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# A NEW SPECIES AND NEW SUB-GENUS OF AEDES (DIPTERA : CULICIDAE) FROM NEW ZEALAND

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## *Summary*

*Nothoskusea*, a new sub-genus of *Aedes*, is erected for *Aedes chathamicus* sp. n. a salt-pool breeder from rocky coasts of Chatham Islands. Its affinities with *Opifex* Hutton and with the *"Caenocephalus"* species group of *Aedes (Pseudoskusea)* Theobald are discussed.

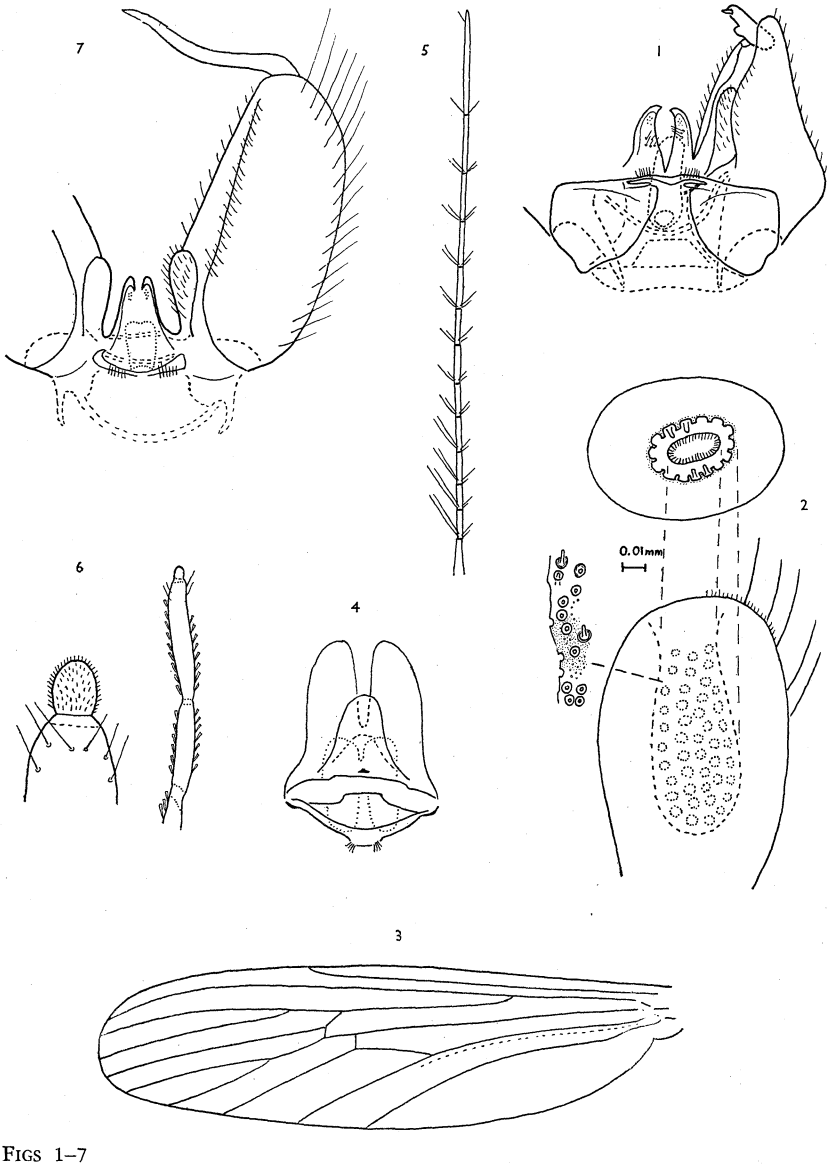

## INTRODUCTION

The new species described below – the first to be collected in New Zealand since 1925 – is of considerable interest in that it is in some respects annectant between *Opifex* Hutton and a group of a typical species at present included in the purely Australian sub-genus *Aedes (Pseudoskusea)* Theobald.

The genus *Opifex* containing the single species *O. fuscus* Hutton (1902) is confined to New Zealand. Miller (1922) redescribed the adult and described the larva and pupa. Wood (1929) included in his study the internal anatomy of the adult and larva. The chaetotaxy of the pupa has been figured by Knight and Chamberlain (1948). Edwards (1921, 1924, 1932) did not accept the new subfamily proposed for the species by Miller and considered that apart from the secondary sexual characters of the male the species did not differ greatly from *Aedes*. He gave (1932) an extended generic prescription.

