

SOME AUSTRALASIAN MOSQUITOES (DIPTERA, CULICIDAE) OF THE  
SUBGENERA *PSEUDOSKUSEA* AND *NEOCULEX*.

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(Eight Text-figures.)

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*Synopsis.*

The type series of *Culex australis* Erichson is redescribed as *Aedes* (*Pseudoskusea*) *australis* (Erichson), with which *Aedes* (*Pseudoskusea*) *crucians* (Walker) and *Aedes* (*Pseudoskusea*) *concolor* (Taylor) are regarded as synonymous. The type of *Aedes* (*Pseudoskusea*) *cairnsensis* (Taylor) is shown to be a species of *Culex*. Both sexes, pupa and larva of *Culex* (*Neoculex*) *cheesmanae*, n. sp., from New Caledonia are described and figured, and the male terminalia of *Culex* (*Neoculex*) *tricuspsis* Edwards figured. The male, pupa and larva of *Culex chaetovenstralis* (Theobald) are described and figured for the first time; characters of the male show that this species should be placed in the subgenus *Neoculex*. The relationships of the various species are discussed.

*AÈDES* (*PSEUDOSKUSEA*) *AUSTRALIS* (Erichson).

*Culex australis* Erichson, *Arch. Naturgesch.*, 8: 270, 1842. *Culex crucians* Walker, *Ins. Saund. Dipt.*, 1: 432, 1856. *Aedes* (*Pseudoskusea*) *crucians* Edwards, *Bull. ent. Res.*, 14: 387, 1924. *Culicada tasmaniensis* Strickland, *Entomologist*, 44: 181, 1911. *Caenoccephalus concolor* Taylor, *Trans. ent. Soc. Lond.*, 46: 700, 1914. *Aedes* (*Pseudoskusea*) *concolor* Edwards, *Bull. ent. Res.*, 14: 387, 1924; 17: 113, 1926.

Theobald (1901) queried whether *C. crucians* might be a synonym of *C. australis*, but the specimens on which he based his redescription of *australis* were a different species (*Aedes* (*Ochlerotatus*) *nivalis* Edwards, 1926). Edwards (1932) placed *C. australis* provisionally in the synonymy of *Tripteroides* (*Mimeteomyia*) *tasmaniensis* (Strickland) despite the fact that Erichson's description of the abdominal markings and the measurements of size which he gives are inconsistent with such an attribution. Through the kindness of Professor Dr. Fritz Peus one of us (P.F.M.) has been able to borrow the type series of three specimens left by Erichson in the Zoologisches Museum der Universität in Berlin. It thus becomes possible to make a more convincing attribution and at the same time to describe and figure the type series and to mark lectotypes. Erichson's original description is brief and can be quoted in full. It runs as follows:

"245. *Culex australis*. Testaceus, thorace dorso fusco, abdomine nigro-fasciato, femoribus tibiisque summo apice pallidis. Long. corp. 3½, haustell. 2 lin.

"Antennae luteae. Haustellum sat elongatum, palpis maris hoc paulo brevioribus. Caput fusco-testaceum. Thorax dorso fuscus, lateribus et infra testaceus. Abdomen griseo-pilosum, segmentis basi pallidis, apice nigris. Pedes fusco-testacei, femoribus tibiisque summo apice albidis. Alae hyalinae, nervis testaceis, anterioribus fusco-villosis."

No doubt appears to exist regarding the identity of the type series, which comprises one female and two male adults. One male has the head missing. This has been marked as a paratype and the other as the hololectotype. The female has been marked as the allolectotype. The hololectotype bears the number 5986 and the series is accompanied by two labels, not individually attached, bearing the data "Terr. Van Diem. Schayer" and "australis Er." respectively. The whole series will be returned to the Berlin Museum. A description of it follows.

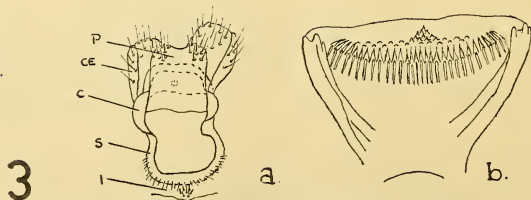
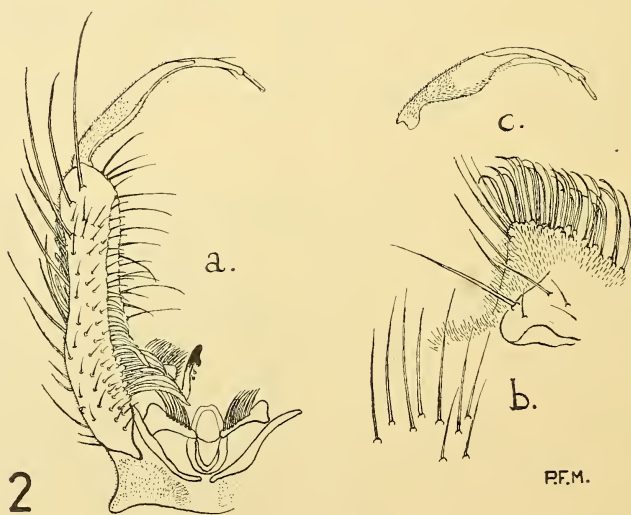
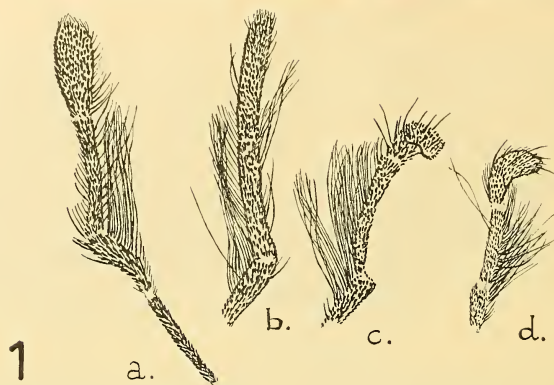


Fig. 1.—*Aedes (Pseudoskusea) australis* (Erichson). Male palps. *a.* Type ♂. *b.* Type ♂ of *Aë. crucians* (Wk.). *c.* ♂ of *Aë. crucians* from Port Davey area. *d.* ♂ of *Aë. concolor* (Taylor) from Sydney.

