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THE GENUS *THEOBALDIA* (DIPTERA, CULICIDAE) IN VICTORIA.

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(Nine Text-figures.)

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Synopsis.

Three species of the genus *Theobaldia*, *T. frenchi* Edw., *T. hilli* Edw., and *T. inconspicua* Lee have been previously recorded from Victoria. To this list are now added *T. littleri* Taylor, *T. victoriensis*, n. sp., and *T. frenchi atritarsalis*, n. subsp.

The adults of *T. hilli*, *T. frenchi* and *T. littleri* are redescribed and descriptions are given of the previously unknown immature stages of these species.

On the basis of the structure of the larvae, *T. victoriensis*, n. sp., is placed in the subgenus *Culicella*. For *T. hilli* Edw. and *T. frenchi* Edw., a new subgenus, *Neotheobaldia*, and for *T. littleri* Taylor a new subgenus, *Austrotheobaldia*, are proposed.

An account is given of the biology of the Victorian species of *Theobaldia*.

INTRODUCTION.

Mosquitoes of the genus *Theobaldia* are widely distributed in the northern hemisphere mainly in temperate regions; a few species extend into the tropics in Africa and North America. In the southern hemisphere the genus is represented only by two species in Africa, one in New Zealand and seven in Australia.

The six species hitherto known from Australia are: *T. atra* Lee, from Western Australia, *T. inconspicua* Lee, from New South Wales and Victoria, *T. hilli* Edw. and *T. frenchi* Edw., from Victoria, *T. weindorferi* Edw., from Tasmania, and *T. littleri* Taylor, from Tasmania and New South Wales.

The original descriptions of these species, except the first two, were inadequate in many respects, so that accurate identification was difficult. Lee's (1937) revision went some way towards clarifying the situation, but he was hampered by having only a few specimens for examination. With an abundance of material of all the Victorian species, some collected in the field and some obtained by laboratory breeding, it has been possible to make a full analysis of their distinctive features and to prepare descriptions of the immature stages, which were previously unknown except in the case of *T. inconspicua*. This paper also includes a description of a new species, *T. victoriensis*, n. sp., and information on the biology and distribution of the genus in Victoria.

BIOLOGY.

The Australian species of *Theobaldia* are bush mosquitoes. They are present in scrub along creeks, in the bush, and are especially numerous in upland forests, where the humidity is higher and the temperature lower than in the open country. Their inability to withstand high temperature and low humidity severely restricts their distribution. Thus, while they are widely distributed in south-eastern Victoria, in the north they are practically confined to hilly and mountainous country. *T. inconspicua* is more adaptable than the other species and is found at lower altitudes and in more exposed situations.

The three species, *T. hilli*, *T. frenchi* and *T. victoriensis*, are man-biting mosquitoes and become very troublesome in late summer and autumn. During the day they fly close to the ground and confine their attacks mainly to the legs. After sunset they rise higher, biting the arms but almost never the face. *T. inconspicua* and *T. littleri* do not attack man.

This difference in feeding habits tends to give a false impression of the relative abundance of the various species. Adults of *T. inconspicua* are not common in the field, but judging from larval numbers, it is by far the most abundant form. The larvae are very numerous in rock and ground pools shaded by trees or grass.

In spite of a sustained search the larvae of the other species have rarely been seen in the field. *T. littleri* was found breeding in only one place. This was in Sherbrooke Forest, in a pool under, and largely covered by, the roots of a fallen tree. The temperature of the water, even in summer, did not rise above 13–14°C. *T. littleri* and *T. inconspicua* were breeding here during two successive years; on one occasion this pool also yielded two larvae of *T. victoriensis*. This species was also found at Ringwood, where, in company with *T. inconspicua* and *T. hilli*, it was breeding in a small, deep, semi-permanent pool shaded by long grass and trees. *T. victoriensis* and *T. hilli* larvae were found here only during the winter of 1952 and probably it is not a typical breeding place for them. It seems likely that they breed, for the most part, in the underground tunnels of the land crayfish (*Engaeus* spp.); this may also apply to *T. frenchi*, the larvae of which have not been seen in nature.

On the basis of colour and behaviour the larvae of these five species fall into two groups. Those of *T. inconspicua* and *T. littleri* are brownish and show the behaviour typical of mosquito larvae, in that, when disturbed either mechanically or by the passage of a shadow over the surface of the water, they move to the bottom of the container. In the other species the larvae are milky-white. They show no response to moving shadows and when disturbed either move just below the surface or, if originally on the bottom, move towards the surface. Their lack of pigment and their behaviour suggest that they normally live in underground water.

In *T. hilli* mating occurs during the day. Normally the males do not swarm but are seen, in small numbers, flying about in the grass close to the ground. Coupling sometimes occurs with resting females but, more usually, is initiated while both sexes are in flight and is completed on the grass. After sunset the number of "searching" males increases but they do not become numerous. However, *T. hilli* does occasionally swarm. One such swarm was observed by Mr. A. Neboiss, at 4 p.m. on May 4th, 1953. It consisted of 150–200 males flying 2–3 feet above the ground. Mating of the other species has not been observed; presumably it occurs at night.

T. inconspicua is the only one of the five Victorian species which deposits egg rafts. These have been collected in the field and can also be readily obtained in the laboratory from engorged females. I have never found the eggs of the other species in nature and for a long time failed to get oviposition in cages. Later work showed that this was a result of maintaining the mosquitoes at too high a temperature, 20–22°C. When engorged females were kept in an ice chest at 8–10°C., they oviposited regularly, 16–29 days after feeding. In the laboratory *T. hilli*, *T. frenchi* and *T. victoriensis* deposited eggs singly on moist filter paper above water level. The eggs cannot withstand desiccation; when laid on the sides of the glass vessel, instead of on filter paper, they invariably perished. After feeding on human blood the number of eggs varied from 28 to 60; an engorged female of *T. frenchi* caught in the field laid 90 eggs.

When eggs are kept in the laboratory at temperatures of 17–20°C. some eggs remain viable for a long period without hatching. Thus in one experiment only 8 out of 60 eggs had hatched after 39 days. The unhatched eggs were then kept for 24 hours at 25°C. without any more hatching; but when they were transferred to a refrigerator all the viable eggs hatched within two hours. In many cases hatching of larvae from these diapausing eggs occurred when the temperature was lowered from 17°C. to 10–11°C., but with a further fall to 2°C., hatching ceased; it was completed when the temperature was raised to 10–11°C.

