TWO NEW WESTERN AUSTRALIAN SPECIES OF THE WASP GENUS *PODAGRITUS* SPINOLA, 1851 (HYMENOPTERA: CRABRONIDAE) THAT PREY ON BEES

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Abstract
Two new crabronid wasps, *Podagritus apivorus* **sp. n.** and *P. stuartae* **sp. n.**, are described from Western Australia.

Key words: New species, *Podagritus*, Crabronidae, Western Australia

Introduction
Podagritus is a genus of 115 currently recognised species, 87 of which have been described by Jean Leclercq between 1951 and 2000; 78 of them occur in Central and South America, 30 in Australia, 6 in New Zealand, and 1 in New Guinea. Although the genus was established by Spinola in 1851, it was treated as a synonym of *Crabro* Fabricius by the 19th and early 20th centuries authors (e.g., F. Smith, 1856; Dalla Torre, 1897) and as a subgenus of *Crabro* by Kohl (1897), until Ashmead (1899) and Pate (1944) accepted its validity. Leclercq dealt with the Australian *Podagritus* in several papers, and provided keys for their identification in 1955 and 1998. He gradually recognised the difficulties in separating the genus from *Rhopalum* Stephens, as he could not find a single character or a stable combination of characters distinguishing them. In 1994 and 1998, he published a list of differences between most *Podagritus* and most *Rhopalum* and reviewed the relationships between the two genera in 1997. The list, slightly modified in 2000 and 2002, is reproduced below (the character states for *Rhopalum* are in parentheses):

1. Head subrectangular in dorsal view (head subquadrate).
2. Prepectus angular, with omaulus (prepectus simple).
3. Pronotal collar carinate or more or less striate (pronotal collar neither carinate, nor striate).
4. Recurrent vein joining the submarginal cell far after the midlength of the latter, the basal section of the cell being at least 2.5 × as long as the distal section, which is not much longer than the radiomedian vein (recurrent vein joining the submarginal cell near the midlength of the latter, the distal section of the cell markedly longer than the radiomedian vein).
5. Pygidial plate of female punctate (impunctate).
6. Male tergum VII with a punctate pygidial plate and well–defined borders (male tergum VII without pygidial plate).
7. Body length more than 8 mm (less than 8 mm).
8. Female foretibia with two to four spines on outer margin, foretarsal rake present (foretibial spines absent, foretarsal rake absent or rudimentary).

A number of species, however, are a mixture of characters of one and the other genus. For example, in the South American *Podagritus neuqueni* Leclercq, the pronotal collar and the recurrent vein are as in *Rhopalum,* whereas the head in dorsal view, the female and male pygidial plates, and the female body length of 9.0–9.5 mm are as in *Podagritus*; the prepectus is intermediate: not simply rounded, but omaulus absent or rudimentary; the foretibia has only one spine on the outer margin, and the foretarsal rake is represented by only four small and fine spines at the basitarsus. In 1998, Leclercq observed that all 28 *Podagritus* of the subgenus *Echuca* Pate do not have an omaulus or the omaulus is rudimentary. Similarly, the keys in Bohart and Menke (1976) and in Menke and Fernández (1996) do not cover the whole diversity of the two genera. The most reliable character appears to be the shape of the prepectus, evenly rounded in the vast majority of *Rhopalum*, but differentiated into two planes in *Podagritus.* Under this situation, Menke and Fernández (1996: 46, footnote) thought that synonymizing *Podagritus* with *Rhopalum* might be the right decision. Leclercq (2000), however, preferred to keep them separate, as according to him the combined genus of more than 400 species would be unmanageable. At this time, I treat them as two genera.

There are five subgenera in *Podagritus*: *Chilichuca* Leclercq, 1981 (Chile), *Ebisu* Tsuneki, 1983 (New Guinea), *Echuca* Pate, 1944 (Australia), *Parechuca* Leclercq, 1970 (Australia, New Zealand, South America), and *Podagritus* Spinola, 1851 *sensu stricto* (South and Central America). Twenty eight out of 30 currently recognised Australian species are *Echuca*, so characterised by Leclercq (1998):

1. Pronotal collar large, flat, in the same plane as scutum, and
2. Mesopleuron without omaulus, with very short, appressed setae.

Two Australian species, *P. burnsi* Leclercq and *P. doreeni* Leclercq, are in *Parechuca*, with the pronotal collar markedly below the level of the scutum, the mesopleuron with an omalus, and mesopleural setae relatively long and erect (omalus absent in several non–Australian *Parechuca*).

