

THE TABANIDAE (Diptera) OF NEW GUINEA

By I. M. Mackerras¹

DIVISION OF ENTOMOLOGY, C. S. I. R. O., CANBERRA, AUSTRALIA

Abstract: One hundred and nineteen species of Tabanidae, distributed in 12 genera and subgenera, are recorded from the Papuan subregion. Their ancestors appear to have entered the area in 3 series of waves: an older Oriental series, stemming back to the Ethiopian region; a younger Oriental; and an Australian, the smallest, probably contemporaneous with the younger Oriental.

Local evolution has been vigorous, with the production of 4 genera and subgenera and several distinctively Papuan species-groups. Speciation has also been vigorous; it probably depended more on eustatic and tectonic breaks in the continuity of island-chains (presumably in late Tertiary and Pleistocene) than on the development of climatic barriers.

The following new species and subspecies are described, the type localities being within New Guinea, except where otherwise stated: *Chrysops australis papuensis* ♀; *Mesomyia (Pseudotabanus) peregrina* ♀ ♂; *Lissimas moluccensis* ♀ (Obi I.), *philipi* ♀ (Louisiade Is.); *Cydistomyia auribarba* ♀ (Louisiade Is.), *barretti* ♀, *hollandiensis* ♀ ♂, *insularis* ♀ ♂ (Louisiade Is.); *macmillani* ♀, *oldroydi* ♀, *perdita* ♀ ♂, *quasimmatura* ♀, *similis* ♀; *Dasybasis standfasti* ♀; *Tabanus herbertensis* ♀, *meraukensis* ♀, *muruenis* ♀ ♂ (Woodlark I.), *rosselensis* ♀ (Louisiade Is.), *siassensis* ♀ (Siassi Is.), *subcohaerens* ♀, *subrecusans* ♀ ♂.

The following new names for species of *Tabanus* are proposed by H. Oldroyd: *bewanensis* for *infuscatus* Oldroyd nec Loew; *papuensis* for *productus* Oldroyd nec Hine; *sepikensis* for *truncatus* Oldroyd nec Walker.

New generic synonymy proposed, the senior name being the last in each sequence: *Paracanthocera* End.=*Lissimas* End.; *Parabolbodimyia* Mack. & Rag.=*Japenoides* Oldr.; *Amanella* Oldr.=*Tabanotelum* Oldr.=*Chasmia* End.=*Cydistomyia* Tayl.

New specific synonymy proposed, the senior name being last in each sequence: In *Scaptia*: *mafulensis* Oldr.=*taylori* Oldr. In *Cydistomyia*: *aluensis* Oldr.=*latisegmentata* (Sch. Stk.); *dimorpha* Oldr.=*atriventer* (Sch. Stk.); *flavicincta* (Sch. Stk.)=*fulgida* (Ric.); *macker-rasi* Philip=*parvicallosa* (Oldr.); *misimensis* Oldr.=*albidosegmentata* (Sch. Stk.); *nigerrima* Oldr.=*torresi* (Ferg. & Hill); *rozeboomi* Philip=*solomensis* (Ric.). In *Tabanus*: *angusticallosus* Sch. Stk.=*pollinosus* Ric.; *angustilineatus* Oldr.=*selene* Sch. Stk.; *aroeensis* Sch. Stk. probably=*serus* Walk.; *bipunctatus* Sch. Stk. (preocc.) and *bipustulatus* Szil.=*rubriventris* Macq.; *olivaceus* Sch. Stk. (preocc.) and *exolivaceus* Philip=*cohaerens* Walk.

New records from islands north and east of New Guinea: Noemfor I.: *Cydistomyia inopinata* Oldr.; Biak: *Japenoides festiva* (Oldr.), *Tabanus recusans* Walk.; Manus: *C. immigrans* Oldr.; Siassi Is.: *T. siassensis* Mack.; New Britain: *C. sol* (Sch. Stk.), *T. ceylonicus* Schin.; New Ireland: *T. rubriventris* Macq.; D'Entrecasteaux Is.: *C. subhastata* (Oldr.), *C. albithorax* (Ric.) var., *C. solomensis* (Ric.), *T. ceylonicus*, *T. pollinosus* Ric., *T. serus* Walk.; Woodlark I.: *C. subhastata*, *C. insularis* Mack., *C. torresi* (Ferg. & Hill), *C. sol*, *T. ceylonicus*, *T. muruenis* Mack.; Louisiade Is.: *Lissimas philipi* Mack., *C. atripes* (Sch. Stk.), *C. insu-*

1. With three new names by H. Oldroyd, British Museum (Nat. Hist.), London,

laris, *C. auribarba* Mack., *C. crepuscularis* Oldr., *C. sol*, *C. hollandiensis* Mack., *C. solomensis*, *T. rosselensis* Mack.

INTRODUCTION

New Guinea has a large and varied tabanid fauna, considerably larger than that of the Moluccan division of Wallacea to the west and nearly half as big as that of Australia to the south. The first species to be described was *Tabanus rubriventris* by Macquart in 1838, the specimen having been brought back by d'Urville from his voyage in "l'Astrolabe"; and the first major collecting appears to have been undertaken by A. R. Wallace during his great voyage in the East Indian Archipelago, his species being described by Francis Walker between 1859 and 1865. There followed a long period during which collections were gradually accumulated, chiefly by Dutch workers, and these were reviewed by Miss Ricardo in 1913, a continuation of the same process of collection and review being included in Schuurmans Stekhoven's (1926) monograph of the Tabanidae of the Dutch East Indian Archipelago. Twenty-one years later, Oldroyd (1947, 1949) published a revision of the species on modern lines, based mainly on the material in the British Museum (Nat. Hist.)—much of it collected by Miss Evelyn Cheesman—and in the School of Public Health and Tropical Medicine, University of Sydney.

A great deal of new material has accumulated since then, chiefly from the efforts of Mr. S. H. Christian, Mr. H. A. Standfast and Dr. W. Peters of the Department of Public Health, Territory of Papua and New Guinea; Mr. J. H. Barrett of the Department of Agriculture, Stock and Fisheries of the Territory; Dr. B. McMillan of the School of Public Health and Tropical Medicine, Sydney; Dr. Elizabeth N. Marks of the Department of Entomology, University of Queensland; and especially of Dr. J. L. Gressitt and his colleagues (W. W. Brandt, E. J. Ford, Jr., M. K. Gressitt, N. L. H. Krauss, D. E. Hardy, T. C. Maa, C. D. Michener, L. and S. Quate) working on the Pacific Insects Survey from Bishop Museum, Honolulu². This was supplemented by a series of unnamed Tabanidae forwarded from the Berlin Museum by Prof. F. Peus, and the Archbold Expedition's collection from the Louisiade Archipelago received from the American Museum of Natural History through the good offices of Dr. C. B. Philip. As a result, the genus *Lissimas* has been found to occur in the subregion, new synonymy has been established, and 21 new species and subspecies require description.

I am very grateful to all these workers for making this review possible. I am also particularly indebted to Dr. W. N. Ellis, of the Zoological Museum, University of Amsterdam; and M. A. Collart, of the Institut Royal des Sciences Naturelles de Belgique, Brussels, for sending me holotypes that have been indispensable in clarifying the identity of Schuurmans Stekhoven's species; to Mr. H. Oldroyd, of the British Museum (Nat. Hist.), for comparing specimens with types in that institution and for much advice on difficult points of identification; to Dr. Cornelius B. Philip, of the Rocky Mountain Laboratory, Montana, for specimens and notes; to Mr. V. S. van der Goot and Prof. T. C. Maa for information about material in the Rijksmuseum of Natural History, Leyden; and to Dr. J. L. Gressitt and his colleagues (especially Miss S. Nakata) at Bishop Museum, for help with the ga-

2. Much of the field work on which this paper is based was supported by grants from the National Institutes of Health, Bethesda, National Science Foundation, Washington, and U. S. Army Medical Research and Development Command.

zetteer and in many other ways. Finally, I wish to thank Mr. F. Manning and Miss N. Key of this Division for completing the illustrations for me; the excellent drawings of whole insects and heads are entirely Mr. Manning's work.

For reasons to be given later, Papuan Tabanidae have been taken to extend from the Aru Is. and Misol in the west to the Santa Cruz Is. in the east. Material from the western end has been scanty, while that from the Melanesian arc in the east (fig. 1) has already been described by Mackerras and Rageau (1958) and Mackerras (1962b). Consequently, as the title implies, the fauna of New Guinea and immediately adjacent islands is treated more particularly in the present paper, although brief notes on outlying species are also included for completeness. One new species from the Moluccas is described, because it is relevant to Papuan synonymy.

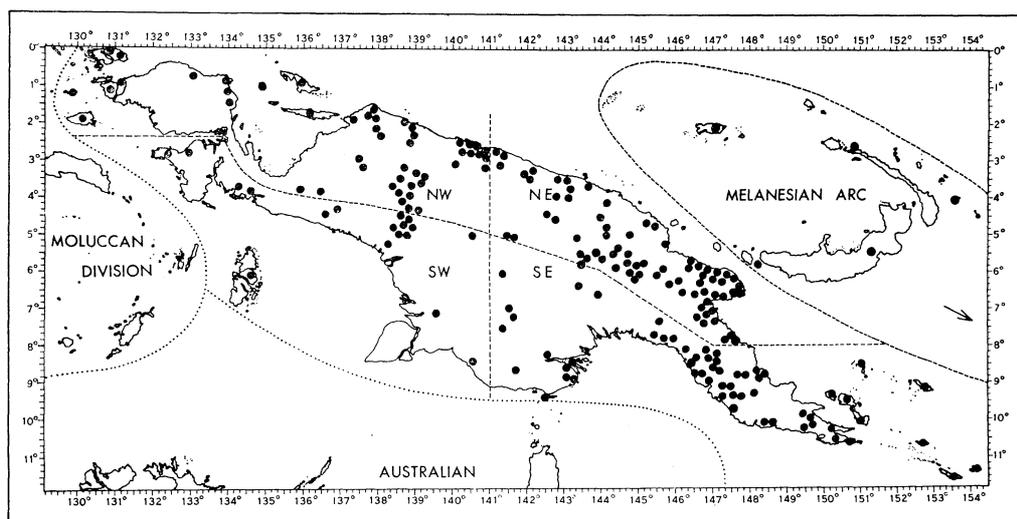


Fig. 1. Map of New Guinea, showing subdivisions and the distribution of the collections examined.

The keys are to females, unless inclusion of males is evident from the context; most of them are based primarily on Papuan material, so they cannot be taken as necessarily reliable for other areas. The descriptive notes have been made as short as is consistent with providing a reasonable check on identifications from the keys. The "material examined" includes all specimens studied at leisure; those examined briefly in the British Museum in 1958 are not listed, although some of them are mentioned in the text. Following discussions with Dr. Gressitt, localities are listed alphabetically under the four divisions shown in fig. 1, and nearly all of them can be plotted more exactly from the gazetteer of names at the end of the paper. The following abbreviations are used for some of the institutions in which holotypes are preserved.

- AMNH = American Museum of Natural History, New York.
- BISHOP = Bishop Museum, Honolulu.
- BMNH = British Museum (Nat. Hist.), London (including part of Archbold Collection held temporarily).
- BRUSSELS = Institut Royal des Sciences Naturelles de Belgique, Brussels.

- MCZ =Museum of Comparative Zoology, Harvard.
 PARIS =Museum National d'Histoire Naturelle, Paris.
 RNH =Rijksmuseum of Natural History, Leyden.
 SPHTM =School of Public Health and Tropical Medicine, University of Sydney.
 USNM =United States National Museum, Washington.
 VIENNA =Naturhistorisches Museum, Vienna.
 ZMA =Zoological Museum, University of Amsterdam (types formerly in Natura Artis Magistra, Amsterdam).

CLASSIFICATION

The classification of the Tabanidae has been discussed in earlier papers (Mackerras, 1954, 1955a) and is shown in tabular form in Mackerras (1961a, p. 103). It is now necessary to rearrange some of the genera of Diachlorini and to take account of the possibility that *Haematopota* may be established in New Guinea, but the basic arrangement still stands. The terminology used was defined in Mackerras (1956), except that American usage is followed here in calling the scale at the base of the costa "subepaulet" rather than "basicosta." It is important to note that the "frons index" is based on the width of the frons at mid-length. This ratio was chosen in preference to one based on the width at the bottom, as used by most other workers, because it is not influenced by convergence or divergence of the frons, and thus usually gives a better indication of its average width. External characters are reliable for identifying the genera in New Guinea, so the formal sequence has been departed from slightly in the following key in order to facilitate field identification.

KEY TO PAPUAN GENERA OF TABANIDAE

1. Ocelli fully developed; hind tibiae with paired apical spurs 2
 Ocelli rudimentary or absent; hind tibiae without spurs (TABANINAE) 4
2. Antennal flagellum subulate, 8-annulate; eyes densely hairy; frons of ♀ without callus; rotund species (PANGONIINAE, Scionini) **Scaptia**
 Antennal flagellum compacted into a basal plate and a style of 3 or 4 annuli; eyes bare; frons of ♀ with shining callus; more oblong or slender species (CHRYSO-PINAE).....3
3. Antennae longer than head and thorax, scape several times as long as wide; small, slender species with pictured wings (Chrysopini) **Chrysops**
 Antennae not longer than thickness of head, scape less than 2× as long as wide; more robust species (Bouvieromyiini)..... **Mesomyia**
4. Subepaulet acutely triangular, densely covered with strong setulae similar to those on costa; usually robust species (Tabanini)..... **Tabanus**
 Subepaulet usually without strong setulae, contrasting with costa; if a few are present (*Haematopota*), subepaulet relatively small and blunt; usually smaller species... 5
5. Antennae longer than thickness of head, with 3-annulate style; frons of ♀ very wide (index about 1); small, slender species, with characteristic ocellated wing-pattern (Haematopotini) **Haematopota**
 Antennae variable, but style always 4-annulate; frons of ♀ narrower (index more than 2); wing-pattern never ocellated (Diachlorini) 6
6. Wings with sharply defined dark pattern as in figs. 36 and 41 7

- Wings usually subhyaline; occasionally almost entirely dark, but any indications of a pattern diffuse or reduced to spots 8
7. Entire frons shining; antennal scape markedly swollen and shiny; eyes unbanded; a large (15-17 mm), robust species.....**Neobolbodimyia**
Callus distinguishable on frons; antennal scape cylindrical, usually more than 2X as long as wide; eyes usually with 2 green bands; smaller more slender species...
.....**Lissimas**³
8. Eyes green, with a single dark band; antennae usually longer than thickness of head, scape distinctly swollen and more or less shining; ocellar tubercle conspicuous; R₄ with strong appendix; usually distinctive species with diffusely darkened wings..... **Japenoides**
Eyes unbanded; other characters collectively not as above..... 9
9. Partly or wholly metallic blue-green, calliphorid-like species, with conspicuous white or yellowish zones on tibiae or hind metatarsi **Chalybosoma**
Not such species..... 10
10. Fronts of ♀♀ usually narrow (index usually greater than 4), sometimes converging; parafacials medium or narrow; vein R₄ usually without appendix; eyes of ♂♂ with enlarged upper facets bare.....**Cydistomyia**
Fronts of ♀♀ wider (index less than 4), sometimes parallel but never converging; parafacials usually wide; R₄ normally with strong appendix; eyes of ♂♂ with enlarged upper facets densely hairy **Dasybasis**

The following genera, which are known from adjacent countries, may ultimately be found to occur in New Guinea.

Philoliche Wiedemann (Amboina, New Caledonia). Distinguished from *Scaptia* by having eyes bare, no ocelli, a strong appendix on vein R₄, and different terminalia in both sexes.

Eucompsa Enderlein (Borneo, Java). Resembles *Mesomyia* (*Pareucompsa*) in having a 3-annulate antennal style, but distinguished from it by wider frons, absence of a callus, different wing pattern, and striking pattern of colored hairs on body (Philip & Mackerras, 1961).

FAUNAL RELATIONSHIPS

THE PAPUAN SUBREGION

The New Guinea area has served as a center of evolution for various groups of animals, and many workers therefore accept it as a zoogeographical subregion. Gressitt (1961) has given a clear account of it, and defined its boundaries, for the insect fauna, as passing between the Solomon and Santa Cruz island groups on the eastern side and to the west of Buru and the Halmaheira group, but east of the Sulu Archipelago, on the western side. The Tabanidae show a high degree of endemism (4 genera or subgenera, several species-groups, and 90% of the species), so they conform to the subregional concept; but different groups of animals differ in their ability to spread and colonize, and it is consequently

3. Three Wallacean species of *Lissimas* with diffusely clouded wings will run out to couplet 8, where they can be distinguished from *Japenoides* by their elongate, cylindrical antennal scapes, absence of an ocellar tubercle, absence of an appendix on R₄, and probably by different pattern on the eyes,

Table 1. Distribution of Moluccan Tabanidae (Subgenera listed as genera).

Species	Java, Borneo, etc.	Philippines	Celebes	Buru, Amboina, Ceram	Halmahera, Ternate, Batchian, Obi	Aru Is., Misol	New Guinea, including Waigeu, Salawatti	Remarks
<i>Chrysops atrivittata</i> Sch. Stk.				←×				
<i>fasciata</i> Wied.	×			?×				
<i>signifer</i> Walk.	×	×	×	×	×			
<i>Neobolbodimyia nigra</i> Ric.						×	×	
<i>Lissimas</i> (7 species)		1 sp.	2 spp.		2 spp.			1 sp. Louisiade Is. 1 sp. N. Queensland
<i>Cydistomyia celebensis</i> (Sch. Stk.)			×					
<i>insurgens</i> (Walk.)					×			
<i>sylvioides</i> (Walk.)						×		
? <i>inequannulatus</i> (Sch. Stk.)					×			
? <i>erythrocephala</i> (Wulp)					×			
<i>Dasybasis caesia</i> (Walk.)						×	×	Also in N. Australia
<i>Pseudobolbodimyia argentata</i> (Szil.)				←×				} Oriental derivation
<i>laticornis</i> (Sch. Stk.)				←×				
<i>Tabanus atrimaculatus</i> Sch. Stk.				←×				
<i>aurantiacus</i> Sch. Stk.			×					} Widely distributed
<i>brunneothorax</i> Sch. Stk.				×				
<i>ceylonicus</i> Schin.	×	×		×			×	
<i>cinnamoneus</i> Dol.	?×			×		×	×	
<i>cohaerens</i> Walk.				?×			×	
<i>doreicus</i> Walk.						×	×	
<i>exagens</i> Walk.						×	×	
<i>extricans</i> Walk.						×	×	
<i>factiosus</i> Walk.		?×	←×		×			
<i>flavipennis</i> Ric.*				×→				
<i>flexilis</i> Walk.			←×	×				
<i>furunculigenus</i> Dol.				×	×→			
<i>humillimus</i> Walk.	×		×					
<i>immixtus</i> Walk.			×					
<i>obtusipalpis</i> Sch. Stk.						×	×	} Also N. Australia
<i>pallipennis</i> Macq.						×	×	
<i>parimmixtus</i> Sch. Stk.			×					} Also Sulu Archipelago
<i>recusans</i> Walk.				?×		×	×	
<i>reducens</i> Walk.	×	×	×	×				
<i>serus</i> Walk.	?×					×	×	

<i>speculum</i> Walk.			←×				
<i>spoliatus</i> Walk.			←×				
<i>succurvus</i> Walk.			←×	×			
<i>tenuis</i> Sch. Stk.						×	
<i>unesignatus</i> Szil.			←×				
<i>wollastoni</i> Ric.						?×	×
<i>xanti</i> Szil.			←×				

* A new name is not proposed for this species pending resolution of the doubt whether *Dia-basis flavipennis* Macq. is really a *Tabanus* (Philip, 1959).

useful to determine how far they conform also to the boundaries defined by Gressitt.

To the east, Mackerras and Rageau (1958) found the most marked break of continuity between the Santa Cruz group, the Tabanidae of which are merely an attenuation of those of the Solomon Is., and the New Hebrides, where the only two species known (Mackerras, 1962b) are shared with Fiji. There does not seem to be anything particularly significant about this displacement of the boundary, which is exceeded, for example, by anopheline mosquitoes. The sudden change, on the other hand, if it is substantiated by further collecting, may be significant in supporting the suggestion (Gressitt, 1961) that the fauna of the New Hebrides was destroyed or greatly reduced by submergence. That could account for the Tabanidae being colonizers from the east during or after the last glacial phase.

The situation on the western side is complicated by a larger, inadequately known fauna, and by difficulty in assessing relationships in the genus *Tabanus* which forms its largest component. The available information is summarized in Table 1. Three species have been omitted, the little-known *Philoliche amboinensis* (Fabr.) from Amboina and Timor and Szilady's (1926) records of *Tabanus fumifer* Walk. and *T. indianus* Ric. from Celebes, which require confirmation. *T. reducens* Walk. is included in the first column of distribution on the basis of a ♀ from Malaya (S. Sedili, Johore, Apr., D. H. Colless) which agrees better with Philippine specimens of this species than with a series of *T. rubidus* Wied. from Indonesia and one from Malaya. Philip's (1960b) records of *T. serus* and *T. cinnamoneus* from Borneo are questioned, because it would be desirable to examine the terminalia before accepting them unreservedly.

Relationships of endemic species are indicated by arrows, where they can be determined with reasonable confidence. There are, in particular, two groups of *Tabanus* for which this has not been possible. One is the series of otherwise rather drab, medium-sized species which are distinguished by having a single pale median vitta or fused triangles on the abdominal tergites (*brunneothorax*, *cohaerens*, *immixtus*). The other comprises somewhat similar species, which lack the vitta, are usually more greyish or yellowish in general coloration, and often have a considerably reduced callus (*aurantiacus*, *humillumus*, *parimmixtus*). Both series of species may be local offshoots from a continuous band of distribution, in the same way that some of the species of *Cydistomyia* appear to be offshoots (or relicts) of an earlier band.

There are several striking features about the Table. 1) The absence of the tribe Bouviromyiini, which occurs on both sides of the Moluccan division. 2) The wide distribution of *T. ceylonicus* (extending far beyond the scope of the Table), in contrast with the absence of the otherwise almost as widely distributed *T. striatus* Fabr. and *T. rubidus*. 3)

The almost complete mutual exclusion that seems to exist between the distributions of *T. rubidus* and *T. reducens*, suggesting that they may be subspecies or, at most, recently separated. 4) The strong endemism in Celebes (13 of 19 species) and the Halmaheira group (6 of 8), as compared with 3 of 13 in Buru-Amboina-Ceram and 2 of 12 in the Aru Is. and Misol. 5) The strong Oriental and weak Papuan contribution to the Tabanidae of the islands west of the Aru group and Misol (16 Oriental, 4 Papuan and 14 undetermined out of 34 species). 6) The strong Papuan affinities of the Aru Is. and Misol, 10 of the 12 species occurring also in New Guinea, and 2 being undetermined.

These observations pose several questions which can be answered only by intensive collecting; but the immediately relevant point is that truly Papuan species extend very little beyond a boundary marked by the Aru Is. and Misol. They are thus limited to the area which is presumed to have been dry land during glaciations (Mackerras, 1962a, fig. 8). Conversely, only one Oriental species has certainly reached New Guinea unchanged, and there are no easily recognizable Oriental-Papuan species-pairs. It seems likely, therefore, that impediments to migration through the Moluccan islands may have been greater since the beginning of the Pleistocene than they were before the end of the Tertiary, and that the "Papuan facies" had not been fully developed as a distinctive feature of the tabanid fauna when the change occurred. The timing of this change in permeability of the zone may have contributed to another striking phenomenon that has been described by Harrison (1962), namely, the remarkably scanty fauna, including insects, that accompanied the tropical rain forest in its migration to New Guinea and Australia.

REGIONAL RELATIONSHIPS

Gressitt, in a series of papers summarized in 1961, has developed the thesis that, so far as the insects are concerned, the Papuan subregion belongs not to the Australian but to the Oriental region, the two regions overlapping in southern New Guinea and northern Australia (Gressitt, 1961, fig. 2). Again the Tabanidae conform in general, but they give the impression that each of these fundamentally separate regions has been infiltrated by the fauna of the other, rather than that they truly overlap.

The three elements that have combined to make up the tabanid fauna of New Guinea

	Older Oriental	Younger Oriental	Australian
<i>Scaptia</i>	—	—	11
<i>Chrysops</i>	—	2	—
<i>Mesomyia (Pareucompsa)*</i>	2	—	—
<i>Mesomyia (Perisilvius)</i>	3	—	—
<i>Mesomyia (Pseudotabanus)</i>	—	—	1
<i>Neobolbodimyia*</i>	1	—	—
<i>Lissimas</i>	1	—	—
<i>Japenoides*</i>	3	—	—
<i>Chalybosoma</i>	?3 (affinities uncertain)	—	—
<i>Cydistomyia</i>	45	—	—
<i>Dasybasis</i>	—	—	5
<i>Haematopota</i>	—	(?)	—
<i>Tabanus</i>	—	38	4
Total:	58 (or 55)	40 (?41)	21 (or 24)

* Evolved in or near the subregion,

have been discussed in an earlier paper (Mackerras, 1961a), and are brought up to date (except for 7 species known only from ♂♂) in the following tabular statement.

The Bouvieromyiini have been analysed by Philip and Mackerras (1961) and Mackerras (1961b); the evolution of the Diachlorini is discussed on p. 96, where it is relevant to the taxonomic problems that have to be considered there; most of the Australian components have been examined in relation to the Pleistocene glaciations by Mackerras (1962a); and it is necessary only to give some further consideration to the genus *Tabanus*. There is no doubt that the whole of the Papuan representation of this genus originated in Malaysia, but its arrival in the subregion was probably spread over a considerable period, and it entered New Guinea from 2 directions. The *denticulatus*, *recusans* and *exagens* groups are the most distinctively "Papuan", their affinities are Malaysian rather than Australian, they have undergone a good deal of local radiation, and they include more than half of the species of *Tabanus* at present known from the subregion. It seems reasonable to conclude that they represent elements which reached New Guinea from the west probably before the beginning of the Pleistocene. The ancestors of a few other divergent species—*tenuis* in Aru Is., *gilingilensis* in New Ireland, *expulsus* in New Hebrides and Fiji, possibly one or two others—presumably belonged to the same period. The *cohaerens* group and part of the *innotabilis* group appear to have come later, also from the west, but there must have been a significant gap between these and *ceylonicus* which has not yet had time to diverge from its parent stock. The Australian element is small, but clearly defined, and its period of migration probably late Pleistocene to Recent. The *pallipennis* and *innotabilis* stocks appear to have evolved in Australia, and *innotabilis* may have crossed the strait twice, once to produce *rubriventris* and later in its present form. On the other hand, Papuan *serus* and Australian *dorsobimaculatus* form a species-pair, with *serus* the more generalized in shape of callus and of sternite 8. It seems likely, then, that ancestral *serus* entered northern Australia during the penultimate glaciation, and differentiated there into *dorsobimaculatus*, which returned to southern New Guinea during or after the last glaciation.

To summarize, the combined evidence from all the tribes suggests that almost half of the present tabanid fauna of New Guinea has evolved from ancestors that diffused out from Africa and around the Indian Ocean at some time between late Mesozoic and late Tertiary, about one third from more specifically Oriental ancestors that reached New Guinea between late Tertiary and Recent times, and one sixth from Australian ancestors contemporaneous with the preceding. There is no evidence of any older Australian element in the fauna.

RADIATION FROM NEW GUINEA

Centers of evolution usually serve also as centers of dispersal, but this has not been a striking feature of the Papuan tabanid fauna. There has been none to the north, and we have already seen that diffusion to the west beyond the presumed Pleistocene shore-line has been slight, comprising, at most, 4 species of *Tabanus* (*cinnamoneus*, *cohaerens*, *recusans*, *serus*) that occur also in New Guinea and 4 Moluccan species (*brunneothorax*, *flavipennis*, *furunculigenus*, *immixtus*) which may have evolved from Papuan ancestors. Similarly, the southward contribution to Australia appears to have included only the ancestors of *Chrysops australis australis*, of 3 species of *Cydistomyia* and of 3 species of *Tabanus*, while *Mesomyia* (*Perisilvius*) *demeijerei*, *Cydistomyia torresi* and *Tabanus ceylonicus* have reached coastal

Queensland unchanged. The remaining 16 species of *Cydistomyia* and 16 of *Tabanus* in Australia show no Papuan characteristics, and their ancestors presumably diverged from the line of migration further to the west.

The third extension was eastward into the Pacific (Mackerras and Rageau, 1958). It was larger than the others, and took place in several waves, probably over a considerable period of time. The break in continuity in the New Hebrides has already been mentioned. From that point (or, perhaps, further back) there were two lines of migration. One led to New Caledonia, carrying at least one ancestral species of *Cydistomyia immigrans* stock, one shared with *C. sol*, another that gave rise to a striking pair of species (*C. imitans* in New Guinea and *C. colasbelcourii* Mack. and Rag. in New Caledonia), and *Dasybasis rubricalloso* (Ric.), the long ancestral journey of which is traced on p. 160. These Papuan invaders account for only part of the New Caledonian fauna. There is also what appears to be a more directly Australian element, a small New Zealand one, and a distinctive group of *Philoliche*, the nearest suspected relatives of which are in Mauritius (Oldroyd, 1962). The other line of migration carried one *Japenoides*, at least two *Cydistomyia* and a *Tabanus* to Fiji, and a *Tabanus* of a different group to Samoa. These five were all independent, and there is little evidence of local speciation.

Broadly, both time and accessibility seem to have favored eastward extension into the Pacific more than diffusion to the south or return migration through the Moluccas. So far as it goes, then, the evidence would fit Miss Cheesman's (1951) concept of an old Cyclopean arc, which is not incompatible with the decrease in permeability of the Moluccan zone during the Pleistocene suggested on an earlier page.

LOCAL EVOLUTION AND SPECIATION⁴

The most striking features of the tabanid (and other) faunas of the wet tropics are the frequency with which divergent, sometimes bizarre forms occur, and the large numbers of species that are encountered. These phenomena are basically independent, one resulting primarily from selection pressures and the other from the operation of isolating mechanisms; but there is a considerable amount of secondary interdependence between them, because selection pressures depend on environmental gradients in space and time, which are controlled by the same geological and climatic changes that tend to break up and reunite the populations on which they are operating. Moreover, the greater the number of species the more varied are the gene pools which the pressures can influence.

It is easy to state the principles, more difficult to apply them to a particular area, such as New Guinea. We do not know enough of tabanid ecology there to speculate about the nature of the selection pressures that have been operating, although we can guess at some of the conditions that have influenced the steepness of the environmental gradients. The first is the well-known geological instability of the area, culminating in the mountain-building period of the late Tertiary and Pleistocene. The second is the series of cyclical climatic changes that have occurred since mid Pliocene. If Willett's (1953) concept of

4. This paper was completed before an important study of a genus of ichneumonid wasps by V. K. Gupta (Pacific Ins. Monog. 4: 1-142, 1962) reached Canberra. He associated speciation in his group with the Pleistocene changes in sea level, but on a much wider geographical scale than could be applied to the present study, and he also found that the Moluccan islands had acted as a filter zone.

contraction and expansion of the climatic belts is correct, the cycles must have affected low latitudes as well as high, and would have had a substantial influence on the vegetation and animals in the tropics. The third is the change in the species-composition of the fauna, and consequently in kinds and intensities of competition, that must have occurred as new populations, already differentially filtered and selected by their passage through the Moluccan division, flowed into the area from the west. This is an entirely different situation from the prolonged relative faunal stability of Australia. A fourth may have been the existence of unoccupied niches into which new-comers could expand, as suggested by Gressitt (1961), but these are not likely to have been as significant here as in the more isolated oceanic islands that he was discussing.

All these influences would have tended to increase the speed of evolution and the amount of divergence between different populations. At least the first two have operated with accelerated intensity since the beginning of the Pliocene. Consequently, it is possible to visualize the degrees of divergence that distinguish *Neobolbodimyia* and *Japenoides* from *Cydistomyia* being produced since then, whereas it may have taken the whole Tertiary to produce *Pseudopangonia* from generalized *Mesomyia* in Australia.

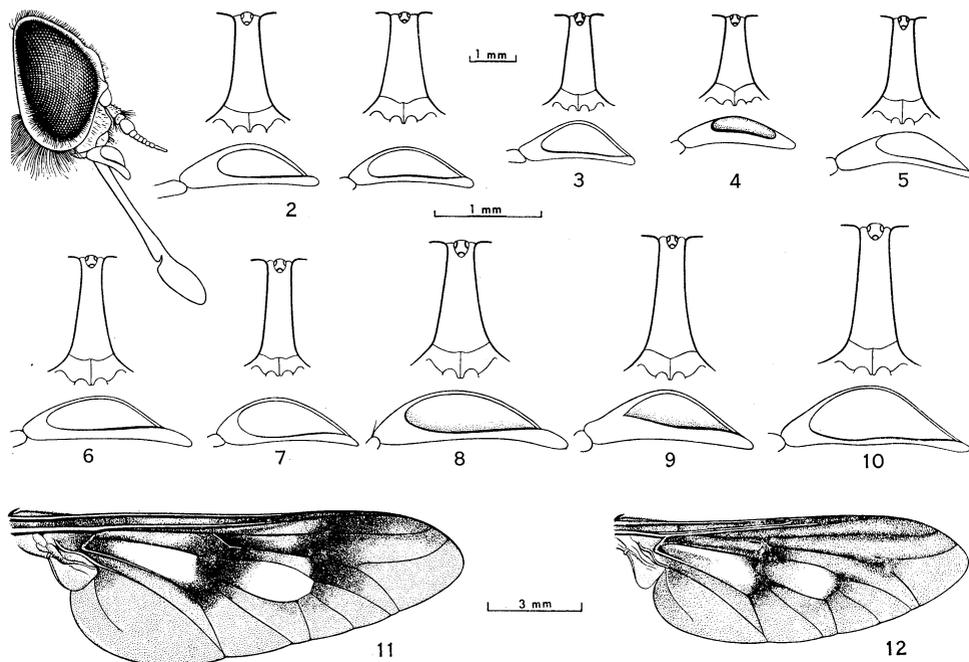
The same applies to the number of species, which depends on the number entering the area (or in it at a given time) and the number of times thereafter that the populations have been broken up for long enough periods to produce genetically determined reproductive isolation. In Australia, the mid-Pliocene aridity and subsequent glacial cycles appear to have provided adequate isolating mechanisms, and about half a glacial cycle long enough for speciation in the Tabanidae (Mackerras, 1962a). Time relations would have been similar in the two countries, but climatic barriers relatively ineffective in New Guinea, and it would be necessary to rely more heavily on eustatic and tectonic changes in sea level periodically interrupting recruitment from the west and promoting speciation by exchange between adjacent areas.

An attempt to throw light on this problem by analysing local distribution in the sub-region has not been particularly fruitful, and it is evident that the data are still inadequate. Differences between the north and south, or the east and west, of the island appear to be insubstantial, and the most suggestive indications have come from populations of *Scaptia taylori* in the mountains and from species-pairs on New Guinea and some of the outlying islands. Thus, the small collection from the Louisiades included representatives of 3 such pairs (*insularis-ochrothorax*, *auribarba-fasciata*, probably *rosselensis-wollastoni*), of which the first appears to have returned to the eastern toe of the mainland and undergone some slight differentiation there (fig. 74). A few other examples are noted in the descriptive part of the paper, but the most that can be attempted effectively at present is to provide a sound taxonomic foundation on which it is hoped that future studies may be built.

Subfamily PANGONIINAE

Genus *Scaptia* Walker

The 11 species known from New Guinea belong to the subgenus *Pseudoscione*, which is represented in Australia by 25 species divided into 3 species-groups, with the *maculiventris* group further divided into 2 subgroups (Mackerras, 1960). The subgroup characters are not as clearly defined in the New Guinea species as they are in the Australian, but *unilineata* and *albibarba* may be allotted with reasonable confidence to the *maculiventris* subgroup



Figs. 2-12. *Scaptia* (*Pseudoscione*), ♀♀: 2, *taylori*, head, frons and palp of holotype, frons and palp of other ♀♀ showing range of variation; 3, *leonina*; 4, *unilineata*; 5, *albibarba*, frons of holotype, palp of paratype; 6, *insularis*; 7, *caliginosa*; 8, *floccosa*; 9, *bernhardi*; 10, *novaeguineensis*, holotype; 11, wing of *floccosa*; 12, wing of *unilineata*.

and the remaining species to the *concolor* subgroup. Although *novaeguineensis* is not as unusual as had been thought before the type was received for study, the earlier suggestion (Mackerras, 1962a) that the subgenus probably colonized New Guinea from Australia in 3 waves still fits the available facts. The nearest relationship with Australia at the specific level is between *taylori* in New Guinea and *neoconcolor* Mack. in north Queensland.

Most of the species seem to be restricted to high country, and there are indications, both from Oldroyd's (1947) review and from my own limited experience, that speciation may still be proceeding actively. It may facilitate identification in the field, if it is appreciated that there is one large yellow-brown species (*novaeguineensis*), 2 large red-brown species with yellow to brown beards (*flavibarbis* and *bernhardi*), one large-medium mahogany-red species with conspicuous white beard (*floccosa*), and 7 small to medium-sized, less distinguished species, of which *unilineata* and *albibarba* have narrow palpi and black femora, *auripilosa* and *leonina* have almost uniform coverings of golden hairs on mesonotum and abdomen, *caliginosa* and *insularis* have 2 conspicuous dark bands on the wings, and *taylori* (by far the commonest species of all) forms an undistinguished, variable residue. There is also an unnamed form (Oldroyd, 1947, pp. 130 and 134), which is distinguished from *caliginosa* by having a conspicuous tuft of pale hairs on the parafacials. The ♀ terminalia figs. 13-16) confirm the separation of *unilineata* from *albibarba* and of *insularis* from *caliginosa*, but not of *taylori* from *caliginosa* or *leonina*. The terminalia of the only ♂ studied (fig. 17) are simply normal for the genus.

KEY TO PAPUAN SPECIES OF SCAPTIA

1. Palpi short and narrow (figs. 4, 5); small-medium (10–12 mm), dark brown species, with distinctly paler presutural dorsocentral vittae on scutum, black femora, and a median black patch on tergite 2 of abdomen 2
- Palpi wider and usually longer; other characters collectively not as above..... 3
2. Frons strongly diverging (fig. 4); antennal scape dark grey-brown; hind tibiae bright brown; wing as in fig. 12 **1. unilineata**
- Frons less diverging (fig. 5); antennal scape brighter brown; hind tibiae black; wing more diffusely darkened apically **2. albibarba**
3. Mesonotum and abdominal tergites with predominantly brown to golden hairs 4
- Mesonotum and abdominal tergites with predominantly black hairs; pale hairs on tergites restricted to median patches and fringes..... 6
4. Large (16–17 mm), rather shining reddish to yellowish brown species, with predominantly brown hairs on mesonotum and abdomen, and vaguely darkened wings **3. novaeguineensis**
- Smaller (12 mm) species, with predominantly golden hairs on mesonotum and abdomen 5
5. Darker species; parafacials with black and some golden hairs; palpi relatively narrow, with small bare area..... **5. auripilosa**
- Paler species; parafacials without hairs; palpi wider, with larger bare area...**4. leonina**
6. Large (15–17 mm), mahogany to red-brown species, with yellow to brownish beards, and no pale hairs on abdominal tergites..... 7
- Smaller (10–14 mm), usually (except *floccosa*) paler or duller colored species, with white to yellowish cream beards, and at least some pale hairs in lateral fringes on abdominal tergites 8
7. Stem of labium markedly inflated; pleural hairs yellow..... **7. flavibarbis**
- Stem of labium slender; pleural hairs predominantly dark brown to black...**6. bernhardi**
8. Robust, 13–14 mm, shining dark red-brown species, with conspicuous zone of dense white hairs on lateral margins of scutum, and no pale hairs on discs of abdominal tergites..... **8. floccosa**
- Smaller (10–13 mm), paler or duller species; lateral pale hairs on scutum not forming a dense white zone; at least a few pale median hairs on some abdominal tergites.....9
9. Hairs on eyes short, relatively sparse, pale; wings with 2 conspicuous dark brown bands; a darker species.....**9. caliginosa**
- Hairs on eyes long, dense, brown, or apical band on wing evanescent; mostly paler species..... 10
10. Wing with 2 conspicuous dark brown bands; palpi long; beard snow-white..... **10. insularis**
- Wings with the apical band diffuse, often evanescent (the basal band also occasionally weak); palpi usually shorter and wider; beard cream to rather yellowish **11. taylori**

1. Scaptia (Pseudoscione) unilineata Oldroyd Figs. 4, 12, 14.

Scaptia unilineata Old., 1947, p. 132, fig. 2a (type ♀, Iwaka R., XI.1910, Wollaston;

BMNH).

MATERIAL EXAMINED: 1 ♀ paratype.

♀. Small-medium (11–12 mm), relatively dark brown species; distinguished from other Papuan species, except *albibarba*, by its narrow palpi, black femora, and characteristic wing pattern. Hairs on eyes dark brown; frons strongly diverging, dark brown; parafacials and face duller brown; antennal segments 1–2 dark greyish brown, 3 orange, darkened only at tip; palpi almost black, with short black hairs marginally and an orange-brown, rather deep, lateral bare concavity; beard contrasting white against darker head and body. Scutum with relatively well-defined greyish dorsocentral vittae and suture; pleural hairs white to dull cream. Femora brown-black, remaining segments lighter brown, darkening on tarsi. Wing with brown band at apices of basal cells and distinct darkening along veins, most of 2nd basal and discal cells clear. Abdomen bright brown, with irregular darker markings, blackish median patch on tergite 1 and smaller one on 2; hairs black, except for conspicuous cream median apical tufts on tergites 2–6 and admixture of white hairs on lateral margins; venter with predominantly dull cream to white hairs on discs as well as apical margins of sternites. Sternite 8 and furca as in fig. 14.

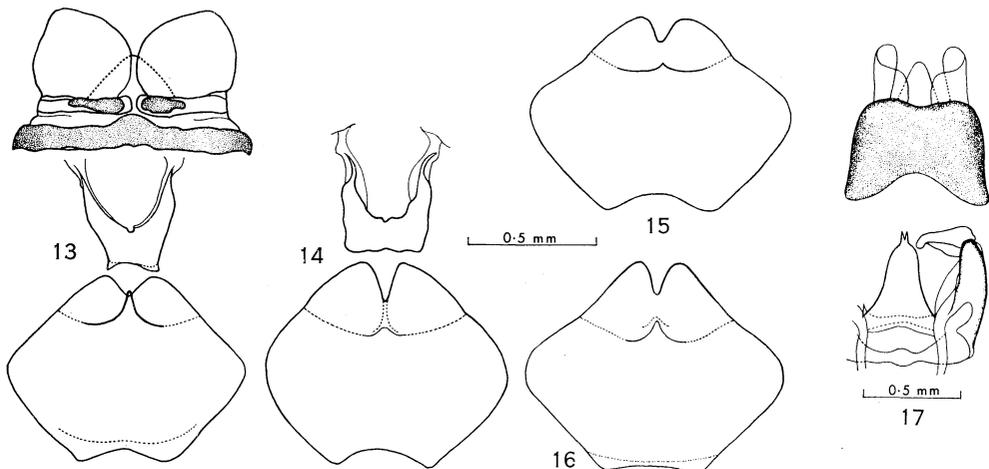
♂. Described as similar to ♀, except that black hairs longer and more numerous, especially on venter and few on mesopleuron; antennal segments 1 & 2 black, contrasting with orange flagellum.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 650 m, X., Olthof; Iebele Camp, 2300 m, XI; Moss Forest Camp, 2650 m, X, Toxopeus. SW NEW GUINEA: Iwaka R., Wollaston.

2. *Scaptia* (*Pseudoscione*) *albibarba* (Schuurmans Stekhoven) Figs. 5, 13.

Erephopsis albibarbus Sch. Stk., 1926, p. 65, fig. 24 (type ♀, SW New Guinea, XII.1912, Versteeg; ZMA).—Oldroyd, 1947, p. 129.

MATERIAL EXAMINED: ♀ holotype and 2 ♀ paratypes.



Figs. 13–17. *Scaptia* (*Pseudoscione*), terminalia: 13, *albibarba*, ♀ holotype; 14, *unilineata*, ♀; 15, *taylori*, ♀; 16, *insularis*, ♀; 17, presumed ♂ of *taylori*.

♀. Very like *unilineata*, but distinguished by: hairs on lower parts of eyes pale; frons less diverging; antennal scape lighter brown; palpi longer, thicker, and with flatter bare area (the palpi of the type appear to have been pinched, which makes them appear thinner and deeper than those of the other 2 specimens); hind tibiae blackish; apical part of wing beyond discal cell more extensively darkened; sternite 8 and furca as in fig. 13. The differences, particularly in the shape of sternite 8, are greater than would be expected from intraspecific variation, and there is no indication of significant geographical separation between the 2 forms.

DISTRIBUTION. NW NEW GUINEA: Doorman track, X, van Heurn. SW NEW GUINEA: Undefined type locality.

3. *Scaptia (Pseudoscione) novaeguineensis* (Ricardo) Fig. 10.

Erephopsis novae-guineensis Ric., 1913, p. 404 (type ♀, Hellwig Mts., 1800 m, I.1909, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 64, fig. 23.

Scaptia novaeguineensis: Oldroyd, 1947, p. 130, fig. 3.

MATERIAL EXAMINED: ♀ holotype.

♀. Large (16–17 mm), rather shining reddish to yellowish brown species; type is somewhat darker and less yellowish than paratype in BMNH. Hairs on eyes short brown; frons reddish brown; subcallus, parafacials and face duller brown; hairs on upper parafacials and face mostly black, beard white; antennae yellow-brown, darkening only at tip, segment 3 unusually slender; palpi short relative to unusually long proboscis, but of normal shape for subgroup. Scutum red-brown, scutellum somewhat paler; hairs mostly brown, conspicuously darker on notopleural lobes, more golden-brown in supraalar and postalar tufts; pleura light greyish cream, with cream hairs. Legs light yellow, darkening distally on tibiae and tarsi. Wings lightly suffused with brown, darker anteriorly and across apices of basal cells, pale distal and posterior veins giving it a vaguely yellowish appearance; cell R_5 not quite closed on margin. Abdomen yellow-brown, with almost uniform covering of brown hairs dorsally, more golden at sides of distal tergites; venter paler, with lighter yellowish hairs and indications of paler apical fringes on sternites. Terminalia not dissected.

DISTRIBUTION. SW NEW GUINEA: Hellwig Mts.

4. *Scaptia (Pseudoscione) leonina* Oldroyd Fig. 3.

Scaptia leonina Old., 1947, p. 131, fig. 2d (type ♀, Mt. Tafa, 2800 m, III.1934, Cheesman; BMNH).

MATERIAL EXAMINED: 1 ♀ paratype.

♀. Yellow-brown, 12 mm species, rather like the paler form of *taylori*, but distinguished by the almost uniformly light brown hairs on mesonotum and golden ones on abdomen. Upper part of frons brown, merging into fawn below and on subcallus, parafacials and face; parafacials without hairs; antennal segment 3 bright orange, darkening at extreme tip; palpi brownish orange, with dense zone of short black hairs round margin of rather flat bare area; beard creamy-white. Pleural hairs mostly cream. Legs yellow, darkening on distal tarsi only. Wing with small but dark basal band and only vague darkening apically. Abdomen rather shining, yellow-brown with irregular darker markings and a thin covering of long golden hairs; venter similar in general color, but with clearly defined

paler apical bands on sternites. Terminalia similar to those of *taylori* (fig. 15).

♂. Described as similar to ♀, but with hairy parafacials and somewhat darker abdomen.

DISTRIBUTION. SE NEW GUINEA: Mt. Tafa.

5. *Scaptia* (*Pseudoscione*) *auripilosa* Oldroyd

Scaptia auripilosa Old., 1947, p. 130, fig. 2f (type ♀, Lake Habbema, 3300 m, VIII, Toxopeus; BMNH, Archbold Coll.).

MATERIAL EXAMINED: Nil.

♀. Close to *leonina*; but with darker brown integument; black and some golden hairs on parafacials; narrower palpi, with smaller bare area and long yellow hairs; erect black hairs among the golden ones on mesonotum; brown band across apices of basal cells faint; and some long black hairs at sides of abdomen and on last 3 tergites.

♂. Similar to ♀, except that black hairs longer and more numerous over the entire body; abdomen orange at sides basally, and recumbent golden hairs tending to form indistinct median triangles.

DISTRIBUTION. NW NEW GUINEA: Lake Habbema.

6. *Scaptia* (*Pseudoscione*) *bernhardi* Oldroyd Fig. 9.

Scaptia bernhardi Old., 1947, p. 132, fig. 2h (type ♀, Bernhard Camp, 800 m, X. 1938, Oltorf, in BMNH, Archbold Coll.); 1949, p. 359.

MATERIAL EXAMINED: 1 ♀.

♀. Moderately large (15 mm), reddish brown species, distinguished by shape of head, which is more triangular in dorsal view than in other species; brown to yellowish beard; predominantly brown to black pleural tufts; rusty yellow to brownish wings, with small brown basal band and clearer areas in basal and discal cells; abdomen with entirely dark hairs. Terminalia not dissected.

♂. Described as differing from ♀ in having eyes more rounded in dorsal view, with dense brown hairs; frons blackish with silvery tomentum; ground color of face darker brown; abdominal hairs longer, more erect, entirely black.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp. NE NEW GUINEA: Mt. Lucreu, 650 m, I, Cheesman.

7. *Scaptia* (*Pseudoscione*) *flavibarbis* Oldroyd

Erephopsis caliginosa Schuurmans Stekhoven, 1926, p. 62, fig. 22 (*nec* Walker). He mistook the specimen recorded below for Walker's type and described it as *caliginosa*.

Scaptia flavibarbis Oldroyd, 1949, p. 359, fig. 71 (type ♀, Upper Utaqua Vall., 1800-3000 m, II-III. 1912, Wollaston; BMNH).

MATERIAL EXAMINED: Nil.

♀. Large (17 mm), mahogany-red species, distinguished by the peculiarly inflated labium as illustrated in Oldroyd's figure; beard, humeral, supraalar and pleural tufts yellow, not conspicuous as in *floccosa*; wings with basal band well-defined, apical band indistinct; abdomen shining, with entirely black hairs.

DISTRIBUTION. SW NEW GUINEA: Utakwa Val., 800 m, XII, Boden Kloss; Upper Utakwa Val. Schuurmans Stekhoven's additional records of *caliginosa* are not included, because it is not clear whether they were of this species.

8. *Scaptia* (*Pseudoscione*) *floccosa* Oldroyd Figs. 8, 11.

Scaptia floccosa Old., 1947, p. 136, fig. 6 (type ♀, Mt. Tafa, 2800 m, II. 1934, Cheesman; BMNH).

MATERIAL EXAMINED: 1 ♀ paratype.

♀. Large-medium (13–14 mm), squarely built, shining dark reddish brown species, with normal proboscis; immediately recognizable by the conspicuous white supraalar, postalar and upper pleural hair tufts, which are clearly visible in dorsal view; white beard and propleural ruff also unusually long and dense; wings with 2 broad dark bands; abdomen with only black hairs on disc, but white marginal tufts on tergites 1, 2 & 6, remaining marginal hairs black. Terminalia not dissected.

DISTRIBUTION. NE NEW GUINEA: Kaindu, 2300 m, Edie Creek, Taylor. SE NEW GUINEA: Mt. Tafa.

9. *Scaptia* (*Pseudoscione*) *caliginosa* (Walker) Fig. 7.

Pangonia caliginosa Walk., 1865, p. 108 (type ♀, New Guinea; BMNH).

Diatomineura caliginosa: Ricardo, 1900, p. 118; 1913, p. 403.

Scaptia caliginosa: Oldroyd, 1947, p. 134, figs. 2e, 5.

Not *Erephopsis caliginosa* Schuurmans Stekhoven, 1926, p. 62 (= *Scaptia flavibarbis* Oldroyd).

MATERIAL EXAMINED: 4 ♀ ♀.

♀. This is the darkest species of the series. Medium-sized (11–13 mm), with 2 conspicuous dark bands on wings, and further distinguished by having short, relatively pale hairs on eyes, less diverging frons, relatively elongate palpi, only faint indications of paler dorsocentral vittae anterior to suture, blackish hind tibiae, and no median black patches on tergites 1 and 2, which are paler than the more distal ones. Oldroyd described the disc of the scutum of the type as having entirely black hairs; the Oriomo specimens are smaller (11–12 mm) and have a considerable sprinkling of recumbent yellowish cream hairs among black ones, but they agree in other respects, and he has kindly confirmed the identity of one of them by comparison with the type. Their terminalia are similar to those of *taylori*.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 600–800 & 1400 m, X–XI, Olthof. NE NEW GUINEA: Lordberg, XII, Bürgers. SE NEW GUINEA: Oriomo, X, Gressitt.

10. *Scaptia* (*Pseudoscione*) *insularis* Oldroyd Figs. 6, 16.

Scaptia insularis Old., 1947, p. 137, fig. 2c (type ♀, Camp 1, Mt. Baduri, 330 m, Japen I., IX. 1938, Cheesman; BMNH).

MATERIAL EXAMINED: 1 ♀ paratype.

♀. Close to *caliginosa* and with similar wing-pattern, but differs in somewhat lighter

general coloration and in having long, dense, conspicuous brown hairs on eyes. Scutum and scutellum with admixture of pale hairs; legs more uniformly yellowish brown, with strong black hind-tibial fringes; pale marginal hairs on abdomen reduced to tufts at corners of tergites; sternite 8 (fig. 16) with larger, more pointed gonapophyses.

♂. Oldroyd described the ♂ as differing from the ♀ in having the pale pubescence distinctly yellow; parafacials with a yellow tuft; mesonotum with yellow hairs on anterior border, but only isolated ones among black hairs elsewhere; tergites 3-6 of abdomen blackish, with translucent yellow hind margins, black hairs on tergites more erect than in ♀ and median yellow triangles more conspicuous. The ♂ from Erave attributed below to *taylori* may really belong here.

DISTRIBUTION. NW NEW GUINEA: Mt. Baduri & Mt. Eiori, 660 m, Japen I., IX, X. 1938, Cheesman. SE NEW GUINEA: Mt. Tafa, 2800 m, II, Cheesman.

11. *Scaptia* (*Pseudoscione*) *taylori* Oldroyd Figs. 2, 15, 17.

Scaptia taylori Old., 1947, p. 133, fig. 4 (type ♀, Edie Ck., 2200 m, Taylor; SPHTM).

Scaptia mafulensis Old., 1947, p. 133, fig. 2b (type ♀, Mt. Mafulu, 1300 m, XII. 1933, Cheesman; BMNH); 1949, p. 359. The status of this form is discussed below.

MATERIAL EXAMINED: 95 ♀♀ (including holotype of *taylori* and a paratype of *mafulensis*), ?1 ♂.

♀. More variable in size (10-13 mm) and color than was indicated by the type series. Three forms may be recognized, normal, pale, and dark. In normal form: eyes with dense but relatively pale hairs; frons relatively wide; parafacials with brown hairs, variably mixed with cream in some specimens; palpi wide, with large, rather shallow bare area; beard and pleural hairs cream with a faint yellowish tint; mesonotum and abdomen more shining and with a more yellowish tint than in the 2 preceding species, with few, inconspicuous pale hairs, even at sides of the tergites; legs yellowish brown; wings with basal dark band well-developed, distal band faint, but diffuse brown shadow extending to the apex; terminalia as in fig. 15.

What may be termed collectively the pale form is represented by the paratype of *mafulensis* and by about 15 ♀♀ sympatric with the normal form. They differ from it in any or all of the following respects: palpi relatively narrow and sometimes short; general coloration paler, and abdomen sometimes almost completely translucent yellow, with scarcely any dark staining even on distal tergites; wings with basal band faint and apical darkening barely indicated. Specimens showing all these characters look like a different species; but terminalia are identical with those of the normal form, the characters vary continuously and independently, and it seems that they represent no more than an unusual range of intraspecific variation.

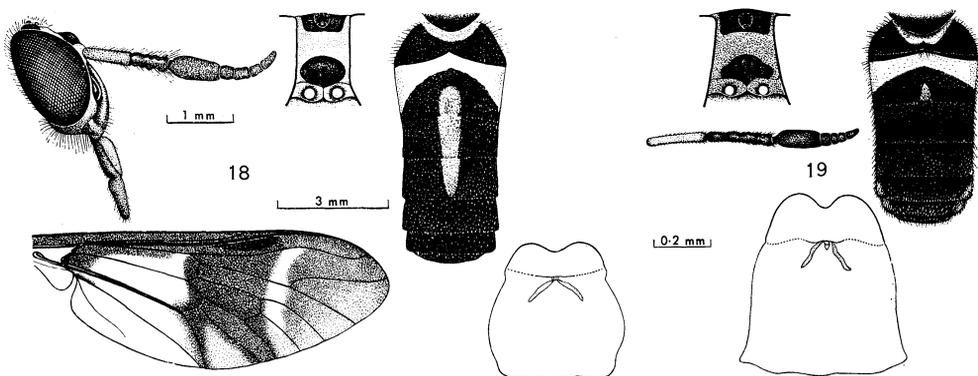
On the other hand, the dark form is represented by 14 quite uniform ♀♀ from Mt. Elandora, 15 miles from and about the same altitude as Aiyura, where normal and pale forms occur, but separated from it by kunai-grassed valleys. They are as dark as *caliginosa*, but distinguished from that species by longer, darker hairs on eyes, wider frons, wide palpi, yellowish tint in beard and pleural hairs, relatively distinct ashy dorsocentral vittae anteriorly on scutum (much as in *albibarba*), less darkened hind tibiae, and less definite apical dark band on wing. They differ less from *taylori*, show no distinguishing features

in the terminalia, and it seems best to treat them provisionally as a form of that species.

♂. Rather duller than ♀ in general coloration, and with more definite apical band on wings; eyes with longer, denser, darker hairs; upper facets somewhat enlarged, but merging into small lower and posterior facets; parafacial and facial hairs entirely brown; palpi large, with long brown hairs, their shape typical of the subgenus; terminalia undistinguished. Association with the common *taylori* rather than the rare *insularis* is presumptive.

S. taylori is much the commonest species of *Scaptia* in the eastern half of New Guinea, and it appears to be quite strongly attracted to man. Mr. Barrett noted that it was numerous between sunset and dark in his garden at Aiyura, and that it had the habit of buzzing up and down a bare leg with the proboscis close to the skin, quite unlike other Tabanidae to which he was accustomed. The ♂ from Erave behaved similarly, and it may have been attempting to feed on sweat. Period of greatest abundance at Aiyura: mid May to mid June.

DISTRIBUTION. NE NEW GUINEA: Aiyura, 2000 m, II-VI, Barrett; Edie Creek, 2200 m, Taylor; Feramin, 120-150 m, VI, Brandt; Kassam, 1350 m, XI, Maa; Kewieng, 2300 m, Stephens; Lake Ak, 2300 m, VIII, Stephens; Mt. Elandora, 2000-2600 m, III, Barrett; Mt. Gwamda, 3000 m, in moss forest, Stephens; Mt. Misim, Stevens; Schraderberg, 2100 m, I, VI, Bürgers; upper Timbe Val., 2300 m, XII, Stephens; Uruwa-Yupna Divide, 2600 m, in moss forest, VIII, Stephens; Wandabong, 1150 m, VIII, Stephens; Weleki, 500 m, biting man, V, McMillan. SE NEW GUINEA: ♂, Erave, 1200 m, X, Barrett; Mt. Mafulu.



Figs. 18-19. *Chrysops*, ♀♀: 18 *australis papuensis*, head, frons, wing, abdomen and sternite 8 (bottom scale for wing and both abdomens); 19, *albicincta*.

