

A NEW SPECIES OF EPHYDRELLA TONNOIR AND MALLOCH (DIPTERA : EPHYDRIDAE) FROM HOT SPRINGS AND NOTES ON OTHER DIPTERA FROM MINERALISED WATERS

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SUMMARY

Ephydrella thermarum sp. n. is described from the central North Island where its immature stages live in hot springs. The occurrence is recorded of **Culex rotoruae** Belkin (Culicidae), **Ephydrella novae zealandiae** Tonnoir and Malloch, **Neoscatella vittithorax** (Malloch) (Ephydridae), **Chironomus** sp. (Chironomidae), and other undetermined ephydrids, in mineralised waters of lower temperatures.

INTRODUCTION

A fly breeding in the Black Terraces hot springs which discharge into the Waipahihi Stream at Taupo was discussed by Poynton (1904). It was originally identified by F. W. Hutton as a species of **Opomyza** Fallen (Opomyzidae) and later (Winterbourn and Brown, 1967) as **Ephydrella aquaria** Hutton. The genus **Ephydrella** Tonnoir and Malloch is closely related to **Ephydra** Fallen which includes some hot springs species in other countries, though most of the species breed in saline or alkaline pools at lower temperatures. The records of the four species of **Ephydrella** which have been described from New Zealand (Harrison, 1959) are predominantly from coastal localities, and in all probability from saline or brackish habitats at normal temperatures. The distinctive habitat of the hot springs species strongly suggests that it is biologically distinct and as it is also morphologically distinct it is described here as new.

A NEW SPECIES OF *EPHYDRELLA* (TONNOIR AND
MALLOCH)

Ephydrella thermarum sp. n.

A black or blackish brown species with slight dull metallic green tinge. Body length about 4mm, wing length about 3.5mm.

Head: Antenna blackish brown; basal segment with a few short hairs; 2nd segment with a dorsal bristle and 4 or 5 shorter hairs; arista finely and densely pubescent basally, rays of pubescence progressively longer towards mid-length where they are longer than diameter of base, thereafter sparse, apex bare. Front and orbits blackish brown, front haired; 2 strong outwardly directed fronto-orbital bristles and shorter hairs in same row; verticals strong; post-verticals absent but a group of short hairs behind ocelli. Face protuberant, blackish brown, short-haired. Cheek greenish, short-haired, with one bristle near middle. Occiput short-haired. Proboscis brown. Palpi elongate, slender, slightly tapered, with short hairs.

