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NOTES ON SOME ASIATIC NUTHATCHES AND CREEPERS¹

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INTRODUCTION

This paper is a report on the nuthatches and creepers collected by Dr. Koelz in Iran, Afghanistan, and India. It includes specimens from a new region of India, the Khasia Hills, not covered by the first four papers in this subseries. This new collection has been received recently from Dr. Koelz.

In the list of specimens the term immature (imm.) indicates specimens in juvenal plumage, and the term subadult (subad.) specimens in first winter plumage, or juvenal specimens in which the moult into first winter plumage is far advanced.

Dr. Ernst Mayr has, as usual, given me the benefit of his friendly guidance, and I have also received suggestions and help from Messrs. Jean Delacour and Dean Amadon. I thank them with much pleasure.

SITTIDAE

SUBFAMILY SITTINAE

I am placing the true nuthatches and the Wall Creeper (*Tichodroma*) in the same family (Sittidae), dividing it into the subfamilies Sittinae and Tichodromadinae. The latter is usually included in the family Certhiidae, but *Tichodroma* in the appearance and texture of its entire plumage including the shape and pattern of its tail appears to be closer to the nuthatches than it is to the true creepers. In habits also it is close to the rock nut-

¹ Notes from the Walter Koelz Collections, Number 6. The previous papers in this subseries are: 1949, American Museum Novitates, nos. 1406, 1424, 1425; 1950, *ibid.*, no. 1459; 1950, Jour. Bombay Nat. Hist. Soc., vol. 49.

hatches. As Hellmayr states (1911, *in* Wytsman, *Genera avium*, pt. 16, p. 2), it is difficult to draw a line between the Sittidae and Certhiidae, *Tichodroma* being decidedly intermediate. Hellmayr places *Tichodroma* in the Certhiidae; however, externally at any rate, about the only thing it has in common with the latter is the shape of the bill, a character which seems to be purely adaptive.

Sitta europaea rubiginosa Tschusi and Zarudny

IRAN: Mazenderan (region of Gurgan): Gozlu, July 15-16, 1940, 1 subad. ♂, 2 subad. ♀; Dimalu, July 22-23, 1 ad. ♂, 3 subad. ♂, 2 subad. ♀; Kherat, July 25, 1 subad. ♂, September 30-October 1, 2 ad. ♂, 1 ad. ♀. Khorasan: Kotaliyekchinar, August 3-4, 1 ad. ♂, 1 unsexed subad.

Sitta europaea persica Witherby

IRAN: Luristan: Kalvar, May 27-28, 1940, 2 imm. ♂, 1 imm. ♀; Durud, October 21, 1941, 1 subad. ♂. Bakhtiari: Pashmshurun, April 30-May 9, 1940, 3 imm. ♂, 2 imm. ♀; Damavar, May 3-6, 3 ad. ♂, 1 imm. ♂, 1 ad. ♀; Belu, May 8, 1 ad. ♂; Baraftab, January 30, 1941, 1 ad. ♀; Ti, February 2-12, 4 ad. ♂, 2 subad. ♂, 3 subad. ♀, 1 unsexed ad., June 6, 1940, 1 ad. ♂; Imarat, February 14-20, 1941, 6 ad. ♂, 1 ad. ♀? [♂], 3 ad. ♀. Fars: Dastarjin, April 9, 1940, 3 ad. ♂, 1 ad. ♀.

The differences between the two Iranian populations are well marked: the population (*rubiginosa*) from northern Iran (Gurgan and Khorasan) is larger, with longer wing and bill, the bill being considerably thicker, more massive, and the plumage above and below very distinctly darker than in the population (*persica*) from the Zagros and Fars.

As noted by Stresemann (1928, *Jour. Ornith.*, vol. 76, p. 365), the northern population is very similar to the population of *caesia* from central Germany. My specimens of *rubiginosa* differ from a long series of *caesia* from central Europe (Hesse, Switzerland, Austria) almost solely in the shape of the bill which in *rubiginosa* is thicker, less compressed laterally. My specimens from the region of Gurgan (topotypical) and Khorasan fail to show the small color differences cited by Stresemann but, on an average, are slightly paler below and the rust is clearer than in *caesia*.

