Revision of the Melanesian Swiftlets (*Apodes, Aves*)

and their Conspecific Forms in the Indo-Australian and Polynesian Region

By FINN SALOMONSEN †

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Synopsis

The Swiftlets belonging to the genus *Collocalia*, inhabiting the Melanesian region and adjacent areas, have not been subject to a taxonomic treatment since about 1937. More recent investigations have mostly dealt with ecology. Even in the other genus of *Apodes* in Melanesia, *Hemiprocne*, a more modern examination appears necessary. Large series of Swifts have been collected in recent years in the Papuan and Melanesian regions, partly by The Noona Dan Expedition, of which the material is kept in the Zoological Museum in Copenhagen, partly by various American expeditions, of which the collections are gathered in The American Museum of Natural History in New York. The present paper is a monograph of the *Apodes* in the Melanesian region, also dealing with the conspecific forms in the Indo-Australian and Polynesian regions, on the basis of an examination of altogether 1,094 specimens.

Six subspecies are recognized of *Hemiprocne mystacea* of which one (*carbonaria*) is restricted to San Christobal Island in the Solomon Islands, being an instance of the unique endemic fauna of this island, divergent from that of the other Solomon Islands. The length of the tail is subject to a noteworthy geographical variation. The function of the tail in this species is of fundamental importance for the flight and aerial catching of prey. It is peculiar that the mean length of the tail expressed in percentage of the wing-length is 78–82 in most populations, but constantly 85–89 in *woodfordiana* and *macrura*, as to be seen in Fig. 3. The biological expediency of these differences is as yet inexplicable.

The genus *Collocalia* presents some of the most difficult problems in avian systematics. There are four species in Melanesia, and the taxanomy of them has given rise to much discussion. For each of them there is in this paper some introductory remarks, explaining the delimitation of the species employed here. In *C. esculenta* there are 22 geographical subspecies east of Wallace's Line, of which many are of considerable zoogeographical and ecological interest. As instances may be mentioned *tametamele* and the New Guinea highland form *erwini*. Of the species *C. spodiopygia* there are 18 subspecies. They display a prominent geographical variation, extending from forms with a broad white rump band (like *delichon*) to some with uniform black upper-parts (*hirundinacea* group), etc. The variation is discussed and summarized in the section "Conclusion". In *C. vanikorensis* there are 12 geographical subspecies, but contrary to the variation in *esculenta* and *spodiopygia* that in *vanikorensis* is slight. It is noteworthy that all the said three *Collocalia* species demonstrate a correlation between body-size and altitude in the New Guinea and the New Ireland populations, most distinct in the New Guinea forms of *esculenta* (*erwini*) and spodiopygia (*excelsa*). The fourth Melanesian species, *C. orientalis*, was formerly united with several other species and regarded as subspecies of the oriental *whiteheadi*. It is shown that *orientalis* is a separate species, the same being the fact with the two New Guinea taxa *papuensis* and *nuditarsus*, which even appear to be sympatric in certain parts of New Guinea.

On p. 4 of this paper there is an index giving the names of the taxa of *Hemiprocne* and *Collocalia* described or discussed.

FINN SALOMONSEN,
D. Sc.
Zoological Museum
Universitetsparken 15
DK-2100 Copenhagen

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Introduction

Both families of the order *Apodes* are represented in Melanesia, *Hemiprocnidae* with one species of the genus *Hemiprocne, Apodidae* with four species of the genus *Collocalia.* The latter genus requires some introductory remarks.

Every student who has studied *Collocalia* seriously has realized that this group presents some of the most difficult problems in avian systematics. A few quotations from recent works show this. Mayr (1937, p. 1) in his treatise of the New Guinea species of *Collocalia* says: "Every author who has ever worked with these small swiftlets of the Indo-Australian region will contend that their classification presents the most difficult problems in the taxonomy of birds. The members of this genus live in large or small colonies, frequently in inaccessible caves, and every population is slightly different from the next one. They are difficult to collect and not one of the museums of the world has adequate material. To make matters worse, most of the species are of practically the same dull sooty gray coloration with almost the same development of the structural characters, such as bill, feet, wing-formula, etc." A few years later Peters (1940, p. 220) in his monograph of the genus said: "The genus *Collocalia* constitutes one of the most difficult of all groups of birds. The principal recent revisors of this genus realize this fact more keenly than any one and admit that their results are purely tentative and their conceptions of relationships liable to modification." Finally, Rand and Gilliard (1967, p. 275), in their description of the New Guinea species of *Collocalia,* remark: "Some of the grey and blackish birds of this genus present some of the most puzzling problems in bird taxonomy. Not only are the specific limits very difficult to draw, but the relationships between some populations of separate island groups are only partly worked out, and the identification of certain specimens is unsatisfactory, and even the identification of some distinct species such as *C.hirundinacea* and *C.vanikorensis* needs careful comparison of specimens."

The result of this complicated situation has been that virtually every student has arranged the different forms (species and subspecies) in his own way, different from the system constructed by other students, or usually even from that used by himself in earlier papers.

Apart from the old and very imperfect systematic and ecological treatments of *Collocalia* (Horsfield and Moore 1854, Bonaparte 1855, Bernstein 1857 and 1859, Wallace 1863, Gray 1866, Salvadori 1879, the exact quotations given by Oberholser 1906, p. 177). The first usable monograph was prepared by Ernst Hartert (1892, p. 496), who also wrote a German version (Hartert 1897, p. 66), which differed only in minor details from the English one. Hartert distinguished between thirteen species, of which eleven were monotypic, one polytypic with two subspecies, and one polytypic with three subspecies. This altogether adds up to sixteen forms.

A few years later a new monograph was worked out by Harry C. Oberholser (1906, p. 177; 1912, p. 11). It contained many new species, but also many incorrect and arbitrary statements which made the taxonomy more complicated than necessary. Almost immediately after Oberholser's treatment these intriguing birds challenged Erwin Stresemann to a painstaking and extremely thorough study which threw much light on the taxonomy of

this difficult group. Stresemann's first paper on *Collocalia* was published in 1912, but the most important ones are Stresemann 1926a, p. 179; 1926b, p. 349 and 1931, p. 83. Stresemann was the first to show that the life-habits, especially the nest-building, of the different species of *Collocalia* in many instances were of greater importance for the discrimination of species than morphological characters. He warned, on the other hand, against attaching too much value on nest-building as a taxonomic character, since it varied within several species and even within the single populations.

A short time after Stresemann's papers *Collocalia* was the subject of a comprehensive contribution by Ernst Mayr (1937, p. 1), who covered a great number of species, especially those of the New Guinea area. Finally, a check-list of the genus was prepared by James Lee Peters (1940, p. 220–231), mainly based on the many important contributions published in the period 1906–1940. Peter's result, therefore, was a far cry from the first real monograph which was made by Hartert in 1892 and comprised sixteen forms. Peters listed altogether 84 forms belonging to sixteen species, of which only three (*gigas*, *troglodytes* and *marginata*) were considered monotypic.

In the next forty years (1940–1980) only little taxonomic works was done, although a few new subspecies and even two new species have been described (*nuditarsus* Salomonsen (cf. p. 105) and *sawtelli* Holyoak), giving a total number of 18 species in *Collocalia*. However, the study now was focussed on the life-habits of *Collocalia*, particularly on nest-building. David Lack (1956, p. 1) described the nest-building in all swifts, but the species of *Collocalia* were somewhat foreign to him, and his remarks on this group (p. 7–8) was a compilation, not based on his own original observations. Therefore, he had no new taxonomic ideas to offer. Further descriptions of nest-building were published by R. W. Sims (1961, p. 205) who dealt with the Malaysian species, and by Lord Gathorne Medway, who in a series of excellent papers described the nest-building of all species within the genus *Collocalia*. In a comprehensive work (Medway 1966, p. 151, and in a more popular summary 1969, p. 57) he gave a new and convincing systematic treatment of the genus of swiftlets, based on morphology as well as on various field characters, such as nest-building and echolocation. This latter phenomenon, developed in most species of these fantastic birds, was discovered almost simultaneously by A. Novick (1959, p. 497) and Medway (1959, p. 1352); cf. also Cranbrook and Medway (1965, p. 258) and Medway and Pye (1977, p. 227).

From a taxonomic point of view it is to note that Medway included 16 species in *Collocalia*, the same number as Peters (1940, p. 220), but nevertheless his system differs on many points. There are even some nomenclatorical changes. In a previous paper (Medway 1961, p. 625) he showed that the name of the well-known *Collocalia fuciphaga* was misapplied and should be replaced by *C. salangana* Streubel. Another name change was, on the other hand, quite unnecessary and superfluous. Deignan (1955, p. 118) had on very slender grounds revived the name *Collocalia maxima* Hume 1876, which first appeared as a *nomen nudum* and has been regarded as such by all students. This name was claimed by Deignan to have a few years' priority over *C. lowi* Sharpe 1879, which had been used by all ornithologists for about a hundred years. This unfortunate change was accepted by Medway, thus violating art. 23(b) of the International Code of Zoological Nomenclature.

Medway's work is of great importance for the understanding of the relationship and evolution of the different populations and species of swiftlets. It appears, however, that he overestimated the value of field characters, particularly of nest-building. He is of the opinion that "each species of *Collocalia* is characterized by the type of nest it builds" (Medway 1961, p. 625) and in this way regarded nest-structure as a genetically fixed character, constant within all populations of each species. It is a wellknown fact that most mor-

phological characters in *Collocalia* may change from one population to another within each species, for instance the size, relative tail-length, pale rump band, feathering of tarsus, etc., and it is difficult to understand why the same condition should not apply to different life-habits.

The most recent studies of the swifts are in my opinion not satisfactory. They deal mainly with endeavours to split the genera of swifts into smaller units, creating a number of new genera. A few of them may be useful, as *Schoutedenapus,* which in its foot-structure appears to unite some of the fundamental characters of the *Chaeturinae* and *Apodinae* (De Roo 1968, p. 412), but *Collocalia* is a firmly knit group of closely allied species which cannot be split up into several smaller genera. It is symptomatic that in the most recent attempt to a classification of *Chaeturinae* (Orr 1963, p. 126) based on a thorough anatomical investigation, the genus *Collocalia* (four species examined) appears to be a uniform group without any tendency to generic division. The two other genera accepted by Hartert (1892, p. 496), *Chaetura* and *Cypseloides,* are subject to so much variation, particularly the large South American species, that it may be necessary to accept some other genera (*Streptoprocne, Aerornis,* etc.), now used by most students.

In his conclusions about the evolution of *Collocalia* Medway (1966, p. 170) remarks that "if such observations [on echolocation] support the separation into a "grey" group and a "glossy", it may be desirable to divide the genus formally. In this case it should be noted that *esculenta* Linn. is by designation the type species of the genus *Collocalia,* which would accordingly be restricted to the "glossy" group. Earlier names already proposed for supraspecific taxa within the genus (*Aerodromus* [misprint for *Aerodramus*] Oberholser 1906, *Zoonava* Mathews 1920) do not accommodate the "grey" group as a whole, and for this a new name would be required." The latter inference is not correct, however. The type of *Aerodramus* is *Collocalia innominata* Hume (Oberholser 1906, p. 182), which is one of the "grey" forms.

It was to be expected that this hint about genus splitting by Medway would be too tempting to weaker brethren. A separation of *Collocalia* and *Aerodramus* in the sense proposed by Medway has been undertaken recently by R. K. Brooke (1970, p. 16; 1972, p. 55). *Collocalia,* comprising *esculenta, marginata* (which is nothing but a subspecies of *esculenta*) and *troglodytes,* is "characterized by glossy plumage and the inability to echolocate." These characters are not valid for erection of genera. As far as the plumage colour is concerned, *C. esculenta neglecta* is as "grey" as members of *Aerodramus.* It is true that *esculenta* does not have the capacity of echolocation, but nothing is nown about *troglodytes* in this respect. Further, there are species of *Aerodramus* which do not echolocate either, at least *C.gigas* (Medway and Wells 1969, p. 609) and *C.leucophaea* (Holyoak 1974, p. 147). It must be noted, however, that the statement concerning *leucophaea* later was corrected (Holyoak and Thibault 1978, p. 62), since it appeared that this species after all had echolocation when it nested in deep caves with no light.

The presence or absence of echolocation may characterize species, but in *Collocalia* it is not so profound a faculty that it alone is sufficient to distinguish genera. When bearing in mind how taxonomically important nest-structure is held to be it is strange that *C.troglodytes* is said to belong to *Collocalia* and not to *Aerodramus,* because it produces more or less edible nests (Lack 1956, p. 7; Medway 1966, p. 156) just as a number of species of *Aerodramus* and contrary to *C.esculenta.*

Brooke (1960, p. 17) even separated *Collocalia gigas* in a new monotypic genus, *Hydrochous,* because it is "absolutely bigger than any other member of the genus (wing-length more than 150 mm, instead of less than 140 mm)", and that it places its nest behind a waterfall, as recently discovered by Somadikarta (1968, p. 549) and Becking (1971, p. 331). Some other generic characters are mentioned (lack of glossy plumage and echolocation, small differences from other swiftlets in the structure of the rectrices), but they are futile and triv-

ial. It is true that *gigas* is bigger than other species of *Collocalia*, but Brooke exaggerates the differences. According to Somadikarta (1968, p. 551) the wing-length in 25 adult ♂♂ of *gigas* is 142.5–158 mm, while the species *C.papuensis* has a maximum wing-length of 141 mm. It is ridiculous to use such a minimal difference in size as a generic character, especially when bearing in mind that the wing-length of a single species (*C.spodiopygia*) extends from 99 mm (*desolata*) to 137 mm (*excelsa*). The nesting-habits of *gigas* is an interesting phenomenon, but this can neither be used as a generic character. Incidentally, even the nest of *esculenta* may occasionally be placed beside a waterfall (Rensch 1931, p. 538; Lack 1956, p. 7). The splitting of genera on such slender grounds is an artificial procedure and has nothing to do with serious taxonomy. It is tempting to quote Carl Illiger (1775–1813) who as early as the year 1800 said: "Gattung ist die Zusammenstellung der im Habitus übereinstimmenden Arten. Den künstlichen, nur nach einzelnen Merkmalen unterschiedenen Gattungen widerstrebt unser Gefühl", as quoted by Stresemann (1951, p. 136). It is regrettable that Medway himself in a recent paper used Brooke's quite unnecessary genera (Medway and Pye 1977, p. 228).

A few words on the wing-formula and the moult in the swifts are necessary on account of the measuring of wing-length. In all swifts the length of the primaries gradually increases from the first (innermost), to the tenth (outermost) one. However, the tenth and the ninth primaries are sometimes equal in length or the ninth may be slightly longer or shorter than the tenth. It is possible, therefore, to use the wing-length of specimens with a growing tenth primary, in which thus the ninth primary is the longest. In the tables of the measurements such specimens are listed in special sections headed "p_{10} in growth". In this way it was possible to augment the usable material.

The moult of the primaries takes place in a descending order, beginning with the innermost and ending with the outermost one. It is noteworthy, however, that the tenth primary is not shed immediately after the ninth, but is kept for a long period of time and does not drop out until the ninth primary has reached its final length and its growth is stopped. This phenomenon is due to aerodynamic reasons, in so far as the outermost primary is the feather which is most heavily taxed during the incessant flight of these birds and, therefore, must be absolutely strong and resistant to the force of the air. When finally the tenth primary is moulted, it grows very slowly, and this is the reason why so many specimens of *Collocalia* are found with "p_{10} in growth". This was distinctly to be seen in my large material of *Collocalia*, but has not been described previously, to the best of my knowledge. Stresemann and Stresemann (1966, p. 410) in their handbook of avian moult do not mention it. However, Langham (1980, p. 455), who studied the moult of no less than 353 specimens of *Collocalia fuciphaga* mentioned in his table 9 that 199 specimens had the tenth primary "not moulting". Langham's presentation, however, is somewhat unclear and confusing. The best description of the primary moult in the swifts was given by Weitnauer (1977, p. 89), who studied *Apus apus*. An examination of swifts in a breeding colony in Switzerland 1965–75 demonstrated that in 25% of 142 ringed adult birds the tenth primary remained unshed until the migration in the autumn, and sometimes for a whole year. It appeared that this feather remained unmoulted every fifth year on the average.

From a geographical point of view Melanesia covers the islands in the Pacific Ocean from the Bismarch Islands to the Fiji Islands, *i.e.* the area inhabited by people who show great similarity to the Papuans of New Guinea in appearance as well as in culture. Mayr (1933, p. 306; 1939, p. 197) demonstrated that for zoogeographical reasons the Melanesian region has to be limited to the areas west of the Fiji Islands, *i.e.* the New Hebrides forming the eastern boundary. This conception is also accepted in this paper, but the forms of *Apodes* in the extralimital regions in the Pacific are briefly described and discussed.

It is a wellknown fact that the islands in the

Pacific show the phenomenon of numerical reduction of land-bird species with increasing distance from continents (Mayr 1939, p. 202). This applies also to the swifts. The Bismarck Islands and the Solomon Islands are inhabited by five species, the New Hebrides by three, New Caledonia by two species, while Polynesia and Micronesia everywhere have one species only.

The taxonomy of the *Apodes* in Melanesia has not yet been properly treated, and the material is scarce from many islands. This was the reason why on the Noona Dan Expedition 1961–62, during my scientific leadership on the Bismarck Islands, it was decided to collect good series of these birds. We succeeded in obtaining about 100 specimens. The Noona Dan Expedition was described by Torben Wolff (1966, p. 287) who also have given lists of collecting stations.

A much larger material was studied in the magnificent collections of the American Museum of Natural History in New York, and also a number of specimens, particularly the numerous types within the polytypic species *Collocalia esculenta*, in the British Museum in Tring. Altogether I examined 1,094 specimens. I wish to thank the authorities of these two institutions for giving me access to their valuable collections, and also Dr. Lester L. Short from the American Museum for permitting me to borrow substantial series of swifts for further studies in Copenhagen.

I also wish to express my appreciation to Mrs. Hanne Jacobsen and Mr. Robert Nielsen at the Zoological Museum in Copenhagen for drawing the diagrams and maps with careful accuracy. Acknowledgements are further due to Mr. Geert Brovad at the Zoological Museum in Copenhagen and to the Ornithological Department of the American Museum of Natural History for the fine photographs of skins used in this paper.

Since the wing-lengths of male and female are alike in *Hemiprocne* and *Collocalia* I have often united them in order to present as large a material as possible in a common scheme. In the tables giving individual measurements the sexes are separated in *Collocalia* (but not in *Hemiprocne*), as are also the specimens with "p_{10} in growth", and immature (but not always fully grown) specimens. Mention is also made of specimens in moult which could not be measured, but could be examined in all other respects. The material from the different institutions are kept apart in the tables, and the following abbreviations are used throughout in this paper:

AMNH = The American Museum of Natural History.
BM = British Museum.
ND = Noona Dan Material, in the Zoological Museum in Copenhagen.
ZMC = Other collections in the Zoological Museum in Copenhagen.

Hemiprocnidae

Hemiprocne Nitzsch 1829

This genus is of oriental origin and consists of three or four species. The most primitive is *H. longipennis* and its near ally *H. coronata*, and these two taxa are usually regarded as conspecific (cf. however Brooke 1969, p. 168); more advanced is *H. comata*. These taxa inhabit Southeast Asia and the Great Sunda Islands, *comata* even the Philippine Islands, while *longipennis* does not extend further east than Sibutu Island in the Sulu Archipelago (Du Pont and Rabor 1973, p. 40). The highest development has been reached in *H. mystacea*, which is the subject of the following review.

Hemiprocne mystacea Lesson 1830

Distributed from the Moluccas over New Guinea and Northern Melanesia this species is the only Indoaustralian one in the genus *Hemiprocne*. There are no differences in the body proportions of male and female, and the two sexes are, therefore, not kept apart in the list of measurements.

According to Stresemann (1923, p. 29) there are four subspecies (*confirmata, mystacea, aëroplanes* and *woodfordiana*), and Peters (1940, p. 258) has a quite identical arrangement. In recent years students reduced the number of subspecies and recognize only *woodfordiana* and nominate *mystacea;* cf. Mees (1964, p. 11; 1965, p. 173), Gilliard and Lecroy (1967, p. 201). In these reviews no attention was paid to the coloristic diagnosis given by Stresemann, nor to the length of the tail, although in this species with its particular life-habits and function of the tail, it must be of fundamental importance to the flight and aerial catching of prey. It has been necessary, therefore, to reconsider the problems concerning the geographical variation of this species. I have laid the main stress on the Melanesian forms, but I also studied the Papuan and Indonesian ones, and recognize the following forms. Map of distribution of the subspecies accepted by me is given in Fig. 1.

Hemiprocne mystacea confirmata Stresemann

Hemiprocne mystacea confirmata Stresemann, 1914, Novitates Zool., vol. 21, p. 110 – Ceram, Moluccas.

A large swallow-like bird with long and pointed wings and very long tail, which is deeply cleft, the furcation being about 120 mm.

The adult male has the crown, wings and tail black with a distinct bluish gloss, upper-parts dark bluish grey, sides of head black with a distinct reddish spot on the distal part of the ear-coverts and with a contrasting white streak of elongated feathers from the bill over the eye to sides of nape; another much narrower white line extends from chin below lore and ear-coverts to side of nape, the tips of the very elongated feathers reaching farther back than the white streak over the eye-region; chin white, throat bluish grey, gradually being paler caudally, being grey on breast and flanks and usually pure white, sometimes only greyish white, on the central abdomen and under tail-coverts; the inner secondaries white, strongly contrasting with the black wings.

The adult female is similar to the male, but lacks the reddish spot on the ear-coverts.

Measurements: Forty-four adult specimens have a wing-length of 210–232 (average 221.7) mm

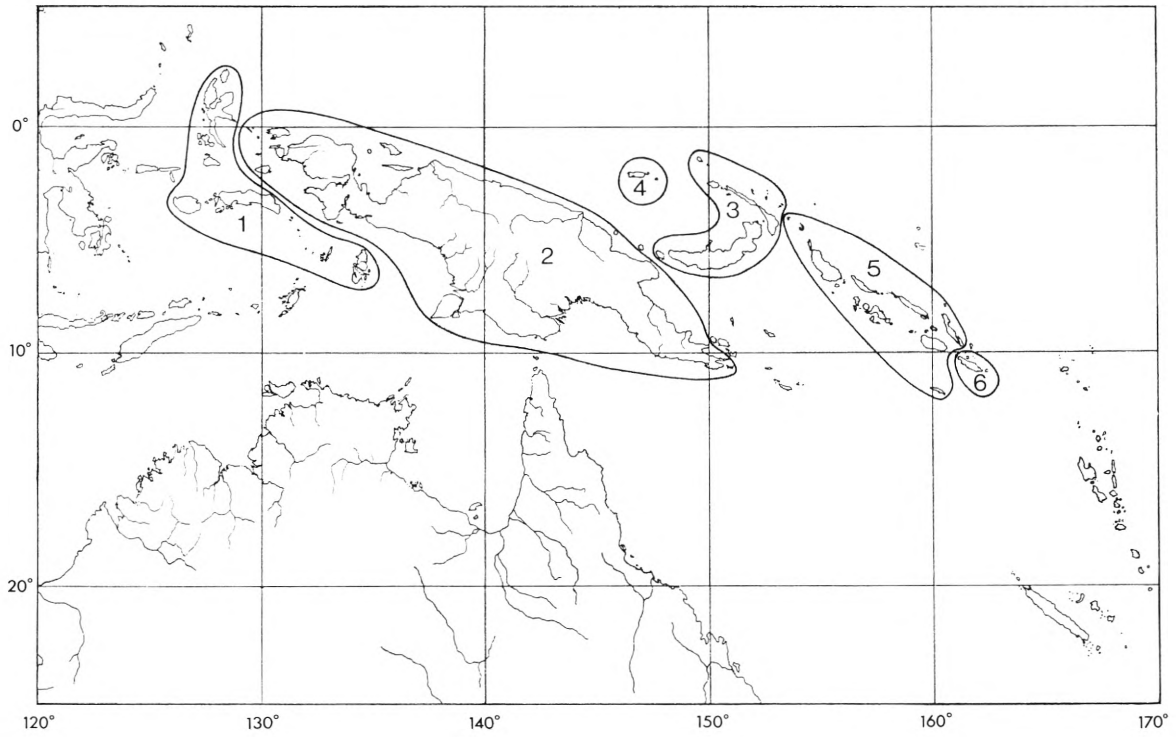


Fig. 1. Distribution of the different forms of *Hemiprocne mystacea*.
1. *confirmata*, 2. *mystacea*, 3. *aëroplanes*, 4. *macrura*, 5. *woodfordiana*, 6. *carbonaria*.

according to Streseman (1914, p. 111); an unknown number of specimens measure 210–230 mm, according to Gilliard and Lecroy (1967, p. 201); a few specimens examined by me had wing-lengths agreeing with these measurements.

Range: The Moluccas, known from Obi, Batjan, Halmahera, Ternate, Morotai, Buru, Ceram, Ambon and Haruku (Van Bemmel 1948, p. 361) and Aru Islands. Apparently unknown in the Kai Islands.

Remarks: This subspecies differs from nominate *mystacea* from New Guinea only by its smaller size. Some students found the differences between the two forms to be too insignificant to give rise to a separation of the Moluccan form. Siebers (1930, p. 270) gave the wing-length of three specimens from Buru as 216–230 (average 221.0) mm, and six from New Guinea as 220–239 (average 227.3) mm. Mees (1964, p. 11) gave the wing-length of six specimens from the Moluccas as 208–236 (average 220.3) mm and of seven specimens from the New Guinea area 219–239 (average 229.0) mm. Both these critics found the average wing-length of the two forms to be about 221 mm and 228 mm, respectively, based on comparatively small collections. Still, the measurements of nominate *mystacea* are usually decidedly larger than those stated by Siebers and Mees.

Hemiprocne mystacea mystacea (Lesson)

Cypselus mystaceus Lesson, 1827, Voy. "Coquille", Atlas, pl. 22; Zool., 1830, p. 647 – Dorey, Vogelkop, New Guinea.

Differs from *confirmata* only by its larger size.

TABLE 1
Measurements (in Millimeters) of the Material of *Hemiprocne m. mystacea*
Examined from New Guinea and *H.m.aëroplanes* and
H.m.macrura from the Bismarck Islands.
w: wing-length, t: tail-length, %: tail in percentage of wing.

mystacea			w:	221,	225,	226,	226,	229,	229,	229,	231,	232,	234,	235,	237
AMNH	New Guinea		t:	164,	184,	172,	175,	170,	177,	167,	182,	197,	186,	191,	182
			%:	74,	82,	76,	77,	74,	77,	72,	79,	85,	79,	81,	77
aëroplanes															
AMNH	New Britain		w:	209,	209,	210,	210,	211,	212,	212,	212,	212,	212,	214,	214,	214
			t:	175,	168,	177,	172,	182,	184,	180,	178,	175,	179,	172,	187,	186
			%:	84,	80,	84,	82,	86,	87,	85,	84,	83,	84,	80,	87,	87
			w:	214,	214,	214,	215,	216,	216,	217,	218,	218,	219,	221,	221,	221
			t:	175,	179,	174,	184,	182,	167,	179,	190,	176,	–[a]	190,	190,	178
			%:	82,	84,	81,	86,	84,	77,	82,	87,	81,		86,	86,	81
			w:	223,	223,	223,	226,	227,	230							
			t:	176,	154,	149,	179,	182,	195							
			%:	79,	69,	67,	79,	80,	85							
			w:	203,	210,	212,	213									
		imm.	t:	130,	135,	138,	142									
			%:	64,	64,	65,	67									
	New Hanover		w:	211,	217,	217,	218,	218,	219,	221,	222,	224				
			t:	173,	145,	173,	161,	175,	–[a]	175,	185,	172				
			%:	82,	67,	80,	74,	80,		79,	83,	77				
			w:	221												
		imm.	t:	124												
			%:	56												
	Emira (Storm) Isl.,		w:	222												
	St. Matthias Group		t:	177												
			%:	80												
			w:	216,	216,	218										
		imm.	t:	136,	144,	142										
			%:	63,	67,	65										
	Mussau Isl.,		w:	216												
	St. Matthias Group		t:	173												
			%:	80												
	Tabar Isl.,		w:	208,	209,	212,	218									
	Tabar Group		t:	173,	165,	179,	176									
			%:	83,	79,	84,	81									
			w:	200,	209											
		imm.	t:	174,	138											
			%:	87,	66											

[a] Tail broken. [b] Tail in moult.

	Lihir and Mahur Isl.,		w:	206,	206,	208,	208,	215,	218		
	Lihir Group		t:	176,	177,	170,	183,	177,	160		
			%:	85,	86,	82,	88,	82,	73		
			w:	203,	209						
		imm.	t:	159,	152						
			%:	87,	73						
	Boang Isl.,		w:	209,	215,	216					
	Tanga Group		t:	180,	184,	170					
			%:	86,	86,	79					
ND	New Britain		w:	216,	218,	220					
			t:	184,	178,	186					
			%:	85,	82,	86					
	New Ireland		w:	211,	217,	218,	219,	219,	220,	221,	221, 221
			t:	166,	181,	179,	187,	182,	–[a]	179,	176, 169
			%:	79,	83,	82,	85,	83,		81,	80, 76
	New Hanover		w:	219							
			t:	169							
			%:	77							
			w:	222							
		imm.	t:	184							
			%:	83							
	Mussau Isl.,		w:	228							
	St. Matthias Group		t:	180							
			%:	79							
macrura											
AMNH	Manus Island		w:	216,	221,	223,	224,	225,	226		
			t:	202,	–[b]	199,	203,	202,	188		
			%:	94,		89,	91,	90,	83		
			w:	212							
		imm.	t:	191							
			%:	90							
	Rambutyo Island		w:	216,	219,	220,	220,	227			
			t:	182,	179,	–[a]	194,	196			
			%:	84,	82,		88,	86			

Measurements: Twelve adult specimens have a wing-length of 221–237 (average 229.5) mm, tail-length 164–197 (average 178.9) mm, tail in percentage of wing 72–85 (average 77.8). (Table 1). Thirty-seven specimens measured by Stresemann (1914, p. 111) had a wing-length of 225–243 (average 231.7) mm.

Range: New Guinea and the surrounding islands Misoöl, Batanta, Waigeo and Gebe, as well as Japen, Numfor and Biak in Geelwink Bay. Restricted to the lowland, up to about 1,200 m (Mayr 1941, p. 86) or to 1,500–1,600 m (Diamond 1972, p. 182).

Remarks: A number of students have contributed to the knowledge about the body-proportions of this subspecies in New Guinea. Ogilvie-Grant (1915, p. 195) measured the wing-length of three specimens as 225–235 (average 228.7) mm. Mayr and Rand (1937, p. 78) gave the wing-length of four specimens as 229–238 (average 234.0) mm, Rand (1942a, p. 317) of five specimens as 222–236 (average 228.8) mm, Mees (1964, p. 11) of seven specimens as 219–239 (average 229.0) mm, Stresemann (1923, p. 29) of six specimens as 229–248 (average 236.7) mm, and Gilliard and Lecroy (1967, p. 201) of an unknown number of specimens from Central New Guinea as 226–245 mm and from Southeast New Guinea as 220–243 mm. With average wing-lengths of 229–237 mm in this material and 222 mm in *confirmata*, it appears that a satisfactory difference exists between the two subspecies. It cannot be denied, however, that there is a good deal of overlap between the wing-lengths of *confirmata* and *mystacea*. Moreover, it appears that the populations of Vogelkop Peninsula and of the islands in the Geelvink Bay have a smaller wing-length than the typical *mystacea*, tending towards nearby *confirmata*. Gyldenstolpe (1955b, p. 225) gives the wing-length of four specimens from Vogelkop Peninsula as 222–230 (average 228.0) mm and Stresemann and Paludan (1932, p. 232) of three specimens from Japen Island as 216–226 (average 221.0) mm.

Since *Hemiprocne mystacea* is a lowland bird, not occurring at altitudes higher than 1,500 m, it does not show any size variation with altitude, as is the case with all species of *Collocalia* in New Guinea. This was demonstrated by Rand (1942b, p. 459) when working with the material of the 1938–39 Archbold New Guinea Expedition. He stated from the Bernhard Camp area that the wing-length of three specimens collected at an altitude of 50 m was 232–240 (average 237.3) mm and that of five specimens collected at 850 m was 228–245 (average 234.4) mm.

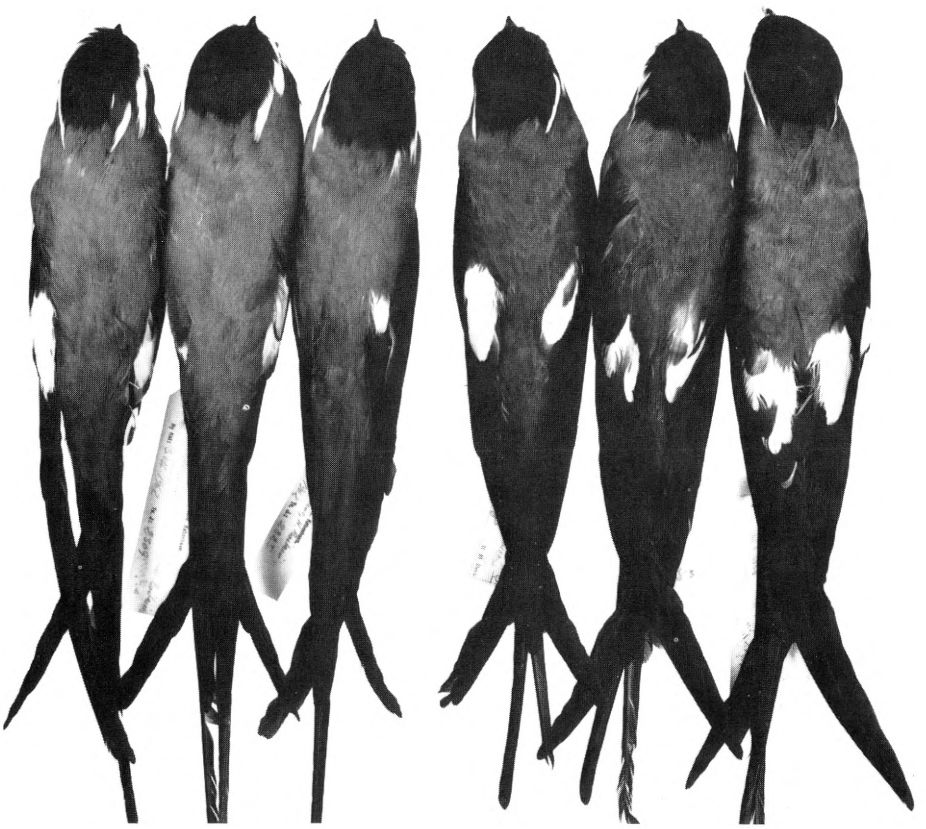
Hemiprocne mystacea aëroplanes Stresemann

Hemiprocne mystacea aëroplanes Stresemann, 1921, Anz. Ornith. Ges. Bayern, Nr. 5, p. 38 – Blanche Bay, New Britain.

Differs from *mystacea* and *confirmata* by having the bluish grey colour of the upper-parts distinctly paler, the colour of the under-parts slightly paler and the white central parts of the abdomen as a rule not so prominent and contrasting, more mixed with greyish; also the under tail-coverts with more grey than in *mystacea*. The differences between *mystacea* and *aëroplanes* in the colour of the pectoral region and the abdomen are slight, while the upper-parts usually are much paler in *aëroplanes*, as seen in Fig. 2. Sometimes *mystacea* may be as pale, but this is an exception. In addition, the measurements of *aëroplanes* are much smaller than those of *mystacea*.

Measurements: Thirty-five adult specimens from New Britain (type-locality) have a wing-length of 209–230 (average 216.6) mm, tail-length 149–195 (average 179.1) mm, tail in percentage of wing 67–87 (average 82.4). (Table 1).

Range: The Bismarck Archipelago, including all islands except Feni Islands. Not yet recorded from Dyaul and Umboi and the Vitu Islands; apparently not occurring in Green (Nissan) Islands.



a *b* *c* *d* *e* *f*

Fig. 2. *a Hemiprocne mystacea aëroplanes* New Britain ♂
b –"– –"– –"– –"– ♀
c –"– –"– –"– –"– ♀
d Hemiprocne mystacea mystacea New Guinea ♀
e –"– –"– –"– –"– ♀
f –"– –"– –"– Misoöl ♀

Notice the paler grey upper-parts in *aëroplanes*.
(The specimens *a–c* in ND, *d–f* in AMNH).

Noona Dan Material: (1) ♂ ad., Kwalakessi, Cape Hoskins, New Britain, 3. July 1962, collector's no. 2,308. Scattered body moult. Testes rather large, 5 × 3 mm. Weight 65 g.

(2) ♀ ad., Kwalakessi, Cape Hoskins, New Britain, 3. July 1962, collector's no. 2,309.

(3) ♀ ad., Valoka, Cape Hoskins, New Britain, 6. July 1962, collector's no. 2,323. Ovary granulated, eggs at most 2 × 2 mm.

(4) ♀ ad., Kalili, New Ireland, 12. April 1962, collector's no. 1,563. .Iris black, bill black, legs black.

(5) ♂ ad., 10 miles south of Kalili, New Ireland, 30. April 1962, collector's no. 1,607. Testes rather large, 3 × 3 mm. Weight 79 g.

(6) ♂ ad., 10 miles south of Kalili, New Ireland, 30. April 1962, collector's no. 1,608. Testes rather large, 3 × 3 mm. Weight 75 g.

(7) ♀ ad., 10 miles south of Kalili, New Ireland, 30 April 1962, collector's no. 1,609. Oviduct broad and sinuous, ovary granulated, eggs at most 2 × 2 mm. Weight 56 g.

(8) ♂ ad., 10 miles south of Kalili, New Ireland, 1. May 1962,

collector's no. 1,626. Testes rather large, 2 × 3 mm. Weight 62 g.

(9) ♀ ad., 10 miles south of Kalili, New Ireland, 1. May 1962, collector's no. 1,627. In body moult. Evidently in egg-laying. Weight 73 g.

(10) ♀ ad., 10 miles south of Kalili, New Ireland, 1. May 1962, collector's no. 1,628. In body moult. Evidently in egg-laying. Weight 72 g.

(11) ♀ ad., 10 miles south of Kalili, New Ireland, 2. May 1962, collector's no. 1,647. Scattered body moult. Ovary granulated, eggs at most 1 × 1 mm. Weight 75 g.

(12) ♂ ad., 10 miles south of Kalili, New Ireland, 2. May 1962, collector's no. 1,648. Scattered body moult. Testes rather large, 2 × 3 mm.

(13) ♀ ad., Banatam, New Hanover, 18. March 1962, collector's no. 1,150. Scattered body moult. Ovary granulated, eggs at most 2 × 2 mm. Iris black, bill black, legs greyish black. Weight 74.5 g.

(14) ♀ imm., Banatam, New Hanover, 26. March 1962, collector's no. 1,285. Scattered body moult. Oviduct narrow and straight. Weight 69.5 g.

(15) ♀ ad., Schadel Bay (by river), Mussau Island, 16. January 1962, collector's no. 682. With incubation spot; evidently in egg-laying. Iris dark bluish, bill black, legs black.

(16) ♀ pull., Yalom (1,000 m attitude), New Britain, 12. May 1962, Cullectors no. 2,032. Iris brown, bill black, legs lilac.

Remarks: It was necessary to restrict the description and measurements to the birds of New Britain, which are regarded as the typical *aëroplanes*. A considerable interisland variation exists owing to the fact that the Bismarck Islands populations are influenced, partly by *macrura* of the Admiralty Islands, partly by *woodfordiana* from the Solomon Islands. A cline leads from New Britain over New Ireland and St. Matthias Islands to the Admiralty Islands, another along the Hibernian Islands, from Tabar to Feni Islands. There is undoubtedly a certain amont of gene-flow among neighboring populations, tending to neutralize the differences between the subspecies.

The wing-length of the New Britain population is much smaller than that of *mystacea* from New Guinea, and even smaller than that of *confirmata*. The tail, however, is not shorter, with the result that it is 5% larger in percentage of the wing-length; cf. Table 2. The same applies to New Ireland. The percentage is still greater in the Hibernian island-groups, where the influence of nearby *woodfordiana* is strong. In New Hanover and St. Matthias Islands the percentage is not much greater than in New Guinea. The tail-length proper appears to be similar in the different island populations, being of the same size as in *mystacea* from New Guinea. The wing-length varies a good deal. It is small and almost equal in the central islands (New Britain, New Ireland, New Hanover), still much smaller in the Hibernian Islands, where the populations tend towards the small *woodfordiana,* and bigger in the St. Matthias group, where it is of the same size as *macrura* of the Admiralty Islands.

As far as the coloration of the plumage is concerned, the New Ireland birds on an average are slightly paler on the under-parts than the New Britain birds. Those from St. Matthias Islands are still paler, tending towards the form of the Admiralty Islands, *macrura*. The birds of the Hibernian Islands usually have the abdomen grey (without white), and have also the under tail-coverts with more grey. This is most distinctly to be seen in the Tanga specimens, demonstrating that the populations on these islands are intermediate between *aëroplanes* and *woodfordiana,* in colour as well as in measurements, as shown above, and demonstrated in Table 2.

Without careful consideration of the subspecific differences and of the complicated interisland variation in this species it is impossible to get a proper understanding of the status of the populations. This makes it easy to explain why so many students have thrown *confirmata,* nominate *mystacea* and *aëroplanes* into one basket. Virtually no-one has considered Stresemann's original description of *aëroplanes* in which he said: "Im Vergleich zu *H.m.mystacea* und *H.m.confirmata* ist das Grau von Nacken, Rücken, Kehle, Kropf und Brust heller, nicht so bläulich, und die weisse Färbung der Bauchmitte nicht so ausgedehnt" (Stresemann 1921, p. 38). Most students compared only the wing-length, and this must give rise to confusion in this complicated group. Only Har-

TABLE 2
Measurements (in Millimeters) of Wing and Tail of the Material Examined of *Hemiprocne mystacea* from each Island in Papua and Melanesia.
n: number of specimens examined, w: wing-length, t: tail-length, %: tail in percentage of wing.

