**Parasitic Wasps of the Proctotrupoid Complex:
a New Family from Australia and a Key to
World Families (Hymenoptera :
Proctotrupeoidea *sensu lato*)**

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Abstract

A new family Peradeniidae is proposed for *Peradenia*, gen. nov., comprising *P. clavipes*, sp. nov. and *P. micranepsia*, sp. nov. from south-eastern Australia. Peradeniidae is assigned to the proctotrupoid complex of parasitic wasps, as the sister group of the Heloridae. Extant proctotrupoid families of the world are compared with respect to 43 morphological and biological characters, and an illustrated key to families is provided.

Introduction

Recent, family-level classifications of the members of the proctotrupoid complex of parasitic wasps differ widely. Conservative schemes (e.g. Riek 1955, 1970) have recognized five major families (Proctotrupidae, Ceraphronidae, Diapriidae, Platygasteridae and Scelionidae) and grouped the remaining, morphologically distinct but relatively small, proctotrupoid genera into two or three portmanteau families. More radical schemes (e.g. Rasnitsyn 1980; Mason, unpublished) have tended to recognize numerous families, and to subdivide the complex into several superfamilies. Families have been erected within the Proctotrupeoidea for several genera known only from Mesozoic or Caenozoic fossils (Rasnitsyn 1980), but for the present our knowledge of the morphology of these genera is poor. Some may belong to extant proctotrupoid families, but others probably represent families now extinct and possibly misplaced in the proctotrupoid complex. We have excluded families represented only by fossils from the discussion below.

The Ceraphronidae *sensu lato* and the Loboscelidiidae can now be excluded with certainty from the Proctotrupeoidea (Maa and Yoshimoto 1961; Masner and Dessart 1967; Day 1979). However, the remaining assemblage still appears to be heterogeneous, and is very probably not monophyletic (Königsmann 1978). The Platygasteridae and Scelionidae are certainly closely related to each other and remote from the other families (Mason, unpublished). They could be regarded as constituting a separate superfamily but for the present we retain them within the Proctotrupeoidea *sensu lato*.

The present paper summarizes our morphological studies of adults of extant members of the proctotrupoid assemblage (Tables 1, 2). It supports a relatively fragmented family classification, and presents a new key to these families. We do not attempt a definitive cladistic analysis. A new family is proposed for a morphologically isolated, new genus from south-eastern Australia. The species described below as *Peradenia clavipes*, gen. et sp. nov., was figured by Riek (1970), who referred it, without comment, to the Proctotrupidae. However, the morphology of the metasoma of *P. clavipes* and that of a second species, *P. micranepsia*, sp. nov., clearly excludes them from this family. In habitus, species of *Peradenia* are similar to species of *Helorus* Latreille (Heloridae), or even to some crabronine

Table 1. Characters of proctotrupoid families and coding of states

No.	Character	States and coding
1	OOL/OD (distance between lateral ocellus and compound eye/diameter of lateral ocellus)	
2	Inner orbits ventrally	Strongly convergent (+); not strongly convergent (-)
3	Antennal socket and clypeus: degree of separation	Widely separated (++); very narrowly separated (+); contiguous (-)
4	Malar space: size	Wide (+); narrow (-)
5	Labrum: shape	Narrow, tongue-like (+); wide (-)
6	Mandibles: orientation of teeth	Exodont, not crossing (+) endodont, crossing (-)
7	Mandibles: development of teeth	Atrophied (0); unidentate (1); bidentate (2); tridentate (3); tetridentate (4)
8	Palpal formula (maxillary/labial)	
9	Antennal formula (female/male)	
10	Length A1/width A1	
11	Annellus	Present (+); absent (-)
12	Modified segments of male antenna	Present (+); absent (-)
13	Re-entrant declivity of pronotum	Present (+); absent (-)
14	Posterior margin of pronotum overlapping mesoscutum	Broadly (++); narrowly (+); not at all (-)
15	Transverse postmarginal carina on anterior mesoscutum	Continuous (++); medially interrupted (+); absent (-)
16	Acetabular carina	Present (+); absent (-)
17	Mesoscutellum: microsculpture	Posteriorly with 2 transverse rows of punctures (+); with 1 row or without such rows (-)
18	Trochantellus	Absent (0); present on foreleg (1), midleg (2), hindleg (3)
19	Basitarsus of hindleg: relative size	Longer than (+); shorter than following tarsomeres (-)
20	Tibial spur formula	1/2/2 (+); 1/1/1 (-)
21	Tarsal claws: shape	Pectinate (+); not pectinate (-)
22	Pterostigma	Present (+); absent (-)
23	Radial cell of forewing posteriorly	Closed by tracheate vein (++) or colour streak (+); open (-)
24	Rs of forewing	Forked (+); unforked or absent (-)
25	Rs + M of forewing	Tracheate, sclerotized (++) indicated by colour (+); absent (-)
26	Rs intercept of 'basalis' of forewing	Tracheate, sclerotized (++) indicated by colour (+); absent (-)
27	Medial cell of forewing	Polygonal (++) triangular (+); absent (-)
28	Isolated medial sclerite of forewing	Present (+); absent (-)
29	Basal vein (Rs/1rm/distal intercept of M) of hindwing	Present, tracheate (+); absent (-)
30	M + Cu ₁ of hindwing	Tracheate or indicated by colour (++) present, colourless (+); absent (-)
31	Hindwing posterobasal: shape	Convex (+); concave (-)
32	Petiole: relationship to synsternite	Formed by fusion of tergite and sternite of abdominal segment II and synsternite (+); petiole not so formed (-)
33	Suture between tergite and sternite of abdominal segment II	Present (+); absent (-)
34	Gaster: shape	Laterally compressed (+); not laterally compressed (-)
35	Gastral tergites: in relation to sternites	Broadly overlapping (+); not broadly overlapping (-) sternites
36	Metasoma: fusion patterns of sclerites	Syntergite formed by fusion of tergites of abdominal segments III, IV and V and synsternite by fusion of sternites of III, IV, V and VI (+); syntergite and synsternite not so formed (-)
37	Apical metasomal sternite: shape	Medially slit (+); not slit (-)

