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Review of the New Caledonian species of *Paroxyethira* Mosely, 1924 (Trichoptera: Hydroptilidae)

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Abstract

New Caledonian representation of the New Zealand–New Caledonian hydroptilid caddisfly genus *Paroxyethira* Mosely, 1924, is reviewed on the basis of a considerable collection from widespread New Caledonian localities. Description of 8 new species brings to 10 the known fauna for the island. Males of all New Caledonian species are illustrated, a key to adult males is provided, and the associated females are described for 6 species.

Keywords: caddisflies, New Caledonia, new species, revised diagnoses, key

Introduction

The New Caledonian hydroptilid caddisfly fauna at present comprises 28 described species in the genera *Acritoptila* Wells, 1982 (9 species), *Caledonotrichia* Sykora, 1967 (5 species), *Oxyethira* Eaton, 1873 (10 species), *Hellyethira* Neboiss, 1977 (1 species), *Hydroptila* Dalman, 1819 (1 species) and *Paroxyethira* Mosely, 1924 (2 species) (Sykora 1967, Kelley 1989, Wells 1995, Oláh & Johanson 2011). The genus, *Paroxyethira* Mosely, 1924, erected for 3 species, was described originally as a New Zealand endemic. Subsequently, the known New Zealand fauna was increased to 5 species by Leader (1972) and the distribution was extended with description by Kelley (1989) of 2 species from New Caledonia. More recently, Ward & Henderson (2004) described another 10 New Zealand species.

As a result of several field trips to New Caledonia by one of us (KAJ) and his associates (in 2001, 2003–2004 and 2006), an interesting collection of hydroptilids, including new species of *Paroxyethira*, is now available. The extensive material constitutes around 120 male and 240 female *Paroxyethira* specimens collected in light traps or Malaise traps and includes also many species in the genera *Caledonotrichia*, *Oxyethira*, *Hellyethira* and *Acritoptila*. These genera will be treated in separate papers. Here we described 8 new species of *Paroxyethira*, revise diagnoses and provide new figures for Kelley's 2 species. In addition, females of 6 of the New Caledonia species are described and illustrated and a key is supplied to males of all New Caledonian *Paroxyethira* species.

Paroxyethira was assigned by Marshall (1979) to the subfamily Hydroptilinae, tribe Hydroptilini, with which members it conforms in presence of ocelli, reduced tentorial arms, form of antennal segments, tibial spur count, shapes of the mesoscutellum and metascutellum, somewhat reduced wing venation (forks 1 and 2 present on forewing, 2 on hind wing), and absence of the jugal lobe on the forewing. Holzenthal *et al.* (2007), following Mosely (in Kelley 1989) and Morse (2011), listed *Paroxyethira* in Hydroptilini and this is undoubtedly a correct assignment of the genus. Known larvae are hydroptiline in morphology, according to Leader (1972), separated only with difficulty from larvae of *Oxyethira*. The 'oblong, purse-shaped cases' are quite readily distinguished from the characteristic flask-shaped cases of all known *Oxyethira* larvae, but indistinguishable from those of some species of *Acritoptila* or the mostly Australian genus *Hellyethira*.

Despite our confidence in placement of *Paroxyethira* in Hydroptilini, the remarkable convergence in form of some of the male genitalic structures with those of males in other Hydroptilinae tribes is unsettling. For example, the

slender (generally), elongate, simple phallic apparatus, (usually) large ventral process on abdominal sternite VII, together with the form of the phallic sheath ('aedeagal sheath' of Ward & Henderson (2004), 'penis sheath' of Mosely & Kimmins (1953)) with a basal apodeme seen in some of the New Caledonian species, very closely resemble structures in the male genitalia of some Australasian species of *Orthotrichia* Eaton, 1873, especially species in the *Orthotrichia aberrans*-group (Wells 1979, 1983). Superficially, too, the general form of the male genitalia and particularly the very elongate gonopods bear very close similarities to those of many species in the ochrotrichiine genus *Ochrotrichia* Mosely, 1934 (e.g., Bueno-Soria & Holzenthal 1998, 2004, 2008); the elaborations of tergite X in many species of *Ochrotrichia* resemble the structures we identify as the phallic sheath in *Paroxyethira*.

Among New Caledonian *Paroxyethira*, 7 of the new species show general resemblance to *P. dumagnes* Kelley, 1989, which conforms quite closely in form of its male genitalia to the New Zealand species. However, rather than having sclerotised teeth on the elongate gonopods (= inferior appendages) as seen in the New Zealand species, the gonopods of most males of the New Caledonian species bear dense brushes of rather stout black setae described by Kelley (1989) to '... appear like magnetic filings'; only *P. serrata*, new species, has a row of tiny sclerotised teeth or serrations on each gonopod. Most of the new New Caledonian species have quite asymmetric gonopods. Both *Paroxyethira anomala*, new species, and *P. nigrispina* have short gonopods and lack sclerotised teeth. *Paroxyethira anomala*, new species, also lacks any stout black setae; and it resembles the New Zealand *P. tillyardi* Mosely, 1924, in having a very small rounded ventral process, but on abdominal segment IX, rather than the elongate spatulate structure on abdominal segment VIII seen in all other congeners.

Unlike the New Zealand species, all of which have a spine on the phallic apparatus, most of the New Caledonian species have the phallic apparatus very simple, slender and elongate and with a short titillator; *P. anomala*, new species, has a pair of spines subapically on the phallic apparatus and *P. koegi*, new species, has a small distal spine on the phallic apparatus.

The female terminalia of the New Caledonian species are distinctive, quite unlike those known for other Hydroptilini, and difficult to interpret. In ventral view the abdomen appears to terminate in an elongate, generally stout cone, apparently formed by fusion of sternites VII and VIII, whereas, dorsally, tergite VIII usually appears to be discrete and in some species has a single slender, elongate distal process arising from the apical margin of VIII and produced posteriorly; segments IX and X are generally retracted into the cone formed by segments VII/VIII. The setae on these terminal segments generally have very prominent bases, but these are not always illustrated in the figures provided.