A series from the Caucasus (*caucasica*) is distinctly darker below than *rubiginosa*, and darker above and much darker below than *persica*. A lone specimen in comparative plumage of *levantina* from Eregli, Asia Minor, is paler above than *rubiginosa*; below, this specimen is like *rubiginosa*, slightly paler than *caucasica*, and distinctly darker than *persica*. In *caesia* and *rubi-*

TABLE 1
GEOGRAPHICAL VARIATION IN SOME RACES OF *Sitta europaea*

Race and Region	N	Wing	Bill	Coloration	Frontal Band and Superciliary Stripe
A <i>caesia</i> central Europe	10 ♂ 9 ♀	85-89 (86.85) 83-88 (85.70)	Long, more compressed laterally and more pointed than B	—	Lacking
B <i>rubiginosa</i> Gurgan, Khorasani	4 ♂ 1 ♀	86-89 (87.50) 89	Long, thicker	Perhaps very slightly darker and duller above; slightly paler below, clearer than A	Of five adults: present in one, faint trace in another
C <i>caucasica</i> Wladikawkas	4 ♂ 2 ♀	86-87 (86.25) 84, 85	Short, thick as in <i>rubiginosa</i>	Darker below than A and B	Present
D <i>levantina</i> Eregli, Asia Minor	1 ♂ 1 ♀	84.5 86	Short, more compressed laterally and more pointed than in <i>caucasica</i>	Above, slightly paler than A, B, and C; below like B	Present
E <i>persica</i> Zagros and Fars	17 ♂ 6 ♀	82-87 (84.50) 79-85 (82.10)	Short, pointed and thinnest	Palest above and below	Present

Individual bill lengths of the specimens in table 1: A, *caesia*: males, 20.5, 21, 21, 21.5, 21.8, 22, 22, 22.3, 22.5, 23; females, 20, 20.5, 21.3, 21.5, 22, 22, 22, 22. B, *rubiginosa*: males, 22, 22, 23, 23.5; female, 23.5. C, *caucasica*: males, 20, 20, 20.2, 20.5; females, 18.5, 19.5. D, *levantina*: male, 19.5; female, 21.5, unsexed, 20. E, *persica*: males, 19.5, 19.5, 19.8, 20, 20, 20.2, 20.5, 20.5, 20.5, 21, 21, 21, 21, 21.5; females, 19.5, 20, 20, 20.5, 21.

ginosa the bill is long; it is shorter in *caucasica*, *levantina*, and *persica*, averaging thinnest in the latter.

The geographical variation is best visualized in tabular form (table 1). The white frontal band and superciliary stripe when present is poorly marked at best. The bill is measured from the skull; the individual measurements are given below the table.

MOULT: The moult in *rubiginosa* and *persica* seems to start towards the end of May. Adult specimens from the early part of this month are extremely worn but show no signs of moult, the first moulting adult being a male taken on June 6 at Ti in Bakhtiari. The moult may be over by early August, for it is just about completed in two specimens taken on August 3-4 in Khorasan. The partial postjuvinal moult takes place at the same time as the complete moult of the adult. When the specimens are not worn, first winter birds can be distinguished from adults by the color of their wing quills which are browner, less dark.

THE INDIAN RACES OF *Sitta europaea*

Meinertzhagen (1927, *Ibis*, p. 410) and Deignan (1945, *Bull. U. S. Natl. Mus.*, no. 186, p. 317) have treated *S. cashmirensis* and the chestnut-bellied nuthatches (*S. castanea* and its allies) as races of *S. europaea*. All these forms are strict geographical representatives, and in my region, furthermore, the intermediate and geographically intervening *cashmirensis* is the link that connects the heavily saturated and sexually dimorphic races of the *castanea* type to the paler races of the *europaea* type in which the sexes are alike. In *cashmirensis* the male is darker below than the female, but the sexual difference is very far from being as marked as in the races of the *castanea* type, and female *cashmirensis* is very similar to female *europaea* (subspecies *caesia* and *rubiginosa*).

The chestnut-bellied nuthatches have been reviewed, under the specific name of *S. castanea*, by Whistler and Kinnear (1932, *Jour. Bombay Nat. Hist. Soc.*, vol. 35, p. 522) who recognize four races: *almorae* Whistler, 1930 (type locality, Ramganga Valley between Almora and Pethora), for the population of the western Himalayas; *cinnamoventris* Blyth, 1842 (type locality, Darjeeling), for the populations of "Nepal and eastern Himalayas to Assam"; *castanea* Lesson, 1830 (type locality, Bengal), for the birds of "India"; the authors separating from the last the population of the upper Eastern Ghats as *prateri* Kinnear and Whistler, 1932 (type locality, Vizagapatana district).

