NOTES ON REMARKABLE WASPS AND BEES.
WITH SPECIFIC DESCRIPTIONS.

By Tarlton Rayment, F.R.Z.S.

(Plates xix–xxi and text-figs. 1–2.)

Introduction.

Ten of the twelve bees and the wasp discussed in this paper were collected in New South Wales; two are indigenous to Western Australia and two were taken in Victoria.

The morphological structure of the several species is remarkable. The wasps are specially interesting, because they are rare and anomalous, and very little is known of the biology of this genus. I am indebted to Norman W. Rodd, of Lane Cove, New South Wales, for the specimens, and he has worked out the host relationships. He proposes to publish a paper at an early date.

The *Euryglossa* from Western Australia has been observed by Rica Erickson, Bolgart, to pollinate the orchid *Caladenia filamentosa* sub sp. *tentaculata*, and her notes are appended to the description of the allotype.

The huge scapes of the bees from Patonga Beach, Hawkesbury River, New South Wales, are surely unique in the *Apoidea*.

It is better to treat *Euryglossimorpha* Strand as a genus, for its characters are distinct and easily recognized, the "golf-club" of the male antennae is very conspicuous, and the strigil of the anterior leg of the female approaches the form of *Megachile*, and is far removed from the spined malus of *Euryglossa*. The details of the life history were supplied by Phillip Whiteley, of Orange, N.S.W., and is the first published account of the biology of these strange bees.

The black *Exoneura* was taken from a communal chamber with a number of eggs, by Owen Dawson, Cranbourne, Victoria. The species appears to follow the typical biological pattern for the genus. (See Rayment, July, 1946.)

The research was assisted by a small grant from the Trustees of the Commonwealth Scientific and Industrial Endowment Fund, and the author desires to express his appreciation of the courtesy received and the support accorded by the Chairman, Sir David Rivett, to his researches in the Australian Hymenoptera.

1. THE ANOMALOUS TRIGONALIDAE.

Excluding Schultz's monograph there is little information on these rare wasps in the literature of the *Hymenoptera*. Only two species have been described from Australia: *Mimelogonalos bouvieri* Sch. from Tasmania, and *Taeniogonalos maculatus* (Sm.) from Moreton Bay, Queensland, while *T. heterodoxus*, a new species from Lane Cove, New South Wales, is described below. Tillyard mentions an undescribed species from Stradbroke Is., Queensland, but the author has not been able to study this specimen.

The family is widely distributed, but nowhere plentiful, although specimens have been recorded from South, Central and North America, Africa, Burma, Europe and Australia. England has only one species.

Schultz (1907) monographed the family, with good diagrams in colour of the known species, and Bugnion (1890), too, published a study of certain genera. Imms (1942) lists a total of 17 genera with about 40 species. The South American genus *Nomadina* looks very like yellow-spotted parasitic bees.

The sole British species, *Trigonalys*, is said to be parasitic in the cells of *Polistes lanio* (Cambridge Natural History), and there is some evidence that these anomalous wasps are parasitic on the Aculeate *Hymenoptera*.

Imms (1942) quotes Clausen (1931), who says the eggs are laid on leaves and subsequently are swallowed by the larvae of saw-flies and various Lepidoptera. The larvae are spinose, and to complete their life cycle successfully must come into contact with Ichneumonid or Tachinid larvae. Trigonalids have been bred from the cells of Vespoidea, but this host relationship is said to be doubtful. In the face of this uncertainty in Europe Mr. Rodd's observations in Australia on the biology have a special interest and value.

These wasps are of particular interest in all comparative studies of the Order, because they appear to link the superfamilies *Ichneumonoidea* with the *Sphecoidea*, for they have the very long filiform antennae of many segments, the small compound eyes, and the divided trochanters of the Ichneumonids, although the general facies is that of a *Cerceris* wasp, with the sting issuing from the tip of the abdomen; the colours, too, black, red and yellow, are very similar to those of the *Philanthidae*, and the integument is coarsely rugoso-punctate. The quadrate head has the long vertex so characteristic of Crabronid wasps and the Megachiles, and bestows the "bull-head" aspect seen in combination with well-developed genae. The mandibles are elbowed and triangular and large, like those of leaf-cutting ants and bees, and there are several well-defined teeth, but the clypeus is excessively short, with a tendency to become porrect and emarginate, as in *Megachile*. The three small ocelli are close together, high on the vertex, the frons being occupied largely by two prominences which form the bases of the short-stalked ovoid scapes, similar stalks being seen in mutated forms of *Apis*.

There appear to be 25 segments in the slender flagellum, the five apical ones being the slenderest and terminating in a point. The labrum could not be examined, and there is a small malar space. The compound eyes are small, with the anterior margins parallel, but the genae are large.

The mouth parts are not fully exposed in the type specimen of the new species, and no satisfactory study could be made of these important organs, but it would appear that the labial palpi have four stout segments and the maxillary palpi six very slender ones. The apical segment of the labial palpus is spatulate and the whole organ is very hairy.

The thorax is larger than the abdomen, with the prothoracic collar produced laterally into "ears" which reach the tegulae and at the same time cover the tubercles. The parapsidal sutures are prominent, extending back to the scutellum as deep channels, as though indicating three separate plates. The scutellum is large, with a deep sulcus laterally, and the postscutellum has a median suture and a deep excavation laterally, as though to accommodate the base of the posterior wing. The metathoracic area is large and coarsely rugose, but flattened, not at all convex. The tegulae are small, but the tubercles are large. The pleurae have a finer sculpture and are well developed, with more hair.

The ovoid abdomen is small, with the first segment constricted off to form a short waist. The general aspect suggests a relationship to the *Mutillidae*, for there is a similar red colour and hairiness towards the apical segments, which are curved down and forward in a peculiar manner. The significance of this is evident when the gaster is studied, for sternite 2 is produced to a strong lamina (a spine in lateral view) directed apicad, and almost vis-a-vis a pointed structure on segment 6. Since segments 3, 4 and 5 are excessively constricted, a kind of arched structure is formed. Authorities give only five apparent segments for the abdomen.

There can be little doubt that the tubercles on sternite 2 of the bees *Parasphecodes arciferus* Ckll. and *P. fulviventris* Friese are the vestigial remnants of a structure of this type, and the ventral plates on the unique bee, *Meroglossa miranda* Raym., are homologous developments of the sternal structures. The apical structure suggests the elements of the apical plates of such bees as *Paracolletes* and *Anthophora.*

The legs are long and slender, with little hair; the short coxae are large, the anterior pair with a small process showing some relation to the spines of certain leaf-cutter bees. The short trochanters are not clearly divided; the femora having the best development; the tibiae are small. The hind calcariae lack strong teeth, being finely serrated, and carrying considerable hair, but they are remarkable since one is short and the other long, exactly as in the extraordinary bees *Goniocolletes.* The strigil of the anterior leg is short and thick, the malus having two teeth, and the velum narrowly concave, a form very suggestive of that of *Megachile* and *Exoneura.* The single calcar of the median pair is similar to the large hind one.

The basi-tarsi are long and slender, segments 2, 3 and 4 are short and cup-like in form, 5 being the broadest, with a very large pulvillus and bidentate claws. Each tarsal segment is produced to a small hyaline tooth apically.

The wings are large, with the pterostigma long and prominent, the anterior wings with a large dusky cloud along the costal margin; the posterior wings have twelve symmetrical but weak hamuli. The nervures are strongly developed. The pterostigma appears to be in a transitional stage, from a separate cell, for it is bounded by a distinct nervure.

There is a well-defined costal cell, and the large radial cell is not at all like the long sinuate radial of the saw-flies; the first cubital cell is large, but the three cubitals are very uneven in size; 1 is extremely long and wide, 2 very small and narrow, 3 is about the same length, but twice as high. The radial cell, where it meets the third cubital, is quite straight, as in the bees *Euryglossa* and *Meroglossa.*

The basal nervure is arched and fails to reach the nervulus, and the cubitus and the subdiscoideus nervures reach the margin of the wing.