In the laboratory, growth of the larvae is slow. They require clean water and at temperature of 17–19°C. take about two months to reach the fourth stage. At higher temperatures few survive.

T. inconspicua and *T. frenchi* maintain reproductive activity throughout the year; the second species was recorded as biting in July (temperature 13.5°C.) and August (temperature 8.5°C.).

T. littleri, *T. hilli* and *T. victoriensis* hibernate as larvae, mainly in the fourth stage, and the spring generation of *T. hilli* and *T. victoriensis* appears in October.

Genus THEOBALDIA Neveu-Lemaire.

Theobaldia Neveu-Lemaire, 1902, *C.R. Soc. Biol.*, 54: 1331. Type, *annulata* Schr. *Culicella* Felt, 1904, *N.Y. State Mus. Bull.*, 79: 391c. Type, *dyari* Coq. *Culiseta* Felt, 1904, *N.Y. State Mus. Bull.*, 79: 391c. Type, *absorbrina* Felt. *Theobaldinella* Blanchard, 1905, *Les Mostiques*, p. 390. Type, *annulata* Schr. *Pseudotheobaldia* Theobald, 1907, *Monog. Cul.*, 4: 271. Type, *niveitaeniata* Theo. *Climacura* Howard, Dyar and Knab, 1915, *Mosq. N.C. Am.*, 3: 452. Type, *melanura* Coq. *Allotheobaldia* Brolemann, 1919, *Ann. Soc. Ent. France*, 88: 90. Type, *longiareolata* Meg. *Theomyia* Edwards, 1930, *Bull. Ent. Res.*, 21: 303. Type, *fraseri* Edw.

Characters of the Genus.

(Adapted to Victorian species.)

Adult. The head has narrow, curved, upright, forked scales on the vertex and flat scales laterally. The eyes are almost touching. The proboscis is moderately long. The palpi of the male are about as long as the proboscis and more or less hairy. The palpi of the female are always short, with a vestige of a fourth segment.

The thorax has strong acrostichal and dorsocentral bristles; the scales are always narrow and curved. The scutellum has narrow scales and long border bristles. The anterior pronotal lobes have a few strong bristles and several shorter ones, and in some species a few narrow curved scales. The posterior pronotal lobes have bristles and, in most species, narrow curved scales.

The spiracular bristles are fine and few in number; post-spiracular scales are usually absent (a few minute ones are present in *T. littleri*).

The sternopleura has on the lower part a few strong bristles, several shorter ones and scales. The pre-alar has a patch of bristles. The upper posterior part of the mesepimeron has a patch of erect hairs and, below this, a patch of flat scales or fine hairs; there are two or three strong lower mesepimeral bristles, a few short ones, and scales.

The legs are dark, with pale reflections apically in some species. The claws on the anterior legs of the males are toothed; in the females all are simple. Pulvilli are absent.

The wings are unspotted. The venation is very uniform; the subcosta extends beyond the end of the radius; the fork cell of the second longitudinal vein is longer than its stem; the cross-veins are well separated. The outstanding scales of the wings are narrow; on the base of the radius there are, on the upper surface, a few long hairs, and on the lower surface a group of hairs and scales in front. The squama has a long dense fringe, and the alula long narrow scales.

The abdomen is always unbanded, blunt tipped, and with a non-retractile eighth segment. Hypopygium of male: the coxite is rather long; its basal lobe varies in size and in the extent to which it is separated from the coxite; the tip of the lobe bears a number of hairs and spines. The style is simple, long and slender, with a terminal spine. The paraprocts have a few terminal teeth.

Pupa. This is similar to that of *Aedes*; the trumpet is always short, with a large oblique opening. The distal margin of the paddle is smooth or very finely spiculate.

Larva. The siphon is rather long. All species, except *T. littleri*, have the tuft, which may consist of a single hair, at the base of the siphon. The comb consists of a large patch of small teeth.

Subgeneric Division.

The various subgenera of *Theobaldia*, although clearly defined in the larval stage, are often difficult or impossible to recognize in adult specimens. Thus Edwards (1923) suggested that the two Australian species then known belonged to the subgenus *Culicella*, but pointed out that this placing was tentative pending an examination of larval stages. Subsequently (1932) and still without access to larval material, he placed all the species in the subgenus *Climacura*.

With the discovery of the larval stages the Victorian species can be definitely assigned to their subgenera. As Lee (1937) showed, *T. inconspicua* belongs to the

subgenus *Culicella*; this is also the case with *T. victoriensis*. *T. hilli* and *T. frenchi*, on the one hand, and *T. littleri* on the other, require new subgenera.*

Edwards (1932) defined the subgenus *Culicella*, on larval characters, as follows: "Head large and broad. Antennae long and stout, with a large tuft well beyond middle; two of the apical bristles very long and somewhat removed from the tip. Mouth brushes very large. No air sacs in thorax. Siphon long and tapering, with one pair of basal tufts; pecten consisting of spine-like teeth only, no fine hairs distally. Comb-teeth in a large patch. Anal segment ringed by the plate (in fourth stage); several tufts piercing the plate ventrally before the brush. Outer dorsal hair of anal segment branched. Gills rather long, pointed."

The larva of *T. victoriensis* agrees with this description, but two of the apical antennal bristles are not removed from the tip; the outer dorsal hair of the anal segment is unbranched. Not more than one tuft pierces the anal plate before the brush.

NEOTHEOBALDIA, n. subg.—Larva (Fig. 6): The head is not very large. The antennae are of moderate length; the tuft is well beyond the middle; none of the apical bristles are removed from the tip. The siphon is of moderate length, with one pair of basal tufts; the pecten teeth are in the form of hairs. The anal segment is ringed by the plate; no tufts pierce the plate before the brush. The outer dorsal hair of the anal segment is unbranched. The anal papillae are not large.

This subgenus is erected for *T. hilli* and *T. frenchi*. It is close to *Theobaldia*, s. str., but is distinguished by the absence of a row of hairs following the pecten and by the form of the pecten teeth.

AUSTROTHEOBALDIA, n. subg.—Larva (Fig. 9): All the hairs are simple. The head is very large and broad. The antennae are long; two of the apical bristles are removed from the tip. The siphon is long and tapering; the siphonal tuft consists of a two-branched hair, or a single one, about half-way along the siphon. The pecten consists of triangular teeth. The comb has a long row of small scales and two or three irregular short rows of long scales. The outer dorsal hair of the anal segment is branched. The anal papillae, which are not large, are pointed.