The male genitalia of *O. fuscus* (Fig. 1) are mainly remarkable for the massive laterally-angulate coxites, the short stout dististyle with a basal internal lobe, the short stout apical appendage and the strongly sclerotised 9th sternite. The secondary sexual characters of the male include the non-plumose antennae with an enlarged scape and a reduced torus and hypertrophied hairs on flagellar segments 2–4, the shortened forelegs and the greatly enlarged fore tarsal claws. The characters common to both sexes are the absence of upright forked scales on the vertex of the head, the presence of an invagination or sac in the apex of the distal segment of the maxillary palp and the stoutness and sub-equal lengths of the flagellar segments of the antennae.

Edwards (1924) considered the absence of upright forked scales on the vertex to be a primitive character. Wood (1929) cited the following characters as primitive: the enlarged scape and reduced torus of the antennae and the paired condition of both the oesophageal ganglion and the last abdominal ganglion in the adult; the distinct antennal and optic lobes of the brain and the presence of two sub-oesophageal ganglia in the larva.




FIGS 1–7

(1) *Opifex fuscus,* male genitalia.
(2) *Opifex fuscus,* maxillary palp: tip of distal segment and sac, end view, and detail of surface of sac. (Scale in mm.)
(3) *Aedes chathamicus,* female, wing.
(4) *Aedes chathamicus,* female, terminal segment of abdomen.
(5) *Aedes, chathamicus,* male, antenna.
(6) *Aedes chathamicus,* male, palp and enlarged apex.
(7) *Aedes chathamicus*, male, genitalia.

Marks (1958) drew attention to the possible relationship between *Opifex* and *Aedes (Pseudoskusea) australis* (Erichson). *Pseudoskusea* was defined by Edwards (1932) on the following characters: male antennae plumose, male palpi long, claspettes absent, coxite without median or apical lobes, phallosome smooth and simple. Two species groups were recognised, the typical group containing *multiplex* (Theobald) and the second (*"Caenocephalus"*) group containing *australis* Erichson and *ashworthi* Edwards. This latter group is characterised by the absence of broad scales on the head, the presence of lower mesepimeral bristles, the large 8th abdominal segment and short cerci, the larger basal lobe on the coxite and the presence of flat black scales on the posterior pronotum. The flagellar segments of the plumose male antennae of *australis* are bead-like except for the two distal segments which are greatly elongated. Mattingly and Marks (1955) have described *A. (P) australis.*

In Edwards (1932) key to the genera the new species would key out to *Opifex* except for the presence of upright forked scales on the vertex and the more slender antennae. If it is run to *Aedes* it is excluded from *Pseudoskusea* in the key to subgenera of *Aedes,* by the short male palpi and in other respects does not fit either of the two species groups of *Pseudoskusea.* Nor does it fit other subgenera such as *Leptosomatomyia* which also have non-plumose male antennae. The strongest affinities of the new species appear, however, to be with the *"Caenocephalus"* group of *Pseudoskusea* viz. the possession of upright forked scales on the vertex, the proportions of the flagellar segments of the male antenna, the form of the maxillary palp and the general similarity of the male genitalia. There is little except the non-plumose male antennae and the proportions of the flagellar segments of the male antennae to suggest close affinity with *Opifex.*

The large invagination or sac in the tip of the distal segment of the maxillary palpi in *Opifex fuscus* (Fig. 2) is apparently unique in the Culicidae. Wood (1929) noted the occurrence of very numerous sensillae in the wall of the sac. The organ is in fact an invaginated concentration of sensillae presumably chemo-tropic in nature. The organ appears to be identical in structure with Lauterborn's organ (sensory vesicle) which occurs, for example, on the third segment of the palp in Simuliidae. The sac is also present in the female palp which, though shorter, is similar to that of the male and not as figured by Miller (1922).

In the new species there is no sac but there is in both sexes, a minute apical pseudosegment. In so far as this is clothed with spinules but is without long hairs or scales it resembles an evaginated sac but it is without the dense concentration of sensillae and is not clearly homologous with the sac in *O. fuscus.* A similar apical pseudosegment is present in the female of *A. australis* (absent in the male) and Edwards (1932) mentions a minute apical segment in *A. (Banksinella) albicosta* Edwards and states that it is often found in genera other than *Culex.*

Neither the larva nor the pupa contributes any strong evidence as to the nearest affinities of the new species. It is not clearly congeneric with

*Opifex* and while it has strong affinities with the *"Caenocephalus"* group of *Aedes (Pseudoskusea)* it is excluded from that subgenus by the current definition.