Methods

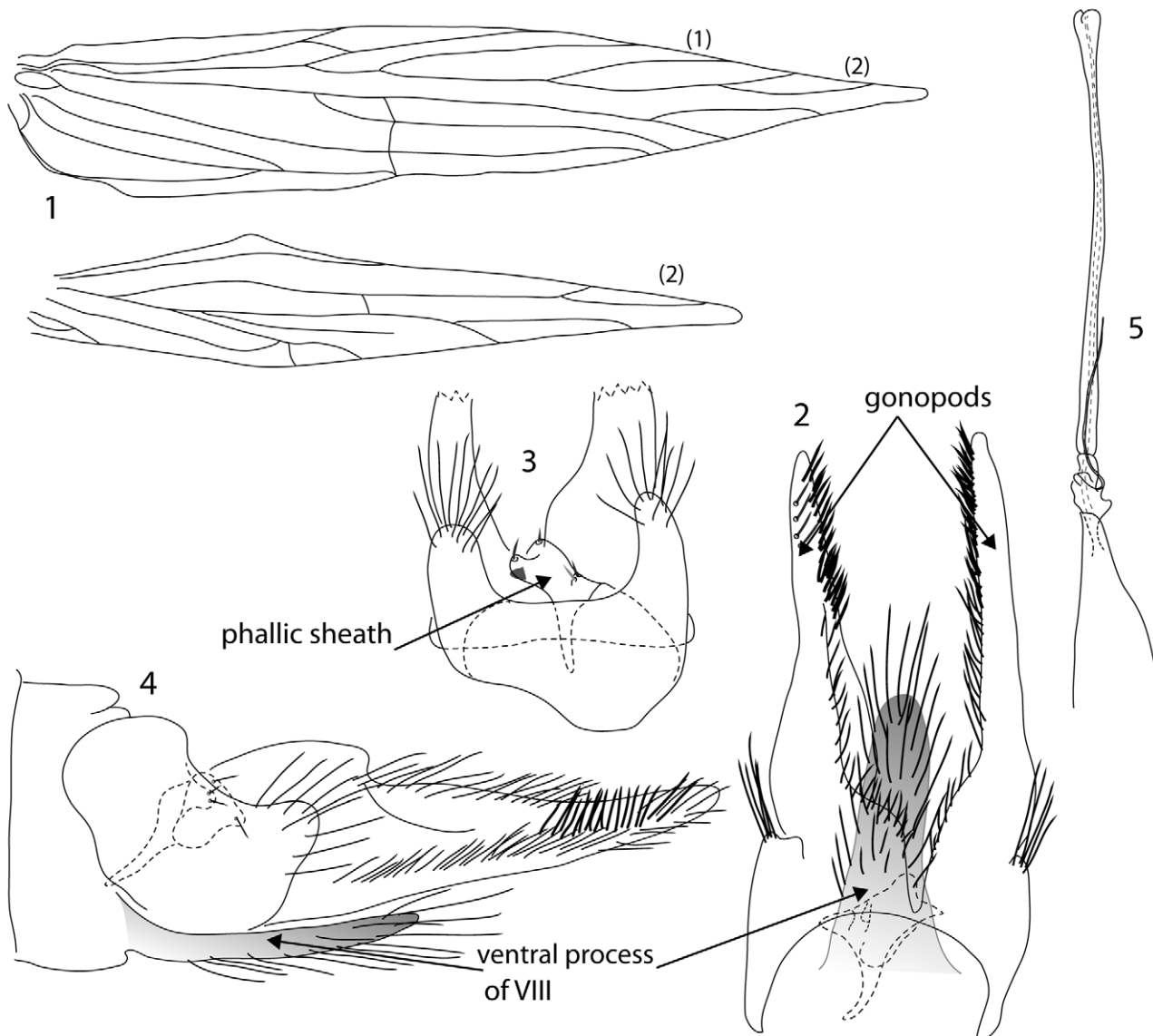
An identification key and descriptions of New Caledonian *Paroxyethira* species are provided, as well as revised diagnoses of *P. dumagnes* and *P. nigrispina* and new illustrations of their male genitalia, drawn from newly collected non-type specimens. Specimens were prepared for study by maceration in KOH and clearing in clove oil; draft figures were prepared and then traced using Adobe Illustrator CS5; not all setae are represented, and setal bases are omitted from most illustrations. Specimens were subsequently mounted in Canada Balsam.

Holotypes are deposited in the Muséum National d'Histoire Naturelle, Paris, France (MNHP); most other material is in the collections of the Naturhistoriska Riksmuseet, Stockholm, Sweden (SMNH, = Swedish Museum of Natural History), with several specimens in the Australian National Insect Collection, Canberra (ANIC). Kelley's types were examined by AW in the Bishop Museum, Hawaii (BPBM), in 1995.

Key to adult males of New Caledonian *Paroxyethira* Mosely

- 1 Mid ventral process situated on abdominal sternite VIII, elongate, with length far greater than narrowest width (e.g., Figs 2, 6, 10, 13) 2
- Mid ventral process situated on abdominal sternite VIII, short, with width greater than length (Fig. 29) *P. anomala*, new species.
- 2(1) Gonopods without brush of stout black setae, but may have rows of sclerotised teeth 3
- At least 1 of pair of gonopods bearing brush of stout black setae 4
- 3(2) Gonopods both short, less than half length of median process of sternite VIII, rounded apically, left gonopod bearing brush of fine setae; phallic apparatus simple, without spines, phallic sheath broadly twisted distally, apex black (Figs 27, 28)

- *P. nigrispina* Kelley.
- Gonopods both elongate, about same length as median process of sternite VIII and each bearing mesal row of short, sclerotised teeth; phallic sheath broadly axe-shaped apically, 1 black spur on left side (Fig. 23) *P. serrata*, new species.
 - 4(2') Gonopods both almost equal length, not greatly dissimilar in form or length, each bearing brushes of stout black setae (Figs 2, 6, 17) 5
 - Gonopods dissimilar in appearance and/or length and 1 or both bearing brush of stout black setae (Figs 10, 13, 19, 22) 7
 - 5(4) Gonopods close-pressed distally, about equal in length to ventral process on VIII; phallic sheath a substantial cylinder around phallic apparatus, apically with elongate and curved spine (Figs 16–18) *P. atypica*, new species.
 - Gonopods widely separated distally, at least 1 of pair more than twice length of ventral process on VIII; phallic sheath either short ventral plate with 1 pair of fine apico-lateral setae or an elongate band with single apical seta (Figs 8, 10) 6
 - 6(5) Phallic sheath visible ventrally as curving band, reaching to about 2/3rd length of gonopods (Figs 6, 8) *P. koegi*, new species.
 - Phallic sheath not visible ventrally, dorsally visible as a short plate bearing 2 short setae at apico-lateral angles (Figs 3, 4) *P. dumagnes* Kelley.
 - 7(4') One gonopod less than half length of other; phallic sheath short, not visible in ventral view 8
 - One gonopod always shorter than other, but never less than 2/3rds its length 9
 - 8(7) Right gonopod less than 1/2 length of left (Fig. 10) *P. asymmetrica*, new species.
 - Left gonopod less than 1/2 length of right (Fig. 13) *P. opposita*, new species.
 - 9(7') Left gonopod slender, without brush of black setae; phallic sheath with apical strap and 1 pair of widely spaced setae (Figs 19, 20) *P. dzumac*, new species.
 - Left gonopod narrow, bearing brush of black setae distally; phallic sheath with stout subapical strap and 1 pair of setae almost at same level from base (Figs. 21, 22) *P. hamata*, new species.



FIGURES 1–5. *Paroxyethira dumagnes* Kelley, male specimen from Ouenghi River, Boulouparis. 1—right wings, dorsal; 2—genitalia, ventral; 3—genitalia, dorsal (gonopods in part only); 4—genitalia, left lateral; 5—phallic apparatus, dorsal view. Numbers in parentheses in Fig. 1 refer to fork numbers.

Paroxyethira dumagnes Kelley

Figs 1–5, 33

Paroxyethira dumagnes Kelley, 1984: 201, figs 27–29.

Revised diagnosis

Males resemble superficially those of *P. koegi*, new species, but males (Figs 1–5) are distinguished by having the gonopods less asymmetric, no spine on the phallic apparatus, and the phallic sheath in the form of a short basal plate with a long apodeme. The phallic sheath resembles those of *P. asymmetrica*, new species, and *P. opposita*, new species, but those species have the gonopods strongly asymmetric. Females are difficult to distinguish but ventrally (Fig. 33) have a sclerotised notch on the left at the apical margin, and the margin is angled left to the shortest point on the right.

Male antennae each with 21–23 flagellomeres; female antennae each with 20–21 flagellomeres.

Forewing (Fig. 1) length. Male 1.9–2.3 mm (n=10); female 1.60–2.3 mm (n=10).

Holotype male: New Caledonia, Boulari River, BPBM, examined.

