

## **Description of First Basic Plumage of Three Muscicapid Species Found in the Southeastern Sub-Himalayan Foothills, with Notes on Their Taxonomy and Ecology**

Authors: Renner, Swen C., Conservation Ecology Center, National Zoological Park, Smithsonian Institution, 1500 Remount Road, Front Royal, Virginia 22630, USA, and Rappole, John H., Conservation Ecology Center, National Zoological Park, Smithsonian Institution, 1500 Remount Road, Front Royal, Virginia 22630, USA

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## CHAPTER 7

### DESCRIPTION OF FIRST BASIC PLUMAGE OF THREE MUSCICAPID SPECIES FOUND IN THE SOUTHEASTERN SUB-HIMALAYAN FOOTHILLS, WITH NOTES ON THEIR TAXONOMY AND ECOLOGY

SWEN C. RENNER<sup>1,2,3</sup> AND JOHN H. RAPPOLE<sup>1</sup>

<sup>1</sup>Conservation Ecology Center, National Zoological Park, Smithsonian Institution, 1500 Remount Road, Front Royal, Virginia 22630, USA; and

<sup>2</sup>Institute of Experimental Ecology, University of Ulm, Albert-Einstein-Allee 11, 89069 Ulm, Germany

**ABSTRACT.**—Many species in Southeast Asia are hardly known in many aspects (biology, ecology, distribution, plumage characteristics), especially in the southeastern sub-Himalayan Mountains in the border region of Myanmar, China, northeast India, and Tibet. During a September 2005 survey of Naung Mung, Putao District, Kachin State, Northern Myanmar, we obtained specimens of three species evidently in first basic plumage, for which this plumage type was new, hardly known, or significantly different from that seen in specimens in collections or descriptions in the literature. After thorough examination, we identified these specimens as immature members of the following muscicapid species: White-tailed Robin (*Myiomela leucura*), including both a light and darker plumage type; Large Blue Flycatcher (*Cyornis magnirostris*); and Rufous-gorgeted Flycatcher (*Ficedula strophhiata*). We discuss some taxonomic and biological implications of our findings.

**Key words:** Burma, *Cyornis magnirostris*, *Ficedula strophhiata*, first basic plumage, immature, India, Myanmar, *Myiomela leucura*, Southeast Asia, taxonomy.

#### Descripción del Primer Plumaje Básico de Tres especies de Muscicapidae del Piedemonte Sub-Himalayo del Sudeste, con Notas sobre su Taxonomía y Ecología

**RESUMEN.**—Muchas especies del sudeste de Asia son muy poco conocidas en muchos aspectos (biología, ecología, distribución, características del plumaje), especialmente en la parte sudeste de las montañas sub-Himalayas cerca de las fronteras entre Birmania (Myanmar), China, el noreste de India y el Tibet. Durante un muestreo realizado en septiembre de 2005 en Naung Mung, en el distrito de Putao, estado de Kachin, norte de Birmania, obtuvimos especímenes de tres especies que se encontraban evidentemente en su primer plumaje básico, para las cuales ese tipo de plumaje era nuevo, poco conocido o significativamente diferente del conocido por especímenes de colecciones o por descripciones encontradas en la literatura. Después de un examen exhaustivo, identificamos a estos especímenes como miembro inmaduro de las siguientes especies de Muscicapidae: *Myiomela leucura*, incluyendo tanto un plumaje claro como uno más oscuro, *Cyornis magnirostris* y *Ficedula strophhiata*. Discutimos algunas implicaciones taxonómicas y biológicas de nuestros hallazgos.

THE HKAKABO RAZI National Park and its surroundings in northern Kachin State, Myanmar (the former Burma), is one of the most remote and inaccessible regions in the world; few biologists have had the chance to sample there (Rabinowitz et al. 1999, Rappole et al. 2005, Renner et al. 2007). Among the first and, for a long time, the only ones were Lord Cranbrook, R. Kaulback, F. Kingdon-Ward, B. C. Smythies, and G. Forrest, while they were collecting samples of plants, birds, and

<sup>3</sup>E-mail: [swen.renner@uni-ulm.de](mailto:swen.renner@uni-ulm.de)

mammals for the Vernay-Cutting expedition (Kingdon-Ward 1921, 1930, 1949; Stanford and Ticehurst 1935a, b, 1938a, b, c, d, 1939a, b; Ticehurst 1939; Stanford and Mayr 1940, 1941a, b, c, d; Chapters 2 and 6, present volume). All these collections were made mainly during the dryer non-breeding season (Chapters 2 and 6, present volume), when travel in the region is more feasible.