This subgenus is erected for *T. littleri*. It differs from all other subgenera of *Theobaldia* in that all the hairs are simple and the siphonal tuft is half-way along the siphon.

The Victorian members of the genus *Theobaldia* can be distinguished from other genera by the unbanded, blunt-ended abdomen, the absence of pulvilli and the presence of spiracular hairs. Within the genus the males of the various species are easily distinguished, particularly by their hypopygial characters, but the females of *T. hilli* and *T. frenchi* are hardly distinguishable from one another and in fact cannot always be separated with certainty. The larvae of these two species are also very similar.

Key to Victorian Species of *Theobaldia*.

Adult Males.

- | | | |
|---|-------------------------------|---|
| 1. Proboscis pale beneath; last two segments of palpi, in living specimens, bent backwards | <i>inconspicua</i> . | 2 |
| Proboscis black beneath | | |
| 2. Last segments of tarsi with pale reflections | | 4 |
| Tarsi entirely dark | | 3 |
| 3. Upright scales on vertex pale, basal lobe of coxite long and well separated from the base | <i>littleri</i> . | |
| Upright scales on vertex dark; basal lobe separated only towards the tip | <i>frenchi atritarsalis</i> . | |
| 4. Base of tarsal segments with pale scales. Coxite with black scales and golden bristles dorsally, and dense goldish hairs ventrally | <i>victoriensis</i> . | |
| Proximal segments of tarsi dark scaled, distal segments pale | | 5 |

* A new Victorian species of *Theobaldia* has recently been found by Mr. G. Douglas. On the structure of the larva, it belongs to the subgenus *Climacura*, which hitherto has been known only from North America.

5. Palpi slightly longer than proboscis, densely hairy apically. Coxite more than twice as long as broad; basal lobe separated only towards the tip *frenchi*.
 Palpi slightly shorter than proboscis, with scanty and relatively short hairs. Coxite only about twice as long as broad; basal lobe is large, well separated and reaching nearly to the tip of the coxite *hilli*.

Adult Females.

1. Proboscis pale beneath *inconspicua*.
 Proboscis black beneath 2
 2. Tarsi entirely dark 3
 Last segments of tarsi with pale reflections 4
 3. Vertex with pale scales *littleri*.
 Upright scales on vertex dark *frenchi atritarsalis*.
 4. Base of tarsal segments with pale scales *victoriensis*.
 Base of tarsal segments without pale scales 5
 5. Upright scales on vertex mostly pale. Venter usually with more or less conspicuous median patches of black scales *hilli*.
 Upright scales on vertex mostly dark. Venter pale scaled *frenchi*.

Larvae (fourth stage).

1. Hair tuft near the middle of siphon *littleri*.
 Hair tuft at base of siphon 2
 2. Pecten consisting of spine-like teeth 3
 Pecten consists of a row of hairs 4
 3. Larva milky-white in colour. Siphon tapering; anal papillae very long *victoriensis*.
 Larva brown. Siphon slightly swollen in middle. Anal papillae short .. *inconspicua*.
 4. Siphonal tuft with two branches *hilli*.
 Siphonal tuft of single hair *frenchi*.

DESCRIPTION OF SPECIES.

Subgenus NEOTHEOBALDIA, n. subgen.

THEOBALDIA HILLI Edwards.

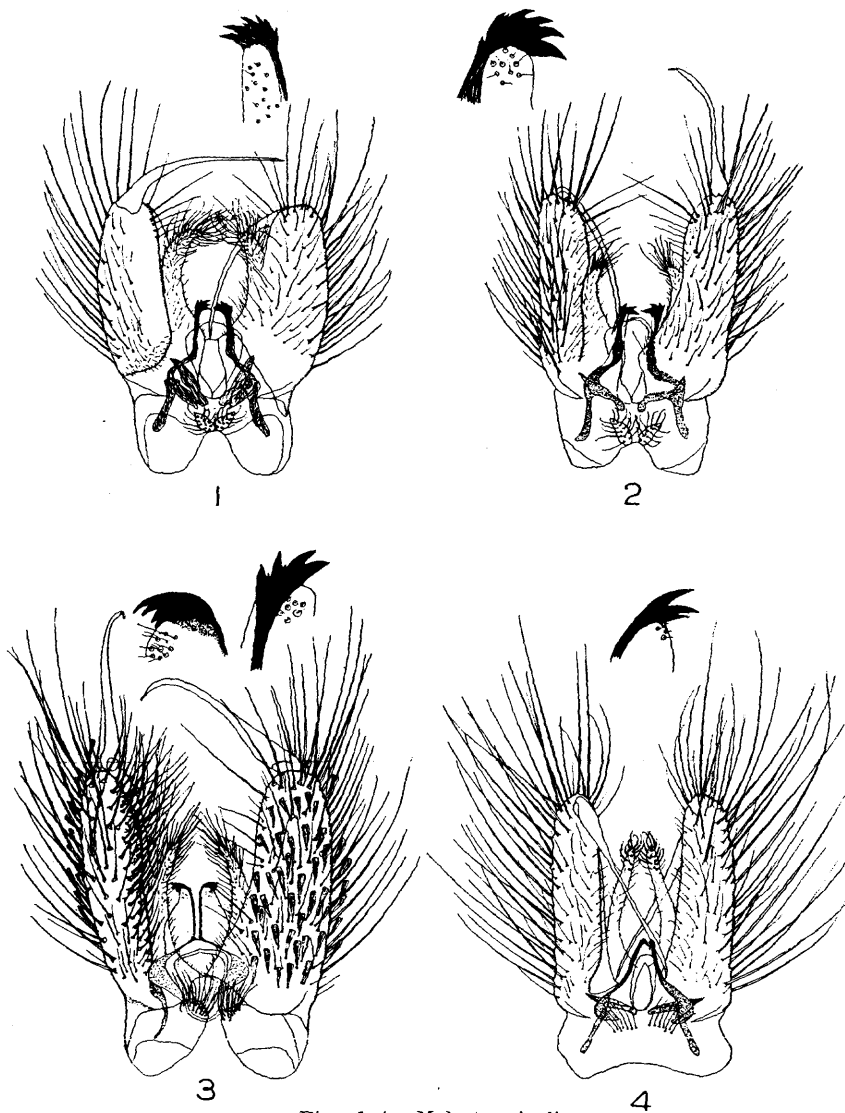
Edwards, F. W., 1926, *Bull. Ent. Res.*, 17: 111.

