# SYNOPSES OF THE GENERA ORNITHOPHILA AND ORNITHOCTONA WITH REMARKS ON THEIR HABITAT DIVERSIFICATION

(Diptera : Hippoboscidae)<sup>1</sup>

# By T. C. Maa<sup>2</sup>

Abstract: The 2 and 12 species of Ornithophila Rndn. and Ornithoctona Speis, respectively, are reviewed briefly with reference to their host relationships, hyperparasitism by fungi and mites and phoresy of Mallophaga. Also included are a description of Ornithoctona hulahula n. sp. from the Hawaiian Is. and a short discussion on the phenomenon of disharmonic habitat diversification in the 2 genera.

Among bird-louseflies (and probably many other ectoparasites, too) with low host specificity, closely related species coexisting in the same major biogeographical provinces are generally similar or parallel in the ranges of their hosts and / or distribution. Since each species in such cases fits into a certain ecological niche, biotic or abiotic, the ranges do not, or hardly, overlap. The most significant exceptions for this phenomenon seem to be in the genera *Ornithophila* Rndn. and *Ornithoctona* Speis. where almost all species fall into 2 categories, here termed as A and B for convenience. Each pair of A and B is composed of closely related species coexisting in one and the same general area. Category A denotes the species having high population density and very wide host and distributional ranges while its counterpart B has low population density and much more restricted host and/or distributional ranges. A complete list of the species of the 2 genera is summarized as in Table 1.

It may be noted that (1) In most species of the category B (exceptions: *idonea*, *hula-hula*, *rugicornis*), the distributional ranges lie well within those of their respective counterparts in category A; (2) All species of category B except *oxycera* and *orizabae* are confined to islands; (3) All species of category B are very rare, so far only 7 specimens each are known for *gestroi* and *orizabae*, 6 for *soror*, 2 each for *idonea*, *hulahula* and *rugicornis*, and 1 for *orizabae*; (4) In the Australasiae group, the 3 species belonging to category A are closer to each other than to their respective counterparts in category B; (5) The known host range of all species of category B are within the range of their respective counterparts in category A, but as exemplified by *gestroi*, the host preference of B may be different.

<sup>1.</sup> Partial results of a grant to Bishop Museum from the U.S. National Institutes of Health (AI 01723-11).

<sup>2.</sup> B. P. Bishop Museum, Honolulu, Hawaii 96819, USA.

Categor	у А	Category B	Region	
Ornithophila	metallica Schin.	O. gestroi Rndn.	Palaearctic	
Ornithoctond	a laticornis Mcq.	O. idonea Falc.	Ethiopian	
О.	australasiae Fabr.	O. soror Ferr. & O. hulahula n. sp.	Oriental	
0.	fusciventris Wdm.	O. oxycera Falc.	Neotropical	
О.	nitens Bigot	O. orizabae Beq.	Neotropical	
О.	erythrocephala Lch.	? ? 3>	Neotropical	
 0.	plicata Olf.	O. rugicornis Maa	Ethiopian	

Table 1. Interspecific relationship of Ornithophila and Ornithoctona.

The above-described disharmonic habitat diversification cannot be satisfactorily explained as merely a combined result of biotic and abiotic isolations which, in the cases of *Ornithophila* and *Ornithoctona*, apparently have not been complete during the course of evolution (see points 1 and 5, above). Why this phenomenon is so significant in these 2 genera, but not in others, is another question to be answered.

#### Genus Ornithophila Rondani 1879

Generic Characters. The following description is intended to be supplementary to that given by Theodor et al. (1964: 33) and to serve for comparison against Ornithomya and Ornithoctona. Eye large; ocelli always well developed. Antennal segment 2 with  $10\pm$  long pale fine setae arranged in single arcuate row on outer surface near base (basad to level of arista); arista leaflike, broader than in Ornithomya; antennal appendage fairly long, acute and with weak terminal bristle at apex; outer surface with long pale setae, with rounded upper and sharp lower margins; dorsal surface gently convex and rather evenly setose. Palpus moderately long. Frons proper (interantennal area) shorter than in Ornithomya; frontal process very long, largely membranous, protruding forward much beyond vibrissal area. Usually no vibrissal spines. Anterior thoracic spiracle dorsal. Single notopleural bristle; scutellar bristles long, strong, closely arranged, 3-7, usually 4 in number, innermost pair well spaced. Posterior scutellar margin densely fringed with pale fine setae; axillary cord also with pale setae; metapleurotergal callus with single row of  $30\pm$  black strong setae. Prosternum large, squarish, moderately sclerotized; anterior mesosternal process small, acute at apex. Wing ample, widest near base; vein C interrupted before apex of  $R_1$ ; apical 1/2 of  $R_{2+3}$  coalescent with C; apical 1/2 of  $R_{4+5}$  running very close and practically parallel to C, with 1 sensorium at midlength of its abscissa 2, and 6-8 sensoria near apex; im nearly equidistant to rm and mcu; axillary area unusually large, with well developed vein 2A; cell 3bc short; wing membrane lacking setulae; no cilia on anal margin. Femur 1 rather robust, anterior surface rather evenly setose, with  $8\pm$  long and  $2\pm$  short erect bristles near apex. Basitarsus 3 ventrally with basal setae irregularly arranged, not forming comb. Abdomen of  $\mathfrak{P}$ : Median plates of tergites 3-5 small, occasionally hardly definable; sidepiece of tergite 6 fairly large, of similar size and shape as that of tergite 7; supra-anal plate

<sup>3.</sup> Possibly the O. erythrocephala sensu Bequaert 1954, as shown by his figures 38 I and K, is composed of 2 closely related species belonging to categories A and B respectively. Their separation would need intensive comparison of both the types of 12 nominal species and extensive series of fresh material. The problem is here left open.

well definable; sternite 1 with 3-4 rows of well spaced spines; pregenital plate quite large, posteriorly projecting, medially interrupted, forming pair of lamella-like processes. Abdomen of  $\sigma$ : Median plates of tergites 3-5 very large; sternite 1 as in  $\varphi$ ; sternite 5 represented by pair of large elliptical, moderately sclerotized plates; aedeagus in profile long, slender; paramere moderately long, slender, bare. Puparium with numerous pneustic pores evenly covering 6 sectors of posterior "cap"; median groove sparsely granulose.

Systematics. Ornithophila has no very close relatives and is apparently one of the most archaic of the Ornithomyinae. It can immediately be distinguished from other hippoboscid genera in having very characteristic wing-shape and venation and having large side-pieces of sternite 5 in both sexes. It more or less serves as a link between Ornithoica and Ornithomya and stands much closer to the latter than to the former genus. It shares with Ornithoica in the forward crowding of branches of vein R, pale rings on tibiae, absence of basal comb under basitarsi 3, presence of supra-anal plate and well developed side-pieces of tergite 7 (9) but the structure of its head and thorax as well as the chaetotaxy of abdomen are closely similar to that of Ornithomya. In addition to the characters mentioned above, Ornithophila differs from Ornithomya in having anterior thoracic spiracle not dorsolateral, scutellar bristles not loosely arranged, prosternum not small and indistinct, and so on. Superficially the former genus can usually be recognized by its very dark and characteristic color pattern of thorax. The 2 species included, metallica and gestroi, are very closely allied to each other.

#### Ornithophila metallica (Schiner, 1864)

MATERIAL. 140 33, 309 우우. The following data are summarized chiefly from collections in Bishop Mus., Field Mus. and Mus. Comp. Zool.

BECHUANALAND: 19. Shakawe, Ngamiland, ex Turdoides m. melanops.

MOZAMBIQUE: 233. Chiuta, ex Tchagra senegala & bird #ALM -A-138.

TANZANIA: 19. Masailand, Messeran, 1000 m, ex Lanarius funebris.

UGANDA: 833, 1699. Bunyoro, Budongo Forest; Bunyoro, Kasokwe; Busana; Entebbe; Kampala; Kigezi; ex Campethera cailliaudi nyasae, Chrysococcyx caprius, Cinnyricinclus leucogaster, Clamator cafer, Corvus albus, Cuculus solitarius, Eurystomus afer, Gymnobucco bonapartei intermedius, Lamprocolius splendidus, Lybius bidentatus aequatorialis, Malaconotus p. poliocephalus, Onychognathus wallacei alaoncensis, Prionops cristatus omoensis, Stilbopsar stuhlmanni.

LIBERIA: 333, 599. Banga; Moala; Shawe Yanghi nr Bakratown; ex Andropadus [Pycnonotus] latirostris, Chrysococcyx c. cupreus, Dicrurus modestus atratus, Melittophagus g. gularis, Oriolus nigripennis.

NIGERIA: 13. Ondo Prov., Ifon.

GABON: 299. M'Bigou, Mt du Chaillu; Mimorgo-Poing, ex Halcyon badius, Ploceus nigerrimus.