After a long period of war, revolution, and political turmoil during which travel to the region was restricted, Western and Myanmar ornithologists had the chance to visit the almost untouched primary forests of the Naung Mung area (Rappole et al. 2005, 2008; Renner et al. 2007, 2008; Chapter 2, present volume). During five intensive sampling trips to the region by our party, a new species was discovered (Rappole et al. 2005), and further undetermined taxa wait to be analyzed (compare Renner et al. 2008, 2009). Here, we describe first basic plumage characteristics of three muscicapid species on the basis of specimens collected during the postbreeding season (wet season), all of which are new or different from specimens in collections or descriptions in the literature. We analyze the systematic status of these three species—the White-tailed Robin (*Mylomela leucura*), including both a light and darker plumage type; the Large Blue Flycatcher (*Cyornis magnirostris*); and the Rufous-gorgeted Flycatcher (*Ficedula strophhiata*)—and add notes on their ecology and biology.

#### METHODS

We visited Naung Mung (for synonymies and localities, see Chapter 6, present volume) and the Hkakabo Razi National Park in February–March 2001, February 2004, September 2005, March 2006, and July 2006 (results of the latter visit are described in more detail in Chapter 5 of the present volume) to survey the bird community. All individuals captured were examined for obvious plumage differences from descriptions in field guides (Harington 1909; Smith 1943; King et al. 1995; Robson 2000, 2008; Smythies 2001; Rasmussen and Anderton 2005). We prepared specimens if any doubt about the taxonomy and systematics arose. Here, we focus on the September 2005 trip, because all specimens relevant here were derived from that trip (further results on the other trips are given in this volume, specifically by Rappole et al. in Chapter 2 and Rasmussen et al. in Chapter 5). All birds are in their first basic plumage

and just recently left the nest, most likely molting into their first prebasic plumage for the winter.

We spent most of our time mist netting in the vicinity of the township capital of Naung Mung, and at Nam Ti Rest House and Maza. We had a total of 25 mist nets, all 12 × 2.6 m and of different mesh sizes (20 at 30 mm, 3 at 26 mm, and 2 at 61 mm). Nets were set at five localities around the town of Naung Mung, one at the Rest Houses in Maza, and at two localities near Nam Ti Rest House. On most days, nets were opened (first net) at 0630 hours and closed at 1630 hours (closing first net). Individuals of species with samples of more than five specimens in our reference collection (National Museum of Natural History [NMNH], Smithsonian Institution) were released, except for those species for which we had questions concerning their taxonomy or some other aspect of their biology. Specimens were saved as study skins, whole bodies preserved in formalin, skeletons, and tissue samples. A photo was taken of at least every captured species, but most times from all captures.

All exported specimens were analyzed in comparison with specimens representing neighboring regions of India, China, Tibet, and Myanmar, in an attempt to determine the ornitho-geographic relationships of the southeastern Himalayan and sub-Himalayan region of extreme northern Myanmar (cf. Chapter 8, present volume).

We took several measurements from the specimens and compared the morphometrics with those from museum collections (for details and acronyms, see Acknowledgments). With a digital caliper, we measured the bill length from tip to operculum, bill width at operculum, wing length (unflattened) from tip to bow, tarsus, and inner- and outermost rectrix to the nearest of 0.5 mm (Table 1). Because we have only a small sample size for *Cyornis magnirostris*, any statistical test is not permitted here. For morphometric comparison between localities of *Ficedula strophhiata* we had enough samples from different localities to statistically compare morphometrics of pooled individuals. We compared the specimens descriptively by visual differences in plumage characteristics and bill shape otherwise.

The characteristics of six specimens from the September 2005 trip are examined in detail here; other results have been published elsewhere (Rappole et al. 2005, 2008; Renner et al. 2007, 2008; Chapter 2, present volume). We visually compared the plumage characteristics between

TABLE 1. Morphometrics of the studied juvenile specimens from Naung Mung (Kachin State). All measurements are in millimeters.

Field number	Taxon	Colortype <sup>a</sup>	Sex	Bill length	Bill width	Bill height	Wing	Inner rectrix	Outer rectrix	Tarsus
2005-006	<i>Cyornis magnirostris</i>	n/a	F	12.8	6.8	4.5	76.9	56.2	56.2	18.6
2005-005	<i>Ficedula strophilata</i>	n/a	F	7.1	4.2	3.5	54.1	47.3	44.7	17.7
2005-004	<i>Myiomeles leucura</i>	Light	F	13.2	5.5	4.5	8.5	56.0	56.4	28.8
2005-024	<i>M. leucura</i>	Light	F	11.5	5.2	4.9	85.9	56.2	57.9	27.5
2005-026	<i>M. leucura</i>	Dark	M	11.3	5.2	4.4	90.4	62.3	60.2	29.5
2005-032	<i>M. leucura</i>	Dark	F	10.0	5.0	4.0	m <sup>b</sup>	m <sup>b</sup>	m <sup>b</sup>	26.7

<sup>a</sup>Light = lighter-colored plumage, dark = darker-colored plumage (see text).