Table 1 (continued)

No.	Character	States and coding
38	Cercus	Articulated, finger-like (F); articulated, not protruding (A); plate-like (P); absent (-)
39	Metasomal spiracles	Present (+); absent (-)
40	Ovipositor: external visibility	Internal (+); at least partially exerted (-)
41	Apical metasomal tergites in relation to sternites	Partially overlapped by apical sternite (+); not overlapped by apical sternite (-)
42	Hosts of immature stages	Arachnida (A); Coleoptera (C); Diptera (D); Hemiptera (HE); Hymenoptera — Apocrita (HA); Hymenoptera — Symphyta (HS); Neuroptera (N); Orthoptera (O); Lepidoptera (L)
43	Stage of host attacked	Egg (E); larva (L); pupa (P)

or pemphredonine sphecids. The fusion of the tergites of abdominal segments III, IV and V to form a syntergite, and of the sternites of III, IV, V and VI to form a synsternite, in females of *Peradenia* (Fig. 23), is a character state shared only by *Helorus* and *Peradenia*, and is considered a strong synapomorphy for the two genera. On the other hand, numerous autapomorphies on the head, antenna, mesosoma, wings and legs sufficiently distinguish *Peradenia* from *Helorus*, and indicate, in our opinion, that the two genera represent two distinct families.

Terms and Abbreviations

Morphological terms follow Richards (1977); sculpturing terms are those of Eady (1968). The mesosoma comprises the thorax plus the propodeum (first abdominal segment, I). The metasoma comprises the petiole (second abdominal segment, II) plus the gaster (remaining abdominal segments, III–IX). Some apparent tergites and sternites of the metasoma are the products of the fusion of two or more sclerites and are thus termed 'syntergites' or 'synsternites'.

A1, A2,, A13: antennal segments, 1, 2, . . . , 13 (A1 = basal segment = scape).

Antennal formula: denotes number of female and male antennal segments respectively.

Medial sclerite: isolated sclerotized fragment in forewing formed by remnants of $M + Cu_1$, M , Cu_1 and $cu-a$ (Fig. 50).

Tibial spur formula: denotes number of apical spurs on fore-, mid- and hindtibia respectively.

Other abbreviations are detailed in the legends to figures and Tables. Abbreviations of collections:

ANIC Australian National Insect Collection, CSIRO, Canberra
 AEI American Entomological Institute, Gainesville, Florida, USA

PERADENIIDAE, fam. nov.

Type-genus *Peradenia* Naumann & Masner, gen. nov.

Diagnosis

OOL less than OD. Inner orbits strongly convergent ventrally (Fig. 3). Antenna of female 13-segmented, antenna of male 12-segmented. Pronotum with sharp, re-entrant declivity (Figs 4, 6). Mesoscutellum posteriorly with 2 transverse, crenulate-punctate furrows (Fig. 5). Forewing with isolated medial sclerite (Figs 1, 50). Hindwing: basalis absent, posterobasal margin convex. Gaster pedunculate. Syntergite of female formed by fusion of tergites of abdominal segments III, IV and V; synsternite by fusion of sternites of III, IV, V and VI (Fig. 23). Metasoma with functional spiracle on pre-apical tergite only. Cercus (Fig. 7) articulated, rudimentary, recessed on apical tergite.

Table 2. Extant proctotrupoid families: family-character matrix

See Table 1 for coding of character states. In wing-reduced forms (some Monomachidae, Diapriidae, Platygasteridae, Scelionidae) wing venation character states will not necessarily be as given. Explanation of abbreviations: Aust., Austroniidae (monotypic; data from *Austronia* Riek); Dia., Diapriidae (polytypic; data from numerous genera); Hel., Heloridae (polytypic; data from only extant genus, *Helorus* Latreille); Mon., Monomachidae (polytypic; data from *Monomachus* Klug, *Tetraconus* Szepilgeti and undescribed genus); Pel., Pelecniidae (polytypic; data from only extant genus, *Pelecinus* Latreille); Per., Peradeniidae (monotypic; data from *Peradenia*, gen. nov.); Plat., Platygasteridae (polytypic; data from numerous genera); Proct., Proctotrupidae (polytypic; data from numerous genera); Rop., Roproniidae (monotypic; data from *Ropronia* Provancher); Scel., Scelionidae (polytypic; data from numerous genera); Van., Vanhorniidae (monotypic; data from *Vanhornia* Crawford)