I find that the population of northeastern Assam from Margherita and the Patkai Hills constitutes an undescribed race, which I propose to name

***Sitta europaea koelzi*, new subspecies**

TYPE: A.M.N.H. No. 683925; Rothschild Collection; adult female; Patkai Hills, Assam-Burma border; September 2, 1888; Ernst Hartert, collector.

SUBSPECIFIC CHARACTERS: The adult female differs from the adult females of the races listed above, and from the adult female of *neglecta* from Burma, by the much richer cinnamon of the under parts; above, by being slightly darker than *cinnamoventris* and *almorae*, and considerably darker than the others.

The adult males of *koelzi* are not separable from comparative specimens of *cinnamoventris*, and the measurements of *koelzi* in both sexes are similar to those of *cinnamoventris*.

The difference in coloration is not due to wear or to the age of the specimens. The plumage in all the *koelzi* female specimens is fresh, and both old and recently collected female specimens of the other races in fresh or worn plumage lack the strong and rich cinnamon tint.

RANGE: The range of *koelzi* is probably continuous southward from the Patkai Hills through the Naga Hills to the Barail Range in northern Cachar, for in the last region an adult female taken at Mahur on April 9 is identical with the females from Margherita and the Patkai Hills; a juvenal female in worn plumage taken at Guilang on May 12 is paler but still shows the rich cinnamon tint. In the neighboring Khasia Hills the population is not separable from that of *cinnamoventris* from Sikkim.

GEOGRAPHICAL VARIATION IN THE INDIAN RACES: The variation affects both size and coloration.

MEASUREMENTS: The measurements given in table 2 show that the populations from the hills of Assam, along the Himalayas, and from eastern Afghanistan have similar measurements, the more western populations tending to have a slightly longer wing. All these populations of the subspecies *koelzi*, *cinnamoventris*, *almorae*, and *cashmirensis* have a longer wing, and a longer, much heavier bill than populations of *castanea* from the lowlands of northern India, and from central, peninsular, and southern India. In separating the population of the upper Eastern Ghats from *castanea*, Kinnear and Whistler stated that in this population

(*prateri*) the bill was longer than in *castanea*. I have no specimens from the upper Eastern Ghats but in three specimens from neighboring Bastar, the bill is not different in size or shape from populations of *castanea* from United Provinces, Bihar, Surguja, northern Central Provinces, and Mysore. Kinnear and Whistler give the bill length of their specimens from the upper Eastern Ghats as "5♂ 21-22, 6♀ 20-22." The bill length of my specimens of *castanea* in table 2 for 27 males is 18.5-21.5 (20.4), for 21 females, 18.7-21.0 (19.8). The difference does not seem large enough to warrant separation, and there is too much overlap, 10 of my males having a bill length of 21 or more, and nine females a bill length of 20 or more.

COLORATION: Coloration varies more than the measurements. In the specimens examined this variation is as follows:

In two specimens from Kashmir and four from eastern Afghanistan (*cashmirensis*) males are much paler below, less rufous, and females are buffier, less rufous, than in any of the other populations. In the specimens of *koelzi* from Margherita, Patkai Hills, and northern Cachar, females are, as stated, much richer cinnamon below.

Specimens from Kumaon and Tehri (*almorae*) and from Sikkim (*cinnamovenstris*) are darker above; below, the males are more rufous, the chestnut being more cinnamon, less brown and dark, and the females less "pinkish" than specimens of *castanea* from United Provinces, Bihar, Surguja, northern Central Provinces, Bastar, and Mysore. All these populations of *castanea* are very constant.

The specimens of Kumaon and Tehri (*almorae*) differ from those of Sikkim (*cinnamovenstris*) by being paler below in the male and slightly paler in the females. Specimens from lower Nepal are intermediate but on the whole closer to *almorae*. Recently collected adult males from the Khasia Hills are a little darker below than the specimens from Sikkim; however, the latter are old and the difference appears to be due to the age of the skins. In any case the differences in the case of the Nepal and Khasia Hills populations are much too slight to warrant separation.

Specimens from the upper Eastern Ghats are not available. In separating this population as *prateri*, Kinnear and Whistler stated that, in addition to its having a longer bill (discussed above), it differed from *castanea* by being paler below in the male, and by having narrow pale subterminal bands on the under tail coverts.