Recent studies by Dobrotworsky (1961) indicate that the *"Caenocephalus"* group is differentiated from the *multiplex* group not only by adult characters but also by those of the larva and to a less extent those of the pupa. The present definition of the *"Caenocephalus"* group excludes the new species and it appears that this will continue to be the case if the group is given subgeneric status, as seems justified. For this reason it is necessary to erect a new subgenus for the new species described here and a short diagnosis of this is given below.

## NOTHOSKUSEA sub-gen. nov.

Upright forked scales present on vertex of head. Male antennae non-plumose, flagellar segments elongate, not bead-like, only the distal segment markedly longer than the preceding ones. Maxillary palpi short in both sexes and with a small terminal pseudosegment; male palpi without long hairs on the two distal segments.

Male genitalia with simple smooth mesosome, coxite without apical lobe, basal lobe finger-like, not free at apex, extending about one-quarter the length of the coxite between dorsal and ventral flaps. Dististyle long slender, apical appendage short. Claspettes absent.

Type of sub-genus ***Aedes chathamicus*** sp. n.

### *Aedes (Nothoskusea) chathamicus* sp. n.

FEMALE

A large species, larger than *O. fuscus*

HEAD: Long hairs on anterior half. Narrow golden scales on each side of median line and on posterior margin, broader white scales antero-laterally, elsewhere black. Upright forked scales on vertex narrow black.

Antennae: torus yellowish brown, haired mesally, without scales; flagellum grey, flagellar segment 1 nearly twice as long as 2 with a few scales and strongly haired on distal half, 2 shortest, 2–13 increasing in length, short haired along length, basal verticillate hairs about as long as segments, 13 slightly longer than 1. Clypeus brown, bare. Palpi short, about $^1/_6$ length of proboscis, not clubbed or curved, three principal segments dark scaled and haired, segment 1 short, 2 about twice as long, 3 about four times as long, cylindrical, without apical sac but with an apical pseudo-segment which is minute sub-globular, finely spinulose but without scales, long hairs, or sensillae. Proboscis: about as long as fore femora, completely dark scaled, labellum paler.

THORAX: Integument dark, mesonotum mostly clothed with narrow dark scales, scattered narrow golden scales on anterior and anterior lateral margins, a small sub-lateral patch of narrow golden scales on each side at mid-length, traces of median and two sub-lateral lines of golden scales

caudad of the patches. Median lobe of scutellum with long hairs, median and lateral lobes with scattered narrow golden scales. Propleural, anterior pronotal, posterior pronotal, post-spiracular, pre-alar, sternopleural and upper mesepimeral hairs present. Spiracular, lower mesepimeral and post-notal hairs absent. Narrow white scales on anterior pronotum, below post spiracular hairs and on mesepimeron, and two groups on sternopleuron. Narrow dark scales on posterior pronotum.

Legs: dark scaled, deep blue in some lights, tarsi unbanded. Tarsal claws toothed on all legs.

Wings (Fig. 3) length 6·5 mm. Dark scaled, squama and alula fringed. Vein Sc reaching C well beyond mid-length, beyond r–m and level with fork of radial cell. Rs leaving $R_1$ at less than half length of C, without retrograde stub vein. Radial cell nearly four times as long as stem, the fork nearer the wing base than that of medial cell.

Medial cell about three times as long as fork. Anal vein reaching margin past fork of Cu.

ABDOMEN: Tergites dark scaled, in some specimens with a basal lateral patch of white scales on segments 3–5 or 3–6, largest on 4. Seventh longer than wide, tapering, 8th small semi-circular, cerci short little longer than 8th tergite. Sternites dark haired and scaled, 7 longer than wide, tapered, 8th transverse, slightly emarginate apically, less than half as long as 7th. Atrial structure as in Fig. 4.

MALE:

Antennae (Fig. 5) scape not enlarged, 13 flagellar segments, basal verticillate hairs 2–3 times as long as segments on 2–5, on others as long as segment. Segment 1 nearly twice as long as 2, 2–12 increasing in length, 12 three times as long as 2, 13 nearly twice as long as 12. Palpi (Fig. 6) short, with apical pseudosegment as in female.

