The Australian Ant Genus *Froggattella* Forel (Hymenoptera: Formicidae) Revisited

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ABSTRACT The dolichoderine ant genus *Froggattella* Forel is revised. The genus contains two species, *F. kirbii* (Lowne) and *F. latispina* Wheeler. *Froggattella kirbii* is widely distributed in sclerophyll woodlands of Australia while *F. latispina* is known from only two localities in South Australia. The subspecies *F. kirbii bispinosa* Forel, *F. k. ianthiana* Wheeler, *F. k. laticeps* Wheeler, *F. k. lutescens* Wheeler and *F. k. nigripes* Wheeler are newly synonymised under *F. kirbii*.

Introduction

Froggattella was established by Forel (1902) for the species *Acantholepis kirbii* Lowne (1865) and the newly described *F. kirbii bispinosa* Forel. Earlier, *A. kirbii* had been transferred to *Hypoclinea* by Mayr (1870) and then to the related genus *Dolichoderus* by Dalla Torre (1893). The placement of these species in a distinct genus, as suggested by Forel (1902), was followed by Wheeler (1936) during his species-level revision of the group, and by Shattuck (1992) as part of a generic-level reevaluation of the subfamily Dolichoderinae.

Although fairly common in Australia, these ants have received limited discussion in the literature. They were examined by Wheeler (1936), who established four new subspecies of *F. kirbii* and the species *F. latispina* Wheeler. He also provided an overview of their biology as known at that time. More recently, Wheeler and Wheeler (1951, 1966) examined the larvae, and Shattuck discussed the relationship of *Froggattella* to *Turneria* (Shattuck 1990) as well as the placement of *Froggattella* within the Dolichoderinae (Shattuck 1995). More detailed studies have not been undertaken and available information is limited primarily to that found on specimens in collections.

Here, I reduce the number of species and subspecies in *Froggattella* from the seven recognised by Wheeler (1936) to two. While this reduction is rather drastic, no justification could be found for retaining any of the subspecies previously established by Forel and Wheeler. This decrease is based on several factors. First, the amount of material available to earlier workers has been relatively small, with Wheeler (1936) limited to specimens from only about 12 localities. Because of this, four of his subspecies were based on single collections and one subspecies on two specimens collected at the same locality 2 d apart. Second, *Froggattella* is widespread in Australia (Fig. 5). This seems to have led to the conclusion that distinct forms occur in different regions even though morphological differentiation is slight. Third, several of the taxa established by Wheeler (1936) were stated as being based on only slight differences from other forms. For example, the subspecies *F. k. nigriceps* was said to be "very similar to the typical *kirbyi*", *F. k. ianthina* was "closely resembling the two preceding forms [*kirbii* and *nigripes*]", and *F. k. lutescens* was reported as "structurally very similar to the subsp. *bispinosa*". In the case of *ianthina*, Wheeler stated that one of the two specimens this form was based on "seems to be transitional to the typical *kirbyi*". Additionally, *F. k. lutescens* was established using part of Forel's (1902) original type series of *F. k. bispinosa* which had been retained in Australia. Wheeler's concept of Forel's *bispinosa* was based solely on its original description and not the actual types in Forel's collection. Thus Wheeler apparently accepted a much lower level of intraspecific variation than that permitted by Forel. These factors resulted in the establishment of numerous forms which can no longer be justified based on currently available material.

The placement of *Froggattella* within the Dolichoderinae was examined by Shattuck (1990, 1995). In the first of these studies *Froggattella* was found to be most closely related to *Turneria*. The more recent study examined the entire subfamily Dolichoderinae and again placed *Froggattella* closest to *Turneria*. In addition, these genera were grouped together with *Iridomyrmex*, *Ochetellus*, *Papyrius* and *Philidris* in an informal group, the *Iridomyrmex* genus-group. All of these genera are found in the Indo-Australian region and their close relationship is supported by several unique morphological characters.