The authors presumably imply that these pale bands are lacking in *castanea*, but in my specimens of the latter they are present or absent in specimens of both sexes as follows:

PRESENCE OR ABSENCE OF PALE SUBTERMINAL BANDS ON THE UNDER
TAIL COVERTS OF *S. e. castanea*

Region	Absent	Faint Trace	Present
United Provinces	3	5	10
Surguja	1	2	4
N. Central Provinces	4	6	10
Bastar	0	0	3
Mysore	1	1	0

Pending confirmation of a sufficiently distinct difference in the coloration of the under parts of the males, I believe that *prateri* should be considered as synonymous with *castanea*.

The pale subterminal bands on the under tail coverts are lacking in *cashmirensis* and are broadly present in *almorae*, *cinnamoventr*, and *koelzi*.

ECOLOGY: In northern India, where the large, heavy-billed forms meet the smaller and thin-billed *castanea*, the larger birds are restricted to the hills and *castanea* to the plains where it occurs around the towns. Elsewhere in central, peninsular, and southern India, where the large forms do not occur, *castanea* is found on both low and high ground. Koelz collected both on October 28 at Lechiwala in Kumaon, but although Lechiwala could not be located, it appears to be in the lower part of Kumaon where the lowlands and foothills meet. Undoubtedly members of Dr. Koelz' party collected in different directions, and, although no notes as to elevation appear on the labels, a few miles would make an important difference. Apparently the ecological separation is sharp and prevents interbreeding, as no intermediates are found.

MOULT: Adults have a complete postnuptial moult and juvenals moult into first winter plumage through a partial postjuvinal moult through which only the body plumage, lesser and middle upper wing coverts, and sometimes (two specimens out of 12) the top pair of rectrices are replaced. Both moults take place at the same time of the year. First winter specimens can be distinguished from adults by their distinctly browner wing quills but only when the latter are in fresh or not too badly worn plumage. The body plumage appears to be the same in both.

TABLE 2
MEASUREMENTS OF ADULTS AND FIRST WINTER BIRDS IN
SOME POPULATIONS OF *Sitta europaea*

Race and Region	Wing	Individual Bill Lengths
<i>cashmirensis</i>		
Kashmir	1 ♂, 86; 1 ♀, 81	♂, 21; ♀, 21
E. Afghanistan	1 ♂, 86; 3 ♀, 83.5, 84, 85	♂, 22.5; ♀, 22.5, 22.8, 23.5
<i>almorae</i>		
Kumaon, Tehri	12 ♂, 82-87 (84.3); 7 ♀, 81-84.5 (82.8)	♂, 22, 22, 22.5, 22.5, 22.5, 22.7, 22.8, 23, 23, 23, 23.2, 23.3, 23.5, 24.7; ♀, 22, 22.5, 22.5, 22.8, 23, 23, 23, 23.5 ^a
Lower Nepal	11 ♂, 81-85 (84.0); 3 ♀, 79, 81, 84	♂, 22.3, 22.5, 22.5, 23, 23, 23, 23.5, 23.5, 23.5, 24, 24.2; ♀, 21.7, 22.2, 23
<i>cinnamoventris</i>		
Sikkim	6 ♂, 80-84 (81.7); 2 ♀, 79, 82	♂, 22, 22.3, 22.5, 22.7, 23, 23; ♀, 21.5, 22.5
Khasia Hills	4 ♂, 81, 82, 82, 84; 1 ♀, 81	♂, 22.8, 23, 23, 24; ♀, 21.5
<i>koelzi</i>		
Assam, Patkai Hills	2 ♂, 80, 81; 4 ♀, ^b 76-81.5 (79.4)	♂, 21.5, 24; ♀, 22, 22, 22.3, 22.5
N. Cachar	3 ♂, 80, 81, 82; 2 ♀, 77, 80	♂, 22, 22.5, 23; ♀, 21.8, 22
<i>castanea</i>		
Kumaon, W. United Provinces	1 ♂, 76.5; 3 ♀, 73, 74, 75.5	♂, 19.3; ♀, 19, 19, 21
E. United Provinces, Bihar	9 ♂, 71-77 (74.0); 4 ♀, 70.5, 71, 71, 71	♂, 19.2, 20, 20.2, 20.2, 20.5, 21, 21, 21.5, 21.5; ♀, 19, 19.5, 20, 20.5
Surguja	3 ♂, 73, 77, 79; 3 ♀, 73, 74.5, 75	♂, 21, 21, 21.5; ♀, 19, 20.5, 20.7
N. Central Provinces	8 ♂, 71-78.5 (74.7); 7 ♀, 71.5-73.5 (72.3)	♂, 18.5, 19.3, 19.3, 19.7, 20, 20, 20.2, 20.2, 20.5, 21, 21.2; ♀, 18.7, 19, 19.2, 19.5, 19.5, 19.5, 20, 20.5, 20.5
Bastar	2 ♂, 77, 79; 1 ♀, 72	♂, 20.3, 20.5; ♀, 20.5
Mysore	1 ♂, 78; 1 ♀, 76	♂, 21.5; ♀, 19.5

