X. *Notes on some British Guiana* Hymenoptera (*exclusive of the* Formicidae). By G. E. Bodkin, B.A., Dip. Agric. (Cantab.), F.Z.S., F.E.S., Government Economic Biologist, Department of Science and Agriculture, British Guiana.

(Published by permission of the Director of Science and Agriculture, British Guiana.)

[Read December 6th, 1916.]

Plates XXI–XXIII and Sketch Map.

Up to the present time very little has been known of the habits and life-histories of the *Hymenoptera* of British Guiana. Schomburgk,* in his "Fauna and Flora of British Guiana," devotes six pages to the *Hymenoptera* and gives a few observations with regard to their biology as observed by himself, but unfortunately many of the scientific names are quite impossible to trace. Peter Cameron has published in "Timehri" † a comprehensive list of the *Hymenoptera* of this country, with descriptions of many new species, but no biological notes are attached. Scattered references have appeared from time to time in many scientific publications, but the majority of these are descriptions of new species.

The present collection in this laboratory was commenced in 1911 and has been formed chiefly by myself as opportunities have occurred. All the commoner species have now been collected, and in many cases observations made on their life-histories and habits. The accompanying map indicates in red dots the areas where collections and observations have been made. These necessarily follow

* Schomburgk, R., "Fauna und Flora von British Guiana." Leipzig, 1848.

† Peter Cameron, Hymenoptera of the Georgetown Museum, "Timehri." Journal of the Royal Agricultural and Commercial Society, 1911–12. Pt. 1. Parasitica, I, pp. 153–186 (1911). Pt. 2. Parasitica, I, pp. 306–330 (1911). Pt. 3. Marabuntas or Wasps, II, pp. 207–231 (1912). Pt. 4. Fossores, II, pp. 412–440 (1912).

the chief communication routes either by water, road, or trail. Vast areas consequently remain untouched.

The collection at present contains 1,600 specimens, of which 161 species are named. All these identifications have been made either by specialists in the British Museum, through the co-operation of the Imperial Bureau of Entomology, or by specialists in the U.S. National Museum.

The present work clearly shows that in scope it can hardly pretend to do more than outline the vast field which awaits entomologists in this part of the world.

There is a distinct difference between the *Hymenoptera* of the flat, cultivated and inhabited coast lands and those of the forest-clad area. Many species of common occurrence on the coast lands are never found in the forests, and *vice versa*. The climate of these two areas also varies, the interior districts having a higher rainfall and a somewhat higher temperature. The trade-winds which sweep the coast lands most of the year are not experienced to any extent inland. No opportunity has yet occurred to investigate the large tracts of savannah lands which exist at the back of the Colony near the Brazilian frontier.

The observations on the habits and life-histories are mostly my own, but a number of interesting notes by the following gentlemen must be acknowledged: Mr. C. B. Williams, Mr. L. D. Cleare, Jnr., Mr. H. W. B. Moore, and Mr. A. A. Abraham.

I have endeavoured to give as full information as possible concerning each species. Where only one specimen of a species has been collected I have given the locality of collection.

The Ants have not been included in these notes, as Mr. W. C. Crawley has already published * an account of the Family.

Family APIDAE.

Subfamily *SPHECODINAE*.

Genus Temnosoma, Smith.

T. aeruginosum, Smith. Issororo, N.W.D.

* "Ants from British Guiana," W. C. Crawley, B.A. Annals and Magazine of Natural History, Ser. 8, vol. xvii, May, 1916.

Subfamily *ANDRENINAE.*

Genus Augochlora, Smith.

A. graminea, F.
A. thalia, Smith.
A. calypso, Sm.
} Taken while feeding on flowers of "wouralli" (fish-poison plant), Issororo, N.W.D.

Subfamily *PANURGINAE.*

Genus Megalopta, Smith.

M. sodalis, Vachal. Issororo, N.W.D. This species is frequently attracted to artificial light.

Subfamily *XYLOCOPINAE.*

Genus Xylocopa, L.

X. fimbriata, F. The commonest wood-boring bee in British Guiana. The female is black and the male an ochreous yellow with green eyes. The proportion of females is greater than males—about 4 to 1. Both sexes may frequently be seen collecting honey from a number of commonly occurring flowers, especially those of the large red *Hibiscus* and the flowers of the Pigeon Pea. It possesses a powerful sting, and the flight is accompanied by a loud buzzing sound. I have never observed the species in the interior. Any dry decaying wood is utilised for nesting purposes, such as rotten paling-posts or tree-stumps. The softer kinds of wood are preferred. Logs of wood infested by these bees soon become literally riddled with their borings, and large quantities of frass may be seen piled up at the foot of the log. If such a log is sharply tapped a shrill buzzing noise may be heard caused by the contained bees. A log of wood 5 feet long by 2 feet in diameter on being split open was found to contain 20 imagos and 25–30 larvae and pupae. There were about three entrance holes, and these led directly into galleries bored at right angles to the grain of the wood. In such galleries the cells are formed, usually three or four together, never more. Each cell is about an inch in length and about $\frac{3}{4}$ inch in diameter. The cells are separated from one another by a partition or "wad" of sawdust cemented together and hardened by the bee. These partitions are $\frac{1}{4}$ inch in thickness. The galleries and cells are perfectly smooth and very neatly executed. Each cell is stocked with a small, fairly solid mass consisting apparently of a mixture of honey and pollen. It is a dark yellow in