Diagnosis of *Froggattella*

Froggattella is a member of the subfamily Dolichoderinae. It can be diagnosed within the subfamily by the presence of elongate, flattened, posteriorly-directed spines on the propodeum (Fig. 1) and the propodeal spiracles being dorsal and posterior and located on the propodeal spines between ⅓ and ½ spine length distal of their bases (Fig. 2).

This genus is immediately recognisable by the unique configuration of the propodeal spines and the placement of the propodeal spiracles. The

only other dolichoderine genus with similar placement of the propodeal spiracles is *Turneria*, but here the propodeum lacks spines, the spiracles are located on the propodeum proper and the petiolar node is only weakly inclined anteriorly and with distinct anterior and posterior faces (Shattuck 1990). In *Froggattella* the petiolar node is strongly inclined anteriorly and the anterior face is short (Figs 1, 2). For additional characters differing between *Froggattella* and *Turneria*, including those of queens and males, see Shattuck (1992).

In addition to the above diagnostic characters, the two species of *Froggattella* presently known share the following characters: head, mesosoma and petiole red and legs similar in colour but slightly darker, gaster reddish black; sculpturing on head, pronotum and petiole absent to weakly developed (but see Diagnosis of *F. latispina* below), that on mesothorax and propodeum much heavier and in the form of longitudinal rugae superimposed over weak to moderate punctations; erect or suberect hairs present on all body segments (including head, scapes, mesosoma, legs, petiole and gaster).

Methods and abbreviations

Size and shape characters were quantified and are reported as lengths or indices. Measurements were made with a stereo microscope using a dual-axis stage micrometer wired to digital readouts. All measurements were recorded in thousandths of millimetres, but are expressed here to the nearest hundredth. All head measurements (EL, EW, HL, HW) were taken in full-face (dorsal) view without moving the head between measurements. Longitudinal mesosomal length measurements (PnL, ML, PpL) were taken in lateral view, parallel to a line ("measuring axis") drawn between the anterior-most point of the pronotal collar and the posterior-most point of the propodeal process dorsal of the petiolar insertion.

Characters. CI, cephalic index: HW/HL; EL, maximum eye length measured in full face view; EW, maximum eye width measured in full face view; HL, maximum head length in full face view, measured from the anterior-most point of the clypeal margin to the midpoint of a line drawn across the posterior margin of the head; HTL, maximum length of hind tibia, excluding the proximal part of the articulation which is received into the distal end of the hind femur; HW, Maximum head width in full face view, excluding eyes; ML, mesonotal length measured from the pronotal-mesonotal suture to the metanotal groove parallel to the measuring axis (see also above); PnL, pronotal length measured from the anterior edge of the pronotal collar to the pronotal-mesonotal suture parallel to the measuring axis (see also above); PpL, propodeal length measured from the metanotal groove to the posterior-most point of the petiolar insertion parallel to the measuring axis (see also above); SI, scape index: SL/HW; SL, length of the scape (first antennal segment) excluding the basal radicle.

Collectors. BBL, B. B. Lowery; JC, J. Clark; PJMG, P. J. M. Greenslade; PSW, P. S. Ward; RWT, R. W. Taylor; SOS, S. O. Shattuck; TG, T. Greaves; WMW, W. M. Wheeler.

Collections. ANIC, Australian National Insect Collection, Canberra, A.C.T.; BMNH, The Natural History Museum, London, U.K.; MCZC, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.; MHNG, Muséum d'Histoire Naturelle, Geneva, Switzerland; MVMA, Museum of Victoria, Abbotsford, Victoria; NHMB, Naturhistorisches Museum, Basel, Switzerland; USNM, United States National Museum, Washington, D.C., U.S.A.