Subspecies	Locality	n	w	Average	t	Average	%	Average
mystacea	New Guinea	12	221–237	229.5	164–197	178.9	75–82	77.8
aëroplanes	New Britain	35	209–230	216.6	149–195	179.1	67–87	82.4
	New Ireland	9	211–221	218.6	166–187	178.6	76–85	81.2
	New Hanover	10	211–224	218.6	145–185	170.2	67–85	77.8
	St. Matthias Group	3	216–228	222.0	173–180	176.7	79–80	79.7
	Tabar Group	4	208–218	211.7	165–179	173.3	79–84	81.7
	Lihir Group	6	206–208	210.2	160–183	173.8	73–88	82.7
	Tanga Group	3	209–216	213.2	170–184	178.0	82–86	84.3
macrura	Manus	6	216–226	222.5	188–203	198.8	83–94	89.4
	Rambutyo	5	216–227	220.4	179–196	187.7	82–88	85.0
woodfordiana	Feni	8	198–212	204.5	171–185	177.0	83–92	86.7
	Bougainville	20	199–217	205.4	166–192	177.5	81–91	86.2
	Choiseul	9	195–206	200.1	170–191	175.7	83–93	87.9
	Santa Isabel	20	200–210	204.9	155–189	175.7	76–93	84.8
	Vella Lavella	2	202–203	202.5	168–184	176.0	83–91	87.0
	Ganongga	1	201		141		71	
	Gizo	2	203–208	205.5	152		73	
	Kolombangara	4	197–200	198.2	169–192	179.0	85–97	90.5
	New Georgia	12	196–209	201.8	150–192	174.9	75–94	86.3
	Rendova	1	211		198		94	
	Tetipari	3	201–207	204.3	176–177	176.3	85–88	86.3
	Vangunu	2	207–208	207.5	185–201	193.0	89–97	93.0
	Guadalcanal	10	201–212	207.5	174–197	182.8	83–93	88.0
	Malaita	2	201–205	203.0	279–180	179.5	87–90	88.5
	Rennell	2	211–214	212.5	184–185	184.5	86–88	87.0
carbonaria	San Christobal	7	201–206	203.3	166–182	174.1	81–89	85.7

tert (1924a, p. 206) has commented on Stresemann's description stating that "these specimens [from New Hanover] bear out Dr. Stresemann's diagnosis; they have shorter wings than *H.m.mystacea*, and the back is paler, while I cannot find that the breast is constantly paler".

The interisland variation was noticed by Gilliard and Lecroy (1967, p. 201), who state that "Birds from New Britain, the Admiralty Islands, St. Matthias, Storm, and New Hanover having mean wing lengths between 217 and 222, and birds from Tabar, Mahur, Lihir and Boang averaging 210... Western Bismarck Archipelago birds have considerable less white [on abdomen), often having no pure white but some light grey in the middle of the abdomen. Admiralty Islands birds are exceptional in having as much white as southeastern New Guinea birds. Birds from the eastern Bismarck Archipelago are intermediate between *mystacea* and *woodfordiana* in color; those from Ta-

bar have white on the abdomen. " Gillard and Lecroy base their conclusions on the same material in AMNH which I examined, and they arrive at similar results as I have done, although they do not recognize *aëroplanes*.

On the Noona Dan Expedition we found the Moustached Swift* common on all the central islands visited (New Britain, New Ireland, New Hanover) and encountered it even on small islets along the coasts, as Kung Island off northern New Hanover. Only on Dyaul Island we did not meet with it, in spite of much searching. In its life-habits it was pronouncedly crepuscular, hunting insects in the air at dusk, and sometimes also after heavy rain showers during the day. I witnessed the hunting procedure many times. A number of birds, at most 6–7 individuals, were resting on some dead leafless salient branches very high up in a tree overlooking open country, either at the forest border, along a river, or in high mangroves or beach forest near a river mouth or a bay. They caught insects in the air, flying fairly fast like huge swallows and always returned to the tree from which they started, almost as flycatchers do. They did not, however, return to the same spot from which hunting started, as flycatchers usually do, but descended somewhere else on the tree.

Among the specimens obtained during the Noona Dan Expedition some had the oral cavity and the oesophagus filled with food, which consisted of much larger insects than those taken by *Collocalia;* cf. p. 25. The content of mouth and gullet in one specimen included four winged *Formicidae,* one large *Hemiptera,* one *Elateridae,* one little beetle and two small black wasps. Another specimen had the mouth filled with winged *Formicidae,* small beetles and wasps, and some other specimens possessed only numerous winged *Formicidae* as prey.

The predilection of the Moustached Swift for twi-light has not been mentioned by other students, although it is a very characteristic feature. Only Dahl (1899, p. 184) observed it and says: "Gegen Abend scheint die Hauptjagdzeit zu beginnen, da unternimmt er auch kleine Dauerflüge und lässt dabei oft langgezogene Laute vernehmen, welche entfernt an die Stimme unseres Bussards erinnern." Also Bradley and Wolff (1956, p. 103) say about the subspecies *woodfordiana* on Rennell Island that it was "flying in the dusk together with *Collocalia sp.* in search of insects."

While Dahl compared the voice of the Moustached Swift with that of the "Bussard" = Buzzard (*Buteo buteo*) it appears to my ears more similar to the screaming of the Sparrow Hawk (*Accipiter nisus*). Still, the voice, at any rate was like that of a bird-of-prey. Cain and Galbraith (1956, p. 134) stated that "in flight a high loud "wick" is frequently repeated," which corresponds to my bird-of-prey sound.

Dahl (1899, p. 184) also examined the food of the Moustached Swift and in four specimens found the stomach-content to consist of "Bienen" (= *Apidae*), "Ameisen" (= *Formicidae*), "Käfer" (= *Coleoptera*) and "Wanzen" (= *Hemiptera*), exactly the same food items as found by me and mentioned above. Dahl found the size of the insect prey to vary between 6 mm and 18 mm, proportions which are much greater than those of the insects taken by *Collocalia;* cf. p. 25.

We observed *Hemiprocne mystacea* everywhere in the open lowland, never in closed forest. It also reached relatively far up the mountains. In the Lelet Plateau, in central New Ireland, a flock of three birds were seen hunting in the air along the forest border at an altitude of about 1,000 m. A few birds were observed at Yalom at 1,000 m altitude in the mountains of Gazelle Peninsula, New Britain, where even a nestling was collected. In New Guinea the upper limit of the Moustached Swift runs at about 1,500 m; cf. p. 14.

The material collected by the Noona Dan Expedition appears to show that the breeding-time is April–July. A number of males from this period

* Recently the better name Greater Treeswift has been proposed by Brooke (1969, p. 168).

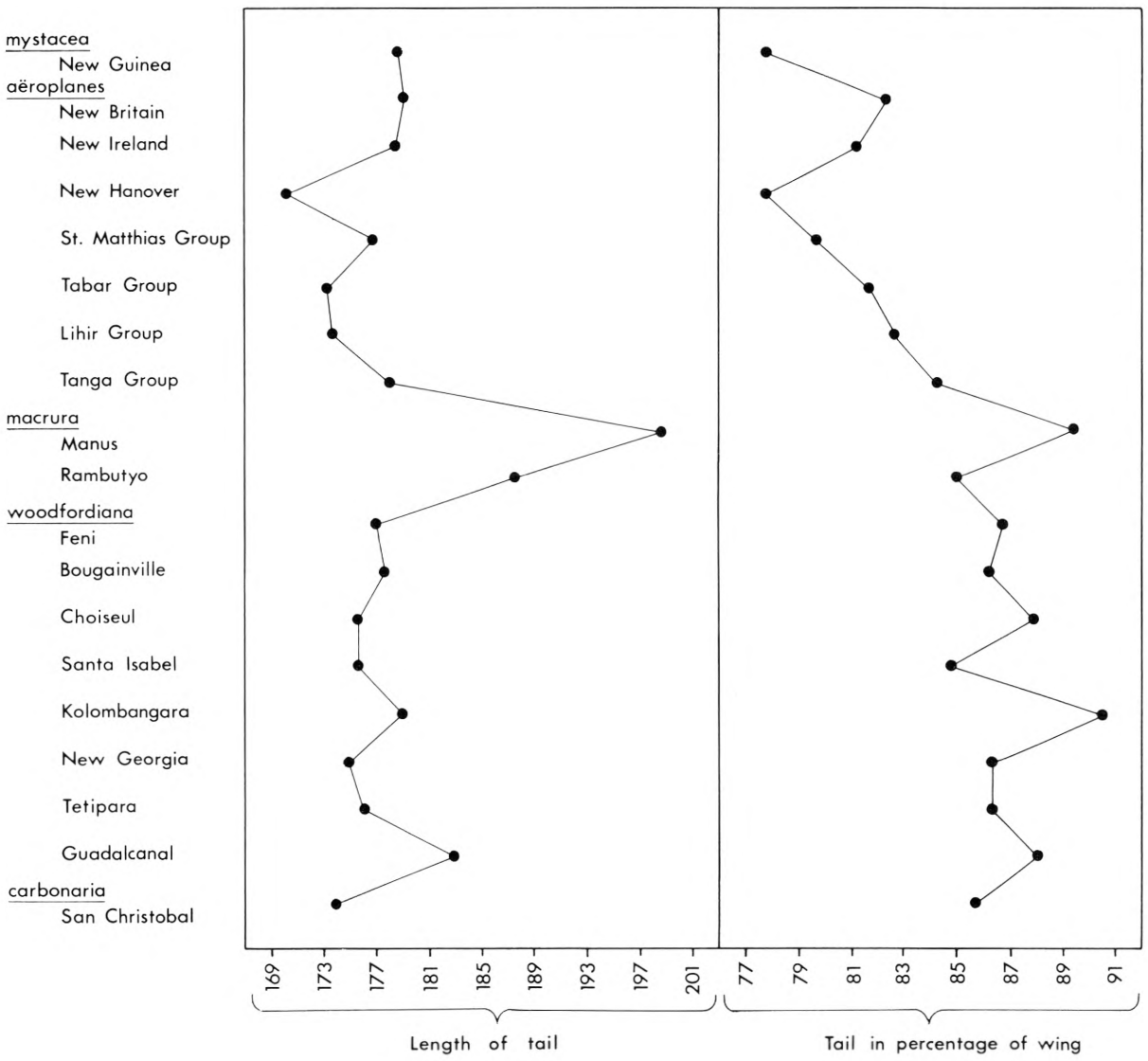


Fig. 3. Mean values of length of tail (left) and of tail in percentage of wing (right) of *Hemiprocne mystacea* in all populations examined in the Papuan and Melanesian region. Only populations with samples of at least three specimens examined have been considered.

had enlarged testes, and many females were evidently in egg-laying. Apparently, the breeding-time is correlated with the dry season, which begins in April after the rainy season from December to March. This conclusion agrees fairly well with the meagre observations made by Dahl (1899, p. 184), who found nestlings on the 10th of February and on the 28th of June. A juvenile specimen was obtained on the 29th of July. Future observations will no doubt throw more light on the life-habits of this remarkable bird.

Hemiprocne mystacea macrura, new subspecies
Type: ♂ ad., Manus Island, Admiralty Islands, 6. January 1934, coll. W. F. Coultas, in AMNH, no. 334773.

Differs from *H.m.aëroplanes* by having a longer tail and on an average greater wing-length; the colour of the under-parts is slightly paler grey than in *aëroplanes*.

Measurements: Six adult specimens from Manus Island have a wing-length of 216–226 (average 222.5) mm, tail-length 188–203 (average 198.8) mm, tail in percentage of wing 83–94 (average 89.4) (Table 1 and 2). The population of Rambutyo Island is intermediate between *macrura* and *aëroplanes,* but closest to the former and is better included in the Manus form. Five adult specimens from Rambutyo Island have a wing-length of 216–227 (average 220.4), tail-length 179–196 (average 187.7) mm, tail in percentage of wing 82–88 (average 85.0). Wing-measurements of two specimens from Los Negros Island are 225 and 227.5 mm according to Ripley (1947, p. 101).

Range: The Admiralty Islands, known from Manus, Rambutyo and Los Negros.

Remarks: It appears from Table 2 that the mean tail-length in nominate *mystacea,* and in the populations of all the islands inhabited by *aëroplanes,* varies between 170 mm and 179 mm, while it is 199 mm in *macrura* in Manus and 188 mm in Rambutyo. The population of the type-locality Manus have thus on an average the tail 20 mm larger than in *aëroplanes*. It is apparent also that the tail-length in percentage of the wing is greater in *macrura,* reaching 85–89%, compared with 78–82% in *aëroplanes*. Only Lihir and Tanga birds demonstrate a slightly larger percentage, 83–84%, in agreement with the tendency of these populations to approach the Solomon Islands form *woodfordiana* which has a larger tail/wing percentage than *aëroplanes;* see Fig. 3.

Hemiprocne mystacea woodfordiana (Hartert)
Macropteryx mystacea woodfordiana Hartert, 1896, Novitates Zool., vol. 3, p. 19 – Guadalcanal Island, Solomon Islands. (Type in AMNH examined.)

Differs from all the preceding forms by having the entire under-parts dark grey, without white on the abdomen, and with very little white on the under tail-coverts, on which the white colour even may be completely missing. The upper-parts are darker grey than in *aëroplanes,* of about the same colour as in nominate *mystacea*. The measurements are much smaller than in all the preceding subspecies.

Measurements: Ninety-eight adult specimens have a wing-length of 195–214, one 217 (average 204.3) mm, tail-length 142–201, usually 170–185 (average 177.4) mm, tail in percentage of wing 71–97, the majority 81–92 (average 86.7); cf. Table 2 and 3.

Range: Feni Islands in the Bismarck Archipelago and all the Solomon Islands except San Christobal.

Remarks: The small measurements of *woodfordiana* are apparent when comparing its wing-length with that in *aëroplanes,* 195–214 mm as against 209–230 mm in *aëroplanes* from the type-locality, New Britain. Gilliard and Lecroy (1967, p. 201) gave the wing-measurements of *woodfordiana* as 190–215 mm, which is very similar to the figures given by me. According to Gilliard and Lecroy even the birds of the Lihir and Tanga Groups should be "provisionally included with *woodfordiana* since they lack white on the abdomen and average rather small in size' (p. 202). It appears, however, from Table 2 that the wing-length of these populations is much closer to that in *aëroplanes,* and it would be more correct to include them in this form than in *woodfordiana*. The birds of Feni Islands are typical *woodfordiana,* on the other hand, with a wing-length of the same modest size as those of the Solomon Islands and with the same coloration. This was pointed out by Hartert as early as 1926. He stated that ten specimens from Feni had a wing-length of only 199–210 mm (Hartert 1926 a, p. 39).

Contrary to the condition in *aëroplanes* the measurements of the different isolated island-populations of *woodfordiana* do not display much varia-

tion. It appears from Table 2 that they are very similar, their mean values varying only a few mm, from 200 to 207 mm in most populations. Only the birds from Rennell Island appear to be slightly larger, with an average wing-length of 212.5 mm, a character pointed out already by Mayr (1931 a, p. 17); unfortunately, only two specimens were obtained.

In spite of the smaller proportions of *woodfordiana* the tail is not shorter than in the other subspecies. It appears from the diagram Fig. 3 that the tail-length of all populations in the Papuan and Melanesian region varies very little, when excepting the long-tailed form *macrura*. In the remaining island populations the mean value of the tail-length usually oscillates between 174 and 180 mm. Therefore, the relation between wing-length and tail-length results in a peculiar situation. Fig. 3 shows that the mean length of the tail expressed in percentage of the wing is about 78–82 in *mystacea* and *aëroplanes*, but constantly 85–88 in the populations of *woodfordiana*, which is the same magnitude as in the long-tailed *macrura*. The biological expedience of these differences is unknown to me.

While there is practically no difference between the body proportions of the different island populations of *woodfordiana* there is a slight variation in the general colour. The palest birds are those from Bougainville, Santa Isabel, Vella Lavella and Ganongga, and the remaining populations are slightly darker, namely those from Choiseul, Gizo, Kolombangara, New Georgia, Rendova, Tetipara, Vangunu, Guadalcandal, Malaita and Rennell. The birds of the two latter islands appear to be still a trifle darker than the other populations, however, though they do not approach the very dark *carbonaria*. In Fig. 4 two specimens from Bougainville and two from Guadalcanal are photographed, and it is perhaps possible to see the very slight difference in colour between them.

It should be added that the fact that Feni Islands are inhabited by the Solomon Islands form *woodfordiana* is an interesting phenomenon. Only in a few cases did species or subspecies belonging to the Solomon avifauna extend their range westwards to the Bismarck Islands. This holds good of the Solomon species *Eos cardinalis*, *Ptilinopus eugeniae* and *Accipiter albogularis*, which all have reached the Hibernian Islands, the subspecies *Butorides striatus solomonensis*, which has occupied New Ireland, and *Hemiprocne mystacea woodfordiana*, which is found on Feni in the Hibernian Islands; cf. Salomonsen 1966, p. 282.

Considering the great number of specimens of the Moustached Swift collected in the Solomon Islands by various expeditions it is interesting to note that Diamond (1975, p. 18) stated that it is more common in Bougainville Island than in New Guinea.

Hemiprocne mystacea carbonaria,
new subspecies

Type: ♂ ad., San Christobal Island, Solomon Islands, 10. December 1929, W. F. Coultas coll., in AMNH, no. 227948.

Differs from *woodfordiana* by being much darker, the under-parts including the abdomen and usually also the under tail-coverts being dark plumbeous grey, upper-parts much darker grey and scapulars, lower back, rump and upper tail-coverts with a distinct bluish gloss. This subspecies can easily be distinguished from all other form of this species (Fig. 4).

Measurements: Seven adult specimens have a wing-length of 201–206 (average 203.3) mm, tail-length 166–182 (average 174.1) mm, tail in percentage of wing 81–89 (average 85.7). The measurements differ in no way from those of *woodfordiana*.

Range: Restricted to San Christobal Island in the Solomon Islands.

Remarks: The only students who have noticed the remarkable coloration of this subspecies are Gilliard and Lecroy (1967, p. 201) who say: "Our six Bauro Island [= San Christobal] specimens are darker grey, both on the back and the abdomen, than typical *woodfordiana*".

TABLE 3
Measurements (in Millimeters) of the Material Examined of *Hemiprocne mystacea woodfordiana* and *H.m.carbonia* from the Bismarck and Solomon Islands.
w: wing-length, t: tail-length, %: tail in percentage of wing.

woodfordiana															
AMNH	Feni Islands		w:	198,	200,	202,	202,	204,	208,	210,	212				
			t:	171,	[a]	179,	185,	173,	181,	175,	183				
			%:	86,		88,	92,	85,	87,	83,	86				
	Bougainville		w:	199,	199,	200,	200,	200,	202,	202,	203,	203,	204,	205,	206,	207
			t:	180,	[a]	171,	172,	166,	184,	173,	172,	169,	166,	178,	185,	182
			%:	90,		86,	86,	83,	91,	86,	85,	83,	81,	87,	90,	88
			w:	207,	209,	210,	211,	212,	212,	217						
			t:	185,	172,	183,	185,	180,	177,	192						
			%:	89,	82,	87,	88,	85,	83,	88						
			w:	206												
		imm.	t:	140												
			%:	68												
	Choiseul		w:	195,	197,	197,	198,	200,	201,	201,	206,	206				
			t:	170,	171,	177,	170,	174,	183,	172,	171,	191				
			%:	87,	87,	90,	86,	88,	91,	86,	83,	93				
			w:	191,	196,	196										
		p_{10} in	t:	165,	172,	174										
		growth	%:	86,	88,	89										
			w:	187,	196											
		imm.	t:	181,	[a]											
			%:	97												
	Santa Isabel		w:	200,	201,	202,	202,	202,	202,	203,	204,	204,	204,	204,	206,	206
			t:	169,	174,	178,	183,	170,	172,	189,	176,	170,	155,	183,	181,	176
			%:	85,	87,	88,	91,	84,	85,	93,	86,	83,	76,	90,	88,	85
			w:	206,	207,	208,	209,	209,	210,	210						
			t:	171,	174,	182,	184,	178,	174,	175						
			%:	83,	84,	88,	88,	85,	83,	83						
			w:	202												
		imm.	t:	144												
			%:	71												
	Vella Lavella		w:	202,	203											
			t:	168,	184											
			%:	83,	91											
	Ganongga		w:	201												
			t:	142												
			%:	71												
	Gizo		w:	203,	208											
			t:	[a)]	152											
			%:		73											

[a] Tail broken. [b] Type of *woodfordiana*.

	Kolombangara		w:	197,	198,	198,	200						
			t:	183,	192	172	169						
			%:	93,	97,	87,	85						
			w:	203									
		imm.	t:	141									
			%:	69									
	New Georgia		w:	196,	198,	198,	198,	199,	199,	200,	204,	205,	207, 208, 209
			t:	[a]	175,	162,	172,	150,	178,	170,	192,	167,	181, 191, 186
			%:		88,	82,	87,	75,	89,	85,	94,	81,	87, 92, 89
	Rendova		w:	211									
			t:	198									
			%:	94									
	Tetipari		w:	201,	205,	207							
			t:	177,	176,	176							
			%:	88,	86,	85							
			w:	198,	205								
		imm.	t:	137,	[a]								
			%:	69									
	Vangunu		w:	207,	208								
			t:	201,	185								
			%:	97,	89								
			w:	205									
		imm.	t:	140									
			%:	68									
	Guadalcanal		w:	201,	205,	206,	207,	207,	208,	209,	209[b]	211,	212
			t:	179,	182,	178,	174,	184,	184,	184,	174,	192,	197
			%:	89,	89,	86,	84,	89,	88,	88,	83,	91,	93
			w:	200,	202								
		imm.	t:	133,	162								
			%:	67,	80								
	Malaita		w:	201,	205								
			t:	180,	179								
			%:	90,	87								
	Rennell		w:	211,	214								
			t:	185,	184								
			%:	88,	86								
carbonaria													
AMNH	San Christobal		w:	201,	202,	202,	203,	204,	205,	206			
			t:	176,	174,	170,	179,	182,	172,	166			
			%:	88,	86,	84,	88,	89,	84,	81			

a *b* *c* *d* *e* *f* *g* *h*

Fig. 4. *a–d Hemiprocne mystacea carbonaria* San Christobal
e–f –"– –"– *woodfordiana* Guadalcanal
g–h –"– –"– –"– Bougainville
Notice the darker plumage in *carbonaria*.
(All specimens in AMNH).

This subspecies is an example of the divergent fauna of San Christobal. This island is quite unique in the Solomon Islands by possessing a great number of peculiar endemic species and subspecies. This phenomenon has often been discussed, and an explanation was attempted by Galbraith and Galbraith (1962, p. 7) and Greenslade (1968, p. 754). Cf. also the San Christobal form *Collocalia esculenta makirensis*, mentioned below, p. 58.

Apodidae

Collocalia G. R. Gray 1840

Four species of this genus inhabit Melanesia. They all differ from each other in size. This may suggest that these species each have their own food-niche. They forage in the same environment, in the open space of air during flight, and it is possible that they to some extent may compete for food. According to Hespenheide (1975, p. 82), who studied the selective predation in two swifts and one swallow in Central America, "the average size of beetle prey items is strongly correlated with the weights of birds which forage in a similar fashion." Something similar undoubtedly applies to the species of *Collocalia*. We do not have the weights of these species, however, but we know the wing-lengths. In the Melanesian species they vary as shown in Table 4. More convincing may the proportions of the bill turn out to be, because they demonstrate more directly the specific differences in feeding habits. It is a wellknown fact that differences in bill-size is a dominant factor in determining the compatibility of related species, particularly on small islands; cf. Salomonsen 1976, p. 597.

When measuring the bill-size it is necessary not only to consider the length, but also the breadth of the bill. This is especially important in the swifts on account of their feeding-habits. Since no species of swifts appear to use the bill to pick up a heavy material from the ground or to catch a large prey it has been advantageous to develop "a large mouth opening and speed of mandible rotation on the sacrifice of a powerful biting force" (Morioka 1974, p. 14). The length of the bill (from feathers) and the breadth of the bill at the base were measured in ten adult specimens of each species from the New Ireland and Dyaul populations in the Bismarck Archipelago (but only one *orientalis* could be examined). The measurements taken are shown in Table 5, the range and average of the different species in Table 6.

It appears from Table 6 that the differences between *esculenta* and *spodiopygia* are minute, but the two other species show distinct differences. The measurement length × breadth of bill is more theoretical, but indicates nevertheless in a symbolic way the area of the mouth opening. These figures demonstrate an increasing size from *esculenta* to *orientalis*, which undoubtedly is of importance in the mutual competition for food. The investigation of the gut contents of *C.vanikorensis*, *C.spodiopygia* and *C.esculenta* in the Solomon Islands, made by Cain and Galbraith (1956, p. 133) is noteworthy in this respect. It was demonstrated that "the insects taken by *C.esculenta* were all smaller, except for a small beetle." A somewhat similar result was achieved by Dahl (1899, p. 185), who examined the stomach content of the same three species in the Bismarck Islands. He found the size of the prey items to be similar in *vanikorensis* and *spodiopygia* (1–6 mm), while in *esculenta* the size varied between 0.5 and 6 mm. Unfortunately, Hails and Amirrudin (1981, p. 328) in their recent very detailed investigation of the food samples of *Collocatia esculenta* did not elucidate the size of the prey items.

It appears that there is a certain competition between *Collocalia* and the *Molossidae*, the "swifts" among the bats. These are common in Africa and South America, comprising 35–40% of the insectivorous bat species there, while in the areas where *Collocalia* is numerous, from India to Australia, the Molossid fauna is depauperate, constituting

TABLE 4
Wing-length (in Millimeters) of Adult Males of the four Species of *Collocalia* Inhabiting the Central Bismarck Islands.

	Number of Specimens	Wing-length	Average
C. esculenta kalili	8	95–102	97.6
C. spodiopygia noonaedanae	14	102–108	104.5
C. vannikorensis pallens	44	113–124	117.2
C. orientalis leletensis	1[a]	134	134.0

[a] The only specimen known (type of *leletensis*), ♀ ad.

less than 10% of the insectivorous bat species. Since Molossids are of similar size as swiftlets and have similar flight patterns it is reasonable to suppose that they would select prey of equal size with similar flight characteristics. Some evidence point towards partly nocturnal feeding in echolocating swiftlets, and since these birds are more efficient predators in the air than bats, it is probable that the swiftlets are responsible for a certain competitive exclusion of Molossids (Fenton 1975, p. 6).

The four species of Melanesian *Collocalia* can be distinguished by the following key:

(1) Upper-parts with a strong gloss, abdomen more or less white, contrasting with dark throat and breast ..... *esculenta*
Upper-parts dark, usually without gloss, rarely with a slight iridescence, under-parts uniform brown to greish-white, without contrast between breast and abdomen; but chin or throat may be dark ..... (2)
(2) Upper-parts uniform dark .... *vanikorensis*
Upper-parts with a grey or white, contrasting band across the rump ..... (3)
(3) Small; wing shorter than 120 mm *spodiopygia*
Large; wing longer than 125 mm . *orientalis*

TABLE 5
Bill Measurements (in Millimeters) of the Species of *Collocalia* Inhabiting the Central Bismarck Islands.

	Length from Feathers	Breadth at base
C. esculenta kalili	3.7, 3.8, 3.8, 3.9, 4.0, 4.0, 4.0, 4.1, 4.2, 4.2	2.8, 2.8, 2.9, 2.9, 3.0, 3.2, 3.6, 3.6, 3.7, 3.8
C. spodiopygia noonaedanae	3.7, 3.8, 4.0, 4.0, 4.0, 4.0, 4.0, 4.0, 4.0, 4.5	2.8, 3.0, 3.2, 3.2, 3.5, 3.5, 3.7, 3.8, 3.9, 4.0
C. vanikorenses pallens	4.5, 4.6, 4.8, 4.8, 4.9, 4.9, 5.0, 5.0, 5.0, 5.1	4.0, 4.0, 4.0, 4.0, 4.2, 4.3, 4.5, 4.9, 5.0, 5.0
C. orientalis leletensis[a)]	6.0	5.0

[a)] Only the type-specimen known.

TABLE 6
Range and Average of the Bill Measurements given in Table 5 of the Species of *Collocalia* in the Central Bismarck Islands.

	Length from Feathers		Breadth at Base		Length × Breath
	Range	Average	Range	Average	
C. esculenta kalili	3.7–4.2	3.97	2.8–3.8	3.23	12.82
C. spodiopygia noonaedanae	3.7–4.5	4.00	2.8–4.0	3.46	13.84
C. vanikorensis pallens	4.5–5.1	4.86	4.0–5.0	4.39	21.34
C. orientalis leletensis[a)]	6.0	(6.00)	5.0	(5.00)	30.00

[a)] One specimen only; type of *C.o.leletensis*.

Collocalia esculenta (Linnaeus) 1758

This species can be divided into two different sections, the *linchi*-group, inhabiting the regions west of Wallace's Line (and including Lombok Island), and characterized by uniform blackish rectrices, and the *esculenta*-group, inhabiting the areas east of Wallace's Line and having a smaller or larger white spot on the basal part of the inner webs of all rectrices except on the central pair; cf. Stresemann 1940, p. 393. The Melanesian forms belong of course to the *esculenta*-group.

This widespread species has been revised by a number of students, most of them dealing with the forms inhabiting only a certain geographical area. The most important revisions were made by Oberholser (1906, p. 203–212), Stresemann (1912, p. 347–349; only the Malayan forms), Stresemann (1923, p. 28–29; mainly the New Guinea forms), Mayr (1931a, p. 15–17; the Solomon Islands forms), Stresemann and Paludan (1932, p. 199–200; the forms of New Guinea and its satellite islands), and Mayr (1944, p. 153–154; the forms of the Timor area). Stresemann (1923, p. 28) was the first to arrange the various subspecies belonging to *esculenta* and thus to define the delimitation of the present species as it is accepted to-day.

Collocalia esculenta has a wide distribution, from the Andaman and Nicobar Islands, across Malaysia and Indonesia, to Papua and Melanesia where it is found right to New Caledonia and the New Hebrides. The nominate form ranges from the Celebes region, across the Northern and Southern Moluccas, to New Guinea with all its satellite islands, according to Stresemann (1940, p. 394) and Mayr (1941, p. 84). It appears peculiar that one single form of a species within *Collocalia* should inhabit such a vast area, and Mayr (1941, p. 84), when describing the distribution of nominate *esculenta*, remarked that "the geographical variation within this range is not yet understood." When I worked with these birds it dawned upon me that this opinion certainly was correct and that the Indo-Australian forms were in urgent need of revision. This is the reason why I have extended my study of *esculenta* to the areas further west and incorporate all forms belonging to the *esculenta*-group, as defined above, while I did not consider the remote *linchi*-group. This group was already monographically treated by Stresemann (1912, p. 347).

The feathering of the tarsus is an important taxonomical character in *Collocalia*. In *C. esculenta*, however, there is no geographical variation in the tarsal feathering. All populations have naked or very thinly feathered tarsus, individually but not geographically somewhat varying.

The distribution of the numerous forms within the *esculenta*-group is shown in Fig. 5.

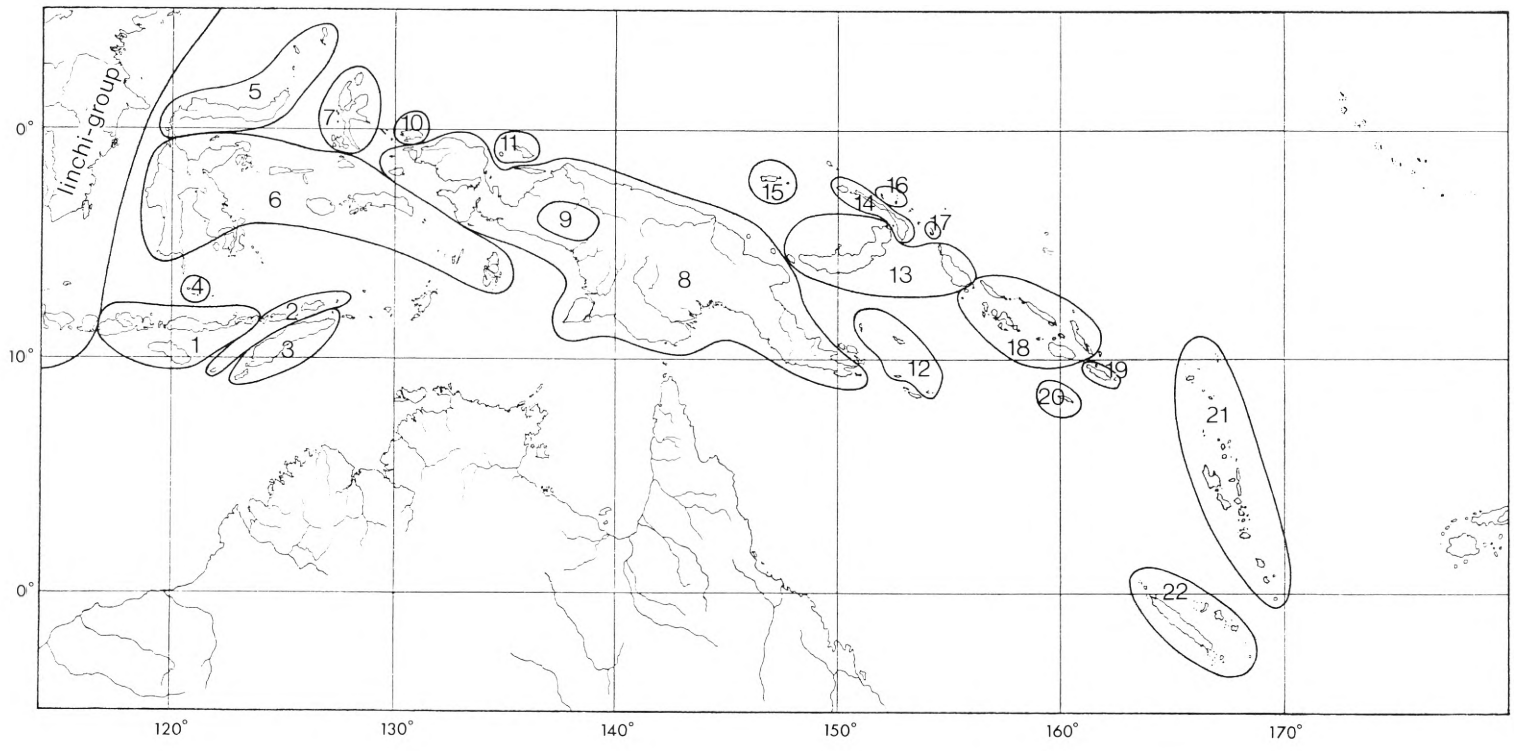


Fig. 5. Distribution of the different forms of *Collocalia esculenta;* the *linchi*-group is not included.
1. *sumbawae*, 2. *perneglecta*, 3. *neglecta*, 4. *minuta*, 5. *manadensis*, 6. *esculenta*, 7. *spilura*, 8. *nitens*, 9. *erwini*, 10. *ametysthina*, 11. *numforensis*, 12. *misimae*, 13. *tametamele*, 14. *kalili*, 15. *stresemanni*, 16. *spilogaster*, 17. *hypogrammica*, 18. *becki*, 19. *makirensis*, 20. *desiderata*, 21. *uropygialis*, 22. *albidior*.

Collocalia esculenta sumbawae Stresemann

Collocalia esculenta sumbawae Stresemann, 1926, Mitt. Zool. Mus. Berlin, vol. 12, p. 189, note 2 – Sumbawa Island. (Type in AMNH examined.)

Like nominate *esculenta*, but gloss of upper-parts duller and not greenish-blue, but darker blue; under-parts with more white, flanks white, also breast with broader white fringes to the grey feathers.

Measurements: Small; wing-length of eight specimens from Sumba 92–95 (average 93.3) mm. Mayr (1944, p. 154) gives the wing-length in a series from Sumba as 91–96 (average 94.0) mm in ♂♂ and 91.5–96 (average 93.8) mm in ♀♀. Rensch (1931, p. 538) gives the wing-length of one ♀ from Sumbawa as 97 mm, and of three ♂♂ from Flores as 93, 96 and 98 mm and of one ♀ as 94 mm.

Range: Sumba, Flores and Sumbawa in the Lesser Sunda Islands.

Remarks: It appears that Lombok is inhabited by *E.e.linchi*, but I have not been able to examine any material. Rensch (1931, p. 538) did not collect any specimens on this island, neither did Doherty (Hartert 1896b, p. 555). Everett was more lucky, and Hartert (1896c, p. 595) mentions that he collected "two skins, no doubt this species", under the heading *Collocalia linchi*. Stresemann (1912, p. 347) examined two ♂♂ (Everett's two specimens) and only stated that they belonged to *C.e.linchi* without further comments.

Meise (1941, p. 357) described a new subspecies, *C.esculenta plesseni* from the small island Nusa Penida in the Lombok Strait and compared it both with *linchi* and *sumbawae*, but it appears from the description to be much closer to *sumbawae*, perhaps identical with it. Meise did not, however, say anything about the colour of the tail-feathers, which is necessary to decide whether the population should be included in the *linchi*- or the *esculenta*-group. I have not been able to examine *plesseni*, and canot say anything definite about the status of this form. Meise also stated that he did not see any Lombok birds, and therefore, the subspecific relation of *esculenta* from this island must await the obtaining of new material.

Collocalia esculenta perneglecta Mayr

Collocalia esculenta perneglecta Mayr, 1944, Bull. Am. Mus. Nat. Hist., vol. 83, p. 153 – Wetar Island, South West Islands. (Type in AMNH examined.)

Intermediate between *sumbawae* and *neglecta*, differing from *sumbawae* by being much duller, not so glossy on the upper-parts and also by being paler, not so deep bluish-black, and from *neglecta* in being more glossy on the upper-parts and not greyish but bluish. Under-parts as in *sumbawae*.

Measurements: According to Mayr (1944, p. 153) the wing-length of ♂♂ is 91–97 (average 94.7) mm, of ♀♀ 90–96 (average 94.2) mm.

Range: Alor, Wetar, Roma, Kisser (Kisar), Damar and Sawu Islands.

Remarks: Mayr stated that Sawu specimens were slightly closer to *neglecta*, while Alor birds approached *sumbawae* by being darker and glossier. A series from Damar Island was still closer to *sumbawae*.

It is unknown to which subspecies the *esculenta* belong which inhabit the islands between Flores and Alor, and those from Leti, Sermata and Babar Islands as well as from Timor Laut (Tanimbar).

Collocalia esculenta neglecta G. R. Gray

Collocalia neglecta G. R. Gray, 1866, Ann. and Mag. Nat. Hist., vol. 17, p. 121 – Timor.

Strikingly different from all other subspecies of *esculenta* by having greyish-blue upper-parts almost devoid of gloss (Fig. 6), and by having distinct white linings on the inner webs of the secondaries and primaries (except outermost four pairs) and even some of the scapulars and with very broad white outer parts of the feathers of breast and lower throat, to the effect that these

Fig. 6. *a Collocalia esculenta esculenta* South Celebes ♀
b –"– –"– *perneglecta* Roma Island ♀
c –"– –"– *neglecta* Timor ♂
Notice difference in gloss of upper-parts.
(All specimens in AMNH).

parts appear virtually pure white, contiguous with the white abdomen. The feathers of the rump are very narrowly edged with white.

Measurements: Mayr (1944, p. 153) gave the following measurements: Wing-length of seven adult ♂♂ 95–101 (average 98.1) mm, four ♀♀ 93–105 (average 99.5) mm. I only measured a few specimens in AMNH, and the wing-lengths agree with those given by Mayr.

Range: Timor Island.

Collocalia esculenta minima Stresemann

Collocalia esculenta minima Stresemann, 1926, Mitt. Zool. Mus. Berlin, vol. 12, p. 189, note 3 – Kalao Island. (Type in AMNH examined.)

Differing from nominate *esculenta* only by smaller size.

Measurements: I have measured the type specimen, a ♀ from Kalao, another ♀ from Kalao and a ♀ from Djampea; all three had a wing-length of 93 mm. Stresemann in his original description gave the wing-length of two specimens also as 93 mm and 93 mm. Meise (1929, p. 466) gave the wing-length of two specimens from Djampea as ♂ 93 mm. ♀ 94 mm. Most specimens of nominate *esculenta* are larger, having wing usually measuring 97–102 mm; cf. measurements of this form and Table 7.

Range: Djampea (Tanahdjampea) and Kalao Islands in the Flores Sea.

Remarks: Collocalia esculenta is not yet recorded from Salajar Island (cf. Hartert 1896a, p. 183), and so it is unknown whether this island is inhabited by *minuta* or by nominate *esculenta*.

Collocalia esculenta manadensis, new subspecies

Type: ♂ ad., Mt. Rurukan (at 800 m altitude), North Celebes, 11. January 1931, coll. G. Heinrich, in AMNH, no. 299155.

A very dark form. Differs from nominate *esculenta* and *nitens* by having throat and upper breast black

with a slight iridescent, dull greenish gloss and with very narrow white feather-edges which give a scaly pattern and which soon wear off; lower breast and abdomen white, sharply contrasting with the blackish chest; flanks with much black with a slight gloss on the feathers and with narrow whitish feather-edges, being of the same colour as throat and chest (Fig. 7). Upper-parts and also under tail-coverts in fresh plumage with a strong greenish gloss, in worn plumage more bluish. White spots on base of inner web on tail-feathers large and distinct.

Measurements: The wing-length of four adult ♂♂ is 99–102 (average 100.3) mm, of seven adult ♀♀ 97–101 (average 98.6) mm. Stresemann (1940, p. 394) gave the wing-length of eight ♂♂ as 96–103 (average 99.9) mm, of eleven ♀♀ 96–101 (average 98.7) mm.

Range: Northern part of Celebes (Sulamwesi), at least the northern peninsula; how far south is unknown. The greatest number of specimens were collected at Mt. Rurukan, not far from Manado. This locality and all other important collecting stations are shown on the map in Stresemann (1940, p. 14) and mentioned in the accompanying gazetteer.

Remarks: Stresemann and Paludan (1932, p. 199) gave a description of *C.e.viridinitens* Gray from Celebes, which clearly is the same as *manadensis*. The description is based on twenty specimens collected by G. Heinrich in 1931. He obtained the greater part of these birds (altogether nineteen specimens) in the northern part of Celebes, inhabited by *manadensis*, but the authors supposed that their *viridinitens* occurred all over Celebes. Unfortunately, *viridinitens* cannot be used as the designation for the North Celebes form, since this name is based on birds from S. W. Celebes (type examined), which is inhabited by nominate *esculenta*. In his subsequent description of the avifauna of Celebes Stresemann (1940, p. 394) apparently changed his mind, stating that the Celebes birds belong to nominate *esculenta*, even adding that there is "anscheinend keine" (apparently no) geographical variation in the Celebes region.