colour with a peculiar though not unpleasant odour. These masses of foodstuff weigh about 2·5 grammes, and an equal quantity is deposited in each cell. On this mass the egg is finally deposited and gradually increases in size as development proceeds; later, the segmentation of the future larva may dimly be perceived through the enveloping shell. It is sausage-shaped, slightly curved, and almost transparent in the earlier stages. Length 1·7 cm., diameter 0·4 cm. During development one end becomes somewhat larger than the other. Eventually the extremely thin pellicule strips off and the wrinkled larva is exposed, which starts feeding immediately. The larval excrement is hard, and formed in short rods black in colour. The full-grown larva measures 3·9 cm. in length, and is creamy white in colour. The larval stage lasts about three weeks. Gradually the outlines of the pupa may be seen through the larval skin, which eventually peels off. The period between the full-fed larva and the final stripping of the larval skin is 48 hours. The pupa is at first creamy white, and in form roughly resembles the future adult insect. Length of pupa 2·5 cm., breadth 1·4 cm. Within the first week of pupation a general darkening of colour takes place, the eyes going almost black; hardening of the integument occurs simultaneously. These two processes progress rapidly till the perfect insect is formed in about 3 weeks. It then makes its exit from the cell by gnawing away the wad of hardened sawdust.

X. barbata, F. A fairly common species on the coast lands.

X. brasilianorum, F. A not uncommon species within the forest area. Rockstone, Essequebo River, and H.M. Penal Settlement, Mazaruni River.

X. aurulenta, F. An uncommon species within the forest area. Rockstone, Essequebo River.

Subfamily *PROSOPIDINAE*.

Genus Caupolicana, Spinola.

C. eximia, Smith. Essequebo River, in vicinity of Rockstone.

Subfamily *ANTHOPHORINAE*.

Genus Eucera, Scopoli.

E. festiva, Sm. Vicinity of Georgetown.

Genus Exomalopsis, Spinola.

E. globosa, F. Botanic Gardens, Georgetown.

Genus Epicharis, Klug.

E. rustica, Oliv. Rockstone, Essequebo River.

Genus Melitoma, Latr.

M. euglossoides, Lep. From cultivated Cotton blossoms, Georgetown. This bee has a curious habit of clinging to the edges of blades of Para grass, with its mandibles firmly embedded in the tissues. The reason for this is not apparent. They remain quite motionless in this position, and at times may be seen in considerable numbers. Fairly common about coast lands.

Genus Centris, F.

C. longimana, Lep. A common species both on the coast lands and in the interior. It is attracted to strong-smelling substances such as salt fish, and will follow boats with this substance on board for long distances up the rivers. Frequently seen about buoys moored in the centre of the tidal passages in the big rivers and elsewhere. It is apparently attracted there by the excreta dropped by sea-birds on these objects. It has a swift, noisy flight.

C. lanipes, F. Fairly common on the coast lands and in the interior. Has been taken at flowers and also in the act of collecting soft mud from a pathway.

C. versicolor, F. Taken on one occasion while attracted to artificial light. Appears to occur only in the interior.

C. personata, Sm. It has similar habits to *C. longimana*, Lep. Taken under similar conditions in the North-west District.

C. labrosa, Friese. An uncommon species. H.M. Penal Settlement, Mazaruni River.

Genus Thygater, Holmb.

T. rubricata, Sm. Rockstone, Essequebo River.

Genus Euglossa, Latr.

E. dimidiata, F. A fairly common species in most parts of the Colony. Observed on several occasions to collect mud from a pathway. A somewhat clumsy insect,

easy to capture, but when alarmed assumes a rapid flight. Frequently observed flying about and alighting upon the bark of certain trees, though on closely inspecting the bark no feature which might attract the bee could be observed.

E. cordata, F. The commonest *Euglossa* in British Guiana. Observed in all areas visited. It will construct its somewhat sticky nest in all sorts of curious places, such as the inside of a disused reel of cotton, interior of empty cartridge case, eye-piece of polariscope, keyholes, small cavities in timber, etc. It also takes over the disused cells of *Sceliphron fistulare*, Dahlb. In the forest areas I have observed this bee to construct its nest on the under surface of a leaf. The nest varies in the number of its cells, some only containing two or three, others as many as six. The cells are roughly about 1 cm. in length and about 5 mm. in breadth, with the ends neatly rounded. Each cell is stored with a viscid mixture of honey and pollen, on which the larva feeds. The walls of the cells are thin and soft, being constructed of some dark vegetable substance. The whole exterior is sticky. This insect has an extremely rapid, darting flight, and is particularly fond of the white, sweet-smelling flowers of a certain species of prickly wild Solanaceous plant. While the bee is within the white blossoms it emits an exceedingly shrill buzzing sound, which is often difficult to locate.

E. surinamensis, L. Another very common species of *Euglossa* throughout British Guiana. It is greatly attracted to the flowers of the same Solanaceous plant as attracts *E. cordata*, L. Its loud buzzing and somewhat slow flight makes its presence conspicuous. The nest is constructed sometimes in artificial holes in timber, in cavities in the trunks of trees, and at times on the top of roof-beams. The substance of the nest is thin flakes of bark, or sometimes flakes of white plaster from houses, exceedingly strongly cemented together. Several cells are usually formed united in an irregular mass. Each cell is stored up with a quantity of honey and pollen of moderately hard consistency. The cells are about 1·5 cm. in length, with a diameter of about 1 cm., ovoid in shape, with a perfectly smooth lining.