The vast majority of *Podagritus* hunt Diptera (Leclercq, 1954; Bohart and Menke, 1976), with several important exceptions in New Zealand. So, *P. albipes* and *P. cora* prey on Diptera in one part of the island, but on the ephemeropteran genus *Deleatidium* and on trichopteran *Pycnocentrodes aureola* (McLachlan) in Mount Cook National Park (Harris, 1990, 2006); *P. parrotti* (Leclercq) takes only adult chrysomelids *Adoxia vulgaris* Broun and *A. pubicollis* Broun (Harris, 1998, 2000); *P. carbonicolor* (Dalla Torre) collects Diptera (Harris, 2000), but also larval cockroaches *Cutilia truncata* Brunn. (Gourlay, 1964). Preying on bees, as done by the two new species, was previously unknown for the genus. Detailed description of their nesting habits is given by the concurrent paper by Houston and Stuart, 2023.

Specimens of the two bee hunting *Podagritus*, collected in Western Australia in 2021, one by Dr Terry Houston of the Western Australian Museum, Perth,

Australia, the other by Mrs Kerry Stuart, Perth, Australia, were originally sent for identification to Helen K. Court, a volunteer at the Department of Entomology, California Academy of Sciences, and an expert on Crabronini. She recognised them as undescribed species in *Podagritus*, but her death in May 2022 prevented her from further action, and describing them fell on me. I subsequently received additional material of *Podagritus* from the Western Australian Museum in Perth. In preparing the descriptions, I relied on Leclercq's, 1998 revision of Australian *Podagritus*, and was able to study 11 Australian species in the California Academy of Sciences collection, determined by either Helen K. Court or Jean Leclercq. Two characters used were not previously observed in the genus: 1. the sparsely punctate female orbital fovea, and 2. the shape of the median sulcus on the propodeal posterior surface.

Institutional Abbreviations

CAS: California Academy of Sciences, San Francisco, California, USA.; WAM: Western Australian Museum, Perth, Australia.

Morphological terms

I follow Bohart and Menke (1976) in their use of morphological terms, but the term humeral plate may be unfamiliar. It is a small, triangular sclerite between the tegula and the anterior part of the forewing base (Fig. 5); it was called posttegula by Bohart, 1969. The length of tergum I below is measured from the apex of the tergo–propodeal ligament.

Description of the New Species

The specimens examined are clearly *Podagritus:* the shape of their prepectus leaves no doubt about their generic association and the characters of the subgenus *Echuca* (as defined above) are clearly visible. Other characters shared by both species are the following: recurrent vein joining submarginal cell markedly beyond cell's midlength (proximal portion of cell's posterior margin markedly longer than distal portion); ventral end of occipital carina effaced; mandible black, bidentate apically; pronotal collar neither carinate nor striate, rounded laterally (not dentate), its posteromedian incision about half of collar length (longer in some *P. stuartae)*; scutum uniformly punctate, without fine longitudinal ridges adjacent to posterior border; propodeal enclosure not delimited, at most minimally alutaceus, shiny (except a foveolate row adjacent to foremargin); hindcoxa without dorsolateral carina; terga I–III ferruginous (tergum I black basally in *P. stuartae*). Female foretibia with two thin, evanescent spines in *P. apivorus*, without spines in *P. stuartae*; forebasitarsus with four rake spines; lateral carina of pygidial plate evenly curved in lateral view (Fig. 9). Male hindtibia conspicuously clavate.

***Podagritus apivorus* Pulawski, sp. n.**

(Figs 1–10)

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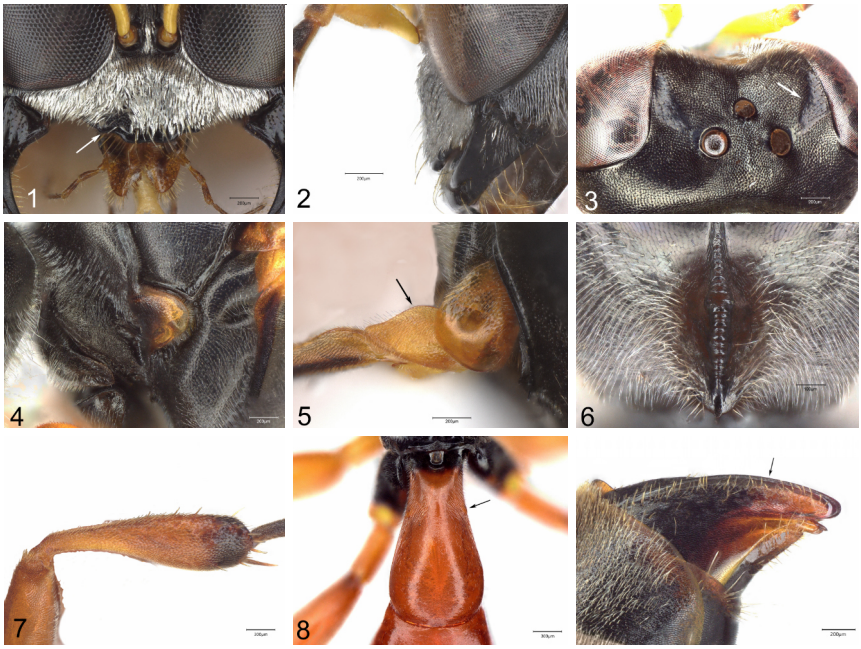
Origin of name.—*Apivorus* is a combination of *apis* (stem: *ap*-), Latin for bee, and the Latin adjective *vorus,* meaning *eating, devouring*, based on this species' habit of using bees as food for its larvae.