Genitalia (Fig. 7) mesosome smooth undivided. Paraprocts with group of sub-apical short conical setae but no long sub-basal setae. Claspettes absent. Coxites not angulate laterally, long haired with few scales, no apical lobe, basal lobe between dorsal and ventral flaps, not free at apex, about $\frac{1}{4}$ as long as coxite, haired. Style long tapering, distal appendage very short conical.

HOLOTYPE: Male, bred ex pupa, Chatham Is., 18/11/59.
Deposited in Entomology Division, D.S.I.R.

PARATYPES: 2 males, 8 females, same data.
Paratype male, paratype female, larva and pupa deposited in University of Queensland.

All bred from larvae and pupae collected by the author in saline rock pools at or about high tide mark.

TYPE LOCALITY: Low rocky coast immediately adjoining the cliffs south of Point Weeding near Waitangi, Chatham Island. Other material from a similar site at Point Durham 5 miles to south-west.

PUPA

CEPHALOTHORAX: (Fig. 8): cephalic hairs 3, all trifid; 4 prothoracic hairs, three 5–8 branched, one simple; 2 mesothoracic hairs both bifid; 3 metathoracic hairs, 2 bifid, one 4–5 branched. Trumpet sub-triangular, little longer than wide, basal half with spinules, bases of which give an imbricated appearance, margin of meatus with rounded scalloping.

ABDOMEN: Chaetotaxy as in Fig. 9. Float hair on segment 1 long, 10–15 branched. Long hairs on dorsum of segments 4–6 not longer than the segment. Paddle sub-circular, without fringe, apical hair 4-branched.

The pupa of *O. fuscus* differs in the following respects: submedian mesonotal hair long simple; trumpet without spinules on basal half, reticulated appearance, margin of meatus angularly notched; first abdominal segment with float hair short, 3-branched; hairs on segments 3–5 longer especially on 5 where they are twice as long as the segment; apical paddle hair simple.

The pupa of *A. australis* differs in the following respects: Trumpet less triangular, not as wide as long, apex oblique, margin of meatus not scalloped or notched; float hair on abdominal segment 1 with very broad base and 40–50 branches; paddle with simple apical hair.

LARVA

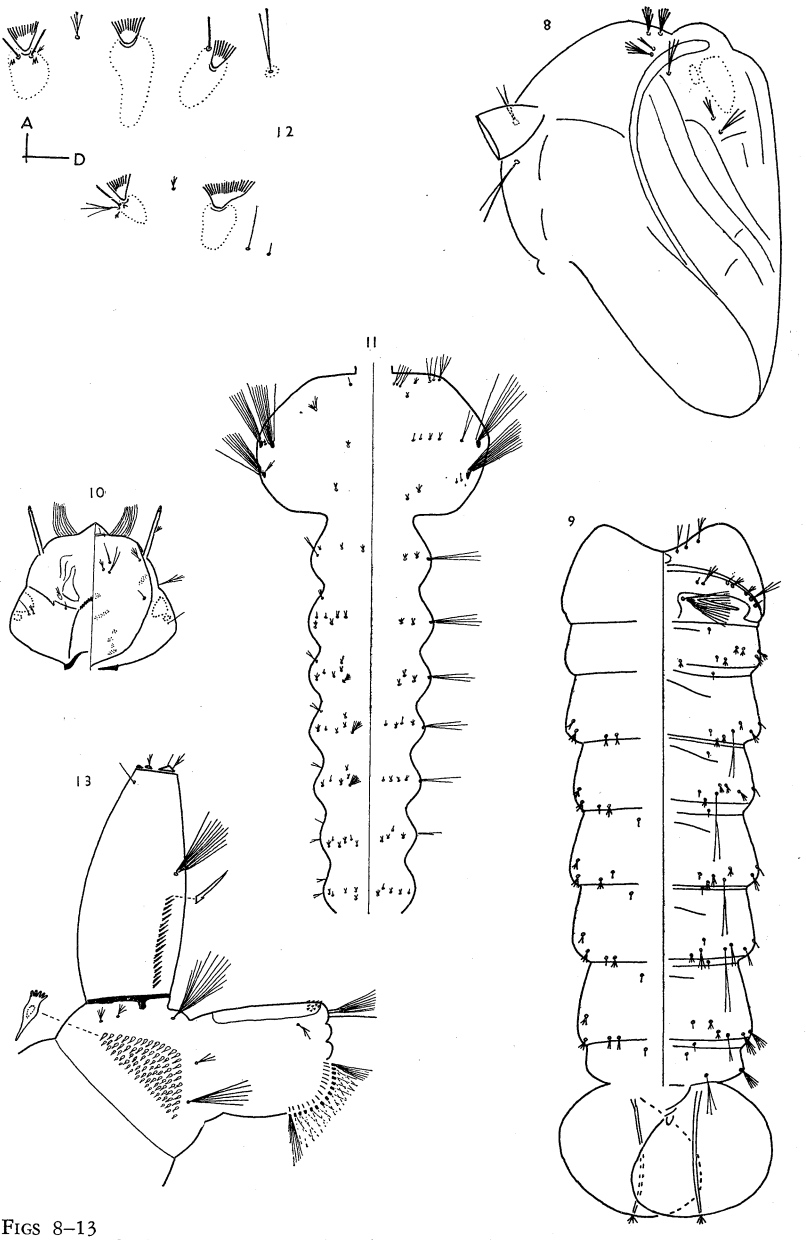
A large larva. Length 9–12 mm.

