

Wasps and Bees in the Raffles Museum, Singapore

By CEDRIC DOVER

I. Wasps.

My examination of the *Vespidæ* in the collections of the Raffles Museum has resulted in nothing of outstanding interest but a list of the species will be useful as most of the locality records are new¹. The collection is a representative one of the commoner species and indicates the paucity of our knowledge of the Malayan *Vespidæ*. As an incentive to further work I have added an annotated bibliography: the classification adopted is that of Bequaert (1918) and it will be noted that many nomenclatorial changes have taken place since the publication of Bingham's volume in the "Fauna of British India" series.

Family *Vespidæ*

Sub-family ZETHINÆ

Genus *Labus* Saussure

1. *Labus exigua* Sauss. Dover, 1925, p. 291; *Labus humbertianus* Sauss. Bingham, 1897, p. 349; *Eumenes exigua* Sauss. Bingham, 1897, p. 348.

Singapore Island.

Attention is drawn to the absence of the genus *Zethus* in the collection.

Sub-family EUMENINÆ

Genus *Eumenes* Latreille.

2. *Eumenes architectus* Smith, Bingham, 1897, p. 339.

Singapore Island.

3. *Eumenes coarctatus punctatus* Sauss., Dover, 1925, p. 291; *Eumenes punctata* Sauss., Bingham, 1897, p. 339.

Singapore Island; Sarawak, Borneo.

I have expressed doubt (*loc. cit.*) as to the validity of Bingham's Tenasserim record, but the above localities show that it is obviously correct.

¹ These accounts of the wasps and bees in the Raffles Museum, Singapore, S. S. were written by Mr. Dover early in 1926. The material they deal with has since been transferred to the Selangor Museum, Kuala Lumpur, F. M. S.—C. Boden Kloss.

4. *Eumenes maxillosus* var. *petiolatus* Fabr., Dover and Rao, 1922, p. 237; Dover, 1925, p. 295; *Eumenes petiolata* Fabr., Bingham, 1897, p. 341.

Pegu, Burma.

5. *Eumenes maxillosus* var. *circinalis* Fabr., Dover, 1925, p. 295; *Eumenes circinalis* Fabr., Bingham, 1897, p. 340.

Singapore Island; Selangor; Tebing Tinggi, Kelantan; Kuala Tembeling, Pahang; Gurun, Kedah; Matang, Sarawak.

6. *Eumenes caffer* var. *esuriens* Fabr., Dover, 1925, p. 295; *Eumenes esuriens* Fabr., Bingham, 1897, p. 342.

Singapore Island.

7. *Eumenes caffer* var. *gracilis* Sauss., Dover, 1925, p. 295; *Eumenes gracilis* Sauss., Bingham, 1897, p. 343.

Singapore Island; Tebing Tinggi, Kelantan; Rangoon, Burma.

8. *Eumenes arcuata* Fabr., Dover, 1925, p. 296, fig. 6.

Singapore Island: Lubok Tamang, Pahang, 3,500 feet; Kedah Peak, Kedah, 3,200 feet; Matang and Lundu, Sarawak; Mount Ophir, Johore; New Guinea.

Genus *Pareumenes* Saussure

9. *Pareumenes depressa* Sauss., Dover, 1925, p. 296, *Eumenes depressa* Sauss., Bingham, 1897, p. 337.

Baram River, Sarawak.

Genus *Odynerus* Latreille

10. *Odynerus* (*Rygchium*) *hæmorrhoidalis* Fabr., Dover, 1925, p. 298, *Rhynchium hæmorrhoidale* Fabr., Bingham, 1897, p. 354.

Singapore Island and Pulau Ubin; Mount Ophir, Johore; Lundu, Sarawak.

Bequaert (1918) regards *Rhynchium* Sauss. (= *Rygchium* Spinola, which has priority), as a sub-genus of *Odynerus*, and this arrangement is now generally accepted.

11. *Odynerus* (*R.*) *mellyi* Sauss., Bingham, 1897, p. 356.

Rangoon, Burma.

12. *Odynerus* (*R.*) *argentatum* Fabr., Dover, 1925, p. 297; *Rhynchium argentatum* Fabr., Bingham, 1897, p. 358.

Singapore Island; Kota Tinggi and Gunong Pulai, Johore; Gurun, Kedah; Ronpibun, Peninsular Siam.

13. *Odynerus* (*s.s.*) *confluentus* Smith, Bingham, 1897, p. 367; Meade-Waldo, 1910, p. 100.

Baram River, Sarawak.

14. *Odynerus fragilis* Smith, Bingham, 1897, p. 367.

Singapore Island.

15. *Odynerus multipictus* Smith, Bingham, 1897, p. 368.

Singapore Island; Gurun, Kedah.

16. *Odynerus bipustulatus* Sauss., Bingham, 1897, p. 369.

Singapore Island.

17. *Odynerus guttatus* Smith, Dover, 1925, p. 298.

Singapore Island.

Sub-family STENOGASTRINÆ

Genus *Stenogaster* Guerin

18. *Stenogaster micans* Smith, Bingham, 1897, p. 378; *Ischnogaster fulvipennis* Cam., Journ. Str. Br. Roy. As. Soc., No. 37, p. 106, 1902.

Singapore Island; Kuala Teku, Pahang, 500—700 feet; Gunong Angsi, Negri Sembilan, 2,000—2,900 feet; Gurun, Kedah; Nakon Sri Tamarat, Peninsular Siam; Baram River, Sarawak.

Following Bequaert (1918) I have sunk *Ischnogaster Guerin*, in favour of the same author's *Stenogaster*, and have discussed the question in my first paper (Dover and Rao, 1922, p. 235). Cameron's *I. fulvipennis* is without any doubt a synonym of this species.

19. *Stenogaster fraterna* Bingham, 1897, p. 378; Dover, 1925, p. 301.

Mount Ophir, Johore; Bukit Kutu, Selangor; Maxwell's Hill, Perak, 3,800 feet. There is also a specimen of the var. *scitula* Bingham, from the Khasi Hills, Assam.

20. *Stenogaster nigrifrons* Smith, Bingham, 1897, p. 397; Dover and Rao, 1922, p. 241.

Singapore Island; Pulau Bulang.

21. *Stenogaster flavolineata* Cam., Journ. Str. Br. Roy. As. Soc., No. 37, p. 108, 1902.

Kota Tinggi, Johore; Maxwell's Hill, Perak, 3,800 feet.

22. *Stenogaster nitidipennis* Sauss., Bingham, 1897, p. 380. Singapore Island.

It might be noted that the locality "Cayenne" recorded by Bingham with a query, is certainly erroneous.

Sub-family EPIPONINÆ

Genus *Polybia* Lepel

23. *Polybia orientalis* Sauss., Bingham, 1897, p. 383; Meade-Waldo, 1911, p. 108, 1914 B, p. 406; Dover and Rao, 1922, p. 243; *Icaria singaporensis* Cam., 1904, p. 120.

Singapore Island; Kota Tinggi, Johore; Gurun, Kedah.

I have examined the type of *Icaria singaporensis* Cam. in the Raffles Museum and it is certainly the same as *Polybia orientalis* Sauss.

24. *Polybia indica* Sauss., Bingham, 1897, p. 384.

Pegu Hills, Burma.

25. *Polybia sumatrensis* Sauss., Bingham, 1897, p. 385; Meade-Waldo, 1911, p. 108.

Lubok Tamang, Pahang, 3,500 feet; Jor, Batang Padang, Perak; Maxwell's Hill, Perak, 3,570 feet; Kedah Peak, 3,200 feet; Gunong Kledang, Perak, 2,646 feet; Gunong Angsi, Negri Sembilan, 2,060—2,200 feet; Bukit Kutu, Selangor; Semangko Pass, Selangor—Pahang, 2,700 feet; Kuala Teku, Pahang, 530—570 feet; Pulo Adang, Peninsular Siam; Penang Hill, 2,500 feet; Mount Poe, Sarawak.

In a long series the absence of specimens from Singapore is noteworthy.

Sub-family ROPALIDINÆ

Genus *Ropalidia* Guerin

26. *Ropalidia ferruginea* Fabr., Dover and Rao, 1922, p. 244; *Icaria ferruginea* Fabr., Bingham, 1897, p. 387.

