

Kazukuru gen. nov. – a new Ricaniidae planthopper from Solomon Islands (Hemiptera, Fulgoromorpha)

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Abstract

A new monotypic genus of ricaniid planthoppers (Hemiptera: Fulgoromorpha: Ricaniidae) from New Georgia Island (Solomon Islands), *Kazukuru* gen. nov., is described for *K. zingiberis* sp. nov. (type species). Habitus, female, external and internal genital structures of the new species are described and illustrated.

Key Words

Fulgoroidea, Oceanian Region, New Georgia, taxonomy, morphology, eggs

Introduction

The planthopper family Ricaniidae Amyot et Audinet-Serville, 1843 consists of 67 genera (2.7% of the Fulgoromorpha) and covers 437 species (3.2% of the Fulgoromorpha) (Bourgoin 2021).

The fauna of Ricaniidae of the Solomon Islands is not very rich. Only six genera with thirteen species and one subspecies have been recorded from the Solomon Islands. These are: *Armecia hyalinata* (Donovan, 1805) – Guadalcanal Is., Vella Lavella Is., *A. atrofascialis* Distant 1911 – Solomon Islands; *Euricania discigutta* (Walker, 1862) – Solomon Islands, *E. gloriosa* Distant, 1911 – Solomon Islands; *Parapiromis guadalcanalensis* Bu, Larivière & Liang, 2010 – Guadalcanal Is., Malaita Is., *P. santacruzensis* Bu, Larivière & Liang, 2010 – Santa Cruz Is., *P. hieron* (Fennah, 1970) – Rennell Is.; *Ricania corusca* Van Duzee, 1940 – Santa Catalina Is., *R. lutescens* Distant, 1911 – Solomon Islands, *R. sigillata* Van Duzee, 1940 – Malaita Is.; *Ricanula conspersa* (Melichar, 1898) – Shortland Is., *R. trimaculata trimaculata* (Guérin-Méneville, 1838) – Shortland Is., *R. trimaculata rennelli* Fennah, 1970 – Rennell Island; *Tarundia curtula* Melichar, 1898 – Shortland Is.

Unfortunately, the exact location is known only for some species, with others (four species) recorded only generally. All of these species belong to widely distributed genera.

The new genus described below, based on two females, is unique in family Ricaniidae and known only from a single locality.

Material and methods

Dry pinned specimens were used for this study.

Label information for all specimens examined is provided verbatim with each line separated by a slash (/) and each label given in square brackets.

Terminology

The nomenclature of fore wing (tegmen) follows the interpretation proposed by Bourgoin et al. (2015) and Stroiński (2020). Antennal structures are named in accordance with Stroiński et al. (2011). The terminology of the genitalia follows Bourgoin (1988) and Bourgoin and Huang (1990) for the male and Bourgoin (1993) for the female. The whole abdomen of the specimen examined was cut off and cleared for 30 min in a warm (50 °C) 10% potassium hydroxide (KOH) solution with a few drops of black chlorazol (CAS No. 1937-37-7) for staining the ectodermic genital structures, based on the method introduced by Carayon

(1969). Dissections and cleaning of the genital structures were carried out in distilled water. Final observations were made in glycerol using an Olympus SZH10 stereomicroscope. The photographs of the habitus and internal structures were taken using a stereomicroscope Leica MZ 16 with IC3D camera. Final images were adjusted using Helicon 5.0 software and Adobe Photoshop (version 7.0).

The SEM photographs of uncoated specimens were taken in the Laboratory of Scanning Microscopy, MIZ PAS (Warsaw), using a scanning electron microscope HITACHI S-3400N under low vacuum conditions.

Measurements and abbreviations.

Measurements were made with an ocular micrometer. The following measurements, ratios and their abbreviations were used in this study:

Total length	measured (in dorsal view) from head apex to tegmina apex;
A/B	width of vertex measured at anterior margin / length of vertex measured at mid-line;
C/E	width of frons at upper margin / length of frons at mid-line;
D/E	maximum width of frons / length of frons at mid-line;
F/B	length of pronotum at mid-line / length of vertex at mid-line;
G/F	length of mesonotum / length of pronotum at mid-line;
G/B+F	length of mesonotum / cumulative length of vertex and pronotum at mid-line;
G/H	length of mesonotum at mid-line / width of mesonotum between lateral angles;
I/J	length of tegmen measured from the base to the apical margin in median portion / width of tegmen measured at the widest part.

The material studied is deposited in Bernice P. Bishop Museum, Honolulu, Hawaii, USA (**BPBM**).

Results

Class Insecta Linnaeus, 1758

Order Hemiptera Linnaeus, 1758

Suborder Fulgoromorpha Evans, 1946

Superfamily Fulgoroidea Latreille, 1810

Family Ricaniidae Amyot & Audinet-Serville, 1843

Subfamily Ricaniinae Amyot & Audinet-Serville, 1843

Genus *Kazukuru* gen. nov.

<http://zoobank.org/FC2D5242-4CC3-4DFF-B747-E4C8303E84D5>

(Figs 1–60)

Type species. *Kazukuru zingiberis* sp. nov., by present designation and monotypy.

Etymology. The generic name *Kazukuru* refers to an extinct language once spoken in New Georgia (Solomon Islands). Kazukuru language was last recorded in the early twentieth century when its speakers were in the last stages of language shift (Dunn and Ross 2007). Gender neuter.

Diagnosis. The genus *Kazukuru* gen. nov. can be distinguished from all other genera in Ricaniidae by the following combination of characters: frons with three carinae separated at base (Figs 12 and 13), frontal disc with transverse massive thick shaft; all longitudinal veins leaving basal cell separately (Fig. 20); tegmen's cells C1 and C5 open; basimetatarsomere with two rows of partly flattened teeth (Fig. 30); all teeth of similar size; posterior margin of gonoploc with two rows of teeth: first row with well-developed teeth (Fig. 42) – larger interspersed with smaller ones, second row with very small, weakly-developed teeth placed irregularly.

Description. Head. Head with compound eyes (in dorsal view) narrower than thorax.

Vertex (Figs 2–3 and 11–13) transverse, with all margins well carinated, distinctly wider at level of anterior margin angles than long at mid-line, posterior angles placed about level of mid-length of compound eyes; posterior margin slightly elevated. Disc of vertex without median carina.

Frons (Figs 2–5 and 11–15) transverse, with all margins well carinated; frons at upper margin slightly wider than high at mid-line, widest near level of lower part of compound eyes and distinctly wider than high at mid-line; lateral margins distinctly bent before half of frons, covering base of pedicel, not incised at level of ocelli. Upper part of frons to level of transverse eminence protruded, below eminence retracted; disc of frons smooth.