	Per.	Hel.	Van.	Proct.	Pel.	Rop.	Aust.	Mon.	Dia.	Platy.	Scel.
1	<1.0	>1.0	>1.0	>1.0, <1.0	>1.0	>1.0	>1.0	>1.0	≥1.0	≥1.0, <1.0	≥1.0, <1.0
2	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+
4	-	+	-	-	-	-	-	-	-	-	-
5	-	+	-	-	-	-	-	-	-	-	-
6	-	-	+	-	-	-	-	-	-	-	-
7	1	3	4	0, 1, 2	2	2	2	2, 3	2	2	1, 2, 3
8	5/3	5/3	5/3	4/3, 3/2	5/3	5/3	5/3	5/3	5/3, 4/2, 2/1, 1/0	2/1, 1/1	5/3, 4/2, 3/2, 2/1, 1/1
9	13/12	16/16	13/13	13/13	14/14	14/14	15/14	15/14	(3-) 9-15/12-14	7-10/8-10	6-12, 14/11-12, 14
10	<2.0	<2.0	<2.0	<2.0	<2.0	1.6-2.2	1.9-2.1	2.4-3.3	>2.5	>2.5	>2.5
11	-	+	-	-	-	-	-	-	-	+	+
12	-	±	+	±	-	-	-	-	±	-	-
13	+	-	-	-	-	+	+	+	-	-	-
14	-	-	-	-	-	+	+	+	-	-	-
15	-	-	-	-	-	+	+	+	-	-	-
16	+	+	+	±	-	-	-	-	-	-	-
17	+	+	-	-	-	-	-	-	-	-	-
18	0	3	0	0 or 1	0	1+2+3	1+2+3	1+2+3	1+2+3	1+2+3	0
19	+	+	+	+	-	+	+	+	+	±	±
20	+	+	+	+	+	+	+	+	+	±	±
21	-	+	-	-	+	+	+	+	-	-	-
22	+	+	+	+	+	+	+	+	+	-	-
23	++	++	++	++	-	++	++	++	++	-	-
24	-	-	-	-	+	-	-	-	-	-	-
25	-	++	+	±	+	++	-	-	-	-	-

Per.	Hel.	Van.	Proct.	Pel.	Rop.	Aust.	Mon.	Dia.	Platy.	Scel.
26	+	+	+	+	++	++	++	+	±	±
27	-	++	-	++	++	-	-	-	-	-
28	+	-	±	-	-	-	-	-	-	-
29	-	-	-	-	-	+	+	±	-	±
30	+	+	+	+	+	+	++	-	-	-
31	+	+	+	+	+	+	+	-	+	+
32	-	-	+	-	-	-	-	-	-	-
33	-	+	-	+	-	-	-	-	+	+
34	-	-	+	-	+	+	+ ^g - ^g	±	±	±
35	-	-	±	+ ^(g) -(^g)	+	+	+ ^(g) ±(^g)	+	+	+
36	+	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	+	-	-	-	-
38	A	-	F	P	A	F	F(^g) P(^g)	F PA	-	F P
39	+	-	+	+	+	+	+	+	-	-
40	+	-	-	+	-	-	+	±	+	+
41	-	-	-	+ ^(g) -(^g)	-	-	+ ^(g) -(^g)	-	-	-
42	?	C	C,D	C	HS	?	D	C,D,HA L,P	C,D,HE L,E	A,C,D,HE,L,O E
43	?	L	L	L	L	?	L	-	-	-

Female

Head. In dorsal view wider than long. Hypognathous. Occipital carina complete, ventrally meeting base of mandible. OD greater than OOL. Antennal socket mid-face, widely separated from weak fronto-clypeal suture, not overhung by frontal lamella. Frons flat, without shelf, lacking grooves for reception of A1. Compound eye very large, subcircular; each inner orbit entire, the two strongly convergent ventrally (Fig. 3). Malar space very narrow. Labrum broadly transverse. Mandible unidentate, endodont. Maxillary palpus 5-segmented. Labial palpus 3-segmented.

Antenna (Figs 1, 2). Very short, 13-segmented. A1 short, less than $2.0\times$ longer than wide. Annellus absent. A3–A12 unmodified, without carinae, emarginations or smooth surfaces; basiconic sensilla, placoid sensilla absent.

Mesosoma. Pronotum with acute, re-entrant declivity (Figs 4, 6); anterior and lateral surfaces deeply recessed for reception of head and reflexed forefemur; posterolateral lobe reaching tegula; posterior margin deeply emarginate, not overlapping mesoscutum. Mesoscutum anteromedially without transverse carina. Mesoscutellum posteriorly with 2 transverse, punctate-crenulate furrows (Fig. 5). Discrete prepectus absent. Acetabular carina well defined, continuous (Figs 9, 10, 12). Metasternum not forked between hindcoxae. Petiolar foramen low on propodeum, close to hindcoxae.

Forewing (Fig. 50). Not longitudinally folded. Pterostigma present. *C*, *Sc + R* and *R*₅ tracheate, sclerotized; point of separation of *M* and *CuA* from *M + Cu*₁ sclerotized, forming medial sclerite. *M + CuA*, *M*, *CuA*, *CuA*₁, *CuA*₂ represented by weak coloration. *Rs* slightly curved, not forked. Distinct costal cell present. Radial cell closed. Medial cell absent.

Hindwing (Fig. 61). Posterobasal margin convex. Anal lobe absent. *Sc + R* not reaching hamuli as tracheate vein. Hamuli in cluster of 3, $\frac{2}{3}$ of wing length from base. *M + Cu*₁ and basal part of *M* present as colourless veins. *Rs/Irm*, distal part of *M* absent.

Legs (Figs 1, 2). All legs with narrow, basal constriction of coxa entering coxal cavity. Forecoxa widely separated from midcoxa; midcoxa close to hindcoxa; hindcoxa neither dorsally produced nor carinate. Trochantellus absent from all legs. Tibial spur formula 1/2/2; foretibial spur slightly curved, not forked, with a row of closely set hairs; midtibia without spiniform setae; tibia more or less clavate; both hindtibial spurs lacking row of closely set hairs. All tarsi 5-segmented; basitarsus the longest segment; tarsal claws simple, their bases not angulate or enlarged; arolium well developed.