CONGO: 13, 499. Avakubi; Elisabethville, Kabirda; Semliki R.; ex *Eurystomus afer*, *Machaerhamphus anderssoni*.

SUDAN:  $2\varphi\varphi$ . Madart on R. Gash, Aroma, Kassala Prov.; Malakal, Taufikia Forest; ex Dicrurus adsimilis divaricatus, Necrosyrtes monachus.

EGYPT: 13, 499. Abu Limkel; Abu Rawash Imbaba, Giza Prov.; El Barada, Qalyub; Wadi Nassim; ex Corvus corone, Pycnonotus barbatus arsinoe, Tyto a. alba, Upupa epops major.

SPAIN: 13. Fraga, SW Leride, ex Galerida cristata.

FRANCE:  $13^{\circ}, 399$ . Carmargue, Tow de Valat; ex Anthus campestris; Passer domesticus. NETHERLANDS:  $13^{\circ}$ . Putten, ex Garrulus glandarius.

GERMANY: 233, 399. Prov. Brandenburg: Charlottenburg.

JUGOSLAVIA: 19. Trieste.

GREECE: 499. Parnes; ex Athene noctua, Garrulus glandarius, Otus scops.

CYPRUS:  $3\varphi\varphi$ . Limassol; Yermasoyia R.: Zakaki; ex Corvus corone pallescens [C. c. sardonius], Falco tinnunculus, Parus major aphrodite.

ASIA MINOR:  $13^{\circ}$ ,  $19^{\circ}$ . SE Tatvan Bitlis; Abant; ex quail; hoopoe [Upupa epops]

AFGHANISTAN:  $2\Im \Im$ ,  $3\varphi \varphi$ . Bamian; Doab; Kabul; ex *Emberiza luteola*, *E. cimpar*, *Motacilla alba*, *Passer domesticus bactriana*.

CHINESE TURKESTAN: 2♂♂, 1♀. Khardong Valley, Karakorum, Sinkiang.

W. PAKISTAN: 19. Quetta, ex Passer montanus.

INDIA:  $13^{\circ}, 49^{\circ}$ . Bombay; Deccan; Ganges; New Delhi; ex Copsychus saularis, Coturnix c. coturnix, Merops orientalis, Passer montanus, Psittacula krameri, Ruticilla atrata, Strix ocellata, Turdoides malcolmi.  $13^{\circ}$  (Zool. Surv. India, Calcutta), Kurseong, E. Himalayas, "type" of Ornitheza holochrocera Speis. (unpublished!)

E. PAKISTAN: 12. Chittagong Hill Tracts, Mahallya, 10 km N of Manimukh, ex Pellorneum ruficeps.

BURMA: 499. Myitkyina, ex *Eurystomus orientalis, Garrulax l. leucolophus*, black-headed oriole.

THAILAND: 2533, 5899. Bangkok; Chaiyaphum; Chanthaburi; Chiengmai; Chiengrai; Kamphaeng Phet; Kanchanaburi; Lampang; Lopburi; Nakhonsithammarat; Nakhon Sawan; Nan; Phangnga; Prachuap Khiri Khan; Ranong; Sakhon Nakhon; Satun; Trang; ex Acridotheres fuscus, A. tristis, Actinodura ramsayi, Actitis hypoleucus, Cettia diphone, Chloropsis aurifrons, Chrysococcyx maculatus, Chrysocolaptes lucidus, Cinclidium (= Myiomela) l. leucurum, Copsychus saularis, Coracias benghalensis, Coracina novaehollandiae, Corvus macrorhynchos, Corydon sumatranus, Dendrocitta formosae, Dicrurus hottentottus, D. paradiseus, D. remifer, Garrulax leucolophus, Gracula religiosa, Heterophasia annectans, Hirundo rustica, Hypsipetes flavala, Irene puella, Megalaima faiostricta, M. franklinii, Monticola solitarius, Muscicapa banyamas, M. grandis, M. monileger, Myiophoneus caeruleus, Napothera brevicaudata, Nyctiornis athertoni, Otus sp., Pellorneum ruficeps, Phragmaticola aedon, Pitta brachyura, P. cyanea, Pomatorhina sp., Pycnonotus aurigaster, P. jocosus, Sturnus contra, S. leucocephalus, S. nigricollis, Tephrodornis paradisi, Timalia pileata.

VIETNAM:  $3\varphi\varphi$ . Muong Moun, Tonkin, Dalat; Lao Bao; ex Alcippe poliocephala, Garrulax leucolophus, Heterophasia sp.

CHINA PROPER: 299. Hainan I.; Mong Tseng, Hong Kong; ex *Erithacus calliope*, *Motacilla* sp.

TAIWAN: 1933, 4199. Chiayi; Kaohsiung; Nantou; Taipei; Taitung; ex Alcippe nipalensis morrisonia, Chaimarrornis fuliginosus affinis, Corvus macrorhynchos, Dendrocitta f. formosae, Dicrurus aeneus braunianus, D. macrocercus harterti, Garrulax canorus taewanus, Heterophasia auricularis, Hypsipetes madagascariensis nigerrimus, Megalaima oorti nuchalis, Otus bakkamoena, Turdus ch. chrysolaus, Urocissa caerulea.

KOREA: 233. Seoul, ex Motacilla alba leucopsis.

JAPAN: 19. Yamaguchi, ex Emberiza cioides.

MALAYA: 13, 899. Pahang, Bentong; Selangor, R. Panjang; Selangor, Subang; Selangor, Sungei Way; ex Copsychus saularis, Halcyon concreta, Hirundo rustica, Otus scops, Pitta brachyura, Pycnonotus goiavier.

BORNEO: 233, 299. Jesselton, Kalabakan, Ranau, Tenom: all in Sabah; ex Copsychus malabaricus, C. saularis, Malacopteron affine, Pycnonotus goiavier.

JAVA: 19. Bogor, ex Oriolus chinensis.

PHILIPPINES: 933, 2399. Luzon: Dupax; Nueva Vizcaya, Dalton Pass; Solsona; Tayabas, Casiguran; Mindoro: Pasi; Oriental. Leyte: Santa Cruz; Mt Lobi Range. Negros Oriental: Maria. Mindanao: Mt Hilong-Hilong, Agusan Prov.; Mt Malindang, Zamboanga Prov.; Mt Mayo, Davao Prov. Basilan. Palawan: Brooke's Point; Puerto Princesa. Balabac: Minagas Point. Ex Artamus l. leucorhynchus, Chrysocolaptes lucidus rufopunctatus, Cisticola exilis rustica, Coracina striata, Criniger tephrogenys, Dicrurus hottentottus striatus, D. leucophaeus, Emberiza sulfurata, Eurystomus orientalis cyanicollis, Gracula religiosa, Halcyon smyrnensis gularis. Harpactes a. ardens, Hypsipetes everetti, Macronus flavicollis, M. striaticeps cummingi, Malacopteron magnum, Merops americana, Oriolus basilanicus, O. chinensis, Otus (=Mimizuku) gurneyi, Pachycephala philippinensis, Prioniturus discurus water-stadti, Pycnonotus goiavier samarensis, Sarcops calvus melanotus.

W. NEW GUINEA: 233, 599. Hollandia; Kebar Valley, Vogelkop Penin.; Nabire; ex Aplonis sp., Cracticus c. cassicus, Gymnocoryus tristis, Paradisaea m. minor.

E. NEW GUINEA: 2533, 4199. Ahola; Amboga, Mt Lamington; Ambunti, Sepik Distr.; Balimo; Bulolo; Dobadura; Finschhafen; Jumbora; Cape Killerton; Morobe Distr.; Oriomo; Pindiu; Popondetta, N. Distr.; Saha; Sangara; Sinaeada, Milne Bay; Soputa; Wau; Zeani; ex Ailuroedus crassirostris, Aplonis metallica, Coracina caeruleogrisea strenua, Corvus orru, Cracticus cassicus, Dicrurus bracteatus, Eurystomus orientalis, Gymnocorvus tristis, Haliastur indus, Hemiprocne mystacea, Henicopernis longicauda, Manucodia ater, Melanopyrrhus anais, Mino dumontii, Oriolus szalayi, Psittaculirostris edwardsi, Sauromarptis gaudichaud, "bird-of-paradise", "cougal" (?Centropus sp.), drongo (?Dicrurus bracteatus), grackle (?Mino dumontii), "black-headed blue jay", "kingfisher", black-cap lory (?Lorius roratus), "magpie", "pigeon", shrike (?Lanius schach), "starling", "shining starling", swift", "wagtail", "man".

BISMARCK ARCHIP.: 333, 1299. Gaulim, Mt Sinewit, Taliligap: all in New Britain; ex Accipiter novaehollandiae, Centropus violaceus, Corvus orru, Eurystomus orientalis, Halcyon albonotatus, H. chloris tristrami, Gallicolumba beccarii johannae, Hemiprocne mystacea aeroplanes, Mino dumontii, Philemon novaeguineae, Pitta macklotii. 19, Lihir I., ex Halcyon chloris. 19, Boang I., Tanga Is., ex Halcyon chloris.