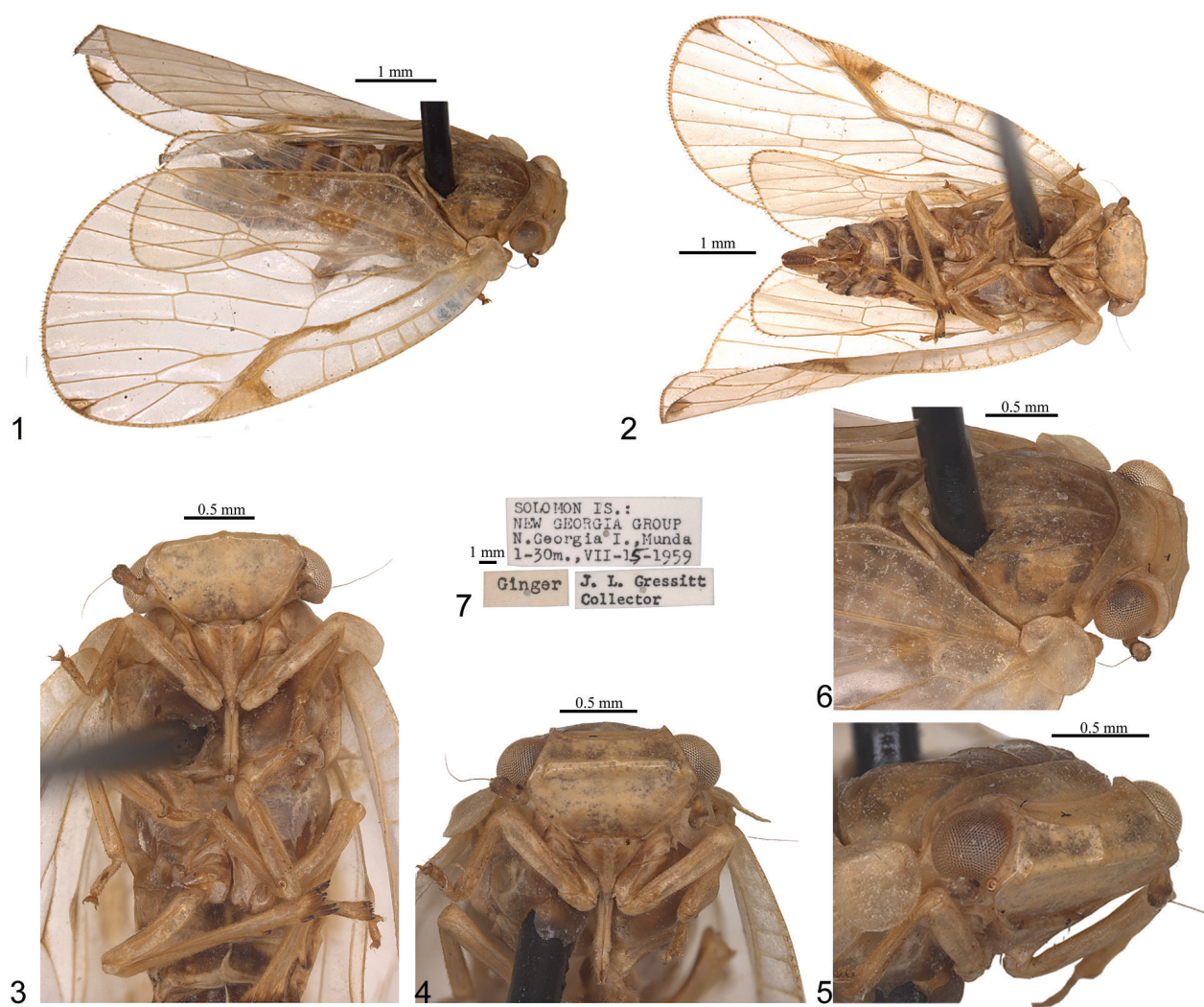
Frontal disc tricarinate, all carinae (median and lateral) separated at upper margin of frons and all carinae reaching ventrad to transverse bar before frons mid-length (not extending the 'breaking' point of lateral margins); median carina straight, ending in thick transverse shaft; lateral carinae parallel to lateral margins, subparallel to each other, just longer than median carina and slightly extending transverse thick shaft; transverse thick shaft massive; surface of frontal disc smooth. Frontoclypeal suture straight.

Clypeus (Figs 2–4 and 12–13) triangular, narrowed ventrally; distinctly narrower than frons, without carinae.

Rostrum (Figs 2–4 and 14, 17), with apical segment shorter than subapical one, reaching mid-coxae.

Compound eyes (Figs 6 and 8) rounded with an extremely narrow callus at posterior margin. Ocelli present, large, located near ventro-anterior edge of eye, above antenna.

Antenna (Figs 13, 18–19 and 25–26): scape short, wider than long; pedicel more elongate with slightly wider tip, with functional area (trichoid sensilla type 1 and antennal plate organs) present on top and tip of dorsal surface and distinctly smaller area on ventral surface; plate organs of crenellated type surrounded by a ring of elevated spines.



Figures 1–7. *Kazukuru zingiberis* gen. et sp. nov; **1.** Habitus, dorso-lateral view; **2.** Same – ventral view; **3.** Head and thorax, ventral view; **4.** Head and rostrum ventral view; **5.** Head and thorax, fronto-dorsal view; **6.** Same, dorso-lateral view; **7.** Labels.

Thorax. Pronotum (Figs 1, 6 and 8–11) distinctly wider than vertex at mid-line; disc of pronotum with median carina and two lateral impressions; anterior part medially produced medially truncate; posterior margin weakly concave; pronotum ascending posteriorly.

Mesonotum (Figs 1, 6 and 8–11) about as long in mid-length as wide in lateral angles, distinctly longer at mid-line than combined length of vertex and pronotum; median, lateral and anterolateral carinae present; median carina and lateral carinae connected anteriorly in one point; median carina reaching scutellum, lateral carinae reaching posterior margin; anterolateral carinae connected with lateral carinae after lateral angles of mesonotum; lateral angles placed before mid-length of mesonotum.

Tegmina (Figs 1–2 and 20–24) membranous with small sclerotised area in distal part of costal area and postcostal cell, elongately rounded, flattened, with distinct longitudinal venation with incomplete apical line of transverse veinlets.

