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THE EXTERNAL MORPHOLOGY OF *KALLITAMBINIA AUSTRALIS* MUIR (HOMOPTERA: TROPIDUCHIDAE)

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Abstract

The external morphology of the egg and 5 nymphal instars of *Kallitambinia australis* are described and the adult redescribed. A key is given to separate the adults and nymphal instars.

Introduction

Kallitambinia australis Muir has appeared in the literature 3 times. The original description of the genus and species by Muir (1931) was followed by a figure of the adult in Woodward, Evans and Eastop (1970). Fletcher (1979) described the oviposition sites in *Aegiceras corniculatum* (L.) (Myrsinaceae), the river mangrove.

Muir (1931), in establishing *Kallitambinia* with type-species *K. australis*, stated that the genus "combines the characters of *Kallitaxila* (Kirkaldy 1901 = *Taxilana* Melichar 1914) and *Tambinia*" and concluded with a description of a few diagnostic characters. A redescription of *K. australis* is given below.

The species has been collected primarily, if not exclusively, in mangroves on the eastern Australian coastline. All stages of the life cycle are described below from material collected on *A. corniculatum* at Patonga, north of Sydney, N.S.W., during 1975-1976. The egg is described from numerous individuals extracted from oviposition sites. Three individuals were used for the measurements of first and third instars, 5 for second instar, and 9 for fourth and fifth instars. Five males and 5 females were used for the measurements of adults.

All nymphal instars have several long, thin, brittle filaments 1.0-1.5 times the body length and arranged in a posterior fan. These are raised over the body by flexing the abdomen dorsally and appear to have a sensory function, although they probably also assist in parachuting the nymphs to the mud surface if the animal is forced to leap from the plant. Due to their length these filaments are omitted from the figures of the nymphs (Figs 2-11) and the stated body length excludes them.

Instar separation

In addition to the characters given below in the key, the third and fourth instars can be distinguished by the lengths of the vertex and wingpads. The number of sensory pits on the postclypeus, a feature of all fulgoroid nymphs known, varies between instars. This is correlated with the increased length of the vertex and postclypeus in higher instars.

Key to sexes and nymphal instars of *Kallitambinia australis*

1. Fully winged; body more than 5 mm long 2
   Wings not separated from nota; body less than 5 mm long 3
2. Hind wing more than 4 mm long; fore wing more than 5.7 mm long; toothed, sclerotised ovipositor present ventrally at posterior end of abdomen .. .. **Adult female**
   Hind wing less than 4 mm long; fore wing less than 5.7 mm long; apex of abdomen with unsclerotised structures dorsally and ventrally without toothed ovipositor .. .. **Adult male**
3. Hind tibia with 2 black-tipped spines along shaft and row of 5 black-tipped spines at apex 4
   Hind tibia with 1 or no black-tipped spine along shaft and with row of 3 to 4 black-tipped spines at apex 6
4. Hind tarsus 3-segmented 5
   Hind tarsus 2-segmented .. .. **Third instar**
5. Segment 2 of hind tarsus with black-tipped spine at either side .. **Fifth instar**
   Segment 2 of hind tarsus without spines.. .. .. .. **Fourth instar**

6. Hind tarsus with row of 5 black-tipped spines at apex of segment 1; hind tibia with 1 black-tipped spine on shaft and row of 4 at apex .. .. **Second instar**
Hind tarsus with row of 4 black-tipped spines at apex of segment 1; hind tibia without spines on shaft but with row of 3 black-tipped spines at apex .. .. **First instar**

Egg (Fig. 1)

Uniformly translucent immediately after laying, with yolk globules varying from 4 to 39 μm in diameter; Length 660-720 μm; maximum width 279-306 μm. Posterior pole convex, lacking projections.

Anterior pole with elongate, dorsally curving, peg-like projection 50-70 μm long (containing micropylar canal) situated on anterior margin of circular operculum 145-165 μm in diameter lying anterodorsally on chorion (operculum only part of chorion left exposed to view after egg laid in leaf). Opercular surface covered with evenly spaced minute projections, thereby differing in surface texture from general chorionic surface. Operculum surrounded by strongly rugose ridge on which is mounted anterior projection.

Chorionic surface bearing polygonal impressions of ovariole follicle cells ranging from 128 to 205 μm long (measured around egg) and from 32 to 45 μm wide (measured parallel to long axis of egg). Cell outlines readily visible in reflected light under medium to high magnification, very faint towards posterior pole. Anteriorly, follicle cell impressions lying in rows forming concentric rings around operculum.

First instar (Figs 2-3)

Body length 1.2-1.35 mm.

Head.—Anteclypeus triangular, extending to base of mid coxae. Postclypeus carinate at edges, discal carinae 3, 1 median and 2 lateral parallel to postclypeal margins; line of 8 sensory pits on each side running parallel to lateral carina between carina and margin. Antenna with broad scape, larger pedicel and small globular third segment; arista 0.2-0.3 mm long. Vertex as in Fig. 2, creamy yellow with medially incomplete transverse orange band in front of eyes; length along single median carina 0.16-0.20 mm; breadth 0.25-0.27 mm.