Type.—The type series from Beaconsfield, Victoria (6.XI and 8.XII.1923), is in the British Museum.

Distinctive Characters.—*The Male*. The upright scales on the vertex are pale becoming dark towards the neck. The proboscis and palpi are clothed with blackish scales with violet reflections. The palpi are slightly shorter than the proboscis; the apex of the shaft and the last two segments bear scanty and relatively short hairs; the terminal segment is about half as long as the penultimate. The thorax is brown with pale golden scales, which are rather larger and lighter than those of *T. frenchi*. The bristles are dark brown. The anterior pronotal lobe has three-four strong black bristles, several shorter pale golden ones, and a few narrow curved scales. The posterior pronotum bears narrow curved scales and four or five pale golden strong proepimeral bristles. The scutellum has five-seven strong black border bristles on each lobe. There are two pale spiracular bristles. The lower part of the sternopleura bears a long strong bristle and, below this, one or two shorter ones, several short fine ones and pale scales. The mesepimeron has a patch of pale scales and short bristles towards the middle; there are two strong bristles (the upper is shorter) on the lower part. The legs are black-scaled with conspicuous knee spots; the femora are pale beneath; the ends of the tarsi have light brown or pale reflection. The wing length is 3.5–3.6 mm. The first to seventh tergites are black-scaled with violet reflection; the eighth has black and pale scales. The colour of the venter is variable; usually the first to fourth sternites are black-scaled; the fifth to seventh have pale scales apically and these extend forward progressively so that the seventh sternite may have only a median patch of black scales; the eighth is black-scaled. But in some specimens the venter is pale with more or less conspicuous median patches of black scales on all sternites. The hypopygium (Fig. 1): The coxites are relatively short, being only about twice as long as broad. The basal lobe is large, well separated, and reaches nearly to the tip of the coxite; its tip has dense, long curved hairs. The aedeagus is rather large and strongly chitinized with four strong teeth and four shorter ones; on

the distal end there are about thirteen fine hairs. The lobes of the ninth tergite are prominent, with 9-10 curved hairs.

The females are similar to the males but differ as follows: The upright scales on the vertex are usually darker than in the male; in some specimens they are almost black. The last two segments of the tarsi are pale. Wing length is 3.5-3.8 mm. The upper fork cell is four times as long as its stem. The tergites are black-scaled with violet reflections; the fifth-seventh tergites have some pale scales on their apical corners. The venter is pale with, or without, median patches of black scales.

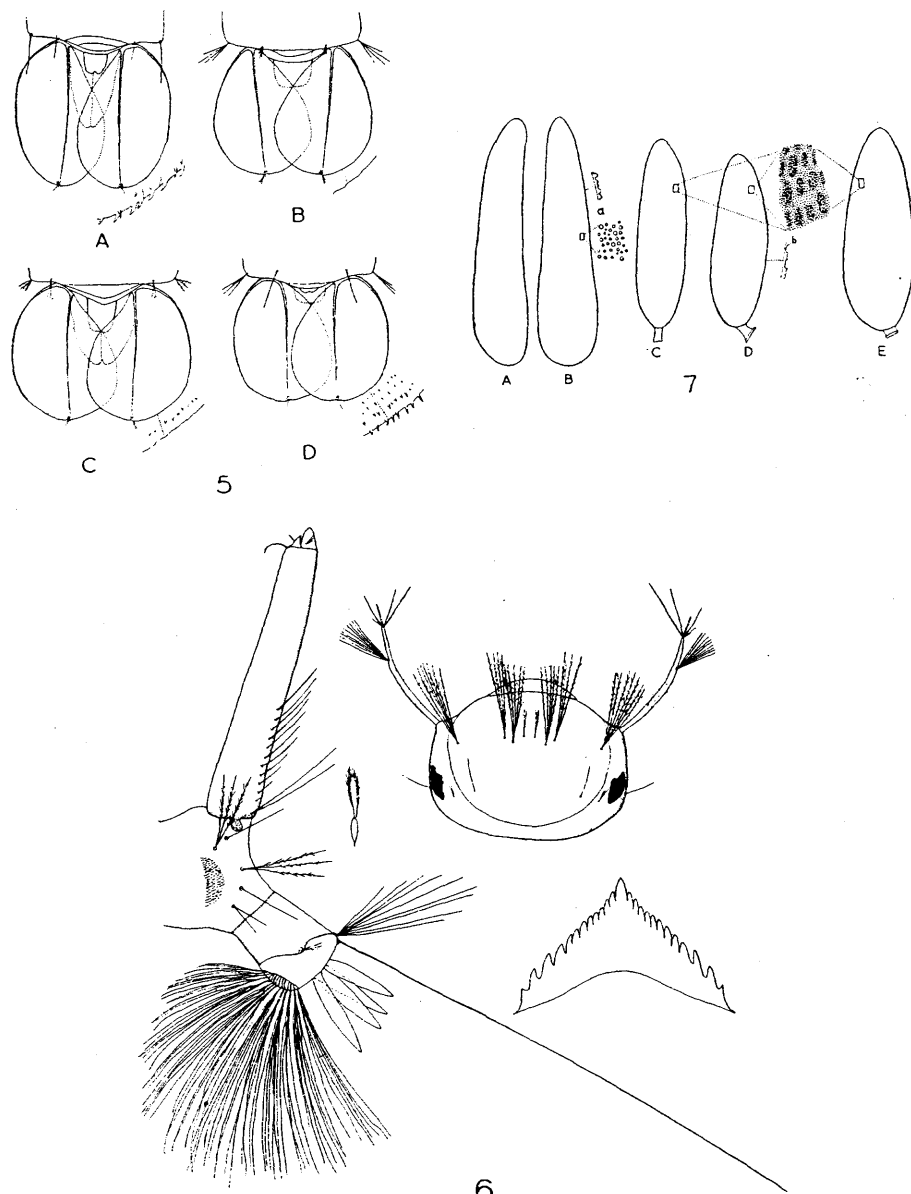


Figs. 1-4.—Male terminalia.

1, *T. hilli*; 2, *T. frenchi*; 3, *T. victoriensis*; 4, *T. littleri*.