SOLOMON IS.: 233, 999. Arambu Is., Fauro; Malangona, Choiseul; Pepele, Kolombangara; Tabalia, Guadalcanal; Toumod, Fauro; Ulo Crater, Vella Lavella; ex Aplonis metallica, Coracina papuensis, Eurystomus orientalis, E. solomonensis, Geoffroyus laterocercus, Mino dumontii, Monarcha castaneiventris, "Rousettus amplexicaudatus" (fruitbat).

AUSTRALIA: 433, 699. Brisbane, Queensland; Broot I.; Coolabah, N. S. Wales; Dinner Creek, Queensland; Mt Lyndhurst, S. Australia; Cape York; ex *Acanthogenys ru*-

fogularis, Artamus leucorhynchus, Eurystomus orientalis, Halcyon macleayi, Megapodius reinwardt tumulus, Merops ornatus.

NEW HEBRIDES: 1533, 21우우. Espirito Santo; Tanna; ex Halcyon chloris.

NEW CALEDONIA: 19. Paita, ex Halcyon sancta.

LOYALTY IS.: 233, 299. Lifou.

FIJI: 699. Lau (Kimbombo, Ongea, Sovu); Munia I.; ex Halcyon chloris.

SAMOA: 233, 19. Tutuila, Upolu, ex Aplonis brevirostris, Halcyon chloris.

Habitats. Breeding in Old World tropics and subtropics, with southernmost records from Cape Prov. and Tasmania, westernmost from western Europe, northernmost from Bering I. and easternmost from the Samoan Is. The lack of records from the Indian Ocean islands is apparently due to insufficient collecting. Polyxenous, probably in most countries breeding chiefly on Passeriformes, while in Melanesia and Polynesia, chiefly on Alcedinidae. Often found in association with louseflies of other genera, the population density is never high. Among the 218 field numbers of fresh material from the Pacific area, 193 revealed 1 metallica each, 21 revealed 2 each; highest density per infested bird was 3 flies, the hosts involved and other data were Monticola solitarius (SMRL 399), II.1962, Thailand; "drongo" (BBM 29920), X.1963, New Guinea; Eurystomus orientalis (BBM 28744), IX.1963, New Guinea; Dicrurus bracteatus (BBM 22391), no date, New Guinea. An analysis of host records listed under the subheading "Material" is given below. Accipitridae 5 records (Accipiter 1, Haliastur 1, Henicopernis 1, Machaerhamphus 1, Necrosyrtes 1); Falconidae (Falco) 1. Megapodiidae (Megapodius) 1; Phasianidae 3 (Coturnix 2, quail 1). Charadriidae (Actitis) 1. Columbidae 2 (Gallicolumba 1, pigeon 1). Psittacidae 4 (Prioniturus 1, Psittacula 1, Psittaculirostris 1, black-cap lory 1). Cuculidae 8 (Centropus 1, Chrysococcyx 4, Clamator 1, Cuculus 1, cougal 1). Strigidae 8 (Otus 4, Strix 3, Tyto 1). Apodidae 5 (Hemiprocne 2, swift 3). Trogonidae 1 (Harpactes). Coraciidae 19 (Coracias 1, Eurystomus 18); Alcedinidae 27 (Halcyon 24, Sauromarptis 1, kingfishers 2); Meropidae 5 (Melittophagus 1, Merops 3, Nyctiornis 1); Upupidae (Upupa) 2. Picidae 4 (Campethera 1, Chrysocolaptes 3); Capitonidae 7 (Gymnobucco 1, Lybius 1, Megalaima 5). Eurylaimidae (Corydon) 1; Pittidae (Pitta) 4; Alaudidae (Galerida) 1; Hirundinidae (Hirundo) 2; Pycnonotidae 28 (Criniger 1, Hypsipetes 17, Pycnonotus 10); Campephagidae 5 (Coracina 4, Tephrodornis 1); Muscicapidae 58 (Actinodura 1, Alcippe 3, Cettia 1, Chaimarrornis 1, Cinclidium 1, Cisticola 1, Copsychus 7, Emberiza 4, Erithacus 1, Garrulax 7, Heterophasia 3, Macronus 2, Malacopteron 2, Monarcha 1, Monticola 5, Muscicapa 3, Myiophoneus 1, Napothera 1, Pachycephala 1, Pellorneum 3, Phragmaticola 3, Pomatorhinus 1, Ruticilla 1, Timalia 1, Turdoides 2, Turdus 1, sylviid 1); Motacillidae 6 (Anthus 1, Motacilla 4, wagtail 1); Laniidae 6 (Laniarius 1, Lanius 3, Malaconotus 1, Tchagra 1); Prionopidae (Prionops) 1; Artamidae (Artamus) 3; Irenidae 2 (Chloropsis 1, Irene 1); Paridae (Parus) 1; Meliphagidae 3 (Acanthogenys 1, Philemon 1, Pogonornis 1); Ploceidae 5 (Passer 4, Ploceus 1); Sturnidae 31 (Acridotheres 4, Aplonis 4, Cinnyricinclus 1, Gracula 4, Lamprocolius 1, Melanopyrrhus 1, Mino 3, Onychognathus 1, Sarcops 1, Stilbopsar 1, Sturnus 5, grackle 3, starling 2); Oriolidae (Oriolus) 7; Dicruridae 14 (Dicrurus 13, drongo 1); Corvidae 38 (Corvus 11, Dendrocitta 16, Garrulus 1, Gymnocorvus 2, Urocissa 5, blue jay 1, magpie 4); Cracticidae (Cracticus) 5; Ptilonorhynchidae (Ailuroedus) 1; Paradisaeidae 5 (Manucodia 1, Paradisaea 2, bird-of-paradise 2).

In summary, there were 6 records for Falconiformes, 4 for Galliformes, 1 for Charadriiformes, 2 for Columbiformes, 4 for Psittaciformes, 8 for Cuculiformes, 7 for Strigiformes,

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5 for Apodiformes, 1 for Trogoniformes, 53 for Coraciiformes, 11 for Piciformes, 219 for Passeriformes.

Bequaert (1953a: 247-282), Evans et al. (1963: 486) and Zumpt (1966: 83), basing upon both material examined and records previously published, listed 49, 2 and 12 birdgenera respectively as hosts of *O. metallica*. Among them, I have not seen material from the following genera: Ardea; Aviceda; Francolinus, Perdix; Loriculus, Micropsitta; Corythaeola; Colius; Apaloderma; Aerops; Mesopicos, Trachyphonus; Cheramoeca, Leiothrix, Melocichla, Myiagra, Oenanthe, Parisoma, Telophorus, Meliphaga, Carduelis, Montifringilla, Poliospiza, Bubalornis, Quelea, Pastor, Pyrrhocorax. In short, up to the present, O. metallica is known from 134 genera, 42 families, 13 orders of birds.

Affinities. Among the many synonyms listed by me (1963: 92), odontoscelis Speis. 1904 was recognized by Theodor et al. (1964: 35) as a distinct species. The type ( $\mathcal{F}$ ) and the only known specimen, now destroyed, was ex Saxicola aurita Temm<sup>4</sup>., Jugoslavian coast on the Adriatic Sea. The type-host belongs to a group of birds (Muscicapidae: Turdinae) preferred by O. metallica and the type-locality lies well within the range of that fly. Meanwhile the only known distinctive character of odontoscelis (Greek, toothed leg), i. e., the sharp, right-angled ventral edge near the knee of midleg, seems to have been over-emphasized or exaggerated, or might have resulted from the contraction state of a dry specimen. Until any topotypes ex the type host become available, odontoscelis would at best stand as a synonym of metallica.

Hyperparasitism, Phoresy. One case of fungus infestation (Beq. 1953: 140) and 2 cases of mite parasitism (Evans et al. 1963: 486) have been recorded for Ornithophila metallica. The fungus involved was undetermined, the mite was Myialges macdonaldi Evans & Fain whereas the host birds were Halcyon chloris (Bismarck Archip.), Telophorus zeylonus (Transvaal) and Leiothrix lutea (introduced from the Far East), respectively. Among the material at hand, 25 new cases of mite parasitism were noted (Table 2). The mites are yet undetermined. They are mostly found attaching to axillary cords of the parasitized flies. This is a phenomenon different from that in Ornithoica, Ornithomya and other flies where the mites are mostly on abdomen. Although there is only 1 previous record, the phoresy of Mallophaga Ischnocera seems rather common in O. metallica. The 15 new cases of such phoresy is given in Table 3. With no exceptions, all lice in question are found attached to the sides of abdomens of flies, with their heads directed forward. The host-birds are nearly all of Passeriformes.

