

Species limits of the cave swiftlets (*Collocalia*) in Micronesia

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Abstract - Cave swiftlets (*Collocalia*) from the Mariana, Caroline, and Palau islands build different types of nests and differ morphologically from each other and from *C. vanikorensis*. Populations from the three respective island groups are here considered specifically distinct from *C. vanikorensis* and each represent the following separate species: *bartschi*, *inquieta*, and *pelewensis*.

Introduction

Cave swiftlets (*Collocalia*), a group of small swifts (Apodidae), breed on islands from the western Indian Ocean to the central Pacific and mainlands of southeastern Asia and Australia. Peters (1940) recognized three species of *Collocalia* from Micronesia. Medway (1975) considered the Micronesian taxa *bartschi* of the Mariana Islands, *inquieta*, *rukensis*, and *ponapensis* of the Caroline Islands, and *pelewensis* of Palau as subspecies of *Collocalia vanikorensis* on the basis of their similar nests and morphology. Most authors (e. g.: Pyle and Engbring 1985, Pratt *et al.* 1987) follow Medway

(1975). However, the types of nests of the taxa from Micronesia are not uniformly similar to *C. vanikorensis*. The taxa *bartschi*, *inquieta* (with *rukensis* and *ponapensis*), and *pelewensis* differ morphologically from one another and *C. vanikorensis*, and are here treated as separate species. Sibley and Monroe (1990), citing my personal communication, listed the same taxa as allospecies of *vanikorensis*. Use of the generic name *Collocalia* instead of *Areodramus*, a name widely in current use, follows Salomonsen (1983) and others (e. g., Marle and Voous 1988, Sibley and Monroe 1990). The ranges and type localities of the taxa discussed are summarized in Table 1.

Table 1. List of type localities (in parenthesis) and ranges of *Collocalia* in this paper.

<i>C. vanikorensis</i> ^a - Celebes, Moluccas, New Guinea to New Hebrides
<i>C. v. vanikorensis</i> (Island of Vanikoro) - New Hebrides
<i>C. v. waigeuensis</i> (Island of Waigeu) - Morotai and Halmahera in norther Moluccas, Misoöl, Waigeo, Batanta islands
<i>C. v. moluccurum</i> (Banda Island) - Banda IIs. in Moluccas, Ambon, Serem Laut Tajandu, and Kai islands
<i>C. v. pallens</i> (Dyaul Island) - Bismarck Archipelago
<i>C. v. lihirensis</i> (Lihir Island) - Hirberman and Nuguria islands
<i>C. salangana</i> ^b (Java) - Greater Sundas
<i>C. pelewensis</i> (Palau Islands) - Palau Islands
<i>C. inquieta inquieta</i> (Kusaie Island) - Caroline IIs., Kosrae I.
<i>C. i. rukens</i> (Ruk Island) - Truck I.
<i>C. i. ponapensis</i> (Ponapé) - (now) Pohnpei
<i>C. bartschi</i> (Guam) - Mariana IIs.; introduced in Hawaii ^c
<i>C. germani</i> ^d (Conchinchina) - coasts of Malay Peninsula, Borneo, Palawan

^a Sensus Solomonsen (1983)

^b *Collocalia (fuciphaga) fuciphaga* of Peters (1940; see Medway 1961). Considered specifically distinct from *C. vanikorensis* by Dickinson (1989).

^c American Ornithologists' Union (1983)

^d Subspecies of *C. fuciphaga* of Medway (1966); but see Solomonsen (1983) and Bruce, in White and Bruce (1986)

Table 2. Summary of the taxonomic history of the Micronesian *Collocalia*.

Source	<i>bartschi</i>	<i>inquieta</i>	<i>pelewensis</i>
Mayr (1937)	in <i>C. germani</i>	species	in <i>C. germani</i>
Peters (1940)	in <i>C. inexpectata</i> ^a	species	in <i>C. inexpectata</i>
Medway (1966)	in <i>C. vanikorensis</i>	species	in <i>C. vanikorensis</i>
Medway (1975)	in <i>C. vanikorensis</i>	in <i>C. vanikorensis</i>	in <i>C. vanikorensis</i>
Solomonsen (1983)	species	species	in <i>C. bartschi</i>
This study	species	species	species

^a *C. fuciphaga* of Medway (1966)

Taxonomic History

Classifications of *Collocalia* are summarized in Table 2. Earlier authors relied entirely on morphological characters. Mayr (1937:17-18) stated "it seems that the ... "races" (*pelewensis* and *bartschi*) "belong to (*C. germani* ... "and commented that *C. inquieta* and *C. vanikorensis* may be conspecific. Peters (1940:220) adapted "the best features of the various reviewers (cited therein) of the genus ..." Mayr (1945), Baker (1951), and Brandt (1966) followed Peters. Medway (1966, 1975) focused less on morphology and more on ecology and behavior, especially nest structure. Salomonsen (1983) relied on both morphology and nest types.

