## THE PLUQMED BEES.

## By Tarltón Rayment.

Fred Smuth, working on the hymenoptera in the British Muscum, described many Australian bees which that institution had received from collectors in the antipodes. Among the remarkable insects from the new country were a few black bees, having bright golden bands on the abdominal segments. That was in 1879 , when Smith included them in his genus Paracolletes, and gave them the specific name of marginatus.

Previously, in 1862, Smith had published, in Transactions of the Eintomological Society, London, the description of somewhat similar females, under the title of Lamprocollctes venustus. These: too, were black, banded with gold; but he did not mention a very unusual character of the eyes. The large compound structures have a number of long, sensory hairs projecting from between the convex facets, a feature which is found in only one other genus, Apis meilifcra, the honey-bee of the hives. The elements of these hairs are, however, found in Pachyrpoosopis haematostoma, small, glossy, purple-black bees, whose large eyes, when viewed through the microscone, exbibit a number of short, stout, peg-like fairs among the cornules.

Smith's genis, Lamprocolletes, has now been merged in his more comprehensive one, Paracollctes, but I regret the supersedure, as the chayacters for this genus, and also those for his L cioproctus, are sufficient justification for the retention of his generic names. However, that is a matter to be referred to elsewhere. Professor Cockerell, my mentor in the mazes of taxonomy, in the Armals and Magazine of Natural History, 1913, reviewed these black and gold females, and, noting the hairy eyes, created the genus Trichocolletes. He had already written to Meade-Waldo, at the Museum in London, requesting him to study the compound orbits of Smith's Lamprocolletes venustus, and that entomologist had assured Him that they, too, had the distinctive hairs, so the bees became Trichocolletes venustus, That was the last overseaz record of these large and beautiful Australian natives.

Soon after the Great War hrad ended. I decided to pay some attention to these plumed honey-gatherers, which were collected at Brisbane and Birkdale, in Queensland, seven hundred or more miles from my home on Port Phillip. I have long refused to be daunted by distance, and the record from the far noth did not deter me from endeavouring to find the bees close at hand. I waited until the spring month of October, and set out, for the hundredth time, to find some plumed bees. Fabre, you will remember, told naturahists to keop looking in the right place and
they would surely find, a dictum to which I whole-hesrtedly subscribe.

Where, one might ask, is the best locality? Well, 1 had searched, year after year, the blossorns of the Coast Iea-tree, the Beard-heath, the "Boobialla," the Coast-hop, the Mcsembryanthemum, and dozens of other plants comprasing the "Dandringham Flora," and there were no plumed bees on all that sea of bloom. Of course, 1 was not looking in the right place. In the dense growth I had passed over a few odd plants some three feet or more in theight, and beaving numerous small, yellow-and-red pea-shaped flowers. The leaves are attenuated, sharp and hard, and these are responsible for the common name "Gorse-leaf Bitterpea " Daviesia ulicina of the botanist.

Certainly I should not have neglected such richly nectariferous bloom, for had I nol much experience with this genus, having harvested from it many tons of exguisitc, pale, delicatelyflavoured honey, perhaps the most attractive in the world. Never shall I forget the apiarist who had in his store-house 12 tons of honey, all sealed in thousands of snow-white combs, each holding one pound avoirdupois. The fragrance of that hatvest permeated the atmosphere. I say 1 should not have passed over the Davicsia, though where that magnificent harvest was gathered there were "miles of bloom," whereas, on Port Phitlip, I have to search many acres to find one plant.

Convinced that I was looking along the wrong avenue, I at last turned my attention to the rare Biter-pea. After days of watching I observed a honey-gadherer hover for a minute or two over the blooms, and then disappear with remarkably rapid fight. It looked very like the familiar honey-bee, but its high treble note made me curious and eager to capture one. This I did with difficulty, after swooping through the air with my met many, many times in vain.