Subfamily CHRYSOPINAE

Genus *Chrysops* Meigen

The genus is so distinctive in the fauna that nothing need be said about it. The 2 known species may be distinguished by the following key.

KEY TO PAPUAN SPECIES OF CHRYSOPS

Antennal segment 3 about equal in length to 1 & 2 together; abdomen with median

- brownish yellow vitta on tergites 2-4; a larger (10-11 mm) species.....
 **13. australis papuensis**
 All 3 antennal segments of nearly equal length; abdomen without median vitta, at most
 yellow spot on tergite 2; smaller (9 mm) species..... **12. albicincta**

12. *Chrysops albicincta* Wulp Fig. 19.

Chrysops albicinctus van der Wulp, 1868, p. 103, pl. 3, fig. 6 (type ♀, Salawatti, Bernstein; RNH).—Schuurmans Stekhoven, 1926, p. 22, fig. 7, pl. 1, fig. 2.—Taylor, 1946, p. 328, fig. 1, pl. x (top).—Oldroyd, 1947, p. 125.

Psilochrysops albicinctus: Kröber, 1929, p. 518, pl. 13, fig. 31, pl. 14, fig. 32 (lists earlier literature).

MATERIAL EXAMINED: 4♀♀.

♀. Small (9 mm, antenna 3.5 mm) species, which does not appear to be closely related to either of the described Moluccan species. Eyes (relaxed) dark green, with indications of purplish brown mottling which could not be resolved into a definite pattern. Frons wide (index 1.2), dark grey; callus short and wide; face and upper part of parafacials shining; antennal segment 1 light yellowish brown, 2-3 dark brown. Thorax greyish black, with a narrow zone of strong golden hairs extending from notopleural lobe below and behind wing-root and another on posterior margin of scutum. Legs yellowish brown, fore and mid tibiae slightly swollen. Wing-pattern essentially similar to that of *australis papuensis* (fig. 18), but apical shadow faint. Abdominal pattern as in fig. 19, basal patch on tergite 1 yellow, 2 more velvety black than others, with translucent cream basal band and brownish yellow median patch; venter with sternites 1 & 2 translucent cream except for lateral edges, remainder entirely dark. Terminalia unusually large, as indicated by size of sternite 8 in fig. 19 in comparison with that of *australis papuensis* in fig. 18.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 50 m, VIII, Olthof; Hollandia, VII, Malkin; Kloofbivak, X, Versteeg; Salawatti. SW NEW GUINEA: Alkmaar, XII, Lorentz; Bivak I, II, IV, IX, XII, Lorentz; Lorentz R., Lorentz; Mimika R.; Rivierkamp, II, Lorentz. SE NEW GUINEA: Kiunga, Fly R., XI, Peters; Lalapipi, Lake-kamu R., IX, Waterhouse.

13. *Chrysops australis papuensis* Mackerras, n. subsp. Fig. 18.

Holotype ♀ (BISHOP 3542), Hollandia-Binnen, 25 m, 16. X. 1957, J. L. Gressitt.

MATERIAL EXAMINED: 6♀♀.

Larger (10-11 mm, antenna 4 mm) than *albicincta*, from which it may be separated by the characters given in the key. Distinguished from the nominal subspecies in north Queensland by more slender build, darker general coloration, apical shadow on the wing almost as dark as cross-band, and median pale vitta on the abdomen not extending beyond tergite 4; terminalia are similar.

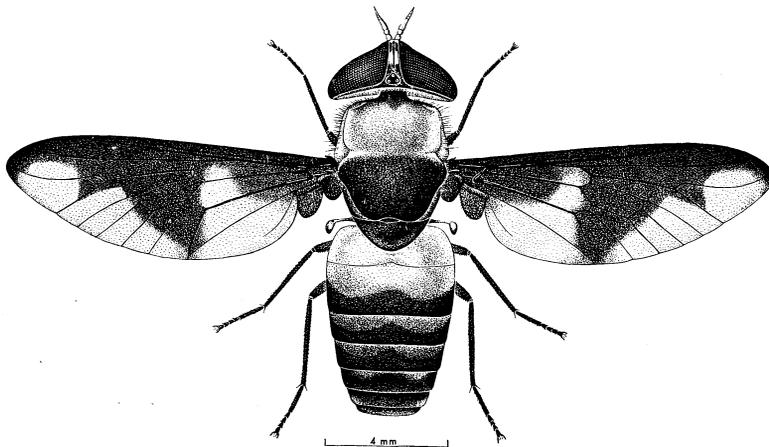
♀. *Head*: Eyes (relaxed) greenish black, without detectable pattern. Frons narrower than in *albicincta* (index 1.5), grey, with concolorous hairs in middle and shining brown zone on upper 1/3; callus dull dark brown, not reaching eye margins. Subcallus grey; parafacials grey, with a shining dark brown patch above middle; face shining bright brown;

beard sparse, greyish white. Antennal segment 1 light brown, 2 dark brown, 3 not quite so dark. Palpi shining light brown. *Thorax*: Scutum and scutellum blackish brown, with indications of paler dorsocentral vittae anterior to suture, and inconspicuous dark brown and greyish hairs; brilliant yellow patch of strong hairs on notopleural lobes and smaller one on post-alar ridge. Pleura concolorous with scutum, with dark hairs, except for brilliant yellow patch extending from upper posterior part of mesopleural convexity below wing-root to above posterior spiracle. *Legs*: Bright yellowish brown, darkening apically on hind femora, most of mid and hind tibiae and distal tarsi. Fore tibiae slightly swollen, mid and hind rather uniformly thicker than femora. *Wings*: Hyaline areas clear, contrasting with dark brown pattern shown in fig. 18; R_4 without appendix; cell Cu_2 narrowly open. *Abdomen*: Deep, almost blackish brown; tergite 1 with translucent yellowish cream basal patch, 2 with translucent creamy yellow basal band, light brownish yellow median vitta extending from apical 1/2 of tergite 2 to apical edge of 4. Venter with sternites 1 and 2 translucent brownish cream, except at apical lateral corners, remainder blackish brown.

DISTRIBUTION. NW NEW GUINEA: Hollandia, III, Philip; Hollandia-Binnen. SE NEW GUINEA: Kiunga, Fly R., VIII, Brandt; Komania, 1100 m, XI, Brandt; Vailala R., X, Murray.

Genus *Mesomyia* Macquart

Three subgenera, of which *Pareucompsa* is so distinct that it almost merits generic rank, are represented in New Guinea. Their relationships have been discussed by Mackerras (1961b). Only 6 valid species can be recognized. They are all rather small to small-medium (9–12 mm), with bare eyes, and they show the subfamily characters clearly. Schuurmans Stekhoven (1926, 1932) described 6 of his smaller Papuan species as "*Silvius*", but all except *atratus* proved to be Diachlorini when the types were examined, and they are included below under *Cydistomyia*.

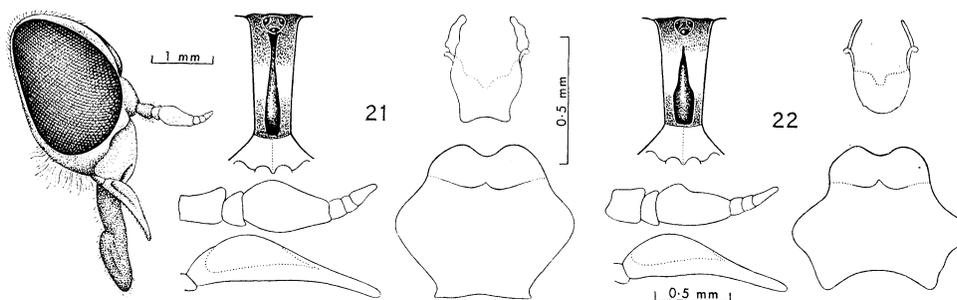


20

Fig. 20. *Mesomyia (Pareucompsa) dimidiata*. ♀.

KEY TO PAPUAN SUBGENERA AND SPECIES OF MESOMYIA

1. Subcosta with a line of small but strong setulae below; antennal style 4-annulate; frons narrow (index 5 or more). Subgenus *Pseudotabanus*. Dark, parallel-sided species, with pale dorsocentral vittae on scutum and large white median triangles on abdominal tergites..... **19. peregrina**
Subcosta bare; frons usually wider (index 2.5-4) and more converging..... 2
2. Antennal style 3-annulate; scutum fawn-cream on anterior 1/2, black posteriorly; wings with conspicuous black pattern. Subgenus *Pareucompsa* 3
Antennal style normally 4-annulate; scutum and wings without distinctive pattern.
Subgenus *Perisilvius* 4
3. Second and subsequent abdominal tergites with conspicuous apical black bands; femora dark brown..... **14. dimidiata**
Second and subsequent abdominal tergites vaguely marked with brown; femora yellow **15. femoralis**
4. A yellowish species, with conspicuous serrated yellow vitta on abdominal tergites...
..... **16. vittata**
Abdomen with transverse bands, not vittate..... 5
5. A yellowish brown species; abdominal tergites obscurely banded with brown; costal and anterior radial cells of wing diffusely brown **17. demeijerei**
A blackish species; abdominal tergites with narrow apical white bands; costal and anterior radial cells of wings blackish **18. atrata**



Figs. 21-22. *Mesomyia (Pareucompsa)*, ♀♀: 21, *dimidiata*, head, frons, antenna, palp, furca and sternite 8; 22, *femoralis*.

Subgenus *Pareucompsa* Enderlein

♀. Eyes bare, with oblique, blue, green-bordered band, which is sometimes visible even in dried specimens; frons strongly converging; antennae with 3-annulate style; palpi expanded basally, and with lateral bare area; wings with vein Sc bare; genitalia undistinguished. The striking patterns of thorax and wings (fig. 20) make identification easy. ♂. Unknown.

14. *Mesomyia (Pareucompsa) dimidiata* (Wulp) Figs. 20, 21.

Silvius dimidiatus van der Wulp, 1868, p. 6 (type ♀, Salawatti, Bernstein; RNH).—Ricardo,

1901, p. 296; 1913, p. 404.—Schuurmans Stekhoven, 1926, p. 56, fig. 19.

Pareucompsa dimidiata: Enderlein, 1922, p. 344; 1925, p. 320.—Oldroyd, 1947, p. 139, figs. 8A, 9.

Mesomyia (Pareucompsa) dimidiata: Mackerras, 1955b, p. 605.

MATERIAL EXAMINED: 3♀♀.

♀. 12 mm, ornate species. Frons deep brown, with yellowish cream transverse band slightly below middle; callus little lighter than upper part of frons; subcallus, parafacials and face yellowish cream; beard cream; antennae orange-yellow, basal segments paler; palpi dark brown on distal 2/3. Pleura fawn-cream, with conspicuous dark brown hairs on posterior margin of upper mesopleural convexity adjacent to dark area of integument below wing-root. Legs entirely dark to blackish brown. Wing-pattern as in fig. 20; R₄ strongly curved, but without appendix. Abdomen with tergite 1 and basal 2/3 of 2 yellowish cream, ground color of others yellowish brown, darkening progressively posteriorly; tergite 1 inconspicuously darkened behind scutellum, others with broad black apical bands which become more diffuse on 6 & 7; venter bright yellowish brown, somewhat darkened in median zone, with paler apical bands on sternites 2-5, 6 & 7 uniformly paler.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 50 m, VIII-X, Olthof; Doré; Salawatti. SW NEW GUINEA: Bivak I., XII, Lorentz; Digoel Mts.; Regen I., X, Lorentz.

15. *Mesomyia (Pareucompsa) femoralis* (Ricardo) Fig. 22.

Silvius dimidiatus Osten-Sacken, 1880, (nec Wulp) (cited by Oldroyd, 1947, p. 139).

Silvius dimidiatus femoralis Ricardo, 1913, p. 405 (type ♀, Regen I.; ZMA).—Schuurmans Stekhoven, 1926, p. 57.

Pareucompsa femoralis: Oldroyd, 1947, p. 139.

Mesomyia (Pareucompsa) femoralis: Mackerras, 1955b, p. 633, fig. 26A.

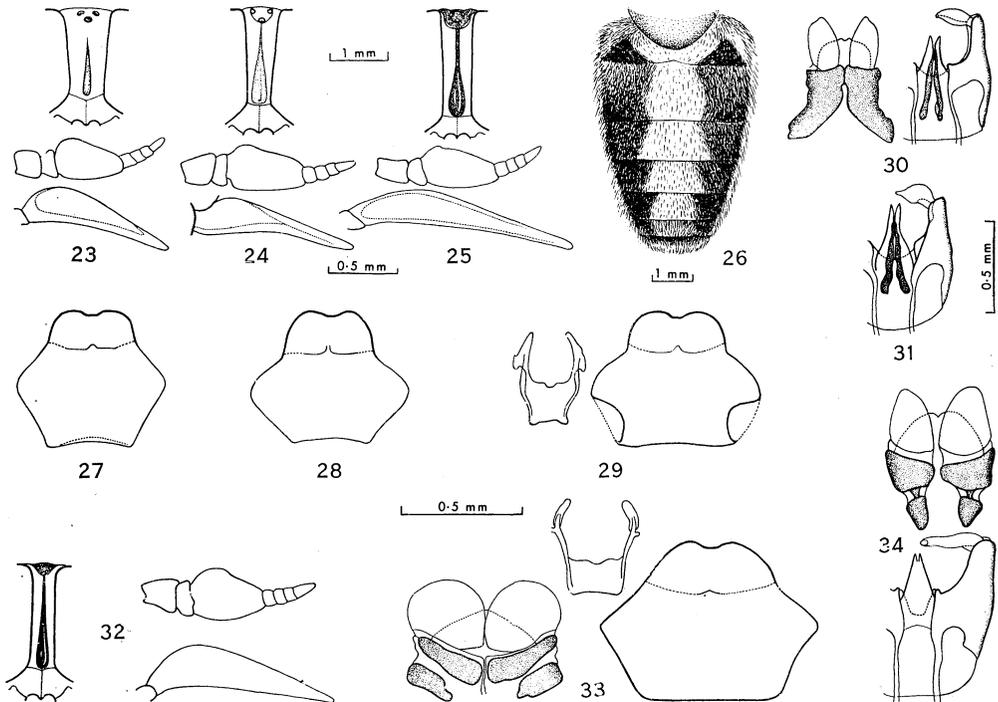
MATERIAL EXAMINED: 4♀♀.

♀. Oldroyd pointed out that the 2 supposed subspecies occurred together, and that differences between them appeared to be constant. Differs from *dimidiata* in slightly smaller size (10-11 mm); broader pale band on slightly wider frons (index 2.5 as against 3); blackish callus; lighter brown palpi; light yellowish hairs on posterior margin of upper mesopleural convexity; bright yellow femora, with pale color extending onto basal 1/2 of mid tibiae; no black bands on abdominal tergites, but basal ground color of 3 and subsequent tergites irregularly darker and more brownish than their apical bands; sternite 8 and furca (fig. 22) also differ significantly from those of *dimidiata*.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 50 m, VIII-X, Olthof; nr. Djöebaren, 80 m, VII, Maa; Doré. SW NEW GUINEA: Regen I. NE NEW GUINEA: Wewak, Deland.

Subgenus *Perisilvius* Enderlein

Two of the 3 Papuan species (*vittata* and *demeijerei*) have had a somewhat checkered taxonomic history. In common with almost all southern Bouvieromyiini, they were described originally as *Silvius*. Oldroyd (1947) recognized that they were not congeneric with Holarctic *Silvius*, and transferred them to *Lilaea*, which he used broadly as the earliest



Figs. 23–31. *Mesomyia (Perisilvius)*: 23, 26, 27, *vittata*; 24, 28, 30 (♂ terminalia), *demeijerei*; 25, 29, 31, *atrata*. Figs. 32–34. *M. (Pseudotabanus) peregrina*, ♀ ♂.

available name for Australasian segregates. Mackerras (1955b) restricted *Lilaea* to a group of Australian species more nearly related to the type species, and allotted the Papuan species to the subgenus *Pseudotabanus*. Later (1961b), he transferred them to the subgenus *Perisilvius*, thereby emphasizing their Ethiopian relationships. The suggestion then made that *Lilaea* had also evolved from the same ancestral stock has received further support from the shape of the ♀ palpi in *atrata* and especially from the remarkable similarity in the ♂ terminalia (compare figs. 30, 31 in this paper with figs. 13, 21, 32 of Mackerras, 1961b).

♀. Eyes bare, unbanded; frons converging, callus fusiform; subcallus tomentose; antennal style normally 4-annulate; palpi rather flattened, expanded basally and with lateral bare area; wings with vein Sc bare; terminalia undistinguished. Rather slender species lacking distinctive body and wing patterns of *Pareucompsa* and Indonesian *Eucompsa*.

♂. Sexual dimorphism not marked. Eyes holoptic, bare, unbanded; upper facets enlarged in *atrata*, not in *demeijerei*; no projecting interocular hairs; palpi slender, rod-like; terminalia with wide styles and unusually heavy "flagella", otherwise similar to *Lilaea*.

16. *Mesomyia (Perisilvius) vittata* (Ricardo) Figs. 23, 26, 27.

Silvius vittatus Ric., 1913, p. 405 (type ♀, Bivak I., XII. 1909, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 49, fig. 13.

Lilaea vittata: Oldroyd, 1947, p. 141, fig. 8B.

Mesomyia (Perisilvius) vittata: Mackerras, 1961b, p. 860.

MATERIAL EXAMINED: 16 ♀ ♀.

♀. Distinctive, yellowish, 9–11 mm species, characterized as in key. Eyes (relaxed) green with bluish reflections. Frons wide, index 2.5, bright fawn-yellow; callus light brown, narrow, almost linear in some specimens; subcallus concolorous with frons; parafacials and face paler, with pale cream hairs, including beard; antennal segment 3 orange, with black style; palpi bright brownish yellow, darkening apically. Thorax covered with fawn-yellow tomentum and yellow hairs, pleura little paler than avittate dorsum. Femora light yellow, tibiae more brownish, darkening to black on tarsi. Wings faintly greyish, slightly darker below and distal to brown stigma; R_4 somewhat angulate, but without appendix. Abdomen (fig. 26) with dark brown ground color reduced to series of sublateral triangles by broad, serrated, fawn-yellow median vitta and lighter brown lateral areas; venter pale, undistinguished.

DISTRIBUTION. SW NEW GUINEA: Bivak I.; Lorentz R., Lorentz. SE NEW GUINEA: Upper Fly R., XI, Peters.

17. *Mesomyia (Perisilvius) demeijerei* (Ricardo) Figs. 24, 28, 30.

Silvius de meijerei Ric., 1913, p. 405 (type ♀, Rivierkamp, II. 1910, Lorentz; ZMA).—
Schuurmans Stekhoven, 1926, p. 52, fig. 15 (misspelt *de Meyeri*).

Lilaea de meijerei: Oldroyd, 1947, p. 141, fig. 8C.

Mesomyia (Pseudotabanus) demeijerei: Mackerras, 1955b, p. 607.

Mesomyia (Perisilvius) demeijerei: Mackerras, 1961b, p. 861, fig. 50 (lists Australian synonymy).

MATERIAL EXAMINED FROM NEW GUINEA: 123 ♀ ♀, 1 ♂.

Widespread species, which also occurs down the coast of Queensland from Cape York to Stradbroke I. Eyes (relaxed) dark green with brown reflections in Papuan ♀ ♀, bright green in those from Queensland, but no other differences detected.

♀. 9–12 mm, yellowish brown species; with narrower frons (index 3.5) and wider, darker callus than *vittata*; white parafacials and face; brown antennal style; somewhat narrower, paler palpi; and pale grey pleura. Wings with costal cell and distal part of cell R_1 more definitely brown; R_4 often angulate, and sometimes with short appendix. Abdomen light brown on tergites 1 & 2, becoming progressively darker more distally; paler apical margins covered with yellowish cream hairs, giving tergites banded appearance, and extending forwards to form indefinite median and lateral triangles but not a continuous vitta.

♂. Similar to ♀. Eyes with upper facets only slightly enlarged, dark green (relaxed), separated by fine line from concolorous lower facets; frontal triangle and subcallus yellowish cream; parafacials and face creamy white, with white hairs; palpi fawn-cream, with short white hairs and few dark ones distally.

DISTRIBUTION. NW NEW GUINEA: Bakoesa, Mamberamo R., V, Marks, van den Assem; Bernhard Camp, 50–100 m, IV, VIII, X, Olthof, Toxopeus; Bodem, 100 m, VII, Maa; Hollandia, IX, den Hoed; Motorbivak, VI, van Leeuwen; 24 km N of Pionierbivak, V, Marks, van den Assem; Sarmi, VII, Maa. SW NEW GUINEA: Digoel R., III, Koch; Rivierkamp. NE NEW GUINEA: Angoram, X, Christian, Pullen. SE NEW GUINEA:

Brown R., X, in Malaise trap, Gressitt; Cape Rodney, XI, in Malaise trap, XI, Gressitt; Fly R. (upper), XI, Peters; Lake Daviumbu, XI, Brandt; Oriomo, X, Gressitt (♂ and some of ♀♀ in Malaise trap); Otomata plantn., 1 m, in Malaise trap, XI, Gressitt. Also Australia (coastal Queensland).

18. *Mesomyia* (*Perisilvius*) *atrata* (Schuurmans Stekhoven) Figs. 25, 29, 31.

Silvius? atratus Sch. Stk., 1926, p. 57, fig. 20 (type ♀, Bivak I., II. 1910, Lorentz; ZMA).

The paratype ♀, from Obi, in RNH is a diachlorine, and is described below as *Lissimas moluccensis*, n. sp.

MATERIAL EXAMINED: 81 ♀♀, including holotype, 2 ♂♂.

Small-medium species, with basically similar pattern to *demeijerei*, but black, and further distinguished by shining black rim to the black ocellar tubercle, less converging frons, longer, narrower palpi, and presence of pale scutal vittae in front of suture. Length 9–11 mm.

Schuurmans Stekhoven's type fits within range of variation of Oriomo ♀♀, though its frons and callus are slightly wider and sternite 2 of abdomen darker than in most of them. He described the antennal style as 2- or 3-annulate, and there does seem to be partial fusion of apical annuli on the one antenna that is still intact, but its form is normal, and similar occasional aberrations have been encountered in Australian species of *Mesomyia*. A full description is desirable in order to define the species precisely.

♀. *Head*: Eyes (relaxed) greenish black. Frons relatively narrow (index 4), slightly converging, with light fawn tomentum and short black hairs; callus fusiform, raised, dark brown below, becoming blackish above, and extending to shining black margin of black ocellar tubercle. Subcallus and parafacials fawn cream, face a little darker; hairs, including beard, sparse, cream to whitish. Antennae with segments 1 & 2 light brown, paler at base, with short black hairs; 3 brown, brighter basally, style normally 4-annulate, blackish. Palpi long and relatively narrow, blackish brown, with short black hairs. *Thorax*: Scutum and scutellum deep, almost blackish brown, with faint greyish overlay, and greyish dorso-central vittae in front of suture; notopleural lobes, lateral and posterior margins of scutum and anterior margin of scutellum greyish; hairs on disc inconspicuous black mixed with some creamy white ones, especially laterally and in front of scutellum; notopleural hairs mixed brown and yellowish cream (described by Schuurmans Stekhoven as black); supra- and post-alar tufts inconspicuous, predominantly creamy white. Pleura pale grey, a little darker below, with creamy white hairs. *Legs*: Coxae similar to pleura; remaining segments brownish black, with brown knees and black hairs. *Wings*: Faintly grey, with dark brown costal cell, and blackish suffusion in anterior part of radial area; stigma blackish brown; veins dark brown, somewhat lighter basally; R₄ sometimes strongly curved, but usually without appendix. *Abdomen*: Tergite 1 brown, remainder black, with black hairs; light brownish to brownish grey, white-haired apical bands decreasing progressively in depth from tergites 1–4, trace of paler color but no white hairs on apical edge of 5, remaining tergites entirely dark. Venter with sternites 1 and 2 light brownish yellow, with creamy white hairs, which show some concentration on paler apical margin of 2; remaining sternites darkening from deep brown to blackish, 3 and 4 with wide, white-haired, pale apical bands, 5 with vaguely paler apical band and few white hairs, 6 and 7 entirely dark. Terminalia as in fig. 29.

♂. Similar to ♀, but more brown in general coloration, with thicker grey bloom anteriorly and posteriorly on scutum, and more contrast between paler antennal plate and blackish style. Eyes with upper facets markedly enlarged, dark red, contrasting with small, dark olive-green, lower and narrow zone of posterior facets; facial characters as in ♀; palpi yellowish, brown at tip, with longer cream and dark hairs than in ♂ of *demeijerei*.

DISTRIBUTION. SW NEW GUINEA: Bivak I. SE NEW GUINEA: Oriomo, X, Gressitt (♂♂ and most of ♀♀ in Malaise trap).

Subgenus *Pseudotabanus* Ricardo

This typically Torresian subgenus in Australia was not known to occur in New Guinea until Dr. Philip collected a ♀ of the *distincta* group at Hollandia during the war. For brevity, the following definition is limited to group characters.

♀. Eyes bare, unbanded; frons narrower and less converging than in *Perisilvius*; subcallus tomentose; antennal plate often showing incipient subdivision, style 4-annulate; palpi smoothly curved, without lateral bare area; scutum not bicolored; wings often diffusely darkened, but the pattern, when definite (in some Australian species), not like that of *Pareucompsa*; vein Sc setulose, at least below; terminalia undistinguished.

♂. Sexual dimorphism marked, ♂♂ differing strikingly from ♀♀ in the color and patterns of abdomens; enlargement of upper facets of eyes variable; palpi subcylindrical, tapering; style of hypopygium with a ventral projection which shows in dorsal view as a characteristic oval clear area near tip (fig. 34).

19. *Mesomyia* (*Pseudotabanus*) *peregrina* Mackerras, n. sp. Figs. 32-34.

Holotype ♀ (SPHTM), from Hollandia, II. 1945, C. B. Philip.

MATERIAL EXAMINED: 1♀, 1♂.

Relatively slender, dark species, with wide pale scutal vittae, and conspicuous median triangles on abdominal tergites. Length 11 mm. It is similar to *M. (Ps.) queenslandi* Ric., but may be separated by less robust build and parallel-sided body; darker callus, with wider extension to anterior ocellus; longer hairs on subcallus; shorter, somewhat differently shaped antennal plate; diffuse darkening of median area of scutum; almost complete absence of brown coloration on abdominal tergites, there being no lateral contrast with the black adjacent to the white median triangles. The ♀ might have been treated as subspecies of *queenslandi*, but presumed ♂♂ of the 2 forms are certainly not conspecific. Further collection will be needed to show whether they are correctly associated with the respective ♀♀.

♀. *Head*: Frons narrow, index 5, almost parallel, pale creamy grey, with inconspicuous pale hairs; ocellar tubercle brown; callus narrowly club-shaped, blackish brown, with tapering extension reaching anterior ocellus. Subcallus, parafacials and face pale creamy grey, with creamy white hairs, including fairly conspicuous group at sides of subcallus; beard creamy white. Antennae blackish, segment 2 and base of 3 more brownish; 1 & 2 with short, strong, black hairs; basal plate of 3 with indications of subdivision. Palpi deep brown to blackish, with short black hairs. *Thorax*: Scutum with brown ground color reduced by grey dorsocentral vittae to vague median darkening and sharply defined

sublateral stripes; notopleural lobes and lateral margins brownish grey; hairs mixed obscure cream and brown on disc, mostly dark brown on notopleural lobes, and creamy white above and behind wing-root. Scutellum deep brown, margined with grey, with inconspicuous dark hairs on darker part and thin creamy white apical fringe. Pleura light grey, with cream to creamy white hairs. *Legs*: Black, tibiae more brownish basally; with some pale hairs ventrally on femora, black elsewhere. *Wings*: Faintly brownish, darker in costal cell and radial area; stigma and veins light brown; R₄ evenly curved, without appendix. *Abdomen*: Black, with dark brown hairs; all visible tergites with pale grey, white-haired apical margins, which decrease in depth from before backwards, and are produced into conspicuous median triangles on 2-4, smaller ones on 5 & 6, and apical lateral triangles which decrease in size from tergite 1 backwards. Venter with sternite 1 translucent yellowish cream, 2 dark brownish grey, remainder brownish black; 2nd and subsequent sternites with greyish white apical bands prominent on 2-5, narrower on remainder; hairs predominantly black on darker parts, creamy white on pale bands. Terminalia undistinguished.

♂. Specimen received already dissected. More robust than ♀, larger (ca. 12 mm), and looks very different, but comes within the range of dimorphism usual in the *distincta* group. Upper facets of eyes slightly enlarged, not sharply differentiated from lower facets. Frontal triangle, subcallus, parafacials and face light fawn-brown, darker in center of subcallus and middle or parafacials; hairs, including beard, mixed brown and dull cream; palpi fawn-grey, with black hairs above, brown below. Thorax more brown and paler pattern more obscured than in ♀. Wings more strongly suffused with brown, costal cell darker. Tergites 1 & 2 of abdomen bright brown, darkening in center and at lateral margins, 3 & 4 darker brown, with central and marginal zones blackish; a wide, brownish cream, apical band on tergite 1, narrower band with distinct median triangle on 2, and still narrower band without evident median triangle on 3; hairs black on darker part, apical fringes dull golden; venter similar to dorsum, but without median triangles and with more diffusely arranged golden hairs, especially on paler sternites 1 & 2; remaining segments missing. Terminalia typical of group.

DISTRIBUTION. NW NEW GUINEA: Hollandia, II, Philip. NE NEW GUINEA: ♂, Maprik, III, Standfast.

Subfamily TABANINAE

Tribe DIACHLORINI

All Papuan species studied have the subepaulets unequivocally without short, strong setulae, so the distinction from *Tabanus* (and also *Haematopota*) is always clear.

Division of the tribe into genera and subgenera has presented considerable difficulty. In the earlier (1962b) review of the Oriental-Australasian elements, I endeavoured to arrive at a practical compromise between the demands of morphological divergence, on the one hand, and those of phylogeny on the other. Such an arrangement is convenient, but a re-examination of the principles involved has led me into closer agreement with Hennig's (1957, 1960) contention that the intrusion of an empirical element into a phylogenetic classification can lead only to confusion, especially if it is to be used as a basis for zoogeographical reasoning. It is, perhaps, significant that changes in perspective resulting from the study of new material have pointed to the same practical conclusions as the

theoretical considerations.

There are many problems in developing a phylogenetic classification, of which two are of immediate concern to us: how to deal with assemblages of primitive animals, and how to deal with divergent offshoots from them. Both problems are represented diagrammatically in fig. 35, and it will be convenient to begin with the central core, which represents what can be inferred about the basic evolution of the Diachlorini.

When one looks at the primitive pangoniines which are presumably modified relicts of the stock that included the ancestors of the chrysopine-tabanine stem (Mackerras, 1954), and, in turn, at the primitive southern chrysopines, one receives a strong impression that the ancestral Diachlorini, in addition to having the tribal characters, must have been drab, rather long-bodied, not very hairy insects, with a not very wide frons, an ocellar tubercle bearing rudiments of ocelli, an elongate fusiform callus, small antennal scape, slender, somewhat flattened palpi, short, soft proboscis, rather long legs and wings, vein R_4 with an appendix, dorsoventrally compressed terminal abdominal segments in the ♀, and relatively slight sexual dimorphism; the ♂♂ having moderately enlarged eyes, a projecting ocellar tubercle, and cylindrical, tapering palpi. It is not to be expected that all these characters would be preserved together in any one recent form, or that some of them would not become masked or displaced by adaptive modifications that have enabled otherwise lowly stocks to survive the environmental changes that have occurred since they evolved. Nevertheless, the Oriental *Tabanotelum* and some Papuan-Pacific *Cydistomyia* have retained the presumed ancestral characteristics to a remarkable extent, and whole series of species in all the southern regions have diverged in only minor ways.

To take the extremes first, it is evident, on any theory of the distribution of animals, that the Neotropical, Ethiopian and Australian elements have been separated from each other for a very long time; yet I have failed, in spite of intensive search, to find satisfactory characters to distinguish them at the generic level. Divisions of this kind

are indicated by the deep but narrow clefts in the central part of the diagram. It may also be presumed that the African, Oriental, and Papuan elements have not been separated from each other for as long as the extremes, but, in general, for longer than locally evolved groups within the regions. Nevertheless, African-Oriental *Amanella*, Mauritian and Indian

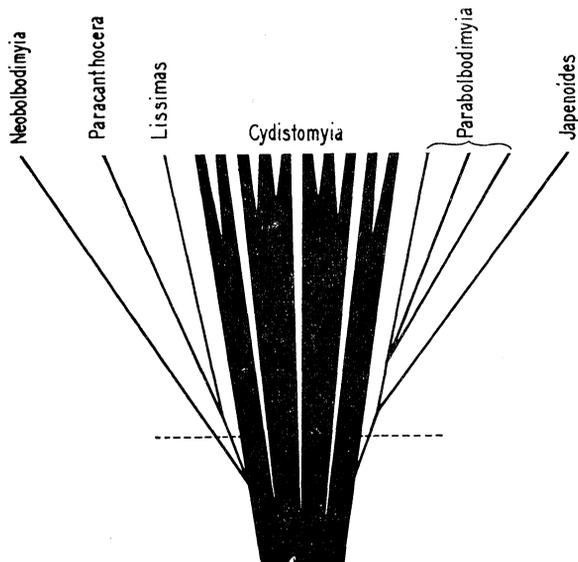


Fig. 35. Diagram showing phylogenetic relationships in the Diachlorini. The general arrangement is consistent with present knowledge, the details are conventionalized; the broken line is the level at which generic distinctions are now made.

Tabanotelum, and Oriental-Pacific *Cydistomyia* lack morphological differentiation even at the level that characterizes, for example, the subgenera of *Mesomyia*. *Amanella* and *Tabanotelum* might be distinguished from each other subgenerically; but *Amanella* cannot be separated from one section of Papuan *Cydistomyia* and *Tabanotelum* from another. It is, indeed, easier to break up single faunas into discrete sections than to distinguish morphologically between those of the different regions, although their general appearance is sometimes subtly characteristic.

There is evidence of parallel evolution but none of convergence between these elements, and it does not seem reasonable on either theoretical or practical grounds to give taxonomic weight to geographical separation, even for long geological time, unless it is supported by usable morphological features. I would therefore sink both *Amanella* and *Tabanotelum* as synonyms of *Cydistomyia*.

Most of the species in this band around the Indian Ocean and extending into the Pacific and Australia are not as primitive as those that have been included in *Tabanotelum*. There has been a widespread tendency towards compaction of the body, shortening of the legs, and truncation of the abdomen, which may possibly have been associated with improved efficiency in attacking vertebrate hosts, and there have also been local outbursts of evolution of varied intensity. The criteria described by Henning (1957) can be applied with advantage to these.

Chasmia and *Chasmiella* undoubtedly evolved from *Cydistomyia* within the Papuan sub-region. They were treated as a separate subfamily by Enderlein and accepted as 2 genera by Oldroyd (1949), but reduced to a single subgenus of *Cydistomyia* by Mackerras (1962b). That status could still be maintained, were it not for 3 considerations. The most important is that the group lacks an adequate level of distinctiveness—*i. e.* a sufficient degree of synapomorphy, in Henning's terminology—to justify the rank. Secondly, the *lamellata* group of *Cydistomyia* is distinguished at an equivalent level and should, for consistency, receive similar treatment. Thirdly, with the disappearance of other subgenera, to be discussed below, it becomes convenient to abandon the category, although I do not agree with those who disapprove of it purely on the grounds that it is cumbersome. For these reasons, I propose to treat both the *basifasciata* group (representing *Chasmia* and *Chasmiella*) and the *lamellata* group as species-groups within the genus *Cydistomyia*.

Chalybosoma, which was proposed by Oldroyd for 3 metallic species, presents a different problem. It also undoubtedly evolved locally, but its ancestry is obscure. Its antennal and palpal characters suggest relationship with the *basifasciata* group, and its habitus and pattern might associate it with part of the *albithorax* group; but the metallic coloration of both sexes and the shiny subcallus and face of the ♀ are unusual, while the hairy eyes of the ♂♂ appear to be out of place in the genus *Cydistomyia*. Hairs on the eyes are usually associated with life in cold to temperate climates, and they persist on the ♂♂ of those species of *Dasybasis* that have invaded the tropics, but there is no other indication that *Chalybosoma* may have been derived from *Dasybasis*. It would seem appropriate, therefore, to retain it as separate from both genera until a clearer indication of its relationships can be obtained.

To come to the more divergent groups, *Japenoides* and *Parabolbodimya* share enough characters (p. 105) to indicate that they were derived from a common ancestry, but they separated into 2 series, one leading to *veitchi* (fig. 46) and the other to *cheesmanae*

(fig. 44). These relationships are shown on the right hand side of the diagram, from which it is clear that *Parabolbodimyia* should be associated with *Japenoides*, rather than with *Cydistomyia*, if full weight is to be given to phylogeny. Moreover, a study of fresh material has revealed more resemblances between *festiva* and *cheesmanae* than had previously been apparent. *Parabolbodimyia* could be retained as a subgenus of *Japenoides*, but that seems to be an unnecessary refinement when so few species are involved.

Lissimas and *Paracanthocera*, shown on the left of the diagram, present an exactly similar problem, and the same reasoning applies. Again, new material (the discovery of *moluccensis* and *philipi*) has helped, because it has tended to bridge the gap between the segregates, and has also provided indications that the aberrant *Neobolbodimyia* probably arose from the same stem.

The same kind of relationship probably exists between *Udenocera* and *Lissimodes*. However, the evidence is less clear, annectant forms are lacking, and it would seem appropriate at the moment to treat them as separate genera, as was done by earlier workers.

The new arrangement, which may be compared with the previous one on p. 105 of Mackerras (1962b), is set out in the following tabular statement.

ORIENTAL-PACIFIC GENERA OF DIACHLORINI

<i>Udenocera</i> Ric.	— Ceylon
<i>Lissimodes</i> Mack. (syn. <i>Neotabanus</i> Ric. nec Lutz)	— Ceylon
<i>Lissimas</i> End. (syn. <i>Paracanthocera</i> End.)	— Wallacean-Papuan-Australian
<i>Neobolbodimyia</i> Ric.	— Papuan
<i>Japenoides</i> Oldr. (syn. <i>Parabolbodimyia</i> Mack. & Rag.)	— Papuan-Pacific
<i>Chalybosoma</i> Oldr.	— Papuan
<i>Cydistomyia</i> Tayl. (syns. <i>Chasmia</i> End. <i>Chasmiella</i> End. <i>Tabanotelum</i> Oldr. <i>Amanella</i> Oldr.)	— Ethiopian-Oriental-Papuan-Pacific-Australian (also probably Neotropical)
<i>Dasybasis</i> Macq.	— Papuan-New Caledonian (derived from Australia and New Zealand)

Genus *Neobolbodimyia* Ricardo

♀. Eyes bare, unbanded. Frons slightly diverging, entirely shining, without ocellar tubercle; callus not clearly differentiated; subcallus bulging, shining; parafacials with thin tomentum; face normal in profile, entirely shining, with large round tentorial pits; antennal segment 1 long, swollen, shining, 2 short, moderately shining, 3 little longer than 1, of normal form and mat surface; palpi of normal form, slightly shining; proboscis short and thick. Thorax and legs normal. Wings with striking dark brown pattern; R_4 usually without appendix. Abdomen normal; terminal segments dorsoventrally compressed; terminalia with tergite 10 unusually deep, cerci small, otherwise undistinguished.

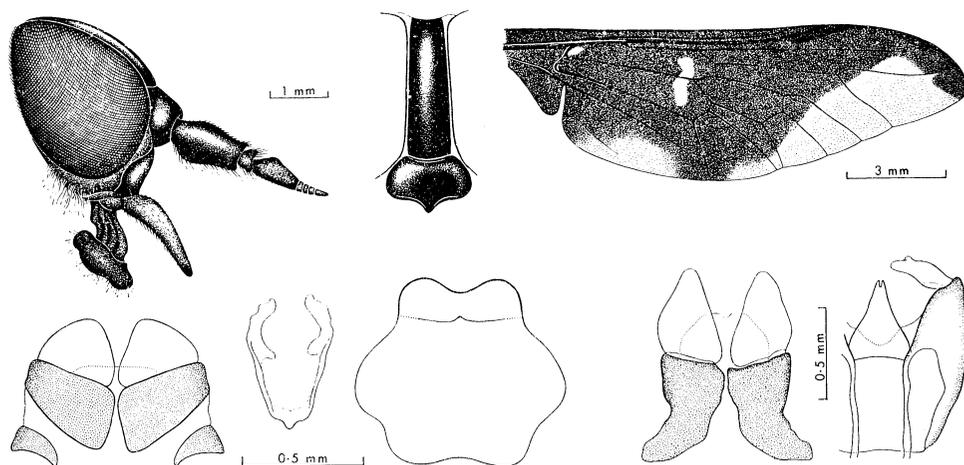


Fig. 36. *Neobolbodimyia nigra*, ♀ ♂.

♂. Sexual dimorphism slight. Eyes bare, unbanded, with upper central facets markedly enlarged; ocellar tubercle not visible. Subcallus and antennal scape even more bulbous and polished than in ♀; face slightly sunken; palpi short, truncate. Terminalia undistinguished.

This remarkable genus is not closely related to Neotropical *Bolbodimyia*, from which its name is derived, although they belong to the same tribe. It remains monotypic, the species added to it by Bezzi, Schuurmans Stekhoven and Szilady having subsequently been transferred elsewhere (Mackerras and Rageau, 1958; Mackerras, 1962b).

20. *Neobolbodimyia nigra* Ricardo Fig. 36.

Neobolbodimyia nigra Ric., 1913, p. 403 (type ♀, Bivak I., II. 1910, Lorentz; ZMA).—Surcouf, 1921, p. 94, pl. 2, fig. 13 a, b.—Schuurmans Stekhoven, 1926, p. 136, fig. 57.—Oldroyd, 1949, p. 330.

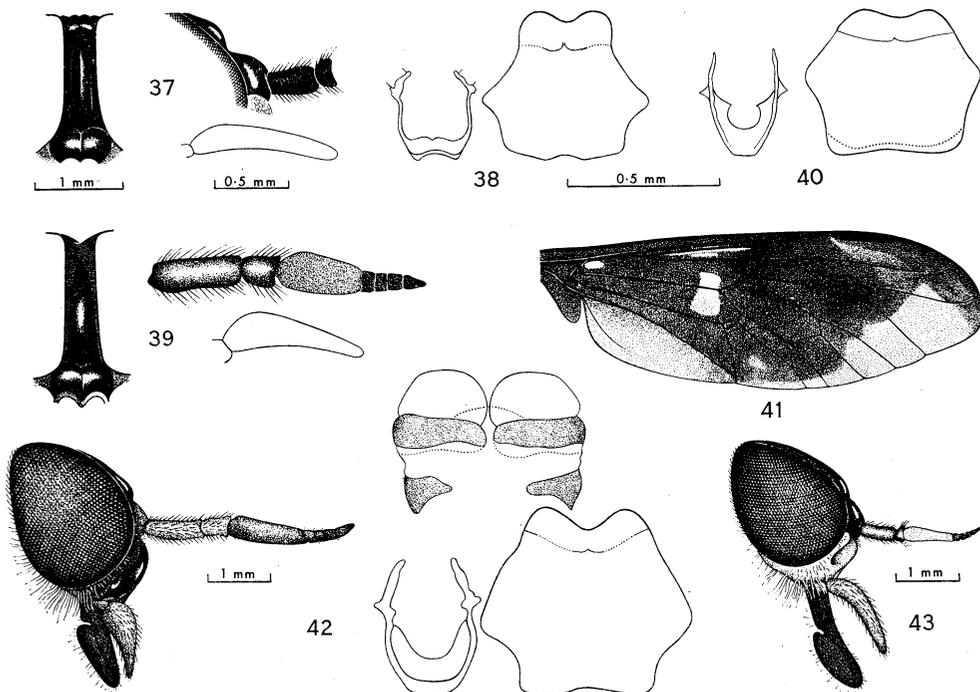
MATERIAL EXAMINED: 1 ♀, 1 ♂.

♀. Robust, 15–17 mm, black-brown, rather shining species. Eyes (relaxed) dark green. Frons medium (index about 3.5), shining dark brown, with extensive slightly protruding central area which may represent the callus; subcallus shining dark brown; parafacials with thin greyish to dark brown tomentum; face shining dark brown; beard black; antennal segments 1 & 2 shining dark brown, with black hairs, 3 dull black; palpi slightly shining, dark brown, with black hairs. Scutum and scutellum deep brown, somewhat shining, and with traces of dorsocentral vittae anteriorly; hairs black, except for small dense tuft of white at inner margin of notopleural lobes (present also on holotype—Dr. W. N. Ellis, personal communication); pleura dark brown, with dark brown to black hairs. Femora somewhat shining brown-black; remaining segments brown, darkening on distal tarsi. Wings deep brown, with clear islands and apical area as illustrated; stigma dark brown; veins black; R_4 strongly curved or angulate. Abdomen rather shining black-brown, with no pale hairs dorsally, but apical white fringes on 2 and subsequent sternites ventrally. Ter-

minalia as illustrated.

♂. Similar to ♀, but somewhat smaller (13–15 mm) and body shining mahogany brown. Eyes with enlarged facets dark red-brown, contrasting with small black facets; notopleural lobes without white tuft; yellow-brown tibiae and basal tarsi contrasting more with femora than in ♀; venter without fringes of pale hairs. This ♂ may represent a different population distinguished by entirely dark notopleural hairs and relatively pale tibiae, but is otherwise similar to more typical ♂♂ described by Oldroyd.

DISTRIBUTION. NW NEW GUINEA: Idenberg R., headwaters, 300–600 m, Stüber. SW NEW GUINEA: ♀, Aru Is., Froggatt; Bivak I. NE NEW GUINEA: ♂, Saidor, VIII, Brandt.



Figs. 37–43. *Lissimas*, ♀♀: 37, 38, *moluccensis*; 39, 40, 41, *philipi* (wing drawn from a photograph); 42, *australis* (terminalia at same scale as in 38 and 40); 43, *fenestratus*.

Genus *Lissimas* Enderlein

Lissimas Enderlein, 1922, p. 350; 1925, p. 336.—Mackerras, 1962b, p. 106, figs. 7–8, 10 (as subgenus of *Cydistomyia*). Originally monotypic for *Lissimas fenestratus* End., Celebes (fig. 43).

Paracanthocera Enderlein, 1923, p. 545; 1925, p. 333.—Oldroyd, 1949, p. 331.—Mackerras, 1959, p. 165; 1962b, p. 105. Originally monotypic for *Acanthocera australis* Ric., north Queensland (fig. 42).

♀. Eyes bare, usually (perhaps always) banded. Frons medium (index 3.5–5), slightly converging to slightly diverging, usually dark, often more or less shining; ocellar tubercle absent or rudimentary; callus large, spear- or wedge-shaped; subcallus pouting, more or less thinly tomentose, sometimes completely shiny; parafacials medium to narrow, thinly tomentose; face normal and tomentose, or more or less bulging and shiny; antennae relatively long and slender, usually longer than thickness of head, scape cylindrical and usually more than 2× as long as wide; palpi usually slender to medium, sometimes slightly shiny; proboscis short and stout. Thorax and legs normal. Wings often with conspicuous pattern; R₄ strongly curved, but usually without appendix. Abdomen elongate, usually parallel-sided; terminal segments dorsoventrally compressed; sternite 8 usually with wide, shallow gonapophyses. Small to medium-sized (10–15 mm), narrow-bodied, smooth, usually rather ornate species.

♂. The only ♂ known (*moestus*, Celebes) was described by Szilady (1926) as having eyes with area of larger facets not sharply demarcated; ocellar tubercle narrow and deeply sunken; antennal scape bell-shaped and almost 2× as long as wide; palpi slender, of unusually primitive form; and R₄ without appendix.

Essential features that distinguish this genus from *Cydistomyia* are banded eyes (although bands have not been detected on *fenestratus*, which was not relaxed, and *pechumani*, which was); shape, and usually length, of antennae; presence of either a pouting, shiny subcallus or a bulging, shiny face; rather *Chrysops*-like body form; and general resemblance between less clearly differentiated species and those distinguished by more definite characters in head or pattern of wings. That *Japenoidea* belongs to a separate evolutionary line is indicated by presence of well-developed ocellar tubercle in both sexes, generally different shape of frons and callus, differently shaped antennae (which show progressive development in a single line of specialization), presence of strong appendix on R₄, different form of body, and possibly by differently shaped gonapophyses. Eyes might also be distinctive, but *L. philipi* shows how double-banded eye of *Lissimas* might have arisen by intrusion of brown into the general green coloration above and below the central dark band.

The 2 new species provide indications that were previously lacking of relationship between *Lissimas* and *Neobolbodimyia*, *moluccensis* on account of its dark, mostly shiny frons, and *philipi* by its shiny face, relatively thick antennae and similarity in wing-pattern (cf. figs. 36 and 41). *Neobolbodimyia*, however, is still so distinctive that it merits retention as a separate genus.

KEY TO THE SPECIES OF LISSIMAS

1. Wings with a sharply defined dark pattern 2
 Wings diffusely darkened anteriorly..... 5
2. Face tomentose, subcallus shining; wings with most of basal cells clear, triangular clear window from stigma to tip of Cu₁, and distal clear zone ending posteriorly at tip of M₃; 13.5 mm, brownish black species. Celebes **fenestratus**
 Face shining, subcallus more or less thinly tomentose; wings with smaller clear windows at base and middle, but distal clear zone extending beyond M₃..... 3
3. Larger (13–14 mm), chocolate brown species, with brown to yellowish legs; brown pattern on wing barely invading base of cell R₄ and not extending behind apex

- at margin; abdomen parallel-sided, truncate apically, with narrow, sharply defined apical bands of white hairs on tergites 1 & 2; North Queensland..... **australis**
 Smaller (10–11 mm), blackish species, with dark legs; brown pattern on wing extending well into base of cell R_4 and well behind apex at margin..... 4
4. Notopleural lobes without white tuft; tibiae yellowish brown on basal 1/4; edge of wing-pattern not extending into cell R_3 ; abdomen parallel-sided, truncate apically, with barely a trace of paleness on incisures; Batchian **parallela**
 Notopleural lobes with conspicuous tuft of white hairs; tibiae almost entirely dark; edge of wing pattern extending into cell R_3 ; abdomen tapering, conical apically, with conspicuous apical band of white hairs on tergite 1 and fringes on 2 & 3; Louisiade Is. **22. philipi**
5. Small (9.5 mm), dark species, with broad brown band across scutum and extending down pleura, dark brown scutellum, and broad, ashy, white-haired apical bands on tergites 1, 2, 4 & 6 of abdomen; Obi I **21. moluccensis**
 Larger (13–15 mm) species; thoracic and abdominal patterns otherwise..... 6
6. Greyish black species, with ashy zone round sides of scutum and scutellum; wings darkened in costal cell only; abdomen with ashy apical bands on tergites 2 & 4 and small triangle on 3; Philippine Is. **pechumani**
 Duller brown species, with uniformly dark brown scutum and scutellum, diffusely darkened wings, and apical fringes and triangles of golden yellow hairs on abdominal tergites; Celebes (σ only) **moestus**

21. *Lissimas moluccensis* Mackerras, n. sp. Figs. 37–38.

Holotype ♀ (RNH), from Obi I., Bernstein. This specimen is the paratype of *Silvius? atratus* recorded by Schuurmans Stekhoven, 1926, p. 57.

MATERIAL EXAMINED: 1 ♀.

Dark chocolate-brown species, distinguished from other members of the genus by its small size, entirely shining frons, bicolored thorax and abdominal pattern. Length 9.5 mm.

♀. *Head*: Eyes (relaxed) brown, with 2 broad, oblique, gold-margined, green bands, separated by slightly narrower, deep purple-brown band. Frons slightly diverging, index 3.5, entirely shining dark brown, except for somewhat duller vertexal triangle, without distinguishable ocellar tubercle, and with short, inconspicuous black hairs; callus concolorous with frons, but distinguishable by being raised and having a median keel. Subcallus pointing, shining dark brown; parafacials and face dull fawn-grey, brown below, and face with shining brown patch on each side medial to tentorial pit; beard sparse, white. Antennal segments 1 & 2 dark brown, with black hairs, 3 missing; segment 1 about 1.5× as long as wide. Palpi slender, dark brown, with dark brown hairs. *Thorax*: Scutum dark brown anteriorly, with greyish transverse band in front of suture, dark brown in broad band behind suture, and lighter, more greyish brown posteriorly; scutellum dark brown, contrasting with part of scutum anterior to it; hairs mostly dark brown, but mixed with some pale cream ones on paler areas. Pleura crumpled, but appear to be mostly greyish brown and with broad brown band extending below wing root at level of band on scutum; hairs mostly greyish cream. *Legs* (fore and hind femora and tibiae and fore tarsi only): Femora dark chocolate-brown, tibiae somewhat lighter, fore tarsi darker; hairs predomi-

nantly dark brown. *Wings*: Ground color greyish brown; costal and anterior radial cells darker brown, broad brown suffusion along most of remaining veins; stigma concolorous with costal cell; veins brown, darker anteriorly; R_4 strongly curved, but without appendix. *Abdomen*: Deep chocolate-brown, tergite 1 slightly paler; black-haired, and with broad, ashy, white-haired apical bands on tergites 1, 2, 4 & 6; the band on 1 widens to fill almost the whole of inturned lateral part of tergite; 7 appears wholly greyish or ashy. Venter with sternite 1 grey, contrasting with dark brown remaining sternites; broad, grey, white-haired apical band on 2, apical fringe of white hairs on 4 and small median apical white patch on 6; 7 entirely dark. Sternite 8 with relatively deep gonapophyses.

DISTRIBUTION. MOLUCCAS: Obi I., S of Halmahera, Bernstein (no other data).

22. *Lissimas philipi* Mackerras, n. sp. Figs. 39-41.

Holotype ♀ (AMNH), from Mt. Riu, 250-350 m, Sudest I., Louisiade Arch., 27. VIII. 1956, L. J. Brass.

MATERIAL EXAMINED: 1 ♀.

Small (10.5 mm), dark species, distinguished from *parallela* (Walker, 1861b, p. 276; Oldroyd, 1949, p. 331) by characters given in key, and further differentiated from *australis* by pattern of eyes as seen in relaxed specimens. In *australis*, eyes show 2 green bands on a purple-brown ground; in *philipi*, green with narrow purple-brown band at middle, but some brown at top and bottom, suggesting how the difference may have arisen. The species is named after Dr. C. B. Philip, through whose kindness it was received for study.

♀. *Head*: Frons medium, index 4, black, mostly shining, but with some thin blackish grey tomentum and short black hairs; vertex deeply cleft, vertexal triangle indefinite, only faint indication of an ocellar tubercle; callus wide, moderately bulging, shining black. Subcallus shining blackish brown, with thin overlay of tomentum laterally and brown tomentose antennal sockets; parafacials greyish black, thinly tomentose, with sparse dark brown hairs, including beard; face shining black, trace of tomentum in median area. Antennal segments 1 & 2 shining brown, with black hairs; 3 dull brown, style blackish. Palpi somewhat shining blackish brown, with short black hairs. *Thorax*: Scutum and scutellum rather shining blackish brown, with traces of greyish overlay anteriorly, mainly obscure dark brown to black hairs, scattered white ones anteriorly, and conspicuous white tuft on notopleural lobes. Pleura dark greyish brown to blackish, with black hairs. *Legs*: Deep to blackish brown, with black hairs, femora somewhat darker than tibiae. *Wings*: With a conspicuous deep brown pattern, which ends abruptly at vein 1A, becomes somewhat diffuse in cells M_1 to M_4 , curves upward through basal 1/3 of cell R_4 into cell R_3 and back behind the apex, and contains small clear windows as illustrated; stigma blackish brown; veins deep to blackish brown; R_4 strongly curved, but without appendix. *Abdomen*: Shining black, with apices of tergites 1-3 slightly paler, a conspicuous fringe of white hairs on 1 and narrow white apical fringes on 2 & 3. Venter similar, but without white fringe on sternite 1. Apical segments conical (truncate in *australis*) and cerci projecting apically, but not giving appearance of permanent extrusion that is seen in *Cydistomyia lamellata*; sternite 8 wider and furca narrower than in *australis*.

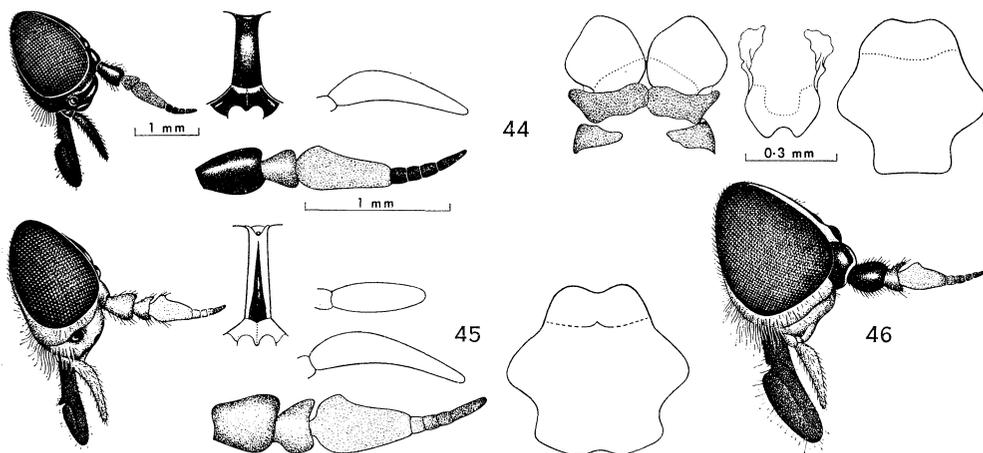
DISTRIBUTION. SE NEW GUINEA: Sudest I.

Genus *Japenoides* Oldroyd

Japenoides Old., 1949, p. 341. Originally monotypic for *Japenoides cheesmanae* Old., Japen I.

Parabolbodimyia Mackerras & Rageau, 1958, p. 680, fig. 2 B, C (as subgenus of *Cydistomyia*).

Type: *C. P. ratcliffei* Mack. & Rag.; Solomon Is., orig. design.



Figs. 44-46. *Japenoides*, ♀♀: 44 (whole top row), *cheesmanae*; 45, *festiva*; 46, *veitchi* (Fiji).

♀. Eyes bare; green, with single, broad, oblique, purple, gold-bordered band, often visible even on dried specimens. Frons diverging, index 3-6, with conspicuous ocellar tubercle, usually tomentose and with a wedge-shaped callus, entirely shining black in *cheesmanae*; subcallus tomentose, or bulging and shining; face tomentose or shining; antennae characteristically large, scape distinctly swollen and usually shining; palpi undistinguished; proboscis short and stout. Thorax and legs normal. Wings darkened anteriorly or diffusely; R_4 with strong appendix. Abdomen normal; terminal segments dorsoventrally compressed; sternite 8 with deeper gonapophyses than in most species of *Lissimas*. Small to large (8-16 mm), rather elongate, distinctive species.

♂. Sexual dimorphism slight. Eyes moderately large, bare, with transverse band; upper central facets somewhat enlarged, not sharply differentiated from small facets. Ocellar tubercle prominent; palpi variable, short and oval in *festiva* and *veitchi*, longer and more slender in *ratcliffei*.

The genus, so far as is known, is strictly insular. *J. festiva* is the most generalized species, filling a position that is analogous to that occupied by *pechumani* in *Lissimas*. It is, indeed, so little differentiated from *Cydistomyia* that care is needed to identify it; yet it leads directly to *ratcliffei* and the highly modified *veitchi* (fig. 46). It also shows considerable resemblance in form of body and darkening of the wings to the somewhat differently specialized *cheesmanae*, though it cannot be regarded as directly ancestral to both evolutionary lines. *C. oudella*, also from Japen I., may possibly belong here too, but is retained in *Cydistomyia* until the pattern of its eyes can be determined. It is tempting to

think that the divergence seen in this genus is a reflection of the turbulent geological, and possibly climatic, history of the area.