Thorax.—Pronotum bright red laterally and yellowish on central third; ventrally covering propleura; shaped as in Fig. 2; median longitudinal carina; 2 lateral carinae angling outwards from level with inside margins of eyes towards hind margin; 8 sensory pits on each side, 4 along inside margin of lateral carina, 2 against outside margin of lateral carina posteriorly and 2 in posterolateral angle. Fore coxae widely separated by anteclypeus; fore femur and tibia angulate with minute hairs along angles of tibia; fore tarsus brown, 2-segmented, proximal segment much smaller than distal; 1 claw.

Mesonotum bright red laterally with small yellowish central portion; ventrally covering mesopleura; shaped as in Fig. 2; carinae 3, arranged as on pronotum; sensory pits 4 on each side, arranged as in Figs 2-3; mid leg similar to fore leg but coxa larger.

Metanotum longer than either pro- or mesonotum; with bright red lateral portions and brown mark in central yellowish portion; shaped as in Fig. 2; 3 carinae arranged as in Fig. 2; sensory pits 2 on each side, 1 in posterolateral angle and 1 midway between lateral carina and posterolateral angle; hind coxa immobile, fused to metasternum; hind femur and tibia angulate; tibia without shaft spines, with 3 black-tipped apical spines; hind tarsus with 2 equal segments, proximal apically truncate with row of 4 black-tipped spines ventrally, distal brown with single claw.

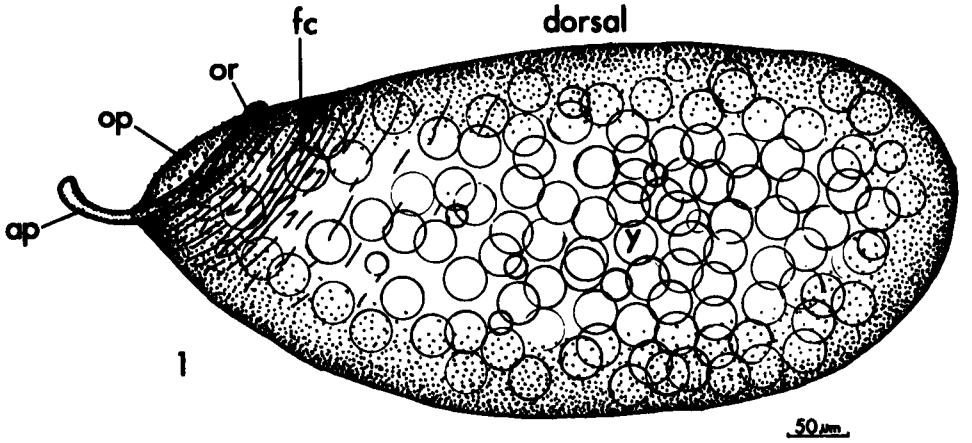


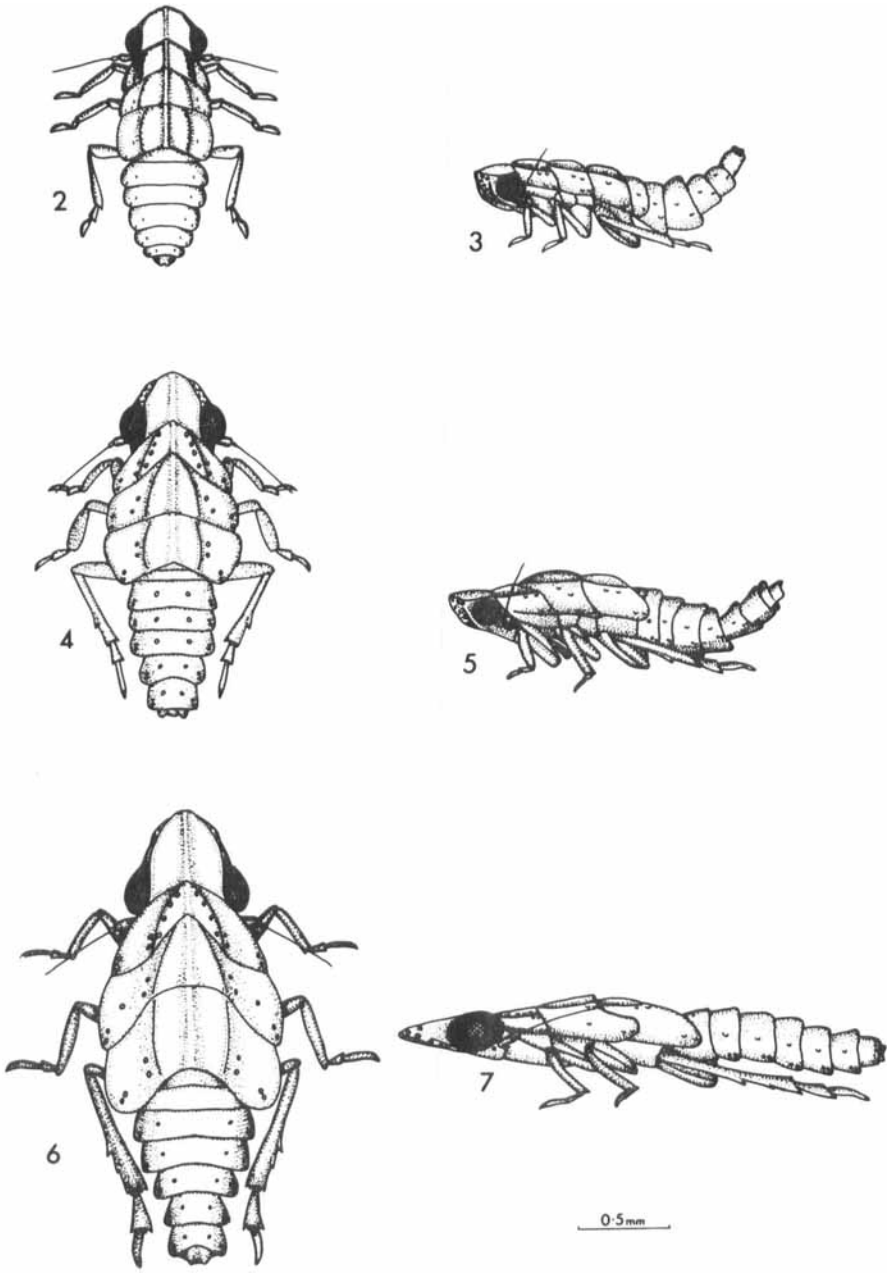
Fig. 1—Egg of *K. australis*, lateral view (ap anterior projection, fc follicle cell impressions, op operculum, or opercular ridge, y yolk).