Fig. 2.—*Aedes (Pseudoskusea) australis* (Erichson). *a.* Terminalia of type ♂ in tergal view. *b.* The same in sternal view. *c.* Style of *Aëdes concolor* from Sydney showing unfurling.

Fig. 3.—*Culex cheesmanae*, n. sp. Female. *a.* Terminalia. *b.* Pharynx. *c.* Cowl. *CE.* Cercus. *I.* Insula. *P.* Post-genital plate. *S.* Sigma.

*Adult ♂.* The specimens are very old, faded, discoloured and in some places denuded. Characters other than structural characters are thus difficult to interpret. *Head:* proboscis mainly dark brownish but with a diffuse yellowish ring at about half-way and some scattered pale scales on both upper and lower surface anteriorly and posteriorly to this. Palps (Fig. 1) dark, about four-fifths the length of the proboscis, their apices swollen, clavate, flattened. Faint indications of pale scaling present at the articulations, especially the terminal one. Clypeus, antennal flagellum and torus apparently devoid of scales. Vertex largely covered with narrow, curved, golden scales. Upright scales golden-brown towards the front, the more posterior ones smaller and black. Broad, flat, yellow scales at sides of head. *Thorax* largely desquamated. Anterior pronotum with broad yellowish scales. Posterior pronotum with broad, flat, dark scales. Similar scales, mixed with broad whitish ones on postspiracular area and sternopleuron. Prealar scales present just below the knob of the latter. Mesepimeron with numerous broad, whitish scales and with a row of four stout lower mesepimeral bristles rather high up near the anterior edge. Scutum and scutellum with narrow, curved, golden and narrow, curved, dark scales. *Wings* apparently entirely dark, length about 5 mm. Knob of halteres appearing mainly dark but with a spot of pale scales. *Legs:* Front femur about two-thirds the length of the proboscis, pale below nearly to tip with a very small knee-spot. Front tibia dark except for a small apical pale patch. First front tarsal largely desquamated, others missing. Mid-femur and tibia similar to those of the front leg. Mid-tarsi dark, the claws unequal, the larger with two teeth, the smaller with one. Hind femur, tibia and first three tarsals apparently much as for the more anterior legs. Last two hind tarsals missing. *Abdomen:* Tergites with very broad whitish basal bands. Sternites mainly pale with small apicolateral spots of dark scales. *Terminalia* (Fig. 2): Style slender, curved, tapering with a more or less pronounced bulge before half-way, pilose towards the base. Terminal appendage cylindrical with cleft and slightly flared tip. Coxite long and narrow with scales on the outer surface, incompletely divided into tergal and sternal flaps, the former with numerous foliate setae on its inner edge towards the base, these becoming smaller and passing into small, curved, unmodified setae anteriorly. The inner edge of the sternal flap has a row of long unmodified setae of which the most basal is longer than its immediate neighbours and therefore conspicuous (Fig. 2b). Basal lobe of coxite densely pilose and with numerous somewhat flattened, recurved setae. Phallosome simple, membranous. Paraprocts (Xth sternites) with strongly sclerotized, hooked apices and each with two microsetae. Lobes of IXth tergite pyramidal, each with about seven strong setae on the inner face. IXth sternite membranous with a median group of nine long, stout setae.

*Adult ♀.* Proboscis appearing paler on about the basal two-thirds. Palps very short, about one-tenth the length of the proboscis or rather less. Torus and first segment of antennal flagellum with small pale scales. Front femur about three-quarters the length of the proboscis. Front and hind claws missing. Mid-claws subequal, each with a single large tooth. Otherwise much as in the ♂.

Save for the appearance of rather extensive pale scaling on the proboscis, the type series of *Aedes australis* agrees well in its colour characters with the types and other specimens of *Aedes crucians* and the series of *Aedes concolor* in the British Museum. The appearance of pale scaling on the proboscis appears to have been exaggerated by fading and it is perhaps significant that Erichson did not mention it in his description. Nevertheless a definite, though less exaggerated, tendency of the same kind is to be observed in some specimens of *Aedes tasmaniensis* in the British Museum. This is also implied in Strickland's description of this form, where he described the proboscis as "darker at the apex than at the base". By analogy with certain species of the related subgenus *Ochlerotatus* this seems likely to be a variable character. The type of *Aedes crucians* is now reduced to thorax, abdomen, wings, and hind femur and tibia, so that a useful comparison is scarcely possible. However, none of these structures shows any characters which are at variance with the inclusion of *crucians* in the present synonymy. Edwards (1924, 1926) based his suggestion that *Aē. crucians* and

*Aë. concolor* should be treated as separate species on the following differences: 1, smaller size of *Aë. concolor*; 2, the swollen last segment of the male palps of this species; 3, its less swollen male style.

One of us (E.N.M.) while collecting in the Port Davey area of Tasmania found it possible to obtain intergrading series from different localities of all sizes from *concolor* up to full-sized *crucians* (wing length of ♀, 4.7–6.2 mm.). The larvae were indistinguishable from those of *Aë. concolor*, descriptions of which can be found in Woodhill and Pasfield (1941) and in Lee (1944). Despite their size the terminalia of the larger specimens appeared to be identical with those of *Aë. concolor*. In all cases except one the male palps were of the *Aë. concolor* type. In this specimen, which was pinned very shortly after emergence, the terminal segment failed to expand and instead retained the appearance considered by Edwards to characterize *Aë. crucians*. The term "swollen" as applied by Edwards to the male style is misleading, since this is not a solid object, but, like many structures in the terminalia of mosquitoes, an incompletely closed integumental tube. The appearance of increased swelling can be produced by rotation of the style into the position in which its greatest breadth is exhibited and by a slight unfurling during manipulation in a viscous mounting medium (Fig. 2c). In the light of this evidence we are no longer prepared to follow Edwards in treating these species as distinct. Instead, we prefer to synonymize them.