### Ornithophila gestroi (Rondani, 1878)

MATERIAL. Besides the type series  $(13^{\circ}, 49^{\circ})$  in Genova, Firenze and Harvard museums, the only specimen I have seen is  $13^{\circ}$  (Brit. Mus. Nat. Hist.), Crete: Heraklion, ex *Falco eleonorae*, VIII.1960, I.C.T. Nisbet. The single specimen (wing 5 mm long) from Switzerland (no host record) doubtfully referred to as *gestroi* by Theodor et al. (1964: 33) and not seen by me, most probably belongs to *metallica* instead.

Habitats. Confined to Mediterranean Subregion and apparently to Falconiformes: Fal-

<sup>4.</sup> The name Saxicola aurita Temm. was not included in Peters' (1964) Check-List of birds of the world, vol. X which deals with Saxicola and related genera. Some authors considered it a synonym of Oenanthe h. hispanica Linn.

## Pacif. Ins. Monogr.

Bird		Fly	Country	Site of Attachment
Accipitridae: Haliastur indus	13	(BBM 29263)	SE New Guinea	axillary cord; wing-base
Strigidae : Otus scops	1우	(M 1853)	Malaya	abdomen
Meropidae: Nyctiornis athertoni	1우	(RE 6283)	Thailand	abdomen
Capitonidae : Megalaima franklini	1우	(MAPS 2562)	"	axillary cord
Irenidae: Chloropsis aurifrons	18	(SMRL 1258)	"	axillary cord
Pittidae: Pitta brachyura	1우	(M 1262)	Malaya	wing-base
Pycnonotidae : Hypsipetes flavala " madagascariensis	1우 1우	(MAPS 2848) (TMT 601)	Thailand Taiwan	axillary cord axillary cord; wing-base
Pycnonotus goiavier " jocosus	1우 1우	(H 0999) (MAPS 3493)	Malaya Thailand	metanotum axillary cord
Muscicapidae: Copsychus malabaricus Heterophasia auricularis "sp. Macronus flavicollis	18 19 19 19	(JF 8694) (TMT 384) (#204) (BBM 947)	Borneo Taiwan Vietnam Philippines	wing-base abdomen wing-base axillary cord
Sturnidae : Acridotheres fuscus	13 13	(SMRL 1089) (SMRL 1114)	Thailand	neck abdomen; axillary
" tristis	13	(SMRL 1223)	11	axillary cord
Sarcops calvus Sturnus contra "grackle" "shining starling"	18 18 18 18	(#7836) (SMRL 674) (BBM 28795) (BBM 28707)	Philippines Thailand SE New Guinea	" wing-base neck
Oriolidae : Oriolus szalayi	1우	(BBM 20777)	New Britain	axillary cord
Dicruridae: Dicrurus hottentottus	1우	(SMRL 198)	Thailand	axillary cord
Corvidae : Dendrocitta formosae	1우	(TMT 553)	Taiwan	axillary cord;
"Bird"	13	(RE 6267)	Thailand	axillary cord

 Table 2 Mite parasitism of Ornithophila metallica.

conidae, so far only recorded from Galita I. nr Malta; Crete: both ex *Falco eleonorae*, and from Tangier, ex *F. tinnunculus* (vide Gil Collado 1932: 40). This is quite in contrast to *O. metallica* which has much wider distributional range and different host preference (see above) and had very few stray records from Falconiformes.

Affinities. Rondani (1878: 156 footnote) separates gestroi from metallica by "proboscide lutescente non nigra, tibiis praesertim anticis linea nigra anteriore non marginatis, femoribus satis crassis, tarsis intermediis non totis nigricantibus, et statura circiter duplo majore"; while Theodor et al. (l. c.), by eyes relatively smaller, postvertex relatively shorter, orbital setae darker and stronger, palpi longer, lunula and antennae very pale, scutellum with broader pale band at base and with an additional pale triangular marking at apex, me-

Bird	Fly	Country	Lice
Alcedinidae: Halcyon chloris	19	New Hebrides	1
Pittidae: Pitta brachyura	19 (M 1262)	Malaya	1
Pycnonotidae : Hypsipetes madagascariensi	s 13, 19 (TMT	Taiwan	6;1
Pycnonotus goiavier	1우 (#31038)	Malaya	3
Muscicapidae: Garrulax canorus Heterophasia auricularis Pellorneum ruficeps	1 우 (TMT 005) 1 우 (TMT 301) 1 우	Taiwan E. Pakistan	$ \begin{array}{c} 1\\ 2\\ 1 \end{array} $
Laniidae: Tchagra senegala	1ð (ALM-A-93)	Mozambique	12
Sturnidae: Gracula religiosa Mino dumontii Sturnus nigricollis	1♂(BBM 698) 1♂(BBM 22559) 1♂(SMRL 1088)	Philippines NE New Guinea Thailand	1 1 3
Dicruridae: "drongo"	19 (BBM 29920)	SE New Guinea	1
Corvidae: Dendrocitta formosae	19 (TMT 535)	Taiwan	1
Paradisaeidae : Paradisaea minor	13 (BBM 810)	NW New Guinea	1

 Table 3.
 Mallophagan phoresy of Ornithophila metallica.

dian plates of  $\mathcal{J}$  tergites 3 and 4 hardly more than 1/2 as wide as scutellum, size larger. The color pattern as well as the shape of postvertex and relative width of median plates of tergites 3 and 4, are too variable to be relied upon. The chief criteria for the separation of the 2 species appear to be the body size (wing length 6.5-7 vs 4-5 mm), relative length of palpi (ca 1 vs 0.6 as long as lunula), relative width and convexity of inner orbits, relative length of eyes, and abdominal chaetotaxy. The 3 genitalia as well as chaetotaxy of femora 1 and tarsi 3, yet unexamined, may show some differences, too. Relative measurements of the  $\mathcal{F}$  from Crete (scale 35 units = 1 mm): Length, head (frontal notch to occipital margin) 53 units, eye 40, postvertex 14, mediovertex 22, lunula 12, frons proper (interantennal area) 5, palpus (exposed part) 13, prescutum 37, scutum 27, scutellum 22; width, head 72, eye (in front view of head) 18.5, mediovertex (minimum) 19, inner orbit (maximum) 9; interdistance, inner ocular margins (minimum) 33, bases of vertical bristles 36, outer margins of anterior thoracic spiracles 76. Measurements of the  $\rho$  paratype at Mus. Comp. Zool. Harvard (scale 60 units=1 mm): Length, postvertex 28 units, mediovertex 45, lunula plus frons 21; width, mediovertex (minimum) 41, inner orbit (maximum) 17, eye (in front view of head) 42. In the same  $\varphi$  paratype, the side-pieces of tergites 6 and 7 each bears 5-6 long bristles plus few short setae; setae forming anterior urogenital fence hardly stouter and longer than neighboring ones; pregenital plates each bears ca 8 long and 12 short setae.

### Genus Ornithoctona Speiser 1902

Generic Characters. Eye large; ocelli always well developed. Antennal segment 2 with 10 + black strong setae arranged in double row on outer surface near base; arista leaf-like, slightly broader than in Ornithomya; antennal appendage leaf- or spoon-shaped, long or very long, acute, blunt or very broadly rounded at apex, no terminal bristle; outer surface with black strong setae, its upper and lower margins both sharp; dorsal surface depressed along outer margin and near apex, its setae largely arranged near outer and inner margins. Palpus short. Frons proper (interantennal area) shorter than in Ornithomya; frontal process short, narrowly membranous along anterior margin, not or hardly protruding forward to level of vibrissal area. Vibrissal spines fairly numerous. Anterior thoracic spiracle dorsolateral. Single or several notopleural bristles; scutellar bristles usually fine and short, always loosely arranged, 6-8 in number, innermost pair well spaced. Posterior scutellar margin sparsely fringed with pale fine setae; axillary cord with black strong setae; metapleurotergal callus bare. Prosternum small, usually hardly definable from mesosternum; anterior mesosternal process large, usually very long, acute at apex. Wing ample, distinctly narrower than in Ornithophila and Ornithomya, widest near midlength; vein C interrupted before apex of Sc;  $R_{2+3}$  normal;  $R_{4+5}$  also normal, with 1 sensorium near midlength of abscissa 2 and 3-4 sensoria near apex; im much closer to rm than to mcu; axillary area normal, vein 2A poorly developed; cell 3bc rather long; wing membrane either entirely bare or with setulae on part of cells 3r and 1m; anal margin very sparsely ciliate. Femur 1 robust, anterior surface unevenly setose, with  $15\pm$  long and  $5\pm$  short erect bristles near apex. Basitarsus 3 with uniseriate ventral comb at base. Abdomen of  $\varphi$ : Median plates of tergites 3-5 small, or entirely wanting; side-piece of tergite 6 rather small, that of tergite 7 either exceedingly small or wanting; supra-anal plate wanting; sternite 1 with many rows of dense spines; pregenital plate wanting. Abdomen of  $\mathcal{F}$ : Median plates of tergites 3-5 large; sternite 1 as in  $\varphi$ ; sternite 5 sometimes represented by pair of large plates; aedeagus in profile usually long, slender; paramere also long, slender. Other characters similar to that in Ornithophila and Ornithomya. Puparium (in species already described) with numerous pneustic pores evenly covering 6 sectors of posterior "cap"; median groove densely granulose.