Common all over Singapore. Reasons for sinking *Icaria* Saussure, as a synonym of *Ropalidia* Guerin, are given by Bequaert, 1918, p. 244.

27. *Ropalidia guttatipennis* Sauss., Bingham, 1897, p. 387. Singapore Island.

28. *Ropalidia variegata* Smith, Dover and Rao, 1922, p. 244; *Icaria variegata* Smith, Bingham, 1897, p. 388.

Common all over Singapore; Kota Tinggi, Johore; Tras, Pahang.

29. *Ropalidia speciosa* Sauss., Bingham, 1897, p. 390 (*Icaria*); Meade-Waldo, 1914, B, p. 406 (*Icaria*).

Singapore Island; Bukit Kutu, Selangor, 3,457 feet; Kota Tinggi, Johore; Kuala Teku, Pahang, 510—700 feet, 3-12-1921, Gunong Angsi, Negri Sembilan, 2,000—2,700 feet; Lubok Tamang, Lipis District, Pahang, 3,500 feet, 23-6-1923, F. N. C.; Mount Ophir, Johore; Gunong Kledang, Perak, 2,646; Maxwell's Hill, Perak, 2,150 feet; Kedah Peak, 3,200 feet; Khao Ronpibun, Peninsular Siam, 2-3-1922; Khao Ram, Peninsular Siam, 750—1,200 feet, 23-11-1922; Baram River, Sarawak.

The type of Cameron's *Icaria rufinoda* from Singapore in the Raffles Museum is undoubtedly the same as *Ropalidia speciosa* as Meade-Waldo supposed.

30. *Ropalidia aristocratica* Sauss., Bingham, 1897, p. 391 (*Icaria*).

Singapore Island.

Genus *Paraicaria* Grib

31. *Paraicaria bicolor* Grib.; Bingham, 1897, p. 392.

Singapore Island.

Sub-family POLISTINÆ

Genus *Polistes* Latreille

32. *Polistes marginalis* var. *stigma* Fabr., Dalla Torre, 1904, p. 70; *Polistes stigma* Fabr., Bingham, 1897, p. 396.

Singapore Island; Mount Ophir, and Kota Tinggi, Johore; Tebing Tinggi, Kelantan; Nakon Sri Tamarat and Khao Ronpibun, Peninsular Siam.

33. *Polistes maculipennis* Sauss., Bingham, 1897, p. 396.

Singapore Island.

34. *Polistes hebraeus* Fabr., Dover, 1925, p. 303; Gunong Tahan, Pahang, 5,550 feet.

There are two specimens of the variety *macensis* from Singapore and Rangoon.

34. *Polistes sagittarius* Sauss., Bingham, 1897, p. 395.
Singapore Island; Mount Ophir, Johore, 2-8-1905; Kedah Peak, 3,200 feet; Gunong Tahan, Pahang; Ronpibun, Peninsular Siam.

35. *Polistes sagittarius* Sauss., Bingham, 1897, p. 395.
Singapore Island; Mount Ophir, Johore, 2-8-1905; Kedah Peak, 3,200 feet; Gunong Tahan, Pahang; Ronpibun, Peninsular Siam.

Sub-family VESPINÆ

Genus *Vespa* Linn.

36. *Vespa dorylloides* Sauss., Bingham, 1897, p. 400.

Gunong Kledang, Perak, 2,646 feet; Kuala Tahan and Gunong Tahan, Pahang; Bukit Kutu, Selangor, 3,457 feet; "Johore"; Gunong Tamabo, Sarawak.

I am unable to give references to Du Buysson's monograph (1904) as it is not obtainable locally, but this work should be consulted if possible.

37. *Vespa cineta* Fabr., Bingham, 1897, p. 402.

This species is common all over the Indo-Malaysian areas. It is the commonest species of the genus in Singapore.

38. *Vespa basillis* Smith, Bingham, 1897, p. 403.

Khao Ram, Peninsular Siam, 750—1,200 feet.

39. *Vespa auraria* Smith, Bingham, 1897, p. 407.

Lubok Tamang, 3,500 feet, and summit of Gunong Berumban, 6,050 feet, Pahang.

40. *Vespa tyrannica* Smith, Bingham, 1897, p. 66.

Singapore Island.

This species was identified by Meade-Waldo by comparison with the type, but if I had not seen his label I would have been very much inclined to place it under *V. velutina* Lepel, going according to Bingham's description of the latter. *V. tyrannica* is known, I think, only from Singapore.

41. *Vespa annulata* Smith, Dalla Torre, 1904, p. 64.

Singapore Island; Bukit Kutu, Selangor, 3,457 feet; Gunong Angsi, 2,000 2,790 feet; Semangko Pass, Selangor—Pahang, 2,700 feet; Kota Tinggi, Johore; Kuala Teku, Pahang, 550—700 feet; Gurun, Kedah; Tras, Pahang; Gunong Tamabo and Mount Poe, Sarawak.

BIBLIOGRAPHY

The following is a complete list of papers since 1904 and up to 1925 on Malayan, Bornean, Sumatran and Javanese *Vespidæ*. Though stray papers on Indian species are not recorded, the list has been so compiled as to contain practically all that is necessary for the student of Malayan wasps. Biological references are listed separately. It will be observed that the biology of no Malayan wasp has been studied thoroughly.

Systematic

1897. Bingham, C. T.: The Fauna of British India including Ceylon and Burma. *Hymenoptera*, I. (An indispensable work).
1903. Cameron, P.: Descriptions of new genera and species of *Hymenoptera* taken by Mr. Robert Shelford at Sarawak, Borneo—Journ. Straits Branch Roy. As. Soc. Ni. 39, pp. 89—181. (Missed out of Dalla Torre's list. Describes *Icaria malayana*, *I. maculifrons*, *Ischnogaster fuscipes*, *Montezumia flavobaltea*, *Odynerus rugifrons*, *O. carinicornis*, *O. robertianus*, *Rhynchium matangense*, *Zethus rufofemoratus*, spp. nov.).
1904. Dalla Torre, K. W. von.: *Hymenoptera*, fam. *Vespidæ*, in Wyssman's Genera Insectorum, Fasc. xix, Bruxelles. (Lists all the known species till 1904).
1904. Cameron, P.: On some *Hymenoptera* from the Raffles Museum, Singapore—Journ. Str. B. Roy. As. Soc. No. 41, pp. 110—122.
1904. Buysson, R. Du: Monographies des Guepes ou *Vespa*—Ann. Soc. Ent. France, pp. 485—556, 565—633, pls. V—X. (An important work).
1905. Buysson, R. Du: Descriptions d'Hymenopteres nouveaux—Bull. Soc. Ent. France, pp. 281—282. (*Ischnogaster serrei*, Batavia, *I. striatulus*, Sumatra, spp. nov.).
1905. Cameron, P.: On the Malay Fossorial *Hymenoptera* and *Vespidæ* of the Museum of R. Zool. Soc. "Natura artis magistra" at Amsterdam—Tijdschr. Ent., xviii, pp. 48—78. (*Icaria intermedia*, *I. rugoplagiata*, *I. bilineata*, *Odynerus drescheri*, *Polistes varicornis*, *P. javanicus*, Java, spp. nov.).
1905. Cameron, P.: A third Contribution to the Knowledge of the *Hymenoptera* of Sarawak—Journ. Straits Branch Roy. As. Soc. No. 44, pp. 93—168. (*Odynerus kuchingensis*, *O. matangensis*, spp. nov.).