Methods

Standard measurements of wing chord, tail length, their ratios, and other information are from museum study skins unless otherwise stated. A dissecting scope was used for examining tarsi.

Results

Morphology

Medway (1966, 1975) characterized *C. vanikorensis* as 115-126 mm in wing chord, pale gray with dark shaft stripes ventrally and blackish brown dorsally with the concealed barbs (rami) on the back white in the *vanikorensis* group and black in the *salangana* group. The wing chord of *C. vanikorensis* (excluding the *salangana* group) actually ranges from 109 (*waigeuensis*) to 127 (*lihirensis*) (see Mayr 1937; Salomonsen 1983). Of 12 subspecies in *C. vanikorensis* only *waigeuensis* was characterized by Salomonsen (op cit.) as lacking dark shaft-streaks, and *pallens* as having a pale rump. However,

specimens of *waigeuensis* from Halmahera (USNM) have dark shaft streaks and *pallens* is also paler on the upper back than the other subspecies in *C. vanikorensis*. The tarsi of *C. vanikorensis* is usually bare but feathers are present in some populations and individuals.

Several morphological characters (Table 3) in *C. vanikorensis* and the taxa from Micronesia differ.

Collocalia bartschi (wing 100-108) is smaller and, based on its ratio of wing chord and length of tail, has a proportionally longer tail than subspecies in *C. vanikorensis*. The plumage of *C. bartschi* differs from *C. vanikorensis* in lacking dark ventral streaks and the supraloral spot is very small or lacking. The density of the feathers on the tibia adjacent to the tarsus is noticeably greater in *C. bartschi* than in the other Micronesian taxa and *C. vanikorensis*. Seven of 10 specimens of *C. bartschi* have bare tarsi; three have single feathers on the middle of one tarsus. The tarsi of *C. pelewensis*, *C. i. ponapensis*, and *C. i. rukensis* are bare (Mayr 1935; pers. obsv.). I found one specimen of nominate *inquieta* with a single feather on the inside of its tarsus. The wing chord in the Caroline Islands population (*C. inquieta*) varies (*rukensis*, 103-109; *ponapensis*, 96-119; *inquieta*, 110-120), but the tail is proportionally longer than in *C. pelewensis* and *C. vanikorensis*. Specimens of *C. inquieta* are darker throughout, with the supraloral spot smaller, the auricular region darker, and the throat less silvery than that of typical *C. vanikorensis*. *Collocalia pelewensis* differs from the other Micronesian taxa and *C. vanikorensis* by its pale rump (with darker back) and proportionally short tail. It also differs from *C. bartschi* in wing chord (107-113) and paler auricular region. The tail/wing ratio of *C. pelewensis* (mean, 0.44) does not overlap that of *C. bartschi* (0.48) or *C. inquieta* (0.49) and overlaps only slightly with that of nominate *vanikorensis* (0.46) (Table 3).

Table 3. Morphological characters of some Pacific Island species of *Collocalia*.

Character ^a	Species			
	<i>vanikorensis</i> ^b	<i>bartschi</i>	<i>inquieta</i>	<i>pelewensis</i>
feathers on tarsi	none	30%	2%	none
supraloral spot	1	3	2	3
pale auricular	2	2	3	3
pale throat	1	2	3 ^c	2
ventral streaks	1	3	2	2
dorsal sheen	1	3	2	2
tail/wing ratio	.45-.48	.47-.51	.47-.53	.41-.46
means±S.D.	.467±.009	.489±.018	.494±.012	.440±.018
number	19	12	46	6

^a 1 = obvious, 2 = less obvious, 3 = nearly or completely absent

^b Nominate subspecies

^c Some individuals of *ponapensis* have pale throats (Mayr 1935)

Statistical (Student t-test) differences between the means of the ratios are significant ($P < 0.05$) between *vanikorensis*, *pelewensis*, and between the similar means ($P > 0.05$) of *bartschi* and *inquieta*. Two subspecies in *C. vanikorensis* (*moluccurum* and *waiyuensis*) are similar to *C. pelewensis* in wing chord and relative tail length, but differ in plumage pattern and some individuals have feathers on the tarsi.

