

Descriptions of Hymenoptera from Baltic Amber.

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I am greatly indebted to Dr. A. TORNQVIST for the opportunity of studying the very interesting specimens described below. Among the amber insects in the collection at Königsberg, out of more than 100000 specimens, only those here described (9 species, represented by 20 individuals) are bees. This extreme rarity of Apoidea is compensated for by the interesting character of the species, representing as they do undescribed genera, throwing much light on the evolution of the higher bees of today. The wasps and the proctotrypid sent with the bees, although undescribed, and carrying their respective genera far back into the past, do not represent new genera. The social wasp (*Palaeovespa*) belongs to a genus already known from the American Miocene, and very close to modern *Vespa*. The others are strictly of modern genera. The indications are that we must go to the Eocene or even to the Cretaceous, to find the beginnings of most of the modern genera of wasps; but the higher bees seem to have evolved more recently, and in the amber materials we have genuine „stem-forms“ of the Apidae, Bombidae and Megachilidae. None of the amber bees seen by me are related to the lower bees of today, such as *Colletes*, *Prosopis* or *Halictus*; it is very likely that these genera were already fully evolved during the Oligocene. The occurrence of bees in amber is not a new discovery, although the present paper contains the first detailed descriptions of bees from Baltic amber. My colleague Dr. HELLEMS points out to me that as early as about 89 A. D. MARTIAL wrote the following verse which is singularly appropriate at the present moment:

De Ape Electro Inclusa.

Et latet, et lucet Phaëtonide condita gutta,
Ut videatur apis nectare clausa suo;
Dignum tantorum pretium tulit illa laborum,
Credibile est ipsam sic voluisse mori.

Schriften d. Physik.-ökonom. Gesellschaft. Jahrgang L.

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Proctotrypidae.

Hadronotus FÖRSTER

A genus with numerous living species, parasitic on Hemipterous eggs.

Hadronotus electrinus sp. nov.

Length about 1836 μ ; black anterior and middle legs bright deep ferruginous, hind legs apparently black; antennae red, with the last six joints, forming a thickened club, dark fuscous; eyes perfectly bare. The appearance of the antennae agrees very well with those of *Hadronotus rugosus* HOWARD.

Head broad (breadth 595 μ); vertex with very strong but sparse punctures; lateral ocelli 51 μ distant from eye; antennae 12-jointed, thick, the club 68 μ in diameter; second antennal joint 85 μ long, the third to sixth successively shorter, the sixth and seventh much broader than long (seventh 60 μ broad and 34 long); penultimate joint 60 μ long; last joint pointed, 68 μ long. The antennae arise very low down on face.

Mesothorax and scutellum moderately shining, sculptured alike, with a network of fine lines breaking the surface up into minute triangular areas, which average about 17 μ in diameter; no punctures or grooves, except that the posterior margin of scutellum, postscutellum and base of metathorax have each a transverse row of punctures; there is a similar row of punctures, each about 17 μ diameter, and contiguous to one another, 34 μ from base of second abdominal segment. First abdominal segment very broad, its basal part with elongate foveae or grooves, its apical margin smooth; second segment with a strong reticulate sculpture, except the hind margin, which is smooth; remaining segments smooth or nearly, the second with feeble reticulate markings on disc. Ovipositor short but visible. Second abdominal segment larger than third.

Wings clear, with ferruginous venation; stigmal vein about 85 μ long; postmarginal evident, apparently longer than stigmal, but gradually evanescent apically; marginal punctiform; submarginal diverging considerably from costa; margin of wings strongly fringed, the fringe 34 μ long; base of stigmal vein 612 μ from base of wing, and 510 from level of apex, not counting fringe.

Legs normal, all the tarsi 5-jointed; spur on middle tibia short, little over half length of basitarsus; spur of anterior tibia strongly curved; length of middle tibia 323 μ .

Prussian Amber.

By the sculpture of the abdomen, and other characters, this species is closely related to *H. leptocorisae* HOWARD.

Crabronidae.

Crabro succinalis sp. nov.

♀. Black, 5 mm long; knees, tibiae and tarsi, scape and base of flagellum ferruginous; abdomen narrowed basally, but sessile; antennae 12-jointed; mandibles not visible in type, but in another example shown to be bidentate, the inner tooth subapical, obtuse and very small; ocelli in a triangle.

Wings hyaline, nervures and stigma dark fusco-ferruginous; stigma large, about 136 μ deep; marginal cell 1105 μ long, and about 204 μ broad at apex, receiving the transverso-cubital nervure 408 μ (on marginal nervure) from base; submarginal cell 1173 μ long, receiving the recurrent nervure 561 μ from base and 476 from apex, measuring along cubital nervure; first discoidal cell 884 μ long; basal nervure falling about 68 μ short of transversomedial; second discoidal cell about 700 μ long.

Prussian Amber. The collection contains eight specimens, agreeing in the venation, and apparently all of one species. The insect is a perfectly ordinary and normal member of the *Tracheliodes* or *Brachymerus* group of *Crabro*, of which I have previously described a fossil species (*Crabro mortuellus*, Bull. Mus. Comp. Zool., 1906) from the Miocene of Colorado. I have compared every visible part with modern species, and find nothing to indicate even subgeneric difference. The hind tibiae, with their spines and spurs, are quite ordinary, as also is the shape of the head, with the antennae placed close together, etc. Comparing the venation with KOHL's figure of *C. megerlei* DAHLB., only the following slight differences appear:

- 1.) The lower apical corner of marginal cell is rounded, and the apex of marginal cell is at right angles to costa.
- 2.) The basal nervure is a little nearer to transversomedial.