1906. Cameron, P.: A fourth Contribution to the Knowledge of the Hymenoptera of Sarawak—op. cit., No. 46, pp. 103—123. (*Ischnogaster clypealis*, sp. nov.).
1906. Bingham, C. T.: Report on the Aculeate Hymenoptera—Fasciculi Malayenses, Zoology, III, pp. 19-60, pi. A.
1907. Cameron, P.: A Contribution to the Knowledge of the Hymenoptera of the Oriental Region—Ann. Mag. Nat. Hist. (7), XX, pp. 81—92. (*Odynerus hewitti*, *O. heterospilus*, Borneo, spp. nov.).
1907. Cameron, P.: Descriptions of New species of Hymenoptera from Borneo—Journ. Str. Br. Roy. As. Soc., No. 48, pp. 1—26. (*Icaria parvimaculata*, sp. nov.).
1908. Cameron, P.: On Some undescribed *Vespidæ* from Borneo—Deuts. Ent. Zeits., pp. 561—565. (*Icaria erythrospila*, *I. ornatipes*, *I. curvilineata*, *Odynerus brooksii*, *O. santubongensis*, spp. nov.).
1908. Buysson, R. Du: Deux Hyméoptères nouveaux de Java—Leiden, Notes Mus., 39, pp. 123—126. (*Icaria jacobsoni*, Batavia, sp. nov.).
1909. Buysson, R. Du: Monographie des Vespides du genre *Belanogaster*—Ann. Soc. Ent. France, 78, pp. 199—270, pls. II—VII. (A revision of the genus).
1909. Cameron, P.: On a new species of *Zethus* (*Eumenidæ*) from Borneo—Entom., 42, p. 206. (*Z. eichellsii*, sp. nov.).
- 1910A. Meade-Waldo, G.: New Species of *Diploptera* in the collection of the British Museum—Ann. Mag. Nat. Hist. (8), V, pp. 30—51. (*Montezumia wallacei*, Sumatra, sp. nov.).
- 1910B. Meade-Waldo, G.: New Species of *Diploptera* in the collection of the British Museum—Ann. Mag. Nat. Hist. (8), VI, pp. 100—110. (*Odynerus moultoni*, Sarawak, sp. nov. *O. hyades* Cam. = *O. confluentus* Sm., *O. cilicius* Cam. = *O. latipennis* Sm.).
1911. Meade-Waldo, G.: New Species of *Diploptera* in the collection of the British Museum—Ann. Mag. Nat. Hist. (8), VII, pp. 98—113. (*Icaria flavobilineata* Cam. to *Polistes*, *Icaria sulcisculis* Cam. et *I. rubriscutis* Cam. M. S. = *Polybia Sumatrensis* Sauss., *I. fuscipennis* Cam. = *Polybia orientalis* Sauss.).
1913. Schulthess, A. V.: Vespiden aus dem Stockholmer Museum—Ark. Zool. Stockholm, 8, No. 17. (*Odynerus aurivillianus*, Philippines, Sumatra, sp. nov.).

1913. Schulthess, A. V.: *Parapolybia* Saussure, *Vespidæ* sociales Bern. Mitt. Schweiz. ent. Ges., 12, pp. 152—164, pl. XI, XIa (*P. Mcadeana*, Borneo, sp. nov.).
1913. Buysson, R. Du: Sur deux Vespides de Java—Bull. Mus. Paris, pp. 436—437. (*Ischnogaster jacobsoni*, Java, sp. nov.).
- 1914A. Meade-Waldo, G.: Notes on the Hymenoptera in the collection of the British Museum with descriptions of New Species—Ann. Mag. Nat. Hist. (8), XIV, pp. 450—464. (*Ischnogaster levifoveatus*, Borneo, sp. nov.; various records of species of *Ischnogaster* from Borneo and Straits Settlements).
- 1914B. Meade-Waldo, G.: Notes and synonymy of Hymenoptera in the collection of the British Museum—Ann. Mag. Nat. Hist. (8), XIV, pp. 402—407. (*Zethus erythrostromus* Cam. = *Calligaster cyanopterus* Sauss., *Zethus rufofemoratus* Cam. = *Montezumia pulchella* Sm., *Odynerus kuchingensis* Cam. = *O. drescheri* Cam., *O. santubongensis* Cam. = *O. megaspilus* Cam., *Icaria rufinoda* Cam. = *I. speciosa* Sm. Also synonymy of *Polybia trientalis* Sauss.).
1918. Bequaert, J.: A Revision of the *Vespidæ* of the Belgian Congo based on the collection of the American Museum Congo Expedition with a list of the Ethiopian Diplopterous Wasps—Bull. Amer. Mus. Nat. Hist., IX, pp. 1—384, pls. I—VI. (Though not strictly necessary for the student of Malayan Hymenoptera this is an ideal work, containing remarks on classification, taxonomic characters, distribution, excellent descriptions, life-history notes, etc., and every student of the Hymenoptera should endeavour to study it).
1922. Dover, C.: Resumé of Recent Progress in our knowledge of the Indian Wasps and Bees—Journ. As. Soc. Beng. (n.s.) XVIII, pp. 17—23. (Indicates all the important literature on Indian *Vespidæ*, etc.).
1922. Dover C. and Rao, H. S.: A note on the Diplopterous Wasps in the collection of the Indian Museum—Journ. As. Soc. Beng. (n.s.) XVIII, pp. 235—249. (*Stenogaster sarawakensis*, *S. bicarinata* Sarawak, spp. nov. Many locality records and life-history notes).
1925. Dover, C.: Further notes on the Indian Diplopterous Wasps—Journ. As. Soc. Beng. (n.s.) XX, pp. 289—305. (Many notes on synonymy which are not recapitulated as the paper is easily obtainable).

BIOLOGICAL

In my two papers in 1922 most of the literature on the biology of Indian Wasps is indicated. See also Gravely, Rec. Ind. Mus., XI, XXVIII, p. 960, 1921 (insect-eating habits of *Vespa cincta*); Khare, J. B. N. H. S., XXIX, p. 304, 1923 (*Eumenes conica* nest); Chopra, J. B. N. H. S., XXX, p. 858, 1925 (*Vespa cincta* nest).

II. BEES.

(With a note on the Honey Bees in the Federated Malay States Museums.)

In this paper is given a complete list of the bees in the Raffles Museum, except for some thirty specimens in indifferent condition and obscure species which it is impossible to identify in the absence of a good reference collection; new species are described. It will be seen that the collection does not represent even a fair proportion of the rich Apid-fauna of the Malay Peninsula, several common genera such as *Halictus*, *Prosopis*, *Nomioides*, *Sphcodes*, etc., being absent.

With so large a group it is practically impossible to provide a really useful bibliography, as I have attempted to do for the Vespidae: the principal literature may, however, be indicated. The most useful work is still Bingham's first volume on *Hymenoptera* in the "Fauna of British India" series and the literature on Indian *Hymenoptera* has been listed by Ramakrishna Aiyar in *Journ. Bomb. Nat. Hist. Soc.*, XXIV—XXV, 1916—1917, and surveyed by myself in *Journ. As. Soc. Beng.* (n.s.) XVIII, 1922. Cockerell's various papers in the *Annals and Magazine of Natural History*, and Meade-Waldo's papers in the same journal are practically indispensable, while Cameron's papers in *Journ. Straits Branch Roy. As. Soc.*, 1902 onwards should also be consulted. The honey-bees have been monographed by Buttel-Reepen (1906) and Enderlein (1906), the *Xylocopina* by Maidl (1912), the *Megachilina* by Friese in *Das Tierreich* (1911). Important contributions have also been made by Friese, Maidl and Strand, and these can always be listed from the *Zoological Record*.

Family Apidae

Sub-family ANDRENINÆ

Genus *Nomia* Latr.1. *Nomia terminata* Smith.

1897. *Nomia terminata* Sm., Bingham, Faun. Brit. Ind. Hym. I, p. 459, fig. 146.

1916. *Nomia terminata* Sm., Meade-Waldo, Ann. Mag. Nat. Hist. (8), XVII, p. 459.

1902. *Nomia robusta* Cam., Journ. Str. Br. Roy. As. Soc., 37, p. 114.

Gurun, Kedah; Maxwell's Hill, 4,500 ft., and Gunong Kledang, 2,646 ft., Perak; Santubong, 2,600 ft. and Kuching, Sarawak.