Other material examined: Ouenghi River, Boulouparis, 14.xii.1983, leg. A. Wells—2 males, 1 female (ANIC); Province Sud, Couvelée River at Haute Couvelée, 2.8 km SV summit of Mt. Piditéré, 3.5 km NNE Dumbéa, 22°07.405'S, 166°28.023'E, 27 m, 28.xi.2003, light trap, loc#052, leg. K.A. Johanson—42 males, 51 females (SMNH); Province Sud, lower part Rivière des Pirogues, 800 m WNW summit of Mont Imbaah, 4.7 km E Lucky Creek in Plum, 22°18.559'S, 166°41.227'E, 1.3 m, 1.xii.2003, light trap, loc#059, leg. K.A. Johanson—2 males, 4 females (SMNH); Province Sud, Monts Kwa Ne Mwa, on road between Noumea and Yaté, 1.5 km E Pic Mourange, 22°12.545'S, 166°40.246'E, 143 m, 9.xi.2003, light trap, loc#018, leg. K.A. Johanson—11 males, 94 females (one KAJ genitalic prep. (SMNH)); same data, except, 30.xii.2003, light trap, loc#018, leg. K.A. Johanson—9 females (SMNH); Province Sud, Rivière Bleue, 282 m, stony river, loc 4, 22°05.705'S, 166°38.225'E, Malaise trap, 13–16.xi.2001, leg. K.A. Johanson, T. Pape & B. Viklund—2 females (SMNH).

Paroxyethira koegi, new species

Figs 6–9

Superficially very similar to *P. dumagnes*, but males distinguished by the spine on the phallic apparatus, more asymmetric gonopods, and elongate phallic sheath.

Male antennae each with 20–21 flagellomeres.

Forewing length. Male 1.8–1.9 mm (n=5).

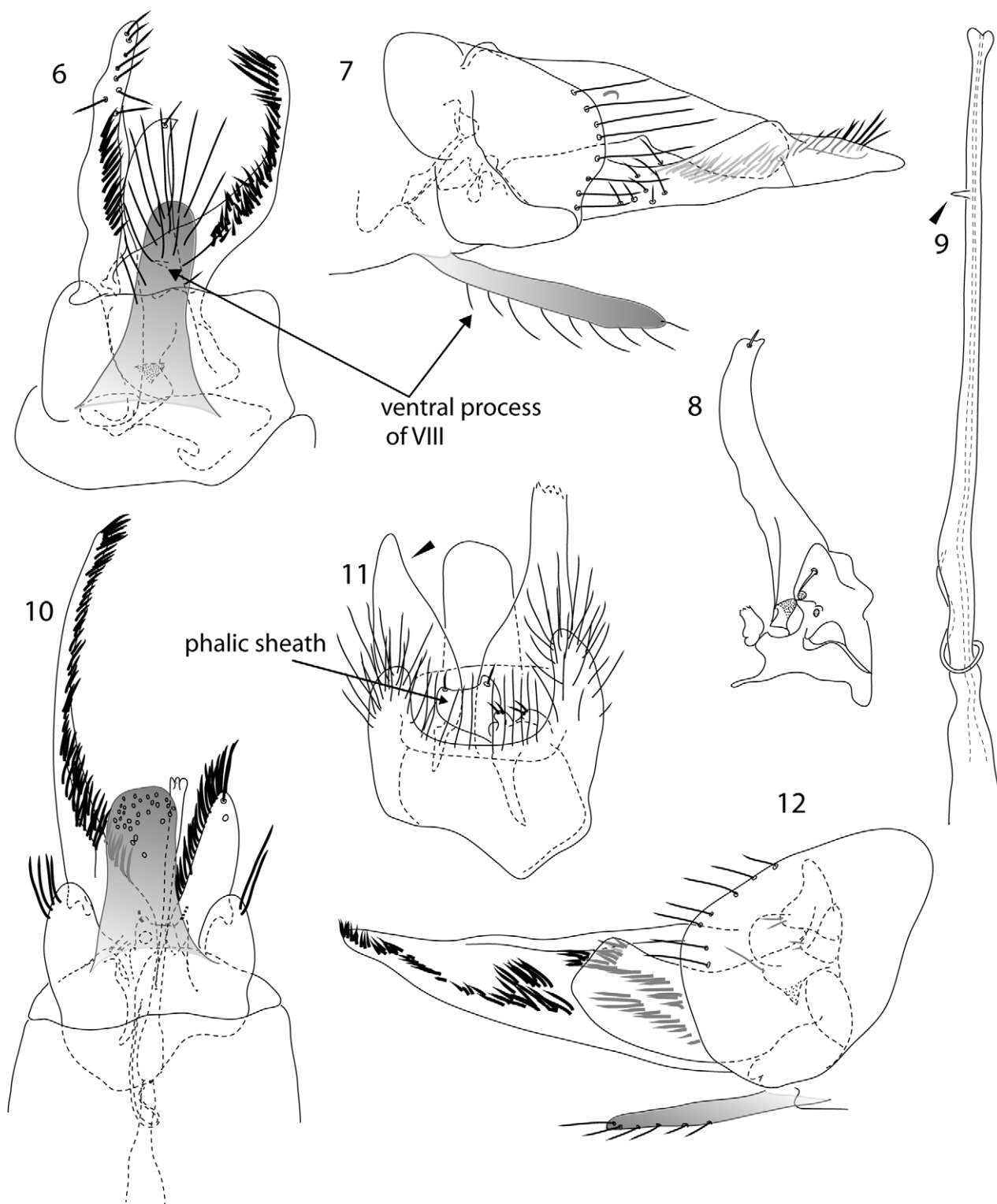
Male genitalia (Figs 6–9). Short sharp spur present medially on abdominal sternite VII. Median process on abdominal sternite VIII stoutly spatulate, length about 5 times width at 1/2 length. Abdominal sternite and tergite IX fused, laterally only slightly produced posteriorly, dorsally deeply concave. Gonopods inserted asymmetrically; right well to left of centre; both bearing brushes of stout black setae. Phallic apparatus (Fig. 9) slender, elongate, constricted at 1/4 length at which constriction arises short, threadlike titillator; short sharp spine at about 2/3 length. Phallic sheath (Fig. 8) short, broad at base; extended posteriorly as elongate, curving sheath, about 1/2 length of gonopods, with setae apically; basal structures difficult to interpret.

Female not associated with certainty.

Holotype male: Province Nord, Ponandou Tiôgé River at Kôgi, 3.9 km SSW Touho, 20°49.043'S, 165°13.551'E, 25 m, 26.xii.2003, light trap, loc#100, leg. K.A. Johanson (on slide KAJ in MNHP).

Paratypes: Same data as for holotype – 4 males (SMNH).

Etymology: *Koegi*, named after the type locality.



FIGURES 6–12. 6–9: *Paroxyethira koegi*, new species, holotype, male. 6—genitalia, ventral; 7—genitalia, left lateral, ventral; 8—phallic sheath; 9—phallic apparatus, dorsal view. 10–12: *Paroxyethira asymmetrica*, new species, holotype, male. 10—genitalia, ventral; 11—genitalia, dorsal (left gonopod in part only); 12—genitalia, right lateral.

***Paroxyethira asymmetrica*, new species**

Figs 10–12, 34–36

Most closely similar to *P. opposita*, new species, with which it shares the feature of male gonopods strongly asymmetric; however, with the right gonopod shorter than the left, in contrast to *P. opposita* in which the left

gonopod is shorter than the right. *Paroxyethira asymmetrica* is distinguished from other species with markedly unequal gonopods by the very short phallic sheath. The female of *P. asymmetrica* has terminalia more symmetrical than other congeners, regularly conical in ventral view; the surface is noticeably 'pocked' by setal bases; and in dorsal view there is a prominent 'pocket' subapically on the right.

Male antennae each with 21–22 flagellomeres; female antennae each with 19 flagellomeres.

Forewing length. Male 1.7–2.4 mm (n=5); female 1.6–2.0 mm (n=10).

