The Sphecidae (Hymenoptera) of New Zealand

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Abstract

The New Zealand Sphecidae are represented by the subfamilies Sphecinae, Nyssoninae, Larrinae, Crabroninae, and Pemphredoninae. Their relationships lie with Australia, and in the genus *Podagritus* with South America. The sphecid fauna is isolated and restricted and 16 species are discussed. A key is given to the genera and subgenera. The names applied to these wasps are updated and present knowledge of their nesting behaviour and prey is recorded. Most species are endemic, but there are two adventive species of Australian origin. *Pison spinolae* Shuckard was introduced into New Zealand probably in about 1880. *Podalonia tydei suspiciosa* (F. Smith) was evidently established only some 10 years ago. Two species of Crabroninae, which normally provision their nests with flies, are reported to prey occasionally on large geometrid and pyralid moths and on mayflies.

INTRODUCTION

The family Sphecidae is represented in New Zealand by relatively few species, and their relationships lie with Australia and tenuously with South America. In this review an attempt is made to bring together what is known of the nesting behaviour and prey of these wasps, and to update the names applied to them. The appearance of Bohart & Menke's (1976) world revision of the family provided an opportunity to assign correct names to the species. In the Sphecidae 8 major subfamilies are currently recognized, 5 of which – the Sphecinae, Nyssoninae, Larrinae, Crabroninae, and Pemphredoninae – are present in New Zealand. Early catalogues of New Zealand Hymenoptera listed 9 sphecid wasps (Kirby 1881; Hutton 1881), but several species have since been reduced to synonymy and a few new species have been described. Valentine (1967) referred to only 5 sphecids but the present account discusses 16 species.

The composition of the New Zealand sphecid fauna is shown in Table 1, from which it is apparent that it is isolated and restricted. Several subfamilies and tribes are absent and some of those that do occur are represented by only a single genus and species. The Crabroninae is the only subfamily to have been at all thoroughly revised taxonomically and comprises 7 species assigned to the genera *Rhopalum* and *Podagritus*. The majority of New Zealand sphecids are endemic species. Several wide-ranging genera such as *Bembix* and *Cerceris,* which are well represented in Australia, are entirely absent. Although New Zealand has received numerous invading organisms over the years, the fauna has been enriched by only 2 adventive sphecids. A species of *Pison* is a long-standing immigrant, and an introduced *Podalonia* species has recently become established (Faulds 1977). It is noteworthy that many New Zealand sphecids are predominantly black and some are all-black species. *Argogorytes, Tachysphex, Pison,* and the most common species of *Podagritus* are wholly black; *Rhopalum* and other *Podagritus* species are mainly black with limited areas of the body or legs yellow, and in *Podalonia* the basal half of the gaster is orange-red.

The New Zealand sphecids are solitary and most are fossorial wasps nesting in burrows in the ground; others construct mud-cells in protected situations or use the abandoned tunnels of wood-boring beetles. Their prey, which serves as food for the larvae, comprises spiders and an array of insects including cockroaches, plant bugs, thrips, several families of flies, caterpillars, and occasionally moths and mayflies. Varying degrees of prey-specificity are exhibited by different wasps. *Argogorytes* preys on only a single species of spittlebug. By contrast, a *Rhopalum* preys on flies and sometimes on large geometrid and pyralid moths, and a *Podagritus* provisions its nests with numerous species of flies belonging to 5 different families, as well as sometimes preying on mayflies.

Table 1. Composition of the New Zealand sphecid fauna

Subfamilies and tribes	Known from New Zealand	
	Genera and subgenera	Number of species
AMPULICINAE	None	
SPHECINAE		
Sceliphronini	None	
Sphecini	None	
Ammophilini	*Podalonia*	1
ASTATINAE	None	
NYSSONINAE		
Nyssonini	None	
Gorytini	*Argogorytes*	1
Stizini	None	
Bembicini	None	
CRABRONINAE		
Crabronini	*Rhopalum(Aporhopalum)*	1
	Rhopalum(Zelorhopalum)	2
	Podagritus(Parechuca)	4
Oxybelini	None	
LARRINAE		
Trypoxylonini	*Pison*	3
Miscophini	None	
Larrini	None	
Tachytini	*Tachysphex*	1
PEMPHREDONINAE		
Psenini	None	
Pemphredonini	*Spilomena*	2
	Gen. indet.	1
PHILANTHINAE	None	