The birds of the Talaud and Sangihe Islands probably belong to *manadensis*. It is noteworthy, however, that Mayr and Camras (1938, p. 470) has drawn attention to a specimen collected during the Crane Expedition, stating that "the gloss on this puzzling specimen from Sangihe Island is greenish instead of bluish and it may belong to a new race. The bird, however, is apparently young, as indicated by the dull coloration and the softness of the feathers. The lack of white of the tail-feathers may also be a sign of immaturity." Since this latter assumption is not correct because even young birds have white spots on the tail-feathers, it indicates that the birds of the Sangihe and Talaud Islands may belong to some subspecies within the *linchi*-group as the birds of Lombok Island. It should be remarked, however, that *manadensis* has a strong greenish gloss, not bluish, just like the bird from the Sangihe Island.

Collocalia esculenta esculenta (Linnaeus)

Hirundo esculenta Linnaeus, 1758, Syst. Nat., ed. 10, vol. 1, p. 191–China, error for Amboina (Ambon), *ex Apus marina* Rumphius, 1750, Herb. Amboin., vol. 6, p. 183: cf. Hartert 1892, p. 509.

Collocalia hypoleuca G. R. Gray, 1858, Proc. Zool. Soc. London, p. 170 & 189 – Aru Islands. (Type in BM examined.)

Collocalia viridinitens G. R. Gray, 1866, Ann. and Mag. Nat. Hist., vol. 17, p. 120 – Macassar, South Celebes. (Type in BM examined.)

Throat and chest grey, much paler than in *manadensis* and without any gloss, with white feather-edges broad and distinct, and throat and chest therefore appearing as a mixture of white and gray, seen even in worn birds; flanks with more or less grey at base of feathers, but white is predominating, and sometimes the flanks are almost pure white. Upper-parts glossy bluish-green, slightly duller than in *manadensis*. White spots on the base of the tail feathers smaller and more blurred than in *manadensis*, but always distinctly

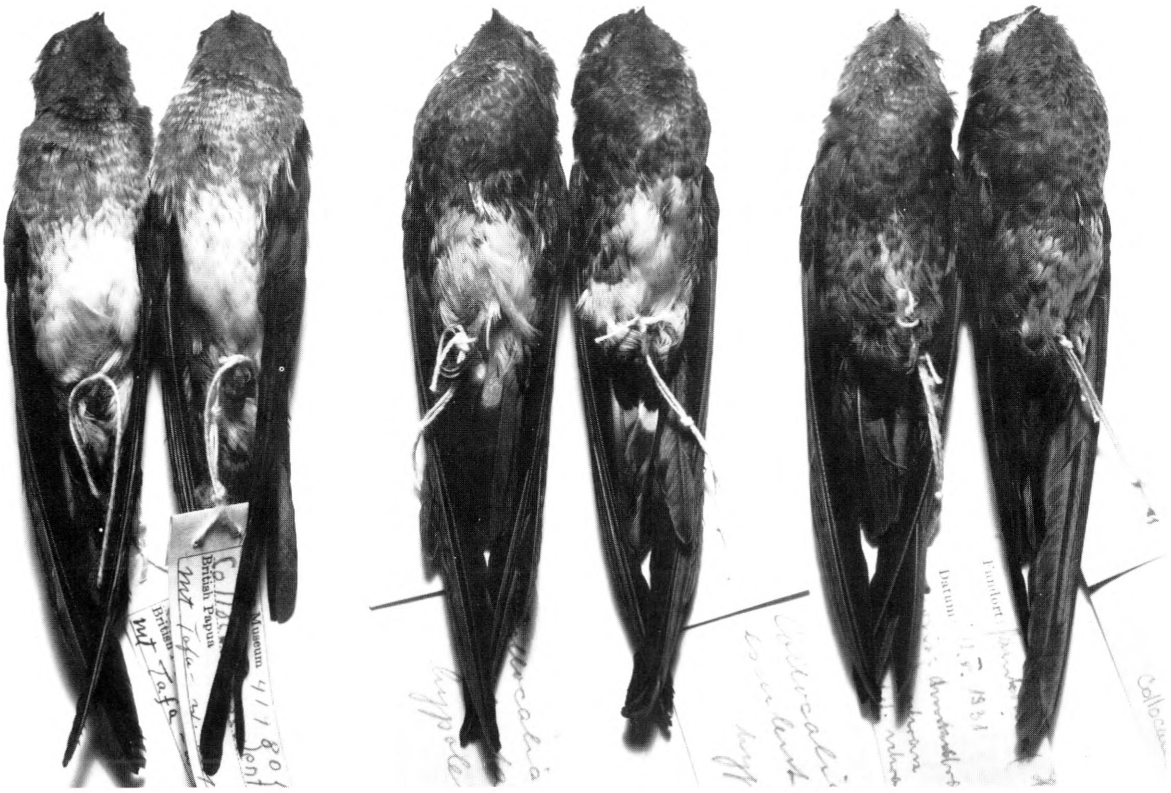


Fig. 7. *a–b Collocalia esculenta nitens* Mt. Tafa, New Guinea ♀♀
c–d –"– –"– *manadensis* Mt. Rurukan, Celebes ♂♂
e–f –"– –"– *spilura* Halmahera ♂♂
Notice distinct differences in colour of under-parts in the three forms.
(All specimens in AMNH).

present. The colour of the under-side in *nitens*, *manadensis* and *spilura* is shown in Fig. 7, but since *nitens* and nominate *esculenta* have the under-parts very similarly coloured this figure may very well demonstrate the differences between *esculenta* and its neighbouring forms *manadensis* and *spilura*.

Measurements: Seventeen adult ♂♂ from different localities (cf. Table 7) have the wing-length 94–105 (average 99.4) mm, five adult ♀♀ 97–105 (average 99.8) mm, six unsexed specimens 97–106 (average 100.2) mm.

Range: Southern Celebes (Sulamwesi), probably northwards to the Gulf of Tomini (unknown from Muna and Buton (Butung); cf. Van Bemmel and Voous 1951, p. 55), Banggai and Sula Islands (Eck

TABLE 7
Wing-length (in Millimeters) of the Material of *Collocalia esculenta* Examined from Central Indonesia.

manadensis			
AMNH	Mt. Rurukan, North Celebes	♂♂	99, 100, 100, 102
		♀♀	97, 97, 98, 98, 99, 100, 101
		imm.	–[a] –[a]
esculenta			
AMNH	South Celebes	♂♂	97, 99, 100, 102
		♀♀	97, 100
	Banggai		–[b] –[b] –[b] –[b] –[b] –[b]
	Buru	♂♂	100, 101, 102
		unsexed	101, 106
	Ceram	♂♂	94, 101
	Ambon	unsexed	97
	Obi	♀	97
	Kai Islands	♀	100
BM	Macassar, South Celebes	unsexed	97[c]
	Indrulaman, South Celebes	♂♂	97, 100
	Ceram	♂	96
	Kai Islands	♂♂	98, 101, 101, 105
	Aru Islands	♀	105[d]
spilura			
AMNH	Halmahera	♂♂	95, 97
		imm., unsexed	94
BM	Batchian	♀	94
		unsexed	97
		imm. ♀	92[c]

[a] Immature specimens in growth. [b] All six specimens in growth. [c] Type of *viridinitens*. [d] Type of *hypoleuca*. [e] Type of *spilura*.

1976, p. 78), Obi Island, the Southern Moluccas (specimens from Buru, Ceram and Ambon examined), Kai (Ewab) Islands and Aru Islands.

Remarks: The typical birds are those from the Southern Moluccas, Ambon being the type-locality. I have seen sufficient material from Buru and Ceram, but only one from Ambon. They are all very similar. The greater part are from the mountains (650–1,000 m altitude), but they do not appear to differ in wing-length or coloration from the lowland birds. I examined six specimens from the Banggai-Sula Archipelago, but all were in moult, being immature specimens. The plumage coloration, however, did not differ from that of typical *esculenta*. I have, further, examined a good material from southern Celebes, most from In-

drulaman, Lompabatang (at an altitude of 2,500 m), Bonthain Peak (2,000 m) and Talassa in AMNH, and Indrulaman and Macassar in BM. The type of *viridinitens* Gray, examined by me, was collected at Macassar by Wallace in 1857 and is a typical *esculenta*, quite similar to the Indrulaman specimens. The populations in the eastern part of the range, the Kai and Aru Islands, are not quite typical *esculenta*, but tend towards the New Guinea form *nitens*. Four specimens from the Kai Island in BM, collected during the British Ornith. Union's New Guinea Expedition 1909 are very similar to *esculenta* in the gloss of the upper-parts, while the predominance of white on flanks and lower breast is a *nitens* character. I would call the Kai population intermediate between *esculenta* and *nitens*, but prefer to keep it with *esculenta*. The type specimen of *hypoleuca* Gray, examined by me, was collected in the Aru Islands by Wallace and in most respects is very similar to the Kai specimens. I find it, therefore, most convenient to unite also the Aru Islands' population with nominate *esculenta*.

Collocalia esculenta spilura G. R. Gray

Collocalia spilura G. R. Gray, 1866, Ann. and Mag. Nat. Hist., vol. 17, p. 120 – Batchian (Batjan) Island. (Type in BM examined.)

Collocalia esculenta nubila Ripley, 1959, Postilla, no. 41, p. 4 – Halmahera.

Strikingly different from all other forms of *esculenta*. The throat, chest and flanks brownish grey, much darker than in nominate *esculenta*, but not as dark as in *manadensis* and without any gloss, white borders to feathers narrow, producing a similar scaly pattern as in *manadensis;* feathers of lower breast and abdomen not white, but dark grey with only a broad white border and with prominent dark shaft-streaks right to the tip of the feathers (cf. Fig. 7); gloss of upper-parts and under tail-coverts as strong as in *manadensis*, but being dark blue, not greenish. White spots on tail-feathers rather small and indistinct as in nominate *esculenta*, or even quite missing.

Measurements: Two ♂♂ from Halmahera have the wing-length 95 and 97 mm, an immature specimen 94 mm; a ♀ from Batchian measures 94 mm, an unsexed specimen 97 mm and an immature one 92 mm (Table 7). Ripley (1959b, p. 5) had a larger material and gave the following wing-measurements of Halmahera birds: Six ♂♂ 93–96 mm, three ♀♀ 92–95 mm, five unsexed specimens 90–96 mm.

Range: The Northern Moluccas. I have examined specimens from Halmahera and Batchian, Ripley (1959, p. 5) adds Morotai, Ternate and Tidore, and Van Bemmel (1948, p. 361) the island Rau. Gebe Island may be inhabited either by this form or by the New Guinean *nitens*, but no *Collocalia* was ever recorded from Gebe (Mees 1972, p. 80).

Remarks: The birds from Halmahera agree with the description given above, while Batchian birds are not quite so typical. The type-specimen, examined by me, collected on Batchian by Wallace in 1859, is in many ways rather similar to nominate *esculenta*, but has much more grey on lower breast and flanks, approaching the Halmahera specimens. Another specimen in BM, from the Tweeddale Collection, only labelled Batchian, but without further data, is like the Wallace specimen mentioned above. A third specimen from Batchian in BM, also collected by Wallace, is a quite typical *spilura* in all respects. According to this meagre material it appears that the Batchian population tends towards nominate *esculenta* and may be described as intermediate between *spilura* and *esculenta*, but I find it most convenient to unite it with the Halmahera birds and use the name *spilura* for this characteristic subspecies. According to Hartert (1903, p. 51) Wallace has been the only collector of this species on Batchian, and to the best of my knowledge it has not later been collected there.

Stresemann and Paludan (1932, p. 199) gave a good description of Halmahera birds which they correctly called *spilura*. It is, however, peculiar that they maintain they cannot distinguish

Halmahera and Numfor birds, neither in colour nor in size. These two populations differ in the colour of both upper- and under-parts, although it is true that the Numfor birds in the coloration of breast and abdomen has a remarkable similarity with *spilura;* cf. Fig. 10.

It is, however, quite incomprehensible that Mees (1965, p. 172) states that "several specimens from Ambon are quite as dark below as our series from the North Moluccas," which latter he rightly holds to be *spilura.* I have seen only one specimen from Ambon, but good series from nearby Buru and Ceram, and they are certainly true nominate *esculenta.* Incidentally, Mees quotes Linnaeus' original description of *esculenta,* stating that the type-locality is Ambon. This is correct, and it is peculiar, therefore, that he calls his Ambon specimens *spilura.* This name would become a synonym to *esculenta* if the Ambon population was identical with the Halmahera birds.

Ripley (1959b, p. 4) described *C.esculenta nubila* from Halmahera as a new subspecies, and the description agrees with *spilura* in all respects, but Ripley did not know this senior synonym. He states that this subspecies "differs strikingly from typical *esculenta* of Obi, Buru, the southern Moluccas, Celebes (Sulawesi) and New Guinea". This quotation demonstrates that Mees was incorrect in saying that Ambon specimens were similar to North Moluccan birds.

Collocalia esculenta nitens Ogilvie-Grant

Collocalia nitens Ogilvie-Grant, 1914, Bull. British Ornith. Club, vol. 35, p. 35 – Utakwa River (2,900 feet), New Guinea. (Type in BM examined.)

Very similar to nominate *esculenta,* but with distinctly stronger gloss on the upper-parts, of about the same colour as in *manadensis,* but more billant bluish, not greenish blue; grey colour of throat and chest as in *esculenta,* with broad white borders on the feathers, but with the dark feather bases of flanks more restricted than in *esculenta,* the lower breast and abdomen therefore being more extensively white. The white spots on the tail-feathers variable, usually distinct and large, but sometimes small and blurred and in some specimens even quite missing.

Measurements: Nineteen ♂♂ from different localities (see Table 8) have a wing-length of 97–107, one 110 (average 101.8) mm, fifteen ♀♀ 97–108 (average 101.1) mm, fifteen unsexed specimens 96–104 (average 99.3) mm.

Range: The lowland of entire New Guinea, to an altitude of about 600–800 m, the height varying from one area to another, in some mountains found much higher up, almost to 2,500 m (cf. *erwini,* below p. 36); the range of *nitens* further includes Japen, Karkar (Dampier) Island, Long Island, Misoöl and Batanta (where it was collected by Gilliard in 1964; cf. Greenway 1966, p. 12), and probably also Salawati. Has straggled a few times to northern Australia.

Remarks: This is a weak form in size as well as in coloration, being very similar to nominate *esculenta,* and it has previously not been separated from the latter form. However, the difference in coloration, particularly the gloss of the upper-parts, is distinct and constant, and I do not hesitate to recognize *nitens.* There are, however, some differences between typical *nitens* and the populations inhabiting the peripheral areas of the range. Specimens from S. E. New Guinea (Aroa River, Angabunga River, Bihagi at Mambare River) have a tendency to more green gloss on the upper-parts, and this also is the case in Karkar Island and Long Island birds. From the remaining New Guinea (and Japen) the populations all appear to be quite typical *nitens.* Specimens from Misoöl have the strong bluish gloss on the upper-parts as *nitens,* but have more dark feathers on flanks and lower breast, in this respect being similar to nominate *esculenta.* One out of three specimens from Arfak Mountains is similar to the Misoöl specimens, both as regards the dark spots on the under-parts and the strong gloss on the upper-parts. The type specimen of *nitens,* examined by me in BM, agrees in all details with the description given

above of this subspecies, which also appears from the original description (Ogilvie-Grant 1914, p. 35). This single specimen was described as a new species because it had no white spots on the tail-feathers. However, the presence of white tail-spots is an individually varying character in this subspecies. Ogilvie-Grant gave the wing-length of the type as 92 mm, but acutally it is about 100 mm. It is difficult, however, to take measurements of this specimen owing to awkward skinning.

Under the heading *Collocalia esculenta* subsp. Stresemann and Paludan (1932, p. 199) united birds from Japen, the Sepik region and the Saruwaged Mts., stating that they are sharply differentiated from Numfor birds. The above-mentioned specimens are all typical *nitens*. Stresemann and Paludan also mentioned that birds from the Weyland Mts. belong to this subspecies, but emphasized that the white spots on the tail-feathers are considerably reduced, the birds in this respect approaching the type specimen of *nitens*. A closer description of the birds from the Weyland Mts. was given by Stresemann and Paludan 1936, p. 225. Birds from Salawati probably belong to *nitens*, but no material of *C.esculenta* has been collected on this island, and the range of *nitens*, therefore, is only provisionally extended to cover the said island.

As said above *C.esculenta nitens* is a rare visitor in northern Australia. The specimens examined by me are similar to New Guinea or Aru Islands birds. There are specimens from Cape York in both AMNH and BM. On the label of one of the BM specimens is written: "Erroneously recorded from Australia; cf. Peters, vol. 4, p. 231. These specimens could have been collected on Aru Islands by Cockerell; it is not the first time that he has done this," signed G. Cowles. It is of course wellknown that Cockerell was somewhat rash when stating his localities, but *esculenta* is, nevertheless, known as a rare visitor at Cape York, North Queensland. One specimen (without date) was obtained at Cape York, and a flock of about forty birds were observed on January 24, 1966 at Iron Range, Cape York. All other Australian records are not reliable (McKean 1967, p. 98). However, a new record from Eungella National Park in Queensland in 1975 was given by Boles and Barry (1975, p. 97).

Collocalia esculenta erwini Collins and Hartert

Collocalia esculenta maxima Ogilvie Grant, 1914, Bull. British Ornith. Club, vol. 35, p. 35 – Utakwa River (8,000 feet), New Guinea. Not *Collocalia maxima* Hume, 1876, Stray Feathers, vol. 4, p. 223, where a *nomen nudum* in synonymy of *Collocalia innominata*.

Collocalia esculenta erwini Collins and Hartert, 1927, Novit. Zool., vol. 34, p. 50. New name for *C.e.maxima*, preoccupied.

This form differs from *nitens* only by its considerable size (Fig. 8).

Measurements: Four ♂♂ from the Western Mountains of New Guinea (Nassau-Oranje Range) have a wing-length of 113–120 (average 116.3) mm, five ♀♀ 107–118 (average 112.8) mm, and seven unsexed specimens 108–115 (average 111.6) mm, compared with 96–108 (average 100.8) mm in fortysix specimens (♂♂ and ♀♀ combined) of the lowland *nitens* (Fig. 8).

Range: The upper altitudes of the highest mountains in the western range of highland in New Guinea, *i.e.* the Carstenz Peaks, the Nassau Range, the Snow Mountains and the Oranje Range, where *erwini* occurs from about 1,600 m, up to the highest mountain areas. In other mountains only approaches to *erwini (erwini ≷ nitens)* are found at similar altitudes, while in the peripheral mountains (Arfak Mountains, Sepik Mountains, Huon Peninsula mountains, S. E. New Guinea mountains and perhaps the Weyland Mountains) *nitens* or populations very similar in size to *nitens* occur, apparently even at great altitudes.

Remarks: Collocalia esculenta inhabiting the mountain ranges of New Guinea gradually increases in size in correlation with altitude. There are, therefore, no sharp limits between *nitens* and *erwini*. So it is necessary to define certain arbitrary limits for the two subspecies in order to make

TABLE 8
Wing-length (in Millimeters) of the Material Examined of *Collocalia esculenta nitens*.

nitens			
AMNH	Siwi, Arfak Mts. (800 m)	♀♀	101, 101, 107
	Lower Menoo, Weyland Mts. (300 m)	♂	107
		♀	108
	Gebroeders Mts. (1,600 m)		—[a] —[a]
	Hollandia	♂	102
		unsexed	96, 97, 97, 98, 98, 98, 98, 100, 102
			102, 104, —[a] —[a] —[a] —[a]
	Huon Pen. (lowland)	♀	105
		unsexed	101, 102
	Bihagi, S.E. New Guinea	♂♂	104, 104, 105, 110
		♀♀	103, —[a]
	Aroa River (2,200 m), S.E. New Guinea	♂	99
		♀	98
	Angabunga River (2,200 m), S.E. New Guinea	♂♂	101, —[a]
	Port Moresby	unsexed	101
	Mt. Tafa (350–580 m), S.E. New Guinea	♂♂	97, 102, 102
		♀♀	97, 97, 98, 100, 100, 101
	Japen Island	♂	97
	Dampier Island	♂♂	100, 103, 105
	Long Island	♂	102
	Misoöl Island	♀	98
	Cape York, Australia (?)	♂	95
		unsexed	102
BM	Utakwa (950 m), S.W. New Guinea	♂	100[b]
	Moroka Mts. (1,300 m), S.E. New Guinea	♂♂	98, 102
		♀♀	101, —[a]
	Misoöl Island	unsexed	98
		imm. ♂	94
	Cape York, Australia (?)	unsexed	98

[a] In moult, not measured. [b] Type of *nitens*.

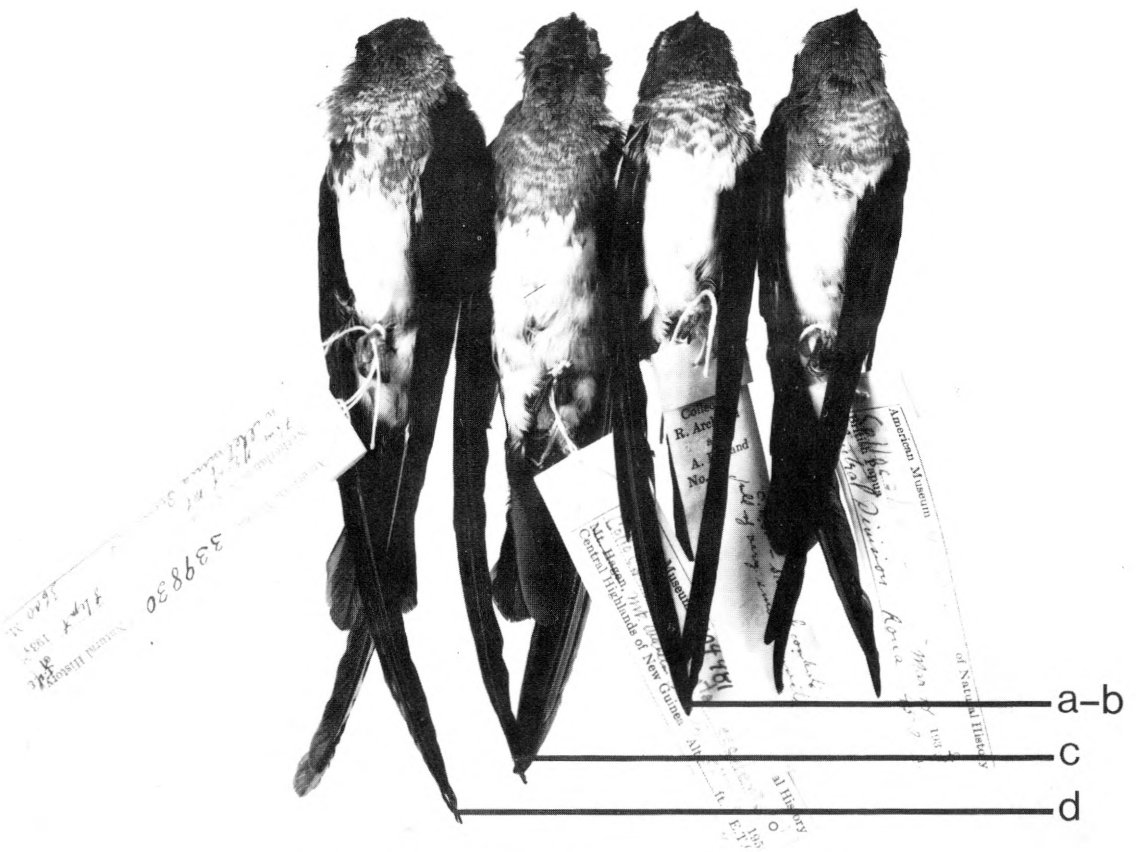


Fig. 8. *a Collocalia esculenta nitens* wing-length 97 mm
b –"– –"– –"– –"– 100 mm
c –"– –"– *nitens* ≷ *erwini* –"– 108 mm
d –"– –"– *erwini* –"– 120 mm
Notice size difference of the New Guinea forms.
(All specimens in AMNH).

geographical arrangements possible. Populations with an average wing-length of 110 mm or more (in ♂♂ and ♀♀ combined) are here said to represent true *erwini*. Populations with an average wing-length below 102 mm are *nitens*, while those with average wing-length between 102 and 110 mm are intermediate between the two said subspecies *(erwini* ≷ *nitens)*. The total material of *esculenta* inhabiting the New Guinea mountain ranges examined by me, all belonging to AMNH, is shown in Table 9. This table gives wing-length of ♂♂, ♀♀ and unsexed birds, as well as the total variation (of ♂♂ and ♀♀ combined) at each altitude where collecting has been done, and the number of birds examined. The result has been presented in the diagram Fig. 9. It appears from this figure that *erwini*, according to the definition given above, occurs only in the "Western Mountains", *i.e.* the area comprising the Snow Mountains and adjacent mountain ranges. In the so-

called "Central Mountains" (Bismarck Range and surrounding mountains) the body proportions of *esculenta* are smaller, and the limit towards the size of *erwini* is just skirted. Finally, in the "Eastern Mountains" (Wharton Range) *erwini* does not occur at all, even not at the highest altitudes investigated (3,680 m), where the intermediate form *erwini* ≷ *nitens* is found (wing-length 106.3 mm). The meagre material from the "Southeastern Mountains" (from Hall Sound to Owen Stanley Range) appears to show that these mountains are inhabited by the lowland form *nitens*, with a wing-length not exceeding 100 mm even at 2,200 m altitude; cf. measurements on Table 8 of *nitens* from Aroa River (2,200 m), Angabunga River (2,200 m) and Moroka Mts. (1,300 m).

It appears from Fig. 9 that *nitens* is usually found in the highlands to a height of about 600–800 m and is there replaced by populations of the type *erwini* ≷ *nitens*, which in the "Central Mountains" and "Eastern Mountains" are found to the uppermost altitudes, while in the "Western Mountains" they are replaced by true *erwini* (with average wing-length of 110 mm or greater) from altitudes upwards of about 1,600 m. It is noteworthy that this altitude (1,500–1,700 m) in New Guinea also signifies the general change from tropical lowland environment to subtropical and montane areas (Schodde and Hitchcock 1968, p. 18). It must be admitted, however, that this altitude does not agree with the figures given by Archbold *et al.* (1942, p. 285) according to whom the change between the tropical and the subtropical zone takes place at about 1,200 m in Southeast New Guinea. On the other hand, in the Snow Mountains the savanna and savanna-forest of the tropical zone reaches 1,700 m, and the mossy forests of the subtropical zone begins at 1,500 m (Archbold *et al.* 1942, p. 281).

The distribution of the *esculenta* forms in the New Guinea mountains, described above, is borne out by the literature statements. Regarding the "Western Mountains" the type of *maxima* (= *erwini*) from Utakwa River, at an altitude of about 2,600 m, has a wing-length of 115 mm, according to the original description (Ogilvie-Grant 1914, p. 35). Rand (1942b, p. 458) examined the material of the Archbold Expeditions and called the birds from the Snow Mountains *Collocalia esculenta* subsp. I have examined the same material (given in Table 9), and my measurements agree with those taken by Rand, or they are sometimes 1 mm shorter. Ripley (1964, p. 40) examined a series from the Carstenz Peaks, obtained at Baliem River and Ilaga River (about 2,250–2,900 m; the altitude is not exactly given) and states that the wing-length is 108–114 (average 112,5) mm, *i.e.* the birds are evidently *erwini*.

Much collecting has been done in the "Central Mountains". Large series were collected by E. Th. Gilliard in the Wahgi area, between the Kubor Range and the Bismarck Range. His material was used in this study (Table 9), from which it appears that the average wing-length increases from 104 to 108–110 mm at altitudes from 1,300 to 2,900 m. This does not agree with the measurements of the same specimens taken by Mayr and Gilliard (1954, p. 342), who give the wing-length as 97–107 mm in 7 ♂♂ and 94–102 mm in 6 ♀♀. These faulty measurements must be due to a misunderstanding of some kind. Gyldenstolpe (1955a, p. 70) gave the wing-length of three specimens from the same area (Nondugl, Dagie) of 1,600–1,800 m altitude as 106, 107 and 108 mm. Diamond (1972, p. 180) stated the following measurements of *esculenta* from the Kubor Range and surroundings: Two ♂♂ from 1,900–2,100 m 106 and 109 mm, one ♀ from 1,450 m 102 mm and one unsexed specimen from 480 m 98 mm. The measurements taken both by Gyldenstolpe and Diamond agree with mine shown in Table 9 and Fig. 9. Two ♂♂ from the Hindenburg Mountains at 1,900 m altitude measure 106 and 109.5 mm (Gilliard and Lecroy 1961, p. 43), which also very well agree with my measurements in Table 9.

From the "Eastern Mountains" I examined the material collected by the Archbold Expeditions and described by Mayr and Rand (1937, p. 76–

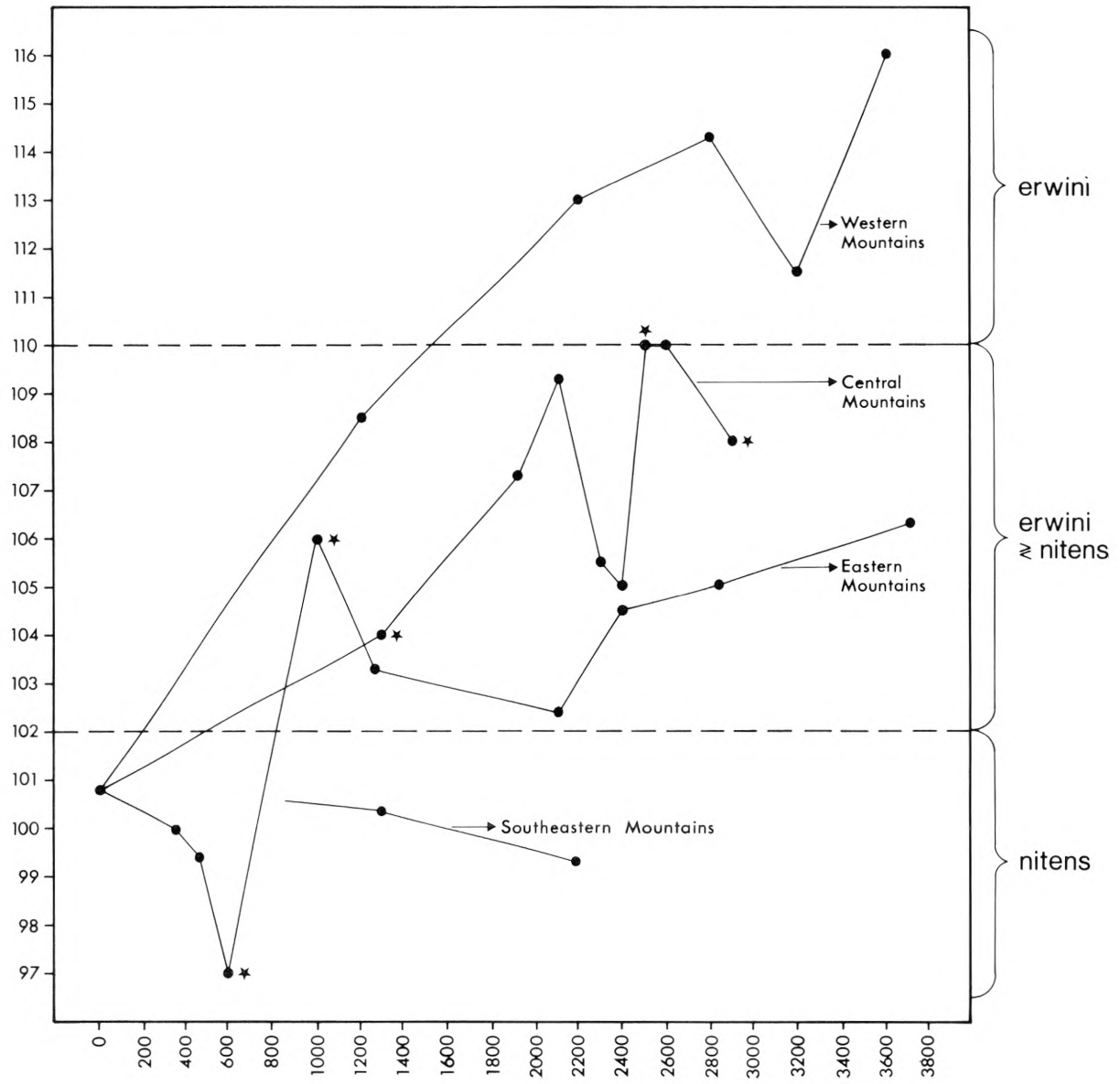


Fig. 9. Average wing-length (in millimeters) of *C. esculenta* populations in New Guinea (ordinate) in relation to altitude (in meters) of different mountain ranges (abscissa). The subspecific categories are mentioned to the right. Figures based on a single specimen are marked with an asterisk.

77). The same material was used by Rand (1936, p. 3) as an example of a species with altitudinal variation in size in New Guinea, while the material of the Archbold Expeditions from the Snow Mountains ("Western Mountains") was used in a similar study by Archbold *et al.* (1942, p. 285). The measurements taken by Mayr and Rand agree with mine, being only sometimes 1 mm larger, except

TABLE 9
Wing-length (in Millimeters) of the Material Examined in AMNH of *Collocalia esculenta* in New Guinea in Relation to Altitude (in Meters).
n: number of specimens examined.

	Altitude	♂♂	♀♀	○○	Total Variation	Average	n
Lowland of all New Guinea					96–108	100.8	46
"Western Mountains"							
(coll. 1938–39 Archbold Exped.)	1,200	108, 110	107	109	107–110	108.5	4
	2,200	114, 118	107, 113		107–118	113.0	4
	2,800	113	113, 113, 118		113–118	114.3	4
	3,200			108, 108, 111, 113, 114, 115	108–115	111.5	6
	3,600	120		112	112–120	116.0	2
"Central Mountains"							
(coll. AMNH Exped. 1950–52; Gilliard 1954)	1,300			104		(104.0)	1
	1,900	105, 108, 109	107		105–109	107.3	4
	2,100	110, 111	107		107–111	109.3	3
	2,300	104, 105 105, 108			104–108	105.5	4
	2,400	105	105			105.0	2
	2,500		110			(110.0)	1
	2,600	108		112	108–112	(110.0)	2
	2,900	108				(108.0)	1
"Eastern Mountains"							
(coll. 1933 Archbold Exped.)	350	102	98, 100		98–102	100.0	3
	450	97, 102	97, 100 101		97–102	99.4	5
	580		97			(97.0)	1
	1,000		106			(106.0)	1
	1,250	103	102, 105		102–105	103.3	3
	2,070	102, 102, 103	102,103		102–103	102.4	5
	2,400	103, 103, 104, 106, 107	103, 104, 106		103–107	104.5	8
	2,840	104, 106			104–106	105.0	2
	3,680	103, 104, 107, 107, 110	107		103–110	106.3	6

those given for the population inhabiting the highest altitude (3,680 m) in Mt. Albert Edward. The wing-length of the birds there was said to be 109–110 in ♂♂ and 108 mm in one ♀; average 109.4 mm. I measured the wing-length of the same individuals to be 103–110 mm in ♂♂ and 107 mm in the ♀, with an average of 106.3 mm, *i.e.* about 3 mm smaller than the figures achieved by Mayr and Rand. Even if the measurements taken by Mayr and Rand were correct they would only show that the populations of the highest areas of the "Eastern Mountains" did not quite reach the minimum average size (110 mm) of *erwini*.

Regarding the peripheral mountain ranges of New Guinea it appears that *esculenta* is represented there by the form *nitens* or *nitens* ≷ *erwini* right up to the highest peaks. The material examined from the "Southeastern Mountains" was already discussed above p. 39. In the Arfak Mountains Mayr collected 3 ♀♀ at Siwi (800 m) (Hartert 1930, p. 21); they measure 101–107 (average 103) mm, which is very close to *nitens* (cf. Table 8). Two specimens from the Weyland Mountains at 300 m are slightly larger, 107–108 mm, these specimens being the only material which I have seen from there (cf. Table 8). The same birds are called *Collocalia esculenta* subsp. by Stresemann and Paludan (1936, p. 225) who add that they agree with specimens from Japen, the Sepik area and the Saruwaged Mountains. Two ♂♂ collected at about 1,750 m in the Wissel Lake area, east of the Weyland Mts., measure 104 and 105 mm and it is added about these specimens that they "are rather small, considering the altitude at which they are collected" (Junge 1953, p. 39), which of course is correct. A few specimens have been mentioned from the mountains of the Sepik region. A specimen from the Hunsteinspitze (1,532 m) measured 105 mm, while two others from localities without data of altitude measured 103 and 108 mm (Stresemann 1923, p. 29). In the mountains of the Huon Peninsula only a few specimens were collected. Two unsexed specimens from Junzaing (1,370 m) measure 101 and 106 mm, two ♂♂ from Ogeramnang (1,785 m) 107 and 109 mm and an unsexed specimen from the same locality 109 mm (Mayr 1931 b, p. 694). Mayr adds: "Nach den Massen zu urteilen zu *esculenta* [= *nitens*] gehörig." It is true that these specimens are close to *nitens*, but they are nevertheless better referred to the intermediate category *nitens* ≷ *erwini*.

The agreement between size (wing-length) of *C.esculenta* and altitude must not invite to the belief that these swiftlets are stationary birds. Their unique capacity of flight, the fact that they spend almost their whole life in the air, makes it easy for them to follow air currents vertically, or in other ways change their altitudinal position. Each population must have a certain altitudinal amplitude, probably with a maximum of about 500 m. On the other hand, the correlation between body-proportions and altitude obviously demonstrate that local populations have developed a certain adaptation to the environmental conditions at the particular altitude. If imagining that all populatons mixed in the mountains all morphological differences would be swamped and there would be no possibility to develop altitudinal populations with different morphology.

If the above argument is accepted it is quite peculiar that populations inhabiting similar altitudes in different mountain ranges are not alike in their body-proportions. Presumably birds adapted to a special altitudinal zone would everywhere be subject to quite similar environmental influences and selection would, therefore, presumably produce similar results. It might also be assumed that populations of a special altitudinal zone would mix with others in the same zone, and the result would be a parallelism in the correlation between body size and altitude within great parts of the mountaineous area of New Guinea. However, such parallelism is not developed. To take an example, based on the material used in preparing Fig. 9: Birds collected at 2,200 m altitude in the "Southeastern Mountains" have an average wing-length of 99 mm, in the "Eastern Mountains" of about 103 mm, in the "Central

Mountains" of about 107 mm and in the "Western Mountains" of 113 mm. The altitude in the different parts of the central cordillera of New Guinea appears to be almost the same and, consequently, the selection pressure for assuming increasing size must presumably be similar in these areas. In the "Eastern Mountains" the highest peaks are Mt. Scratchley (3,810 m), Mt. Victoria (4,010 m) and Mt. Albert Edward (3,980 m) in the Wharton Range (cf. Archbold and Rand 1935, map 28). In the "Central Mountains" the Bismarck Range reaches a height of 4,300 m, and in the "Western Mountains" the Carstenz Mountains reach 4,884 m. Only the Arfak Mts. on the Vogelkop Peninsula are somewhat lower, with altitudes less than 2,900 m.

There is, however, at difference between the mountain ranges. The "Western Mountains" with the greatest height is the only place where the form *erwini* occurs. The Carstenz Mountains in the Western area were vividly described by Schodde *et al.* (1975, p. 65) as towering above the other mountain ranges of New Guinea, "reaching a height of 4,884 m. Capped with permanent snow and glaciers, they are the highest range between the Himalayas and the Andes. Their ice caps are remote, shrouded in cloud for much of the time." The "Western Mountains" are the only area in New Guinea with permanent ice on the peaks, and this fact together with the actual, considerable height and the great extension of this area lower the ambient temperature and very markedly reduce the baromethrical pressure, and in this way produce a so strong selection pressure for the aerial swiftlets that it has given rise to development of the large *erwini*. The populations in the "Western Mountains" have greater body proportions than those in other areas at all altitudinal levels, because the superior size of *erwini* radiates to the populations inhabiting lower altitudes through mixing of the gene-pools.

It is probable that the increase in size, as shown in the measurements of wing-length, might also be demonstrated in the weight. The material is scanty, however, and for various reasons not quite reliable. A large material from the island of Numfor has been examined by Stresemann and Paludan (1932, p. 199). This population, belonging to *numforensis*, is of about the same size as *nitens*, only slightly smaller. The wing-length of twentytwo specimens is 95–101 (average 98.5) mm; the weight of the same specimens is 5.8–7.7 (average 6.5) g. Ripley (1964, p. 40) measured some *erwini* from the Carstenz Mts. with a wing-length of 108–114 (average 112.5) mm; they had a weight of 9–10 g. Finally, Diamond (1972, p. 180) examined a few specimens of *nitens* ≷ *erwini* in the "Central Mountains" and gives the measurements as 8.0 for a ♂ with wing-length of 109 mm and 7.3 g for an unsexed specimen with wing-length 98 mm. According to these few measurements it appears that *nitens* (and *numforensis*), with a wing-length smaller than 102 mm, have a weight of 5.8–7.7 g, while the large mountain form *erwini* has a weight of 8–10 g. A larger material is needed, however, to decide the matter.

The development of *erwini* and its special distribution, as described above, is not unique. Other New Guinean birds have accomplished a similar development, having a large form occupying the "Western Mountains" and smaller forms in the remaining parts of the central cordillera. As a good example *Paramythium montium* can be mentioned. A large form, *P.m.alpinum* Salomonsen, with wing-length in adult ♂♂ of 114–123 mm, is found in the "Western Mountains" from an altitude of 3,200 m to the timber-line (4,100 m). It is replaced in the areas down to 2,100 m by *P.m. olivaceum* Van Oort with the wings in ♂♂ measuring 100–108 mm. In the "Central Mountains" and eastwards to the "Southeastern Mountains" *C.m.montium* De Vis occurs right up to the timberline (3,800 m), with a wing-length in ♂♂ of 95–107 mm. Finally, the mountains in Huon Peninsula is inhabited by *C.m.brevicauda* Mayr and Gilliard up to 3,600 m, with a wing-length in adult ♂♂ of 100–105 mm (Salomonsen 1961, p. 5). It is easy to see that there is a pronounced parallelism

in the development of size variation in the two species. Another example is *Rhipidura albolimbata* (Salomonsen 1961, p. 7).