Crabro tornquisti sp. nov.

In addition to the eight examples of *C. succinalis*, there is one specimen of a closely allied but much larger species, about 10 mm long. It has the same coloration as *C. succinalis*, but the venation is not quite the same; the basal nervure meets the transversomedial, and the recurrent nervure joins the submarginal cell well beyond the middle.

The wings are distinctly dusky. The antennae are so close together that the scapes, when directed upwards, are contiguous. Tibiae with the usual short spines.

Prussian Amber. Respectfully dedicated to Dr. A. TORNQVIST.

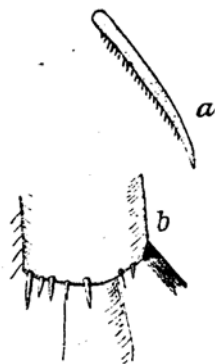


Fig. 1.
Crabro tornquisti CKLL.
a Spur of mesotibia.
b Apex of left metatibia,
showing spines.

Larridae.

Pison oligocaenum sp. nov.

♀. Black or very dark brown, dull, not strongly sculptured; length 8 mm or a little less; head broad (breadth about 2 mm), cheeks rounded, prominent; length of anterior wings about 4 mm, nervures dark; metathorax (seen in profile) rounded; antennae twelvejointed, length of third joint 246μ , of last joint 255 ; width of flagellum 170μ .



Fig. 2.
Pison oligocaenum CKLL.
Second submarginal cell.

Stigma very slender, little developed; marginal

cell long, narrow, sharply pointed, ending on costa, its length 1139μ ; three submarginal cells, the first much longer than the other two combined, its length 1020μ ; second submarginal petiolate above, a subequilateral triangle about 272μ across; third submarginal, measured obliquely, 493μ long, but only 170 on marginal; first recurrent nervure meeting first transversocubital, second joining third submarginal cell 51μ from its base; basal nervure falling about 100μ short of transversomedial; transversomedial 238μ long, a little oblique, the lower end about 50μ more basal than the upper; upper section of basal nervure about 153μ long, lower 595 , not allowing for the slight curve.

Femora rather stout; depth of hind femora 476μ ; hind tibiae broad (340μ) at apex. Middle tibiae with spur 561μ long, perfectly straight, microscopically pectinulate. Middle tibiae at apex above with three short ferruginous teeth, about 50μ long; fourth joint of middle tarsi very short, only about 136μ long; longer spur of hind tibiae 748μ long, the apical two-thirds pectinulate like the spur of middle tibia, but the basal part with a brush of long bristles on inner side.

Prussian Amber, one specimen. Mr. S. A. ROHWER has now in press the description of a species of *Pison* from the Miocene of Colorado.

Vespidae.

Palaeovespa COCKERELL.

This genus was based on three species from the Miocene of Florissant, Colorado.

Palaeovespa baltica sp. nov.

♀. Length about 16 mm, or perhaps a little less; head and thorax 6 mm; anterior wing about 11 mm; abdomen broad at base, and with the apical part of the segments ferruginous; venter ferruginous, darkened apically; sting visible; legs dark ferruginous or fuscoferruginous; wings dark rufofuliginous, first submarginal cell longer than the other two together; third submarginal much broader than second above, the two sides of the second concave, as in *Vespa occidentalis*. The structure of the legs seems entirely as in modern *Vespa*, with very long hind basitarsus, bearing short hair on its inner side; middle tibiae with two apical spurs; claws simple, with a strong basal bristle, exactly as in *Vespa*.

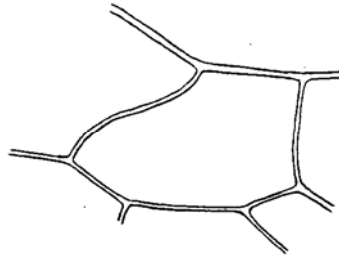


Fig. 3. *Palaeovespa baltica* CKLL.
Second submarginal cell.

Head with long fuscous hair, as in modern *Vespa*; eyes normal for *Vespa*, apparently; the markings of head, thorax etc., cannot be seen;

Antennae normal for *Vespa*; flagellum black, thick, not curled at end; third antennal joint long, exactly as in *V. occidentalis*.

Marginal cell pointed, as in *Palaeovespa*, and also the modern *Vespa occidentalis*.

Apex of first discoidal cell oblique, as in *Palaeovespa*; it is not oblique in *V. occidentalis*.

Recurrent nervures joining second submarginal cell far apart (subequally distant from base and apex); in *V. occidentalis* they are far apart, but the second joins the cell near the middle.

Base of second submarginal cell scarcely deflected or bent to first recurrent nervure; in *Vespa* it is strongly bent.

Prussian Amber.