Abdomen.—Seven segments visible; flattened; flexible dorsoventrally; segments bright red laterally, yellowish medially, first visible segment nearly entirely red; 2 sensory pits on each side of visible segments 2-6; apex with pair of tapering projections and fan of 8 to 16 long, brittle, hair-like filaments radiating from pores in last visible segment and forming flat fan with outermost filaments perpendicular to body axis.

Second instar (Figs 4-5)

Coloration similar to first instar.

Body length 1.6-1.9 mm.



FIGS 2-7—Dorsal and lateral views of *K. australis* nymphs: **(2-3)** first instar nymph; **(4-5)** second instar nymph; **(6-7)** third instar nymph.

Head.—Rostrum bent ventrally at base of mid coxae. Anteclypeus large, triangular, extending between fore coxae, evenly convex. Postclypeus carinate at edges; discal carinae 3, 1 median and 2 lateral parallel to postclypeal margins; line of 9 sensory pits on each side running parallel to lateral carina between carina and margin; 2 further sensory pits along apical margin. Antenna with broad scape, enlarged cylindrical pedicel and small globular third segment; arista 0.3-0.5 mm long. Vertex as in Fig. 4; length 0.23-0.27 mm along median carina; breadth 0.29-0.31 mm.

Thorax.—Pronotum reaching to coxae ventrally; shaped as in Fig. 4; lateral margins strongly carinate; carinae as in Fig. 4; sensory pits as in first instar. Propleuron visible as small plate anterior to coxae. Fore leg as in first instar; 1 fleshy claw.

Mesonotum longer than pronotum; reaching to coxae ventrally; discal carinae 3, arranged as in Fig. 4; each side with 4 sensory pits, arranged as in Figs 4-5; wingpads beginning to show laterally on hind margin. Mesopleuron visible as small plate anterior to coxa. Mid leg as in first instar; 1 fleshy claw.

Metanotum large; reaching to coxae ventrally; hind margin excavate, revealing first abdominal tergite centrally; with carinae as in first instar; 4 sensory pits on each side arranged as in Figs 4-5. Metapleuron visible as small plate anterior to coxa. Hind femur slightly curved anteriorly. Hind tibia with single black-tipped spine on shaft; apex emarginate with ventral row of 4 black-tipped spines, smallest at centre of emargination. Hind tarsus hairy, brown, of 2 subequal segments; apex of proximal segment emarginate with ventral row of 5 black-tipped spines, central spine smallest.

Abdomen.—With 8 segments visible dorsally and 6 ventrally. Visible segments 3-7 with 3 sensory pits on each side dorsally, arranged as in Figs 4-5. Ventral pits absent. Pair of tapering projections from posterior end.

Third instar (Figs 6-7)

Coloration similar to first and second instars but red areas slightly less extensive and head green instead of cream.

Body length 2.2-2.8 mm.