Key to species of *Froggattella* (workers)

1. Sculpturing weakly developed and uniform over entire upper surface of head; rugae on

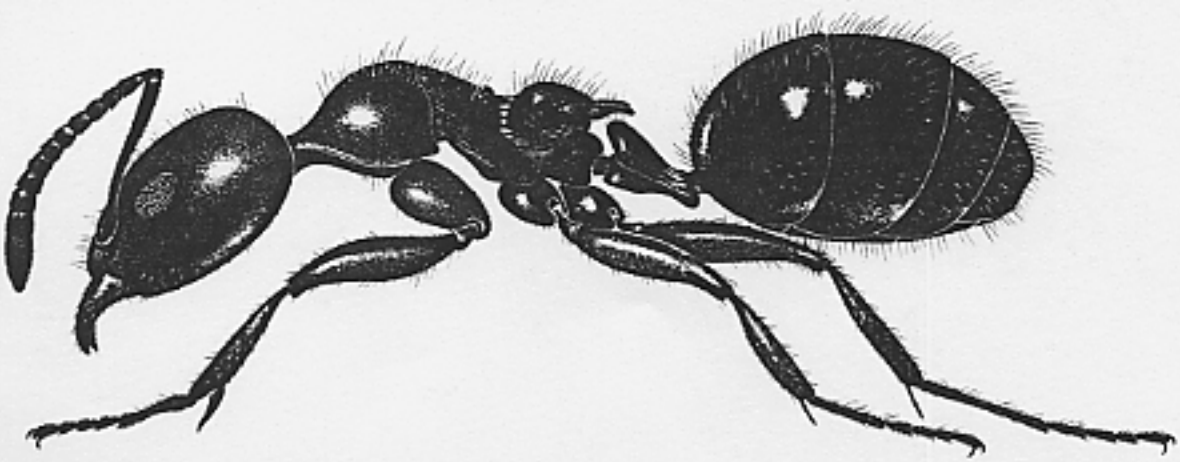
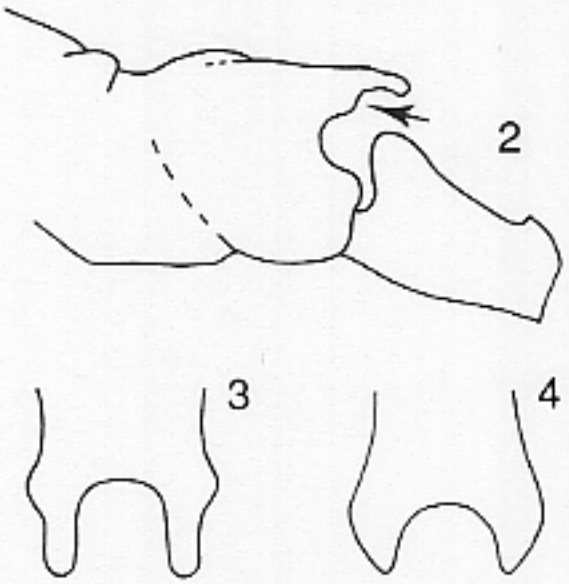


Fig. 1. Lateral view of *F. kirbii* (drawn by R. J. Kohout).

mesopleuron well developed and not interrupted by underlying punctate or reticulate sculpturing; posterior region of the propodeal spines in dorsal view with their outer surfaces concave (Fig. 3)..... ..... **F. kirbii** (Lowne)

Sculpturing on upper surface of head smooth or very weakly leather-like posteriorly (above the level of the eyes) and very finely striate anteriorly (especially between the frontal carinae), so that there is a noticeable difference in the development of sculpturing between posterior and anterior regions; rugae on mesopleuron weakly developed and interrupted by underlying punctations or reticulations; posterior region of the propodeal spines in dorsal view with their outer surfaces flat or convex (Fig. 4)..... ..... **F. latispina** Wheeler



Figs 2-4. (**2**) lateral view of propodeum of *F. kirbii* showing placement of propodeal spiracle; (**3**) propodeum of *F. kirbii* in dorsal view; (**4**) propodeum of *F. latispina* in dorsal view.