*Distribution*: Widely distributed along the south-east coast of Australia. The northernmost record is Fingal, N.S.W., about 10 miles south of the Queensland border (J. L. Wassell, 29:xi:1943). New Tasmanian records are South Arm (17:v:1953, E. G. Connah); Blackman's Bay (6:ii:1954, E. G. Connah); Port Davey area: Bond Bay, Coffin Creek, and coast near Trumpeter I. (—:ii:1954, E. N. Marks); Fisher I., off Flinders I., Bass Strait (22:xi:1952, J. H. Calaby and D. L. McIntosh). Lee (1944) records *Aë. concolor* from Norfolk I. Carter (1920) mentions five ♀♀ of a "probably undescribed species of *Ochlerotatus*" from Lord Howe I., captured by Mr. Laurie in a dwelling house. These specimens were loaned by the Liverpool School of Tropical Medicine to the British Museum, and represent a species of *Aëdes* (*Pseudoskusea*) closely allied to, if not identical with, *Aë. australis*, but males would be needed to determine whether they are conspecific.

#### AËDES (PSEUDOSKUSEA) CAIRNSENSIS (Taylor).

*Pseudoskusea cairnsensis* Taylor, PROC. LINN. SOC. N.S.W., 43: 829, 1919. *Aëdes* (*Pseudoskusea*?) *cairnsensis* Edwards, Bull. ent. Res., 14: 387, 1924.

The type ♀, in the collection of the School of Public Health and Tropical Medicine, Sydney, is not an *Aëdes* but a *Culex*, probably of the subgenus *Lophoceraomyia*. Determination of its identity must await a revision of the Australian species of that subgenus.

#### CULEX (NEOCULEX) CHEESMANAE, n. sp.

*Culex* (*Neoculex*) *pseudomelanoconia* Williams (nec Theobald), Hawaii Plant. Rec., 47: 217, 1943. *Culex* (*Neoculex*) *pseudomelanoconia* Laird (nec Theobald), Bull. ent. Res., 45: 286, 1954.

This species is named in honour of Miss Evelyn Cheesman who, as a collector, has made notable contributions to our knowledge of the mosquitoes of the Australian Region and to whom we are indebted for part of the material here described.

The description is based on holotype ♂, allotype ♀, one paratype ♂, two paratype ♀♀ and six whole larvae, also marked as paratypes, from Nassirah, near Boulouparis, 50–60 miles north of Noumea, New Caledonia, —:viii:1954, bred out by Dr. M. O. T. Iyengar from "rock pools in river" and seven paratype ♂♂, five paratype ♀♀, one pupal pelt, two whole pupae and six whole larvae (paratypes) from Pueblo, near coast, 1500 ft., New Caledonia, —:ix:1949, bred out by Miss L. E. Cheesman from "rock-basins in mid-stream". Types and paratypes in the British Museum collection; two male, two female and two larval paratypes in the University of Queensland collection.

*Adult* ♂. A very small, jet black mosquito. *Head*: Palps and proboscis black, the palps almost exactly equal in length to the proboscis, excluding the labella, the proboscis slightly swollen distally and somewhat darker in this region than towards

the base. Palps with long, stout black hairs at apices of third and fifth segments, some shorter hairs on fourth and fifth segments and a few very short ones on the third segment and the distal half of the second. Torus black, this and the first flagellar segment apparently devoid of scales. Vertex with narrow, curved white decumbent scales and narrow dark upright ones. Broad, flat white scales confined to two small lateral patches in the occipital region which show no tendency to extend onto the vertex. *Thorax*: Anterior pronotum with a few very fine, pale hair-like scales or bristles. Posterior pronotum bare of scales, with numerous fine dark hairs in front of the bristles. Scutum clothed with narrow, rather scanty brown scales with bronze reflection. Some of these scales appear lighter than others, but there is no definite pattern. Scutellum with similar scales apparently confined to the mid-lobe. Postnotum bare. Acrostichal and dorsocentral bristles very strongly developed. Pleura with integument blackish, as in the case of the scutum. Prealar and postspiracular scales absent, some fine pale hairs on postspiracular area. Sternopleuron with an extensive posteromedian patch of moderately broad whitish scales and pale hairs and bristles. Mesepimeron devoid of scales but with an extensive patch of fine pale hairs covering most of the upper three-quarters. Lower mesepimeral bristle absent. *Wings*: dark, length a little less than 2.5 mm. Plume scales narrow and very numerous. Upper (anterior) fork cell 1.8-3.0 times the length of its stem. Lower (posterior) 1.0-1.5 times the length of its stem. Knob of halteres dark, their stems pale on the lower, dark on the upper surface. *Legs*: Coxae with pale scales, some dark ones on the front coxae. Front femur slightly shorter than the proboscis. All femora pale below nearly to tip but with extreme apex dark. On the hind femur the pale ventral line extends onto the anterior surface as a broad stripe ending abruptly just before the apex. Posterior surface similar. On both surfaces the pale stripe tapers somewhat towards the apex, the tapering rather more pronounced on the posterior surface. Anterior claw of front leg larger than the posterior claw, the former with a strongly developed tooth near the middle, the latter with a much smaller tooth towards the base. Mid-claws similar but with the discrepancy in size between anterior and posterior greater. Hind claws small, equal, simple. *Abdomen*: Tergites and sternites entirely black, without pale scales. All segments with very numerous long setae giving an unusually hairy appearance. First tergite devoid of scales. *Terminalia* (Fig. 5a): Style stout, only slightly curved, swelling slightly to a point just before the tip, beyond which it narrows abruptly. Preapical crest strongly developed. Two setulae arising on the distal half. Terminal appendage short, pointed. Coxite not abnormally swollen, narrowing somewhat beyond the proximal portion of the subapical lobe. Subapical lobe in two widely separate portions of which the more distal bears three delicately fringed setae, a short, unmodified seta, a very narrow leaflet and a slender seta with hooked tip. This portion of the lobe is accompanied, as usual, by a long, straight, detached seta. Proximal portion with two long, ligulate setae with recurved tips, separated from the distal portion by an irregular double row of about ten short, stout setae with sinuous tips. Lateral plates of phallosome with the tips hooked but without teeth or tubercles, joined by a narrow, partly sclerotized bridge unusually near the tips. Paraprocts with all teeth relatively broad and blunt, without sub-basal arm. Xth tergites lightly sclerotized, as is usual in this subgenus, with rather numerous microsetae near their point of attachment. Lobes of IXth tergite scarcely detectable, without setae.