The following comparative measurements are in micromillimeters:

	First recurrent nervure from beginning of second submarginal cell.	First recurrent nervure (on cubital nervure) from second recurrent nervure.	Second recurrent nervure from end of second submarginal cell.
<i>Palaeovespa baltica</i> n. sp.	238	561	306
<i>Vespa occidentalis</i> CRESSON.	204	578	680
<i>Vespa diabolica</i> SAUSS.	187	272	816
	Upper end of basal nervure to stigma.	Upper end of basal nervure to base of marginal cell.	
<i>Palaeovespa baltica</i> n. sp.	425	1088	
<i>Vespa occidentalis</i> CRESSON.	748	1276	

MENGE has indicated, without figure, a *Vespa dasypodia* from Baltic amber

Apoidea.

In all, six species of bees have been described from amber; others have been referred to as pertaining to *Andrena*, *Anthophora* (?), *Chalicodoma*, *Dasypoda* aff., *Melipona* aff., *Osmia* and *Trigona* (?); but specific names have not been given, and I believe the generic references are quite worthless.

One of the amber bees, — the only one properly described, — is *Meliponorytes succini* TOSI, from Sicilian amber, which is of middle miocene age, and therefore very much more recent than the Prussian or Baltic amber. This *Meliponorytes* is very close to the modern *Trigona*, and is very distinct from the bees of Prussian amber.

The four species from Baltic amber, named by MENGE and MOTSCHULSKY, have been published in the most insufficient manner. A fifth, recently (1906) made known by BUTTEL-REEPEN, is somewhat better, but still very imperfectly, known.

Bombusoides mengei MOTSCHULSKY (1856) is merely stated to be a small *Bombus* hardly 1½ line long; it is of course wholly unrecognisable.

Apis proava MENGE is said to be very like the modern honey-bee, but about a third smaller, and with bare eyes. The body is 7 mm long, to the end of the wings 10 mm.

Bombus carbonarius MENGE is a small black species, about 10 mm long. It is said to resemble among living forms the small black one with yellowish-red apex to the abdomen; this being I suppose *B. pratorum*, or perhaps *B. cullumanus*.

Bombus pusillus MENGE is very small, scarcely 3 mm long, and has yellowish-white hair.

Apis meliponoides BUTTEL-REEPEN is principally known by the structure of the hind basitarsus, which is figured. The posterior apical angle, instead of being rounded, is pointed, as in *Bombus*.

Bombus pusillus is not like anything I have seen; it cannot be a *Bombus*. *B. carbonarius* may be identical with one of the smaller species in the collection before me, and the same may be said of *Apis proava*, but it is quite impossible to recognise either from the description. *Apis meliponoides* I have recognised, but it is not a member of the genus *Apis*.

The bees from Prussian amber may be divided into two groups, those with three submarginal cells, and those with two.

Group A. *With three submarginal cells in the anterior wings. Basal nervure meeting transversomedial. Eyes without hair.*

Larger bees, about the size of the honey-bee; hind basitarsus about twice as long as broad; posterior tibiae with a single short spur; second submarginal cell receiving first recurrent nervure a little before the middle.

Electraxis n. g.

Smaller, more compact bees, hind basitarsus short.

Third submarginal cell much produced apically; second submarginal cell receiving first recurrent nervure much before the middle.

Protobombus n. g.

Third submarginal cell ordinary; second submarginal cell receiving first recurrent nervure beyond the middle.

Chalcobombus n. g.

Electraxis gen. nov.

♀ (or worker). General appearance very like that of *Apis*, not like *Bombus*; face convex; mandibles truncate, much as in *Apis*, but the cutting edge with two notches; labrum semicircular; tongue elongate, it and the labial palpi essentially as in *Apis*; spoon on end of tongue small; maxillary palpi very small, thick, apparently 2-jointed; malar space very short; anterior edge of clypeus straight; scape rather long, curved; antennae (as also the head) much as in *Apis*; eyes prominent, not hairy; ocelli large, in a slightly curved line; posterior and middle tibiae each with one sharp broad simple spur, but that of

hind tibia is only about half as long as that on middle one; hind basitarsus broad and flat, as figured by BUTTEL-REEPEN (*Apis meliponoides*); claws deeply bifid; pulvillus large; stigma very small, triangular; marginal cell only moderately long, ending rather bluntly, away from costa; three submarginal cells, subequal in length; second submarginal receiving first recurrent nervure a little before its middle, its lower side with the end of the recurrent nervure forming a broad Y; third submarginal cell receiving second recurrent nervure just before the end, the cell narrowed at least one-half above; all three submarginals about equally broad on marginal; first recurrent nervure with a bend

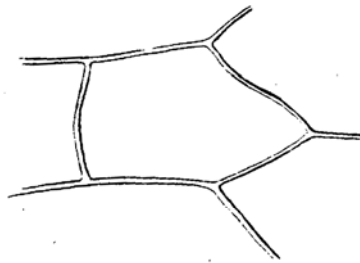


Fig. 4.

Electrapis meliponoides (BUTTEL)
Second submarginal cell.

or angle near end, as in *Bombus*; second recurrent nervure forming with third submarginal cell an angle somewhat greater than a right angle; third discoidal cell with a very strong appendicular nervure nearly reaching the margin; basal nervure meeting transversomedial; lower section of basal nervure at least four times as long as upper; first discoidal cell fully as long as marginal; transversomedial nervure of hind wing transverse, hardly oblique.

♂. Similar to the female (or worker), with eyes far apart, and facial quadrangle about square, but antennae much longer, over 5 mm, the last joint obliquely truncate; upper side of flagellar joints with very numerous oval sensory pits; hind basitarsus broad as in ♀.