KEY TO THE NEW ZEALAND GENERA AND SUBGENERA OF SPHECIDAE

1. Inner margin of eyes deeply emarginate ..... **Pison** Jurine
—Inner margin of eyes not emarginate 2

2. Fore wing with 1 submarginal cell 3
—Fore wing with 2 or 3 submarginal cells 5

3. Pygidial plate of female nearly flat, triangular and punctate. Male with well defined pygidial plate ..... **Podagritus** Spinola **(Parechuca)** Leclercq
—Pygidial plate of female bisected by longitudinal carina. Male without pygidial plate ..... **Rhopalum** Kirby

4. In male genitalia parameres less than twice length of aedeagus, valves of which are large and enveloped by delicate membrane. Pygidial plate of female shining and impunctate. **Rhopalum (Aporhopalum)** Leclercq
—In male genitalia parameres more than twice length of aedeagus. Pygidial plate of female dull and punctate ..... **Rhopalum (Zelorhopalum)** Leclercq

5. Fore wing with 2 submarginal cells. Small species ..... **Spilomena** Shuckard
—Fore wing with 3 submarginal cells. Larger species 6

6. Middle tibiae with 1 apical spur ..... **Tachysphex** Kohl
—Middle tibiae with 2 apical spurs 7

7. Basal lobe of hind wing large, extending beyond submedial cell. Abdomen petiolate ..... **Podalonia** Spinola
—Basal lobe of hind wing short, not extending beyond submedial cell. Abdomen not petiolate ..... **Argogorytes** Ashmead

Subfamily SPHECINAE

Until comparatively recently this subfamily was unrecorded in New Zealand. Its sole representative is the lately introduced Australian subspecies of a wide-ranging species of *Podalonia*, which belongs to the tribe Ammophilini.

Podalonia tydei suspiciosa (F. Smith)

Ammophila tydei Le Guillou, 1841:319.
Ammophila suspiciosa F. Smith, 1856:214.
Podalonia tydei subsp. *suspiciosa*: Bohart & Menke, 1976:145.

In *Podalonia* the gaster is petiolate, but the petiole is relatively short and 1-segmented and the body form resembles the Sphecini rather than typical Ammophilini, in which the petiole is long and thin and appears to be 2-segmented. Bohart & Menke (1976) stated that *P. tydei* ranges from the Canary and Madeira Islands through the Mediterranean area, and eastward to China and the Oriental region. The subspecies *suspiciosa* occurs commonly in sandy areas throughout Australia and Tasmania, where it is the only representative of the genus.

In Australia brief biological observations have been made on this wasp (Chandler 1926; Bristowe 1971). It exhibits primitive characteristics in searching for prey before digging a nest, in dragging the prey to the nest instead of carrying it in flight, and in having only one cell at the end of the burrow. Bristowe observed wasps digging in the soil for cutworms (Noctuidae). After locating and digging up the cutworm, the wasp stung it and dragged it to a suitable nesting site, where it was hung up on a convenient plant stem away from the attention of ants. A burrow was dug nearby to which the cutworm was carried and deposited at the entrance. The wasp entered the burrow, turned round within the nest and dragged in the prey, and an egg was presumably laid on it. Finally, Bristowe described how the wasp emerged to fill in the burrow and ram down the earth using a pebble held in the mandibles. This instinctive behaviour is well known in several species of *Ammophila* which nest in compacted soil.

I am indebted to Mr E. W. Valentine for drawing my attention to the recent establishment of *P. tydei suspiciosa* in New Zealand. This Australian sphecid is a comparative newcomer and Mr Valentine informs me (1977, *in litt.*) that this species first came to his notice in January 1975 with specimens collected at Aupori, North Auckland (R. Wallace). Later it was learnt from the Forest Research Institute, Rotorua that wasp populations had been found at Kaituna River mouth (W. Faulds) and Kawhia (C. Scott), and also of a collection made in 1967 at Papamoa (J. Styles). Mr Valentine has kindly placed some of the localities not shown on available maps and tells me that Aupori is the name given to the region at the far northern end of Ninety Mile Beach. The Kaituna River drains from Lake Rotoiti north to the Bay of Plenty and Papamoa is nearby about 8 km SE of Tauranga. Kawhia is on Kawhia Harbour on the west coast.