<sup>b</sup>m = feather in molt and not measured.

the specimens in question and collection material from the NMNH.

## RESULTS

During our September 2005 trip we captured six specimens with plumage characteristics that were different from existing descriptions in the literature (Harington 1909; Smith 1943; King et al. 1995; Robson 2000, 2008; Smythies 2001; Rasmussen and Anderton 2005) or lacking completely. Fortunately, we could compare the specimens directly with existing material. All specimens were aged on the basis of skull pneumatization. On the basis of the plumage characterization and measurements (Table 1) as well as structural features, we assigned the six specimens to the following taxa.

*Specimen 2005-006*.—This specimen was identified as a female (gonads) *Cyornis magnirostris* on the basis of the general plumage features of females of the species as described by Renner et al. (2009). Specimen 2005-006 exhibits typical first basic plumage of *Cyornis* spp. (Fig. 1). The dorsal plumage is somewhat more colorful than that of adult females of the closely related *C. banyumas whitei* and have more brownish mottled plumage. The ventral parts from chin to abdomen are whitish with gray mottled parts and exhibit a darker grayish throat. The cinnamon chin to throat is just initially developed and looks rather unfinished or “dirty” compared with those of other females of several *Cyornis* taxa (Fig. 1). The bill shape is similar to those of female *C. banyumas*. The specimen exhibits grayish-tinged feathering throughout, typical of almost all immature *Cyornis* species. P. C. Rasmussen (pers. comm.) confirmed the species identification. Final species assignment must await genetic analysis, because all first basic plumages of the closely related *Cyornis* spp. are very difficult to distinguish and poorly known.

Several other taxa of similar size among the blue flycatchers of Southeast Asia (*Cyornis*, *Ficedula*, *Muscicapa*, and *Niltava*) have quite similar plumage pattern and characteristics. However, the measurements of specimen 2005-006 are comparable to those of all *C. magnirostris* museum specimens, so we tentatively identify the bird as *C. magnirostris*. It is the first specimen of an immature individual in first basic plumage for this species of which we are aware; all other immature specimens have been assigned to *C. banyumas*. *Cyornis banyumas* is sympatric with *C. magnirostris* in northern Myanmar (Renner et al. 2009).

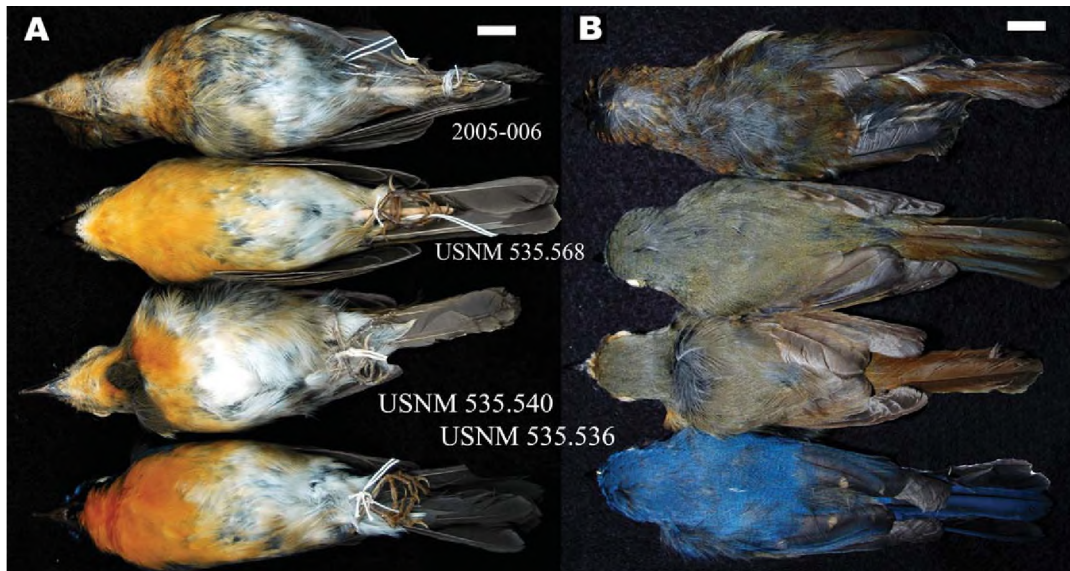


FIG. 1. Specimen 2005-006. (A) Ventral and (B) dorsal views of immature female *Cyornis magnirostris* (top). *Cyornis banyumas whitei* USNM 535.568 (female, Doi Inthanon, Chiang Mai region, north Thailand), USNM 535.540 (female, Chieng Saen, Chiang Rai region, north Thailand), and USNM 535.536 (male, Doi Inthanon, Chiang Mai region, north Thailand) are included for comparison because no first basic plumage of *C. magnirostris* is available. Scale (white bar) = 10.0 mm. (Photographs by S. C. Renner.)