HEAD (Fig. 10): Chaetotaxy as in Fig. 10. Antennal shaft hair branched. Mentum triangular with 8 teeth on each side of median tooth.

THORAX: (Figs 11, 12) Mesothoracic pleura with three large pigmented sclerites caudad of hair bases and a smaller sclerite at base of 2-branched hair dorsad of these (Fig. 12). Metathorax with both pleural groups with prominent sclerites caudad of bases.

ABDOMEN: (Fig. 11) Prominent basal sclerites on pleural groups on segments 1–5 decreasing in size posteriorly. 8th segment (Fig. 13) with a large triangular comb area, with very numerous comb scales each 5 or 6-fid apically; hairs as in Fig. 13. Siphon twice as long as greatest width which is slightly basad of mid-length, acus present. Pecten of 12–30 spines often extending to mid-length, interrupted at mid-length. Siphonal hair 11-branched. Dorsal apical siphonal hair simple. All valve hairs short. Anal segment with saddle long narrow, twice as long as wide, and spinulose apico-dorsally, saddle hair not on saddle, 3-branched. Dorsal brush with upper caudal many-branched, lower caudal simple. Papillae indistinct small semi-globose. Ventral brush with about 14 tufts.

The larva of *O. fuscus* differs in the following respects: head hairs more distant from median line; antennal shaft hair simple, pigmented spot sub-laterally on dorsum between pro- and mesothorax, less strong development of basal sclerites of pleural hairs of thorax and abdomen; few spines on siphon; the presence of one long hair on the valves; absence of acus; larger wider saddle.




FIGS 8–13
(8) *Aedes chathamicus,* pupa, cephalothorax, lateral.
(9) *Aedes chathamicus,* pupa, abdomen and metathorax, dorsal (R) and ventral (L).
(10) *Aedes chathamicus,* larva, head dorsal (R) and ventral (L).
(11) *Aedes chathamicus,* larva, thorax and abdomen, dorsal (R) and ventral (L).
(12) *Aedes chathamicus,* larva, pleural chaetotaxy of thorax.
(13) *Aedes chathamicus,* larva, anal segment and siphon.

The larva of *A. australis* differs in the following respects: head hairs more distant from median line; less strong development of basal sclerites of pleural hairs of thorax and abdomen; shorter saddle.

The larvae of the *multiplex* group possess a longer and narrower siphon and are characterised by the hooked hairs on the siphonal valves (Dobrotworsky, 1961).

## BIOLOGY

The biology of *O. fuscus* has been discussed by Kirk (1923) and Wood (1929) and, in relation to that of *A. australis,* by Marks (1958). *A. ashworthi* is apparently similar in its biology and ecology to *australis.* These three species, like *A. chathamicus,* all breed in saline water on rocky coasts. *A. australis* is known to be able to breed in fresh water also and it appears (O'Gower, 1960) that the choice of oviposition site is determined principally by the presence of a moist porous substratum adjacent to free water, irrespective of the salinity. *O. fuscus* has also been bred from a freshwater stream at Murray's Mistake, Banks Peninsula. The larvae were taken from still water in a pool containing large rocks. There is no evidence as to the salinity requirements of *chathamicus* but from the nature of the coast and the situation of some pools it is likely that at times there is a considerable dilution with fresh water.

All the adults of *chathamicus* were reared, none being seen at the time of collection, on or around the rock pools containing the larvae and pupae. Most of the larvae appeared to be of nearly the same age. No information was obtained on the biting habits of the females. No other culicine species was associated with *chathamicus* in the breeding sites. The only other species collected on the island was *Culex pervigilans* Bergroth, a common New Zealand species which breeds in fresh water.