E. nigrita, Lep. Not a particularly common species. So far only observed on the coast lands. On one occasion the bees were observed to be nesting within a hollow beam in the large dining-hall of one of the largest hotels in

Georgetown. The bees passed to and fro, apparently quite regardless of the proximity of human beings.

E. piliventris, Guér. An uncommon species from Upper Essequebo River. Attracted to flowers of the wild Solanaceous plant previously mentioned.

E. analis, Lep. An uncommon species. A large nest consisting of many ovoid cells was once taken from the soil on the East Coast of Demerara. The cells were hard, dark in colour, and joined together. Only one bee hatched from this nest.

E. cayennensis, Lep. (= *fasciata*, Lep.). A fairly common and widely distributed species throughout the Colony. Nesting habits not observed.

E. decorata, Sm. An uncommon species from the interior. Essequebo River.

Genus Exaerete, Hoffm.

E. smaragdina, Guér. A common species in some parts of the interior, especially the N.W.D. All of my specimens were collected while flying about piles of cordwood from which a strong-smelling sap was exuding, and on which the bees were feeding. Occasionally seen on the coast lands and in the Botanic Gardens, Georgetown. Nesting habits unobserved.

Subfamily *MEGACHILINAE.*

Genus Megachile, Latr.

M. lobitarsis, Smith. An uncommon species with a wide distribution.

M. lanata, F. This insect has only once been collected, and that beneath the Government Laboratory, Georgetown. The mud cells were situated within a disused $\frac{3}{4}$-inch iron pipe. The nest was cylindrical in shape and contained about four cells. The nest was very firmly cemented together, making the whole structure exceedingly strong and hard to break. This bee is well known in India.*

Subfamily *COELIOXYNAE.*

Genus Coelioxys, Latreille.

C. simillima, Smith. Apparently a widely distributed though not common species. Nest observed in cylindrical borings in a wooden post.

* Lefroy, H. Maxwell, "Indian Insect Life," p. 219.

Subfamily *BOMBINAE.*

Genus Bombus, Latr.

B. cayennensis, F. A common species found only in the interior.

Genus Melipona, Ill.

M. interrupta, Latr. This species is widely distributed and common. The specimens in the collection were all taken while they were collecting soft mud from paths.

M. pallida, Latr. A fairly common species in the interior. A small nest on one occasion observed in a rotten log of timber with a small circular hole formed of wax for exit. When the nest is disturbed they swarm out and attack by biting the exposed parts of the head and neck, emitting at the same time a shrill buzzing sound. These small bees possess a peculiar odour which is characteristic.

M. favosa, F. A common species on the coast lands, where it is known as the Courida Bee, from a supposed habit of collecting honey from the flowers of the maritime Courida (*Avicennia nitida*). The nests are found in hollow trees, etc., especially in old Courida trees, but they have been found in disused drain-pipes and other unlikely places. This bee possesses no sting, and I have never observed it to attack in any way; when the nest is disturbed the bees swarm out, but do not demonstrate their resentment in any more practical manner. This bee is frequently domesticated, and when the nests are found in the field they are removed, taken home, and put in wooden boxes with a small exit hole. They thrive in captivity. The honey which they produce is thin and of a somewhat insipid flavour; mixed with other ingredients it is utilised by the natives as a cure for cold in the throat or chest. The honey is stored in egg-shaped cells constructed of wax, about $1\frac{1}{2}$–2 inches in length; similar cells are also constructed containing nothing but wax. The cells containing the larvae are 8 mm. in length and about 5 mm. in breadth.

M. clavipes, F. A common species in most parts of the Colony. The nests are usually constructed in hollow decaying logs. The following notes on the nesting habits of this species were made from a nest which was found in a hollow log of Trysil wood (*Pentaclethra filamentosa*). The extreme length of the hollowed-out portion containing

the nest was 32 inches. Three distinct layers of various kinds of cells were observed on splitting open the log longitudinally. The layer next to the entrance consisted of wax cells about $\frac{1}{2}$ inch in length and $\frac{3}{8}$ inch in diameter; ovate in shape. The length of this layer was 8 inches. These wax cells were yellowish in colour and contained solid wax. To the taste the wax had an exceedingly bitter flavour, and a sour smell which seemed to pervade the whole nest. The layer next to the wax cells contained honey cells; this layer was 9 inches in length. The cells themselves were slightly smaller than the wax cells, same shape and dark brown in colour. The contained honey was thick, very sweet and possessed quite a good flavour, but if the slightest trace of the wax coating of the cell got mixed with the honey the bitterness of the wax entirely obliterated the pleasant flavour of the honey. The next layer consisted of the cells with embryonic bees in various stages of development; it was 9 inches in length. These cells were about $\frac{1}{8}$ inch in length and dull yellow in colour. In shape they were cylindrical. Apparently the nest was entirely enclosed, with the exception of the exit. This exit was by no means a conspicuous object, as it was constructed of wax much the same colour and texture as the surrounding bark. It was slightly raised above the surface of the bark, and roughly cone-shaped with a very small exit hole. Attention was drawn to the presence of this nest by the bees hovering around the exit. This species is by no means so pugnacious as some of the other species of *Melipona*.

M. recurva, Sm. An uncommon species from the N.W. District.

M. lineata, Lep. Bartica, Essequebo River.

M. flavipennis, Sm. Taken on one occasion while attending flowers of Guava.

M. varia, Lep. A nest of this species observed in a large greenheart beam supporting the hotel at Rockstone, Essequebo River. A non-pugnacious species. The entrance to the nest is funnel-shaped and constructed of wax.