*Adult ♀. Head*: Palps about one-sixth the length of the proboscis. *Wings*: Length about 2.5-3.0 mm. Upper fork cell about 2.2-2.7 times the length of its stem. Lower fork cell about 1.0-2.0 times the length of its stem. *Legs*: Tarsal claws all small, subequal, simple. *Terminalia* (Fig. 3a): The terms used in the following description are those of Edwards (1941) (for an alternative nomenclature, see Coher (1949)). Cerci very broad, bluntly rounded. Postgenital plate distinctly bilobed. No atrial plates seen. Insula with a small but distinct circular patch of setulae. IXth tergite not seen, apparently unsclerotized and without setae as in the ♂. Spermathecae three in number, oboval. *Pharynx* (Fig. 3b): Teeth of lower row sharply pointed, those of upper row

difficult to distinguish, apparently blunt. Six teeth in the middle narrower and somewhat longer than the remainder. Lateral and ventral flaps normal for the subgenus.

*Pupa.* The nomenclature employed in the following description is that of Belkin (1952, 1953, 1954). *Cephalothorax:* Trumpet (Fig. 4a) long, slender. Meatus about four-fifths of greatest length. The available material is in poor condition and it is therefore impossible to gain very much idea of the extent of variation in chaetotaxy. Seta 1 long, stout, single; 2 of moderate length, slender, pentafiled; 3 and 4 of moderate length, slender, trifid; 5 long, moderately stout, heptafiled; 6 short, slender, apparently bifid; 7 long, slender, trifid; 8 long, moderately stout, apparently bifid, lightly plumose; 9 missing. *Metanotum:* Seta 10 of moderate length, slender, trifid to pentafiled; 11 long, stout, single, plumose; 12 of moderate length, slender, bifid to tetrafiled. *Abdomen:* Segment I with seta 1 dendroid, as usual, strongly developed with numerous branches which are further subdivided; 2 short, single; 3 long, stout, single, plumose; 4 short, tetrafiled; 5 short, bifid to pentafiled; 6 of moderate length, single; 7 minute, single; 10 minute, trifid. Segment II with seta 1 dendroid, a rather unusual condition, with numerous branches which are further subdivided; 2 minute, single; 3 of moderate length, single; 4 short, bifid; 5 long, slender, bifid or trifid; 6 long, stout, single; 7 minute, single; 10 minute, bifid. Segment III with seta 1 of moderate length, slender, apparently with about 8 or 9 branches; 2 minute, single; 3 long, stout, single; 4 short, single; 5 long, slender, bifid or trifid; 6 missing; 7 to 12 not seen. Segment IV with seta 1 of moderate length, slender, apparently with about six branches; 2 minute, single; 3 of moderate length, slender, bifid or trifid; 4 short, single; 5 long, stout, bifid or trifid; 6 long, slender, single; 7 minute, single; 8 short, single to trifid; 10 short, single or bifid; 11 not seen; 12 of moderate length, single or bifid. Segment V with seta 1 of moderate length, apparently with about four branches; 2 minute, single; 3 of moderate length, bifid; 4 short, bifid or trifid; 5 missing; 6 of moderate length, single; 7 minute, single; 8 short, single or bifid; 10 short, trifid; 11 minute, single; 12 not seen. Segment VI with seta 1 of moderate length, apparently with about four branches; 2 minute, single; 3 of moderate length, single; 4 of moderate length, bifid; 5 long, stout, trifid; 6 long, slender, single or bifid; 7 minute, single; 8 short, single; 10 long, slender, single; 11 not seen; 12 long, slender, single. Segment VII with seta 1 short, slender, trifid or tetrafiled; 2 minute, single; 3 of moderate length, bifid; 4 long, slender, single; 5 short, bifid; 6 short, single to trifid; 7 of moderate length, stout with 5-6 plumose branches; 8 short, bifid or trifid; 10 short, bifid; 11 minute, single; 12 moderate to long, single and plumose or bifid and simple. Segment VIII with seta 5 missing; 7 short, stout, with four plumose branches. Paddles largely destroyed. Dorsal sensillum present near seta 4 on segments III-V. Seta 0 present on segments II-VIII. Seta 14 present on segments IV-VIII, not seen on III.

*Larva* (Fig. 4b). This has been described and figured from New Caledonian material by Williams (1943) and Laird (1954) (in both cases as *C. pseudomelanoconia* Theo.). Their descriptions are very brief and, since they differ from one another in certain respects, it has been thought desirable to redescribe and refigure the larva from material forming part of the type series. Details follow. *Head:* Antenna about two-thirds the length of the head, dark for its whole length, strongly spiculated basad of the antennal tuft, less strongly so beyond it, the tuft well developed with numerous delicate branches which are rather more than half the length of the antenna, subterminal setae arising shortly before the tip. Clypeal spines long, slender, simple, sharply pointed. Inner setae of mouth-brushes stout with numerous teeth. Head seta A (in the notation of Hopkins, 1952) with about 8-10 branches, B and C each with about 5-6, *d* and *e* single or bifid, *f* bifid. Mentum small with seven teeth on either side of the main central tooth, the basal tooth very small. Comb of 29-37 narrow, dark scales. First and third pentad setae strong, plumose, about 6-9 branched; second slender, bifid, arising from a large sclerotized plate; fourth long, slender, single; fifth strong, plumose, with about four branches. Pecten of 16-22 curved spines, those at the base small and atypical, the more typical distal ones with a distal fringe of fine denticles and 1-2 coarse denticles at the base. Siphon tapering sharply on the basal half, more gradually on the distal