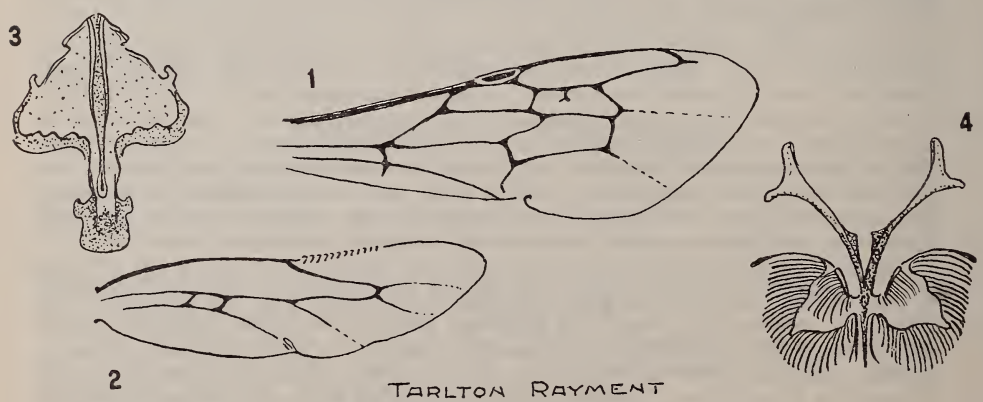

Fig. 1.—A male mutation of *Trichocolletes venustus* Smith. 1: Anterior wing, showing the short second intercubitus nervure. 2: Posterior wing, showing the small submediellan cell. 3 and 4: Seventh and eighth sternites of the male genitalia.

It would appear from the author's studies of the neuration of the Hymenopterous wing, that the second intercubitus often disappears, leaving only two cubital cells, the second and third being united, but referred to by taxonomists for convenience as the second cubital cell where only two are present, as in *Megachile*.

This opinion is based on a study of the wings of mutated forms in several genera, and splendid examples are provided by the wings of several male *Trichocolletes venustus* Sm. These bees were collected by the author on an excursion with the Field Naturalists' Club of Bendigo, Victoria, in September, 1947.

All the intercubiti in *Taeniogonalos heterodoxus*, sp. nov., have a line of weakness doubtless homologous with that in the remarkable Australian bee *Mellitidia manskii* Raym. and the European species *Andrena flessae* Pz.

TAENIOGONALOS HETERODOXUS, sp. nov. (Plate xix).

Type, female. Length, 12 mm. approx. Black, red and yellow.

Head quadrate, varicoloured. The whole insect coarsely and densely rugosopunctate; facemarks yellow, shaped like large lunettes laterally, filling the space between the scapes and the compound eyes; frons black and shining; two yellow prominences around bases of scapes; clypeus excessively short, black, emarginate anteriorly, with a large yellow area laterally; supraclypeal area black; vertex broadly rounded, dull-red suffused irregularly with black; compound eyes small, claret-brown, anterior margins parallel; genae strongly developed, a large yellow mark; labrum not visible in the specimen before me; mandibulae yellow, subtriangular, black basally and apically, with some reddish suffusion, four prominent black teeth, strongly elbowed; antennae uniformly filiform, light ferruginous, 25 segments in the flagellum, and the almost ovate scapes on short stalks. The five apical segments of the flagellum are black and terminate in a point.

Prothorax black, suffused with reddish, with a leaf-like process laterally which reaches the tegulae and yellow tubercles; mesothorax black, with two bands laterally suffused with red, each with a yellow dot, the parapsidal furrows deeply incised, almost separating into plates; scutellum red, with a median black patch; postscutellum black, more or less suffused with red, and a yellow dot laterally, and a median sulcus; metathorax black, large, wrinkled, more or less suffused with reddish, but not convex; abdominal dorsal segments reddish, the margins more or less suffused with blackish, 1 with a yellow band, some yellowish hair apically; 2 with a lateral yellow band, others with yellow dots laterally; ventral segments blackish, shining, 2 developed to a lamellate spine, but the description requires an illustration to be intelligible.

Legs slender, ferruginous, the coxae black, the divided trochanters yellowish; tarsi ferruginous, slender, each segment with a hyaline nodule apically; claws strong, bifid, with a large pulvillus; hind calcar reddish, finely serrated, one long and one less than half the length; tegulae reddish; wings strongly suffused with blackish along the costal half; nervures strong, blackish-brown; cells: the wide costal cell is a prominent feature, and so is the small second cubital; pterostigma appears to be in a transitional stage from a cell; hamuli twelve, weakly developed.

Locality: Lane Cove, New South Wales; 22nd April, 1946; Norman W. Rodd.

Type in the collection of the author.

Allies: The new species has a superficial likeness to *T. lugubris* Westwood (1868), from the Amazon River, South America, and approaches it in the neuration and suffusion of the wings; the disposition of the yellow maculae and the structure of the sternal segments, but the American species is easily separated by the absence of the reddish colour.

T. maculatus (Smith,* 1851), 4½ lines, is easily distinguished by the yellow clypeus and apical segments of the abdomen, the absence of any red colour, and the 19 segments of the antennae. It was described from Moreton Bay, New South Wales (now Queensland).

EXPLANATION OF PLATE XIX.

1. Front of head-capsule of wasp, *Taeniogonalos heterodoxus* Rayment. Note the anomalous many-segmented flagellum.
2. Lateral view of abdomen to show sternal processes.
3. Posterior view of apical segments of abdomen.
4. Ventral view of sternal process.
5. Leaf-like development of prothoracic collar.
6. Each of the tarsi has a stout peg.
7. Fifth tarsus, with claws and large pulvillus.
8. There is one short and one long calcar in the hind pair.
9. The yellow trochanters are divided.
10. The strigil of the anterior leg approaches the form of *Megachile,* the leaf-cutting bee, and the mandibles have a similar likeness.
11. Anterior wing showing the suffused area and small second cubital cell.
12. Posterior wing; note the large costal cells.
13. The six segments of the maxillary palpus are slender and hairy.
14. The four spatulate segments of the labial palpus are stout and hairy.
15. The entire tegument of the wasp is coarsely rugoso-punctate.

2. NOTES ON THE BIOLOGY OF *EURYGLOSSIMORPHA NIGRA* (SMITH).

Euryglossa nigra Smith, New Sp., Hym. B.M., 1879, p. 13.

The ancient town of Orange, in France, was fortunate enough to have as a citizen the famous naturalist Jean Henri Fabre. Orange, in New South Wales, has a special interest for Australian naturalists, for it supplies the first account of the life history of a bee. Situated on the Western Slopes, it has a warm, sunny climate and a picturesque landscape dominated by an extinct volcano, Mount Canobolas, some 4,610 feet above sea level, and situated about eleven miles from the town itself. The soil of Canobolas is of the rich, dark-brown colour usually associated with decomposed volcanic ash, but the flora is a limited one. The only Euclaypt present is Mountain Silver Top (*E. sieberiana*), with scattered patches of Woolly Tea-tree (*Leptospermum lanigerum*). A few Capeweed flowers appear in spring, together with a rare Austral Blue-bell (*Wahlenbergia gracillis*?); there is very little grass.

A correspondent, Phillip Whiteley, visiting the mountain, observed a number of black bees of medium size darting among the grass-stalks, and ever and anon the smaller males gave some attention to the more industrious females. He captured several specimens of each sex and posted them to the author for critical examination.

The males are easily identified by the long, slender, amber-coloured antenna, with its contrasting black apex expanded until it resembles a miniature golf-club. The females, however, lack the peculiar "club" of the antenna, but the cleaner or strigil of the front leg is smooth, as in Plate xx, fig. 5. Both sexes have shining heads, and the equally glistening thorax is closely beset with large punctures, the abdomen having a peculiar silky sheen, dull in comparison with the other portions of the body.

* The Australian species, *T. maculatus,* was included by Smith in the genus *Trigonalys,* but Schultz (1907) proposed *Taeniogonalos,* and separated certain species, including *maculatus.*

For many years the author had concluded that these honey-gatherers were confined to high altitudes, but more recently he collected specimens near Sydney, in New South Wales, and at Croydon, in Victoria. A fellow-member of the Field Naturalists' Club of Victoria, J. E. Dixon, presented the author with several specimens which he had taken at Frankston, on the shores of Port Phillip Bay. None of these localities is flat, but the bees are more often found at higher elevations. Keith McKeown, of the Australian Museum, Sydney, sent another species, which he had obtained at Mount Victoria, in the Blue Mountains.