Systematics. Ornithoctona stands intermediate of Stilbometopa and the Ornithomya-complex. In structure and particularly in tendency of deviation-speciation, it is evidently closely related to Stilbometopa. Due to the wide variational range of certain characters within the genus itself and to the uniform but much advanced stage of speciation in Stilbometopa, Ornithoctona is less easily separable from Ornithomya than from Stilbometopa. Thus from the former genus, and its close relatives Crataerina and Myophthiria, it differs chiefly in the shapes of antennal appendages and wings, and the chaetotaxy of axillary cord; while from the latter genus, it differs in the presence of ocelli, normal shape and normal bristle-arrangement of scutellum, indistinct metapleurotergal calli and metasternal processes, much larger lower-calypteres and much denser bristles on axillary cords. There are, however, several important characters to separate it from the Ornithomya-complex, and at the same time to bring it closer to Stilbometopa, such as the paired plates for sternite 5 (a), the apical lamella-like process under tibia 1 ( $\varphi$ ), the absence of wing-setulae and median tergal plates ( $\varphi$ ), etc. None of these is universal within the genus, and they cannot be counted as "key" characters.

The genus was subdivided by Bequaert (1954) into 2 subgenera, *Ornithopertha* for *nitens* and *Ornithoctona* s. s. for all remaining species, and by Maa (1963), into 3 species-groups typified by *australasiae*, *nitens* and *plicata*, respectively. In this paper, the Plicata group is further split into 2 independent groups, one for the New World and another for the Old World species. There is no published synoptic key for the entire genus and the one

by Bequaert (1954: 186-187) covers only 5 American species. As mentioned above, nearly every species of the genus has a very closely related counterpart coexisting in the same zoogeographical region. This makes the construction of a workable key quite difficult particularly when the intraspecific variation of a given species is little explored.

Hyperparasitism, Phoresy. In contrast to that in Ornithophila, the hyperparasitism by mites and the phoresy of Mallophaga Ischnocera are rare in Ornithoctona. Nothing heretofore is known about its hyperparasitism by fungi. There are only 2 and 10 published records of mite-parasitism in O. fusciventris and O. erythrocephala, respectively (Beq. 1953: 156, 1954: 200, 1957: 575); the host-birds involved were Calospiza arthus in O. fusciventris, and Accipiter striatus, Falco sp., Columba inornata, Oreopeleia linearis, and "gavilan" in O. erythrocephala. Also recorded were 1 case of phoresy in O. fusciventris ex Pselliophorus tibialis and 4 cases in O. erythrocephala ex Amazona aestiva, Momotus momota, Oreopeleia montana, and Pionus sordidus (Beq. 1953: 172, 1954: 200). Among specimens unreported by Bequaert, I find only 2 new cases of phoresy (see p. 240).

#### KEY TO ORNITHOCTONA SPECIES

- - Wing-setulae covering part of cells 3r and 1m, sometimes even apex of 2r as well; anterior mesosternal process narrow, distinctly longer than wide at base; length of postorbit subequal to greatest width of inner orbit; anterior ocellus situated on or slightly above level of posterior eye-margins;  $\varphi$  abdomen with 3 median tergal plates; wing (except in *oxycera*) not more than 7.5 mm long. (Australasiae group) ... 6

#### Pacif. Ins. Monogr.

Sternite 1 (fig. 12) distinctly narrowed posteriorly; bristles fencing urogenital area (fig. 27) less numerous; laterite 2 (fig. 21) relatively shorter. Continental Africa<sup>4</sup>

laticornis
 10 (9). Antennal appendage (fig. 1-2) usually long, narrow and pointed at apex in frontal view, its under surface lacking inner submarginal carina; palpus (fig. 9) relatively long and narrow; sides of abdomen (fig. 24) with more numerous bristles. Malaya to Solomon Is.
 australasiae
 Antennal appendage (fig. 6) blunt at apex, never as described above, its under surface with well defined inner submarginal carina; palpus (fig. 8) relatively short and broad; sides of abdomen (fig. 22) with few bristles. Borneo.

#### Ornithoctona australasiae (Fabricius, 1805)

Fig. 1, 2, 9, 13, 18, 24, 33.

Material. 7♂♂, 75♀♀.

JAPAN: 19. Mt Fuji, ex Parus major minor.

MALAYA:  $2\varphi\varphi$ . Mt Brinchang, Cameron Highlands, ex Alcippe poioicephala. Leiothrix argentauris.

SUMATRA: 3우우. Dempu, 1400 m; Sungei Kumbang; Tandjong Morawa, Serdang; no host records.

JAVA: 399. Tijbodas, 1400 m; Mt Gede; ex Pycnonotus bimaculatus.

PHILIPPINES: 533, 3899. Mt Mayo, Davao Prov.; Mt Matutum, Cotabato Prov.; Mt Hilong-Hilong, Agusan Prov.; Mt Katanglad, Bukidnon Prov.; Mt Canlaon, Negros Oriental; ex Anthus h. hodgsoni, Apoia goodfellowi, Basilornis miranda, Bradypterus caudatus, Coracina striata kochii, Dendrocopos maculatus fulvifasciatus, Dicrurus hottentottus striatus (2 lots), Halcyon hombroni, Hypocryptadius cinnamomeus ssp. (2 lots), Hypothymis a. azurea, Hypsipetes philippinus saturatior, Lanius cristatus lucionensis (2 lots), Muscicapa crypta (2 lots), M. mugimari, Orthotomus cinereiceps obscurior, Pachycephala philippinensis apoensis (4 lots), Parus elegans, Phylloscopus olivaceus, Rhinomyias ruficauda samarensis (3 lots), Rhipidura superciliaris apo (3 lots), Turdus poliocephalus ssp. (3 lots), Zoothera andromedae (2 lots).

NEW GUINEA: 233, 2699. Enarotali; Star Mts, Sibil Valley; Telefomin, Sepik Distr; Banz, W. Highl.; Kuta, W. Highl.; Tari, S. Highl.; Mt Kaindi; Bulldog Rd; Edie Creek; Mt Missim; Wau (all 5 localities in Morobe Distr.); Simbai, Madang Distr.; Kamang, Kubor Range; Uinma, Kubor Rge; ex Chlamydera lauterbachi, Ducula chalconota smaragdina, Edalisoma m. montanum, Epimachus fastosus, Falco severus papuanus, Lanius schach stresemanni, Megalurus timoriensis (2 lots), Melidectes belfordi, Poecilodryas albonotata, Ptiloprora g. giusei, Rhipidura sp., giant wood swallow [Artamus maximus] (BBM 21536), shrike [Lanius schach stresemanni] (BBM 28244), "possum" (BBM 28880), birds indet. (BBM 177, 20041, 52117, 52265, 52314, S 147).

SOLOMON IS.:  $2\varphi\varphi$ . Gollifer's Camp, Kolombangara, ex *Pachycephala pectoralis*.

Habitats. Widely spread over SW Pacific Area; so far known from Malaya, Sumatra,

<sup>4.</sup> Probably *idonea* of Madagascar runs to here. If the drawings in the original description are to be trusted and were based on Madagascan material, the species would be separable from *laticornis* in having antennal appendage relatively more acute at apex, palpus longer, mesosternal processes closer to each other and posterior marginal bristles on laterite 2 much shorter.



Fig. 1-9. Ornithoctona, 2, antennae (under surface, 1-6) and palpi (outer surface, 7-9), drawn to same scale. O. australasiae Fabr. from New Guinea; O. fusciventris Wdm., Venezuela; O. hulahula n. sp., Hawaii; O. laticornis Mcq., Tanganyika; O. soror Ferr., Borneo. Fig. 2 showing an abnormal antenna. Compare fig. 15-16 for palpi of other species.

6 soror

Java, Philippines, Tondano nr Celebes, New Guinea and Solomon Is. The single record from Japan is probably a straggler. Host range fairly wide, probably breeding on Passeriformes, particularly Muscicapidae. Analysis of available data follows. Falconidae (Falco) 1 record; Columbidae (Ducula) 1; Alcedinidae (Halcyon) 1; Picidae (Dendrocopos) 1; Pycnonotidae 2 (Hypsipetes 1, Pycnonotus 1), Campephagidae 2 (Coracina 1, Edalisoma 1), Muscicapidae 29 (Alcippe 1, Apoia 1, Bradypterus 1, Hypothymis 1, Leiothrix 1, Megalurus 2, Muscicapa 2, Orthotomus 1, Pachycephala 5, Phylloscopus 1, Poecilodryas 1, Rhinomyias 3, Rhipidura 4, Turdus 3, Zoothera 2), Motacillidae (Anthus) 1, Laniidae (Lanius) 4, Artamidae (Artamus) 1, Paridae (Parus) 1, Meliphagidae 2 (Melidectes 1, Ptiloprora 1),



Fig. 10-21. Ornithoctona, 99, basal abdominal sternites (10-14), palpi (15-16) and anterolateral areas of abdomens (ventral view, 17-21), drawn to same scale. Compare fig. 7-9 for palpi of other species.