The Pupa. This is milky-white with black hairs. The trumpet is short, with a large and very oblique opening, the margin of which is fringed. Seta A of the VIII segment of abdomen has four to six branches. The paddle (Fig. 5, B) is broadly oval with a smooth margin. At the tip of the midrib there are two setae, one very small and single, the other about three times as long and consisting of three or four branches.

The Larva. The fourth stage larva (Fig. 6) is milky-white in colour with black setae. The head is not very large; it is rounded, pale and almost transparent; the antennae have the subapical hairs slightly removed from the tip; the tuft consists of



Figs. 5-7.

5, Paddle of pupa: A, *T. littleri*; B, *T. hilli*; C, *T. victoriensis*; D, *T. inconspicua*. 6, *T. hilli* Edw. Head, terminal segments and mentum of larva. 7, Eggs of *Theobaldia*. A, B, *T. inconspicua* (two views); C, *T. hilli*; D, *T. frenchi*; E, *T. victoriensis*. a and b show the structure of the exochorion.

non-plumose hairs. The anterior frontal setae have three-five branches, the inner frontal four-six, middle frontal three-four, and the outer frontal five-eight. The sutural seta (e) is single, and the trans-sutural (f), which is one-third to one-half the length of

(e), has two-three branches. Prothoracic chaetotaxy: The first, second, fourth, fifth and sixth are single, the third has two-three branches, the seventh has two branches, and the eighth is a single minute tuft with about six branches. Abdomen: The hairs on segments I-VIII are short except for three lateral hairs on the first segment and a single lateral hair on the following five. The pentad hairs on the eighth segment: α usually has three branches, rarely four, β is single, γ has three plumose branches, δ is single and ϵ has two to three simple branches. There are about 90 comb teeth forming a large triangular patch. The inner dorsal brush consists of nine to eleven branches and a single long outer hair. The ventral brush has twelve to fourteen tufts. The anal papillae are pointed and of about the same length as the saddle. The saddle tuft is short with three or four branches. The siphonal index is 5.0-5.4. The siphon has a tuft of two hairs at the base. The pecten consists of a row of seven to eleven hairs.

The eggs (Fig. 7, c) are elongate-oval, silvery in colour, with a black base and a short transparent stem. The egg is about 0.88 mm. long with an index of about 4.3.

Distribution.—A total of 50♂♂ and 80♀♀ have been examined from the following localities: Ringwood, Christmas Hills, Beaconsfield, Healesville, Head of Cement Creek, Achern River, Grace Burn Creek, Nyora, Tarra Valley Park, Stony Creek (Gippsland), Franklin River (N. Dobrotworsky), Trafalgar South, Upper Pakenham, Thompson, Tarago River, Dollar (near Meeniyah), Boolarra, Mirboo, Gembrook (A. Neboiss). *T. hilli* is confined to Victoria.

THEOBALDIA FRENCHI Theobald.

Culex frenchi Theobald, *Mon. Cul.*, 2: 66 (1901).

Type.—The type series of four females from Victoria (locality not stated) are in the British Museum.

The male was described by F. W. Edwards (1926) from Sassafra, Victoria.

Distinctive Characters.—*The Male.* Most of the upright scales on the vertex are dark. The palpi are slightly longer than the proboscis. Apically the shaft and the last two segments have dense, long hairs. The last segment is about half as long as the penultimate. The palpi and the proboscis are clothed with dark brown scales. The thorax is reddish and is clothed with pale golden scales; the bristles are black. The anterior pronotal lobes have two or three black bristles, some pale golden ones and a few narrow pale scales. The posterior pronotal lobes have a few narrow pale scales and four-five dark proepimeral bristles. There are one or two spiracular bristles. There are six-seven border bristles on each lobe of the scutellum. The sternopleura has, on the lower part, a patch of scales, a few pale hairs, one dark strong bristle and a second shorter one below. There are two lower mesepimeral bristles; the middle part of the mesepimeron has a patch of scales. The legs are clothed with dark brown scales; the tarsi are pale apically.

The abdomen is clothed dorsally with black scales, except the last segment, which has pale golden scales; the venter is clothed with pale, or black and pale scales. Hypopygium (Fig. 2*): Each lobe of the ninth tergite has a patch of nine-fifteen curved hairs. The coxite is more than twice as long as broad; the basal lobe is about two-thirds the length of the coxite; it is separated only towards the tip, which bears a tuft of rather short hairs. The aedeagus is rather large and strongly chitinized, with four large and three small teeth.

The female is similar to the male, but differs as follows: The anterior pronotal lobes have four-five strong black bristles. Each lobe of the scutellum has about eight

* It will be noted that this figure is very similar to that given by Lee (1937, p. 296, Text-fig. 3) for *T. weindorferi*. Through the courtesy of the Division of Entomology, C.S.I.R.O., I have been able to examine the type of *T. weindorferi*; the mounted terminalia correspond exactly with Lee's Text-figure 4, labelled *T. frenchi*. There can be no doubt that in Lee's paper, Text-figures 3 and 4 were transposed. Text-fig. 3 should refer to *T. frenchi* and Text-fig. 4 to *T. weindorferi*.

border bristles. The patch of scales on the pleurae is more distinct. The legs are darker, almost black above; the femora and tibia are pale beneath. There are conspicuous knee spots of pale scales; the last three segments of the tarsi are pale. The venter is pale. Wing length is 3.8-5.0 mm. The upper fork cell is 3.0-4.5 times the length of the stem.

The Pupa. This is very similar to the pupa of *T. hilli*.

The Larva. The fourth stage larva is similar to that of *T. hilli* but can be distinguished from it as follows: The frontal setae are more branched, the pentad hair γ on the eighth abdominal segment usually has 4-5 branches, the basal siphonal tuft is represented by a single hair. (In *T. hilli* the basal tuft always has two branches.)

The eggs (Fig. 7, D) are similar to those of *T. hilli*; they are about 0.7 mm. long, with an index of 3.4-3.5.

Distribution.—A total of 15♂♂ and 120♀♀ were examined from the following localities: Sherbrooke, Kalista, Grace Burn Creek, Healesville, Head of Cement Creek, Tarra Valley Park (N. Dobrotworsky), Menzies Creek, Tanjil South (A. Neboiss). As far as is known, *T. frenchi* is confined to Victoria.

THEOBALDIA FRENCHI ATRITARSALIS, n. subsp.