Froggattella kirbii (Lowne)
(Figs 1-3, 5)

Acantholepis kirbii Lowne, 1865: 333.
Hypoclinea kirbii: Mayr, 1870: 956.
Hypoclinea kirbyi: Mayr, 1876: 80.
Dolichoderus kirbyi: Dalla Torre, 1893: 159.
Froggattella kirbyi: Forel, 1902: 459.
Froggattella kirbyi bispinosa Forel, 1902: 460. **Syn. nov.**
Froggatella [sic] *kirbyi ianthina* Wheeler, 1936: 8. **Syn. nov.**
Froggattella kirbyi lasiceps Wheeler, 1936: 10. **Syn. nov.**
Froggattella kirbyi lutescens Wheeler, 1936: 9. **Syn. nov.**
Froggatella [sic] *kirbyi nigripes* Wheeler, 1936: 8. **Syn. nov.**

Types. *Acantholepis kirbii* Lowne: **New South Wales:** Sydney, 3 worker syntypes without locality data in BMNH.

Froggattella kirbyi bispinosa Forel: **New South Wales:** Oatley, 5 worker syntypes in NHMB (Baroni Urbani 1977: 74) (not examined); Sydney, 3 worker syntypes in MCZC, 2 worker syntypes in ANIC, 7 worker syntypes in MVMA; **Australia:** specific locality not given, 2 worker syntypes in USNM; additional material without locality data, 6 worker syntypes in ANIC, 2 worker syntypes in BMNH; 60 additional worker syntypes in MHNG.

Froggatella [sic] *kirbyi* subsp. *ianthina* Wheeler: **Queensland:** near Brisbane, holotype worker (collected 12 Nov., 1914) and 1 worker paratype (collected 10 Nov., 1914) in MCZC.

Froggattella kirbyi subsp. *lasiceps* Wheeler: **South Australia:** Lucindale, 42 worker syntypes (1 missing head) in MCZC.

Froggattella kirbyi subsp. *lutescens* Wheeler: **New South Wales:** near Sydney, 7 worker syntypes (Wheeler 1936: 9) in MCZC.

Froggatella [sic] *kirbyi* subsp. *nigripes* Wheeler: **Queensland:** Coen, Cape York Peninsula, 13 worker syntypes (Wheeler 1936: 8); 11 workers in MCZC, 2 workers in USNM.