Metasoma (Figs 13, 23). With 5 free tergites and 2 free sternites externally visible. Tergites without lateral carinae, without laterotergites. Tergite and sternite of 1st metasomal segment (abdominal segment II) fused to form petiole, sternite not membranous posteriorly. Anterior margins of syntergite and synsternite enter foramen of petiole. Gaster pedunculate, not laterally compressed, tergites not broadly overlapping sternites; tergites of abdominal segments III, IV and V fused to form syntergite; tergites of VI, VII, VIII and IX free. Spiracle present on tergite of VIII. Cercus (Fig. 7) short, broad, articulated, deeply recessed, on tergite of IX. Apices of ovipositor valves protruding. Sternites of III, IV, V and VI fused to form synsternite. Synsternite without transverse, vestigial sutures. Abdominal sternites of VII, VIII and IX fused.

Male

Differs from female as follows:

Antenna. 12-segmented.

Metasoma (Fig. 21). With 5 free tergites and 3 free sternites externally visible. Syntergite with 2 rudimentary, transverse sutures (not reaching lateral margins) indicating partially fused tergites of abdominal segments III, IV and V. Tergites of abdominal segments VI, VII, VIII and IX free. Spiracle on VIII, cercus on IX. Synsternite with 3 rudimentary, transverse sutures (not reaching lateral margins), indicating partially fused sternites of abdominal

segments III, IV, V and VI. Genitalia (Fig. 8) with short basal ring, simple paramere and volsella closely associated with aedeagus.

Superfamily Classification of Peradenia

The following character states in *Peradenia* exclude it from all superfamilies of Apocrita (*sensu* Riek, 1970) except the Proctotrupoidea *sensu lato*:

- (1) Placoid sensilla absent from antenna (excluding *Peradenia* from the Ichneumonoidea, Cynipoidea and Chalcidoidea);
- (2) The antennal formula (13/12) and absence of a lamella overhanging the antennal insertion (excluding *Peradenia* from the Trigonoidea);
- (3) The antennal formula, cercus present, hindwing without anal lobe (excluding *Peradenia* from the Bethyloidea);
- (4) The antennal formula, presence of cercus in female, absence of spiniform setae from midtibia (excluding *Peradenia* from Chrysidoidea, Pompiloidea, Scoliidae, Vespoidea, Sphecoidea, Apoidea and Formicoidea);
- (5) Head without subantennal groove for reception of A1, hindtibial preening brush (Riek 1970) absent (excluding *Peradenia* from the Megalyroidea);
- (6) Foretibia with one spur (excluding *Peradenia* from the Ceraphronoidea);
- (7) Costal cell broad and completely enclosed (excluding *Peradenia* from the Megalyroidea, Ichneumonoidea, Ceraphronoidea, Cynipoidea and Chalcidoidea);
- (8) Insertion of metasoma low on the propodeum (excluding *Peradenia* from the Evanioidea).

Each of the above character states (except the antennal formula, which is autapomorphic for *Peradenia*, and the absence of an anal lobe in the hindwing) is the plesiomorphic condition for the Apocrita. We know of no synapomorphy for all families of the proctotrupoid complex, and the monophyly of the complex thus remains in question.

Classification of Peradenia within the Proctotrupoid Complex

Table 2 gives the states of 43 characters for *Peradenia*, and for each of the 10 previously described families of the proctotrupoid complex. Figs 50–70 depict the wing venation of representatives of all families. Figs 21–30 and 36–48 illustrate the post-thoracic morphology of representatives of all families, and indicate the (abdominal) segmental origin of the various sclerites and synsclerites. The combination of the following character states invites comparison of *Peradenia* with the Roproniidae, the Austroniidae, the Monomachidae and the Heloridae:

- (1) Antenna inserted remote from clypeus;
- (2) A1 short;
- (3) Rs of forewing unforked;
- (4) Pterostigma present;
- (5) $M + Cu_1$ at least weakly indicated in hindwing;
- (6) Gaster articulated anteriorly by both tergite and sternite, both of which enter the petiole;
- (7) Suture between tergite and sternite of abdominal segment II absent;
- (8) Metasoma with one pair of spiracles.

The identical formation of the syntergite and synsternite, the narrow lateral overlap of gastral sternites by tergites, and the two transverse rows of punctures on the posterior of the mesoscutellum, are synapomorphies indicating that *Peradenia* and Heloridae are sister groups (cf. Figs 21, 22, and Figs 23, 24).

Comparison of Peradenia and Heloridae

Rudimentary sutures in the syntergite and synsternite of male *Peradenia* (Fig. 21)

demonstrate that these sclerites are fusion products. These sutures are obliterated in male Heloridae (Fig. 22), which are thus more apomorphic than *Peradenia* with respect to this character. The sutures of the syntergite and synsternite have been lost from females of both *Peradenia* and Heloridae (Figs 23, 24).

Peradenia and Heloridae are each characterized by several striking autapomorphies: *Peradenia* by the strongly pedunculate gaster, strongly ventrally converging inner orbits, unidentate mandibles, the 13/12 antennal formula (unique within the Hymenoptera), strongly declivous pronotum, loss of the medial cell from the forewing, and the presence of an isolated medial sclerite in the forewing; the Heloridae by the narrow labrum, 16/16 antennal formula, the triangular medial cell in the forewing (Fig. 49), the plate-like cercus, and the pectinate tarsal claws.