Whiteley gives the following account of his ascent of Canobolas. "We arrived on the top about 10 a.m. on the 19th of January, 1936, lit a fire and boiled a billy of water. After a drink of hot tea we searched about and found many hundreds of holes all over the top. There were heavy clouds about, and the wind was cool, although the sun was shining."

"Towards noon it grew warmer, and from then on, until we left at 2.30, the bees were very numerous. There were many scores of them; the females gathering cream pollen and amber honey from the Eucalypt, a twig of which I am forwarding to you for identification."

On the author pointing out to him that the nesting habits of *Euryglossimorpha* were unknown and the discovery of the nidus would be a genuine contribution to the science of entomology, Phillip Whiteley again climbed to the summit of Canobolas.

"On our next visit, on the 2nd February, we dug some of the nests out, but could not do so accurately owing to the stones in the ground. The holes go down at an angle and then turn back abruptly, so that the shaft is < shaped, with a cell at the bottom, which is only four inches down vertically from the surface."

"We got two or three cells out of what we thought was one nest, but found that one cannot tell which entrance-hole belongs to each, they are so close together. We did not see, on the second trip, any bees mating, though there were plenty on our previous visit."

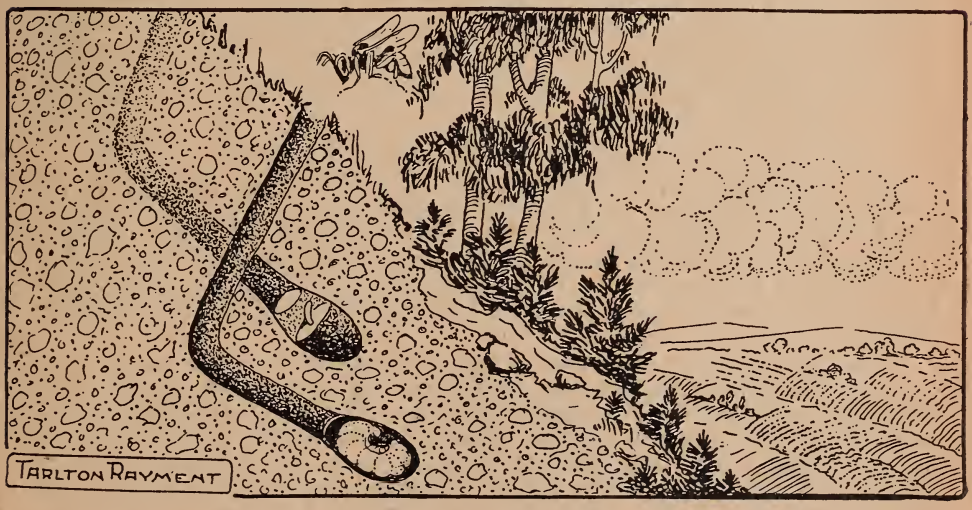

Fig. 2.—Graphic section of "nests" of *Euryglossimorpha nigra* (Smith) on Mount Canobolas, New South Wales.

Considering the size and strength of the bee, and the small amount of labour involved in the excavation of so short a shaft, it seems that the mother could easily construct without difficulty several chambers, and she probably does, since she is a-wing for five or so weeks. That there is more than one cell to each shaft is probable, but this point is not quite clear.

It is of interest to find the shafts so close together that it is difficult to distinguish between them. The shafts of *Euryglossa* (to which these bees are not closely related), though more or less grouped, are always well separated, for bees of the family HYLAEIDAE are regarded as of purely solitary habit.

In the material which reached the author's hands he found that 50 percent. of the bees were stylopized—the heaviest infestation yet recorded. Since the abdominal plates of the bee were deformed to permit the parasite to protrude between the body-rings, it is evident that the *Stylops* had in several instances emerged from such places, leaving the empty cavity to indicate the place of exit. The departed parasites may have been mature winged males, though the exact period at which such leave the host does not seem to be definitely known. Several authors assert that the male *Stylops* emerges from the larval bee, and only females remain in the adult host. The conformation of the body-plates proves that a mature *Stylops* had emerged, and it could not have been a female, since she is more or less attached to the interior of the host. She has no wings, of course.

Although only one species (a male, *Austrostylops gracilipes* Lea) of these remarkable parasites is known to the science, the author has the females of four other distinct species, one of which is in a Eumenid wasp which he captured at Sandringham, near shafts of *Halictus eboracensis* Ckll. However, in the absence of the respective males, systematic descriptive work is impossible, and the matter cannot be advanced beyond the existing unsatisfactory stage. The male *Stylops* is small and extremely rare.

The earthen cells of *Euryglossimorpha* are oval and measure 10 mm. at the long axis and 5 mm. at the short; the loose earth of the interior is bound in position by an open network of highly iridescent threads of some colloidal substance, and on these a comparatively thick, white skin lining has been laid down from the remarkably broad tongue. The skin cradle-gown does not adhere to the cell wall and may be removed intact. Mounted in glycerine and examined with a lens of high power, the colloidal skin shows no structure. It is much thicker and stronger than that of *Euryglossa*, and is similar to the tougher one of *Paracolletes*. Its size is, of course, that of the earthen chamber.

The stored cells are about half-full of a yellowish batter composed of the angular pollen-granules and amber-coloured honey from the gum-trees named; the later cells contained greenish honey and pollen from the "Woolly Tea-tree".

The white egg, slightly bowed, is deposited on the surface of the store of food, to which it is fastened at the caudal end by a clear secretion of the glands of the mother bee. The egg measured 1·60 mm. in length and was typical of all bees.

The feeding period could not be precisely ascertained from the material available, but larvae removed from the nest on the 2nd of February were all fully fed, the mesenteron being distended with the contained pollen mass. Since the mothers were collecting puddings during the first week in January, it would appear that about fourteen days are passed in consuming the store, the eggs taking from three to five days to hatch. The pupae lack the numerous nodes that are so prominent on *Halictus*, and more nearly resemble the babies of *Paracolletes*. The development of the larvae in the author's artificial cells extended over 210 days, so there is probably only one brood of males and females each season.

During the microscopical examination of the cells and the larvae, a number of white acarid mites, less than 1 mm. in length, were observed crawling about. These play an important part in maintaining a hygienic condition within the nest, since they live on any biological debris. This species is quite distinct from those studied in the nests of *Halictus emeraldensis* Raym., but there is no doubt whatever that the functions of both are alike.

A large, graceful, red Cryptine wasp was observed searching the apertures of the shafts, but it has already been shown that a close connexion exists between wild-bees and wasps of the genus *Labium*, for the activities of these parasitic wasps have been discussed at length in the author's monograph.

The nests are ravaged by a small, bristly, parasitic fly in the genus *Miltogramma*. It is marked on the abdomen with tan-coloured spots. The species was not determined, but a drawing is given at Plate xx, fig. 16.

Euryglossimorpha ruficauda, sp. nov.

Type, female. Length, 10 mm. approx. Black, with a faint greenish lustre on abdomen.

Head transverse, shining; face markedly convex; facial foveae conspicuous; frons with coarse large punctures and minute ones well separated; clypeus convex, polished, with well-separated large punctures; supraclypeal area similar, with a median suture that encircles the median ocellus; vertex broadly developed, with coarse and minute punctures; compound eyes with anterior margins parallel; genae with coarse and minute punctures, a few white hairs; labrum black, the glossa is exceedingly broad and deeply emarginate; mandibulae black, obscurely red apically; antennae black, obscurely brown beneath.

Prothorax with a few white hairs; tubercles black, with a heavy fringe of white hair; mesothorax polished, with well-separated coarse punctures and many minute ones; scutellum similar; postscutellum dull, with smaller punctures; metathorax shining, smooth, with an area delicately tessellate; abdominal dorsal segments with a faint greenish lustre, hind margins narrowly pale, 5 and 6 red, with ferruginous hair; ventral segments similar.