Other material examined (in ANIC unless otherwise stated). **State Uncertain:** Lindfield (Nicholson). **New South Wales:** 10 km W Temora, 34°28'S 147°39'E (SOS); 1 km S Bateau Bay Faunal Reserve (BBL); 23 mi (= 36.8 km) W West Wyalong (BBL); 30 km N Coonabarabran (BBL); Asquith (H. P. Schrader) (MCZC); Berowra [as Berowa], N Sydney (RWT); Brookvale (TG); Burns Bay on Lane Cove River, Sydney (BBL); Burns Bay, Lane Cove, Sydney (BBL); Como, nr. Sydney (A. Musgrave); Epping (WMW) (MCZC); French's Forest, Sydney (BBL); Galston Gorge, nr. Hornsby, 33°40'S 122°27'E (TG); Gilgai, 4 mi (= 6.4 km) E Inverell (BBL); Glenfield Vet. Res. Stn, Liverpool (collector unknown); Gordon, 33°46'S 151°09'E (PSW); Gordon, Sydney, 33°46'S 151°09'E (PSW); Gravel Pit Creek, Kaputar, Narrabri (P. M. Room); Grotto Point, Clontarf (BBL); Gwandalan, nr. Swansea (BBL); Home Rule (collector unknown); Hornsby (WMW) (MCZC); Ingalba Nat. Res., W. Temora (BBL); La Perouse (W. M. Mann) (MCZC); Mona Vale (D. Sands); Mt. Wilson, Blue Mts. (BBL); National Park (WMW) (MCZC); Pearl Beach, 33°33'S 151°18'E (PSW); Pymble (J. M. McAreavey); Roseville Chase (BBL); Sutherland [as Southerland] (WMW) (MCZC); Sydney (W. W. Froggatt); Tollway W of Wollongong nr. Picton turnoff (BBL); Woronora (M. L. Bason); hills W of Mudgee (BBL); **Northern Territory:** Bathurst Island (G. F. Hill); Howard Springs, nr. Darwin (BBL); **Queensland:** 16 km S Mareeba, 17°09'S 145°26'E (PSW); 18 km W Paluma (BBL); 40 km S Mt. Garnet (BBL); 8 mi (= 12.8 km) W Ravenshoe (A.H.W.); Atherton (collector unknown; BBL); Atherton Road, Mareeba (BBL); Callide Dam, Biloela (BBL); Conjuboy Creek, E Einasleigh (BBL); Davies Creek Road, Atherton Tableland (P. F. Darlington) (MCZC); Emu Creek, Mareeba (BBL); Hidden Valley, 18°59'S 146°01'E (RWT); Meadowbank (collector unknown); Millstream Nat. Pk., nr. Ravenshoe (BBL); Milmerran (J. McQueen); Mossman (M. Geeves); Mt. Garnet (TG); Mt. Molloy (BBL); Ravenshoe (C. Davis); Stanthorpe (BBL); W of Ravenshoe, Atherton Tableland (Darlingtons) (MCZC); Wandoan (BBL); ca. 5 mi (= 8 km) W Ravenshoe (P. F. Darlington) (MCZC); ca. 8 km SW Mt. Garnet (RWT & J. Feehan); nr. Atherton (RWT); **South Australia:** Belair (PJMG); Ceduna (BBL); Coonalpyn, 45 mi (= 72 km) S Tailem Bend (BBL); Coorong-Keith, 5 km SSE Bunbury (PJMG); Lucindale (B. A. Feuerheerdt) (MCZC); Oraparinna, Flinders Ranges (PJMG); Peake, 30 mi (= 48 km) E Tailem Bend (BBL); Port Lincoln (JC); Sutherlands, nr. Eudunda (BBL); Yudnamutana, NE Flinders (BBL); **Victoria:** Greensborough (J. McAreavey); Inglewood (F. E. Wilson) (MCZC); **Western Australia:** 1.5 km W King Edward River crossing, 14°53'34"S 126°12'04"E (SOS); 10 mi (= 16 km) SE Karonie (RWT); 23 km E by N Dongara, 29°12'S 115°10'E (I. D. Naumann & J. C. Cardale); 23 mi (= 36.8 km) W Fraser Range HS, 32°04'S 122°24'E (RWT); 27 mi (= 43.2 km) N Mt. Ragged, 33°03'S 123°27'E (RWT); 29 mi (= 46.4 km) NW by N Fraser Range, HS, 31°41'S 122°30'E (RWT); 2 mi (= 3.2 km) NNW Widgiemooltha (RWT); 36 mi (= 57.6 km) SE by E Zanthus, 31°29'S 123°53'E (RWT); 4 mi (= 6.4 km) S Ravensthorpe (BBL); 9 mi (= 14.4 km) W Zanthus (RWT); Balladonia (BBL); Norseman (BBL); Tammin (JC); nr. Kalumburu (< 5 mi (= 8 km)), Kimberley area (W. Leutert).

Worker diagnosis. Sculpturing weakly developed and uniform over the entire upper surface of the head, varying only slightly between the anterior and posterior regions; rugae on the mesopleuron well developed and superimposed on top of the underlying sculpturing, individual rugae are more or less straight and are not influenced by the underlying punctations or reticulations; posterior region of the propodeal spines in dorsal view with their outer surfaces concave (Fig. 3).

Measurements. *Worker* (n = 11): CI 0.91-0.96; EL 0.15-0.22; EW 0.09-0.12; HL 0.69-0.95; HTL 0.55-0.75; HW 0.66-0.91; ML 0.26-0.39; PnL 0.41-0.63; PpL 0.30-0.47; SI 0.71-0.76; SL 0.46-0.65.