^a The discrepancy in this and other populations between the number of wing and bill measurements is due to the moult.

^b Type of *koelzi*, adult female: wing, 80 (old quills); tail, 37 (moult nearly finished); bill, 22.

Sitta europaea cashmirensis Brooks

EASTERN AFGHANISTAN: Above Khudi Khel, 8000 feet, May 22, 1937, 1 ad. ♀; Daulatshah, June 1, 1 ad. ♂, 1 subad. ♀; Kail, June 3, 1 ad. ♀.

Sitta europaea almorae Whistler

NORTHERN INDIA: Tehri: Junana, September 16, 1948, 1 ad. ♂, 1 ad. ♀. Kumaon: Kathgodam, April 8-18, 2 ad. ♂, 1 subad. ♂, 1 ad. ♀; Askot, August 2-3, 1 ad. ♂, 2 subad. ♀; Berinag, August 6, 1 subad. ♂, 1 ad. ♀; Barichina, August 10, 1 ad. ♂; Lechiwala, August 31-November 3, 6 ad. ♂, 1 subad. ♂, 2 ad. ♀, 2 subad. ♀. Nepal: Simra, March 5, 1947, 1 ad. ♂; Amlekganj, March 6-9, 2 ad. ♂, 1 ad. [♀], 1 subad. ♀; Bhimpedi, March 13, 1 ad. ♂, May 6, 1 ad. ♂; Thankot, March 22, 1 ad. ♀; Hitaura, May 13-June 19, 6 ad. ♂, 2 imm. ♂, 1 subad. [♀], 3 unsexed imm.

Sitta europaea cinnamoventris Blyth

INDIA: Khasia Hills: Umran, April 4, 1949, 1 ad. ♂; Nongpoh, April 26, May 1, 1 ad. ♂, 1 ad. ♀; Bara Pani, May 18-June 14, 2 ad. ♂.

Sitta europaea castanea Lesson

INDIA: Kumaon: Lechiwala, October 28, 1948, 1 ad. ♂. United Provinces: Allahabad, April 15, 1937, 1 imm. ♂; Benares, January 24, 1947, 1 ad. ♂, 1 ad. ♀; Gorakhpur, January 28, 1 ad. ♂, 1 ad. ♀; Siswa Bazar, January 30, 1 ad. ♂; Nichlaur, January 31-February 4, 2 ad. ♂, 2 ad. ♀. Bihar: Raxaul, March 1, 1 ad. ♂; Patna, April 4, 1937, 1 ad. ♂. Surguja: Ramanujganj, October 6-7, 1947, 1 ad. ♂, 1 ad. ♀; Gargori, October 20-24, 2 ad. ♂, 2 ad. ♀. Central Provinces: Bichhia, July 1-11, 1946, 1 ad. ♀, 1 subad. ♀; Mandla, June 21-28, 1 ad. ♂, 2 subad. ♂, 1 ad. ♀, 2 subad. ♀, October 14-15, 2 ad. ♂, December 2-3, 1947, 1 ad. ♂, 1 ad. ♀; Belwani-Kisli, August 5-September 26, 1946, 5 ad. ♂, 3 subad. ♀. Bastar: Taroki, March 19-20, 1949, 1 ad. ♂, 1 ad. ♀; Korher, March 22, 1 ad. ♂.

Sitta leucopsis leucopsis Gould

EASTERN AFGHANISTAN (NEAR GARDEZ): Sirotai [Saroti], June 20, 1937, 3 ad. ♂.

INDIA: Northern Punjab, Chamba: Kukti, July 4, 1936, 1 ad. ♂, 1 imm. ♂, 1 ad. ♀, 1 imm. ♀. Northern Punjab, Lahul: Tsokang Nulla, October 19-21, 2 ad. ♂, 3 imm. ♂, 2 ad. ♀, 1 imm. ♀; Muling, October 24, 1 ad. ♀. Northern Punjab, Kulu: Rahla, October 26, 1 ad. ♂; 8000 feet above Bandrole, November 13, 1 ad. ♀, 1 subad. ♀.