KEY TO THE SPECIES OF JAPENOIDES

1. Frons, subcallus, most of parafacials, face and antennal scape shining dark brown to black; small (8–9 mm), black species, with dark wings; Japen I... **23. cheesmanae**
Frons, parafacials and face predominantly or wholly tomentose; callus characteristically wedge-shaped; not such dark species 2
2. Small (8–10 mm), yellow and orange, *Cydistomyia*-like species; antennal scape only slightly shining; Biak, Japen I. **24. festiva**
Larger (12–16 mm), olive-brown to greyish species; antennal scape shining brown to black 3
3. Subcallus tomentose; antennal scape moderately swollen; Solomon Is. **25. ratcliffei**
Subcallus and antennal scape strikingly swollen and shining (fig. 46); New Hebrides, Fiji..... **veitchi**

23. *Japenoides cheesmanae* Oldroyd Fig. 44.

Japenoides cheesmani Old., 1949, p. 341 (type ♀, Camp 2, Mt. Eiori, 650 m, Japen I., X. 1931, Cheesman; BMNH). The name is now emended to *cheesmanae* in accordance with the 1961 International Code of Zoological Nomenclature.

MATERIAL EXAMINED: 2♀ paratypes.

♀. Small (8–9 mm), slender, blackish species. Frons medium (index 3.5), bulging, especially on lower part, shining dark brown; subcallus, most of parafacials and face shining dark brown, parafacials with brown tomentose strip above, long brown hairs on the shiny part, and brown tomentum below; beard dark brown to black; 1st antennal segment shining blackish brown, 2nd bright brown, both with black hairs, 3rd orange-brown, darkening to the black style; palpi dark brown, with black hairs. Scutum and scutellum brownish black, greyish anteriorly and laterally, with short black and conspicuous white hairs; pleura dark greyish brown, with dark brown and black hairs, except for cream tuft at posterior margin of mesopleural convexity. Femora dark brown; tibiae and most of tarsi lighter brown. Wings strongly suffused with dark brown, becoming clearer in and behind basal cells, centers of some cells also paler. Abdomen blackish brown, with some greyish dusting dorsally, inconspicuous black hairs, and yellowish cream ones scattered on the discs of most tergites and more concentrated in apical and lateral fringes; venter more shining and with fewer pale hairs.

DISTRIBUTION. NW NEW GUINEA: Mt. Eiori, Japen I. — still known only from the type series.

24. *Japenoides festiva* (Oldroyd) Fig. 45.

Cydistomyia festiva Old., 1949, p. 348, fig. 55 (type ♀, Camp 2, Mt. Eiori, 650 m, Japen I., X. 1938, Cheesman; BMNH).

Cydistomyia (*Parabolbodimyia*) *festiva*: Mackerras & Rageau, 1958, p. 681.

MATERIAL EXAMINED: 3♀ ♀, 1♂.

♀. Small (8–10 mm), yellow and orange species. Eyes (relaxed) brilliant green, with characteristic band, detectable even in unrelaxed specimens. Frons slightly diverging, index 4.5–5, brownish yellow; ocellar tubercle projecting, brown; callus projecting, brownish black; subcallus, parafacials and face brownish yellow, with dark brown shining spots in center of face and surrounding tentorial pits; beard yellow; antennal segments 1 & 2 brownish yellow, with black hairs, 3 orange, darkening from brown to black on style; palpi somewhat shining, light brownish yellow, with black hairs. Thorax, including pleura, with bright fawn-yellow tomentum and yellow hairs. Legs dark brown, becoming blackish on femora. Wings dark brown anteriorly, becoming clearer posteriorly and in centers of some of the cells. Abdominal tergites 1–3 or 4 rich orange, with bright golden hairs, apical tergites becoming blackish and with some black hairs among yellow ones; venter similar, except for greater admixture of black hairs, especially on apical sternites. Considerable variation in amount of darkening of the apical tergites and all sternites.

♂. Similar to ♀. Eyes with purple band very oblique and upper facets only a little enlarged; face without shining dark spots; palpi brown; abdomen darkened on 6th and subsequent segments only; venter with all hairs black.

DISTRIBUTION. NW NEW GUINEA: Biak, 30 km NE of airstrip, 40 m, VII, Hardy (incl. ♂); Mt. Eiori, Japen I.

25. *Japenoides ratcliffei* (Mackerras & Rageau)

Cydistomyia (*Parabolbodimyia*) *ratcliffei* Mack. & Rag. 1958, p. 692, figs. 2B, 4C (type ♀, Guadalcanal, Solomon Is., XII.1953, J. D. Bradley; BMNH).

♀♂. Distinctive, 12–15 mm, dark greyish olive and brown species, with wedge-shaped callus, tomentose subcallus, shining black antennal scape, yellow-brown legs, wings extensively suffused with brown, especially anteriorly and along veins, and fawn-cream apical bands and incipient median triangles on abdominal tergites.

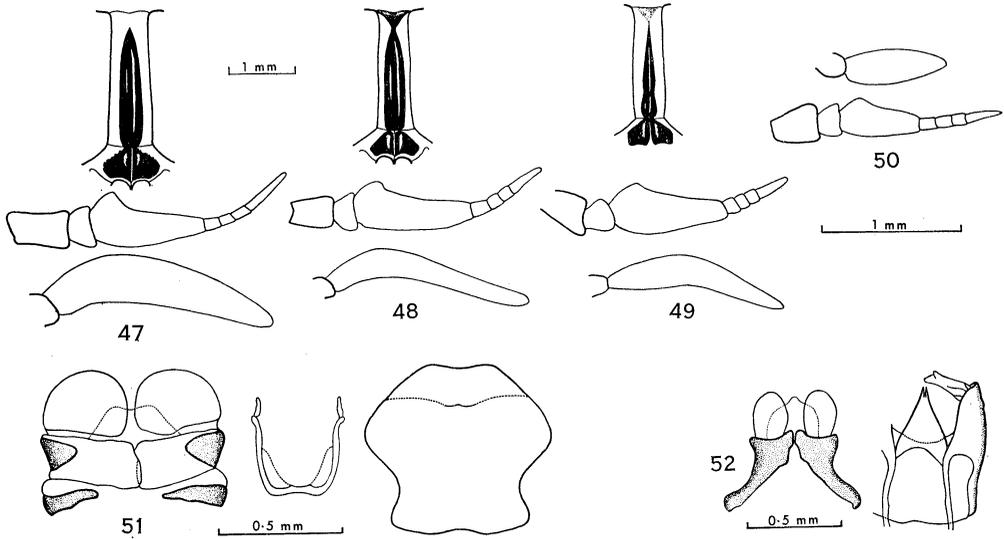
DISTRIBUTION. SOLOMON IS.: Ysabel, VII, Lever; Malaita, IV, Lever; Mala, V, Lever; Guadalcanal.

Genus *Chalybosoma* Oldroyd

♀. Eyes bare, unbanded. Frons nearly parallel, index 3–4, tomentose; ocellar tubercle absent; callus large; subcallus and face partly shining brown or black; antennae and palpi slender; proboscis normal. Tibiae contrastingly white basally. Wings mostly clear, appendix on R₄ variable. Terminal abdominal segments dorsoventrally compressed; terminalia lightly chitinized, but undistinguished. Small (8–10 mm), rotund, partly or wholly metallic blue-green, calliphorid-like species.

♂. Sexual dimorphism slight, but subcallus and face not shiny in 2 species examined. Eyes large, upper markedly enlarged facets densely hairy and contrasting with small facets; ocellar tubercle not detectable; palpi normal. Terminalia undistinguished.

The type species is *Tabanus metallicus* Ric., New Guinea, by original designation. The genus is poorly characterized, but is retained for reasons already given. Metallic coloration and mimicry of muscoid flies have developed independently a number of times in the Tabanidae, and I would now doubt that the 2 Australian species included here by English,



Figs. 47-52. *Chalybosoma*: 47, 51, *malkini*, ♀; 48, *luciliaeformis*, ♀; 49, *metallicum*, ♀ (after Schuurmans Stekhoven, 1926, and Oldroyd, 1949); 50, 52, sp. nr. *metallica*, ♂.

Mackerras and Dyce (1957) are really congeneric – they would seem rather to be convergent in coloration though not in mimicry – so that *Chalybosoma*, as at present understood, should be regarded as restricted to New Guinea.

KEY TO THE SPECIES OF CHALYBOSOMA

1. Mesonotum extensively yellowish at sides and in front of scutellum; tergite 2 of abdomen with broad, brownish cream basal band; tibiae extensively white... **26. malkini**
- Mesonotum entirely metallic blue-green, except for humeral and notopleural lobes..... 2
2. Most of tergite 2 of abdomen yellow-white; tibiae extensively white ... **27. luciliaeformis**
- Abdomen entirely metallic blue-green, or with only a trace of pale tomentum at base of tergite 2 3
3. Tibiae extensively white; pleural hairs white, except for vertical black band below wing-root..... **28. metallicum**
- Tibiae entirely dark; pleura with white hairs restricted to small patches below notopleural lobes and behind wing-root..... 29. sp. (♂)

26. *Chalybosoma malkini* Oldroyd Figs. 47, 51.

Chalybosoma malkini Old., 1949, p. 333, fig. 58 (type ♀, Hollandia, IV.1954, Malkin; USNM).

MATERIAL EXAMINED: 1♀, 1♂. The identity of the ♂ was confirmed by Mr. Oldroyd, and the ♀ agrees with it very well.

♀. 10 mm, dark metallic blue and creamy yellow species. Eyes (relaxed) red-brown. Frons greyish white, becoming brownish above; callus large, black; sides of subcallus,

parafacials and face greyish white, most of subcallus and center of face shining black, no shining spots at tentorial pits; beard cream, yellowish anteriorly; antennae light creamy brown, with black style; palpi cream, with brown hairs. Thorax dark blue-green to blackish, with yellowish, yellow-haired zone in sublateral part of scutum behind suture, widening irregularly in front of scutellum, and extending anteriorly on each side over notopleural lobes onto upper part of pleura. Legs black; basal 2/3 of fore tibiae, 4/5 of mid and 1/3 of hind contrastingly white, white-haired. Wings greyish, somewhat darker anteriorly, and with brown zone across base of basal cells; R_4 without appendix in Lake Kutubu specimen, described by Oldroyd as with a short appendix in his specimens. Abdomen dark metallic blue-green, with light creamy brown band covering most of tergite 2, and obscure, pale, white-haired apical bands on 4 and subsequent tergites, venter with sternites 1 & 2 irregularly brownish, apical paler bands on subsequent sternites more conspicuous than those on tergites. Terminalia as illustrated.

♂. Similar to ♀ in coloration and pattern, except that subcallus and face entirely greyish white tomentose. Upper enlarged facets of eyes red-brown, with dense pale hairs, small, bare lower and lateral facets dark brown; palpi fusiform, segment 2 dark brown, with black hairs; beard and lateral thoracic hairs, including metapleural tuft, more richly orange-yellow than in ♀; squamal tuft contrastingly cream as in ♀.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 2500 m, III, Toxopeus; Hollandia. SE NEW GUINEA: ♂, Dogon, 800 m, X-XI, Brandt; Kokoda, 400 m, VI, Cheesman; ♀, Lake Kutubu, 850 m, in bush margin, X, Barrett.

27. *Chalybosoma luciliaeformis* (Schuurmans Stekhoven) Fig. 48.

Tabanus luciliaeformis Sch. Stk., 1926, p. 504, fig. 262 (type ♀, Alkmaar, X. 1909; NAM).

Chalybosoma luciliaeformis: Oldroyd, 1949, p. 333, fig. 57.

MATERIAL EXAMINED: 1 ♀.

♀. An aptly named, 9-10 mm species, distinguished by its bright yellowish notopleural lobes and most of abdominal segment 2. Eyes (relaxed) dark brown. Frons brown, index 3.5; vertexal triangle raised, shining black, continuous with callus, which is more extensive than in *malkini*; most of subcallus shining brown; parafacials dull greyish brown, with white hairs, including beard; face shining deep brown on most of central area and below tentorial pits; antennae bright brown darkening on style; palpi dark brown, unusually slender. Mesonotum bright metallic blue, with faint whitish dusting; humeral and notopleural lobes yellow, with dense tufts of bright yellowish cream hairs; pleura black-haired, except for conspicuous cream hairs anteriorly continuous with those on notopleural lobe and in 2 tufts posteriorly on and below squamae. Legs shining black, except for contrasting cream, cream-haired zones on basal 1/2 of fore tibiae, 3/4 of mid and 1/3 of hind. Wings faintly brownish, dark brown basally in costal cell, in basal 1/3 of both basal cells, in small patch at fork of M, and diffusely along radial veins; stigma dark brown; R_4 without appendix. Abdomen bright metallic blue, except for contrasting brownish cream band on basal 3/4 of tergite 2 and all of sternites 1 and 2; hairs black on segments 1-4, thin but contrastingly white more distally. Terminalia not dissected.

♂. Described as similar to ♀; eyes with dense silvery hairs.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus. SW

NEW GUINEA : Alkmaar.

28. *Chalybosoma metallicum* (Ricardo) Fig. 49.

Tabanus metallicus Ric. 1913, p. 393 (type ♀, Iwaka R., Wollaston; BMNH).—Schuurmans Stekhoven, 1926, p. 503, fig. 261.

Chalybosoma metallicum: Oldroyd, 1949, p. 332, fig. 18.

MATERIAL EXAMINED: Nil.

♀. Schuurmans Stekhoven and Oldroyd have re-described the type, which is apparently still unique. Frons white, with dark vertexal triangle; callus wide, dark brown; subcallus almost entirely shining brown; parafacials and face yellowish white, central area of face and a small spot adjoining each tentorial pit shining pale brown; beard pale reddish brown; antennal segment 3 bright orange, darkening only slightly on style; palpi brown, with brown to black hairs. Scutum and scutellum metallic green, dull reddish behind wing-roots, with black hairs; humeral lobes orange, with yellow hairs; notopleural lobes pale yellow, with conspicuous yellow hairs and a small black tuft posteriorly; pleura less completely metallic, with pale areas, band of black hairs from notopleural lobe to sternopleuron and yellow to whitish ones elsewhere. Legs dark brown to black; basal 1/2 of fore tibiae, 2/3 of mid and 1/4 of hind white, white-haired. Wings clear, except for brown costal, 1st basal, most of 2nd basal and a little of anal cells; R₄ without appendix. Abdomen metallic blue-green, slightly reddish on anterior margin of tergites 1 & 2 and more so on sternites 1 & 2; hairs black. Length 9 mm.

DISTRIBUTION. SW NEW GUINEA : Iwaka R.

29. *Chalybosoma* sp. Figs. 50, 52.

A ♂, from Kiunga, Fly R., X, Brandt, appears to differ significantly from *metallicum* in having mostly black hairs on pleura, entirely dark tibiae and pale metatarsi, but it is generally undesirable to give names to species of Tabanidae that are represented only by ♂♂. It may, however, be described in some detail, so that it can be associated with the ♀♀ when they are discovered.

♂. Eyes large; upper large facets reddish brown, with whitish hairs, lower small blackish facets bare. Vertex deeply cleft, but no ocellar tubercle visible; frontal triangle brown; subcallus somewhat lighter, entirely tomentose; parafacials and face with greyish brown tomentum and dark brown hairs; no bare area on face; beard greyish white posteriorly, more brownish anteriorly; antennal segments 1 & 2 bright brown, 3 creamy yellow, becoming brownish on style; palpi dark brown. Scutum and scutellum metallic bluish, white-dusted anteriorly, becoming brownish at sides, including humeral and notopleural lobes; hairs black, except for rather straggling white ones across anterior margin and anterior part of notopleural lobes; pleura with dark brown hairs, except for whitish ones on anterior edge of mesopleural convexity, a thin white patch above and anterior to posterior spiracle, and yellowish white squamal tuft. Femora shining blue-black, tibiae shining brown-black, knees brown; fore metatarsus brown-black, most of mid dull yellow-brown, hind contrasting yellow-brown, with dull golden hairs, dark at apex; remaining tarsal segments brown-black. Wings greyish, with brown costal cell and brown shadows extending across bases and apices of basal cells; R₄ angulate and with trace of appendix. Abdo-

men metallic blue with greenish and violet reflections, apices of tergites marked by narrow brown lines; hairs entirely black; venter similar.

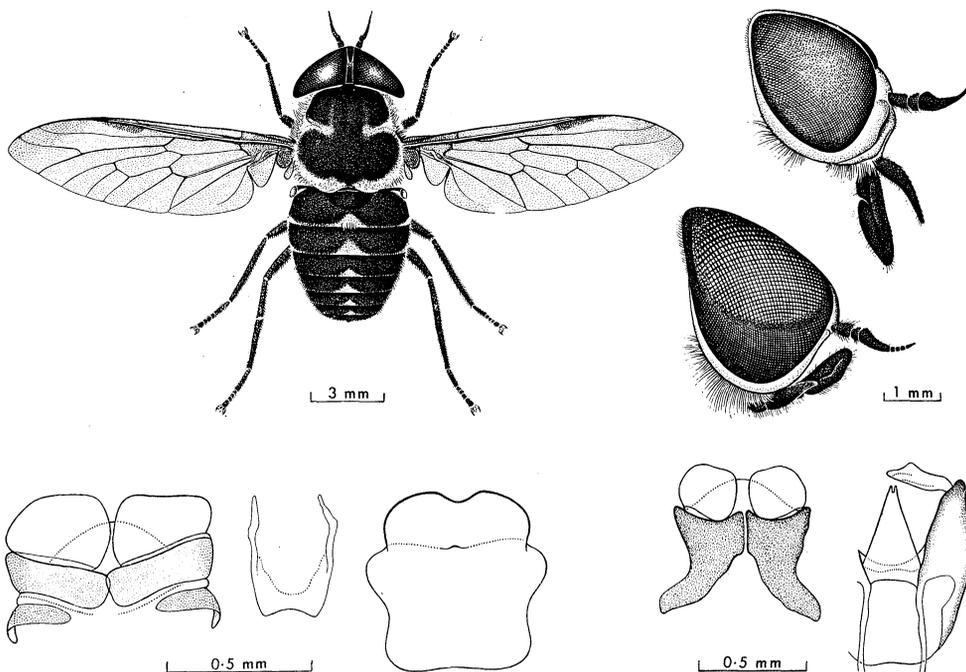


Fig. 53. *Cydistomyia albithorax*, ♀ ♂. For frons see fig. 90.

Genus *Cydistomyia* Taylor

Cydistomyia Tay., 1919, p. 47.—Oldroyd, 1949, p. 342.—Mackerras, 1959, p. 166. Originally monotypic for *Cydistomyia doddi* Tay. (= *albithorax* Ric.), New Guinea (wrongly recorded as Kuranda, north Queensland).

Chasmia Enderlein, 1922, p. 344; 1925, p. 331.—Oldroyd, 1949, p. 333.—Mackerras, 1962b, p. 105 (as subgenus of *Cydistomyia*). Originally monotypic for *Chasmia bicincta* End. (= *basifasciata* de Meij.), New Guinea.

Chasmielia Enderlein, 1922, p. 344; 1925, p. 331.—Oldroyd, 1949, p. 333; Mackerras, 1962b, p. 107 (as synonym of *Chasmia*). Originally monotypic for *Tabanus brevisculus* Walk., New Guinea.

Tabanotelum Oldroyd, 1949 (Ent. Mon. Mag. 85), p. 21; 1954, p. 59.—Mackerras, 1962b, p. 102 (as subgenus of *Cydistomyia*). Originally monotypic for *Tabanotelum jactum* Old., Mauritius.

Amanella Oldroyd, 1954, p. 75. Type: *Tabanus imbecillus* Karsch, Tanganyika, by orig. design. (The status of the Ethiopian subgenus *Canalicula* Old. is not considered here.)

♀. Eyes bare, unbanded. Frons mostly or entirely tomentose, slightly converging, to slightly diverging, index greater than 3 (except *heydoni*); callus usually well-developed (absent or rudimentary in 3 species); subcallus (except *imitans* and *perdita*) tomentose; pa-

rafacials tomentose; face usually tomentose, occasionally more or less shiny; antennae sometimes slender, scape at most slightly swollen; palpi usually slender. Thorax and legs undistinguished. Wings sometimes long, sometimes diffusely darkened, especially anteriorly, but almost entirely blackish only in *imitans*; R_4 usually without appendix. Terminal abdominal segments usually dorsoventrally compressed, occasionally (*lamellata* group) modified. Very small to large (6–21 mm), smooth, non-metallic, sometimes rather bare flies, usually of medium build, but sometimes slender or rotund.

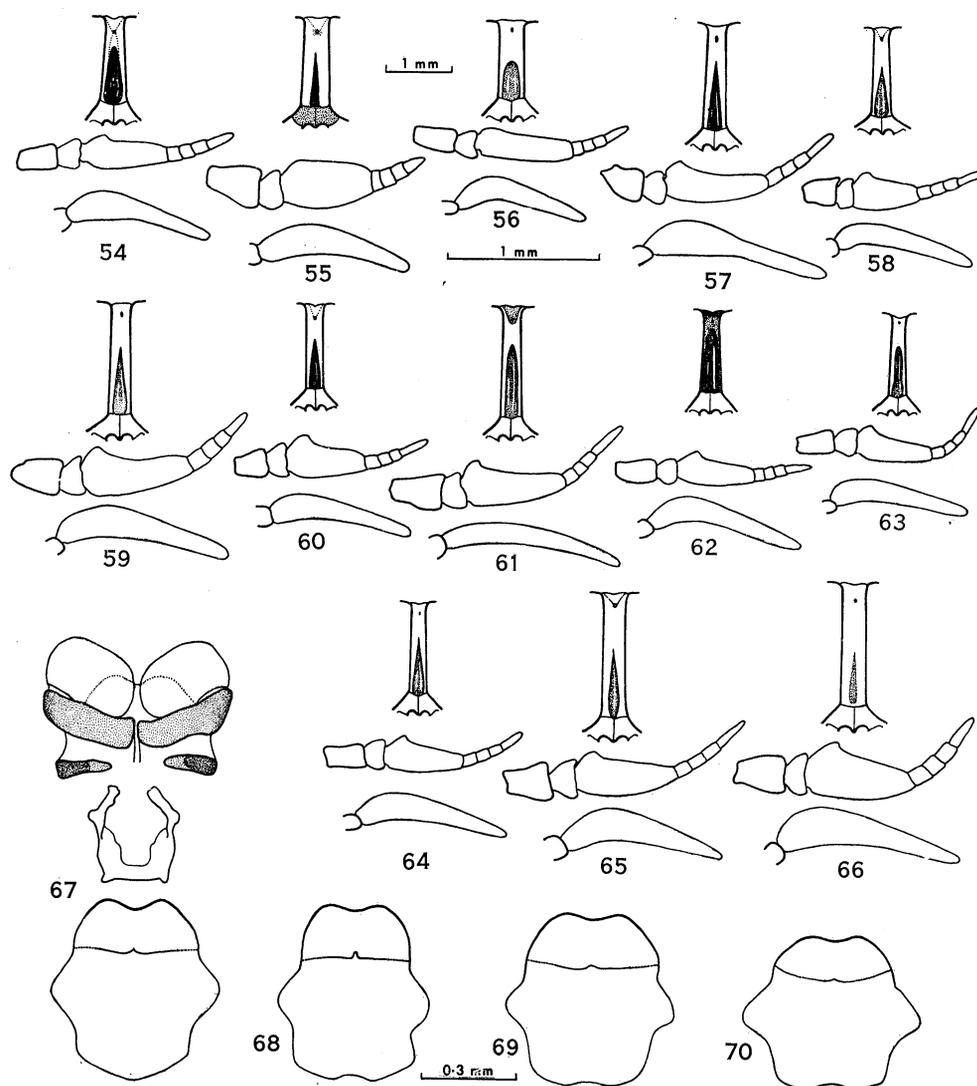
♂. Sexual dimorphism slight to moderate. Eyes bare, upper facets usually enlarged and contrasting with the lower; ocellar tubercle sometimes small and hidden, usually visible at vertex; palpi conical or acorn-shaped. Terminalia undistinguished.

It is difficult to frame a satisfactory definition of this genus, because, as already noted, it is characterized essentially by lack of specialization. Moreover, the incipient specializations that do occur introduce numerous exceptions into what could otherwise be simple statements. The general features of the type species, including its rather broad build and unusual thoracic pattern, are shown in fig. 53, but it represents a diverging branch rather than the central core of the genus. The Australian species are less diverse, suggesting that they have been subjected to less intense selection pressures.

The Papuan species could be divided into 8 or more groups, but only 2 of them are at all sharply distinguished, and it is convenient to treat the remainder as sub-groups of a single inclusive group. This arrangement is only approximately natural, but it facilitates identification and reduces the keys to species to manageable lengths. There are exceptions to the following key to the groups, so doubtful specimens should be checked against the more detailed notes. It is also necessary to exclude *Japenoides festiva* (p. 106), which may cause confusion if it is not correctly identified.

KEY TO SPECIES-GROUPS OF PAPUAN CYDISTOMYIA

1. Small (6–8, occasionally 10 mm), mostly rather shiny, rotund, muscid-like species; ocellar tubercle prominent, often elongate; antennae usually slender, scape cylindrical; vein R_4 normally originating at an acute angle (fig. 71), and almost always smoothly curved; cell Cu_2 often narrowly open or closed at wing-margin; cerci of ♀♀ often rather tent-like and contrasting yellow..... **basifasciata** group
Not such species; if small, the body more slender and tomentose, cerci of ♀♀ not so contrasting, R_4 often with an appendix, and other characters collectively not as above 2
2. Narrow-bodied, 9–11 mm, mostly dark species, usually with contrasting pale zone around scutum and scutellum; wing darkened anteriorly; abdomen with pattern of median and lateral triangles or vittae, but inconspicuous or no apical bands on tergites; cerci often tent-like in end view and sometimes completely exposed **lamellata** group
Usually more robust species with different thoracic and abdominal patterns; if small and slender, color more drab and ornamentation inconspicuous; terminal abdominal segments dorsoventrally compressed and cerci usually more flattened..... **albithorax** group



Figs. 54-70. *Cydistomyia, basifasciata* group, ♀♀: 54, 67, *basifasciata*; 55, *atriventer*; 56, *fulgida*; 57, 68, *raffrayi*; 58, *atripes*; 59, *breviuscula*; 60, *subhastata*; 61, *variegata*; 62, 69, *ochrothorax*; 63, 70, *insularis*; 64, *parva*; 65, *auribarba*; 66, *parvicallosa*.

The *basifasciata* Group

In addition to the characters in the key, the frons is nearly parallel, index 4-8; callus usually large; subcallus tomentose, but face sometimes partly shining; antennal scape sometimes nearly 2× as long as wide; palpi slender; proboscis with relatively small labella, which are usually not more than 1/3 of its total length. Legs slender. Wings long, cell R_4 often unusually long. Terminal segments of abdomen somewhat laterally compressed,

the cerci meeting at about right-angle in end view; sternite 8 rather narrow, with relatively deep gonapophyses; these parts rather uniform, and have provided little assistance in discriminating between the species. Sexual dimorphism not marked, except possibly in *atriventer*; eyes of ♂♂ with upper facets markedly enlarged; ocellar tubercle narrow but distinctly visible; terminalia undistinguished. The most striking feature of most of the species is their resemblance to small testaceous muscids which occur in the same localities. This parallels the calliphorid-like appearance of the species of *Chalybosoma*, those of the *Myiotabanus* group in South America and of *Myioscaptia* in Australia, and it may be adaptive, as suggested by Nicholson (1927) for *Myioscaptia*.

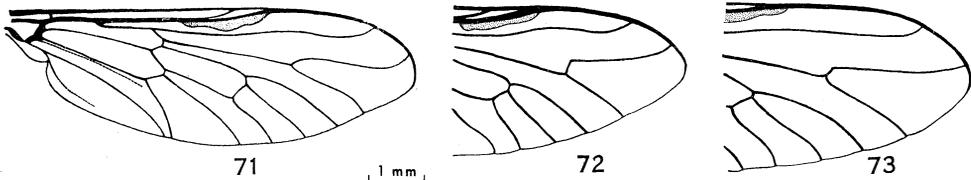
Two of the species (*atriventer* and *parvicallosa*) have more tomentose bodies than the others, and may seem out of place. *C. atriventer* also has an unusually wide frons, narrow callus and short antennae (fig. 55), but its thoracic pattern and wings are so like those of *basifasciata* that it is best placed near that species. *C. parvicallosa* is an unusually large, pale species, with small, pale callus and a distinctive abdominal pattern, but it is rotund, rather muscid-like, with normal antennae and palpi, and shows indications of relationship with *fasciata* and *auribarba*. On the other hand, *papouina* has been excluded on account of its venation (fig. 72) and indications of relationship with the slightly aberrant Australian *C. brevior* (Walk.). *C. nana* (New Britain, Solomon Is.) is likely to be the most confusing of the small species that have not been included in the group, but its tomentose body, drab yellowish fawn coloration, callus, palpi, appendix on R₄ and shape of sternite 8 should be sufficient to separate it. *C. hollandiensis* is further distinguished by its slender build.

The group includes 4 of the species described by Schuurmans Stekhoven as "*Silvius*." It appears to be strictly Papuan, and is widely distributed in the subregion from Waigeu to the Louisiade Is., but is not yet known from further east. At least some of the species are attracted to man, and their resemblance to muscids is as apparent in the field as it is in preserved specimens (McMillan, personal communication).

KEY TO SPECIES OF THE BASIFASCIATA GROUP OF CYDISTOMYIA

1. Face at least partly shining brown; small (6–8.5 mm) species.....2
 - Face entirely tomentose 4
- 2 (1). A dark brown species, with vaguely spotted wings, a clear whitish band covering junction of tergites 1 & 2 of abdomen, a narrower apical band on 2 and variable white fringes on remaining tergites.....**30. basifasciata**
 - Yellow-brown species, with unspotted wings, and abdomen yellow on basal tergites, shining dark brown to black apically 3
- 3 (2). Face mostly shining brown; antennal plate slender, with rounded dorsal angle; mesopleura with vertical brown band below wing-root..... **32. fulgida**
 - Face with semilunar shining patch above and lateral to each tentorial pit; antennal plate shorter, wider, with definite dorsal angle; pleura concolorous yellow..... **40. insularis**
- 4 (1). Relatively large (10 mm), strongly patterned species, with inconspicuous pale callus, yellowish brown, sometimes vittate scutum, black scutellum, and broad cream to yellowish band covering tergite 1 and basal 1/4 of 2 of otherwise dark, narrowly banded abdomen..... **43. parvicallosa**

- Smaller (6-8, rare individuals up to 10 mm), differently patterned species, with darker, better defined calli..... 5
- 5 (4). Dark brown, tomentose species; scutum with notopleural lobes, band covering transverse suture and band in front of scutellum whitish **31. atriventer**
More shining, usually more yellowish species, without transverse bands on scutum, and with less contrasting notopleural lobes..... 6
- 6 (5). Scutum with broad black median and sublateral vittae on yellow ground; scutellum black.....7
Scutum without black vittae, though median area and scutellum may be darkened 8
- 7 (6). Antennal plate entirely orange; beard black; pleura with dark, black-haired zone below wing..... **41. fasciata**
Antennal plate orange on basal 1/4 only; beard bright yellow; pleura without dark-haired zone below wing **42. auribarba**
- 8 (6). Pleura with brownish tint and vertical darker stripe or brown-haired zone extending down mesopleuron 9
Pleura concolorous yellow, with entirely yellow to brownish hairs.....11
- 9 (8). Paler species, with light fawn-brown frons, and yellowish brown callus and stigma.....**35. breviscula**
Darker species, with dark frons, blackish brown callus, and dark brown stigma..... 10
- 10 (9). Antennae and palpi relatively long (fig. 57); scutum more yellowish... **33. raffrayi**
Antennae and palpi short (fig. 58); scutum duller brown..... **34. atripes**
- 11 (8). Frons ashy, callus blackish; subcallus, parafacials and face white to cream; palpi yellow, usually with more yellow than black hairs; stigma clear yellow-brown..... **36. subhastata**
Frons mostly brown; subcallus, parafacials and face yellow to brownish 12
- 12 (11). Palpi unusually long and slender, yellow, with mostly yellow hairs; stigma yellow-brown; abdomen yellow basally and distally, broadly black from hind border of segment 2 to apical margin of 4 dorsally and ventrally...**37. variegata**
Palpi shorter and darker, with entirely black hairs; stigma brown; abdomen yellow on variable number of basal segments, becoming shining dark brown to black distally, at most retracted terminal segments and cerci pale..... 13
- 13 (12). Callus brown, of medium size, not filling frons below; palpi blackish ... **38. parva**
Callus blackish, extensive, full width of frons below; palpi yellow-brown..... **39. ochrothorax**



Figs. 71-73. Wings of: 71, *C. basifasciata* ♀; 72, *C. papouina* ♂; 73, *C. hollandiensis* ♀.

30. *Cydistomyia basifasciata* (de Meijere) Figs. 54, 67, 71.

Tabanus basifasciatus de Meij., 1915, p. 107 (type ♀, Bougainville Mt., 525 m, VI. 1910, V. K.; ZMA).—Schuurmans Stekhoven, 1926, p. 281, fig. 121, pl. 18, fig. 4.

Chasmia basifasciata: Oldroyd, 1949, p. 334, fig. 46.

Chasmia bicincta Enderlein, 1922, p. 344 (type ♀, Grat, 1150 m, XI. 1912; BERLIN); 1925, p. 331.—Synonymy by Oldroyd, 1949, p. 334.

MATERIAL EXAMINED: 21 ♀ ♀.

♀. A distinctive, relatively narrow-bodied, 7–8.5 mm, dark, rather shining species. Eyes (relaxed) uniformly brown. Frons diverging, index 4–4.5, dark brown, with diffuse grey sheen above brownish black callus; ocellar tubercle small; subcallus, parafacials and face brown, tomentose, except for shining dark brown upper 1/2 of face and adjacent part of parafacials; beard black; antennae sometimes longer than thickness of head, slender, light brown, with black style; palpi dark brown, with black hairs. Thorax brown, with blackish scutellum, a broad whitish band on each side anteriorly covering notopleural lobes and extending to below anterior spiracles, a narrower one from wing-roots around posterior margin of scutum, yellow-haired white patch above posterior spiracle, and a darker brown zone from posterior corners of notopleural lobes down over posterior part of mesopleural convexity; squamal tuft white. Legs entirely dark brown. Wings long, brownish, with darker brown suffusion in costal cell, across apices of basal cells, along radial veins, and in diffuse spots at fork of R_{4+5} and apex of discal cell; veins and stigma dark brown; cell R_4 unusually long. Abdomen brown on tergites 1 & 2, blackish more distally, with conspicuous, white, white-haired band covering apex of tergite 1 and base of 2, and variable, narrow, paler apical margins on other tergites; venter similar, basal whitish band wider than on dorsum. Terminalia as in fig. 67.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 600–800 m, III, XI, Olthof, Toxopeus; Sabron, 650 m, V, Cheesman. NE NEW GUINEA: Bewani Mts., 400 m, VII, Stüber; Bougainville Mt.; Finschhafen, Wagner; Grat⁵; Kalalo, 700 m, XI, McMillan; Lordberg, XII; Meanderberg, 1000 m, VIII; Nineia, 500 m, X, McMillan; Wanuma, 800–1000 m, Adelbert Mts., X, Gressitt.

31. *Cydistomyia atriventer* (Schuurmans Stekhoven) Fig. 55.

Silvius atriventer Sch. Stk., 1926, p. 53, fig. 16 (type ♀, S. New Guinea, XII. 1902, Versteeg; ZMA).—Oldroyd, 1949, p. 360.

Cydistomyia dimorpha Oldroyd, 1949, p. 349, fig. 56 (type ♀, Araucaria Camp, 800 m, III. 1939, Toxopeus; BMNH, Archbold Coll.). The synonymy was confirmed by Mr. Oldroyd by comparison of the types.

MATERIAL EXAMINED: ♀ holotype of *atriventer*.

♀. Slender, 8–9 mm, dark chocolate-brown, tomentose species, with entirely tomentose face, distinctively banded thorax, faintly darkened wings, and white transverse bands on abdominal tergites. Eyes (not relaxed) dark brown. Frons diverging, index 3.5, ashy grey, darkened around ocellar tubercle, contrasting with brown subcallus; callus blackish, nar-

5. I have not been able to trace this locality in the former German territory.

row, irregularly spear-shaped; parafacials and face ashy grey, white-haired, with a brown, brown-haired zone on lower part of face and extending laterally to eye margin below level of tentorial pits; beard white; antennae and palpi deep brown to blackish, with predominantly black hairs. Scutum dark chocolate-brown, with transverse greyish band at level of suture and widening to cover notopleural lobes, and 2nd band in front of scutellum; pleura of Schuurmans Stekhoven's type more extensively greyish than described by Oldroyd, and with broad, vertical, dark chocolate-brown band below wing-root. Legs deep to blackish brown. Wings greyish; costal cell brown, and faint brownish suffusion across apices of basal cells and along veins, darkening at wing margin anterior to apex, but giving no more than hint of the pattern seen in *basifasciata*; stigma and veins dark brown; R₄ slightly angulate, but without appendix. Abdomen dark chocolate-brown, black-haired, except for narrow, even, pale, white-haired apical bands on tergites and sternites. Terminalia not dissected.

♂. Described by Oldroyd as differing strikingly from ♀ (hence his name) in lacking brown patch on parafacials, and in having whole of segment 2 and parts of 1 & 3 of abdomen translucent yellow dorsally and ventrally.

DISTRIBUTION. NW NEW GUINEA: ♀, ♂♂, Araucaria Camp; ♂, Mt. Eiori, 650 m, Japen I., XI, Cheesman. SW NEW GUINEA: ♀, Unspecified type locality.

32. *Cydistomyia fulgida* (Ricardo) Fig. 56.

Tabanus fulgidus Ric., 1913, p. 402 (type ♀, Heuvelbivak, 800 m, XI.1909, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 385, fig. 188.

Chasmiella fulgidus: Oldroyd, 1949, p. 337, fig. 23.

Silvius flavicinctus Schuurmans Stekhoven, 1932, p. 12, fig. 1 [type ♀, forest betw. "Lomira" & Lake "Kamakawalla" (apparently errors in transcription of Loemida and Kamakawator), III.1929; Inst. Roy. Sci. Nat., Brussels]. This specimen agrees very well with a ♀ of *fulgida* sent to me by Mr. Oldroyd.

MATERIAL EXAMINED: 2♀♀, including holotype of *flavicinctus*.

♀. Small (7 mm), yellow and black species. Eyes (relaxed) black-brown. Frons relatively wide, index 3-4, grey, with dark, slightly shining ocellar tubercle; callus short and broad; subcallus, parafacials and sides of face brownish grey tomentose, most of rest of face shining brown; beard sparse, cream; antennae variable, sometimes very slender (fig. 56), light yellow basally, darkening distally on segment 3 to black style; palpi brown, with dark brown hairs. Scutum light brown, scutellum blackish; pleura pale brownish grey, with broad, dark brown, vertical band below and just in front of wing-root. Legs dark brown. Wings faintly brownish, costal cell slightly darker; stigma brown; veins dark brown; R₄ only slightly curved at base. Abdominal segments 1, 2 and base of 3 yellow dorsally and ventrally, remainder brownish black. Terminalia not dissected.

DISTRIBUTION. NW NEW GUINEA: Mt. Eiori, 650 m, Japen I., X, Cheesman. SW NEW GUINEA: Heuvelbivak, betw. Loemida and Lake Kamakawator.

33. *Cydistomyia raffrayi* (Bigot) Figs. 57, 68.

Tabanus raffrayi Bigot, 1892, p. 690 (type ♀, New Guinea; BMNH).—Ricardo, 1913, p. 402.—Schuurmans Stekhoven, 1926, p. 291, fig. 127.

Chasmiella raffrayi: Oldroyd, 1949, p. 338, figs. 25, 48.

MATERIAL EXAMINED: 2 ♀♀ (identity confirmed by Mr. Oldroyd).

♀. Dark, 7–8.5 mm species, with almost entirely shining deep brown abdomen contrasting with more yellowish scutum. Frons dark brown, index 6; callus black; subcallus, parafacials and face dark brown, somewhat lighter in center of face; beard black; basal antennal segments brown, plate more yellowish at base, darkening to black on style; palpi brown, with black hairs. Scutum and scutellum variable yellow-brown to brown, darker in median zone, and with indistinct median and dorsocentral vittae in 1 ♀ (possibly partly a result of preservation before pinning); pleura irregularly brown to greyish, with white hairs, but diffusely darker and with black hairs on mesopleural convexity and upper part of sternopleuron. Legs with all femora and fore tibiae and tarsi dark brown, mid and hind tibiae and tarsi paler. Wings faintly brown, with light brown stigma. Abdomen shining deep to blackish brown, black-haired, the 1st incisure and median part of tergite 1 and narrow apical lines on remaining tergites greyish to yellowish white, with a few white hairs; venter similar, except that most of sternite 1 is pale, and hairs are entirely dark; cerci bright yellow. Sternite 8 as illustrated.

DISTRIBUTION. NW NEW GUINEA: Mt. Eiori, 650 m, Japen I., X, Cheesman; Mt. Nok, 800 m, and Waifor, Waigeu, IV, Cheesman. NE NEW GUINEA: Prince Alexander Ra., 900 m, IX, Pullen. SE NEW GUINEA: Mt. Mafulu, 1300 m, I, Cheesman.

34. *Cydistomyia atripes* (Schuermans Stekhoven) Fig. 58.

Silvius atripes Sch. Stk., 1926, p. 54, fig. 17 (type ♀, Doorman track, X, 1920; ZMA).—Oldroyd, 1949, p. 361.

MATERIAL EXAMINED: 5 ♀♀, including holotype.

♀. Very close to *raffrayi*, but shapes of antennae and palpi probably sufficient to distinguish it. Darker and duller in general coloration; frons slightly narrower (index 6–6.5); basal antennal segments not so dark, and plate shorter and wider; palpi shorter and darker; scutum more concolorous brown; fewer pale hairs on pleura; wings with more brownish tint, especially along veins, and stigma darker; abdominal tergites with better defined pale apical margins and fringes of pale hairs, at least in eastern specimens. Terminalia not distinguishable from those of *raffrayi*.

DISTRIBUTION. NW NEW GUINEA: Doorman track. SW NEW GUINEA: Bomberai, 700–900 m, VI, Gressitt. SE NEW GUINEA: Komania, 1100 m, XI, Brandt; Sudest I, 0–100 m, IX, Brass.

35. *Cydistomyia breviscula* (Walker) Fig. 59.

Tabanus brevisculus Walk., 1865, p. 109 (type ♂, New Guinea, Wallace; BMNH).—Schuermans Stekhoven, 1926, p. 451, fig. 221.—Not Ricardo, 1913, p. 401 (= *ochrothorax* Sch. Stk.).

Chasmiella brevisculus: Enderlein, 1922, p. 344; 1925, p. 331.—Oldroyd, 1949, p. 339, fig. 49.

MATERIAL EXAMINED: 4 ♀♀, 2 ♂♂.

The ♂♂ agree precisely with Oldroyd's notes; the ♀♀ are from different localities and,

like his, are associated with the ♂♂ by general resemblances. They differ from his ♀♀ in having the pleura more brownish, vertical darker zone diffuse, and legs more uniformly brownish yellow.

♀. Somewhat larger (7–9.5 mm) than *raffrayi* and more yellow-brown in general coloration. Eyes (relaxed) brown, with green reflections below, but no line of demarcation. Frons fawn-yellow tomentose; ocellar tubercle brown, prominent; callus light yellowish brown; subcallus, parafacials and face brown, with some yellowish reflections and dark brown hairs, including beard; antennae light yellowish brown, style black; palpi brown, with black hairs. Mesonotum bright brown, with fawn overlay anteriorly and laterally; pleura similar, upper mesopleural convexity darker, hairs brown in vertical zone extending down from posterior part of notopleural lobes, yellow elsewhere. Legs light yellowish brown, darkening somewhat on fore tibiae and all tarsi. Wings faintly greyish, costal cell yellow, and trace of brown cloud at apices of basal cells; stigma yellowish brown; R₄ more strongly curved than usual, sometimes with short appendix. Abdomen yellow-brown, becoming blackish distally, with yellow hairs in indefinite median patches and on apical tergites, elsewhere black; venter with entirely dark hairs; sternite 8 and cerci bright yellow-brown.

♂. Paler in color than ♀; with paler subcallus, parafacials and face; antennal segment 3 more slender; scutum with long brown hairs on posterior 3/4, relatively bare anteriorly; dark brown zone on pleura more sharply defined; femora and anterior tibiae darker brown; dark hairs on abdomen brown rather than black.

DISTRIBUTION. NW NEW GUINEA: ♀♀, Araucaria Camp, 800 m, III, Toxopeus; ♀, Archbold Lake, 760 m, XI–XII, Quate; ♂, Cyclops Mts., 330 m, III, Laffoon. NE NEW GUINEA: ♀♀, Feramin, 120–150 m, III, Brandt; ♀, Kassam, 1350 m, XI, Maa; ♂♂, Mokai, 750 m, Torricelli Mts., III, VIII, Brandt.

36. *Cydistomyia subhastata* (Oldroyd) Fig. 60.

Chasmiella subhastata Old., 1949, p. 336, fig. 50 (type ♀, Camp 2, Mt. Eiori, 650 m, Japen I., X. 1938, Cheesman; BMNH).

MATERIAL EXAMINED: 12♀♀, 9♂♂.

♀. 6–8 mm, bright yellowish species. Eyes (relaxed) red-brown. Frons narrow, index 6–6.5, ashy with variable greyish reflections; ocellar tubercle conspicuous, elongate, shining black; callus almost full width of frons below, not usually extending much above its middle, brown at base, brownish black above; subcallus, parafacials and face pale cream, sometimes with faint yellowish tint; hairs on parafacials inconspicuous, beard brown; antennal segment 1 white basally, more brownish yellow apically, 2 brownish yellow, 3 brownish yellow at base, brown distally, style black; palpi light yellow, hairs varying from entirely yellow to almost entirely black. Scutum and sometimes scutellum bright brownish yellow, median area and most of scutellum variably darkened, sometimes to extent of forming a broad, blackish, median stripe; pleura entirely bright yellow, with yellow hairs. Fore femora variably yellowish basally, blackish distally, mid and hind yellow; tibiae and tarsi brown, sometimes paler basally, sometimes blackish distally. Wings faintly brownish, costal cell slightly darker; stigma light yellowish brown. Segments 1 & 2 of abdomen brownish yellow, sometimes irregularly darker in median zone; 3–6 shining brownish black;

apical segments variably paler, but sternite 8 and cerci always yellowish.

♂. Paler than ♀, the median darkening on scutum and scutellum indicated in only a few of the specimens; facial area sometimes more yellowish; abdomen diffusely darkened on tergites 3-6 only. Two ♂♂ from Normanby I. are larger than others (9.5 mm), but appear to be conspecific. The undistinguished yellowish ♂♂ known to me all have anterior 1/4 of scutum relatively bare, and may usually be separated by the following key.

1. Pleura with a contrasting brown-haired vertical zone below wing-root..... **35. breviscula**
Pleura concolorous yellow, at most some hairs on mesopleural convexity brownish..... 2
2. Proboscis yellow, sometimes brownish towards tips of labella; stigma clear yellow
..... **36. subhastata**
Proboscis with at least labella brown; stigma brown..... 3
3. Fore femora yellow on basal 1/2 or more; shaft of proboscis more or less yellowish; palpi yellow..... **39. ochrothorax**
Fore femora often entirely blackish; shaft of proboscis entirely brown; palpi brown
..... **40. insularis**

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus; Bodem, 100 m, VII, Maa; Camp Nok, 800 m, Waigeu, IV, Cheesman; Hollandia, in rain forest, XII, Hoogstraal, Philip (incl. ♂); Japen I.; Mt. Nomo, 200 m, II, Cheesman; Swart Val., W. side, 1400-2000 m, XI, Gressitt; Waris, 450-500 m, VIII, Maa (incl. ♂). NE NEW GUINEA: Mobitei, 750 m, Torricelli Mts., III, Brandt; Mt. Lucreu, 650 m, I, Cheesman; Nineia, 500 m, X, McMillan; Saidor, VI, Brandt; Torricelli Mt., 250 m, I, Cheesman; ♂, Wantipi, Torricelli Mts., XI-XII, Brandt; Wanuma, 800-1000 m, Adelbert Mts., X, Gressitt. SE NEW GUINEA: Dogon, 800 m, X-XI, Brandt; Goilala, 1950 m, Owen Stanley Range, IV, Brandt (incl. ♂); ♂♂, Kiunga, Fly R., VIII, Brandt; Mt. Mafulu, 1300 m, I, Chessman; ♂♂, Normanby I., XI, Brandt; ♂, Woodlark I., III, Brandt.

37. *Cydistomyia variegata* (Schuurmans Steekhoven) Fig. 61.

Silvius variegatus Sch. Stk., 1926, p. 55, fig. 18 [type ♀, (originally in alcohol), Tor R., middle loop, jungle, X. 1911; ZMA].

MATERIAL EXAMINED: 3 ♀♀, including holotype.

♀. The holotype (9 mm) is larger than ♀♀ of *subhastata* studied, and differs from them in having brown frons, somewhat yellowish above; yellow subcallus, parafacials and face; longer antennae; unusually long and thin, entirely yellow-haired palpi; concolorous yellow scutum and only slightly darkened scutellum; and different abdominal pattern. Tergites 1 & 2 more brownish yellow and entirely black-haired, 3 & 4 dark to blackish brown, rather shining, and distal tergites all pale yellow; venter similar, so that whole abdomen appears to have a dark mid section. Two ♀♀ from Waris (where typical *subhastata* also occurred) are about the same size as the type, and agree with it very well, except that the median zones of scutum, scutellum and basal abdominal tergites are darker. One of these (though not the other) showed paler patches on parafacials and face after it had been cleaned in amyl acetate, suggesting that *variegata* might be no more than a variant of *subhastata*, but Mr. Oldroyd, through whom the type was returned, has informed me that 4 ♂♂ in BMNH that agree with it are distinct from the ♂♂ of *subhastata*.

DISTRIBUTION. NW NEW GUINEA: Tor R.; Waris, 450-500 m, VIII, Maa. (Cy-

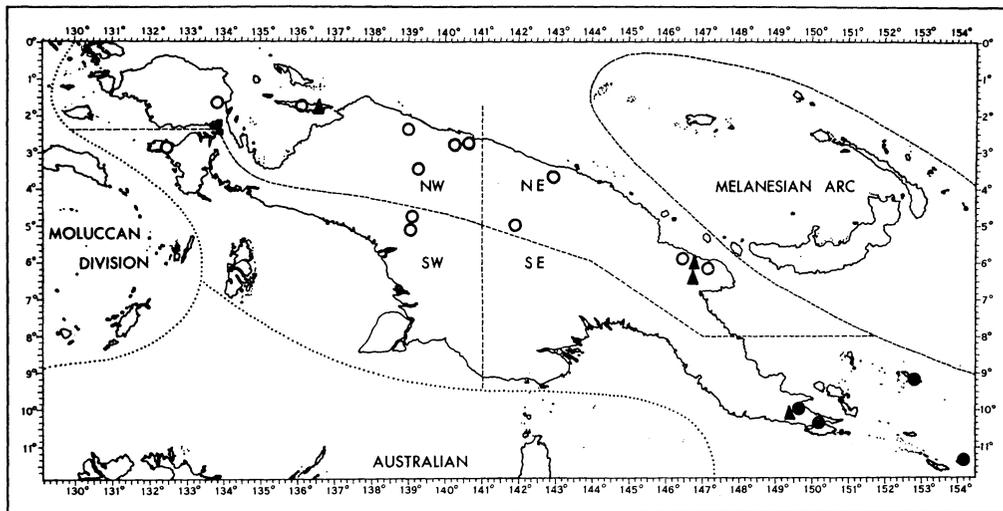


Fig. 74. Distribution of *Cydistomyia parva* (triangles), *ochrothorax* (open circles), *insularis* (solid circles).

clops Mts., Kokoda, Mt. Mafulu—Oldroyd, pers. comm.).

38. *Cydistomyia parva* (Oldroyd) Figs. 64, 74.

Chasmiella parva Old., 1949, p. 337, fig. 47 (type ♀, Camp 2, Mt. Eiori, 650 m, Japen I., X, 1938, Cheesman; BMNH).

MATERIAL EXAMINED: 7 ♀♀, including a paratype.

This species is similar to *ochrothorax* and *insularis*, and I had thought that they might be geographical races of a single species. However, there is little indication of morphological overlapping, and the distribution of *parva* bridges the allopatric distributions of the other two (fig. 74). It seems best to treat them as separate species until more is known about them.

♀. A 7–9 mm, rather brownish species, duller than *ochrothorax*, and differing from it in the following details: frons narrower, index 6–6.5, brown, without the shining appearance above that is usually typical of *ochrothorax*; callus narrower, not reaching eye margins below, dark brown rather than black; subcallus, parafacials and face duller fawn-brown; antennal segment 3 more slender; palpi brown, with black hairs; pleura duller, with brownish tint, and sometimes brown hairs on mesopleural convexity; legs darker, most of fore legs and mid and hind tibiae and tarsi brown to blackish; basal abdominal tergites brownish yellow, color diffusing into the black of more distal tergites.

DISTRIBUTION. NW NEW GUINEA: Japen I. NE NEW GUINEA: Timbe R., 1600 m, XII, Stephens; Wandabong, 1100 m, VIII, Stephens. SE NEW GUINEA: Komania, 1100 m, XI, Brandt.

39. *Cydistomyia ochrothorax* (Schuurmans Stekhoven) Figs. 62, 69, 74.

Tabanus ochrothorax Sch. Stk., 1926, p. 444, figs. 214, 215, pl. 18, fig. 1 (type ♀, Heuvel-

bivak, 800 m, XI. 1909, Lorentz; stated to have been in *Natura Artis Magistra*, but not found by Dr. Ellis); 1932, p. 16.

Chasmiella ochrothorax: Oldroyd, 1949, p. 335, fig. 45.

Tabanus brevisculus Ricardo, 1913, p. 401, *nec* Walker, 1865. Error of identification noted by Schuurmans Stekhoven, 1926, p. 451.

MATERIAL EXAMINED: 11 ♀♀, 3 ♂♂.

♀. Rotund, 6–8 mm, yellowish species, generally smaller and duller than *subhastata* and with less evident dark markings on mesonotum and abdomen. Eyes (relaxed) red-brown. Frons slightly wider (index 5–6), dark brown to blackish, mostly filled with blackish brown callus; ocellar tubercle small but distinct; subcallus, parafacials and face fawn-brown, entirely tomentose; beard yellowish brown; antennae light yellowish, darkening distally, becoming blackish on style; palpi yellow-brown, with brown hairs. Scutum and scutellum yellow, with variable traces of darker median and sublateral patches anteriorly; pleura bright yellow, lower part of sternopleuron sometimes greyish and with a small dark patch, but no dark band in front of wing-root. Coxae and femora yellowish, darkening apically on fore femora; tibiae and tarsi brown, except for yellowish bases of the tibiae. Wings faintly brownish, with brown stigma and veins. Abdomen yellow dorsally and ventrally on segments 1 and most of 2, sometimes on 3 & 4, more distal segment black; sternite 8 and cerci yellow. The specimens from Kalalo have a smaller callus than those from further west, but agree in other details.

♂. Similar to ♀, but legs paler, and abdomen black on 4th and subsequent tergites only. The parafacials may be ashy, and the only distinction from small ♂♂ of *subhastata* appears to be in the darker proboscis and stigma and usually duller general coloration.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus; ♂, Bodem, 100 m, VII, Maa; Cyclops Mts., 300 & 1100 m, III, Cheesman, Laffon; Hollandia, in rain forest, IV, V, Hoogstraal, Malkin; Japen I., 850 m, X, Cheesman; Siwi, III. SW NEW GUINEA: ?Alkmaar, II, Lorentz (♂—Oldroyd doubted the identity of this specimen); Bivak I., XII, Lorentz; Fak Fak, 100–700 m, VI, Maa; Heuvelbivak. NE NEW GUINEA: ♂, Feramin, 120–150 m, VI, Brandt; Kalalo, 700 m, XI, McMillan; ♂, Maprik, Deland; Saidor to Finisterre Range, 1200 m, IX, Brandt.

40. *Cydistomyia insularis* Mackerras, n. sp. Figs. 63, 70, 74.

Chasmiella parva var. Oldroyd, 1949, p. 337, ♀ from Milne Bay.

Holotype ♀ (AMNH), from Abaleti, 0–50 m, Rossel I., 27. IX. 1956, L. J. Brass.

MATERIAL EXAMINED: 21 ♀♀, 10 ♂♂.

♀. Small, (6.5–8 mm), dark species. Eyes (relaxed) chocolate-brown. Distinguished from *ochrothorax* by: callus smaller, not completely filling frons below, and not extending so far towards vertex; face with a shining brown patch above each tentorial pit, but not extending onto parafacials; antennae slightly longer and more slender; palpi dark brown, with black hairs, as in *parva*; proboscis darker brown; fore femora and tibiae entirely blackish brown; wings darker on fore-border, sometimes with deeper shading at tips of R_{2+3} and R_4 ; sternite 8 (fig. 70) shorter and wider, but difference not great enough to be of definite specific value.

♂. Face without shining patches, but otherwise distinguished in same way as the ♀; hairs on parafacials and palpi and beard dark brown; proboscis with shaft and labella dark brown. Males of *ochrothorax* have palpi and shaft of proboscis paler, and fore femora largely yellowish.

DISTRIBUTION. SE NEW GUINEA: ♀♀, ♂♂, Dogon, 800 m, X-XI, Brandt; ♀, Komania, 1100 m, XI, Brandt; ♀, Milne Bay, II, I. M. M.; ♀♀, ♂♂, Rossel I.; ♂♂ Woodlark I., III, Brandt.

41. *Cydistomyia fasciata* (Oldroyd)

Chasmiella fasciata Old., 1949, p. 340, fig. 52 (type ♀, Araucaria Camp, 800 m, III. 1938, Toxopeus; BMNH, Archbold Coll.).

MATERIAL EXAMINED: Nil.

♀. 8 mm species, easily recognizable by black scutal vittae. Frons parallel, index 5, with golden tomentum, black at vertex; callus narrow, tapering, reaching about mid-length of frons, light brown; subcallus golden, becoming a little blackish on parafacials, somewhat reddish in center of face; beard sparse, black; antennal segments 1 & 2 bright yellow, 3 bright orange style brown; palpi orange, with mostly black hairs. Mesonotum yellow, with 3 black-brown vittae (representing the restricted dark ground color), the median one widest anteriorly and tapering towards the brown-black scutellum, sublateral vittae straight on medial side, convex laterally; pleura mostly yellow with yellow hairs, anterior 1/2 of mesopleuron immediately below the wing-base black-brown with black hairs. Legs mostly black-brown; mid and hind tibiae paler, with dark tips. Wings clear; stigma pale yellow. Tergites 1 & 2 of abdomen partly or wholly yellow, remainder black-brown; hairs mainly black, a yellowish apical fringe and median triangle on tergite 1, white median triangles and lateral fringes on other tergites, terminal segments with more numerous white hairs; venter similar, but without white-haired segmentations and triangles.

♂. Similar to ♀, except for normal sexual differences, including longer clothing hairs which give the body more woolly appearance.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp; Idenberg R., headwaters, 300-600 m, Stüber. NE NEW GUINEA: Nadzab, VII, Krombein.