Comments. As conceived here, *F. kirbii* shows considerable variation in size. Although this variation occurs primarily between nest series (i.e. all members of a given nest series are similar in size), it is continuous between the smallest and largest and occurs throughout the range of the species. Thus while this variation appears to have a genetic component, its variability and presence in all populations of *F. kirbii* suggests that only a single species is involved. In addition, no evidence could be found to suggest that more than one species is present as all specimens share an overall similarity in most morphological characters, including sculpturing, colour, pilosity and general habitus (including the shape of the head, mesosoma and petiole).

Collections of *F. kirbii* are from drier sclerophyll woodland areas (including mallee), and it is not known from wet sclerophyll woodlands or rain forests. Specimens are most often encountered as foragers on tree trunks or low vegetation although they commonly forage on the ground. All known nests have been found in rotten wood above the ground, usually in a stump or dead branch on a living tree.

Biogeographically, *F. kirbii* occurs in four distinct, disjunct regions: (i) south-eastern Australia; (ii) south-western Western Australia; (iii) coastal northern Queensland; and (iv) the Darwin and Kimberley regions (Fig. 5). Its absence from the areas between south-eastern Australia and south-western Western Australia (the Nullarbor Plain), and between northern Queensland and the Darwin region (the Gulf Country) is not unexpected. These intermediate areas have significantly different climates and vegetation types than the neighbouring regions and thus may not provide suitable habitat for *Froggattella*. Additionally, several other ant genera show similar distribution patterns in these areas, including *Acropyga*, *Anochetus*, *Hypoponera*, *Podomyrma* and *Solenopsis*.