This subspecies is clearly distinguished from the type by its general darker colour; the thorax is brown, the proboscis, the palps and the legs are clothed with almost black scales; the legs also are dark apically. The male palpi are even more hairy than those of the type, and the shaft apically has about thirty long hairs. The male genitalia are identical with that of the type.

The pupa, larva and eggs are identical with those of the type.

Types.—The holotype male, allotype female and a paratype series from Stony Creek (Gippsland) are in the collection of the National Museum, Melbourne.

Distribution.—A total of 5♂♂ and 44♀♀ have been examined from the following localities: Stony Creek (Gippsland), Franklin River, Kalimna, Tarra Valley Park (N. Dobrotworsky), Boolarra, Mirboo North, Thompson, Hiawatha, Tyres River, Gould (A. Neboiss).

Subgenus CULICELLA Felt.

THEOBALDIA VICTORIENSIS, n. sp.

Types.—The holotype male and allotype female were bred from larvae collected at Ringwood, Victoria, 3.8.52. These, together with a paratype series of 10♂♂ (three from Ringwood 3.8.52 with associated larval and pupal skins, five from Tarra Valley Park 5.5.53, two from Boolarra 8.5.53) and 10♀♀ (six from Ringwood 1.1.52, 7.1.53, 1.3.53 and 6.4.53, two with associated larval and pupal skins, two from Tarra Valley Park 5.3.53, two from Healesville 30.1.53), are in the collection of the National Museum, Melbourne.

Description of Adult.—*Holotype* ♂. The head scales are pale; a few upright ones become dark toward the neck. The palpi are as long as the proboscis. The shaft bears about 10 long hairs; the last two segments have long but relatively sparse hairs; the terminal segment is about half as long as the penultimate. The proboscis and the palpi are clothed with black scales with violet reflections. The thorax is brown, with pale golden scales; the small bristles are pale, the strong ones are pale at the base and dark at the end. The anterior pronotal lobe has pale golden bristles and a few narrow curved scales; the posterior pronotum has a number of curved scales and five pale golden proepimeral bristles. There are two fine pale spiracular bristles. The scutellum has narrow curved pale scales, with four-five border bristles on the lateral lobe and eight on the central. On the lower part of the sternopleura there are fine hairs, a few narrow scales, one strong bristle and several shorter ones. The mesepimeron has a number of fine hairs towards the middle and two strong lower mesepimeral bristles (upper is shorter). The legs are dark brown with inconspicuous knee spots. The tarsi: the second to fourth segments of the forelegs and the first to third of the mid- and hindlegs are pale at the base; the last two segments of the tarsi are covered with pale scales. The wing length is 4 mm. The abdomen is unbanded. The tergites are clothed with black scales with violet reflections and pale hairs. The apical border

of the eighth tergite has pale scales. The venter is also black-scaled but the fourth-seventh sternites have pale scales apically. The hypopygium (Fig. 3): The coxites have long pale goldish hairs, black scales dorsally, and dense pale goldish hairs ventrally on the inner face.

Paratypes ♂. The series of 10 paratype males differs from the type in colouring. The venter in some specimens is pale with large median patches of black scales. Each lobe of the ninth tergite has a patch of ten-twelve curved hairs. The coxites are more than twice as long as broad. The basal lobes of the coxites are hairy; they are about two-thirds of the length of the coxite and are separated from them only at the tip, which bears a tuft of long hairs. Wing 4.0-4.1 mm.

Allotype ♀. This differs from the holotype as follows: The forked upright scales on the head are pale only in front and gradually become black towards the neck. The strong bristles on the thorax are black. The anterior pronotal lobes have three strong black bristles, several golden ones and a few narrow scales. There are three pale spiracular bristles. The sternopleura has one strong bristle and several shorter ones. The mesepimeron has a patch of hairs towards the middle and one strong and three short lower mesepimeral bristles. The legs are almost black, with violet reflections. There are conspicuous knee spots. The first three segments of the tarsi have pale basal rings; the fourth and fifth are pale; the third segment of the hind-tarsi is also pale apically. Wing: The upper fork-cell is 3.8 times as long as its stem; wing length is 4.7 mm. The venter is pale-scaled with inconspicuous median patches of black scales.

Paratype ♀. The series of 10 paratype females do not show much variation; the upright scales on the head are predominantly pale in some specimens and become dark only towards the neck. The mesepimeron has a patch of hair, a few narrow scales and two-three strong lower mesepimeral bristles. The length of wing is 3.8-5.1 mm.; the upper fork cell is three-four times as long as its stem. The median patches of black scales on the venter may be large.

The Pupa. The trumpet is similar to that of *T. hilli*. Seta A of VIII abdominal segment has three or four plumose branches. The paddle (Fig. 5, C) is broadly oval with a smooth margin and a few minute denticles slightly removed from the margin. At the tip of the midrib there are two setae; one is small and single, the other is twice as long and usually two-branched.

The Larva. The fourth-stage larva (Fig. 8) is milky-white with black setae. The head is large, oval, pale, almost transparent and with very small eyes. The antennae are long, thin and curved, with a tuft of fourteen-sixteen slightly plumose hairs. The anterior frontal setae are single or double, the inner frontal consist of four to five hairs, the middle frontal of two, and the outer frontal of six-seven. All these except the anterior frontal are plumose. The sutural seta (*e*) has two branches and the trans-sutural (*f*), which is half as long, has two-three branches. Prothoracic chaetotaxy: The third seta is single or two-branched, the fourth is short and has two or three branches, the fifth and sixth are single, the seventh has three branches, and the eighth is minute with about four branches. Abdomen: The hairs on segments I-VIII are very short, except three lateral ones on the first segment and a single lateral hair on segments II-VI. The pentad hairs on segment VIII: *α* has four-five slightly plumose branches, *β* is single, *γ* has two-three plumose branches, *δ* is single, and *ε* has two branches. The comb teeth form a large patch. The inner dorsal brush consists of seven-eight tufted hairs and a single long outer hair. The ventral brush has about fifteen tufts. The anal papillae are slender, pointed and twice the length of the saddle. The saddle tuft, which has two-five branches, is small. The siphon is long, slender, pale at base but gradually becoming brown apically. The siphonal tuft is at the base and has two branches. The siphon index is 6.3-6.8. The pecten consists of ten to thirteen spine-like teeth.

The eggs (Fig. 7, E) are similar to those of *T. hilli*, but have more pointed ends; the index is 2.8-3.2, the length 0.8 mm.