*Specimen 2005-005*.—This specimen was identified as an immature *Ficedula strophiate* in first basic plumage. The gonads of the specimen establish the individual as female. The plumage (Fig. 2) is relatively dark as compared with immature specimens of this species in the NMNH bird collection. Although the dorsal view is the same as that of other first-year *F. strophiate* (Fig. 2), the ventral parts lack almost all the buff-and-whitish mottled parts that are present on the known first-year specimens from collections. In addition, the wing coverts of specimen 2005-005 lack the brownish parts and are all dark sepia-colored.

*Specimens 2005-004, 2005-024, 2005-026, and 2005-032*.—The remaining four specimens are all of one species, *Myiomela leucura*, but had two different plumage types: a lighter type with brighter-colored dots and a darker type generally less colorful or duller. The two lighter-colored specimens were both females (2005-004 and 2005-024), but the two darker specimens most likely represent one female (2005-032) and one male (2005-026) (Fig. 3). However, all could be assigned to *M. leucura*. The lighter plumage type was known from the NMNH collection, but the dark form is new and has not been described so far in the literature (Harington 1909; Stanford

and Ticehurst 1935a, b, 1938a, b, c, d, 1939a, b; Ticehurst 1939; Stanford and Mayr 1940, 1941a, b, c, d; Smythies 1953, 2001; King et al. 1995; Robson 2000, 2008; Rasmussen and Anderton 2005). We did not find specimens representing this plumage type in any other collection.

#### DISCUSSION

The Hkakabo Razi region is of high conservation value (Rabinowitz et al. 1999, Rabinowitz 2003, Renner et al. 2007) as well as being of considerable ornithogeographic interest, although hardly explored. There have been few expeditions to the region exploring biodiversity in general or birds in particular. As a consequence of the remoteness and limited access, recent expeditions have yielded several new vertebrate taxa, including one new bird species, the Naung Mung Scimitar-Babbler (*Jabouilleia naungmungensis*; Rappole et al. 2005), one new avian subspecies (*Tesia olivacea chiangmaiensis*; Renner et al. 2008), and several taxa whose status is under review (e.g., *C. magnirostris*; cf. Renner et al. 2009).

*Specimen 2005-006*.—*Cyornis magnirostris* has frequently been confused and merged with other taxa. Names for the taxon reflect this confusion,