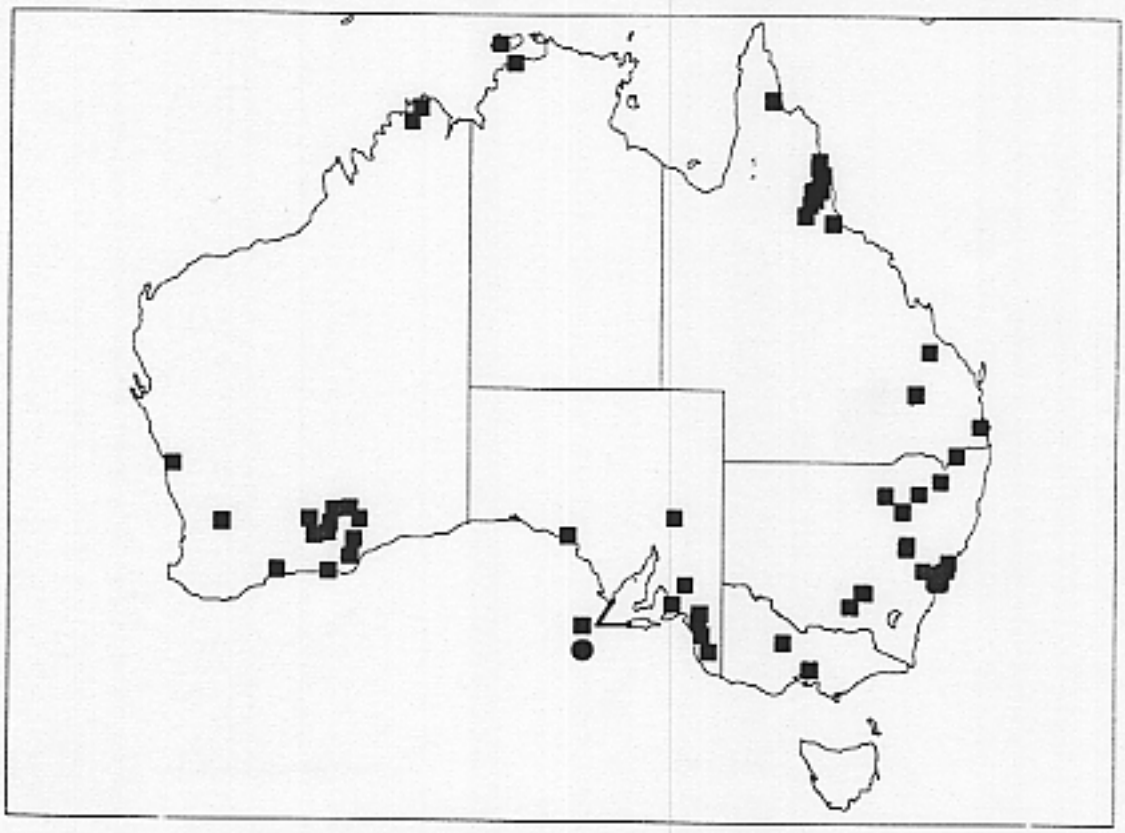


Fig. 5. Distribution of *Froggattella* specimens examined during this study (squares = *F. kirbii*, circles = *F. latispina*).

The remaining disjunction, between northern and southern coastal Queensland, is also shared with numerous other ant taxa, including *Cryptopone*, *Discothyrea*, *Epopostruma*, *Heteroponera*, *Lordomyrma*, *Metapone*, *Myopias*, *Myrmecina*, *Notostigma*, *Oligomyrmex*, *Prionopelta* and *Pristomyrmex*. The apparent cause for the absence (or scarcity) of *F. kirbii* between approximately Townsville and Rockhampton is apparently climatic. This region has a lower annual mean rainfall (< 1,200 mm) and rainfall is more variable than the area occupied by the northern population of *F. kirbii* (> 1,600 mm), and has higher mean temperatures than areas occupied by the south-eastern populations (AUSLIG 1986). Additionally, grasslands make up a much higher proportion of the habitats in this region when compared to areas further north and south where *F. kirbii* is more common (AUSLIG 1990). It seems probable that low, unpredictable rainfall and high temperatures have combined with reduced suitable habitat (woodlands replaced by grasslands) to limit the occurrence of *Froggattella* in this area. At the same time, it is likely that *F. kirbii* (and perhaps other taxa showing a similar pattern) do occur in this region but are limited to small patches of suitable habitat. This seems especially likely for species which occur on both sides of this disjunction, but less likely in genera where distinct species occur across this gap.

Froggattella latispina Wheeler (Figs 2, 4, 5)

Froggattella latispina Wheeler, 1936: 10.
Types. South Australia: Port Lincoln, 10 worker syntypes (Wheeler 1936: 11), 7 in MCZC, 3 in ANIC.

Other material examined (in MCZC). **South Australia:** 1 mi (= 1.6 km) S Ravine des Casoars, Kangaroo Island (W. L. Brown).

Worker diagnosis. Sculpturing on the upper surface of the head smooth or very weakly leather-like posteriorly (above the level of the eyes) and very finely striate anteriorly (especially between the frontal carinae) so that there is a noticeable difference in the development of the sculpturing between the anterior and posterior regions; rugae on mesopleuron are weakly developed and are interrupted by the underlying punctations so that individual rugae are not straight; posterior region of the propodeal spines in dorsal view with their outer surfaces flat or convex (Fig. 4).

Measurements. *Worker* (n = 5): CI 0.86-0.92; EL 0.15-0.16; EW 0.08-0.11; HL 0.65-0.73; HTL 0.40-0.46; HW 0.56-0.67; ML 0.26-0.29; PnL 0.36-0.46; PpL 0.25-0.32; SI 0.67-0.77; SL 0.41-0.47.

Comments. *Froggattella latispina* is currently known from only two collections in South Australia. This area is on the periphery of the known range of the south-eastern Australia population of *F. kirbii* (Fig. 5). The occurrence of a second species of *Froggattella* in this region is consistent with the pattern seen in other ants, where related species occur in close proximity in eastern South Australia. For example, within the *Iridomyrmex purpureus* species group, 4 of the 11 species have distribution patterns involving this region. Specifically, *I. galbanus* Shattuck and *I. spodipilus* Shattuck are limited to this area, and *I. greensladei* Shattuck and *I. purpureus* (Smith) have distributions which extend to but not beyond this area (Shattuck 1993). This would suggest that eastern South Australia may be of significant biogeographic interest, being an area critical to the distribution of numerous species.

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