It should be emphasized that *C.esculenta* is very common and widespread in the upper parts of the mountain ranges and that it occurs to the highest peaks, everywhere numeorus, as a matter of fact much more common than in the lowland. From the Carstenz Mts. Schodde *et al.* (1975, p. 69) say that *C.esculenta* is "one of the most wide ranging of all New Guinean birds ... and observed regularly singly, in pairs or in groups of up to ten at 3,600–4,500 m." Rand (1942b, p. 458) stated that in the Snow Mountains *C.esculenta* "was a fairly common species, feeding over the open ground and about the tops of the forest trees, usually in parties of a half dozen or so, but sometimes up to about twenty." In the "Central Mountains" *C.esculenta* is said to be "abundant between 5,000 and 12,000 feet in the Wahgi region (Mayr and Gilliard 1954, p. 342). Something similar is said by Diamond (1972, p. 180), who states that "above 5,000 feet *C.esculenta* may be seen over almost any kind of habitat... up to 12,000 feet". There is a short remark about Mt. Albert Edward in the "Eastern Mountains" by Mayr and Rand (1937, p. 77), saying that "this was a common bird at our 3,680 meter camp." Although *C.esculenta* is widespread in the lowland also, "et seemed absent from the extensive flat country of the Fly and Idenburg Rivers" (Rand and Gilliard 1967, p. 276).

Collocalia esculenta amethystina, new subspecies
Type: ♂ ad., Waigeo Island, 11. June 1931, coll. G. Stein, in AMNH, no. 300710.

The whole upper-side, wing-coverts and under tail-coverts with brillant dark violet blue gloss, a colour which is unique in the genus *Collocalia*. The lower breast and flanks are supplied with much grey, with white only on the apical parts of the feathers, in this respect being similar to *numforensis*.

Measurements: Only the type known, a ♂ ad. with wing-length 96 mm.

Range: Waigeo Island.

Remarks: The type and only specimen is in freshly moulted plumage and is beautifully prepared by the collector. It may be regarded as irresponsible to describe a subspecies of this difficult group based on a single specimen. It is, however, so remarkably different from all other forms of *esculenta* that I want to draw the attention to this bird, admitting that more material is needed before *amethystina* can be safely recognized.

It is significant that among three specimens from the neighbouring Vogelkop Peninsula in New Guinea (from Arfak Mts.) one freshly moulted bird has a colour of the upper-parts which very much approaches that of *amethystina*. No material of this species has hitherto been collected on Waigeo apart from a specimen obtained by H. A. Bernstein in 1863; cf. Stresemann and Paludan (1932, p. 164). These authors worked with the Stein collection and say (p. 199) about the specimen which forms the type of *amethystina:* "... während das einzige Exemplar von Waigeu auf Oberseite, Flügel und Schwanz durch intensiven violettblauen statt grünlichblauen Schiller höchst auffällig abweicht, aber es mag sich um eine individuelle Variation handeln." It is possible that this assumption may be correct.

Collocalia esculenta numforensis, new subspecies
Type: ♀ ad., Numfor Island, Geelvink Bay, 16. April 1931, coll. G. Stein, in AMNH, no. 301306.

Differs distinctly from *nitens* by having the flanks and sides of breast grey with prominent dark shaft-streaks and broad white borders to the feathers, while in *nitens* these parts are pure white (cf. Fig. 10). It approaches the appearance of

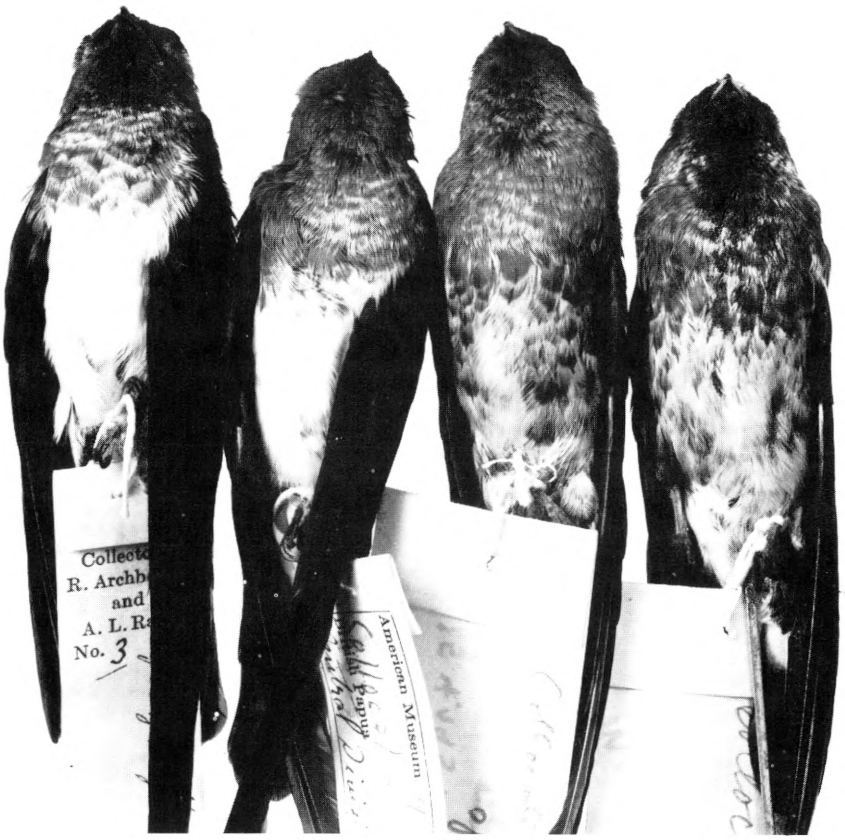


Fig. 10. *a–b Collocalia esculenta nitens* New Guinea, lowland
c–d –"– –"– *numforensis* Numfor Island
Notice difference in coloration of the under-parts.
(All specimens in AMNH).

spilura, but this form has the whole underside mixed with grey, while in *numforensis* the abdomen and the centre of breast are white. The difference between the two forms is distinctly to be seen in Fig. 7 and Fig. 10. Besides, *spilura* is darker also on the upperside. The upper-parts of *numforensis* is distinctly duller than in *nitens* with a less brillant gloss and the colour being slightly more greenish, and also being duller than in nominate *esculenta*.

Measurements: Seven adult ♂♂ have a wing-length of 95–99 (average 97.0) mm, seven adult ♀♀ 96–100 (average 98.1) mm, thus being slightly smaller than *nitens* (cf. Table 10).

Range: Numfor Island in the Geelvink Bay, western New Guinea, probably also Biak Island.

Remarks: No material has been examined from Biak Island, but Salvadori (1880, p. 541) stated that *C.esculenta* has been obtained by Beccari on Misori (= Biak), and Stresemann and Paludan (1932, p. 190) also mentioned it in their list of Biak birds. More recently a specimen was collected on

TABLE 10
Wing-length (in Millimeters) of the Material Examined of
Collocalia esculenta numforensis and *C. e. misimae*.

numforensis											
AMNH	Numfor Island	♂♂	95,	96,	97,	97,	97,	98,	99		
		♀♀	96,	97,	98,	98,	99,	99,	100,	–[a]	–[a]
misimae											
AMNH	Misima Island	♂♂	99,	99,	100.5,	–[b]	102				
		♀	101								
	Rossel Island	♀♀	96,	98,	98						
	Kiriwina Island, Trobriand Islands	♀♀	96,	98							
	Woodlark Island	♂♂	100,	103,	–[a]						
		♀♀	100,	100							

[a] In moult, not measured. [b] Type of *misimae*.

Biak by Ripley, who states that it is "very common" on the island (Mayr and De Schauensee 1939, p. 26). I tentatively refer the Biak birds to *numforensis*.

As already mentioned p. 34 Stresemann and Paludan united *numforensis* and *spilura* and stated that they cannot separate the Halmahera and the Numfor specimens. There are distinct differences, as described above, but it cannot be denied that the two forms are similar in the coloration of the chest and flanks. They are the only forms of *C.esculenta* in the Papuan and Indonesian area with the underside mixed with grey. This may indicate a close relation of *spilura* and *numforensis* in spite of the considerable distance of water separating them. The situation may be compared with that in *Myzomela obscura*, in which one of the forms of the *simplex* group, inhabiting the Northern Moluccas, has crossed the broad expanse of water to Geelvink Bay, where it colonized Biak (but not Numfor) and developed the form *rubrobrunnea*. The evolutionary explanation of this extraordinary phenomenon has previously been given by me (Salomonsen 1976, p. 596), and I am inclined to believe that a similar development has taken place in *C.esculenta*. A further example of this zoogeographical phenomenon is *Otus beccarii*, inhabiting Biak, the only Papuan representative of the genus *Otus* and with the nearest relatives on the Moluccas.

***Collocalia esculenta misimae*,** new subspecies

Type: ♂ ad., St. Aignan (= Misima) Island, Louisiade Archipelago, 11. August 1894, coll. A. S. Meek, in AMNH, no. 634526.

Similar to *nitens*, but feathers on rump with narrow white edges, upper-parts with a duller gloss, even slightly duller than in *numforensis* (Fig. 11), but with a more bluish, not so greenish sheen. The colour of the under-parts is exactly as in *nitens*. In very worn birds, as those examined from Rossel Island, the white linings on the rump feathers tend to be worn off, but they are noticeable even in such birds. Specimens from Southeast New Guinea also have a tendency to acquire white edges on the rump feathers.

Measurements: Six adult ♂♂ have a wing-length of 99–103 (average 100.6) mm, eight ♀♀ 96–101 (average 98.4) mm (cf. Table 10). The size does not differ from that of *numforensis*.

Range: Misima and Rossel Islands in the Louisiade Archipelago, but not known from Tagula Island; further Woodlark Island and the Trobriand Islands. It is doubtful whether the species occurs on the D'Entrecasteaux Islands.

Remarks: It appears that *C.esculenta* has not yet been collected on Tagula (= Sudest) Island, according to Hartert (1898, p. 521) and Rothschild and Hartert (1918b, p. 313), but it probably occurs there, nevertheless. On Misima it appears to be common (Hartert 1899, p. 211).

Nothing is known about the occurrence of *C. esculenta* on the D'Entrecasteaux Islands. At any rate it has never been recorded from these often visited islands, although it is elsewhere a very common bird. It has neither been collected nor recorded on the D'Entrecasteaux Islands by the older expeditions in the 19th century, nor by Meek, the Eichhorns or by Hamlin (for the Whitney South Sea Expedition) or by Van Deusen in spite of long sojourns on the islands (cf. Mayr and Van Deusen 1956, p. 7). However, recently Bell (1970, p. 180) stated that *esculenta* is "extremely abundant" on Goodenough Island, which is very surprising.

In their comments on specimens from Rossel Island Rothschild and Hartert (1918a, p. 312) mention that "the throat and the chest of these specimens is rather dark, similar to Dampier Island examples. Generally eastern specimens, from the Louisiade Archipelago, eastern New Guinea and Dampier Island are rather darker on the throat and chest than a series rom the Moluccas and Celebes region." I cannot with my best will detect any differences in the colour of the throat of nominate *esculenta, nitens, erwini* and *misimae.* In worn specimens the white borders on the chest feathers may disappear, in this way producing a darker colour of the chest, but this may happen in all the said subspecies.

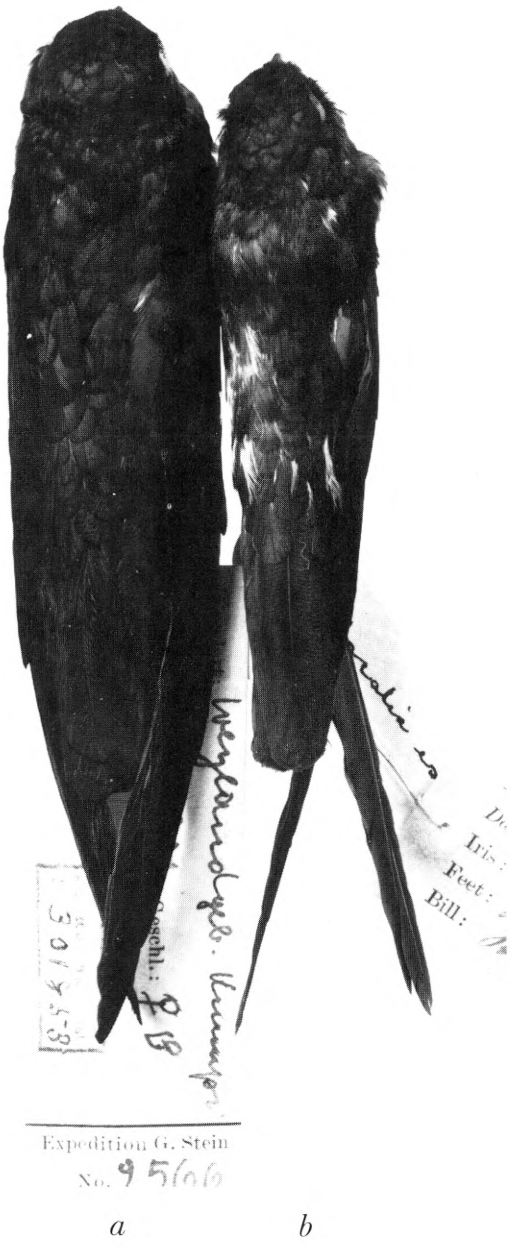


Fig. 11.
a Collocalia esculenta nitens Weyland Mts., New Guinea ♀
b –"– –"– *misimae* Misima Island ♂
Notice white borders on rump feathers and dull gloss on upper-parts in *misimae.* (Both specimens in AMNH).

Collocalia esculenta tametamele Stresemann

Collocalia esculenta tametamele Stresemann, 1921, Anz. Ornith. Ges. Bayern, no. 5, p. 37 – Ralum, Gazelle Peninsula, New Britain.

Differs primarily from *nitens* by having feathers on sides of rump with broad white edges or sometimes predominently white, only with dark shaft-streaks and base of feathers; median parts of rump glossy like rest of upper-parts (Fig. 12). Feathers of throat and chest like those in *nitens,* but their dark colour is not sharply delimited towards sides of breast and flanks, but these parts are grey with broad white feather-edges, while the middle of breast and the entire abdomen are white; the longest under tail-coverts with broad white borders or almost pure white, whereas in *nitens* they are glossy, of the same colour as the upper-parts. The white spots on base of inner web on tail-feathers extraordinarily large and distinct, sometimes extending to the outer web.

Measurements: Twenty adult ♂♂ from New Britain and Vitu Islands have a wing-length of 95–101, one 103 (average 98.3) mm, twelve adult ♀♀ 97–104 (average 101.0) mm (Table 11). It is noteworthy that in this form the ♀♀ on an average are bigger than the ♂♂. Bougainville birds appear to be slightly larger according to the measurements taken by Mayr (1931, p. 16), who gives the wing-length of ten specimens as 101–109 (average 104.0) mm.

Range: New Britain and Vitu Islands in the Bismarck Islands and Bougainville Island in the Solomon Islands. It probably occurs also on Umboi (Rook) Island in the Bismarck Islands, but there are no records from this island.

Noona Dan Material: (1) ♂ ad., Kwalakessi, Cape Hoskins, New Britain, 3. July 1962, collector's no. 2,314. Both body, wings and tail moulting. Testes minute, 1 × 1 mm. Weight 5.5 g.

Remarks: It may appear quite peculiar that a subspecies, inhabiting New Britain and the Vitu Islands in found also in Bougainville Island in the Solomon Islands, but nowhere else in any of the two archipelagos. Nevertheless, Bougainville birds are so close to *tametamele* that I cannot distinguish them properly from this form, and I therefore remove the Bougainville population from *becki* and place it in *tametamele*. Even one bird from Shortland Island, a few from Choiseul and a single one from Santa Isabel are similar to *tametamele,* but the majority of specimens from these islands are indistinguishable from *becki.* Still, the appearance of *tametamele*-like specimens so far east in the Solomon Islands tends to show that there is a gradual transition between the two forms, and that *tametamele* probably originated in Bougainville. This is not quite a unique situation, although I have never seen it described by anybody. At any rate, there are two similar examples. In *Halcyon chloris* the form *alberti* Rothschild and Hartert is found on Bougainville and on the islands further east and south in the Solomons. It appears, however, that the population of Bougainville is almost indistinguishable from *tristrami* Layard from New Britain, while specimens from Santa Isabel and farther east and south are true *alberti.* The close similarity of the two forms was already emphasized by Hartert (1926 b, p. 132), who says that *alberti* "by some ornithologists might be united with *tristrami,*" and also other students have noticed it. I find only the Bougainville specimens indistinguishable from *tristrami,* and in *Halcyon chloris* just as in *Collocalia esculenta* there is thus one single form inhabiting Bougainville and New Britain but no other island. Finally, *Ninox odiosa* Sclater, only found on New Britain, should be united with the very complex species *N.jacquinoti* (Bonaparte) from the Solomon Islands and should be called a subspecies of this species, while the other forms of the Bismarck Islands and New Guinea (*theomacha* from New Guinea and surrounding islands, *meeki* from the Admiralty Islands and *solomonis* from New Ireland and New Hanover) are separate species, but might be united in a superspecies with *jacquinoti.* In all these cases I suppose that the subspecies of New Britain has originated in the Solomon Islands and colonized New Britain. If the develop-

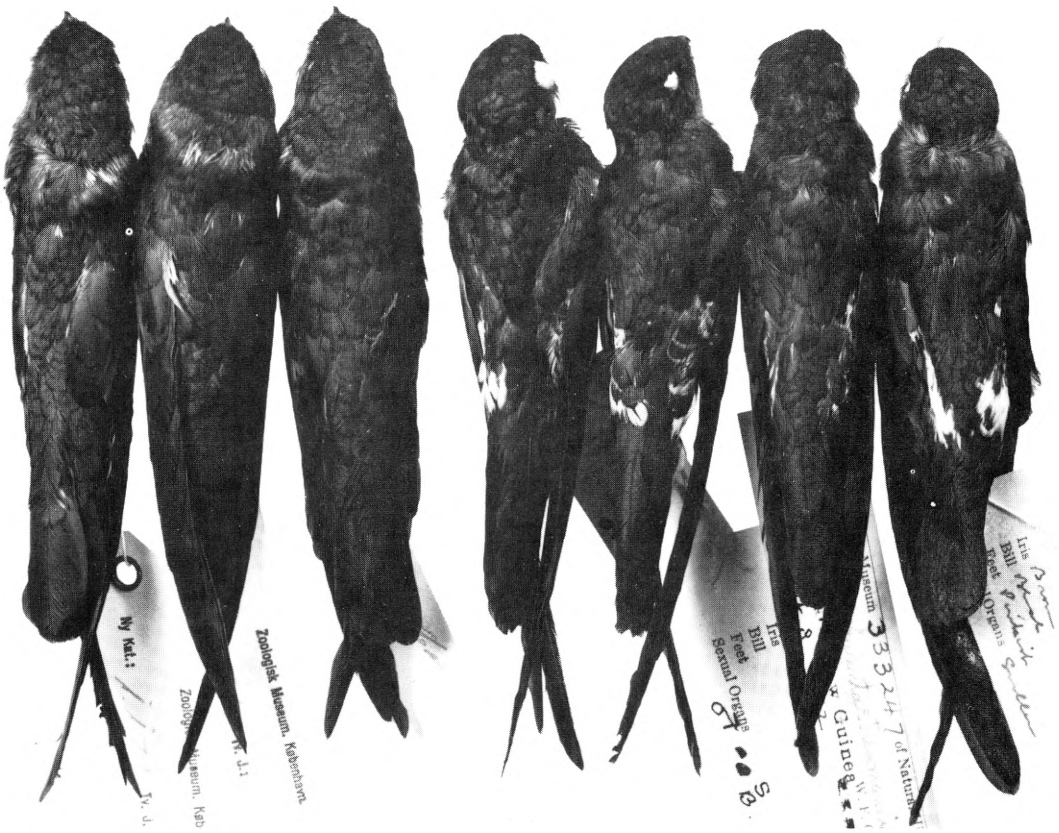


Fig. 12. *a* *Collocalia esculenta kalili* New Hanover, Bismarck Islands
b –"– –"– –"– New Ireland, –"– –"–
c –"– –"– –"– Dyaul Island, –"– –"–
d–f –"– –"– *tametamele* New Britain –"– –"–
g –"– –"– –"– Bougainville Island, Solomon Islands
Notice white feathers on sides of rump in *tametamele*.
(The specimens *a–c* in ND, the specimens *d–g* in AMNH).

ment had taken the opposite direction, it should be supposed that morphological characters of the New Britain form had radiated to the neighbouring islands in the Bismarck Archipelago, but this is not the case.

Mayr (1931a, p. 17), on a very meagre material, united all the Bismarck Islands forms under the name *stresemanni*, but when he says that "feathers on the side of the rump sometimes with white edges", he must have alluded to his four New Britain specimens.

Collocalia esculenta kalili, new subspecies

Type: ♀ ad., 10 miles southeast of Kalili, New Ireland, Bismarck Islands, 30. April 1962, coll. Finn Salomonsen on the Noona Dan Expedition, collector's no. 1,617.

Differs from *nitens* by having the gloss of the upper-parts deeper blue, still more brillant and iridescent; the neck-feathers with some concealed white rami; the throat and chest definetely paler greyish, and this colour not so sharply contrasting with the white abdomen as in *nitens,* as the sides of breast and the flanks are more mixed with grey, just as in *tametamele;* the under tail-coverts as in *nitens;* the white spots on the inner web of the tail-feathers either missing or very small, thus being very different from those in *tametamele.* Also differing from *tametamele* by having the upper-parts uniform glossy without white on rump and in having throat and chest paler grey.

Measurements: Eight adult ♂♂ have a wing-length of 95–102 (average 97.6) mm, seven adult ♀♀ 97–104 (average 99.6) mm (Table 11).

Range: New Ireland, New Hanover and Dyaul Island in the central Bismarck Islands. *Collocalia esculenta* is unknown in the St. Matthias Group.

Noona Dan Material: (1) ♂ ad., Dyaul Island, 3. March 1962, collector's no. 944. Iris, bill and legs black. Testes small, 2 × 3 mm.

(2) ♀ ad., Dyaul Island, 7. March 1962, collector's no. 1,027. Wings moulting juvenile primaries. Ovary granulated, eggs at most 1 × 1 mm.

(3) ♀ ad., Dyaul Island, 31. May 1962, collector's no. 2,113. Iris brown, bill black, legs light brown.

(4) ♂ ad., Dyaul Island, 4. June 1962, collector's no. 2,126. Wings moulting juvenile primaries. Testes rather small, 2 × 3 mm and coloured bluish.

(5)♂ ad., Banatam, New Hanover, 20. March 1962, collector's no. 1,173. Testes minute, 1 × 1 mm.

(6) ♂ ad., Banatam, New Hanover, 20. March 1962, collector's no. 1,174. Testes minute, 1 × 1 mm.

(7) ♀ ad., Banatam, New Hanover, 21. March 1962, collector's no. 1,187.

(8) ♂ ad., Lemkamin, Lelet Plateau, 900 m altitude, New Ireland, 6 April. 1962, collector's no. 1,344. Iris, bill and legs black. Testes small, 2 × 2 mm.

(9) ♀ ad., Lemkamin, Lelet Plateau, 900 m altitude, New Ireland, 8. April 1962, collector's no. 1,362.

(10) ♀ ad., 10 miles southeast of Kalili, New Ireland, 30. April 1962, collector's no. 1,617. (Type of *C.e.kalili.*)

(11) ♂ ad., 10 miles southeast of Kalili, New Ireland, 1. May 1962, collector's no. 1,629. Testes small, 2 × 2 mm, coloured blackish.

Remarks: The difference in the coloration of the feathers on the rump in *kalili* and *tametamele* is distinctly to be seen in Fig. 12. Even the concealed white rami on the neck-feathers in *kalili* are vaguely to be seen in Fig. 12. Mayr (1931, p. 17) has already remarked that "specimens from New Britain and the Witu Islands have the throat and upper breast very dark (metallic), while in those from New Ireland and New Hanover they are lighter and more greyish." This is definetely true; *tametamele* from New Britain and Vitu Islands as well as *nitens* from New Guinea have the throat and chest darker than in *kalili,* though I would not have used the word "metallic". The white rami of the neck-feathers is not a constant character, but are found in the greater part of the specimens. In *nitens,* on the other hand, this character is found only exceptionally.

The dark bluish sheen on the upper-parts in *kalili* is remarkable. The most brillant specimens are those from Lemkamin, Lelet Plateau, on 900 m altitude, above Kalili, which may even approach the unique coloration of *amethystina.*

Collocalia e. kalili is very wide-spread on the three islands on which it was found by the Noona Dan Expedition. It flew rather low, over cultivated fields, open and scattered forests and in glades and clearings in forests, sometimes even near villages, in the mountains found at least to 900 m (Lelet Plateau in New Ireland). On the small islands Kung and Tingwon off New Hanover it was not observed; only *C.vanikorensis* was found there, but I doubt whether any swiftlets could breed on these tiny and low islands. On Dyaul Island I observed two specimens by a river in the interior of the island fluttering just above the water, apparently drinking (or snatching insects?) from the surface of the river.

TABLE 11
Wing-length (in Millimeters) of the Material Examined of *Collocalia esculenta*. from the Bismarck Islands.

tametamele				
AMNH	New Britain	♂♂	96, 97, 97, 97, 98, 98, 98, 99, 99, 99, 100, 100, 100, 100, 101	
		♀♀	100, 100, 101, 101, 103, 103, 104	
	Vitu Islands	♂♂	95, 97, 99	
		♀♀	97, 98, 101, 102, 102	
ND	New Britain	♂	103	
kalili				
AMNH	New Ireland	♀♀	101, 104, –[a]	
	New Hanover	♂♂	95, 95, 96	
		♀	97	
ND	New Ireland	♂♂	98, 98	
		♀♀	99,[b] 101	
	Dyaul Island	♂♂	92,[c] 101	
		♀♀	94,[c] 97	
	New Hanover	♂♂	98, 99	
		♀	98	
stresemanni				
AMNH	Manus Island	♂♂	98, 98, 98, 99, 99, 100, 102.5, 103	
		♀♀	98, 98, 99, 99, 99, 100, 101, 101, 102, 102, 103	
		imm. ♀	96	
	Rambutyo Island	♂♂	98, 99, 100	
		♀♀	97, 98, 98	
	Nauna Island	♂	97	
		♀	99	
ND	Manus Island	♂	103	
spilogaster				
AMNH	Lihir Island	♂♂	93, 96, 96, 97, 97, 98, 98, 98, 99, 99, 100, 100	
		♀♀	94, 97, 97, 97, 97, 97, 97, 98, 98, 98, 98, 99, 102	
	Tabar Island	♂♂	95, 97, 97, 98, 98, 99	
		♀♀	94, 96, 97, 97, 97, 98, 98, 98	
hypogrammica				
AMNH	Nissan Island	♂♂	92, 95, 95, 96, 96, 100, 100, –[a]	
		♀♀	96, 96, 96, 98, 99, 99	

[a] Primaries moulting, not measured. [b] Type of *kalili*. [c] In growth, moulting from immature plumage.

a *b* *c*

Fig. 13. *a Collocalia esculenta stresemanni* Rambutyo Island ♀
b –"– –"– –"– Manus Island ♂
c –"– –"– –"– –"– ♂
Notice much white on rump.
(The specimens *a–b* in AMNH, the specimen *c* in ND).

Collocalia esculenta stresemanni
Rothschild and Hartert

Collocalia esculenta stresemanni Rothschild and Hartert, 1914, Novit. Zool., vol. 21, p. 293 – Manus, Admiralty Islands. (Type in AMNH examined.)
Collocalia uropygialis heinrothi Neumann, 1919, Ornith. Monatsber., vol. 27, p. 110 – Nusa Island, off the northern tip of New Ireland.

Differs strikingly from all other forms of *esculenta*, mentioned, by having very much white on the rump, both on the sides and in the median parts, the feathers with only shafts and proximal parts of the webs glossy greenish blue as the rest of the upper-parts, some feathers being pure white; the general impression is that the rump is mixed equally with white and dark colour (Fig. 13). The gloss of upper-parts is much duller than in *kalili;* neck-feathers sometimes with concealed white rami; grey of throat and chest of the same light shade as in *kalili* and sharply delimited from the pure white of lower breast, flanks and abdomen; much white on the under tail-coverts, even the longest ones with white borders (as in *tametamele*); inner webs of the secondaries and of the inner primaries, sometimes even the greater under wing-coverts with broad white borders, which is a unique character in *esculenta;* white spots on base of inner web of tail-feathers large and distinct as in *tametamele.*

Measurements: Thirteen adult ♂♂ have a wing-length of 97–103 (average 99.6) mm, fifteen adult ♀♀ 97–103 (average 99.8) mm (Table 11).

Range: Manus in the Admiralty Islands, and the surrounding smaller islands, known from Rambutyo and Nauna (specimens in AMNH) and also from Los Negros (Ripley 1947, p. 101).

Noona Dan Material: (1) ♂ ad., Manus Island, 25. June 1962, collector's no. 2,283. Body moulting. Weight 5.5 g.

Remarks: C. uropygialis heinrothi is a synonym to *stresemanni,* which appears from the fact that the describer, Neumann (1919, p. 110), calls it a form of *uropygialis,* which has a white rump band. This also appears from the description of *heinrothi* given by Stresemann (1921, p. 37), who says: "Die unteren Bürzelfedern und die Oberschwanzdecken sind grösstenteils rein weiss geworden." Only Mayr (1931, p. 17) who calls all the Bismarck Islands *esculenta* for *stresemanni,* without having any material at all from the Admiralty Islands, comes to the conclusion that "the type of *heinrothi* Neumann seems to be an albinistic specimen."

The peculiar fact remains that *heinrothi, i.e.* a specimen of *stresemanni,* was collected on Nusa Island in the Steffen Strait off the northern tip of New Ireland, far from the Admiralty Islands. However, it appears that *stresemanni* has been *insularized* (cf. Salomonsen 1976, p. 590), which means that it has developed into a small-island form, which probably occurs on all the minute islets around Manus and at least has been met with on several of them and even is known to occur on the distant island Nauna. It may easily visit and even breed on the islets surrounding New Hanover or situated in the Steffen Strait between New Ireland and New Hanover. It is well-known among other species that itinerant small-island subspecies may breed on islets closely attached to bigger islands where other subspecies occur. Among the many instances may be mentioned the case of *Myzomela nigrita,* in which the subspecies *nigerrima,* belonging to the insularized group *pammelaena,* breeds on the very distant Long Island, which is very close to the mainland of New Guinea, where nominate *nigrita* occurs. Another example is the subspecies *Nectarinia sericea nigriscapularis,* a form which is very typically insularized, being found on the numerous small islands in the Geelvink Bay and also on islands quite close to Biak, which latter is inhabited by a very dissimilar subspecies, *mysoriensis* (cf. Mayr and De Schauensee 1939, p. 35).

Although Hartert (1924a, p. 206) treated the birds from the Bismarck Islands as one subspecies, he is aware of the fact that there are three forms, those which here are called *tametamele, kalili* and *stresemanni.* He distinguishes between the New Hanover birds, which are "typical *esculenta,* without any white on the rump", *stresemanni* "from Manus with some rump feathers chiefly white and others edged with white" and *tametamele* "from New Britain, like *stresemanni,* but the middle of the rump without white." These distinctions between the three forms are quite correct. Hartert finally adds: "Are they really three different subspecies, or do they belong to one variable form?"

The development of white colour on the rump-feathers in various subspecies, which possibly may have taken place independently in each subspecies, is found in many of the forms inhabiting the Bismarck-Solomon Islands and the eastern Papuan islands (*misimae, tametamele, stresemanni* and *desiderata*). This is an interesting phenomenon and may illustrate the different stages which *esculenta* has gone through on its way towards *uropygialis* with distinct white rump-band.

Collocalia esculenta spilogaster, new subspecies

Type: ♀ ad., Lihir Island, Lihir Group, Hibernian Islands, 26. September 1934, coll. W. F. Coultas, in AMNH, no. 335882.

Is like *kalili* in most particulars (has no white on rump), but lower breast, flanks and abdomen with distinct dark needle-like shaft-streaks and dark feather bases (Fig. 14). The neck-feathers with many concealed white rami, in fact with more white there than in any other form of *esculenta,* the white rami sometimes being visible as a white-speckled nape band (Fig. 15). The colour of the upper-parts is duller than in *kalili,* being still more dull than in *stresemanni* and slightly more greenish. The colour of throat and under tail-coverts and other particulars as in *kalili,* but white spots on the tail-feathers more distinct, although small.

Measurements: Eighteen adult ♂♂ have a wing-length of 93–100 (average 97.5) mm, twenty-one adult ♀♀ 94–102 (average 97.3) mm (Table 11). The proportions are on an average smaller than in *kalili.*

Range: The Lihir Group and Tabar Islands in the Hibernian Islands. There are no records from Tanga Islands and Feni Islands, and it appears that *C.esculenta* is missing on these islands.

Remarks: The population of Tabar is intermediate between *kalili* and *spilogaster,* but it has for practical reasons here been united with the Lihir from *spilogaster.* The intermediacy of the Tabar birds indicates that the Hibernian Archipelago was colonized from New Ireland via Tabar, and

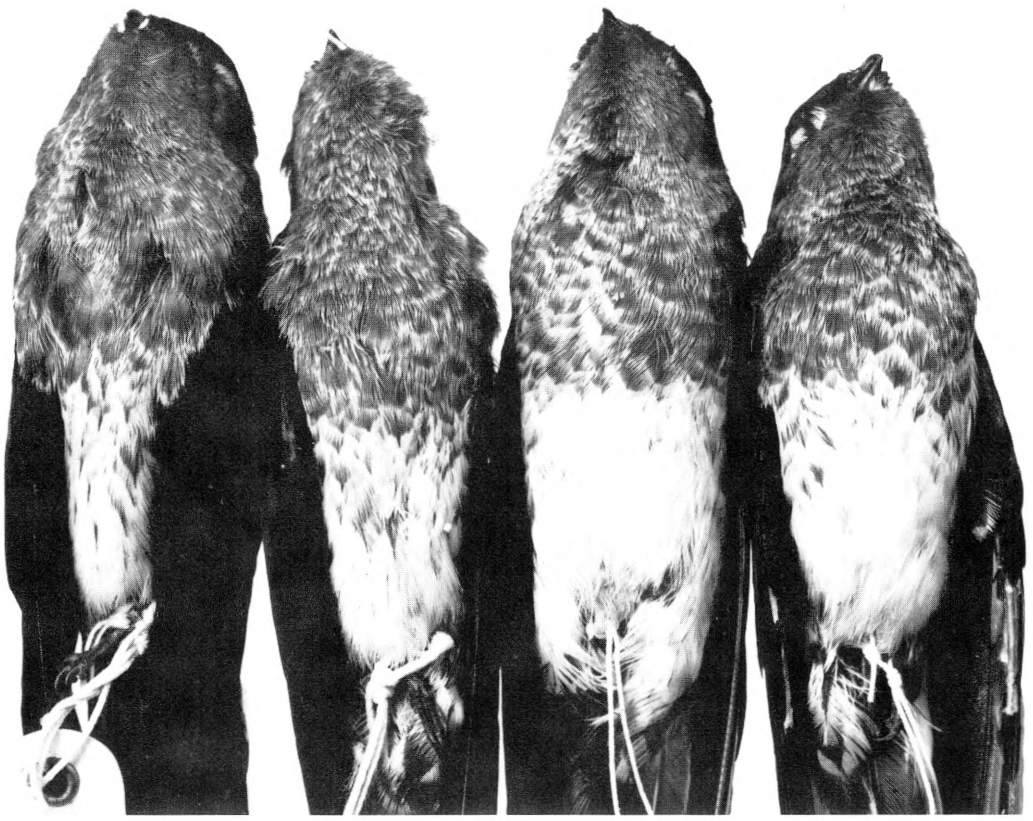


Fig. 14. *a Collocalia esculenta spilogaster* Lihir Island ♂
b –"– –"– *hypogrammica* Nissan Island ♀
c –"– –"– *kalili* Lemkamin, New Ireland ♀
d –"– –"– –"– Kalili, New Ireland ♂
Notice needle-shaped dark shaft-streaks on abdomen in *spilogaster* and *hypogrammica*.
(The specimens *a–b* in AMNH, *c–d* in ND).

that the insularized population then occupied Lihir, and finally Nissan, gradually diverging morphologically in accordance with the colonization of new island groups. This appears to be the usual way of inter-island colonization in the Hibernian Islands and of the subsequent differentiation of the island populations (cf. Salomonsen 1976, p. 593 and Fig. 3).

It is noteworthy that *kalili* in Dyaul Island has a tendency to require dark needle-like shaft-streaks on the feathers of the lower breast and abdomen, but by far not so distinctly as in *spilogaster*. Both the Dyaul population and that on the Hibernian Islands are off-shoots of *kalili* from New Ireland. There are other cases of a parallel development of the Dyaul and the Hibernian populations, for instance in *Lalage leucomela;* cf. Salomonsen 1964, p. 18.

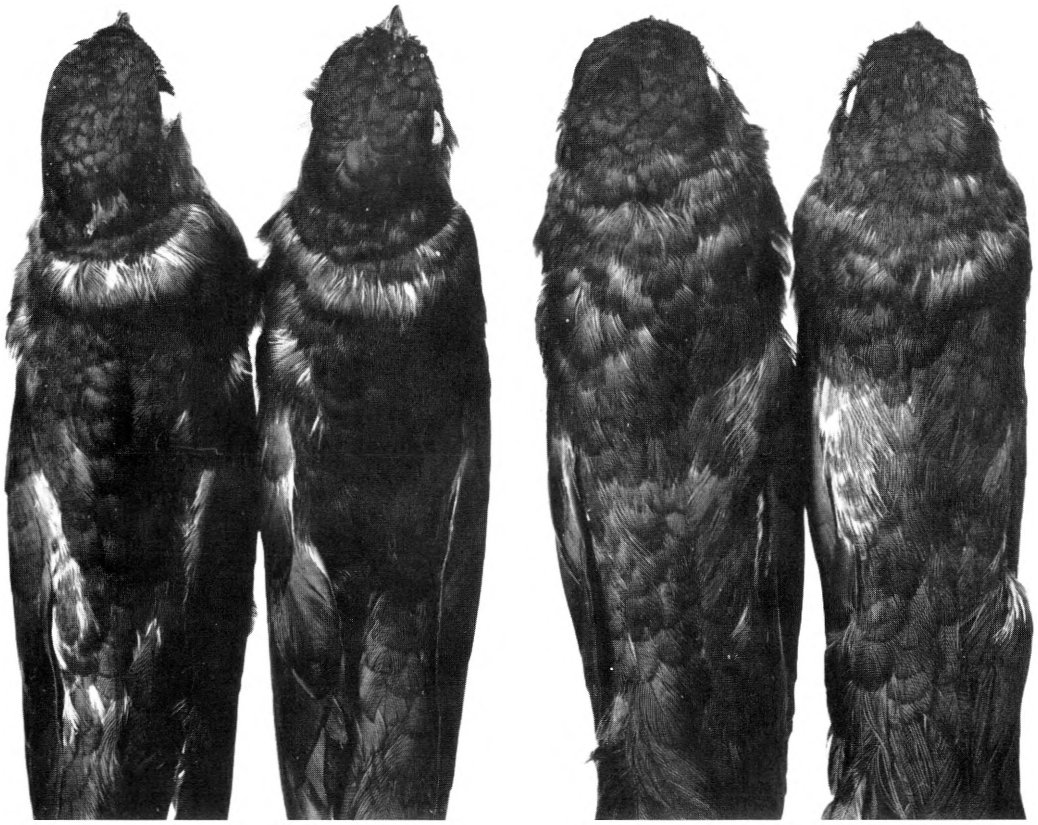


Fig. 15. *a–b Collocalia esculenta spilogaster* Lihir Island 2 ♂♂
c–d –"– –"– *hypogrammica* Nissan Island ♂ and ♀
Notice nape-feathers, with scattered white rami in *spilogaster*, uniform blackish in *hypogrammica*.
(All specimens in AMNH).

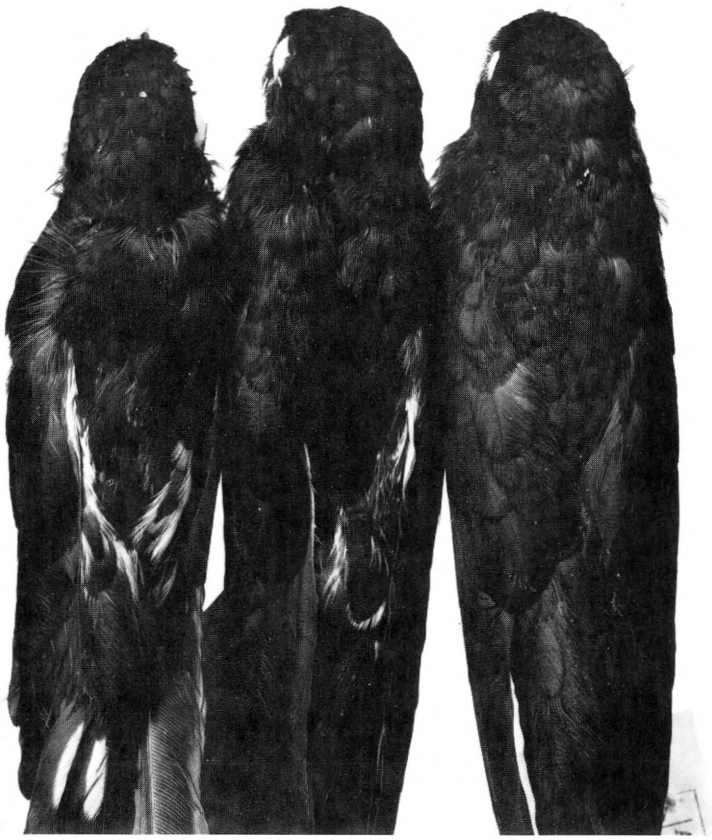
Collocalia esculenta hypogrammica,
new subspecies
Type: ♀ ad., Nissan Island, Green Islands, 30. April 1924, coll. A. F. Eichhorn, in AMNH, no. 634451.