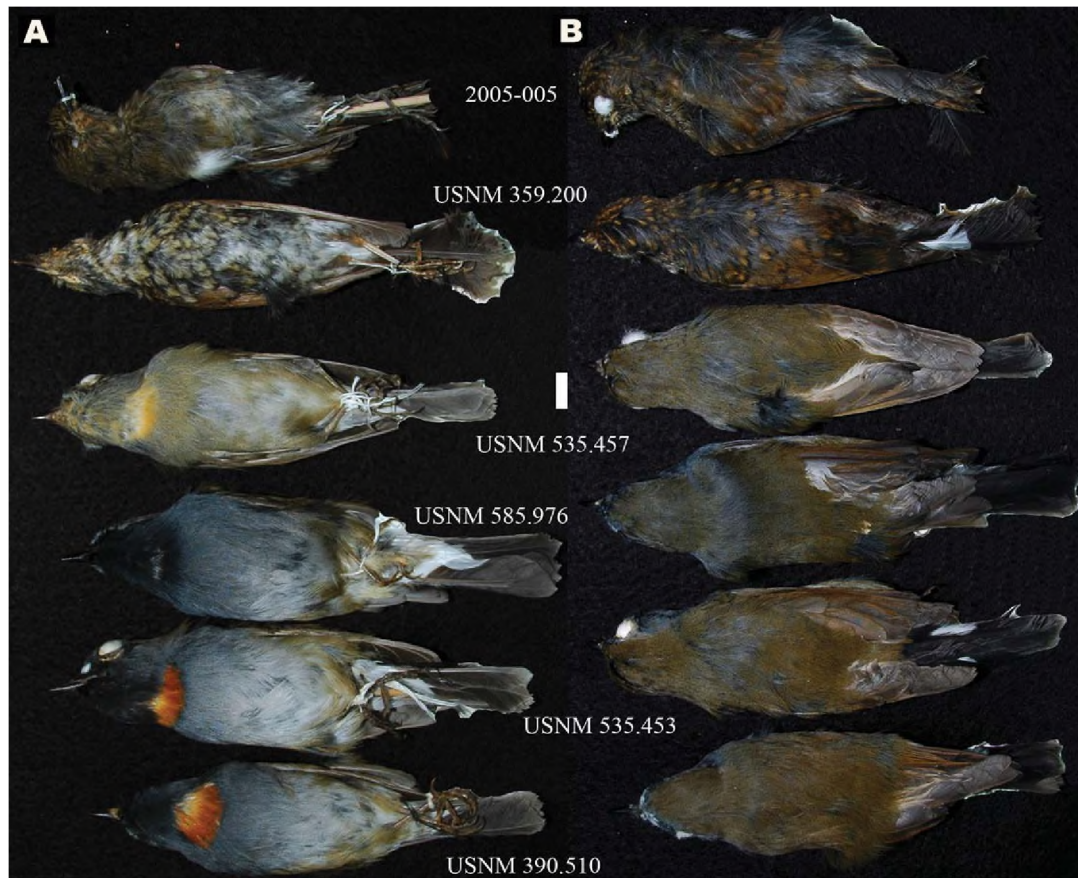


FIG. 2. Specimen 2005–005. (A) Ventral and (B) dorsal views of immature female *Ficedula strophilata* (top). Included for comparison are USNM 359.200 (male, Langbian Peaks, Annam, southwest Vietnam), USNM 535.457 (female, Doi Pha Hom Pok, Chiang Mai region, north Thailand), USNM 585.976 (male, Noa Dining River, Arunachal Pradesh, northeast India), USNM 535.453 (male, Doi Pha Hom Pok, Chiang Mai region, north Thailand), and USNM 390.510 (male, Mishmi Hills, northeast Assam, northeast India). Scale (white bar) = 10.0 mm. (Photographs by S. C. Renner.)

including but not limited to *C. banyumas magnirostris* and *C. banyumas*, as well as all of these combinations under the generic names *Muscicapa*, *Niltava*, and *Ficedula* (Rasmussen and Anderton 2005, Renner et al. 2009).

The breeding grounds extend from the Hkakabo Razi region toward the Himalayan slopes of Sikkim and probably also through all Assam as well as Arunachal Pradesh, northeast India (February–March) in mid-elevations. *Cyornis magnirostris* winters in Tenasserim and the northern Thai–Malay Peninsula (for details on breeding range, see Renner et al. 2009). We did not capture any adults during the late migration period. However, we captured several individuals in and around Naung Mung at the end

of the breeding season (September) migrating south to the wintering grounds on Thai–Malay Peninsula. The species most likely occurs at the eastern edge of the breeding range in northern Myanmar (Renner et al. 2009), but further occurrence is unknown. We have not observed any breeding *magnirostris* in Kachin State, but we hypothesize that the species is breeding in the western and northern forests in specific habitats, such as in Hponkan Razi and the lower slopes of the higher peaks that are found in Hkakabo Razi National Park. Rasmussen et al. (Chapter 5, present volume) postulates breeding *magnirostris* in the Naung Mung area.

The typical habitat of *C. magnirostris* is dense forest undergrowth, thickets, and bamboo in the