All the localities in which this wasp has been found are in the northern part of the North Island, where it has evidently been established for over 10 years. Faulds (1977) records the earliest collected specimens and suggests that the most likely hosts are the larvae of *Heliothis armiger* (Hübner), *Agrotis innominata* Hudson, and *Mecyna maorialis* Felder which feed on sand dune lupins in the known habitats of *P. tydei*. This wasp is well suited for experimental studies and detailed observations would be worthwhile, as it occupies a useful niche in preying on cutworms not filled by any other sphecid in New Zealand. It would be interesting also to monitor its spread through the North Island and to the South Island, which I think is probably inevitable.

Subfamily NYSSONINAE

This subfamily comprises several tribes found in most parts of the world, but in New Zealand is represented by only a single species of the primitive genus *Argogorytes,* which belongs to the tribe Gorytini. The gorytines are relatively little-known wasps and are thought to represent the ancestral stock of the Nyssoninae.

Argogorytes carbonarius (F. Smith)

Gorytes carbonarius F. Smith, 1856:366.
Gorytes trichiosoma Cameron, 1888:180.
Argogorytes carbonarius: Ashmead, 1899:324.
Arpactus carbonarius: Tillyard, 1926:299.
Gorytes carbonarius: Valentine, 1967:1145.
Argogorytes carbonarius: Bohart & Menke, 1976:492.

Argogorytes is nearly worldwide in distribution, being absent only from the Ethiopian region, and subgeneric divisions are scarcely justified. *A. carbonarius* is the type-species of the genus as designated by Ashmead (1899), and Bohart & Menke (1976) stated that they have studied a series of the generotype.

Nothing is known of the nesting behaviour of the 4 Australian or single North American species of *Argogorytes,* nor of most of the other species of the genus. However, 2 palaearctic species have been studied in Europe and Japan, where they nest in the ground and prey only on nymphs of spittlebugs (froghoppers) of the genus *Aphrophora* (Aphrophoridae), which they extract from their spittlemasses on vegetation. Most Gorytini provision their nests with Homoptera of various species belonging to one or several families, and I have recorded a neotropical gorytine wasp preying on 6 homopterous families (Callan 1976). According to H. E. Evans (1966), there appears to be little tendency for one genus to restrict itself to one family of prey. In this respect *Argogorytes* is exceptional in that this genus specializes on spittlebug nymphs of the family Aphrophoridae.

A. carbonarius is endemic to New Zealand. Gourlay (1964) reported this species (as *Gorytes*) nesting in the soil of garden beds at Nelson and provisioning its nests with late nymphal spittlebugs, *Carystoterpa fingens* (Walker). Gourlay recorded the prey as *C. trimaculata* (Butler), which J. W. Evans (1966) synonymized with *fingens. Carystoterpa* is an endemic genus, and this species is the more abundant of the 2 Aphrophoridae occurring in New Zealand. Gourlay observed that the immature spittlebugs were feeding nearby on young shoots of Meyer lemon trees, where the wasps located them within their spittlemasses. Multicellular mass-provisioned nests are characteristic of Gorytini, and, although the number of cells leading from one burrow was not recorded, Gourlay reported that up to 3 spittlebug nymphs were placed in each cell, with an egg deposited longitudinally between the developing wing-buds and legs of one of the prey. Adult spittlebugs vary in length from 7–9 mm, and the large size of the late nymphs accounts no doubt for the small number of prey stored per cell. Miller (1971) stated that nymphs of *C. fingens* are captured and stored underground by *A. carbonarius* (as *Gorytes*), presumably merely repeating Gourlay's observations, but mentioned in error that flies are also captured.