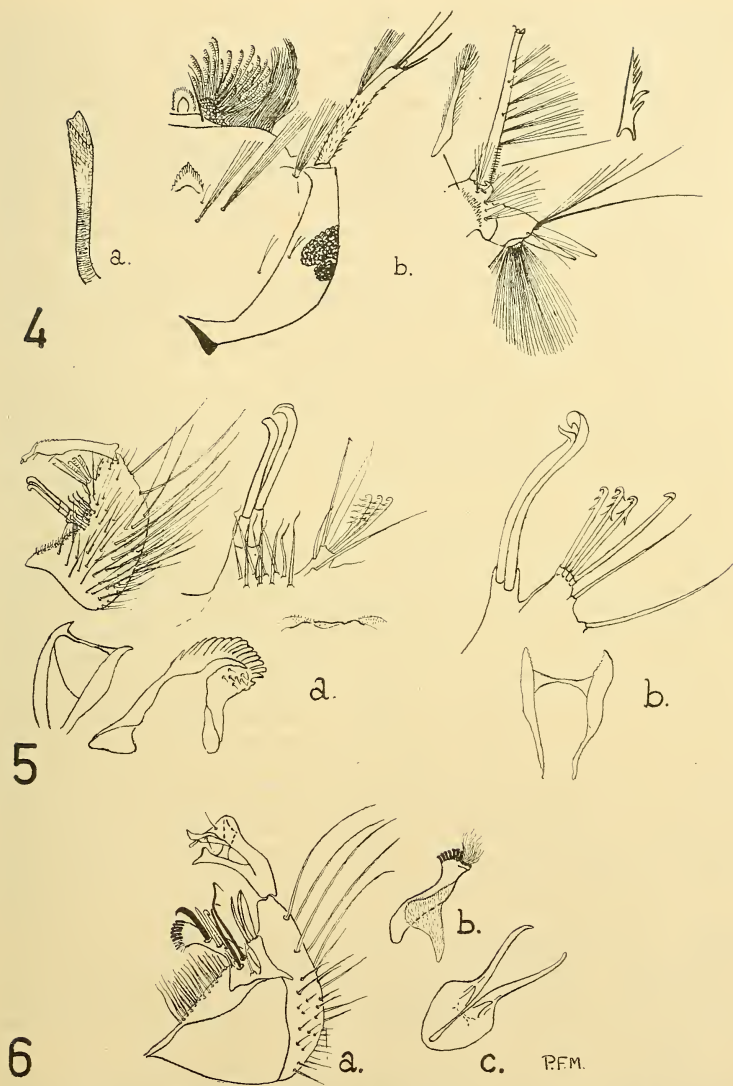


Fig. 4.—*Culex cheesmanae*, n. sp. Early stages. *a.* Pupal trumpet. *b.* Head and terminal segments of 4th instar larva.

Fig. 5.—Male terminalia. *a.* *Culex cheesmanae*, n. sp. Coxite and style, subapical lobe of coxite, phallosome, paraproct and Xth tergite, IXth tergite. *b.* *Culex pseudomelanoconia* Theo. Subapical lobe of coxite, phallosome (specimen from Burpengary, Qld.).

Fig. 6.—*Culex tricuspis* Edwards. Terminalia of holotype male. *a.* Coxite and style. *b.* Paraproct and Xth tergite. *c.* Phallosome.

half. Index about 7.5. In some cases a rather nebulous dark band is apparent on about the middle quarter. Subventral setae of siphon arising near the midline, each about six times the diameter of the siphon at point of attachment and with 4-6 branches. Dorsal to this submedian row are 3-4 delicate single or, occasionally, bifid setae on either side, the most distal of which lies beyond the end of the sub-median row about half-way between this and the apex of the siphon. The spines on the dorsal valves of the siphon are long, slender and curved. Saddle complete, its distal edge spiculate but only slightly more so than the adjacent parts of the general surface. Saddle hair bifid to tetrafid, about twice as long as the saddle. Upper caudal seta with 5-6 branches, lower single. Setae of ventral brush with numerous branches, two precratal tufts present. Dorsal pair of anal papillae narrow, pointed, about half as long again as the saddle. Ventral pair somewhat shorter than the dorsal.

*Variation.* Miss Cheesman's larvae and adults are both decidedly paler than those from Nassirah. The effect may have been enhanced by ageing but appears to be to a large extent intrinsic. It may be an altitudinal effect or it may be associated with individual differences in breeding waters. The similarity in dates of collection suggests that it is not a seasonal effect.

*Synonymy.* The larva figured by Laird (1954) is stated to have head seta B double, C single and *d* branched (figured as double). There can be no doubt that this is an error arising from the fact that ventral setae have been mistaken for dorsal. Working with skins this would be an easy mistake to make, particularly as the multiple branching of setae B and C in the present species is most unusual in *Neoculex* (see below). There appears to be no other reason to doubt that both Laird and Williams described the larva of the present species.

*Relationships.* Edwards (1932) divided the subgenus *Neoculex* into three groups. The same author later (1941) added two further groups, one of these being formed by separating eight species which had previously been grouped under the name *Culex rima* Theobald. King and Hoogstraal (1947) proposed the creation of a sixth group to contain a new species described by them from New Guinea together with *Culex crassistylus* Brug. These groups have no practical value and since they are based on an arbitrary choice of characters, other characters which may well have equal significance being ignored, they can give little idea of relationships. The comments which follow are offered mainly as an illustration of the difficulties involved in determining relationships in this group and of the desirability of exercising caution until all the known members have been adequately described. The outstanding characters of the present species appear to be the pilose mesepimeron, the hairy abdomen, the structure of the female pharynx, the ornamentation of the subapical lobe of the male coxite, the smooth phallosome, absence of fine setulae from the crest of the paraproct, reduction of the male and female ninth tergite, structure of the larval mouth brush, multiple branching of larval head setae B and C, structure of the pecten teeth and long subventral tufts of the siphon. One of us (P.F.M.) is engaged on a comprehensive study of this subgenus and it is hoped that in due time it will be possible to study all these characters on a comparative basis. The present comments are in the nature of an interim statement based on the limited information at present available.

*Mesepimeron.* The pilose condition is very unusual. A similar condition is, however, shown by a West African member of the *Culex rima* group, *Culex calabarensis* Edwards. The latter has a well-developed lower mesepimeral bristle in both sexes. The present species has not.

*Female pharynx.* The pharyngeal armature of the present species is unlike that of *C. calabarensis* but closely resembles that of another member of the *C. rima* group occurring in the West African subregion, *Culex andreanus* Edwards. The pharynx of *C. calabarensis* resembles that of yet other members of this group. Only the pharynxes of the Ethiopian and one Oriental member of the subgenus have previously been described (see Edwards, 1941; Barraud, 1934).

*Abdomen.* The very hairy abdomen recalls the Mediterranean *Culex impudicus* Ficalbi, in which, however, it mainly characterizes the male.



