially fused tubercles; with a high carina marking inner margin. Spiracle-bearing processes of eighth segment hidden from above, pale. When retracted genital capsule is triangular with truncated apex.

Female: Dorsally eighth segment connexivum wide; outer margin with three prominent pale tubercles and varying numbers of smaller pale tubercles; inner margin with three almost coalesced granules. Ventro-lateral (spiracle-bearing) lobes of eighth segment with three prominent pale rounded tubercles, two dorsal, one ventral; dorso-lateral tubercle bears the spiracle.

General Coloration: Dorsally ochreous with dark brown mottling on thorax and scutellum. Scutellum often with a pale chevron marking midway along its length, apex directed forwards, arms concave; obscure pale patch near antero-lateral angle of scutellum. Each connexival segment except the first and eighth with a dark brown area. Eyes black; lateral aspects of vertex black.

LENGTH OF BODY: Males: 2.8mm (mean, 14 specimens); range 2.6–2.9mm.

Females: 3.1mm (mean, 9 specimens); range 3.0–3.3mm.

Holotype: Male, Mt. Algidus, 2,000', 2–13.12.59, J. I. Townsend.

Allotype: Female, same data as holotype.

Paratypes: Three males and two females, same data as holotype.

All types in the collection of the Entomology Division, D.S.I.R., Nelson.

Additional specimens: 12 ♂♂, 9 ♀♀, same data as holotype (E.D.); 1 ♀, Korokoro, T. Cockcroft, 15.1.22, J. G. Myers Coll. B.M. 1937–789 (B.M.).

The collections are from only two localities. In the circumstances no conclusions can be reached concerning the distribution of this species. Mt. Algidus Station is in the Upper Rakaia region, Canterbury. Townsend (1960) gives more details of the locality of these specimens. Korokoro is west of Petone, Wellington.

C. zealandicus n.sp. is allied to *C. annulicornis* Bergroth from Tasmania and Australia. They are to be distinguished by: the frontal process which is more rounded in *zealandicus*; the antennal tubercles which are more acute and longer and reach past the first antennal segment in *annulicornis*; the median carina of the scutellum which is high and carries about 20 small tubercles in *annulicornis* while in *zealandicus* they number about 10 and are bigger. The body shape is very similar in both species although *zealandicus* is smaller. It appears that *annulicornis* is closer to *zealandicus* than to *C. tasmanicus* Kormilev or *C. intervenius* Bergroth. I have not had the opportunity to examine *C. australis* Kormilev which Kormilev (1958) considers to be close to *annulicornis*.

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