Gourlay's observations confirm the high degree of prey specificity exhibited by the two species of *Argogorytes* studied in the northern hemisphere. In view of our limited knowledge of the ethology of these wasps, it would be interesting to learn more of the nesting behaviour of the New Zealand species. Observations should be made on how the spittlebug nymphs are removed from the spittlemass and the method of prey carriage, whether the burrows are left open or closed in the absence of the wasp (in this respect reports differ for the same palaearctic species studied in Europe and Japan), the length of the burrows and the number of cells constructed from one burrow, and other matters. *A. carbonarius* would undoubtedly repay further study in New Zealand.

Subfamily LARRINAE

In New Zealand this subfamily is represented by two tribes – Tachytini, with a single species of *Tachysphex,* and Trypoxylonini, with 3 species of *Pison.*

Tachysphex nigerrimus (F. Smith)

Tachytes nigerrimus F. Smith, 1856:302.
Tachytes sericops F. Smith, 1856:302.
Tachytes depressus Saussure, 1867:69.
Astata nigerrimus: White & Butler, 1874:p1.7, fig.14.
Tachytes helmsii Cameron, 1888:182.
Tachysphex nigerrimus: Turner, 1908:491.
Tachysphex nigerrimus: Hudson, 1950:57.
Tachytes nigerimmus [sic]: Valentine, 1967:1146.
Tachysphex nigerrimus: Pulawski, 1975:311; Pulawski, 1977:308.

This species, which Turner (1908) assigned correctly to the genus *Tachysphex,* is endemic to New Zealand. Pulawski (1977) redescribed both sexes, illustrating male and female clypeus, female mandible and pygidial plate, and male hind tibia and genitalia. He included biological data and a map showing its distribution in the North and South Islands, based on over 50 specimens examined.

This is an all-black wasp, 13 mm in length, and nests in sandy soil. That it preys on cockroaches was reported by Hudson (1950), who stated "there is no doubt that *Tachysphex nigerrimus* feeds its larva on cockroaches, storing them in its nest". Hudson mentioned first observing a wasp carrying a cockroach on 18 January 1917 at Picton. Six observations were recorded of this species capturing cockroaches and dragging or carrying them to its nest in December, January, and February of successive years at various places in the North and South Islands.

Gourlay (1964) expressed uncertainty in regard to the generic placement of this species, which he reported (as *Tachytes*) nesting in sandy river beds, where burrows were dug in partly consolidated banks above normal flood level. He stated that it stored for larval food late nymphal stages of the endemic cockroach *Celatoblatta undulivitta* (Walker), which was recorded as *Cutilia truncata* Brunner. Valentine (1967) listed the prey as *Celatoblatta undulvitta* [sic], and Miller (1971) repeated Gourlay's observations. Mr P. M. Johns informs me (1977, *in litt.*) that he has observed wasps taking as prey at least 2 species of cockroaches of the endemic brachypterous genus *Celatoblatta,* one of them being definitely identified as *C. peninsularis* Johns, a species known only from Banks Peninsula in the South Island.

In many parts of the world *Tachysphex* species prey on cockroaches. The cockroach-hunting species belong to the *brullii* species-group (= *bicolor* group), as defined by Pulawski (1971), in which the females have prehensile claws and peculiar asymmetrical last tarsomeres, which may well be adaptations for handling the prey. Cockroach-hunting species also tend to have the body depressed or flattened, an adaptation no doubt for crawling into crevices, under stones, etc., in search of their prey, which also have characteristic dorsoventrally compressed bodies. The *brullii* species-group is widespread and to it belong no less than 32 of the 39 recognized Australian species. Most representatives prey on cockroaches, and such a high proportion of cockroach-hunting species is unknown elsewhere.

Pison spinolae Shuckard

Pison spinolae Shuckard, 1837:76.
Pison australe Saussure, 1853:11.
Pison tasmanicum F. Smith, 1856:316.
Taranga dubium W. F. Kirby, 1883:201.
Pison pruinosum Cameron, 1898:44.
Pison spinolae: Turner, 1916:607; Cowley, 1962:355; Valentine, 1967:1146.