*Male terminalia.* It is not proposed to discuss the ornamentation of the subapical lobe of the coxite in detail. This is because even the best of the many published descriptions of this structure are insufficiently critical while some of the worst are grossly misleading, as, e.g., the description and figure of *Culex salisburyensis* Theobald by Edwards (1941) (see Knight, 1953). It is clear that in all or nearly all the members of the subgenus the seemingly very various types of ornamentation are derived from a single basic setal pattern and there is good reason to believe that a careful study of the extensive material available will furnish first-rate evidence regarding relationships. The smooth phallosome is characteristic of a number of Mediterranean species, though not of the holarctic *Culex territans* Walker and its allies or of *C. impudicus*. Some species are intermediate, as, e.g., the Australian *Culex pseudomelanoconia* Theobald (Fig. 5b) and the very interesting *Culex deserticola* Kirkpatrick, which has a close ally, *C. salisburyensis* occurring along the line of the East African highlands from Abyssinia to the Cape of Good Hope (Mattingly, 1954). The crest of the paraproct shows reduction of the finer setae in most of the Mediterranean *Neoculex* (including a new one from Baluchistan, of which a description is in the press) and in *C. salisburyensis*. It would seem that in most of the Ethiopian species these setae are more strongly developed, and the same is true, curiously, of the Mediterranean *Culex hortensis* Ficalbi, which has a smooth phallosome. The latter species is the only one at present known to us which resembles *C. cheesmanae* in the extreme reduction of the ninth tergite. The reduction of the ninth tergite of the female is probably equally significant, but, so far as we are aware, the present species is the only *Neoculex* for which the female terminalia have been described.

*Mouth-brushes and larval head setae.* The presence of stout, toothed setae in the mouth-brushes is characteristic of many species breeding in tree-holes, leaf axils and containers of various kinds. It is, however, extremely rare in the subgenus *Neoculex*. Even the larvae of the Ethiopian tree-hole breeding species *Culex albiventris* Edwards, *Culex adersianus* Edwards, *Culex acrostichalis* Edwards, *Culex wansoni* Wolfs and *Culex horridus* Edwards do not show them. They are, however, exhibited by the very remarkable larva of *Culex stellatus* Van Someren from the Seychelles, the zoogeography and relationships of which have been discussed by Mattingly and Brown (1955). The same is true of the multiple head setae. Toothed mouth-brush setae are also shown by the highly specialized larva of *C. (Neoculex) sumatranus* Brug, but, like other pitcher plant breeders, this has greatly reduced head setae.

*Siphon and pecten.* These recall the subgenus *Lophoceraomyia* (for which see Mattingly, 1949) and may, perhaps, be mentioned as illustrating the close relationship which undoubtedly exists between this and *Neoculex*. There is also a striking resemblance between the pecten and siphon of *Culex prosecutor* Séguéy (1927, figured by Séguéy, 1925, as *Culex pseudomimeticus* Séguéy, nec Sergent). This is a highly interesting species from the south of France which is still known only from the larva. Edwards (1932) treated it as a species *incertae sedis* but it seems very likely that it is a *Neoculex*.

*Distribution.* Since this species is confined, so far as is known, to New Caledonia, little can be said regarding its geography beyond noting the markedly different altitudes at which the two sets of specimens available to us were collected. Before discussing the distribution of its close relatives it is necessary to determine which these are and, as has been seen, this is not very easy. The most that can be said at present is that *C. cheesmanae* appears to possess characters relating it both to the Mediterranean (and East and South African) species group and to the West African species group. It might be inferred from this that it is a primitive annectent species. This is a rather facile assumption, but it seems to receive some support from the characters of the larval head. Thus the multiple head setae undoubtedly suggest some affinity with species of subgenera other than *Neoculex* while the remarkable mouth-brushes suggest even remoter affinities. It must, however, be stressed that in assessing the value of larval characters such as these it is necessary to allow for coenogenesis and kindred phenomena (see, e.g., De Beer, 1951, on *Culex moucheti* Evans).

## CULEX (NEOCULEX) TRICUSPIS Edwards.

*Culex trifidus* Edwards, *Bull. ent. Res.*, 17: 108, 1926. *Culex tricuspis* Edwards (nom. nov.), *ibid.*, 21: 294, 1930. *Culex (Neoculex) tricuspis* Edwards, *Genera Insect.*, 194: 194, 1932.

This species is annectent between the subgenera *Culiciomyia* and *Neoculex*. On the basis of the head scaling it would be placed in the former, but the absence of modified scales from the male palps and the presence of apical pale bands on the abdominal tergites appear to justify its inclusion by Edwards in *Neoculex*. The male terminalia are perhaps the most remarkable in the whole genus. They were well described by Edwards (1926) but have not been figured. It has therefore been thought worth while to include a figure in the present paper (Fig. 6). The species is at present known only from the unique holotype male from Alor I. in the British Museum (coll. Rodenwaldt, —:i:1926). The trifid style is unique and can be compared only with the bifid style of the Indomalayan *C. (Culiciomyia) spathifurca* Edwards (figured by Carter and Wijesundara, 1948, as *C. stylifurcatus*, n. sp.). The basic structure of the style is, however, closer to that of many species of the subgenera *Culiciomyia*, *Lophoceraomyia* and *Mochthogenes* and a few remarkable species of the typical subgenus, e.g. the Polynesian *C. atriceps* Edwards and the Ethiopian *C. nakuruensis* Mattingly. The remarkable outgrowth from the subapical lobe of the coxite with its crown like that of the paraproct can only be compared with that found in the Mediterranean *C. (Neoculex) hortensis* Ficalbi, but here the crown is replaced by a flattened, vesicular structure. The phallosome recalls that of the Ethiopian *C. (Culiciomyia) subaequalis* Edwards which it very closely resembles. The pilose Xth tergite recalls *C. (Neoculex) peringueyi* Edwards from the Cape Town area of South Africa. The membranous IXth tergite recalls *C. cheesmanae* and *C. hortensis*.

## CULEX (NEOCULEX) CHAETOVENTRALIS (Theobald).

*Neomelanconion chaetoventralis* Theobald, *Mon. Cul.*, 5: 461, 1910. *Culex (Lophoceratomyia?) chaetoventralis* Edwards, *Bull. ent. Res.*, 14: 397, 1924.