Distribution.—Besides the type series, a total of 10♂♂ and 70♀♀ have been examined from the following localities: Ringwood, Christmas Hills, Healesville, Grace Burn Creek, Head of Cement Creek, Meeniyah, Tarra Valley Park, Franklin River, Nyora, Stony Creek (Gippsland) (N. Dobrotworsky), Boolarra, Thompson, Upper Pakenham, Menzies Creek, Kinglake, Dollar (near Meeniyah) (A. Neboiss).

THEOBALDIA INCONSPICUA Lee.

Lee, D. J., 1937. PROC. LINN. SOC. N.S.W., lxii: 294-298.

Type.—The type series from Tinderry and Mittagong. Holotype and allotype are in the Museum of the Commonwealth Scientific and Industrial Research Organization, Canberra.

As the adults and larva were carefully described by Lee (1937) only a brief description is given here.

Adult. The upright scales on the vertex are dark brown, some in front are pale. The proboscis is dark brown above and pale beneath. The male palpi are as long as the proboscis. The penultimate segment has scanty and relatively short hairs; the last has only a few long hairs on the inner side at the basal part. The last two segments of the palpi, in living specimens, are bent backwards. The anterior and posterior pronotal lobes are devoid of scales. The tarsi are entirely dark. Ventrally the abdomen is clothed with dark scales basally becoming pale goldish apically. The male hypopygium: The coxites taper and are more than twice as long as broad; the basal lobes are very small and imperfectly separated from the coxites. The aedeagus has three large teeth.

The pupa is brown; the trumpet is short with a very large and oblique opening. Seta A of the eighth abdominal segment has two or three branches. The paddle (Fig. 5, D) is oval, with minute denticles on its surface and larger ones at the margin. At the tip of the midrib there are two setae; one is minute and single, the other is single or two-branched.

The Larva. The fourth-stage larva is brown. The head is large; the antennae are long. The anterior and middle frontal setae are single, the inner frontal seta consists of two branches. Prothoracic chaetotaxy: The first, second, fifth, sixth and eighth setae are single; the third, fourth and seventh setae each consists of two branches. The hairs on the abdomen are well developed. The eighth abdominal segment: The comb teeth form a large patch; the siphon is long, slightly swollen in the middle, with an index 5.0-5.5. There is a single hair at the base of the siphon. The pecten consists of 9-10 serrate teeth.

The eggs (Fig. 7, A, B) are deposited in rafts, which are rounded or oval in shape with raised margins, and look like a basket. The egg rafts, which contain up to 217 eggs, exceed 4 mm. × 2 mm. The eggs are black, thick at one end and tapering to the other; the length of egg is 0.9-1.0 mm., with index of about 4.0.

Distribution.—A total of 30♂♂ and 40♀♀ have been examined from the following localities: Ringwood, Melbourne, Kalista, Sherbrooke, Healesville, Tarra Valley Park, Kalimna, Violet Town (N. Dobrotworsky), Shoreham (F. Drummond), Menzies Creek (A. Neboiss). The species also occurs in New South Wales (Lee, 1937) and Tasmania (Sulfur Creek, K. W. Dillon).

Subgenus AUSTROTHEOBALDIA, n. subg.

THEOBALDIA LITTLEI Taylor.

Chrysoconops littlei Taylor, 1913-1914, *Trans. Ent. Soc. Lond.*, p. 702. *Theobaldia littlei* Taylor, Lee, 1937, PROC. LINN. SOC. N.S.W., lxii: 295.

Type.—The type female, from Mt. Arthur near Launceston, is in the School of Tropical Medicine, Sydney. The presumed males, described by Lee, one from Barrington Tops, N.S.W., another from National Park, N.S.W., are in the Macleay Museum.

Distinctive Characters.—*Adult.* The male. The upright scales on the head are pale. The palpi are slightly shorter than the proboscis; the shaft has six to eight long apical hairs; the last segment, which is about twice as long as the penultimate, bears

dense long hairs. The palps and the proboscis are clothed with brown scales. The thorax is brown and bears pale golden scales; the strong bristles are black, the short ones, pale golden. The anterior pronotal lobe has three to four strong black bristles, several pale shorter ones and narrow curved scales. The posterior pronotum has narrow curved scales, and five-six pale golden proepimeral bristles. The scutellum has four-six border bristles on the lateral lobe and six on the central. There are three very fine spiracular bristles. The postspiracular area has four-five minute scales. The sternopleura has one strong bristle, several shorter ones and flat pale scales. The mesepimeron has a patch of flat scales towards the middle, and two strong and a few short lower mesepimeral bristles. The legs are black without knee spots; the femora are pale beneath. The tarsi are entirely dark brown. Wing length is 3.8-4.0 mm.

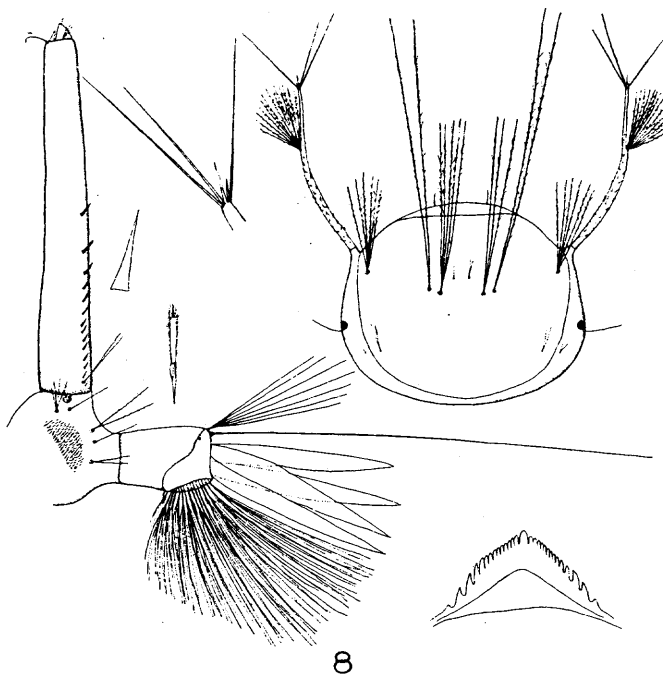
The wing veins are covered with brown scales. The underside of the subcostal vein has hairs and some narrow scales proximal to the humeral cross-vein. The upper corner of the alula has four-five scales. The abdomen: 1st-7th tergites are black with violet reflections and pale bristles; the VIIIth tergite is clothed with a mixture of black and light brown scales. The venter is light brown, with or without lateral triangular areas of brown and black scales; the VIIIth sternite is entirely black-scaled. The hypopygium (Fig. 4): The coxites are almost three times as long as broad. The basal lobes are about two-thirds of the length of the coxite and are separated for nearly their whole length; they bear rather strong spines. The lobes of the ninth tergite are not prominent; each bears four-seven bristles. The aedeagus is rather large and strongly chitinized, with three strong teeth and, under them, a few fine bristles.