The Santubong specimen, though agreeing with the others in every particular, has only two cubital cells in the forewing, which, if it had been an unique specimen, would prevent its inclusion in the genus *Nomia*. *N. terminata* is not easily separated from *N. fuscipennis*, but I believe I am right in regarding Cameron's species (though his description is very poor) as a synonym of *N. terminata* and not of *N. fuscipennis*. It may be mentioned here that Meade-Waldo (*loc. cit.*) gives *Nomia bicarinata* Cam., as a synonym of *N. bidensis* Cam., doubtfully supposing *bicarinata* to be an M. S. name. In *Journ. Str. Br. Roy. As. Soc.*, 39, 1903, p. 177, Cameron describes a *Nomia* as *N. bicarmata*, which seems to be a misprint for *bicarinata*, the description also agreeing fairly well with that of *N. bidensis*.

2. *N. iridescens* Smith.

1897. *Nomia iridescens* Sm., Bingham, tom. cit., p. 452. Singapore Island.

3. *N. formosa* Smith.

1897. *Nomia formosa* Sm., Bingham, tom. cit., p. 451. Singapore Island; Kota Tinggi, Johore.

These specimens were labelled *N. iridescens* by Cameron, but that species is readily distinguished by the absence of a metallic blue band on the basal abdominal segment, which is present in the specimens before me. *N. formosa* is rather close to *N. curvipes*, but the enclosed space at the base of the median segment is closely punctured in the former and longitudinally striate in the latter. *N. curvipes* also apparently does not usually extend very much further than Burma, while *N. formosa* is found in the Malaysian Sub-region.

There is an interesting aberrational specimen from Seletar, Singapore Island, VIII, 1911, belonging I am sure to this species, which might be noted. It has the whole of the face distorted: the left eye is very much more curved than the right, its apex below not reaching as far as that of the right eye; the left antenna is also inserted nearer the inner orbital margin than the right, and the clypeus and the convex portion above it are very much misplaced. The second abdominal segment is apparently broader on the right side than on the left, and the segment is so constricted about the middle as to give it the appearance of being two

segments. The legs and tegulae are pale ferruginous and this, together with the fact that the enclosed space at the base of the median segment is not distinctly punctured but has an indefinite striated appearance, led me to believe that it may be a specimen of *N. curvipes*, but I do not think that this can be so.

Sub-family NOMADINÆ

Genus *Crocis* Jurine4. *C. smithii* Dalla Torre.

1924. *C. smithii* Dalla Torre, Dover, Ann. Nat. Hofmus. Wien. XXXVIII, p. 119.

Singapore Island; Pulau Ubin; Pulau Aor off E. coast of Johore; Kota Tinggi and Gunong Parali, Johore; Baram, Sarawak.

Bingham gives this form as a synonym of *C. emarginate* (tom. cit. p. 517), but it is constantly smaller and certainly distinct, at least variably.

Sub-family MEGACHILINÆ

Genus *Megachile* Latr.5. *M. tuberculata* Smith.

1897. *Megachile tuberculata* Sm., Bingham, tom. cit., p. 475. Perhentian Tinggi, Negri Sembilan; Baram River, Sarawak.

6. *M. atrata* Smith.

1897. *Megachile atrata* Sm., Bingham, tom. cit., p. 475. Singapore Island.

7. *M. conjuncta* Smith.

1897. *Megachile conjuncta* Sm., Bingham, tom. cit., p. 479. Singapore Island; Mt. Ophir, Johore; Tebing Tinggi, Kelantan; Ronpibun, Peninsular Siam.

8. *M. miniata* Bingham.

1896. *Megachile miniata* Bingham, Journ. Bomb. Nat. Hist. Soc. X, p. 199, pl. 1, fig. 6.

Bukit Kutu, IV.1915; Semangko Pass, 2,700 ft., III.1912; Perhentian Tinggi, 2.IV.1915; Gunong Angsi, Negri Sembilan, 2,000—2,290, IV.1918; Gunong Tamba, Long Kaliman, Lio Matu and Long Ayap, Baram River, Sarawak, X.1920.

The description of this beautiful insect agrees precisely with the specimens before me, but I have not been able to consult Friese's monograph, to see if it still stands as a distinct species. Mr. H. M. Pendlebury tells me, however, that in the British Museum it is placed as a synonym of *M. ornata* Smith.

Genus *Dianthidium* Ckll.9. *Dianthidium apice-pilosum* sp. nov.

Female: Head and thorax coarsely punctured with short pale ferruginous pubescence; clypeus ferruginous, finely punctured, roughly pentagonal, anterior margin transverse; mandibles dark ferruginous, blackish at apex; antennæ rufo-piceous, scape ferruginous; eyes light brown; mesonotum convex, with a medial longitudinal carina; scutellum not so coarsely punctured as the mesonotum, flat, overhanging the median segment, more or less lunate, broadly notched posteriorly, ferruginous, except for a triangular black marking in the middle anteriorly, margins posteriorly fringed with golden hairs; median segment considerably broader than long, very finely punctured with greyish, short, flat hairs arising from the punctures which covers the whole segment, except for a small finger-shaped area in the middle posteriorly which is smooth and shining and without hairs; abdomen finely and uniformly punctured, three basal segments brownish-black, more brown about the middle transversely, segments 4 and 5 more or less ferruginous with short pale golden pubescence, mixed with whitish on segment 5; segment 6 black, entirely covered with dense light grey hair, sides of segments 4 and 5 also with light grey hair; pollen brush ferruginous; anterior legs entirely dark ferruginous with short pale hairs, intermediate and posterior coxæ and femora, except for a dark stripe on the outside of the latter, dark ferruginous, tibiae and basitarsi black with erect black hairs, apex of tarsi ferruginous with ferruginous hairs; wings dark brown at base, apical half clear hyaline, slightly iridescent; tegulae dark ferruginous, very finely punctured, with a black spot in the middle.

Length: about 9mm.

Holotype from Khao Ram, Peninsular Siam, 750—1,200 ft., 24-11-1922 and one paratype from Gunong Angsi, Negri Sembilan, 2,000—2,790 ft., IV.1918 in the Raffles Museum. The paratype is a darker specimen than the holotype. This species is apparently closely allied to *Protoanthidium rufo-maculatum* Cam. (*Journ. Str. Br. Roy. As. Soc.*, No. 37, p. 127, 1902) resembling it markedly in the apical abdominal pubescence, the wings, the puncturation, etc., but the top of the head and thorax is not thickly covered with rufo-fulvous hair, the intermediate and posterior legs are not entirely black, and the front legs have practically no black markings on them.

Sub-family ANTHOPHORINÆ

Genus *Anthophora* Latr.10. *A. himalayensis* Rad.1897. *Anthophora himalayensis* Rad., Bingham, tom. cit., p. 532.1914. *Anthophora himalayensis* Rad., Meade-Waldo, Ann. Mag. Nat. Hist., (8), XIII, p. 57.

Gunong Angsi, Negri Sembilan, 2,000—2,700 ft.; Kuala Tahan, Pahang; Mt. Ophir, Johore.

11. *A. himalayensis* var. *pahangensis* M-W.1914. *Anthophora himalayensis* var. *pahangensis* Meade-Waldo, loc. cit., p. 58.Mt. Ophir, Johore, Kedah Peak, 3,200 ft.; Maxwell's Hill, Perak, 4,076 ft. Originally described from Gunong Tahan, Pahang, and doubtfully recorded from Mt. Ophir. The Mt. Ophir specimen mentioned by Meade-Waldo was one of the present series in the Raffles Museum, and there is no doubt that they belong to the variety *pahangensis*, though the typical form also occurs on Mt. Ophir. Meade-Waldo's variety is readily separated from the *forma typica* by the rufous pubescent fasciæ on tergites 1—3.12. *A. fulvohirta* M-W.1914. *Anthophora fulvohirta* Meade-Waldo, loc. cit., p. 51. Gunong Angsi, Negri Sembilan, 2,000—2,700 ft.; Kota Tinggi, Johore, Lundu, Sarawak. Meade-Waldo records it from Singapore, Kukub, S. W. Johore and Sandakan, Borneo.13. *A. hanitschi* M-W.1914. *Anthophora hanitschi* Meade-Waldo, loc. cit., p. 52.

The Raffles Museum has examples from the type-locality (Maxwell's Hill, 4,101 ft., Perak), and also from Mt. Ophir, Johore and Bukit Kutu, Selangor, 3,457 ft.

14. *A. zonata* Linn.1924. *Anthophora zonata* Linn., Dover, Entomologist, LVII, p. 228, figs.