Type *Electrapis meliponoides*, described below; *Apis meliponoides* BUTTEL-REEPEN is identical so far as can be ascertained, and is assumed to be the same. This very interesting genus is fairly between *Apis* and *Bombus*. With the general form of *Apis*, it has a venation nearer to that of *Bombus*, hairless eyes, and a single spur on the hind tibia. Whether the females and workers were fully differentiated, it is perhaps impossible to say; but from the occurrence of many specimens crowded together in one small piece of amber, it seems likely that it was a social insect, with habits similar to those of *Apis*. In a rough and general sense, *Electrapis* may be regarded as representing the ancestral stock of *Apis*, and to some extent that of *Bombus*; but it is no doubt actually a side-branch derived from that stock, and not strictly in the line of descent leading to the modern genera. Thus, with the hind tibial spurs already far toward elimination, it could not very well produce *Bombus*; with the eyes already hairless it is perhaps doubtful

whether it could lead direct to *Apis*. The miocene genus *Calypptapis*, though referred to the Anthophoridae, shows much resemblance to *Electrapis*, and may be allied.

Electrapis meliponoides.

♀ (or worker). Black, about 14 mm long, with much erect fuscous hair on head and thorax above; clypeus and labrum with scattered rather large punctures, and many very minute ones between; width of terminal joint of maxillary palpi 51 μ ; third joint of labial palpi 204 μ long, last joint obliquely truncate, 272 μ long; tongue extending about 2125 μ beyond end of second joint of labial palpi; fourth antennal joint very short, much broader than long, third almost as long as fourth and fifth together; last joint of flagellum 595 μ long and 289 broad; penultimate joint 425 long; tibiae and tarsi with coarse dark fuliginous hair; wings fuliginous; stigma piceous; nervures dark brown.

♂. Wings not so dark. The following measurements are in micromillimeters¹): antennal joints, length, (2) 119, (3) 238, (4) 170, (5) 459, (6 to 13), about 510 each. Length of marginal cell, 2380; length of first discoidal cell, 2261; lower side of third submarginal cell, 1020; puper side of third submarginal, 493.

Prussian amber: one male and seven females.

***Protobombus* gen. nov.**

♀. Small (about 10 mm long), with subglobose abdomen; eyes apparently not hairy; mandibles *Apis*-like in shape, obliquely truncate, with three notches on the cutting edge; basitarsus broad, as in *Apis*; pulvillus very large; claws with a rather small inner tooth; middle tibia with a single very sharp spur, as in *Bombus*, *Apis*, etc; scutellum elevated, prominent, obtuse, projecting over the rapidly descending metathorax (*Apis* has the same, though a little less pronounced); stigma obsolete; marginal cell rather long, broad, more or less parallel-sided (not cuneiform), with a rounded obtuse end away from costa; three submarginal cells, subequal in length; second very broad, pentagonal, much longer than third on marginal, and receiving first recurrent nervure at or a little beyond end of its first third; first and second transverso-cubital nervures about equally oblique, in opposite directions;

1) It should be stated with reference to these and other microscopic measurements given in this paper, that there is a small element of error, arising from the fact that the objects measured are rarely precisely at right angles to the line of vision. However measurements are not offered of objects placed very obliquely.

third submarginal cell oblique, produced apically, narrowed much more than half above, receiving the second recurrent nervure one sixth or a little more from end; first recurrent nervure with a bend or angle in its upper part, and a little appendiculation at this point; second recurrent gently bowed outwards; first discoidal cell not so long as marginal; basal nervure meeting transversomedial; lower section of basal nervure more than twice as long as upper; transversomedial of hind wing strongly oblique, the lower end more basal.

Type *Protobombus indecisus* sp. nov.

Apis differs from *Protobombus* by:

- (1.) The hairy eyes.
- (2.) The longer marginal cell.
- (3.) The apex of second submarginal cell much more produced (so also in the fossil subgenus *Synapis*).
- (4.) Basal nervure not nearly reaching transversomedial.
- (5.) Basal nervure in hind wings oblique, with its lower end most apical (*A. mellifera* and *dorsata*), or practically vertical (*A. florea*).

Bombus differs from *Protobombus* by:

- (1.) The produced apical corner of second submarginal cell.
- (2.) The apex of third submarginal cell little produced.

They agree, however, in the transversomedial of hind wings.

Protobombus cannot be described so fully as *Electrapis*, the hind spurs and the mouth-parts not being visible, and the male unknown. It doubtless stands much nearer to *Bombus* than to *Apis*, and may well be directly ancestral to the former.

***Protobombus indecisus* sp. nov.**



Fig. 5. *Protobombus indecisus* CKLL.
Plumose hairs from penultimate dorsal segment of abdomen.

♀. Black, about 10 mm long (the exact length is hard to determine, owing to the position of the insect); abdomen brownish basally, with sparse pale hair; thorax and occiput quite densely covered with rather short white or yellowish-white hair, which is very finely plumose; no dark hairs are intermixed; legs black, hind femora a little brownish; hair of legs mostly pale, but fuscous or black on inner side of tarsi, and hind tibiae with long dark hairs; tegulae very dark brown, moderate in size, with sparse small pale hairs; wings rather light fuliginous, with a very dark fuliginous cloud (such as is seen in some *Bombus*) at the end of the marginal cell.