Legs black, with white hair rather sparse; tarsi piceous, with slightly yellowish hair, basitarsus very long; claws reddish-black; hind calcar reddish-black, with one large and several smaller teeth; tegulae black; wings dusky; nervures blackish and heavy; the second cubital very long, receiving the first recurrent nervure at its basal corner; pterostigma large and black; hamuli ten, strong.

Locality, Patonga, New South Wales; 16th January, 1947; Norman W. Rodd. Type in the collection of the author.

Allies: *E. nigra* (Sm.), but easily separated by the red apical segments of the abdomen. It is better to treat *Euryglossimorpha* as a genus, for there are several excellent characters which separate it from *Euryglossa*. The strigil is very different, for the form is close to that of *Megachile*, the malus having no spines. (See Plate xx, fig. 5.)

These females were working on the flowers of a "smooth-barked" Eucalypt?

EXPLANATION OF PLATE XX.

1. Genitalia of *Euryglossimorpha nigra* (Sm.).

2. The titillatum of the genitalia is very remarkable and, under higher magnification, utterly unlike that of *E. antennata* Raym.

3. Labial palpi and the extraordinarily wide glossa of the female.

4. The labrum is subtriangular.

5 and 5*a*. Strigil of female and male. In this genus the malus of the former is without teeth.

6. The mandible has a subobsolete tooth.
7-8. Sculpture of mesothorax and abdomen.
9. The hind calcar of the female.
10. Maxilla and palpus; note the huge comb and other unusual characters responsible for the name of the genus.
11. The tergites are deformed to accommodate a *Stylops*, which is of a different species from that found on *Paracolletes providellus bacchalis* Ckll.
12. Sixth tergite with its naked red plate.
13. Hamuli or hooklets of the posterior wing.
14. Ovate fifth tarsus with tiny claws and empodium.
15. Neuration of the anterior wing.
16. A bristly parasitic fly belonging to the genus *Miltogramma* (SARCOPHAGIDAE).
17. The arista of the fly is conspicuously plumose.

KEY TO THE SPECIES.

The several species of *Euryglossimorpha* may be separated by the following key:

Whole insect shining 1
1. Apex of abdomen red ..... *E. ruficauda* Raym.
Legs black 2
2. Apex of abdomen black ..... *E. nigra* (Sm.)
Mesothorax densely punctured 3
3. Long white hair on face ..... *E. cincticornis* (Ckll.)
Whole insect dull 4
4. Sternites ferruginous, margins of tergites pallid ..... *E. abnormis* Raym.
Metathorax densely rugoso-punctate 5
5. Margins of tergites broadly paler ..... *E. proxima* Raym.
Very small insect, tarsi amber 6
6. Mesothorax rugoso-punctate ..... *E. antennata* Raym.
Flagellum greatly elongated, apical segment somewhat flattened 7
7. Clypeus densely punctured ..... *Euryglossa tenuicornis* Ckll.

The relationships of the unique bee *E. tenuicornis* are obscure, but it should be removed from *Euryglossa* and form the type of new genus, but it is better to defer naming this until the female is known. Professor Cockerell remarked that the filiform flagellum with its expanded apical segment approached the form of *Thaumatosoma*, which, however, is in the Megachilidae.

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3. A BEE AND AN ORCHID.

(Plate xxi.)

Bolgart, 80 miles north of Perth, is pushing its wheat-fields farther and farther over the gentle slopes, and the Salmon-gums (*Eucalyptus salmonophloia*) and the Wandoo (*E. redunca*) give way to the plough. Lower down are the odoriferous "Jam" (*Acacia acuminata*) and the York-gum (*Eucalyptus loxophleba*). Other plants are Sheokes (*Casuarina fraseriana* and *C. distyla*); the sedge-like Conostylis; a blue Goodenia (*G. caerulea*); delicate, scented pink Everlastings (*Helichrysum Lawrencella roseum*); the stiff Blue Stars (*Calectasia cyanea*), the white flowers of the Swamp Rainbow (*Drosera heterophylla*), and Rock-ferns. There are orchids, too—numbers of them: "Women's Caps" (*Thelymitra antennifera*), "Donkey Ears" (*Diuris longifolia*), and "Spiders" (*Caladenia hirta, C. deformis, C. filamentosa* and its subspecies *tentaculata*).

A correspondent in Western Australia, Rica Erickson, sends the following details of the visits of a tiny black bee to the orchid *Caladenia tentaculata*.

"The labellum is critically balanced on a 'claw', so that the size and weight of the insect is of prime importance. The bee alights and its weight pulls the labellum forward, leaving the flower open, but as the bee walks in and down it transfers its weight to a lower position, with the result that the labellum

is then pulled shut. It remains closed, so long as the weight of the insect is applied low on the inside of the base. As the insect struggles up, and backwards, to throw the labellum 'off balance', its thorax comes into contact with the pollinia, the viscid disc of which adheres to the mesothorax. Blowflies do go in, but are trapped to death, because their greater weight keeps the labellum so tightly closed as to prevent any escape."

The bees were determined by the author as *Euryglossa rejecta* Ckll., and one of the males had several pollinia glued to the mesothoracic disc. As these bees are not typical of the genus, some notes are appended, together with the specific description of the allotype female. The males were observed to rest in the white flowers of the Swamp Sundew, and many elliptical golden pollen grains were present on both males and females.

The males from Bolgart are not quite typical and differ from Perth (type locality) specimens by the colour of the ventral segments, the type having yellowish-ferruginous colour on the second and third.

Cockerell (1905, p. 476) said: "I put this aside as not belonging to the genus. I have concluded to leave it there for the present, however, to be separated when more is known about the group."

The large series received from Rica Erickson has permitted the dissection of several specimens, and it is clear that *rejecta* is not a typical *Euryglossa*. The head is large; the palpi of the mouth parts are jet black and articulated in a peculiar manner; the apical segment of the maxillary palpus has a spiral twist, with an indentation, the blade of the maxilla being equally black. The glossa is extremely wide, short and emarginate, but typical of the genus. A number of olfactory pore organs (group 3 of McIndoo) are clearly visible on the median plates of the wing bases.

The apex of the male abdomen has a truncated spoon-like process (seventh plate), but the smooth apical plate of the female is very similar to that of a female *Anthophora*. The abdominal fringes, too, are more like those of *Paracolletes*, to which the bees seem to have some affinity.

The white hind calcar lacks the strong teeth of the genus, for it is very finely serrated, the serrations being longer than is typical. The strigil of the anterior leg is typical of *Euryglossa*, and this microscopic organ is usually a stable index of affinities.

The author can do no better than Professor Cockerell, for he can find no morphological characters to warrant the separation of the species from *Euryglossa*. The finely serrated calcar is found in a few Halictine and Paracolletid species; in both genera the typical form is strongly dentate.

Euryglossa rejecta Ckll.

Euryglossa rejecta Cockerell, Ann. Mag. Nat. Hist., Ser. 7, vol. xvi, 1905, p. 476 (Perth, W.A.).

Allotype, female. Length, 7·5 mm. approx. Black.

Head transverse; face with long loose white plumose hair, a few black hairs laterally; frons rugoso-punctate; clypeus convex, shining, scattered large punctures, a delicate sculpture; supraclypeal area similar to clypeus, but rising to a fine carina that encircles the median ocellus; vertex rugoso-punctate, sharply developed, a few black hairs; compound eyes with anterior margins parallel; genae rugoso-punctate, a few yellowish hairs; labrum small and black; both the maxillary and labial palpi are conspicuously black; mandibulae long, acute, deeply grooved; antennae with scapes roughly sculptured, flagellum rather short.

Prothorax large for such a small bee, very rough; tubercles black, masked with a tuft of white hair; mesothorax shining, finely and closely punctured, with white and black hair; pleura sculptured like the clypeus; scutellum even more

shining, with finer punctures; postscutellum rougher and dull; metathorax with a large enclosed area of scale-like sculpture; abdominal dorsal segments bright, a delicate lineation, with fine punctures, hind margins amber, a few white hairs, a blackish tuft apically, and a small polished plate as in *Anthophora*; ventral segments with prominent fringes of smoky plumose hair.