Costal margin weakly arcuate, apical angle broadly rounded distad to claval angle; claval angle widely

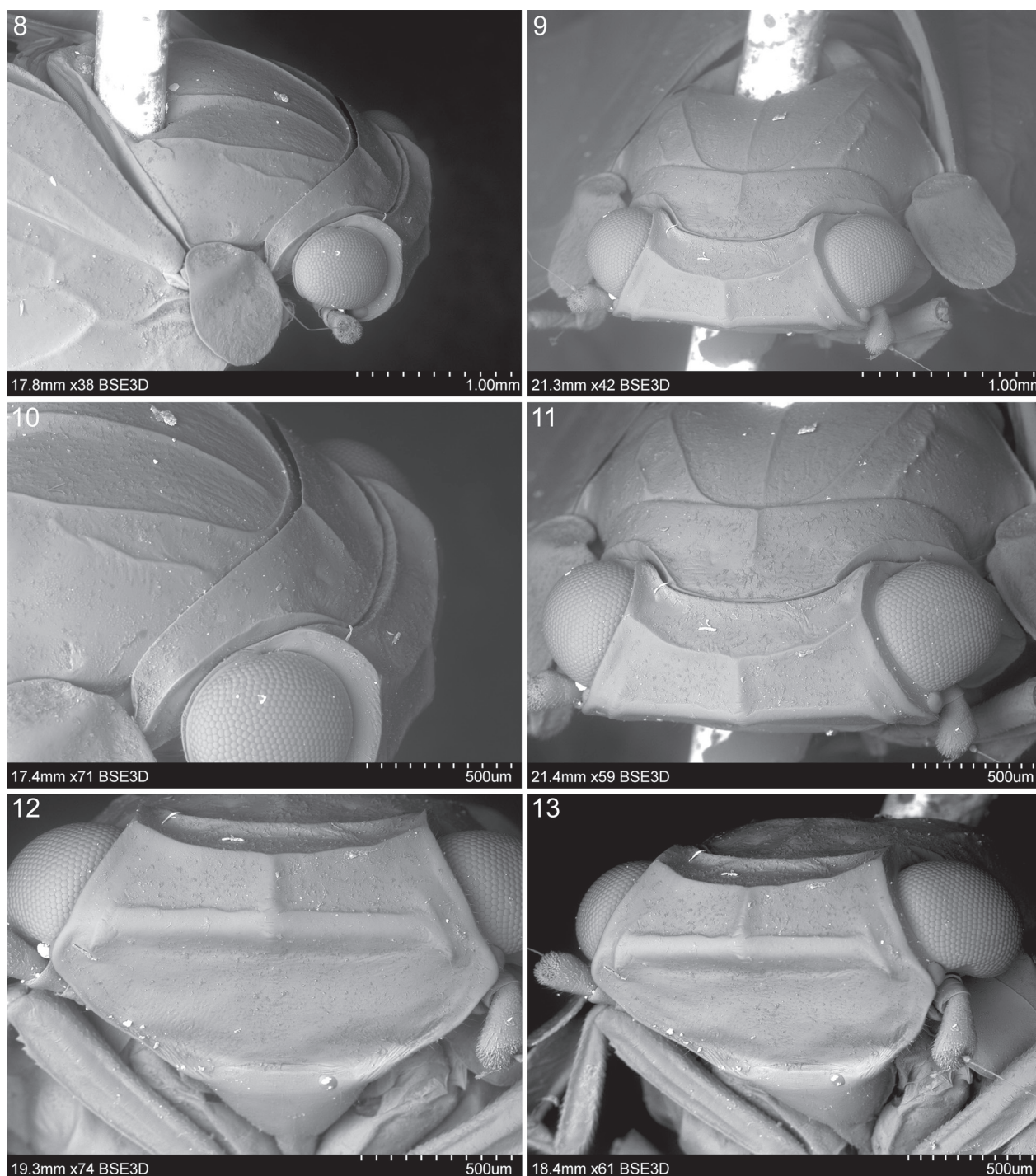
rounded; posterior margin arcuate with; postclaval margin (tornus) absent.

Costal area with dense transverse veinlets ending slightly after level of tip of clavus, in basal half about as wide as postcostal cell; subapically expanded and tapering distad.

Postcostal cell in proximal half as wide as costal area in posterior part distinctly narrower without transverse veinlets. Basal cell large, elongately rounded, about 1.5 times longer than wide.

Longitudinal veins ScP+R, MP and CuA leaving basal cell separately; veins ScP+RA and RP arising as long common stem from basal cell with first fork distad of MP and CuA forks and about level with tip of clavus; cell C1 open; first fork of MP before half of tegmen, branch MP₁ touching/fused with vein ScP+R. CuA with dichotomic model of forking, first fork placed between first forks ScP+R and MP, before tip of costal area and before tip of clavus.

Tegmina with single apical line of transverse veinlets; apical cell distinctly longer than wide, median cell large, approximately trapezoidal.



Figures 8–13. *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs; **8.** Head and thorax, latero-dorsal view; **9.** Same, fronto-dorsal view; **10.** Anterior part of body latero-dorsal view; **11.** Same, fronto-dorsal view; **12.** Frons and clypeus, frontal view; **13.** Head frontal view.

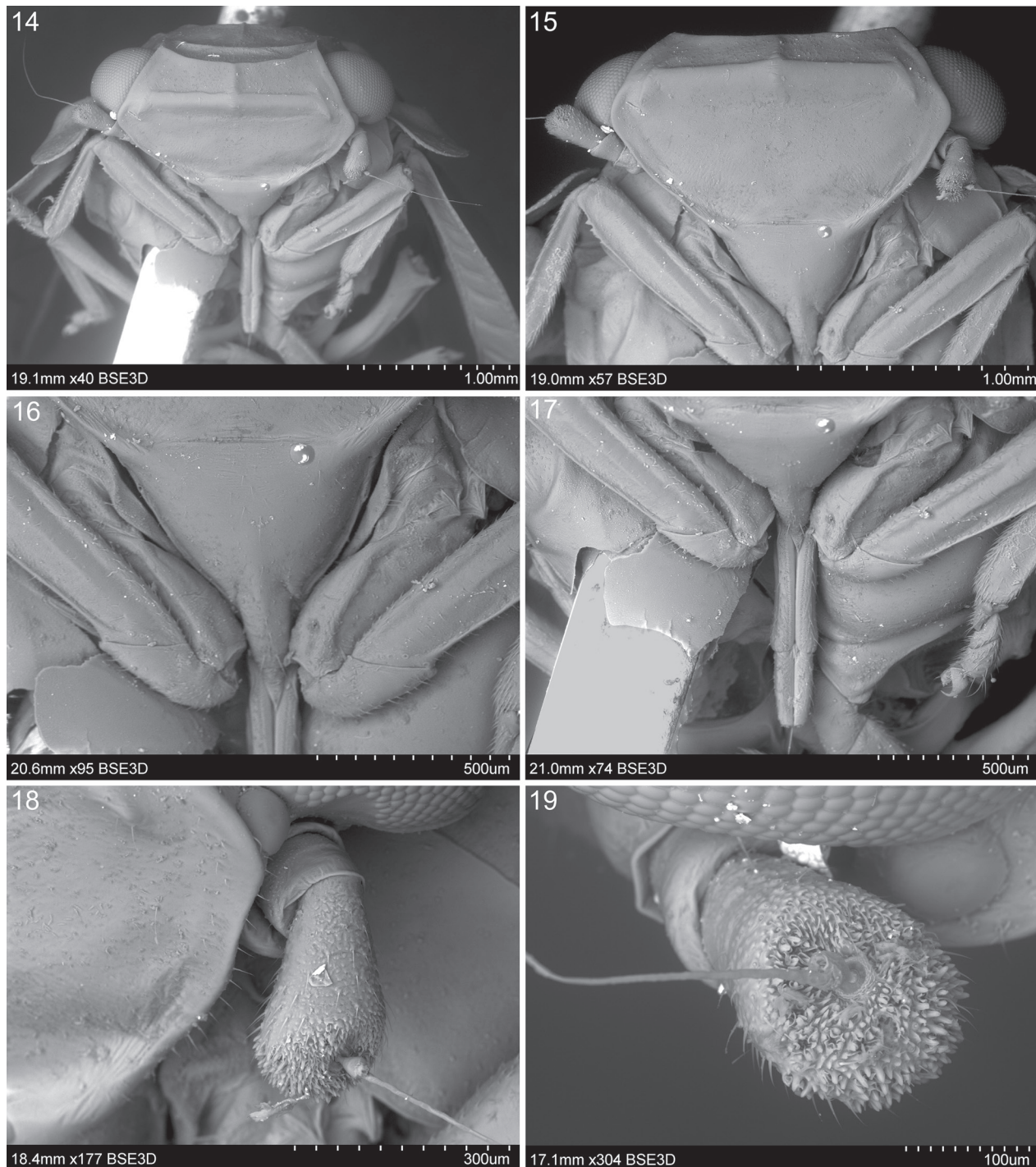
Cubital cell without transverse veinlets. Clavus closed; claval veins P_{cu} and A_1 fused just after mid-length of CuP vein; postercubital cell at basal part and posterior part with scarce transverse veinlets; postcubital and anal cell without transverse veinlets.