The following wing-measurements are in micromillimeters:

Length of second submarginal cell	816
Length of third submarginal cell (obliquely)	816
Third submarginal cell on marginal	306
First recurrent nervure from base of second submarginal	255
First recurrent nervure to apex of second submarginal	680
Length of first submarginal cell	850
Length of marginal cell (approximately)	2380
Depth of marginal cell (approximately)	493

Prussian amber; one specimen.

Chalcobombus gen. nov.

♀. Small and compact, about 8—8½ mm long, with subglobose abdomen; parts of the insect, at least in some species, with metallic tints; eyes not hairy; ocelli large (about 238 μ diameter), close together, in a slight curve; head broad; antennae close together (238 μ between antennal sockets), much less distance between antennal sockets than from either to eye; facial quadrangle much longer than broad; scape rather long, curved; mandibles *Apis*-like, with two marginal notches, the upper one strongest; mouth-parts elongated, projecting about 2380 μ beyond head; tongue slender, very hairy, projecting 850 μ beyond apex of second joint of labial palpi; apical spoon circular, pale; small joints of labial palpi ordinary, each about 136 μ long; scutellum prominent, as in *Protobombus*, and hairy; hind basitarsus broad and short, not nearly twice as long as broad, apical angle sharp; pulvillus large; claws with a strong but short inner tooth beyond the middle; stigma triangular, distinct; marginal cell rather deep, not especially long, ending rather obtusely, away from costa, with a small appendiculation; three subequal submarginal cells, the first rather the larger; second submarginal greatly narrowed above, narrower on marginal than third, and receiving first recurrent nervure beyond its middle; third submarginal narrowed at least half above, and receiving second recurrent nervure a short distance before its end; basal nervure meeting transversomedial; transversomedial of hind wings somewhat oblique, the lower end more basal. There is a strong comb of closely set blunt spines on the apex of the hind tibia.

Type *Chalcobombus humilis*, from the type-specimen of which all the above characters have been derived.

This genus appears to represent a side branch near to the others, but not ancestral to anything now living.

Chalcobombus humilis sp. nov.

♀. Black, about 8½ mm long; abdomen with a sericeous lustre and a decided green tint, with the hind margins of the segments broadly reddish; hind coxa with crimson-metallic tints; hair of head and thorax above short and black; vertex and front dull, with sparse short coarse erect black bristles, which are sparingly plumose; second antennal joint barrel-



Fig. 6.

Chalcobombus humilis CKLL.
Spur of anterior tibia, and comb of
basitarsus.

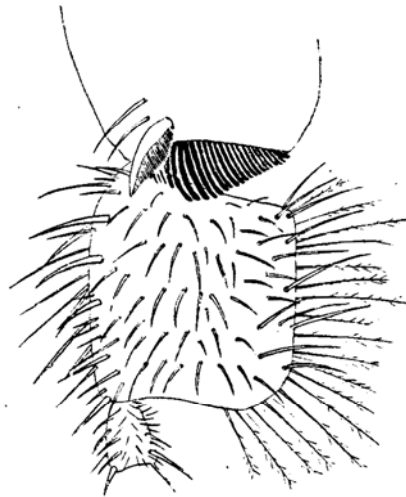


Fig. 7.

Chalcobombus humilis CKLL.
Hind basitarsus, and comb like structure on apex
of hind tibia.

shaped, 170 μ long and about 136 broad; flagellum about 1955 μ long and 187 thick; wings dark fuliginous throughout. Distance between eyes in region of ocelli 1462 μ .

Another specimen, referred to the same species, has the flagellum 2125 μ long.

Prussian amber.

Chalcobombus hirsutus sp. nov.

Compact, black, about 8 mm long, similar to *C. humilis*, but head and thorax above with long hair, that on scutellum about 612 μ long, and sparingly plumose; this hair is white or yellowish-white, with brownish hairs intermixed. The face is much broader than in *C. humilis*; at the vertex the breadth is about the same in both, but the face widens below in *hirsutus*, and rather narrows in *humilis*. The hind margins of the abdominal segments are not reddish. The hind basitarsus is formed as in *C. humilis*.

Ocelli large in a slight curve; antennae close together (340 μ between sockets), comparatively long, flagellum about 2550 μ long and

170 thick, the last joint 323 μ long; distance between eyes in region of ocelli 1428 μ ; distance between lateral ocelli and eyes 289 μ ; scutellum conspicuously projecting, but the edge (seen in lateral profile) rounded; legs with much coarse fuscous hair; pulvillus large; claws with a strong inner tooth; wings reddish-fuliginous.

Front wings: venation essentially as in *C. humilis*; first recurrent nervure joining second submarginal cell about twice as far from base as from apex, the basal corner of the cell being produced; third submarginal cell much longer than second, about 680 μ long, and narrowed more than half above, that is, to about 272 μ on marginal; basal nervure meeting transversomedial.

Hind wings: transversomedial 153 μ long, with the upper half straight (vertical), and the lower somewhat deflected (25 μ) basally. Costal hooks eleven (in the type of *C. humilis* there are eight costal hooks.)



Fig. 8. *Chalcobombus hirsutus* CKLL.
Transversomedial nervure of hind wing.

Prussian amber.