Legs black, slender, with white hair, some black on median and hind tibiae; tarsi black, hair yellowish, very small; claws bifid, reddish; hind calcar white, with long fine serrations not typical of the genus; tegulae black and polished; wings subhyaline; extremely iridescent; nervures black and strong, radius pointed off the costa, and all markedly sinuate; the second cubital cell large and contracted above; pterostigma large, brown and black-bordered; hamuli five strongly developed.

Locality: Bolgart, Western Australia; September, 1947; Rica Erickson.

Allotype in the collection of the author.

Allies: Not very close to any described species.

Euryglossa ricae, sp. nov.

Type, female. Length 9 mm. approx. Black, yellow markings.

Head circular from the front; face shining; frons with a deep median depression that encloses the median ocellus; clypeus polished, convex, with scattered large punctures and a few white hairs; supraclypeal area similar; vertex sharply developed, with a tessellate sculpture, compound eyes with anterior margins converging only slightly below; genae with long lank hair; labrum blackish; mandibulae yellowish, black apically, with a median red band; antennae black, flagellum with each segment showing a ferruginous band.

Prothorax black; tubercles black, with a heavy fringe of white hair; mesothorax shining, with a scale-like sculpture and a few shallow punctures, a very few pale hairs; scutellum similar; postscutellum duller; metathorax with an area of shining scale-like sculpture; abdominal dorsal segments shining, with a finer scale-like sculpture and a few white hairs, 1 with the yellow basally cut into a curious black design like a fleur-de-lis, with a black mark laterally; 2 with the interrupted yellow band broadened laterally; 3, 4, 5 with a yellow isosceles triangle laterally; ventral segments yellow, each with a couple of black marks.

Legs black, knees of anterior and median pair yellow, anterior tibiae with a yellowish-red line; tarsi on anterior and median legs reddish-amber; claws reddish; hind calcar white, with four or five strong teeth; tegulae piceous; wings hyaline; nervures dilute brown, strong; cells: the second cubital contracted at apex, receives the two recurrents at equal distances; the first markedly sinuate; pterostigma dilute brown; hamuli seven.

Locality: Bolgart, Western Australia; September, 1947; Rica Erickson.

Type and allotype in the collection of the author.

Allies: *E. undulata* Ckll., which has red legs and black mandibles; *E. maculata* Sm. and *E. nitidifrons* Ckll., both of which have the apical segments of abdomen all yellow.

The species is dedicated to the collector in appreciation of her zealous assistance.

Taken on flowers of *Baeckea camphorosmae*.

Euryglossa baeckeae, sp. nov.

Type, male. Length, 5 mm. approx. Green.

Head transverse, greenish-purple lustre; face with a few white hairs; frons rugose; clypeus tessellate, green, a few punctures; supraclypeal area rising to a fine carina that reaches the median ocellus; vertex adapted to the mesothorax,

finely rugose; compound eyes with anterior orbital margins parallel; genae with long white hair; labrum blackish; mandibulae blackish, with an obscured red patch apically; antennae with black scape, but flagellum yellowish-ferruginous beneath; numerous large pore-organs on black parts of flagellum like pale oval scales.

Prothorax with a metallic green lustre; tubercles black, with a fringe of white hair; mesothorax strongly convex, purplish green, a strong tesselation which seems to run in concentric lines; scutellum blackish, with finer sculpture; postscutellum duller, metathorax large, an extensive enclosed area with an excessively coarse scale-like sculpture, a greenish lustre, abdominal dorsal segments clavate, dull, a microscopic lineation, an obscure greenish lustre, 1, 2 and 3 with a pale luteous band apically and basally (some specimens with only a spot on 1); ventral segments yellowish-ferruginous.

Legs with coxae and femora black, knees and tibiae ferruginous, median and hind tibiae infuscated; tarsi yellowish, hind one suffused with blackish; claws yellowish; hind calcar finely serrated, white; tegulae pale amber, somewhat suffused with blackish; wings hyaline; nervures brown, strong; second cubital cell almost as large as the first; pterostigma dark-brown; hamuli about five.

Locality: Fairleigh, Bolgart, Western Australia; September, 1947; Rica Erickson.

Type in the collection of the author.

Allies: Plainly between *E. walkeriana* Ckll., which has ferruginous mandibles and black abdomen, and *E. inconspicua lutea* Raym., which has a polished clypeus, and ferruginous mandibulae, and luteous bands on abdomen.

On flowers of *Baeckea camphorosmae.*

At first I thought the largest of these might be the males of *E. ricae,* but the sculpture of the abdomen is very different.

4. DESCRIPTIONS OF BEES.

Palaeorhiza hierogliphica Raym.

Palaeorhiza hierogliphica Rayment, A Cluster of Bees, 1935, p. 666 (Mt. Tambourine, Q.).

Allotype, female. Length, 8 mm. approx. Black and yellow.

Head oily-bright, long and narrow, face-marks yellow, resembling those of *Euprosopis elegans,* the wide lateral ones ending in a peculiar division with a large median lobe; frons narrow, elevated, with a median suture that encircles the median ocellus; coarsely punctured; clypeus aciculate, with a wide yellow band, amber anteriorly; supraclypeal area yellow, rising to a high dome; vertex rugoso-punctate, black, in sharp contrast to the yellow of the postoccipital region; compound eyes converging below in a marked manner; genae black, with the occipital yellow continued down as a wide band; labrum and mandibulae black; antennae black above, ferruginous beneath.

Prothorax with a wide yellow collar, a large yellow patch adjacent to the tubercles, tubercles butter-yellow, large with fringe of white hair; mesothorax black, a wide yellow band above the tegulae like an epaulette; shining, with even puncturing on a fine tessellate sculpture; scutellum black, sculptured similarly, with a large yellow triangular mark laterally; postscutellum with a finer sculpture; metathorax large, black, oily-bright, a delicate tessellate sculpture; some white plumose hair laterally; abdominal dorsal segments black, with a silky lustre, a few punctures, and short erect white hairs, hind margins depressed; ventral segments similar.

Legs black, more or less suffused with amber; claws reddish; hind calcar pale amber; tegulae piceus; wings dusky; nervures dark sepia; cells: the large

quadrate second cubital receiving both recurrents, the second recurrent at its apical third; pterostigma large and blackish; hamuli few and weak.

Locality: Narooma, New South Wales; 30th August, 1947; Norman W. Rodd.

Type in the collection of the author.

The collector thought it was a black species of *Euprosopis*. Although the localities are far apart (the male was described from Mt. Tambourine, Q.) I believe the sexes as associated by the collector are correct. This record adds the species to the fauna of the State.

The females were visiting *Prostanthera* sp. and also the "Wild Raspberry", *Rubus* sp.; the males were taken on the latter plant, and females were taken on the 14th December, 1946.

Sphaerhylaeus bicoloratus, sp. nov.

Type, male. Length, 6 mm. approx. Black and yellow.

Head almost circular from the front; face entirely lemon-yellow, the lateral marks reaching almost to the vertex as long finger-like extensions; frons completely masked by the huge bicoloured spherical scapes; clypeus evenly punctured, but not closely, a few white hairs; supraclypeal area yellow, with a high-domed pattern; vertex black, rugoso-punctate; there are two deep black depressions to accommodate the extraordinary scapes; compound eyes with anterior orbital margins almost parallel; genae lineolate with some puncturing and white hair; labrum yellow (the labial and maxillary palpi of these bees are black); mandibulae black, with a subapical reddish mark and a yellow dot; flagellum black above, ferruginous beneath, the enormously dilated scapes ruggedly punctured, and divided obliquely, one half being black, the other half yellow, the black forming a V from the front.

Prothorax with an interrupted yellow line; tubercles yellow; mesothorax shining, evenly punctured with far more numerous microscopic punctures which could be overlooked; scutellum similar, punctures not so close; postscutellum rugoso-punctate; metathorax covered with dense coarse anastomosing rugae, perhaps vermiform; abdominal dorsal segments black, bright, closely punctured on a minute rugose sculpture, laterally there are a few white hairs on the margins; ventral segments black, shining, with scattered coarse punctures.