Zosteropidae (Hypocryptadius) 2, Sturnidae (*Basilornis*) 1, Dicruridae (*Dicrurus*) 2, Ptilonorhynchidae (*Chlamydera*) 1, Paradisaeidae (*Epimachus*) 1. In summation, Bequaert (1953: 247-282) listed as hosts of *O. australasiae* 8 bird-generaof which I have no fresh material-from the following: Columbidae (*Sphenurus*), Alcedinidae (*Lacedo*), Pittidae (*Pitta*), Oriolidae (*Oriolus*). By combining Bequaert's and my lists, *australasiae* is known up to the present from 35 genera, 18 families and 5 orders of birds.

**Remarks.** One of the  $2\varphi\varphi$  from Wau, New Guinea ex an undetermined bird (S 147) has apices of its antennal appendages noticably blunt. Since it does not differ in other respects, and since the second  $\varphi$  of the same lot has normal antennae, this is considered to be an individual variation. The fig. 2 was drawn from another abnormal  $\varphi$  from Mt Kaindi, New Guinea ex "possum" (BBM 28880).

## **Ornithoctona soror** Ferris, 1926 Fig. 6, 8, 11, 19, 22, 28.

MATERIAL. BORNEO:  $4\varphi\varphi$ . Sabah, Trus Madi, Pampang, Ulu Kaingaran, 1300 m, ex Dicrurus leucophaeus stigmatops (B 19719), Garrulax mitratus treacheri (B 19716), Pachycephala h. hypoxantha (B 19670), VII-VIII.1953, Colonial Off. Med. Res. Unit. All received from Field Nat. Hist. Mus. Chicago.

Habitats. Apparently confined to alpine region of Borneo. The species was hitherto known from  $2\,$  types ex *D. l. stigmatops*, Sarawak, Mt Murud which is not far from Trus Madi. The host preference as well as host range are not quite clear but most probably the species breeds on certain endemic montane Passeriformes. The type host *Dicrurus* belongs to Dicruridae, whereas *Garrulax* and *Pachycephala*, both to Muscicapidae. According to J. Whitehead (1893 Explor. Mt Kinabalu, N Borneo), quoted by B. E. Smythies (1957, *Sarawak Mus. J.* 7 (9): 728, 775), both *stigmatops* and *treacheri* were "One of the ornithological features of the lower slopes of Kinabalu." The former bird is common and conspicuous throughout the cultivated uplands in all parts of Borneo, coming into clearings and as low as 300 m at times and the latter, an abundant montane resident ranging from Kinabalu to Mt Batu Tibang and in mountainous country, found at times in the valleys at low altitude (Smythies, *l. c.*). Both *leucophaeus* and *mitratus* are rather widely distributed in SE Asia (the subspp. *stigmatops* and *treacheri* are endemic to Borneo) while *hypoxantha*, confined to Borneo and ranging from 1000–2500 m but more plentiful at the higher elevation (Smythies, tom cit.: 753).

Affinities. Soror was at first suppressed as a synonym of australasiae by Bequaert (1941b: 269-270) on the assumption that there was only 1 small Ornithoctona species in the Indo-Pacific area. Later it was resurrected by him (1954: 219) but without making any comparison against australasiae. On the other hand, the describer of the species Ferris (1926: 285), after comparing directly with the type of strigilecula (syn. of fusciventris) from S. America, found the only significant differences being that in soror, the antennae were noticeably blunter, the anterior mesosternal processes sharper and longer, and the abdominal setae noticeably more numerous and more slender. He even suggested that soror and strigilecula might eventually be regarded as a subspecies of the same thing. As shown in the key, soror is very closely related to australasiae. The shape of its antennal appendages approaches that in fusciventris. The body size is slightly larger than that of australasiae in average.



Fig. 22-26. Ornithoctona, 99, abdominal apices, dorsal view, drawn to same scale.

Ornithoctona hulahula Maa, new species Fig. 5, 10, 15, 17, 23, 30.

MATERIAL. 299. HAWAIIAN IS.; Holotype (BISHOP 7578), Hawaii I., Olaa, IV.1918, F. X. Williams; paratype (Brit. Mus. Nat. Hist. 1903. 80), head seriously damaged, Molokai I., 950 m, V.1893, R. C. L. Perkins.

Habitats. Confined to the Hawaiian Is., submontane. Host unknown.

Affinities. The damaged Molokai  $\mathcal{Q}$  has a long story in nomenclature. It was first listed as the second unnamed species of Hawaiian Hippoboscidae by Grimshaw (1901: 77), then as Ornithomyia varipes Wk. by Speiser (1902c: 89) and as Ornitheza metallica Schin. by Bequaert (1941b: 262). Finally, it was recorded as Ornithoctona fusciventris Wdm. by Hardy (1952: 481), on the authority of Bequaert who "first named it as O. australasiae Fabr. but later considered it most probably O. fusciventris." The availability of a perfect specimen made it possible to reconsider the true identity of this Hawaiian species. After much comparison and hesitation, it is concluded to be referable to neither australasiae nor fusciventris but to represent an undescribed species. The chief character is the very long bristles on lateral margins and abdominal apex, for which the name hulahula is suggested in allusion to the grass skirts worn by native dancing girls in Hawaii. This is the first endemic hippoboscid to be known from oceanic islands – no Ornithoctonae are known from Galapagos, St Helena, Ascension, etc. Its occurrence in the Hawaiian Is, is apparently a result of long isolation in geological age as well as in

distance. The species can be distinguished easily from its relatives by the unusually short broad sternite 1, large basal papillae of abdominal setae-bristles, large sidepieces of tergite 6 and long strong bristles on sides and apex of abdomen. Insofar as the palpi and antennal appendages are concerned, *hulahula* is closer to *australasiae* than to *fusciventris*.

Description. 9. Head very wide, in front view  $43 \times 60$  (length measured from frontal notch to occipital margin, relative measurements in this and below all at the scale 31 micrometric units=1 mm); interocular face hardly narrowed anteriorly, its smallest width much more (28: 15) than greatest width of eye in front view of head; postorbit slightly longer than width of inner orbit at ptilinal suture; anterior ocellus lying on level of posterior eye-margins. Antennal appendage (fig. 5)  $2.5 \times$  as long as greatest width, in front view apically long, narrow, pointed; inner margin slightly concave before apex; lateral surface very narrow and nearly parallel-sided for its full length; under surface with inner submarginal carina. Palpus (fig. 15) short, broad, sparsely setose. Vibrissal area with 1-2 spines. Scutellum with 6 moderately strong preapical bristles, those of outermost pair much finer than in inner pairs. Anterior mesosternal processes much longer than wide at bases and as long as interdistance of apices. Wing 7.4 mm long; setulae not extensive (? constant), cell 3r similarly setulose as in *fusciventris* and australasiae, 2r and Im entirely bare; vein im as long as 2nd abscissa of  $M_{1+2}$ . Femora less strongly swollen than in *australasiae*; anterior surface of femur 1 (fig. 30) basally strongly setose; tarsi as in australasiae, with more soft setae than in fusciventris. Abdomen (fig. 10, 17, 23) strongly setose, basal papillae of bristles on lateral and apical membranous areas as large as spiracles; urogenital area fenced by numerous, very long robust bristles. Side-piece of tergite 6 unusually large, ca 0.36 mm in length and width, with 5 strong bristles; side-piece of tergite 7 represented by fairly small papilla bearing single seta; interspace between side-pieces of tergite 6 entirely bare; sternite 1 much shorter (17:24) than wide widest immediately behind base, posteriorly distinctly narrowed, with  $4\pm$  rows of spines; laterite 2 long, with very short weak bristles; interspace between spiracles 3 and 5 with many very robust moderately long setae. Other characters similar to that in australasiae. 3 unknown.

## Ornithoctona laticornis (Macquart, 1835) Fig. 4, 7, 12, 21, 26, 27, 31.

MATERIAL. Among specimens examined, the following represents a new host record:  $3\varphi\varphi$  (Canad. Nat. Coll.), Tanganyika, W. Usambara Mts, 1600 m, ex *Cossypha heuglini*. Males exceedingly rare; I have seen only  $1\beta$  in Mus. Comp. Zool. Harvard.