Male genitalia (Figs 10–12). Sternite VII bearing short sharp spur medially. Median process on abdominal sternite VIII stoutly spatulate; length about 3x width at middle. Abdominal segment IX with broadly rounded posterolateral lobes; dorsally with distal margin deeply concave. Gonopods unequal, left elongate, slender, ~2.5x length of right; both bearing mesal brushes of stout black setae. Phallic apparatus as for *P. dumagnes* (Fig. 5), being slender and straight but with distal portion proportionally shorter, constricted at 1/4 length, at which constriction short, threadlike titillator arising. Phallic sheath short, broad; with seta at each apico-lateral angle; on left 2 setae-bearing papillae and proximally anteriorly directed apodeme.

Female (Figs 34–36). Abdominal sternites VII–VIII fused, broad-based, constricted laterally at about 1/3 length, conical in distal 2/3, almost symmetrical. Tergites VII–VIII dorsally discrete; VIII with prominent 'pocket' subapically on right; surface of VII–VIII disrupted by pronounced sockets of scattered fine setae; apex rounded ventrally, concave dorsally. Segment X divided distally to form 2 lobes.

Holotype male: Province Sud, Xwé Pemöu Stream, 300 m N bridge over Dathio River at Atè, 6.2 km WNW Thio, 21.58835°S, 166.15117°E, 13 m, 29.xi.2003, light trap, loc#056, leg. K.A. Johanson (MNHP).

Paratypes: Same data as for holotype – 5 males, 22 females (SMNH).

Etymology: *Asymmetrica*, named for the strongly asymmetric gonopods of the male genitalia.

***Paroxyethira opposita*, new species**

Figs 13–15

This species most closely resembles *P. asymmetrica* but differs in having the left gonopod short, not the right, and in lacking any lateral lobes on abdominal segment IX. It is distinguished from other species with markedly unequal gonopods by the very short phallic sheath. The female is unknown.

Male antennae each with 21 flagellomeres.

Forewing length. Male 1.9 mm.

Male genitalia (Figs 13–15). Median process on abdominal sternite VIII stoutly spatulate; length about 3x width at middle. Abdominal segment IX apico-lateral angles not produced; dorsally with distal margin narrowly cleft. Gonopods unequal; right elongate, more than 2x length of left; both bearing dense brushes of stout black setae. Phallic apparatus as in Fig. 5, forming slender, straight, elongate tube; constricted at 1/4 length at which constriction arises short, threadlike titillator. Phallic sheath (Fig. 14) short, broad; in ventral view conical; 1 seta at apex of cone, 1 seta dorsally, 1 stout black spur near base on left; proximally with anteriorly directed apodeme.

Female: unknown.

Holotype male: Province Nord, Plaine des Gaïacs, Rivière Rouge, 14.2 km NW summit of Mt. Rouge, 50 m upstream road RT1 Noumea-Koné, 20°31.573'S, 164°46.690'E, 23 m, 2.i.2004, light trap, loc#104, leg. K.A. Johanson (MNHP).

Etymology: *Opposita*, named for the conversely arranged gonopods in comparison with *P. asymmetrica*.

***Paroxyethira atypica*, new species**

Figs 16–18, 37, 38

The male of *P. atypica* is distinguished by having the paired gonopods in ventral view parallel in midline, and almost equal in length, whereas other New Caledonian species have the gonopods either widely separated or divergent, often unequal in length. The phallic sheath has a long slender curved spine arising apically and curving widely, forming a rounded hook, in contrast to the rather similar phallic sheath in *P. dzumac*, new species, which has a short, slender, curved process arising at the apex, or *P. hamata*, new species, which has a broad, strap-like

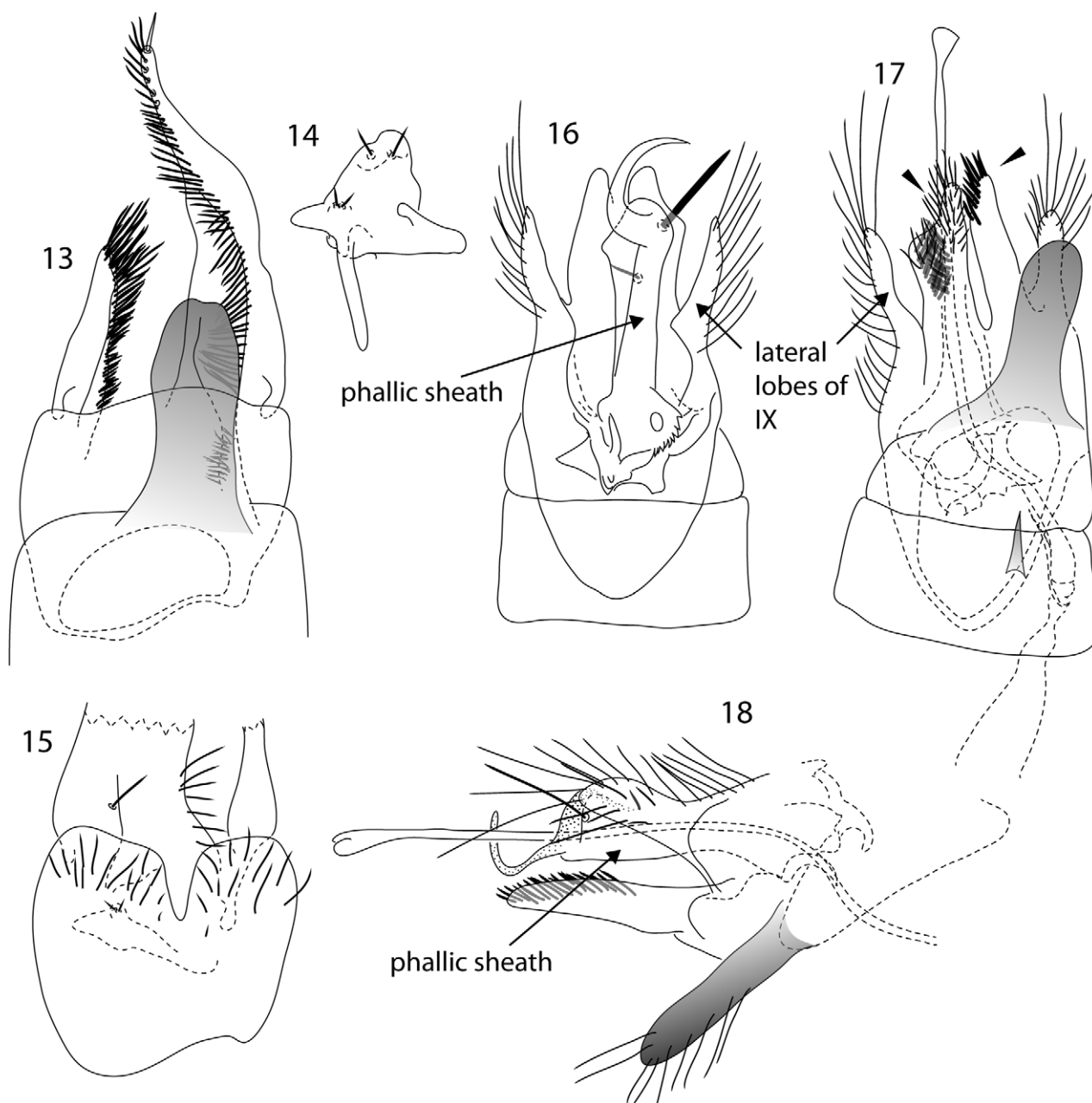
anteriorly directed process arising subapically. The female shares with that of *P. dzumac*, a single curving process distally on abdominal tergite VIII, but in *P. atypica* it is swollen and bulbous subapically, in *P. dzumac* straplike.

Male antennae each with 19 flagellomeres; female antennae each with 16 flagellomeres.

Forewing length. Male 1.2–2.2 mm (n=2); female 2.0–2.1 mm (n=2).