Head.—Flattened dorsoventrally. Rostrum held against body when not in use, reaching to apex of mid coxae. Anteclypeus large, triangular, evenly convex. Postclypeus nearly flat, parallel-sided against eyes but margins sinuous and convergent towards apex; 3 carinae on disc with 12 sensory pits on each side outside lateral carinae; pits scattered along outside margin of carina, not in line as in previous instars. Antenna as in second instar; arista 0.38-0.40 mm long. Vertex similar to postclypeus in outline (see Fig. 6); median carina present; length along median carina 0.36-0.38 mm; breadth 0.36-0.38 mm.

Thorax.—Pronotum reaching to near base of fore coxae ventrally; with shape, position of carinae and sensory pits arranged as in Fig. 6. Propleuron present between anteclypeus and pronotum. Fore leg as in previous instars; tarsi 2-segmented but with 2 claws separated by fleshy arolium.

Mesonotum broad, extending laterally and posterolaterally to form plates incorporating developing wingpads, overhanging front of metanotum; 3 discal carinae; sensory pits 5 on each side. Mesepisternite and mesepimeron distinct, former with vertical carina. Mid leg similar to fore leg; with 2 claws.

Metanotum with broadly excavate hind margin; posterolateral angles incorporating developing wingpads; disc with 3 longitudinal carinae and 4 sensory pits on each side arranged as in Fig. 6. Metapleuron not divided, appearing as flat plate between lateral margins of metanotum and coxa. Metasternum large, fused to hind coxa. Hind femur slightly curved dorsally, fitting against side of coxa. Hind tibia held parallel to axis of body; angulate, long, with angles lined with hairs; with 2 black-tipped spines on shaft; apex emarginate with ventral row of 5 black-tipped spines, smallest situated closest to body. Tarsus 2-segmented, proximal segment as in second instar, distal segment with 2 claws separated by large arolium.

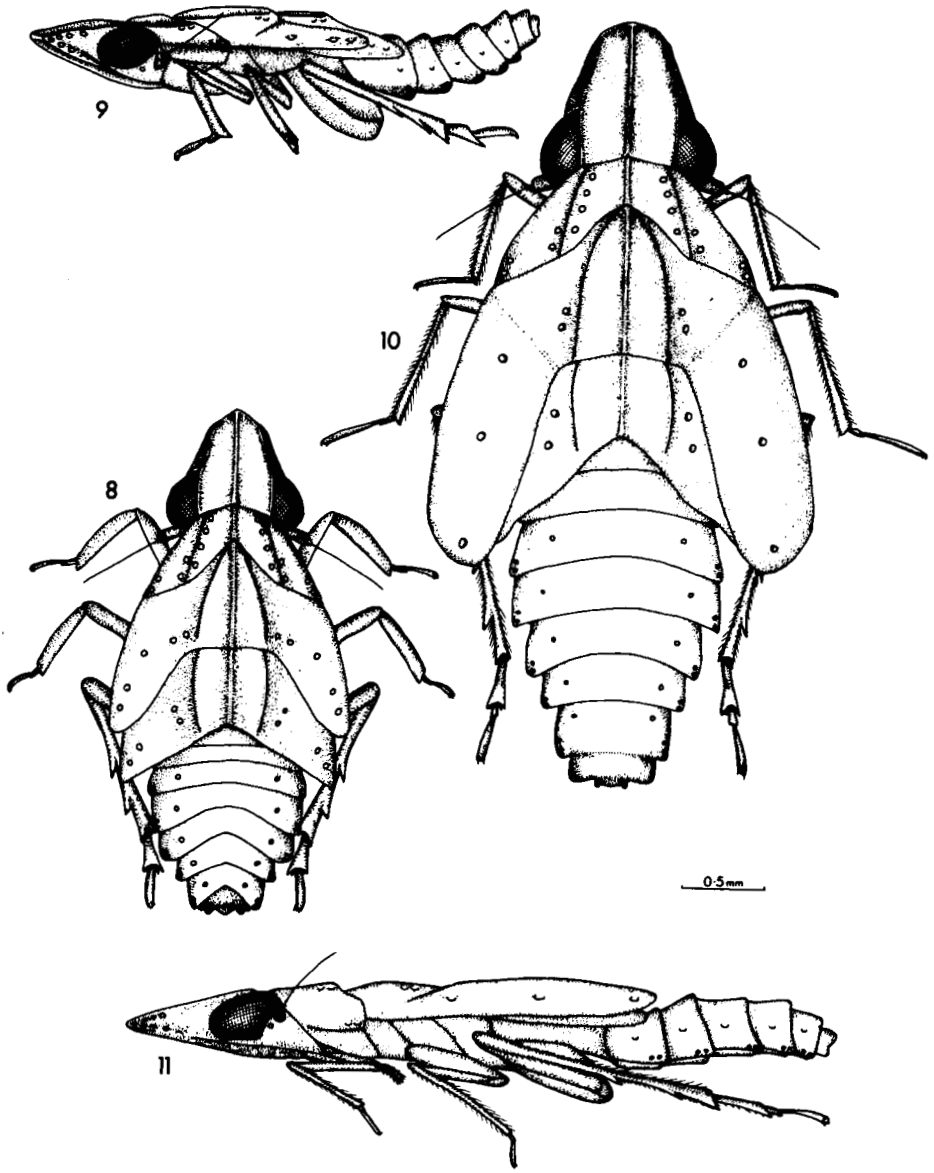
Abdomen.—8 visible segments dorsally and 6 ventrally; visible tergites 3-7 with 3 sensory pits on each side arranged as in Figs 6-7; sixth visible sternite emarginate ventrally; eighth visible tergite with openings of filament glands visible as semicircle of pits surrounding posterior projections around anus; lateral edges of seventh visible segment produced posteriorly a short distance to form triangular flaps, sometimes black-tipped, on each side of eighth visible segment.