M. guianae, Ckll. A most pugnacious species. If the nest is only slightly disturbed the bees swarm out and attack the intruder by biting the exposed parts of the head and neck, at the same time emitting a shrill buzzing. The nests (which are large) are usually constructed in the branches of trees at some distance from the ground. The

bees possess a peculiar smell, due to the character of the substance which they collect on their hind-legs. A large nest observed on one occasion on the branches of a Pimento tree (*Pimenta officinalis*).

M. rufiventris, Lep., var. *flavolineata*, Friese. Tumatumari, Essequebo River.

Melipona amalthea, F. A common and widely distributed species. May be observed on the blossoms of most garden plants, and is particularly fond of feeding on over-ripe fruit. It may also frequently be seen collecting mud from damp paths, creeks, etc. Known locally as "Tarbaby bees." It has a habit of collecting the scrap-rubber from recently tapped trees of *Hevea brasiliensis*.

M. rufiventris, Lep. Rockstone, Essequebo River.

M. dallatorreana, Friese. East Coast, Demerara.

M. mutata, Lep. Upper Demerara River.

Genus Apis, Linn.

A. mellifera, L. Only a small number of hives of the domestic bee are kept in the Colony, and these are principally owned by the Chinese and Portuguese. The honey produced is of good quality and very sweet. Fresh stock is usually imported from the United States. They are mostly "Italian bees." The Wax Moth (*Galleria mellonella*, L.) is common and causes much damage.

Family VESPIDAE.

Subfamily *VESPINAE*.

Genus Polistes, Latr.

P. pacificus, F. Essequebo Coast. An uncommon species.

P. analis, F. A fairly common species in the interior.

P. versicolor, Oliv. A common species on the coast lands.

P. goeldii, Ducke. A rare species in the interior.

P. canadensis, L., var. *amazonicus*, Schulz. The commonest species of *Polistes* in the Colony, occurring everywhere. Unless severely molested it rarely attacks people, but its sting is both powerful and painful, and causes a severe swelling. Large nests are rarely seen, the usual number of cells being about twenty. Beneath bridges, houses, on the rafters, under the eaves, beneath the platform of railway stations, behind pictures, etc., are favourite

nesting-places for this species. It appears to prefer domestic habitations for its nesting-places. The short wooden bridges which span the navigation trenches on sugar estates are always thickly infested beneath with the nests of these insects, and passing beneath such bridges in a small boat is always an exciting and quite occasionally a painful experience. In dwelling-houses they are always a source of danger, especially when children are about. The local name is "marabunta." Destroying marabunta nests with a wad of dried palm leaves attached to a long pole soaked in kerosene and ignited is an interesting operation for an onlooker at a respectful distance. At times these wasps will remain quite motionless in an alert position on their nests for hours together, as though on guard. From the economic standpoint they are exceedingly useful, for they may often be seen hunting for and consuming the larvae of various agricultural pests, especially the Rice Worm (*Laphygma frugiperda*, S. & A.). The nests are irregular in structure and not strongly made, for pieces are frequently falling from the nest. The flight of this insect is somewhat clumsy.

P. crinitus, Felton. An uncommon species on the coast lands.

Genus Polybia, Lep.

P. fulvofasciata, de G. (= *phthisica*, F.). A common species on the coast lands; the nests are frequently found attached to the under surfaces of leaves, especially those of the mango tree. Large nests are seldom encountered.

P. occidentalis, Oliv. An exceedingly common species throughout the coast lands, and at times encountered in the interior. The nests are found attached to the under surfaces of many species of palms. The nests are never large, more or less circular in shape, and constructed of exceedingly light and fragile material. This small wasp is not unduly pugnacious, and seldom attacks unless the nest is damaged; it is thus frequently encountered when felling the branches of young coconut palms. The sting has no great lasting effects, but the first shock is exceedingly painful. On one occasion a gardener who was trimming a hedge of Barbados Cherry (*Malphigia glabra*) brought into the laboratory a good-sized nest of this species which he had very carefully removed with some of the wasps *in situ* on the outside of the nest. The local

name is "honey marabunta." A native method of destroying such nests is to seize the nest quickly and firmly with both hands and then crush it. An individual possessed of large and thick-skinned hands is likely to be the most successful.

P. fastidiosuscula, Sauss., var. *sampaioi*, Ducke. Appears to take the place of the foregoing in the interior, where it is common. It has never been taken on the coast lands. The nest is often met with attached to the under surfaces of palm leaves.

P. fasciata, Lep. A species by no means of infrequent occurrence both on the coast lands and interior. A small nest was taken on one occasion attached to the floor-boards beneath a house; the structure is somewhat peculiar (see photo). Length about $2\frac{1}{2}$ inches; length of single cell $\frac{3}{4}$ inch.

P. fuscicornis, Lep. A rare species from the interior.

P. chrysothorax, Web. A fairly common species only encountered on the coast lands. Large pendant nests nearly a foot in length and roughly cylindrical are constructed; the one actually observed was attached to a bush only a short distance from the ground. This nest was unfortunately destroyed in an attempt to secure it.

P. dimidiata, Oliv. Rockstone, Essequebo River.

P. constructrix, Sauss. Tumatumari, Essequebo River.

P. jurinei, Sauss. Issororo, N.W.D.

P. sericea, Oliv. Tumatumari, Essequebo River.

P. sycophanta, Gribodo. An uncommon species with a wide distribution.

P. velutina, Ducke. Issororo, N.W.D.

P. rejecta, F. A species with a wide distribution, but uncommon.

P. obidensis, Ducke. Puruni River.

Genus Protopolybia, Ducke.