42. *Cydistomyia auribarba* Mackerras, n. sp. Fig. 65.

Holotype ♀ (AMNH), from Mt. Sisa, 350 m, Misima I., 18. VII. 1956, L. J. Brass.

MATERIAL EXAMINED: 1♀.

Distinctive species, which differs from *fasciata* in having darker callus, yellow beard, antennal plate orange only on basal 1/4, no black-haired zone on mesopleuron, and few pale hairs on abdominal tergites. Length 9 mm.

♀. *Head*: Eyes (relaxed) green with brown reflections. Frons almost parallel, index 6.5, fawn-yellow, with inconspicuous yellowish hairs; vertexal triangle darker, ocellar tubercle prominent, raised, somewhat shining dark brown; callus brown, tapering evenly to about middle of frons. Subcallus, parafacials and face as in *fasciata*, except that beard bright yellow. Antennal segments 1 & 2 light yellow; 3 orange on basal 1/4, becoming black more distally, style black. Palpi yellow, with black hairs. *Thorax*: As in *fasciata*,

except that entire pleura bright orange-yellow, with bright yellow hairs. *Legs and wings*: As in *fasciata*. *Abdomen*: Tergite 1 extensively blackish sublaterally, broadly yellow on apical and lateral margins; 2 shining black, except for narrow basal yellow band and light brown apical line; remainder entirely shining black; hairs black, except for bright yellow on apical zone of tergite 1, a few dull cream hairs in middle of apical margins of 2-4 and a dull cream apical fringe on 6. Venter with sternite 1 and basal 1/4 of 2 yellow; remainder shining blackish brown, except for trace of paler apical line on 2; hairs black. Terminal segments somewhat compressed, cerci yellow-brown; not dissected.

DISTRIBUTION. SE NEW GUINEA: Misima I.

43. *Cydistomyia parvicallosa* (Oldroyd) Fig. 66.

Chasmiella parvicallosa Old., 1949, p. 340, fig. 51 (type ♀, Kokoda, 400 m, VIII. 1933, Cheesman; BMNH). The name was spelt "*parvacallosa*" on p. 340, but "*parvicallosa*" on pp. 305, 334, 346, and by Mr. Oldroyd in correspondence, and that is selected as the correct spelling.

Cydistomyia mackerrasi Philip, 1960a, p. 5, fig. 2 (type ♀, Hollandia, in rather deep shade of rain forest, X. 1944, C. B. Philip; was presented to the Queensland Institute of Medical Research, but it has been transferred to SPHTM). This specimen was sent to Mr. Oldroyd, who reported that it was conspecific with the type of *parvicallosa*.

MATERIAL EXAMINED: 1 ♀, 1 ♂.

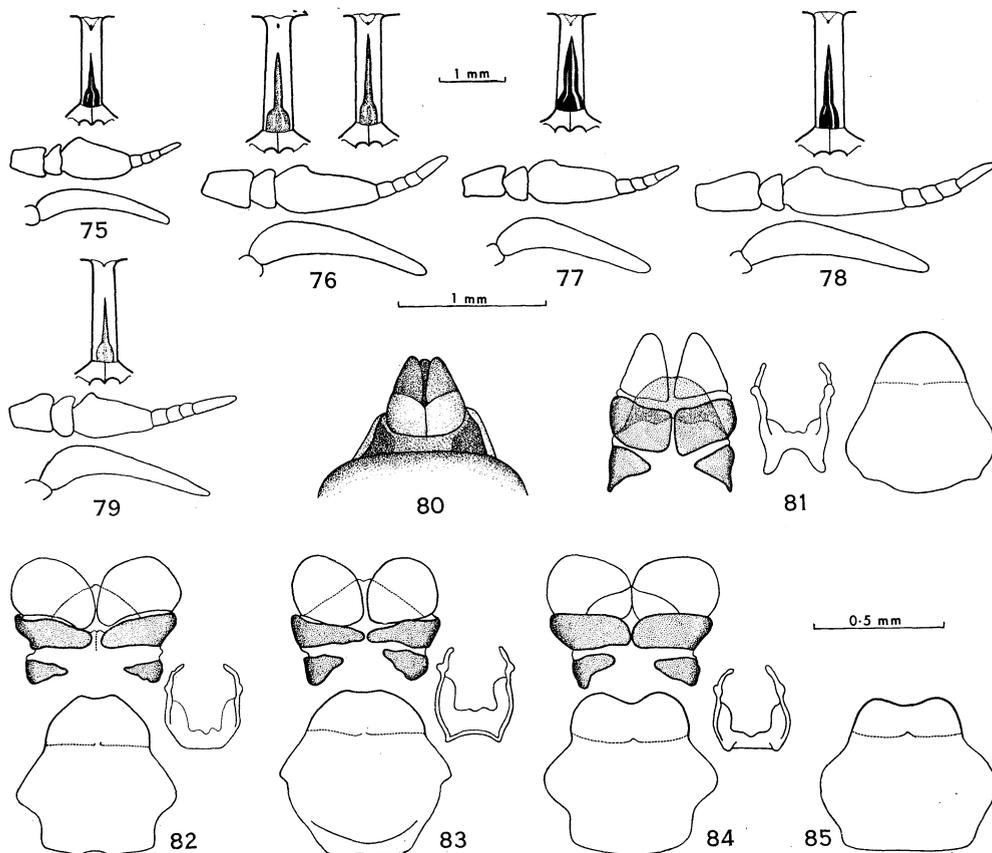
♀. Relatively large (10 mm), ornate species. Eyes (relaxed) black (Philip, 1960a). Frons parallel, index 4-5, yellowish cream, with distinct brown ocellar tubercle and slender pale callus (Philip's figure is very good); subcallus, parafacials and face cream, entirely tomentose; beard cream. Antennal segments 1 & 2 yellowish cream, 3 orange, darkening on style; palpi fawn-cream, with black hairs. Scutum brownish yellow, with pair of variable, sublateral, black stripes which are almost absent in the type of *mackerrasi*; scutellum black; pleura yellow, greyish on lower part of sternopleuron and above mid coxae, with yellow hairs. Femora yellow, darkening apically on fore and hind legs; tibiae and tarsi brown, except for yellowish base of mid tibiae. Wings faintly brownish, slightly darker in costal cell; stigma and veins brown; R₄ strongly curved and cell shorter than in most species of group. Abdomen with whole of tergite 1 and base of 2 broadly yellowish cream, basal yellowish cream band on 3 and narrow apical bands on 4-6, elsewhere brownish black; venter with pale color covering sternites 1-3 and in apical pale bands on remainder.

♂. Similar to ♀, but median as well as sublateral brown scutal vittae well-defined, and tergite 2 of abdomen yellow, with a broad dark band across its middle.

DISTRIBUTION. NW NEW GUINEA: Hollandia; Idenberg R., headwaters, 300-600 m, I, Stüber. SE NEW GUINEA: Kokoda; ♂ Oro Bay, XI-XII, Struck.

The *lamellata* Group

Small-medium (9-11 mm), slender, rather ornate species. Ocellar tubercle well defined only in *lamellata*; subcallus and face entirely tomentose; palpi slender, dark brown to black; proboscis and labella normal. Scutum and scutellum (except *latistriata*) with contrasting pale marginal zone. Costal and anterior radial cells of wing darkened; R₄ usually without appendix; cell Cu₂ normally closed and short-petiolate. Abdomen either vittate



Figs. 75-85. *Cydistomyia*, *lamellata* group, ♀♀: 75, 80, 81, *lamellata* (80 same magnification as antennae); 76, 82, *latistriata*; 77, 83, *oldroydi*; 78, 84, *laeta*; 79, 85, *similis*.

(*latistriata*), or with median and lateral pale triangles, but inconspicuous or no apical bands, on tergites. Terminal segments exposed and modified in *lamellata*, more or less narrowed in other species; sternite 8 with gonapophyses correspondingly deepened. The only ♂ known has upper facets of eyes enlarged and ocellar tubercle narrow and deeply buried.

C. latistriata is orange-brown and has vittate abdomen. Other species are brown to black, with well-defined abdominal triangles, and may be separated from the somewhat similarly patterned species of *albithorax* subgroup by their shape, orange to brown antennal plates, and anteriorly darkened wings. *C. latisegmentata* (p. 142), which has similar wings, has shorter, distinctively banded abdomen. That the group is probably monophyletic is further suggested by progressive deepening of the gonapophyses from normal in *similis* to extreme in *lamellata*. It appears to be strictly Papuan, and nothing is recorded of the habits of the species, except that the ♂ of *latistriata* was attracted to light.

KEY TO SPECIES OF THE LAMELLATA GROUP OF CYDISTOMYIA

1. Orange-brown species, with yellow median and lateral vittae on abdominal tergites

- **45. latistriata**
 Brown to black species, with pale median and lateral triangles on abdominal tergites 2
2. Dark brown species, with wide yellowish cream marginal zone on thorax and yellow dorsocentral vittae in front of suture; sternite 8 and cerci permanently exerted (fig. 80) **44. lamellata**
 Dorsocentral vittae inconspicuous or absent; only tips of cerci normally visible at apex of abdomen 3
3. Callus small, brown; subcallus, parafacials, face and pleura almost uniformly brown; brown species, with narrow yellowish cream thoracic margin **48. similis**
 Callus larger, black; subcallus brown, contrasting with cream to white lower parafacials, face and pleura 4
4. Dark brown species (like *lamellata*), with yellowish cream pattern, including wide zone round scutum and scutellum; antennae and palpi shorter (fig. 77) ... **46. oldroydi**
 Blackish species, with white pattern, including narrow zone round scutum and scutellum; antennae and palpi longer (fig. 78)..... **47. laeta**

44. *Cydistomyia lamellata* Oldroyd Figs. 75, 80, 81.

Cydistomyia lamellata Old., 1949, p. 345, fig. 54 (type ♀, Camp 2, Mt. Eiori, 650 m, Japan I., X. 1938, Cheesman; BMNH).

MATERIAL EXAMINED: 3 ♀ ♀.

♀. 9 mm, dark brown, yellow-patterned species. Eyes (relaxed) greenish black. Frons parallel, index 4-5, fawn-cream, becoming brown on vertexal triangle; ocellar tubercle oval, shining brown, rather prominent; callus brown-black, bulging distinctly forward; subcallus, parafacials and face creamy yellow, irregularly brown in mid-line above oral margin; hairs dark, rather sparse, beard brown; antennal segments 1 & 2 yellow-brown, 3 orange, becoming black on style; palpi dark brown, with dark brown hairs. Scutum and central part of scutellum blackish brown, with sharply defined yellowish cream dorsocentral vittae which fade behind suture, and broad yellowish cream band extending around lateral margins, including apical 1 2 or more of scutellum; pleura brown, with irregular greyish patches and entirely brown hairs. Legs deep to blackish brown, mid femora and tibiae lighter. Wings faintly brownish, costal cell and a vague radial suffusion darker; stigma dark brown, conspicuous; cell R₄ unusually long, vein R₄ without appendix. Abdomen deep to blackish brown, with large, brownish yellow, yellow-haired median and lateral triangles on tergites 1-5 or 6; venter brown, with broad, apical, brownish yellow bands on sternites; terminal segments apparently permanently exerted, giving abdomen a distinctively pointed appearance, with sternite 8 and cerci fully exposed. Tergites 9, 10 and cerci unusually long, and gonapophyses of sternite 8 shovel-shaped (fig. 81).

This description is based on 2 paratypes kindly sent to me by Mr. Oldroyd. The ♀ from Eliptamin Valley is larger (11 mm) than the type series, and has the frons almost entirely dark brown, subcallus brownish centrally, the face and lower part of parafacials more extensively suffused with brown, legs darker, wings more extensively brownish in radial area, and pale markings on the abdomen creamy white. Most of these differences can be associated with freshness of the specimen, and it seems to be conspecific with the others.

DISTRIBUTION. NW NEW GUINEA: Mist Camp, 1800 m, I, Toxopeus; Mt. Baduri, 300 m and Mt. Eiori, Japen I.; Rattan Camp, 1200 m, II, Toxopeus. NE NEW GUINEA: Eliptamin Val., 1200–1350 m, VIII, Brandt.

45. *Cydistomyia latistriata* (Schuurmans Stekhoven) Figs. 76, 82.

Silvius latistriatus Sch. Stk., 1926, p. 50, fig. 14 (type ♀, S. New Guinea, XI.1902, Versteeg; ZMA).—Oldroyd, 1949, p. 361.

MATERIAL EXAMINED: 8 ♀♀, including the holotype, 1 ♂.

10–11 mm, parallel-sided, bright orange-brown species, with median yellow vitta and yellow lateral margins on abdominal tergites. This unusual species is worth a detailed description.

♀. *Head*: Eyes (relaxed) dark brown with greenish reflections. Frons almost parallel, index 4.5–5, bright yellow-brown, with short brown hairs; vertexal triangle slightly paler, ocellar tubercle barely indicated; callus deep, almost blackish brown, bulging distinctly forward, tapering into long extension. Subcallus concolorous with frons; parafacials and most of face yellowish cream, lower central part of face brown; hairs brown, becoming paler on lower cheeks and posterior part of beard. Antennal segments 1 & 2 bright yellow-brown, with short black hairs; 3 orange, with contrasting black style. Palpi slender, deep brown, with black hairs. *Thorax*: Scutum and scutellum with bright orange-brown tomentum, irregularly darker where ground color shows through, with predominantly yellow hairs, except for long brown ones on the more brownish notopleural lobes. Pleura yellowish cream, more greyish anteriorly, inconstantly brownish below wing-root, with cream hairs. *Legs*: Brown, darkening on tarsi; fore legs darker than mid and hind. *Wings*: Dark brown in costal and 1st radial cells, and suffused with brown along veins, especially in radial area, leaving centers of cells extensively clearer; stigma and most veins dark brown, those in posterior part of wing brighter brown; R₄ strongly curved, with inconstant trace of appendix; cell Cu₂ closed on wing border. *Abdomen*: Ground color of tergites brown, darker posteriorly, with brown hairs; tergite 1 extensively yellowish in central area; broad, yellow, yellow-haired median vitta on 2–5 or 6, and narrower, yellowish, yellow-haired stripe on lateral margins, wider and paler on sides of tergite 1. Venter blackish brown, with yellow, yellow-haired apical and lateral margins to the sternites. Terminal segments with tent-like cerci, and gonapophyses produced nearly as much as in *lamellata*.

♂. Paler than ♀, with antennal style not so darkened, wings clearer, and median yellow vitta on abdominal tergites not so clearly differentiated from slightly darker sublateral ground color. Eyes almost black, with upper large facets little paler than lower ones; ocellar tubercle small, elongate, rather deeply buried; palpi fawn-yellow, with brown and yellow hairs. This specimen was taken separately from any of the ♀♀, but it is probably correctly associated.

DISTRIBUTION. NW NEW GUINEA: ♂, Bodem, 100 m, in light trap, VII, Maa. SW NEW GUINEA: Bomberai, 700–900 m, and Fak Fak, 10–100 m, Vogelkop, VI, Maa; unidentified type locality, Versteeg.

46. *Cydistomyia oldroydi* Mackerras, n. sp. Figs. 77, 83.

Holotype ♀ (BISHOP 3543), from Kiunga, Fly River, SE New Guinea, 18–23. VIII. 1957,

W. W. Brandt.

MATERIAL EXAMINED: 5 ♀ ♀.

Slender species, distinguished from *lamellata* by larger callus, contrastingly brown subcallus, absence of dorsocentral vittae on scutum, more extensively yellowish cream pleura, and terminal segments of abdomen not permanently exerted. Length 10–11 mm.

♀. *Head*: Eyes (relaxed) dark brown. Frons almost parallel, index 4–4.5, with dark brown tomentum and inconspicuous black hairs; vertexal triangle and ocellar tubercle not clearly differentiated; callus blackish brown, bulging, full width of frons, with tapering extension to include ocellar tubercle. Subcallus and adjacent part of parafacials dark brown, remainder of parafacials and most of face yellowish cream, with irregular brown staining in center of face; hairs inconspicuous, beard brown. Antennal segments 1 & 2 brownish yellow, with short black hairs; 3 yellowish at base, becoming more brown distally, and merging into black on style. Palpi brownish black, with black hairs. *Thorax*: Scutum and anterior part of scutellum deep brown, without vittae, almost completely surrounded by the yellowish cream, cream-haired lateral areas and apical part of scutellum, but leaving longitudinal brown stripe extending through lower part of notopleural lobes laterally. Pleura yellowish cream, with cream hairs, defined by brown stripe above and marked by large brown patch on sternopleural area. *Legs*: Black, knees and mid tibiae more brownish; hairs black. *Wings*: Faintly brownish, costal cell and distal part of radial area darkened; stigma dark brown; R₄ without appendix. *Abdomen*: Dark brown, becoming black-brown apically; with paired, median, apical, yellowish cream spots on tergite 1, apical margins of 2–4 narrowly pale, large median triangles on 2–4, smaller ones on 5 & 6, large lateral triangles on 1–4, and a small one on 5; apical segments entirely black; hairs dark brown to black on darker parts, cream to yellowish on pale triangles. Venter dark brown, black-haired, with broad, yellowish cream, cream-haired apical bands decreasing in width from sternites 2–5 and trace on 6. Terminal segments not as acuminate as in *lamellata*; cerci not completely exposed, but tent-like in end view, and gonapophyses moderately produced distally.

DISTRIBUTION. NW NEW GUINEA: Bodem, 100 m, VII, Maa. SE NEW GUINEA: Kiunga, Fly R.

47. *Cydistomyia laeta* (de Meijere) Figs. 78, 84.

Tabanus laetus de Meij., 1906, p. 74 (type ♀, New Guinea; ZMA).—Ricardo, 1913, p. 391.—Schuermans Stekhoven, 1926, p. 333, fig. 156.

Cydistomyia laetus: Oldroyd, 1949, p. 350, fig. 24.

MATERIAL EXAMINED: 13 ♀ ♀.

♀. 9–11 mm species, darker than other members of the group, and with pale pattern white. Eyes (relaxed) brown-black. Frons almost parallel, index 4.5, dark brown; ocellar tubercle not detectable; callus large, brown below, darkening to blackish on extension; subcallus and adjacent parafacials dark brown, contrasting with white remainder of parafacials and most of face; some brown hairs above, remainder and beard white; antennae relatively long and slender, brown, darkening progressively to black style; palpi blackish. Scutum and base of scutellum dark brown, with white band of variable prominence extending from humeral lobes above notopleural lobes and around apical part of scutellum, leav-

ing brown stripe running back to wing-root and separating off greyish white, white-haired pleura. Legs dark brown to blackish, mid femora and tibiae somewhat lighter. Wings with costal cell and anterior part of radial area deep brown and vaguer darkening along other radial veins, leaving remaining of wing nearly clear; stigma blackish brown, conspicuous; R_4 without appendix. Abdomen brown at base, remainder blackish; small median white patch and large lateral triangles on tergite 1, median and lateral white, white-haired apical triangles joined by narrow indefinite apical bands on 2-5, remaining tergites dark; venter blackish brown, with broad, white, white-haired apical bands increasing in depth from sternites 2-6. Terminal segments much as in *similis*, but sternite 8 narrower and gonapophyses larger. The difference from the barely separated gonapophyses of *oldroydi* is probably specific.

DISTRIBUTION. NW NEW GUINEA: Kloofbivak, Versteeg. SW NEW GUINEA: Etna Bay; Heuvelbivak, XI, Lorentz; Rivierkamp, II, Lorentz. NE NEW GUINEA: Bachlager 12, XI, Bürgers; Bougainville Mt., 526 m, VI, V. K.; Etappenberg, 850 m, X-XI, Bürgers; Maprik, III, Standfast; Prince Alexander Ra., 900 m, IX, Pullen; Standlager am Aprilfluss, IX, Bürgers. SE NEW GUINEA: Mondo, 1550 m, Stewart; Mt. Mafu, 1300 m, XII, Cheesman.

48. *Cydistomyia similis* Mackerras, n. sp. Figs. 79, 85.

Holotype ♀ (BISHOP 3544), from Bomberai, 700-900 m, Vogelkop, SW New Guinea, 7. VI. 1959, T. C. Maa.

MATERIAL EXAMINED: 7 ♀ ♀.

Slender species, related to *oldroydi*, but more generally brown in color, with smaller, paler callus, almost concolorous brown subcallus, parafacials and face, less definite scutal pattern, and brownish pleura and legs. Length 10-11 mm.

♀. **Head:** Eyes (relaxed) deep brown. Frons almost parallel, index 5, rather dark dull brown, with inconspicuous brown hairs; vertexal triangle and ocellar tubercle barely indicated; callus more sharply tapering than in *oldroydi*, brown, almost concolorous with tomentum of frons. Subcallus brown, parafacials and face only a little lighter in color, though becoming paler on lower parts of cheeks; hairs, including beard, mostly brown. Antennal segments 1 & 2 brownish yellow, with black hairs; 3 dull orange-brown, style black. Palpi slender, dark brown, with black hairs. **Thorax:** Scutum dark, somewhat reddish brown, with not very contrasting lighter brown median line, dorsocentral vittae, lateral areas, notopleural lobes and scutellum. All specimens are rather rubbed, but hairs appear to be predominantly brown mixed with some golden ones on the disc of the scutum and more conspicuously golden on lateral margins and scutellum; hairs on notopleural lobes dark brown below, conspicuously golden on upper margin. Pleura brown, with creamy yellow hairs and brown ones on and below mesopleural convexity. **Legs:** Brown, darkening somewhat on fore and mid tibiae and tarsi. **Wings:** Lightly brownish, darker in costal cell and along veins, especially in radial area; stigma brown, not as dark as in *oldroydi*; R_4 without appendix. **Abdomen:** Dark brown, with dark brown hairs on disc, and large, yellowish, cream- to golden-haired median triangles, smaller lateral triangles and narrow apical bands on tergites 2-5; 1 more extensively pale laterally, and 6 with very small triangles. Venter dark brown, with narrower pale, cream-haired apical bands on the sternites than in *oldroydi*. Terminal segments and sternite 8 (fig. 85) least modified of the group.

DISTRIBUTION. SW NEW GUINEA: Bomberai, Fak Fak, 100–700 m, Vogelkop, VI, Gressitt, Maa.

The *albithorax* Group

Frons of ♀♀ of varied shape, but index less than 3 only in *heydoni* and *quasimattura*; ocellar tubercle rarely prominent; subcallus shiny only in *imitans* and partly in *perdita*; face shiny only in *oudella* (which should possibly be transferred to *Japenoides*—see p. 105); antennae of varied length and shape, scape occasionally rather short and thick; palpi generally not as slender as in the *basifasciata* and *lamellata* groups, occasionally swollen; proboscis normal. Wing with cell R₄ usually short, and vein R₄ sometimes with appendix (often a useful character for placing the small or slender species); cell Cu₂ almost always closed and short-petiolate. Terminal abdominal segments dorsoventrally compressed; cerci usually subtending obtuse angle in end view; sternite 8 usually with rather shallow gonapophyses. Sexual dimorphism slight to moderate; ♂♂ with upper facets of eyes usually considerably enlarged; ocellar tubercle small, but often visible at vertex. Species of the group are of very varied size (7–21 mm), shape (from the rotund *albithorax* to the very slender *solomensis*), and pattern (from the ornate *imitans*, *albithorax* and *heydoni* to the uniformly dark *macmillani* and *crepuscularis*).

There is considerable diversity in this section of the genus, and some of the evolutionary lines that are included may be equivalent phylogenetically, though not morphologically, to the groups that have been separated. A strict phylogenetic arrangement would probably result in subdivision into 9 subgroups, of which 4 would be monotypic and one would have only 2 species. This would be splitting hairs on rather slender evidence, so the following more conservative arrangement has been adopted.

barretti subgroup: Very large to small-medium (10–21 mm), dark species, with more or less infuscated wings, uniformly blackish, unadorned abdomen, and some contrasting feature, such as orange or yellowish antennae, palpi, legs, or thoracic pattern. The 1st 2 are closely related, but the others probably evolved independently. Includes: *barretti*, *macmillani*, *imitans*, *bisecta*.

albithorax subgroup: Medium-sized to very small (7–13 mm), compact, mostly brightly patterned, dark species, with black antennae (except an unidentified ♂) contrasting with white parafacials and face, either black or unusually plump, hairy palpi, costal cell of wing clear (except *latisegmentata*), and sharply defined whitish abdominal pattern. Includes 3 series: *albithorax*—with whitish subcallus, short-haired, black palpi, and unusual scutal pattern; *heydoni*, *perdita*, *albidosegmentata*—with contrasting brown subcallus and plump, hairy, usually pale palpi; and *latisegmentata*—with brown subcallus, smooth, blackish palpi, anteriorly darkened wings, and distinctive abdominal pattern.

immigrans subgroup: Small to rather large (9–15 mm), less compact, lighter or duller brown or grey species, with antennae and palpi (except *griseiventer* and *torresi*) not contrastingly dark, costal cell of wing sometimes brown, but radial area nearly always clear, and well-defined pale apical bands and usually median triangles on abdominal tergites. Includes: *immatura*, *pseudimmatura*, *quasimattura*, *griseiventer*, *torresi*, *immigrans*, *inopinata*, probably *papouina*. The 1st 3 might be separated on absence of callus, but they seem to be aberrant members of this group, rather than related to the peculiar

erythrocephala (Wulp) from Batchian.⁶

lorentzi subgroup: Small to rather large (8–15 mm), compactly built, dark reddish to pale yellowish brown or golden, unadorned species (*crepuscularis* blackish), with medium fronts (index not more than 6), wide antennal plates, and scutum and abdomen without clearly defined pattern, though *sol* sometimes has an indefinite vitta of pale hairs on the tergites. Includes: *crepuscularis*, *oudella*, *lorentzi*, *sol*, *nana* (New Britain, Solomon Is.).

sylvioides subgroup: Small to medium-sized (8–13 mm), narrow-bodied, usually rather drab yellowish brown to reddish yellow, unadorned species, with narrow fronts (index usually more than 5), narrow, often pale calli, usually long, slender antennae, costal and radial areas of wing usually darkened, R₄ often with appendix, and abdomen with vague apical fringes and median triangles of paler hairs or none. Includes: *sylvioides*, *hollandiensis*, *solomensis*, *nokensis*. Extralimital species are: *celebensis* (Sch. Stk.), Celebes (fig. 122); *insurgens* (Walk.), Batchian; *pacifica* (Ric.), Fiji; *bezzii* Mack. & Rag., Fiji. This subgroup tends to merge both with the Oriental *Tabanotelum* and the local *immigrans* and *lorentzi* subgroups.

C. papuana, known only from ♂♂, is omitted from the key to the species. The chief precaution necessary in using it is to exclude *Dasybasis*, particularly *D. anomala*, which would run down to couplet 15, where it can be separated by its compact build, relatively wide frons (index 3), large blackish brown callus (fig. 131) and partly shiny subcallus.

KEY TO PAPUAN SPECIES OF THE ALBITHORAX GROUP OF CYDISTOMYIA

1. Subcallus shining yellow; mesonotum covered with dense golden tomentum; wings dark brown, except for clear marginal zone extending back from R₄; 12 mm species, with dark brown, unadorned abdomen..... **51. imitans**
Subcallus normally tomentose (except *perdita*); mesonotum not uniformly contrasting; wings diffusely infuscated or mostly clear..... 2
- 2 (1). 10–12 mm species, brownish black except for orange-yellow band on upper 1/2 of pleura extending onto mesonotum and a yellow stripe along inturned lateral parts of tergites 1 & 2 of abdomen **52. bisecta**
Without this combination of thoracic and abdominal markings 3
- 3 (2). Large, rather bare, almost uniformly greyish black species, with diffusely infuscated wings, no pale pattern on abdominal tergites, and at least antennal plates contrastingly orange 4
Mostly smaller, patterned or paler species, with wings largely clear; if blackish brown and without abdominal pattern (*crepuscularis*), body notably hairy... 5
- 4 (3). Very large (usually 20–21 mm) species, with bright orange-yellow antennae, palpi and legs, and no white hairs on pleura..... **49. barretti**
Somewhat smaller (14–16 mm) species, with only antennal plates orange; pleura with anterior and posterior tufts of white hairs..... **50. macmillani**
- 5 (3). Yellow-brown to blackish species, with clearly defined pattern of pale triangles or bands, or both, on the abdominal tergites..... 6

6. I have seen 2 ♀♀ from North Borneo that appear to be similar to this species, about which Dr. Philip had sent me notes, and I find it difficult to place them in either *Cydistomyia* or *Dasybasis*.

- Usually more reddish to yellowish, occasionally blackish, unadorned species, without clearly defined abdominal pattern, though there may be paler fringes or vague median vitta on tergites 19
- 6 (5). Ornate species, with brown subcallus and black antennae contrasting with pure white parafacials and face and unusually plump, long-haired, generally whitish palpi 7
- Not such species; palpi slender, darker, short-haired..... 9
- 7 (6). 11–13 mm, strikingly patterned species, with unusually wide frons (fig. 91); scutum with conspicuous greyish white dorsocentral vittae and lateral areas merging on each side in front of scutellum; abdomen with large, discrete, greyish white median and lateral triangles on tergites..... **54. heydoni**
- Less strikingly patterned species, with narrower frons, less definite scutal pattern, and different abdominal markings 8
- 8 (7). Darker, 12 mm species, with long callus, long antennal style, and small, discrete white triangles on abdominal tergites **55. perdita**
- Brightly patterned, usually 8–9 mm species, with short callus, short antennal style, and greyish white apical bands expanded into median and lateral triangles on abdominal tergites **56. albidosegmentata**
- 9 (6). 10–12 mm, rotund, black species, with white subcallus and black antennae; scutum with golden to cream notopleural lobes, dorsocentral vittae (variable) and crescents in front of black scutellum; abdominal tergites with small median and lateral golden to cream triangles **53. albithorax**
- Not rotund; scutal pattern otherwise..... 10
- 10 (9). 9–11 mm, black and white species, with black antennae and palpi, white scutellum, large white spot on upper mesopleural convexity, and white pattern on abdominal tergites limited to conspicuous apical bands on 2 & 3 or 2–4 and lateral triangles on 1–4..... **58. latisegmentata**
- Brown or grey species, with less contrasting pattern, and pale apical bands on most visible tergites..... 11
- 11 (10). Frons with indefinite or no callus, though there may be thinly tomentose raised area on its lower part..... 12
- Frons with clearly defined callus..... 14
- 12 (11). Palpi very short and plump; beard and pleural hairs mainly brown; clearly defined, yellow-haired median triangles on abdominal tergites; yellow-brown, 13–15 mm species..... **59. immatura**
- Palpi of more normal shape; beard and pleural hairs mainly white; median pale triangles on abdominal tergites shallow, indefinite..... 13
- 13 (12). Larger (15 mm), yellow-brown species, with narrower frons (index 3.5) **60. pseudimmatura**
- Smaller (11 mm), duller greyish brown species, with wider frons (index 2.8) **61. quasimmatura**
- 14 (11). 12 mm, grey species, with black callus, slender antennae, dark palpi, and whitish apical bands but indefinite median triangles on abdominal tergites **62. griseiventer**
- Dark to yellowish brown species 15
- 15 (14). 10–12 mm, dark brown species, with black palpi, diffusely paler scutal margin

- and scutellum, and abdominal tergites with fawn-cream apical bands, but usually an evident median triangle only on 2 **63. torresi**
 Brighter or duller brown species, with brown or cream palpi, more evenly colored mesonotum, and different abdominal pattern 16
- 16 (15). Normally shaped, brighter brown species, with at most costal cell of wing brown, and clearly defined pattern of apical bands and triangles on abdominal tergites..... 17
 More slender, duller brown species, with wings darkened in radial area, and less definite abdominal pattern..... 18
- 17 (16). 13 mm species, with pale yellow callus, wide, orange antennal plate (fig. 105), only slightly darkened style, and whitish, black-haired palpi **66. inopinata**
 10–12 mm species, with brown callus, more slender, brown antennal plate (fig. 104), deep brown style, and fawn palpi **65. immigrans**
- 18 (16). 12 mm species, with wide yellowish callus, and brown subcallus contrasting with white lower parafacials and face; beard white..... **73. sylvioides**
 8–10 mm species, with narrower brown callus, and brown parafacials and face almost concolorous with subcallus; beard brown..... **74. hollandiensis** (pt.)
- 19 (5). Face shining yellow-brown; 11 mm, red-brown species, with wedge-shaped callus, dark beard, yellowish legs, and diffusely yellowish wings, darker on fore border; R₄ with strong appendix **69. oudella**
 Face entirely tomentose; callus not wedge-shaped; R₄ usually without appendix 20
- 20 (19). 12–14 mm, blackish species, with dense covering of dark brown to black hair, including beard; legs dark brown to black..... **68. crepuscularis**
 Brighter red-brown to yellowish or fawn, less hairy, smoother species..... 21
- 21 (20). Very small (8–9 mm), yellowish fawn species, with blackish brown callus and blackish fore legs (New Britain, Solomon Is.)..... **72. nana**
 Mostly larger, red-brown to yellowish species, with brown to yellow calli, and reddish to yellow fore legs 22
- 22 (21). Robust (mostly 12–15 mm), variable, dark red-brown to orange-yellow species, with relatively wide frons and callus (fig. 110), and wings often stained brown **70. lorentzi**
 Smaller or more slender, paler or duller yellow-brown to golden or greyish species, with narrower frons, and wings usually darkened only in costal and radial areas 23
- 23 (22). Compact, usually 10–12 mm, light yellow to golden, occasionally greyish species, with moderately narrow, almost parallel frons (index 6), short antennae (fig. 111), and often with median vitta of golden hairs on abdominal tergites **71. sol**
 More parallel-sided or longer-bodied, yellowish to dull brown species, with longer, more slender antennae..... 24
- 24 (23). Small (8–10 mm), dull brown species, with brown, moderately narrow frons (index about 5), brown beard, and usually indications of pale apical bands and median triangles on abdominal tergites **74. hollandiensis** (pt.)⁷

7. *C. sylvioides* might run out here, and would be distinguished as in couplet 18.

- Longer-bodied (11–13 mm), yellow-brown species, with very narrow, yellowish fronts (index more than 6), and yellow hairs on abdominal tergites usually not tending to form definite pattern 25
- 25 (24). Frons converging, callus oblong, filling frons below, and with short linear extension (fig. 125) **76. nokensis**
- Frons almost parallel, callus usually forming longitudinal ridge on almost its whole length (fig. 124)..... **75. solomensis**

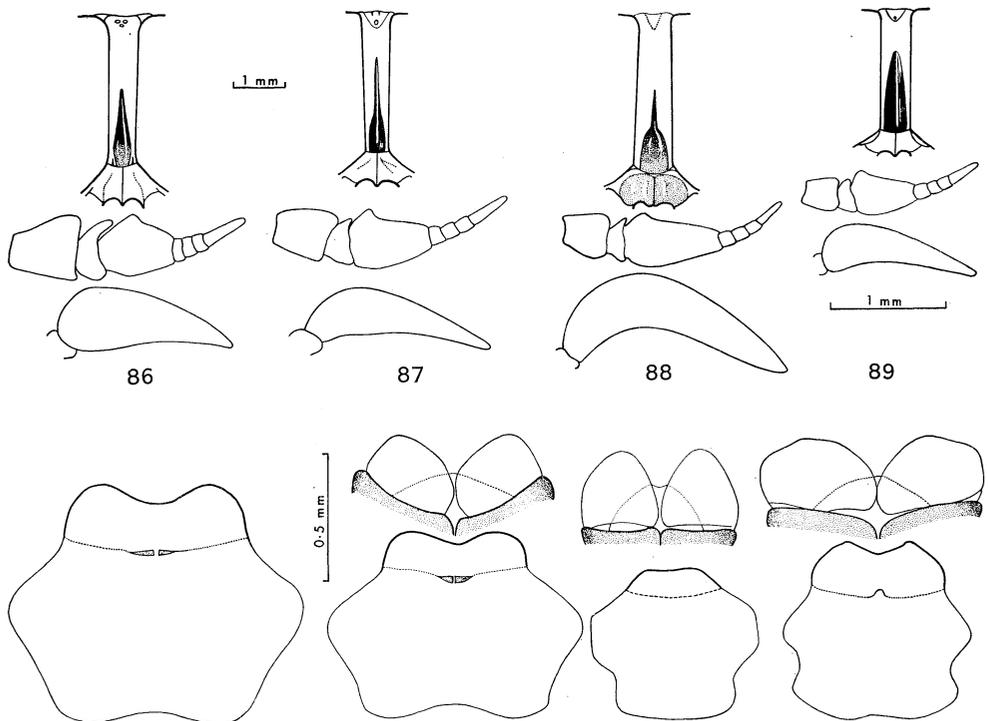
The **barretti** Subgroup

49. *Cydistomyia barretti* Mackerras, n. sp. Fig. 86.

Holotype ♀ (SPHTM), from Aiyura, 2000 m, E. Highlands, bred from pupa collected in axil of *Pandanus*, 12. VII. 1960, J. H. Barrett.

MATERIAL EXAMINED: 4 ♀♀ (and their associated pupal shells), ?1 ♂.

Large, striking, dark species; with contrasting bright orange-yellow antennae, palpi, and legs; diffusely brownish wings; and shining black, unadorned abdomen. Length 20–21 mm (1 ♀ 13 mm).



Figs. 86–89. *Cydistomyia, barretti* subgroup, corresponding ♀ terminalia below: 86, *barretti*; 87, *macmillani*; 88, *imitans*; 89, *bisecta*.

♀. *Head*: Eyes (relaxed) black-brown. Frons narrow (index 6), converging, dark greyish brown, narrowly paler along eye margins, with short black hairs; ocellar tubercle irregular, poorly defined; callus small, projecting, red-brown, with blackish tapering extension. Subcallus velvety brown; parafacials and face grey with brownish hue along eyes, hairs, including beard, black. Antennae suggestive of "*Parabolbodimyia*" in shape, but shorter; segments 1 & 2 orange-brown, with brown hairs and some yellow ones below; 3 bright orange-yellow, darkening at tip of style. Palpi yellow-brown, with long black hairs on segment 1, short, dense, bright orange-yellow ones on 2. *Thorax*: Scutum and scutellum dark brown with some greyish overlay, especially in sublateral areas, and black hairs; humeral lobes grey, notopleural lobes brown, with greyish overlay in some specimens. Pleura grey with brownish reflections; hairs entirely black. *Legs*: Coxae brown, with greyish dusting and black hairs; femora orange-brown, with orange hairs and some black ones towards base; remaining segments yellow, with bright yellow hairs, darkening somewhat on tarsi. *Wings*: Lightly suffused with brown, more definitely in costal cell and along veins; stigma darker brown; R₄ sharply bent, with variable appendix. *Abdomen*: Shining black, with trace of greyish overlay on tergites 1 & 2; hairs entirely black, except for considerable mixture of greyish white across tergite 1 and few greyish white ones sublaterally on 2. Venter similar, but without white hairs. Terminalia with cerci as in *macmillani* (fig. 87), sternite 8 as illustrated.

The small ♀ was bred from a larva, which was collected from the axil of a *Pandanus* and may have been starved before pupation; it agrees with the type in all respects except size.

♂. The ♂ from Kandep belongs to this group, and its association with the ♀♀ is presumed from its size (19 mm) and general appearance, though its color is much lighter. Eyes (relaxed) with upper facets moderately enlarged, dark crimson, sharply separated from the small, blackish, lower and lateral facets; ocellar tubercle deeply buried, just visible through the dense brown hairs at vertex; frontal triangle and subcallus velvety brown, with a pale mark on each side above antennae; parafacials and face lighter, with greyish bloom and brown hairs; antennae orange-brown, basal segments with golden brown hairs; palpi short and plump, bright brown, with long, dense, golden brown hairs. Mesonotum red-brown, with greyish tomentum in median area anterior to suture and brown hairs; pleura more variegated brown, with long, dense, rich to golden brown hairs. Legs as in ♀. Wings with yellowish tint in costal cell and stigma; veins mostly yellow-brown. Abdomen bright to reddish brown, with rich reddish to orange-brown hairs; venter somewhat duller.

DISTRIBUTION. NE NEW GUINEA: Aiyura, 2000 m, emerged in V, VII, VIII, X, Barrett; ♂, Kandep, 2700 m, I, Brandt.

50. *Cydistomyia macmillani* Mackerras, n. sp. Fig. 87.

Holotype ♀ (SPHTM), from Nineia, 500 m, Finschhafen dist., biting man, V. 1960, B. McMillan. The specific name has been formed in accordance with Recommendation 21 (a) of the International Code, 1961.

MATERIAL EXAMINED: 2♀♀.

Large, dark species; distinguished from *barretti* by its differently shaped callus, darker

antennal style, darker palpi, legs and wings, and presence of small tufts of white hair on the pleura. Length 14–16 mm.

♀. *Head*: Eyes (relaxed) black-brown. Frons narrow (index 6.5), converging, dark fawn-brown, with short black hairs; ocellar tubercle clearly defined, blackish; callus larger than in *barretti*, deep red-brown, tapering more evenly into blackish extension. Subcallus velvety brown; parafacials and face light grey, brownish along eye, with black hairs, including beard. Antennae with segments 1 & 2 bright brown, with black hairs; 3 rich orange-brown, darkening on style. Palpi brown, with black hairs. *Thorax*: Scutum and scutellum deep brown, with greyish dusting and black hairs, except for some white hairs at upper corners of notopleural lobes and in postalar tuft. Pleura grey, with black hairs, except for mixture of white in propleural zone, white tuft below wing-root, and a small one on dark brown squamae. *Legs*: Coxae grey, with black hairs; remaining segments deep to blackish brown, slightly paler on tibiae; hairs entirely black. *Wings*: Suffused with brown, especially in costal cell and along veins; stigma darker brown; R₄ angulate, with well-defined appendix. *Abdomen*: Blackish brown, with considerable grey dusting on tergites 1 & 2, and apices of all tergites very narrowly paler; hairs entirely black. Venter similar, pale apices of sternites clearer than those on tergites. Terminal segments as illustrated.

DISTRIBUTION. NE NEW GUINEA: Nineia.

51. *Cydistomyia imitans* Oldroyd Fig. 88.

Cydistomyia imitans Old., 1949, p. 348, fig. 53 (type ♀, Araucaria Camp, 800 m, III. 1939, Toxopeus; BMNH, Archbold Coll.).

MATERIAL EXAMINED: 1 ♀, 1 ♂ paratypes.

♀. Medium-sized (12 mm), strikingly patterned, dark species; distinguished from *C. colasbelcouri* from New Caledonia by having pale callus, shining subcallus, orange antennal segment 3, and brown abdomen. Eyes (not relaxed) without trace of band (*C. colasbelcouri* has intensely blue, unbanded eyes in life); frons parallel, index 4–5, golden yellow, with long brown hairs; ocellar tubercle obscure; callus yellow below, darkening above; subcallus shining yellow; parafacials golden, face more brownish, hairs brown, including beard; antennal segments 1 & 2 brown, 3 bright orange; palpi unusually long, dark brown, with dark brown hairs. Whole mesonotum covered with golden yellow tomentum, which is especially dense on notopleural lobes; pleura dark brown, with dark brown and a few yellow hairs. Legs blackish brown. Wings blackish brown, slightly clearer in some cells, and with clear marginal strip extending back from vein R₄, which is strongly curved but without appendix. Abdomen dark brown dorsally and ventrally, with entirely black hairs, except for small median yellow patch on tergite 1. Terminalia small, with longer cerci than other members of the group.

♂. Similar to ♀; upper facets of eyes normally enlarged; ocellar tubercle very small and thin, but visible; palpi large; terminalia undistinguished.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp.

52. *Cydistomyia bisecta* Oldroyd Fig. 89.

Cydistomyia bisecta Old., 1949, p. 354, fig. 63 (type ♀, Bernhard Camp, 600–700 m, XI.

1938, Olthof; BMNH, Archbold Coll.).

MATERIAL EXAMINED: 5 ♀ ♀.

♀. Medium-sized (10–12 mm), brownish black species, with striking orange marking anteriorly on thorax. Eyes (relaxed) very dark brownish green. Frons dark velvety brown, index 4, vertexal triangle obscurely shining; callus large, brownish black; subcallus and central part of face brown, remainder of face and parafacials yellow; hairs black above and centrally, bright yellow below, including beard; antennae brownish orange; palpi dark brown, with black hairs. Mesonotum deep brown, paler anteriorly, with bright yellow, yellow-haired humeral and notopleural lobes; yellow color invades adjacent part of scutum, and is continuous with an extensive similar zone along upper 1/2 of pleura, lower 1/2 of which is dark brown, with black hairs. Legs blackish brown, tibiae somewhat paler; some yellow hairs basally on hind tibiae, black elsewhere. Wings faintly brownish, darker in costal cell and along veins; stigma light brown; R₄ angulate, with appendix. Abdominal tergites and sternites deep to blackish brown, with black hairs, their apices only slightly paler, but conspicuous yellow-brown, yellow-haired stripe along inturned part of tergites 1 & 2 continuous with pale zone on pleura.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp. NE NEW GUINEA: Bachlager, XI, Bürgers; Etappenberg, 850 m, XII, Bürgers; Flusslager 15, XI, Lederman. SE NEW GUINEA: Dogon, 800 m, X–XI, Brandt; Papua (no further data).

The *albithorax* Subgroup

53. *Cydistomyia albithorax* (Ricardo) Figs. 53, 90, 99.

Tabanus albithorax Ric., 1913, p. 391 (type ♀, Iwaka R., 1911, Wollaston; BMNH).—Schuurmans Stekhoven, 1926, p. 338, fig. 160.

Tabanus albithorax var. *flavifemur* Schuurmans Stekhoven, 1926, p. 339 (type ♀, Heuvelbivak, 800 m, XI, 1909, Lorentz; ZMA).

Tabanus albithorax var. *brunnifemur* Sch. Stk., 1926, p. 340 (type ♀, Dutch New Guinea, Lorentz; ZMA).

Tabanus albithorax var. *citribarbus* Sch. Stk., 1926, p. 340 (type ♀, Heuvelbivak, 800 m, XI, 1909; ZMA).

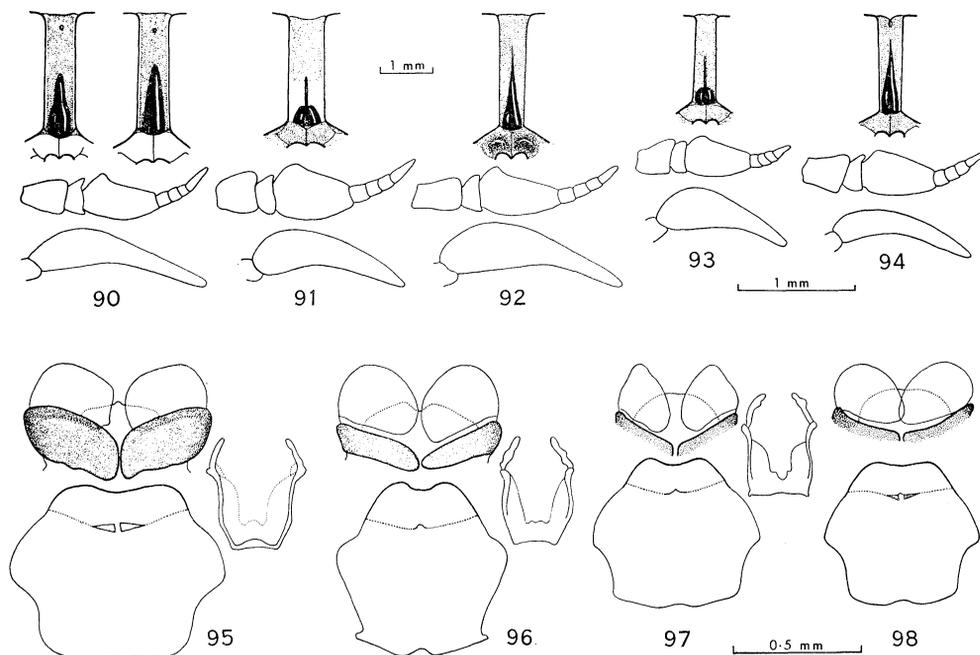
Cydistomyia albithorax: Oldroyd, 1949, p. 343, fig. 20.

Cydistomyia doddi Taylor, 1919, p. 47 (type ♀, err. Kuranda, north Queensland; SPHTM) —Ferguson, 1926, p. 301.—Oldroyd, 1949, p. 343. This species is not to be confused with *Tabanus doddi* Taylor, 1917, from north Queensland, which was transferred to *Cydistomyia* by Mackerras, 1959.

MATERIAL EXAMINED: 96 ♀ ♀, 3 ♂ ♂.

Thickset, medium-sized, black species; very distinctive by reason of its conspicuous yellowish to cream thoracic and abdominal pattern. Length 10–12 mm. It appears to be the most abundant and widely distributed member of the genus in the subregion, especially in the higher country (fig. 99).

♀. Eyes (relaxed) dark greenish brown. Frons dark brown, index 4, ocellar tubercle and vertexal triangle vaguely shining; callus bulging smoothly forward, black-brown; subcallus, parafacials and face with dense white tomentum, variably brown along sutures and on lower central part of face; hairs inconspicuous, mostly white, including the rather sparse



Figs. 90-98. *Cydistomyia*, *albithorax* subgroup, ♀♀: 90, *albithorax*, showing variation in callus; 91, 95, *heydoni*; 92, 96, *perdita*; 93, 97, *albidosegmentata*; 94, 98, *latisegmentata*.

beard; antennae and palpi black. Scutum and scutellum black, with wide dorsocentral vittae, bands along suture sublaterally, almost complete curved band from wing-tip to wing-tip in front of scutellum, and the whole of notopleural lobes yellow to cream; pleura greyish white, with creamy yellow and white hairs, except for a conspicuous, yellow, yellow-haired patch on upper mesopleural convexity. Legs black. Wings faintly brownish, costal cell not darkened; stigma brown; R_4 strongly curved, with variable vestige of an appendix. Abdomen black, apices of tergites inconspicuously paler, 1-5 with conspicuous rounded median and acute lateral white to cream apical triangles; venter with apical white bands on sternites increasing progressively in depth from before backwards, until more distal sternites almost entirely white; terminal segments narrowed, so that cerci are rather tent-like; this may not be apparent if they are fully retracted.

♂. Easily associated with the ♀ by reason of the similar color-pattern, including white subcallus. Eyes very large, narrow bronze band between the lower blackish and upper large red-brown facets; ocellar tubercle oval, conspicuous.

There is considerable variation, especially in the development of dorsocentral vittae and color of the pale markings on thorax and abdomen, which varies from white to yellow, although the subcallus, parafacials and face appear to be consistently white. The most extreme form encountered was the ♀ from Normanby I., which has a brown antennal plate, lemon-yellow beard, the presutural ground color on scutum brown, reducing the black to a transverse postsutural band, and abdominal tergites with yellow apical bands linking the median and lateral triangles. Actually, it is not very different from the type ♀ of

doddi, and it does not seem necessary to recognize it, or any of the sympatric extremes described by Schuurmans Stekhoven, by a formal name.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus; Arfak Mts., V, Mayr; Bernhard Camp, 100 & 600–800 m, IV, XI, Olthof; Karubaka, 1300–1450m, Swart Val., XI, Gressitt; Kloofbivak; Kutsime, 1500 m, W of Swart Val., XI, Gressitt; Lower Mist Camp, 1400 m, I–II, Toxopeus; Mt. Nomo, 200 m, II, Cheesman; Rattan Camp, 1200 m, III, Toxopeus; Sigi Camp, 1300 m, II, Toxopeus. SW NEW GUINEA: Alkmaar, X; Heuvelbivak; Hoofdbivak, 250 m, IX, XI, v. Leeuwen; Iwaka R. NE NEW GUINEA: Banz, 1800 m, I, II, Christian; Eliptamin Val., 1200–1350 m, VIII–IX, Brandt; Etappenberg, 850 m, X–XII, Bürgers; Feramin, 120–150 m, VI, Brandt; Flusslager 18, 160 m, XI, Bürgers; Hauptlig b. Malu, I, Bürgers; Kalalo, 700 m, XI, McMillan; Kerowaghi, 1600 m, II, Cole; Kumur, 1000 m, U. Jimmi Val., VII, Gressitt; Lordberg, XII, Bürgers; Mokai, 750 m, Torricelli Mts., XII, Brandt; Mt. Lucreu, 650 m, I, Cheesman; Mt. Misim, Stevens; Nineia, 500 m, biting man, V, X, McMillan; Saidor, VI, Brandt; Standlager am Aprilfluss, XII, Bürgers; Weleki, 500 m, biting man, V, McMillan. SE NEW GUINEA: ♂♂, Dogon, 800 m, X–XI, Brandt; Goilala, 975 m, Owen Stanley Range, XI–IV, Brandt (incl. ♂); Keria, 550 m, XII–I, Brandt; Mondo, 1600 m, II, Cheesman; Mt. Mafulu, 1300 m, I, Cheesman; Mt. Tafa, 2800 m, III, Cheesman; Normanby I., Mt. Pabinama, 820 m, V, Brass; Tapini, 1100 m, V, Gressitt; Yule I., III, Cheesman.

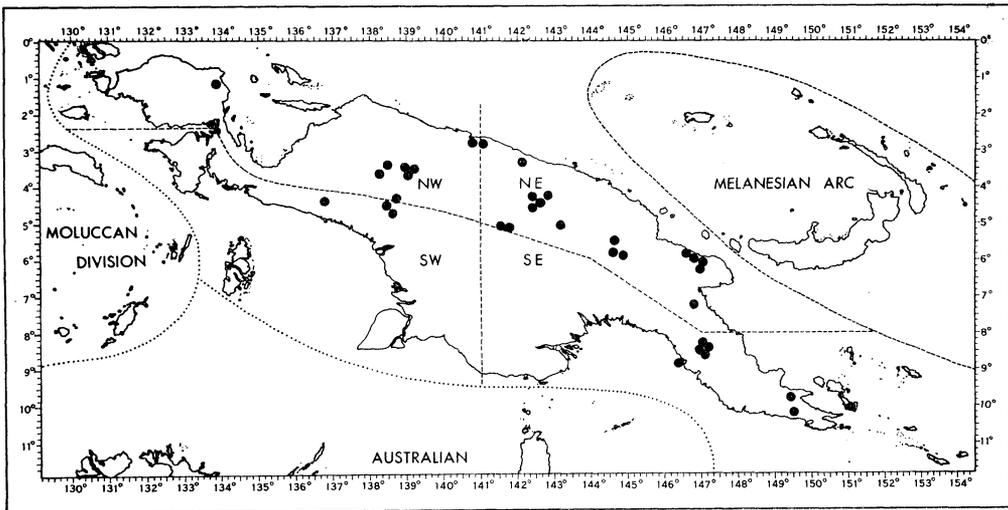


Fig. 99. Distribution of *Cydistomyia albithorax*.

54. *Cydistomyia heydoni* Oldroyd Figs. 91, 95.

Cydistomyia heydoni Oldroyd, 1949, p. 353, fig. 68 (type ♀, Upper Ramu R., Bearup; BMNH).

MATERIAL EXAMINED: 13 ♀♀, including 4 paratypes, 1 ♂.

♀. Medium-sized (11–13 mm), blackish, distinctively patterned species. Eyes (relaxed)

dark bluish green. Frons unusually wide (index 2.5-3), dark brown on upper part, white below and surrounding short, wide, brown callus; subcallus and adjacent part of parafacials deep velvety brown, contrasting strongly with pure white, white-haired remainder of subcallus and face and white beard; antennae black; palpi light fawn, with pale greyish overlay and relatively long dense white hairs. Scutum with dark brown ground color broken into 3 stripes by conspicuous greyish white dorsocentral vittae and lateral areas which become confluent in wide band in front of scutellum, which is brown centrally, greyish white laterally; pleura white, becoming greyish below, with relatively long dense white hairs. Legs brown becoming blackish on fore femora, distally on fore tibiae and on all tarsi. Wings clear, costal cell not darkened; stigma light brown; R_4 with appendix. Abdomen dark brown, becoming blackish distally, apical margins of tergites not appreciably paler; pair of wide lunate greyish white sublateral basal patches on tergite 2, large median greyish white apical triangles on 2-4 or 5, largest on 3, and smaller whitish lateral triangles on some tergites; venter brown basally, becoming blackish distally, with narrow white apical bands and lateral triangles on sternites 2-4 or 5. Terminalia dark, tergite 10 deep, cerci truncate.

♂. Similar to ♀, but even more brightly patterned. Marked contrast in size, but little in color, between bright copper-red upper and lower facets of eye; ocellar tubercle smaller and less conspicuous than in ♂ of *albithorax*.

DISTRIBUTION. NW NEW GUINEA: Baliem Camp, 1850 m, XII, Toxopeus; Iebele Camp, 2300 m, XI, Toxopeus; Moss Forest Camp, X, Toxopeus. NE NEW GUINEA: ♂, Aiyura, 2000 m, at u. v. light, X, Barrett; Banz, 1150 m, I-II, Christian; Dingat, 1500 m, Uruwa Val., Stephens; Feramin, 120-150 m, VI, Brandt; Goiburung, 1560-1650 m, X, Gressitt; Jungaing, I, Mayr; Kewieng, 2300 m, Yupna Val., Stephens; Ramu R.

55. *Cydistomyia perdita* Mackerras, n. sp. Figs. 92, 96.

Holotype ♀ (BISHOP 3545), from Bokondini, 1300 m, 40 km N of Baliem Valley, taken by sweeping, 5-11. XI. 1961, S. & L. Quate.

MATERIAL EXAMINED: 3 ♀♀, 2 ♂♂.

Greyish black species, not as ornate as *heydoni*, larger than *albidosegmentata*, and distinguished from both by more uniformly dark brown frons, longer, differently shaped callus, and very small, though conspicuous, white triangles on abdominal tergites. Length 12 mm.

♀. *Head*: Frons slightly converging, index 5, uniformly dark brown, with short black hairs; callus black, elongate wedge-shaped. Subcallus deep brown, rather shiny, sharply marked off from, and strongly contrasting with, pure white, white-haired parafacials and face; beard white, relatively dense. Antennae black, except for some grey tomentum at base of scape. Palpi dark grey, paler and with long white hairs basally, black-haired distally. *Thorax*: Scutum and scutellum blackish grey, grey-dusted anteriorly, without evident vittae, and with predominantly black hairs; notopleural lobes dark brown, black-haired; some white hairs above wing root and on margin of scutellum, but supraalar and postalar tufts inconspicuous. Pleura almost uniformly ashy, with long, relatively dense white hairs; halteres contrastingly black. *Legs*: Coxae as pleura, white hairs on fore pair particularly conspicuous; mid and hind femora brown, predominantly white-haired; remainder of legs deep brown to black, black-haired. *Wings*: Greyish hyaline, costal cell darkened only at

extreme base; stigma dark brown, veins almost black; R_4 strongly curved, but with at most rudiment of an appendix. *Abdomen*: Black, black-haired, except for narrow ashy basal band on tergite 2, very narrow white, white-haired bands widening into small median triangles on 2-6, and pale, conspicuously white-haired lateral margins expanded into apical triangles at corners of tergites. Venter black, with wide greyish cream apical bands on sternites 2-7; 1-5 predominantly white-haired, 6 & 7 predominantly black-haired. Terminalia undistinguished.

The ♀ from Eliptamin Valley is paler than the others, with light brown callus, brown mesonotum, almost yellowish femora, dark brown abdomen, and mostly unpigmented, more flattened sternite 8. It agrees structurally and in pattern, is obviously immature, and is probably correctly placed here.

♂: Similar to ♀, but dark brown rather than black, with lighter brown rather than ashy pleura, and with brown femora. Eyes large, upper facets markedly enlarged, but concolorous with the black lower and narrow rim of posterior facets; ocellar tubercle deeply sunken, not visible; deep brown subcallus contrasting with white parafacials and face as in ♀; palpi yellow-brown, with long white hairs below, some black ones laterally above.