The differences between *Peradenia* and the Heloridae are so great that it is appropriate to treat *Peradenia* as a distinct family.

Phylogeny of Families of Proctotrupoid Complex

It would be premature to speculate here on the phylogeny of the proctotrupoid families. As remarked above, the monophyly of the complex is by no means certain. Such monophyly, if it exists, and a ground-plan for proctotrupoid families, can be established only as part of a review of the phylogeny of the Apocrita as a whole.

For the present, we restrict ourselves to the following observations:

- (1) Each of the families recognized in Table 2 is phenetically very isolated;
- (2) Such character states as the relative richness of wing venation (e.g. compare Figs 49, 51, 55, 56, 58, 59 with Figs 50, 52–54, 57; or Figs 62, 66 with Figs 60, 61, 63–65, 67–70), or the absence of fusion of metasomal tergites and sternites (e.g. Figs 36–38, 42–44), which have been used in the past to unite small genera into portmanteau families, are plesiomorphic for the Apocrita, and thus of little value in phylogenetic analysis;
- (3) Two sister-group relationships are clear: Peradeniidae–Heloridae (see above) and Platygastriidae–Scelionidae (Mason, unpublished).

Key to Extant Families of Proctotrupoid Wasps

1. Antennal sockets (toruli) contiguous with dorsal margin of clypeus or separated from clypeus by <1 socket-diameter (Figs 15, 16) 2
Antennal sockets (toruli) separated from dorsal margin of clypeus by distinctly >1 socket-diameter (Figs 17, 18) 5
- 2(1). A1 short and stout, <2× as long as wide; antenna with 13 segments; mandibles exodont, if flexed with tips not contiguous; forewing with rich venation (Fig. 51), thick pterostigma and closed radial cell; 1 genus, Holarctic region only **Vanhorniidae**
A1 long and slender, distinctly >2.5× as long as wide; antenna never with 13 segments; mandibles endodont, if flexed with tips contiguous or widely crossing; forewing with reduced venation (Figs 54, 57), pterostigma absent and radial cell never closed 3
- 3(2). Tergite III not longest of all metasomal tergites, at most subequal to tergite IV (Figs 27, 28); numerous genera, world-wide **Scelionidae** (part)
Tergite III distinctly longest of all metasomal tergites (Figs 29, 30), several times longer than tergite IV 4
- 4(3). Forewing with stigmal and usually also postmarginal veins (Fig. 57); antenna usually with 11 or 12 segments, rarely 10; A5 in male modified (Figs 19, 20); numerous genera, world-wide **Scelionidae** (part)
Forewing without stigmal and postmarginal veins (Fig. 54), often veinless; antenna with 10 or fewer segments; A4 or (rarely) A3 in male modified; numerous genera, world-wide **Platygastriidae**

- 5(1). Basitarsus of hindleg distinctly shorter than following tarsomere; forewing with *Rs* distally forked (Fig. 52); 1 genus, Nearctic and Neotropical regions only **Peleciniidae**
 Basitarsus of hindleg distinctly longer than following tarsomeres; forewing with *Rs* not forked (e.g. Fig. 50) or absent 6
- 6(5). Inner orbits strongly convergent ventrally (Fig. 3); OOL < OD; in lateral view pronotum with sharp, concave, re-entrant declivity (Figs 4, 6); 1 genus, Australia only **Peradeniidae**, fam. nov.
 Inner orbits not ventrally convergent (Figs 17, 18); OOL > OD; in lateral view pronotum convex and produced forward 7
- 7(6). Tergite III subequal to tergite IV in length (Figs 36, 38, 42) 8
 Tergite III considerably longer than tergite IV (Figs 25, 43) 9
- 8(7). Metasoma remarkably elongate, tail-like in female (Fig. 36), petiole in both sexes at least 3 times longer than wide; tarsal claws simple; 3 genera, Neotropical and Australian regions only **Monomachidae**
 Metasoma short, not tail-like in female (Fig. 42), petiole in both sexes at most twice as long as wide; tarsal claws each with a basal rectangular lobe; 1 genus, Australia only **Austroniidae**
- 9(7). A1 distinctly elongate, at least 2.5× as long as wide; antennal shelf usually distinct (Fig. 17); pterostigma absent (Fig. 53); numerous genera, world-wide **Diapriidae**
 A1 short, at most 2.2× as long as wide; antennal shelf absent; pterostigma present (Figs 49, 55, 58) 10
- 10(9). Antenna with 13 segments; medial cell of forewing not defined (Fig. 55), basal intercept of *Rs* + *M* absent; numerous genera, world-wide **Proctotrupidae**
 Antenna with 14 or 16 segments; medial cell of forewing defined, basal intercept of *Rs* + *M* present (Figs 49, 58) 11
- 11(10). Antenna with 16 segments, including 1 anellus (Figs 34, 35); gaster slightly wider than high, in lateral view with tergites subequal in height to sternites (Figs 22, 24); medial cell of forewing triangular (Fig. 49), not contacting *R*; 1 genus, world-wide **Heloridae**
 Antenna with 14 segments and no anellus (Fig. 33); gaster strongly compressed laterally, much higher than wide, in lateral view with tergites much higher than sternites (Fig. 43); medial cell of forewing polygonal (Fig. 58), contacting *R*; 1 genus, Nearctic, Palearctic and Oriental regions only **Roproniidae**

Genus *Peradenia*, gen. nov.

‘Undetermined genus of Proctotrupidae’; Rick, 1970, p. 906, fig. 37.22E.

Type-species: *Peradenia clavipes*, sp. nov.

Generic diagnosis and description as for family Peradeniidae.