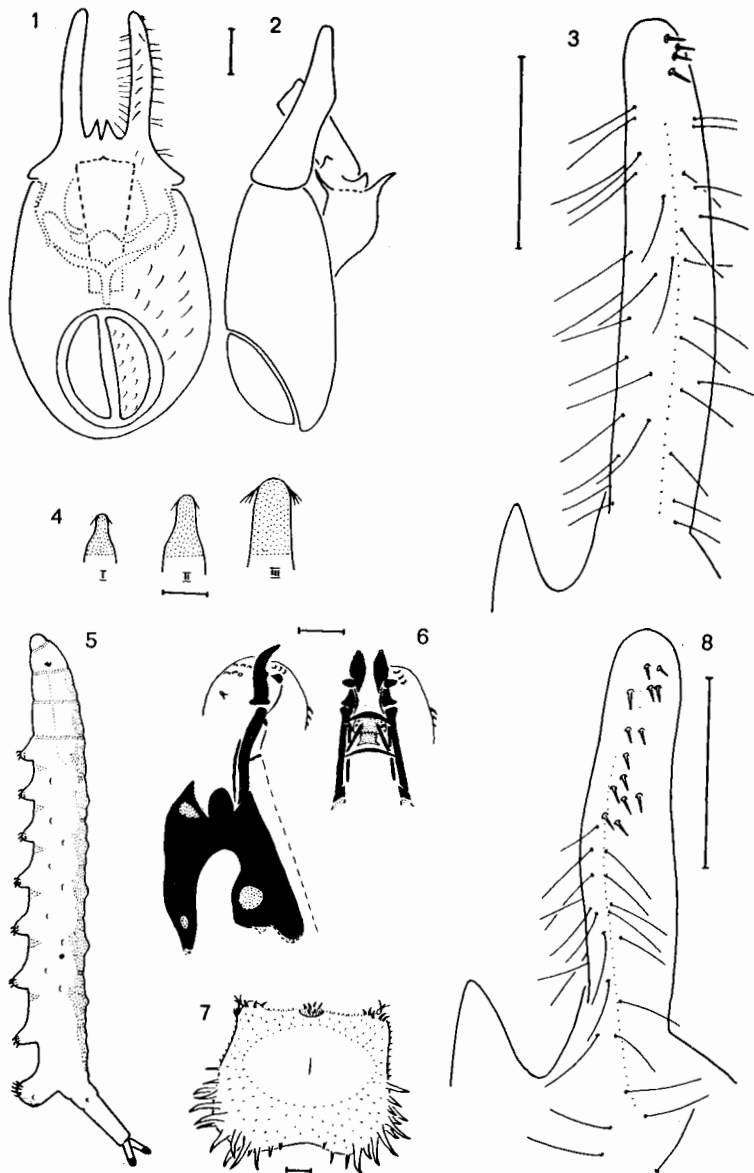
Thorax. Metanotum blackish brown, with slight green tinge, short-haired; 1 prescutellar acrostichal, often absent or present on one side only in male; 5 dorsocentrals, of which one is on the suture and one anterior to it; 1 presutural; 1 relatively small humeral and accompanying short hairs; 2 notopleurals; 1 supraalar; 2 post alar. Scutellum short-haired, with smooth surface, apical scutellars longer than basal scutellars. Mesopleuron with 1 strong posterior bristle and about 5 posterior hairs. Sternopleuron with one strong bristle and short hairs. Legs blackish brown with slight green reflections, mid and hind tibiae with short stout curved spines apico ventrally, basal segment of mid tarsus blackish brown. Wing pale brownish, veins brown, venation as in genus. Wing indices: costal, 3.6-4.1; 4th vein, 1.2-1.6; 4c, 0.5-0.6; 5x 0.4-0.6. Halteres pale creamy to yellowish.

Abdomen. Blackish brown with green reflections.

Male genitalia (Figs. 1 & 2). Anal plate elongate-ovoid, short-haired; genital arch as long as anal plate, narrowly joined dorsally. Clasper as long as genital arch, wide basally, separated from arch by lateral notch and from triangular paramedian lobe by a deep concavity; distal process (Fig. 3) slender, sub parallel-sided, about 7 times as long as paramedian lobe (measured from apex of concavity), haired on dorsum and both sides except tip, hairs longer than width of process, apical eighth without long hairs but with 2-4 short conical spines on outer surface.

Female. Anal plate sub elliptical, short-haired dorsally, with 2 long stout curved bristles ventrally. Ovipositor lobe elongate.

Egg. Elongate-ovoid, length 0.88mm, width 0.3mm, white, chorion finely mammillate.



(Scale lines = 0.1mm)

Figs. 1-7 *Ephydrella thermarum*. (1) Male genitalia, ventral; (2) Male genitalia, lateral; (3) Clasper, ventral; (4) Pigmented spiracular area of tail-branches of larval stages I-III; (5) Larva, stage III; (6) Larva, stage III, buccopharyngeal armature, later (L) and ventral (R); (7) Larva, stage III, 8th segment caudal. Fig. 8 *Ephydrella*, clasper of paratype, ventral.

Larva: Stage I. Length up to 3mm. Resembles Stage II but buccopharyngeal armature smaller (0.29mm long) and without rounded para-pharyngeal plate, the pigmented apex of each branch of the forked tail (Fig. 4) of same teat-like shape but only half as long (0.07mm).

Stage II: Length up to 6mm. Resembles Stage III but without darker dorsal pattern of spinules. Buccopharyngeal armature 0.45mm long. Pigmented apex of each branch of the tail (Fig. 4) teat-like in shape, 0.16mm long, sub-equal in length to basal portion.