Fourth instar (Figs 8-9)

Coloration as in third instar but with greenish areas on head and thorax instead of yellowish areas. Orange markings on head as in first instar. Red areas on body less extensive. Body broad across thorax and very much flattened.

Body length 2.8-3.3 mm.

Head.—Rostrum reaching to apex of mid coxae, clearly 2-segmented. Anteclypeus forming nearly equilateral triangle, evenly convex. Postclypeus slightly rugose, concave between lateral carinae with median carina raised; nearly vertical between lateral carinae and margins against vertex; margins carinate, nearly parallel-sided against eyes and for short distance anterior to eyes; anteriorly, margins sinuous towards rounded apex; line of 15 sensory pits lateral to lateral carina on each side. Antenna with scape and pedicel cylindrical, pedicel twice as long as scape, crowded with sensilla on distal half; third segment small; arista 0.43-0.54 mm long. Vertex shaped as in Fig. 8; length along median carina 0.43-0.54 mm; breadth 0.41-0.49 mm.

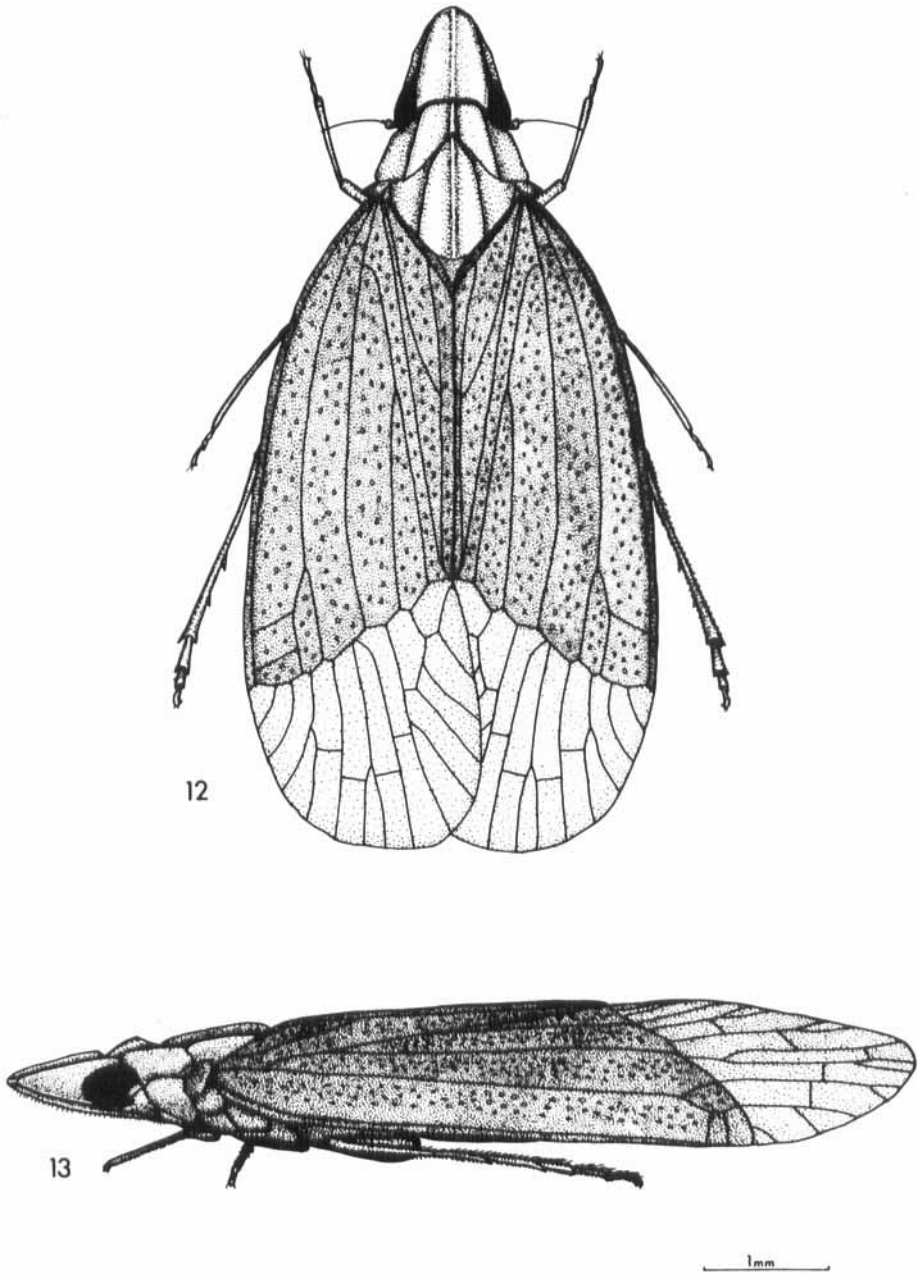


FIGS **8-11**—Dorsal and lateral views of *K. australis* nymphs: **(8-9)** fourth instar nymph; **(10-11)** fifth instar nymph.