Male genitalia (Figs 16–18). Abdominal sternite VII bearing short sharp spur medially. Median process on abdominal sternite VIII stoutly spatulate; length about 2.5x middle width. Abdominal sternite and tergite IX fused, posterolaterally produced to form narrow, elongate lobes. Gonopods fused at base, both bearing brushes of stout black setae distally. Phallic apparatus slender, elongate; constricted at 1/4 length at which constriction short, threadlike titillator arising. Phallic sheath forming elongate sheath, with long, widely curved spine at apex; 1 elongate seta at base of spine, at about 2/3rds length.

Female terminalia (Figs 37, 38). Abdominal sternites VII–VIII fused into stout cone distally, apically truncate; dorsally forming elongate process arising from tergite IX apex, produced posteriorly, expanded subapically. Segment X undivided apically.

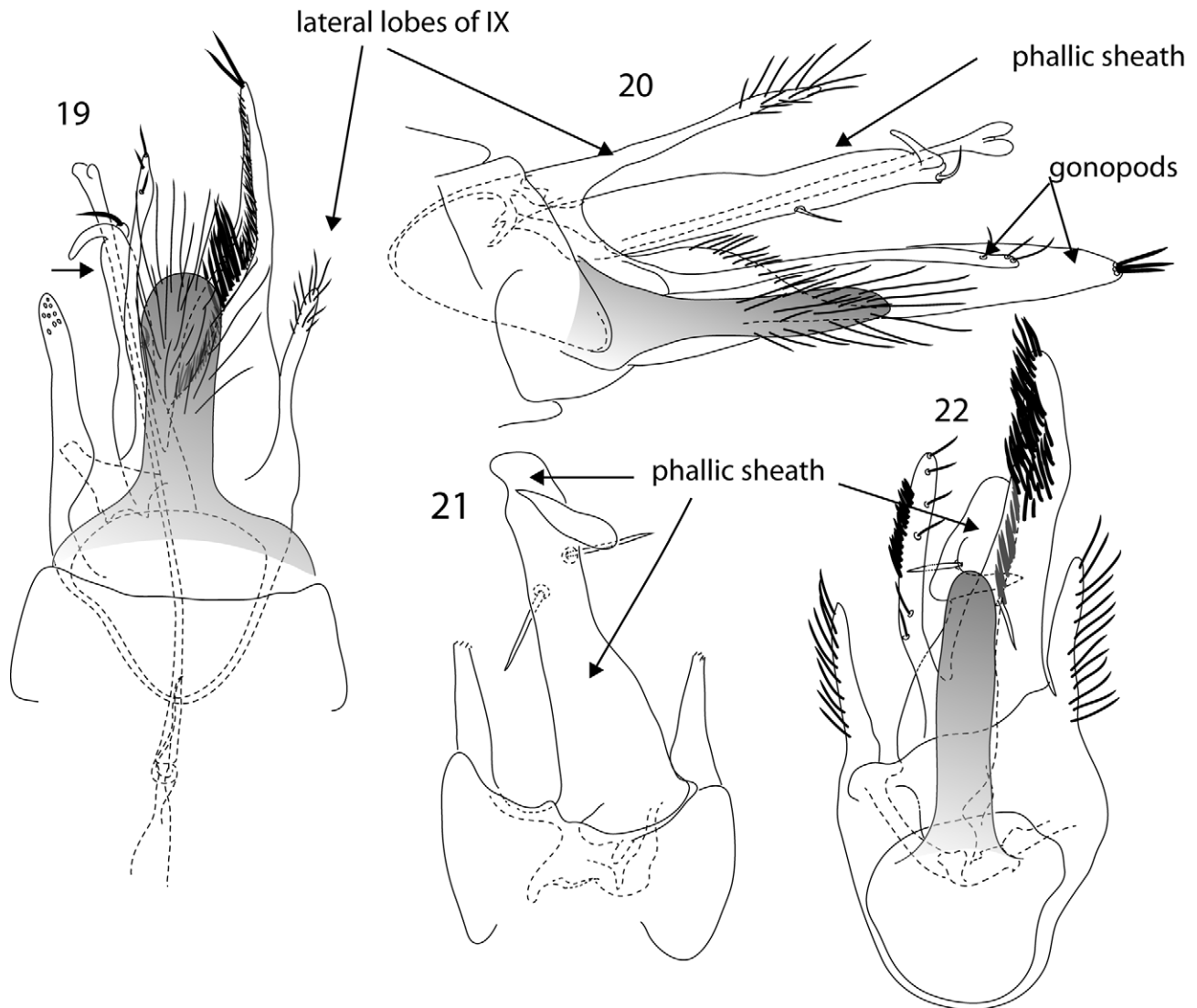


FIGURES 13–18. 13–15: *Paroxyethira opposita*, new species, holotype, male. 13—genitalia, ventral; 14—phallic sheath, ventral; 15—genitalia, dorsal (gonopods in part only). 16–18: *Paroxyethira atypica*, new species, holotype, male. 16—genitalia, dorsal; 17—genitalia, ventral; 18—genitalia, left lateral.

Holotype male: Province Sud, Mt. Dzumac, source stream of Ouinne River, downstream crosspoint to mountain track, 22°01.997'S, 166°28.486'E, 795 m, over about 30 m waterfall, 18.xi–4.xii.2003, Malaise trap, loc#031, leg. K.A. Johanson (MNHP).

Paratypes: Same data as for holotype—2 females (one on slide) (SMNH); Province Sud, Mt. Dzumac, source stream of Ouinne River, near crosspoint to mountain track, 22°02.073'S, 166°28.460'E, 810 m, 18.xi–4.xii.2003, Malaise trap, loc#030, leg. K.A. Johanson, 1 male (headless), 1 female (SMNH).

Etymology: *Atypica*, referring to the unusual distal process on the female abdominal terminalia.



FIGURES 19–22. 19, 20: *Paroxyethira dzumac*, new species, holotype, male. 19 — genitalia, ventral; 20 — genitalia, left lateral. 21, 22: *Paroxyethira hamata*, new species, holotype, male. 21 — genitalia, dorsal (lateral lobes in part only); 22 — genitalia, ventral.

Paroxyethira dzumac, new species

Figs 19, 20, 39

The male is similar to that of *P. hamata*, new species, having strongly asymmetric gonopods, but is distinguished by having the phallic sheath with an apical rather than subapical process, and pair of widely separated setae; and left gonopod more slender and lacking a brush of black setae. The form of the phallic sheath resembles that of *P. atypica*, but the apical process is short, not curving broadly. Both *P. dzumac* and *P. hamata* have an elongate dorsal process on the female terminalia, but in *P. dzumac* the process is narrow and straplike, not expanded subapically.

Male antennae each with 19 flagellomeres; female antennae each with 19 flagellomeres.

Forewing length. Male 2.1–2.7 mm (n=6); female 2.2–2.5 mm (n=10).

Male genitalia (Figs 19, 20): Abdominal sternite VII with small sharp median spur. Median process on abdominal sternite VIII elongate spatulate; length around 3.5x width at middle. Abdominal segment IX dorsally with distal margin deeply concave; lateral angles produced into lateral lobes that are slender in ventral view; elongate, as long as ventral process of VIII. Gonopods quite dissimilar, right stout, tapered distally to narrow apex; brush of stout black setae on mesal margin, longest near mid length; closely joined at base to very slender left gonopod without brush of setae; bearing 3–4 setae distally. Phallic apparatus slender, straight, elongate; constricted at about 1/6 length at which constriction arises a short, threadlike titillator. Phallic sheath elongate, sheathlike; with straplike apical process and single large apical seta, second similar seta at about half length.