Stage III (Fig. 5). Length 9mm. Widest about mid-length, narrowing to head, posterior half sub-cylindrical, with forked respiratory tail arising from dorsum of caudal segment. Integument beset with sclerotised spines, hooks or tubercles and amongst these, except on head, wider regularly-arranged tubercles each bearing 3 or 4 long colourless tapering processes. The spines on the dorsum shorter, stouter and denser, forming a darker inverted sub-triangular area on each abdominal segment. Digitiform antenna on dorsum of head with membranous base and apex and sclerotised segment in middle third. Maxillary palps anterior to antenna, pore-like, with 4 anteriorly spinose sclerotised plates between them, and a row of similar plates more anteriorly. Oral lobes lateroventral, each with a small group of hook-like spines. Buccopharyngeal armature (Fig. 6) 0.74mm long; oral hooks with blunt apical tooth, 4 or 5 similar teeth on mesal margin, and 10 or 11 more pointed teeth on lateral margin; pharyngeal sclerite with large dorsal and ventral cornuae, the latter with a clear area postero-dorsally; an ovoid para-pharyngeal sclerite between the anterior process of the dorsal cornua and the hypopharyngeal sclerite. Prothorax dorsally with dense armature of sclerotised tubercles except for two circular paramedian posterior areas; tubercles less strongly developed ventrally but anterior band of small spines present; thoracic tracheae 3 or 4-branched, projecting shortly from the posterior pleural region. Mesothorax dorsally with anterior band of spines extending posteriorly in the median line, ventrally without plates but with anterior band of spines. Metathorax wholly spinose dorsally, denser and darker in the median region, the anterior band stronger both dorsally and ventrally. First abdominal segment wholly spinose with a more prominent band anteriorly. Abdominal segments 1-7 ventrally with two paramedian conical prolegs each with about 15 backwardly directed apical hooks in three rows. Caudal (8th) segment (Fig. 7) short, directed downward, with two large rounded ventral prolegs each bearing about 25 forwardly-directed hooks; the 6th and 8th prolegs not approaching one another apically, the concavity between them wide and shallow; anus in a transverse oval non-spinose area, above it a small triangular pigmented median plate, and on each side a small latero-dorsal lobe bearing small hooks. Antero-dorsally on the 8th segment and forming a right

angle with it posteriorly arises a respiratory process about half as long as rest of body, tapering, spinose, with a small dorso-lateral tubercle on each side at one-third length from base; two non-spinose retractable tracheal tubes about 2/7 as long as process projecting from apex and diverging at right angles, the distal fourth of each 0.17mm long, brown-pigmented, sides straight and only slightly diverging basally, bearing the spiracular openings apically and below these four palmate hairs.

Puparium. Formed from the larval skin. Length 6.6 mm. Colour brown. Dorsoventrally flattened anteriorly; the emergence suture running from head along pleura of thoracic segments and joining near the posterior dorsal margin of the 1st abdominal segment; in lateral view slightly concave between head and tail dorsally; strongly convex ventrally; the hook-bearing prolegs projecting, those of 6th and 8th segments not apposed, the concavity between them wide and shallow.

Holotype. Male: Black Terraces, Taupo, coll. J. S. Armstrong 25.x.66, in Entomology Division, D.S.I.R., Nelson.

Paratypes. 9 males same data as holotype—1 on pin with female and genitalia of both on same slide, 3 with genitalia mounted on pin.

7 females—1 on pin with male and genitalia of both on same slide.

Distribution. Thermal areas in central North Island, N.Z.: Ohine-mutu, M. Winterbourn, 7.i.67; Waimangu Valley, M. Winterbourn, 7.1.66; Orakeikorako, L. J. Dumbleton, 7.iii.65; Black Terraces (Waipahihi Str.) G. Kuschel, 22.xi.65; M. Winterbourn, —.vi.66; J. S. Armstrong, 25.x.66; Tokaanu, G. Kuschel, 20.xi.65; Ketetahi, M. Winterbourn, 24.x.66.