DISTRIBUTION. NW NEW GUINEA: Bokondini, 1300 m, XI, Quate (incl. ♂). NE NEW GUINEA: Eliptamin Val., 1200-1350 m, VII, Brandt. SE NEW GUINEA: Dogon, 800 m, X-XI, Brandt; ♂, Goilala, Owen Stanley Range, XII, Brandt.

56. *Cydistomyia albidosegmentata* (Schuurmans Stekhoven) Figs. 93, 97.

Tabanus albidosegmentatus Sch. Stk., 1926, p. 332, fig. 155 (type ♀, Dutch New Guinea, Lorentz; ZMA).—Oldroyd, 1949, p. 358. Both type and paratype agree very well with specimens that had been identified as *misimensis* by Mr. Oldroyd.

Cydistomyia misimensis Oldroyd, 1949, p. 354, fig. 66 (3 cotype ♀♀, from Mt. Misim, Morobe distr., Stevens; MCZ).

MATERIAL EXAMINED: 58 ♀♀, 10 ♂♂.

♀. Very small (7-9, occasionally 10 mm), brightly patterned, dark greyish brown species. Eyes (relaxed) blackish green. Frons narrower than in *heydoni* (index 4), fawn to brown, with vertexal triangle and ocellar tubercle poorly differentiated; callus brownish black, with extension usually sharply marked off from the oblong basal part, much as in *heydoni*; subcallus and adjacent part of parafacials deep velvety brown, remainder of parafacials and face pure white, with white hairs, including beard; antennae brownish black; palpi plump, cream, becoming grey distally, with relatively long white hairs. Scutum brown, grey dusted anteriorly, with greyish white dorsocentral vittae and lateral areas relatively diffuse, merging in front of greyish white scutellum; pleura pale grey, with a cream tint in mesopleural convexity, and white hairs. Legs bright brown, darker basally on femora, especially on fore pair, distally on fore tibiae and on all tarsi. Wings faintly brownish, vaguely darkened in distal part of radial area and sometimes across apices of basal cells, but not in costal cell; stigma dark brown; R_4 with strong appendix. Abdomen dark to blackish brown, with narrow greyish white basal band on tergite 2 and wider apical bands which expand to form large median and smaller lateral triangles on 1-6; median triangles increase in size to tergites 3 or 4 and then decrease; venter brown, with wide greyish

white apical bands on all sternites, sometimes so extensive as to overlay dark color and reduce it to broad basal patches. Cerci acuminate.

♂. Similar to ♀, but more hairy, dorsocentral vittae more obscured, femora generally darker, and wings almost completely clear. Upper facets of eyes generally much paler than lower facets and separated from them by a narrow still paler zone; ocellar tubercle small and inconspicuous.

There is a similar variation in pattern to that seen in *albithorax*, the pale median triangles on the abdominal tergites in particular varying from almost imperceptible expansions on basal tergites to an almost vittate appearance on apical ones.

DISTRIBUTION. NW NEW GUINEA: Karubaka, 1350 m and W. side, 1400–2000 m, Swart Val., XI, XII, Gressitt. SW NEW GUINEA: Heuvelbivak, 800 m, XI, Lorentz. NE NEW GUINEA: Aiyura, 2000 m, in house, I, Barrett; Baiyer R., 1150 m, X, Gressitt; Banz, 1150 m, I, Christian; Etappenberg, 850 m, X–XI, Bürgers; Ethitno, 1500 m, XII, Stephens; Lordberg, XII, Bürgers; Maprik, III, IX–XI, Standfast; Mokai, 750 m, Torricelli Mts., XII, I, Brandt; Mt. Misim, Stevens; Mumeng, 800 m, XII, Barrett; Nineia, 500 m, X, McMillan; Ongake, 1900 m, XII, Stephens; Saidor, 1200 m, XI, Brandt; Wanuma, 800–1000 m, Adelbert Mts., X, Gressitt. SE NEW GUINEA: Dogon, 800 m, X–XI, Brandt; Goilala, Owen Stanley Range, XII, Brandt.

57. *Cydistomyia* sp.

Two ♂♂ (Eliptamin Val., 1200–1350 m, VIII, and Saidor, VII, both Brandt) are paler than the ♂♂ of *albidosegmentata*, and probably represent a different species, because they do not appear to be albinos. I have seen no ♀♀ that could be associated with them.

♂. Eyes with lower facets blackish, upper ones dark red-brown, without a paler zone separating them; ocellar tubercle small, pale, inconspicuous; subcallus, parafacials and face uniformly yellowish cream, hairs on parafacials and face cream; antennae bright yellow to orange, with contrasting blackish style; palpi dull yellow, with yellow hairs. Scutum and scutellum greyish cream, with ground color reduced to 3 rather vague brown vittae, hairs predominantly yellowish cream; pleura with same yellowish cream tint in tomentum and hairs. Legs and wings paler than in the ♂ of *albidosegmentata*. Abdomen with median triangles extended to form wide, serrated, greyish cream vitta, dark brown being reduced to sublateral lunules; venter also with dark ground color greatly reduced.

Another ♂, from Enarotadi, 1900 m, in light trap, VIII, Gressitt, is even paler and more yellowish in general color, but it is obviously teneral.

58. *Cydistomyia latisegmentata* (Schuurmans Stekhoven) Figs. 94, 98.

Tabanus latisegmentatus Sch. Stk., 1926, p. 294, fig. 130 (type ♀, Heuvelbivak, 800 m, XI, 1909, Lorentz; ZMA).—Oldroyd, 1949, p. 358. The type is in poor condition, but it agrees well, including the remains of the characteristic abdominal pattern, with specimens identified as *aluensis* by Mr. Oldroyd.

Cydistomyia aluensis Old., 1949, p. 350, fig. 65 (type ♀, mountain slopes above Bernhard Camp, 700 m, III–IV, 1939, Toxopeus; BMNH, Archbold Coll.).

MATERIAL EXAMINED: 12 ♀♀, including holotype of *latisegmentata*, 1 ♂.

♀. 9–11 mm, blackish species, superficially rather like *laeta*, but not as narrow-bodied, and with an unusual abdominal pattern which led Schuurmans Stekhoven to think that the distal segments had been "wetted". Eyes (relaxed) brown-black. Frons grey-brown, index 3.5–4; callus large, tapering, black; subcallus blackish brown, contrasting with the ashy, white-haired parafacials and face; tentorial pits deep; beard white; antennae and palpi black. Scutum dark brown, grey-dusted anteriorly, with narrow ashy band extending from behind brown notopleural lobes to the almost completely ashy scutellum; pleura separated from scutum by a brown zone, variegated brown and ashy, with prominent ashy spot on upper mesopleural convexity and mostly white hairs. Legs black. Wing dark brown in costal and anterior part of radial area, and with variable brown suffusion elsewhere; veins blackish, R_4 without appendix. Abdomen black, with conspicuous white, white-haired apical bands, slightly widened in mid-line, on tergites 2–3 or 2–4 only, and lateral white triangles on 1–4; venter with sternite 1 grey, remainder black, and wide, white, white-haired apical bands on 2–4. Terminalia with short cerci and gonapophyses.

The ♀ from Komania has relatively short triangular callus, shorter, plumper palpi, and a black beard. The specimens recorded by Oldroyd from Waigeu and Idenberg R. appear to have been of this form, which may represent a separate race.

♂. Larger (12 mm) than ♀♀, less strongly patterned, with greyish thorax and brownish abdomen. Eyes with enlarged facets on upper 1/2 dark reddish, contrasting with small, deep brown lower facets; ocellar tubercle small, but reaching level of vertex; frontal triangle brown, and narrow brown line extending down each side of ashy subcallus; parafacials and face ashy, with white hairs, including beard; antennae blackish brown, scape with some ashy tomentum; palpi blackish. Scutum and scutellum brown, with greyish overlay and mixed black and white hairs, not as contrasting marginally as in ♀; pleura pale grey, with white hairs. Legs as in ♀. Wings with stronger brown suffusion along veins. Abdomen with tergites 1–3 brown, remainder black, and narrow paler apical margins on 1–5; white hairs in median patch on 1, in rather indefinite apical fringes, densest near mid line, on 2–4, and in lateral crescents on 1–4, elsewhere black; venter similar, but with scattered white hairs on basal sternites and clearly defined apical fringes on 2–4. The differences from the ♀ are considerable, but the association seems likely to be correct.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus; Bernhard Camp area; Camp Nok, 800 m, Waigeu, IV, Cheesman; Idenberg R., headwaters, 300–600 m, I, Stüber; Rattan Camp, 1200 m, III, Toxopeus. SW NEW GUINEA: Heuvelbivak. NE NEW GUINEA: Etappenberg, 850 m, XII, Bürgers; Finschhafen, Wagner; Nineia, 500 m, X, McMillan; Regenberg, 550 m, V, Bürgers. SE NEW GUINEA: ♂, Dogon, 800 m, X–XI, Brandt; Komania, 1100 m, XI, Brandt.

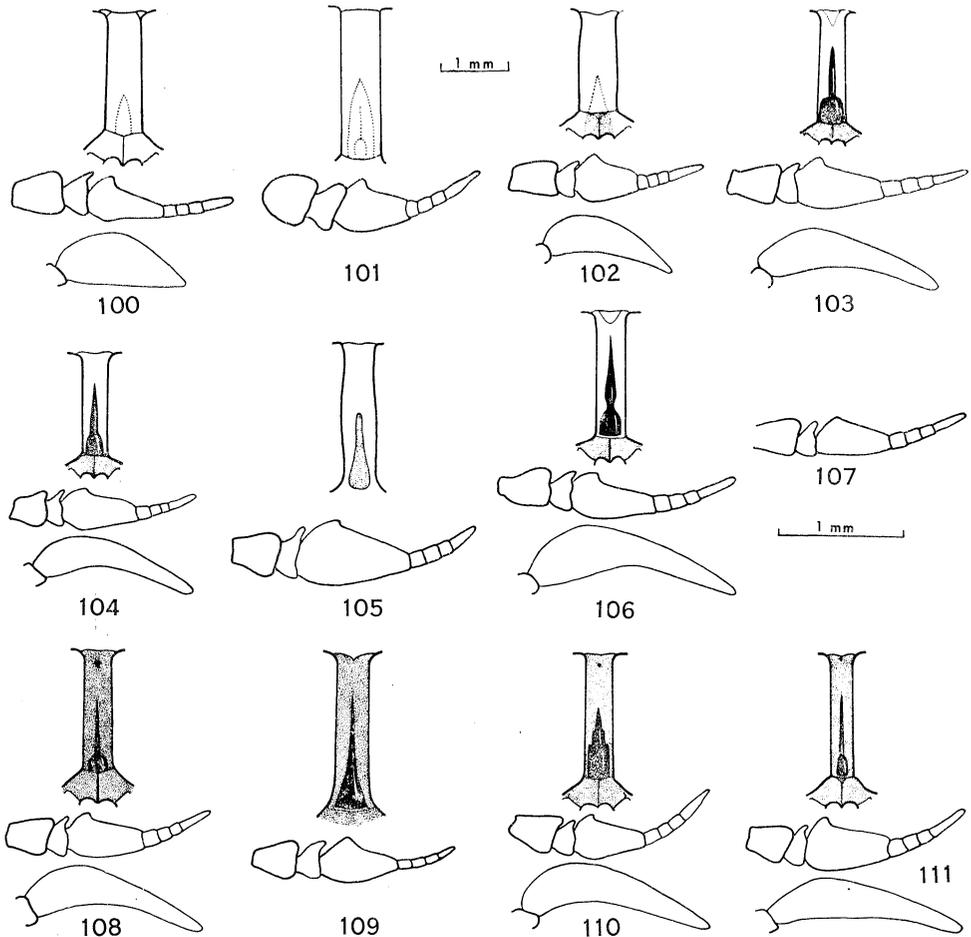
The *immigrans* Subgroup

59. *Cydistomyia immatura* Oldroyd Figs. 100, 113.

Cydistomyia immatura Old., 1949, p. 347, fig. 59 (type ♀, Mt. Lina, 1150 m, Cyclops Mts., III. 1936, Cheesman; BMNH).

MATERIAL EXAMINED: 1 ♀ paratype.

♀. Robust, 13–15 mm, brown species, related to *immigrans* and *inopinata*, but distinguish-



Figs. 100-111. *Cydistomyia*, *immigrans* and *lorentzi* subgroups, ♀♀ except 107: 100, *immatura*; 101, *pseudimmatura* (after Oldroyd, 1949); 102, *quasimmatura*; 103, *torresi* (holotype of *nigerrima*); 104, *immigrans*; 105, *inopinata* (frons after Oldroyd, 1949); 106, *griseiventer* (holotype); 107, *papouina* ♂ (after Schuurmans Stekhoven, 1926); 108, *crepuscularis*; 109, *oudella* (modified from Oldroyd, 1949); 110, *lorentzi*; 111, *sol*.

ished by the absence of a callus. Frons parallel, index 3.5-4, brown, darker centrally, swollen median area (partly denuded in ♀ studied) in position of callus; subcallus brown; parafacials and face paler, with brown hairs, including most of beard, some paler hairs posteriorly; antennae short, light brown, more orange on plate, darkening at tip of style; palpi short, curved, stumpy, brown, with dark brown hairs. Scutum and scutellum bright brown, irregularly paler on lateral margins, with yellowish brown dorsocentral vittae merging in median area behind suture which is yellowish brown laterally; pleura brown, with dark brown hairs, except for pale tufts on propleural area, behind wing root and on squamae. Legs brown. Wings faintly brownish, costal cell darker, trace of darkening across apices of basal cells and along radial veins; stigma brown; R_4 with, at most, trace

of an appendix. Abdomen brown, darkening on distal tergites, with dark brown hairs on discs, and creamy white ones on paler median triangles on tergites 1-5 and on apical bands expanding into lateral triangles on 2-6; venter brown, with sharply defined, creamy, cream-haired apical bands on sternites 2-6.

♂. Oldroyd recorded a ♂ from Moss Forest Camp, but did not describe it.

DISTRIBUTION. NW NEW GUINEA: Moss Forest Camp, 2800 m, X, Toxopeus; Mt. Lina and Cyclops Mts., 300 m, IV, Cheesman; Rattan Camp, 1200 m, II, Toxopeus. NE NEW GUINEA: Surprise Ck., Morobe dist., X, Stevens.

60. *Cydistomyia pseudimatura* Oldroyd Fig. 101.

Cydistomyia pseudimatura Old., 1949, p. 347, fig. 60 (type ♀, Iebele Camp, 2250 m, XI, 1938, Toxopeus; BMNH, Archbold Coll.).

MATERIAL EXAMINED: Nil.

♀. Similar to *immatura*, differing mainly in its slightly larger size (15 mm) and in the characters given in key. Oldroyd also noted that the parafacials were broader, facial area paler and contrasting more with brown subcallus; palpi short, though relatively slender; beard snow-white, no recumbent yellow hairs on mesonotum, and legs and wings paler.

♂. Noted by Oldroyd as agreeing with the ♀ in essential features.

DISTRIBUTION. NW NEW GUINEA: Iebele Camp; Moss Forest Camp, 5 km N of Lake Habbema, X, Toxopeus.

61. *Cydistomyia quasimatura* Mackerras, n. sp. Figs. 102, 114.

Holotype ♀ (SPHTM), from Aiyura, 1800 m, indoors, 21. II. 1962, J. H. Barrett.

MATERIAL EXAMINED: 1 ♀.

Dull species, with the same appearance of immaturity as the 2 preceding, but distinguished from *pseudimatura* by smaller size, paler general coloration, wider frons, and differently shaped palpi. Length 11 mm. Its distinctness was confirmed by Mr. Oldroyd by comparison of the holotypes.

♀. *Head*: Frons parallel, index 2.8, light fawn-brown, with inconspicuous black hairs; a darker, irregularly raised, central area on lower part presumably represents the callus. Subcallus fawn-grey, brownish in centre; parafacials and face grey, with a fawn tint above, and inconspicuous brown and pale hairs; beard white. Antennal segments 1 & 2 yellowish brown; 3 more orange, scarcely darkening on style. Palpi only moderately plump, light fawn, with brown hairs and some pale ones basally and below. *Thorax*: Scutum and scutellum greyish-brown, with only traces of paler dorsocentral vittae, but somewhat darker in sublateral area; hairs mixed black and dull cream, mainly dark on notopleural lobes, and with barely differentiated supraalar and postalar tufts. Pleura light fawn-grey, with long but fine creamy white hairs. *Legs*: Light brownish yellow, darkening to brown apically on fore tibiae and to dark brown on tarsi. *Wings*: Almost clear, costal cell yellow-brown; stigma and main veins brighter yellow-brown; R₄ without appendix. *Abdomen*: Dull brown, with wide but poorly contrasting lighter fawn-brown apical bands, which are only slightly expanded in mid-line and laterally; hairs dark brown, no pale ones on apical margins (specimen somewhat rubbed), but zone of white to yellowish cream

hairs on lateral margins and in incipient lateral triangles; venter greyish brown, with wide but diffuse light fawn-brown apical margins to sternites, and predominantly creamy white hairs, except for some dark ones in median area of sternite 6 and extensively on 7.

DISTRIBUTION. NE NEW GUINEA: Aiyura.

62. *Cydistomyia griseiventer* (Schuurmans Stekhoven) Fig. 106.

Tabanus griseiventer Sch. Stk., 1926, p. 288, fig. 125 (type ♀, Lorentz R., V. 1907, Lorentz; ZMA.)—Oldroyd, 1949, p. 358.

MATERIAL EXAMINED: ♀ holotype.

11.5 mm, almost uniformly rather dark grey species, distinguished from related species by color, differently shaped callus, and darker palpi and legs. Also resembles *C. griseianulata* (Tayl.) from northern Australia, but that species has black basal antennal segments, wider antennal plate, more pale hairs basally on palpi, entirely black legs, and wider, better defined pale bands and median triangles on abdominal tergites.

♀. Frons parallel, index 4.5, fawn-brown; callus black; subcallus little darker than lower part of frons, with brown patch on each side lateral to antennae; parafacials and face paler, with white hairs, including beard; antennae red-brown, darkening distally on plate, becoming blackish on style; palpi dark brown, with black hairs. Thorax grey, pleura somewhat paler, with mostly white hairs. Femora blackish, mid and hind becoming brown distally; most of fore tibiae and tarsi blackish, mid and hind brown. Wings faintly greyish, costal cell only slightly darkened; stigma bright brown, veins brown; R₄ angulate, with trace of appendix. Tergites 1 & 2 of abdomen grey, remainder blackish, 2-6 with paler, white-haired apical bands and vague median triangles; venter darker, with wider, more uniform pale apical bands on sternites 2-6. Terminalia not dissected.

DISTRIBUTION. SW NEW GUINEA: Lorentz R.

63. *Cydistomyia torresi* (Ferguson & Hill) Figs. 103, 112, 115.

Tabanus torresi Ferg. & Hill, 1922, p. 257 (type ♀, Moa I., Torres Strait, II. 1921; SPHTM). *Cydistomyia torresi*: Mackerras, 1959, p. 166.

Cydistomyia nigerrima Oldroyd, 1949, p. 351, fig. 70 (type ♀, Milne Bay, New Guinea, II. 1943, Mackerras; SPHTM). I had previously thought that 2 closely related species could be distinguished, but examination of fresh specimens from both areas has convinced me that all fall within the range of variation of *torresi*.

MATERIAL EXAMINED FROM NEW GUINEA: 42 ♀♀, 6 ♂♂.

♀. Small-medium (10-12 mm), brown species, "blackest" only in relation to the paler *immigrans*, to which it is related, and with which it is, broadly, sympatric (fig. 112). Eyes (relaxed) dark brown with hint of green. Frons fawn-brown, index 4.5-5, with ill-defined vertexal triangle and no detectable ocellar tubercle; callus deep brown, normally quadrate with abrupt, narrow, blackish extension; subcallus and top of parafacials brown, remainder of parafacials and face creamy white, with white hairs, including beard; antennae long, dark brown, variably reddish to orange basally on plate, style black; palpi black. Scutum and scutellum brown, with dense fawn-yellow tomentum, which shows dark or pale according to the angle of light, and often gives a paler appearance to the lateral margins be-

hind suture and to the scutellum; hairs mixed black and recumbent cream to yellowish; dark, black-haired zone on lateral margin anteriorly, including most of the notopleural lobes, and separating off the light yellowish cream to greyish pleura. Legs deep to blackish brown, mid tibiae and tarsi lighter. Wings almost clear, yellowish in costal cell and faintly brownish distal to bright brown stigma; R_4 strongly curved, but usually without appendix. Abdomen with tergites 1 & 2 brown, remainder blackish brown, a vaguely paler apical margin to 1, broader fawn-cream, cream-haired apical bands and small lateral triangles on 2-6, and vague median triangle or vitta indicated only on 2; venter dark to blackish brown, sternites 1 & 2 extensively grey-dusted, 2-6 with broad, fawn-cream, cream-haired apical bands. Cerci small, rounded, terminalia otherwise undistinguished.

There is considerable variation. The type of *nigerrima*, from Milne Bay, is very dark, whereas specimens from the higher Deria-Komania area, which is not far away, are more orange-brown in color, and a few have distinct apical shadows in the wings. Some paler specimens have tergites 1-4 of abdomen yellow-brown to brown, and some darker ones have vague median triangles of pale hairs on tergites 3-5 or 6. All have black palpi which are a useful distinguishing feature of the species.

♂. Brighter brown and with more yellowish tint than the associated ♀♀. Eyes with upper facets markedly enlarged, dark red-brown, paler in narrow zone where they meet the small black lower facets that extend up in an occipital band to vertex; ocellar tubercle narrow, sunken but visible; subcallus and top of parafacials brown, contrasting with creamy white lower parafacials and face much as in ♀; antennae similar to ♀; palpi acorn-shaped, fawn-brown, with black and some white hairs. Scutum and scutellum with considerable admixture of dull golden hairs, which also occur in triangles and fringes on abdominal tergites. Wings with more tendency to clouding along the anterior radial veins than in ♀.

DISTRIBUTION. NW NEW GUINEA: Dojo, IV, Simon Thomas; Hollandia, IV, IX, den Hoed; Lake Sentani, 90-250 m, VI, Maa; Maffin Bay, X; ♂, Mulik R., 1050 m, 10 km W of Archbold Lake, XI-XII, Quate. NE NEW GUINEA: Bainyik, in Malaise trap, VI, Gressitt; Maprik, IV, Standfast; Nadzab, VII, Krombein; Singorakai, VI, McMillan. SE NEW GUINEA: Deria, 230 m, XII-I, Brandt (incl. ♂♂); Dogon, 800 m, X-XI, Brandt (incl. ♂♂); Fly River, Strong (Oldroyd noted this specimen as differing from the others, but it comes within the range of variation of the species); Komania, 1100 m, XI, Brandt; Milne Bay; Mt. Lamington, 400-500 m, McNamara, Murray; Oriomo, X, Gressitt; Woodlark I., II, Brandt. Also Torres Strait Is. (Moa, Badu).

64. *Cydistomyia* sp.

The ♂ from Bougainville, Solomon Is., VI, Standfast, recorded by Mackerras (1962b, p. 110) is similar to *torresi*, but upper facets of eyes are only slightly enlarged, frons, parafacials and face yellow, beard bright yellow, pleura yellowish grey with yellow hairs, legs black, and pale hairs on abdomen rich golden. I have seen no ♀ that can be associated with it.

65. *Cydistomyia immigrans* Oldroyd Figs. 104, 112, 117.

Cydistomyia immigrans Old., 1949, p. 362, fig. 64 (type ♀, Kokoda, 400 m, IX-X. 1933, Cheesman; BMNH).

MATERIAL EXAMINED: 77 ♀♀, 4 ♂♂.

♀. Small-medium (10–12, occasionally 9 mm), bright brown species; nearly as abundant as *albithorax*, though not so widely distributed (fig. 112). Eyes (relaxed) dark brown with greenish to bronze reflections. Frons, subcallus and adjacent parts of parafacials brown, appearing irregularly darker in certain lights; vertexal triangle poorly defined, ocellar tubercle barely indicated; callus medium brown, not contrasting much with color of frons, tapering abruptly into relatively short extension; lower part of parafacials and face pure white, with white hairs, including beard; antennae rather slender, brown, with variable orange tint in plate, and deep brown style; palpi pale at base, segment 2 light fawn, with black hairs, a useful distinction from *torresi*. Scutum and scutellum brown, with greyish dusting anteriorly, and only vaguely paler on narrow dorsocentral vittae, suture and lateral areas; hairs mostly dull cream; pleura greyish cream, with white hairs, separated from scutum by a somewhat darker, black-haired zone through lower part of notopleural lobes. Fore legs brown, darkening to blackish apically on tibiae and tarsi; mid and hind more yellowish, with some grey dusting on femora and darkening on tarsi. Wings almost clear, costal cell sometimes slightly darkened; stigma yellow-brown; R_4 usually without appendix. Abdomen brown, with black hairs on most of discs of tergites, a narrow pale basal band on 2, and wider fawn-cream apical bands, widening in mid-line, on 2–5, median and lateral triangles made more definite by patches and fringes of cream hairs; venter dark brown, with considerable greyish overlay on basal sternites, and conspicuous greyish white, white-haired apical bands on 2–6. Terminalia undistinguished.

♂. Similar to ♀, but with less definite abdominal pattern, and distinguished from ♂ of *torresi* by lighter brown general coloration, orange antennal plate, yellowish cream, white-haired palpi, brownish cream pleura, completely clear wings, and duller yellowish cream hairs on abdominal tergites.

DISTRIBUTION. NW NEW GUINEA: Cyclops Mts., 300 m, II, IV, Laffon. NE NEW

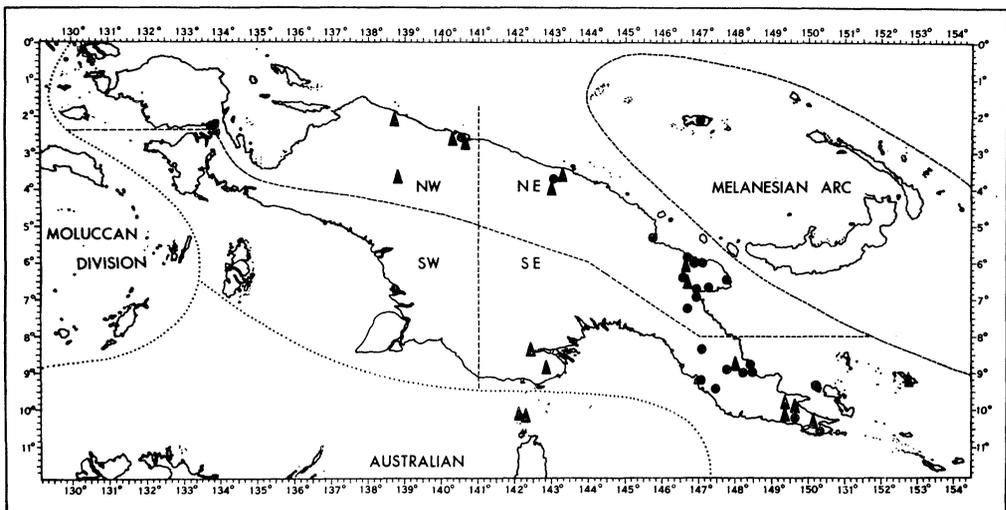


Fig. 112. Distribution of *Cystostomyia immigrans* (spots) and *torresi* (triangles).

GUINEA: Bonga, XI, McMillan; Buba, in Malaise trap, VI, Gressitt; Bulolo, 700 m, Taylor; Busu R., 100 m, E of Lae, IX, Gressitt; Huon Gulf, V-VI, Froggatt; Lae, IX, Bayley, Krauss; Lowes, 600 m, X, Maa; Madang, Lohe; Maprik, III, X, Standfast (incl. ♂); Ninia, 500 m, X, McMillan; Roinji, X, McMillan; Singorakai, X, McMillan. SE NEW GUINEA: Brown R., 5 m, X, Gressitt; Buna Bay, McNamara; Deria, 230 m, I, Brandt (incl. ♂); ♂♂, Goilala, Owen Stanley Range, I, Brandt; Goodenough I., Clinton; Kokoda; Modewa, XII, Brass, Wagner; Mt. Lamington, 400-500 m, McNamara; Oro Bay, XII, Philip; Subitana-Musgrave dist., X, Gressitt. Also Manus (Lorengau, XI, McMillan), new divisional record.

66. *Cydistomyia inopinata* Oldroyd Figs. 105, 118.

Cydistomyia inopinata Old., 1949, p. 352, fig. 69 (type ♀, Surprise Creek, Morobe dist., Stevens; MCZ).

MATERIAL EXAMINED: 2♀♀, 1♂.

♀. Oldroyd described this species as larger (13 mm) and more robust than *immigrans*, with pale yellow, more evenly tapering callus, shorter antennae and only slightly darkened style. The following supplementary notes have been made from a rather crushed ♀, the only one now available. Eyes (relaxed) brown; antennae shorter and wider than in *immigrans*, segments 1 & 2 with creamy yellow tomentum and black hairs, 3 bright orange, with a conspicuous tuft of short black hairs at dorsal angle, style brownish orange, not contrasting; palpi whitish, but with similar black hairs to *immigrans*; costal cell of wing brown, stigma brown, and R₄ with well-developed appendix (the only discrepancies from the description); pale hairs on abdominal tergites appear to form more sharply defined triangles than in *immigrans*.

♂. Identification of ♂♂ is particularly difficult in this subgroup, and the one from Banz tentatively allotted here differs from the ♂♂ of *immigrans* only in larger size (13 mm), thicker antennal scape, shorter, wider, orange plate and concolorous style (very like antenna of ♀), brown hairs on subcallus, parafacials and palpi, and yellow-brown costal cell of wing.

DISTRIBUTION. NW NEW GUINEA: Noemfor Is., II, Blakemore. NE NEW GUINEA: ♂, Banz, 1750 m, VII, Gressitt; Silaum b. Kap König Wilhelm, XII, Neuhass; Surprise Creek.

67. *Cydistomyia papouina* (Walker) Figs. 72, 107.

Tabanus papouinus Walk., 1865, p. 108 (type ♂, New Guinea, Wallace; BMNH).—Ricardo, 1913, p. 401.—Schuurmans Stekhoven, 1926, p. 297, fig. 134.

Chasmiella papouinus: Oldroyd, 1949, p. 335, fig. 26.

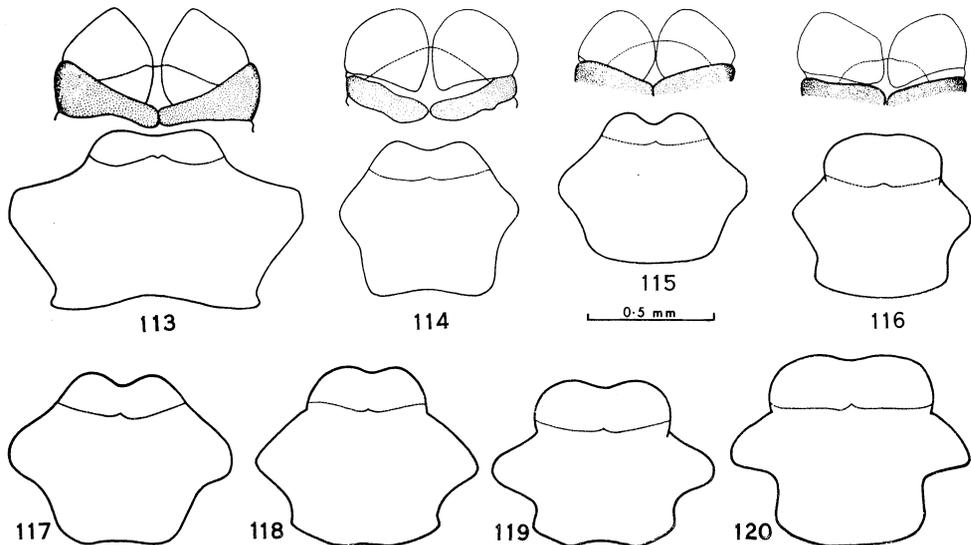
MATERIAL EXAMINED: 1♂.

This species is known from only 3♂♂ and 1 supposed ♀ identified by Osten-Sacken (Oldroyd, 1949). I have examined the ♂ from Mt. Gyifrie, which Oldroyd had found to agree with the type except for the yellow rather than silvery color of the hairs on thorax and abdomen. I would exclude this species from the *basifasciata* group, because the ocellar tubercle is deeply sunken, cell R₄ short and wide, vein R₄ angulate near base, and cell Cu₂ petiolate. On the other hand, it is close to, though differing in detail from, the ♂ of

C. brevior (Walk.), a species that is distinguished in the Australian fauna by the same venational characteristics. The following notes are based on Schuurmans Stekhoven's redescription of the type, supplemented by observations on the Mt. Gyifrie specimen which is not in good condition.

♂. Small (9 mm), yellow-brown species. Eyes with upper large brown facets bare, and small black lower facets extending in narrow border along occiput to vertex; subcallus and upper parafacials olive-brown, lower parafacials white, hairs white, including beard; antennal segments 1 & 2 olive-brown, with black hairs, 3 red-yellow, style black; palpi olive-brown, with yellow hairs and black ones at apex. Mesonotum greyish blue, with yellow-brown tomentum and yellow hairs; pleura grey-white, white-haired. Legs with fore femora dark red-brown, mid and hind and all tibiae yellow to olive-brown, darkening on tarsi. Wings clear, stigma sienna-brown. Tergites 1 & 2 of abdomen dark yellow-brown, more distal tergites darker, apex blackish, 2-5 with yellow-haired segmentations; venter with sternites 1 & 2 reddish brown, with yellow-white hairs, 2 with yellow apical fringe, remainder black-brown, with black hairs, 3-5 with yellow-white apical fringes.

DISTRIBUTION. NW NEW GUINEA: Hollandia, VII, Toxopeus; Mt. Gyifrie, 0-30 m, IV, Cheesman.



Figs. 113-120. *Cydistomyia*, *immigrans* and *lorentzi* subgroups, parts of terminalia of ♀♀: 113, *immatura*; 114, *quasimmatura*; 115, *torresi*; 116, *sol*; 117, *immigrans*; 118, *inopinata*; 119, *crepuscularis*; 120, *lorentzi*.

The *lorentzi* Subgroup

68. *Cydistomyia crepuscularis* Oldroyd Figs. 108, 119.

Cydistomyia crepuscularis Old., 1949, p. 357, fig. 67 (type ♀, Haumo R., Milne Bay, III, 1944, Krombein; USNM).

MATERIAL EXAMINED: 22 ♀♀, 2 ♂♂.

♀. 12–14 mm, almost uniformly black-brown species, less robustly built than *lorentzi*. Eyes (relaxed) dark green. Frons nearly parallel, index 4–5, dark brown, ocellar tubercle diffuse but slightly shining; callus brown-black; subcallus, parafacials and face dark brown, with deep brown to black hairs, including beard; antennae black, except for the deep, somewhat reddish brown plate; palpi black, with black hairs. Thorax entirely deep velvety brown, with relatively long dense brownish black hairs, especially conspicuous on pleura. Legs blackish brown, tibiae little lighter basally. Wings suffused with dark brown in costal cell and along all veins, leaving the centres of most cells extensively clearer; stigma light brown; R_4 without appendix. Abdomen black, apices of all tergites and sternites narrowly brown; hairs black, except for brown apical fringes on tergites. Terminalia like those of *lorentzi*, but much more deeply pigmented.

♂. Not as dark as ♀♀, with orange-brown antennal plate and dark brown abdomen and legs, but with even longer and denser dark hairs over the whole thorax. Eyes with upper coppery facets markedly enlarged, but not much darker than the small lower facets; ocellar tubercle prominent, reaching level of vertex; palpi dark brown, with black hairs.

An unassociated ♂ (Normanby I., XII, Brandt) is also dark brown, but probably belongs to a different species. It is larger (16 mm); eyes almost entirely blackish; ocellar tubercle narrow and rather deeply buried; subcallus, parafacials, face, palpi and basal antennal segments (3rd missing) fawn-brown; legs more yellowish brown, femora darkened basally; thorax and abdomen more uniformly dark brown, but with shorter hairs, and tergites with apical fringes and incipient median triangles of brighter brown hairs.

DISTRIBUTION. NW NEW GUINEA: ♂, unspecified locality, XII, Steinhauser. NE NEW GUINEA: ♂, Waghi, 1550 m, III, Barrett. SE NEW GUINEA: Deria, 230 m, XII–I, Brandt; Haumo R., Milne Bay; Sudest I., 0–350 m, IX, Brass.

69. *Cydistomyia oudella* Oldroyd Fig. 109.

Cydistomyia oudella Old., 1949, p. 355, fig. 61 (type ♀, Mt. Oud, 1150 m, Japen I., Cheesman; BMNH).

MATERIAL EXAMINED: Nil.

♀. 11 mm, deep red-brown species, distinguished by its shining face. Frons slightly diverging, index 4.5, brownish yellow, with black hairs; callus elongate wedge-shaped; subcallus and parafacials golden brown, face largely shining yellow-brown; hairs brown, becoming black in beard; antennal segments 1 & 2 yellow-brown, 3 dark red-brown basally, yellow apically above, style dark red-brown; palpi yellow-brown, with black hairs. Mesonotum light brown, with abundant silky yellow-brown hairs, the fine erect hairs mainly black or brown, but with many yellow ones, especially on sides and hind margin; pleura yellow-brown, with yellow hairs. Legs yellowish, with orange and yellow hairs on femora and bases of tibiae, tips of fore tibiae and all tarsi darkened by black hairs. Wings yellowed to Cu_1 , fore border darkened; R_4 rectangular, with moderately long appendix. Abdominal tergites and sternites reddish brown, with orange hairs, discs of segments little darker, hind margins little lighter.

DISTRIBUTION. NW NEW GUINEA: Mt. Oud, Japen I.

70. *Cydistomyia lorentzi* (Ricardo) Figs. 110, 120.

Tabanus lorentzi Ric., 1913, p. 400 (type ♀, Alkmaar, X. 1909, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 447, fig. 217.

Cydistomyia lorentzi: Oldroyd, 1949, p. 357, fig. 19.—Mackerras & Rageau, 1948, p. 697, fig. 4E.

MATERIAL EXAMINED: 31 ♀♀, 1 ♂.

♀. Medium-sized (12–15 mm), solidly built, variable, dark reddish brown to bright yellowish brown species. Eyes (relaxed) dark brownish green. In the dark form, frons, subcallus, parafacials and face almost uniformly rather dark brown; callus blackish brown; hairs on parafacials and face, including beard, dark brown; antennal segments 1 & 2 dark brown, with black hairs, 3 red-brown, style black; palpi dark brown, with blackish brown hairs. Thorax and abdomen rather dark reddish brown, with some vaguely paler areas on pleura, and dark brown hairs everywhere, except for mixture of bright to orange brown ones on abdominal tergites and sternites, sometimes forming more definite lateral fringes on tergites. Legs brown, basal 1/2 of fore tibiae and all of mid and hind somewhat lighter; hairs entirely black. Wings with brown costal cell and variably suffused with brown along the veins; stigma light brown; R₄ normally without appendix. Sternite 8 with wide gonapophyses.

The pale form has brighter, more or less yellowish to orange-brown frons, thorax and abdomen; more contrasting ocellar tubercle; bright orange antennal plate; hairs on thorax yellowish brown, those on abdomen darker brown, with orange admixture and fringes. The extremes look like different species, but there are intermediates, and it has not been possible to draw a line between them.

♂. Like ♀, but intermediate in coloration between dark and light forms, and with rather strong brown suffusion in wings. Eyes entirely black, upper large facets occupying about 2/3 of surface; ocellar tubercle rather narrow, but almost reaching level of vertex; parafacial hairs, beard, and hairs on thorax and abdomen longer and denser than in ♀, predominantly yellow-brown; they are neither as dense nor as dark as in the ♂ of *crepuscularis*.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, 50–100 & 600–800 m, IV, VIII, XI, XII, Olthof, Toxopeus; Hollandia, VII, Toxopeus; Karubaka, 1450 m, Swart Val., XI, Gressitt; Kloofbivak, X, Versteeg; Mulik R., 1050 m, XI–XII, Quate. SW NEW GUINEA: Alkmaar; Utakwa exped., Camp 3, 2500 m, XII, Boden Kloss. NE NEW GUINEA: Aiyura, 2000 m, at u. v. light, II, Barrett; Banz, 1800 m, I, II, Christian; Etappenberg, 850 m, X, Bürgers; Flusslager 18, 160 m, XI, Bürgers; Prince Alexander Ra., 900 m, IX, Pullen; Sepik-Houtbiwak, X–XI, Schultze; Sugoite, 900 m, Torricelli Ra., II, Brandt; Waria R., II, Littlechild. SE NEW GUINEA: Goilala, 975 m, Owen Stanley Range, XI–II, Brandt (incl. ♂); Mt. Mafulu, 1300 m, I, Cheesman; Port Moresby, I, Taylor. Also Solomon Is. (Bougainville).

71. *Cydistomyia sol* (Schuurmans Stekhoven) Figs. 111, 116.

Tabanus sol Sch. Stk., 1926, p. 450, figs. 219, 220 (type ♀, Bivak I., II. 1910, Lorentz; BMNH).

Cydistomyia sol: Oldroyd, 1949, p. 356, fig. 21.

MATERIAL EXAMINED: 59 ♀♀, 14 ♂♂.

♀. Smaller (normally 10–12 mm) species than *lorentzi*, and normally much lighter golden yellow in general color, but occasional dark specimens may be superficially difficult to distinguish. Eyes (relaxed) bright green with bluish reflections. Frons narrower than in *lorentzi* (index 5–6), parallel or slightly converging, fawn-yellow, with a small darker ocellar tubercle; callus narrow, light brown, more or less yellowish below; subcallus, parafacials and face yellow, central part of subcallus variably darker; hairs, including beard, predominantly yellow; antennal segments 1 & 2 yellow-brown, 3 relatively wide, bright orange, sometimes darkening apically on style; palpi yellow-brown, with black hairs, variably replaced by yellow ones basally, occasionally, with entirely yellow hairs. Thorax with dense bright yellow tomentum, variably grey-dusted anteriorly on scutum; hairs bright yellow, variably mixed with black on disc of scutum. Legs yellow, darkening somewhat on tarsi. Wings with costal cell yellow-brown and variably, usually faintly, suffused along veins; stigma yellow; R_4 normally without appendix. Abdominal tergites yellow, more or less extensively suffused with brown sublaterally; hairs bright golden yellow in median and lateral areas, dark brown sublaterally and on tergites 6 & 7; when darker hairs are dense, yellow median ones form distinct pale vitta; venter yellowish, more or less suffused with brown, but leaving apices of sternites pale, and with predominantly golden yellow hairs. Sternite 8 with unusually deep gonapophyses.

A few ♀♀ are greyish rather than yellow, with pale hairs dull cream, and basal part of callus and beard more brownish. They may represent a distinct species, but I cannot separate them satisfactorily on the material at present available. Two of the ♀♀ from Rossel I. are remarkably large (13–14 mm), but normal in other respects.

♂. Similar to ♀ and showing the same variation in general coloration, but with greyish suffusion of scutum usually more marked. Eyes bright to reddish brown, the small lower facets but little darker; ocellar tubercle deeply buried, not detectable; antennal style not darkened, except occasionally at extreme tip.

DISTRIBUTION. NW NEW GUINEA: Albatrosbivak, v. Leeuwen; Bodem, 100 m, VII, Maa; Camp Nok, 800 m, Waigeu, IV, Cheesman; Idenberg R., headwaters, 300–600 m, I, Stüber; Sermowai R., upper, 400 m, III. SW NEW GUINEA: Alkmaar, X, Lorentz; Bivak I.; Heuvelbivak, 800 m, XI, Lorentz; Rivierkamp, II, Lorentz. NE NEW GUINEA: Bewani Mts., IX, Stüber; Eliptamin Val., 1200–1350 m, VI, VIII, Brandt; Feramin, 120–150 m, V, VI, Brandt; Finschhafen, Wagner; Mokai, 750 m, Torricelli Mts., XII, I, Brandt; Nineia, 500 m, X, McMillan; Pionierlager, VI, Lederman; Prince Alexander Ra., 900 m, IX, Pullen; Queblag^s, VIII, Bürgers; Saidor, V–IX, Brandt; Standlager am Aprilfluss, X, Bürgers. SE NEW GUINEA: Dogon, 800 m, X–XI, Brandt; Goilala, 975 m, Owen Stanley Ra., XI, Brandt; Kokoda-Pitoki, 400 m, III, Gressitt; Milne Bay, X, Peters; Mt. Lamington, 400–500 m, McNamara; Rossel I., 0–100 m, IX, X, Brass; Woodlark I., I, Brandt. Also New Britain (Nakanai Mts., 5°30'S 151°15'E, ♂ in light trap, VII, Ford), new divisional record. The ♂ recorded by Oldroyd (1949) as from Aru Is. is a *Dasybasis* from New Guinea (p. 160).

72. *Cydistomyia nana* Mackerras & Rageau

Cydistomyia (*Cydistomyia*) *nana* Mackerras and Rageau, 1958, p. 694, fig. 4F (type ♀,

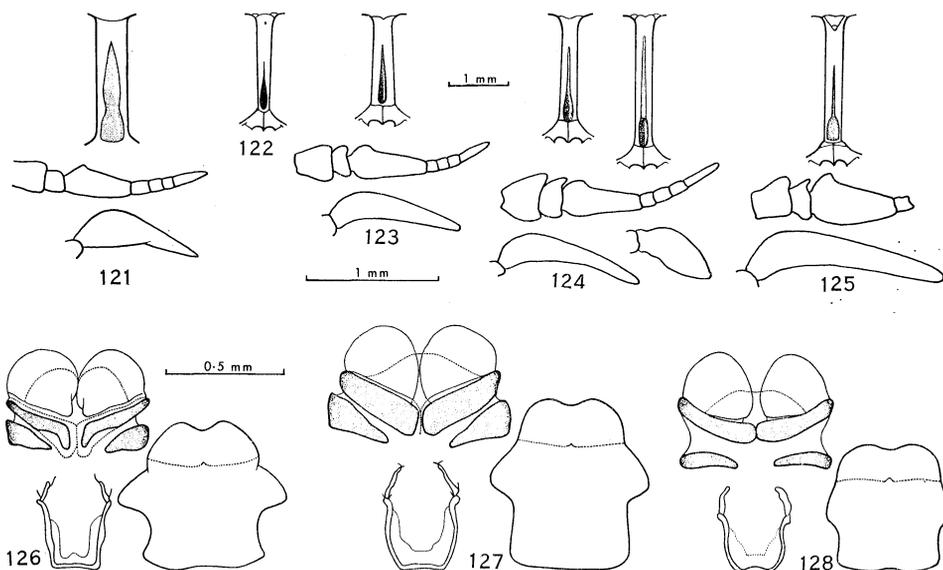
8. I have not been able to trace this locality in the former German territory.

Bougainville, Solomon Is., W. G. Downes; AMNH).—Mackerras, 1962b, p. 109.

♀. Very small (8–9 mm), yellowish fawn species, which is distinguished from *sol* by size, color, blackish, differently shaped callus, dark fore legs, and apparently constant appendix on R₄. It seems to be intermediate between the *lorentzi* and *sylvioides* subgroups, but is abundantly distinct from *hollandiensis*.

♂ (not previously described). Similar to ♀, but more hairy, and brown basal bands on abdominal tergites more definite. Eyes with upper enlarged dark red facets contrasting with small lower black ones; ocellar tubercle prominent, level with vertex; frontal triangle and subcallus brown, parafacials and face pale greyish cream, white-haired; palpi pale yellow, with long white hairs; mesonotum and abdominal tergites with longer, more golden hairs than in ♀. The few specimens of this species known were collected in different areas and at wide intervals of time, so the association of the sexes is tentative.

DISTRIBUTION. NEW BRITAIN: ♀, Keravat, 30 m, IV, Ford. SOLOMON IS.: ♂, Bougainville, Kukugai, 150 m, I, Brandt; unspecified locality, Downes (♀ ♀).



Figs. 121–128. *Cydistomyia, sylvioides* subgroup, ♀ ♀: 121, *sylvioides* (after Schuurmans Stekhoven, 1926); 122, *celebensis* (Sch. Stk.), holotype (for comparison with Mackerras, 1962b, fig. 9); 123, 126, *hollandiensis*; 124, 127, *solomensis*, showing variation in frons and palpi; 125, 128, *nokensis*.

The *sylvioides* Subgroup

73. *Cydistomyia sylvioides* (Walker) Fig. 121.

Tabanus sylvioides Walk., 1864, p. 206 (type ♀, Misol, Wallace; BMNH).—Ricardo, 1913, p. 393.—Schuurmans Stekhoven, 1926, p. 294, fig. 131.

MATERIAL EXAMINED: Nil.

It was noted in London only that the type "belongs to the group of long, slender, inornate species of *Cydistomyia* with long, slender 3rd antennal segment and style." The following notes are combined from the original and Miss Ricardo's and Schuurmans Stekhoven's redescrptions.

♀. 12 mm, yellow-brown species. Frons parallel, index 4, brown; callus wide, yellowish, filling most of frons on lower 2/3; subcallus and upper parafacials brown, lower parafacials and face white, with white hairs, including beard; antennae reddish yellow, darkening to black style; palpi brown, with black hairs. Mesonotum brown, with some yellow hairs; pleura "hoary." Legs yellow-brown, fore femora and tibiae and all tarsi darker. Wings greyish, costal cell and apical shadow in radial area brown; R₄ without appendix. Abdominal tergites havanna-brown, with yellowish apical fringes and subobsolete median triangles; venter dark.

DISTRIBUTION. NW NEW GUINEA: Misol.

74. *Cydistomyia hollandiensis* Mackerras, n. sp. Figs. 73, 123, 126.

Holotype ♀ (SPHTM), from Hollandia dist., 5. III. 1945, C. B. Philip.

MATERIAL EXAMINED: 4 ♀♀, 4 ♂♂.

Small, slender, dull brown species, with narrow callus, slender antennae, and indefinite pale apical bands and median triangles on abdominal tergites. Length 8–10 mm, 1 ♂ 11 mm. To be distinguished from *sylvioides* by smaller size, smaller callus, less contrasting parafacials and face, brown beard, and abdominal pattern.

♀. *Head*: Eyes (relaxed) dark purplish brown. Frons rather narrow (index 5–5.5), slightly diverging, brown, with inconspicuous dark brown hairs; vertexal triangle slightly paler, and very small cream ocellar tubercle or median ocellus; callus small, light brown, lower part marked off by neck from the tapering extension. Subcallus brown, concolorous with frons; parafacials and face slightly paler, with inconspicuous brown hairs; beard sparse, brown. Antennal segments 1 & 2 bright brown, with dark brown hairs; 3 brown at base, becoming blackish distally and on style. Palpi brown, with dark brown hairs. *Thorax*: Scutum and scutellum brown with a yellowish tint, slightly paler anteriorly; hairs brown and cream, inconspicuous, except for group of longer brown hairs on the notopleural lobes; pleura greyish cream, with cream hairs and mixture of light brown ones on upper mesopleural convexity. *Legs*: Light brown, slightly darker on hind femora, distally on fore tibiae, and on all tarsi. *Wings*: Faintly brown, costal cell dark brown, strong suffusion of brown in radial area and faintly along some of the other veins; stigma dark brown; R₄ angulate, often with short appendix. *Abdomen*: Brown, somewhat paler basally, with apical bands on tergites variably lighter or darker, and indications of paler median triangles; hairs mainly brown on discs of tergites, dull yellow on their apical margins, variably in deep, diffuse median triangles, and more definitely in lateral fringe. Venter similar, but paler hairs more scattered. Terminalia much as in *lorentzi* and *crepuscularis*.

♂. Similar to ♀, but somewhat paler, antennal segment 3 yellow-brown, with style contrastingly blackish, and pattern on abdominal tergites barely indicated. Enlargement of upper facets of eyes slight but rather variable, their color not much paler than lower facets; ocellar tubercle oval, almost at level of vertex; frontal triangle, subcallus, parafacials, face and palpi almost concolorous brown. One of 2 ♂♂ from Sudest I. agrees rea-

sonably well with those from New Guinea; the other has even longer antennae, with scape nearly $2\times$ as long as wide, and wing with wide brown bands along veins. It may represent a different species, and is not included in the number of specimens examined.

DISTRIBUTION. NW NEW GUINEA: ♂, Cyclops Mts., 150–250 m, VI, Maa; Hollandia, in rain forest, III, V, Hoogstraal, Philip; Mt. Gyifrie, 0–300 m, IV, Cheesman; Waris, 450–500 m, VIII, Maa (incl. ♂). NE NEW GUINEA: ♂, Krisa, IV, Cheesman. SE NEW GUINEA: ♂, Sudest I., Mt. Riu, 250–350 m, IX, Brass.

75. *Cydistomyia solomensis* (Ricardo) Figs. 124, 127.

Tabanus solomensis Ricardo, 1915, p. 289 (cotype ♀ ♂, Solomon Is., Froggatt; BMNH).—*nec* Bezzi, 1928, Fiji (= *bezzii* Mackerras & Rageau, 1958).

Cydistomyia solomonensis Oldroyd, 1949, p. 343, fig. 22.

Cydistomyia (Cydistomyia) solomensis: Mackerras & Rageau, 1958, p. 695, fig. 4D.

?*Tabanus insurgens* Ricardo, 1913, p. 400, New Guinea, *nec* Walker, 1861b, p. 276, Batchian. Miss Ricardo's descriptive notes on the ♀ ♀ from the Lorentz collection fit Papuan specimens of *solomensis*; the true *insurgens* is a smaller, darker species, close to *hollandiensis* but with shorter antennae. These specimens have not been found, either in BMNH or ZMA, so their identity cannot be checked.

Cydistomyia rozeboomi Philip, 1960a, p. 6, fig. 3 (type ♀, Cyclops Mts., 300 m, nr. Hollandia, I. 1945, L. E. Rozeboom; Philip).

MATERIAL EXAMINED FROM NEW GUINEA: 3 ♀ ♀, 12 ♂ ♂, including a paratype ♀ and the allotype ♂ of *rozeboomi*.

As with the other reddish to yellowish, unadorned species, *C. solomensis* shows considerable variation in external characters, with a tendency to segregation of possibly discrete populations. There are minor variations, too, in the shape of sternite 8 and the base of the furca, but not of a degree in which confidence could be placed without examining more material than is at present available. Papuan specimens, including *rozeboomi*, fall within the range, and I cannot separate them specifically from specimens from the Solomon Is. If this is correct, the species ranges from western New Guinea to Guadalcanal.

♀. Slender, 11–13 mm, yellow-brown species. Eyes (relaxed) brown, sometimes with greenish reflections. Frons very narrow (index 8–10), parallel or slightly diverging, with yellow tomentum which is sometimes darker above and below; callus variable, but normally a brown ridge on nearly full length of frons, sometimes more or less expanded below; subcallus, parafacials and face yellow, with variable brownish shading, hairs and beard light yellowish, sometimes partly brown; antennae slender, yellow to orange, becoming brownish distally and dark brown to blackish on style; palpi of extremely variable shape, usually moderately long and slender, yellow, with yellow to brown hairs, sometimes very short and stumpy. Scutum and scutellum yellow-brown; pleura usually paler. Legs yellowish, darkening on fore tibiae and all tarsi. Wings faintly brownish, costal cell and stigma brown, and variable brown suffusion in radial area; R_4 usually without appendix. Abdomen yellow-brown, darkening on distal tergites, and with quite variable relationship between yellow and dark brown to black hairs, sometimes the pale predominating, sometimes the dark, and the *rozeboomi* form showing an incipient yellow pattern of median triangles and apical bands on the tergites. Terminalia as illustrated, but somewhat variable.

♂. Similar to ♀, but generally more uniformly yellowish, and with antennae, as usual, even more slender. Upper enlarged facets of eyes not much paler than lower facets; ocellar tubercle small, rather deeply buried. The ♂♂ from Rossel I. are darker, more definitely brown than those from the Solomon Is. and most from New Guinea, and the paler hairs on the abdomen are bright brown. They may represent a distinct race.

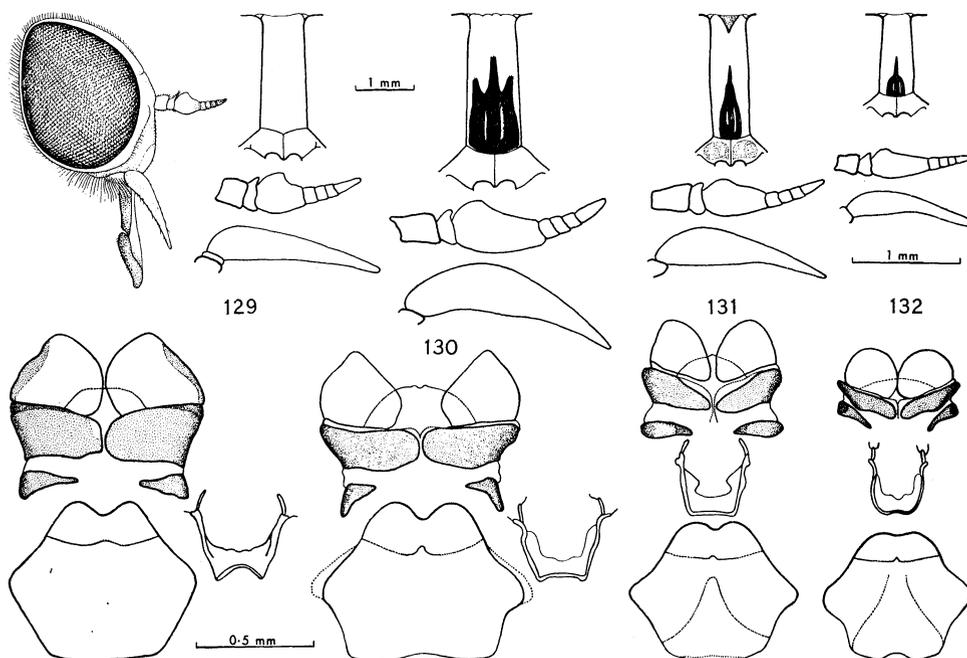
DISTRIBUTION. NW NEW GUINEA: Cyclops Mts. ?SW NEW GUINEA: Alkmaar; Bivak I.; Heuvelbivak; Rivierkamp. NE NEW GUINEA: Busu R., 100 m, IX, Gressitt; Eliptamin Val., 1200-1350 m, VIII, Brandt; Lae, Clinton, Skinner; Wewak, Taylor. SE NEW GUINEA: Normanby I., XI, Brandt; Rossel I., 0-50 m, X, Brass. Also Solomon Is. (Bougainville to Guadalcanal).

76. *Cydistomyia nokensis* Oldroyd Figs. 125, 128.

Cydistomyia nokensis Old., 1949, p. 354, fig. 62 (type ♀, Camp Nok, 800 m, Waigeu, IV, 1938, Cheesman; BMNH).

MATERIAL EXAMINED: 1 ♀, 1 ♂ paratypes, 1 other ♀.

♀. Distinguished from *solomensis* only by the distinctly converging, paler creamy yellow frons, oblong callus, with narrow extension, entirely brown-haired abdominal tergites, and possibly by more compact build. The terminalia (fig. 128) are somewhat different, but barely beyond the range of variation seen in *solomensis*, none of the external characters can be regarded as conclusive, and the species is accepted provisionally until more



Figs. 129-132. *Dasybasis*, ♀♀, corresponding terminalia below: 129, *caesia*; 130, *standfasti*; 131, *anomala*; 132, *germanica*.

specimens are available.

♂. Differs from the ♂ of *solomensis* by more compact build, more inflated eyes, with upper facets more conspicuously enlarged, entirely dark-haired abdominal tergites, and darker brown apical tergites.