The genus *Pison* belongs to the tribe Trypoxylonini. Most of the species occur in the southern hemisphere, many being found in Australia and on various Pacific Islands, and several have become widely distributed by commerce. Three species occur in New Zealand. *P. spinolae* was described by Shuckard (1837) from Australia where it occurs commonly and in Tasmania. Kirby (1883) described it as a new genus and species when it was first discovered in New Zealand. Kirby's name for the genus was no doubt taken from Taranga Island in Bream Bay, North Island. This Australian wasp was probably introduced in about 1880 into New Zealand. It was not mentioned in early lists (Kirby 1881; Hutton 1881), and it is difficult to understand how so large and conspicuous a species could have been overlooked. Turner (1916) observed "I can find absolutely no difference between Australian and New Zealand specimens, and have no doubt that the species has been imported into the latter country during the last century"

P. spinolae is a mason wasp and is a black species with bands of greyish pubescence on the abdominal segments; the female is 13–15 mm and the male 10 mm in length. It is one of the best known solitary wasps in New Zealand, being familiar to householders because of its propensity for building its mud nests in protected situations in houses and outbuildings. Its presence is often disclosed by the loud high-pitched buzzing sound produced by the female while building the nest or storing prey. This phenomenon is well known in mud-dauber wasps *(Sceliphron)*, which do not occur in New Zealand, but the source and possible function of the sound are unknown. The nests comprise few to many mud cells with fragile walls, built often behind doors and under shelves or more frequently in pre-existing cavities of all sorts, the size of the space available determining the number of cells that can be constructed. Spiders of the family Argiopidae are stored as food for the developing larva, 5–10 or more spiders, depending on their size, being crammed tightly into each cell. A comparatively large egg measuring 2.5 × 0.5 mm is attached to the opisthosoma of the last and often the largest spider stored.

Tillyard (1926) referred briefly to this species, and Miller (1971) described its nesting behaviour, mentioning a large nest which took 3 months to complete and contained 20 cells, but stating erroneously that "one or two spiders are placed in a cell and an egg laid on each of them". Sharell (1971) illustrated the wasp, its nest, spider prey with attached wasp egg, and in colour an exceptionally large nest between two glass panes in which some 27 cocoons are visible.

Cowley (1962) discussed the biology of *P. spinolae* with special reference to the immature stages, and recorded 8 named species of argiopid spiders as prey. He found that in New Zealand the life-cycle is bivoltine, every second generation overwintering for 6 or more months by going into diapause at the onset of the prepupal period. Cowley reported that there were 6 larval instars, and that the larval period from hatching until cocoon completion varied from 11–17 days. Male cocoons ranged from 11.5–14 mm and female cocoons from 14–17 mm in length, indicating that size differences are present at least in the 6th larval instar.

Wasps of the genus *Pison* are attacked by several hymenopterous parasites and I reported the rhipiphorid beetle *Macrosiagon diversiceps* (Blackburn) as a parasite of *P. spinolae* in Australia (Callan 1977). In New Zealand Cumber (1953) recorded from *P. spinolae* the almost cosmopolitan gregarious eulophid parasite *Melittobia hawaiiensis* Perkins (as *M. clavicornis* (Cameron), a species originally described from Borneo). Cowley (1961) discussed mite and other associates of *P. spinolae,* but found *M. hawaiiensis* to be the only true parasite. Cowley reported 3 infested wasp cocoons contained 477, 466, and 634 parasites respectively and 46.9% of prepupae and pupae were parasitized in 241 cocoons examined.

Dr B. J. Donovan informs me (1977 *in litt.*) that *P. spinolae* and another smaller species, possibly *P. morosum* F. Smith, have nested in the nest holes provided for the lucerne leafcutting bee *Megachile rotundata* (Fabricius) every year since 1971, when the latter was introduced from North America to New Zealand.

Pison morosum F. Smith

Pison morosum F. Smith, 1856:317.
Pison morosum: Turner, 1916:627.

According to Turner (1916), this is much the larger and commoner of the 2 indigenous species of *Pison* in New Zealand. Nothing seems to have been published on the nesting behaviour and prey of this species. Dr B. J. Donovan informs me (1977 *in litt.*) that a *Pison,* smaller than *P. spinolae,* possibly *P. morosum,* has nested with the former species in nest holes provided for the lucerne leafcutter bee (see above), and that this smaller species is particularly common at Te Pirita on the north bank of the Rakaia River, Canterbury.

Pison tuberculatum F. Smith

Pison tuberculatum F. Smith, 1869:296.
Pison tuberculatum: Turner, 1916:626.