Type of nest

Medway's (1966) characterizations of the nests of the cave swiftlets were based mainly on the literature and nests in museum collections. He described the nest of *C. vanikorensis* as somewhat rounded, tending to be bracket-shaped, and composed of vegetable material held together with sparse to moderate amounts of "firm" (becomes hardened) mucilaginous nest-cement. He (Medway 1975) later described the nest of nominate *vanikorensis* as bound together with moist nest-cement, and stated that the same type of nest is built by *bartschi*, *inquieta*, *ponapensis*, and *rukensis*; Medway (1966) had earlier considered *C. pelewensis* as a subspecies of *C. vanikorensis* even though the nest was unknown. Based on the most recent classification of the types of nests (Medway and Pye 1977), the nest of *C. vanikorensis* is externally supported (attached to or supported by rock outcrops or cracks vs. self-supported) and consists of sparse amount (vs. moderate or copious) of moist (vs. hardened) nest-cement.

The nest of *C. bartschi*, characterized by Jenkins

(1983), is "composed of moss tightly held together and firmly secured to cave walls with copious amounts of hardened mucus-like saliva." He also stated that the nests were often cone-shaped, and high above the cave floor, adding that "cave ceilings appear to be the preferred sites." According to J. Reichel (pers. comm.), the nests in the Marianas are usually externally-supported, but occasionally are self-supported and contain sparse to copious amounts of nest-cement. A nest of *C. bartschi* in Hawaii, where the species was introduced from Guam in 1962 (see beyond), was composed of vegetable material consisting mostly of a liverwort (*Herbertia* sp.) and sparse nest-cement, and all of the nests observed were supported by niches in the cave walls (J. Engbring, pers. comm.).

The nests of members of the *inquieta* group may be externally or self-supported, and consist of sparse or copious nest-cement. For example, Medway (1966) cited Brandt's (1962) description of nests of *rukensis* as held together by copious amounts of cement and that the nests are both externally and self-supported. Brandt (1966) also characterized the nest of *rukensis* as "deeply cupped" and rarely consisting of moss, the nests of other members of *C. inquieta* as consisting mostly of moss held together with a minimal amount of nest-cement and with shallow cups. Brandt (1966:63) considered the nest of *ponapensis* as "distinctly different" from the other subspecies of *C. inquieta*, describing them as ranging from 6 to 16 cm in depth and "often (attached to) perpendicular cave

or crevasse walls". Nests of *C. pelewensis*, found in 1958, were described by Brandt (1966) as "very flat structures" with the cup lined with fine grass and moss that were attached on the high ceilings of caves.

Discussion

Medway and Pye (1977) summarized Medway's (1966) and some other data and characterized nests as self-supporting or externally-supported (attached to or supported by rock outcrops or cracks), round or bracket-shaped, whether nest-cement is "moist", "stickly", or "firm", and whether it is "copious" or "sparse" in amount. Some of the terminology used in the descriptions of the types of nests overlap in meaning and the texture and amount of nest-cement may also depend upon the dryness of the season (Tarburton 1988) as well as the age of the nest when described. Medway (1969:58) commented that the nest-cement of many members of *Collocalia* "hardens on exposure to the air ..." and Wells (1975) reported that the nest-cement of what he identified as *C. vanikorensis* became hard when removed from the cave. *C. spodiopygia* hardened with age but became soft with increases in humidity and surface moisture at the nest site.

Descriptions on nest support are also subject to interpretation; nests described as attached to the ceilings of caves (e. g., Jenkins 1983) implies that the nests are self-supported. However, Engbring (in litt.) stated that most nests of the swiftlet in Micronesia are externally-supported, and that the kind of support could be a function of environment rather than an indication of taxonomic affinity. I concur.