Adults taken on June 20 in Afghanistan and July 4 in Chamba are just starting a complete moult, and a few last traces of moult still show on specimens taken on October 19 and 26 in Lahul and Kulu.

MEASUREMENTS: Wing, seven males, 76-81 (79.0); five females 76-81 (78.4). Tail, seven males, 39-45 (42.1); five females, 40-

44 (41.0). Bill, seven males, 21–22 (21.6); five females, 21–22 (21.4).

***Sitta himalayensis himalayensis* Jardine and Selby**

INDIA: Tehri: Kadukal, September 11, 1948, 1 ad. ♂, 1 ad. ♀; 10,000 feet above Luni, September 24, 2 ad. ♂, 1 ad. ♀; Kanderala, October 18–20, 1 ad. ♂, 2 ad. ♀. Kumaon: Dhakuri, April 26–27, 2 ad. ♂; Shankala, July 24, 1 subad. ♀; Galla, July 26, 1 ad. ♀; Sanandin, August 3–4, 1 ad. ♂, 1 unsexed ad. Nepal: Chitlang, March 15, 1947, 1 ad. ♂, 1 imm. ♂, 2 ad. ♀, 1 imm. ♀; Thankot, March 21–April 6, 2 ad. ♂, 3 ad. ♀; Deorali [near Chisapani Garhi], May 1, 1 ad. ♂; Bhimpedi, May 6–8, 1 imm. ♂, 1 unsexed imm. Bengal: Rangirum, December 26, 1936, 2 ad. ♂, 2 ad. ♀.

These specimens were compared to the specimens in the collection of the American Museum of Natural History from Sikkim, northern Burma, northwestern Yunnan, and Tonkin. The geographical variation in coloration is slight. In comparative plumage, specimens from Tonkin and, to a lesser degree, from northern Burma and northwestern Yunnan are a little paler on the throat,

TABLE 3

INDIVIDUAL MEASUREMENTS IN *Sitta himalayensis*

Region	Wing	Tail	Bill
<i>Sitta himalayensis himalayensis</i>			
Tehri	♂ 76, 76.5, 77, 77	36, 36.5, 37.5, 38	17, 17.7, 18, broken
	♀ 71, 72.5, 74, 74	33, 34, 36, 37	17, 17.2, 17.7, 18
Kumaon	♂ 74, 75, 76	36.5, 38, moult	17, 17.5, broken
	♀ 72, 76, moult	34.5, 35, moult	17, 17.2, 18
	^a 75, 76	36, 37.5	17, 18
Nepal	♂ 71, 71.5, 74, 76	35, 36, 36, 38	17, 17, 17.3, 18
	♀ 72, 72, 72, 72.5, 73	35, 35, 36, 37.5, 38	16.5, 17, 17, 17, 18
N. Bengal and Sikkim	♂ 73, 75, 75.5, 76	35, 36.5, 38, 38	17, 17, 18.2, broken
	♀ 69, 70.5, 72, 73, 76	34, 34.5, 35, 37, 40	17, 17, 17.5, 17.5, 18
	^a 72, 74, 75, 75	34, 37, 37, 40	17, 17.2, 17.2, 17.5
<i>Sitta himalayensis whistleri</i>			
N. Burma	♂ 70.5, 71, 72, 75	35, 35.5, 36, 38	15, 16, 16.2, 16.2
	♀ 70, 71, 74	36, 36, 36.5	15.5, 16, 16
	^a 72.5	39	16.5
N. W. Yun- nan	♂ 72	38	16.2
	♀ 70, 71	35, 35	15, 15.5
Tonkin	♂ 70.5, 71	36, 36	16, 16
	♀ 69	35	15.5
	^a 69	34	15.5

^a Unsexed.

and the upper breast is more yellowish, less rich, than in specimens from farther west in the Himalayas.

Table 3 shows that a cline of decreasing size runs from west to east. There is a good deal of overlap, but the wing length in specimens from Burma, Yunnan, and Tonkin averages definitely smaller. In the case of the bill the difference is well marked: 35 specimens of both sexes from Tehri to Sikkim have a bill of 16.5–18.2 (17.3), and 15 from northern Burma to Tonkin, 15.0–16.5 (15.8); only one measurement overlaps. The population from northern Burma has the short bill of the birds of Tonkin, but, as mentioned by Mayr (1941, *Ibis*, p. 56), it is intermediate as regards the length of the wing.