The new species is very similar to *Ephydra aquaria* Hutton and would run to that species in Harrison's (1959) key to the four New Zealand species, but it is separable on characters of the male claspers. The distal portion of the clasper in both the male paratypes of *aquaria* (Fig. 8) is about four times as long as the paramedian lobe and has long hairs on the basal half, but the distal half bears 12-14 short conical spine—like setae.

The larva of the new species differs from that of *E. novaezealandiae* Tonnoir & Malloch as described below. The larva of *E. aquaria* is unknown.

BIOLOGY

At Orakeikorako and at Black Terraces the adults were flying over and ovipositing on felted mats of blue green algae which floated on the clear running water issuing from the hot springs. An analysis of the Orakeikorako thermal water is given by Mahon (1965) who describes it as near-neutral chloride water characterised by concentrations of 250-400 p.p.m. of chloride 100-300 p.p.m.

of bicarbonate and 50-250 p.p.m. of sulphate. The larvae were entangled in the lower surface of the algal mat, on which they are presumed to feed, or sometimes moving freely on the stones on the bottom. The pupae were also entangled in the algal mat. Winterbourn and Brown (1967) stated that the algae which were predominant and densest at the highest water temperatures in the Waipahihi stream (Black Terraces) were species of *Oscillatoria*. Samples of the algal mat examined by Dr. E. Flint and later by Dr. E. Drouet were found to consist of the following species: *Schizothrix calcicola* (A.) Gomon and *Haplosiphon laminosus* (Ag.) Hansg. from Orakeikorako at temperatures of 41°C and 58°C and from Black Terraces at 51°C, and *Calothrix parietina* (Nag.) Thur. from Orakeikorako at 41°C. Temperatures taken by Dr. J. S. Armstrong at Black Terraces were 51.5°C in the spring, 46°-47.6°C under the algal mat and 40° on the surface of the mat. The larvae were plentiful and active at 51°C in this spring. At Orakeikorako the larvae were moving in the water at 41.5°C, but none were seen at 58°C. Dr. G. Kuschel (pers. comm.) informs me that the larvae were plentiful at Tokaanu between 35° and 45°C. Winterbourn and Brown (1967) found the larvae to be most abundant at temperatures of 44-45°C in the Waipahihi Stream.

In general the existing hydrothermal activity in the North Island appears to date from not earlier than the upper Pleistocene and *E. thermarum* has presumably segregated since that time.

NOTES ON OTHER DIPTERA FROM MINERALISED WATERS

The species mentioned below are mostly from still or very slow flowing water and except for the mosquitoes, appear to be bottom feeders on a more or less solid substratum and not associated with algal mats. Several occur at water temperatures which are little above normal and while they may overlap the lower temperature range of *E. thermarum* this suggests that their particular adaptation is to increased mineralisation rather than to higher temperatures.

EPHYDRELLA NOVAEZEALANDIAE (TONNOIR & MALLOCH) — EPHYDRIDAE

Adults of this species were collected from the margin of a saline pond at Patearoa in Central Otago (Bayly, 1967). The larvae collected from the pond are presumed to be those of the same species. The pond water had a pH of 8.8 and a salinity of 5.99% and was described as a (bi-) carbonate rather than a saline water. The adults were determined by Dr. W. Wirth and subsequent examination showed that claspers of the male genitalia to be identical with the spatulate basally constricted form figured by Tonnoir and Malloch (1926) for *E. novaezealandiae*.

Larvae. Length 6.5mm, generally similar to that of *E. thermarum* in proportions and in the cephalopharyngeal armature. Anterior spiracles small, 3-branched. Integument less densely spinose than in *thermarum*, the dorsal pattern of denser spinosity reduced to relatively small median and sub lateral spots on the abdominal segments. The anterior ventral area of the mesothorax with a band of 3 or 4 rows of pigmented transverse plates whose posterior margins are spinose. The hooks on each of the paired ventral prolegs on the first seven abdominal segments are arranged in two transverse rows each of 4 hooks. There is no spinigerous pigmented platelet in a median dorsal position above the anal area.