Habitats. Widely spread over entire Ethiopian Region except Malagasy Subregion; definitely known from Cape Prov., Cameroon, Congo, Uganda, Tanzania, Kenya and Ethiopia (Abyssinia). Probably breeding on Passeriformes particularly Muscicapidae, Laniidae and Ploceidae. Recorded hosts are Phoenicopteridae (*Phoeniconaias*); Anatidae (*Anas, Sarkidiornis*); Columbidae (*Columba*); Trogonidae (*Apaloderma*); Alcedinidae (*Ispidina*); Picidae (*Dendropicos*); Eurylaimidae (*Smithornis*), Hirundinidae (*Cecropis, Hirundo*), Pycnonotidae (*Pycnonotus*), Muscicapidae (*Batis, Cossypha=Dessonornis=Bessonornis, Dioptrornis, Muscicapa, Myrmecocichla, Saxicola=Pratincola, Seicercus, Sylvietta, Tchitrea, Terpsiphone, Turdus*), Laniidae (*Dryoscopus, Lanius, Tchagra=Antichromus, Telophorus=Chlorophoneus*), Zosteropidae (*Zosterops*), Fringillidae (*Poliospiza, Serinus, Spinus*), Ploceidae (*Coccopygia, Euplectes=Coliuspasser, Lagonosticta, Nigrita, Ploceus*), Sturnidae (*Cinnyricinclus, Creatophora, Onychognathus*), Oriolidae (*Oriolus*), Dicruridae (*Dicrurus*). Altogether 40 genera, 17 families and 7 orders of birds were involved.



Fig. 27-33. Ornithoctona,  $\Im$  abdominal apices (ventral view, 27-29),  $\Im$  fore femora (anterior surface, 30-32) and  $\Im$  genitalia (33). Each organ of involved species drawn to same scale.

Affinities. As believed by Bequaert (1954: 219), the only consistent difference between laticornis and fusciventris was that in the former species, the antennal appendage ended in a longer, sharper point; and the differences of those 2 species from australasiae were that their heads were ca  $1\frac{1}{3} \times (\text{not } 1\frac{1}{4})$  as wide as high and their antennal appendages had distinctly convex (not nearly straight) inner margins. I have little trust in the reliability of the second character and believe the shape of sternite 1 and chaetotaxy of abdomen to be more distinctive. The unique  $\sigma$  in MCZ mentioned above differs from that of fusciventris in (1) anterior mesosternal lobes relatively closer to each other, their inner margins less strongly curved; (2) side-piece of tergite 6 transversely rectangular, not triangular and shortened at inner side; (3) sternite 3 represented at center by 5-6 (not 4) setal rows; (4) lateral membrane between spiracles 3 and 5 with weaker shorter setae; (5) side-piece of sternite 5 longer than wide (not shorter than wide), with  $14\pm$ setae in 5 rows (not  $10 \pm$  setae in 3 rows). The genitalia were not examined and compared.

#### Ornithoctona idonea Falcoz, 1929

MATERIAL. No material available.

Habitats. Confined to Madagascar, so far known from Coraciidae: Leptosoma discolor.

Affinities. This species was originally described from 2 specimens (1 pinned, 1 in alcohol) from Madagascar (no precise locality) plus 1 pinned specimen from Africa (also no precise locality). Both Madagascar specimens were formerly in Falcoz collection which is now untraceable. On the basis of the paratype from Africa in Paris Mus., *idonea* was suppressed (Maa 1963: 39) as a synonym of *laticornis*. Since Falcoz has already definitely selected a holotype from Madagascar, the designation of a lectotype from Africa by me (1 c.) is invalid and the proposed synonymy is only partially correct. By geographical reasons, it seems advisable to leave *idonea* as a dubious species, before the rediscovery of the holotype or the availability of any other material from the restricted type locality Madagascar. For the possible distinguishable characters between *idonea* and *laticornis*, see footnote under the latter species in the key.

## Ornithoctona fusciventris (Wiedemann, 1830) Fig. 3, 14, 16, 20, 25, 29, 32.

MATERIAL. Amongst fresh specimens examined, the following ones represent new host and distributional records: 1  $\bigcirc$  (Calif. Acad. Sci.), Mexico, Oaxaca, Rio Molina, Sierra Maore del Sur, ex *Cypseloides rutilus*; 1  $\bigcirc$  (Canad. Nat. Coll.), Bolivia, El Palmar, Chapare, 900 m, no host record. Males exceedingly rare, so far I have seen only single  $\Im$ in Mus. Comp. Zool. Harvard.

Habitats. Widely spread over Nearctic and Neotropical regions including W. Indies but not known in the Galapagos Is.; mainly a tropical insect, its occurrence in temperate countries being apparently sporadic and seasonal; northernmost records were from Washington State at 46° 40' N and Quebec at 45° 30' N, southernmost record from Argentina at ca 27° 30′ S. Obviously breeding on Passeriformes, particularly Muscicapidae, Thraupidae and Fringillidae; summary of Bequaert's (1955: 210-223; 1957: 576) listings of host records is as follows: Accipitridae 3 (Accipiter 2, Odontriorchis 1), Falconidae (Micrastur) 1; Cracidae (Chamaepetes) 1; Phasianidae (Odontophorus) 1; Columbidae (Leptotila) 1; Trogonidae (*Pharomachrus*) 1; Momotidae (*Momotus*) 1; Picidae (*Dendrocopos*) 1; Rhinocryptidae (Scytalopus) 2, Formicariidae 7 (Cercomacra 1, Grallaria 1, Thamnophilus 5), Furnariidae 4 (Anabacerthia 1, Lepidocolaptes 1, Sclerurus 1, Synallaxis 1), Tyrannidae 8 (Colonia 1, Empidonax 3, Mitrephanes 1, Muscisaxicola 1, Myiochanes 1, Myiotheretes 1), Cotingidae (Lipaugus) 1, Muscicapidae 16 (Cinnycerthia 1, Dendroica 4, Henicorhina 1, Mniotilta 1, Myadestes 1, Platycichla 1, Seiurus 1, Setophaga 1, Turdus 4, Wilsonia 1), Vireonidae 2 (Thlypopsis 1, Vireo 1), Thraupidae 16 (Calospiza 2, Conirostrum 2, Dubusia 1, Piranga 6, Poecilothraupis 3, Tachyphonus 2), Fringillidae 14 (Atlapetes 5, Coryphospingus 1, Euetheia 1, Hedymeles 1, Junco 1, Pezopetes 1, Poospiza 1, Pselliophorus 1, Zonotrichia 3), Icteridae 2 (Icterus 1, Sturnella 1), Corvidae (Xanthoura) 1. Altogether 53 genera, 21 families and 7 orders of birds were involved.

#### Ornithoctona oxycera Falcoz, 1929

MATERIAL. No fresh material. The single 3 so far known was described by Bequaert

#### (1954: 226).

Habitats. Rare. So far recorded only from 6 and 2 places in Colombia and Venezuela, respectively. Host relationship not quite clear, probably on Passeriformes; only 1 record each from the following 6 genera: Accipitridae (Buteo), Tyrannidae (Cnemitriccus, Myiodynastes), Muscicapidae (Dendroica, Turdus) and Thraupidae (Thraupis).

Affinities. This is the most distinct species of the Australasiae group, and differs from other members of the group in having size much larger (wing 8.5-9.5 vs 5.5-7.5 mm), wing-setulae relatively more extensive, antennal apex distinctly compressed bilaterally (hence, somewhat knob-like in lateral view), and eye relatively narrower. The legs, abdominal chaetotaxy and  $\partial$  genitalia are not closely examined and compared yet. They may be distinctive, too.

#### Ornithoctona orizabae Bequaert, 1954

MATERIAL. No fresh material.

Habitats. So far known only from the unique type  $\mathcal{J}$  from SE Mexico; no host record.

Affinities. In the original description, this species was placed intermediate of erythrocephala and fusciventris and was said to be closely related to erythrocephala. But as shown in the key to species-groups (Maa 1963: 99) and in the key to species (supra), it is apparently more closely related to nitens instead. It may even prove to be the opposite sex of nitens, since the quite different antennal appendages are possibly due to sexual dimorphism. Or, as shown in Table 3, orizabae is a very localized and specialized counterpart of nitens.

## Ornithoctona nitens (Bigot, 1885)

MATERIAL. No fresh material.

Habitats. Widely but sparingly spread over Neotropical Region, ranging from SE Mexico at 17°N to SW Colombia at 2°N; not known in the W. Indies. Probably breeding on Trogonidae. Complete list of recorded hosts: Columbidae (*Oreopeleia*), Apodidae (*Phaethornis*), Trogonidae (*Pharomachrus*, *Trogon*), Muscicapidae (*Troglodytes*).

#### Ornithoctona erythrocephala (Leach, 1817)

MATERIAL. Among fresh specimens examined, the following represent a new host record : 299 (Calif. Acad. Sci.), Mexico, Oaxaca, San Gabriel, ex *Dromococcyx phasianellus*.