MOULT AND BREEDING: Adults taken at the end of July and the first few days of August in Kumaon are nearing the end of a complete moult. A specimen taken on September 11 in Tehri still shows a very few last traces.

This species apparently breeds early, as breeding specimens were taken in lower Nepal from March 15 to April 6.

Sitta frontalis frontalis Swainson

SYNONYMS: *Sitta frontalis corallina* Hodgson.

Sitta frontalis simplex Koelz.

INDIA: Kumaon: Kathgodam, April 9–12, 1948, 4 ad. ♂; Lechiwala, August 31–November 1, 6 ad. ♂, 8 ad. ♀. Nepal: Simra, March 4–5, 1947, 4 ad. ♂; Bhimpedi, May 5, 1 ad. ♂; Hitaura, May 11–June 15, 2 ad. ♂, 1 imm. ♂, 3 ad. ♀, 1 unsexed imm. Northern Bengal: Darjeeling district, Badamtam Forest, Rangit, December 24, 1936, 1 ad. ♂, 1 ad. ♀. Khasia Hills: Umrang, April 9–14, 1949, 2 ad. ♂, 1 imm. ♀; Nongpoh, April 23–May 2, 1 imm. ♂, 1 imm. ♀; Barnihat, May 31, 1 ad. ♀; Bara Pani, June 9, 1 imm. ♀. Northern Central Provinces: Belwani-Kisli, July 25–August 1, 1946, 1 subad. ♂, 2 ad. ♀, 2 subad. ♀, September 28, 1 ad. ♂; Kanha, August 22–September 18, 4 ad. ♂, 1 ad. ♀, 1 unsexed subad. Orissa: Mahendra, January 24–25, 1937, 1 ad. ♂, 2 ad. ♀. Bastar: Taroki, March 20, 1949, 1 ad. ♂. Southern Bombay Presidency: Londa, January 9–22, 1938, 4 ad. ♂, 3 ad. ♀, January 31, 1 ad. ♂ (the type of *S. f. simplex*); Jagalbed, March 10, 1 ad. ♂. Nilgiri Hills: Ootacamund, February 14–16, 1937, 2 ad. ♂, 3 ad. ♀; Kunjapanai, February 19, 1 ad. ♀. Palni Hills: Kodaikanal, March 10, 1 ad. ♀.

Ticehurst (1926, *Jour. Bombay Nat. Hist. Soc.*, vol. 31, p. 491) has remarked that the populations found along the Himalayas are “smaller than the Ceylon bird in wing and bill, and should stand as *Sitta frontalis corallina* Hodgson.” This statement is supported by Whistler (1932, *Jour. Bombay Nat. Hist. Soc.*, vol. 35, p. 523) who finds that “Birds from the Nilgiris, Palnis, and Travancore

agree with those of Ceylon . . . [and] As measurements alone distinguish the races and intergradation occurs in the few specimens available from the range of the bird between the Nilgiris and the Himalayas it will be convenient to consider all birds south of the Indo-Gangetic plain as belonging to the typical race."

This treatment is unsatisfactory because, while it is true that the southwestern populations tend to be larger, both large and small birds are found in the peninsular populations (see list of individual measurements below). Since the measurements of the peninsular populations completely or virtually overlap those of the Himalayan and southwestern populations, and since Whistler's measurements show that toptotypical *frontalis* from Ceylon tends again to be small, I believe that it is wiser not to separate the various Indian populations.

Koelz (1939, Proc. Biol. Soc. Washington, vol. 52, p. 63) has separated the population from southern Bombay as *simplex*, stating that "Compared with specimens of *frontalis* from Ceylon in the Rothschild Collection, these Indian specimens are less richly colored and without the strong lilac purple tone that characterizes the typical form." In *simplex* Koelz includes specimens taken in the Nilgiris, the Palnis, and southern Orissa. Koelz, however, lacked proper comparative material, the Ceylon specimens in the Rothschild Collection consisting of only three skins, one undated but ancient, and the other two taken in 1868. These skins are darker below than Koelz' specimens, but they are badly foxed, and old foxed specimens taken in Sikkim from 1870 to 1888 show an identical darkening of the delicate lilac coloration. Fresh skins taken in the Himalayas, northern India, peninsular, and southwestern India from 1936 to 1949 vary very slightly, but no definite geographical trend is apparent. Whistler (1944, Spolia Zeylanica, vol. 23, p. 130) found that specimens taken in Ceylon from 1936 to 1939 were inseparable from the populations of southwestern India.