Hind wings with precostal triangular cell present; $ScP+R$ distinctly after mid-length of wing, MP not forking, single; CuA forking about middle of wing distantly before first of $ScP+R$ before $ScP+R$ and MP fork, slightly

after half of wing; two transverse veinlets present in distal part of wing: $rp-mp$, $mp-cua$.

Protibia and profemur about same length; mesofemur slightly shorter than mesotibia; ventral margin of profemur apically with few small variable teeth (Figs 2–3 and 14).

Hind legs (Figs 3 and 27–30): metatibia distinctly longer than metafemur, partly flattened and widened at distal part; metatibia with two lateral spines on dis-



Figures 14–19. *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs; **14.** Head, rostrum and legs, frontal view; **15.** Same, higher magnification; **16.** Clypeus, frontal view; **17.** Rostrum, ventral view; **18.** Antenna, fronto-lateral view; **19.** Top of antenna, frontal view.

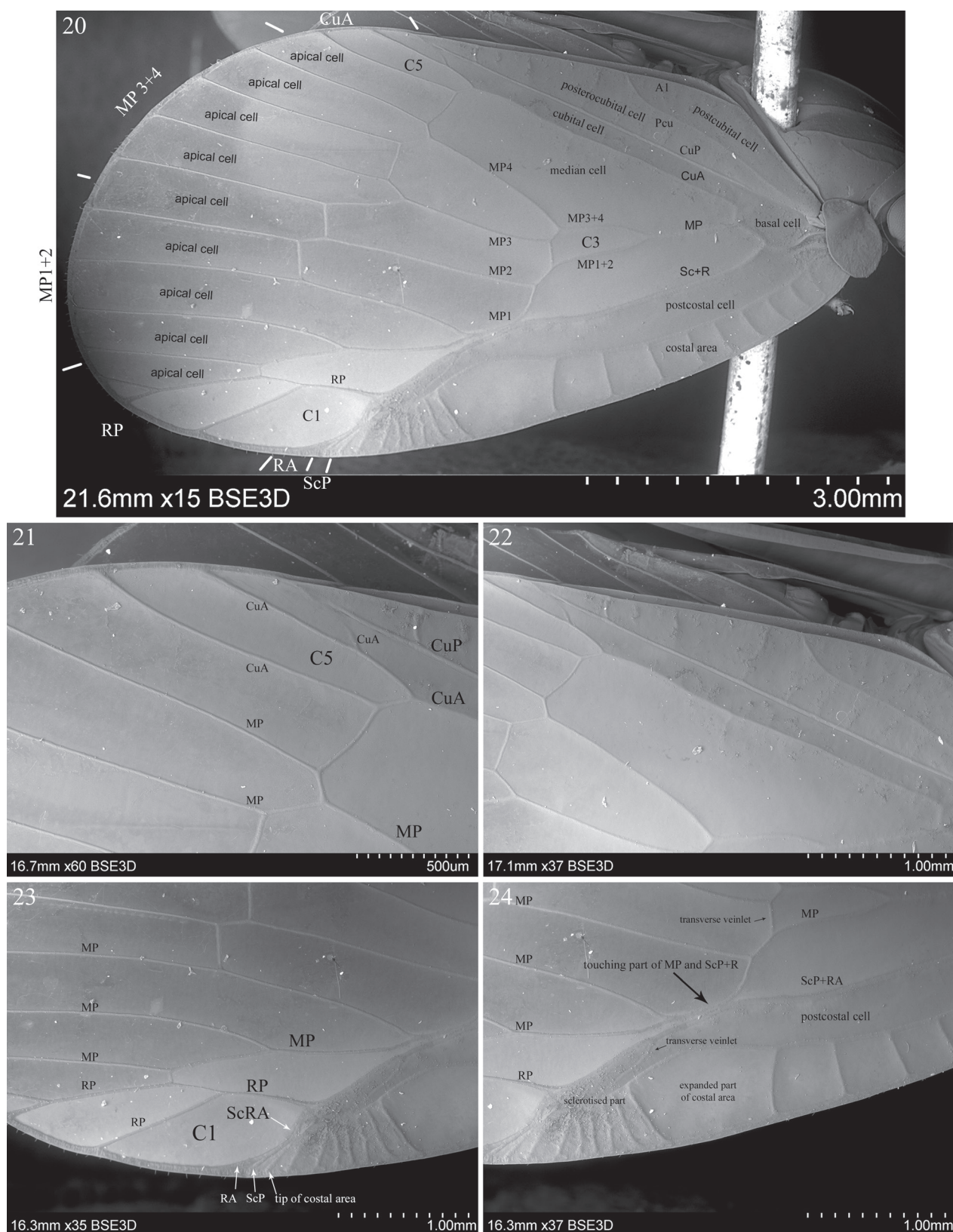
tal half; apical row of teeth huge, irregular, with seven (2+5) well-developed spines, different in size and without diastema; lateral spines similar in size; five internal teeth of differing size, lateral like external teeth, three internal ones distinctly smaller than lateral with median tooth longer.

Basimetatarsomere longer than cumulative length of second and apical metatarsomeres, with two linear rows of partly flattened teeth; all teeth similar size, apical line

with seven teeth, second row narrower, with three teeth; all teeth without setae on ventral side of teeth.

Male. Unknown.