P. laboriosa, Sauss. Rockstone, Essequebo River.

Genus Metapolybia, Ducke.

M. pediculata, Sauss. A fairly common species which builds its nests on beams beneath houses. The nest, which is constructed of papery material, is usually about 5 inches in diameter and about 1 inch in thickness and of a flattened irregular appearance. It is by no means a

conspicuous object, and is often of much the same colour as the beam to which it is attached. This insect shows no hostile tendencies, and the taking of the entire nest is quite a safe undertaking. It has only been observed in the interior.

Genus Chartergus, Lepeletier.

C. chartarius, Oliv. A fairly common species in the interior. The nest of this species is a well-known object and has been previously described by a number of authors. They are prized by many colonists as "curios," and fetch a very fair price in Georgetown. These nests may sometimes be seen attached to the branches of trees overhanging the river. The taking of the nests is by no means an easy matter, as the insects resent any interference with their home. Nests, however, which overhang the river may be taken by getting a native to ascend quietly the particular tree to which the nest is attached and with one well-directed blow of a sharp cutlass sever the branch bearing the nest so that it falls into the river, whence it is eventually retrieved as soon as the wasps have left. An unsuccessful blow, however, spells disaster, and there is a case on record where such an incident occurred, and the unfortunate native rather than suffer jumped into the river many feet below and thus evaded the infuriated wasps.

Genus Charterginus, Fox.

C. pallidilineatus, Cameron. Issororo, N.W.D.

Genus Nectarina, Shuckard.

N. bilineolata, Spin., var. *möbiana*, Sauss. A species so far only taken in the Botanic Gardens, Georgetown. The nest was found attached to the end of a dried "arrow" of sugar-cane. Greatest diameter about $1\frac{1}{2}$ inches—depth $\frac{3}{4}$ inch.

N. scutellaris, F. Issororo, N.W.D.

N. lecheguana, Latr. Issororo, N.W.D.

Genus Synoeca, Saussure.

S. surinama, L. A common species on the coast lands and occurs at times in the interior. The nests of this species, which are irregular in shape, may usually be seen attached to trees in the Botanic Gardens, Georgetown.

The whole of one side of the nest is attached to the tree, and the external wall exhibits a slight "ribbing." The nests are often a foot or more in length. The sting of this species is particularly formidable, and it does not hesitate to use it when occasion arises. The adult wasps may often be seen feeding on decaying fruit which has fallen on the ground, and they frequently visit certain species of flowers. I have taken specimens of this insect with the "pollinia" of a species of Euphorbiaceous plant attached to its legs; this is by no means a common occurrence.

S. irina, Spin. An uncommon species in the interior.

Genus Apoica, Lepeletier.

A. pallida, Oliv. A common species on the coast lands. The nest, which is invariably attached to a tree and never far from the ground, is disc-shaped. The under surface consists of innumerable cells, the ends of which are exposed. The under surface is invariably crowded with adult wasps, which attach themselves each to a particular cell and remain motionless, an aspect is thus presented of a cluster of wasps adhering to the under surface of the nest; in this position the bright yellow tips of their abdomens are very conspicuous. They do not readily move from this position, and if slightly disturbed will only make a slight movement. Once while observing a large nest of this species I happened to approach rather too near, when one wasp left the nest and stung me on the forehead immediately between the eyes, and returned at once to its original position. The effect of the sting was as though a blow had been delivered, and in a short space of time a swelling the size of a fowl's egg made its appearance, accompanied by considerable pain. The species is readily attracted to artificial light.

A. pallens, F. Issororo, N.W.D.

Genus Mischocyttarus, Saussure.

M. labiatus, F. A fairly common species on the coast lands. Only small nests are constructed.

Subfamily *EUMENIDINAE*.

Genus Montezumia, Sauss.

M. leprieuri, Spin. (1841) (= *M. rodwayi*, Cam. (1911). An uncommon species taken in the vicinity of Georgetown.

M. nigriceps, Spin. One of the commonest species of *Hymenoptera* on the coast lands. Also a species of particular economic value, as it hunts for and destroys the larvae of many agricultural pests, including the Rice Worm (*Laphygma frugiperda*, S. & A.) and the Para-grass Worm (*Mocis repanda*, F.). This wasp may frequently be seen searching for its prey amongst grass and tall rice. A large pendant, irregularly-shaped nest is formed, which is somewhat fragile in its structure. These nests contain a large and active community.

M. infernalis, Spin. An uncommon species on the coast lands. According to C. B. Williams, who has observed the habits of this wasp, it constructs burrows in the clay banks of the canals or trenches to be found on all sugar estates. Green caterpillars are stored up in the nest, and an egg is deposited, which is hung from the roof of the burrow by a long stalk. The opening of the burrow is small in comparison with the size of the wasp.

M. infundibuliformis, F. Issororo, N.W.D.

Genus Eumenes, Latreille.