Similar to *spilogaster*, but neck-feathers uniform dark, almost blackish, without any white rami (Fig. 15), the sheen on the upper-parts as dull as in *spilogaster*, but not so greenish, having a more bluish tinge; under-parts with thin dark needle-shaped shaft-streaks as in *spilogaster*.

Measurements: On an average slightly smaller than *kalili*, about the same size as *spilogaster*. Seven adult ♂♂ have a wing-length of 92–100 (average 96.3) mm, six adult ♀♀ 96–99 (average 97.3) mm.

Range: Restricted to the atoll Nissan Island in Green Islands, here included in the Hibernian Islands (cf. Salomonsen 1964, note on p. 26).

Remarks: The bird species inhabiting Nissan have usually originated in the Solomon Islands, as emphasized for instance by Hartert (1926a, p. 42)



a *b* *c*

Fig. 16. *a Collocalia esculenta desiderata* Rennell Island
b –"– –"– *makirensis* San Christobal
c –"– –"– *becki* Guadalcanal
The three endemic subspecies of *Collocalia esculenta* in the Solomon Islands, from above. Notice white on rump in *desiderata*. (All specimens in AMNH).

who states that the Nissan birds are "all of purely Solomonian character". However, *C.e.hypogrammica* is an exception to this rule since obviously it is an offshoot of the *kalili-spilogaster* group of the Bismarck Islands. Mayr (1931a, p. 16) included the Nissan population in his form *becki* from the Solomon Islands, probably for more traditional reasons. The figure of *becki* in this paper (Fig. 16*c*) distinctly shows that this form does not possess the needle-shaped shaft-streaks which are so characteristic for *hypogrammica*. Mayr adds correctly that the Nissan birds have "more white on the belly" (cf. description below of *becki*). Ripley (1947, p. 97), who examined some new material, also says that Mayr's "description fits our two birds". He gives the wing-length of two ♂♂ as 91 and 93 mm, which are very small measurements.

a *b* *c*

Fig. 16A. *a Collocalia esculenta desiderata* Rennell Island
b –"– –"– *makirensis* San Christobal
c –"– –"– *becki* Guadalcanal
The three endemic subspecies of *Collocalia esculenta* in the Solomon Islands, from below. Notice black-and-white mottling on abdomen in *becki*.
(All specimens in AMNH).

Collocalia esculenta becki Mayr

Collocalia esculenta becki Mayr, 1931, American Mus. Novit., no. 486, p. 16 – Florida Island, Solomon Islands. (Type in AMNH examined.)

Upper-parts with the same shade of iridescence as in *nitens* and *tametamele, i.e.* much stronger and more brillant than in *spilogaster* and *hypogrammica*, and without white colour on rump. Nape usually without any white rami on the fathers, just as in *hypogrammica*. Under-parts with dark grey throat and chest, of about the same colour as in *nitens* and *tametamele,* but the white linings on the feathers in fresh dress usually much narrower and soon disappearing with wear. The grey colour of throat and fore-breast continuing on lower breast, flanks and often also abdomen, the feathers of which are dark grey with broad white edges, giving a scaly pattern, but they differ from those of *spilogaster*

and *hypogrammica* by not having dark needle-like shaft-streaks. White spots on tail feathers always present, but rather small. There is much inter-island variation in the coloration of the under-parts, as already noticed by the original describer (Mayr 1931a, p. 16).

Measurements: Mayr (1931a, p. 16) has given the following measurements of wing-length based on a total of twenty-eight specimens from various islands, *viz* 98–107 (average 101.1) mm.

Range: The central Solomon Islands, known from Choiseul, Santa Isabel, Shortland, Velle Lavella, Baga, Kolombangara, Tetipara, Russell Islands, Florida and Guadalcanal; also collected on Malaita Island, by the Crane Pacific Expedition (Mayr and Camras 1938, p. 460), but this is the only record from this island.

Remarks: The development of grey colour on the lower breast and abdomen in *becki* is parallel to that in *spilura,* but is not so pronounced, being more mixed with white. The coloration of the under-parts appears to be somewhat intermediate between that in *spilura* and that in *numforensis;* compare Fig. 7 (*spilura*), Fig. 10 (*numforensis*) and Fig. 16A (*becki*). The colour of the upper-parts is about the same in *becki* as in *spilura,* but the bluish iridescence is perhaps not quite so strong.

Collocalia esculenta makirensis Mayr

Collocalia esculenta makirensis Mayr, 1931, American Mus. Novit., no. 486, p. 15 – San Christobal Island, Solomon Islands. (Type in AMNH examined.)

Similar to *becki,* but differing by having grey of throat and chest sharply delimited from lower breast and abdomen, which are pure white, and flanks with only little grey (Fig. 16A). The colour of the throat and the chest is dark grey with narrow white feather-edges, very similar to *becki.* Nape without white rami on the feathers, just as in *becki.* The gloss of upper-parts is duller and darker bluish than in *becki,* but not quite so dull as in *hypogrammica* and *numforensis.*

Measurements: Mayr (1931a, p. 15) gave the wing-length of ten specimens as 91–96 (average 93.9) mm. In AMNH I measured two ♂♂ with wing-length 94 and 94 mm, three unsexed specimens 94, 94 and 96 mm, average 94.4 mm. The type (♀ ad.) and three other specimens examined were in moult and could not be measured. In BM there are some specimens collected by Cain and Galbraith in 1953 (cf. Galbraith and Galbraith 1962, p. 40), of which an ♂ ad. has a wing-length of 93 mm and a ♀ ad. 93 mm; three other specimens are immature birds in growth. All these measurements tend to show that *makirensis* is much smaller than *becki.*

Range: San Christobal Island in the Solomon Islands. It appears not to be present on the nearby Ugi Island (Galbraith and Galbraith 1962, p. 40).

Remarks: Cf. remark under *Hemiprocne mystacea carbonaria* (p. 24) on the endemic bird fauna of San Christobal.

Collocalia esculenta desiderata Mayr

Collocalia esculenta desiderate Mayr, 1931, American Mus. Novit., no. 486, p. 15 – Rennell Island, Solomon Islands. (Type in AMNH examined.)

Nearest to *makirensis,* but iridescence of upper-parts still more dull, of the same tinge as in *numforensis;* feathers of rump with broad and conspicuous white borders, broader than in *misimae* and in *tametamele,* but by far not so broad as in *stresemanni* (Fig. 16). Nape-feathers usually without white rami. Under-parts quite as in *makirensis,* with sharp separation of grey throat and chest and white abdomen. The grey colour of throat is still slightly darker than in *makirensis* and the preceding forms and with narrow white feather-edges as in *becki* and *makirensis.* White spots on tail-feathers small but distinct.

Measurements: According to Mayr (1931a, p. 15) *desiderata* appears to be almost as small as *makirensis,* the wing-length of 4 ♂♂ measuring 95–97 (average 96.5) mm, 7 ♀♀ 96–101 (average 99.1)

mm. Five specimens from Rennell Island in BM, collected by Bradley in 1953, had a wing-length of 100 and 103 mm in two ♀♀, and 96, 101 and 101 mm in three unsexed specimens. One ♂ ad., collected in 1951 by the Danish Rennell Expedition and now kept in ZMC, measures 101 mm, and a juvenile ♀ only 47 mm (Bradley and Wolff 1956, p. 102). A ♂ ad. in ZMC collected by Wolff in 1965 on Rennell Island (cf. Wolff 1973, p. 16) has a wing-length of 98.5 mm.

Range: Rennell Island in the Solomon Islands, probably also Bellona Island where *esculenta* is known to occur but never has been collected (Bradley and Wolff 1956, p. 118).

Collocalia esculenta uropygialis G. R. Gray

Collocalia uropygialis G. R. Gray, 1866, Ann. and Mag. Nat. Hist., vol 17, p. 123 – Aneityum Island, New Hebrides. (Type in BM examined.)

Differing from all the above mentioned forms of *Collocalia esculenta* by the colour of the upper-parts, which is dull blackish with a very slight gloss and with a conspicuous white band across the rump. The feathers of the neck are usually blackish as those in the Solomon Islands forms, but in a few specimens the nape-feathers are supplied with some white rami. Under-parts with a very sharp and clearcut border between the dark throat and chest and the white abdomen, the coloration more contrasting than in any other form of *esculenta* (Fig. 17); flanks often pure white but usually with some greyish colour at the feather-bases. The colour of the throat and chest is dull greyish black, still darker than in *desiderata*, and the feathers are virtually without white feather-edges, even in freshly moulted specimens. The tail-feathers are uniform black or are supplied with a rather small and indistinct whitish spot on the base of the inner webs.

Measurements: A total of thirty-one adult ♂♂ from various islands have the wing-length 94–100 (average 96.5) mm, twenty-two adult ♀♀ 92–102 (average 97.9) mm, and thirteen unsexed specimens 95–103 (average 98.2) mm (Table 12). The size appears to be similar to that in *desiderata*.

Range: Santa Cruz Islands, Torres Islands, Banks Islands and the New Hebrides.

Remarks: Specimens from the northernmost islands, which are nearest to the Solomon Islands, show transitional characters between *uropygialis* and *makirensis*. Birds from the Santa Cruz Islands have slightly more gloss on the upper-parts, almost as in *makirensis*, and in this respect the specimens from Torres and Banks Islands are intermediate between the Santa Cruz specimens and true *uropygialis* from the southern parts of the New Hebrides. In all other particulars all the populations within *uropygialis* appear to be alike.

I have examined the type of *uropygialis*, which is an unsexed specimen from Aneityum with wing-length 103 mm. There are three other specimens from the type-locality in BM, and they are all more or less approaching the New Caledonian form *albidior* by being somewhat paler on the throat and having more white on the feather-edges. They are, nevertheless, closer to *uropygialis* from the New Hebrides, and I therefore, include them in this form. It is unfortunate, however, that the type was chosen from a locality where the population is not typical but more or less intermediate. There are sixteen more specimens from various islands in the New Hebrides, Santa Cruz and Banks Islands in BM. They were examined, but not measured. With the exception of a single specimen from Efate, which is similar to the Aneityum specimens, they were all typical *uropygialis*.

It appears that *C.esculenta* is the commonest of all species of birds in the New Hebrides, at least on Espiritu Santo, according to Scott (1946, p. 366), but in this statement he also included *C. spodiopygia*, as it was not possible in the field to distinguish these two species (both with white rump in the New Hebrides). However, Medway and Marshall (1975, p. 438) recently found *esculenta* to be "abundant at all places visited" in the New Hebrides where it occurs up to an altitude of 1,080 m (p. 436).

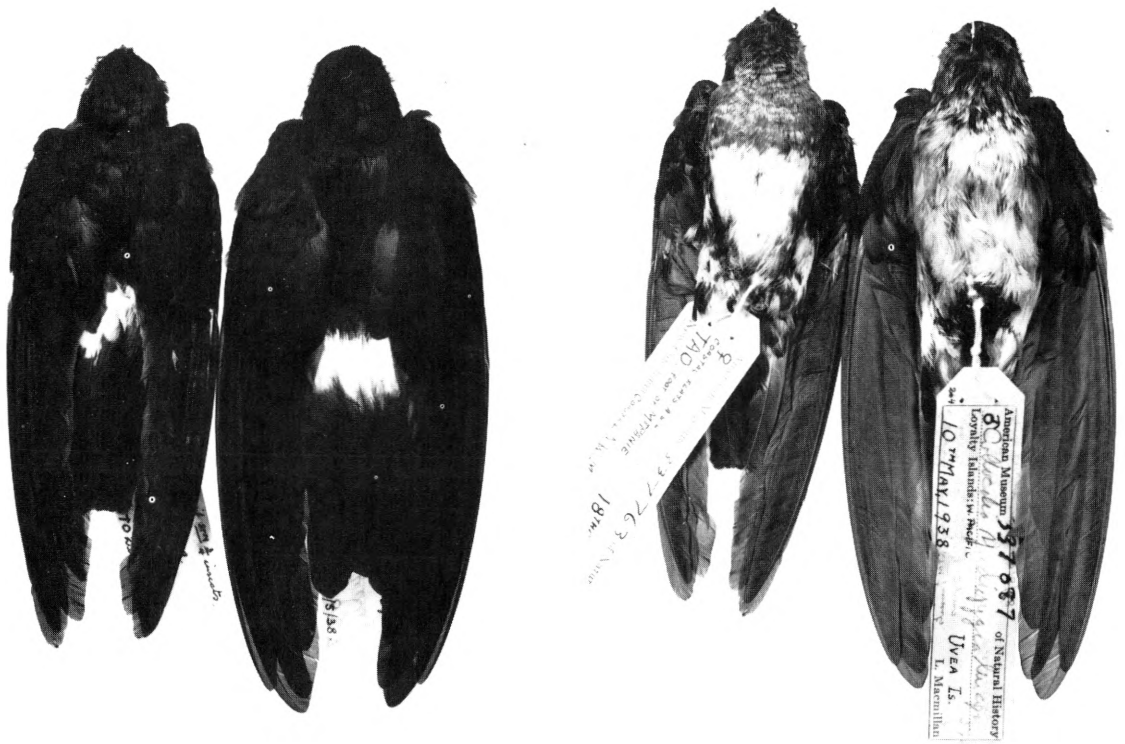
a *b* *c* *d* *e* *f*

Fig. 17. *a Collocalia esculenta albidior* Loyalty Islands ♂
b –"– –"– –"– New Caledonia ♀
c –"– –"– –"– –"– ♀
d –"– –"– *uropygialis* Dolphin Island, New Hebrides unsexed
e –"– –"– –"– Efate Island, –"– unsexed
f –"– –"– –"– Utupua Island, Santa Cruz Islands unsexed
Notice coloration of throat and chest, mottled with white in *albidior*, uniform blackish in *uropygialis*. (All specimens in AMNH).

Collocalia esculenta albidior, new subspecies
Type: ♂ ad., Lifu, Loyalty Islands, 19. August 1938, coll. L. Macmillan, in AMNH, no. 337292.

Differs strikingly from *uropygialis* by having broad white feather-edges on the throat and chest, making these parts a mixture of black and white, almost equally distinct in worn birds (Fig. 17). The grey colour of the throat and chest is much paler than in *uropygialis*. The tail-feathers are supplied with large and conspicuous white spots on the base of the inner webs. In all other particulars similar to *uropygialis*.

Measurements: Seven adult ♂♂ have a wing-length of 95–101 (average 98.0) mm, seven adult



a *b* *a* *b*

Fig. 18. *a Collocalia esculenta albidior* New Caledonia ♀
b Collocalia spodiopygia leucopygia Loyalty Islands ♂
Parallel development of the two species *esculenta* and *spodiopygia* in the Loyalty Islands and New Caledonia, both with upper-parts (left figure) with dull gloss and contrasting white rump band, the under-parts (right figure) with dark throat (*esculenta* also with grey upper-breast) and with white abdomen.
(Both specimens in AMNH).

♀♀ 96–102 (average 98.3) mm, an unsexed specimen 95 mm (Table 12). The wing-length is very slightly larger than in *uropygialis*.

Range: The Loyalty Islands and New Caledonia.

Remarks: According to Vuilleumier and Gochfeld (1976, p. 257) *C.esculenta* is by far not so common on New Caledonia and the Loyalty Islands as *C.spodiopygia*, which agrees with previous statements by various observers.

The two species of *Collocalia* in New Caledonia, *esculenta* and *spodiopygia*, have been subject to a peculiar parallel development and are difficult to distinguish, especially in the field (Fig. 18). *C.esculenta albidior* can be recognized by its slightly more glossy upper-parts, its pure white bar across the rump (without the dark shaft-streaks found in *spodiopygia*), the sharp and clear-cut contrast between the dark throat and upper breast and the white abdomen, the white feather-edges on the dark throat and even on the chin, while *spodiopygia* has only the throat blackish; finally *esculenta* has smaller proportions (wing < 103 mm), in *spodiopygia* the wing is > 103 mm.

TABLE 12
Wing-length (in Millimeters) of the Material of *Collocalia esculenta* Examined from the Southern Melanesian Islands.

uropygialis			
AMNH	Vanikoro, Santa Cruz Islands	♂	94
		♀	97
	Utupua, Santa Cruz Islands	unsexed	96
	Hiw, Torres Islands	♀♀	99, 102
		unsexed	103
	Santa Maria (Gaua), Banks Islands	♂♂	96, 97
		unsexed	100
	Saddle Island (Valua), Banks Islands	♀♀	97, 99
	Mara Lava, Banks Islands	♂	–[a]
	Bligh Island, Banks Islands	♀	97
	Melapao, Banks Islands	♂♂	98, 99
		♀	100
	Espiritu Santo (Marina), New Hebrides	♂♂	96, 97, 98
		♀♀	98, 98, 98, 100, 100
		unsexed	99
	Oba (Aoba), New Hebrides	♂♂	95, 96, 98
		♀♀	95, 98
	Maewo (Aurora)[b],	♀	99
	Malekula, New Hebrides	♂♂	95, 96
	Ambrim, New Hebrides	♂	95
		♀	96,
	Epi, New Hebrides	♂♂	94, 96, 97, 99
		unsexed	95
	Tongoa, New Hebrides	♂♂	95, 96, 98
		unsexed	97
	Emau (Mau), New Hebrides	♂	96
		♀♀	100, –[a] –[a]
	Dolphin, New Hebrides	unsexed	96, 96
	Efate, New Hebrides	♂♂	95, 96, 96, 97, 100
		♀♀	95, 96
		unsexed	96, 97
	Eromanga (Erromango), New Hebrides	♂	96
		♀♀	98, 100
	Tana (Tanna), New Hebrides	♂♂	94, 98
		♀	92

BM[c]	Aneityum, New Hebrides	♂	98
		unsexed	99, 100, 103[d]
albidior			
AMNH	Uvéa, Loyalty Islands	♂♂	99, 101
	Lifu, Loyalty Islands	♂	98
		♀♀	101, 102
	Maré, Loyalty Islands	♂	98
		♀	96
	New Caledonia[e]	♂♂	95, 96
		♀♀	96, 97, 98, 98
BM	New Caledonia	♂	99
		unsexed	95

[a] In moult, not measured.
[b] A long series of moulting specimens and immature birds from Maewo have not been measured.
[c] Sixteen other specimens of *uropygialis* and *albidior* in BM were not measured.
[d] Type of *uropygialis*.
[e] Nine other specimens of *albidior* in AMNH were in moult and were not measured.

Collocalia spodiopygia (Peale) 1848

This species inhabits the region east of Wallace's line, including Celebes, the Moluccas, the Papuan region, North Queensland, Melanesia and east to Samoa, Tonga and Fiji Islands. Being one of the "grey" species *spodiopygia* has been much more difficult to analyse and delimit than *esculenta*. The difficult task of arranging the geographical forms belonging to *spodiopygia* was first attempted by Stresemann (1926a, p. 182), who called the species *C.francica*. However, Stresemann's *francica* was a very complex species and constituted a most peculiar and confusing unit, consisting of forms usually regarded as representatives of the species *fuciphaga, inexpectata, vestita, leucophaea, spodiopygia* and *francica*, according to Peters (1940, p. 220). Also Peters' arrangement has in recent years been changed in various ways, however; cf. Medway 1966, p. 153. The more recent classification of the New Guinea swiftlets by Stresemann and Paludan (1932, p. 166) meant a considerable improvement. They restricted *C. spodiopygia* to the Melanesian and Polynesian forms, while the Indonesian, Australian and Papuan forms were included in the species *C.vanikorensis*, which, however, was a composite species.

A few years later Mayr and Rand (1937, p. 77) made the surprising discovery that there were two "grey" species in New Guinea, *vanikorensis* s.str. and *hirundinacea*, which were extremely similar. The species characters were described in the said paper. Mayr (1937, p. 16) further studied the complicated taxonomy of the two species and elucidated the whole situation in an excellent way. He also repeated the diagnostic characters of the two species. Moreover, he included some of Stresemann's and Paludan's socalled *vanikorensis* in the species *spodiopygia*, and this treatise comes nearest to that one adopted in this paper.

The most characteristic feature of *spodiopygia* is a contrasting white bar across the rump. This is found in the populations inhabiting three areas widely isolated from each-other, namely (1) in a western group of forms, inhabiting Celebes and the Moluccas, (2) in an Australian population, and (3) in an eastern Melanesian-Polynesian group, whereas the Papuan semispecies,

C.hirundinacea, has uniform blackish-brown upper-parts. However, it was demonstrated by Stresemann and Paludan (1932, p. 165) that the form of the northern Moluccas, *infuscata*, bridged the differences in the characters of *spodiopygia* (with white rump bar) and those of *hirundinacea* (with blackish rump) and in this way showed the close relationship of these two species. In a series of five specimens of *infuscata* from Halmahera there were some "mit sehr licht weissgrauem Bürzelband, die fast genau so aussehen wie *C.sororum* from Celebes, und daneben andere, denen jede Aufhellung in der Bürzelregion völlig fehlt und welche dadurch täuschend ähnlich sind den Salanganen von Neuguinea, die man bisher in den Rassenkreis *C.fuciphaga* einbezogen hat." And further: "*C.infuscata* zeigt also, dass *C.sororum* ein Einwanderer von Osten her ist und mit den dunkelbürzligen *Collocalia* von Neuguinea in einen Rassenkreis gestellt werden muss." This conclusion caused Mayr (1937, p. 16) to a similar statement: "The black-rumped *hirundinacea* is obviously a geographical representative of *spodiopygia*." However, he did not take the consequences of his conclusion, but still considered them as two independent species.

In Fig. 20 two specimens of *C.sororum* are shown compared with two *infuscata*, of which one is intermediate between *sororum* and *hirundinacea* in the colour of the rump, while the other has a blackish rump just as *hirundinacea*.

The situation is then as follows: A black-rumped species (*hirundinacea*) inhabits the Papuan area and is surrounded by three other species, all with a white rump band and being exceedingly similar, *infuscata* in the West, *terrae-reginae* in the South and *spodiopygia* in the East, all four species being allopatric and *hirundinacea* filling the gap between the three white-rumped species. There are two alternatives to choose for their classification, either to regard them as four separate species forming a superspecies, or to consider them as one single species. The fact that *infuscata* in the northern Moluccas is a transitional form between the white-rumped western species and the black-rumped *hirundinacea*, and that the Australian *terraereginae* also appears to be more or less intermediate between the white-rumped and the black-rumped species, tends to show that the most natural solution is to regard the whole complex of forms as one species. This view-point is followed in this paper. It was shown above under the description of *C.esculenta* that forms with uniform upper-parts and such ones with a white rump-bar replace each-other, and it is not peculiar, therefore, that something similar is the fact in *spodiopygia*.

It is necessary to insert some words about the nest-building in the *spodiopygia* group. Medway (1966, p. 156 and 161) has demonstrated that the nests of *hirundinacea* and the white-rumped *spodiopygia* differ from each-other in structure and material and that the two groups, therefore, cannot be regarded as conspecific. In *hirundinacea* the nest is constructed of various plant-material and lacks all sign of nest-cement. Similar nests can also be found in the form *Collocalia salangana natunae* in northern Borneo (Medway 1966, p. 162). In *spodiopygia* the nests consist also of vegetable material, but this is bound together by a relatively copious application of nest-cement, which characteristically takes the form of laminae, between which the extraneous plant-material is sandwiched (Medway 1966, p. 156). Although this is the general type of nest in this species, there is some variation in the nest-structure and amount of nest-cement. For instance the nest of *C. spodiopygia leucopygia* from New Caledonia incorporates only a slight proportion of nest-cement, and not in the form of laminae between the layers of plant-material, but only as material used to glue the underside of the nest to the cave wall. This is not far from the condition in *hirundinacea*. I do not attach too much taxonomic importance to these differences, because nest-structure may differ geographically just as morphological characters, which in *spodiopygia* are subject to a particularly large variability. Medway's guiding principle is

similar to that of Sims, who is of the opinion that: "Although the birds are very similar each species builds a characteristic nest" (Sims 1961, p. 207). This is naturally true in many cases, but is too broad a generalization. This view can be proved by many examples, best of which is that of *fuciphaga*. This species is the main producer of edible nests, which are constructed almost exclusively of concentric laminae of firm nest-cement and therefore are of a considerable economic importance. According to Medway (1966, p. 165) the forms *dammermani* and *micans* on the Lesser Sunda Islands both produce "good white edible nests", which *fuciphaga* is known to do exclusively in its entire range. *Collocalia fuciphaga* is the only "grey" species in the Lesser Sunda Islands (from Bali eastwards) and is, therefore, not difficult to identify. It is noteworthy that Rensch (1931, p. 539) examined no less than 8–10 nests of *dammermani* on Lombok, under the name of *C.francica micans*, and also collected some specimens. The nests were placed in complete darkness in a cave at the outlet of a subterranean rivulet. They were built of moss and lichens, glued to the cave wall by a broad layer of nest-cement. Rensch concluded that: "Es handelt sich also nicht um essbare Nester, wie es von einer *francica*-Rasse zu erwarten wäre". He further states (p. 540) that edible white nests of *dammermani* were collected by the natives of Flores and Sumbawa. It is fair to add that Rensch's observations apparently were unknown to Medway.

Medway's taxonomic treatment of the *fuciphaga* forms has brought much clearity over these puzzling birds, but I find that he oversimplified the issue. In the region Sumatra-Malaysia-Borneo *fuciphaga* and allies form a circular cline, in which the terminal populations overlap and remain distinct and reproductively isolated in the area, in which they occur sympatrically. Nevertheless, Medway (1966, p. 166) regards them all as conspecific. It is evident, however, that they should be divided into two species, although the division may be more or less arbitrary. I would suggest *fuciphaga* as one species (with *vestita*, *dammermani*, *micans* and *inexpectata* as subspecies) and *germani* (with *amechana*) as the other species. The Philippine forms *perplexa* and *amelis* may constitute a third species. However, all these forms produce edible nests. The complicated and intriguing situation in these Sumatra-Malaysia-Borneo swiftlets, which was clearified by Medway, has a perfect counterpart in the genus *Dicaeum* of the Flowerpeckers, in which a circular overlapping cline is developed in the same area by the species *agile* and *everetti* with the Philippine forms constituting a third species, *aeruginosum* (Salomonsen 1960, p. 5 and map. Fig. 1, p. 7).

The western forms of *spodiopygia*, including *hirundinacea*, as well as the Australian and Polynesian forms have been discussed several times, whereas the Melanesian forms have only been studied superficially. I shall, therefore, restrict the present investigation to the Melanesian populations, while the western forms (the *infuscata*, *hirundinacea* and *terrae-reginae* groups) as well as the eastern, Polynesian group will be subject only to brief descriptions.

The distribution of the various forms of *spodiopygia* is shown in Fig. 19.

WESTERN FORMS

Collocalia spodiopygia sororum Stresemann
Collocalia francica sororum Stresemann, 1931, Ornith. Monatsber., vol. 39, p. 12 – Latimodjong Mountains (800 m), Celebes. (Type in AMNH examined.)

Upper-parts, wings and tail blackish with a faint iridescence and across the rump with a narrow (6–7 mm broad) greyish-white band of which each feather has a dark shaft-streak (Fig. 20). The entire under-part and a distinct and large supraloral spot silvery grey, the chin slightly darker, more brownish. Tarsus feathered, but in varying degree.

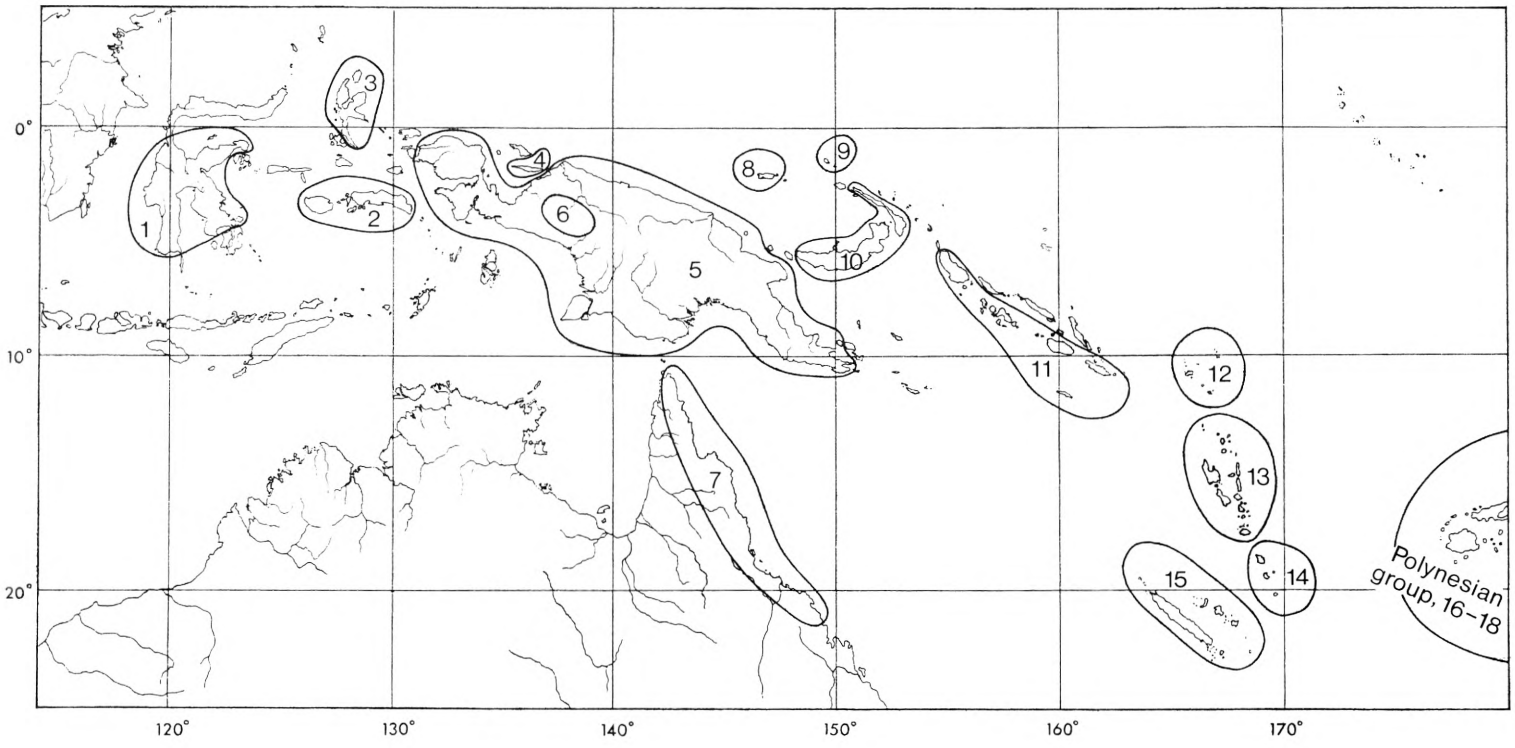


Fig. 19. Distribution of the different forms of *Collocalia spodiopygia*. Western forms: 1. *sororum*, 2. *ceramensis*, 3. *infuscata*, 4. *baru*, 5. *hirundinacea*, 6. *excelsa*, 7. *terrae-reginae*. Melanesian forms: 8. *delichon*, 9. *eichhorni*, 10. *noonaedanae*, 11. *reichenowi*, 12. *desolata*, 13. *epiensis*, 14. *ingens*, 15. *leucopygia*. Polynesian forms: 16. *assimilis*, 17. *townsendi*, 18. *spodiopygia*.

Measurements: Seventeen ♂♂ have a wing-length of 105–114 (average 109.3) mm, eight ♀♀ 106–114 (average 110.9) mm, after Stresemann (1940, p. 395). I measured five specimens (in AMNH) with wing-length 106–110 (average 108.6) mm, tail-length 42–46 mm, furcation of tail 5–8 mm.

Range: Celebes, except northern part, occurring up to the highest mountain peaks. Not recorded from Muna and Buton Islands; cf. Van Bemmel and Voous 1951, p. 55.

Collocalia spodiopygia ceramensis Van Oort
Collocalia ceramensis Van Oort, 1911, Notes Leyden Mus., vol. 34, p. 64 – Ceram.

Similar to *sororum,* but band across rump broader (10–12 mm) and almost pure white, sharply contrasting and with distinct dark shaft-streaks (Fig. 20).

Measurements: Body proportions smaller than in *sororum.* Wing-length 102–109 mm, according to Stresemann and Paludan (1932, p. 169). I measured four specimens (in AMNH) with wing-length 104–108 (average 106.3) mm, tail-length 41–43 mm, furcation of tail 5–6 mm.

Range: The Southern Moluccas, known from Buru, Ambon and Ceram (Van Bemmel 1948, p. 361).

Collocalia spodiopygia infuscata Salvadori
Collocalia infuscata Salvadori, 1880, Atti R. Accad. Sci. Torino, vol. 15, p. 348 – Ternate, Northern Moluccas.

Similar to *sororum,* but band across rump darker greyish or quite missing, the upper-parts thus being uniform black (Fig. 20), the under-parts distinctly darker greyish. Tarsus feathering very varying, from dense covering to the tarsus being almost devoid of feathers, but the feathering is usually fairly well developed.

Measurements: Five specimens have a wing-length of 109–113 (average 110.6) mm, tail-length 44–46 mm, furcation of tail 7–8 mm.

Range: The Northern Moluccas, known from Halmahera, Morotai and Ternate.

Collocalia spodiopygia baru
Stresemann and Paludan
Collocalia vanikorensis baru Stresemann and Paludan, 1932, Novit. Zool., vol. 38, p. 167 – Japen Island, Geelvink Bay. (Type in AMNH examined.)

This is a form of the *hirundinacea* group with uniform very dark upper-parts and with pronounced shaft-streaks on the brownish-grey under-parts. Tarsus with fairly much feathering.

Measurements: Wing-length of six specimens 109–114.5 (average 111.2) mm (Mayr 1937, p. 16), *i.e.* about the same size as *sororum* and *infuscata,* but larger than *ceramensis.*

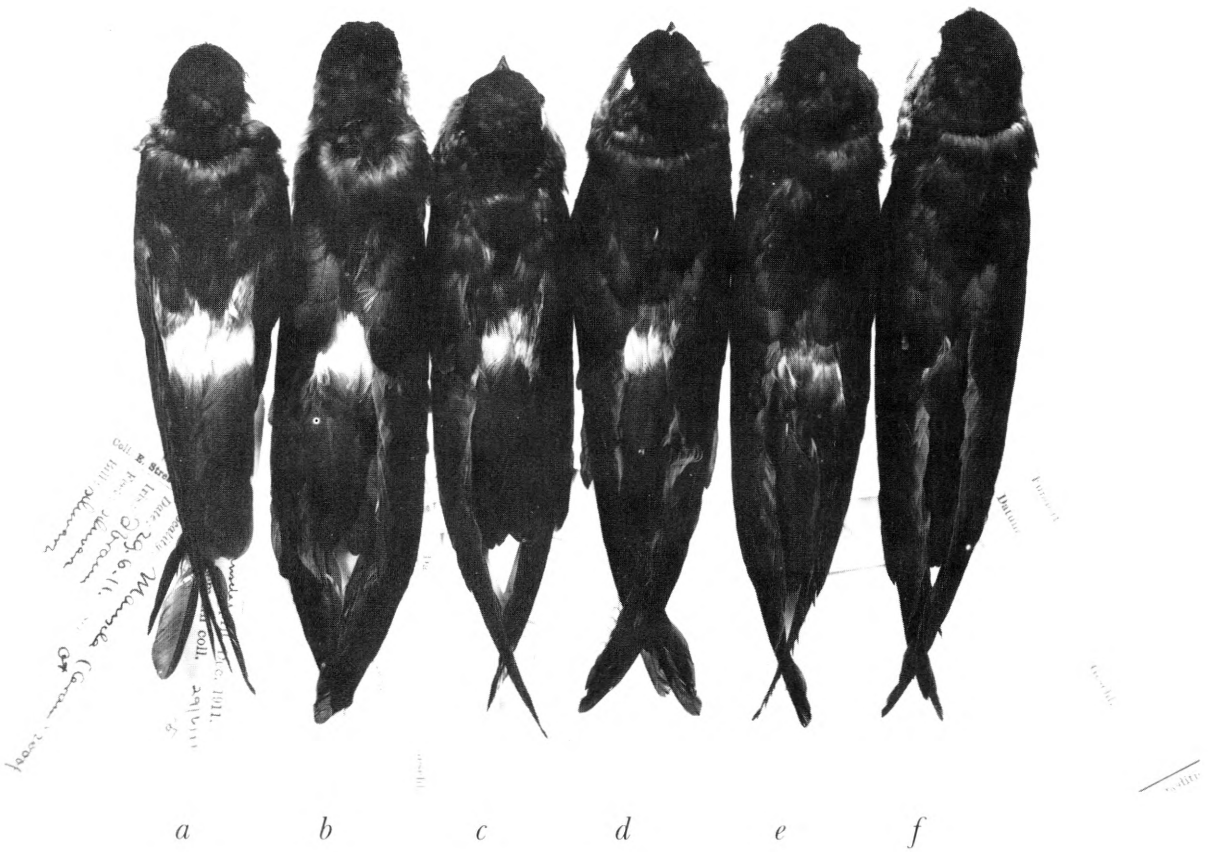
Range: Japen Island in Geelvink Bay.

Collocalia spodiopygia hirundinacea Stresemann
Collocalia fuciphaga hirundinacea Stresemann, 1914, Verh. Ornith. Ges. Bayern, vol. 12, p. 7 – Setekwa River, New Guinea. (Type in AMNH examined.)
Collocalia fuchiphaga pseudovestita Stresemann, 1923, Arch. Naturgesch., vol. 89, abt. A, fasc. 7–8, p. 27 – Madang, Astrolabe Bay, New Guinea.
Collocalia fuciphaga mayri Hartert, 1930, Novit. Zool., vol. 36, p. 93 – Siwi, Arfak Mts., Vogelkop Peninsula, New Guinea. (Type in AMNH examined.)

Similar to *baru,* but upper-parts much lighter, under-parts slightly lighter with shaft-streaks present but inconspicuous. Tarsus feathering usually strong.

Measurements: Distinctly larger than *baru.* Wing-length of a large series 114–117 (average 115.6) mm, according to Mayr (1937, p. 13).

Range: New Guinea (except areas inhabited by *C.spodiopygia excelsa),* Goodenough Island in the D'Entrecasteaux Archipelago (Mayr and Van Deusen 1956, p. 3) and Karkar Island (Diamond and Lecroy 1979, p. 517), but unknown from all other satellite islands around New Guinea.



a *b* *c* *d* *e* *f*

Fig. 20. *a Collocalia spodiopygia ceramensis* Ceram ♂
b –"– –"– –"– Buru ♀
c –"– –"– *sororum* Celebes unsexed
d –"– –"– –"– –"– ♂
e –"– –"– *infuscata* Halmahera ♂
f –"– –"– –"– –"– ♀

Notice decreasing size of white rump-band from *ceramensis* (left) over *sororum* (centre) to *infuscata* (right) in which it is completely missing in specimen *f*.
(All specimens in AMNH).

Collocalia spodiopygia excelsa Ogilvie-Grant

Collocalia hirundinacea excelsa Ogilvie-Grant, 1914, Bull. British Ornith. Club, vol. 35, p. 34 – Utakwa River (2,600 m), New Guinea.

Differing from *hirundinacea* only by its much superior size.

Measurements: Ogilvie-Grant (1914, p. 34) in the original description gave the wing-length of ♂ 127, ♀ 131 mm. Rand (1942b, p. 458) gives the wing-length of 31 specimens collected in the Snow Mountains from 2,200 to 4,000 m altitude as 120–137 mm. Ripley (1964, p. 41) gives the wing-length of some specimens (how many?) from 2,250–2,900 m near the Carstenz Peaks as 121–127 mm.

TABLE 13

Wing-length (in Millimeters) of the Material of *Collocalia spodiopygia excelsa* from the Snow Mountains, New Guinea, Examined by Rand (1942b, p. 458).
n: number of specimens examined.

Altitude (in m)	♂♂	Average	n	♀♀	Average	n
1,600	118–120	119.0	3	113–122	117.2	6
2.200	121–124	122.0	3	120–127	123.7	3
3,225	121–128	125.0	4	121–130	125.0	7
3,600–4,000	129–137	133.4	8	125–134	129.8	6

These figures should be compared with a wing-length of 114–117 mm in lowland *hirundinacea.*

Range: The high altitudes of the largest mountains in the central range of highland in New Guinea, known from the Snow Mountains and the Carstenz Peaks, where *excelsa* occurs above 1,600 m altitude. In the upper altitudes of Wharton Range in S. E. New Guinea the *spodiopygia* populations only approach *excelsa* and constitute an intermediate stage (*hirundinacea* ≷ *excelsa*).

Remarks: The altitudinal variation in New Guinea of the wing-length in *spodiopygia* is an exact counterpart to that in *C.esculenta,* in which the birds of the Snow Mountains belonged to the long-winged form *erwini,* while those of the other mountain ranges in New Guinea at similar altitudes only reached an intermediary stage (*erwini* ≷ *nitens*). The difference between the lowland and highland form is even greater in *spodiopygia* than in *esculenta;* cf. diagram, Fig. 25. The wing-lengths of the very fine and long series of *excelsa* from the Snow Mountains, measured by Rand (1942b, p. 458), are shown in Table 13. All these birds must be said to belong to *excelsa,* since they are distinctly larger than *hirundinacea.* The lower altitudinal limit towards *hirundinacea* is probably about 1,600 m, just as in *esculenta.* The considerable size variation, showing a fast increasing wing-length when moving upwards in the mountains, exactly corresponds to the figures in *esculenta,* as to be seen in Table 9.