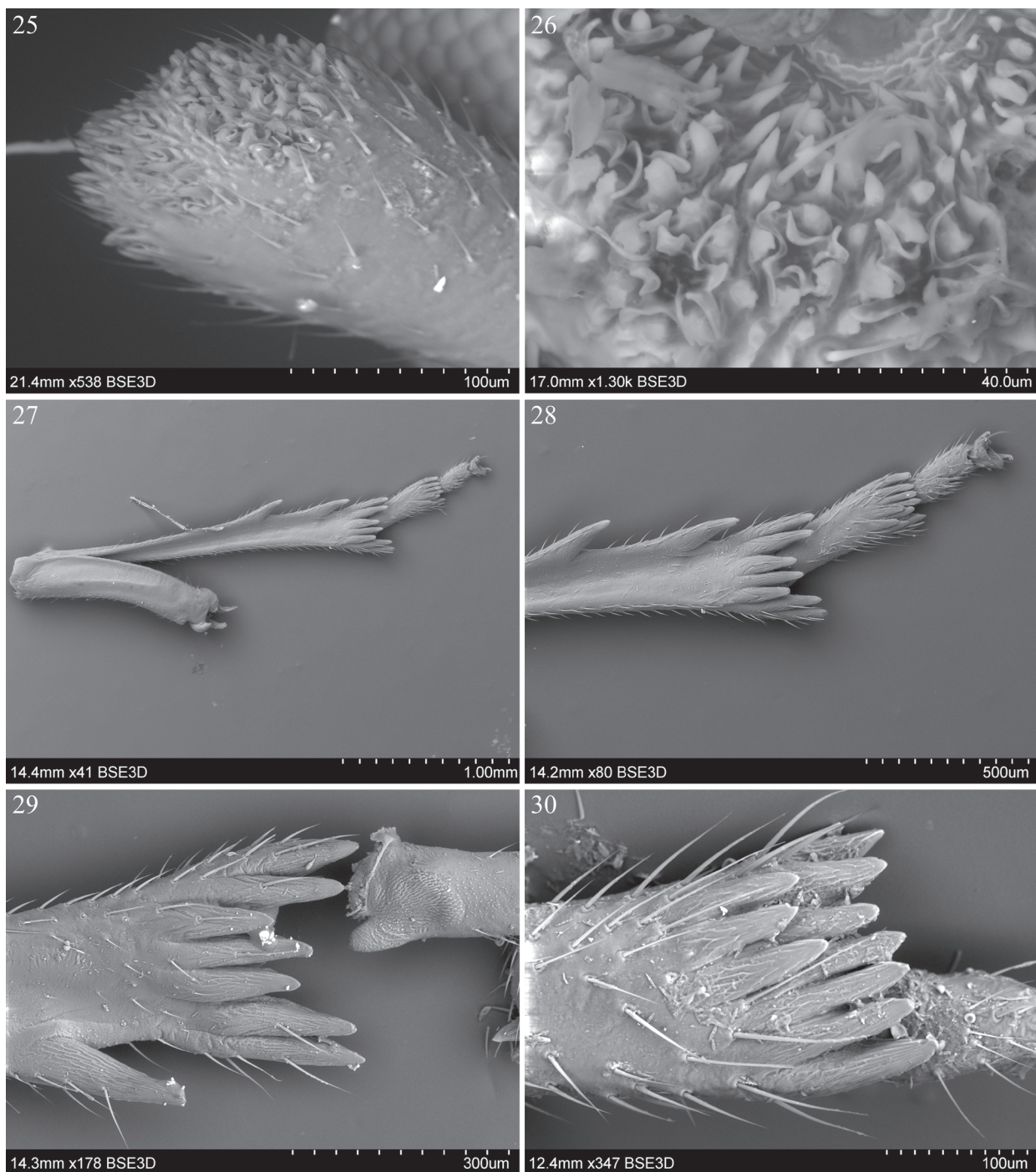
Female terminalia (Figs 31–36 and 49–60). Pregenital sternite massive (Figs 46–48, 54 and 58) with well developed, elongately-rounded and distinctly separated lateral lobes; median part of pregenital sternite wide, anterior margin medially weakly concave, posterior margin medially. Anal tube (in lateral view, Figs 55–56) elon-



Figures 20–24. *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs; **20.** Tegmen, lateral view; **21.** Claval angle area, lateral view; **22.** Clavus, lateral view; **23.** Costal angle area, lateral view; **24.** Tip of costal area and postcostal cell, lateral view.

gate, extending half of upper margin of gonoplac, but not reaching posterior margin; basal part of anal tube distinctly wider than posterior one; anal opening, in dorsal and lateral view, placed after mid-length; anal tube (in dor-

sal view, Figs 50 and 55) elongately club-like, distinctly wider after mid-length; anal style (paraproct) short not extending posterior margin of anal tube and anal segment (epiproct) long extending posterior margin.



Figures 25–30. *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs; **25.** Apex of antenna, lateral view; **26.** Plate organs; **27.** Hind leg, ventral view; **28.** Distal part of tibia and tarsus, ventral view; **29.** Apical part of hind tibia; **30.** Apical part of basimetatarsomere.

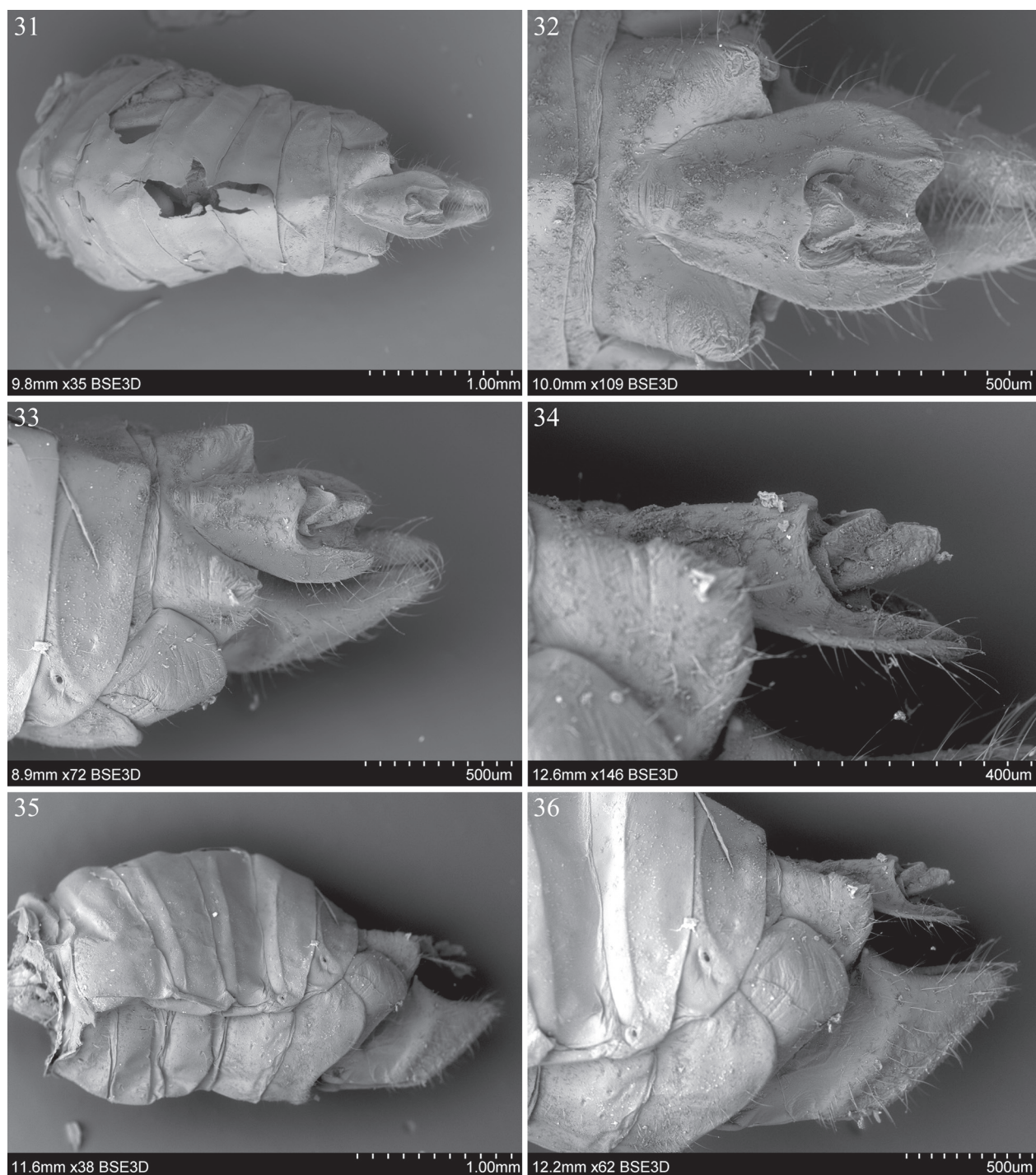
Gonoplac (Figs 41–43, 46, 49–52, 55 and 59) well developed, unilobate, laterally flattened; posterior margin of gonoplac with double rows teeth for nearly full length of posterior margin; first row teeth well-developed – larger interspersed with smaller, second row small, weakly developed and irregularly placed; membranous parts of gonoplac present: first narrow weakly sclerotised placed on lower part of posterior margin below teeth, second one large fully membranous, placed ventro-basal part of gonoplac.