E. canaliculata, Oliv. An exceedingly common species to be met with mostly on the coast lands. Its dome-shaped mud cells, in small colonies of five or six and sometimes more, are objects of common observation attached to the rafters beneath houses and in sheltered spots on walls and palings. These mud cells (see photo) are usually about ½ inch in height and with a diameter of about ½ inch. Some cells possess a kind of "neck" at the top of the cell, giving it the appearance of a squat-shaped earthen bottle. These cells are stored with Lepidopterous larvae usually slightly over an inch in length and, of course, paralysed by the sting of the wasp at the time of capture. From four to six such larvae are stored. The wasp larva becomes mature in ten days to two weeks from the time of emergence from the egg. The pupal stage lasts slightly over a week. The adult wasp emerges from the cell by biting a circular hole in one side. These empty cells are afterwards utilised by a species of *Trypoxylon* for its nest, and stored with spiders. A small species of black ant (*Cremastogaster*, sp.) finally colonises these disused cells. In constructing such cells the adult wasp holds the piece of moist and plastic mud in position on the half-constructed nest by means of the two front pairs of legs, and the deli-

cate process of moulding the mud around the edge of the nest is performed with the mandibles, which are long and well suited to the work. During the operation the long antennae are bent downwards and kept rapidly moving about the work as though guiding it and preserving the symmetry of the structure. A small species of Chrysid was bred on one occasion from the mud cells of this *Eumenes*.

E. callimorpha, Sauss. Vicinity of Georgetown.

Genus Pachymenes, Sauss.

P. pallipes, Oliv. Onderneeming, Essequebo.

Genus Zethus, Fab.

Z. mexicanus, L., var. *lugubris*, Perty. An uncommon species on the coast lands.

Z. gigas, Spin. Issororo, N.W.D.

Z. sichelianus, Sauss. Inhabiting disused borings in timber, Courantyne Coast, Berbice.

Genus Odynerus, Latr.

O. nasidens, Latr. Courantyne Coast, Berbice.

O. clavilineatus, Cameron. An uncommon species in the interior.

FOSSORES.

Family MUTILLIDAE

Genus Mutilla, L.

M. (*Thaumatomutilla*) *parallela*, Klug. A fairly common species on the sandy soils of the interior.

M. mediata, F. From Courantyne Coast, Berbice. Taken while issuing from some disused borings in timber.

Genus Thaumatomutilla, André.

T. ocellaris, Klug. Tumatumari, Essequebo River.

Family SCOLIADAE.

Subfamily *TIPHIINAE*.

Genus Tiphia, Fab.

T. parallela, Smith. The larva of this wasp is parasitic on the larva of *Dyscinetus bidentatus*, Burm. (Coleoptera); fairly common on the coast lands.

Genus Dielis, Sauss.

D. dorsata, F. Of common occurrence in most parts of the Colony.

D. hyalina, Lep. (= *D. fallax*, Sauss.). Fairly common in most parts.

D. variegata, F. Issororo, N.W.D.

Genus Elis, F.

E. flavopicta, Smith. Turkeyn, East Coast, Demerara.

Family RHOPALOSOMIDAE.

Genus Rhopalosoma, Schulz.

R. guianense, Schulz. At light, Rockstone, Essequebo River.

Family PSAMMOCHARIDAE.

Genus Pseudagenia, Kohl.

P. comparata, Sm. Tumatumari, Essequebo River.

P. chlorosoma, Sm. Puruni River.

Subfamily *PEPSINAE.*

Genus Cryptochilus, Panz.

C. purpureipes. A common species on the coast lands.

Genus Pepsis, Fab.

P. tinctipennis, Smith. Issororo, N.W.D.

P. sapphiria, P. de B. Rockstone, Essequebo River.

P. jucunda, Mocs. Rockstone, Essequebo River.

P. chlorotica, Mocs. Onderneeming, Essequebo.

P. nigrescens, Smith. Rockstone, Essequebo River.

P. dimidiata, F. Rockstone, Essequebo River.

P. amethystina, F. A common species in most parts of the Colony.

P. seladonica, Dahlb. Issororo, N.W.D.

Subfamily *PSAMMOCHARINAE.*

Genus Pompilogaster, Ashm.

P. philadelphica, Lep. A common species on the coast lands.

Subfamily *SPHECINAE*.

Genus Sceliphron, Klug.

S. fistulare, Dahlb. This species is widely distributed. Its mud nests are common objects on palings, beneath houses, and at times within the house itself, behind pictures, etc. The nests are somewhat irregular in shape and may contain as many as eight or ten cells. Sometimes only two cells are constructed together, when the architecture is then better demonstrated. The usual procedure is to build one cell and attach it firmly, and then to build other cells around it. Each cell is stored with spiders, from sixteen to twenty according to the size of the spiders. As soon as the requisite number of spiders has been obtained the cell is closed up. The egg, according to C. B. Williams, is deposited on dorsal surface of the abdomen of the first spider placed in the cell. The following observations by Mr. Williams on the habits of this wasp are of interest. A wasp which was engaged in constructing its mud cells was observed, and its movements recorded as follows—

12.5′ 30″ p.m. gone for mud,
12.9′ 10″ p.m. returned,
12.10′ 15″ p.m. gone,
12.17′ 58″ p.m. returned,
12.19′ 20″ p.m. gone again,
12.22′ 20″ p.m. returned,
12.23′ 10″ p.m. gone.

At 12.37′ 45″ the wasp entered its nest and remained inside; 12.38′ 50″ the wasp flew away, and on inspection the nest was found to contain a spider (Fam. *Argiopidae—Gasteracanthinae*) with an egg on dorsal surface of abdomen. This spider was eventually removed by myself. At 12.51′ 15″ the wasp returned with another spider, and went away 12.52′ 15″. At 4.10 p.m. the nest was almost completely closed. The egg of this species is sausage-shaped and slightly curved, dull yellowish white in colour, with small almost transparent areas towards each end; length 3·4 mm. Young larvae when first hatched out are almost 4 mm. in length. They soon attach themselves to a spider, which they proceed to consume, leaving only the legs. Development is completed in about two weeks. The larva then commences to spin its cocoon, which occupies several days. The cocoon is dark brown in

colour, and of a papery consistency, easily broken. Pupation lasts a little over a week, and the adult wasp then bites its way out through the mud wall of the nest, leaving a neat circular hole. The small green metallic bee, *Euglossa cordata*, L., often utilises these disused cells for its nest. A fungus occasionally destroys the stored spiders and finally the young larvae. No actual parasite of the species has been observed up to the present. It appears, however, that only about 60 % of the stored cells produce an adult wasp.