DISTRIBUTION. NW NEW GUINEA: Camp Nok, Waigeu; Hollandia, V, Malkin.
NE NEW GUINEA: Eliptamin Val., 1200–1350 m, VIII, Brandt.

Genus *Dasybasis* Macquart

♀. Eyes of Papuan species bare, unbanded. Frons relatively wide, index less than 3.5, diverging to almost parallel; callus large, pyriform, or absent; parafacials generally wide; antennal segment 1 small; palpi plumper basally, more acuminate apically and with longer hairs than usual in *Cydistomyia*. Vein R_4 normally with strong appendix. Small to large (8–16 mm), smooth, brown, yellow, or grey, non-metallic species.

♂. Sexual dimorphism slight to moderate. Eyes of Papuan species with upper facets markedly enlarged and densely hairy; ocellar tubercle not detectable.

The genus was originally monotypic for *Dasybasis appendiculata* Macq., Australia, but now includes many species in Australia and South America, 10 in New Zealand, 3 in New Caledonia, and, I believe, a few in South Africa. It is clearly distinguished from *Cydistomyia* in Australia, but not so readily in New Guinea, in spite of the fact that the 2 genera belong to different faunal elements. Three of the Australian species-groups (Mackerras, 1959) are represented, and they are of sufficient zoogeographical interest to warrant definition here.

KEY TO PAPUAN SPECIES OF DASYBASIS

1. 12 mm, uniformly bright yellow species, probably of the *vetusta* group sp. (♂)
Grey or brownish species 2
2. 13–14 mm, almost uniformly pale grey species, without callus.....**77. caesia**
Not uniformly pale grey; callus well-developed 3
3. 16 mm, grey species, with large median pale triangles on abdominal tergites; callus
large, almost filling lower 1/2 of frons.....**79. standfasti**
Not such large species, with different abdominal pattern; callus smaller.....4
4. 12–15 mm, grey species, with short, wide, dark antennal plate, diffusely grey-banded
abdomen, and terminal segments acuminate (Admiralty to Santa Cruz Is.).....
..... **80. mellicallosa**
Smaller (8–11 mm), brownish species, with narrower, orange antennal plates, and
terminal abdominal segments truncate..... 5
5. Larger (10–11 mm), darker species, with larger callus (fig. 131); fore femora and
tibiae bright brown **81. anomala**
Smaller (8–10 mm), more fawn to yellowish brown species, with smaller callus (fig.
132); fore femora and most of fore tibiae blackish.....**82. germanica**

The *vetusta* Group

Medium sized to large (11–17 mm), nearly concolorous grey to yellowish, densely tomentose species; fronts of ♀♀ moderately wide (index 2.5–3), nearly parallel; callus small

or absent; terminal abdominal segments of ♀♀ laterally compressed, cerci acutely tent-like in end view. Apparently strictly littoral; 6 species distributed round the coasts of Australia, *caesia* extending to Aru Is. and S. New Guinea, and possibly *vespiformis* to S. New Guinea.

77. *Dasybasis caesia* (Walker) Figs. 129, 133.

Tabanus caesius Walk., 1848, p. 180 (type ♀, ? locality; BMNH).—Schuurmans Stekhoven, 1926, p. 419, fig. 208.

Cydistomyia caesius: Oldroyd, 1949, p. 345.

Dasybasis caesia: Mackerras, 1959, p. 175 (lists Australian synonymy).

Tabanus leucopterus van der Wulp, 1868, p. 98 (type ♀, Aru Is., Rosenberg; RNH). Synonymy by Ricardo, 1913, p. 389 (she recognized the identity of the species, but reversed their seniority).

MATERIAL EXAMINED FROM NEW GUINEA: 2♀♀, 1♂.

♀. Medium-sized, almost uniformly light grey species. Eyes (relaxed) olive green. Frons slightly diverging, index 2.5–3, creamy grey, without callus; subcallus, parafacials and face similar, with white hairs, including beard; antennal segments 1 & 2 yellowish cream, 3 orange-yellow, including style; palpi cream, with white hairs. Thorax, including pleura, densely light grey tomentose, slightly yellowish on notopleural lobes; hairs cream to white. Legs entirely light yellowish. Wings clear, costal cell not darkened; stigma and veins light yellowish brown. Abdomen pointed apically; densely light grey tomentose, except for narrow cream apical margins of tergites and sternites; hairs predominantly cream, mixed with some black ones on more distal tergites. The abdomen appears darker and distinctly fasciate in greasy specimens.

♂. Similar to ♀, and also with abdomen strongly tapering distally. Eyes swollen, hemispherical; upper enlarged facets red-brown, with dense brown hairs, contrasting strongly

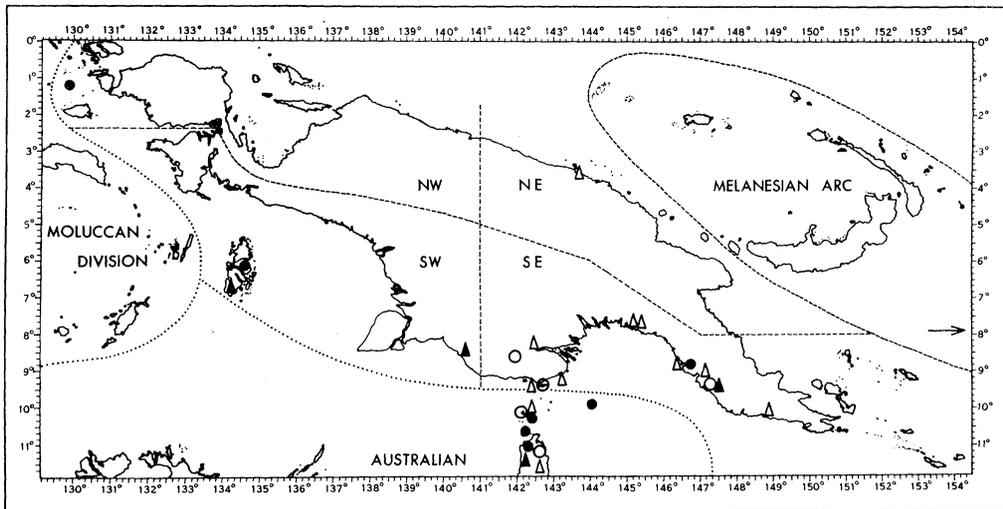


Fig. 133. Distribution of immigrants from Australia. *Dasybasis caesia* (spots), *D. germanica* (open circles), *Tabanus pallipennis* (solid triangles), *T. innotabilis* (open triangles). For *T. dorsobimaculatus* see fig. 213, triangles.

with black, bare, lower and posterior facets; postocular fringe creamy white, conspicuous.

DISTRIBUTION. NW NEW GUINEA: Kofiau I., II, Simon Thomas. SW NEW GUINEA: Aru Is. SE NEW GUINEA: Hall Sound. Also Torres Strait Is. (Murray, Moa, Thursday) and northern Australia from Montebello I. to Townsville.

78. *Dasybasis* sp.

A ♂ from Aviara (Lesi), SE New Guinea, Littlechild, has had a curious history. It was identified as *Cydistomyia sol* by E. E. Austen, and the identification was accepted with reservation by Oldroyd (1949, p. 356), but he misread the label as "Aru Is." It is superficially like *sol*, but has dense hairs on upper facets of eyes, shorter, wider antennal plate, and strong appendix on R₄. It is similar to, and may be the same as, *D. vespiiformis* (Ferg. & Henry) from coastal New South Wales and Queensland, but differs in shorter antennal plate and other minor details.

♂. Eyes large, upper facets markedly enlarged, yellow-brown, with long, light brown hairs, contrasting with small, dark brown, bare lower facets which extend only part way along occipital margin towards vertex; frontal triangle, subcallus and parafacials creamy yellow, face with greyish tint; beard creamy yellow; antennal segments 1 & 2 creamy yellow, with orange hairs, 3 short and wide, orange-yellow, not darkening on style; palpi yellowish, with creamy yellow hairs. Thorax olive-yellow, pleura with brownish tint; hairs long, dense, creamy yellow. Legs light yellowish, darkening on tarsi. Wings faintly greyish, yellow-brown in costal cell; stigma and veins yellowish; R₄ rectangular at base and with strong appendix. Abdomen yellow, with brownish tint, dorsally and ventrally, and with entirely yellow hairs except a few darker ones on apical segments. Terminalia not dissected.

The *macrophthalma* Group

Robust (13–16 mm), mostly greyish, densely tomentose species, with well-developed scutal and abdominal patterns; frons of ♀♀ wide (index 2–3), nearly parallel; callus usually full width of frons and restricted to its lower 1/2; terminal abdominal segments of ♀♀ narrowed, cerci tent-like, sternite 8 either small or pointed apically. Sand-dwelling species, not all of which are littoral, but the two most nearly related to *standfasti* (*macrophthalma* in southern N. S. W. and *rubricallosa* in New Caledonia) breed in the sand of ocean beaches. The 8 known Australian species are distributed in eastern and southern coastal and sub-coastal districts, 1 species is now recorded from New Guinea, *mellicallosa* occurs from Manus to the Santa Cruz Is., and *rubricallosa* in New Caledonia and the Loyalty Is.

79. *Dasybasis standfasti* Mackerras, n. sp. Fig. 130.

Holotype ♀ (SPHTM), from Port Moresby, 1. XI. 1956, H. A. Standfast.

MATERIAL EXAMINED: 1 ♀.

Large greyish species, distinguished from *rubricallosa* (Ric.) by narrower frons, longer, darker callus, and more strongly patterned abdomen. Length 16 mm.

♀. *Head:* Eyes (relaxed) dark green, bare; postocular fringe white. Frons medium (index 2.5), almost parallel, light grey, with short black hairs which are denser at vertex,

but no definite vertexal triangle or ocellar tubercle; callus blackish brown, filling almost whole width of frons below, and with short sublateral and longer median extensions above. Subcallus, parafacials and face smoothly greyish white tomentose, with short white hairs; sutures and tentorial pits shallow, relatively inconspicuous; beard white. Antennal segment 1 with grey tomentum, 2 brown, both with short black hairs; 3 with strong dorsal angle, black, including style. Palpi cream, greyish above on basal 1/2, with short white hairs. *Thorax*: Scutum and scutellum dark grey, with traces of a darker median line, conspicuous pale grey dorsocentral vittae, and diffusely paler on anterior and lateral margins; hairs mainly creamy yellow, some black ones in darker median and sublateral areas and on notopleural lobes; supraalar and postalar tufts white. Pleura light grey, with cream to white hairs. *Legs*: Femora completely grey-dusted, except for yellowish knees, white-haired; tibiae light brownish yellow with cream hairs, darkening and with black hairs distally, especially on fore pair; hind tibiae entirely black-haired posteriorly, fringes short but dense; tarsi brownish black, with black hairs. *Wings*: Entirely clear, including costal cell; stigma barely apparent; veins bright brown; R₄ angulate and with rudimentary appendix on one wing, without appendix on the other. Similar reduction occurs occasionally in species that are normally strongly appendiculate. *Abdomen*: Tergite 1 almost entirely grey, remainder dark grey to blackish, with narrowly pale apical margins and large grey median triangles; hairs greyish white mixed with a few black ones posteriorly on tergite 1, black on darker areas, greyish white on apical fringes, median triangles and in some lateral triangles on remaining tergites; lateral fringe short but dense, entirely white. Venter grey, apical margins of sternites narrowly light brown; hairs white, except for a mixture of black on sternite 6 and entirely black on 7. Terminalia as illustrated.

DISTRIBUTION. SE NEW GUINEA: Port Moresby.

80. *Dasybasis melliccallosa* Mackerras & Rageau

Dasybasis melliccallosa Mack. & Rag., 1958, p. 689, fig. 4A (type ♀, Manus, Admiralty Is., C. M. Deland; BMNH).

♀. Medium-sized, rather narrow-bodied, grey species, with relatively large, bright brown callus, short, wide, dark brown antennae, light brown legs, clear wings, and brown, diffusely grey-banded abdomen.

DISTRIBUTION. ADMIRALTY IS.: Manus, Caldwell, Deland. SOLOMON IS.: Bougainville, IV, Dumbleton, Ratcliffe; Florida I., III, Bohart; Tulagi, II, V, VIII, Carment, Lever; Ysabel I., VII, Lever. SANTA CRUZ IS.: Vanikoro, I, Carment. A ♀ in the Berlin Museum is labelled "Dtsch. N. Guinea", but it could have come from the islands to the E and not from the mainland.

The *clavicallosa* Group

Small to medium-sized (8–13 mm), smooth but not heavily tomentose, yellowish to greyish or brownish species, with avittate scutum, and abdominal pattern usually rather vague; fronts of ♀♀ medium to rather narrow (index 3–3.5 in Papuan species) parallel to slightly diverging; callus distinctly narrower than frons, often, considerably reduced; terminal abdominal segments dorsoventrally compressed. There are 15 Australian species, distributed across the N., including the Torres Strait Is., and down the E. coast to Sydney. Some

are coastal, but, so far as is known, none is strictly littoral. The Papuan species are difficult to separate generically from the *immigrans* subgroup of *Cydistomyia*.

81. *Dasybasis anomala* Mackerras & Rageau Fig. 131.

Dasybasis anomala Mack. & Rag., 1958, p. 691, fig. 4B (type ♀, Bougainville, Solomon Is., Clark; BMNH).

MATERIAL EXAMINED FROM NEW GUINEA: 6 ♀♀.

♀. Small (10–11 mm), brown species, the recent Papuan specimens being rather darker than those from Bougainville. Eyes (relaxed) dark brown. Frons almost parallel, index 3, fawn-brown; callus pear-shaped, blackish brown; subcallus mostly shining light brown; parafacials and face light fawn-grey, beard cream; antennal segment 3 orange, not darkening on style; palpi fawn-cream, with short black hairs. Scutum and scutellum brown, with grey dusting, especially anteriorly and on margins; pleura grey, with mainly cream to white hairs. Legs light brown, darkening basally on femora and distally on tarsi. Wings with faint brownish tint, dark brown in costal area, vaguely across apices of basal cells and along anterior radial veins; stigma brown, conspicuous; veins dark brown. Abdomen dark brown, with paler apical bands on all visible tergites, widening slightly in middle, but not forming definite triangles; venter brighter, more yellowish brown, darkened in median zone, and with cream hairs on paler parts more evident than on dorsum.

There is some variation. Two of the Daru specimens have discs of tergites 2–4 brighter brown, with dark color reduced to large median spots, but they agree in other respects. Those from Hall Sound were recorded previously (Mackerras, 1959) as *D. claviculosa banksiensis* (Ferg. & Hill), but they are old, have evidently faded considerably, and I now believe that they are merely rather small specimens of *anomala*.

DISTRIBUTION. SE NEW GUINEA: Daru, biting at edge of dry jungle and mangroves, XI, Marks, Peters; Hall Sound. Also Solomon Is. (Bougainville).

82. *Dasybasis germanica* (Ricardo). Figs 132, 133.

Tabanus germanicus Ric., 1915, p. 282 (type ♀, Cairns, north Queensland; BMNH).

Dasybasis germanica: Mackerras, 1959, p. 171.

MATERIAL EXAMINED FROM NEW GUINEA: 3 ♀♀, 3 ♂♂.

♀. Small (8 mm, Australian specimens 7–11 mm), fawn-brown to yellowish brown species. Eyes in life green with brown reflections. Frons slightly diverging, index about 3, fawn-cream, with narrow, blackish brown, pyriform callus; subcallus, parafacials and face greyish to fawn-cream, the subcallus entirely tomentose in unabraded specimens; beard white; antennal segment 3 longer and more slender than in Australian specimens, orange, becoming blackish on style; palpi cream, with black hairs variably mixed with white. Thorax grey, with variable brown to yellowish tint on scutum, and predominantly cream to yellowish hairs. Fore legs blackish, except for light brown apices of femora and basal 1/3 of tibiae; mid and hind light to yellowish brown, darkening (or at least grey-dusted) basally on femora and becoming blackish brown on distal tarsi. Wings clear; stigma and veins bright brown. The ♀ from Masava is aberrant in having the continuity of R_{2+3} broken for almost the full length of the stigma in both wings. Abdomen fawn to black-

ish brown, with paler, yellowish-haired apical margins and median triangles on tergites 2-5 and median apical patch of pale hairs on 1; venter paler and with wider pale-haired apical bands on sternites.

♂. Differs from ♀ in having more concolorous orange-brown abdomen, darkening on apical tergites. Eyes with upper facets greatly enlarged, bright brown, with dense brown hairs, contrasting strongly with lower and posterior zone of small, bare, black facets; post-ocular fringe dark.

DISTRIBUTION. SE NEW GUINEA: Port Moresby dist. (Bourke's, Masava, Napana), III, Gressitt, Norris, Standfast; Rouku, IV, Brandt. Also Torres Strait Is. (Saibai, Moa) and N. Australia from Northern Territory to Gladstone.

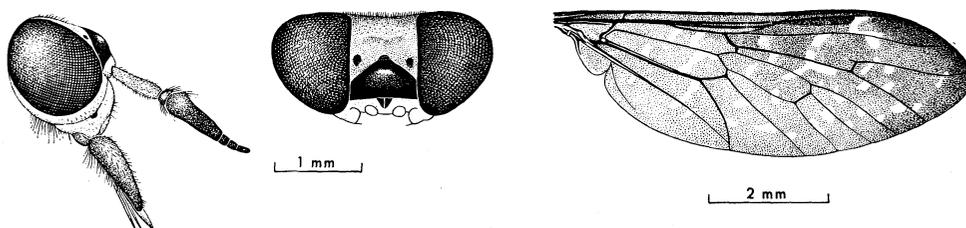


Fig. 134. *Haematopota irrorata* ♀.

Tribe HAEMATOPOTINI

83. *Haematopota irrorata* Macquart Fig. 134.

Two ♀♀ (1 broken) were labelled Lake Murray, Papua, 25. VII. 1957, W. W. Brandt, and the intact specimen has been identified by Mr. Oldroyd as *H. irrorata*, which is known from Malaya, Borneo, Sumatra, and possibly Java (Philip, 1960b, p. 61). As the genus has not been recorded previously from E of Java and the Philippines, it would not be desirable to accept its occurrence in New Guinea without confirmation. Fig. 134 has been included to facilitate identification if it is re-discovered.

Tribe TABANINI

Genus *Tabanus* Linnaeus

The aberrant subgenus *Pseudobolbodimyia* from Celebes, which is distinguished by the markedly enlarged antennal scape (Mackerras, 1962b, fig. 13), has not been encountered, nearly all of the 42 species recognized in the subregion being typical *Tabanus*. All have unequivocally dense setulae on the subepaulet. Their relationships are predominantly Oriental, but there has been considerable filtration in zone of transition. Thus, there are no representatives of the *ixion*, *flexilis*, or *basalis* groups; *ceylonicus*, a recent immigrant, is the only representative of its group; there are no species with cell R₅ closed, though it is narrowed in a few; no species of the *immanis* group with bicolored eyes (Philip, 1960a), and the few with unicolorous eyes that may be related appear to have differentiated in Australia before reaching New Guinea. Moreover, although there is evidence of relation-

ship between the Philippines and Celebes, it does not extend to New Guinea in this genus.

It has proved difficult to divide the fauna into species-groups, because structural characters are few, patterns and coloration tend to merge, and some of the more striking characteristics that have proved useful in other regions seem to occur sporadically here. For example, contrastingly colored bands on eyes of the ♀♀ have been detected only in *ceylonicus*, *pallipennis*, *semicircularis* and part of the *cohaerens* group in New Guinea, *gilingilensis* in New Ireland, and *expulsus* Walk. in New Hebrides and Fiji; while in Australia, *ceylonicus*, *pallipennis* and *particaecus* Hardy have banded eyes, and *strangmani* Ric. and *australicus* Tayl. have them bicolored brown and green. The following arrangement has been adopted as a foundation on which future studies may be built.

ceylonicus group: Small (10–12 mm), slender, dark species, with shining black or brown subcallus, and pale tibiae contrasting strongly with dark femora and tarsi. Terminalia undistinguished. Includes: *ceylonicus*.

denticulatus group: Very large (19–24 mm), strongly built species, with narrow fronts and calli, strongly to moderately hooked 3rd antennal segments, and strongly browned wings; abdominal pattern varied. Sternite 8 wide. The group seems to be a natural one, in spite of differences in color and pattern of species. Includes: *denticulatus*, *yulensis*, *aurivattatus*, *cinnamoneus*.

gilingilensis group: A large-medium, black species, sufficiently defined in couplet 6 of key; apparently not closely related to any of the other species known from the sub-region. Includes: *gilingilensis* (New Ireland).

recusans group: Medium-sized to large (15–21 mm), mostly stoutly built species, with deeply browned wings, and black, usually entirely black-haired abdomens. Sternite 8 wide, gonapophyses usually rather shallow. The last 4 species listed and the ♂ of *flammeus* have some pale abdominal hairs, at least in apical fringes on sternites, and usually in lateral fringes or small median patches on tergites as well, but they conform in other respects. Includes: *stuberi*, *flammeus*, *illustris*, *doreicus*, *wollastoni*, *ros-selensis*, *muruenis*, *pollinosus*, *recusans*, *subrecusans*, *bewanensis*, *obtusipalpis*, *papuensis*, *opalescens*.

exagens group: A possibly heterogeneous group of normally built to rather slender, relatively clear-winged species, which are distinguished by having a single row of well-defined median pale triangles or spots on abdominal tergites and one or more of the following additional characters: antennae and fore femora black; antennal segment 3 short and wide, with short style; palpi unusually short and plump; scutal vittae conspicuous; wing with small dark spots; R₄ with appendix. Terminalia of *patriarchus*, *exagens* and *semicircularis* are undistinguished, although they show progressive deepening of the gonapophyses; the other 3 have narrow sternites 8 and unusual furcae. Includes: *patriarchus*, *exagens*, *semicircularis*, *selene*, *sepikensis*, *lenticulatus*.

pallipennis group: A group of 3 Australian species, distinguished by banded eyes, wide frons (index less than 3), more or less complete division of callus into basal and central sections, vittate scutum, presence of strong appendix on R₄, and trivittate abdomen. Sternite 8 small and narrow. Includes: *pallipennis*.

cohaerens group: Small to rather large (11–16 mm), often rather slender species, with eyes (relaxed) either brown with green to purplish blue band, or with contrasting

brown or green lower lateral zone; scutum avittate; fore tibiae usually whitish basally, contrastingly black apically; wings more or less infuscate in costal and radial areas; abdomen with median vitta or vague triangles, or entirely without pattern. Terminal segments truncate; sternite 8 and gonapophyses moderately wide, and with relatively short hairs on ventral surface. Includes: *cohaerens*, *divisus*, *subcohaerens*, *approximatus*, *indistinctus*, *vanleeuweni*, *leverii* (Solomon and Santa Cruz Is.).

innotabilis group: Mostly larger (16–18 mm, but a few 11–13 mm), dark to reddish or yellowish brown, relatively inornate species, with uniformly dark brown to greenish eyes (relaxed) fore tibiae less contrastingly colored, and wings either clearer or more diffusely infuscated. Terminal segments of abdomen more or less acuminate (extremely so in *tenuis*); sternite 8 usually narrow, pale, with deep gonapophyses, but its most striking feature is the covering of long hairs on ventral surface—these characters provide the most reliable distinction from the *cohaerens* group. Includes: *innotabilis*, *rubriventris*, *siassensis*, *serus*, *dorsobimaculatus*, *meraukensis*, *herbertensis*, *tenuis*.

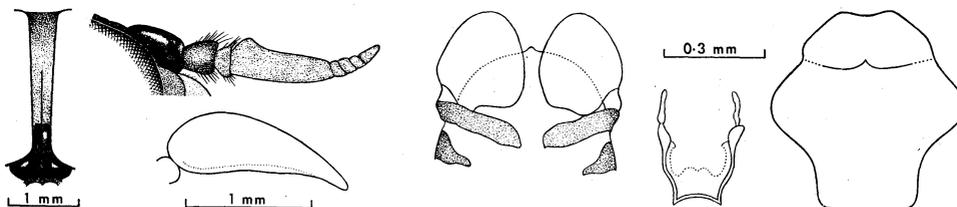


Fig. 135. *Tabanus ceylonicus*, ♀.

KEY TO PAPUAN SPECIES OF TABANUS

1. Subcallus shining black; 10–12 mm, black species, with contrasting yellow antennae and white tibiae..... **84. ceylonicus**
 Subcallus not shining black 2
- 2 (1). Very large (19–24 mm), broadly built, dark species, with strongly hooked 3rd antennal segments (figs. 137, 138), and dark, unbanded abdomens.....3
 Not such species.....4
- 3 (2). Abdomen shining deep to blackish brown, with orange-yellow tufts at sides of tergites 5 & 6 only..... **85. denticulatus**
 Abdomen more reddish brown, tomentose, with orange-yellow fringe on all tergites..... **86. yulensis**
- 4 (2). Very large (20–23 mm), brown to reddish yellow species, with strongly hooked or toothed 3rd antennal segments (figs. 139, 140) and banded abdominal tergites...5
 Not such species.....6
- 5 (4). Brown species, with strongly hooked 3rd antennal segment, brown legs, and brown venter with yellow-haired apical bands on sternites **87. aurivittatus**
 Reddish yellow species, with strongly toothed 3rd antennal segment, black legs, and black, unbanded venter, the orange-yellow hairs being restricted to apico-lateral parts of sternites **88. cinnamoneus**
- 6 (4). 15 mm, rather shining black species, with entirely shining black frons, yellowish antennae, and irregularly clouded wings (New Ireland) **89. gilingilensis**
 Not such species.....7

- 7 (6). Medium-sized to large (14–21 mm), mostly parallel-sided species, with dark legs, strongly browned wings, and black abdomens, which are entirely black-haired dorsally and ventrally, except for an occasional patch of pale hairs on tergite 1 (*recusans* group, part) 8
 Not such species; if abdomen lacks pale hairs, the build is more slender, color brown, and wings brown only in radial area.....17
- 8 (7). Vein R₄ with appendix; antennal segment 3 black; mesonotum contrasting strongly with abdomen; 14–17 mm species..... 9
 Vein R₄ without appendix.....11
- 9 (8). Mesonotum with grey to brown tomentum and thick covering of greyish cream hairs..... **90. stuberi**
 Mesonotum shining orange-red.....10
- 10 (9). Beard and hairs on fore coxae white.....**91. flammeus**
 Beard and hairs on fore coxae brown **92. illustris**
- 11 (8). Antennal segment 3 black; mesonotum with greenish yellow to grey tomentum and short black hairs; broadly built species, with wide abdomens and wings strongly browned along veins 12
 Antennal segment 3 orange to brown; mesonotum with yellow-brown to blackish brown tomentum 13
- 12 (11). Mesonotum and most of pleura greenish to greyish yellow; beard golden yellow; cell R₅ narrowing to wing margin; length 20 mm; New Guinea.....
**94. wollastoni**
 Mesonotum and most of pleura grey; beard black; cell R₅ not narrowing to wing margin; length 16–18 mm; Louisiade Is.**95. rosselensis**
- 13 (11). Mesonotum and pleura contrasting bright yellow-brown; beard yellow; 14–17 mm species **93. doreicus**
 Mesonotum and pleura less contrasting, duller to blackish brown; beard brown to black..... 14
- 14 (13). Larger (17–21 mm) or broader-bodied species, with very narrow fronts (index 10 or more), brown mesonota, and wings usually strongly browned along veins 15
 Usually smaller (15–16 mm), narrower-bodied, darker species, with wider fronts (index 8 or less), blackish brown mesonota, and wings more diffusely darkened..... 16
- 15 (14). Longer-bodied (20–21 mm), with longer antennal segment 3, brown hairs on pleura, and abdomen shining black.....**97. pollinosus**
 Broader-bodied (length 16–18 mm), with shorter antennal segment 3, black hairs on pleura, and abdomen tomentose, basal tergites with deep reddish tint; Woodlark I. **96. muruensis**
- 16 (14). Frons strongly converging, callus small; mesonotum and basal abdominal tergites usually grey-dusted; wings diffusely paler in apical and marginal zone; sternite 8 as in fig. 164.....**98. recusans**
 Frons less converging, callus larger; tomentum of mesonotum and basal abdominal tergites entirely dark; wings more evenly brown to apex; sternite 8 as in fig. 163..... **99. subrecusans**
- 17 (7). Broadly built, black or blue-grey species of *recusans* group, with darkened

- wings, but with at least some pale hairs on abdominal tergites and in apical fringes on sternites 18
- Not members of *recusans* group; either brown to yellow or grey in color, or abdomen with more definite pattern; wings clear, or darkened at most anteriorly and along veins.....21
- 18 (17). R_4 without appendix; black species close to *subrecusans* and with similar terminalia, but with less darkened wings and inconspicuous pale fringes on abdominal tergites and sternites. (Color of antennal flagellum not known) ...
..... **100. bewanensis**
- R_4 usually with appendix; terminalia as in figs. 165-7.....19
- 19 (18). Blue-gray species, with strongly converging frons, black antennae, and tergites 1 & 2 of abdomen conspicuously grey-dusted **103. opalescens**
- Black species, with less converging frons, and basal tergites of abdomen darker.. 20
- 20 (19). Antennal segment 3 black; beard white; abdominal sternites with complete white fringes **102. papuensis**
- Antennal segment 3 red-yellow, with black-brown style; beard black; abdominal sternites with pale fringes interrupted in median zone.....**101. obtusipalpis**
- 21 (17). 10-15 mm, greyish species, with wide frons (index 2.5-3), divided callus, vittate scutum, and trivittate abdomen **112. pallipennis**
- Not such species; abdomen with at most single median vitta 22
- 22 (21). Medium-sized (14-16 mm), black and grey species, with conspicuously vittate scutum, and large median pale triangles or spots on abdominal tergites; antennae and legs black; R_4 with appendix.....23
- Not such species; if abdominal triangles large and conspicuous (*selene*), then scutal vittae less evident, legs brown, and R_4 without appendix 24
- 23 (22). Abdomen with large median triangles decreasing sharply in size from tergites 2-4 and a very small one on 5; eyes (relaxed) unbanded..... **106. exagens**
- Abdomen with semilunar median spots decreasing moderately in size from tergites 2-5; eyes (relaxed) banded **107. semicircularis**
- 24 (22). Antennal segment 3 black, short, wide, with short style; palpi relatively short and plump; all femora brown; wings darkened on fore-border, at fork of R_{4+5} , often at tips of R_{2+3} and R_4 , and sometimes across apices of basal and discal cells; R_4 without appendix; pale median triangles on abdominal tergites well-defined..... 25
- Antennal segment 3 longer, and with longer style; palpi normal; other characters collectively not as above 27
- 25 (24). 14-15 mm, greyish black species with narrow greyish white apical bands and small median triangles on abdominal tergites; callus small, with extension to above middle of frons..... **110. lenticulatus**
- Brownish species, with wider cream to yellowish apical bands and median expansions on abdominal tergites; callus larger, with short extension.....26
- 26 (25). Slender (14-16 mm), dark brown and cream species, with dark markings on wings conspicuous, and greyish cream median triangles on abdominal tergites rounded..... **108. selene**
- Compact (11-12 mm), dull brown and yellowish species, with dark markings on wings inconspicuous, and yellowish median triangles on abdominal ter-

- gites pointed **109. sepikensis**
- 27 (24). 17 mm, dark brown species, with black antennae and fore femora, an appendix on R₄, and small contrasting triangles of pale hairs on abdominal tergites.....**105. patriarchus**
- Not such dark species; antennae, or fore femora, or both brown to yellowish...28
- 28 (27). 17 mm, light fawn-grey species, with avittate scutum, clear wings, cream apical bands on abdominal tergites, and distal segments strongly acuminate; sternite 8 very long and narrow; Aru Is.**127. tenuis**
- Darker, differently patterned species; abdomen often conical apically, but not laterally compressed; sternite 8 not so elongate.....29
- 29 (28). Abdomen with a narrow median pale vitta, usually clearly defined in well-preserved specimens, but sometimes consisting of more or less fused triangles of yellowish hairs; 11–15 mm, with olive to greyish brown scutum, yellowish to dark brown abdomen, and fore tibiae conspicuously pale on basal 1/2 30
- Abdomen without clearly defined median vitta or deep triangles of yellow hairs 33
- 30 (29). Darker brown species, with few or no golden scaly hairs among black ones on mesonotum; antennal scape relatively long; eyes (relaxed) with green band.....**114. divisus**
- Mostly brighter, more yellowish brown species, with many conspicuous recumbent golden scaly hairs among black ones on mesonotum; antennal scape shorter and wider 31
- 31 (30). Median vitta, if present, of yellow hairs only, marginal abdominal fringe yellow; relatively robust (14–15 mm), with banded eyes (relaxed), and fore femora blackish only at tip **116. approximatus** (pt.)
- Median vitta of cream tomentum and hairs continuous, marginal abdominal hairs cream 32
- 32 (31). Smaller (usually 11–13 mm), paler species, with light yellow-brown fore femora; eyes (relaxed) unbanded.....**113. cohaerens**
- Larger (14–15 mm), darker species, with black fore femora; eyes (relaxed) with blue-green band at middle **115. subcohaerens**
- 33 (29). Antennal segment 3 black; 16 mm, with white beard, greyish brown scutum, yellow-brown femora and tibiae, and bright brown abdomen, darkening apically and with inconspicuous median apical fringes on tergites ... **122. siassensis**
- Antennal segment 3 reddish brown to yellowish..... 34
- 34 (33). Beard brown; at least fore femora blackish; 15–18 mm species 35
- Beard cream to white; femora usually brown to yellowish; size varied.....36
- 35 (34). Dark to reddish brown species; callus large, with relatively short stout median extension; antennal segment 3 long and slender..... **121. rubriventris**
- Fawn-brown species; callus small, with longer linear extension; antennal segment 3 shorter, wider, with stronger tooth..... **117. indistinctus**
- 36 (34). 15 mm, rather slender brown species, with strongly converging frons, wings suffused with brown anteriorly and along radial veins, and abdominal tergites with no pale hairs; eyes (relaxed) with purplish-blue band..... **118. vanleeuweni**
- Frons not so converging; abdomen with at least some pale hairs apically on

- tergites; eyes (relaxed) unbanded 37
- 37 (36). 12–14 mm, dark, rather shining brown species, with well-defined narrow pale apical bands but no median triangles on abdominal tergites; Solomon and Santa Cruz Is. **119. leverii**
Larger or paler species with different abdominal patterns..... 38
- 38 (37). 17–18 mm, dark to reddish brown species, with variable greyish white median triangles and sometimes sublateral patches on abdominal tergites...**120. innotabilis**
Brighter to yellowish or olive brown species, with, at most, vague patches or fringes of yellowish cream hairs on abdominal tergites 39
- 39 (38). Femora blackish, grey-dusted 40
Femora entirely yellowish brown..... 41
- 40 (39). Large (17–18 mm), stoutly built, darker species, with brown scutum; callus with tapering extension to about middle of frons **124. dorsobimaculatus**
Smaller (13 mm), slender, paler species, with greyish scutum; callus small, drop-shaped, with very short extension **125. meraukensis**
- 41 (39). Large (17–18 mm) species, with narrow (index 7), moderately converging frons, long narrow callus, and fore tibiae blackish on about apical 1/6.....
.....**123. serus**
Smaller (13–15 mm) species; other characters not collectively as above 42
- 42 (41). Darker species, with narrower (index 6–7), more converging frons, narrow callus, and fore tibiae black on apical 1/3 **116. approximatus** (pt.)
Paler species, with wider (index 4), nearly parallel-sided frons, short, wide callus, with short extension, and fore tibiae almost entirely pale... **126. herbertensis**

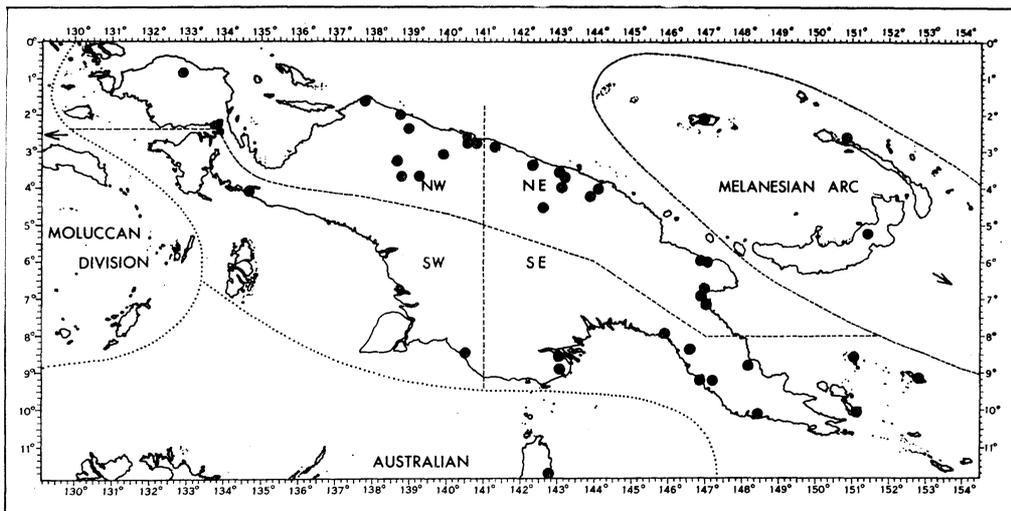


Fig. 136. Local distribution of *Tabanus ceylonicus*.

The *ceylonicus* Group

84. *Tabanus ceylonicus* Schiner Figs. 135, 136.

Tabanus ceylonicus Sch., 1868, p. 93 (type ♀, Ceylon; VIENNA).—Ricardo, 1913, p. 401.—

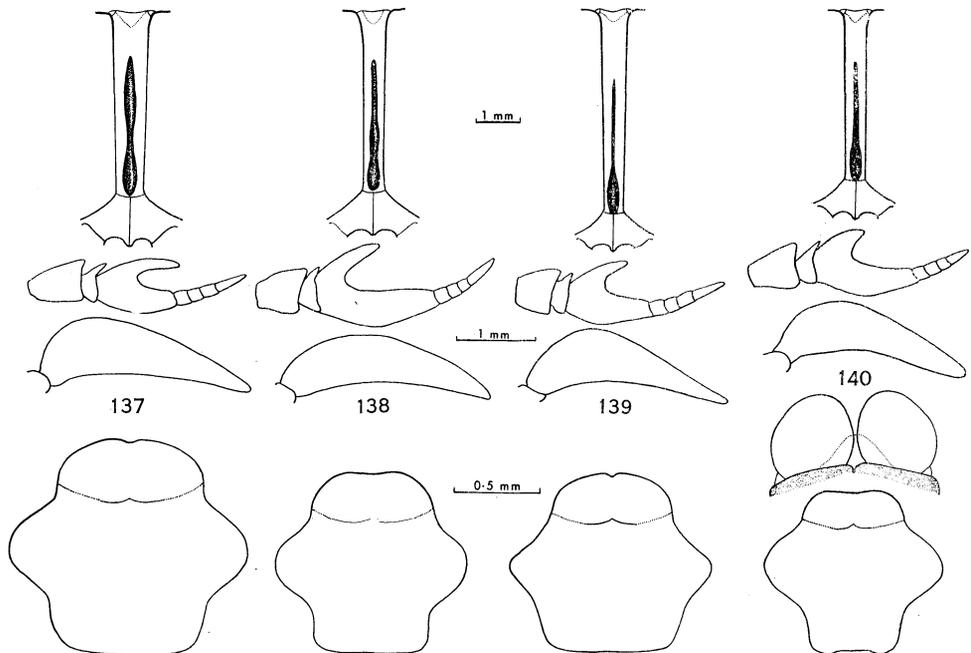
Schuermans Stekhoven, 1926, p. 431, fig. 211, pl. 14, figs. 1, 2.—Oldroyd, 1949, p. 329, fig. 36.—Mackerras & Rageau, 1958, p. 683, fig. 3A. No Papuan synonymy.

MATERIAL EXAMINED FROM NEW GUINEA: 191 ♀♀, 4 ♂♂.

♀. Very distinctive, 10–12 mm species, which is sufficiently defined in New Guinea by the group and key characters. Eyes in life purplish brown, with 3 oblique, green, blue-bordered bands. Abdomen entirely black, except for some variable brown color on sternite 1; terminalia undistinguished.

♂. Similar to ♀, except for large holoptic eyes and predominantly brown abdominal segments 1–2 or 3.

DISTRIBUTION. NW NEW GUINEA: Archbold Lake, 760 m, XI–XII, Quate; Bernhard Camp, 50 m, IX, Olthof; Bodem, 100 m, VII, Maa; Idenberg R., Ter Poorten; Hollandia, V, V. A.; Ifar & 90+m, Lake Sentani, VI, VIII, Cheesman, Maa; Kebar Val., 550 m, I, Quate; Mt. Sabron, 300 m, Cyclops Mts., IV, V, Cheesman, Laffon; Prauwenbivak, IX, v. Heurn; Sarmi, 5 m, biting in sago swamp 1600 hrs, V, Marks, van den Assem; Teba, V, Moszkowski. SW NEW GUINEA: Etna Bay, Koch; Merauke, Koch. NE NEW GUINEA: Amok, 165 m, I, Maa; Angoram, X, Christian, Pullen; Bubia, V, in Malaise trap, Gressitt; Burui, VII, McMillan; Hauptlg. b. Malu, III, Bürgers; Krisa, IV, Cheesman; nr. Lae, in rain forest, VII, Hardy; Maprik, 160 m, III, VIII, X, XI, Gressitt, Hardy, Standfast; Nineia, 500 m, V, McMillan; Salamaua, Taylor; Singorakai, V, McMillan; Stanglager am Aprilfluss, X, Bürgers; Torricelli Mts., 60–300 m, I, Cheesman; Wewak, Taylor. SE NEW GUINEA: Brown R., X, some in Malaise trap, Gressitt; Kerema, IX, Murray;



Figs. 137–140. *Tabanus, denticulatus* group, ♀♀, corresponding terminalia below: 137, *denticulatus*; 138, *yulensis*; 139, *aurivittatus*; 140, *cinnamoneus*.

Maderi plantn., X, Meadows; Maipa, IX, Darbyshire; Normanby I., XII, Brandt; Oriomo, X, XI, some in Malaise trap, Gressitt; Otomato plantn., 1 m, XI, in Malaise trap, Gressitt; Redscar Bay, IX, Gressitt; Saiho, 300 m, flying round base of sago palm, IV, Marks; Trobriand Is.; Woodlark I., III, Brandt.

Also Ceylon, Thailand, Malaya, Sumatra, Java, Borneo, Philippine Is., Buru, Admiralty Is., New Britain (Silango, 150 m, Nakanai Mts., VII, Ford, new divisional record), New Ireland, Solomon Is. (Bougainville; Guadalcanal; Shortland I., VI, Standfast, new record); north coastal Queensland. Abundant as well as widespread; ♀♀ have been taken biting man, ♂♂ attracted to light. The capacity of this not very robust species to disperse is remarkable.

The *denticulatus* Group

85. *Tabanus denticulatus* Ricardo Figs 137, 141.

Tabanus denticulatus Ric., 1913, p. 397 (type ♀, Hellwig Mts., 2000 m, XII. 1909, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 490, fig. 251.—Oldroyd, 1949, p. 311, fig. 28.

MATERIAL EXAMINED: 79 ♀♀, 2 ♂♂.

♀. 19–24 mm, distinctive, dark species. Eyes (relaxed) blackish, unbanded. Frons slightly converging, index 6–7, fawn to grey; callus dark red-brown, lighter below; subcallus brownish grey, parafacials and face grey; hairs on parafacials and face black, beard dull yellowish; antennal segment 1 with grey tomentum, 2 dark-red brown, 3 dark to reddish brown, with long dorsal hook, style black; palpi brown, with black hairs. Scutum and scutellum deep to blackish brown, grey-dusted, with brilliant creamy yellow supraalar and postalar tufts; pleura grey, with dark brown hairs, except for dull yellowish propleural hairs continuous with beard, brilliant creamy yellow tuft below posterior part of prominently bulging notopleural lobes, more diffuse dull yellow hairs below wing-root and creamy yellow squamal tuft; knob of halter also creamy yellow, conspicuous. Legs deep to reddish brown, hind tibiae and tarsi blackish. Wings with deep yellowish brown suffusion, darker along veins; R_4 without appendix; cell R_5 not narrowed. Abdomen wide, rather flat, shining deep to blackish brown, with entirely black hairs, except for orange-yellow tufts at lateral margins of tergite 5 and extending on to 6. Terminalia undistinguished.

♂. Similar to ♀, and with same conspicuous yellow tufts on thorax and abdomen, except that supraalar tufts entirely dark. Eyes with upper facets moderately enlarged; dorsal hook on antennal plate shorter than in ♀.

DISTRIBUTION. NW NEW GUINEA: Doorman track, X, v. Heurn; Iebele Camp, 2250 m, X, Toxopeus; Lake Habbema, 3000 m, VIII, Toxopeus; Moss Forest Camp, 2650 m, X, Toxopeus; Weyland Range, 2000 m, Wickwar; Wichmann Mts., 3000 m, XI. SW NEW GUINEA: Hellwig Mts. NE NEW GUINEA: Al Val., 2000 m, VIII, Woodward; Banz, 1800 m, I, Christian; upper Chimbu-Kerowagi divide, 2800 m, VII, Gressitt; Edie Ck., 2200 m, Taylor; Finisterre Range, 2550 m, X, Brandt; Goroka, 1700 m, XI, Barrett (♂); Kandep, 2650 m, I, Brandt; Kepilam, IX, Hoogland; above Kerowagi, 2300 m, VII, Gressitt; Komba, Wagner; Kotuni, 2400 m, VIII, Woodward; Mt. Elandora, 2000 m, III, Barrett; Mt. Misim, Stevens; Mt. Otto, 2200 m, VI, Gressitt; Mt. Wilhelm, 3000 m, VII, Gressitt; Murmur Pass, 2850 m, XII, Brandt (incl. ♂); Nondugl, 2200–2700 m, V, Miche-

ner; Schraderberg, 2100 m, VI, Bürgers; upper Timbe Val., 2300 m, XII, Stephens; Waria R., II, Littlechild. SE NEW GUINEA: Goilala-Bome, 1950 m, Owen Stanley Range, IV, Brandt; Mt. Tafa, 2800 m, III, Cheesman.

86. *Tabanus yulensis* von Röder Figs. 138, 141.

Tabanus yulensis v. Röd., 1892, p. 244 (type ♀, Mt. Yule; Halle Mus.).—Oldroyd, 1949, p. 358.

MATERIAL EXAMINED: 8 ♀ ♀.

♀. Oldroyd had not recognized this species, but specimens that were thought at first to be variants of *denticulatus* were found to agree closely with von Röder's description. They have dark green, unbanded eyes (relaxed), and differ from *denticulatus* in: frons narrower (index 9–10); antennae and palpi entirely blackish and differently shaped; parafacial hairs and beard paler yellowish cream; scutum and scutellum not as dark; pleura with more diffuse cream to yellow hairs, dark hairs being reduced to conspicuous blackish zone on upper posterior part of mesopleural convexity; all legs black, except for brown basal 1/3 of fore and mid tibiae; wings diffusely yellowish brown, the yellow color particularly evident anteriorly; cell R₅ narrowed at margin; abdomen tomentose, rich deep reddish brown, with complete lateral fringe of golden hairs; terminalia smaller and gonapophyses darker.

DISTRIBUTION. NE NEW GUINEA: Hunsteinspitze, III, Bürgers; above Kerowagi, 2300 m, VII, Gressitt; Lordberg, XII, Bürgers; Schraderberg, 2100 m, V, Bürgers; Tsenga, 1200 m, upper Jimmi Val., VII, Gressitt. SE NEW GUINEA: Mt. Yule (no other data).

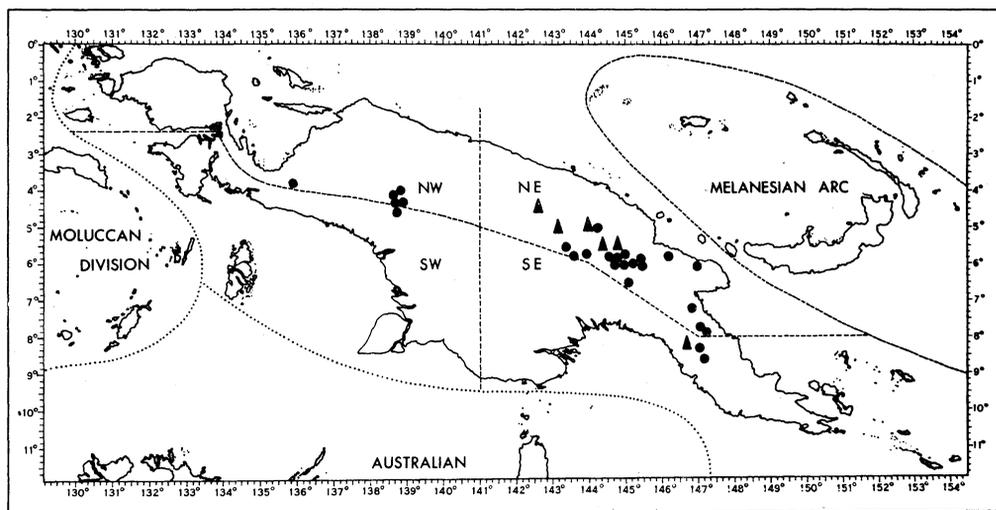


Fig. 141. Distribution of *Tabanus denticulatus* (spots) and *yulensis* (triangles).

87. *Tabanus aurivittatus* Ricardo Fig. 139.

Tabanus aurivittatus Ric., 1913, p. 394 (type ♀, Regen I., II. 1910, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 268, fig. 117.—Oldroyd, 1949, p. 310, fig. 5.

MATERIAL EXAMINED: 32 ♀ ♀.

♀. 21–23 mm, brown species, with conspicuously banded abdomen. Eyes in life green, unbanded (McMillan). Frons, parafacials and face bright fawn-yellow, with golden hairs on parafacials and beard, black ones on face; antennal segment 3 reddish brown, darkened only at tip of style; palpi bright brown, with black hairs. Scutum olive brown, with conspicuous creamy yellow supraalar and postalar tufts; pleura lighter, with greyish hue and predominantly yellow to creamy yellow hairs. Legs brown. Wings lightly brownish, darker along veins, and with strong yellowish suffusion anteriorly; R_4 without appendix; cell R_5 slightly to moderately narrowed. Abdomen dark brown, becoming blackish distally, with lighter brown apical band and conspicuous fringes of golden hairs on all tergites, hairs extending forward to form incipient median triangles on 3–5; venter similarly but less conspicuously banded. Terminalia as in *yulensis*.

♂. Oldroyd noted the ♂ as similar to the ♀, and as having eyes with large and small facets sharply divided.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus; Bernhard Camp, 50 m, X, Olthof; Kloofbivak, Versteeg; Motorbivak, van Leeuwen. SW NEW GUINEA: Bivak I, II, Lorentz; Heuvelbivak, 800 m, XI, Lorentz; Regen I. NE NEW GUINEA: Bukaua, Huon Gulf, Neuhauss; Finschhafen, I, II, Wagner, Wiedenfeld; Jungaig, Mayr; Kalalo, 700 m, XI, McMillan; Nineia, 500 m, X, McMillan; Sattelberg, Biro, Neuhauss; Wareo, Wagner. SE NEW GUINEA: Mt. Lamington, Murray.

88. *Tabanus cinnamoneus* Doleschall Fig. 140.

Tabanus cinnamoneus Doles., 1858, p. 84 (type ♂, Amboina; VIENNA).—Szilady, 1926, p. 13.—Oldroyd, 1949, p. 314, fig. 30.

Tabanus ceramensis Schuurmans Stekhoven, 1926, p. 377, fig. 183 (type ♂, Ceram, Wallace; BMNH). Synonymy by Oldroyd, 1949, p. 314.

MATERIAL EXAMINED: 8 ♀♀, 1 ♂.

♀. 20–22 mm, reddish yellow species, with black legs, deeply browned wings, banded abdomen, and black venter. Eyes (relaxed) greenish, unbanded. Frons, subcallus, parafacials and face orange-yellow, with orange-yellow hairs except for some black ones on upper part of parafacials; basal plate of antennal segment 3 with a smaller, wider hook than in *aurivittatus*, orange, with contrasting black style; palpi brown, paler on basal 1/3, with black hairs. Scutum and scutellum olive brown, with mixed black and yellow-brown hairs, which are conspicuous posteriorly, supraalar and postalar tufts brighter yellow; pleura with yellowish brown hue and brownish yellow hairs, except for paler zone below and behind wing-root and in squamal tuft. Legs black. Wings deeply suffused with brown, which varies in intensity in centers of cells in some specimens; R_4 without appendix; cell R_5 markedly narrowed. Abdomen rich brownish red, with yellowish hue anteriorly, predominantly reddish hairs on discs of tergites, and narrow paler apical margins bearing fringes of rich orange-golden hairs on 2 and subsequent tergites; lateral fringe dense, rich orange-golden; venter black, with entirely black hairs, except for narrow lateral apical tufts of orange-gold on 2nd and subsequent sternites. Terminalia with shallower gonapophyses than in other species of the group.

♂. Similar to ♀ (♂ from Aru Is. 18 mm), but with venter dark brown rather than black. Eyes with upper facets markedly enlarged, more reddish than small facets; antennal plate with strong dorsal angle rather than a hook (Oldroyd's fig. 30 is more like an-

tennae of ♂ than of ♀♀ in present series); cell R_5 not narrowed.

DISTRIBUTION. NW NEW GUINEA: Dojo, IV, Simon Thomas; Hollandia, 80 m, in jungle, IV, VI, VII, X, Philip, van den Assem; Lake Sentani, VI, Maa; Mamberamo R., VII, van Leeuwen; Sabron, 300 m, Cyclops Mts., V, Cheesman. SW NEW GUINEA: Aru Is., Froggatt. NE NEW GUINEA: Bewani Mts., IX, Stüber; 29 km from Meanderbergers to Sepik, VII, Bürgers. Also Ceram, Amboina, Borneo (Philip, 1960a).

The *gilingilensis* Group

89. *Tabanus gilingilensis* Mackerras

Tabanus gilingilensis Mack., 1962b, p. 109, figs. 14, 18 (type ♀, Gilingil plant'n., 2 m, New Ireland, 4. VII. 1956, J. L. Gressitt; BISHOP).

15 mm, rather shining black species. Eyes blue-green, with purplish, green-bordered band. Frons entirely shining black, but callus visible as raised, polished oblong filling lower part of frons and linear extension merging into median keel; subcallus tomentose; beard brownish black; antennae contrasting yellowish to orange-brown, darkening on style. Legs black, except for bright brown basal parts of tibiae. Wings deeply browned anteriorly, some cells clearer, and brown shadows along posterior veins; R_4 with short appendix. Abdomen with narrow pale apical bands on tergites 1-4 and sternites 2-4 and basal patch on tergite 2, otherwise black. Sternite 8 moderately wide.

DISTRIBUTION. NEW IRELAND: Gilingil.

The *recusans* Group

The ♀ terminalia have provided useful characters in this group, particularly in separating *rosselensis* from *stuberi*, *subrecusans* from *furunculigenus*, and *bewanensis* from species here identified as *obtusipalpis*. They show little intraspecific variation (28 ♀♀ dissected), at least in the shape of sternite 8 and its gonapophyses; less reliance has been placed on the furca and cerci, but the more obvious differences seen in those parts are also illustrated in figs. 156-68.

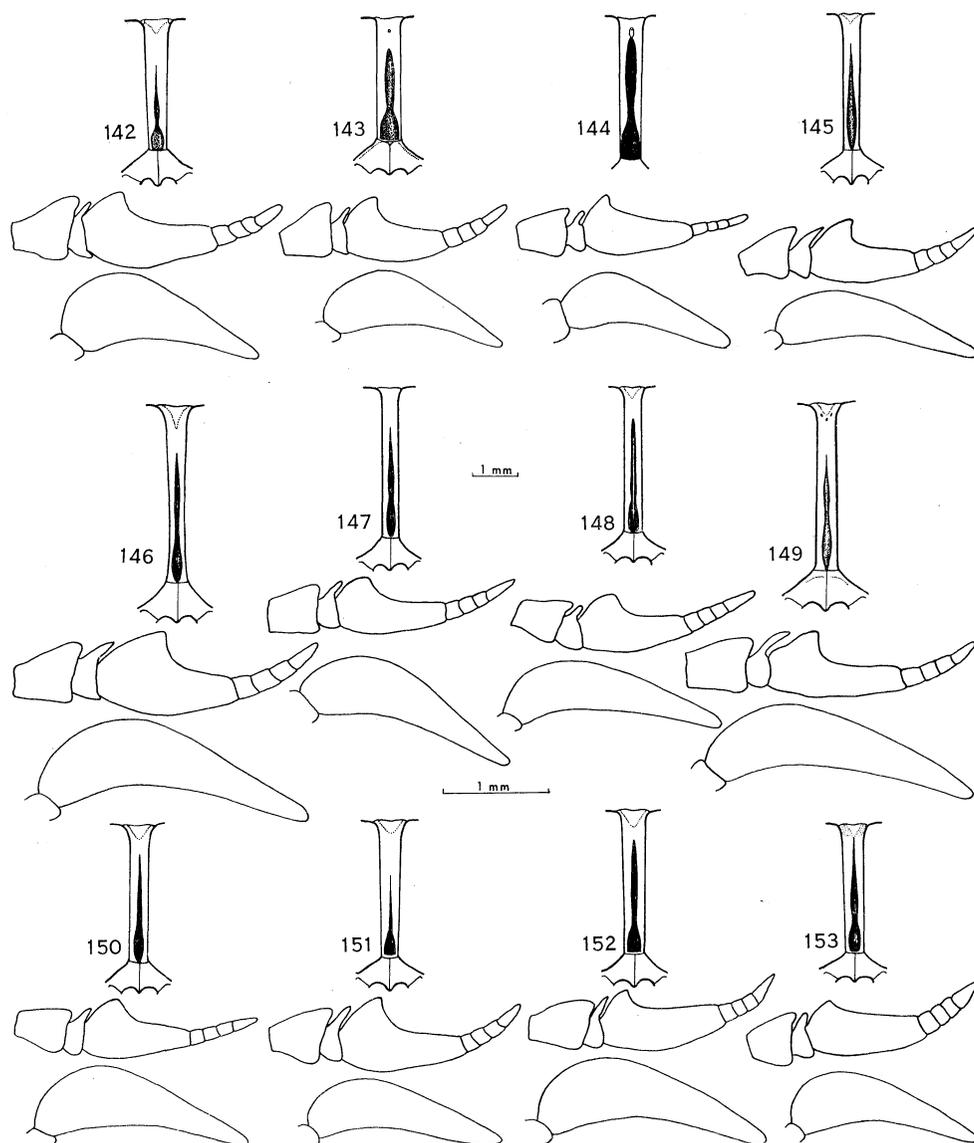
T. patriarchus is difficult to place. Its frons, callus, antennae and sternite 8 suggest that its relationships are with the *recusans* group, but its shape, coloration, relatively clear wings and abdominal pattern would ally it rather with the *exagens* group. It has been included there purely for convenience in identification, but its position would have to be reviewed if any question of phylogeny arose.

90. *Tabanus stuberi* Oldroyd Figs. 142, 156.

Tabanus stuberi Old., 1949, p. 319, fig. 33 (type ♀, Bewani Mts., IX. 1937, W. Stüber; BMNH).

MATERIAL EXAMINED: 19 ♀♀, 20 ♂♂.