In the Schrader Mountains, north of the Bismarck Ranges, Gilliard collected a ♂ and a ♀ on an altitude of 2,250 m and 2,650 m, respectively, with wing-length ♂ 113 mm, ♀ 116 mm (Gilliard and Lecroy 1968, p. 12), proportions not differing from those in *hirundinacea.* In the Wharton Range good material was collected by the Archbold Expedition 1933–34 and measured by Mayr and Rand (1937, p. 77). They stated that the wing-lengh in specimens "found from near sea level to 3,680 m" varies as follows: Eight adult ♂♂ 114–125 (average 118.4) mm, seven adult ♀♀ 113–118 (average 115.7) mm. It is regrettable that the authors did not inform about the altitudes a which the individual specimens were collected, but even if assuming that only the largest specimens were obtained at 3,680 m their average size at this altitude would amount only to about 122 mm in ♂♂, 117 mm in ♀♀. This implies that the size of these birds just skirts the lower limit of *excelsa.* No other records of *excelsa* than those mentioned have been published. It is noteworthy that the variation in body proportions of the New Guinea populations of *spodiopygia* forms an exact parallel to that of *esculenta,* both in size increase, geographical distribution and altitudinal adaptation. The explanation of the development of the two New Guinea forms of *spodiopygia* must, therefore, be the same as that given for *esculenta;* cf. p. 43, above.

Collocalia spodiopygia terrae-reginae (Ramsay)
Cypselus terrae-reginae Ramsay, 1874 (1875), Proc. Zool. Soc. London, p. 601 – Northeast coast of Queensland, near Cardwell, Australia.
Collocalia francica zoonava Mathews, 1916, Bull. British Ornith. Club, vol. 36, p. 89 – Johnstone River, North Queensland. (Type in AMNH examined.)

Closest to *ceramensis* in coloration, but upper-parts distinctly paler, more brownish, band across rump not white but greyish-brown with darker shaft-streaks, under-parts distinctly more saturated, with a sooty brownish tinge (not pale greyish) and completely without darker shaft-streaks. Body proportions as in *hirundinacea*, but the tail longer than in any of the other forms of *spodiopygia*, except the largest specimens of *excelsa*. Tarsus usually strongly feathered. It appears that some specimens have uniformly coloured upper-parts without pale rump-band (Stresemann and Paludan 1932, p. 170), but such specimens have not been seen by me.

Measurements: Only a few specimens of this characteristic subspecies were available to me, belonging to the G. M. Mathews collection i AMNH. Two unsexed specimens had a wing-length of 114 and 115 mm, tail-length 49 and 50 mm (compared to 40–45 mm in *hirundinacea* and other neighbouring forms), furcation of tail 5 and 6 mm. Wing-length of two other specimens 110 and 112 mm.

Range: North-eastern Queensland from Cape York to Mackay.

MELANESIAN FORMS

The spodiopygia forms inhabiting the Bismarck Islands and the Solomon Islands are little known, due to lack of material. The distribution appears to be patchy, and the species is evidently missing on several islands, especially the smaller ones. Mayr (1937, p. 16) stated that *eichhorni* is the form of the Bismarck Islands and *reichenowi* that of the Solomon Islands. Peters (1940, p. 227) follows him, giving the distribution of *eichhorni* as St. Matthias Island, New Ireland and New Britain in the Bismarck Islands and that of *reichenowi* as Guadalcanal in the Solomon Islands. The situation is more complicated, however. This holds good also of the remaining island groups of Melanesia, which by Mayr and by Peters are said to be inhabited by *leucopygia*. Owing to recent collecting carried out by The Whitney South Sea Expedition, by L. MacMillan (both collections in the AMNH) and by The Noona Dan Expedition, it is now possible to understand the geographical variation and describe the distribution in a more satisfactory way.

Collocalia spodiopygia delichon, new subspecies
Type: ♂ ad., Lorengau, Manus Island, Admiralty Islands, 19. June 1962, coll. J. Trap-Lind on the Noona Dan Expedition, collector's no. 2,246.

Upper-parts deep blackish with a dull gloss, not quite so dark as in *noonaedanae*, usually many white rami on feathers of neck and mantle, a broad and shining, strongly contrasting white rump-band (13–17 mm broad), broader and more distinct than in any other population of *spodiopygia* (Fig. 21), with well-defined dark shaft-streaks. Under-parts, including a supraloral spot, pale greyish white with a silvery tinge, paler than in *sororum* and *ceramensis* (cf. also Fig. 22), with inconspicuous, almost indistinguishable darker shaft-streaks, throat paler, almost whitish, chin brownish forming a vaguely defined dark spot, under tail-coverts dark, almost blackish. Tarsus unfeathered or occasionally thinly feathered on upper (proximal) parts.

Measurements: Twenty-two adult ♂♂ have a wing-length of 101–109 (average 105.2) mm, fifteen adult ♀♀ 103–109 (average 105.4) mm (Table 14). Tail-length 44–46 mm, furcation of tail 4–7 mm. Since the tail-length and the furcation are similar in all Melanesian forms of *spodiopygia* I

Fig. 21. *a–d Collocalia spodiopygia delichon* Manus, Admiralty Islands
e–h –"– –"– *noonaedanae* New Ireland, Bismarck Islands
Notice difference between the two subspecies in breadth and whiteness of the rump-band. (All specimens in ND).

found it unnecessary to repeat these measurements in the remaining subspecies.

Compared with the previously mentioned forms of *spodiopygia* the subspecies *delichon* has a shorter wing-length; only *ceramensis* is just as small. Also the following forms are small, and some are even smaller than *delichon*.

Range: Manus Island in the Admiralty Islands; probably also many of the surrounding small islets and at least known from Los Negros (Ripley 1947, p. 101)

Noona Dan Material: (1) ♂ ad., Lorengau River (above waterfall), Manus Island, 15. June 1962, collector's no. 2,226. Iris brown, bill black, legs brown. In wing-moult, p_{10} growing. Testes 3 × 2 mm, one being dark (bluish).

(2) ♂ imm., Lorengau River (above waterfall), Manus Island, 17. June 1962, collector's no. 2,240.

(3) ♂ ad., Lorengau River (above waterfall), Manus Island, 19. June 1962, collector's no. 2,246. (Type of *C.s.delichon*.)

(4) ♂ ad., Lorengau River (above waterfall), Manus Island, 19. June 1962, collector's no. 2,247. Testes 3 × 2 mm.

(5) ♂ (imm.?), Manus Island, 23. June 1962, collector's no. 2,269. Heavy body- and wing-moult. Weight 5 g.

TABLE 14
Wing-length (in Millimeters) of the Material of *Collocalia spodiopygia* Examined from the Bismarck Islands.

delichon				
AMNH	Manus		♂♂	101, 103, 104, 104, 104, 104, 104, 104, 104, 105, 105, 106, 106, 106, 106, 106, 106, 107, 107, 107
			♀♀	103, 104, 104, 104, 104, 104, 105, 105, 105, 105, 106, 106, 108, 108, 109
ND			♂♂	106 [a] 109, [b]
		imm.	♂	106
		p_{10} growing	♂	104
eichhorni				
AMNH	Mussau		♂♂	100, 102,[c] 103
			♀♀	100, 101, 102, 102
BM			♀	100
ND			♂♂	103, 103
			♀♀	102, 103
noonaedanae				
AMNH	New Ireland		♂♂	102, 103, 104
			♀♀	101, 104, 106
	New Britain		♂♂	102, 103, 104, 104, 105, 105, 106, 107, 108
			♀♀	102, 103, 103, 104, 104, 105, 106, 106, 106, 107, 109
		imm.	♂♂	96, 97, 99, 100, 100, 102, 102, 105
		imm.	♀♀	95, 96, 97, 98, 98, 98, 100, 100, 100, 102
		p_{10} growing	♂♂	102, 106
		p_{10} growing	♀♀	98, 99, 100, 100, 100, 104
ND	Kalili, New Ireland		♂	104
			♀	106
		unsexed		102[d]
		imm.	♀	103
		p_{10} growing	♀	108
	Lemkamin (900 m), New Ireland		♂♂	102, 103, 104, 105, 105[e], 111
			♀♀	107, 108, 110
		p_{10} growing	♂	102
		imm.	♂♂	98, 102, 102, 102
		p_{10} growing	♀	103
		imm.	♀	103
	Yalom (1,000 m), New Britain		♂	106
			♀	102
	Cape Hoskins, New Britain			
		p_{10} growing	♂	96

[a] Type of *delichon*. [b] In heavy moult, also primaries; not measured. [c] Type of *eichhorni*.
[d] Outer primaries very worn, inner ones in moult. [e] Type of *noonaedanae*.

Remarks: In many ways this subspecies is similar to *ceramensis* from the southern Moluccas, but can be recognized by the much broader and purer white band across the rump, the usually somewhat paler under-parts, the concealed white rami on neck-feathers, and by the tarsal feathering, which is present in *ceramensis*, but missing in *delichon*.

Albert Meek collected one specimen of *delichon* in 1914 and for many years this was the only one known from the Admiralty Islands. Rothschild and Hartert (1914, p. 293) called this specimen *Collocalia leucopygia*, stating that it agreed with specimens from Buru (= *ceramensis*), which again appeared to be quite like the typical *leucopygia* from New Caledonia. The differences between *delichon* and *ceramensi* have been stressed above, and as to the differences between *delichon* and *leucopygia* I refer to this latter form (p. 80, below).

Collocalia spodiopygia eichhorni Hartert

Collocalia francica eichhorni Hartert, 1924, Novit. Zool., vol. 31, p. 269 – St. Matthias Island, Bismarck Islands. (Type in AMNH examined.)

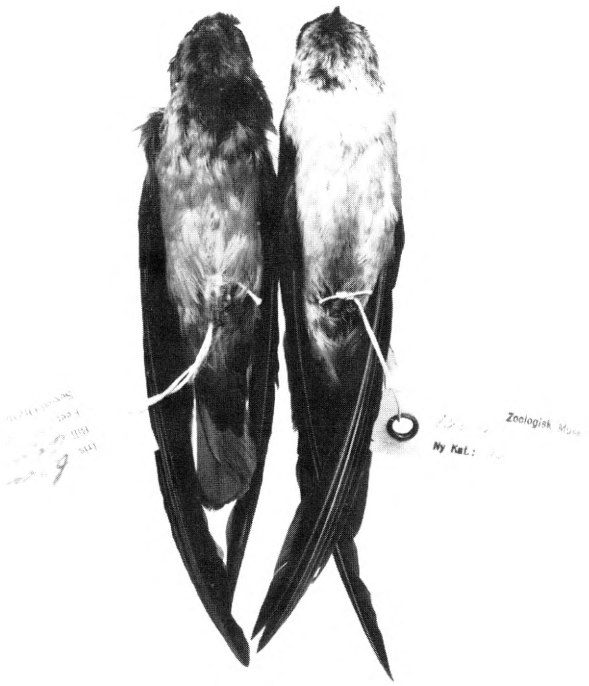
Similar to *delichon*, but upper-parts black-brown without gloss, paler than in *delichon*, the white band across rump narrower (7–14 mm broad) and slightly suffused with greyish, presence of white rami on feathers of neck almost as in *delichon*, under-parts greyish-brown, distinctly darker than in *delichon*. Tarsus unfeathered.

Measurements: Five adult ♂♂ have a wing-length of 100–103 (average 102.2) mm, seven adult ♀♀ 100–103 (average 101.4) mm (Table 14). The wing-length is on an average 3–4 mm shorter than in *delichon*.

Range: Mussau Island in the St. Matthias Group, in the Bismarck Archipelago.

Noona Dan Material: (1) ♂ ad., Schadel Bay (by river), Mussau Island, 15. January 1962, collector's no. 671. Iris black, bill and legs black.

(2) ♀ ad., Schadel Bay (by river), Mussau Island, 15. January 1962, collector's no. 672. Iris black, bill and legs black.



a *b*

Fig. 22. *a Collocalia spodiopygia epiensis*
Epi, New Hebrides unsexed
b Collocalia spodiopygia delichon
Manus, Admiralty Islands ♂
Notice difference between a dark and a very light subspecies, *epiensis* (specimen *a*) with dark brownish throat and sooty brownish breast and abdomen, and *delichon* (specimen *b*) with whitish under-parts with faintly darker shaft-streaks. (Specimen *a* in AMNH, *b* in ND).

(3) ♀ ad., Schadel Bay (by river), Mussau Island, 21. January 1962, collector's no. 741.

(4) ♂ ad., Mussau Island, 4. June 1962, collector's no. 2,195. Body- and wing-moult. Testes 2 × 2 mm. Weight 6 g.

Remarks: This form differs primarily from *delichon* by its distinctly darker under-side, its slightly narrower rump bar, blurred with greyish, its paler upper-parts and its smaller proportions.

When Hartert (1924b, p. 269) described *eichhorni* he compared it with the Polynesian and Australian forms of *spodiopygia,* stating correctly that it had "more pronounced, fairly wide, brownish white band across the rump and somewhat short wings." It is peculiar that he did not compare *eichhorni* with his specimen from neighbouring Manus, which ten years ago he included in *leucopygia* and compared it with *ceramensis,* although both the Manus form (*delichon*) and *ceramensis* morphologically are much nearer to *eichhorni* than any other form of *spodiopygia.*

Collocalia spodiopygia noonaedanae, new subspecies

Type: ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 20. April 1962, coll Finn Salomonsen on the Noona Dan Expedition, collector's no. 1,517.

Easily distinguishable from *delichon* and *eichhorni* by having the pale band across rump grey, darker than in these two forms and narrower (4–7 mm) (Fig. 21), upper-parts deep black, even slightly darker than in *delichon;* white rami on feathers of neck almost as in *delichon* but in some specimens missing, under-parts greyish-brown as in *eichhorni,* but throat very different, being distinctly paler, greyish-white, contrasting with the darker breast and abdomen; also supraloral spot whitish-grey, very distinct. Tarsus unfeathered.

Measurements: The wing-lengths of specimens from New Britain and the lowland of New Ireland are in fourteen adult ♂♂ 102–108 (average 104.5) mm, sixteen adult ♀♀ 101–109 (104.8) mm, while specimens from Lemkamin (900 m altitude) in the mountains of New Ireland are slightly larger: Six adult ♂♂ 102–111 (average 105.0) mm, three adult ♀♀ 107–110 (average 108.3) mm (Table 14).

Range: New Ireland and New Britain, unknown from all other islands in the Bismarch Archipelago.

Noona Dan Material: (1) ♀ ad., Kalili Plantation, New Ireland, 28. April 1962, collector's no. 1,579. Ovary granulated, eggs at most 1 × 1 mm.

(2) ♀ imm., Kalili Plantation, New Ireland, 1. May 1962, collector's no. 1,638. Some body-moult. Ovary finely granulated, eggs less than 1 × 1 mm. Weight 5 g.

(3) ♀ ad., 10 miles south of Kalili, New Ireland, 30. April 1962, collector's no 1,612. Body- and wing-moult, p_{10} growing. Weight 7.5 g.

(4) ♂ ad., 10 miles south of Kalili, New Ireland, 30. April 1962, collector's no. 1,613. Body- and wing-moult, inner primaries new or in growth, outer ones old and very worn. Testes minute, about 0.5 × 0.5 mm. Weight 7 g.

(5) Unsexed, 10 miles south of Kalili, New Ireland, 30. April 1962, collector's no. 1,614. Body- and wing-moult, inner primaries new or in moult, outer ones old and very worn. Weight 6.5 g.

(6) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 20. April 1962, collector's no. 1,517. Testes 2 × 2 mm. (Type of *C.s.noonaedanae.*)

(7) ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 20. April 1962, collector's no. 1,518.

(8) ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 11. April 1962, collector's no. 1,409. Ovary granulated, eggs about 1 × 1 mm.

(9) ♂ imm., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 19. April 1962, collector's no. 1,506. Testes 1 × 1 mm.

(10) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 10. April 1962, collector's no. 1,384. Testes 2 × 2 mm.

(11) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 10. April 1962, collector's no. 1,383. Iris black, bill black, legs dark brown. Testes 1 × 1 mm.

(12) ♀ imm., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 20. April 1962, collector's no. 1,516.

(13) ♂ imm., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 10. April 1962, collector's no. 1,382.

(14) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 11. April 1962, collector's no. 1,410. Testes 2 × 2 mm.

(15) ♂ imm., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 18. April 1962, collector's no. 1,493. Outer primary in growth. Testes 1 × 1 mm.

(16) ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 20. April 1962, collector's no. 1,519. Ovary granulated, eggs about 1 × 1 mm.

(17) ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 10. April 1962, collector's no. 1,381. Iris black, bill black, legs dark brown. Outermost primary in growth, Ovary minute.

(18) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 18. April 1962, collector's no. 1,491. Testes 2 × 2 mm.

(19) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 18. April 1962, collector's no. 1,492. Testes 2 × 2 mm.

(20) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New

Ireland, 18. April 1962, collector's no. 1,490. Wing-moult, p_{10} growing. Testes 3 × 2 mm.

(21) ♂ ad., Yalom (1,000 m altitude), Gazelle Peninsula, New Britain, 18. May 1962, collector's no. 2,063. Iris brown, bill black, legs black brown.

(22) ♀ ad., Yalom (1,000 m altitude), Gazelle Peninsula, New Britain, 23. May 1962, collector's no. 2,099.

(23) ♂ ad., Valoka, Cape Hoskins area, New Britain, 8. July 1962, collector's no. 2,333. Iris brown, bill black, legs brown. Wing-moult, p_{10} growing.

Remarks: It appears by a comparison of the three Bismarck Islands forms that *eichhorni* is almost intermediate between *delichon* and *noonaedanae*, having the rump-band of about the same size and form as the former, although distinctly tending towards that of *noonaedanae*, and having the under-parts saturated as in *noonaedanae*. The slightly lighter brownish upper-parts and the small proportions are special characters of *eichhorni*, and the whitish, contrasting throat colour is found only in *noonaedanae*. It is noteworthy, however, that the birds of New Britain are not quite similar to those of the type-locality (New Ireland), but tend towards *delichon*. They have paler under-parts and more whitish rump-band, but are closest to *noonaedanae* and should be incorporated in that form.

The measurements, given above, demonstrate the interesting phenomenon that the birds of the mountains of New Ireland on an average are bigger than the lowland birds. Although the material is rather small, the differences appear to be statistically significant. It tends to show that the population of the New Ireland mountains on a modest scale has developed the adaptations to the environmental factors of the higher altitudes which are fully developed in the high mountain form *excelsa* in New Guinea.

Although the three Bismarck Islands subspecies were previously united under the name *eichhorni* there are indications in the literature that students have been aware of the differences between the populations. It was already mentioned (p. 73) that Hartert (1914, p. 293) confounded *delichon* with the remote *leucopygia*. The same author stated that a single specimen collected in New Britain was similar to *eichhorni*, but that "the back is slightly darker, less brownish, while the bar across the rump is more brownish" (Hartert 1926, p. 138), which is quite correct and agrees with the description of *noonaedanae* given above. In another paper Hartert (1925, p. 128) mentioned three specimens from New Ireland and said that "the rumps are not quite so white as in the St. Matthias specimens [= *eichhorni*], but more brownish. The underside of one is as brownish as that of the type of *reichenowi* (from Guadalcanar), the other two have it as light as *eichhorni*." The latter description fits the specimens of *noonaedanae*. Owing to lack of material Hartert called the birds from New Ireland "*Collocalia francica reichenowi* or *eichhorni*."

It is peculiar that *spodiopygia* is found only on the two large islands in the Bismarck Islands and is missing on all the smaller islands. On The Noona Dan Expedition we sought for it in vain both on Dyaul Island and New Hanover. It appears that it is neither found on any of the Hibernian Islands. On the other hand, it was very common on New Ireland. At Kalili in the lowland it was extremely numerous and many times flocks of about a hundred individuals were encountered. At the hamlet Lemkamin, at 900 m altitude on the Lelet Plateau in the central mountains of New Ireland it was commonly hunting over the open plateau, cultivated fields and gardens, but also over the treetops in the secondary growth and along the forest edges. *C.esculenta* was also common at Lemkamin, but not as numerous as *spodiopygia*.

Collocalia spodiopygia reichenowi Stresemann

Collocalia francica reichenowi Stresemann, 1912, Novit. Zool., vol. 19, p. 350 – Guadalcanal Island, Solomon Islands. (Type in AMNH examined.)

Similar to *noonaedanae*, but under-parts distinctly

darker, more brownish, and the throat and fore-breast not lighter, but the entire under-parts uniform in coloration. Upper-parts as in *noonaedanae*, but rump-band darker, uniform sooty grey and on an average narrower. Tarsus feathering as in the Bismarck Islands forms, being unfeathered or thinly feathered on uppermost (proximal) part.

Measurements: Eight adult specimens have a wing-length of 102–108 (average 104.4) mm (Table 15), *i.e.* quite as in *noonaedanae*.

Range: The southern and eastern islands in the Solomon Islands, known from Bougainville, Kolombangara, Guadalcanal, San Christobal (with Ugi Island) and Rennell Island.

Remarks: The species must be a rare bird in the Solomon Islands. Only about a dozen skins have been collected and it is recorded from a few islands only. The total number of skins from the islands includes one old skin from Guadalcanal (the type), another from the same island (in BM), four more specimens from Guadalcanal and one from Kolombangara collected by The Whitney South Sea Expedition, two specimens from San Christobal collected by Galbraith and two (immature) specimens from Rennell collected by Bradley. The majority of these specimens have been examined by me. When Mayr (1945, p. 239) wrote his review of the Solomon Islands birds *spodiopygia* was known only from Guadalcanal and Kolombangara, in spite of an intensive collecting activity on most islands in the Solomons. In more recent years some collecting and also some field-work were done on various islands of the archipelago (cf. Davidson 1934, p. 189, Kinghorn 1937, p. 177, Cain and Galbraith 1956, p. 133, Bradley and Wolff 1956, p. 102, Galbraith and Galbraith 1962, p. 39, Filewood 1972, p. 32, Wolff 1973, p. 16, Diamond 1975, p. 18), but it was only possible to extend the distribution of *spodiopygia* to Bougainville, San Christobal and Rennell Island apart from the localities previously known. The absence of *spodiopygia* on so many islands, in the Bismarck Islands as well as in the Solomon Islands may be due to competition with *Collocalia esculenta*, which is common on virtually all the islands.

When Stresemann (1912, p. 350) described *reichenowi*, he compared it only with *assimilis* (Fiji Islands), from which it was said to differ by being smaller and having darker upper-parts; both statements are correct. Stresemann had a very small material and disposed only of the type from Guadalcanal and another specimen (in BM) from the same island. He added an old specimen from New Ireland (now in AMNH, examined by me) and one from New Britain. On basis of this insufficient series he claimed the distribution of *reichenowi* to be the Solomon and the Bismarck Islands and even added, with a question mark, S. E. New Guinea. The Solomon Islands form has never been compared with the neighbouring Bismarck Islands form, apart from the short remark by Hartert, quoted above (p. 75) that the under-parts of *reichenowi* are brownish, while those of *eichhorni* are lighter.

Collocalia spodiopygia desolata, new subspecies

Type: ♂ ad., Treasurers Island, Duff Islands, 5. October 1926, coll. R. H. Beck on The Whitney South Sea Expedition, in AMNH, no. 215731.

The upper-parts have the same colour as in *reichenowi* and *noonaedanae*, the band across the rump is lighter than in *reichenowi*, of the same colour as in *noonaedanae;* no white rami on feathers of neck. The under-parts are still darker than in *reichenowi*, more sooty brownish, and differ distinctly from all the previously described forms of *spodiopygia* by having the throat and sides of face darker brownish, contrasting with the remaining under-parts (Fig. 23). No light supraloral spot developed, only the concealed bases of the feathers whitish. Tarsus completely unfeathered. The body proportions are smaller than in *reichenowi* and *noonaedanae* and even smaller than in any other population of *spodiopygia*.

Measurements: Ten specimens have a wing-

TABLE 15
Wing-length (in Millimeters) of the Material of *Collocalia spodiopygia* Examined from the Solomon Islands and Southern Melanesia.

reichenowi				
AMNH	Guadalcanal		♀♀	103,[a] 104
		unsexed		102, 104, 107
		p_{10} growing	♂	100
	Kolombangara		♂	108
BM	San Christobal		♂	105.5
	Ugi		♂	102
desolata				
AMNH	Treasurers Island, Duff Islands		♂♂	100, 102,[b] 102
			♀♀	100, 101
	Fenualoa, Swallow Islands		♂♂	99, 102
	Lomlom, Swallow Islands		♀	96
	Ndeni (Santa Cruz), Santa Cruz Islands		♀♀	101, 101, 102
		imm.	♀	97
epiensis				
AMNH	Bligh Island, Banks Islands		♂♂	100, 104
	Epi Island, New Hebrides		♂	104
			♀	101[c]
		unsexed		101
ingens				
AMNH	Eromanga, New Hebrides		♂♂	108, 116[d]
		unsexed		109
		p_{10} growing	♂	106
		imm.	♀	95
	Aneityum, New Hebrides		♀	110
leucopygia				
AMNH	Loyalty Islands		♂♂	109, 109, 110, 112, 113, 113, 113, 114, 115
			♀♀	111, 111, 111, 112, 115, 118
		imm.	♂	104
	New Caledonia		♂♂	104, 106, 108, 109, 110, 111
			♀	108
		unsexed		107[e]

[a] Type of *reichenowi*. [b] Type of *desolata*. [c] Type of *epiensis*. [d] Type of *ingens*. [e] Type of *agnota*.

Fig. 23. *a Collocalia spodiopygia desolata* Duff Islands ♀
b –"– –"– *epiensis* Epi, New Hebrides unsexed
c –"– –"– *ingens* Eromanga, New Hebrides ♂
d –"– –"– *leucopygia* Loyalty Islands ♂
The four South Melanesian subspecies of *spodiopygia* with dark, contrasting throat, *a–b* the two small, dark subspecies, *c–d* the two large, pale subspecies.
(ALL specimens in AMNH).

length of 99–102 (average 101.0) mm (Table 15).

Range: Duff Islands, Swallow Islands and Santa Cruz Islands.

Collocalia spodiopygia epiensis, new subspecies
Type: ♀ ad., Epi Island, New Hebrides, 2. August 1926, coll. R. H. Beck on The Whitney South Sea Expedition, in AMNH, no. 212353.

Similar to *desolata,* but slightly darker on the under-parts, also throat darker brown; band across rump on an average lighter. Differs from all the previously mentioned Melanesian forms of *spodiopygia* by having the tarsus densely feathered in its entire length. The body proportions are small, as in *desolata.* The dark under-side and the small proportions appear from Fig. 23 and 24.

Measurements: Five specimens have a wing-length of 100–104 (average 102.0) mm (Table 15).

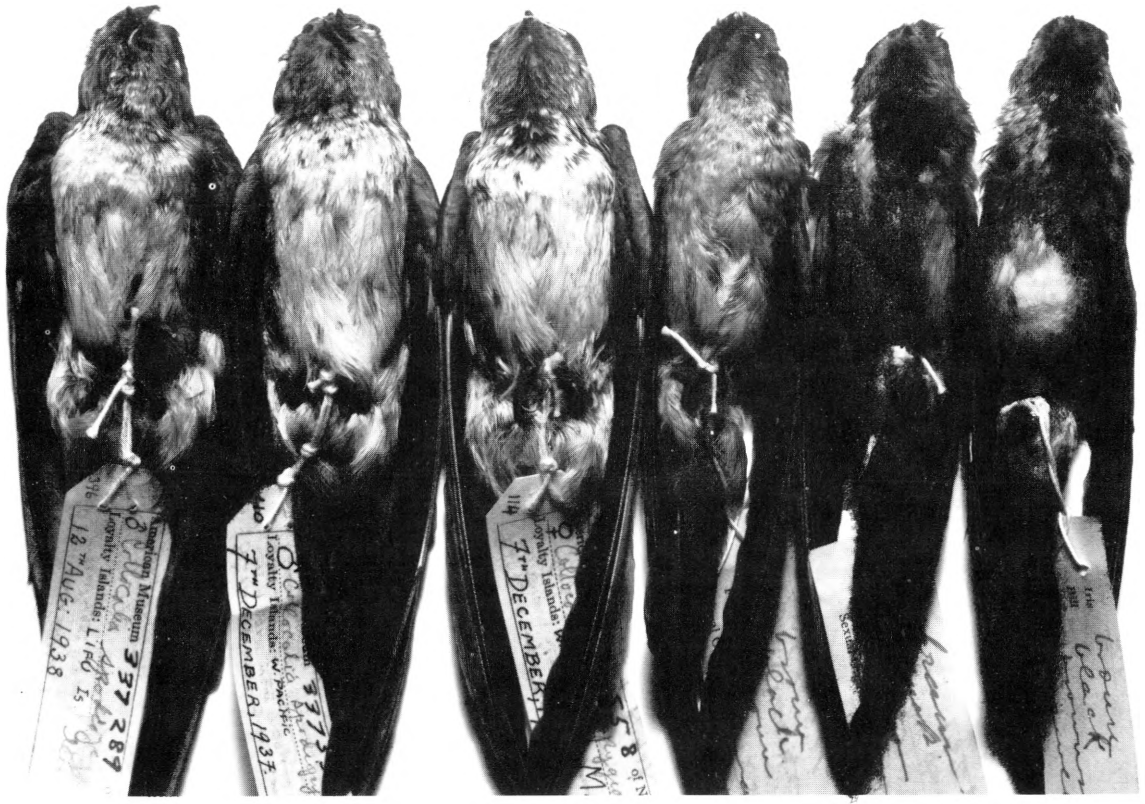


Fig. 24. *a Collocalia spodiopygia leucopygia* Loyalty Islands ♂
b –"– –"– –"– –"– ♂
c –"– –"– –"– –"– ♀
d –"– –"– *epiensis* Epi, New Hebrides ♀
e –"– –"– –"– –"– unsexed
f –"– –"– –"– –"– ♂

Notice difference between the large, light *leucopygia (a–c)* and the small, dark *epiensis (d–f).* (All specimens in AMNH).

Range: Banks Islands and northern part of the New Hebrides, south to Epi Island, but probably also nearby Efate Island.

Remarks: The pronounced difference in tarsal feathering between the previous Melanesian forms of *spodiopygia* and the southern forms (*epiensis, ingens* and *leucopygia*) is remarkable and very distinct. It constitutes a major break in the morphological characters of this species. It is still more remarkable that this break takes place between two subspecies (*desolata* and *epiensis*) which in other respects are very similar; see for instance Fig. 23. Geographical differences in tarsal feathering are known in other species of swiftlets in Asia (*e.g.* in *brevirostris;* cf. Stresemann 1926b, p. 350). The most striking example is probably *papuensis* and *nuditarsus* in New Guinea, which were hitherto considered to be subspecies of the same species, but now are regarded as two independent species (cf. p. 104).

No doubt the population of nearby Torres Islands belongs to this subspecies, but no specimens have been collected in this area. The specimens from Banks Islands (Bligh Island) are quite similar to those from the type locality, but have a tendency towards the coloration of *desolata*. However, the tarsal feathering is as dense as in the Epi specimens.

Collocalia spodiopygia ingens, new subspecies
Type: ♂ ad., Eromanga Island, New Hebrides, 27. March 1937, coll. L. Macmillan, in AMNH, no. 336509.

Upper-parts very deep black and with a slight gloss, no white rami on feathers of neck, rump-band pure white and shining, similar in colour to that in *delichon,* but not so broad (9–13 mm broad), under-parts greyish, distinctly paler than in *epiensis* and *desolata,* being intermediate in colour between *epiensis* and *leucopygia* (Fig. 23). The throat and sides of face brown, strongly contrasting with the colour of breast and abdomen. No supraloral spot developed, only the concealed base of the feathers whitish. Tarsus thickly feathered in its entire length. Proportions very much bigger than in *epiensis* and *desolata.*

Measurements: Wing-length of four specimens 108–116 (average 110.8) mm (Table 15).

Range: The southern islands in the New Hebrides, from Eromanga to Aneityum.

Remarks: The size increase from *desolata* and *epiensis* to *ingens* is very large, no less than 8–10 mm on an average in wing-length. It is noteworthy that the break between the small and dark form (*epiensis*) and the big and light form (*ingens*) occurs where the water gap between two neighbouring islands (Efate and Eromanga) is greater than elsewhere between islands in the New Hebrides and, therefore, must be considered the most difficult barrier to cross. The subspecific change at this place corresponds with the situation existing in several other polytypic New Hebridean species. As examples can be mentioned *Myiagra caledonica* (*marinae-melanura;* cf. Salomonsen 1934, p. 437), *Myzomela cardinalis (tenuis-cardinalis), Lalage maculosa* (*modesta-ultima*), *Lalage leucopyga* (*albiloris-simillima*); cf. Mayr 1945, p. 189.

The small material collected of the New Hebrides subspecies of *spodiopygia* tends to show that this species of swiftlet must be a rather rare bird there. This is borne out by the fact that Lord Medway, the expert on *Collocalia,* did not at all observe *spodiopygia* during his stay in the New Hebrides (Medway and Marshall 1975, p. 458).

Collocalia spodiopygia leucopygia Wallace
Collocalia leucopygia Wallace, 1863 (1864), Proc. Zool. Soc. London, p. 384 – New Caledonia.
Collocalia agnota Oberholser, 1906, Proc. Acad. Nat. Sci. Philadelphia, vol. 58, p. 183 – New Caledonia. (Type in AMNH examined.)

Upper-parts and band across rump exactly as in *ingens,* but under-parts much lighter than in all preceding forms, virtually pure white, throat and sides of face brownish, just as in *ingens, epiensis* and *desolata,* strongly contrasting with the whitish breast (Fig. 23). Just as in the New Hebridean forms there is no supraloral spot, but the concealed base of the feathers are lighter. Tarsus thickly feathered in its entire length. Proportions large as in *ingens.* The striking differences between the small, dark *epiensis* and the large, pale *leucopygia* appear from Fig. 24.

Measurements: Nine adult ♂♂ from the Loyalty Islands have a wing-length of 109–115 (average 112.9) mm, six adult ♀♀ 111–118 (average 113.0) mm; six adult ♂♂ from New Caledonia 104–111 (average 108.0) mm, one adult ♀ 108 mm and one unsexed specimen 107 mm (Table 15).

Range: The Loyalty Islands, known both from Uvea, Lifu and Maré, and New Caledonia.

Remarks: The Loyalty Islands population has bigger proportions than *ingens,* while the New Caledonia birds are smaller than *ingens.* The difference in size between the two populations in my opinion is too small to base a subspecific distinc-

TABLE 16
Wing-length (in Millimeters) of the Material of *Collocalia spodiopygia* Examined from Polynesia.

assimilis			
AMNH	Fiji Islands	unsexed	111, 112, 112, 113, 113, 114, 114, 117, 119
townsendi			
AMNH	Tonga Islands	unsexed	112, 112, 114, 114, 114, 114, 115, 115, 116, 116, 117, 118
spodiopygia			
AMNH	Samoa Islands	unsexed	113, 114, 115, 118, 118, 118, 119, 120, 123, 124

tion on this character, although at least two thirds of the populations can be separated by size.

According to Bruce (1978, p. 301) both *C.esculenta* and *C.spodiopygia* are common species on the Loyalty Islands, and it appears that *spodiopygia* is more numerous than *esculenta*.

Oberholser's *agnota* is a needless synonym. His type and only specimen, in AMNH, examined by me, is completely identical with typical *leucopygia*. Stresemann (1914, p. 114) has taken the following measurements of wing-length of seven unsexed specimens from New Caledonia, all in BM: 106–111 (average 107.9) mm, which exactly agree with those above, taken by me.

POLYNESIAN FORMS

The Polynesian populations are separated from the New Hebridean forms by an enormous expanse of water. On the other hand, they occupy the islands nearest to the New Hebrides and are morphologically so close to the Melanesian forms that I have no hesitation in uniting them in a common species.

Collocalia spodopygia assimilis Stresemann

Collocalia francica assimilis Stresemann, 1912, Novit. Zool., vol. 19, p. 350 – Fiji Islands. (Type in AMNH examined.)

Zoonava francica oberholseri Mathews, 1918, Birds of Australia, vol. 7, p. 253 – Fiji Islands. Preoccupied by *Collocalia esculenta oberholseri* Stresemann, 1912.

Upper-parts dull black, without the gloss found in *leucopygia* and *ingens*, not quite so dark as in *noonaedanae* and *reichenowi*, rump band more greyish white, not pure white as in *leucopygia* and *ingens*. Under-parts dull sooty greyish, about the same shade as in *reichenowi*, but without the faint shaft-streaks found in all Melanesian forms, therefore looking more uniform greyish, resembling *terrae-reginae*, which has also dark under-parts without shaft-streaks. Throat brownish, darker than breast and abdomen. Tarsus unfeathered.

Measurements: Nine specimens have a wing-length of 111–119 (average 113.9) mm (Table 16), which is still somewhat greater than that of *ingens* and *leucopygia*. Stresemann (1912, p. 350) in his original description gave the wing-length of twenty-one specimens as 107–117 (average 111.0) mm, which is slightly smaller than the measurements taken by me and is of the same magnitude as in *ingens*.

Range: Fiji Islands.

Collocalia spodiopygia townsendi Oberholser

Collocalia francica townsendi Oberholser, 1906, Proc. Acad. Nat. Sci. Philadelphia, vol. 58, p. 197 – Eua Island, Tonga Islands.

The under-parts are distinctly darker sooty grey than in *assimilis*, and the rump band darker

greyish, in all other particulars similar to *assimilis*. Tarsus unfeathered.

Measurements: The wing-length of twelve specimens is 112–118 (average 114.7) mm, which is about the same as in *assimilis* (Table 16).

Range: Tonga Islands.

Collocalia spodiopygia spodiopygia (Peale)
Macropteryx spodiopygius Peale, 1848, U. S. Explor. Expedition, vol. 8, p. 176 – Upolu and Tutuila, Samoa Islands.

Exactly like *townsendi* in plumage coloration, only differing by its slightly larger proportions.

Measurements: The wing-length of ten specimens is 113–124 (average 118.2) mm (Table 16).

Range: Samoa Islands.

Remarks: The distinction between the two subspecies *townsendi* and nominate *spodiopygia* is upheld by me mostly for traditional reasons. The form *townsendi* has been recognized since Stresemann (1912, p. 350) wrote about these birds, but no one later compared the two subspecies. It appears that hardly 50% of the birds can be distinguished by their size, this being less than the Loyalty Islands – New Caledonia populations (p. 80). In my opinion the name *townsendi* could very well be rejected as a synonym to nominate *spodiopygia*.

CONCLUSION

The species Collocalia spodiopygia is much more plastic than the other eastern species within the genus *Collocalia*, in so far as many more morphological characters are involved in the geographical variation. The reason for this I cannot say. It is impossible to give an explanation for the fact that for instance some populations of *spodiopygia* on small islands in southern Melanesia have an unfeathered tarsus, while others have densely feathered tarsus. In most cases it does not appear that the variation directly reflects a correlation with environmental factors. This, naturally, is the usual situation in most tropical island birds, contrary to those inhabiting non-tropical areas which in their geographical variation usually follow certain ecogeographical rules. In my opinion, however, the surprising variation in many tropical island birds might be connected with the situation when a founder population colonizes an island. Such small populations have a very depauperate gene pool. New mutations and gene combinations may therefore, easily become fixed during the insularization, without these changes having any adaptive value. The phenotypic characters might also be incidental by-products of pleiotropic actions of genes selected for other contributions to the viability of the phenotype (cf. also Mayr 1963, p. 311).

The most important characters involved in the geographical variation of *Collocalia spodiopygia* are:

(1) Body proportions. The great variation in wing-length is illustrated in the diagram Fig. 25, in which ♂♂ and ♀♀ are combined, and their mutual average value has been calculated. Most surprising is the sudden difference in size between the small *desolata* and *epiensis* and the very large *ingens* and *leucopygia* and the Polynesian forms. The only case of adaptation to environmental factors is the large proportions of *excelsa*, which exceeds the size of all other populations.

(2) Tail-length. It does not appear to differ particularly much geographically, apart from *terrae-reginae*, which has a longer tail than any other population.

(3) The pale bar across the rump varies very much, from the broad and pure white band in *delichon* (Fig. 21), the somewhat narrower one in *ceramensis* (Fig. 20), *ingens* and *leucopygia*, the greyish and narrow band in *noonaedanae* (Fig. 21) and *reichenowi*, the totally missing band in *hirundinacea* and *baru*, and the variation in band coloration from dark greyish to blackish (*i.e.* band missing) in *infuscata* (Fig. 20) and probably *terrae-reginae*.

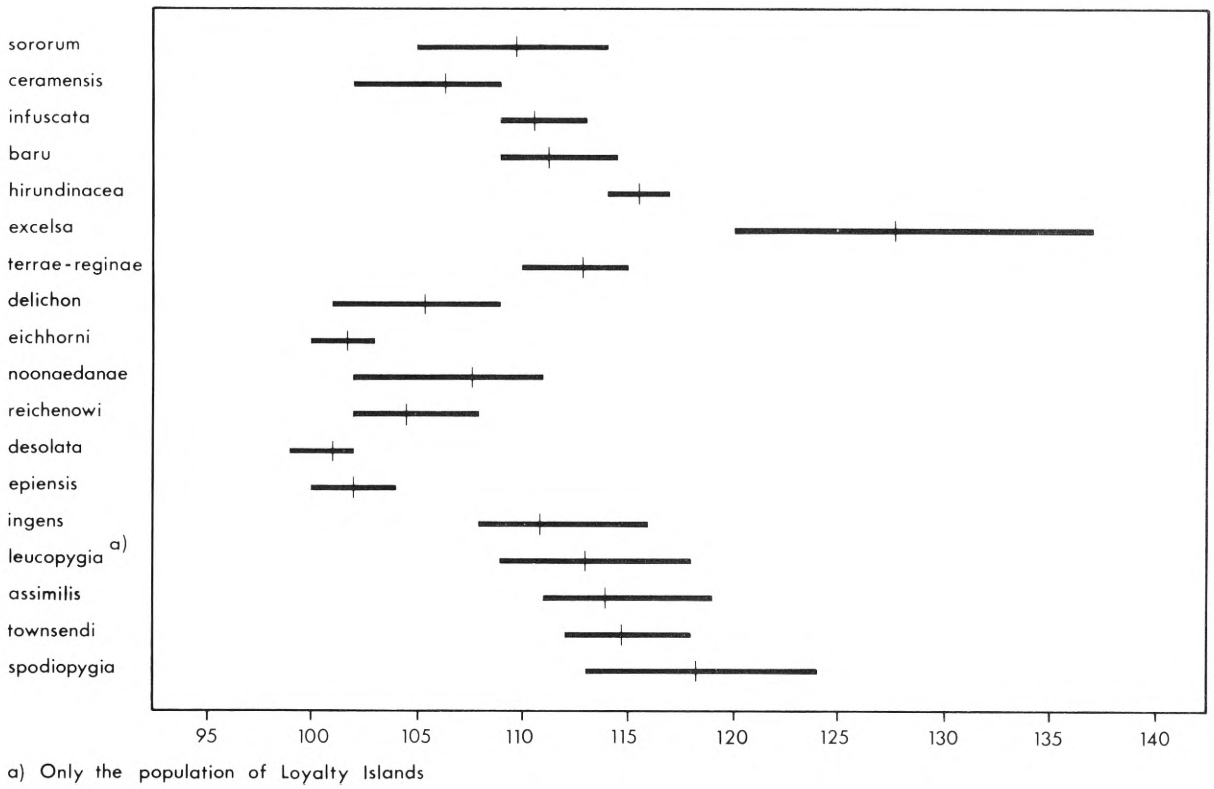


Fig. 25. The variation in wing-length (in millimeters) of all subspecies of *Collocalia spodiopygia*, ♂♂ and ♀♀ combined. The average values are shown by vertical marks.