Group B. *With two submarginal cells in the anterior wings. Small bees.*

- Eyes hairy . . . *Glyptapis* n. g.
- Eyes bare . . . *Ctenoplectrella* n. g.

***Glyptapis* gen. nov.**

Small dark-colored bees, with hairy eyes; mandibles broad, with a long cutting edge, which is strongly notched near the apex; tongue rather broad, short, with a button-like terminal structure; labial palpi 4-jointed, the first two joints elongated, the second much longer than the first; maxillary palpi 4-jointed; claws with an inner tooth; pulvillus large; thorax strongly sculptured, the metathorax divided by ridges into large subquadrangular areas; stigma distinct; marginal cell pointed at end; two submarginal cells, the second receiving both recurrent nervures; basal nervure meeting, or almost meeting, transversomedial; transversomedial of hind wings oblique, the lower end more basal.

In CRESSON's table of North American genera this runs exactly to *Coelioxys*, but except for the hairy eyes, it has little resemblance to that genus. So far as I can judge, *Glyptapis* and *Ctenoplectrella* stand near the stem-form of the Megachilidae, but so remote from the modern members of that group that they at least form a distinct subfamily, Glyptapinae. Their nearest relative in the modern fauna appears to be *Ctenoplectra* — a genus which has always been difficult to place in the system. In *Glyptapis fuscula* the ventral side of the abdomen

is clearly seen to be furnished with strong bristles — the beginning of a ventral scopa.

The type of *Glyptapis* is *G. mirabilis*, but four species occur in the collection, separable thus:

Wings very dark; stigma large	<i>G. fuscula</i> n. sp.
Wings hyaline	1
1. Stigma and nervures ferruginous; length of marginal cell 935 μ	<i>G. reducta</i> n. sp.
Stigma and nervures dark brown; length of marginal cell over 1200 μ	2
2. Entirely black; mesothorax punctate	<i>G. mirabilis</i> n. sp.
With metallic crimson tints on abdomen; mesothorax reti- culate	<i>G. reticulata</i> n. sp.

The insects are more or less covered with „Schimmel“, owing to the inclusion of air and moisture, so that it is difficult at times to interpret the sculptural characters. Some misconceptions may have arisen from this cause, though I have tried to avoid them; but the larger features — e. g. the ridges on the metathorax, cannot be in any sense illusory.

Glyptapis mirabilis sp. nov.

Entirely black; length a little over 5 mm, anterior wing $3\frac{3}{4}$ mm; abdomen very stout, convex, moderately shining, with a sericeous lustre, finely hairy, (the hairs plumose on sides of first segment,) and without punctures.

Clypeus and face ordinary, flattened, dull and obscurely punctured; anterior edge of clypeus not dentate; malar space short and broad, its length 85—102 μ ; eyes hairy, about 595 μ across, not allowing for convexity; front distinctly punctured, with very short fine hair, and longer stout bristles; antennae ordinary, flagellum quite thick, not long, very minutely pubescent; scape rather bent; first flagellar joint globose, strongly separated from the rest; ocelli normal, large, in a curve.

Mandibles broad, with a long cutting edge, which is notched near the apex, and thus bidentate, so that when the mandibles are closed there is left a little space, nearly square; the long inner edges are somewhat concave, and so do not exactly meet, except at the inner point and that next to the notch.

Tongue rather broad, short, with a broad button-like structure at end; surface of tongue transversely lined as usual.

Blade of maxilla of ordinary form, rather broad, with erect bristles on outer side and oblique ones on inner. Tongue and maxillae reaching about the same point, namely the end of the second joint of labial palpi.

Maxillary palpi slender, with three movable joints, and no doubt a fourth basal one, which cannot be distinctly seen; last joint long and very slender.

Labial palpi moderately elongated; first joint apparently short, second long, third and fourth smaller, but in a straight line with the others, the third cordiform, the fourth slender. The second joint has very long hairs on the inner side.

Mesothorax and scutellum with exceedingly large and strong punctures, closely placed but not confluent; metathorax divided by ridges into large subquadrangular areas; two continuous ridges run obliquely down each side, the inner ones to meet and thus outline a very large triangular basal area, the apical part of which is occupied by a very large fovea, the lateral margins of which are finely transversely ribbed; anterior to the fovea, in the basal area proper, four median spaces, separated by ridges forming a cross, are especially conspicuous. The post-scutellum is finely punctured, and has a very large fovea on each side.

Legs with abundant coarse brown hair or bristles, the scopa of hind legs sparingly plumose; the three middle tarsal joints of anterior legs very broad and short, obliquely cordiform; pulvillus large; claws with a short inner tooth beyond the middle.

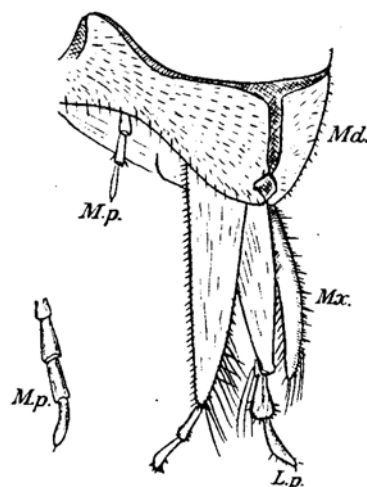


Fig. 9.

Glyptapis mirabilis CKLL.