Figs 1–9. *Podagritus apivorus* **sp. n.** female: (1) clypeus in front view; arrow shows lateral tooth of middle clypeal lobe; (2) clypeus in profile; (3) head in dorsal, slightly oblique view; arrow shows orbital fovea; (4) pronotal lobe; (5) tegula and humeral plate; arrow shows humeral plate; (6) posterior surface of propodeum; (7) hindtibia; (8) tergum I in dorsal view; arrow shows location of spiracle; (9) tergum VI in profile; arrow shows lateral margin of pygidial plate.

Inclusion into Leclercq's key of 1998.—*Podagritus apivorus* runs to couplet 15, and fits all the characters leading to couplet 16, with the restriction that the female clypeus in profile is slightly convex basally (Fig. 2), as in *P. myrmosus* Leclercq. It comes to an impasse in couplet 17: the clypeal free margin is black (and not ferruginous), but not emarginate (Fig. 1).

Recognition.—*Podagritus apivorus* can be recognised by the following: tergum I relatively stout (Fig. 8), its length 1.6–2.0 × its greatest width in female, 2.0–2.5 × in male; clypeal free margin black and not emarginate mesally (Fig. 1); pronotal lobe mostly black, brown along posterior margin (Fig. 4), all black in some males; humeral plate light brown (Fig. 5); median sulcus on posterior propodeal surface broad, without lateral carina (Fig. 6). In the female, the orbital fovea is minutely, sparsely punctate, punctures sparser than on the adjacent vertex (Fig. 3), the lateral carina of the pygidial plate is evenly curved in the lateral view (Fig. 9), and the trochanters, femora, tibiae and tarsi are yellowish reddish to ferruginous (hindtibial apex in most specimens and hindbasitarsus dark brown). In the male, hindtarsomere I is black, while tarsomere V is pale yellow or light brown.

Description (see also the last paragraph of the Introduction).—Clypeus in profile minimally convex basally (Fig. 2); free margin of middle lobe (Fig. 1) with central part (slightly convex to minimally concave) flanked on each side by shallow concavity (as wide as diameter of antennal socket) and obtuse tooth. Mesopleural punctures fine, dense, averaging 1–2 puncture diameters apart in female, about two diameters in male. Propodeal enclosure minimally alutaceus, asetose, with smooth median sulcus; median sulcus of posterior surface broad, without lateral carina.

Head (including clypeus and mandible), thorax, and propodeum all black except pronotal lobe brown along posterior margin (all black in some males). Scape lemon yellow, pedicel yellow, black dorsally; flagellum mostly black, flagellomeres I–IV in female, I–VI to I–IX in male, light brown ventrally. Tegula and humeral plates ferruginous. Gastral segments I–III in female, I–IV in male, ferruginous up to gastro–propodeal ligament, remainder black. Legs: see below.

Female.—Orbital fovea minutely, sparsely punctate, punctures sparser than on adjacent areas, markedly so in most specimens (Fig. 3). Flagellomere I 1.8 × as long as wide apically, flagellomere II 2.0 × as long as wide apically. Forebasitarsus with five or six rake spines. Hindtibia slightly clavate (Fig, 7). Tergum I moderately swollen in distal half (Fig. 8), its length 1.6–2.0 × its greatest width; its spiracles located at about 0.3 of its length. Body length 8.8–10.0 mm. Trochanters, femora, tibiae and tarsi yellowish reddish except hindfemur and hindtibia ferruginous; hindtibial apex in most specimens and hindbasitarsus dark brown; apical tarsomeres yellow.