Gonapophysis VIII (Fig. 57) elongate, sabre-like, “v”-shape in cross section, with teeth at posterior part

of dorsal margin; endogonocoxal process membranous, tapering apicad with very narrow tip, a bit shorter than gonapophysis VIII, without sclerotised belt.

Gonapophyses IX and gonospiculum bridge well developed (as in Figs 58–59).

Bursa copulatrix of two pouches connected with short ductus; first pouch elongate, with cells and sclerotised ornamentation (except dorsal part) with sclerotised plate with 5–8 small petals, but without median huge sclerite; second pouch elongate-oval, smaller than first one, without cells and without sclerotised plates.



Figures 31–36. *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs, female terminalia; **31.** Abdomen and terminalia, dorsal view; **32.** Anal tube, dorsal view; **33.** Same, dorso-lateral view; **34.** Same, lateral view; **35.** Abdomen and terminalia, lateral view; **36.** Terminalia, lateral view.

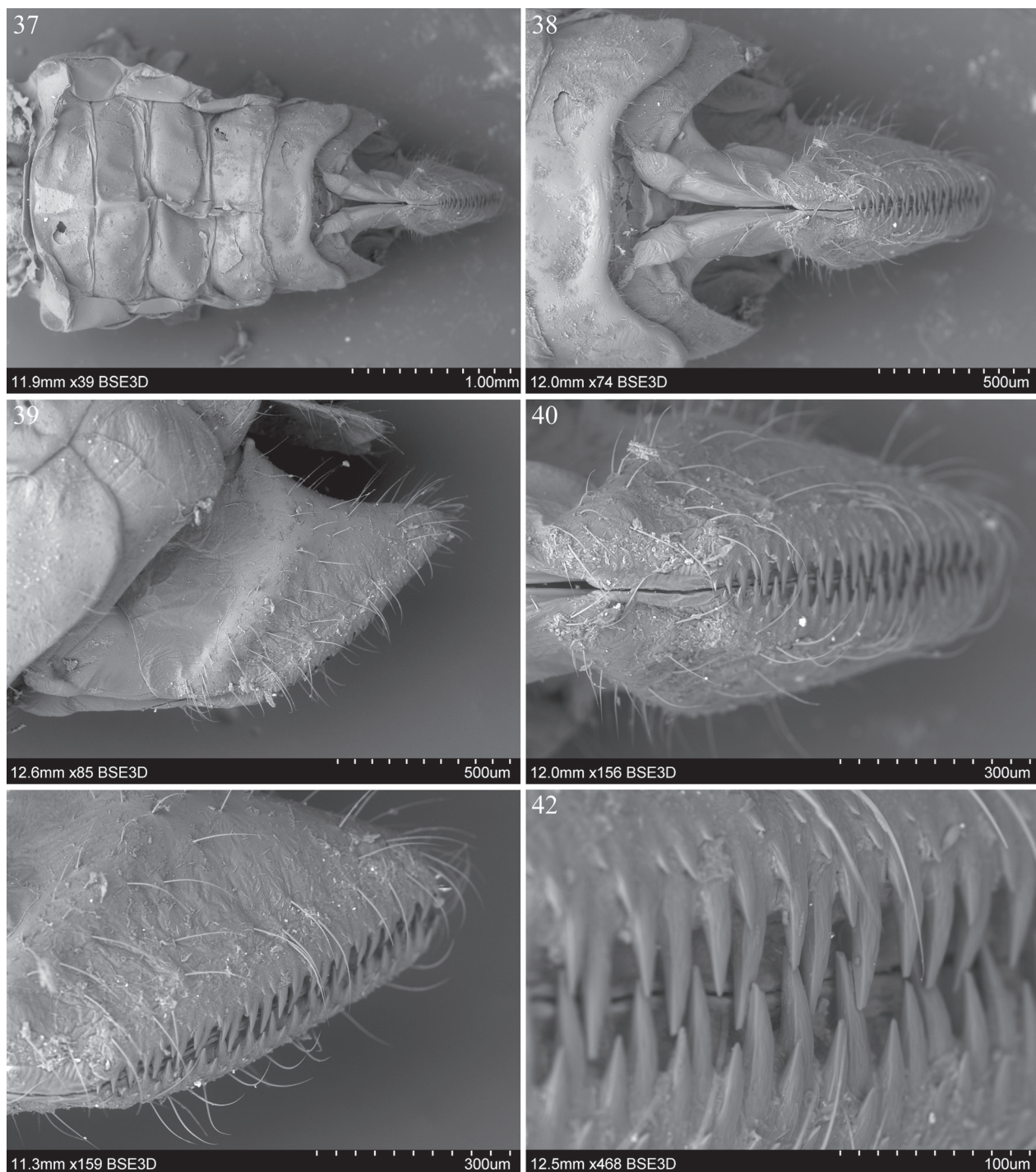
Spermatheca (Fig. 60) well developed; *ductus receptaculi* elongate, smooth and narrow; *diverticulum ductus* with two parts (basal shorter than apical), distinctly longer than *ductus receptaculi*, with long wide smooth ductus and long smooth narrow ductus and apically with ovoid and smooth bulla.