The type female is in the British Museum (Natural History) collection. The discovery of males and larvae enables this species to be placed with certainty in the subgenus *Neoculex*. Theobald gave the type locality as "Kumanda", and this is also on the locality label of the type, but is obviously a mis-spelling of Kuranda; Edwards (1924) gives the correct spelling.

*Adult ♀.* Two additional ♀♀ agree well with Theobald's description and with the type specimen. The thoracic integument is brown; the scutum has a narrow anterior and lateral border of lighter grey, parallel to which on the pleuron there is a broad grey band across the lower half of the posterior pronotum, subspiracular area, upper sternopleuron and middle of the mesepimeron; below this again the coxae are pale. Anterior pronotum bare of scales. Posterior pronotum bare of scales or with 2-3 narrow curved scales on its upper border; 3-5 bristles. Scutal scaling bronzy rather than golden brown, with paler scales on the pale border; acrostichal and dorsocentral bristles very strongly developed. Scutellum with six bristles to the mid-lobe and four to the lateral lobes. A patch of broad pale scales on the upper sternopleuron overlying the pale integument; a few pale scales also along the lower posterior border in front of the bristles. Mesepimeron devoid of scales; about 10 pale upper and no lower mesepimeral bristles. Wings dark, length 2.6-2.9 mm. A short streak of pale scales at the base of  $R_1$  (the type has quite a long stripe of pale scales covering  $R$  and part of the proximal portion of  $R_1$ ; this is not mentioned in the original description). Upper fork cell 1.7-2.0 times the length of its stem, lower 0.7 times its stem. Knob of halteres dark scaled above, pale beneath. *Legs:* Coxae pale scaled, fore femur equal in length to proboscis; hind femur with pale anterior and posterior streaks, almost to apex. *Abdomen:* Second tergite with large sublateral basal pale patches joined medially by a narrow band; third to sixth with almost complete basal bands widest laterally and interrupted by dark scales medially; sternites pale scaled with apparently some darker, reflecting scales laterally and apically. The tip of the abdomen is not down curved in these specimens.

*Adult ♂.* Differs from the ♀ as follows: Palps straight, black scaled, 1.3 times the length of the proboscis (the tip of which, excluding the labella, reaches the middle of the fourth palpal segment); a few long dark hairs at the apices of third and fifth segments, long and short hairs along the fourth and fifth segments. Scutellum with 5-6 bristles to mid-lobe, 3-4 to lateral lobes. Wing length 2.5-2.9 mm.; upper fork cell 1.5 times the length of its stem. Anterior claw of fore- and mid-legs long with a sharp, strongly developed tooth, posterior claw smaller, simple; hind claws small, equal,



Fig. 7.—*Culex chaetovenstralis* (Theobald). Male terminalia. a. Coxite and style. b. Sub-apical lobe of coxite. c. Paraproct and Xth tergite. d. Phallosome, tergal view. e. Lateral plate of phallosome, sternal view.

Fig. 8.—*Culex chaetovenstralis* (Theobald). Early stages. a-b. Pupa. a. Trumpet. b. Paddles. c-g. 4th instar larva. c. Head. d. Mentum. e. Terminal segments. f. Comb scale. g. Pecten spine.

simple. Second tergite with large lateral basal pale patches, reaching almost to the apex, and joined by a narrow band medially, or entirely pale scaled, except for a medial apical dark patch, third to seventh tergites with fairly straight broad basal bands, which may be narrower medially on the seventh; eighth white-scaled laterally, dark medially. Numerous hairs on the sternites and laterally on the tergites, a few also along the apical borders of the tergites. *Terminalia* (Fig. 7): Style stout, curved, narrowing near the tip, without preapical crest; 2-3 setulae arising on the distal half.

Terminal appendage short, with expanded, rounded tip. The two portions of the subapical lobe of the coxite not widely separated; the distal portion bears a row of five setae, three moderately stout, with slightly recurved, flattened tips, one longer unmodified seta, and one slender leaflet and, in addition, a strong detached seta arises near their base; the proximal portion bears two ligulate setae with slightly curved tips, the distal one being the stouter; a long strong seta arises near their base. Lateral plates of phallosome joined by a narrow sclerotized bridge fairly close to their tips, which are rounded and bear minute denticles; on the sternal aspect, the inner surface of the lateral plates is covered with flat, appressed spines, their points directed distally. Paraprocts with nine relatively broad blunt teeth and without sub-basal arm; Xth tergites lightly sclerotized with 2-3 microsetae near the point of attachment. Lobes of IXth tergite distinct, with 3-4 setae.