Puparium. Length 6.5mm. Tail about half as long as body, the terminal branches about 2/7 of the total length of the tail. In some specimens the apices of the 6th and 8th abdominal prolegs approach one another, enclosing a deep concavity in which lie the hooks of the 7th prolegs.

The larvae and pupae are apparently identical with those described and figured by Benham (1905) from a saline pool at Barewood (near Sutton, Central Otago). The species described by Benham was later identified by Miller (1910) as *Ephydrella aquaria*, but in view of the coincidence in morphology, habitat, and locality it seems likely to have been *E. novaezealandiae*. The type locality for both these species is Christchurch, but both are recorded from other, mostly coastal, localities in which they are likely to be breeding in saline (chloride) waters.

NEOSCATELLA VITTITHORAX MALLOCH—EPHYDRIDAE

Larvae and pupae of this species were collected at Waitapu from a shallow still pool with a temperature of 28°C and adults were bred subsequently. The species occurs in Australia and may be an immigrant species in New Zealand. It has been bred from algal material and swept from beaches in the North Island (Harrison, 1959), but has not previously been reported from thermal areas. There was no obvious algal growth in the pool. The pupae were often inserted into or through the remains of *Chironomus* pupae and may be either saprohogous or predaceous.

Puparium. Length 4.4mm. Anterior trachea with 6 branches. Integument of body and undivided portion of tail with moderately dense short spines, without pattern of denser spines on dorsum. Hook-bearing abdominal prolegs absent. Tail about quarter of total length, the branches half the length of the undivided basal portion. A rounded lateral prominence on each side of the body just cephalad of the anus.

The larvae and pupae are readily distinguished from those of *Ephydrella* spp. by the absence of the ventral prolegs, the smaller size and the shorter tail.

SCATELLA SP. — EPHYDRIDAE

An adult of *Scatella* sp. was extracted from one of a number of pupae collected from the Waipahihi Stream.

Puparium. Length 3.4mm. Anterior trachea with 6 branches. Integument of body and undivided portion of tail with spines which are smaller and more dense than in *Neoscatella*, without a pattern of denser spines on dorsum. Hook-bearing abdominal prolegs absent. Tail about one-eighth of total length, undivided basal portion wide basally, much tapered and subequal in length to branches which are also markedly tapered.

The species may be identical with adults collected at Ohine-mutu, Ketetahi and Tokaanu, but differences in the size and pattern of the spines on the integument of the larvae suggest that there may be more than one species present.

CULEX ROTORUAE BELKIN — CULICIDAE

This species was recognised as distinct and described by Belkin (1962, 1968). It is separable from *C. pervigilans* Bergroth in the larval stage by the shorter stouter siphon with 5 pairs (sometimes 6) of ventral siphon hair tufts. The species is widely distributed in the central North Island thermal area and has occurred in both clear and turbid water at the following localities: Onepu, 28.5°C; Waitangi (L. Rotoehu); Tikitere, 20°C; Whakarewarewa, 28°C; Waiotapu, 28°C; and Orakeikorako. Waters from these localities vary in chloride, sulphate and bicarbonate content and the pH varies from 8.5 to 5.6. A record from Ngawha Springs (Kaikohe) in North Auckland, some 230 miles distant from Rotorua, is noteworthy since the species has not been recorded from the few small hot springs in the intervening area, though these may have been both more extensive and more numerous in earlier geological times. The morphological affinities between them suggest that *C. rotoruae* segregated from *C. pervigilans* and if current ideas on the time of origin of this thermal activity are correct this must have been since the Upper Pleistocene.

CHIRONOMUS SP. — CHIRONOMIDAE

This species occurred at Waiotapu in the pool containing *Neoscatella* and *Culex*. The material available is inadequate for specific determination, but it does not appear, on the male genitalia, to be any of the four species recognised by Freeman (1959) and in particular the green species, *Chironomus cylindricus* Freeman, which was recorded by Winterbourn and Brown (1967) at temperatures below 35°C in the Waipahihi Stream at Taupo.

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