Legs black, femora and tibiae somewhat dilated, a little obscure red and a touch of yellow on the anterior tibiae; tarsi black; claws and pulvillus blackish-red; hind calcar blackish, finely serrated; tegulae piceous; wings dusky; nervures blackish-brown, the two recurrents at equal distances inside the intercubiti; the second cubital contracted at its apex; pterostigma blackish-brown; hamuli six or so very weak.

Locality: Narrow Neck, Blue Mountains, New South Wales; 15th December, 1944; Norman W. Rodd.

Type in the collection of the author.

Allies: These very remarkable bees are not close to any others and are easily recognized by the excessively large bicoloured scapes. These records add the genus to the fauna of the State. The genotype, *S. globuliferus* Ckll., was described from Western Australia.

These males were visiting the large red flower-heads of the "Waratah", *Telopea*.

Sphaerhylaeus gibbonsi (Ckll.).

Hylaeus gibbonsi Cockerell, Records of the Australian Museum, vol. xviii, 1929, p. 223 (Sydney, N.S.W.).

Allotype, male. Length, 8 mm. approx. Black and yellow.

Head subcordate from the front; face-marks butter-yellow, wide lateral ones reaching to the scapes, and the orbital margins level with the clypeus; frons hidden by the enormous globose scapes; clypeus yellow, aciculate, a black mark laterally, a narrow carina that reaches to the apex of the long yellow supraclypeal area; vertex with contiguous punctures of even size; compound eyes markedly converging below, and the anterior margins with a line of deep pits, from each of which emerges a stiff peg-hair; genae rugoso-punctate, with a few pale hairs; labrum black, small; mandibulae black, acute, deeply furrowed; flagellum black above, ferruginous beneath, segments 1 and 2 and the scapes black, the latter excessively dilated, with a pear-shaped yellow mark laterally, a few long pale hairs.

Prothorax large, butter-yellow; tubercles large, butter-yellow, with a fringe of white hair; mesothorax entirely black, oily-bright, closely and evenly punctured on a minutely tessellate sculpture; pleura with large punctures; scutellum similar and slightly bi-gibbous; postscutellum with close punctures; metathorax with an area like a Moorish arch, the very fine rugae merging into the coarse tessellate sculpture, some few black and white hairs laterally; abdominal dorsal segments black, dull sheen, microscopically lineate, with scattered punctures of medium size; ventral segments more coarsely punctured, the apical segments invaginated in a peculiar manner that is difficult to describe in words.

Legs black, with all the femora dilated, and tibiae slightly so, some white hair, the anterior legs are obscurely red anteriorly; tarsi black; claws and pulvillus black; hind calcar black, finely serrated; tegulae black, dull, finely punctured; wings dusky; nervures blackish-brown, strong; cells: the long second cubital receiving both recurrent nervures; pterostigma blackish; hamuli about seven very weak.

Locality: Male, Cowan, New South Wales; 7th April, 1947; Norman W. Rodd. Allotype in the collection of the author.

Allies: A most remarkable bee, not close to any others. Differs from the genotype, *S. globuliferus* Ckll. by the structure of the abdomen; from *S. procurvus* Raym. by the head and eyes; from *S. bicoloratus* Raym. by the scapes. We must regard *Sphaerhylaeus* as a genus, although published as a subgenus of *Gnathoprosopis* by Cockerell.

The males were visiting *Pultenaea* sp., but females also were taken within a short distance, at Cowan, New South Wales, on 30th August, 1947.

The sexes as associated by the collector are no doubt correct, and the female conforms perfectly to Professor T. D. A. Cockerell's adequate description, except that the tegulae on the Cowan females are jet black—dark-brown on the type.

The females show a little difference in structure from the typical Hylaeid form; for the face is very long, with the peculiar sculpture of *Meroglossa*, and the broad mandibles are sub-dentate, so that they are almost spoonlike; the hind calcar is finely serrated, and the strigil of the anterior leg is not typical of *Hylaeus*, but approaches that of *Gnathoprosopis*, as do the mandibles. It is regretted that no specimens were available for dissection and microscopical study of the anatomy.

Paracolletes viridicinctus Ckll.

Paracolletes viridicinctus Cockerell, Ann. Mag. Nat. Hist., (7), xvi, 1905, p. 482 (Tasmania).

Allotype, male. Length, 7 mm. approx. Black, slightly metallic abdomen.

Head transverse, shining; face with long loose hair; frons rugoso-punctate; clypeus convex, shining, long loose pale hair, a few black ones laterally, numerous shallow punctures on a wrinkled sculpture; supraclypeal area shining, a few

punctures, rising to a fine carina that encircles the median ocellus; vertex with black hair; compound eyes converging below; genae wrinkled, with long loose white hair; labrum black; mandibulae black, reddish apically; antennae black, flagellum obscurely brownish beneath.

Prothorax black; pleura with much long white hair; tubercles black, mesothorax shining, with sparse punctures on a scale-like sculpture, a few black hairs; scutellum similar, with a median depressed line; postscutellum rougher; metathorax with an enclosed area of coarse scale-like sculpture; a large amount of white hair laterally; abdominal dorsal segments shining, with the slight metallic sheen somewhat brassy, hind margins depressed, a microscopic tessellation; ventral segments polished.

Legs black, with white hair; tarsi obscurely reddish-black; claws reddish; hind calcar pale; tegulae blackish, polished; wings subhyaline; nervures brownish, strong; second cubital contracted at apex, receiving first recurrent at about its middle; pterostigma blackish; hamuli about seven.

Locality: Black Rock, Victoria; 26th September, 1947; T. Rayment.

Allotype in the collection of the author.

Allies: *P. providus* Sm. The females have the brassy lustre over the whole abdomen—only on margins in type from Tasmania—and a scale-like sculpture. Females laden with yellowish pollen from *Casuarina distyla*. The introduced honey-bee has learned to gather the entire gravid anthers of this plant (Rayment in MS.).

Halictus patongensis, sp. nov.

Type, male. Length, 8 mm. approx. Black and red.

Head transverse, black, with loose white plumose hair, shining; frons densely and coarsely punctured; clypeus shining, anterior half amber colour, with a pointed median extension; supraclypeal area closely punctured; vertex closely rugoso-punctate, with the three rather large ocelli prominently elevated; compound eyes converging below; anterior margins sinuate, almost emarginate; genae with long white hair; labrum and mandibulae amber; antennae very long, black above, ferruginous beneath, the segments of the flagellum obliquely crenulate, scapes black.

Prothorax with a narrow band of white mossy hair; tubercles amber, suffused with black, a heavy fringe of white hair; mesothorax shining, finely rugoso-punctate, a few pale stiff hairs on the disc, a little mossy white hair near the scutella suture; scutellum bigibbous, elevations shining, almost impunctate, otherwise it is distinctly and closely punctured; postscutellum rugose, with long white loose hairs; metathorax very long, shining bright, with a few large coarse rugae on the coarse tessellate integument, some long loose white hair laterally; pleura shining, coarsely rugose; abdominal dorsal segments long-clavate, black, with a silky lustre, 2 and 3 with a wide basal band of amber, a few scattered white hairs; ventral segments similar, with more long white hair.

Legs slender, amber, with large areas black, white hairs; tarsi amber, basitarsus slender and very long; claws reddish; hind calcar amber; tegulae amber; wings hyaline; nervures dark amber, first recurrent entering the second cubital at its distal corner; cells: the second cubital almost square, a trifle higher than long; pterostigma darker amber, and conspicuous; hamuli weak, six or seven.

Locality: Patonga, New South Wales; 26th Jan., 1947; Norman W. Rodd.

Type in the collection of the author.

Allies: Plainly in the *bicingulatus* group, and exceedingly near to the larger (10 mm.) *H. ziegleri* Raym., which it closely resembles.

These two bees resemble wasps in the genus *Trypoxylon*, for they have a slender, clavate abdomen.

The males were taken on flowers of *Leptospermum* sp.

Exoneura rufitarsis, sp. nov.

Type, female. Length, 6·5 mm. approx. Black, shining.