*Pupa* (Fig. 8, *a, b*). The longer setae are usually lightly plumose. *Cephalothorax*: Trumpet long, slender; meatus four-fifths of greatest length. Seta 1 long, stout, bifid or trifid; 2 long, slender, bifid or trifid; 3 long, stout, single; 4 short, slender, bifid or trifid; 5 long, moderately stout, bifid to tetrafid; 6 short, slender; 7 moderately long, slender, both trifid or tetrafid; 8 long, stout, bifid to tetrafid; 9 moderately long, slender, bifid. *Metanotum*: Setae 10 and 12 moderately long, slender, bifid or trifid; 11 short, single or bifid. *Abdomen*: Segment I with seta 1 dendroid, strongly developed, with 9-11 primary branches which are further subdivided; 2 short, single; 3 long, stout, single; 4 short, bifid to tetrafid; 5 short, tetrafid to hexafid; 6 long, stout, single; 7 short, single; 10 moderately long, slender, single to trifid. Segment II with seta 1 short, fine, with 6-10 branches; 2 small, single; 3 moderately long, single; 4 short, trifid to heptafid; 5 moderately long, slender, bifid to tetrafid; 6 long, stout, single; 7 minute, single; 10 moderately long, slender, bifid. Segment III with seta 1 moderately long and stout, with 8-13 branches; 2 minute, single; 3 moderately long, stout, single; 4 short, trifid to hexafid; 5 and 6 moderately long, slender, 5 trifid to tetrafid, 6 bifid or trifid; 7 minute, single; 8 short, tetrafid to heptafid; 10 short, trifid to heptafid; 11 short, single; 12 moderately long, slender, bifid. Segment IV with seta 1 long, stout, bifid to tetrafid; 2 minute, single; 3 short, with 7-11 branches; 4 short, bifid or trifid; 5 long, stout, trifid or tetrafid; 6 moderately long, slender, single or bifid; 7 minute, single; 8 short, trifid or tetrafid; 10 short, bifid to tetrafid; 11 short, single; 12 moderately long, slender, single or bifid. Segment V with seta 1 moderately long, slender, single or bifid; 2 minute, single; 3 short, bifid or trifid; 4 short, with 6-8 branches; 5 long, stout, bifid; 6 moderately long, slender, single or bifid; 7 minute, single; 8 short, bifid to tetrafid; 10 short, with 6-9 branches; 11 short, single; 12 moderately long, slender, single. Segment VI with seta 1 moderately long, slender, single or bifid; 2 minute, single; 3 short, bifid or trifid; 4 short, bifid to pentafid; 5 moderately long and stout, single or bifid; 6 moderately long, slender, single or bifid; 7 minute, single; 8 short, trifid to pentafid; 10 and 12 moderately long, slender, single; 11 short, single. Segment VII with seta 1 moderately long, slender, bifid; 2 minute, single; 3 short, trifid to pentafid; 4 short, bifid or trifid; 5 moderately long, slender, single; 6 short, trifid to hexafid; 7 long, very stout, plumose, with 4-8 branches; 8 short, trifid to hexafid; 10 moderately long, slender, single; 11 short, single; 12 moderately long, slender, single or bifid. Segment VIII with seta 5 moderately long, slender, bifid or trifid; seta 7 long, very stout, plumose, with 5-8 branches. Paddles oval, index 1.3-1.5, with well-developed buttress and midrib and inconspicuous small spines scattered along the margin; seta 1 single or bifid. Dorsal sensillum present near seta 4 on segments III-V. Seta 0 present on segments II-VIII, and 14 on segments III-VIII.

*Larva* (Fig. 8, *c-g*). *Head* slightly broader than long, rounded posteriorly. Antenna about one-half the length of the head, concolorous brown, strongly spiculated basad of the antennal tuft which arises at three-quarters length; tuft well developed with numerous branches, which are rather more than half the length of the antenna, subterminal setae arising shortly before the tip. Clypeal spines fairly short, slender, simple, sharply pointed. Setae of mouth-brushes simple. Head seta A 7-9 branched, B and C bifid, *d* single (occasionally with short bifurcation), *e* bifid or trifid, *f* trifid

to heptafid. Mentum small, with 8-9 teeth on either side of the large pointed central tooth, the basal tooth small. Comb of 50-60 slender, fringed scales; first pentad seta strong, plumose, 4-6 branched; second slender, simple, bifid or trifid; third strong, plumose, 6-9 branched; fourth simple, single; fifth stout, lightly plumose, single or bifid. Pecten of 11-18 spines, those at the base small and atypical, the more typical distal ones with a very strong pointed sub-basal tooth, sometimes a small basal tooth also, and with a distal fringe of 2-4 fine denticles. Siphon tapering sharply near base, then more gradually, index 9.0-12.0; five pairs of fine 2-5 branched subventral setae, each about equal to the diameter of the siphon at point of attachment, the more basal setae arising laterally; arising dorsal to the two distal pairs are two pairs of single to tetrafid setae. Dorsal valves of the siphon each with a long slender seta, about three times the diameter of the tip of the siphon. Saddle complete, its distal edge spiculate, but only slightly more so than the adjacent parts of the general surface. Saddle hair bifid to tetrafid, one half as long as the saddle. Upper and lower caudal setae single. Ventral brush of 14 setae, the distal ones with 9-12 branches; 2-4 of these tufts are precratal. Anal papillae stout, bluntly pointed, the upper pair four-fifths as long as the lower pair, which are equal in length to the saddle.

*Relationships.* Though the adults are abundantly distinct, the larva of *C. chaetovenralis* bears a close resemblance to that of *Culex (Neoculex) brevivalpis* (Giles) but can be distinguished by the shape of the pecten spine (which in *C. brevivalpis* has a fringe of fine denticles but no large sub-basal tooth), the long seta of the dorsal valve, and the presence of precratal tufts. In the long palps, the basally banded abdomen and the structure of the paraproct, the male of *C. chaetovenralis* resembles the New Guinea species *Culex (Neoculex) crassistylus* Brug and *Culex (Neoculex) pedicellus* King and Hoogstraal but differs from them in the absence of flat scales bordering the eyes. It further resembles *C. pedicellus* in the presence of appressed spines on the lateral plate of the phallosome, but the two species differ markedly in characters of the coxite and style.

*Distribution.* Known only from north Queensland. The type locality is Kuranda, and the above descriptions are based on the following specimens in the University of Queensland collection: Two ♂♂ and one ♀ with correlated larval and pupal skins and two whole larvae from Kuranda (23:vi:1946), two pupae containing males ready to emerge, with correlated larval skins, and two whole larvae from Lake Barrine (9:vi:1946) and one ♀ with correlated larval and pupal skins from Berner Creek near Innisfail (13:v:1952), all collected by E. N. Marks.

*Biology.* *C. chaetovenralis* breeds in tree-holes in rain-forest. At Kuranda larvae were found in a cavity about 5 in. in diameter and 10 in. deep in the buttress of a rain-forest tree, and in a rot-hole about 4 in. in diameter and 18 in. deep in the trunk of a smaller tree. At Lake Barrine, the breeding place was a deep groove in a large fallen tree, holding a narrow pool of water about 8 ft. long and up to 1 ft. deep; 6-8 gallons were siphoned off without emptying it. At Berner Creek, *C. chaetovenralis* was breeding in a cup-like depression holding about 1½ pints of water, in a buttress of a tree-stump. In all cases the water was fresh and somewhat discoloured, and contained rotting leaves and debris. Associated larvae included *Aedes notoscriptus* (Skuse), *Aedes quasirubithorax* (Theobald), *Aedes candidoscutellum* Marks and *Tripteroides quasiornata* (Taylor).

The pupal period occupied about four days but would probably be less in summer.

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