The female differs from the male as follows: The anterior pronotal lobe has about six strong black bristles. There are three strong black proepimeral bristles and a couple of shorter ones. The scutellum has six black bristles on the lateral lobe and seven on the central one. The postspiracular area has seven to eight minute scales. The sternopleura has one strong bristle and a shorter one. Wing length is 3.8-4.5 mm. The upper fork cell is 3.2-4.0 times as long as its stem. The upper corner of the alula has about eight scales. The fifth-seventh tergites have some pale brownish scales laterally. The venter is pale with light brown reflections.

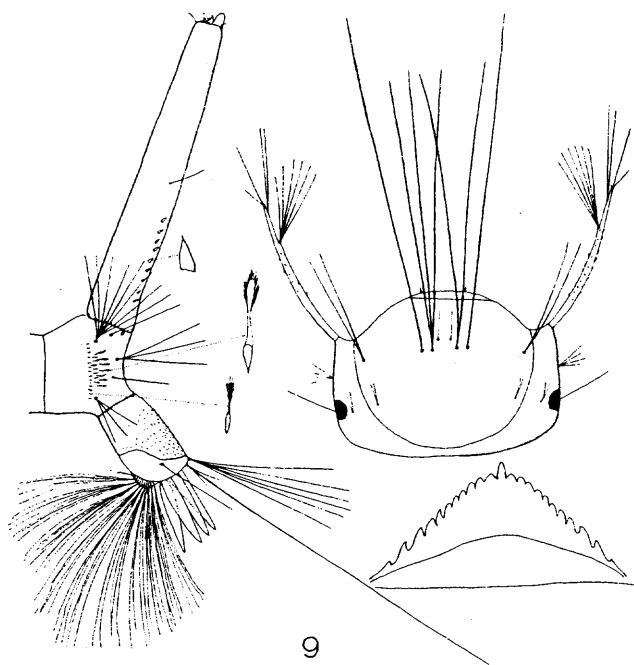
The Pupa. The trumpet is short, with a large and very oblique opening, the margin of which is fringed. Seta A of the eighth abdominal sternite is single. The paddle (Fig. 5, A) is oval with minute denticles on its margin; at the tip of the midrib there are two single setae.

The Larva. The fourth-stage larva (Fig. 9) is reddish-brown; all the hairs are non-plumose. The head is broad and pale; the antennae are long, thin and curved, with a tuft of about seven hairs. The anterior frontal setae are single, the inner frontal have two or three long branches, the mid-frontal are single and longer than the inner frontal, and the outer frontal has two branches. The sutural and the trans-sutural setae (*e* and *f*) have two-three branches. The mental plate has a central tooth and about ten lateral teeth. The thorax: Prothoracic chaetotaxy: the third, fourth and seventh have two branches; the remaining setae are single. The abdomen: The hairs on segments I-VII are well developed; the lateral hairs consist of two or three branches. The pentad hairs on the eighth segment are long: α has eight or nine branches, β is single, γ has three to five branches, δ is single, and ϵ has three branches. The lateral comb consists of sixteen-thirty small scales in a basal row, and eight-fifteen long scales forming a patch. The inner dorsal brush has five to six branches and one long and one or two short outer hairs. The ventral brush has ten or eleven tufts. The anal papillae are narrow and usually equal in length to the saddle. The saddle hair is single and as long as the saddle. The siphon is long and slender, with an index of about seven. The hair tuft consists of one or two hairs about half the way along the siphon; there is no basal hair tuft. The pecten, which does not reach the hair tuft, consists of 13-14 small triangular teeth.

The First-stage Larva. The position of the siphonal hair tuft (a single hair) is variable; in some specimens it is near the middle of the siphon, as in the fourth-stage larva, but sometimes it arises closer to the base.



8



9

Figs. 8-9.

8, *T. victoriensis*, n. sp. Head, terminal segments and mentum of larva. 9, *T. littleri* Tayl. Head, terminal segments and mentum of larva.

In several species of *Theobaldia*, e.g. *T. inconspicua*, *T. victoriensis* and European forms, the siphonal tuft of the first instar larva lies some distance from the base, alongside the pecten. In the second and later instars it shifts to the typical basal position. In *T. littleri* the shift in position is in the opposite direction.

Distribution.—In Victoria *T. littleri* is known only from Sherbrooke Forest. It has also been recorded from Tasmania (Taylor, 1913) and New South Wales (Lee, 1937).

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References.

- DYAR, H. G., 1928.—The Mosquitoes of the Americas, pp. 241-250.
 EDWARDS, F. W., 1921.—A Revision of the Mosquitos of the Palaearctic Region. *Bull. Ent. Research*, 12: 263-351.
 ———, 1924.—A Synopsis of the Adult Mosquitos of the Australasian Region. *Bull. Ent. Res.*, xiv: 351-401.
 ———, 1925.—Mosquito Notes. *Bull. Ent. Res.*, xvii: 101-131.
 ———, 1932.—Genera Insectorum, fasc 194.
 ———, 1941.—Mosquitoes of the Ethiopian Region, iii.
 KENT, N. E., 1953.—Mosquito Survey in the Melbourne Area. *Vict. Nat.*, 70: 117-21.
 LEE, D. J., 1937.—Notes on Australian Mosquitoes (Dip. Cul.). IV. The Genus *Theobaldia*, with description of a New Species. *PROC. LINN. SOC. N.S.W.*, lxii: 294-98.
 ———, 1944.—Notes on Australian Mosquitoes (Dip. Cul.). V. The Genus *Armigeres* and New Species of *Armigeres*, *Theobaldia* and *Culex*. *PROC. LINN. SOC. N.S.W.*, lxix: 215-25.
 TAYLOR, F. H., 1914.—The Culicidae of Australia. I. *Trans. Ent. Soc. London*, pp. 683-708.
 THEOBALD, F. V., 1901.—Monograph of the Culicidae. II.