♀. 15-17 mm, black species, with grey scutum. Eyes (relaxed) dark green with blackish reflections, unbanded. Frons, subcallus, parafacials and face brown, with predominantly brown hairs, including beard; a pair of small, dark brown spots at junction of frons and subcallus; antennae and palpi black. Scutum with brown ground color reduced to 4



Figs. 142-153. *Tabanus, recusans* group, ♀♀: 142, *stuberi*; 143, *flammeus*; 144, *illustris* (after Oldroyd, 1949, and Schuurmans Stekhoven, 1926); 145, *doreicus*; 146, *wollastoni*; 147, *rosselensis*; 148, *muruenensis*; 149, *pollinosus*; 150, *furunculigenus* (Ceram, for comparison); 151, *recusans*; 152, *subrecusans*; 153, *obtusipalpis* (antenna after Schuurmans Stekhoven, 1926).

obscure stripes by grey dusting anteriorly and greyish tomentose median and dorsocentral vittae and lateral areas, densely covered with greyish cream hairs which provide most of the contrast between mesonotum and rest of body; pleura dark brown, with dark brown to blackish hairs, except for paler ones in propleural area, small pale tuft on upper part of mesopleural convexity and 1 on squamae. Legs black, fore and mid tibiae brownish

basally. Wings dark brown with variable accentuation along veins, becoming diffusely paler apically and along posterior margin; R_4 with strong appendix; cell R_5 widely open. Abdomen black, with entirely black hairs dorsally and ventrally. Terminalia distinctive.

♂. ♂♂ collected at the same time as the ♀♀ differ from them in being predominantly dark brown rather than black, with less contrast between scutum and rest of body; legs dark brown, mid tibiae and tarsi distinctly lighter; wings less darkened, sometimes almost clear, R_4 angulate, but sometimes with only stump of an appendix. Eyes with enlarged upper facets clearly defined; frontal triangle dark brown, contrasting with fawn-brown subcallus. It is difficult to be sure of the identity of unassociated ♂♂, so the localities where they are recorded should be treated as provisional.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, IX, X, Olthof; Hollandia, IV, Malkin; Lake Sentani, 90+m, VI, VIII-IX, Gressitt, Maa, Markos-Hart (incl. ♂). NE NEW GUINEA: Bewani Mts.; Hauptlg. b. Malu, III, Bürgers; Maprik, III, IX-XI, Standfast (incl. ♂♂); Mokai, 750 m, Torricelli Mts., XII-I, Brandt (incl. ♂♂); ♂♂, Saidor, VI, VII, Brandt; Standlager, X, Bürgers.

91. *Tabanus flammeus* Schuurmans Stekhoven Figs. 143, 157.

Tabanus flammeus Sch. Stk., 1926, p. 505, fig. 264 (type ♀, Heuvelbivak, 800 m, XI. 1909, Lorentz; ZMA).—Oldroyd, 1949, p. 318, fig. 32.

MATERIAL EXAMINED: 9♀♀, including 1 paratype, 1♂.

♀. 14-15 mm species, distinctive by reason of the contrast between the peculiar violet-red hue of scutum and black body. Eyes (relaxed) dark green with blackish reflections, unbanded. Frons dark greyish brown, contrasting with whitish to pale brown subcallus, parafacials and face; callus deep brown; beard greyish white; antennae greyish black; palpi dark grey, with black hairs. Scutum varying from reddish violet to more orange, but with same peculiar tint still apparent; pleura grey, with greyish white hairs, except for a black zone on mesopleural convexity. Legs black, with brown knees. Wings lightly suffused with brown, color more intense in radial area, especially along veins; R_4 with appendix; cell R_5 widely open. Abdomen black dorsally and ventrally, but diffusely greyish and with greyish white hairs laterally on sternites 1 & 2. Sternite 8 with wide, shallow gonapophyses; furca as in *stuberi*.

♂. Scutum and abdomen contrasting as in ♀, but abdominal tergites brown basally, with very small, dull yellowish cream, median apical tufts on 2 to 5, greyish white lateral fringe, and venter with diffuse white hairs on discs of basal sternites and white apical fringes on 2-5.

DISTRIBUTION. NW NEW GUINEA: Sigi Camp, 1500 m, II, Toxopeus. SW NEW GUINEA: Heuvelbivak. NE NEW GUINEA: Eliptamin Val., 1350-1665 m, VI, Brandt (incl. ♂); Feramin, 120-150 m, VI, Brandt; Lordberg, XI-XII, Bürgers; Mt. Misim, 2300 m, Stevens; Sepikberg, 1570 m, XI, Schultze. SE NEW GUINEA: Bome, 1950 m, Goilala & Tororo, 1560 m, Owen Stanley Range, II, IV, Brandt.

92. *Tabanus illustris* Ricardo Fig. 144.

Tabanus illustris Ric., 1913, p. 398 (type ♀, Iwaka R., Wollaston; BMNH).—Schuurmans Stekhoven, 1926, p. 504, fig. 263.—Oldroyd, 1949, p. 318, fig. 16.

MATERIAL EXAMINED: Nil.

♀. In addition to the characters given in the key, Oldroyd noted the frons as paler than in *flammeus*, callus differently shaped, palpi longer and more pointed, wings yellowish-tinted, darker on foreborder, and R_4 with shorter appendix. It is also somewhat larger (17 mm).

DISTRIBUTION. SW NEW GUINEA: Iwaka R.

93. *Tabanus doreicus* Walker Figs. 145, 158.

Tabanus doreicus Walk., 1861a, p. 233 (type ♀, Doré, Wallace; BMNH).—Ricardo, 1913, p. 396.—Schuermans Stekhoven, 1926, p. 496, fig. 256.—Oldroyd, 1949, p. 313, fig. 6. *Tabanus sonnerati* Bigot, 1892, p. 672 (type ♀, New Guinea; BMNH). Synonymy by Ricardo, 1913, p. 396.

MATERIAL EXAMINED: 1 ♀.

♀. Eyes (relaxed) dark blue with green reflections, unbanded. Smaller species than *wollastoni* (Aru Is. ♀ 16 mm), and further distinguished by pale antennae, with bright orange plate; more yellowish hue and yellow hairs on scutum; light brown pleura, with predominantly yellow hairs (Aru Is. ♀); brighter brown coloration of wings; and brownish hue, though without any pale hairs, on basal abdominal tergites and sternites. Terminalia undistinguished; furca with a wider base than in *stuberi*.

DISTRIBUTION. NW NEW GUINEA: Doré, Wallace (BMNH). SW NEW GUINEA: Aru Is., Froggatt; Fak Fak, Frühstorfer. NE NEW GUINEA: Finschhafen, Kertesz.

94. *Tabanus wollastoni* Ricardo Figs. 146, 154.

Tabanus wollastoni Ric., 1913, p. 395 (misspelt *woollastoni*) (type ♀, Mimika R., VIII. 1910, Wollaston; BMNH).—Schuermans Stekhoven, 1926, p. 493, fig. 253.—Oldroyd, 1949, p. 312, fig. 8.

MATERIAL EXAMINED: 1 ♀.

♀. Large (19–20 mm), ornate species, with strongly contrasting olive green to yellowish mesonotum. Frons rich brownish yellow, very narrow (index 11–12) and callus slender; subcallus, parafacials and face rich brownish yellow; beard orange; antennal segment 3 velvety black; palpi brown, with black hairs. Scutum with black hairs, except for golden tuft on tegula and another on anterior part of postalar area; pleura little duller than mesonotum, with brownish black hairs, except for an orange group in propleural area and a yellowish brown tuft below squamae, the squamal tuft being dark brown. Legs black. Wings diffusely brown, but somewhat darker along veins, and with a clear window behind R_1 ; stigma inconspicuous; R_4 without appendix. Abdomen broad, entirely black, black-haired. Terminalia not dissected.

DISTRIBUTION. NW NEW GUINEA: Kloofbivak, Versteeg. SW NEW GUINEA: Alkmaar, X, Lorentz; ?Aru Is. (recorded by Oldroyd); Bivak I., XII–II, Lorentz; Etna Bay; Mimika R.; Regen I., II, XII, Lorentz.

95. *Tabanus rosselensis* Mackerras, n. sp. Figs. 147, 154, 159.

Holotype ♀ (AMNH), from Abaleti, 0–50 m, Rossel I., 11. X. 1956, L. J. Brass.

MATERIAL EXAMINED: 16 ♀ ♀.

Robust black species, with greyish mesonotum; superficially like *stuberi*, but frons narrower, pale color of thorax due to tomentum rather than hairs, and R_4 without appendix. Its nearest relative would appear to be *wollastoni*, which has head and thorax more yellowish and yellow-brown beard. Length 17–18 mm, 1 ♀ 15 mm.

♀. *Head*: Eyes (relaxed) dark bronze, unbanded. Frons converging, narrow, index 11–11.5, dark brown; vertexal triangle well-defined, greyish; callus very long and narrow, black. Subcallus and most of parafacials and face brown, not as dark as frons, lower parafacials and center of face more greyish; hairs, including beard, black. Antennae black, scape with some greyish tomentum, extreme base of plate brown. Palpi blackish, with some grey tomentum and black hairs. *Thorax*: Scutum and scutellum extensively grey tomentose (none of the specimens is in good condition and variation seen is probably adventitious); hairs black, sparse except laterally, some bright brown ones in postalar tuft. Pleura greyish, with entirely black hairs, except for some bright brown in propleural area and below posterior spiracle and a yellow-brown spiracular tuft. The pale yellowish cream knob of the halteres stands out in contrast. *Legs*: Entirely black, black-haired. *Wings*: Deep brown, with some small clearer areas in some of the cells, especially distally; stigma slightly brighter than ground-color. *Abdomen*: Velvety brown-black, slightly paler and with some greyish dusting on tergite 1 and a trace on sternites; hairs black. Terminalia undistinguished; cerci rounded.

DISTRIBUTION. SE NEW GUINEA: Rossel I.

96. *Tabanus muruensis* Mackerras, n. sp. Figs. 148, 154, 160.

Holotype ♀ (BISHOP 3546), from Kulumadau Hill, Woodlark (Murua) I., 28–30. I. 1957, W. W. Brandt.

MATERIAL EXAMINED: 32 ♀ ♀, 1 ♂.

Rather like a small *pollinosus*, but more thickset, with wider, darker antennal plate, more contrasting thoracic color, darker pleural hairs, and wider, flatter, tomentose abdominal tergites. Length 17–18 mm, 1 ♀ 15 mm.

♀. *Head*: Eyes (relaxed) green-black, unbanded. Frons very narrow, index 11–12, brown, with vertexal triangle defined by short black hairs and indications of an ocellar tubercle; callus a long black-brown ridge widening below. Subcallus, parafacials and face brown, with short black hairs; beard dark brown to black. Basal antennal segments brown, with short black hairs; 3 orange-brown, darkening distally to the blackish style. Palpi brown, with short black hairs. *Thorax*: Scutum and scutellum brown, greyish anteriorly and more vaguely in dorsocentral lines and lateral areas; hairs on disc short, black, longer black on notopleural lobes and dull brown in postalar tuft. Pleura brown with entirely dark brown to black hairs, except for brighter brown below posterior spiracle and pale brown on squamae; knob of halteres contrasting as in *rosselensis*. *Legs*: Entirely brown-black, with black hairs. *Wings*: Deeply suffused with brown, with rather well-defined clearer areas in some cells giving wing a slightly variegated appearance; stigma slightly darker than ground color; veins brown, R_4 without appendix. *Abdomen*: Velvety black-brown, with dark reddish tint on basal tergites and narrowly paler incisures; sternites duller dark brown to black; hairs entirely black dorsally and ventrally. Terminalia with

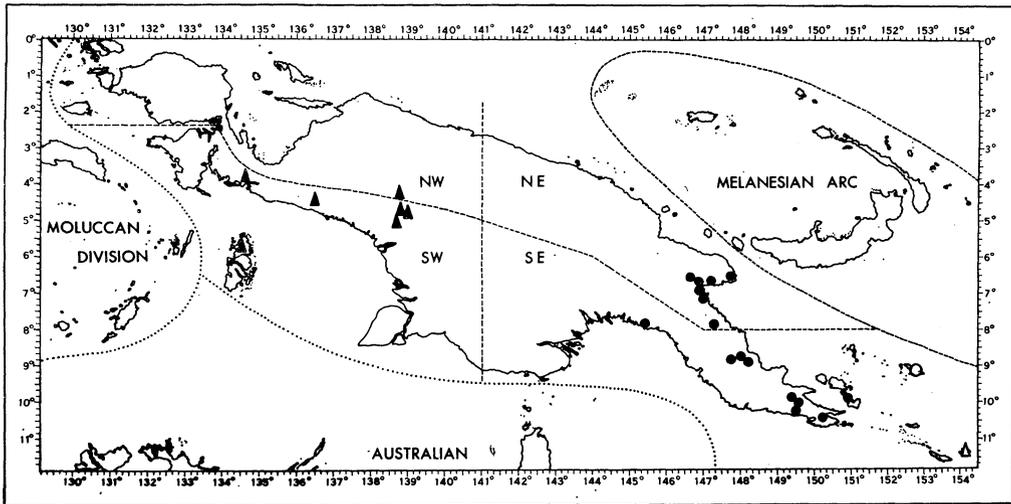


Fig. 154. Distribution of *Tabanus pollinosus* (spots), *muruensis* (open circle), *wollastoni* (solid triangles), *rosselensis* (open triangle).

gonapophyses somewhat wider and furca with narrower, more concave base than in *pollinosus*.

♂. Very like ♂ of *pollinosus*, but smaller (16 mm), darker, more red-brown in general color, with more evident darkening and some black hairs towards apex of abdomen; antennal plate wider; palpi darker, with more black hairs; beard and pleural hairs more definitely brown.

DISTRIBUTION. SE NEW GUINEA: Woodlark I., 0–100 m, I, II, XI, Brandt, Brass.

97. *Tabanus pollinosus* Ricardo Figs. 149, 154, 161.

Tabanus pollinosus Ric., 1913, p. 395 (type ♀, Simbang, nr. Finschhafen; Kertész Coll.)—Schuurmans Stekhoven, 1926, p. 494, fig. 254.—Oldroyd, 1949, p. 311, figs. 3M, 9.

Tabanus angusticallosus Schuurmans Stekhoven, 1926, p. 495, fig. 225 (type ♀, Milne Bay, Kertész; BMNH).—Oldroyd, 1949, p. 312, figs. 3M, 4. Oldroyd accepted this species, with hesitation, as differing from *pollinosus* in paler antennal plate and brighter brown mesonotum and pleural hairs. The terminalia are identical, I have seen an intermediate ♀ from Lae, and *angusticallosus* would seem to be best treated at present as no more than a local variant of *pollinosus*.

MATERIAL EXAMINED: 45 ♀♀, 18 ♂♂.

♀. Relatively long-bodied, 18–21 mm species, distinguished from *muruensis* by size, shape, and shining black abdominal tergites. Eyes (relaxed) dark purplish brown, unbanded. Frons, subcallus, parafacials and face dark brown, with dark brown hairs, including beard; antennae brown, darkening on style, the plate relatively slender and not much paler than basal segments; palpi deep brown, with black hairs. Thorax brown, with some thin greyish dusting and recumbent brown hairs (most specimens are rubbed, but none shows any

yellow hairs on disc, although there is an admixture of brighter brown on one); pleura brown, with brown to blackish hairs. Legs black. Wings dark brown, with tendency to pallor in some cells, especially the discal; R_4 without appendix. Abdomen shining black, with little greyish bloom, especially on tergite 1. Terminalia with gonapophyses somewhat variable in depth; furca with an even wider base than in *rosselensis*; cerci short and rounded.

♂. The ♂♂ associated with the ♀♀ are about the same size, but brighter brown, with little contrast between thorax and abdomen, have many reddish hairs on the discs of abdominal tergites, and narrow orange to bright brown apical fringes on 1-5. Eyes with large upper facets distinct and occupying about 2/3 of the surface.

DISTRIBUTION. NE NEW GUINEA: Bubia, 50 m, biting in swampy jungle, V, VI, IX, Gressitt, Marks; Busu R., 100 m, IX, Gressitt; Kela Samoahafen, Huon Gulf, III, Neuhaus; Lae, VI-VIII, Bayley, Gressitt, Skinner, Womersley; Nadzad, IX, Krombein; Nasawampum, V, Michener; Simbang; Waria R., II, Littlechild. SE NEW GUINEA: ♂, Deria, 230 m, XII-I, Brandt; Dogon, 800 m, X-XI, Brandt (incl. ♂♂); Doveta, 800 m, VII-VIII, Brandt (incl. ♂♂); Kokoda, 400 m, IX, X, Cheesman; Kokoda-Pitoki, 450 m, III, Gressitt; Milne Bay, II, VII, Kertesz, I. M. M., Wind; Mt. Lamington, 400-500 m, McNamara; Normanby I., V, X-XII, Brandt, Brass (incl. ♂♂); Saiho, 300 m, IV, Marks; Vailala R., X, Murray.

98. *Tabanus recusans* Walker Figs. 151, 155, 164.

Tabanus recusans Walk., 1859, p. 83 (type ♀, Aru Is., Wallace; BMNH).—Ricardo, 1913, p. 397.—Schuurmans Stekhoven, 1926, p. 507, fig. 266.—Oldroyd, 1949, p. 315, figs. 3, 31.

MATERIAL EXAMINED: 11 ♀♀, 1 ♂.

One of 4 closely similar species (5, if *furunculigenus* from Amboina, Ceram and Ternate is included in the series). A drawing of sternite 8 of the type sent to me by Mr. Oldroyd agrees closely with fig. 164. It may be defined best by comparison with *subrecusans* which is described below in greater detail.

♀. Usually somewhat smaller (14-16 mm) and less robust. Eyes (relaxed) similar. Frons more converging; lower part of callus more brownish, extension narrower and usually shorter; antennal plate shorter, wider and with stronger tooth, brighter orange-brown; palpi often blue-black or dark greyish and sharply pointed. Scutum with evident grey dusting which usually extends back as far as suture. Wings with darker stigma, and brown color fading markedly in apical zone. Abdomen usually with grey bloom on tergites 1 & 2 and no brown on basal sternites. Sternite 8 with wide, shallow gonapophyses; furca as in *subrecusans*; cerci shorter and more rounded. One ♀ from Maprik has small median patch of white hairs on tergite 2. Some imperfectly preserved specimens of both species could not be identified with certainty until they were dissected.

♂. A ♂ from Oriomo seems likely to belong here. It is about the same size (15 mm) as the smaller ♀♀, but dark brown in color; antennae are similar (although the plate is narrower, as in all ♂♂), and dark color of wings fades distally as in the ♀♀. Upper central facets of eyes markedly enlarged, deep reddish, but not very sharply separated from lower and unusually wide posterior zone of small black facets; antennal plate bright

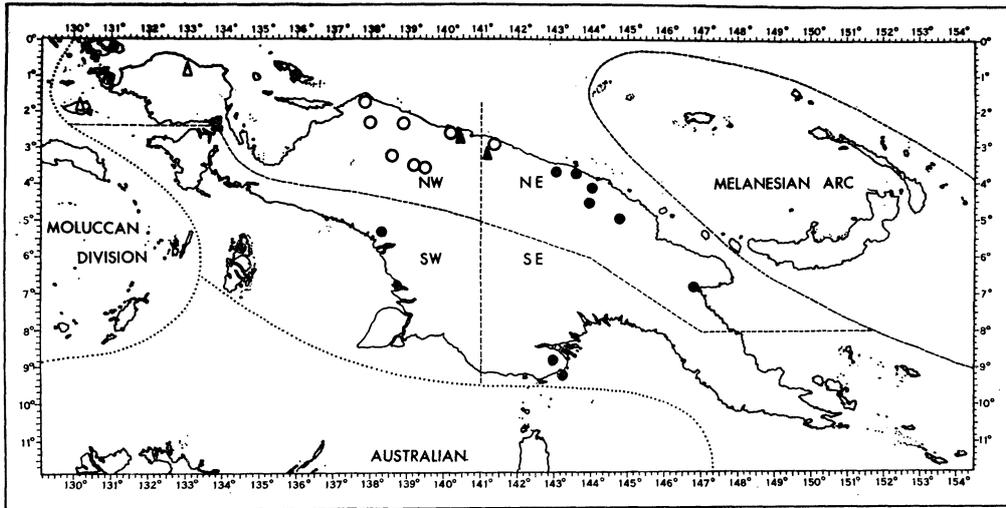


Fig. 155. Distribution of *Tabanus recusans* (spots), *subrecusans* (open circles), *bewanensis* (solid triangles), *obtusipalpis* (open triangles).

orange-brown, contrasting with deep brown style; parafacials and face fawn-brown, with black hairs; beard light brown; palpi light brown, with mostly black hairs. Scutum with greyish overlay anteriorly and silky brown hairs among the black ones.

DISTRIBUTION. NW NEW GUINEA: Camp Nok, 800 m, Waigeu, IV, Cheesman; Salawatti, Bernstein; Samberi, Biak I., X, Moszkowski. SW NEW GUINEA: Aru Is., Wallace; Lorentz R., V, Lorentz. NE NEW GUINEA: Angoram, Christian; Lae, V, Peters; Maprik, IV, XI, Standfast; Ramu R., VI; Wewak, Deland; Yuat R., biting pigs, XI, Pullen. SE NEW GUINEA: Daru, XI, Peters; ♂, Oriomo, X, Gressitt. Also ?Haruku Is. (Amboina group).

99. *Tabanus subrecusans* Mackerras, n. sp. Figs. 152, 155, 163.

Tabanus furunculigenus Oldroyd, 1949, p. 315, fig. 7, New Guinea, *nec* Doleschall, 1858, Amboina. Oldroyd raised the possibility that Papuan specimens might not be conspecific with those from further west, and study of the terminalia of a ♀ from Ceram (fig. 162) has confirmed his suggestion.

Holotype ♀ (SPHTM), from Vanimo, 20. VIII. 1956, A. Pritchard.

MATERIAL EXAMINED: 22 ♀♀, 1 ♂.

Almost uniformly brownish black species; with slightly converging frons; relatively thick median extension of callus; relatively short antennal style; dark brown mesonotum, with at most a trace of grey dusting on anterior margin and sprinkled with pale hairs; wings more diffusely darkened than in *recusans*; and abdomen without grey dusting on basal tergites. Length 15–18 mm. Distinguished from all other species of the group, except *bewanensis*, by the shape of sternite 8, and from that species as noted under it.

♀. **Head:** Eyes (relaxed) brown-black to deep brown, unbanded. Frons nearly parallel,

index 7, almost uniformly brown, with short black hairs; vertexal triangle somewhat greyish; callus brown-black. Subcallus and upper parafacials brown, lower parafacials and most of face more greyish; hairs deep brown to black, including beard. Antennal segments 1 & 2 brown, with black hairs; 3 bright reddish brown basally, darkening distally, style dark brown. Palpi usually stout basally, bluntly rounded apically, dark brown, with short black hairs. *Thorax*: Mesonotum dark, sometimes almost blackish brown, variably brighter brown laterally and on scutellum, and with at most a trace of grey dusting on anterior margin; hairs black, liberally sprinkled with recumbent yellowish cream ones, especially in front of and on scutellum; notopleural hairs black, supraalar and postalar groups variably mixed black and yellowish cream. Pleura dark greyish brown, somewhat paler below, usually with entirely deep brown to black hairs. *Legs*: Usually almost uniformly brownish black, basal 1/4 of fore tibiae and all of mid and hind sometimes more brownish. *Wings*: Strongly suffused with brown, the color little, if at all, darker along veins and fading towards apex less than in *recusans*, but a clear window in base of cell R₁ and sometimes a small one crossing M just before it forks; stigma not much darker than ground color; R₄ sometimes angulate, but without appendix; cell R₃ often with flattened section figured by Oldroyd wider than cell R₅, which usually does not narrow appreciably to wing margin. *Abdomen*: Almost uniformly black, without any grey dusting on basal tergites, but sometimes variably brownish on basal sternites; hairs entirely black. Sternite 8 with relatively deep, narrow gonapophyses; furca much as in fig. 156; cerci as in fig. 158. One of the ♀♀ from Genjem has a hint of green in the relaxed eyes, more greyish pleura, dull cream propleural, posterior mesopleural and hypopleural hairs, and brighter brown tibiae; it could be confused with *bewanensis*. Pale propleural hairs have been seen on a few other specimens, but they all have entirely dark-haired abdomens.

♂. Larger (18 mm) than the ♂ attributed to *recusans*; upper, markedly enlarged, yellow-brown facets occupying almost 2/3 of eye and sharply marked off from lower and narrow posterior rim of small black facets; antennal style not much darker than plate; parafacial hairs and beard dark brown; palpi longer and with longer black hairs; and dark color of wing evanescent distally (as seems to be common in ♂♂ of the group).

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, IV, Toxopeus; Bernhard Camp, 50 m, VIII, Olthof; Bodem, 100 m, VII, Maa; Genjem, 100–200 m, III, Maa; Mamberamo R., V, van Leeuwen; ♂, Motorbivak, v. Leeuwen; Pionierbivak, VI–VIII, van Heurn; Prauwenbivak, IX. NE NEW GUINEA: Vanimo.

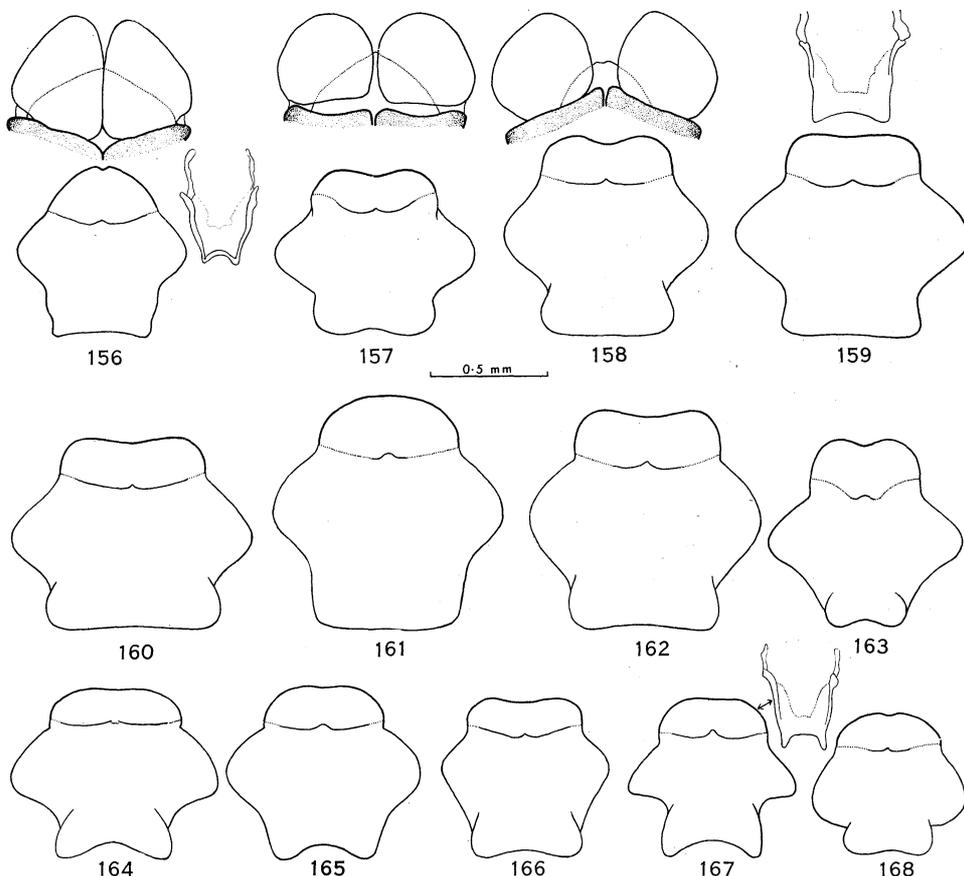
100. *Tabanus bewanensis* Oldroyd, n. name Fig. 155.

Proposed for *Tabanus infuscatus* Oldroyd, 1949, p. 325, fig. 41, *nec* Loew, 1858, Palaearctic. (type ♀, Bewani Mts., 400 m, VII. 1937, Stüber; BMNH) (H. Oldroyd.)

MATERIAL EXAMINED: Nil.

Mr. Oldroyd has dissected the type, and compared it with paratypes of *subrecusans* that were sent to him. He found that the terminalia were similar, but that there were minor external differences which collectively made him feel that it would be appropriate to treat them as separate species.

♀. Robust, 17 mm species, with more reddish tint than *subrecusans* (possibly due to the age of the specimen). Pleura grey, with mostly whitish hairs, except for black on meso-



Figs. 156-168. *Tabanus, recusans* group, parts of ♀ terminalia: 156, *stuberi*; 157, *flammeus*; 158, *doreicus*; 159, *rosselensis*; 160, *muruiensis*; 161, *pollinosus*; 162, *furunculigenus*; 163, *subrecusans*; 164, *recusans*; 165, *obtusipalpis*; 166, *papuensis*; 167, *opalescens*; 168, sp. nr. *opalescens*.

pleuron. Legs as in *obtusipalpis*. Wings not as dark as in *subrecusans*, without pale tip, but with darker shadows along veins. Abdomen with a few orange to yellow hairs in small median triangles and on lateral margins of tergites and orange-yellow apical fringes on sternites. Sternite 8 appears to be little broader than in most *subrecusans* dissected (fig. 163), but the difference is not significant and other parts of the terminalia agree.

DISTRIBUTION. NW NEW GUINEA: Sabron, 300 m, Cyclops Mts., IV, Cheesman. NE NEW GUINEA: Bewani Mts. The ♀ from Bernhard Camp referred doubtfully to this species by Oldroyd (1949) has been transferred to *subrecusans*.

101. *Tabanus obtusipalpis* Schuurmans Stekhoven Figs. 153, 155, 165.

Tabanus obtusipalpis Sch. Stk., 1926, p. 498, fig. 258.—Oldroyd, 1949, p. 359. (type ♀, Misol; stated to be in BMNH, but not found by Oldroyd, 1949).

MATERIAL EXAMINED: 1 ♀.

Mr. Oldroyd has failed to discover the type on a further search in the BMNH material, and Dr. Ellis has also failed to find it in ZMA. A ♀ from Kebar Valley in Bishop Museum agrees with the description reasonably well, and it may be taken to represent the species until the type is found.

♀. Dark, 17 mm species, which can be separated from *bewanensis* by its more *recusans*-like terminalia and general appearance. Eyes (relaxed) dark green. Frons as in *subrecusans*, lower parafacials and face more greyish and beard greyish white posteriorly; antennal segments 1 & 2 bright brown, with black hairs, 3 missing (described by Schuurmans Stekhoven as red-yellow with black-brown style); palpi as in *subrecusans*. Scutum and scutellum as in *recusans*, but with more recumbent yellowish cream hairs; pleura greyish, with black hairs, except for white propleural and fore coxal hairs, dense brownish cream zone on posterior part of mesopleural convexity, similar hypopleural tuft, and slightly darker squamal tuft. Legs black, black-haired, except for brown knees, brown, conspicuously golden-brown-haired basal 1/2 of fore tibiae, and more diffusely brown, brown-haired distal ends of mid and hind femora, most of mid tibiae and basal part of hind. Wings dark brown, slightly paler apically and in some cells, much as in *recusans*; R₄ strongly curved, described as having an appendix in the type, without one in the Kebar Valley specimen. Abdomen black, with greyish overlay laterally on tergite 1, median dull yellowish cream tufts on 1-5, yellowish cream lateral fringe concentrated most at apical corners of same tergites, and narrow apical sublateral pale fringes on sternites, median zones being entirely black-haired. Terminalia much as in *recusans*, but with gonapophyses narrower, base of furca wider, and cerci even shorter.

DISTRIBUTION. NW NEW GUINEA: Kebar Val., 550 m, I, Quate; Misol, Wallace.

102. *Tabanus papuensis* Oldroyd, n. name Figs. 166, 169.

Proposed for *Tabanus productus* Oldroyd, 1949, p. 324, fig. 38, *nec* Hine, 1904, Nearctic (type ♀, Bernhard Camp, 50 m, X.1938, Toxopeus; BMNH, Archbold) (H. Oldroyd.)

MATERIAL EXAMINED: 1 ♀, 1 ♂.

The identity of the ♀ has been confirmed by Mr. Oldroyd. Both specimens agree very well with his description, except that the appendix of vein R₄ is shorter, and pale hairs on the abdomen are white rather than yellow. Eyes of ♀ (relaxed) rich dark green with bluish reflections, unbanded.

♀. The same size (15 mm) as small *stuberi*, and about the same build; but differing in having less contrasting scutum, with sparser greyish white hairs; grey pleura, with greyish white hairs, except for a zone of black ones on upper part of mesopleural convexity; grey dusting and greyish white hairs on femora; small but distinct median apical patches of white hairs on tergites 2-5 of abdomen; and venter grey-dusted basally, and with conspicuous fringes of white hairs at apices of sternites 2-5, fewer on 6. Sternite 8 with wide, shallow gonapophyses; furca much as in *opalescens*; cerci short and rounded.

♂. Agrees with the ♀ in coloration and abdominal pattern. It differs further from the ♂ of *stuberi* in having larger eyes, with a more extensive zone of enlarged facets, and less contrast between colors of frontal triangle and subcallus.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp, 800 m, III, Toxopeus; Bern-

hard Camp. NE NEW GUINEA: Saidor, V, Brandt; ♂, Wapenamanda, 1850 m, III, Barrett.

103. *Tabanus opalescens* Schuurmans Stekhoven Figs. 167, 170.

Tabanus opalescens Sch. Stk., 1926, p. 513, fig. 270 (type ♀, Heuvelbivak, 800 m, XI. 1909, Lorentz; ZMA).—Oldroyd, 1949, p. 317, fig. 34.

MATERIAL EXAMINED: 4♀ ♀, including holotype, 2♂ ♂.

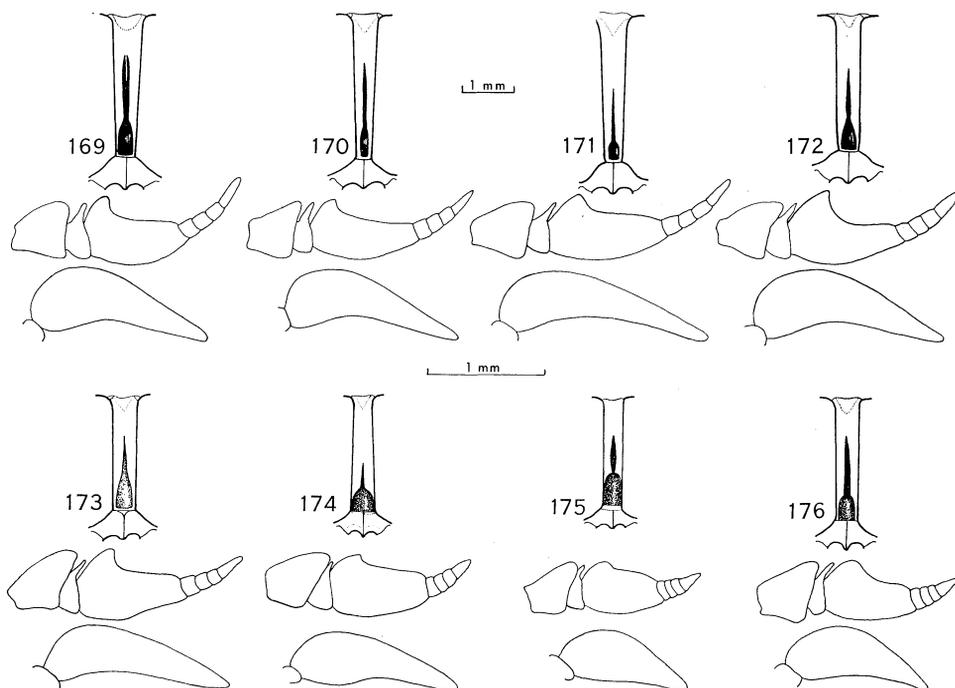
♀. Relatively small, 12–15 mm (the holotype 13.5 mm), blue-grey species, with wings not as dark as in other members of the group. Eyes (relaxed) dark brown. Frons strongly converging, index 7–8, brown to grey, with vague vertexal triangle; callus small, dark brown below, with black extension; subcallus and upper parafacials brown, lower parafacials and face white, hairs brown on upper parafacials, white elsewhere, including beard; antennal segments 1 & 2 brown, grey-dusted, 3 black, brownish at base, style black; palpi with grey tomentum and black hairs. Mesonotum brown, grey-dusted; pleura light grey, with white hairs, except for a black zone on upper mesopleural convexity. Femora black, more or less grey-dusted, tibiae variably brownish basally. Brown suffusion of wings more or less concentrated along veins; R₄ with strong appendix which is nearly 3× length of basal section in the type. Underlying color of abdominal tergites brown-black, but they are all conspicuously blue-grey dusted, especially on 1 & 2, giving abdomen a striking appearance; hairs black, except for median and submedian white tufts on tergite 1, rather indefinite, variable, median and lateral apical white patches on 2–5, and sharply defined white apical fringes on sternites 2–5. Sternite 8 and furca as illustrated; cerci subtriangular (unusual for the group, if constant).

♂. The ♂♂ from Dogon are larger than the ♀♀ (15 and 16 mm) and more brownish in general coloration, but they show the same blue-grey dusting on tergites 1 & 2 of abdomen and the same arrangement of white hairs as in ♀. Eyes large, upper enlarged facets reddish black, sharply separated from duller black small lower and lateral facets which extend in well-defined zone to vertex; ocellar tubercle large, conspicuous; parafacials and face more extensively black-haired than in ♀, palpi acorn-shaped, dark brown, with black hairs, but basal segment with some greyish tomentum; pleura and legs darker than in ♀.

DISTRIBUTION. NW NEW GUINEA: Hollandia, VII; Idenberg R., headwaters, 300–600 m, Stüber; Kloofbivak, X, Versteeg; Mt. Eiori, 800 m, Japen I., X, Cheesman. SW NEW GUINEA: Heuvelbivak. NE NEW GUINEA: Bewani Mts., IX, Stüber. SE NEW GUINEA: ♂♂, Dogon, 800 m, X, XI, Brandt.

104. *Tabanus* sp. Fig. 168.

A ♀ from Rouffaer R., 175 m, VIII, van Leeuwen, is close to *opalescens*, but is relatively small, 13 mm, narrower-bodied, with orange antennal plate, blackish style, and brown beard; wings strongly suffused with brown along veins, R₄ with long appendix. Sternite 8 differs as illustrated, and cerci rounded rather than triangular. It is probably a distinct species, and Oldroyd (1949) appears to have seen similar specimens, but it is not in good enough condition for description.



Figs. 169–176. *Tabanus*, *recusans* and *exagens* groups, ♀♀: 169, *papuensis*; 170, *opalescens*; 171, *patriarchus*; 172, *exagens*; 173, *semicircularis*; 174, *selene*; 175, *sepikensis*; 176, *lenticulatus*.

The *exagens* Group

This group includes 3 rather distinct series. *T. patriarchus* has already been discussed. *T. exagens* and *semicircularis* seem to be related to it, but are more ornate and have different ♀ terminalia. The remaining 3 species—*selene*, *sepikensis*, *lenticulatus*—are sharply distinguished by their unusual calli, wide antennal plates, plump palpi, more or less spotted wings, absence of an appendix on R₄, elongate 8th sternites, and unusually large furcae. They might have been treated as a separate group, but *semicircularis* (fig. 179) provides a link between them and *exagens*. These 3, incidentally, show parallelism with the *heydoni* series of *Cydistomyia*, though there is as yet no evidence to indicate why they should.

105. *Tabanus patriarchus* Oldroyd Figs. 171, 177.

Tabanus patriarchus Old., 1949, p. 325, fig. 40 (type ♀, Araucaria Camp, III. 1939, Toxopeus; BMNH, Archbold Coll.).

MATERIAL EXAMINED: 1 ♀ paratype.

♀. 17 mm, dark brown species. Eyes (relaxed) brown with vague dark green reflections, but no indication of a band. Frons converging, index 7, brown; vertexal triangle slightly raised and darker; callus deep brown, with narrow darker extension; subcallus and upper parafacials brown, lower parafacials and face greyish cream, beard cream; antennal segments

1 & 2 brown, 3 brownish at base, mostly black; palpi dark brown, with grey tomentum and black hairs. Mesonotum almost concolorous dark olive-brown, with many dull cream recumbent hairs, notopleural lobes somewhat brighter, with mixed black and cream hairs; pleura grey, with mostly greyish cream hairs. Legs dark brown to blackish, femora with some greyish overlay and white hairs. Wings faintly and evenly brownish, costal cell not darkened; stigma bright brown; R_4 with strong appendix. Abdomen dark brown, black-haired, only faintly paler on incisures, but with shallow, fawn-cream, cream-haired median triangles on tergites 2-6 and a yellowish cream lateral fringe; sternites dark brown, with narrow fawn-cream apical margins and mainly cream hairs, except for black in median zone and on whole of 6 & 7. Terminalia as illustrated; their discordance in the group is obvious.

DISTRIBUTION. NW NEW GUINEA: Araucaria Camp; Idenberg R., headwaters, 300-600 m, I, Stüber; Mt. Eiori, 650 m, Japen I., X, Cheesman. NE NEW GUINEA: Bewani Mts., IX, Stüber.

106. *Tabanus exagens* Walker Figs. 172, 178.

Tabanus exagens Walk., 1864, p. 205 (type ♀, Misol, Wallace; BMNH).—Ricardo, 1913, p. 390.—Schuermans Stekhoven, 1926, p. 337, fig. 159.—Oldroyd, 1949, p. 320, fig. 12.

MATERIAL EXAMINED: 5 ♀ ♀.

♀. Striking, 15-16 mm species, easily recognized by the vittate scutum and large median pale triangles on tergites 2-4 of abdomen. Eyes (relaxed) dark greenish brown, unbanded. Frons, subcallus, parafacials and face light creamy fawn, becoming cream below, with hairs on lower part and beard, and zone of dark brown ones on parafacials below level of black antennae; palpi dark grey, with black hairs. Scutum with dark brown ground color reduced to narrow median and wider sublateral stripes by grey dorsocentral vittae and grey to brownish lateral areas; pleura grey, with greyish cream hairs and some black ones on mesopleural convexity. Legs mostly black; mid and hind femora with greyish overlay and white hairs; basal 1/3 of fore tibiae light brown, white-haired, most of mid and hind brown, mid with some yellowish cream hairs, hind with all black hairs including strong fringes. Wings faintly greyish, without darker markings; stigma brown; R_4 angulate and with short appendix. Abdomen black, black-haired, except for small, pale, cream-haired median patch on tergite 1, narrow grey basal band on 2, large grey, cream-haired apical triangles decreasing in size from 2-4, and pale, densely cream-haired lateral margins on 1-4; venter blackish, with greyish overlay anteriorly, and narrow paler, white-haired apical margins on sternites 2-4 or 5. Terminalia less modified than in *semicircularis* and *selene*, but showing the beginnings of the same trends in specialization.

DISTRIBUTION. NW NEW GUINEA: Bernhard Camp, VIII, X, Olthof; Idenberg R., headwaters, 300-500 m, Stüber; Misol. SW NEW GUINEA: Alkmaar, X, Lorentz; Bivak I., XI-II, Lorentz; Heuvelbivak, 800 m, X, Lorentz; Regen I., II, X, Lorentz. NE NEW GUINEA: Bewani Mts., 400 m, VII, Stüber; Ramu R., VI; Standlager am Aprilfluss, X, Bürgers. SE NEW GUINEA: Lake Kutubu, 850 m, X, Barrett.

107. *Tabanus semicircularis* Ricardo Figs. 173, 179.

Tabanus semicircularis Ric., 1913, p. 392 (type ♀, from Madew, 650-1000 m, St. Joseph R.,

Stalker; BMNH).—Schuurmans Stekhoven, 1926, p. 335, fig. 157 (misspelt *semicirculus*).
—Oldroyd, 1949, p. 319, fig. 17.

MATERIAL EXAMINED: 9♀♀, 8♂♂.

♀. About the same size (14–16 mm) as *exagens*, but sharply distinguished by having eyes (relaxed) purplish above, green on lower 2/3, with broad purplish band bordered with green and gold extending transversely through the green at level of lower part of callus; frons dark brown on lower 2/3; callus brown; palpi paler; scutellum whitish, contrasting with scutum; legs distinctly paler, except distally on tibiae and tarsi; wings more diffusely darkened apically, with dark brown stigma, small clouds at apices of basal cells, apex of discal cell and fork of R_{4+5} , and stronger appendix on R_4 ; abdomen with pair of pale grey spots at base of tergite 1, broader greyish white basal band, narrowing in middle, on 2, large, half-moon-shaped, greyish white, white-haired median apical spots decreasing somewhat in size from 2–5, and more conspicuous pale lateral margins on 1–5; venter with pale hairs more restricted to lateral parts of sternites. Terminalia as illustrated.

♂. Similar to ♀, but even more brightly ornamented, and with more diffuse white dusting on scutum. Eyes with large upper facets markedly paler than small lower ones.

DISTRIBUTION. NW NEW GUINEA: Idenberg R., headwaters, I, Stüber; Sabron, 650 m, Cyclops Mts., VII, Cheesman. NE NEW GUINEA: Bewani Mts., IX, Stüber; Mokai, 750 m, Torricelli Mts., XII, Brandt (incl. ♂♂); Saidor, VI, Brandt (incl. ♂♂). SE NEW GUINEA: ♂, Dogon, 800 m, X–XI, Brandt; Madew; Mondo, 1650 m, II, Cheesman; Mt. Mafulu, 1300 m, XII, Cheesman; Tapini, 1100 m, V, L. & M. Gressitt.

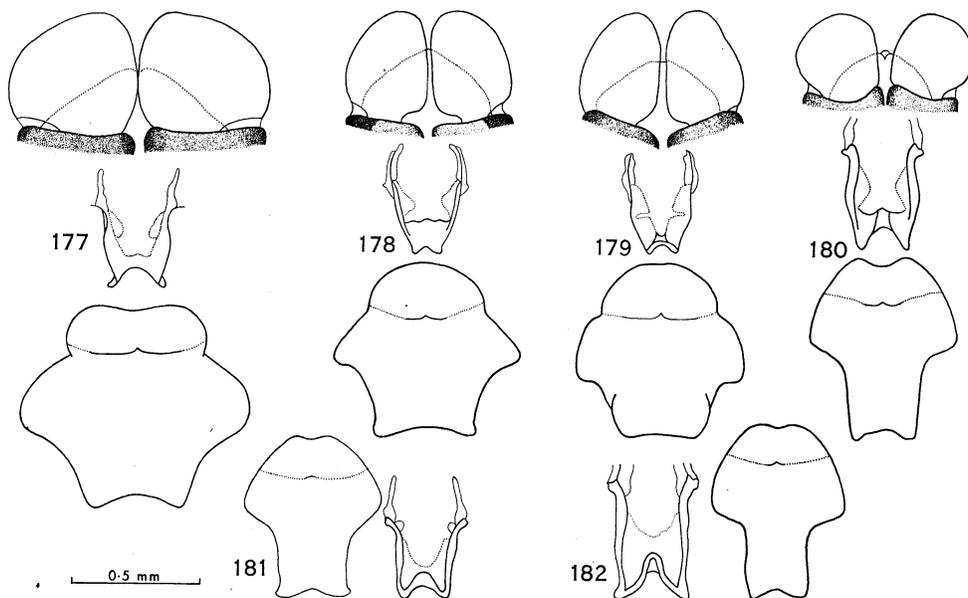
108. *Tabanus selene* Schuurmans Stekhoven Figs. 174, 180.

Tabanus selene Sch. Stk., 1926, p. 292, fig. 129 (type ♀, Dutch New Guinea, Lorentz; ZMA).—Oldroyd, 1949, p. 358. This specimen is larger (16.5 mm) than the holotype of *angustilineatus*, but is otherwise exactly like it.

Tabanus angustilineatus Oldroyd, 1949, p. 321, fig. 44 (type ♀, Angoram, Sepik dist., Christian; SPHTM).

MATERIAL EXAMINED: 6♀♀, including both holotypes, 5♂♂.

♀. Oldroyd compared this species with *exagens* and *semicircularis*, but it is more nearly related to *sepikensis* and *lenticulatus*. Usually somewhat smaller (14 mm) and narrower than preceding. Eyes (relaxed) dark green with purple reflections, unbanded. Frons greyish, variably brown in middle 1/3, callus translucent dark brown, of unusual shape; subcallus, parafacials and face greyish cream, with white hairs, except for dark band across bases of short black antennae; palpi fawn cream, with short black hairs. Scutum brown, greyish-white-dusted, rather inconspicuously vittate, scutellum whitish in some lights; pleura pale grey, with greyish cream hairs. Legs brown, darkening to blackish apically on tibiae and on tarsi. Wings greyish, brown in costal and anterior part of radial cells, and with conspicuous brown markings at apices of basal cells, apex of discal cell and fork of R_{4+5} ; R_4 strongly curved, but without appendix. Abdomen black, with broad, greyish white, cream-haired apical bands, which are produced into conspicuous, usually rounded median triangles on tergites 3–6 and a less definite one on 2; venter brown, with well-defined paler apical margins to sternites. Terminalia with sternite 8 elongate; furca long, deeply indented basally, with strongly chitinized margins; cerci small, rounded.



Figs. 177-182. *Tabanus, exagens* group, ♀ terminalia: 177, *patriarchus*; 178, *exagens*; 179, *semicircularis*; 180, *selene*; 181, *sepikensis*; 182, *lenticulatus*.

♂. Similar to ♀, but duller in general coloration and pattern. Enlarged upper facets of eyes not much paler than small lower facets. Upper part of subcallus white, contrasting strongly with brown frontal triangle above and brown zone round the antennae below.

DISTRIBUTION. NW NEW GUINEA: ♂, Hollandia, in light trap, II, Maa; Sorong-Doom, at u. v. light, II, Simon Thomas. NE NEW GUINEA: Angoram (incl. ♂); ♂♂, Maprik, IX, XI, Standfast; Nadzab, VII, Krombein. SE NEW GUINEA: ♂, Oro, VIII, Pullen.

109. *Tabanus sepikensis* Oldroyd, n. name Figs. 175, 181.

Proposed for *Tabanus truncatus* Oldroyd, 1949, p. 324, fig. 39, *nec* Walker, 1850, New Zealand (type ♀, Angoram, Sepik dist., Christian; SPHTM) (H. Oldroyd).

MATERIAL EXAMINED: 2 ♀♀, including holotype, 1 ♂.

♀. Closely related to *selene*, but shorter (11-12 mm), more thickset (the name "*truncatus*" was apt), and duller in general coloration; mesonotum almost uniformly greyish to fawn-brown, the pale dusting thin, even on scutellum; spots on wings faint; median triangles on abdominal tergites sharper, duller in color, and hairs on them and on apical bands yellow; sternite 8 and furca shorter, cerci larger, somewhat truncate.

♂. Differs from the ♂ of *selene* in smaller size, more compact build, light brown rather than cream palpi, almost entirely clear wings; duller abdominal pattern, and sharply pointed triangles on tergites.

DISTRIBUTION. NW NEW GUINEA: Bakoesa, Mamberamo R., V, Marks, van den Assem. NE NEW GUINEA: Angoram.

110. *Tabanus lenticulatus* Oldroyd Figs. 176, 182.

Tabanus lenticulatus Old., 1949, p. 323, fig. 35 (type ♀, Yule I., III. 1934, Cheesman; BMNH).

MATERIAL EXAMINED: 7 ♀♀, including 2 paratypes.

♀. Medium-sized (14–15 mm) species, darker than *selene*, with only faint dark spots on wings, and smaller white triangles on abdominal tergites 2–6. Eyes (relaxed) black with greenish hue, unbanded. Frons dark grey, vertexal triangle blackish; callus blackish; subcallus, parafacials and face grey, with brown zone at level of antennae, black hairs on upper part of parafacials, white elsewhere, including beard; antennae black; palpi yellowish grey, with white hairs basally, black apically. Scutum and scutellum greyish brown, avittate, with greyish overlay anteriorly, and mixed black and dull yellowish cream hairs; pleura grey, with dull cream hairs and a few black ones. Legs with femora brown, grey-dusted, tibiae light brownish yellow, darkening on apical 1/3 of fore pair and all tarsi. Wings lightly suffused with brown, more definitely in distal part of radial area, and with brown spot at fork of R_{4+5} ; stigma light brown; R_4 strongly curved, but without appendix. Abdomen deep brown to black, with narrow pale apical margins to the tergites, median white-haired spot on 1, and well-defined pale, white-haired triangles on 2–6; venter brown with greyish overlay, mixed black and white hairs on discs of sternites, and fringes of white hairs on pale apical margins of 2–6. Terminalia as illustrated; cerci rounded.

DISTRIBUTION. SE NEW GUINEA: Port Moresby, IV, XI, Sneddon, Standfast, Strong; Yule I.

111. *Tabanus* sp.

Another ♂ (Kieta, VI, Standfast) has been added to the 2 recorded from Bougainville by Mackerras and Rageau (1958, p. 686, fig. 3G) as near *lenticulatus*. No ♀♀ have been discovered, so their identity remains in doubt.

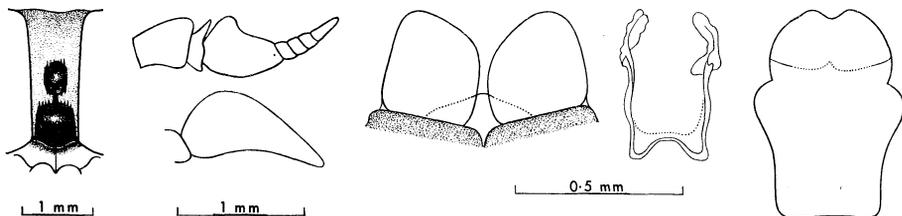


Fig. 183. *Tabanus pallipennis*, ♀.

The *pallipennis* Group

112. *Tabanus pallipennis* Macquart Figs. 133, 183.

Tabanus pallipennis Macq., 1846, p. 32 (type ♀, New Holland; apparently lost).

Atylotus rufinotatus Bigot, 1892, p. 673 (type ♀, Australia; BMNH). Synonymy by Hardy, discussed by Mackerras, 1959, p. 161.

Tabanus rufinotatus: Ricardo, 1912a, p. 349.—Schuurmans Stekhoven, 1926, p. 148, figs. 61, 62, pl. 5, fig. 6.—Oldroyd, 1949, p. 329.

Tabanus designatus Ricardo, 1913, p. 390; 1912a, p. 349 (the note reducing the name to synonymy appeared before the description). Cotype ♀ and ♂, from Etna Bay, Koch, in ZMA.

MATERIAL EXAMINED FROM NEW GUINEA: 1♀, 1♂.

♀, ♂. Small-medium (11–13 mm), greyish species, readily recognized in the Papuan fauna by the group and key characters. Eyes of ♀ (in life) brown, with 2 broad, light green, gold-bordered bands; palpi even shorter and plumper than in *selene* and its allies. Distinguished from its nearest Australian relative by its completely clear wings.

DISTRIBUTION. SW NEW GUINEA: Aru Is., Dobo; Etna Bay, Merauke, Koch. SE NEW GUINEA: Port Moresby, I, Strong. Also Australia.

The *cohaerens* Group

There is a good deal of local variation in the only widespread species of the group, which raises doubts about the status of some of those that are known so far only from limited areas. The terminalia have not been particularly useful; but there is a greater variety of eye-patterns in the ♀♀ than has been encountered in other groups, and a study of this character in living specimens should be rewarding. The less reliable information that has been obtained from rehydration in a saturated atmosphere for 1–2 hours may be summarized here as a guide to future work. Material of most species has been too scanty to justify sacrificing heads by immersing them in Goffe's solution, as recommended by Oldroyd (1954, p. 2).

Eyes purplish brown, with a broad, oblique, green to bluish, gold-bordered band across middle: *divisus*, *subcohaerens*, *approximatus*, *vanleeuweni*. In *subcohaerens* the upper brown zone merges into green at top.

Eyes green, with small but well-defined brown lower lateral segment: *cohaerens*. The nearly related, but probably distinct, *breinli* Ferg. & Hill (northern Australia) and *im-mixtus* Walk. (Celebes) have similar eyes.

Eyes brown, with a narrow, ventro-lateral green zone: *leveri*.

No color revived (possibly owing to preservation before pinning): *indistinctus*, 2♀♀ of *approximatus*.

113. *Tabanus cohaerens* Walker Figs. 184. 190.

Tabanus cohaerens Walk., 1865, p. 177 (type ♀, New Guinea, Wallace; BMNH).—Ricardo, 1912b, p. 71; 1913, p. 389.—Schuurmans Stekhoven, 1926, p. 220, fig. 92, pl. 7, fig. 2.—Oldroyd, 1949, p. 321, fig. 10.

Atylotus picticornis Bigot, 1892, p. 671 (type ♀, New Guinea; BMNH).—Synonymy by Ricardo, 1912b, p. 71.

Atylotus alfourensis Bigot, 1892, p. 672 (type ♀, New Guinea; BMNH).—Synonymy by Ricardo, 1912b, p. 71.

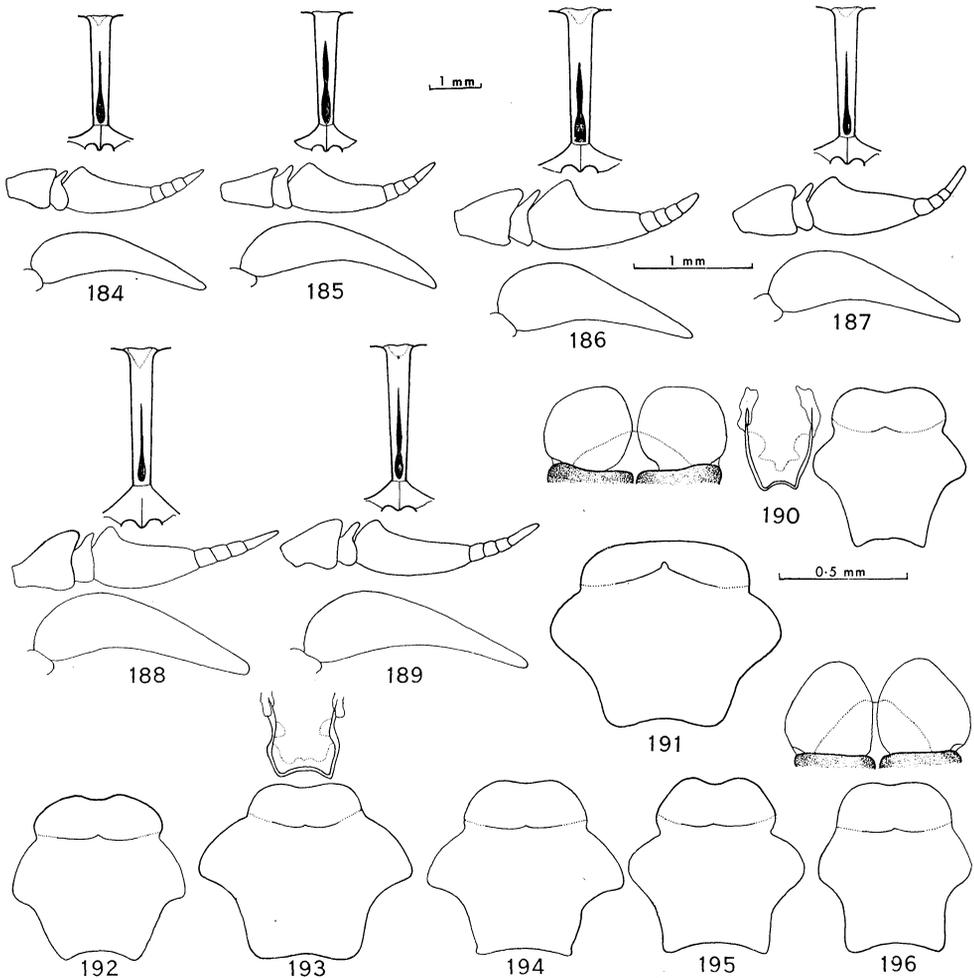
Tabanus olivaceus Schuurmans Stekhoven, 1926, p. 453, fig. 223 (type ♀, S. New Guinea, Versteeg; ZMA).—Oldroyd, 1949, p. 358. Holotype in poor condition, but agrees well

with *cohaerens* in all essentials.