Etymology

The generic name is derived from two Aboriginal words meaning a club-bearing wasp, with reference to the club-shaped metasoma. It is to be regarded as feminine.

Key to Species of *Peradenia*

- Hindtibia abruptly clavate (Figs 1, 2), in lateral view distinctly wider than hindfemur; hindtibia > 3.5× as long as hindbasitarsus; frons dorsal to toruli uniformly heavily sculptured; vertex posterior to ocelli punctate (Fig. 6) *clavipes*
 Hindtibia gradually clavate (Fig. 31), in lateral view about as wide as hindfemur; hindtibia < 2.3× as long as hindbasitarsus; frons dorsal to toruli with smooth area; vertex posterior to ocelli transversely aciculate (Fig. 11) *micranepsia*

Peradenia clavipes, sp. nov.

(Figs 1–8, 13–14, 21, 23, 50, 61; Tables 3, 4)

Types

Holotype ♀, Cobungra, 37°06'S., 147°26'E., Victoria, 27.iii.1957, A. Neboiss, in ANIC.

Paratypes: 1♀, Honeysuckle Creek, 35°35'S., 148°59'E., Australian Capital Territory, on flowers of *Eucalyptus stellulata* Sieb. ex DC., 30.iv.1984, A. R. Griffin, in ANIC; 1♂, Waldheim, 41°38'S., 145°56'E., Tasmania, 800 m, 9.ii.–4.iii, in AEI.

Fig. 1. *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., holotype female, dorsal view. Scale line, 2 mm.

Female

Measurements and ratios given in Tables 3 and 4.

Head. Vertex, frons, gena, clypeus (dorsally and laterally) densely punctate to rugose-punctate, interspaces smooth; frons dorsal to toruli heavily sculptured, with fine longitudinal carina from median ocellus to between toruli; frons ventral to toruli with paired weak grooves parallel to inner margins of compound eyes. Frontoclypeal suture indistinct; anterior tentorial pits distinct. Hyperoccipital carina reaching oral fossa.

Antenna (Figs 1, 2). A1 goblet-shaped; apical rim simple, not produced; length c. 0.1 × head width. A2 about as long as wide. A3–A13 slender; clava, rhinaria, placodes absent. A3 basally slightly narrower than following segments; A4–A13 of approximately equal widths.

Mesosoma. Pronotum: collar rugose to rugose-punctate, anterior margin carinate with row of uniform punctures; neck and vertical surfaces of pronotum smooth except for irregular rugose area adjacent to forecoxa; posterolateral extremity slightly acute. Mesoscutum convex; anterodorsally with pair of short, weak, submedian, longitudinal grooves; median sulcus absent; more sparsely punctate than pronotal collar, interspaces smooth; notaulices percurrent, each represented by row of large punctures; lateral margin with a row of uniform punctures. Mesoscutellum convex; anteriorly with transverse alveolate to crenulate furrow; medially smooth, with a few small punctures; posteriorly with 2 transverse, crenulate furrows, the marginal one at a lower level than the submarginal. Mesopleuron laterally rugose to rugose-punctate, with distinct row of asetigerous punctures parallel and close to posterior margin, and a horizontal row of irregular punctures arising on

Table 3. Length of body and forewing; ratios of head, forewing, hindleg and metasomatic measurements of *Peradenia* spp.

Explanations of abbreviations: BL, length of body (excluding antenna); FW, length of forewing (apex to tegula); GL, length of gaster (= postpetiolar metasoma); HBL, length of hindbasitarsus; HH, maximum height of head (excluding mouthparts); HL, maximum length of head; HTL, length of hindtibia; HTW, width of hindtibia; HW, maximum width of head; M, malar space; MAE, maximum diameter of compound eye; OD, maximum diameter of lateral ocellus; OOL, minimum distance between lateral ocellus and compound eye; PL, length of petiole; POL, minimum distance between lateral ocelli; PW, maximum width of petiole; R1, length of postmarginal vein distal to pterostigma; ST, length of pterostigma; WF, minimum distance between compound eyes (across lower frons)

	<i>P. clavipes</i>			<i>P. micranepsia</i> , holotype female
	Holotype female	Paratype female	Paratype male	
BL (mm)	6.29	7.15	6.24	4.00
FW (mm)	3.61	4.21	3.48	2.65
HW/HL	1.88	1.88	1.64	1.94
OD/POL	0.43	0.35	0.43	0.32
POL/OOL	6.00	6.67	5.29	6.17
WF/MAE	0.32	0.32	0.53	0.43
HH/HL	1.32	1.38	1.23	1.35
WF/HW	0.20	0.20	0.32	0.27
MAE/M	48.0	46.7	41.5	39.5
ST/R1	1.38	1.32	1.41	1.96
HTL/HTW	2.92	2.83	2.91	3.81
HTL/HBL	3.56	4.06	3.64	2.29
PL/PW	7.24	7.22	4.94	4.43
PL/GL	0.85	0.84	0.75	0.76

anterior margin and extending into mesopleural depression as 3–4 asetigerous punctures; mesopleural depression deep and predominantly smooth; sternaulus absent; ventral mesopleuron finely punctate. Metanotum medially punctate to rugose-punctate, laterally with weakly crenulate transverse furrow; dorsellum not clearly differentiated. Propodeum: median carina short, expanding posteriorly to form a smooth knob; anterodorsally with transverse, broadly V-shaped postmarginal carina; dorsolaterally with submedian, spiracular and subspiracular longitudinal carinae; rugae and punctures between carinae irregular; spiracular bulla weakly protuberant. Metapleuron smooth; anterior, dorsal and ventral margins of metapleuron each defined by row of asetigerous punctures.