Thorax.—Heart-shaped, carinate margins of nota almost continuous with each other. Pronotum continuing ventrally to level of fore coxae, cutting off triangular propleuron between anteclypeus and fore coxae; outline as in Fig. 8; concave between lateral carinae; median carina slightly raised at bottom of concavity; sensory pits as in third instar (also see Fig. 8). Fore leg with hairs on angles of femur, tibia and tarsus. Tarsus 2-segmented with 2 claws and large fleshy arolium.

Mesonotum broad, outline as in Fig. 8; 3 carinae on disc and 5 sensory pits on each side arranged as in Fig. 8. Mesepisternite and mesepimeron visible anterior and lateral to mid coxa respectively. Mesepisternite with carina passing from base of coxa towards thoracic margin. Mid leg similar to fore leg.

Metanotum broad, outline and carinae as in Fig. 8; 4 sensory pits on each side arranged as in Fig. 8. Hind coxa large, fused to metasternum. Hind femur curved slightly near trochanter to fit around coxa and against metepisternite; angles lined with short hairs. Hind tibia long, angulate, with long hairs on angles, and 2 shaft spines as in Figs 8-9; apex emarginate ventrally with ventral row of 5 subequal black-tipped spines. Tarsus 3-segmented; proximal segment apically emarginate with ventral row of 5 subequal black-tipped spines; second segment difficult to distinguish from apical segment, lacking spines; apical segment with 2 claws and large arolium.



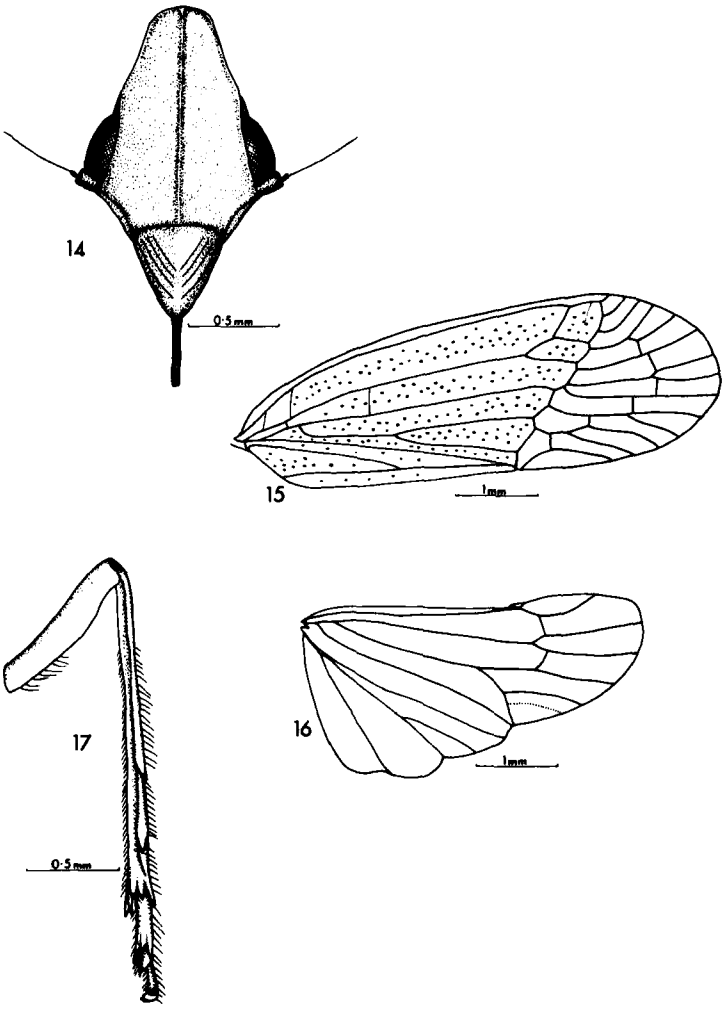
FIGS 12-13—Dorsal and lateral views of *K. australis* adult.