L.p. = Labial palpus. Md. = Mandibles.
M.p. = Maxillary palpus. Mx. = Maxilla.

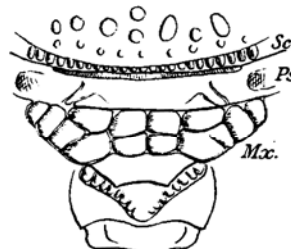


Fig. 10.

Glyptapis mirabilis CKLL.

Diagram showing sculpture of hind part of thorax.

Sc. = Scutellum, with a row of minute foveae along hind margin.

Ps. = Postscutellum, finely punctured, and with a very large fovea on each side.

Mx. = Metathorax.

Wings hyaline, veins dark brown; stigma distinct but narrow; marginal cell large, lanceolate, ending in a point just below costa; two submarginal cells, the first much longer than the second; the second large, much broader than high, receiving the recurrent nervures near its apex and base, the second a little nearer apex than the first to base; lower section of basal nervure about twice as long as upper, strongly bent at its lower end; basal nervure meeting transversomedial, the latter very long, and not or barely oblique; all three discoidal cells very distinct.

The following measurements are in micromillimeters:

Length of marginal cell	1241
Depth of marginal cell	289
Length of first submarginal cell	799
Length of second submarginal cell	527
Length of second submarginal cell on marginal	323
Length of transversomedial	289
Third discoidal on second submarginal cell . . .	425
Width of largest punctures on scutellum	93
Width of cancellate areas on base of metathorax	170 to 238
Length of hair on eyes, approximately	34
Thickness of flagellum	136
Length of longer hairs on vertex	119
Length of last joint of maxillary palpus	85
Length of penultimate joint of maxillary palpus	76
Length of last joint of labial palpus	127
Length of third joint of labial palpus	119
Width at apex of third joint of labial palpus . .	68
Length of labial palpus (approximately; it is perhaps somewhat longer)	765
Width of tongue, approximately	136
Length of second joint of labial palpus, apparently about	357

Glyptapis reticulata sp. nov.

Length nearly 6 mm; black, the abdomen metallic crimson at extreme sides and beneath; mandibles as in *G. mirabilis*; hair on eyes long, some at least 51 μ ; frontal bristles very feebly plumose; metathorax essentially as in *G. mirabilis*; mesothorax with a raised reticulation or cancellation, the areas averaging about 85 μ diameter; legs with fuscous hair; spurs of hind leg with an exceedingly minute serration.

only visible with the compound microscope; wings hyaline, nervures and stigma dark brown; venation much like that of *G. fuscula*; stigma rather large; second submarginal cell high, receiving second recurrent nervure almost at apex, and first quite a long way from base.

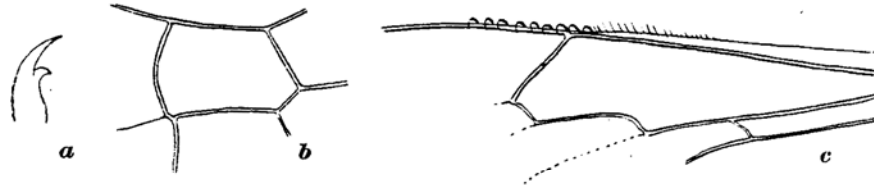


Fig. 11. *Glyptapis reticulata* CKLL.

a Claw. b Second submarginal cell. c Venation of hind wing.

The following measurements are in micromillimeters:

Depth of stigma	170
Length of marginal cell	1292
Depth of marginal cell	357
Second submarginal cell on marginal	357
Second submarginal cell below	544
Height of second submarginal	374
Length of transversomedial nervure	306
Distance between terminations of recurrent nervures on second submarginal cell	442
Length of first discoidal cell	1139

Glyptapis fuscula sp. nov.

Black; length a little over 5 mm; agrees in general with *G. mirabilis*, e. g. in general build, short thick antennae, hairy eyes, strongly curved lower end of basal nervure, strongly sculptured thorax, ridged metathorax, etc. The sculpture of the metathorax, so far as visible (the hindmost part cannot be seen) is similar to that of *G. mirabilis*. The longer bristles of front are very strongly plumose.

Compared with *G. mirabilis*, the large punctures of mesothorax are smaller and less dense, and the surface between them is very densely and minutely punctate.

The scutellum is sparsely punctured in the middle, and its hind part is beset with black bristles. There are strong bristles on the ventral surface of abdomen.

The wings are strongly darkened, and the venation differs from that of *G. mirabilis*. Second submarginal cell comparatively high and

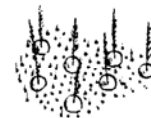


Fig. 12. *Glyptapis fuscula* CKLL.
Sculpture of mesothorax.

short, with first recurrent nervure joining it a considerable distance ($170\ \mu$) from base, and the second very near ($17\ \mu$ from) apex. The stigma also is much larger than in *G. mirabilis*, at least $170\ \mu$ deep. The color of the wings is reddish-fuliginous.

The following measurements are in micromillimeters:

Depth of marginal cell	425
Length of first submarginal cell	680
Length of second submarginal cell	561
Length of second submarginal cell on marginal	340
Greatest depth of second submarginal	442
Length of transversomedial	306
Length of first discoidal	935

Another specimen yields the following measurements:

Distance between antennae	493
Antennae to eye-margin	221

Glyptapis reducta sp. nov.