This is the smallest and least common of the species of *Pison* in New Zealand. Nothing seems to be known of its nesting behaviour and prey.

Subfamily CRABRONINAE

This subfamily is represented in New Zealand by the tribe Crabronini with 7 species referable to 2 genera, *Rhopalum* and *Podagritus. Rhopalum* is a cosmopolitan genus, and 3 species occur in New Zealand, which Leclercq (1955) assigned to his endemic subgenera *Aphorhopalum* and *Zelorhopalum. Podagritus,* which is closely related to *Rhopalum,* is restricted to the southern hemisphere with a clearly disjunct distribution, occurring only in South America, Australia, and New Zealand. *Podagritus* comprises 4 New Zealand species formerly recorded as *Rhopalum* (Leclercq 1954, 1955). The subgenus *Parechuca* was proposed by Leclercq (1970a) to accommodate these 4 species together with several South American entities previously included in *Echuca,* the subgenus to which all the Australian species belong.

The genus *Rhopalum* is little known biologically, although several species have been studied in the northern hemisphere. Most species nest in plant stems, but some use rotten wood and others nest in the ground. In ground-nesting species the pygidial plate in the female is usually broad, flat, and trigonal. The nests are provisioned mainly with small Diptera, but some species use Psocoptera and others aphids. *Rhopalum* is well represented in Australia, where *R. variitarse* Turner was reported by Evans & Matthews (1971) to nest in sandy soil in Canberra and provision its nest with small Stratiomyidae, Dolichopodidae, Lauxaniidae, and a small unidentified tachinid fly.

Scarcely anything is known of the nesting behaviour and prey of the South American and Australian species of *Podagritus.* A Chilean species studied some 50 years ago is known to nest in sandy soil and store its nests with 5 families of Diptera. Leclercq (1970b) recorded a stratiomyid fly as the prey of the Australian species *P. (Echuca) leptospermi* (Turner). This species was studied by Evans & Matthews (1971), who reported it nesting gregariously in sandy soil near Canberra and provisioning its nests with Diptera. Therevidae of two genera made up the bulk of the prey (26 out of 27 flies) and an undetermined tachinid fly was also taken from a nesting wasp.

Rhopalum (Aporhopalum) perforator F. Smith

Rhopalum perforator F. Smith, 1876:483.
Crabro perforator: Dalla Torre, 1897:618.
Rhopalum perforator: Leclercq, 1954:184.
Rhopalum (Aporhopalum) perforator: Leclercq, 1955:16, fig.4.

This is the only species assigned to the endemic subgenus *Aporhopalum* by Leclercq (1955), who redescribed both sexes and illustrated the male antenna and genitalia, which

are quite distinctive. Tillyard (1926) commented that this species has the distal half of the fore femora bright orange, and Miller (1971) mentioned it briefly, but nothing has been published on its nesting behaviour and prey. It is the largest species of *Rhopalum* in New Zealand (female 12 mm, male 9.5–10.5 mm in length), but is reported to be very variable in size. It is evidently a ground-nesting species, and, according to Leclercq (1955), the pygidial plate in the female forms a subequilateral triangle, little depressed, and not excavated apically.

R. perforator might be expected to provision its nests with Diptera, and Harris (1977 *in litt.*) tells me that it indeed normally preys on flies, but "not uncommonly includes an occasional plant bug". In addition, Harris has numerous records of this species capturing other non-dipterous prey in the form of large Lepidoptera, but has not found nests containing this unusual prey. In December 1973 Harris observed female wasps capturing adults of *Gellonia dejectaria* (Walker) (Geometridae:Ennominae) in forest at Mill's Bush, Peel Forest, Canterbury, and "fly rapidly to the ground with this cumbersome prey". This moth, formerly assigned to the genus *Selidosema* and family Selidosemidae, is now included in the geometrid subfamily Ennominae (Boarmiinae). The moth has a wing span of 50 mm and is very much larger than the wasp.

Harris reports (1977 *in litt.*) that he observed *R. perforator* capturing adults of *Orocrambus* sp. (Pyralidae) with a wing span of 48 mm in March 1971 at Tararua Range, Wellington, and in December 1973 at Peel Forest and Geraldine, Canterbury. On these occasions both wasps and moths were notably abundant. In January 1972 he saw what was almost certainly the same *Rhopalum* "diving down with a large moth" in the Botanical Gardens, Wellington.