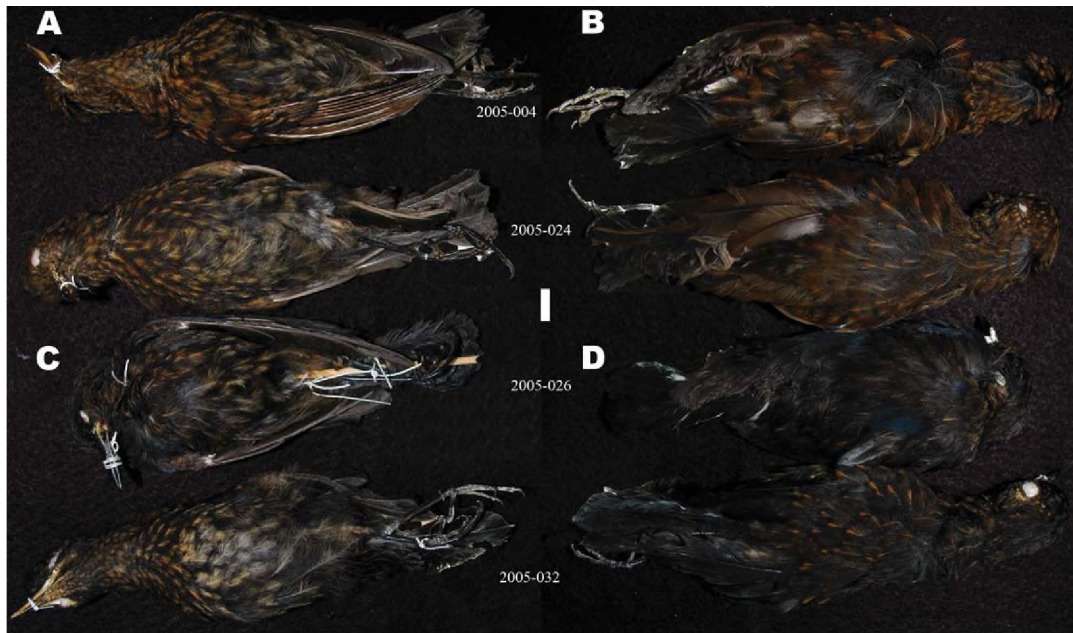


FIG. 3. (A) Ventral and (B) dorsal views of immature specimens 2005-004 (top) and 2005-024, both female *Myiomela leucura* with immature light plumage color type. (C) Ventral and (D) dorsal views of immature male (2005-026, top) and female (2005-032) *Myiomela leucura* with immature dark plumage color type. All specimens were captured near Naung Mung, Putao District, northern Kachin State, Myanmar. Scale (white bar) = 10.0 mm. (Photographs by S. C. Renner.)

Himalayan foothills of northeast India (confirmed occurrence in lower elevations of Sikkim, also to be expected in Assam and Arunachal Pradesh) and northern Myanmar, and lowland forests as wintering grounds in southern Myanmar and southwest Thailand.

The blue flycatchers of the Oriental Region comprise a speciose assemblage of taxa that are very similar, despite having brilliantly plumaged males, and their taxonomy has long vexed systematists (e.g., Rothschild 1926). Stresemann (1925, Stresemann and Meyer de Schauensee 1936) first identified *C. magnirostris* as a race of *C. banyumas* under the supposition that it was entirely allopatric from other populations of this taxon. Stresemann's (1925) treatment of *magnirostris* within *banyumas* has been unanimously followed until very recently. Rasmussen and Anderton (2005) considered *magnirostris* a full species, primarily on the basis of its distinctive morphology, especially in comparison with *C. banyumas whitei*, the form geographically nearest to it, which Stresemann (1925) also placed within *C. banyumas*. The highly migratory habit of *magnirostris* contrasts

strikingly with the resident status of *whitei* and strongly recommends, along with other aspects of the biology and morphometrics, recognition of the species-level status of *magnirostris*.

*Specimen 2005-005.*—*Ficedula strophiiata* (Hodgson, 1837) is a common resident throughout northern Kachin State in the hilly and well-forested areas, especially the temperate forests of the north below the timberline (~4,000 m). We captured many adult birds in Pangnamdim, Wangsewang, Nagwa, Tazaku, and Naung Mung (localities NM/01-1 and NM/04-1; for further details on localities, see Chapter 6, present volume). Elsewhere in its range, the species moves seasonally to 2,440–4,000 m in Nepal (Diesselhorst 1968, Inskipp and Inskipp 1991) but is nowadays rare above 2,000 m (Martens and Eck 1995). *Ficedula strophiiata* winters in Thailand, North Laos, and Vietnam, and its breeding range is in the Himalayas (northeast India; Nepal; Bhutan; southeast Tibet; central and south China, mainly west Yunnan; western and northern Myanmar in March to June). Its preferred habitat is generally forest and forest edge in boreal mountains in elevations

between 1,500 and 3,650 m, mostly below 3,000 m, in winter down to 900 m (Martens and Eck 1995). *Ficedula strophhiata* is an abundant species in *Rhododendron-Quercus-Abies* forests of Nepal (Diesselhorst 1968, Inskipp and Inskipp 1991, Martens and Eck 1995, Robson 2000, Rasmussen and Anderton 2005). We captured few birds in similar high-altitude habitats; we found most individuals below elevations of 500 to 1,000 m in temperate forests (Chapter 2, present volume).

Morphometric measurements of specimens from the British Museum of Natural History (Tring, United Kingdom) revealed significant differences in pooled *F. strophhiata* from Hkakabo Razi (Table 2). Although feather characteristics (inner- and outermost rectrices, wing) did not differ significantly, the pooled individuals from Thailand (Table 2) had significantly differing bill length and tarsi (analysis of variance,  $P \geq 0.05$ ). The described subspecies *fuscogularis* (Vietnam) did not differ in morphometrics from all other pools and, hence, should be neglected. We recommend that all subspecies be revised, using further characters beyond measurements and plumage; the Thailand birds should be treated as a distinguishable subspecies, and the remaining range should be considered the nominate subspecies. Robson (2000) discusses *F. s. fuscogularis* as having warmer upper parts. This subspecies occurs in south Annam (Vietnam). Although we cannot confirm these color findings with the available material in the NMNH, we confirm morphometric differences of this subspecies (see above). Rasmussen and Anderton (2005) noted that individuals—probably referring to *fuscogularis*—are much darker overall in the south Assam hills than in west Himalayan 'euphonia.'