Legs. Densely punctate, tibiae especially so. Hindtibia (Figs 1, 2, 14) abruptly clavate, distinctly wider than hindfemur.

Forewing. Post-pterostigmal portion of radial cell slightly shorter than pterostigma.

Metasoma (Figs 1, 2). Petiole: predominantly longitudinally strigose, posterodorsally irregularly rugose or weakly punctate; laterally coarsely rugose to coarsely punctate. Stalk of tergite III long, anteriorly smooth, posteriorly irregularly rugose. Gastral tergites and sternites otherwise densely punctate, interspaces smooth.

Pubescence. Unless otherwise specified above, all punctures setigerous. Setae simple, unbranched. Head, mesosoma and petiole with erect or suberect setae; these especially dense on lower frons, gena, ventral mesopleuron and dorsolateral propodeum. Legs and gaster with very dense, depressed setae. Wings predominantly densely, uniformly setose, basally more sparsely so.

Colour. Non-metallic. Black. Gaster, palps and legs dark brown to black. Pubescence of body, antenna and legs silver; wing pubescence black.

Fig. 2. *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., holotype female, lateral view. Scale line, 2 mm.

Male

Differs from female as follows:

Measurements and ratios as in Tables 3, 4.

Head (Figs 3, 4, 6). Frons dorsal to toruli with weak median groove, ventral to toruli with a pair of dorsally converging, weak grooves.

Antenna. A3–A7 slightly wider than following segments; A8–A12 of approximately equal widths.

Mesosoma. Mesoscutellum (Fig. 5) medially slightly more rugose. Sternaulus present. Metapleuron longitudinally rugose.

Metasoma. Stalk of tergite III slightly shorter, smooth area smaller.

Etymology

The specific name is from the Latin and refers to the clavate tibia.

Peradenia micranepsia, sp. nov.

(Figs 9–12, 31, 32; Tables 3, 4)

Type

Holotype ♀, Black Mtn, 35°16'S., 149°06'E., Australian Capital Territory, 29.iii.–5.iv.1981, I. D. Naumann, Malaise trap, in ANIC.

Female

Differs from female of *P. clavipes* as follows:

Measurements and ratios in Tables 3 and 4.

Head (Figs 9–12). Vertex posterior to ocelli predominantly transversely aciculate, punctures indistinct; frons dorsal to toruli partially smooth; longitudinal carina from median ocellus and paired grooves ventral to toruli weaker.

Mesosoma (Figs 9–12). Pronotal collar, mesoscutum, and mesoscutellum slightly more finely sculptured.

Table 4. Lengths and length to width ratio (L:W) of antennal segments of *Peradenia* spp.

Segment No.	<i>P. clavipes</i>						<i>P. micranepsia</i> , holotype female	
	Holotype female Length (mm)	L:W	Paratype female Length (mm)	L:W	Paratype male Length (mm)	L:W	Length (mm)	L:W
1	0.19	1.58	0.21	1.62	0.16	1.23	0.14	1.27
2	—	—	—	—	—	—	—	—
3	0.15	2.00	0.17	1.88	0.17	1.55	0.15	1.88
4	0.13	1.63	0.15	1.50	0.14	1.22	0.12	1.33
5	0.11	1.22	0.12	1.14	0.14	1.27	0.10	1.25
6	0.10	1.18	0.13	1.19	0.14	1.27	0.10	1.25
7	0.10	1.11	0.11	1.05	0.14	1.27	0.10	1.25
8	0.10	1.11	0.12	1.20	0.12	1.26	0.10	1.25
9	0.10	1.11	0.11	1.16	0.12	1.33	0.10	1.25
10	0.10	1.18	0.12	1.28	0.11	1.16	0.09	1.19
11	0.10	1.18	0.11	1.13	0.10	1.11	0.09	1.19
12	0.10	1.18	0.11	1.13	0.18	2.00	0.10	1.25
13	0.18	2.00	0.22	2.20	—	—	0.17	2.13

Legs. Hindtibia (Fig. 31) gradually clavate, in lateral view about as wide as hindfemur.

Forewing. Post-pterostigmal portion of radial cell 0.5× as long as pterostigma.

Metasoma. Stalk of tergite III short (Fig. 32), with weak longitudinal rugae.

Male

Unknown.

Etymology

The specific name is from the Greek, meaning a small cousin.

Biology of Peradenia spp.

The host or hosts of the species of *Peradenia* are unknown. The Honeysuckle Creek paratype of *P. clavipes* was netted from flowers of *Eucalyptus stellulata* Sieber ex A. P. de Candolle in *Eucalyptus pauciflora* Sieber ex Sprengel woodland. Of the two other known localities for *P. clavipes*, Cobungra includes both moist woodland (dominated by *Eucalyptus* spp.) and disturbed pastureland, and Waldheim includes heath and temperate rainforest

[dominated by *Nothofagus cunninghamii* (Hooker)]. The holotype of *P. micranepsia* was collected in moist woodland (dominated by *Eucalyptus* spp. and *Acacia* spp.). All localities are at moderate altitude (500–1000 m). The paratype male of *P. clavipes* and the holotype female of *P. micranepsia* were collected in Malaise traps.

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Figs 3–8. *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., paratype male: 3, head, frontal view; 4, head, mesosoma, lateral view; 5, mesoscutellum, propodeum, posterodorsal view; 6, head, pronotum, dorsolateral view; 7, apical metasomal tergites, dorsal view; 8, genitalia, dorsal view. Abbreviations: a, aedeagus; b, basal ring; c, cercus; f, crenulate-punctate furrows of mesoscutellum; fc, frontoclypeal suture; hc, hyperoccipital carina; m, metanotum; p, paramere; s, spiracle; v, volsella.