Male.—Flagellomeres I and II 1.3 × as long as wide apically; flagellomere II conspicuously convex ventrally in some specimens, cylindrical in others; flagellomeres III–IX about as wide as long, slightly shorter than long toward apex. Length of tergum I 2.0–2.5 × its greatest width. Body length 6.0–10.0 mm. Fore and mid legs yellow; hindcoxa black, hindtrochanter yellow, hindfemur varying from nearly all black (yellowish ventrally) to nearly all ferruginous (black dorsoapically), hindtibia predominantly black, yellow in basal third to almost half (yellow extending narrowly on venter to at least tibia's midlength, to apex in some specimens); hindtarsomere I black, remaining tarsomeres pale yellow.

Geographic Range.—South-western part of Western Australia (Fig. 10).

Flight Period.—The adults are active in July, August, and September, i.e., during the Australian winter and early spring.

Material Examined.—Holotype ♀, Western Australia: Yanchep National Park (northern boundary) at -31.5063° 115.6811°, 13 Aug 2021, T.F. Houston (WAM). *Paratypes* (all collected by T.F. Houston unless indicated otherwise, all deposited in WAM except as indicated): Dartmoor–Harris road at -28.0067° 115.1732°, 4 Sept 2017, J. and F. Hort (1 ♀); Geraldton–Mount Magnet road 35 km west of Yalgoo at -28.3797° 116.3281°, 31 July 2019 (2 ♀); Karroun Hill Nature Reserve at -30.076° 117.83°, 12 Aug 2022 (1 ♀); 6.8 km south of Mullewa at -28.6008° 116.6018°, 29 July 2019 (1 ♀); 13 km south of Wannoo at 26°49'S 114°37'E, 30 July 1985 (3 ♀), 21–23 Aug 1985 (1 ♀); same data as holotype (2 ♀,

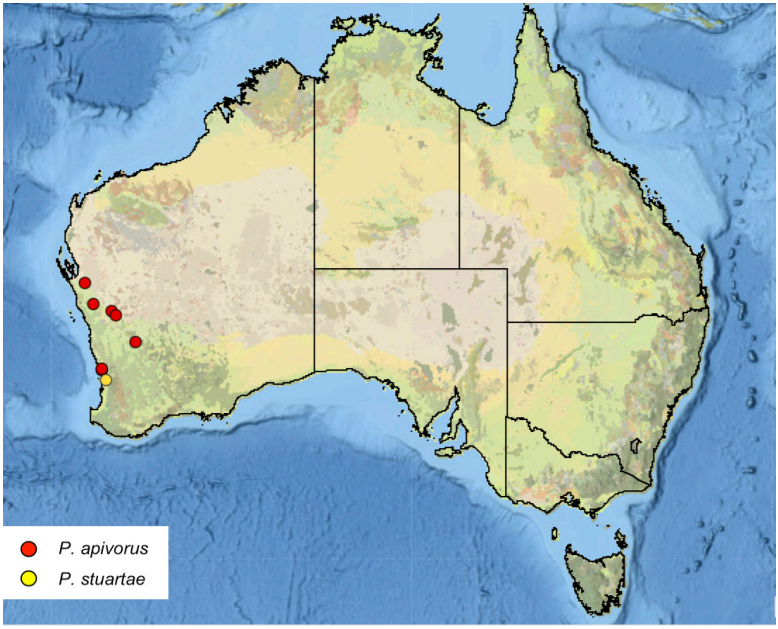


Fig. 10. Collecting localities of *Podagritus apivorus* **sp. n.** and *P. stuartae* **sp. n.**

CAS; 3 ♀, 1 ♂), 6 Aug 2021 (2 ♀, CAS; 2 ♀), 19 July 2022 (4 ♂, CAS; 5 ♂); Yanchep National Park (NE section) at 31°30'22"–32'21"S 115°42'E, 22 Aug 2013, T.F. Houston and E.G. Cunningham (1 ♀), same locality, 6 Sept 2013 (1 ♀); Yanchep National Park on Yeale Swamp road at 31°32'36"S 115°41'47"E, 24 July 2020 (3 ♀).

Podagritus stuartae Pulawski, sp. n.

(Figs 10–17)

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Origin of name.—This species is named in honor of Mrs Kerry Stuart of Perth, Australia, who first observed these wasps carrying paralyzed bees to their nest burrows.

Inclusion into Leclercq's key of 1998.—*Podagritus stuartae* easily runs to couplet 15. Most of its characters lead to couplet 16: gastral tergum I is less than 3.0 × as long as its maximum width in most specimens and slightly shorter than the hindfemur, the lateral carina of the female pygidial plate is visibly curved in profile (as in Fig. 9), and hindtarsomeres II–IV are whitish (Fig. 16). The clypeus, however, is slightly convex only basally in profile (exactly as in Fig. 2), rather than evenly convex, preventing the acceptance of couplet 16.