Female terminalia (Fig. 39). Abdominal sternites VII–VIII fused; broad-based; abruptly constricted to form narrow tube for distal 2/3rds; apico-ventrally truncate; apico-dorsally bearing curved, straplike sclerotised process. Dorsally tergite VIII discrete; whole structure densely setose ventrally, setal bases prominent. Segment X undivided.

Holotype male: Province Sud, Mt. Dzumac, source stream of Ouinne River, downstream crosspoint to mountain track, 22°01.997'S, 166°28.486'E, 795 m, over about 30 m waterfall, 18.xi–4.xii.2003, Malaise trap, loc#031, leg. K.A. Johanson (MNHP).

Paratypes: Same data as for holotype—7 male, 21 female (1 male, 1 female on slides) (SMNH); Province Sud, Mt. Dzumac, source stream of Ouinne River, near crosspoint to mountain track, 22°02.439'S, 166°28.646'E, 805 m, 18.xi.–4.xii.2003, Malaise trap, loc#029, leg. K.A. Johanson—2 males (SMNH).

Other material examined: Province Sud, Mt. Dzumac, source stream of Ouinne River, near crosspoint to mountain track, 22°02.073'S, 166°28.460'E, 810 m, 18.xi–4.xii.2003, Malaise trap, loc#030, leg. K.A. Johanson—1 female (SMNH); Province Sud, Mt. Dzumac, source stream of Ouinne River, downstream crosspoint to mountain track, 22°01.997'S, 166°28.486'E, above waterfall, 795 m, 3.xii.2003, light trap, loc#061, leg. K.A. Johanson—1 female (SMNH).

Etymology: *Dzumac*, derived from the type locality.

Remarks: In a sample from a stream on Mt. Dzumac, most of the males are uniformly of this form. Among them, however, are 2 males that resemble these others, but are distinct, having the spine on the phallic sheath stouter and subapical, and the left gonopod more slender and lacking a brush of stout dark setae. They are described below tentatively as a distinct species, *P. hamata*, new species.

***Paroxyethira hamata*, new species**

Figs 21, 22

Closely resembling *P. dzumac*, new species, but distinguished by the stout, straplike subapical process on the phallic sheath and its pair of setae at almost equi-distance from base, in contrast to more slender apical process of *P. dzumac* with widely separated pair of setae. Also, the left gonopod of *P. hamata* is stouter and bears a lateral brush of black setae.

Male antennae each with 18 flagellomeres.

Forewing length. Male 2.0 mm (n=2).

Male genitalia (Figs 21, 22). Median process on abdominal sternite VIII elongate spatulate; length about 5x width at middle. Abdominal segment IX dorsally with distal margin widely and deeply concave, forming lateral lobes that in ventral view are slender, elongate. Gonopods dissimilar; right gonopod stout, tapered distally to blunt apex; brush of equally long, stout black setae extending along mesal margin; closely joined at base to shorter, more slender left gonopod with brush of setae distolaterally. Phallic apparatus slender, straight, elongate; constricted at about 1/6 length at which constriction short, threadlike titillator arising. Phallic sheath elongate, with tapered, curved straplike process subapically and pair of large setae at about 2/3rds its length.

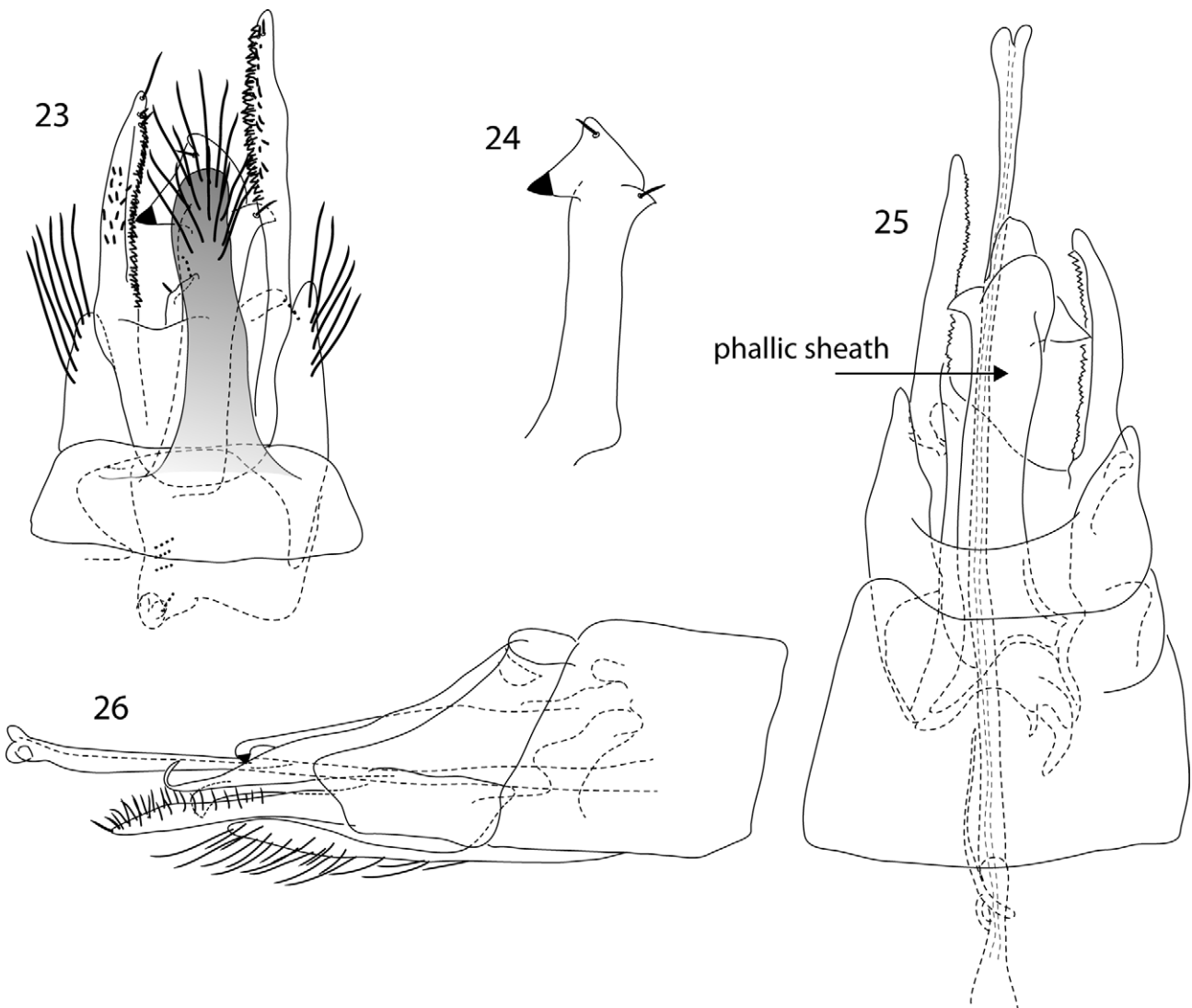
Female unknown.

Holotype male: Province Sud, Mt. Dzumac, source stream of Ouinne River, downstream crosspoint to mountain track, 22°01.997'S, 166°28.486'E, 795 m, over about 30 m waterfall, 18.xi–4.xii.2003, Malaise trap, loc#031, leg. K.A. Johanson (MNHP).

Paratype: Same data as for holotype—1 male (SMNH).

Etymology: *Hamata*, from Latin *hamatus*, meaning hooked, referring to the phallic sheath spine.

Remarks: These curious specimens were collected with *P. dzumac*, and have male genitalia of the same general form, yet significantly different and thus are tentatively assigned to a separate species.



FIGURES 23–26. *Paroxyethira serrata*, new species, holotype, male. 23—genitalia, ventral; 24—phallic sheath, ventral; 25—genitalia, dorsal; 26—genitalia, right lateral.