Singapore Island; Gunong Angsi, 2,000—2,700 ft., Negri Sembilan; Tebing Tinggi, Kelantan; Gurun, Kedah; Kota Tinggi, Johore; Semangko Pass, Selangor-Pahang, 2,750 ft.; Bukit Kutu, Selangor; Kuala Tahan, Pahang.

The taxonomy of the blue-banded bees of the *Anthophora zonata* group is in a very confused state, and in my paper I attempted to provide a working basis for their study. In describing yet another form from Samar, Philippine Islands, as a sub-species of *A. whiteheadi*, which I regard as a

Philippine form of *A. walkeri*, Cockerell and Le Veque (*Philippine Journ. Sci.*, XXVII, p. 171, 1925) remark that it does not appear probable that the blue-banded bees can be reduced practically to three species, on the color of the thoracic pubescence, adding that my dissections prove that the various forms I regard as sub-species, show structural as well as other differences. I do not think, however, that these differences are any more than would normally occur in a sub-species, and the thoracic pubescence is certainly a convenient character for separating the species, even though it may not provide a sure guide to affinity. It may be, however, that *whiteheadi* is a distinct species as Cockerell and Le Veque have treated it, but it may also be noted that they say that "Dover's contention that *whiteheadi* and *cingulifera* are sub-species of one species may prove valid".

I believe that in *A. zonata* and its allies we have found a very ancient species at present undergoing constant and gradual change, and any attempt to provide more than a working classification seems to me to be futile without a very large series of specimens from all parts of their geographical range, and without extensive ecological and experimental observations. The group is certainly one of unusual interest among the Apidae, and would well repay a detailed study.

15. *A. cingulata andrewsi* Ckll.1924. *Anthophora cingulata andrewsi* Ckll., Dover, loc. cit., p. 229, figs.

In the Raffles Museum from the Baram River, Sarawak.

This is a very puzzling form intermediate between *zonata* and *cingulata*, and it is difficult to indicate its taxonomic position. The specimens before me agree in every particular with Cockerell's description, but it is closely allied to *A. zonata*. Indeed, many specimens of *zonata* approach this form very closely, the white hair in the posterior tibiae being lightly tinged with fulvous (typical *andrewsi* has distinctly fulvous hair on the posterior tibiae, with greenish yellow metallic bands on the abdomen and bright fulvous hair mixed with black on the thorax), and the thoracic hair being also very similar to that of *andrewsi*. There is a specimen from Tebing Tinggi, Kelantan, which is almost identical with the Bornean specimens before me, except that the abdominal bands have no trace of yellow, and in my note I have recorded it from Penang, Singapore, and even from Allahabad, India, though I am now a little doubtful of the latter locality. This form, therefore, cannot be a sub-species of *A. zonata* as it occurs in the same localities as that species, and it seems to me natural to regard it as the oriental race

of *A. cingulata*. We seem to have here a new species in the making, and further study will perhaps show that it should be regarded as specifically distinct.

16. *A. walkeri cingulifera* Ckll.

1924. *Anthophora walkeri cingulifera* Ckll., Dover, loc. cit., p. 231, figs.

One example from the Baram River, Sarawak, which is identical with the Indian examples of *cingulifera* that I have seen.

17. *A. borneensis* Ckll.

1924. *Anthophora (zonata) borneensis* Ckll., Dover, loc. cit., p. 230.

There are three specimens in the Raffles Museum from the Baram River, Sarawak (12-18.IX.20, J. C. M.), which I believe I am right in identifying as the *A. zonata borneensis* of Cockerell, previously known only from the Spitang River, N. W. Borneo. It agrees exactly with Cockerell's brief description in all the characters mentioned by him though it is a little difficult to decide, without specimens for comparison, exactly what is meant by "dull and rather greenish mixed with black, giving a general blackish effect" for the color of the thoracic hair. In the specimens before me the individual hairs of the thoracic pubescence are greyish and black, giving a general greenish black effect. The tegulae are of a dark, slightly lustrous, coppery color as mentioned by Cockerell. The tegulae of the specimen I have identified as *cingulifera* are more or less piceous without any coppery lustre.

Prof. Cockerell originally described this form as a sub-species of *zonata*, but recently (*Philipp. Journ. Sci.* 27, p. 171, 1925) says that it should be called *A. whiteheadi borneensis*, but I do not think it is a sub-species of any of these forms. It is more closely related to *walkeri* and *cingulifera* than any other form, but if it were to be placed as a sub-species of *walkeri* that would invalidate *cingulifera* as a sub-species of *walkeri*, as *cingulifera* apparently occurs in the same locality. Perhaps Prof. Cockerell is right and *cingulifera* is specifically distinct from *walkeri*, with *borneensis* as a sub-species, but I cannot help thinking that *cingulifera* and *walkeri* are specifically identical, and that *borneensis* is specifically distinct. It is certainly very different from the form *whiteheadi*. If we were to regard *cingulifera* as specifically distinct, *whiteheadi* would have to be regarded as a form of it.

Sub-family XYLOCOPINÆ

Genus *Xylocopa* Latr.

18. *X. fenestrata* var. *iridipennis* Lepel.

1925. *Xylocopa fenestrata* var. *iridipennis* Lep., Dover, Ann. Mag. Nat. Hist. (9), XV, p. 222.

Singapore Island; Maxwell's Hill, Perak, 1,200 ft. This and the form following are referred to by Bingham and by Maidl in his monograph of the genus (*Ann. Nat. Hofmus. Wien*, XXVI, 1912) as distinct species, but they are almost identical with *X. fenestrata* in structure, the main difference being in the color of the wings, which seems to indicate the specific identity of the three forms.

19. *X. fenestrata* var. *auripennis* Lepel.

1925. *Xylocopa fenestrata auripennis* Lep., Dover, loc. cit., p. 222.

Fort de Kock, Sumatra, 3,000 ft. (E. Jacobson). Labelled by its collector as *X. splendidipennis* Rits.

20. *X. collaris* Lepel.

1897. *Xylocopa collaris* Lep., Bingham, tom. cit., p. 543.

Singapore Island; Semangko Pass, Selangor—Pahang; Gunong Angsi, Negri Sembilan; Tebing Tinggi, Kelantan; Gurun, Kedah; Bukit Lantai, Negri Sembilan; Matang and Baram River, Sarawak; Pontianak, W. Borneo. In my paper (*loc. cit.*, p. 524) I have given a key to the Indian forms of *X. collaris*. Prof. Cockerell describes a Javan variety under the name *bryanti* in *Proc. U. S. Nat. Mus.* 55, p. 171, 1920, which is generally distinguished by the darker wings.

21. *X. caerulea* Fabr.

1897. *Xylocopa caerulea* Fabr., Bingham, tom. cit., p. 544.

Singapore Island; Pulau Ubin, near Singapore, Gunong Kledang, Perak; Gurun, Kedah; Kedah Peak, 3,200 ft.; Fort de Kock, Sumatra; Scenda, Java.

22. *X. aestuans* Linn.

1924. *Xylocopa aestuans* Linn., Dover, Trans. Ent. Soc. Lond., p. 144, bionomics, etc.

1925. *Xylocopa aestuans* Linn., Dover, Ann. Mag. Nat. Hist. (9), XV, p. 223.

Singapore Island; Pulau Ubin; Tebing Tinggi, Kelantan; Gurun, Kedah; Khao Ronpibun, and Nakawn Sri Tamarat, Peninsular Siam; Fort de Kock, Sumatra; Scenda, Java.

When I dealt with the bionomics of *X. astuans* and other Indian carpenter-bees I did not know of a paper by Girault, with a biological note by Roepke, (*Treubia*, I, 2, p. 54 and p. 60, 1919), in which two species of the Chalcid genus *Epanasomyia* from the nests of *X. carulea*, *astuans*, and *tenuiscapa* are described. Dr. Roepke notes that these parasites occur in enormous numbers, and the effect of parasitisation is very similar to what I have observed in India in *X. astuans*. Dr. Waterston referred the chalcids I collected to the family *Encyrtidae*, and is, I believe, about to describe them. It may be that Mr. Girault's species are closely allied to the parasites I collected. In connection with the biology of *X. astuans* it is interesting to note that Bhatia and Setna (*Parasitology*, XVI, p. 279, figs. 1-8, 1924) have described a new cephaline gregarinid under the name *Leidyana xylocopa*, which parasitises *X. astuans* in Lahore, India. A useful summary of our knowledge of the triungulins associated with carpenter-bees is given by C. T. Brues in *Zoologica*, V, No. 11, pp. 125-136, 1924.