Howcycr, I have the bee in my bottle, and am able to study her with my lens. Even with that low power I am able to discern her hairy eyes, and the long, plumed pale hairs of her body. She conforms very nicely to Smith's description in everything except size; she is larger. measuring some 13 millimetres in length. She has brigh red legs, the dense, yellow, hairy covering of the face. and the black abdomen with its golden bands. Smith's dried and contracted mummy could not be measured accurately, and his estimate of length might easily be astray. I am stressing her size because I have to use it as a specific distinetion.

Of course, I was happy to add these fine bees to the fauna of Victoria, and, after alt, such pleasures, small though they be, are very genuine, since they are based on a satisfactory reward
for one's labours. But human nature is a complex problem, for 1 no sooner establish one fact than 1 am again obsessed with a desire to uncover another. What of the males? Neither Smith nor Cockerell say anything about them.

Two years went by before I tasted again the sweets of accomphishment. It was Ootober. 1 knew now that the nght place was the blossoms of the Bitter-pea, so I sut down and waited. It was a glorious pastime, albeit a litile trying or one's patience. However, at Black Rock, for that is where 1 found the bees, I inhaled the sait air of the sea and telt happy. Presently, when the air was quieter, I heard above my head a shrill note far too tuighly pitched for any honey-bee, and quite different in intensity from the treble note of the blue-banded bees of the Anthophoridae.

Peering into the atmosphere I observed darting specks of light and recalled the Belgian poot's words, "shoots like an arrow to the zenith of the blue." Just so, the males passed like arrows. and my net was almost of no avail. Of all bees, this species has the swiftest flight, and is most difficult to capture, even though one be experienced with the net of the collector. But I dd catch a epecimen, and since no one else has done so, I append to this essay a description of the allotype. For the moment I am satisfied to point ont that the male of $T$ : venustus is smaller than the female, for it measures only 11.5 mm in length. The face, I say, is covered with dense yellow hair. The range of habitat is extended from Birkdale, in Queensland, to Black Rock, on Port Phillip. Permit me to leave it at that for the time being.

I prefer to go once or twice a year into the mountains, where the broken contours provide a relief from the long, level horizon of the sea. Moreover, the toH Eucalypts are in strong contrast to the low tea-tree of the cosslline, and the ligbtex air is enjoyable for a chatge. I appreciate the mineral waiers of the springs about Daylesford, and the flora of that high country affords me an opportunity for further work. On the stony northern slopes, where the native granite is broken into small particles by alternate frost and heat, there is a gritty soil that feeds a number of small shrubby plants and a forest of many-branched trees. Behold, among the former are the Bitter-peas, not the few, scattered gorsc-leaf kind, but large areas of a narrow-leaf species, Daviesia corymbosa, which has flowers of similar size and calour,

I walked through acres and acres of Daviesia, listening for the shrill note of the yellow-banded becs. Well, I did hear it, but I could not get near enough to catch a bee. I secured from the blossoms three industriovs females, which, intent on the harvestang of the delicate nectar and the rich orange-coloured pollen. did not escape me - 1 was spurred to greater effort, but the weather
turned cold, my patience san out, the bees disappeared. I left the hills with regret, vowing that next October I would remain until I did secure the objects of my quest.

Alas! In the following year influenza robbed me of my strength, and pneumonia and toxaemia followed. When October opened I lay in the haspital with death lurking on the threshold. My doctor brought me back to the land of bees and sunlight, but a whole year went by before I was again strong enough to climb a mountain and drink the icy water of the springs.

In October, 1929, the entomologists of Melbourne planned an expedition to the hills of Macedon. I alone found three miserable bushes of Daviesia afler some miles of walking. I had no nel, so sure was I that the Bitter-pea was absent. Well. right under my nose I perceived a darting bee wilh a high-pitched note. [ called imperativly for Clarence Borch, and he came running rapidly. "Strike!" And in his net there was the long-soughtfor male. Not another was found. I had now both sexes to compare with my other specimens, and decided they were a new species, the chief distinction being the absence of golden hair from the faces, and the sexes being equal in stature, since both measure 12.3 millimetres in length.