***Paroxyethira serrata*, new species**

Figs 23–26, 40, 41

The male of *P. serrata* is unique among New Caledonian congeners in having a row of short sclerotised teeth on the mesal margin of each gonopod. In other respects it resembles most closely those of *P. dzumac* and *P. atypica*, both of which also have the phallic sheath elongate. The female has abdominal sternites VII and VIII more clearly delineated than do other known females and abdominal segment VIII is strongly produced latero-distally on the right.

Male antennae each with 21 flagellomeres; female antennae each with 18–20 flagellomeres.

Forewing length. Male 2.1–2.5 mm (n=10); female 2.1–2.5 mm (n=10).

Male genitalia (Figs 23–26). Abdominal sternite VII bearing short, sharp spur medially. Median process on sternite VIII spatulate in ventral view; length about 5x width at middle. Abdominal sternite and tergite IX fused, in

lateral view obliquely truncate apically, in dorsal view deeply concave. Gonopods asymmetric, right longer than left; mesal margin of each lined with short sclerotised serrations along length; left with 3 setae at apex. Phallic apparatus slender, elongate, as in Fig. 5; constricted at about 1/5 length at which constriction arises short, threadlike titillator. Phallic sheath (Fig. 24) elongate, forming thin sheath with 3 broad angles posteriorly; more proximal on left darkly sclerotised apically; right and apical angles each with small subapical seta.

Female terminalia (Figs 40, 41). Abdominal sternites VII and VIII scarcely fused ventrally; VIII strongly produced latero-distally to form distal bract; surfaces of segments VII and VIII ventrally bearing setae with prominent bases. Segment X not divided apically.

Holotype male: Province Nord, Mt. Panié, stream at camp, 20.58167°S, 164.76472°E, 1311 m, 9.xii.2003, Malaise trap, loc#073, leg. K.A. Johanson (SMNH).

Paratypes: Same data as for holotype—3 males, 7 females (one female on slide) (SMNH); Province Nord, Mt. Panié, stream at camp, 20.58139°S, 164.76444°E, 1310 m, 9.xii.2003–2.i.2004, Malaise trap, loc#074, leg. K.A. Johanson—9 males, 4 females (1 male on slide) (NMHP).

Etymology: *Serrata*, from Latin *serra*, meaning saw, for the saw-like teeth on the gonopods.

***Paroxyethira nigrispina* Kelley**

Figs 27, 28

Paroxyethira nigrispina Kelley, 1984: 202, figs 30–32.

Revised diagnosis. The male (Figs 27, 28) most closely resembles that of *P. anomala*, new species in having gonopods short, but in contrast the left gonopod bears a dense brush of fine setae mesally; sternite VIII bears a typical broadly spatulate process, elongate, length about 5x width at middle, whereas a very short rounded process occurs on sternite IX in *P. anomala*. In *P. nigrispina* the phallic sheath is elongate, cylindrical, twisted distally and terminating in a stout, darkly sclerotised spine and bearing a stout seta ventrally at the base of the twist and another spine at just under half length, and its basal apodeme is very short; in *P. anomala* the phallic sheath is short and stout.

Male antennae each with 20 flagellomeres.

Forewing length. Male 1.9 mm (n=1).

Holotype male: New Caledonia, Boulari River (BPBM), examined.

Additional material examined: Province Sud, on road between Noumea and Yaté, 1.0 km NW Pont des Japonais, 22°11.427'S, 166°42.868'E, 113 m, 22.xi–4.xii.2003, Malaise trap, loc#039, leg. K.A. Johanson—1 male (SMNH).

Remarks: A female taken with the male was associated only tentatively.

***Paroxyethira anomala*, new species**

Figs 29–32, 42

The male of *P. anomala* is recognised by the short, widely separated gonopods that have only sparse fine setae, in contrast to those of the only other known New Caledonian species with similar short gonopods, *P. nigrispina*, in which the left gonopod has a brush of dense setae. *Paroxyethira anomala* has only a very short median process on abdominal segment IX, not VIII, and a short, broad phallic sheath, while *P. nigrispina* has the median process on VIII and far longer than wide, and an elongate, cylindrical phallic sheath. The female of *P. anomala* is more similar in form to those illustrated by Leader (1972) for his New Zealand species *P. hintoni* and *P. kimminsi*: sternites VII and VIII are fused to form a symmetrical cone, shallowly cleft apico-ventrally, with a small acute 'spine' in the cleft directed posterad.

Male antennae each with 23 flagellomeres; female antennae each with 19 flagellomeres.

Forewing length. Male 1.9–2.3 mm (n=10); female 1.9–2.3 mm (n=10).

Male genitalia (Figs 29–32). Sternite VII with median short sharp spur. Process on abdominal sternite VIII broadly rounded; length about half basal width. Abdominal sternite IX truncate medially. Tergite IX deeply

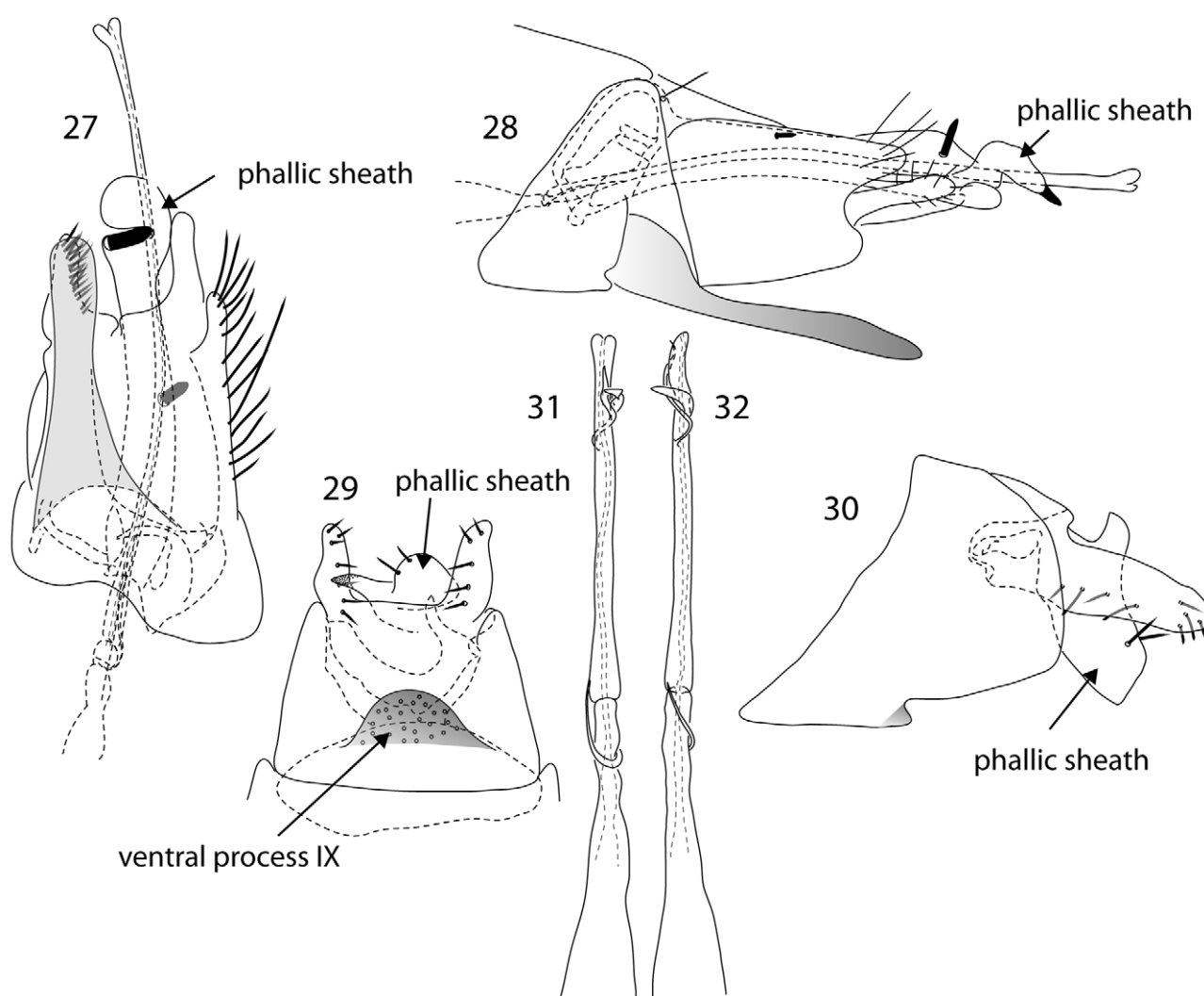
concave apically; laterally scarcely produced distally. Gonopods short, length slightly more than 2x basal width; without dark setae or sclerotised teeth. Phallic apparatus (Figs 31, 32) stout in comparison with other congeners; elongate; constricted at just less than 1/2 length, at which constriction short, threadlike titillator arising; pair of spines present subapically, with one stout and angled, other slender and sinuous. Phallic sheath forming complicated series of mostly sclerotised structures terminating in stout subapical, left-pointing spur and rounded plate bearing 2 rather prominent setae on its left; in lateral view phallic sheath appearing as broad structure with dorsally directed spur.