The analysis of geographic patterns of sexes is somewhat complicated in *F. strophhiata*. All relevant field guides and references (Ripley 1961; Diesselhorst 1968; King et al. 1975, 1995; Tso-Hsin 1987; Inskipp and Inskipp 1991; Martens and Eck 1995; Robson 2000; Penhallurick 2005; Rasmussen and Anderton 2005) generally apply the scheme that males have a dark cinnamon to rufous—nevertheless sometimes lacking—throat patch and plumbeous to dark gray overall plumage. Females are considered to have less bright colors and an overall grayer-to-brown color. In addition, they are considered to have a whitish throat patch, if any. Immatures are clearly distinctive by cinnamon drops on a dark brown plumage. While examining adult specimens from the Hkakabo

Razi region (one male and one female in plumage characteristics but with gonads, indicating female) variation in the sex-plumage characteristics emerged: at least one specimen considered male from plumage characteristics was a female. When we compared the data at the collections (NMNH, AMNH, and ANSP), further details indeed indicated sex-dimorphism to some degree for the southern population (Annam, Vietnam). In the northern part of the range (i.e., China, North India, Nepal), only male specimens in plumage have been recorded so far (Table 2). Their plumage was partly erroneously interpreted as that of males, although they were indeed females.

*Specimens 2005-004, -024, -026, and -032.*—*Myiomela leucura* (Hodgson, 1845), sometimes also considered to be part of different genera (e.g., *Cinclidium* or *Notodela*), has a range that extends from northeastern India, Nepal, Bhutan, Bangladesh, south and central China, Taiwan, Thailand, and Laos to North Vietnam (Ripley 1961; King et al. 1975, 1995; Tso-Hsin 1987; Robson 2000; Penhallurick 2005; Rasmussen and Anderton 2005). Individuals breed in dense undergrowth between 1,050 and 2,450 m and migrate to lowlands in winter. We found the bird in undergrowth of dense, broad-leaved riparian forests and also in second growth close to rivers.

Although adults have no visible plumage variation, immatures exhibit at least two types: a light version and a rather dark form. Given that we found both types within the same locality and representing both sexes, the differences are most likely of an individual nature. The types revealed no geographic pattern, and the specimens did not exhibit sex dimorphism.

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TABLE 2. Measurements of *Ficedula strophhiata* subspecies (NMNH and AMNH specimens only). Elevation is in meters above sea level; all measurements are in millimeters (d = feature defect or bill ajar and consequently not measured).

Sex	Elevation	Location	Country	Bill length	Bill width	Bill height	Wing	Inner rectrix	Outer rectrix	Tarsus	Group ANOVA
<i>strophhiata fuscogularis</i>											
M	—	Pic de Langbian, south Annam	Vietnam	9.4	5.2	3.3	72.0	57.8	54.8	20.0	2
M	2,362	Pic de Langbian, south Annam	Vietnam	11.3	4.3	3.3	72.6	54.9	57.7	21.7	2
F	2,034	Pic de Langbian, south Annam	Vietnam	11.4	4.1	2.9	68.3	49.6	48.7	19.8	2
F	2,362	Pic de Langbian, south Annam	Vietnam	12.3	5.8	3.2	68.0	52.1	53.7	19.8	2
<i>strophhiata strophhiata</i>											
M	1,050	Htingnam	Northern Myanmar	11.9	4.2	3.1	72.9	57.8	60.7	21.0	1
M	1,968	Adung valley	Northern Myanmar	9.3	4.3	3.1	76.1	56.6	55.6	21.1	1
—	328	Near Hkamo, Putao-Myitkyina Road	Northern Myanmar	8.9	4.6	d	71.9	54.3	53.4	18.7	1
M	1,312	Near Hkamo, Putao-Myitkyina Road	Northern Myanmar	11.6	4.6	3.3	67.4	52.5	53.2	21.1	1
M	820	Hkasang, Sadon-Sima Road, Myitkyina	Northern Myanmar	12.1	4.1	3.2	71.3	55.4	55.8	22.8	1
M	1,509	Mali valley	Northern Myanmar	11.8	3.9	3.0	71.0	58.5	57.7	21.2	1
F	—	Mooleyit	Myanmar	9.0	3.0	d	67.2	54.9	55.7	18.5	1
M	1,640	Hkasang, Sadon-Sima Road, Myitkyina	Northern Myanmar	12.4	d	2.8	73.9	58.0	57.5	18.5	1
M	1,312	“Black Rock” Myitkyina-Hpunian Road	Northern Myanmar	8.3	3.7	d	74.5	60.8	62.6	21.3	1
M	1,115	Mogok, Khata Ditric	Myanmar	9.9	4.5	3.1	73.9	57.5	58.6	19.9	1
M	3,280	Tsari Chu, Yarap, Assam	India	10.9	5.8	3.0	71.3	53.9	53.9	21.5	3
M	3,444	Tsungpo valley	Southeast Tibet	d	4.3	3.1	73.1	58.1	59.3	21.3	3
M	3,444	Tsungpo valley	Southeast Tibet	12.5	5.4	2.8	76.0	58.8	55.9	19.6	3
M	—	Chang Tang	Tibet	12.1	4.1	2.8	73.2	55.7	55.7	21.7	3
M	3,772	Lho La Chu, Molo	Southeast Tibet	12.1	6.3	3.2	73.7	57.6	58.5	20.0	3
F	4,100	Mapo	South Tibet	11.4	5.0	3.5	66.0	50.9	50.3	17.9	3
F	—	Jamila	South Tibet	11.6	4.2	2.9	71.2	59.0	58.5	19.9	3
F	1,312	Longong Chu valley, Molo	Southeast Tibet	11.4	5.0	3.1	67.1	51.5	50.6	19.0	3
M	—	Shillong, Assam	Northeast India	9.8	4.4	2.7	72.8	53.9	50.8	20.4	3
M	3,444	Sanqka, Tsungpo valley	Southeast Tibet	11.2	4.2	3.0	70.9	55.6	53.9	22.7	3
M	—	Shillong, Assam	Northeast India	12.1	3.5	2.6	71.9	56.0	56.6	21.1	3
M	—	Shillong, Assam	Northeast India	d	d	d	75.2	60.6	57.1	d	3
M	—	Shillong, Assam	Northeast India	11.9	4.1	2.8	74.1	55.0	55.6	21.7	3