The Paracolleles marginatus, which Smith described in his work. Nem Species of Hymenoptera in the Brilish Muscum, has no hair emanating from the eyes, and Dr. Cockerell thought these bees an example of mutation. According to the theory of De Vries, this phenomenon may arise suddenly: One of the daughters of a hairy-eyed Trichocolletes mother hatches out minus the adornments, and her inability to grow the eye-hairs is transmitted to some of her daughters. The structural change was not spread over acons of timc, but occurred suddenly, and the work of Mendel shows that the loss is a permanent one.

It may have been the other way about; the progeny of a naked-eyed Paracolletes may have conlained an individual with hairs between the facets, and this accession has been transmited to all its progeny. Could we have had the brood undet critical obserpation, the number of naked-eyed and bairy-eyed specimens might have been in Mendelian proportions. It seems to me the short, peg-like hairs of Packyprosopis may some day be absent from a soecimen; or, on the contrary, I may yet find one of this genus exhibiting the long sensory type.

When Cockerell made his observation $P$. marginatus had been recorded only from the southern portion of Australia, namcly, Cheltenham. Victoria, and Bridport, Tammania, while his hairy-eyed specimens wese described from Queensland. My rerords prove that both bees are to be found on the shores of Port Phillip; but.

whereas the Trichocolletes is a-wing only during the last of September and the whole of October, and is confined to visiting the Bitter-pea, the Paracolletes emerges later. during the heat of summer. and harvests from utterly different plants.

Both species are splendidly equipped for digging, and excavate shafts several feet in depth; both lay down from a broad tongue a liguid that hardens into a delicate silvery cell-lining of skin, and place in the cradle a sphere of pollen and honey just frm enough to maintain its shape. The sole brood contains males and females. and the larvae rest in the earth for ten months. A rapid development takes place during the last forinight, and the males precede the females by two or three days.


1. Front of head-capsule of Trichocolletes venustur Smith,
2. Genitalia of $T$. venustus; the plumosa hairs are a remarkable feature.
3. Front of hend-capsule of $T$. nigroclyfealus Rhvment. Nole the hair is tufus on the elypeus.

The nests of $T$. venustus that I have observed continued down until a firm subsoil was reached, and the tumuli at the entrance were so solid that they maintained their volcano-like forms for the whole of the month. The Paracollctes mound is more friable, easily blown down, and is levelled within an hour or so. The males of some Paracolletes make a shrill, thin note when ranging aver the flowers, but the note of Trichocolleies is much more intense.

Smith described another genus of golden-banded bees, the Anthoglossa sericee, and they, too, have a strong resemblance fo the honey-gatherers I have already surveyed, but are closer in facial appearance to my Trichocolletes nigroclypeatus, for both have whitish hair at the margins of the face. The life-history of AnthogJossac is unknown to me, but the large strong comb of the tibial spurs is unsurpassed for digging, and the bees of both these genera must be the greatest of all insect tunnellers. I have followed the shafts of $T$. venustus down for over five feet, and can testify to the efficiency of the pick. The only Anthorlossae I have were
collected on the Grampian hills, and in the National Park, Queensland.

The homes of the banded-bees are never so close together as are the shafts of Paracolletes, which often have only six inches on so separating them, whereas those of Trichocolletes are many yards apart. An interesting feature is the changes in the colour of the hair of the various broods. In 1928 all the niales from the only colony I know had deep, orange-coloured face-hair, but in 1929 all the males from the same colony had white hair at the orbital margins. I know that temperature has a great influence on the pigment of developing bees, and I have reared a brood of young queeri bees, the progeny of a tan-coloufed mother, Apis ligustica, that varied from golden-yellow to black; under normal circumstances and an equable temperature, the colour of her children was dark tan:

The spring of 1928 was abnormally dry and hot, August being noted for the orevalence of northerly winds; the vernal monthis of 1929 were decidedly cool, with frequent light showers: The colour of the boney-bee becomes darker with low registers', but the males of $T$. venustus were pajer when the sptring was a cold one. I would atsa remind you that the bills of Daylesfofd and Macedon enjoy a cool climate with much tain, and the Trichocolletes of 角e regions are distinctly paler in the face hairs.