S. figulus, Dahlb. Closely allied to the above species, and with similar habits and distribution, though not so numerous.

Genus Sphex, L.

S. ichneumoneus, L. A common and widely distributed species throughout the Colony. For its subterranean nests it usually chooses a dry piece of soil, often in the centre of a path or other places where people are frequently passing. While constructing the initial excavation for its nest it is a most conspicuous object, moving rapidly about on the surface of the soil. The following observations made by Mr. C. B. Williams are of interest. "In this instance the insect was boring into soft pegass soil on swampy land at the foot of a hill. High spring tides from the river invariably cover the land. The burrow was commenced about 1.40 p.m., and at 1.45 p.m. it was about ½ inch deep. At 2.19 the wasp entered the hole backwards, remaining below a few minutes, and then came out again. Burrowing continued till 4 p.m. These nests are stored with four or five short-winged grasshoppers, either nymphs or brachypterous species; the nest is not closed up between the insertion of each grasshopper."

Sphex (*Isodontia*) *costipennis*, Spin. Issororo, N.W.D.

S. (*Harpactopus*) *thomae*, F. An uncommon species which does not occur on the coast lands. Constructs burrows in soil and stores them with a single grasshopper, which is placed head first in the nest. The egg is attached at the base of the grasshopper's hind-leg (C. B. Williams).

Genus Podium, F.

P. denticulatum, Sm. An uncommon though widely distributed species.

Subfamily *PHILANTHINAE.*

Genus Cerceris, Latr.

C. (*Trachypus*) *mexicanus*, Cameron. An uncommon species. Taken while emerging from its burrow in sandy soil at the base of a tree. Plantation Bath, Berbice.

Subfamily *BEMBICINAE.*

Genus Bembidula, Burm.

B. discisa, Tasch. Upper Demerara River.
B. variegata, Ol. Upper Demerara River.

Genus Monedula, Latr.

M. pantherina, Handl. A fairly common species in some parts of the interior, especially where sandy soils exist. It is quite the largest and fiercest of these insects to be found in the Colony. Its burrows are stored with *Tabanidae.*

M. punctata, Lep. An uncommon species in the interior.

M. signata, Latr. The commonest and most widely distributed Bembex in British Guiana. It may frequently be seen about mules and cattle in the pastures waiting to carry off the Tabanidae which are always present about these animals. Their burrows may be seen in sandy soil, and usually occur in colonies of twenty or thirty. A large species of Bombyliid fly may be seen about these burrows, occasionally entering them. Its exact relationship to the wasp has never been actually traced, but it is quite possibly parasitic. The fly belongs to the genus *Anthrax.*

Subfamily *GORYTINAE.*

Genus Gorytes, Latr.

G. brasiliensis, Shuck. Rockstone, Essequebo River.

Subfamily *LARRINAE.*

Genus Tachytes, Panzer.

T. ametina, Cameron. Rockstone, Essequebo River.

Genus Larra, Fab.

L. rubricata, Smith. Rockstone, Essequebo River.

Subfamily *TRYPOXYLINAE.*

Genus TRYPOXYLON, Latr.

T. palliditarse, Sauss. A fairly common species on the coast lands.

T. fugax, F. This insect has been bred from the disused cells of *Eumenes canaliculata*, Ol. It is of fairly common occurrence.

T. brevicarinatum, Cameron. A common and widely distributed species all over the Colony. It usually constructs its nest of mud cells beneath a palm leaf. Sometimes as many as twenty-five cylindrical cells are found cemented together. The largest cells are nearly an inch in length and about $\frac{1}{4}$ of an inch in diameter. Small spiders are stored up by this species.

T. albitarse, F. Bred from a large-sized rounded mud nest. Potaro River.

T. nitidum, Sm. Issororo, N.W.D.

T. cinereum, Cameron. The habits of this species have been observed by Mr. C. B. Williams. "An elongate mud cell was constructed by one of these wasps in the angle of the woodwork of a door. When making these nests a 'ball' of mud is collected and applied to the side of the nest, gradually drawing it downwards as it adheres. A shrill buzzing sound is emitted the whole time. Thirty seconds to one minute are occupied in applying one 'ball' of mud. Spiders are stored."

Family TRIGONALIDAE

Genus TRIGONALYS, Westw.

T. melanoleuca, Westwood. A number of these insects emerged from the pupae of the Noctuid moth *Amyna octo*, Guen., which had been taken from just beneath the surface of the soil on a sugar estate.

Family CHRYSIDIDAE

Subfamily *CHRYSIDINAE.*

Genus CHRYSIS, L.

C. punctatissima, Spin. A common species on the coast lands.

C. distinctissima, Dahlb. Bartica, Essequebo River.

C. parvula, F. East Coast, Demerara.

Family BRACONIDAE.

Subfamily *CHELONINAE.*

Genus Fornicia, Brullé.