Head circular from the front; frons excavated round the bases of the antennae; clypeus flat, with a narrow sub-obsolete ivory line, a few lank white hairs; supraclypeal area rising to a fine carina that does not reach the median ocellus; vertex microscopically lineate; compound eyes converging below; genae microscopically lineate; labrum amber-coloured, coarsely punctured; mandibulae black; antennae black, scapes with a reddish dot basally, flagellum obscurely reddish beneath.

Prothorax not visible from above; tubercles ivory; mesothorax almost polished, with a delicate tessellation, a few white hairs; scutellum similar, postscutellum rougher; metathorax with a coarse scale-like sculpture in a more or less concentric pattern; abdominal dorsal segments black, hind margins depressed, a microscopic lineation, a few pale-straw coloured hairs; ventral segments polished, with a few pale hairs.

Legs black, a few white hairs; tarsi red; claws red; hind calcar reddish; tegulae piceous; wings dusky; nervures blackish-brown; cells: second cubital very wide, but contracted at apex; pterostigma blackish-brown; hamuli weak.

Locality: Cranbourne, Victoria; September, 1947; Owen Dawson.

Type in the collection of the author.

Allies: *E. atterrima* Ckll., which has entirely black face; *E. melaena* Ckll., also with a black face; and *E. nitida* Ckll., which has tergites narrowly reddened, and a broad clypeal band.

This female was taken in a dry stalk of "Wild Parsnip", in the pith of which she had excavated a three-inch chamber 3 mm. in diameter, and which contained three eggs attached horizontally to the lumen of the tube at intervals of about 5 mm. There was no trace of cell divisions, nor was there any pollen stored. The biology thus far follows the typical pattern.

Exoneura parvula perparvula, subsp. nov.

A large series of very small females from New South Wales are very close to *Exoneura parvula* Raym., but are distinct. They can be readily separated by the absence of the black bands on the abdomen, which is of a darker red colour, with a black macula laterally on tergite 2. The legs have more black, and there is very little red, even in the hair.

The head is larger than that of *E. parvula*, with a greater development of the genae. The antennae are short and stout, and there are no pale marks on the face, scutella or tubercles. These characters are very constant in the series.

It is extremely difficult to separate many of the adults in *Exoneura*, but the larvae show quite distinct characters, and until the communal nest is discovered and the larval appendages studied critically, I propose the subspecies *E. parvula perparvula* for these Bundeena females, which were taken at the same time and place as the species.

Locality: Bundeena, National Park, New South Wales; October, 1947; Alex. Holmes.

Type in the collection of the author.

Taken on flowers of *Eucalyptus* sp.

EXPLANATION OF PLATE XXI.

1. Front of head-capsule of male bee *Sphaerhylaeus bicoloratus*, sp. nov. Note the huge globose bicoloured scapes.
2. Front of head-capsule of bee *Sphaerhyaelus gibbonsi* (Ckll.).
3. Front of head-capsule of bee *Palaeorhiza hierogliphica* Raym.
4. Aciculate sculpture of clypeus.
5. The large convex "face" of *Euryglossimorpha ruficauda*, sp. nov., has the plates fused.
6. Punctate sculpture of mesothoracic disc.
7. Dorsal view of the short wide glossa.
8. Apical segments of flagellum of *E. nigra* Smith.
9. Dentate hind calcar of female *E. ruficauda*.
10. Bee, *Euryglossa rejecta* Ckll. opening the labellum of orchid *Caladenia filamentosa* subsp. *tentaculata*.
11. The genitalia of the male is not typical of the genus.
12. Group of olfactory ? pores at base of posterior wing.
13. Seventh tergite of the male.
14. Strigil of male.
15. Sensory hairs on anterior orbital margin of *Sphaerhylaeus gibbonsi* (Ckll.).
16. Microscopical sculpture of scapes of *Sphaerhylaeus bicoloratus*.

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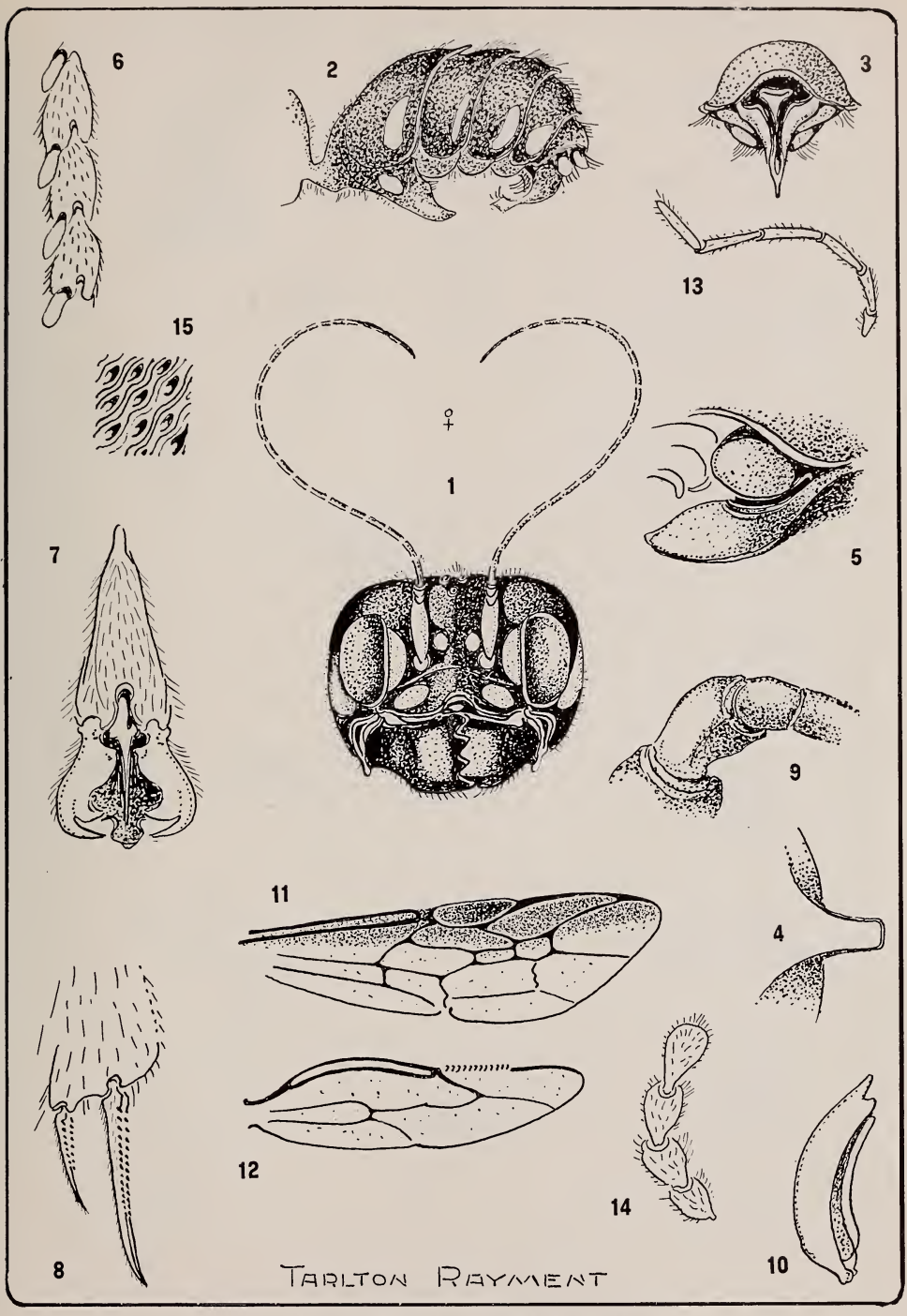
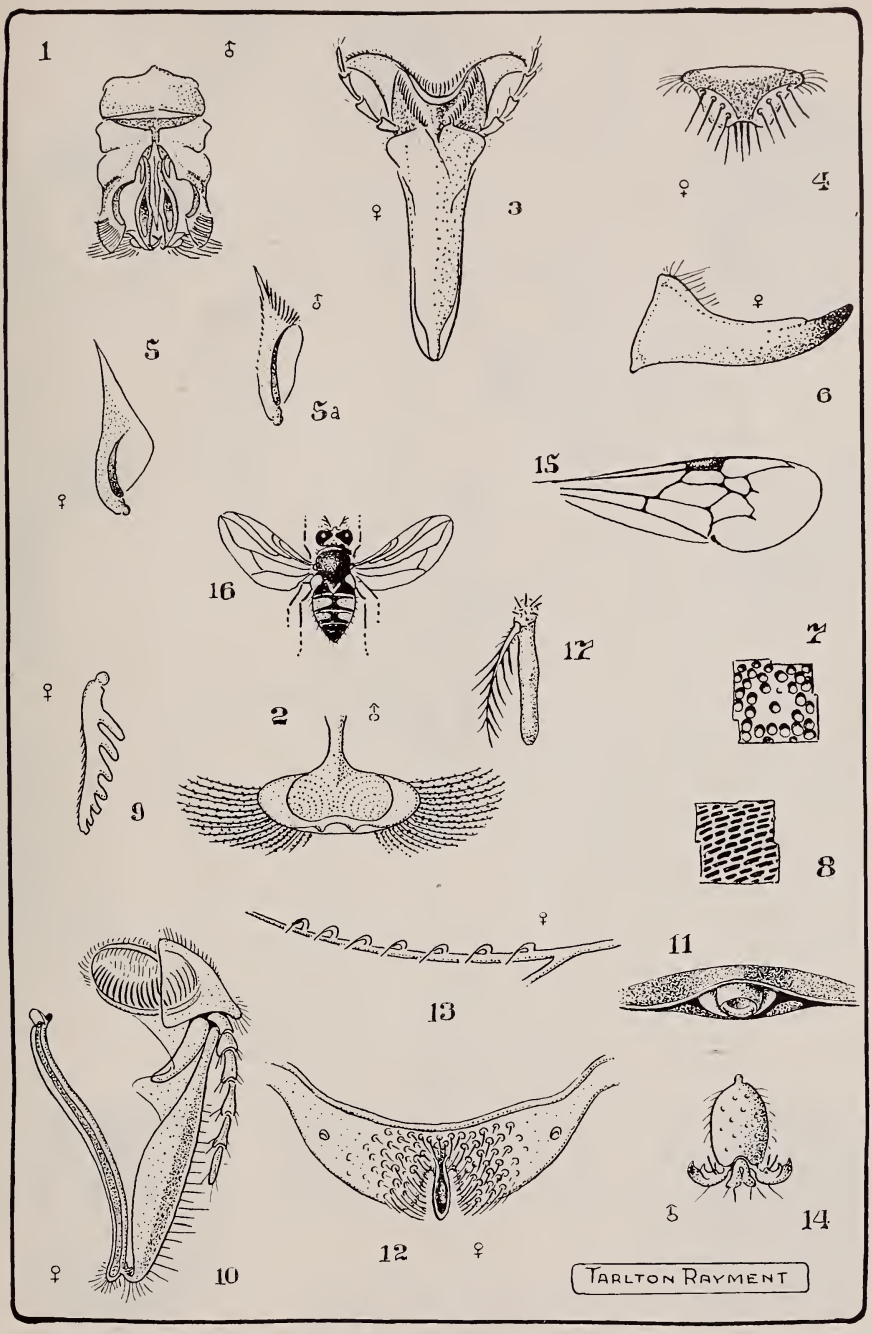
POSTSCRIPT ON THE TRIGONALID PROBOSCIS, BY TARLTON RAYMENT, 12 JANUARY, 1948.