Habitats. Widely spread over Nearctic and Neotropical Region including W. Indies, ranging from northern Canada at 56°N to central Chile at 33°S; very rare in Pacific states W to the Rocky Mts (only 1 odd record from Brit. Columbia); absent in the Galapagos. Summary of Bequaert's (1954: 190-199, 1957: 575-576) analysis of host records: Ardeidae 6 records (Botaurus 1, Butorides 2, Leucophoyx 1, Nyctanassa 1, Nycticorax 1); Anatidae (Branta) 1; Accipitridae 73 (Accipiter 18, Buteo 30, Buteogallus 1, Chondrohierax 1, Circus 1, Elanoides 1, Elanus 1, Haliaeetus 2, Hypomorphnus 1, Ictinia 1, Leucopternis 1, Odontriorchis 1, Oroaetes 2, Spizaetus 2, Urubitornis 1, genera indet. 9), Falconidae 32 (Falco 26, Caracara 1, Daptrius 1, Herpetotheres 1, Micrastur 3), Cathartidae 2 (Cathartes

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1, Coragyps 1), Pandionidae (Pandion) 2; Cracidae 9 (Chamaepetes 2, Ortalis 2, Penelope 4, Penelopina 1), Phasianidae 9 (Dactylortyx 1, Gallus [introduced] 1, Odontophorus 5, Phasianus [introduced] 2); Eurypygidae (Eurypyga) 1; Columbidae 48 (Claravis 1, Columba 13, Columbigallina 1, Geotrygon 1, Leptotila 2, Oreopeleia 12, Zenaida 11, Zenaidura 3, genera indet. 4); Psittacidae 9 (Amazona 5, Aratinga 1, Pionus 3); Cuculidae 3 (Piaya 1, Saurothera 2); Strigidae 13 (Asio 3, Glaucidium 1, Otus 1, Pseudoscops 2, Strix 2, Tyto 2, genera indet. 2); Caprimulgidae 2 (Chordeiles 1, Siphonorchis 1); Trogonidae 2 (Pharomachrus 1, Tennotrogon 1); Alcedinidae (Megaceryle) 1, Momotidae (Momotus) 2; Picidae 3 (Melanerpes 2, Sphyrapicus 1), Ramphastidae (Ramphastos) 1; Furnariidae (Margarornis) 1, Tyrannidae (Myiobius) 1, Pipridae (Pipra) 1, Cotingidae (Platysaris) 1, Icteridae 3 (Dives 1, Holoquiscalis 1, Xanthornus 1), Corvidae 3 (Corvus 2, Cyanolyca 1). Altogether 76 genera, 25 families and 14 orders of birds were involved. Polyxenous, probably breeding on Accipitridae, Falconidae, Columbidae and Psittacidae. As in O. plicata, the Passeriformes serve only as occasional hosts.

# Ornithoctona plicata (von Olfers, 1816)

MATERIAL. 1633, 3999, not including those previously reported (Maa 1962, 1963).

THAILAND:  $13^{\circ}$ ,  $109^{\circ}$ . Chanthaburi, Khao Soidaotai, ex *Accipiter badius, A. virgatus, Arborophila cambodiana.* Loei, Dansai, Goksatawn, ex birds # RE 3430, 3485, 3509. Also, lot 624, sublot 2; lot 2127, sublot 9; both in Kasetsart Univ., Bangkok, details of collection data unavailable.

JAPAN: 19, Nagano-ken, ex Ninox scutulata japonica.

PHILIPPINES: 533, 1499. Luzon, Laguna, Sarai Barrio, Paete, ex Leucotreron merrilli; Nueva Vizcaya, Dalton Pass, ex Aviceda jerdonii; Negros Oriental, Siaton, ex Phapitreron leucotis nisororum; Leyte, Mt Kabalanti-An, Mahaplag, ex Ducula p. poliocephala, Penelopides samarensis; Mindanao, Surigao del Sur, Carcanmadlan, ex Bubo philippensis mindanaensis; Mindanao, Davao, Mt Mayo, ex Accipiter virgatus confusus (2 lots), A. trivirgatus extimus, Columba vitiensis griseogularis, Dryocopus javensis, Phapitreron amethystina mindanaensis; Mindanao, Davao, Mt Apo, E slope, CNHM Philipp. Exped. #1189.

BORNEO: 12. Sabah, Sandakan, Sapagaya For. Reserve.

NEW GUINEA. 733, 1399. Brugnowi, Sepik Distr., ex *Cacatua galerita triton*; Bulldog Rd, Morobe Distr., ex bird BBM 52483; Coviak, ex *Gymnophaps albertisii*; Kebar Valley, Vogelkop Penin., ex *Ducula p. pinon, Lorius l. lory*; Cape Killerton, ex pigeon BBM 29269; Oriomo, ex *Megaloprepia magnifica* and pigeon BBM 29491; Sandy Creek, ex *Ducula zoeae*; Subitana, Sogeri, ex *Accipiter poliocephalus*; Wau, Morobe Distr., ex *A. fasciatus*; Wantoat, Finisterre Mts.

NEW BRITAIN: 233. Mt Sinewet, ex *Ducula spilorrhoa*; Gaulim, ex *Lorius roratus*. SOLOMON IS.: 13. Santa Ysabel, Tatamba, ex *Aviceda subcristata*.

*Habitats.* Very widely spread over Pacific and Indian Oceans, usually not penetrating very far inland; westernmost limits of known range at Comoro Is. and Madagascar, easternmost at Tonga, southernmost at N. S. Wales, northernmost at Mongolia and Kurile Is. Polyxenous, chiefly on Accipitridae, Columbidae and Psittacidae. The following list of known hosts is compiled from Bequaert (1941b: 247-292), Maa (1962: 597-598, 1963:

159-160) and the records enumerated above. Ardeidae (Demigretta, Gorsakius); Accipitridae (Accipiter, Aviceda, Circus, Haliastur, Henicopernis, Milvus), Falconidae (Falco); Megapodiidae (Aepypodius, Megapodius), Phasianidae (Arborophila, Gallus); Charadriidae (Capella); Columbidae (Chalcophaps, Columba, Didunculus, Ducula, Gallicolumba, Geopelia, Gymnophaps, Leucotreron, Lopholaimus, Macropygia, Megaloprepia, Phapitreron, Ptilinopus, Reinwardtoena, Streptopelia, Treron); Psittacidae (Cacatua, Coracopsis, Lorius, Tanygnathus); Cuculidae (Eudynamys, Rhamphococcyx); Strigidae (Asio, Bubo, Ninox, Tyto); Trogonidae (Harpactes); Alcedinidae (Halcyon), Bucerotidae (Penelopides); Picidae (Dryocopus, Mulleripicus); Campephagidae (Pericrocotus), Muscicapidae (Cossypha), Artamidae (Artamus, Artamides), Sittidae (Sitta), Sturnidae (Gracula), Oriolidae (Oriolus), Corvidae (Corvus). Altogether 52 genera, 20 families, 12 orders of birds. The noticeable scantiness of records from Passeriformes was explained by Bequaert (1953a: 329) to have been due to quite insufficient collecting in the Indo-Australian area. Results of recent intensive collecting in the Philippines and New Guinea, however, do not support this view. More likely the big robust hippoboscids such as O. plicata and O. erythrocephala do not prefer small passerine birds.

#### Ornithoctona rugicornis Maa, 1963

MATERIAL. No fresh material.

Habitats. Apparently confined to São Tomé I. in the Gulf of Guinea; host relationship not quite clear; so far, known only from Psittacidae (Agapornis) and Sturnidae (Onychognathus).

## LITERATURE CITED

Bequaert, J. C. 1941b. Occ. Pap. B. P. Bishop Mus. 16 (11): 247-92; 1953. Ent. Amer., n. s. 32-33: 1-442; 1954. Ibid. 34: 1-232.

Evans, G. O., A. Fain & J. Bafort. 1963. Bull. Ann. Soc. Ent. Belg. 99: 486-500.

Ferris, G. F. 1926. Sarawak Mus. J. 3 (10): 279-86.

Gil Collado, J. 1932. Eos 8: 29-41.

Grimshaw, P. H. 1901. Fn. Hawaii. 2: 77.

Hardy, D. E. 1952. Proc. Hawaii. Ent. Soc. 14: 443-84.

Maa, T. C. 1962. Pacif. Ins. 4: 583-614; 1963. Pacif. Ins. Monogr. 6: 1-186.

Theodor, O. & H. Oldroyd. 1963. In E. Lindner, Die Flieg. d. Pal. Reg. 65: 1-68. (Ornithophila, p. 33-35, fig. 37-43).

Zumpt, F. (Editor). 1966. Arthrop. Paras. Vertebr. Afr. S. Sahara 3: 1-283. (Hippoboscidae, p. 79-99, fig. 58-69).

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