Nest shape, although a character in Medway (1966), was excluded for *C. vanikorensis* (sensu Medway 1975) and two other taxa of the 15 listed by Medway and Pye (1977). According to his earlier paper (Medway 1966) the nests are somewhat rounded but tending to be bracket-shaped in *C. vanikorensis*, are rounded in *C. bartschi*, and are "distinctly rounded, (and) suppressed bracket-shaped" to "more rounded" in *C. inquieta*. The shape of the nest of *C. bartschi* was based on two museum specimens, one (USNM) of which is presently too damaged to determine its shape. Brandt (1962), cited by Medway (1966), reported both bracket-shaped and rounded nests in *C. inquieta ponapensis*.

Salomonsen (1983) discussed briefly the variation of nest types among some species (sensu Medway) and similarity of nest types between different species. He concluded that, although information on the type of nest is useful, heavy reliance on nest type for classification of cave swiftlets should be used with

caution. I concur. The characters used in the descriptions of nests of *C. vanikorensis* (sensu Medway 1975) include conflicting data; not all populations assigned to *C. vanikorensis* have similar nests. Tarburton (1986) found variation in characters and incorrect localities reported by Medway (1966) of some nests of *C. spodiopygia*. Nests, including the amount of nest-cement, may vary geographically and probably individually in Micronesia. Until standardized and detailed data on nests and nest sites (e. g., humidity) are available I recommend identifying the Micronesian birds on the basis of their morphology.

Biological barriers between the geographically isolated Micronesian populations and *C. vanikorensis* (sensu Salomonsen 1983), if any, are unknown. However, the shared morphological characters of some of the Micronesian populations differ from one another and *C. vanikorensis* (Table 3). Because of these differences I follow Devillers (1977), Owen (1977), and Salomonsen (1983) in recognizing *C. inquieta* as a separate species. I reject the merger of *C. bartschi* with *pelewensis* as a subspecies (Salomonsen 1983) because of their morphological differences. *Collocalia bartschi* likewise differs from *C. vanikorensis*, and is more similar to *C. inquieta*.

Conclusions

The population status of *Collocalia* in Micronesia and Hawaii, based principally on the most current information is:

***Collocalia bartschi*.** Marshall (1949) reported the species as abundant on Saipan and Guam, and flocks on Tinian in mid-October 1945 but none there in mid-November. Breeding on Tinian is not documented. No birds were seen on there in 1976 (Pratt *et al.* 1979) and 1979 (Jenkins and Aguon 1981). Ralph and Sakai (1979) listed the species as common on Saipan. The species was considered abundant by Marshall (1949) and Hartin (1961), and common at one locality there in 1965 (Tubb 1966). Jenkins (1983) considered the population of Guam as one of the rarest native species. Pratt *et al.* (1987) listed swiftlets as uncommon on Tinian, Agiguan, and Saipan, extirpated from Rota, and nearly so on Guam. Birds from Guam were introduced to Oahu, Hawaii, in 1962 (Woodside 1970, Berger 1981). A dozen pairs nested in the central interior in Halava Valley, Oahu, Hawaii, in 1989 (Engbring, pers. comm.).

***Collocalia inquieta*.** Although not observed on Moen Island, Truk Atoll (Baker 1951), Brandt (1962) stated that "it is now one of the commoner birds, of the atoll and is widely distributed among the high islands". Ralph and Sakai (1979) listed the species as abundant

on Truk and common on Pohnpei. Population estimates in 1983-84 from unpublished data (J. Engbring *et al.*) are: Kosrae, 27,900; Pohnpei, 29,800; Truk, 25,800.

Peters (1945), Baker (1951) and others included Yap in the range of *C. inquieta ponapensis*. This is based on a sight record of an alleged small swift which Hartlaub and Finsch (1872:93) listed as "*Collocalia*, sp. but was reported as *C. "vanikorensis"* by Wigglesworth (1891:353). Pyle and Engbring (1985) reported that this is the only record of the cave swiftlet on Yap and doubt its authenticity.

Collocalia pelewensis. Marshall (1949) reported the species to be abundant. Pratt *et al.* (1987) reported absent on Angaur Island. The species is common to abundant on all larger islands from Babeldoab to Peleliu (Engbring 1988), including Ngerukewid (= Ngerukeuid) Islands wildlife Preserve (Wiles and Conry 1990).

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Riassunto - Le Collocalie delle isole Mariana, Caroline e Palau costruiscono differenti tipi di nido e differiscono morfologicamente tra di loro e da *Collocalia vanikorensis*. Le popolazioni delle tre isole sono dunque considerate buone specie, distinte da *C. vanikorensis* e denominate: *bartschi*, *inquieta* e *pelewensis*.

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