In 1925 I indicated that the taxonomy of the yellow-haired carpenter-bees was in a very confused state, and that the name *confusa* Perez could not stand in place of *astuans*. A long series of specimens and a reference to the Linnean type of *X. astuans* would greatly facilitate the nomenclature of this carpenter-bee and its allies.

23. *X. tranquebarica* Fabr.

1897. *Xylocopa rufescens* Sm., Bingham, tom. cit., p. 543, fig. 182.
1922. *Xylocopa tranquebarica* Fabr., Dover, Rec. Ind. Mus., XXIV, p. 87.

There are eleven specimens from Singapore Island. This is a crepuscular species, apparently very local in habitat. Prof. Cockerell has pointed out that the name *tranquebarica* should be used for *rufescens*.

24. *X. latipes* Drury.

1897. *Xylocopa latipes* Drury, Bingham, tom. cit., p. 536.

Singapore Island, Pulau Ubin and Pulau Ayer Merbau near Singapore; Semangko Pass, Selangor-Pahang; Bukit Kutu, Selangor, 3,451 ft.; Pulau Tioman; Gunong Angsi, Negri Sembilan, 2,000 ft.; Tebing Tinggi, Kelantan; Gurun, Kedah; Gunong Kledang, Perak, 2,646 ft.; Lundu, Baram River and Saribas, Sarawak; Fort de Kock, 3,000 ft., Sumatra.

The females of the species are hard to separate from *X. tenuiscapa*. Maidl's monograph (*Ann. Nat. Hofmus. Wien*, XXVI, p. 294, 1912) should be consulted.

25. *X. malayana* Cam.

1901. *Xylocopa malayana* Cam., Proc. Zool. Soc. Lond., p. 32.
1903. *Xylocopa sarawakensis* Cam., Journ. Str. Br. Roy. As. Soc., No. 39, p. 180.

In the Raffles Museum from Matang, Sarawak; Bukit Kutu, Selangor, 3,457 ft.; Gunong Kledang, Perak; Kedah Peak, 3,000 ft.

Away from a type collection I find the synonymy of this species very confusing. Meade-Waldo (*A. M. N. H.* (8), XVII, p. 465, 1916, under *X. carulea* var. *viridis* M-W) mentions that *X. sarawakensis* is the same as *X. malayana*, but had previously published (*A. M. N. H.* (8), XVI, p. 454, 1914) *X. malayana* as a synonym of *X. flavonigrescens* Smith, while Prof. Cockerell (*Entomologist*, LI, p. 104, 1918) so far as I remember (the paper not being obtainable here) indicates that they are distinct. The specimens before me are large, with olive-green pubescence, the thoracic pubescence more green, the bases of the abdominal segments 3-6 each with two transverse tufts of white hair towards the sides. They agree precisely with Cameron's description of *sarawakensis*, but not with *malayana* and *flavonigrescens* in which the thoracic pubescence is described as bright yellow. Cameron was so indifferent a worker, however, that these differences may not exist in his types and *malayana* and *sarawakensis* are in all probability synonyms of *flavonigrescens*. It would be very useful if some worker at the British Museum would publish the definite synonymy of these species after examining the types. As far as I remember the species recorded by me as *flavonigrescens* in the Indian Museum (*Rec. Ind. Mus.* XXIV, p. 87, 1922) are nothing like the specimens before me now.

Sub-family BREMINÆ

Genus *Bremus* Jurine

26. *Bremus rufoflavus* Pendlebury.

1923. *Bombus rufoflavus* Pendlebury, Journ. F. M. S. Mus., XI, p. 66.

Summit of Gunong Berumban, 6,050 ft., and No. 4 Camp, 4,800 ft., "Cameron's Highlands", Pahang. Mr. Pendlebury places his species under the old genus *Bombus*, but most apidologists now accept the name *Bremus* Jurine, which has a year's priority, according to Morice and Durrant (*Trans. Ent. Soc. Lond.*, 1914, p. 428).

There is also a long series of a closely allied form, which Mr. Pendlebury tells me he is about to describe as new.

Sub-family MELIPONINÆ

Genus *Trigona* Jurine.27. *T. collina* Smith.1897. *Melipona collina* Sm., Bingham, tom. cit. p. 562.1923. *Trigona collina* Sm., Cockerell, Ann. Mag. Nat. Hist. (X), XII, p. 241.

Semangko Pass, 2,700 ft., Selangor-Pahang; Kedah Peak, 3,200 ft. Bingham's description is very poor, and without detailed descriptions Prof. Cockerell's excellent table of Malayan *Trigonas* (*loc. cit.*) is of little use in definitely determining the species. In the insects I have determined as *T. collina* it may be noted that the abdomen varies from being almost as long as broad to about twice as long as broad, but in all the specimens the segments are of a bright, polished brown color, except at the apices where they are darker and finely aciculate. The hind tibiae also are conspicuously paler than the rest of the legs.

28. *T. canifrons* Smith.1897. *Melipona canifrons* Sm., Bingham, tom. cit., p. 362.1923. *Trigona canifrons* Sm., Cockerell, *loc. cit.*, p. 241.

Two specimens from Singapore Island, agree in all particulars with the descriptions of this species.

29. *T. thoracica* Smith.1897. *Melipona thoracica* Sm., Bingham, tom. cit., p. 564.1923. *Trigona thoracica* Sm., Cockerell, *loc. cit.*, p. 240.

Three specimens from Singapore Island and Kuala Tahan, Pahang.

30. *T. kusutkana* sp. nov.

Female or worker: A dark brownish species. Head and thorax indefinitely and inconspicuously punctured, almost opaque and smooth, with erect brownish black hairs arising from the punctures, the hairs longest on the vertex, the anterior margin of the mesonotum and sides of the thorax and the scutellum anteriorly; face with fine pale ferruginous pubescence, mixed on the clypeus with a few erect black hairs; antennæ ferruginous, outer side of scape and flagellum considerably darker, apical joint brown, first joint of the flagellum a little shorter than the second, the second a trifle longer than the others, except the apical joint which is cylindrical, bluntly rounded at the tip and about twice as long as the sub-apical joint; ocelli dark brown, closely set together almost in a line on the vertex, a short impressed line extending from the anterior ocellus to about half-way from the insertion of the antennæ raised,

dark ferruginous, more or less triangular above, the point of the triangular portion meeting the impressed line from the ocellus; eyes pitch-black, inner orbital margins with a roughly lunate lighter ferruginous marking not quite touching the point of insertion of the antennæ, extending along the whole side of the face and meeting the point of a similar marking which extends round the top of the eyes from the cheeks, which are more or less entirely ferruginous and covered with very short pale pubescence with a few longer erect hairs; clypeus ferruginous, distinctly broader than long, more or less transverse anteriorly, emarginate posteriorly; mandibles dark ferruginous, black along the margins at the apex, inner side with a short triangular tooth, the apex sharp and pointed; mesonotum and scutellum very dark reddish-brown with a slight shine, the former more or less as long or a little longer than its maximum breadth, narrower posteriorly than anteriorly, convex, the latter broader anteriorly than posteriorly, more or less triangular and truncated posteriorly, over-hanging the median segment; median segment shining brown, convex, a little broader than long, with erect brownish hairs on the sides; abdomen more or less dark ferruginous, shining, scarcely punctured at all, first segment paler, second with a pale, yellowish transverse marking anteriorly which is broadest in the middle, much narrowed laterally, the extreme posterior margin of this marking edged with black, segments three or four conspicuously emarginated posteriorly, segment five with distinct tufts of dark hairs on the postero-lateral margins, segment six almost entirely covered with longish dark hairs, underside darker with a few rather long, erect black hairs; presenting a granular appearance, anterior legs ferruginous with more or less golden pubescence, the tibiae with darker and longer hairs, the tarsi considerably darker than the other joints; intermediate and posterior legs of the same colour as the mesonotum, the femora lighter, with long, closely set black hairs which are most conspicuous on the rounded margin of the tibiae; wings flavo-hyaline for the most part, almost clear hyaline at the apex; tegulæ dark ferruginous.