Abdomen.—With 8 segments visible dorsally and 6 ventrally. Three sensory pits on each side of visible segments 3-7 arranged as in Figs 8-9. Seventh visible tergite produced posteriorly on either side to form lateral triangular flaps around eighth visible segment. Sixth visible sternite deeply emarginate posteriorly with last segment forming a cup opening posteriorly and ventrally. Differentiation of male and female not apparent.

Fifth instar (Figs 10-11)

Coloration predominantly mottled yellowish green. Head entirely yellowish green, without orange.

Body flattened, broad across thorax. Abdomen dorsoventrally flexible. Body length 3.87-4.41 mm.



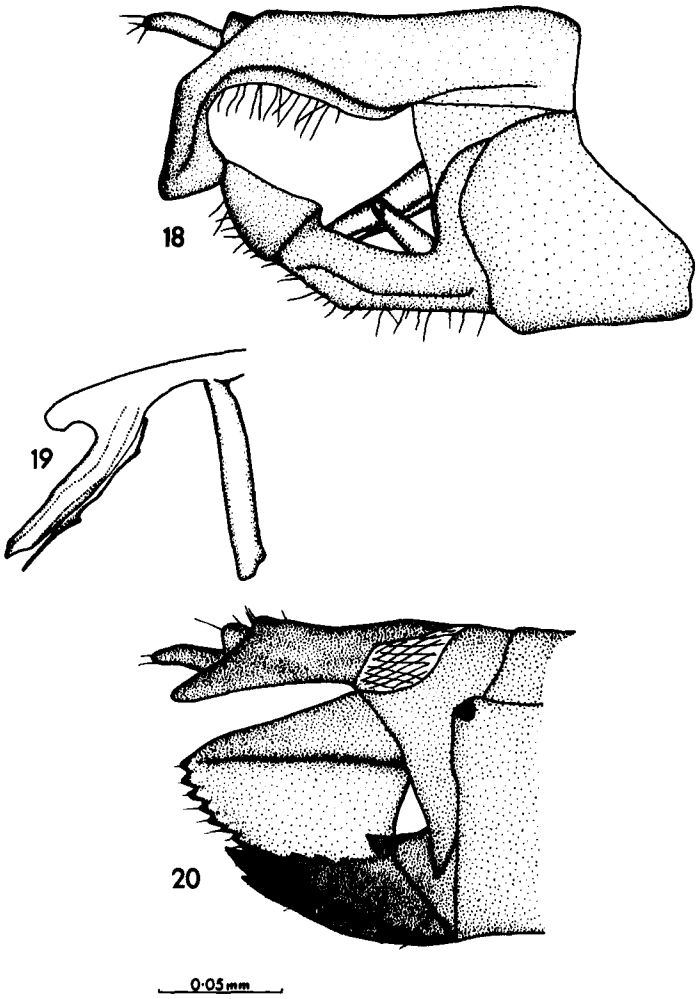
FIGS **14-17**—*K. australis* adult: **(14)** head, facial view; **(15)** tegmen; **(16)** hind wing; **(17)** hind leg.

Head.—Rostrum reaching to apex of mid coxae. Anteclypeus triangular, evenly convex on disc but more strongly convex at sides. Postclypeal outline as in fourth instar; disc flat but area between lateral carinae and margin curved dorsally in front of eyes and at rightangles to disc near apex of head; lateral carinae very faint; median longitudinal carina distinct; 17-19 sensory pits outside lateral carina on each side. Antenna with club-shaped pedicel; arista 0.49-0.63 mm long. Vertex shape as in Fig. 10; median carina single from apex to two-fifths distance to base and double for remaining distance; length along median carina 0.65-0.74 mm; breadth 0.54-0.61 mm.

Thorax.—Pronotum yellowish green with pale orange markings outside lateral carinae; continued ventrally beneath carinate lateral margins to base of fore coxae; dorsal outline as in Fig. 10; disc flat between lateral carinae with median carina double; outside lateral carinae pronotum at angle of about 30° to disc; sensory pits as in previous instars (see also Fig. 10). Propleuron present in front of coxa as a triangular sclerite. Fore leg as in previous instars except for presence of long hairs along tibia; tarsus 2-segmented with 2 claws and large fleshy arolium.

Mesonotum yellowish green, with pale green central stripe and orange bands outside lateral carinae from middle of mesonotum to hind margin; broad, with fore wingpads continuing posteriorly to level of base of fourth visible abdominal tergite; median longitudinal carina double, lateral carinae as in Fig. 10; a groove, marking base of wingpad, present between anterolateral angle and point on posterior margin where lateral carina ends on each side; sensory pits 5, arranged as in Fig. 10. Mesepisternite swollen, with oblique longitudinal carina. Mesepimeron flat with faint carina passing from posterolateral corner to base of coxa. Mid leg similar to fore leg but femur and tibia longer.