(4) The coloration of upper-parts, varying from blackish with faint iridescence, which is the usual colour, to blackish-brown without gloss in *eichhorni* and the Polynesian forms and to brownish in *terrae-reginae*.

(5) The presence of white rami on the neck feathers found in all the Bismarck Islands subspecies (*delichon*, *noonaedanae* and *eichhorni*), but missing in the populations further east and developed only in a slight degree (or totally missing) in all the Indonesian and Papuan populations.

(6) The coloration of the underside. This is almost pure white in *leucopygia* (Fig. 23 and 24), pale greyish white with a silvery tinge in *delichon* (Fig. 22), almost as pale in *sororum* and *ceramensis*, darker greyish or brownish of various shades in the remaining forms with the darkest extreme in *terrae-reginae*, *desolata* and *epiensis* (Fig. 23 and 24).

(7) Dark shaft-streaks on the underside, present and distinct in all Indonesian subspecies, inconspicuous in *hirundinacea*, almost indistinguishable in the Melanesian forms, quite missing in *terrae-reginae* and the Polynesian forms.

(8) Pale supraloral spot, found in all forms of *spodiopygia* except those of southern Melanesia, in which only the concealed bases of the supraloral feathers are paler than the apical parts.

(9) The colour of the throat in most forms is similar to that of the breast and abdomen, but in *delichon* and particularly in *noonaedanae* (but not in *eichhorni*) the throat is distinctly paler than the breast, of a greyish white colour. Contrary to the

conditions in these forms the throat and sides of face are much darker than the breast and abdomen and showing a marked contrast to the paler coloration of these parts in the subspecies of southern Melanesia (Fig. 23) and Polynesia.

(10)The feathering of the tarsus shows a peculiar variation. In the Indonesian, Papuan and Australian forms the tarsus is feathered, sometimes very strongly, sometimes more sparsely, in the Melanesian forms as well as the Polynesian ones the tarsus is unfeathered, with the exception of the forms *epiensis, ingens* and *leucopygia,* which all have the tarsus densely feathered in its entire length.

Collocalia vanikorensis (Quoy and Gaimard) 1830

Mayr (1937, p. 4–11) has made a thorough study of this species, which is distributed from Celebes and the Moluccan area through New Guinea to Melanesia eastwards to the New Hebrides. Contrary to the geographical variation in *spodiopygia* that in *vanikorensis* is slight, and it is not easy to characterize subspecies. Mayr recognizes only a single subspecies, nominate *vanikorensis,* in the area from Southern Melanesia to the Solomon Islands. He refrains from naming the birds of the main chain of the Bismarck Islands, calling them *C.vanikorensis* subspecies, although he had a large series of birds at his disposal. On the other hand he described four new subspecies from the New Guinea region and the outer island groups of the Bismarck Archipelago. I examined the large series in the AMNH, already studied by Mayr, and to this I could add the recently collected skins of the Noona Dan Expedition and some from Rennell Island, collected in 1965 by Dr. Torben Wolff, altogether a total of 38 specimens.

In the study of this species it is necessary to exercise the utmost care at the comparison of different populations, because during the seasons wear is pronounced, and because foxing due to age is very striking. It is easy to group the birds in samples collected before the year 1900, those collected by Meek and Eichhorn about 1916–1925, those from the Whitney South Sea Expedition, collected by W. F. Coultas, about 1934 and the brandnew Noona Dan specimens. These considerable differences combined with the seasonal changes and the moult and age differences make a comparison of populations very difficult.

Owing to the nondescript plumage of *vanikorensis* this species looks very similar to a number of other species, and many attempts have been made to extend the distribution of *vanikorensis* by combining it with other similar species in a common unit. In recent years similarities also in nest-building have been used as arguments in the discussion.

The Micronesian swiftlets have by various students been associated with *vanikorensis* and it was postulated that they were conspecific with this species. These swiftlets are usually considered to belong to two species. The Caroline Islands are inhabited by *inquieta,* an endemic species with the subspecies *rukensis, ponapensis* and nominate *inquieta,* and the Palau and Mariana Islands by the widespread *inexpectata,* with the two subspecies *pelewensis* and *bartschi* (Baker 1951, p. 221–226). The systematic arrangement of the latter forms, which are included under the polytypic species *inexpectata,* is not correct, however, because *inexpectata* is a composite complex. Most of the forms of *inexpectata* are now regarded as subspecies of *fuciphage,* others belong to *salangana,* while those of the Palau – Mariana Islands are stated by Medway (1966, p. 167) to belong to *vanikorensis.*

The many different name combinations applied to the five kinds of swiftlets inhabiting Micronesia are evidence of the profound confusion among previous workers concerning the correct systematic position of these birds. They have been referred to the species *fuciphaga, francica, germani, inexpectata, unicolor and vanikorensis,* apart from old synonyms not recognized any longer (cf.

Baker 1951, p. 221–226). In his monograph of the swiftlets Mayr (1937, p. 18) stated that *pelewensis* and *bartschi* belong to *germani* (now called *fuciphaga*), and that the *inquieta* forms are similar to *vanikorensis*, and that a more detailed examination will probably prove that they belong to that species. "At the time being," he comments (p. 11), "it seems advisable to treat *inquieta* as a separate species, particularly in view of the fact that most other widespread genera are represented in the Caroline Islands by endemic species." I agree with this conclusion.

The *pelewensis* and *bartschi* cannot belong to *fuciphaga* (or *germani*) on account of their very different nests, and should in my opinion provisionally be regarded as another endemic species, *C. bartschi*. It is much more probable that this species is an offshoot of Philippine populations, for instance of *C.mearnsi*, which is very close to *vanikorensis*, and by Medway (1966, p. 167) even is incorporated in this species. The distance from the Philippine Islands to Micronesia is much shorter than that from Melanesia. The life-habits of *bartschi* show so many peculiar details, for instance concerning the flight (Marshall 1949, p. 210) that it is questionable whether it is especially closely related to *vanikorensis*. The fact that *pelewensis* has a light rump patch (cf. Pratt *et al.* 1980, p. 124), whereas nominate *bartschi* has a uniform dark dorsal coloration, very much resembles the geographical variation of *spodiopygia*. For this reason the species *bartschi* might as well be referred to *spodiopygia* as to *vanikorensis*. The nest-building of these species appears also to be very similar.

According to Medway (1966, p. 159) the nest of *vanikorensis* is "composed largely of strands of vegetable material bound together with a moderate to sparse application of firm nest-cement." He adds (p. 160) that there are no observations on the ability to echolocate in any member of the species *vanikorensis*. He does not give any description of the nesting localities (open air or dark caves), but a colony was found breeding on Goodenough Island "at the edge of a small stream under an overhanging bank of earth and rock interlaced with tree roots" (Mayr and Van Deusen 1956, p. 6). If this is typical of the species *vanikorensis* it would not be necessary for it to orientate in darkness and to possess the capacity of echolocation. However, in a recent paper Medway showed that *vanikorensis* has echolocation (Medway 1975, p. 154).

Medway could not find records of the nest of the subspecies from the Bismarck Islands (*pallens*) or of a number of other subspecies. He has, however, overlooked the description of a nest from New Britain by Dahl (1899, p. 185), under the name of *C.fuciphaga* (= *vanikorensis*). Dahl maintained that the nest belonged to this species, because it was the only *Collocalia* species observed and collected in the area around the nesting locality. The nest was found in hardened volcanic ash in a cave so low that it was necessary to crawl in order to visit it. The nest consisted of "Spelzenhaarbüscheln von *Pennisetum macrostachyum* Trin., die sehr fest in einander verfilzt und durch Speichel, der allerdings dem Auge nicht erkennbar ist, zusammengeklebt sind. Nur zur Befestigung an das erdige Gestein war soviel Speichel erforderlich, dass man die gelblich durchscheinende Masse deutlich erkennt." This description is very similar to that given of *C. spodiopygia leucopygia*, mentioned above p. 64.

The far eastern Polynesian species, *C. leucophaea*, has been said to be closer to *vanikorensis* than to any other Melanesian species (Holyoak and Thibault 1978, p. 60). I do not believe that this is correct. The species *C.leucophaea* consists of three subspecies, nominate *leucophaea* (Society Islands), *ocista* (Marchesas Islands) and *sawtelli* (Cook Islands). The latter form was recently described as a full species (Holyoak 1974, p. 146), and subsequently the three forms were all regarded as full species by Holyoak and Thibault (1978, p. 64), but belonging to a common superspecies. I see no reason why they should not be considered subspecies of a single species, although there appears to be some differences between them in nest site and structure. Mayr (1937,

p. 3) already showed that *leucophaea* stands quite by itself and is not conspecific with any other species. Apart from the considerable morphological differences between *leucophaea* and other species of *Collocalia,* the distance from the easternmost *vanikorensis* (nominate *vanikorensis* on the New Hebrides) to the westernmost *leucophaea* (*sawtelli* on the Cook Islands) is so enormous, about 3,500 km, that it is not possible to postulate any close relationship between the two species. It is just as possible that *leucophaea* is related to *spodiopygia.*

Medway (1975, p. 155) and Wells (1975, p. 148) simultaneously came to the conclusion that even a species west of Wallace's Line, *C.salangana* of Sumatra, Java and Borneo, was conspecific with *vanikorensis,* having the same nest-building as that species. Medway, however, has overlooked the fact that in a previous paper (1966, p. 162) he had found that the nest of *salangana* in Borneo sometimes is similar to that of *hirundinacea* (cf. also this paper above, p. 64). This particular nest-structure constituted the main reason why he kept *hinrundinacea* as a separate species and did not unite it with *spodiopygia.* It appears that he has no difficulty now in maintaining the conspecificity of *salangana* and *vanikorensis,* in spite of the fact that *vanikorensis* and *spodiopygia* have a very similar nest-structure. In addition, in his 1966 paper Medway emphasized the importance of the dorsal feather colour in *salangana* which differs from that of *fuciphaga* and *vanikorensis* by lacking the white base of the concealed barbs of the neck feathers. However, he has changed his mind in his 1975-paper, stating p. 155 that "it seems unnecessary to separate *salangana* (with *natunae*) from *vanikorensis* solely on the basis of one slight character of plumage." Bearing in mind the whole situation in the genus *Collocalia* in which species living thousands of km apart from each other nevertheless are extremely similar, Medway's point of view appears to be precarious. I draw attention to *C.whiteheadi* of the Philippine mountains, probably a subspecies of the continental Asian *brevirostris,* and *C.nuditarsus* from southern New Guinea, which in spite of the enormous distances between their breeding ranges are almost impossible to distinguish from each other morphologically, but nevertheless should be regarded as separate species.

Wells (1975, p. 148) has collected specimens and nests of *salangana* in Sumatra where previously it was not known with certainty as a breeding bird. He states that the skins are quite similar to *vanikorensis,* having the same size and agreeing in most other features as well. He noticed "the all dark basal barbs of the back feathers", which character, however, is not found in most subspecies neither of *spodiopygia* (with *hirundinacea*) nor *vanikorensis.* According to his description *salangana* from Sumatra could as well be attached to *hirundinacea* as to *vanikorensis.* Wells' measurements of wing-length of his *salangana* corresponds also to *hirundinacea,* being slightly greater than those of nominata *hirundinacea* (or rather *C.spodiopygia hirundinacea*), but smaller than found in *excelsa.*

The only difference between *hirundinacea* and *salangana* concerns the dorsal plumage colour, as mentioned above. The tarsal feathering in *salangana* appears to be present, but scarce, while it is absent in *vanikorensis* and well developed in *hirundinacea.*

Summarizing all the considerations given above it appears inadvisible to extend the distribution of *vanikorensis* further than the limits given in this paper, at least at the present time. I may add that I feel a high admiration for the excellent work done by Medway and Wells, but I cannot follow them in their final conclusion concerning the taxonomic status of *vanikorensis* and its allies. I would like to quote the wise words of Mayr (1937, p. 3) about the natural relationship of the different species within the genus *Collocalia:* "Reviewers of this genus have too frequently forgotten the principle that whenever closely related species break up into numerous subspecies (as *Collocalia*), the genus to which they belong almost always also

breaks into numerous species. The widely distributed genus *Collocalia,* which ranges from the Madagascar region to the Marquesas Islands (practically halfways around the world) is no exception to this rule."

The western forms of *vanikorensis,* including the Indonesian and Papuan subspecies, are well known, primarily due to the excellent review by Mayr (1937, p. 4–11) and shall here only be briefly described. My studies have been concentrated on the Melanesian forms, which are much less known and of which I have copious new material.

All subspecies within *vanikorensis* have the tarsus constantly quite bare, without any feathers, and since this character is uniform and stable it will not be mentioned under the different forms.

The distribution of all the forms of *vanikorensis* is shown in Fig. 26.

WESTERN FORMS

Collocalia vanikorensis aenigma Riley
Collocalia vestita aenigma Riley, 1918, Proc. Biol. Soc. Washington, vol. 31, p. 156 – Parigi, north central Celebes.

Upper-parts, wings and tail dark brown with a faint bluish iridescence, forehead and crown slightly darker, almost blackish, concealed barbs of nape and mantle feathers greyish white on the median parts, but not very pronounced, concealed bases of the supraloral feathers whitish, under-parts greyish brown with inconspicuous darker shaft-streaks, throat and fore-breast distinctly paler, greyish.

Measurements: Sixteen adult ♂♂ have a wing-length of 114–120 (average 116.6) mm, eleven adult ♀♀ 112–121 (average 117.2) mm (Stresemann 1940, p. 396); tail-length 47–52 (average 49.4) mm, furcation of tail 5–9 (average 6.4) mm (Mayr 1937, p. 10).

Range: Central region of Celebes from about 1° S. lat. (Parigi) to 4° S. lat. (Oeroe, Wawo, Lalolei), also the island of Muna (Van Bemmel and Voous 1951, p. 55). The species is unknown in the northern part of Celebes.

Collocalia vanikorensis heinrichi Stresemann
Collocalia francica heinrichi Stresemann, 1932, Ornith. Monatsber., vol. 40, p. 110 – Talassa (Maros), south Celebes. (Type in AMNH examined.)

Differing from *aenigma* only by having more greenish gloss on the upper-parts and being somewhat paler greyish on the under-parts.

Measurements: Five adult specimens have a wing-length of 111–115.5 (average 112.5) mm, being slightly smaller than *aenigma* (Stresemann 1932, p. 111).

Range: Southernmost part of Celebes, known only from Maros and Makasar.

Remarks: Stresemann described this subspecies on the basis of only one specimen from Maros, but included four specimens collected by Wallace at nearby Makasar. He did not, however, have access to these birds when he described *heinrichi,* and it is possible that the differences in coloration between this form and *aenigma* may not hold on a closer examination.

Collocalia vanikorensis moluccarum Stresemann
Collocalia fuciphaga moluccarum
Stresemann, 1914, Verh. Ornith. Ges. Bayern, vol. 12, p. 7 – Banda Island in the Moluccas.

This very ill-defined form is distributed on a number of small islands in the eastern part of Indonesia and appears to be rare in most places. I have not examined specimens of this subspecies, but according to the description given by Stresemann and Paludan (1932, p. 169) and Mayr (1937, p. 9) it must be very similar to the above-mentioned Celebes forms. The upper-parts have a bluish-green gloss, the supraloral spot is said to be large, the under wing-coverts usually have conspicuous pale edges, all other particulars as in *aenigma.*

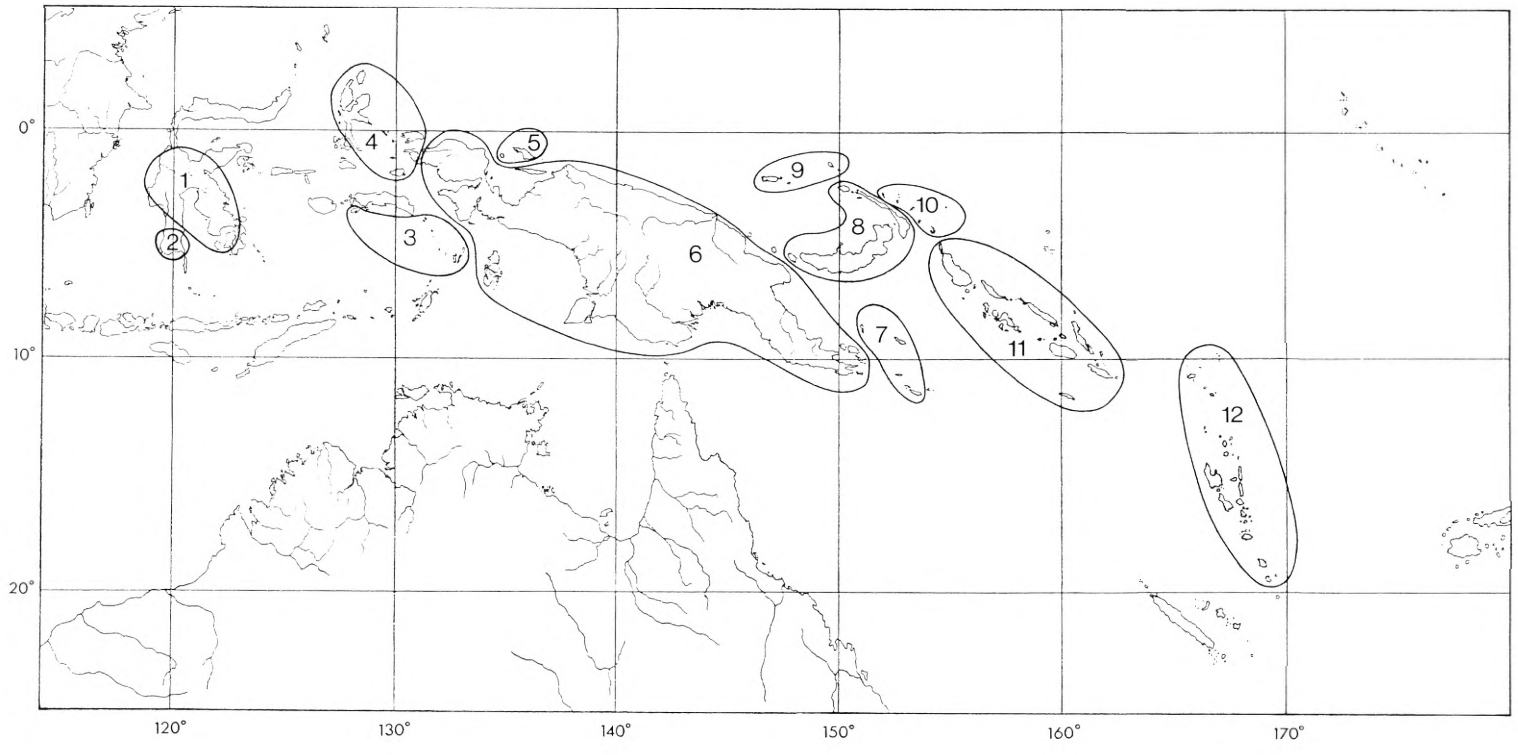


Fig. 26. Distribution of the different forms of *Collocalia vanikorensis*. Western forms: 1. *aenigma*, 2. *heinrichi*, 3. *moluccarum*, 4. *waigeuensis*, 5. *steini*, 6. *granti*, 7. *tagulae*. Melanisian forms: 8. *pallens*, 9. *coultasi*, 10. *lihirensis*, 11. *lugubris*, 12. *vanikorensis*.

Measurements: The wing-length of twenty-three adult specimens is 110–118 (average 114.5) mm (Stresemann and Paludan 1932, p. 169).

Range: Banda Islands in the Moluccas, Ambon, Seram Laut Islands (Gorong, Manowoka), Tajandu Islands (Kur Island and also Taäm Island; cf. Schodde and Mathews 1977, p. 9), and the Kai Islands.

Remarks: This form is also said to occur on Morotai Island, and was recently found to occur even on Halmahera (Ripley 1959 b, p. 4). Both Mayr (1937, p. 10), Peters (1940, p. 225) and Van Bemmel (1948, p. 312) question that all these birds from scattered localities really belong to *moluccarum*. At any rate, the birds from Morotai and Halmahera are so far removed from the remaining range of *moluccarum* that they hardly belong to this subspecies. Ripley (1959b, p. 4) stated that one of his two specimens secured on Halmahera "seems exceedingly close to the race *waigeuensis*." I find it more satisfactory to unite the populations of the northern Moluccas with *waigeuensis* rather than with the remote *moluccarum*, also because this form appears to prefer small islands. Its range covers only such small islets while it avoids the larger ones. It occurs for instance on the small Seram Laut Islands, but has never been found on the nearby large islands Ceram and Buru, which are well-studied ornithologically. Such pronounced insularization is not developed in any other form of *vanikorensis*. (The term "insularization" was described and discussed in Salomonsen 1976, p. 590).

Collocalia vanikorensis waigeuensis
Stresemann and Paludan

Collocalia vanikorensis waigeuensis Stresemann and Paludan, 1932, Novit. Zool., vol., 38, p. 168 – Waigeo Island. (Type in AMNH examined.)

Very similar to *aenigma*, but slightly darker. Upper-parts tending towards a more blackish colour, forehead and crown being of the same colour as the rest of upper-parts, not of darker coloration, under-parts darker brownish and shaft-streaks virtually indistinguishable, throat and fore-breast slightly paler, in other respects quite similar to *aenigma*.

Measurements: Distinctly smaller than the subspecies already described. Five adult ♂♂ have a wing-length of 109–112 (average 110.3) mm; also tail shorter (cf. *aenigma*), measuring in five specimens 44–47 (average 45.5) mm, with furcation 5.5–8 (average 6.9) mm.

Range: Morotai and Halmahera in the northern Moluccas, Misoöl, Waigeo, Batanta and probably also Salawati.

Remarks: When this form was described in 1932 it was known only from Waigeo, but in recent years a number of other islands have been incorporated in the distribution of *waigeuensis*. It has already been shown above that the northern Moluccas probably are inhabited by this form and not by *moluccarum*. It has been found on Batanta, from where a specimen was said to be very similar to *waigeuensis*, according to an identification made by Streseman, the describer of *waigeuensis* (Gyldenstolpe 1955b, p. 387). It is almost certain that it occurs also on Salawati, where it has not yet been collected, however. The birds from Misoöl were discussed by Ripley (1959a, p. 16) and Mees (1965, p. 172). Ripley calls the Misoöl birds *granti*, but his wing-measurements 114–116 (average of three birds 114.7) mm are somewhat too small for this subspecies and tends toward those of *waigeuensis*. Mees refrains from using subspecific designations, stating that he cannot se any differences between *moluccarum* and *waigeuensis*. His only specimen from Misoöl has a wing-length of 122 mm, which shows greater proportions than in *waigeuensis*. His long series of *moluccarum* (from Little Kai, Manawoka and Ambon), however, has measurements very well agreeing with those given above for this subspecies. His eleven specimens have a wing-length of 113.5–119 (average 116.0) mm. On account of the conflicting information I prefer to unite the Misoöl birds with *waigeuensis*, pending new material and a closer examination.

Collocalia vanikorensis steini
Stresemann and Paludan
Collocalia vanikorensis steini Stresemann and Paludan, 1932, Novit. Zool., vol. 38, p. 167 – Numfor Island, Geelvink Bay. (Type in AMNH examined.)

Similar to *waigeuensis*, but usually still somewhat darker on upper- and under-side; mainly differing from *waigeuensis* by having distinctly longer wings and tail.

Measurements: Six adult specimens have a wing-length of 115–123 (average 118.2) mm, tail-length (of eight specimens) 49–55 (average 52.6) mm, furcation 8–12 (one 5) (average 9.0) mm. Apparently, there is also a difference in weight between the two subspecies, according to Stresemann and Paludan (1932, p. 167–168). The weight of five specimens of *waigeuensis* is 9–10.2 (average 9.4) g, of nine *steini* 9.5–13.5 (average 11.6) g.

Range: Biak and Numfor Islands in Geelvink Bay.

Remarks: Mayr and De Schauensee (1939, p. 26) say that the ten specimens secured on Biak Island "agree in coloration and proportions very well with *steini*".

Collocalia vanikorensis granti Mayr
Collocalia vanikorensis granti Mayr, 1937, American Mus. Novit., no. 915, p. 8 – Setekwa River, New Guinea. (Type in AMNH examined.)
Collocalia francica yorki Mathews, 1916, Bull. British Ornith. Club, vol. 36, p. 77 – Cape York, Queensland. (Type in AMNH examined.) (Subspecific status not certain.)

Very similar to *waigeuensis* and *steini*, but upper-parts distinctly lighter, more brownish, not so black, crown and rump of the same colour as mantle and back, only a slight development of greyish-white on the bases of the nape and mantle feathers, the whitish bases of the supraloral feathers reduced, sometimes almost missing, ear-coverts and subocular area blackish, as in all the preceding subspecies, under-parts as in *waigeuensis* and *steini*.

Measurements: Forty-four specimens have a wing-length of 110–123 (average 117.0) mm. These measurements are calculated on the basis of the large material examined by Mayr (1937, p. 8) and Rand (1942a, p. 317; 1942b, p. 459). Ten specimens measured by me had a wing-length of 116–122 (average 118.6) mm (Table 17). According to Mayr (1937, p. 8) the tail-length is 48.5–49 (average 48.8) mm, and the furcation 6.5–7 (average 6.7) mm, and according to Rand (1942b, p. 459) the tail-length (of ten specimens) is 48.5–51 (average 49.6) mm, the furcation 7–8 (average 7.2) mm. Three specimens measured by me had the tail-length 46–50 (average 48.7) mm and the furcation 7.5–8 (average 7.8) mm. In short, *granti* has a comparatively short tail with a rather small cleft.

Range: Lowland of New Guinea, including Japen Island, the D'Entrecasteaux Islands and Aru Islands. A very rare vagrant to Queensland, northern Australia.

Remarks: This form is not uniform in its large distributional range. The measurements given above (wing-length 110–123 mm) indicate that different populations which may represent undescribed subspecies, have been included in *granti*. Measurements from single populations, inhabiting smaller, circumscribed areas, demonstrate a limited variation in wing-length. As an example can be mentioned that six specimens from the central northern part of New Guinea had wing-lengths of 116–120 mm (Gilliard and Lecroy 1968, p. 12), which corresponds to the measurements taken by me, mentioned above. Three specimens from the type-locality measure 115–116.5 mm. Six birds from southeastern New Guinea (Hall Sound area) measure 117–120 mm. Even the coloration of the plumage differs locally. Birds from northwestern New Guinea (Japen Island, Weyland Mountains) appear to be almost as dark as the neighbouring forms *steini* and *waigeuensis*, while birds from the D'Entrecasteaux Islands appear to be lighter in coloration, tending towards the nearby form *tagulae*. It may be possible to distinguish more subspecies in New Guinea, as already

TABLE 17
Wing-length (in Millimeters) of the Material Examined of *Collocalia vanikorensis granti*, *C.v.tagulae* and *C.v.pallens*.

granti			
AMNH	New Guinea	unsexed	116, 116, 117, 117, 118, 119, 119, 120, 122, 122
tagulae			
AMNH	Tagula	unsexed	122, 123, 124, 125, 129[a]
	Misima	unsexed	121, 122, 122, 123, 123, 124
pallens			
AMNH	Wide Bay, New Britain	♂♂	114, 115, 115, 116, 116, 116, 116, 117, 117, 117, 118, 118
			118, 119, 119, 119, 120, 121, 121, 122, 122, 124
		♀♀	114, 115, 116, 116, 118, 119, 119, 120, 120, 120, 122, 124
	imm.	♂♂	114, 116
	p_{10} growing	♂	114
	p_{10} growing	♀♀	108, 111, 112, 114, 115
	Kandrian, New Britain	♂♂	113, 113, 114, 114, 114, 115, 116, 117, 118, 120
		♀	116
		unsexed	117
	New Hanover	♂♂	117, 119, 120, 123
		♀♀	117, 117, 119, 122
ND	Dyaul Island	♂	113[b]
		♀♀	118, 121, 121, 122
		unsexed	114
	Kalili, New Ireland	imm. ♀	117
	Lemkamin (900 m), New Ireland	♂	125
		♀♀	117, 125
	Banatam, New Hanover	♂♂	113, 115, 115, 116, 117, 118, 119

[a] Type of *tagulae*. [b] Type of *pallens*.

stressed by Mayr (1937, p. 8) and Rand (1942b, p. 459), but the differences between the populations are slight, and the variation appears to be mosaic.

This species does not occur at higher altitudes, contrary to *C.esculenta* and *C.spodiopygia*, but has its upper limit at about 1,400 m (Mayr 1941, p. 85). However, it was found breeding at an altitude of 1,600 m on Goodenough Island (Mayr and Van Deusen 1956, p. 6). Owing to its attachment to the lowland *vanikorensis* has not been able to develop high-mountain forms such as *C.esculenta erwini* and *C.spodiopygia excelsa*, but it demontrates, nevertheless, a distinct tendency to an increase of wing-length with altitude. A series of specimens collected during the American Museum's 1933–1934 Papuan Expedition to Southeast New Guinea had the following wing-measurements: Four specimens from 100 m altitude and below 113–117 (average 115.5) mm, four specimens from 1,250 m 118–123 (average 120.0) mm (Mayr and Rand 1937, p. 78). This difference is interesting since it shows that the correlation between body

proportions and altitude is discernible even in comparatively low mountain ranges, and that the same extreme susceptibility to altitudinal environmental factors is found in all the said three species of *Collocalia* in New Guinea.

Only little is known about the occurrence of this species in the D'Entrecasteaux Islands. A single specimen collected on Ferguson Island, mentioned under the name of *C.fuciphaga* by Rothschild and Hartert (1896, p. 243) is said by Mayr (1937, p. 9) to be closest to *granti*. More recently *vanikorensis* was found nesting on Goodenough Island (Mayr and Van Deusen 1956, p. 6), and it occurs probably on all the bigger islands in the D'Entrecasteaux Archipelago.

It may be repeated here that the New Guinea subspecies of *spodiopygia*, *C.s.hirundinacea*, and *C.vanikorensis granti* are extremely difficult to distinguish from each-other. The best character is the feathering of the tarsus, feathered in *hirundinacea*, unfeathered in *vanikorensis*. Moreover, *hirundinacea* has a smaller bill, slightly darker upper-parts and lighter under-parts and more concealed white in the feathers of the nape and mantle.

As said above, *C.vanikorensis* is a very rare vagrant to northern Australia. As a matter of fact, there is only one certain record. It is a specimen collected near Peak Point, Cape Yok on 10. September 1913, and by Mathews described as a new subspecies (*yorki*). The description (Mathews 1916, p. 77) does not say anything usable. It just states that *yorki* lacks the white rump of *C.spodiopygia terrae-reginae*, is darker and has a bigger bill, characters which hold good of all subspecies of *vanikorensis*. However, I find it most reasonable to suppose that the Cape York specimen belongs to the New Guinea subspecies *granti*, although I am not quite certain. Apart from this specimen the only Australian record is a sight-record on 20. January 1971 from the Atherton Tableland (Bravery 1971, p. 182), which, however, has been doubted by Schodde and McKean (1972, p. 116); cf. also Bravery and Schodde 1973, p. 29.

Callocalia vanikorensis tagulae Mayr

Collocalia vanikorensis tagulae Mayr, 1937, American Mus. Novit., no. 915, p. 7 – Tagula Island, Louisiade Archipelago. (Type in AMNH examined.)

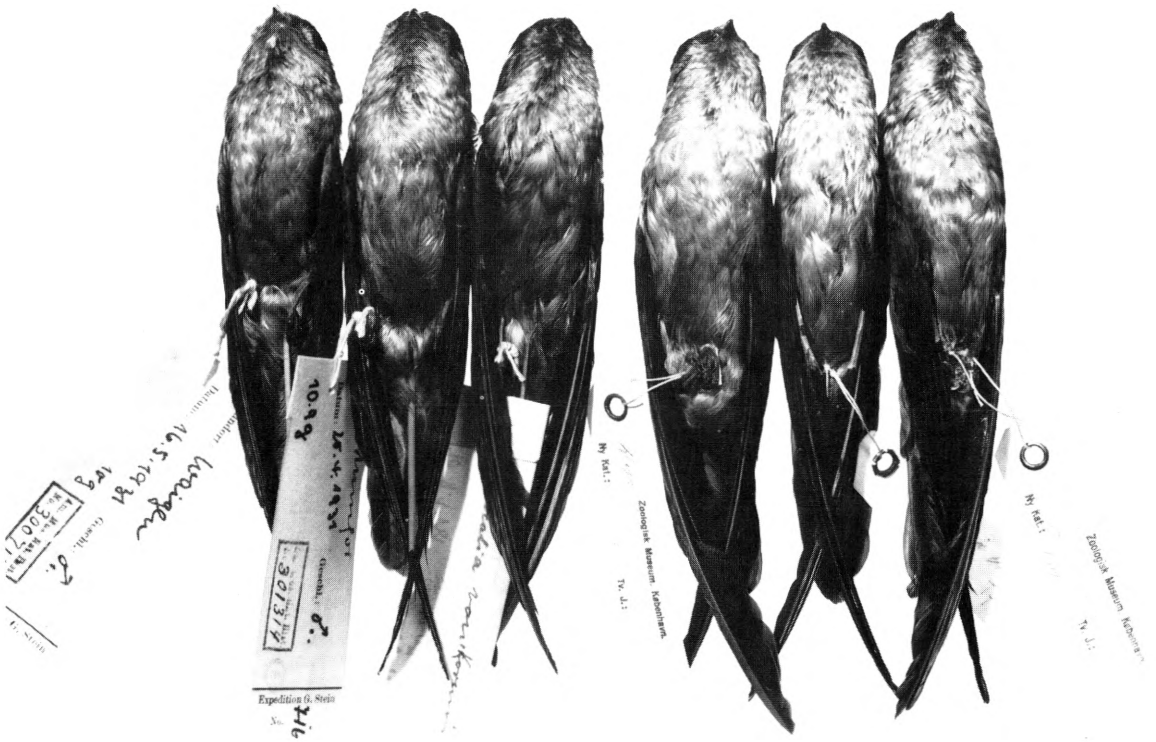
Paler than *granti* in most respects. Upper-parts lighter brownish with a more greenish sheen, crown darker, more blackish, but rump of same colour as mantle and back, white on base of nape and mantle feathers much reduced or completely lacking, whitish base of supraloral feathers reduced as in *granti*, ear-coverts and subocular area paler brownish, under-parts paler brownish and throat slightly lighter, more greyish. The wing-length is longer than in *granti*, the tail-length larger and the tail-cleft much deeper.

Measurements: Eleven adult specimens have a wing-length of 121–125, one 129 (average 123.5) mm, being distinctly larger than *granti*. The tail-length is about 54–56 mm, the furcation 9–12 (average 10.1) mm.

Range: Tagula and Misima in the Louisiade Archipelago, Trobriand Islands and Woodlark Island.

Remarks: There are apparently no records of this species from Rossel Island. The birds from the Trobriand Islands and Woodlark Island differ from specimens from the type-locality by being darker, particularly on the abdomen, and having smaller proportions (average of wing-length 117.3 mm), according to Mayr (1937, p. 7). They appear to be intermediate between *granti* and typical *tagulae*, but are here incorporated in *tagulae*.

Mayr states that the population of Misima differs from that of Tagula by having smaller proportions. The difference is, however, insignificant, which appears from the measurements taken by me (Table 17). Only the type-specimen of *tagulae* with an extraordinarily long wing-length of 129 mm differs from the ordinary size of this subspecies. Stresemann (1923, p. 28) gave the wing-length of six adult specimens from Misima as 122–123.5 (average 122.3) mm, which corresponds to the measurements taken by me.



a *b* *c* *d* *e* *f*

Fig. 27. *a Collocalia vanikorensis waigeuensis* Waigeo Island ♂
b –"– –"– *steini* Numfor Island ♂
c –"– –"– *granti* New Guinea ♂
d –"– –"– *pallens* Dyaul Island ♀
e –"– –"– –"– –"– ♂
f –"– –"– –"– –"– ♀

The three dark subspecies from the New Guinea area seen from the under-side *(a–c)*, compared with the light *pallens* from the Bismarck Islands *(d–f)*.
(The specimens *a–c* in AMNH, *d–f* in ND).

MELANESIAN FORMS

Collocalia vanikorensis pallens, new subspecies
Type: ♂ ad., Dyaul Island, Bismarck Archipelago, 2. June 1962, coll. I. Trap-Lind on the Noona Dan Expedition, collector's no. 2,120.

Nearest to *tagulae*, but with slightly lighter underparts, darker brownish-black upper-parts with paler rump, with lighter ear-coverts and with much white on the concealed bases of the nape and mantle feathers.

Upper-parts darker brownish than in *tagulae*, but distinctly paler than in *granti*, crown black, contrasting with the lighter mantle and back, rump paler, more greyish brown; the base of nape and mantle feathers supplied with much more white than in *tagulae* and *granti* and sometimes producing an ill-defined nape band, whitish bases of supraloral feathers varying in appearance, sometimes as in *tagulae*, but often more distinct and producing a conspicuous whitish spot, ear-coverts and subocular area usually still paler, more greyish than in *tagulae*, throat much paler than breast and abdomen and with a silvery, almost whitish tinge. The differences between the dark forms from New Guinea (*waigeuensis, steini, granti*) and *pallens* of the Bismarck Islands is to be seen in Fig. 27 (under-parts) and Fig. 28 (upper-parts). The wing length of *pallens* is much smaller than that of *tagulae*, the tail is shorter and the tail-cleft much smaller. Generally, the measurements are similar to those of *granti*.

Measurements: Forty-four adult ♂♂ of the lowland populations have a wing-length of 113–124 (average 117.2) mm, twenty-one adult ♀♀ 114–124 (average 118.9) mm, two unsexed specimens 114 and 117 mm (Table 17); tail-length (of twelve birds) 46–50.5 (average 49.0) mm, furcation 4.5–8.5 (average 6.6) mm (Table 19).

Range: The large, central islands in the Bismarck Archipelago (New Britain, New Ireland, Dyaul and New Hanover); not recorded from Umboi, Vitu Islands and Duke of York Group, but no doubt present also on these islands.

Noona Dan Material: (1) ♀ ad., Dyaul Island, 12. March 1962, collector's no. 1,093.

(2) ♀ ad., Dyaul Island, 31. May 1962, collector's no. 2,114. Outermost primaries moulting. Ovary granulated. Iris brown, bill black, legs brown.

(3) ♂ ad., Dyaul Island, 2. June 1962, collector's no. 2,120. Outermost primaries growing. Testes 2 × 3 mm. (Type of *C.v.pallens*.)

(4) ♀ ad., Dyaul Island, 4. June 1962, collector's no. 2,129. Ovary granulated, eggs at most 1 × 2 mm.

(5) ♀ ad., Dyaul Island, 9. June 1962, collector's no. 2,189. Body and wing moult. Weight 13.5 g.

(6) Unsexed, Dyaul Island, 9. June 1962, collector's no. 2,192. Weight 10 g.

(7) ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 20. April 1962, collector's no. 1,520. Ovary granulated, eggs at most 1 × 1 mm.

(8) ♂ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 21. April 1962, collector's no. 1,534.

(9) ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 21. April 1962, collector's no. 1,535. Primaries moulting, the innermost quite new, the outermost old and very worn. Ovary granulated.

(10) ♀ imm., 10 miles south of Kalili, New Ireland, 2. May 1962, collector's no. 1,660.

(11) ♂ ad., Banatam, New Hanover, 20. March 1962, collector's no. 1,183. Body and wing moult. Testes small, 1 × 2 mm. Iris black, bill black, legs greyish. Weight 13 g.

(12) ♂ ad., Banatam, New Hanover, 20. March 1962, collector's no. 1,185. Primaries growing. Testes 1 × 1 mm. Iris black, bill black, legs greyish.

(13) ♂ ad., Banatam, New Hanover, 21. March 1962, collector's no. 1,186. Testes 1 × 1 mm. Weight 8.5 g.

(14) ♂ ad., Banatam, New Hanover, 22. March 1962, collector's no. 1,205. Testes 1 × 2 mm. Weight 10.5 g.

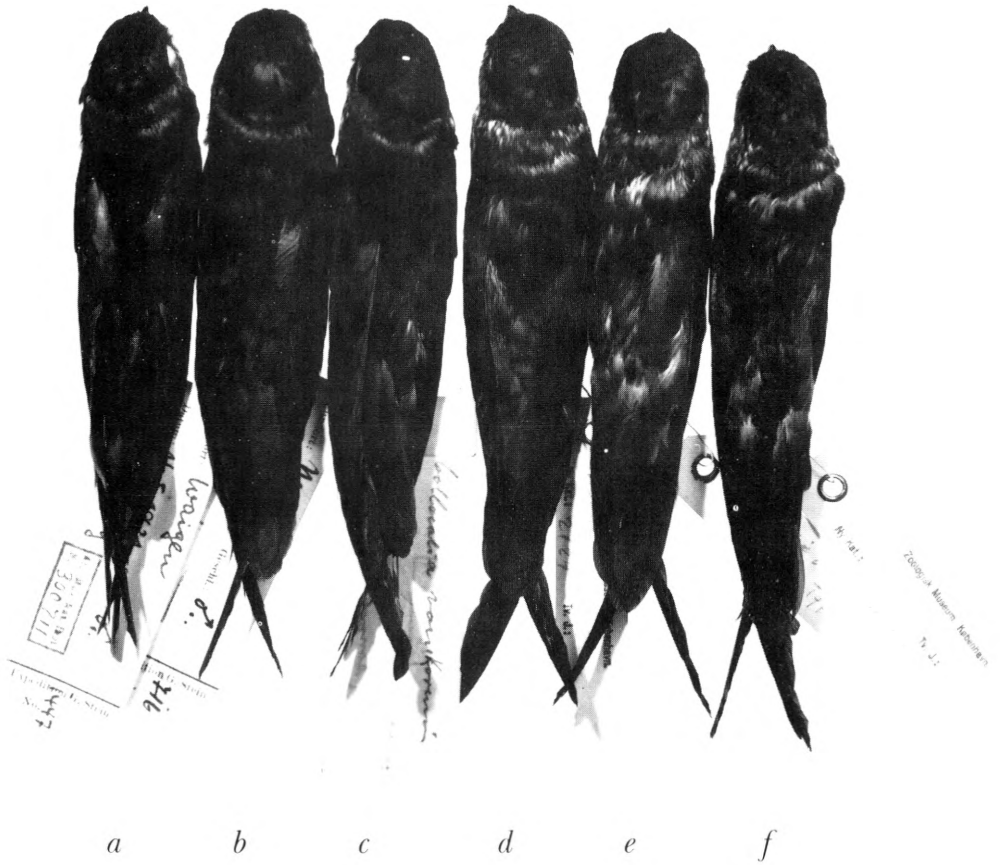
(15) ♂ ad., Banatam, New Hanover, 23. March 1962, collector's no. 1,217. Body and wing moult. Testes 2 × 3 mm. Weight 11 g.