Length: 7—8 mm.

Habitat: Kedah Peak, 3,200 ft., December, 1915.

Holotype and one paratype from the same locality.

The paratype differs from the holotype in being generally lighter in colour on the head and thorax, the mesonotum anteriorly being conspicuously polished and shining, but the abdomen is darker with more black hairs on the apical segments. The characteristic marking on the second segment is present and well-defined.

This species has its nearest ally in *Melipona castanea* Bingham (*Fasc. Malay. Zool.*, II, *Appendix*, p. vi, 1903, and III, p. 59, Pl. A, figs. 10, 10a, 10b, 1906), but appears to be quite distinct. Bingham's description is very brief, discussing only the general coloration and distribution of the pubescence, but he mentions that the abdomen is broader than the thorax and about half as long as the head and thorax united, which is distinctly not the case in my species. His figure of *castanea*, though coloured, is not of much use for comparison, but his figures of the apical abdominal segments and the hind legs, show some structural difference from the same parts in my species. The hind tibiae for example in *castanea* is not so prominently rounded on the outside as in *kusutkan*. The species is named *kusutkan* after the Malay word *kusutkan* (=confusing, perplexing) as the determination of its a nities was a perplexing problem owing to the poor descriptions of species of the genus *Trigona*.

Sub-family APINÆ

Genus *Apis* Linn.31. *A. dorsata* Fabr.

1897. *Apis dorsata* Fabr., Bingham, tom. cit., p. 557.
 1906. *Apis dorsata* Fabr., Buttel-Reepen, Mittl. Zool. Mus., Berlin, III, p. 194.
 1906. *Apis dorsata* Fabr., Buttel-Reepen, Mittl. Zool. Mus., XXXVIII, p. 120.

Singapore Island; Horsburgh Light-house; Semangko Pass, 2,750 ft., Selangor-Pahang; Gunong Angsi, Negri Sembilan; Kota Tinggi, Johore; Mt. Ophir, Johore; Bukit Kutu, 3,457 ft., Selangor; Pulau Tioman; Gunong Kledang, 2,646 ft., Perak; Baram River, Sarawak. There are Indian specimens in the British Museum from Sikkim; Naga Hills and Khasi Hills, Assam; Salsette and Khandala, Bombay Presidency; Coonoor, S. India; Ceylon.

The three Indo-Malaysian honey-bees, *A. dorsata*, *A. mellifica indica*, and *A. florea* may be readily separated by their length, which in *dorsata* is about 16—18 mm., in *indica* 10—12 mm., and in *florea* 7—9 mm.

32. *A. dorsata* form *testacea* Sm.

1897. *A. dorsata* var. *testacea* Sm., Bingham, tom. cit., p. 558.
 1906. *A. dorsata* var. *testacea* Sm., Buttel-Reepen, loc. cit., p. 295.

Singapore Island; Kedah Peak, 3,200 ft. This form is represented in the British Museum from Faridpur, Bengal; Andaman Ids.; Borneo; Sumatra; Penang; Cochinchina.

The forms of *A. dorsata* may be separated as follows:

- Abdomen reddish-brown, segments 5 and 6, sometimes 3 and 4 dark brown or black.....*A. dorsata* F. (*typica*).
 Abdomen pale testaceous yellow.....*A. dorsata* form *testacea* Sm.
 Abdomen black with white bands on segments 3—5; thoracic pubescence black.....*A. dorsata* form *binghami* Ckll.
 Abdomen with inconspicuous white bands on segments 3—5; thoracic pubescence rufo-fulvous.....*A. dorsata* form *sladeni* Ckll.

The form *binghami* Ckll., (Canad. Entom. XXXVIII, p. 166, 1906) was described as a valid species. It is found mainly in the Celebes and Philippines, and is the *A. zonata* of Smith (Journ. Linn. Soc. Lond., III, p. 8, 1859, name pre-occupied). Cockerell's *sladeni* (*A. M. N. H.* (8), XIV, p. 13, 1914) was described as a sub-species of *binghami*, and is known only from the Khasi Hills. I regard both *binghami* and *sladeni* as forms of *A. dorsata*.

33. *A. mellifica indica* form *peroni* Latr.

1897. *A. indica* var. *nigrocincta* Sm., Bingham, tom. cit., p. 558.
 1906. *A. mellifica* var. *peroni* Latr., Buttel-Reepen, loc. cit., p. 191.
 1906. *A. mellifica* var. *peroni* Latr., Enderlein, loc. cit., p. 335.
 1925. *A. mellifica indica* form *peroni* Latr., Dover, Ann. Nat. Hofmus. Wien., XXXVIII, p. 120.

Singapore Island; Gunong Angsi, Negri Sembilan; Bukit Kutu, Selangor; Kedah Peak, 3,200 ft.; Mt. Ophir, Johore; Gunong Kledang, Perak; Semangko Pass, Selangor-Pahang; Baram River, Sarawak.

There is much confusion in the taxonomy of the common Indian honey-bee. Bingham and Enderlein treat *indica* as a distinct species, while Buttel-Reepen makes it the Indian race of the common *A. mellifica*, and his opinions coincide with my own. Apparently the form *peroni* can be separated from typical *indica* as follows:

- Abdominal segments 1—4 brownish-yellow.....*A. mellifica indica* (*typica*).
 Abdominal segments 1—2, sometimes 1—4 brownish ochraceous with dark bands posteriorly.....*A. mellifica indica* f. *peroni*.

Going according to this key I do not remember to have seen any specimens of typical *indica*, either at the British

Museum, Indian Museum or elsewhere, all the specimens I have examined belonging to the form *peroni*. Bingham does not give any precise localities for *indica*, and exact records would be useful. On the basis of our present information it would appear that the form *peroni* should be treated as a valid variety of *indica*.

It is represented in the British Museum from Dehra Dun; Chitral; N. Khasi hills; Salsette, Nasik and Angini (Bombay Presidency), Calcutta; Mussoorie; Coonoor; Kandy, Maskeliya, Madulissima, Peradeniya and Trincomalee in Ceylon; Tenasserim; Borneo; Sumatra; Philippines; Formosa; China.

34. *A. florea* Fabr.

1897. *Apis florea* Fabr., Bingham, tom. cit., p. 559.

1906. *Apis florea* Fabr., Enderlein, loc. cit., p. 337.

1906. *Apis florea* Fabr., Buttel-Reepen, loc. cit., p. 197.

This species is not represented in the collection of the Raffles Museum, but it occurs in Malaya, and I take this opportunity of publishing a few notes compiled at the British Museum. I find I have notes on the following forms:

forma typica: Represented in the British Museum from Nasik, Bombay Presidency; Batavia, Java.

form *rufiventris* Freise: Bangalore; Bombay (British Mus.); Tonkin. Type from Palawan Island.

form *fuscata* Enderlein: This form is at present known only from a single worker described by Enderlein (*loc. cit.*, p. 338) from "India". It is probably only an individual variation.

form *andreniformis* Smith: Trincomalee, Peradeniya, Kandy, Hambantota and Colombo in Ceylon (Brit. Mus.). Also recorded from Java; Sumatra; Siam; Kelantan.

form *sumatrana* Enderlein: Penang; Mt. Matang, Sarawak; Dambulla, Ceylon (Brit. Mus.).

form *nasicana* Ckll: Type from Nasik in the British Museum (cf. Cockerell, Trans. Amer. Ent. Soc., XXXVII, p. 241, 1911 for description). Also specimens from Bandra, Krohi, Salsette, and Angini (Bombay Presidency); Faridpur, Bengal; N. Khasi hills; Bangalore; Ataran valley, Tenasserim; Muscat; Arabia. This form is not very distinct from the *forma typica*.

The forms mentioned above may be separated as follows:

Abdomen brownish-black; basal two segments reddish-brown.....*A. florea* (typica).