Metanotum yellowish green with pale green central stripe; outline as in Fig. 10; hind wingpad without sensory pits; reaching to same point as, and mostly hidden by fore wingpad; median longitudinal carina double, lateral carinae and 2 sensory pits as in Fig. 10. Metepisternite swollen medially but carinate laterally



FIGS **18-20**—*K. australis* genitalia: **(18)** male terminalia, lateral view; **(19)** aedeagus, right lateral view; **(20)** female terminalia, lateral view.

to form groove into which femur fits. Metepimeron carinate against metepisternite but otherwise unadorned. Hind coxa large, fused to metasternum. Hind femur long, angulate with small hairs along angles. Hind tibia with long hairs along angles; 2 thick, black-tipped spines on shaft (see Fig. 11); apex emarginate, with 5 black-tipped spines, 3 outer ones at different level from inner 2. Hind tarsus 3-segmented, first segment emarginate at apex with ventral row of 5 black-tipped spines, second segment small with 1 small black-tipped spine at each side, third segment with 2 claws and large fleshy arolium.

Abdomen.—Yellowish green with pale green stripe down midline dorsally. Second visible dorsal segment with dark red patch on either side of midline. Abdomen with 8 visible segments dorsally and 6 ventrally. Visible segments 3-7 dorsally with 3 sensory pits on each side arranged as in Figs 10-11. Seventh visible segment produced posteriorly on either side forming triangular plate. Eighth visible segment posteriorly emarginate ventrally, revealing ninth visible segment which forms cup described in previous instars. Sexual differentiation not apparent.

Adult (Figs 12-20)

Body pale green, dorsoventrally flattened. Length 5.46-6.05 mm (males), 4.51-6.19 mm (females).

Head (Fig. 14).—Long in front of eyes. Rostrum short, reaching to middle of mid coxae. Anteclypeus evenly convex on disc but more convex at edges; disc with some indication of muscle impressions, lacking carinae. Postclypeus with carinate margins, shaped as in Fig. 14; disc flat with median longitudinal carina. Antennae with short broad scape, oblong pedicel with sensilla towards apex and small third segment; arista 0.52-0.63 mm long (males), 0.56-0.63 mm (females). Vertex with carinate margins, shaped as in Fig. 12; median length 0.77-0.79 mm (males), 0.74-0.83 mm (females); breadth at base 0.61-0.67 mm (males), 0.67-0.68 mm (females).

Thorax.—Pronotum ventrally reaching to top of fore coxae leaving part of propleuron exposed as small plate below pronotum; lateral margins broadly carinate between eyes and tegulae; posterior margin extending laterally to above and below tegulae; 3 carinae on disc, arranged as in Fig. 12. Fore coxae obliquely elongate; fore femur and tibia 4-angled, setulae lining angles.

Mesonotum diamond-shaped, evenly convex, lateral margins declivous and extending to base of hind wings; 3 carinae, arranged as in Fig. 12. Scutellum small, roughly triangular. Mesepimeron and mesepisternite each with longitudinal carina passing from anterodorsal corner to posteroventral corner. Mid coxae transverse, contiguous medially. Mid femur and tibia longer than, but otherwise similar to those of fore leg. Tegmen with crossveins forming line separating thicker basal two-thirds from membranous apical portion. Venation as in Fig. 15.

Metanotum nearly as long as mesoscutum, parallel-sided. Metapleuron carinate; metepisternite swollen. Hind leg as in Fig. 17. Hind coxa very large, immobile, fused to swollen metasternum. Hind femur reaching to mid coxa, 4-angled, curved to fit around coxa and into cavity between swollen metepisternite and metepimeron. Hind tibia elongate, held parallel to axis of body; angles lined with hairs, outside angle with 2 black-tipped spines; 5 black-tipped spines at apex. Hind tarsus hairy; first segment as long as other 2 together; with row of 5 black-tipped spines at apex; arolium large. Hind wing (Fig. 16) hyaline with green veins; with recurved flap on anterior border at apex of Sc and hooking over toughened anal margin of fore wing to join wings in flight.

Abdomen.—*Male* with 6 visible terga and 5 visible sterna before genitalia (Fig. 18). Sixth visible sternite expanded dorsally to surround base of genital armature; distal margin emarginate ventrally to expose base of subgenital plates, these broadly fused to form ventral plate with upturned apical lip and 2 lateral margins extending posteriorly to form 2 large arrow-shaped expansions held together beyond ventral plate. Two ventral extensions of anal segment curving downwards around ends of arrow-shaped expansions of subgenital plate and ending as blunt flaps. Parameres curving outwards, each ending in hook. Aedeagus (Fig. 19) a simple tube with accompanying spike.

Female with 7 terga and 6 sterna visible before genitalia (Fig. 20). Sixth visible sternite elongate in midline, with small dark ventral protuberance at base of ovipositor valves. Seventh visible sternite divided, expanded dorsally. Third valves attached dorsally, triangular, emarginate anteriorly, with group of incurved apical teeth. First valves heavily sclerotised, dark brown, with strong teeth along dorsal surface and apex curving dorsally. Second valves sharp blades, thin, without teeth, held against inside margins of first valves.

Acknowledgments

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