Although *fuscus, australis,* and *chathamicus* are all characteristically on windswept rocky coasts, only *O. fuscus* has specialisations in morphology and mating habits which could be interpreted as adaptations to that type of habitat. The other species, appear, however, to be equally successful in this habitat.

## DISTRIBUTION

*O. fuscus* is known to occur on the New Zealand coast from Three Kings Islands, offshore of North Cape, to Dunedin (Marks, 1958). Additional records from the North Island are from Hen Is., Tauranga, and Kapiti Is. (Entomology Division Collection) and from Kaikoura (Canterbury Museum Coll.), Cable Bay, and Banks Peninsula (L.J.D.) in the South Island. The species was not found in the Chatham Islands and has not been recorded from Campbell Island or Auckland Islands.

The species of the *"Caenocephalus"* group range from coastal New South Wales, Tasmania, Norfolk Island, and Lord Howe Island (*australis*) to West Australia (*ashworthi*) (Mattingly and Marks (1955) ).

*A. chathamicus* is known only from the Chatham Islands, five hundred miles to the east of the South Island. Kingma (1959) considers the

Chatham Islands to be a relic of a land mass which was present from the lower Jurassic to the upper Cretaceous, and Dr C. A. Fleming (pers. comm.) states that the islands were relatively stationary during the Tertiary, though subject to recurrent volcanism, and that the endemism of the land fauna implies a fairly long history as land.

The contiguity of the distribution areas of *Opifex, Nothoskusea,* and the *"Caenocephalus"* group of *Pseudoskusea* is consistent with the morphological evidence of relationship. The features in *Opifex* which have been advanced as primitive might suggest that it is a relict genus which has perhaps been isolated in New Zealand since the Cretaceous. It could, however, be a strongly deviant form of later origin. It is curious that the more deviant form (*O. fuscus*) has a much wider distribution than the more normal form (*O. chathamicus*). The suggestion that this group of genera and subgenera may be a result of the disruption of an ancient coastline finds some support in plant distribution. Several species which are present in the Chatham Islands occur in New Zealand only in the extreme north or in the northern half of the North Island. *Leucopogan richei* (Epacridaceae), for example, occurs in the Chatham Is., at North Cape, and in Australia.

## FAUNAL RELATIONS

*Opifex* alone of the New Zealand genera is endemic. While *Opifex* has been considered to be primitive, neither it nor any close relative has so far been recorded from South America, and the apparent southern distribution of the complex is that much less convincing as evidence of a Palaeantarctic origin. The remainder of the native New Zealand culicine fauna is an impoverished representation of genera which are more strongly represented in Australia and other areas to the north of New Zealand. Most of them appear to have reached New Zealand from the north. *Culex, Theobaldinella, Tripteroides,* and *Mansonia* are more numerous in species in Australia, New Guinea, and Melanesia.

*Culex* is represented in New Zealand by one species *C. pervigilans* Bergroth, which occurs throughout and also in the Chatham Islands. The genus is also recorded by Harrison (1955) from the Auckland Islands – the southernmost distribution of any species in the culicine fauna. Females from the Auckland Islands, collected later by Mr E. S. Gourlay, fall within the range of variation of *C. pervigilans. C. pervigilans,* however, belongs to the *trifilatus* group, its nearest relative is *C. iyengari* Mattingly and Rageau (1958) from New Caledonia, and the group has two other species in the Ethiopian region and two in the Holarctic.

*Aedes (Finlaya) notoscriptus* Skuse occurs in New Guinea, Melanesia, Australia, and New Zealand. The species of *Finlaya, Mansonia,* and *Tripteroides* tend to be northern in their distribution within New Zealand.

The Australian *Aedes (Ochlerotatus)* were considered by Edwards (1930) to have probable South American affinities and one species group, occurring in Australia and New Zealand, was stated (1924) to have the same male genitalic characters as one of the South American species groups. Included in this group are two New Zealand species. One of

these *A. (O) antipodeus* Edwards occurs throughout New Zealand. The other *A. (O) subalbirostris* Klein and Marks, though poorly known, appears to be southern in distribution. Mackerras (1950) also considered this Australian species group to be southern in origin, while a second group, not represented in New Zealand was considered to be possibly Lemurian.

*Aedes (Ochlerotatus)* is thus, at the present time, the only taxon in the New Zealand culcine fauna which shows even slight evidence of a faunal affinity with South America.

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