## KEY TO ILLUSTRATIONS (Page 159).

(1) Adult female Trichbeolleles nigoclypeatus Raymenti.
(2) Antenna-cleather of strigil! Note the prodicied velum.
(3) Portion of compound eye showing senstry hairs.
(4) The remarkable tibial spurs.
(5) A view of irside the teeth of the efjur.
(6) Glossa or tongue with loig paraglassae and palpi.
(7) Maxillary palpus.
(8) Mandibie or jaw.
(9) Labrum of lip.
(10) Tarsel joints añd tlaws.
(II) Antenna-cleaner of Paracolletes pluniñstias Sinith.
(12) Tibial spurs of $P$ f tubertulathé Cockerelli.
(13) Genitalia of $P$. facialis.
(14) Hind tibial spup of male $T$, veilsueitus Smith.
(15) Anténina-cleaner of miste T. vehstistust.

In a letter to Mr. C. French, Jun., Mri H. W. Ault, of Lakes Entrance, writes:- "On November 21 discovered ari Etriperor. Moth in my cage. which häd éfierged from a cocoon placed there al some time beiween April and July. 1924. The cocoons were pulled from a peppere-fee, and givetit to toe by Mrs. Perkins,"

## TRICHOCOLLETES NIGROCLYPEATUS. Sp. nov:

Female.-Length 12.3 m.m., approx.
Head black; bright, wider than thorax: face marks nil, a tuft of whitish hair at each-side; Frons with a minute shagreen, and with large evenly distributed punctures; Clypeus prominently convex, polished, with sparse coarse puncturing, the posterior edge with a few scattered long light hairs, the anterior with golden hair, shagreen well defined; Vertex developed to a sharp edge, with a fringe of long golden hair; 'compound eyes claret-brown, margin's parallel, with long straw-coloured hastg between the facets; Genae with long white plumose hair; Labrum amber-red, subtriangular: Mandibulae dark red with black tips, with a strong imer tooth; Antennae black, apical ends of Hagella obscurely fulvous.

Prothorax not visible from above, tubercules obscured by a ruft of golden hair. Mesothorax black, bright, with a minute shagreen and with even, but not dense puncturing, a few golden plumose hairs surroundings the disc. -Scutellum slightly bigibbous, sirinilar in colour; sculpture and hair. Postscutellum similar to scutellum. Metathorax 'very short,' but similar to mesothorax in colour and sculpture.
1.. Abdomen with dorsal segments black, dull, thind margin of first obscurely lighter, the others golden yellow friaged with pale hair, the segments having an excessively fine transverse striation;'ventral surface similar to dorsal, but with numerous coarse punctures. Legs reddish-amber, coxae and a large patch on femora black, with long pale plumose hair; Farsi redder, the hair reddish-golden; claws dark red; find Calcariae red, exceedingly wide, with seven large, strong teeth and three small ones; the Strigil has five strong. long teeth, and the velum is produced almast to a pyramid; Tegulae yellowish-amber, dark basally and anteriorly.

Wings subblyaline, ridescent, anterior $7.5 \mathrm{~m} . \mathrm{m}$; Nervures sopia, first recurrent entering the sccond cubital cell at apical third of its length. the second recurrent entering the third cubital cell near apical end, basally slightly curved and falling short of Nervulus; cells radial, long and narrow. second and third cubital greatly contracted al top; Pterostipma inconspicuous, sepia colour; Hamuli thirteen in number, of moderate dçelopment.

Localily. Daylesford, Victoria, 12/10/27.
Allies: Close to $T$. venustus, Smith, which is lareen has brighter bands, and more hair of an ochreous tint; Paracolleles morginatus. Smith, which has no hair on the eves: Anthoglossa aureotincta. Cockerell, which has black legs and which is larger.

Biological. data: I find these females fremuent only the plant Davissia corymbosa from which they barvest sollen of a dull orange colont; and nectar of a deliciously delicate flavour. No mating takes place in the flowers.


Rayment, Tarlton. 1929. "The plumed bees." The Victorian Naturalist 46, 155-162.

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