These instances of *R. perforator* preying occasionally on adult Lepidoptera represent a breakdown in prey specificity and may well be in the nature of "mistakes", such as have been reported for several bembicine wasps (Evans *et al.* 1974). Competition for food under conditions of fly scarcity and high population density of both wasps and moths may result in the wasps capturing unusual prey.

Rhopalum (Zelorhopalum) aucklandi Leclercq

Rhopalum (Zelorhopalum) aucklandi Leclercq, 1955:14, fig.3.

This species is known only from the North Island and both sexes have been described. Nothing is known of its biology.

Rhopalum (Zelorhopalum) zelandum Leclercq

Rhopalum (Zelorhopalum) zelandum Leclercq, 1955:16.

This species was described from the South Island. The male is unknown. The nesting habits and prey remain to be discovered.

Podagritus (Parechuca) cora (Cameron)

Crabro carbonarius F. Smith, 1856:424.
Crabro cora Cameron, 1888:181.
Crabro carbonicolor Dalla Torre, 1897:586.
Crabro jocosum Cameron, 1898:43.
Rhopalum cora: Leclercq, 1954:185.
Rhopalum (Rhopalum) cora: Leclercq, 1955:11, fig.7, 11.
Crabro carbonicolor: Valentine, 1967:1145.
Podagritus (Parechuca) cora: Leclercq, 1970a:87; Leclercq, 1970b:276.

This species was redescribed by Leclercq (1955), who figured the distinctive male antenna and female clypeus, by which it can be distinguished from related species. This all-black wasp is the largest crabronine in New Zealand, the female attaining a length of 15.5 mm and the male 12 mm. It is a ground-nesting species, and Miller (1971) noted

Table 2. Dipterous prey records for *Podagritus (Parechuca) cora.*

Species of fly	Observer	Author
STRATIOMYIDAE		
Eulalia chloris (Walker)	D. Miller	Valentine (1967)
TABANIDAE		
Dasybasis (Protodasyommia) truncata (Walker)	D. Miller	Miller (1950)
	H. Hamilton	Mackerras (1957)
D. (P.) viridis (Hudson)	D. Miller	Miller (1950)
Scaptia (Pseudoscione) milleri Mackerras	H. Hamilton	Mackerras (1957)
S. (P.) montana (Hutton)	H. Hamilton	Mackerras (1957)
THEREVIDAE		
Anabarhynchus bilineatus (Hutton)	D. Miller	Valentine (1967)
Ectinorhynchus castaneus (Hutton)	D. Miller	Valentine (1967)
CALLIPHORIDAE		
Calliphora quadrimaculatus (Swederus)	D. Miller	Valentine (1967)
TACHINIDAE		
Pales nyctemeriana (Hudson)	D. Miller	Valentine (1967)

that it "burrows in sandy soil near rivers; though gadflies are a favoured prey, some blowflies and others are also captured".

Valentine (1967) noted Gourlay's (1964) erroneous report of Blattidae as prey. Valentine also recorded named species of dipterous prey belonging to 4 families removed by Dr D. Miller from a single nest and in addition 2 species of Tabanidae (Miller 1950) (Table 2). Wasps in seeking prey often exploit habitats inaccessible to collectors, and Mackerras (1956) reported 3 interesting and rarely collected species of Tabanidae taken by Mr H. Hamilton from nests of a *Rhopalum* sp. Subsequently, Mackerras (1957) identified the tabanid prey and recorded these species from nests of *P. cora* (as *R. carbonicolor*) (Table 2).

I am informed by Dr R. P. Macfarlane (1977 *in litt.*) that he found *P. cora* preying on the blowfly *Calliphora* sp. alonr the lower reaches of the Whataroa River, Westland, where it was nesting near the beach in company with various native bees.