F. clathrata, Brullé. A larval parasite of the Limacodid moth, *Sibine fusca*, Stoll. This is a very abundant moth on the coast lands and attacks a large variety of economic plants. The parasite emerges before the larva is half developed. The percentage of parasitism is never very high.

Subfamily *BRACONINAE.*

Genus Lasiophorus, Hal.

L. fortispinus, Cameron. A fairly common species on the coast lands.

Genus Iphiaulax, Forster.

I. medianus, Cameron. This is the well-known parasite of the several species of *Diatraea* (Lepidoptera) which bore into sugar-cane in British Guiana. The species is a common one, it being an easy matter to capture either sex in the cane-fields. The life-history of the species has been observed in the field by Mr. Harold Moore, and the following is his own description : *—" On the morning of the 12th, in a field at Non Pareil, I noticed a female alight near the top of a cane-stump, run down the shoot, tapping it the while with her antennae, till she got to a *Diatraea* hole near the base. Into the tunnel she began pushing her ovipositor, when a slight movement on my part, in an endeavour to obtain a closer view of the proceedings, disturbed her. Off she flew, but merely to wheel round and alight again on the shoot, when she found the hole the same way, and began inserting her ovipositor. I lay prostrate on the trash bank, as motionless as possible, and watched. It was 9.28 a.m. Soon after her ovipositor had been inserted she gave a slight quick backward jerk with her abdomen, showing she had evidently felt something. Back down went her abdomen and again a similar jerk. This occurred three or four times, after which she kept quite still for several minutes, her ovipositor being well in the caterpillar's tunnel. She withdrew her ovipositor at 9.38, thus occupying about ten minutes in parasitising the caterpillar, of the presence of which I had no doubt.

* Published in the " Daily Argosy," Demerara, March 1913.

I cut out the cane-shoot and took it home. I could not examine it till next morning (13th), when I found it contained a caterpillar, and in the same tunnel with it was the egg of the parasite. It is about 3 mm. by about 1 mm. at the widest part—whitish, translucent, firm or leathery—narrow, elongated, tapering to a long point posteriorly, where there is a small curved blackish hook. The hook at the end is evidently for the purpose of keeping the egg in place. From the above it seems that the caterpillar is paralysed by the parasite at the time of oviposition. From observations made on previous occasions, however, it would appear that paralysis does not, or at least does not always, occur immediately, but comes on gradually. The firm texture of the egg prevents it from being injured should the caterpillar happen to wriggle against it. At 3.30 p.m. on the same day (13th) I observed that the egg had hatched and that the young larva was peacefully feeding, attached to the side of the ninth segment of the caterpillar. It had probably hatched during the forenoon. The egg-period is therefore very short—about one day. On the morning of the sixteenth the caterpillar was dead, almost the whole posterior half having been devoured by the parasite larva. By the morning of the 17th the parasite larva had completely devoured the caterpillar, and was spinning a cocoon in order to pupate. The larval period, too, is very short—about four days. The shortness of both the egg and larval stages can be very readily understood, when it is remembered that the larva requires fresh food, and has only a single caterpillar on which to feed. It of necessity therefore has to get through it rapidly, before extreme decomposition is reached, and do all its growing in that short time. The larva pupated at the angle between the shoot and the glass jar. It left the tunnel, probably on account of the latter shrinking through drying of the shoot. From other observations I know that the larval period is sometimes certainly a week. On the morning of the 31st the perfect insect emerged. Pupal period therefore about fourteen days. Time from egg-laying to adult is therefore about nineteen days." The cocoon is transparent and constructed of closely woven silk, giving a membranous appearance. In shape cylindrical, blunted at both ends. Colour whitish. Length 2·1 cm., diameter ·4 cm.

I. obscuricarinatus, Cameron. Issororo, N.W.D.

Subfamily *RHOGADINAE.*

Genus Megarhogas, Szep.

M. fuscipalpis, Cam. Rockstone, Essequebo River.

Subfamily *AGATHINAE.*

Genus Spilomicrodus, Cam.

S. nigriceps, Cam. Bartica, Essequebo River.

Family CHALCIDIDAE.

Subfamily *TRICHOGRAMMATINAE.*

Genus Trichogramma, Westw.

T. minutum, Riley. This well-known parasite is of common occurrence in the Colony as an egg-parasite of the Cane Borers (*Diatraea*) and several other species of Lepidoptera. Its life-history and habits when parasitising the ova of *Diatraea* have been fully worked out by myself and published in the Journal of the Board of Agriculture, British Guiana, vol. vi, No. 4.

Subfamily *CHALCIDINAE.*

Genus Chalcis, F.

C. pandora, Cwfd. Bred from the pupa case of a species of Hesperid (sp. indet.) butterfly feeding on cane blades. An uncommon species.

C. annulata, F. A common parasite of *Brassolis sophorae*, L. (*Lepidoptera*) and also *Caligo ilioneus ilioneus*, Cramer (*Lepidoptera*). It is widely distributed and the commonest Chalcid in the Colony.

Genus Smicra, Spin.

S. fulvomaculata, Cam. Bred from the pupa of a Hesperid butterfly (sp. indet.). An uncommon species.

Family EVANIIDAE.

Subfamily *EVANIINAE.*

Genus Evania, F.

E. erythraspis, Cameron. Issororo, N.W.D.

E. appendigaster, L. This insect emerged from a large box containing a quantity of seed rice packed in bags. Innumerable Blattid egg-cases (*Periplaneta americana* L.), as well as adult insects, were in the box.

NOTICE TO BINDER

Sketch Map facing p. 164, Part I, to face p. 321, Parts II–IV.