Recognition.—*Podagritus stuartae* is one of the species with hindtarsomeres I and V black (hindtarsomere V narrowly yellow basally), and hindtarsomeres II–IV contrastingly pale yellow in both sexes (Fig. 16). It can be recognised by the

Figs 11–17. *Podagritus stuartae* **sp. n.** female: (11) clypeus in front view; arrow shows lateral tooth of middle clypeal lobe; (12) pronotal lobe; (13) tegula and humeral plate; arrow shows humeral plate; (14) propodeum posterior surface in lateral oblique view; arrow shows lateral carina; (15) hindtibia; (16) hindtarsus; (17) tergum I.

following: tergum I relatively stout (Fig. 17), its length 2.1–3.1 × its greatest width in female, 2.1–2.8 × in male; clypeus all black, free margin of clypeal lobe shallowly emarginate mesally in female (Fig. 11), truncate in male; flagellomere II cylindrical, 1.2–1.5 × as long as wide apically; pronotal lobe pale yellow; median sulcus on posterior propodeal surface narrow, bordered with lateral carina in ventral half (Fig. 14), carinae practically parallel; hindfemur all black, hindtibia clavate (Fig. 15); gastral terga I–III and base of tergum IV ferruginous (tergum I black basally, Fig. 17). In the female, lateral carina of pygidial plate is evenly curved in lateral view (as in Fig. 9).

Description (see also the last paragraph of the Introduction).—Clypeus in profile minimally convex basally (as in Fig. 2); free margin with central part (which is shallowly emarginate mesally in female (Fig.11), truncate in male) flanked on each side by concavity (which is as wide as about twice diameter of antennal socket) and obtuse tooth; orbital fovea finely, densely punctate, like surrounding area. Mesopleuron finely, densely punctate, punctures averaging about two diameters apart. Propodeal enclosure fully unsculptured, asetose, with finely crenulate median sulcus; median sulcus on posterior surface narrow, bordered laterally by carina in ventral half (Fig. 14).

Head black, including clypeus and mandible; scape yellow, pedicel black dorsally, brown ventrally; basal flagellomeres (also median ones in female) brown apicoventrally. Thorax and propodeum black, pronotal lobe pale yellow (Fig. 12). Tegula brown, humeral plate black (Fig. 13). Fore– and midcoxae yellow, hindcoxa yellow ventrally, black dorsally (except apex). Fore– and midtrochanters and femora yellow, femora narrowly black or brown dorsally, also midfemur ventrally in some males; hindtrochanter black, yellow ventrally; hindfemur all black; foretibia and foretarsus yellow, apical foretarsomere light brown in female; midtibia and midtarsus yellow, but tibia brown or black in apical half or nearly so (only dorsally in female) and apical tarsomere black dorsally except yellow basally; hindtibia black, yellow in basal third or quarter (longer ventrally); hindtarsomeres I and V black (tarsomere V narrowly yellow basally), hindtarsomeres II–IV pale yellow (Fig. 16). Gastral terga I–III and base of tergum IV ferruginous (tergum I black on basal one quarter in female, one quarter to one–half in male), remainder black.

Female.—Flagellomere I 1.1–1.3 × as long as wide apically, flagellomere II 1.2–1.4 × as long as wide apically. Forebasitarsus with four or five rake spines. Hindtibia clavate (Fig. 15). Tergum I moderately swollen in posterior half (Fig. 17), 2.1–3.1 × as long as its greatest width; spiracles located at about 0.4 of its length. Body length 7.8–8.5 mm.

Male.—Flagellomere I 0.9–1.2 × as long as wide apically, flagellomere II cylindrical, 1.2–1.5 × as long as wide apically (flagellomere II longer than I); flagellomeres III–IX shorter than wide. Length of tergum I 2.1–2.8 × its greatest width. Body length 5.6–7.0 mm.

Geographic Range.—Known only from the type locality in Western Australia (Fig. 10).

Flight Period.—The adults are active in September, i.e., during the early spring in Australia.

Material Examined.—Holotype ♀, Western Australia: Creyk Park in Kelmscott (a south-eastern suburb of Perth) at -32.132° 116.015°, 7 Sept 2021, K. Stuart (WAM). *Paratypes*: same data as holotype (1 ♀, WAM); same data as holotype except 4 and 13–18 Sept 2021 (2 ♂, WAM), 4 Sept 2022 (3 ♂, WAM), 7 Sept 2022 (1 ♂, CAS; 2 ♂, WAM), 8 Sept 2022 (1 ♀, WAM), 10 Sept 2022 (3 ♀, 2 ♂, CAS; 2 ♀, WAM).

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