Figs 9–12. *Peradenia micranepsia* Naumann & Masner, gen. et sp. nov., holotype female, head, mesosoma: 9, 10, lateral view; 11, dorsal view; 12, ventral view. Abbreviation: *ac*, acetabular carina.

Figs 13, 14. *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., holotype female: 13, metasoma, posterior view; 14, hindtibia, end view. Abbreviations: *c*, cercus; *ht*, hindtibia; *ov*, ovipositor valve; *s*, spiracle; *ts*, hindtibial spur.

Figs 15–20. *Baryconus* sp. (Scelionidae) and *Aclista* sp. (Diapriidae): 15, 16, *Baryconus* sp., head, lateral and frontal views; 17, 18, *Aclista* sp., head, lateral and frontal views; 19, 20, *Baryconus* sp., A1–A6 and detail of A5. Abbreviations: as, antennal socket; fc, frontoclypeal suture.

Figs 21–24. Post-thoracic morphology: 21, *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., paratype male; 22, *Helorus* sp. (Heloridae), male; 23, *Peradenia clavipes*, holotype female; 24, *Helorus* sp., female. Scale lines, 0.5 mm. Abbreviations: a, aedeagus; b, basal ring; c, cercus; ov, ovipositor valve; p, paramere; I IX, abdominal segments I IX.

Figs 25–35. 25, *Belyta* sp. (Diapriidae), male, post-thoracic morphology; 26, *Belyta* sp., female, metasomal sternites; 27, *Calliscelio* sp. (Scelionidae), male, post-thoracic morphology; 29, *Macroteleia* sp. (Scelionidae), post-thoracic morphology; 29, *Trissolcus* sp. (Scelionidae), female, post-thoracic morphology; 30, *Platygastrides* sp. (Platygastridae), male, post-thoracic morphology; 31, *Peradenia micranepsia* Naumann & Masner, gen. et sp. nov., holotype female, hindtibia and basitarsus; 32, *Peradenia micranepsia*, holotype female, metasoma, dorsal view; 33, *Ropronia* sp. (Roproniidae), female, A1–A3; 34, *Helorus* sp. (Heloridae), female, A1–A4; 35, *Helorus* sp., female, antenna. Scale lines, 0.5 mm. Abbreviations: c, cercus; p, paramere; s, spiracle; I.....IX, abdominal segments I.....IX.

Figs 36–41. Post-thoracic* morphology: 36, 37, *Monomachus* sp. (Monomachidae), female; 38, *Monomachus* sp., male (spiracle on tergite VIII, overlapped by tergite VII); 39, 40, *Pelecinus* sp. (Pelecinidae), female; 41, *Pelecinus* sp., male. Scale lines: for all except 39, 0.5 mm; for 39, 5 mm. Abbreviations: c, cercus; p, paramere; s, spiracle; I . . . IX, abdominal segments I . . . IX.

Figs 42–48. Post-thoracic morphology: 42, *Austronia* sp. (Austroniidae), female (spiracle on tergite VIII, overlapped by tergite VII); 43, *Ropronia* sp. (Roproniidae), male; 44, *Ropronia* sp., female, post-petiole sternites; 45, *Austroserphus* sp. (Proctotrupidae), male; 46, Gen. indet. (Proctotrupidae), female; 47, *Vanhornia* sp. (Vanhorniidae), male; 48, *Vanhornia* sp., female. Scale lines, 0.5 mm. Abbreviations: c, cercus; ov, ovipositor valve; p, paramere; s, spiracle; I . . . IX, abdominal segments I . . . IX

Figs 49–57. Forewing venation: 49, *Helorus* sp. (Heloridae); 50, *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., holotype female; 51, *Vanhornia* sp. (Vanhorniidae); 52, *Pelecinus* sp. (Pelecinidae); 53, *Aclista* sp. (Diapriidae); 54, *Inostemma* sp. (Platygastridae); 55, *Austroserphus* sp. (Proctotrupidae); 56, *Monomachus* sp. (Monomachidae); 57, *Calliscelio* sp. (Scelionidae). Scale lines: for all except 52, 0.5 mm; for 52, 2 mm. Abbreviations: *ms*, medial sclerite; *pm*, postmarginal vein; *pt*, pterostigma; *RC*, radial cell; *st*, stigmal vein. Venation terminology after Richards (1977).

Figs 58, 59. Forewing venation: 58, *Ropronia* sp. (Roproniidae); 59, *Austronia* sp. (Austroniidae). Scale lines, 0.5 mm.

Figs 60–70. Hindwing venation: 60, *Helorus* sp. (Heloridae); 61, *Peradenia clavipes* Naumann & Masner, gen. et sp. nov., holotype female; 62, *Monomachus* sp. (Monomachidae); 63, *Ropronia* sp. (Roproniidae); 64, *Inostemma* sp. (Platygastridae); 65, *Vanhornia* sp. (Vanhorniidae); 66, *Austronia* sp. (Austroniidae); 67, *Calliscelio* sp. (Scelionidae); 68, *Pelecinus* sp. (Pelecinidae); 69, *Aclista* sp. (Diapriidae); 70, *Austroserphus* sp. (Proctotrupidae). Scale lines: for all except 68, 0.5 mm; for 68, 2 mm. Abbreviation: *pt*, pterostigma. Venation terminology after Richards (1977).