Abdomen more or less uniform ochraceous brown.....*A. florea* form *rufiventris*.

Abdomen, except segments 1 and 2, black.....*A. florea* form *fuscata*.

Abdomen black, basal halves of first two segments dark red.....*A. florea* form *andreniformis*.

Abdomen entirely black.....*A. florea* form *sumatrana*.

Abdomen black, segments 1 and 2 and basal half of 3, bright ferruginous.....*A. florea* form *nasicana*.

It might be mentioned here that *A. nursei* Ckll. (*A. M. N. H.* (8), VII, p. 319, 1911), which is a new name for *A. testacea* Bingham (*J. B. N. H. S.*, XII, p. 129, 1898), was based on an unique specimen from Deesa, Bombay Presidency, characterised by its pale honey-yellow abdomen. The type was in Col. Nurse's collection, but was destroyed in removal. He says that it is undoubtedly a pale aberration of *A. florea*, and unless further specimens were forthcoming, I would not consider the name worth retaining, even as a varietal one.

The above notes indicate how imperfect is our knowledge of the Indo-Malayan honey-bees.

Contrary to the opinion of some entomologists, I believe that apiculture in the Indo-Malayan region could be developed into a profitable minor industry, yielding a considerable revenue. Those who are of this opinion may find the works of Hooper (*Agric Ledger*, No. 7, 1904), Ghosh (*Bull. Agric. Inst. Pusa*, No. 46, 1915 and *Rep. 3rd Ent. Meet. Pusa*, II, p. 770, 1920), Newton (*Agric. Journ. Ind.* (XI), p. 44, 1917) and Sladen (*Bull. No. 26, Dept. Agric., Dominion of Canada*, 1916) very useful in their apicultural efforts. It might be pointed out that experimental work on honey-bees has not received all the attention it deserves in Indo-Malaya: data such as the relative importance of the various plants which supply honey to the bees, are woefully scanty (cf. Burkill, *Journ. As. Soc. Beng.* (n.s.), VI, p. 105, 1910). The discovery of a Tarsonemid mite in the tracheal tube of bees from the Isle of Wight is interesting, and should serve as a warning for the need of careful selection in importing foreign bees into India (cf. Rennie, White and Harney, *Trans. Roy. Soc. Edin.*, LII, pp. 739-779, 1921; Hirst, *A. M. N. H.*, (9), VII, p. 509, 1921).

Honey-Bees in the Federated Malay States Museums

In connection with the remarks on honey-bees in the preceding pages, the following list of the honey-bees in the F. M. S. Museums at Kuala Lumpur will be found to have some interest. Most of the specimens have been collected by Mr. H. M. Pendlebury.

1. *Apis dorsata* Fabr. (typical form).

Selangor: Kuala Lumpur (common in all months); Gombak Valley near Kuala Lumpur; Bukit Kutu, 2,500 ft.; Klang; Kuala Selangor; Kuala Kubu; Kuala Pilah; Ginting Bidai, 2,000 ft.

Pahang: Gunong Tahan Padang, 5,550 ft.; Lubok Tamang, 3,500 ft.

Perak: Jor Camp, 2,000 ft.

Johore: Lubok Kedondong, N. W. of Mt. Ophir, Lalang and Beluka, 200 ft.

Peninsular Siam: Khao Luang, 5,800 ft. and Khao Ram, 750 ft.; Nakon Sri Tamarat; Nowonse, Patalung.

2. *Apis dorsata* form *testacea* Sm.

Selangor: Kuala Lumpur; Kuala Selangor; Klang.

Kedah: Kedah Peak.

Perak: Taiping ("At light").

Pahang: Gunong Tahan, 4,900 ft.

The records indicate that *A. dorsata* and its var. *testacea* are widely distributed in the Malay Peninsula, *testacea* being the rarer insect. Both forms often come to light.

3. *Apis mellifica indica* form *peroni* Latr.

Selangor: Kuala Lumpur (not as common as either *A. dorsata* or *A. florea*); Bukit Kutu, 3,000 ft.

Pahang: Wray's Camp, Gunong Tahan, 3,300 ft.; Gunong Tahan Padang, 5,500 ft.; Gunong Benon, 6,000 ft.; Lubok Tamang, 3,500 ft.; Kuala Lipis; Kuala Teku, 500 ft.

Perak: Batang Padang, Jor Camp.

Peninsular Siam: Khao Ram, 750 ft. and Khao Luang, 2,000 ft., Nakon Sri Tamarat.

Java: Papandajan, 5,500—7,000 ft., Preanger Regency.

Borneo: Brunei.

From the very large series of this form in the F. M. S. Museums both Mr. Pendlebury and I are quite unable to pick out a typical specimen of *indica* as defined by Buttel-Reepen. Mr. Pendlebury thinks that the form *japonica* Rad., which I have not seen, is very similar to *peroni*.

4. *Apis florea* Fabr. (typical form).

Pahang: Rhododendron hill, 5,300 ft., "Camerons Highlands".

Perak: Batang Padang, Jor Camp, 1,800 ft. ("a nocturnal insect").

There are only two examples of the typical form in the F. M. S. Museums, and four of the very curious fly-like males from Kuala Lumpur, July, 1924, which were described by Smith as *A. lobata*.

5. *Apis florea* form *sumatrana* Ender.

Selangor: Kuala Lumpur.

Pahang: Kuala Taban, 300 ft.; "Camp No. 4, "Cameron's Highlands" 4,000 ft.

Perak: Batang Padang, Jor Camp, 1,800 ft.

This is the commonest bee in Kuala Lumpur, being found in very large numbers about the flowers of the Honolulu, or Straits, creeper. In fresh specimens the abdomen is contracted. Enderlein must have had before him examples with contracted abdomens, which led him to describe the abdomen as entirely black. Many of our specimens have a short transverse reddish marking on the second abdominal segment, but though this character is constant in a large number of examples, I have not thought it worth while to separate them. The specimens before me establish the validity of Enderlein's form, but prove that it has no claim to sub-specific rank.

6. *Apis florea* form *rufiventris* Friese.

Selangor: Kuala Lumpur.

Mr. Pendlebury has identified this specimen as *andreniformis*, but I think it is nearer *rufiventris*, as the abdomen is more or less ochraceous brown. The fact that these forms are almost impossible to identify with certainty indicates their doubtful validity.

7. *Apis florea* form *andreniformis* Smith.

Pahang: Lubok Tamang, 3,500 ft.

According to my key this insect is the true *andreniformis*, having the basal halves of the first two segments dark red.

8. *Apis florea* form *nasicana* Ckll.

Selangor: Kuala Lumpur.

This specimen was caught on the same plant at the same time as the form *sumatrana*. It runs in my key to *nasicana*, having the first two abdominal segments and the basal half of the third, more or less ferruginous. It seems to be distinct from the typical form, but is certainly no more than an occasional variety produced in a brood. It has not previously been recorded from any locality south of Tenasserim.

In concluding I would emphasize the fact that if workers in various museums, publish a detailed analysis of the honey-bees in their collections, giving locality records, noting variations, etc., in some easily accessible journal, we may eventually be able to assign a more definite taxonomic value to the various forms of this plastic genus.

[Col. C. G. Nurse, the well-known student of Indian Hymenoptera has very kindly sent me some notes on *Apis*, which it seems worth while to add as an addendum to this paper.

Notes on Honey-Bees

I agree with Mr. Dover in considering that there are only three well defined species of *Apis* in India, viz. *dorsata* F., *mellifica* L. (Bingham calls this *mellifera*) and *florea* F. These have of course varieties and local races.

A. nursei (originally determined as *A. testacea* by Bingham from a specimen or specimens he received from me) is undoubtedly merely a pale variety, or perhaps immature specimen of *A. florea*. The type was in my possession, but was hopelessly damaged when my collection was moved from India. *A. florea* at Pusa was very pale. I think *nursei* may safely be deleted as a species.

Both *A. dorsata* and *A. florea* frequently work at night at Pusa. I have seen them working between 10 and 11 p.m. It is curious that at Pusa *A. florea* is never to be seen in October, when other bees are very numerous. It appears in November when there are very few flowers left.—C. G. Nurse.]