Egg description. The eggs were extracted from the dry abdomen and observed dry. Eggs are sub-elliptical (elongate-oval), yellowish, about 640 μm long and about 300 μm wide at mid-length (Figs 43–48 and 52–53). The egg surface has two main regions: a special-

ised area on the antero-dorsal part and an unspecialised egg capsule.

The specialised area is characterised by a micropylar cap placed apically with sclerotised base with rounded spongy appearance. Surface of eggs with well developed polygonal cells with margins bearing nodules apically larger than in lower part of eggs; operculum absent. About 19 eggs were found in abdomen.

Distribution. Solomon Island: Western Province, New Georgia Island.



Figures 37–42. *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs female terminalia; **37.** Abdomen and terminalia, ventral view; **38.** Pregenital sternite and terminalia, ventral view; **39.** Gonoplac, lateral view; **40.** Posterior margin of gonoplac, ventral view; **41.** Same, ventro-lateral view; **42.** Teeth of posterior margin of gonoplac.

***Kazukuru zingiberis* sp. nov.**

<http://zoobank.org/CD5F4BE6-B87C-469A-9A3F-0C8F9D59B92A>

(Figs 1–60)

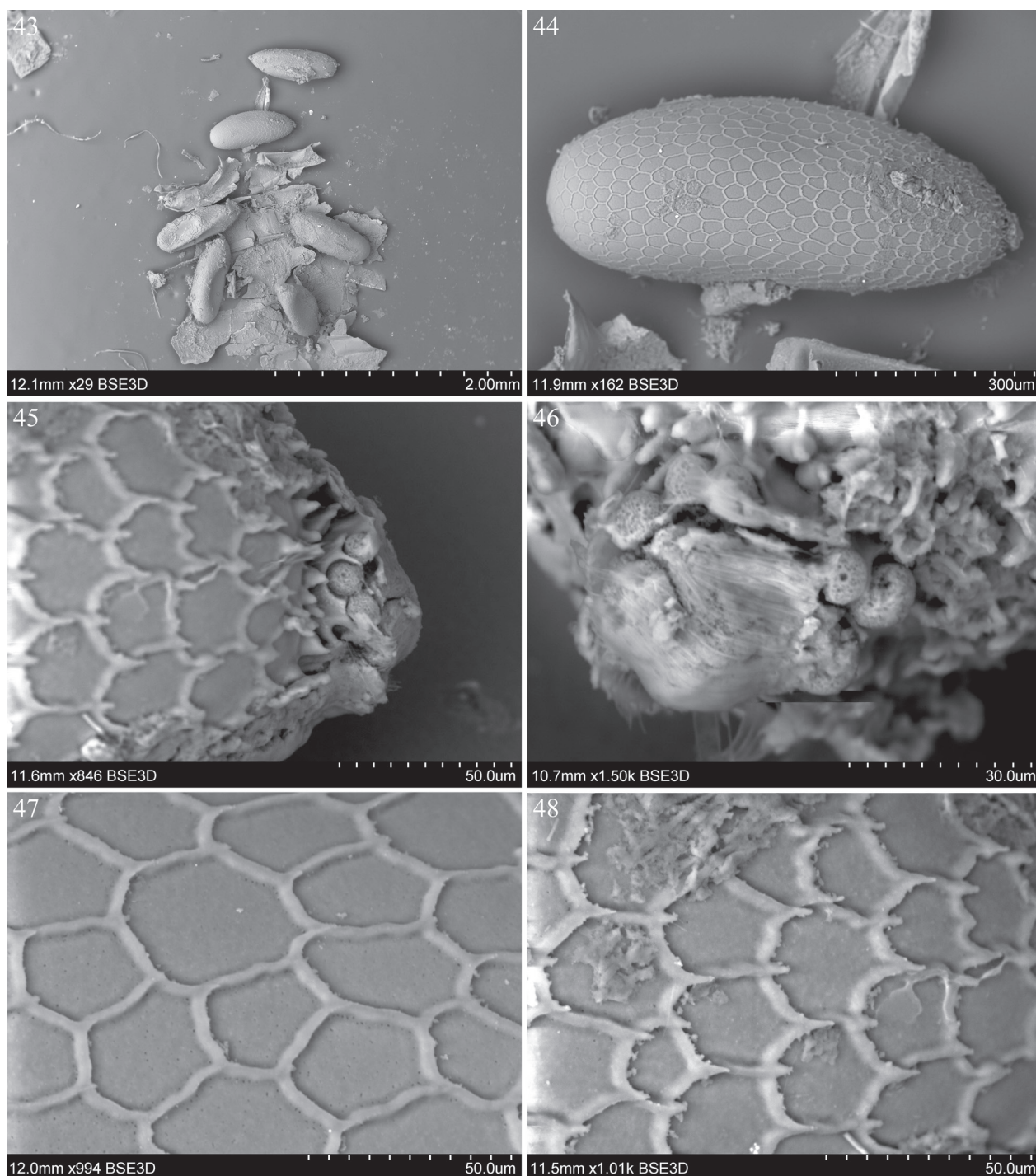
Etymology. The specific name *zingiberis* follows the host plant genus *Zingiber* Mill. on which the new species was collected. The specific name is intended as indeclinable.

Diagnosis. For now, a single species in the genus, see diagnosis of genus.

Description. Total length 0.85–0.86 cm.

Head. Vertex: proportion A/B = 6.00; anterior and posterior margins of vertex arcuate about same curvature; lateral margins almost straight and parallel.

Frons: proportion C/E = 1.15–1.20; proportion D/E = 1.73–1.80; upper margin weakly concave; frontoclypeal suture almost straight.



Figures 43–48. Eggs of *Kazukuru zingiberis* gen. et sp. nov., SEM micrographs; **43.** Group of eggs; **44.** Egg, lateral view; **45.** Micropylar cap, lateral view; **46.** Same, dorso-lateral view; **47.** Polygonal cell, lower part of egg; **48.** Same, dorsal part of egg.