(16) ♂ ad., Banatam, New Hanover, 24. March 1962, collector's no. 1,221. Body and wing moult. Testes 2 × 3 mm. Weight 11 g.

(17) ♂ ad., Banatam, New Hanover, 24. March 1962, collector's no. 1,222. Testes 2 × 2 mm. Weight 10.5 g.

Remarks: The good material collected by the Noona Dan Expedition shows that the populations of the different islands are very similar in proportions as well as in colour-pattern. Only the birds from New Hanover have distinctly darker under-parts, tending towards the colour of nearby *lihirensis*.

It is noteworthy that a small series collected on the Lelet Plateau in central New Ireland, at an altitude of 900–1,300 m, have on an average larger body proportions than the lowland birds. Three specimens have wing-length of 117–125 (average 122.3) mm, tail-length 51–52 (average 51.5) mm, furcation 7–9 (average 8) mm. These measurements, which are not included in those given for the above mentioned lowland birds, demonstrate the same correlation between body-



a *b* *c* *d* *e* *f*

Fig. 28. The same specimens as in Fig. 27, seen from the upper-side, to show contrast between the dark New Guinea forms (*a–c*) and the pale form (*pallens*) from the Bismarck Islands, with ill-defined "nape-band", paler back, lighter rump and contrasting dark crown.

size and altitude as in the New Ireland mountain population of *C.spodiopygia noonaedanae* (p. 75) and in the populations of the New Guinea mountains of *C.esculenta*, *C.spodiopygia* and *C.vanikorensis*.

Some students previously examined and measured specimens of *pallens*. Stresemann (1923, p. 28) stated the wing-length of six specimens from New Britain as 117–121 (average 119.0) mm, and Gilliard and Lecroy (1967, p. 200) gave for specimens from the lowland of New Britain, near Kandrian, the wing-length as 113–121.5 mm and the tail-length as 44.5–52 mm. I examined Gilliard's birds, and their measurements are given in Table 17. Other statements in the literature refer to specimens in AMNH, already measured by me (Table 17) and, therefore, not considered here.

Mayr (1937, p. 6) states that the birds from the Bismarck Islands are similar in coloration to nominate *vanikorensis*, but that they are "slightly lighter above and below, particularly on upper throat and ear-coverts, and the white supraloral spot seems to be larger." This is quite correct, but Mayr apparently did not realize that *pallens* is much closer

to his own subspecies *tagulae* than to nominate *vanikorensis*.

During the Noona Dan Expedition *C.vanikorensis* was commonly observed in most places in the Bismarck Archipelago. On Dyaul Island it was hunting over cultivated fields, at the villages near the sea and appeared to be numerous. The same was the fact on New Hanover and the small islands off its north coast. At Kalili in the lowland of New Ireland it was hunting along the border of the rain-forests and over the open secondary forest but appeared to be scarce. On the Lelet Plateau in the mountains of New Ireland it was common over the open mountain slopes with only scattered groups of trees, but it was more rarely seen over the gently sloping cultivated fields where it was replaced by *spodiopygia*, or over villages and secondary forests where *esculenta* occurred.

Collocalia vanikorensis coultasi Mayr

Collocalia vanikorensis coultasi Mayr, 1937, American Mus. Novit., no. 915, p. 7 – Manus, Admiralty Islands. (Type in AMNH examined.)

Upper-parts still paler brownish than in *pallens*, crown black, distinctly contrasting with the lighter mantle and back, rump much paler, sometimes light greyish; the bases and rami of nape, mantle and back feathers with more white than in *pallens*, which gives a variegated pattern characterized by white spots and narrow lines on the upper-parts, particularly pronounced on the nape (Fig. 29), supraloral feathers forming a distinct whitish spot, but sometimes only the bases of the feathers being white; ear-coverts and subocular area as in *pallens*, under-parts very similar to that of *pallens* and with the same silvery whitish tinge on the throat. The proportions distictly larger than in *pallens*.

Measurements: Five adult ♂♂ from the Admiralty Islands have a wing-length of 118–124 (average 121.4), eleven adult ♀♀ 118–126, one 130 (average 123.0) mm (Table 18), tail-length about 54–56 mm, furcation of tail 6–11 (average 8.0) mm. Eleven specimens (including some immature birds) from Mussau, St. Matthias Group, have a wing-length of 121–129 (average 124.8) mm, tail-length 53–57 (average 54.9) mm, furcation 8–11 (average 9.3) mm.

Range: The St. Matthias Group in the Bismarck Islands and the Admiralty Islands, known from Manus, Rambutyo and also Los Negros (Ripley 1947, p. 101), but probably found on all islands in the archipelago.

Noona Dan Material: (1) ♂ ad., Schadel Bay (by river), Mussau Island, 19. January 1962, collector's no. 717.

(2) ♀ ad., Schadel Bay (by river), Mussau Island, 20. January 1962, collector's no. 718.

(3) ♀ ad., Schadel Bay (by river), Mussau Island, 20. January 1962, collector's no. 724.

(4) ♂ ad., Schadel Bay (by river), Mussau Island, 21. January 1962, collector's no. 742. Body moult. Testes 2 × 3 mm. Weight 12.5 g.

(5) ♀ imm., Schadel Bay (by river), Mussau Island, 22. January 1962, collector's no. 749.

(6) ♀ imm., Schadel Bay (by river), Mussau Island, 22. January 1962, collector's no. 750.

(7) ♂ ad., Schadel Bay (by river), Mussau Island, 22. January 1962, collector's no. 751.

(8) Unsexed, Schadel Bay (by river), Mussau Island, 22. January 1962, collector's no. 752.

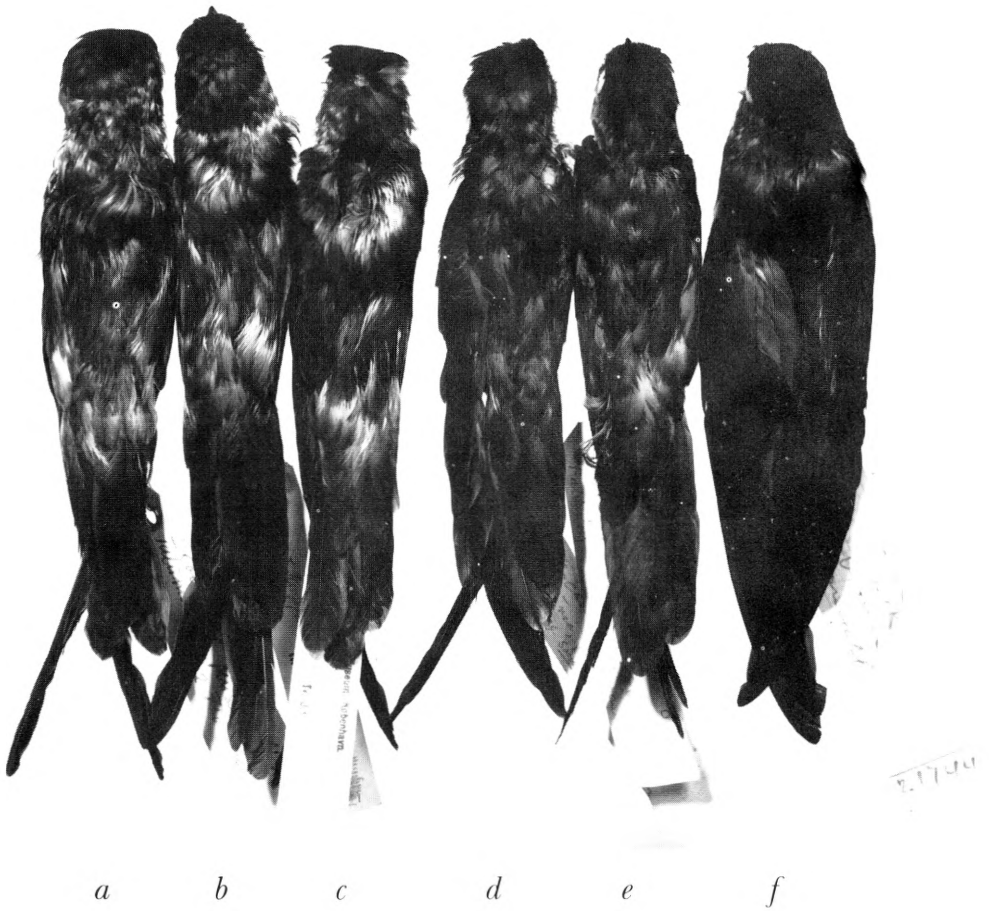
(9) ♀ imm., Schadel Bay (by river), Mussau Island, 23. January 1962, collector's no. 753.

(10) ♂ imm., Schadel Bay (by river), Mussau Island, 23. January 1962, collector's no. 764. Testes minute, at most 1 × 1 mm.

(11) ♀ imm., Schadel Bay (by river), Mussau Island, 3. February 1962, collector's no. 900.

Remarks: The large series obtained by the Noona Dan Expedition in Mussau Island was collected in mist net placed in secondary growth near a waterfall of a river, at a place called Talumalaus (1°29′S, 149°40′E), not far from Schadel Bay (cf. Wolff 1966, p. 319).

Formerly only one specimen of *vanikorensis* was collected on Mussau Island in the St. Matthias Group (Hartert 1924b, p. 269). This specimen is in AMNH, where I examined it. The upper-parts had the same coloration as *coultasi*, while the un-



a *b* *c* *d* *e* *f*

Fig. 29. *a Collocalia vanikorensis coultasi* Mussau Island ♂
b –"– –"– –"– –"– ♂
c –"– –"– –"– –"– ♀
d –"– –"– *lihirensis* Nukuria Atoll ♂
e –"– –"– –"– Feni Island ♂
f –"– –"– *vanikorensis* Epi Island ♂
The pale *coultasi* (*a–c*) with much white on upper-parts compared with the darker *lihirensis* (*d–e*) and the still darker *vanikorensis* (*f*). (The specimens *a–e* in ND, *f* in AMNH).

der-side was slightly darker. This character, however, is somewhat varying in all these forms. Mayr (1937, p. 7) who had only this specimen at his disposal, identified it as *lihirensis* on account of the darker under-parts. The large series collected by the Noona Dan Expedition demonstrates that the St. Matthias birds in all respects are indistinguishable from specimens of *coultasi* from the type-locality, both in colour-pattern and in proportions. The measurements, as given above and in Table 18 are on an average even greater than those of the typical *coultasi*.

TABLE 18
Wing-length (in Millimeters) of the Material Examined of *Collocalia vanikorensis coultasi*, *C.v.lihirensis*, *C.v.lugubris* and *C.v.vanikorensis*.

coultasi				
AMNH	Manus		♂	120
			♀♀	120, 122, 122, 122, 125, 126, 130[a]
	Rambutyo		♂♂	118, 122, 123, 124
			♀♀	118, 120, 122, 124
		imm. unsexed		119
		p_{10} growing	♀♀	115, 116
	St. Matthias		♂	120
ND	St. Matthias		♂♂	121, 125, 128
			♀♀	124, 126
		unsexed		123
		imm.	♂	123
		imm.	♀♀	124, 125, 125, 129
lihirensis				
AMNH	Lihir		♂♂	120, 120, 121, 123, 124, 125, 125, 125, 127
			♀♀	120, 120, 120, 121, 121, 122, 123, 124, 124, 124, 125, 127, 128[b]
		imm.	♂	118
	Tabar		♂♂	123, 124
ND	Feni		♂	122.5[c]
	Nuguria	imm.	♂	118[a]
lugubris				
AMNH	Bougainville	unsexed		114, 116
	Choiseul	imm.	♂	108
	Vella Lavella		♂	116
	New Georgia	unsexed		111
	Guadalcanal		♂♂	112, 113
			♀♀	114,[d] 116
		p_{10} growing	♂	109
		p_{10} growing	♀	107
	Santa Ana		♂	115
			♀♀	114, 117
	Ugi		♀	112
BM	Rennell	unsexed		111, 114
		p_{10} growing, unsexed		108
ZMC	Rennell		♂	111
			♀♀	111, 113, 114, 117
		p_{10} growing, unsexed		114
		imm.	♂	111
		imm.	♀	115
vanikorensis				
AMNH	Duff-Swallow		♂♂	115, 117, 118
			♀♀	115, 120

Banks Islands		♂	119
		♀	122
North. New Hebrides			
(Espiritu Santo-Epi)		♂♂	118, 118, 119, 119, 119, 120, 120, 120, 120, 121, 121, 121, 122
		♀♀	118, 119, 121, 121, 123, 123, 125
	unsexed		120
	imm.	♂♂	115, 117, 118, 119
	imm.	♀♀	112, 114, 115
Efate		♂	125
	imm.	♂	118
Eromanga		♂	125
		♀♀	121, 125
	imm.	♀	117
Tana		♀	121
"New Hebrides"	unsexed		119

[a] Type of *coultasi*. [b] Type of *lihirensis*. [c] In heavy moult. [d] Type of *lugubris*.

TABLE 19
Length and Furcation of Tail (in Millimeters) of the Material Examined of *Collocalia vanikorensis* from the Papuan and Melanesian Regions.

		Tail-length	Furcation
granti			
AMNH	New Guinea	46, 50, 50	7.5, 8, 8
pallens			
ND	Central Bismarck Islands	46, 47, 49, 49, 49, 49, 49, 49.5, 50, 50, 50, 50.5	4.5, 5.5, 6, 6, 6.5, 6.5, 7, 7, 7, 7, 8, 8.5
	New Ireland, mountains	51, 52	7, 9
coultasi			
ND	St. Matthias	53, 53, 53.5, 54, 54, 56, 56, 56, 56, 57	8, 8, 8, 8.5, 8.5, 9.5, 10, 10, 10, 11, 11
lihirensis			
ND	Feni and Nuguria	54	9, 9
lugubris			
ZMC	Rennell	49, 50, 51, 51, 51, 52, 52	6, 6.5, 6.5, 7, 8, 8, 8

Collocalia vanikorensis lihirensis Mayr

Collocalia vanikorensis lihirensis Mayr, 1937, American Mus. Novit., no. 915, p. 6 – Lihir Island, Lihir Group, Bismarck Islands. (Type in AMNH examined.)

This form appears to be intermediate between *coultasi* and *lugubris*. The upper-parts are darker than in *coultasi*, almost as in *lugubris*, the back is as dark as the crown, but the rump is slightly paler, proximal rami of scattered feathers of mantle white, but this character is by far not so well developed as in *coultasi* and *pallens*, and a pale nape band never occurs. In Fig. 29 the colour-pattern of the upper-parts of *coultasi* and *lihirensis* are compared. The under-parts of *lihirensis* are dark, much darker greyish-brown than in *pallens* and *coultasi*, but slightly lighter than in *lugubris*, throat slightly paler than rest of under-parts. The proportions are large, just as in *coultasi*.

Measurements: Eleven adult ♂♂ from Lihir and Tabar have a wing-length of 120–127 (average 123.4) mm, thirteen adult ♀♀ 120–128 (122.8) mm (Table 18), tail-length about 54–57 mm, furcation 6–9 (average 8.0) mm.

Range: The Hibernian Islands (the island groups of Tabar, Lihir and Feni, not yet recorded from Tanga and Nissan) and Nuguria Islands.

Noona Dan Material: (1) ♂ ad., Feni Island, 8. May 1962, collector's no. 1,700. In body moult. Weight 12 g.

(2) ♂ imm., Nuguria Islands, 9. May 1962, collector's no. 1,715. In body moult. Testes minute, at most 1 × 1 mm. Weight 12.5 g.

Remarks: This form was known only from the Lihir and Tabar Islands, but during the Noona Dan Expedition I succeeded in securing a specimen on Feni Island and another on the atoll group Nuguria Islands (or Fead Islands), on 3°23′S, 154°48′E, far out in the Pacific, about 200 miles east of Tanga Islands. Both these specimens belong to *lihirensis*, having a colour-pattern typical of this form (Fig. 28) as well as the large proportions. The Nuguria specimen is an immature ♂, but has a wing-length as great as an immature ♂ from Lihir (cf. Table 18).

Collocalia vanikorensis lugubris, new subspecies

Type: ♀ ad., Guadalcanal Island, Solomon Islands, 1. June 1927, coll. R. H. Beck on The Whitney South Sea Expedition, in AMNH, nr. 217424.

A very dark form, with upper-parts blackish and with crown and rump about the same colour as back, the whitish bases and rami of nape and mantle feathers virtually missing, with the result that the upper-parts are almost uniform black, ear-coverts and subocular area blackish, supraloral feathers blackish, only the concealed bases more or less whitish, but a supraloral spot not developed or, at any rate, quite inconspicuous, under-parts darker greyish brown than in any other subspecies of *vanikorensis* mentioned above. The proportions are much smaller than in *lihirensis* and *coultasi*, even smaller than in *pallens*, and the tail is shorter with a smaller furcation.

Measurements: Five adult ♂♂ have a wing-length of 111–116 (average 113.4) mm, nine adult ♀♀ 111–117 (average 114.2) mm, five unsexed adult specimens 111–116 (average 113.2) mm, tail-length (of seven birds) 49–52 (average 50.9) mm, furcation 6–8 (average 7.1) mm. Mayr (1937, p. 6) stated the average wing-length of birds from the Solomon Islands as 114.4 mm, the furcation as 5–8 (average 6.1) mm, and added that "the tail is medium". These measurements quite agree with those taken by me.

Range: The Solomon Islands, occurring on all islands investigated.

Remarks: In 1953 Bradley discovered *C.vanikorensis* on Rennell Island, from where it had not previously been recorded (Bradley and Wolff 1956, p. 102). She collected two specimens, which are now in BM, where I have examined them. In the same paper *C.vanikorensis* is stated to occur also on Bellona Island (p. 118). In 1965 Wolff collected eight specimens on Rennell Island (Wolff 1973, p. 16), now in ZMC, which were also examined by me. Unfortunately, they are in bad shape, having been preserved in alcohol for some time, but they are usable as far as measurements are concerned.

Galbraith and Galbraith (1962, p. 39) gave measurements of three adult ♂♂ from San Christobal which had wing-lengths of 113–115.5 (average 114.7) mm, which agrees with the measurements taken by me.

Table 18 shoes that the proportions of the populations inhabiting the different islands in the Solomons are almost uniform, and the same applies to the colour of the plumage. Only some specimens from Santa Ana Island have somewhat paler under-parts than those from the other islands.

Collocalia vanikorensis vanikorensis
(Quoy and Gaimard)

Hirundo vanikorensis Quoy and Gaimard, 1830, Voy. "Astrolabe", Zool., vol. 1, p. 206; atlas, Oiseaux, pl. 12, fig. 3 – Vanikoro Island, Santa Cruz Archipelago.

Similar to *lugubris*, differing only by considerably bigger proportions

Measurements: Sixteen adult ♂♂ from the New Hebrides, including Banks Islands, have a winglength of 118–125 (average 120.4) mm, eleven adult ♀♀ 118–125 (average 121.7) mm, two unsexed adult specimens 119 and 120 mm, taillength about 50–53 mm, furcation 7–11 mm. Five adult specimens from Santa Cruz Islands, including Duff and Swallow Groups, have a winglength of 115–120 (average 117.0) mm.

Range: The Santa Cruz Islands with the Duff Group and the Swallow Group and the New Hebrides with the Banks Islands, but not recorded with certainty from the southernmost island, Aneityum.

Remarks: It appears from Table 18 that there is a gradual increase in wing-length from the Santa Cruz Islands in the north to the islands of Efate, Eromanga and Tana in the southern part of the New Hebrides. It is unfortunate that the typelocality of *vanikorensis* is Vanikoro Island in the Santa Cruz Islands, because the measurements of the population of these islands are exactly intermediate between *lugubris* and nominate *vanikorensis*. It was not possible to examine specimens from Vanikoro Island. Since the islands of Duff and Swallow, from where specimens have been examined, are situated about 100 miles north of Vanikoro Island is must be supposed that the population of this latter locality have somewhat bigger body proportions than those of the Swallow-Duff Islands, as the size increases to the south in the archipelago. It must, therefore, be assumed that the Vanikoro birds have wing-lengths that are within the size limits of the New Hebridean populations. The only specimen which until recently was collected on Vanikoro Island is the ancient type, which is kept in the Muséum National d'Histoire Naturelle in Paris, but it has been impossible for me to obtain measurements of this specimen. Recently a specimen of *C.vanikorensis* was collected on Vanikoro (Hadley and Parker 1965, p. 156). The specimen is in BM, and Dr. Ian C. J. Galbraith was kind enough to examine and measure the specimen for me. He tells me that the bird is kept in alcohol and that it was caught by hand on the nest, and, therefore, most probably is a young bird, although it appeared to be adult. "Because the primaries are bent by being forced into a jar, I had to straighten the wing laterally as well as flattening it on the rule, and in this way I obtained a length of 112 mm." Since this procedure was rather artificial and the wing-length measured was much smaller than in even immature birds of *vanikorensis* I do not think this measurement is usable in the comparison.

The AMNH possesses specimens from nearly all islands of the New Hebrides, except the southernmost island, Aneityum. It has never been recorded on this island, and recently Medway and Marshall (1975, p. 437) state that during their stay on the New Hebrides they encountered *C.esculenta* and *C.vanikorensis*, but that "the latter was not noted on Aneityum, but was common elsewhere in the lowland." Therefore, I do not include Aneityum in the range of *C.vanikorensis*. It should be noted, however, that Diamond and

Marshall (1976, p. 197), during their recent expedition to the New Hebrides, found *vanikorensis* on most of the islands visited, including what in their check-list they call "An" and which should be Aneityum.

It neither appears that *vanikorensis* is present on New Caledonia and the Loyalty Islands. There is only one field-record from this area, and this is more than a hundred years old, made by Layard (1880, p. 223). No student has met with it later on these well-studied islands (Bruce 1978, p. 301). In the new hand-book on the birds of this region *vanikorensis* is not mentioned at all (Delacour 1966, p. 113).

Superspecies *Collocalia orientalis* Mayr 1935

The superspecies *Collocalia orientalis* inhabits New Guinea, the Bismarck Islands and the Solomon Islands. It consists of three species, *papuensis*, *nuditarsus* and *orientalis*. The two first mentioned species are monotypic, while *orientalis* has two subspecies, *leletensis* and nominate *orientalis*. All four taxa have been described as subspecies of the Philippine species *C.whiteheadi*. They appear to be rare, and only the type specimens or very small series of specimens have been collected.

The first to record *whiteheadi* from New Guinea was Ogilvie-Grant (1912, p. 283; cf. also 1913, p. 95 and 1915, p. 190) who described a single specimen collected by Wollaston by Mimika River, S. W. New Guinea. Almost simultaneously Rothschild and Hartert (1913, p. 491) recorded a specimen collected by Meek at Mt. Goliath in the Snow Mountains at an altitude of at least 1,600 m. Mayr and Rand (1937, p. 76) reported a specimen taken at Baroka in the lowland of Hall Sound, S. E. New Guinea, also stating that they had observed a party of six birds flying overhead "for a moment or so just at dark" and that this was the only time the species was seen. They called the birds *C.lowi whiteheadi*, indicating that they believed *whiteheadi* should be regarded as a subspecies of the oriental *lowi*, which now is regarded as a form of *maxima*. It would have been more appropriate if they had incorporated *whiteheadi* in *brevirostris* in agreement with the proposal by Stresemann a few years earlier (Stresemann 1926b, p. 352). All the specimens mentioned above belong to the species *nuditarsus*, which was recently described by me (Salomonsen 1962, p. 510).

Rand (1941, p. 10) described *C.whiteheadi papuensis*, based on thirteen specimens collected in N. W. Guinea from Sukarnapura (= Hollandia) and Idenburg River, between sea-level and 1,800 m. In *papuensis* Rand included the bird from Mt. Goliath and that from Baroka, mentioned above. *C.w.papuensis* was said to be "similar to *whiteheadi* from north Luzon, but differs in having the throat considerably paler, more silvery grey, contrasting with the brownish abdomen; and the upperparts slightly more iridescent." Rand also noticed that the pale throat was more marked in the north New Guinea birds than in the Mt. Goliath-Baroka specimens, which as said above, belonged to *nuditarsus*. All these diagnostic characters are quite correctly described. It appeared that *papuensis* was common by Idenburg River, "feeding in parties of twenty to thirty but usually so high as to be out of gunshot" (Rand 1942b, p. 459).

Finally, Mayr and Gilliard (1954, p. 342) report on four specimens (two skins and two in spirit) obtained in the Kubor Mountains in the central part of E. New Guinea, but south of the watershed. They called the birds *C.whiteheadi papuensis* and added: "Apparently very uncommon in the Kubor region and rare or absent in the Hagen and Bismarck region." These birds turned out to belong to *nuditarsus*. It then appeared that all birds living north of the central watershed in New Guinea belonged to *papuensis*, while those south of it were *nuditarsus*.

The two Melanesian forms are very little known, and only the type specimens have been

collected. Their main difference from the New Guinea forms is a pale rump, contrasting with the blackish colour of the remaining upper-parts. They appear to be mountain forms. Mayr (1935, p. 3) described *C.lowi orientalis* from Guadalcanal in the Solomon Islands. In a later publication (Mayr 1945, p. 238) he changed the name to *C.whiteheadi orientalis* and added that this form "is perhaps restricted to the mountains." Subsequently, I described *C. whiteheadi leletensis* from the Lelet Plateau in the mountains of central New Ireland (Salomonsen 1962, p. 511).

Concerning the relationship of all these forms, there is no doubt that they are closely allied. Not only are they all very large with wing-lengths usually exceeding 130 mm, but they are extremely similar in plumage pattern. They all have whitish tips to the feathers on the side of the head, forming a kind of light supercilium, not to be found in any other of the Papuan and Melanesian species. They all have a short tail, considering their general superior size, and an extremely small tail-furcation (3–4 mm). They have all been safely deposited in the species *whiteheadi*, but it is questionable whether this is correct. In his review of the oriental species *brevirostris* Stresemann (1926b, p. 352) included the Philippine form *whiteheadi* in this species, which has a wing-length of the same large size as *whiteheadi*, and said about the New Guinea specimens that they apparently agreed with *whiteheadi* in all respects. However, *whiteheadi* differs from the remaining *brevirostris* forms by having naked tarsus, while it is densely feathered in *brevirostris*. Stresemann, therefore, took the consequence of this situation, and in a later paper (Stresemann 1931, p. 95) excluded the Philippine *whiteheadi* from the forms inhabiting Malaysia and the Greater Sunda Islands which he united under the name *lowi*. This name was recently replaced by *maxima*, which has a few years' priority (cf. above p. 6). This arrangement does not correspond to that adopted by Medway (1966, p. 162), who again included *whiteheadi* in *brevirostris* stating that they have the tarsus "lightly feathered or unfeathered" while *maxima* has a "heavily feathered tarsus". However, the South Chinese form *C.brevirostris inopina* has also well-feathered tarsus. As recently as in 1977 Medway and Pye united *brevirostris*, *whiteheadi*, *nuditarsus* and *orientalis* (Medway and Pye 1977, p. 227) in spite of the important informations published in the last fifteen years.

The main thing is, however, that there are two oriental species, *brevirostris* and *maxima*, both with large body proportions and with a very similar plumage pattern, distributed from the eastern Himalayas, eastwards to the Philippine Islands and southwards to Sumatra and Java. It would be an easy matter to attach *nuditarsus* and *orientalis* which both have unfeathered tarsus to *brevirostris*, and *papuensis* which has a very dense feathering on the tarsus to *maxima*. This procedure would, in my opinion, be quite wrong. *C.brevirostris* and *C.maxima* are species widely distributed in the Oriental region, a very large distance from the superspecies *C.orientalis*, which is found in the Australian region, extremely far removed from the Oriental region. For zoogeographical reasons it is, therefore, quite out of the question to regard these forms as conspecific. There is no case at all existing of oriental birds breeding in New Guinea and being isolated from the main range by so great distances as is the case in these swiftlets. Even *Lanius schach stresemanni* of New Guinea is not so isolated, for allied subspecies are found eastwards to Timor and to the Sula Islands. In the case of the Spinetailed Swifts called *Mearnsia* (Peters 1940, p. 242), which I regard as synonymous with *Chaetura*, there is a Philippine species *(M.picina)* and another, isolated in New Guinea (*M.novaeguineae*). These two taxa are regarded as two different species, and no one ever suggested that they should be conspecific. Besides, an allied form, *Chaetura gigantea celebensis*, is found in Celebes. It is true that the two species of *Mearnsia* morphologically differ much more from one another than do the *Collocalia* forms, but I have emphasized repeatedly in this paper that the species of this genus usually are extremely similar.

These considerations demonstrate why I cannot agree to unite the *orientalis* superspecies with *whiteheadi, brevirostris* or *maxima*, living so far away in the Oriental region. I am much more in agreement with Iredale (1956, p. 220), who said about *C.papuensis:* "It has been associated with Whitehead's Swiftlet (*Collocalia whiteheadi*) from Luzon in the Philippine group, but its resemblance seems to be coincidal, as to many local species are known in this group".

The matters became still more complicated when Somadikarta (1967, p. 4) discovered that *papuensis* had only three toes, the hallux being absent. This very interesting character, unique within the whole order of Apodes, was overlooked by Rand, Mayr, Gilliard and myself when studying these birds. The loss of hallux is a widespread phenomenon in birds, and formerly it was regarded as sufficient for a generic separation. This was the case in *Charadriidae (Squatarola = Pluvialis*), in *Picidae* (*Picoides = Dendrocopos; Sasia = Verreauxia; Brachypternus = Dinopium*), *Alcedinidae* (*Ceycopsis = Ceyx*) and even in the passerine family *Timaliidae* (*Cholornis = Paradoxornis*), and many others. Some of them were discussed by Delacour (1951, p. 49) and Short (1976, p. 186). The loss of a toe is not correlated with other anatomical changes or with striking changes in the colour pattern, and this empasizes the low taxonomical value of this character. Still, *papuensis* must of course be regarded as a separate species, and this makes it necessary to discuss the position of *nuditarsus* and *orientalis*. They are now still further removed from the *whiteheadi* population of the Philippine Islands, and are totally isolated from each other, with *papuensis* sandwiched in between them.

I find the best solution to be a recognition of them both as separate species. I have, therefore, followed the conclusion of Somadikarta (1967, p. 2) who says: "A large number of the New Guinea records belong to the species to be recharacterized in this paper [= *papuensis*], and I believe the rest belong to what may prove to be another unrecognized species [= *nuditarsus*]. The unique Guadalcanal specimen belongs to still another species [= *orientalis*], and the single specimen from New Ireland [= *leletensis*] may be conspecific with it." The position of *nuditarsus* as a subspecies of *whiteheadi* (= *brevirostris*) has been doubted also by Diamond (1972, p. 182) who states that "whether *nuditarsus* is actually conspecific with *C.whiteheadi* of the Philippines is uncertain." In the newest check-list of birds the proper consequences have been taken, the three taxa *papuensis, nuditarsus* and *orientalis* being treated as full species (Howard and Moore 1980, p. 200).

Schodde (*in* Bravery and Schodde 1973, p. 29) is of the opinion that "*nuditarus* is clearly a race of *brevirostris*, while *C.papuensis* is apparently the New Guinean vicariant of the Black-nest Swiftlet, *C.maxima*." He has, therefore, walked into the trap I warned against above (p. 103), and he did so in spite of the fact that nests of all the species in question are quite unknown.

The superspecies *C.orientalis* is characterized by its large size, with wing-length 128–141 mm, and its dark colours with black upper-parts and sooty-brown under-parts. The species belonging to this superspecies also have in common the short tail with slight furcation and the pale feather tips above the eye forming a supercilium. There are, on the other hand, distinct differences between the three species forming the superspecies, and they are characterized in the following.

The distribution of the forms belonging to the superspecies. *C.orientalis* is shown in Fig. 30.

Collocalia papuensis Rand 1941

Collocalia whiteheadi papuensis Rand, 1941, American Mus. Novit., no. 1102, p. 10 – Idenburg River, West Irian, New Guinea, at 1,800 m altitude. (Type in AMNH examined.)

Upper-parts black with a slight greenish iridescence, feathers of nape with greyish white bases,

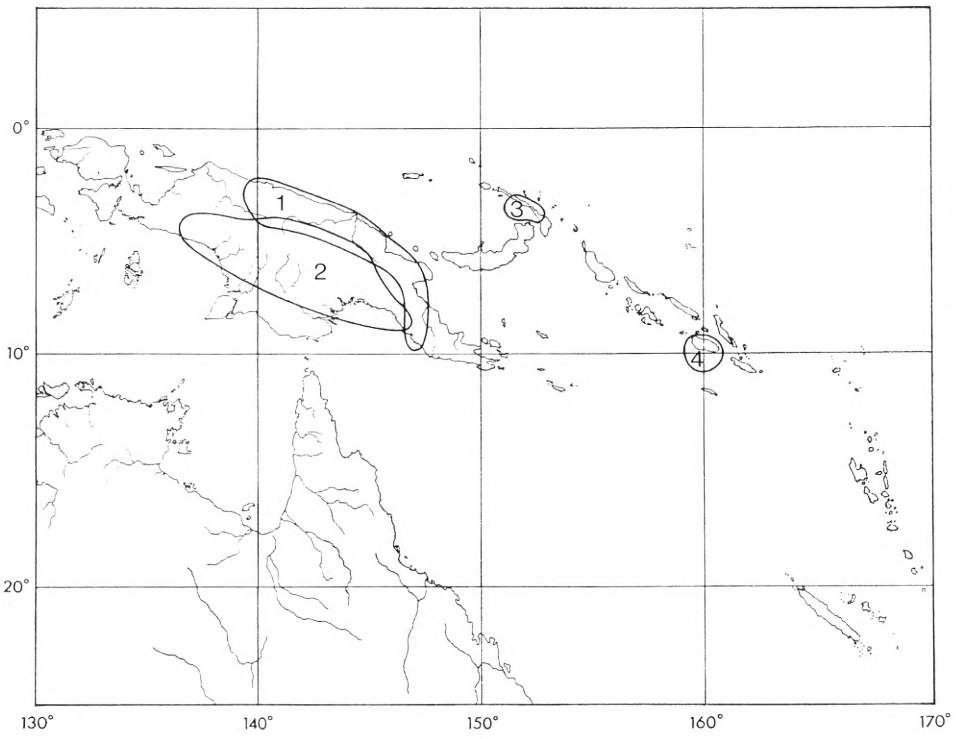


Fig. 30. Distribution of the forms belonging to the superspecies *Collocalia orientalis*.
1. *C. papuensis*,
2. *C. nuditarsus*,
3. *C. orientalis leletensis*,
4. *C. orientalis orientalis*.

strongly contrasting with the black tips (Fig. 31), feathers above eye with whitish tips forming a supercilium. Throat silvery grey, contrasting with the dark sooty brown breast and abdomen. With only three toes, hallux missing. Tarsus densely and thickly feathered along its entire length.

Measurements: Five adult ♂♂ have a wing-length of 128–141 (average 136.8) mm, two adult ♀♀ 129 and 133 mm, three adult ♂♂ with the longest primaries growing 127–133 (average 130.7) mm. Tail-length of thirteen specimens 48.5–56.5 (average 52.2) mm, according to Somadikarta (1967, p. 5), furcation 2.5–5.5 (average 3.9) mm.

Range: New Guinea, north of the central watershed, known from Sukarnapura or Jayapura (formerly Hollandia) and the Idenburg River area, from sea-level up to 1,800 m. Apparently also found in the lowland of S. E. New Guinea, in the area of Port Moresby.

Remarks: Somadikarta (1975, p. 41) discovered a specimen of *papuensis* in the Museo Civico di Storia Naturale in Italy, collected in 1892, without any locality given, but probably from about Port Moresby. Somadikarta gives good reason for this assumption, which would imply that *papuensis* has been able to cross the central mountain barrier and that this species and *nuditarsus* are partly sympatric.

Collocalia nuditarsus Salomonsen 1962

Collocalia whiteheadi nuditarsus Salomonsen, 1962, Vidensk. Medd. fra Dansk Naturhist. Forening, vol. 125, p. 510 – Baroka, Bioto Creek, near Hall Sound, Papua, New Guinea. (Type in AMNH examined.)

The upper-parts are dull black, almost without

Fig. 31. Superspecies *Collocalia orientalis*
a Collocalia papuensis Idenburg River (50 m altitude), New Guinea ♂
b Collocalia nuditarsus Mt. Goliath (500 m altitude), New Guinea ♀
c Collocalia orientalis leletensis Lelet Plateau (900 m altitude), Bismarck Islands ♀

Notice pale bases of nape feathers in *papuensis* (*a*), darker nape in *nuditarsus* (*b*), and darker upper-parts with pale, greyish rump band in *leletensis* (*c*). The differences in size of the three specimens is artificial, due to different skinning. (The specimens *a–b* in AMNH, *c* in ND).

a *b* *c*

any iridescence, the feathers of nape as a rule whith blackish grey bases, not or almost not contrasting with the black tips; pale supercilium as in *papuensis;* the colour of the throat not differing from that of breast and abdomen, the entire under-parts being uniform sooty-grey, darker than in *papuensis*. With four toes as usual in *Collocalia*. Tarsus bare, completely devoid of feathers.

Measurements: The wing-length of an adult ♂ 138 mm, of two adult ♀♀ 137 and 140 mm, of an adult ♀ with the longest primaries growing 130 mm; tail-length 49–51 mm, furcation 4–5 mm.

Range: Southern and southeastern New Guinea, south of the central water-shed, known from Mimika River, Mt. Goliath (in the Snow Mountains), Kubor Mountains and Baroka (near Hall Sound), from sea-level up to about 1,800 m altitude. Apparently also found in the Schrader Range in the Western Highlands of Papua, north of the central water-shed.

Remarks: It is possible that *nuditarsus* may have crossed the central mountain range and occurs on the north side of New Guinea sympatrically with *papuensis*. Diamond (1972, p. 182) stated laconically about *nuditarsus:* "Breeding records at 6,000 ft. (= 1,920 m) in the Kaironk Valley of the Schrader Range (Bulmer, pers. comm.)."

The difference between *nuditarsus* and *papuensis* in the colour of the basal parts of the nape feathers is equal to that found between various subspecies of many species in *Collocalia*. Of the forms mentioned in this paper those with the most extensive development of white coloration on the proximal parts of nape and mantle feathers are *Collocalia esculenta spilogaster, C.spodiopygia delichon* and *C.vanikorensis coultasi*.

It is noteworthy that *C.nuditarsus* is so extremely similar to *C.brevirostris whiteheadi* from the remote Philippine Islands. It also has an unfeathered tarsus and dull black upper-parts of the same colour shade as in *nuditarsus;* also the wing-length is the same (134–136 mm). However, the under-parts of *whiteheadi* are paler, with a more brownish tinge and less conspicuous shaft-streaks.

Collocalia orientalis Mayr 1935

This Melanesian species is very similar to *nuditarsus,* with the tarsus unfeathered or only very thinly feathered, and of course having four toes. It differs strikingly from both *papuensis* and *nuditarsus* by having a pale band across the rump (Fig. 31). When it appears from this figure that *orientalis* has bigger proportions than the two New Guinea species, it is due to different skinning of the specimens. All the mensurable dimensions are very similar in all three species, but since no information of weight is available it is not possible to decide the question with certainty.

There are two subspecies of *orientalis*, both known only from their type specimen. It is probably a rare species, difficult to obtain, and is undoubtedly a mountain bird.

Collocalia orientalis leletensis Salomonsen.
Collocalia whiteheadi leletensis Salomonsen, 1962, Vidensk. Medd. fra Dansk Naturhist. Forening, vol. 125, p. 511 – Lelet Plateau, central New Ireland, Bismarck Islands, at 900 m altitude. (Type in ZMC examined.)

The upper-parts have a much stronger and darker bluish gloss than *nuditarsus* and *papuensis* and have a grey, contrasting band across the rump; there is a whitish supercilium as in the two other members of the superspecies; the under-parts are uniform sooty-grey as in *nuditarsus*. Tarsus unfeathered.

Measurements: Wing-length of an adult ♀ (type) 134 mm, the feathers being worn. Tail-length 52 mm, furcation 4 mm.

Range: The mountains of central New Ireland, known only from the type-locality.

Noona Dan Material: ♀ ad., Lemkamin (900 m altitude), Lelet Plateau, New Ireland, 10. April 1962, collector's nr. 1,380. Iris and bill black, legs dark brown.

Collocalia orientalis orientalis Mayr
Collocalia lowi orientalis Mayr, 1935, American Mus. Novit., no. 820, p. 3 – Guadalcanal Island, Solomon Islands. (Type in AMNH examined.)

Similar to *leletensis,* but differing by having a much broader, almost double as broad and slightly paler rump band; the colour of upper-parts exactly as in *nuditarsus,* without the dark, bluish gloss of *leletensis;* colour of under-parts as in *leletensis* and *nuditarsus*. Tarsus very thinly feathered.

Measurements: Wing-length of an adult ♀ (type) with the longest primaries growing 127 mm.

Range: Guadalcanal Island, Solomon Islands, known only from the type-locality.

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