The reference of this species to *Glyptapis* is perhaps a little uncertain.

Wings hyaline, minutely hairy, stigma and nervures ferruginous; stigma large, $459\ \mu$ long and 136 deep, about $238\ \mu$, not counting curve, on marginal cell. Marginal cell cuneiform, pointed, the point $34\ \mu$ from costal margin; length of marginal cell $935\ \mu$, its depth 255 . First submarginal cell much larger than second; length of first submarginal (obliquely) $544\ \mu$; length of second $374\ \mu$; second submarginal on marginal $204\ \mu$; third transverso-cubital oblique but straight; lower section of basal nervure evenly curved, longer than upper, but not nearly twice as long.

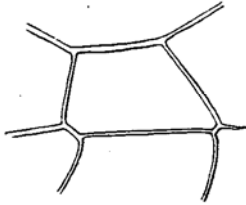


Fig. 13.
Glyptapis reducta CKLL.
Second submarginal cell.

The following measurements are in micromillimeters:

Lower section of basal nervure (not allowing for curve)	272
Upper section of basal nervure	204
Basal nervure falling short of transversomedial	34
Transversomedial short, bowed outwards, its length	102
Length of first discoidal cell	714
First recurrent nervure joining second submarginal cell from base of latter	51

(Second recurrent joins second submarginal cell at apex.)
 Width of flagellum 136
 Distance between antennae 255
 Length of flagellum 986
 Venation of hind wings as in *G. mirabilis*.
 A moderate ventral scopa, as in *G. fuscula*.

Ctenoplectrella gen. nov.

Ctenoplectrella viridiceps sp. nov.

♀. (Sting visible.) Eyes bare. A small black stout bee like *Glyptapis*, hardly 5 mm long. The abdomen is slightly greenish, and in a strong light it can be seen that the face and front are metallic green, the clypeus with some coppery tints; but the mesothorax and

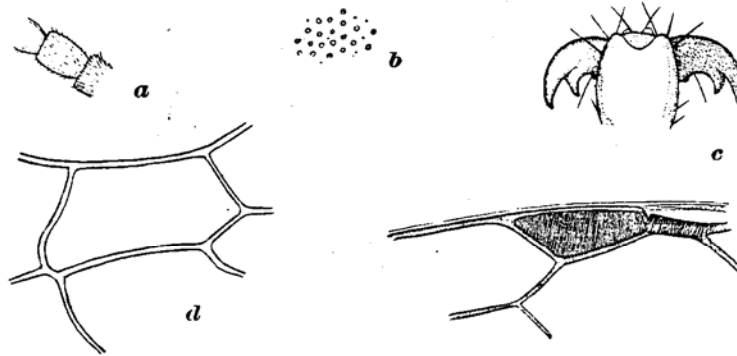


Fig. 14. *Ctenoplectrella viridiceps* CKLL.
 a Second antennal joint. b Sculpture of mesothorax. c Claw. d Second submarginal cell.
 e Stigma.

vertex are pure black. Head broad; thorax with a rather shining, sericeous surface, not obviously sculptured; abdomen similar, the hind margins of the segments narrowly pallid. Antennae wide (714 μ) apart, but only about 221 μ from eye margin; anterior edge of clypeus straight; mandibles with a sharp apical tooth, 85 μ long (another specimen shows the mandibles better; they are truncate-tridenticulate, the middle tooth nearer to the upper than to the lower); malar space an exceedingly narrow band, little more than 34 μ from eye to mandible; ocelli large, in a curve, diameter of middle ocellus 187 μ ; antennae much as in *Glyptapis*, but first joint of flagellum, though very distinct from the rest, barrel-shaped, 136 μ long and 102 broad; flagellum 136 μ across, and 1105 long; scape with very short hair; front with sparse but distinct punctures, and sparse erect hairs, which are sparingly plumose.

Hair on sides of thorax beautifully plumose; legs with very abundant coarse dark fuscous hair; small tarsal joints cordiform, as in *Glyptapis*; pulvillus large; claws strongly cleft; abdomen with short erect hairs, and with only piliferous punctures, or almost without others.

Wings dark rufo-fuliginous; stigma large but rather short, about 391 μ long and 170 deep, the side on marginal cell about 204 μ . Marginal cell large, rounded at end, away from costa.

Two submarginal cells, subequal in length, the second receiving first recurrent nervure some distance (153 μ) from base, and second not far (51 μ) from apex; third transversocubital nervure curved below; basal nervure with the lower section longest, but not nearly twice as long as upper; the lower section strongly curved. The basal nervure meets transversomedial, but a little on the apical (apicad) side; second recurrent nervure strongly bowed outwards. Hind wing with eight costal hooks.

The following measurements are in micromillimeters:

Length of marginal cell	1037
Depth of marginal cell	306
Apex of marginal cell from costa	68
Length of first submarginal cell	646
Length of second submarginal cell	629
Second submarginal on marginal	357
Greatest depth of second submarginal	323
Length of upper section of basal nervure	221
Length of first discoidal cell	867

With regard to these and other microscopical measurements given in this paper, it should be stated that the units for the microscope and micrometer used are 17 μ , and the measurements are multiples of 17. It is not pretended, of course, that they are accurate down to a micromillimeter, as the figures would seem to imply.