Female terminalia (Fig. 42). Abdominal sternites VII–VIII fused to form stout, symmetrical cone; apically cleft; surface disrupted by pronounced sockets of scattered setae. Segment X not divided apically.

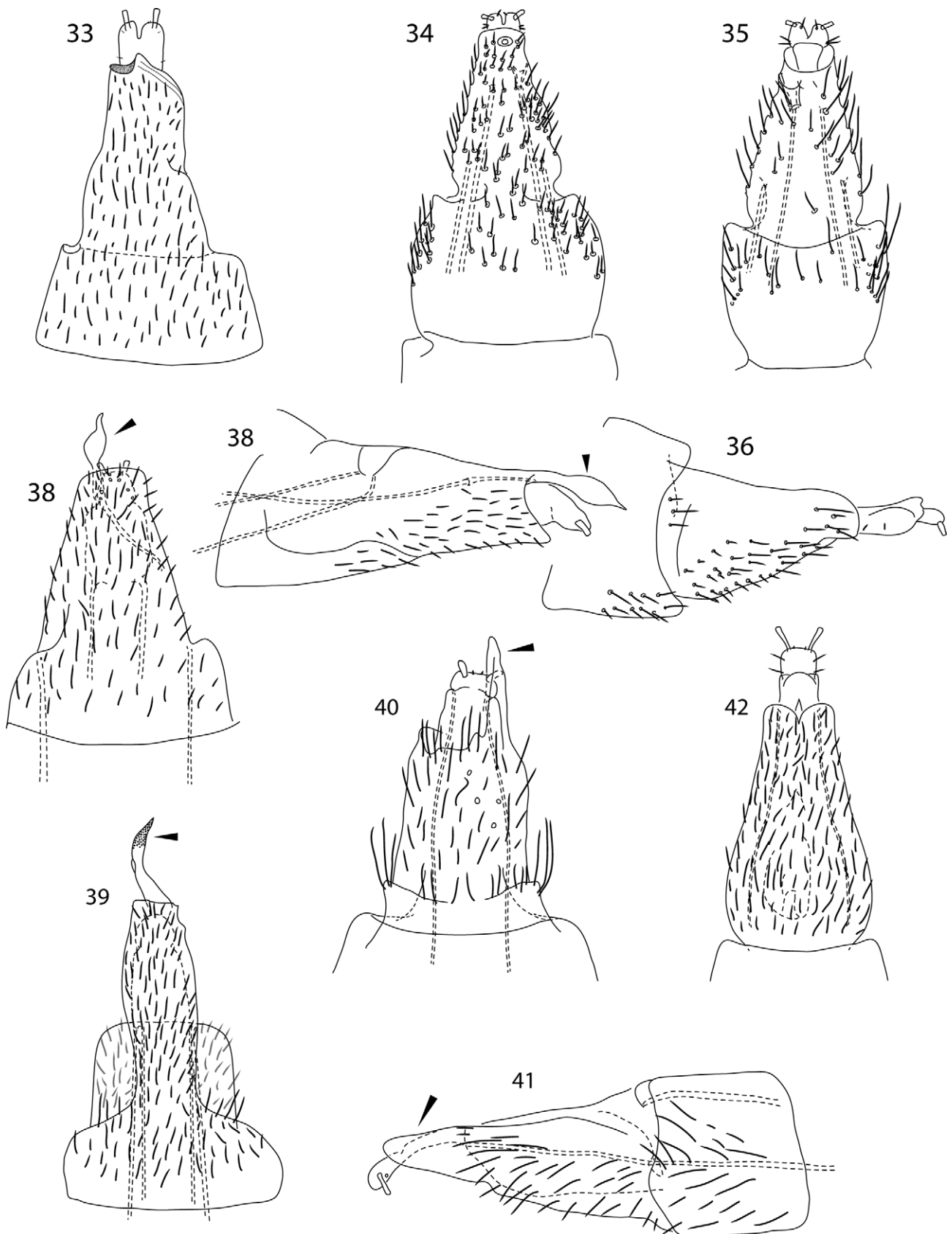
Holotype male: Province Sud, Monts Kwa Ne Mwa, on road between Noumea and Yaté, Rivière des Pirogues, 22°11.225'S, 166°43.338'E, 100 m, 7.xi.2003, light trap, loc#016, leg. K.A. Johanson (MNHP).

Paratypes: Same data as for holotype – 23 males, 16 females (one on slide) (SMNHH); Province Nord, 50 m upstream bridge on Hienghène-Tnèdo road, 3.9 km S summit of Mt. Tnèda, 2.2 km E Tnèdo, 20°43.085'S, 164°49.928'E, 29 m, 7.xii.2003, light trap, loc#071, leg. K.A. Johanson, 1 male (SMNH).

Etymology: *Anomala*, descriptive of the unusual male genitalia.



FIGURES 27–32. 27, 28: *Paroxyethira nigripina* Kelley, male, specimen from Province Sud, on road between Noumea and Yaté, 1.0 km NW Pont des Japonais. 27—genitalia, ventral; 28—genitalia, left lateral. 29–32: *Paroxyethira anomala*, new species, holotype, male. 29—genitalia, ventral; 30—genitalia, left lateral; 31—phallic apparatus, ventral; 32—phallic apparatus, dorsal.



FIGURES 33–42. *Paroxyethira* species, female terminalia. 33—*P. dumagnes* Kelley, ventral; 34—*P. asymmetrica*, new species, ventral; 35—*P. asymmetrica*, new species, dorsal; 36—*P. asymmetrica*, new species, left lateral; 37—*P. atypica*, new species, ventral; 38—*P. atypica*, new species, dorsal view; 39—*P. dzumac*, new species, ventral; 40—*P. serrata*, new species, ventral; 41—*P. serrata*, new species, right lateral; 42—*P. anomala*, new species, ventral. In Figs 37–39 arrow indicating position and shape of process on tergite VIII; in Figs 40, 41 indicating lateral extension of tergum VIII.

Checklist of New Caledonian *Paroxyethira* species

Paroxyethira

anomala, new species
asymmetrica, new species
atypica, new species
dumagnes Kelley, 1989
dzumac, new species
hamata, new species
koegi, new species
nigrispina Kelley, 1989
opposita, new species
serrata, new species

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