After the specific description had been set up by the printer, the author received from Norman Rodd a mounted preparation of the palpi of a female, and he was able to study these parts of the proboscis more critically. The basal segment of the maxillary palpus is excessively short, two and three quite as stout but much longer, four, five and six conspicuously slender.

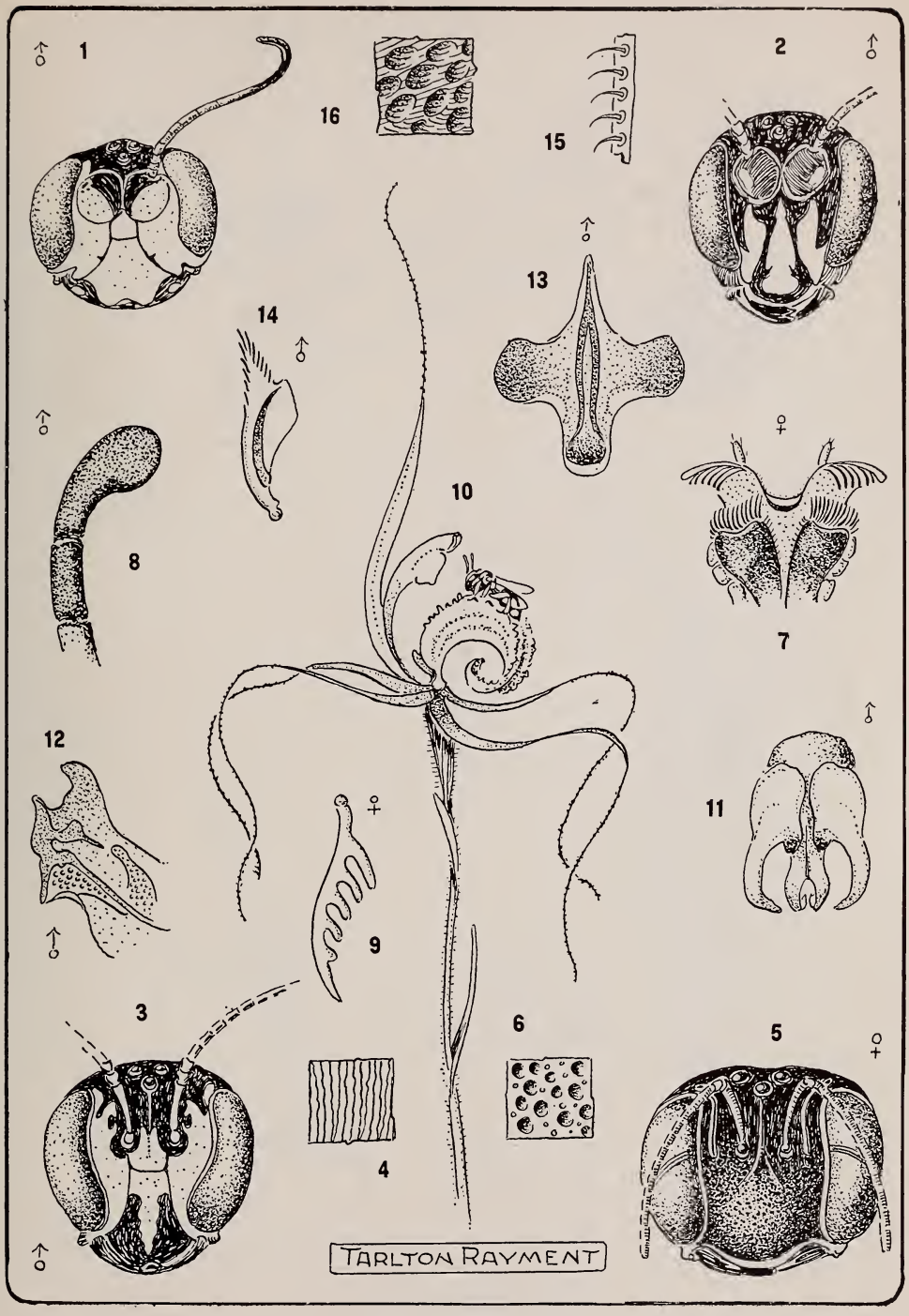
The following measurements, in microns, are approximate: 1st seg., 185; 2nd, 400; 3rd, 425; 4th, 500; 5th, 425; 6th, 500. The labial palpus has only three conspicuous segments, but there appears to be an excessively short basal palpiger. The author is unable to work out the homologues from this mount of the mouth-parts, but the stipes appear to be short and stout, the galea exceedingly short; the pharyngeal rod spread at a wide angle; the pharyngeal plate short and strong.



Taeniogonalos heterodoxus Rayment.



Euryglossimorpha nigra (Smith).



A Bee and an Orchid.