Tabanus exolivaceus Philip, 1960a, p. 31, n. name for *olivaceus* Sch. Stk., New Guinea, *nec* de Geer, Neotropical.

MATERIAL EXAMINED: 57 ♀♀, including holotype of *olivaceus*, 1 ♂.

♀. Relatively small (11–12 mm, 1 ♀ 14 mm), olive to yellowish brown species; usually easily recognizable by narrow abdominal vitta. Frons and subcallus brown, subcallus sometimes paler, top of parafacials brown, with brown hairs, remainder of parafacials and face whitish, with white hairs, including beard; antennal segment 1 usually short and wide but variable, 3 bright orange, often with style blackish; palpi with whitish tomentum and black hairs. Scutum olive brown, with grey dusting anteriorly, numerous recumbent yellowish



Figs. 184–196. *Tabanus, cohaerens* group, ♀♀: 184, 190, *cohaerens*; 185, 192, *divisus*; 186, 193, *subcohaerens*; 187, 194, *approximatus*; 188, 191, *?indistinctus*; 189, 196, *vanleeuweni*; 195, *leverii*.

cream hairs and less conspicuous erect black ones; pleura pale grey, with mainly white hairs. Legs light yellowish brown, fore femora somewhat darker; apical 1/3 of fore tibiae, all fore tarsi, and distal tarsi of mid and hind legs blackish. Wings lightly brownish, costal cell and stigma brown, and a dark cloud in radial area distally extending to R_4 , which sometimes has a short appendix. Abdomen yellow-brown basally, darkening apically; cream hairs restricted to yellowish cream median vitta and lateral fringes; venter somewhat paler, with wide, cream-haired apical bands on sternites. Terminalia usually as illustrated, but variable, and not always distinguishable from *divisus*.

Five ♀♀ from Otomato plantation have recumbent hairs on the scutum pale cream and unusually dense, giving them a somewhat distinctive appearance, but others taken at the same time are normal. Some old specimens are considerably paler, and the abdominal vitta is sometimes evanescent (as in the type of *olivaceus*), but the general size and appearance of the species, and especially the apical dark cloud on the wing, remain fairly distinctive.

DISTRIBUTION. NW NEW GUINEA: Bodem, 100 m, VII, Maa; Cyclops Mts., 300 m, IV, Cheesman; Hollandia, VII, Toxopeus; Kloofbivak, X, Versteeg; Lake Sentani, VIII, Cheesman; Pionierbivak, VIII, v. Heurn; Prauwenbivak, VIII, v. Heurn; Sarmi, 5 m, biting in sago swamp, V, Marks, van den Assem; Teba, V, Moszkowski; Tor R., X, Middleburg. SW NEW GUINEA: Bivak I., VI, Lorentz; Etna Bay, Koch; Lorentz R., V, IX, Lorentz; Regen I., II, Lorentz; Rivierkamp, II, Lorentz; Sabang, VII, Lorentz; Varen R., V, Lorentz. NE NEW GUINEA: Ramu R., VI. SE NEW GUINEA: Brown R., X, Gressitt; Cape Rodney, XI, Gressitt; Kiunga, Fly R., X, Brandt; Kiwai I., Stewart; Maderi plantn., biting man, X, Meadows; Oriomo, X, Gressitt; Oro Bay, XI, Philip; Otomata plantn., 1 m, XI, some in Malaise trap, Gressitt. Also Ceram (Ricardo, 1912b).

114. *Tabanus divisus* Ricardo Figs. 185, 192.

Tabanus divisus Ric., 1913, p. 392 (type ♀, Rivierkamp, II, 1910, Lorentz; ZMA).—Schuurmans Stekhoven, 1926, p. 335, fig. 158.—Oldroyd, 1949, p. 332, fig. 11.

MATERIAL EXAMINED: 9♀♀ of type series, including holotype. Two other paratypes from Rivierkamp proved to be *cohaerens* when the eyes were relaxed and one was dissected.

♀. Close to *cohaerens*, but slightly larger (12–14 mm), darker brown in general coloration, and with banded eyes. Frons generally more converging, antennal scape longer, more cylindrical, and plate of segment 3 rather narrower; palpi darker, with greyish tomentum and black hairs. Scutum and scutellum dark brown, with almost entirely black hairs and only a few scattered recumbent yellowish ones; pleura grey, with white hairs, except for a few dark ones on mesopleural convexity. Fore femora dark brown (they might be black in fresh specimens); fore tibiae contrastingly pale on basal 1/2 or more; mid and hind femora and tibiae entirely light brown; all tarsi dark to blackish brown. Wings with ground-color more brownish than in *cohaerens*, otherwise similar. Abdomen dark chocolate brown, slightly paler basally, with entirely black hairs, except for small cream apical triangles on the narrow, rather indefinite, paler median vitta on tergites 2–5 and cream lateral fringe on same tergites; venter considerably darker than in *cohaerens*, almost blackish apically, with scattered cream hairs on discs of sternites 1 & 2 and apical fringes on

the narrowly paler apical margins of 2-5. Sternite 8 as illustrated; furca much as in *subcohaerens*.

DISTRIBUTION. SW NEW GUINEA: Bivak I., XII, I, Lorentz; Digoel R.; Etna Bay, Koch; Lorentz R., IX, Lorentz; Lutch; Regen I., XII, II, Lorentz; Rivierkamp. Still known only from the type series, which is divided between BMNH and ZMA.

115. *Tabanus subcohaerens* Mackerras, n. sp. Figs. 186, 193.

Holotype ♀ (SPHTM), from Singorakai, Finschhafen dist., X. 1960, B. McMillan.

MATERIAL EXAMINED: 3 ♀ ♀.

Somewhat larger species than the preceding, darker than *cohaerens*, but brighter than *divisus* and with better defined median vitta on abdomen. Length 14-15 mm. If the eye-pattern, as determined, is reliable, it is certainly distinct from both, because it is closer to *cohaerens* in other external characters.

♀. *Head*: Eyes banded. Frons converging, index 6.5, brown with short black hairs, fawn on bottom 1/5, vertexal triangle indefinite; callus dark brown below, blackish on extension. Subcallus and upper parafacials brown, lower parafacials and face greyish white; hairs black above, white below and on most of face, including beard. Antennae bright brown, segment 1 produced dorsally, 1 & 2 with black hairs, 3 with wide plate, brighter orange-brown basally, style black. Palpi with grey tomentum, darkened by the short black hairs. *Thorax*: Scutum and scutellum olive-brown, with some greyish overlay anteriorly and laterally, inconspicuous short erect black hairs and many dull cream recumbent ones; notopleural hairs black, supraalar and postalar tufts cream, barely differentiated. Pleura light grey, with white hairs except for some black ones on upper mesopleural convexity. *Legs*: Fore legs entirely black, black-haired, except for pale, cream-haired basal 1/2 of tibiae; mid and hind femora yellowish brown, variably grey-dusted basally, cream-haired, tibiae light yellowish brown, mostly black-haired, tarsi blackish. *Wings*: Clear, only lightly darkened in costal cell and anterior part of radial area; stigma brown; veins dark to bright brown, R₄ strongly curved, without appendix. *Abdomen*: Bright, somewhat yellowish brown basally, darkening to blackish apically, with well-defined, serrated, yellowish cream median vitta on tergites 2-6 and yellowish cream lateral margins; hairs black on discs of tergites, cream in median and submedian tufts on 1, in median vitta and in lateral fringe on tergites 1-5. Sternites 1-5 bright brown, darkened in median zone, with wide paler apical bands; hairs predominantly cream sublaterally and in apical fringes, black in median zone; sternites 6-7 contrastingly black, black-haired. Sternite 8 and furca wider than in *cohaerens*, but cerci similar.

DISTRIBUTION. NE NEW GUINEA: Singorakai.

116. *Tabanus approximatus* Oldroyd Figs. 187, 194.

Tabanus approximatus Old., 1949, p. 322, fig. 42 (type ♀, Angoram, Christian; SPHTM).

MATERIAL EXAMINED: 6 ♀ ♀, including holotype, 3 ♂ ♂.

♀. More robust (14-15 mm) species than *cohaerens*. Eyes banded. Frons brown, converging, index 6.5; basal part of callus narrower than in *subcohaerens*; subcallus yellowish

brown, parafacials and face creamy white, white-haired; antennae large, darker brown than in other species, plate with strong tooth but differently shaped from *subcohaerens*. Mesonotum dark greyish brown, with yellow-brown notopleural lobes and abundant dull yellowish cream hairs on disc; pleura light grey. Legs brownish yellow, apical 1/3 of fore tibiae and all fore tarsi contrastingly black, mid and hind tarsi more brownish. Wings with costal cell brown and usual apical shadow in radial area. Abdomen rather uniformly bright yellowish brown, darkening only moderately on apical tergites, with median vitta very variable, sometimes faintly indicated on integument, sometimes consisting of more or less fused narrow triangles of golden-yellow hairs, and sometimes reduced to narrow median fringes on tergites; lateral fringe dense, continuous, golden-yellow, darker and more conspicuous than in the other species; venter yellow-brown, with relatively dense yellow hairs on sternites 2-5, 6 & 7 black-haired. Sternite 8 much as in *subcohaerens*, but base of furca narrower.

Two ♀♀, from the type locality but not in type series, showed no bands on relaxed eyes; they also have a rather wider, less converging frons, more orange antennal plate, and somewhat differently shaped sternite 8. They seem to be no more than variants.

♂. Similar to ♀. Upper enlarged facets occupying more than 1/2 the surface of the eyes, blackish brown, not contrasting in color with small lower and lateral facets; frontal triangle dark brown, subcallus fawn-cream, fading into white parafacials and face; palpi yellowish cream, with white and scattered black hairs; abdominal pattern as in ♀, with same rich golden lateral fringe on tergites.

DISTRIBUTION. NE NEW GUINEA: Angoram.

117. *Tabanus indistinctus* Bigot Figs. 188, 191.

Tabanus indistinctus Big., 1892, p. 689 (type ♀, Doré, Laglaise; BMNH).—Ricardo, 1913, p. 394.—Schuurmans Stekhoven, 1926, p. 332, fig. 154.—Oldroyd, 1949, p. 327, fig. 14.

MATERIAL EXAMINED: 1♀ (identity not certain).

It is difficult to recognize this species, because the type is teneral. The specimen sent to Mr. Oldroyd was greasy, and he could say only that the characters of the head and wings were in general agreement. I was inclined, at first, to compare it with *serus*, but the terminalia separate it widely, and are so distinctive that dissection of the type should settle its identity.

♀. 16 mm, fawn-brown species. Eyes unbanded. Specimens in good condition would probably be rather like *serus*, but distinguishable by: more converging frons (index 7); narrower callus, with shorter extension; uniformly yellowish brown color of entire frons, subcallus and parafacials, face only slightly paler; brown to yellow-brown beard; shining brown-black, less grey dusted femora; wings more extensively suffused with brown along all radial veins, R₄ with long appendix. Sternite 8 as illustrated; base of furca deeply concave; cerci rather truncate.

DISTRIBUTION. NW NEW GUINEA: Doré. NE NEW GUINEA: Bubia, 50 m, IX, Gressitt.

118. *Tabanus vanleeuweni* Oldroyd Figs. 189, 196.

Tabanus vanleeuweni Old., 1949, p. 316, fig. 37. Two cotype ♀♀, from Albatrosbivak V, Mamberamo R., VII. 1926, van Leeuwen, in SPHTM (2 types designated, because one had lost the antennae and the other was greasy).

MATERIAL EXAMINED: 8 ♀♀, including both cotypes, 1 ♂.

♀. Rather slender, 15–16 mm species. Eyes banded. Frons, subcallus and top of parafacials brown, remainder of parafacials and face greyish white, with white hairs and beard; antennae reddish brown, darkening on style; palpi with whitish tomentum and black hairs. Scutum and scutellum dark olive brown, with scarcely a trace of vittae; pleura pale grey, with mainly white hairs. Fore legs black, except for contrasting brownish yellow basal 1/2 of tibiae; mid and hind light to yellowish brown. Wings strongly browned on fore border and along radial veins, with indications of darker spot at fork of R_{4+5} ; R_4 without appendix. Abdomen brown, with yellowish hue basally, darker apically; hairs on tergites entirely black and no trace of pale median triangles or apical fringes; venter brighter brown, with paler apical margins and yellowish cream fringes on sternites. Sternite 8 darker than in *cohaerens*; furca much as in *subcohaerens*; cerci longer than in other species of the group.

♂. Similar to ♀, but darker, with brown beard and pleural hairs, and no pale hairs on venter. Upper large facets of eyes sharply defined.

DISTRIBUTION. NW NEW GUINEA: Albatrosbivak; Bernhard Camp, 50 m, IX, Olthof. NE NEW GUINEA: Meanderberg, VIII, Bürgers. SE NEW GUINEA: ♂, Lake Kutubu, 750 m, X, Barrett.

119. *Tabanus leveri* Mackerras & Rageau Fig. 195.

Tabanus leveri Mack. & Rag., 1958, p. 686, fig. 3C (type ♀, Vanikoro, Santa Cruz Is., De-land; BMNH).

♀. 12–14 mm, rather shining brown species; distinguished by light brown lower part of callus contrasting with dark extension, large antennal scape, and general lack of ornamentation, except for narrow paler apical bands and inconstant traces of median triangles on abdominal tergites. Terminalia (not previously illustrated) with sternite 8 conforming to the *cohaerens* group, other parts undistinguished.

DISTRIBUTION. SOLOMON IS.: Tulagi, I., Carment. SANTA CRUZ IS.: Utupua, III, Lever; Vanikoro.

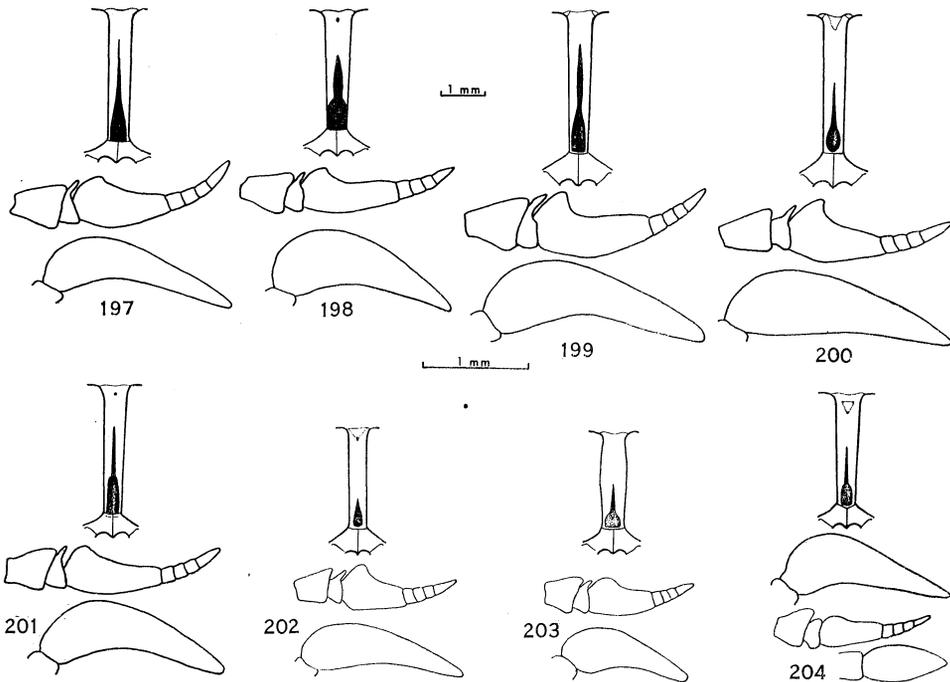
The *innotabilis* Group**120. *Tabanus innotabilis* Walker** Figs. 133, 197, 205.

Tabanus innotabilis Walk., 1848, p. 177 (type ♀, New Holland; BMNH).—Mackerras & Rageau, 1958, p. 684, fig. 3B. Australian synonymy in Mackerras, 1959, p. 163.

Tabanus daruensis Oldroyd, 1949, p. 328, fig. 43 (type ♀, Daru, I. 1927, A. J. Nicholson; SPHTM). Synonymy by Mackerras & Rageau, 1958, p. 684.

MATERIAL EXAMINED FROM NEW GUINEA: 15 ♀♀, including holotype of *daruensis*.

♀. Variable, usually robust (17–18 mm), dark to reddish brown species, but some speci-



Figs. 197-204. *Tabanus, innotabilis* group, ♀♀, except 204: 197, *innotabilis*; 198, *rubriventris*; 199, *serus*; 200, *dorsobimaculatus*; 201, *siassensis*; 202, *meraukensis*; 203, *herbertensis*; 204, *tennis*, frons and palp of ♀, antenna and palp of ♂.

mens are smaller (about 16 mm), less stoutly built, and rather lighter in general coloration. Eyes (relaxed) blackish brown with dark green reflections, unbanded. Frons, subcallus and upper part of parafacials usually brown, lower part of parafacials and face grey, with black hairs; beard dull cream to whitish; antennae brown, darkening on style; palpi relatively slender, brown, with black hairs. Scutum brown, with traces of paler median and dorsocentral vittae; pleura grey, with mainly greyish white hairs, some yellow ones posteriorly and in squamal tuft. Legs brown to yellowish brown, darkening to blackish on distal part of fore tibiae and all tarsi. Wings greyish, with yellowish costal cell and yellowish brown stigma; R_4 without appendix. Abdomen bright to dark brown, tergites 1-6 usually with distinct yellowish cream median apical triangles, and 2-5 often with vaguer sublateral pale patches on discs; sublateral patches present in most specimens from north Queensland and Torres Straits, indicated in the type and some paratypes of the *daruensis* form, and practically absent in other specimens from New Guinea and the *kurandae* form in Queensland; venter deep brown, paler basally, and with pale, cream-haired apical bands on sternites. Terminalia as illustrated.

DISTRIBUTION. NE NEW GUINEA: Wewak, Deland. SE NEW GUINEA: Bisianumu, 150 m, VI, Hardy; Daru; Fly R. delta, XI, Peters; Orokolo, X, Murray; Otomata plantn., XI, Gressitt; Port Moresby, III, Standfast; Vailala R., II, Murray; Yule I., I, Nicholson. Also Solomon Is.; Santa Cruz Is.; Torres Strait Is. (Dauan, Moa, Saibai); Australia (Northern Territory, N. Queensland).

121. *Tabanus rubriventris* Macquart Figs. 198, 206.

Tabanus rubriventris Macq., 1838, p. 131 (type ♀, Offak, d'Urville; PARIS).—Schuurmans Stekhoven, 1926, p. 417, fig. 203.—Oldroyd, 1949, p. 327, fig. 13.

Tabanus novaeguineensis Ricardo, 1913, p. 399 (Cotypes ♀ ♂, Lorentz R., Lorentz; ZMA).
Synonymy by Schuurmans Stekhoven, 1926, p. 417.

Tabanus bipunctatus Sch. Stk., 1926, p. 519, fig. 274 (type ♀, Idenberg R., 1911, ter Poort; ZMA).—Oldroyd, 1949, p. 358. Holotype in poor condition, but agrees with the descriptions of *rubriventris* and with a ♀ identified by Dr. Philip.

Tabanus bipustulatus Szilady, 1926, p. 10.—Philip, 1960a, p. 31. N. name for *bipunctatus* Sch. Stk., New Guinea, *nec* van der Wulp, Ethiopian.

MATERIAL EXAMINED: 8 ♀ ♀, including holotype of *bipunctatus*.

This species has been compared with *serus* in earlier descriptions, but fresh specimens are much more like *innotabilis*, of which I had thought at first that they were a malanic form. The 2 series are almost allopatric, there is some variation in shape of callus, and some ♀ ♀ have partly white beards. They may be subspecies, but it would not be desirable to displace a well-known name without stronger evidence than is available at present.

♀. Dark brown, 16–18 mm species. Eyes (relaxed) dark brown, unbanded. Distinguished from *innotabilis* by: more converging frons; larger callus filling frons below and with more abrupt extension; narrower antennal segment 3; wider, more tapering palpi; brown beard (sometimes with some white hairs posteriorly); brownish black, grey-dusted femora and darker fore tibiae; less definite abdominal pattern, but with apical fringes on tergites more complete. The differences in sternite 8 and furca are scarcely of specific value; the cerci are similar.

DISTRIBUTION. NW NEW GUINEA: Camp Nok, 800 m, Waigeu, Cheesman; Hollandia, II, in light trap, Maa; Idenberg R.; Kofiau I., II, at u. v. light, Simon Thomas; Offak, d'Urville. SW NEW GUINEA: Bivak I., X, Lorentz; Lorentz R., Lorentz. NEW IRELAND: Kavieng, VII, McMillan; Anir I., 4°04' S, 153°37' E, VIII, Carson (new divisional records).

122. *Tabanus siassensis* Mackerras, n. sp. Figs. 201, 209.

Holotype ♀ (SPHTM), from Aronai-Moto I., Siassi Group, nr. New Britain, X. 1960, B. McMillan.

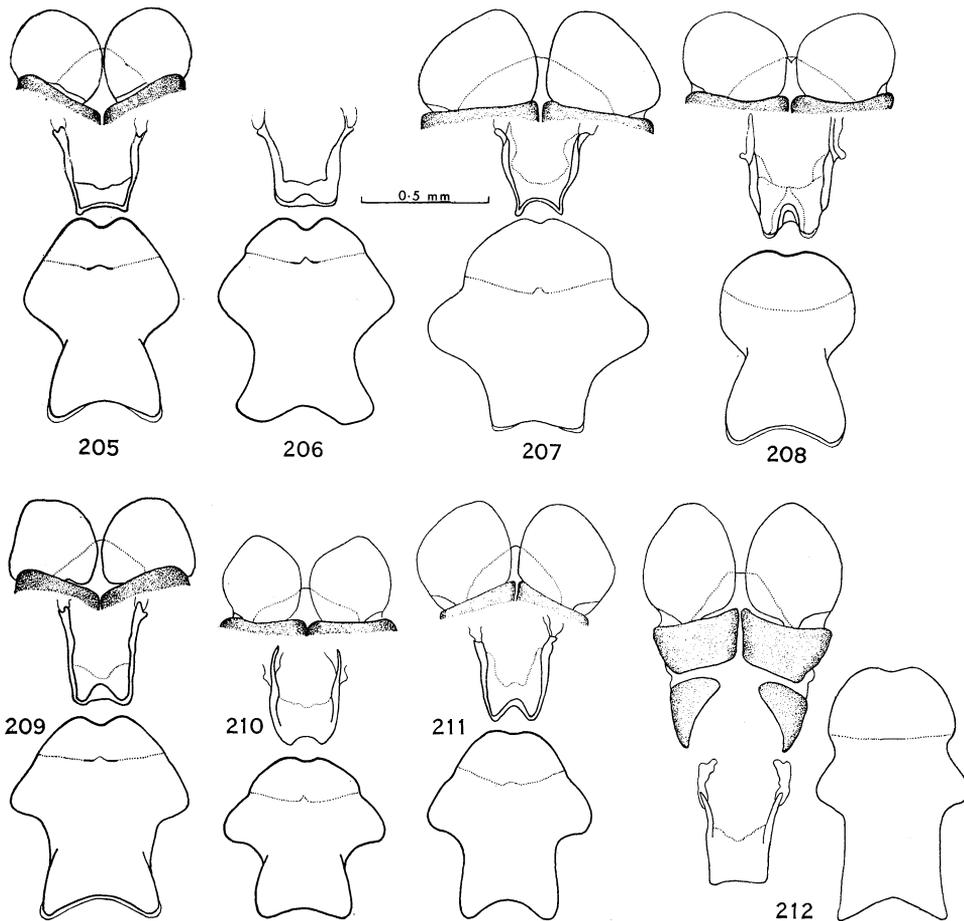
MATERIAL EXAMINED: 1 ♀.

Medium-sized (16 mm) species, distinguished from other members of the group by having entirely black antennal segment 3. It resembles some of the species described by Philip (1959) from the Philippines in this respect, but it will not run down to any species in his key, nor in the key to the species of Thailand, Malaya and Borneo (Philip, 1960b).

♀. *Head*: Eyes (relaxed) bright green, unbanded. Frons converging, index 7.5, brown, with short inconspicuous dark brown hairs, no vertexal triangle, and very minute ocellar spot; callus deep brown, with elongate basal section and short extension. Subcallus brighter brown than frons, without hairs; parafacials brown at top, remainder and face pale grey, with black hairs mixed with some white ones on face; beard white. Antennal segments 1 & 2 light brown, with black hairs; 3 slender, entirely black. Palpi light brownish yellow.

low, with black hairs. *Thorax*: Scutum and scutellum olive brown, with greyish dusting, mainly black hairs, and scattered inconspicuous dull yellowish ones; notopleural lobes more reddish, with black hairs; supraalar and postalar tufts small, white. Pleura grey, with creamy white hairs, except for some black ones on mesopleural convexity. *Legs*: Brown, femora slightly darker, and darkening to blackish on tarsi. *Wings*: Faintly brownish, slightly darker in costal cell, along veins and at fork of R_{4+5} ; stigma brown; veins blackish brown; R_4 angulate, but without appendix. *Abdomen*: Bright brown on tergites 1-3, vaguely darkened in median line of 2, and more diffusely darkened apically; hairs black, except for narrow cream apical fringes on median sections of tergites 1-4 and inconspicuous pale hairs in black lateral fringe. Venter similar to dorsum, but more definitely darkened in median zone of sternites, and with paler, cream-haired apical margins on 2-5 and very inconspicuous pale fringe on 6. Terminalia normal for the group.

DISTRIBUTION. NE NEW GUINEA: Siassi Is.



Figs. 205-212. *Tabanus*, *innotabilis* group, ♀ terminalia: 205, *innotabilis*; 206, *rubriventris*; 207, *serus*; 208, *dorsobimaculatus*; 209, *siassensis*; 210, *meraukensis*; 211, *herbertensis*; 212, *tenuis*.

123. *Tabanus serus* Walker Figs. 199, 207, 213.

Tabanus serus Walk., 1862, p. 20 (type ♀, Misol, Wallace; BMNH).—Ricardo, 1912b, p. 71; 1913, p. 398.—Schuermans Stekhoven, 1926, p. 415, fig. 202, pl. 13, fig. 3.—Oldroyd, 1949, p. 326, fig. 15.—Philip, 1960b, p. 56. Holotype was described as from Ceram, and Miss Ricardo (1913) corrected the error.

Tabanus facilis Walker, 1864, p. 206 (type ♀, Misol, Wallace; BMNH). Synonymy by Ricardo, 1913, p. 398.

Atylotus laglaisei Bigot, 1892, p. 673 (type ♀, Waigeu; BMNH). Synonymy by Ricardo, 1913, p. 398.

?*Tabanus aroeensis* Schuurmans Stekhoven, 1926, p. 448, fig. 218, pl. 14, fig. 4 (type ♀, Dobo, Aru Is., XI. 1922, on horse, in the State Veterinary Lab., Bogor (Buitenzorg).—Oldroyd, 1949, p. 358. Described as "medium-sized" and compared with *Cydistomyia lorentzi* (Ric.), the length is nevertheless given as 17.8 mm, and the figures strongly suggest that it is a *Tabanus*. If this is correct, there is nothing in the description or colored illustration to distinguish it from *serus*.

MATERIAL EXAMINED: 62 ♀ ♀.

♀. Robust (16–18 mm), yellowish to vaguely reddish brown species. Eyes (relaxed) dark green, unbanded. Frons, subcallus and upper part of parafacials fawn-brown, with black hairs on parafacials lateral to antennae; lower part of parafacials and face creamy white, with cream hairs, including beard; antennal segment 3 bright orange, darkening vaguely on style; palpi light fawn brown, with black hairs. Scutum and scutellum olive brown, with grey dusting anteriorly, and black and dull golden hairs; pleura pale grey, with mainly cream to yellowish hairs. Legs light yellowish brown, darkening to blackish at apices of fore tibiae and on all tarsi. Wings greyish; costal cell, stigma and most veins yellowish brown, and variable brownish suffusion of membrane anteriorly and apically; R_4 strongly curved, sometimes with short appendix. Abdomen yellowish brown, sometimes vaguely reddish, and darkening variably on more apical tergites; hairs black, except for yellowish to golden lateral fringe, and small, inconstant, median apical triangles of yellow hairs on some tergites; the degree to which these are developed appears to be quite variable, and a few specimens also show traces of golden apical fringes; venter brighter yellowish than dorsum, with paler apical margins on sternites, variable transverse darkening of the more apical sternites, and golden hairs sublaterally and in apical fringes, variably replaced by black in the median zone. Sternite 8 unusually wide, but gonapophyses pale, with dark distal edge and many long hairs, as is normal for the group.

DISTRIBUTION. NW NEW GUINEA: Albatrosbivak, Mamberamo R., V, v. Leeuwen; Araucaria Camp, 800 m, III, Toxopeus; Bernhard Camp, IV, VIII–XI, Olthof, Toxopeus; Bodem, 100 m, VII, Maa; Camp Nok, 800 m, Waigeu, IV, Cheesman; Genjem, 100–200 m, III, Maa; Misol; Pauwi, VI, Moszkowski; Pionierbivak, VIII, v. Heurn; Prauwenbivak, VIII, IX, XI, v. Heurn; Siribua⁹, VII, Moszkowski; Taua, VII, Moszkowski; Waigeu, XII, de Beaufort. SW NEW GUINEA: ?Aru Is., XI. NE NEW GUINEA: Angoram, Christian; Bewani Mts., 400 m, VII, Stüber; Lae, VII, Clinton, McMillan, Skinner; Maprik, III, Standfast; 29 km d. Meanderberg a Sepik, VII, Bürgers. SE NEW GUINEA: Cape Rod-

9. I have not been able to trace this locality. It is presumably near Pauwi and Taua, where Moszkowski collected at about the same time.

ney, XI, Gressitt; Fergusson I., X, Peters; Kokoda, 400 m, VIII, Cheesman; Oriomo, X, Gressitt; Otomata plantn., 1 m, in Malaise trap, XI, Gressitt; Samarai, X. Also ?Borneo (Philip, 1960b).

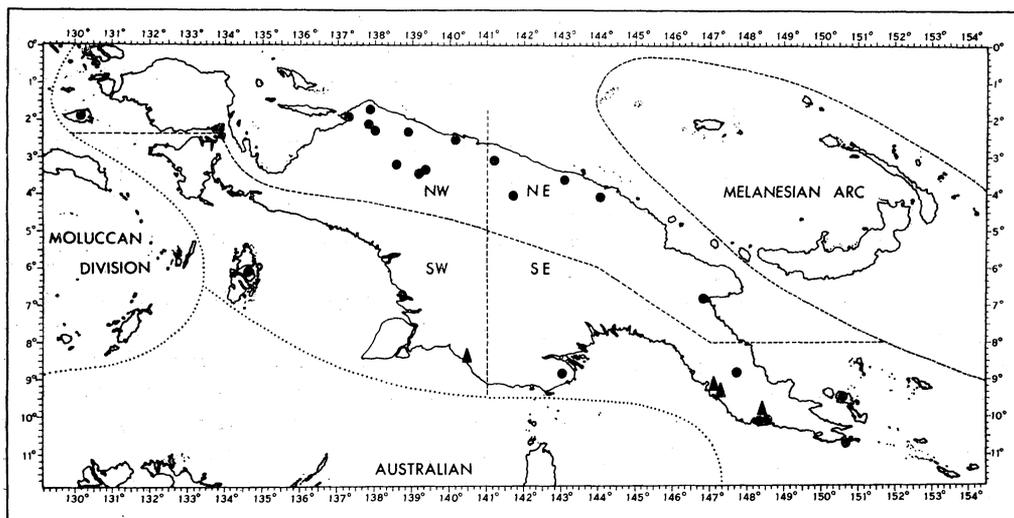


Fig. 213. Distribution of *Tabanus serus* (spots) and *dorsobimaculatus* (triangles).

124. *Tabanus dorsobimaculatus* Macquart Figs. 200, 208, 213.

Tabanus dorsobimaculatus Macq., 1850, p. 29 (type ♀, east coast of New Holland; PARIS).
—Mackerras, 1959, p. 164 (lists Australian synonymy).

MATERIAL EXAMINED FROM NEW GUINEA: 5 ♀♀, 1 ♂.

♀. 15–18 mm species, with green, unbanded eyes (relaxed). It may be confused with *serus* in the field, but can be distinguished by: callus smaller, its median extension ending at or little above middle of frons; antennal plate shorter and wider; all femora black, grey-dusted, except for yellow-brown knees; fore tibiae contrastingly blackish on apical 1/3; wings with darker costal cell and more vague suffusion in region of radial fork; R_4 strongly bent and often with stump of an appendix; sternite 8 unusually long, narrow and very hairy. There is some variation, the antennal plate being wider and the style black in the ♀ from Port Moresby, which also has palpi almost entirely yellow-haired.

♂. Somewhat darker than ♀♀. Eyes with upper enlarged bronze facets in central zone smaller than surrounding area of small dark facets; subcallus, parafacials and face cream; antennal style contrasting brown; wings more evidently darkened through basal cells to 1A posteriorly.

DISTRIBUTION. SW NEW GUINEA: Merauke, I-II, Maa. SE NEW GUINEA: ♂, Brown R., X, Gressitt; Otomata plantn., 1 m, XI, in Malaise trap, Gressitt; Port Moresby, I, Standfast. Also Australia (Northern Territory, north Queensland).

125. *Tabanus meraukensis* Mackerras, n. sp. Figs. 202, 210.

Holotype ♀ (SPHTM), Merauke, 20. V. 1943, D. C. Swan.

MATERIAL EXAMINED: 1 ♀.

Relatively small (13 mm), slender species, distinguished from other members of the group by its small callus, orange antennal plate contrasting with black style, greyish scutum and femora, and what appears to be an unusually sharp distinction between paler basal and darker apical segments of abdomen. This may be partly adventitious, but the fly was cleaned in amyl acetate without appreciably altering the appearance. Its nearest relative appears to be *T. obscurilineatus* Tayl. of N. Australia.

♀. *Head*: Eyes (relaxed) green with blue reflections, unbanded. Frons almost parallel, index 6, greyish fawn, with short brown hairs on most of length and white ones lateral to short, drop-shaped, brownish black callus; vertexal triangle indicated, but no definite ocellar spot. Subcallus, parafacials and face cream, with some pale grey reflections, and white hairs on parafacials and face, including beard. Antennal segment 1 brownish cream, 2 slightly darker, both with black hairs; 3 with bright orange basal plate and black style. Palpi cream, with black hairs above, white below. *Thorax*: Scutum and scutellum brownish grey, with considerable grey dusting and mixed black and yellowish cream hairs; notopleural lobes lighter brown, with mainly black hairs; supraalar and postalar tufts cream, inconspicuous. Pleura light grey, with predominantly creamy white hairs. *Legs*: Coxae and femora completely grey dusted; knees, basal 1/2 of fore tibiae and nearly all of mid and hind brownish cream, contrasting with black apical 1/2 of fore tibiae and tarsi and brown to black mid and hind tarsi. *Wings*: Greyish, with yellowish brown costal cell and stigma, brown veins, and hint of darkening along radial veins and across apices of basal cells; R₄ without appendix. *Abdomen*: Tergites 1 & 2 bright, somewhat translucent yellowish, remainder deep to blackish brown; hairs black, except for inconspicuous creamy yellow median triangles and lateral fringes. Venter similar, but with pale hairs on discs of sternites sublaterally and in apical fringes, black in darkened median zone. Sternite 8 relatively wide, but otherwise normal; cerci acuminate.

DISTRIBUTION. SW NEW GUINEA: Merauke.

126. *Tabanus herbertensis* Mackerras, n. sp. Figs. 203, 211.

Holotype ♀ (SPHTM), from Herbert R., 22. XI. 1956, W. Peters.

MATERIAL EXAMINED: 1 ♀.

Small yellowish brown species. Distinguished from *approximatus* by wider frons; short, wide callus; differently shaped antennal segment 3, with undarkened style; greyish fawn scutum; almost entirely yellow-brown fore tibiae; more extensive brown suffusion of wings; darker venter, and different terminalia. Length 13 mm.

♀. *Head*: Eyes (relaxed) green, unbanded. Frons relatively wide (index 4), brown, with inconspicuous black hairs; vertexal triangle indefinite, but relatively large, shining ocellar spot; callus pyriform, brown, with darker extension narrowing to line of which the upper limit is difficult to determine. Subcallus fawn-cream, fading to cream on parafacials and face; hairs mainly white mixed with a few black ones; beard white. Antennae short; segment 1 fawn-cream, 2 orange-brown, both with black hairs; 3 orange-brown, not darkening appreciably on style. Palpi yellow, with black and a few cream hairs. *Thorax*: Scutum and scutellum densely covered with brownish grey tomentum, more whitish and with faint indications of vittae anteriorly; hairs erect, black and numerous recumbent dull

golden; notopleural lobes light brown, with mainly black hairs; supraalar and postalar tufts barely differentiated, creamy gold. Pleura pale grey, with mainly cream and white hairs. *Legs*: Light yellowish brown, darkening on apical 1/4 of fore tibiae, and becoming blackish on tarsi. *Wings*: Greyish, suffused with brown basally and along veins as far as R₄ and apex of discal cell; stigma and veins yellowish brown; R₄ without appendix. *Abdomen*: Bright yellowish brown, darkening vaguely on tergite 3 and more evidently on subsequent tergites, small median triangles and narrowly paler apical margins on 2 and subsequent tergites; hairs black, except for pale gold in a rather conspicuous median patch on tergite 1, in median triangles and on apical margins of subsequent tergites, and becoming more cream in lateral fringes. Venter similar, rather darker in basal bands on 4 and subsequent sternites; hairs creamy gold, especially in apical fringes, but mixed with black in median zone of sternites 2 & 3, more extensively on 4-6, 7 entirely black-haired. Terminalia normal for group.

DISTRIBUTION. SE NEW GUINEA: Herbert R.

127. *Tabanus tenuis* Schuurmans Stekhoven Figs. 204, 212.

Tabanus tenuis Sch. Stk., 1932, p. 15, fig. 3 (type ♂, Poeloe Karang, Aru Is., III.1929; BRUSSELS).

MATERIAL EXAMINED: 1♀, 1♂ holotype.

Sexual dimorphism appears to be somewhat greater than usual in this species, and the identity of the ♀ was not suspected until the type ♂ was received through the kindness of M. Collart. It is unfortunate that the antennae of the ♀ are incomplete, but it still seems likely that the association is correct. The ♀ is fawn-grey, with clear wings, and is distinguished by acuminate apical abdominal segments and narrow terminalia, all of which suggests that it may breed in sand. The ♂ has an evenly tapering, less tomentose, more yellow-brown abdomen, and is distinguished by black antennal segment 3. Length of ♀ 17 mm, of ♂ 15 mm.

♀. *Head*: Eyes (relaxed) green with brown reflections, unbanded. Frons converging, index 5.5, pale fawn-cream, with inconspicuous black hairs; vertexal triangle grey, ill-defined, blackish, at apex, but without definite ocellar tubercle; callus bright brown, with dark linear extension. Subcallus cream, slightly brownish above antennae, without hairs; parafacials and face creamy white, with white hairs, including beard. Antennal segments 1 & 2 light brown, with black hairs; 3 missing. Palpi cream, with short black hairs on most of lateral surface, longer white ones basally and below. *Thorax*: Scutum and scutellum almost concolorous fawn-grey, with dull cream and some inconspicuous black hairs; notopleural lobes paler, with longer black and dull cream hairs, supraalar and postalar tufts cream. Pleura grey, with creamy white hairs. *Legs*: Fore femora blackish, mid and hind light brown, darker basally, grey-dusted; fore tibiae light brown, with light brown hairs on basal 3/4, apical 1/4 and tarsi black; mid and hind tibiae bright brown, tarsi darker. *Wings*: Faintly greyish, costal cell light brown; stigma and veins bright to yellowish brown; R₄ strongly curved, with trace of appendix on 1 wing. *Abdomen*: Tergite 1 largely grey-dusted, 2-4 light yellowish brown, 5-7 blackish, all with cream apical bands; hairs mixed dull cream and black on discs of 1-4, mostly black on 5-7, and bright cream on apical and lateral margins of tergites. Venter brownish, strongly grey-dusted, with cream apical bands on sternites 2-6; hairs white on all sternites, except for a few black ones on

5 and entirely black on 6 & 7, which are darker than others. The strong lateral compression from segment 5 onwards may be partly adventitious, but segments 6 & 7 are longer than wide, and the terminalia are remarkably long and narrow.

♂. Head wider than thorax, and abdomen long and evenly tapering, giving insect a rather characteristic appearance. Eyes with upper bronze facets markedly enlarged, sharply distinguished from small blackish lower and narrow zone of posterior facets. Ocellar tubercle compressed, deeply sunk below vertex; subcallus, parafacials and face light yellowish to greyish cream; antennal segments 1, 2 and extreme base of 3 bright yellowish, contrasting with the black remainder of segment 3 and style; palpi creamy yellow, with cream and a few black hairs. Thorax, legs, and wings as in ♀, except that there is no appendix on R₄. Abdomen bright yellow-brown, darkening on discs of apical tergites, with paler apical bands narrower and less conspicuous than in ♀, and with predominantly yellowish cream hairs; venter similar to dorsum.

DISTRIBUTION. SW NEW GUINEA: Aru Is.

REFERENCES

- Bigot, J. M. F. 1892. Descriptions de diptères nouveaux. Mem. Soc. Zool. France **5**: 602-91.
- Cheesman, L. E. 1951. Old mountains of New Guinea. Nature, Lond. **168**: 597.
- Doleschall, C. L. 1858. Derde bijdrage tot de kennis der dipteren fauna van nederlandsch Indië. Natuurk. Tijd. Ned. Ind. **17**: 73-128.
- Enderlein, G. 1922. Ein neues Tabanidensystem. Mitt. Zool. Mus. Berl. **10**: 333-51.
- 1923. Vorläufige Diagnosen neuer Tabanidengenera (Dipt.). Dtsch. Ent. Zschr. **1923** (5): 544-45.
- 1925. Studien an blutsaugenden Insekten. I. Grundlagen eines neuen Systems der Tabaniden. Mitt. Zool. Mus. Berl. **11**: 253-409.
- English, K. M. I., I. M. Mackerras & A. L. Dyce. 1957. Notes on the morphology and biology of a new species of *Chalybosoma* (Diptera, Tabanidae). Proc. Linn. Soc. N. S. W. **82**: 289-96.
- Ferguson, E. W. 1926. Additional notes on the nomenclature of Australian Tabanidae. Bull. Ent. Res. **16**: 293-306.
- & G. F. Hill. 1922. Notes on Australian Tabanidae. Part ii. Proc. Linn. Soc. N. S. W. **47**: 245-65.
- Gressitt, J. L. 1961. Problems in the zoogeography of Pacific and Antarctic insects. Pacific Ins. Monogr. **2**: 1-94.
- Harrison, J. L. 1962. Mammals of Innisfail. I. Species and distribution. Austl. Jour. Zool. **10**: 45-83.
- Henning, W. 1957. Systematik und Phylogenese. IN: "Bericht über die Hundertjahrfeier der Deutschen Entomologischen Gesellschaft Berlin 30 September bis 5 Oktober 1956" pp. 50-71 (Berlin: Akademie-Verlag).
- 1960. Die Dipteren-Fauna von Neuseeland als systematisches und tiergeographisches Problem. Beitr. Ent. **10**: 221-329.
- Kröber, O. 1929. Indo-australische Chrysopini. Zool. Jahrb. **56**: 463-528.
- Mackerras, I. M. 1954. The classification and distribution of Tabanidae (Diptera). I. General review. Austl. Jour. Zool. **2**: 431-54.

- 1955a. The classification and distribution of Tabanidae (Diptera). II. History: morphology: classification: subfamily Pangoniinae. *Ibid.* **3**: 439–511.
- 1955b. The classification and distribution of Tabanidae (Diptera). III. Subfamilies Sceptidinae and Chrysopinae. *Ibid.* **3**: 583–633.
- 1956. The Tabanidae (Diptera) of Australia. I. General review. *Ibid.* **4**: 376–407.
- 1959. An annotated catalogue of described Australian Tabaninae (Diptera, Tabanidae). *Proc. Linn. Soc. N. S. W.* **84**: 160–85.
- 1960. The Tabanidae (Diptera) of Australia. III. Subfamily Pangoniinae, Tribe Scionini and supplement to Pangoniini. *Austl. Jour. Zool.* **8**: 1–152.
- 1961a. The zoogeography of Western Pacific Tabanidae (Diptera). *Pacific Ins. Monogr.* **2**: 101–6.
- 1961b. The Tabanidae (Diptera) of Australia. IV. Subfamily Chrysopinae. *Austl. Jour. Zool.* **9**: 827–906.
- 1962a. Speciation in Australian Tabanidae. IN “The Evolution of Living Organisms,” G. W. Leeper Ed., pp. 328–58 (Melbourne Univ. Press).
- 1962b. On some Oriental and Pacific Tabaninae (Diptera, Tabanidae). *Pacific Ins.* **4**: 101–13.
- & J. Rageau. 1958. Tabanidae (Diptera) du Pacifique sud. *Ann. Parasit. Hum. Comp.* **33**: 671–742.
- Macquart, P. J. M. 1838. Diptères exotiques nouveaux ou peu connus. T. 1, pt. 1, 221 pp.
- 1846. Diptères exotiques nouveaux ou peu connus. Supplement i, 238 pp.
- 1850. Diptères exotiques nouveaux ou peu connus. Supplement iv, 161 pp.
- Meijere, J. C. H. de. 1906. Diptera. Nova Guinea. Resultats de l'expédition scientifique Néerlandaise à la Nouvelle Guinée en 1903 sous les auspices de Arthur Wichmann, Chef de l'Expédition. *Leiden* **5** (1): 67–99.
- 1915. Diptera aus Nord Neu-Guinee gesammelt von Dr. P. N. van Kampen und K. Gjellerup in den Jahren 1910 und 1911. *Tijdschr. Ent.* **58**: 98–139.
- Nicholson, A. J. 1927. A new theory of mimicry in insects. *Austl. Zoologist* **5**: 10–104.
- Oldroyd, H. 1947. The Diptera of the Territory of New Guinea. XIV. Family Tabanidae. Part II. Pangoniinae, except the genus *Chrysops*. *Proc. Linn. Soc. N. S. W.* **72**: 125–42.
- 1949. The Diptera of the Territory of New Guinea. XIV. Family Tabanidae. Part III. Tabaninae. *Ibid.* **73**: 304–61.
- 1954. The horse-flies (Diptera: Tabanidae) of the Ethiopian region. Vol. II. *Tabanus* and related genera. *Brit. Mus. (Nat. Hist.)*, 341 pp.
- 1962. The genus *Philoliche* (Diptera: Tabanidae) in the island of Mauritius. *Proc. Roy. Ent. Soc. Lond. ser. B*, **31**: 107–8.
- Philip, C. B. 1959. The Philippine Expedition: Tabanidae (Diptera). *Fieldiana: Zool.* **33**: 543–625.
- 1960a. Malaysian parasites XXXV. Descriptions of some Tabanidae (Diptera) from the Far East. *Stud. Inst. Med. Res., Malaya* **29**: 1–32.
- 1960b. Malaysian parasites XXXVI. A summary review and records of Tabanidae from Malaya, Borneo, and Thailand. *Ibid.* **29**: 33–78.
- & I. M. Mackerras. 1961. On Asiatic and related Chrysopinae (Diptera: Tabanidae). *Philippine Jour. Sci.* **88**: 279–324.

- Ricardo, G. K. 1900. Notes on the Ponganinae of the family Tabanidae in the British Museum collection. *Ann. Mag. Nat. Hist. ser. 7*, **5**: 97-121.
- 1901. Further notes on the Ponganinae of the family Tabanidae in the British Museum collection. *Ibid.* **8**: 286-315.
- 1912a. Notes on Tabani from the East Indies. *Tijdschr. Ent.* **55**: 347-49.
- 1912b. Dipteren. ii. Notes on species of *Tabanus* from Ceram, Waigiou and Buru. *Bijdr. Dierk.* **19**: 70-72.
- 1913. Dipteren. ii. The Tabanidae of New Guinea. Nova Guinea. Résultats de l'expédition scientifique néerlandaise à la Nouvelle Guinée. Leiden **9**: 387-406.
- 1915. Notes on the Tabanidae of the Australian region (continuation). *Ann. Mag. Nat. Hist. ser. 8*, **15**: 270-91.
- Röder, V. von. 1892. Drei neue Dipteren. *Stett. Ent. Zeit.* **53**: 241-44.
- Schiner, J. R. 1868. Diptera. IN: "Reise der...Fregatte *Novara* um die Erde, in 1857-59 ... " *Zool. Theil*, Bd. II, Abt. B. pp. 3-388.
- Schuurmans Stekhoven, J. H. 1926. The bloodsucking arthropods of the Dutch East Indian Archipelago. VII. The tabanids of the Dutch East Indian Archipelago. *Treubia* **6**, suppl. 551 pp.
- 1932. Tabanidae. Résultats scientifiques du voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique. *Mem. Mus. R. Hist. Nat. Belg. hors sér.*, **4** (7) : 11-16.
- Surcouf, J. M. R. 1921. Diptera. Fam. Tabanidae. Wytzman's *Genera Insectorum*. Fasc. **175**: 182 pp.
- Szilady, Z. 1926. New and Old World horseflies. *Biol. Hung.* **1** (7) : 1-30.
- Taylor, F. H. 1919. Australian Tabanidae (Diptera). No. iv. *Proc. Linn. Soc. N. S. W.* **44**: 41-71.
- 1946. The Diptera of the Territory of New Guinea. XIII. Family Tabanidae. Part I. The genus *Chrysops*. *Ibid.* **70**: 328-32.
- Walker, F. 1848. List of the specimens of dipterous insects in the collection of the British Museum. Part I, 229 pp. (London).
- 1859. Catalogue of the dipterous insects collected in the Aru Islands by Mr. A. R. Wallace, with descriptions of new species. *Jour. Proc. Linn. Soc. Lond. (Zool.)* **3**: 77-131.
- 1861a. Catalogue of the dipterous insects collected at Dorey, New Guinea, by Mr. A. R. Wallace, with descriptions of new species. *Ibid.* **5**: 229-54.
- 1861b. Catalogue of the dipterous insects collected in Batchian, Kaisaa and Makian, and at Tidon in Celebes, by Mr. A. R. Wallace, with descriptions of new species. *Ibid.* **5**: 270-303.
- 1862. Catalogue of the dipterous insects collected at Gilolo, Ternate, and Ceram, by Mr. R. Wallace, with descriptions of new species. *Ibid.* **6**: 4-23.
- 1864. Catalogue of the dipterous insects collected in Waigiou, Mysol, and North Ceram by Mr. A. R. Wallace, with descriptions of new species. *Ibid.* **7**: 202-38.
- 1865. Descriptions of new species of the dipterous insects of New Guinea. *Ibid.* **8**: 102-30.
- Willett, H. C. 1953. Atmospheric and oceanic circulation as factors in glacial-interglacial changes of climate. IN "Climatic Change: Evidences, Causes, and Effects," H. Shapley

Ed., pp. 51-71 (Harvard Univ. Press).
 Wulp, F. M. van der. 1868. Diptera uit den oost-indischen Archipel. Tijdschr. Ent. 11: 97-119.

APPENDIX

GAZETTEER OF LOCALITIES

Many of the locations are approximate. Altitudes are given in the text.

Northwestern					
Place	S. lat.	E. long.			
Albatrosbivak	1° 45'	137° 50'	Moss Forest Camp	4 00	138 43
Araucaria Camp	3 30	139 11	Motorbivak	3 05	137 27
Archbold Lake	3 40	138 52	Mt. Gyifrie	2 38	140 59
Arfak Mts.	1 09	133 59	Mt. Lina	2 30	140 30
Bakoesa	1 50	137 49	Mt. Nomo	2 45	140 55
Baliem Camp	3 56	138 29	Mt. Sabron	2 30	140 30
Bernhard Camp	3 29	139 13	Mulik R.	3 41	138 47
Biak I.	1 00	136 00	Noemfor I.	1 02	134 53
Bodem	2 20	138 55	Offak (=Fofak Hbr., Waigeu)	0 03	130 44
Bokondini	3 41	138 40	Pauwi	1 55	137 10
Cyclops Mts.	2 30	140 30	Pionierbivak	2 19	138 00
Djoebaren	2 16	138 52	Prauwenbivak	3 15	138 35
Dojo	2 34	140 28	Rattan Camp	3 30	139 09
Doorman track	4 25	138 40	Rouffaer R.	3 05	137 30
Doré (=Manokwari)	0 53	134 06	Salawatti I.	1 10	130 50
Enarotadi	3 55	136 22	Samberi (Biak I.)	1 09	135 55
Genjem	2 36	140 10	Sarmi	1 52	138 45
Hollandia	2 32	140 42	Sermowai R. (upper)	2 45	140 13
Hollandia-Binnen	2 38	140 40	Sigi Camp	3 33	139 02
Idenberg R. (upper)	3 10	140 00	Siwi	1 29	134 02
Iebele Camp	3 58	138 46	Swart Valley	3 38	138 30
Ifar	2 35	140 33	Sorong Doom	0 56	131 07
Japen I.	1 45	136 20	Taua	2 09	137 50
Karubaka	3 35	138 30	Teba	1 28	137 54
Kebar Valley	0 48	133 03	Top Camp	3 30	139 02
Kloofbivak	4 25	138 45	Tor R. (upper)	2 28	138 49
Kofiau I.	1 10	129 50	Waigeu I.	0 15	130 50
Kutsime	3 40	138 20	Waris	3 14	140 58
Lake Habbema	4 08	138 40	Weyland Range	3 50	135 50
Lake Sentani	2 37	140 30	Wichmann Mts.	4 25	138 50
Maffin Bay	1 58	138 52			
Mamberamo R.	1 45	137 50	Southwestern		
Misol I.	1 50	130 10	Alkmaar	4° 45'	138° 50'
Mist Camp	3 30	139 05	Aru Is.	6 00	134 30
			Bivak I.	5 00	138 41
			Bomberai	2 47	132 48

Digoel Mts.	5 05	140 30	Finisterre Range	5 50	146 10
Digoel R.	7 10	139 30	Finschhafen	6 34	147 51
Etna Bay	3 58	134 40	Flusslager 15, 18	4-4 30	142-3
Fak Fak	2 56	132 18	Goiburung	5 50	144 15
Hellwig Mts.	4 30	138 45	Goroka	6 04	145 24
Heuvelbivak	4-5	138-9	Hunsteinspitze	4 31	142 40
Hoofdbivak	4-5	138-9	Huon Gulf	6 50	147 10
Iwaka R.	4 25	136 50	Jimmi Valley	5 35	144 45
Lake Kamakawator	3 45	134 12	Jungaing	6 23	147 37
Loemida	3 50	134 11	Kainantu	6 17	145 52
Lorentz R.	5 20	138 15	Kalalo	6 04	147 11
Lutch	4-5	138-9	Kandep	5 50	143 30
Merauke	8 30	140 23	Kassam	6 20	145 55
Mimika R.	4 30	136 30	Kepilam	5 36	143 32
Regen I.	4 48	138 55	Kerowagi	5 53	144 51
Rivierkamp	4-5	138 45	Kewieng	5 55	146 40
Sabang	4 46	138 47	Komba	7 55	147 15
Utakwa Valley	4 30	137 10	Korn	5 50	144 19
Varen R.	5 20	138 10	Kotuni	6 02	145 28
			Krisa	2 51	141 17
			Kumur	5 30	144 38
			Lae	6 43	147 00
			Laiagam dist.	5 30	143 29
			Lake Ak	5-6	146-7
			Lordberg (=Mt. Burgers)	5 03	143 12
			Lowes	6 20	146 30
			Madang	5 13	145 49
			Malu (=Ambunti)	4 14	142 51
			Maprik	3 38	143 03
			Markham Valley	6 35	146 25
			Marok	3 10	142 15
			Meanderberg	4 03	141 42
			Mobitei	3 25	142 08
			Mokai	3 20	142 12
			Morobe	7 45	147 36
			Mt. Bougainville	2 39	141 02
			Mt. Elandora	6 32	146 05
			Mt. Gwamda	5 38	146 20
			Mt. Lucreu	2 47	141 03
			Mt. Misim	7 13	146 50
			Mt. Otto	5 58	145 29
			Mt. Wilhelm	5 47	145 01
			Mumeng	7 00	146 35
			Murmur Pass	5 47	143 56
			Nadzab	6 35	146 46
			Nasawampum	6 40	146 55
Northeastern					
Adelbert Mts.	4° 40'	145° 10'			
Aiyura	6 20	145 55			
Al Valley	5 48	144 45			
Amok	3 35	142 57			
Angoram	4 04	144 04			
Aprilfluss (April R.)	4 30	142 30			
Bachlager 12	4-4 30	142-3			
Bainyik	3 40	143 03			
Baiyer R.	5 31	144 11			
Banz	5 48	144 37			
Bewani Mts.	3 10	141 10			
Bonga	6 26	147 51			
Bubia	6 40	146 55			
Bukaua	6 42	147 09			
Bulolo	7 12	146 39			
Burui	4 00	143 02			
Busu R.	6 41	147 13			
Cape König Wilhelm	6 04	147 35			
Chimbu	6 05	144 55			
Dingat	6 10	146 50			
Edie Creek (Kaindu)	7 21	146 40			
Eliptamen Valley	5 08	141 35			
Etappenberg	4 37	142 28			
Ethitno	6 15	145 55			
Feramin	5 09	141 32			

Saiho	8 49	148 04	Tororo	8 18	146 58
Samarai	10 37	150 40	Trobriand I.	8 30	151 05
Subitana-Musgrave dist.	9 24	147 28	Vailala R.	7 52	145 25
Sudest I. (Tagula)	11 30	153 30	Woodlark I.	9 05	152 50
Tapini	8 22	146 59	Yule I.	8 48	146 31

Publication announcement

PACIFIC BASIN BIOGEOGRAPHY: A SYMPOSIUM

Edited by J. L. Gressitt

This is a volume incorporating two symposia held at the Tenth Pacific Science Congress, Honolulu, 1961. The first and major one has the same title as the volume. It consists of three subsymposia. The second symposium is on a related subject. These are listed below with their conveners:

I. Pacific Basin Biogeography.

- A. Bering Arc Relationships. C. H. Lindroth
- B. Tropical Relationships. F. R. Fosberg
- C. Antarctic Relationships. C. A. Fleming

II. Modification of Biotic Balance of Island Faunas and Floras. E. G. Turbott

The volume includes 45 papers. The 45 authors include 15 entomologists, 11 other zoologists, 13 botanists, 3 paleontologists, 2 geologists and 1 geographer. The entomologists are G. E. Ball, L. Brundin, J. F. G. Clarke, M. S. Ghilarov, J. L. Gressitt, G. P. Holland, A. I. Kurentzov, G. Kuschel, M. Laird, C. H. Lindroth, E. G. Linsley, H. Townes, R. L. Usinger, C. M. Yoshimoto and E. C. Zimmerman.

There is a wide range in the scope of the various contributions. In general, most aspects of biogeography are covered. There is particular emphasis on the Bering Bridge in relation to birds, certain insect groups and plants; to dispersal and paleogeography in the tropical area; and to *Nothofagus* and podocarps in the southern (Antarctic) section.

x+561 pp., many maps and illustrations; Dec. 1963, price \$12.00

Order from Bishop Museum, Honolulu, Hawaii 96819.