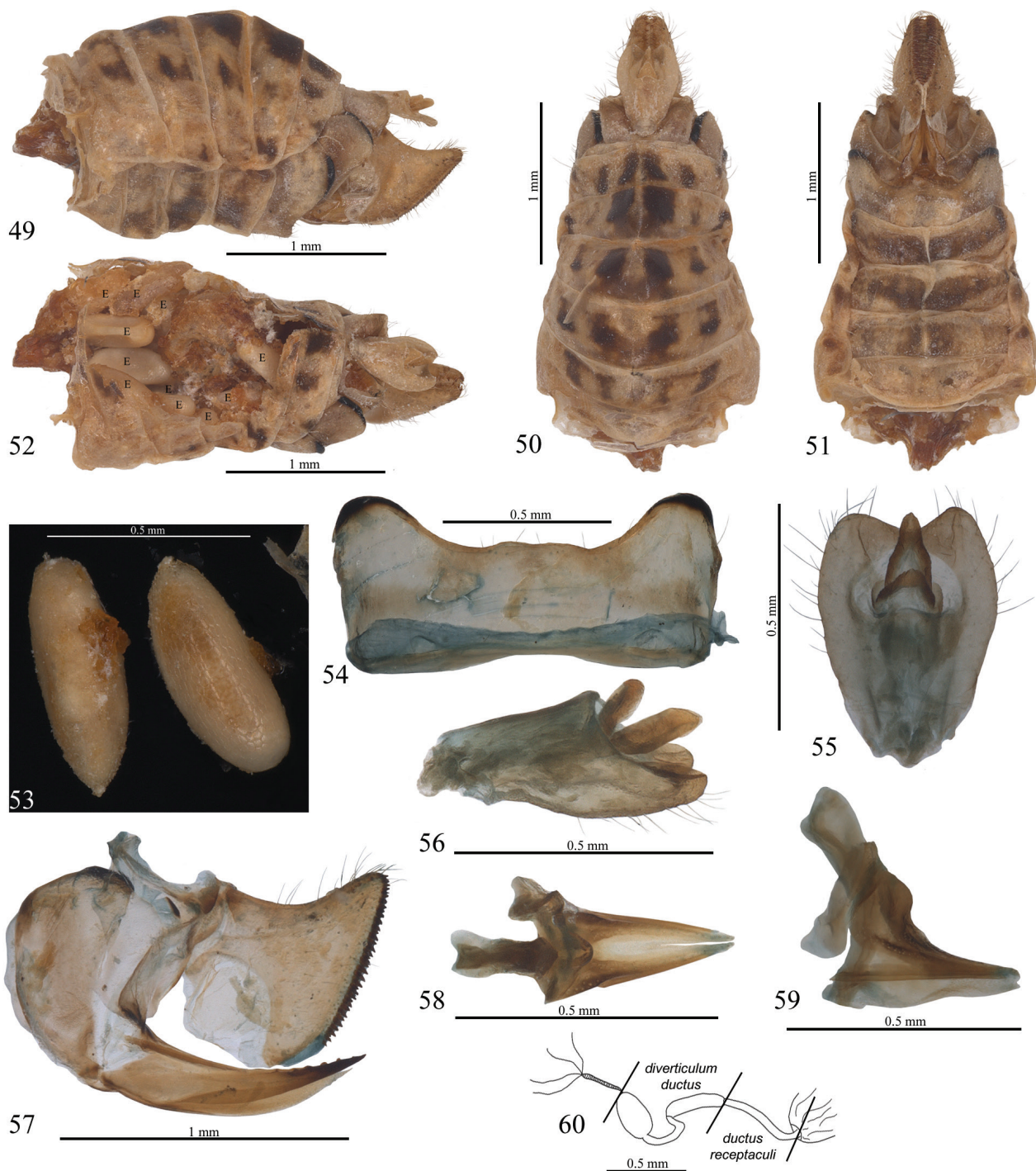
Thorax. Pronotum: proportion F/B = 5.81–6.00.

Mesonotum: proportion G/F+B = 3.50–3.87, proportion G/F = 5.81–6.00, proportion G/H = 1.0; connection between anterolateral carinae and lateral weakly visible.

Tegmina: proportion I/J = 1.71–1.77; longitudinal veins ScP with single terminal; RA with single terminal; MP with 8 terminals (MP₁₊₂ with four terminals, MP₃₊₄ with 4 terminals); RP with three terminals; CuA with three terminals. Hind wing. ScP+RA not forking, single, RP single; CuA with three terminals.

Female terminalia. Anal tube (in dorsal view): posterior margin medially with distinct concavity.

Colouration (Figs 1–6 and 49–52). General colouration yellowish-brownish. Tegmina hyaline with a few brownish patches: elongate alongside ScP+R vein; small rounded patch near posterior margin between RP forks and three separated, rounded patches present alongside CuP vein; tip of costal area yellowish. Abdomen (sternites and tergites) brownish with black patches (Figs 49–52); terminalia brownish.



Figures 49–60. *Kazukuru zingiberis* gen. et sp. nov; **49.** Abdomen and terminalia, lateral view; **50.** Same, dorsal view; **51.** Same, ventral view; **52.** Abdomen with eggs; **53.** Eggs; **54.** Pregenital sternite, ventral view; **55.** Anal tube, dorsal view; **56.** Same, lateral view; **57.** Gonoploc and gonapophysis VIII with endogonocoxal process, lateral view; **58.** Gonapophyses IX and gonospiculum bridge, dorsal view; **59.** Same, lateral view; **60.** Spermatheca.

Type material. *Holotype*, female: [SOLOMON IS.: / NEW GEORGIA GROUP / N. Georgia I., Munda / 1–30 m. VII-15-1959], [Ginger], [J. L. Gressitt / Collector] – BPBM.

Paratype, female: [SOLOMON IS.: / NEW GEORGIA GROUP / N. Georgia I., Munda / 1–30 m. VII-13-1959], [J. L. Gressitt / Collector] – BPBM.

Distribution. Solomon Island: Western Province, New Georgia Island.

Host plant. Genus *Zingiber* Mill. (as ginger; Order: Zingiberales Griseb., family: Zingiberaceae Martinov).

Discussion

The genus, described above, presents a set of unique characters that broadens our knowledge of the morphology

diversity of planthoppers from the family Ricaniidae: the presence of a transverse shaft on the face and its double plane (upper part projected, lower part – below the shaft, retracted) and open cells C_1 and C_5 on the tegmen.

This unique set of characters within the family Ricaniidae allows the definitive description of this new species, based on only two female specimens, in a new genus, even in the absence of any male specimen. Its discovery in the future will be very interesting for completing the description with the male genitalia characteristics.

Knowledge about the host plants in relation with Ricaniidae is far from sufficient. The specimens of *Kazukuru zingiberis* gen. et sp. nov. were collected on ginger, *Zingiber* sp., a plant association not previously recorded for the family. The only other record from the family Zingiberaceae Martinov is *Hedychium gardnerianum* Sheppard ex Ker Gawl. (kahili ginger, wild ginger) for *Scolypopa australis* (Walker), a polyphagous species, recorded in New Zealand (Martin 2017).

The current knowledge about ricaniids egg ultrastructure is very scarce and high-resolution images from a scanning electron microscope (SEM) are only known for *Ricania speculum* (Walker, 1851) (Rossi et al. 2014). The present description is based on the eggs extracted from the dry abdomen, which share obvious similarities with eggs of *R. speculum*. Both eggs have the same shape, without operculum and have developed polygonal cells on the surface. Significant differences occur however in construction of micropylar caps. Unfortunately, these differences may be due to incomplete development of immature eggs. However, differences at the base of the cap (sclerotised in *Kazukuru* gen. nov., porous in *Ricania*) and spongy-like structures are observed in both species. A comparative morphology analysis of these characters would be of great interest in the future.

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