(continued)

TABLE 2. Continued.

Sex	Elevation	Location	Country	Bill length	Bill width	Bill height	Wing	Inner rectrix	Outer rectrix	Tarsus	Group ANOVA
M	3,608	Li Chiang Range; northwest Yunnan	Southwest China	10.2	4.3	3.2	76.7	57.8	57.7	19.0	4
M	3,280	Washan, Yunnan	Southwest China	10.0	4.1	3.0	73.5	55.2	57.4	18.2	4
M	3,280	Li Chiang Range; northwest Yunnan	Southwest China	10.5	4.1	3.1	73.8	55.8	54.0	18.0	4
M	3,280	Li Chiang Range; northwest Yunnan	Southwest China	10.0	4.3	3.1	74.7	55.5	57.5	19.5	4
M	3,280	Li Chiang Range; northwest Yunnan	Southwest China	9.8	4.5	3.3	70.6	57.0	57.3	19.4	4
M	—	Li Chiang Range; northwest Yunnan	Southwest China	9.6	3.5	2.9	71.2	53.1	54.5	18.9	4
M	—	Megtze, Yunnan	Southwest China	10.2	4.5	3.1	73.6	56.5	58.1	18.3	4
M	1,150	Ranmagra Camp, Noa Ding River, Arunachal Pradesh	Northeast India	10.2	4.3	3.4	75.9	59.3	61.0	21.5	3
M	2,231	Doi Pha Hom Pok, Chiang Mai	North Thailand	10.2	4.1	3.0	74.7	57.5	58.3	19.9	5
M	2,034	Doi Pha Hom Pok, Chiang Mai	North Thailand	7.6	2.8	3.2	72.5	55.3	57.0	18.2	5
M	2,034	Doi Pha Hom Pok, Chiang Mai	North Thailand	8.4	4.2	3.1	74.4	57.4	57.5	20.1	5
M	2,034	Doi Pha Hom Pok, Chiang Mai	North Thailand	7.2	4.0	3.4	73.0	57.6	55.8	21.0	5
F	2,231	Doi Pha Hom Pok, Chiang Mai	North Thailand	7.7	4.5	3.1	73.1	57.6	56.8	19.1	5
M	1,530	Doi Pui, Muang District, West of Chiang Mai	North Thailand	8.7	4.4	3.0	73.3	56.3	54.9	21.2	5
M	1,150	Ranmagra Camp, Noa Ding River, Arunachal Pradesh	Northeast India	8.1	4.6	3.4	71.6	52.0	52.8	19.6	3
M	1,150	Ranmagra Camp, Noa Ding River, Arunachal Pradesh	Northeast India	9.7	4.2	3.2	72.2	52.8	54.6	19.3	3
M	1,150	Ranmagra Camp, Noa Ding River, Arunachal Pradesh	Northeast India	8.8	4.2	3.3	75.6	59.3	59.2	19.1	3
M	1,150	Ranmagra Camp, Noa Ding River, Arunachal Pradesh	Northeast India	7.5	3.4	3.2	73.4	57.4	58.1	21.3	3
M	1,968	Denyi, Mishmi Hills, northeast Assam	Northeast India	7.2	3.7	3.8	67.7	51.6	50.5	21.9	3

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