In addition to provisioning its nests with Diptera, *P. cora* has been reported by Mr A. C. Harris (1977 *in litt.*) to prey on subimagines of the mayfly *Deleatidium* sp. (Ephemeroptera). Harris observed wasps capturing the mayfly subimagines as they surfaced from a mountain stream in March 1971 at Tararua Range, Wellington. He had the impression that the wasps were taking the mayflies to their nests, and noted that they flew a considerable distance with their prey. This observation is the more extraordinary in that Harris stated that "at least 30 individuals were observed to do this", evidently having found an excellent source of prey. There must presumably have been nearby a large nesting aggregation of wasps.

Podagritus (Parechuca) albipes (F. Smith)

Rhopalum albipes F. Smith, 1878:7.
Crabro albipes: Dalla Torre, 1897:582.
Rhopalum albipes: Leclercq, 1954:185.
Rhopalum (Rhopalum) albipes: Leclercq, 1955:9, fig.1, 5, 9.
Podagritus (Parechuca) albipes: Leclercq, 1970a:87.

This species was redescribed by Leclercq (1955), who illustrated the male antenna and genitalia, and female clypeus. It is a much smaller wasp than *P. cora,* the female reaching a length of 11.5 mm and the male 9.5 mm. Miller (1971) mentioned this species, but, although widely distributed and apparently a ground-nesting species, nothing seems to have been recorded of its habits and prey.

Dr R. P. Macfarlane informs me (1977 *in litt.*) that what he took to be *P. albipes* was common in the upper part of the beach zone near Christchurch, where a nest was excavated and contained an undetermined acalypterate fly. What appears to be this species has also been found nesting by the same observer in fine sandy dry river beds in the South Island.

Podagritus (Parechuca) parrotti Leclercq

Rhopalum (Rhopalum) parrotti Leclercq, 1955:13.
Podagritus (Parechuca) parrotti: Leclercq, 1970a:87.

Both sexes of this species were described from the North Island. Its biology is unknown.

Podagritus (Parechuca) swalei Leclercq

Rhopalum (Rhopalum) swalei Leclercq, 1955:12.
Podagritus (Parechuca) swalei: Leclercq, 1970a:87.

The male of this species was described from North and South Islands, but the female is unknown. Nothing is known of its biology.

Subfamily PEMPHREDONINAE

In New Zealand this subfamily is represented apparently by 2 species of *Spilomena* and an undetermined genus belonging to the tribe Pemphredonini. These small wasps nest in abandoned tunnels of wood-boring beetles.

Spilomena spp.

I am informed by Mr E. W. Valentine (1977 *in litt.*) that 2 species of *Spilomena* occur at Nelson, both preying on thrips, obtained mostly from citrus flowers, and nesting in abandoned burrows of the introduced furniture beetle *Anobium punctatum* (DeGeer). The fact that 2 closely related wasps both occupy *Anobium* burrows is of interest, as in order to co-exist they probably nest under slightly different conditions or exhibit different behaviour, perhaps provisioning their nests with different thrips species. These wasps are evidently endemic species or possibly introductions from Australia, where several species of *Spilomena* occur. Mr Valentine also informs me that he has collected specimens of a larger "pemphredonine" wasp, which nests in the burrows of some other wood-boring beetle, but unfortunately nothing is known of its identity or of its prey.

Gourlay (1964) reported first seeing *Spilomena* at Christchurch in 1919 and since 1924 at Nelson, and mentioned it being found also at Auckland in 1945 and at Dunedin in 1949. The wasp was observed nesting by Gourlay in the abandoned burrows of *Anobium* in the woodwork of old houses and provisioning its nests with the introduced greenhouse thrips *Heliothrips haemorrhoidalis* (Bouché), an almost cosmopolitan polyphagous species. Valentine (1967) referred to Gourlay's observations and recorded *Spilomena* preying on both immature and adult thrips. Miller (1971) mentioned that the wasps are very abundant in spring and may give the false impression, because of their activity, that they are parasites of the still active wood-boring beetles.

Dr B. J. Donovan informs me (1977 *in litt.*) that he has found the small bee *Euryglossina proctotrypoides* (Cockerell), which is very similar in appearance to *Spilomena*, nesting also in *Anobium* burrows. The bee belongs to the family Colletidae and endemic Australian subfamily Euryglossinae, and is widely distributed in Australia (Exley 1968). According to Dr Donovan, this is the first record of this subfamily in New Zealand.

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