MOULT: Adults have a complete postnuptial moult, and juvenals moult into first winter plumage through the usual partial postjuvinal moult. Except at the time of the moult, adult and first winter plumages cannot, apparently, be distinguished. The moult probably starts towards the end of June, for specimens taken on June 15 in lower Nepal, though extremely worn, show no signs of moult, whereas it is well advanced in specimens taken on July 25 in the Central Provinces. The moult continues through

August and is almost ended in a specimen taken on September 1 in Kumaon, and a few last traces still show on specimens taken on September 18 in Central Provinces. In Ceylon, Whistler (1944, *loc. cit.*) found that the moult also took place in July and August.

Individual wing and bill measurements in Indian populations are as follows:

Kumaon: Wing: males, 71, 73, 73, 73.5, 73.5, 74, 75, 75, 76.5, 77; females, 70, 70, 73, 73, 73, 73, 74. Bill: males, 15, 15.2, 15.5, 15.5, 15.5, 15.6, 16, 16, 16, 16; females, 15.5, 15.5, 15.6, 15.7, 15.7, 15.7, 15.8, 16.

Nepal: Wing: males, 72, 72.5, 72.5, 74, 75, 75, 77; females, 69, 72, 72.5. Bill: males, 15.5, 15.5, 16, 16, 16.2, 16.5; females, 15.7, 16, 16.5.

Northern Bengal: Sikkim: Wing: males, 73.5, 74.5, 76, 77; females, 71, 72.5. Bill: males, 16, 17, 17, 17; females, 16.5, 16.5.

Northern Assam (Dibrugarh): Wing: female, 72.5. Bill: female, 15.5.

Garo Hills: Wing: male, 74.5; females, 72, 75. Bill: male, 16.2; females, 16.5, 17.5.

Khasia Hills: Wing: males, 75.5, 77.5; female, 73. Bill: males, 16.2, 17.2; female, 15.

Northern Cachar: Wing: male, 72; female, 73. Bill: male, 16.2; female, 16.

Central Provinces: Wing: males, 71, 73.5, 74.5, 76.5, 77.5; female, moulting. Bill: males, 16, 16, 16, 16.7, 17; female, 15.5, 16, 17.

Orissa: Wing: male, 79; females, 73, 74. Bill: male, 15.5; females, 15, 16.4.

Bastar: Wing: male, 74. Bill: male, 16.4.

Southern Bombay Presidency (Londa and region): Wing: males, 72, 74, 75, 76, 76, 77.5; females, 72.5, 72.5, 74. Bill: males, 15.5, 15.7, 16, 17, 17.5, 17.7; females, 16, 16.5, 17.

Mysore: Wing: male, 78; females, 72.5, 75. Bill: male, 16; females, 16.5, 17.

Shevaroy Hills: Wing: females, 70, 73.5. Bill: females, 16, 16.2.

Nilgiri Hills: Wing: males, 80, 80, 82; females, 74, 75, 76, 77, 79.5. Bill: males, 17, 17, 17.2; females, 15, 15.5, 16.5, 16.8, 17.

Travancore and Palni Hills: Wing: females, 72, 73, 74, 75.5. Bill: females, 15.5, 16.8, 17, 17.

Ceylon: Wing: males, 78, 79; female, 75. Bill: males, 16.5, 16.5; female, 16.2.

Ceylon (Whistler, 1944, *Spolia Zeylanica*, vol. 23, p. 130): Wing: eight males, 75-81.5; eight females, 73.5-77.5. Bill: eight males, 16-17; eight females, 15.5-17.

SITTA NEUMAYER AND *SITTA TEPHRONOTA*

The ranges of the rock nuthatches, *S. neumayer* and *S. tephronota*, extend from southeastern Europe through western Asia to the western Tian Shan in Turkestan. The first, *S. neumayer*, is a western form which reaches its eastern limits in the mountains of

Kirman in southern Iran and in the region of Gurgan at the eastern end of the Elburz. The other, *S. tephronota*, reaches its western limits in Armenia and Kurdistan. Thus, over a large part of Iran, in the north, west, southwest, south, and parts of central Iran, the two species overlap. In the zone of overlap they occur side by side, and, with the possible exception of the Kirman

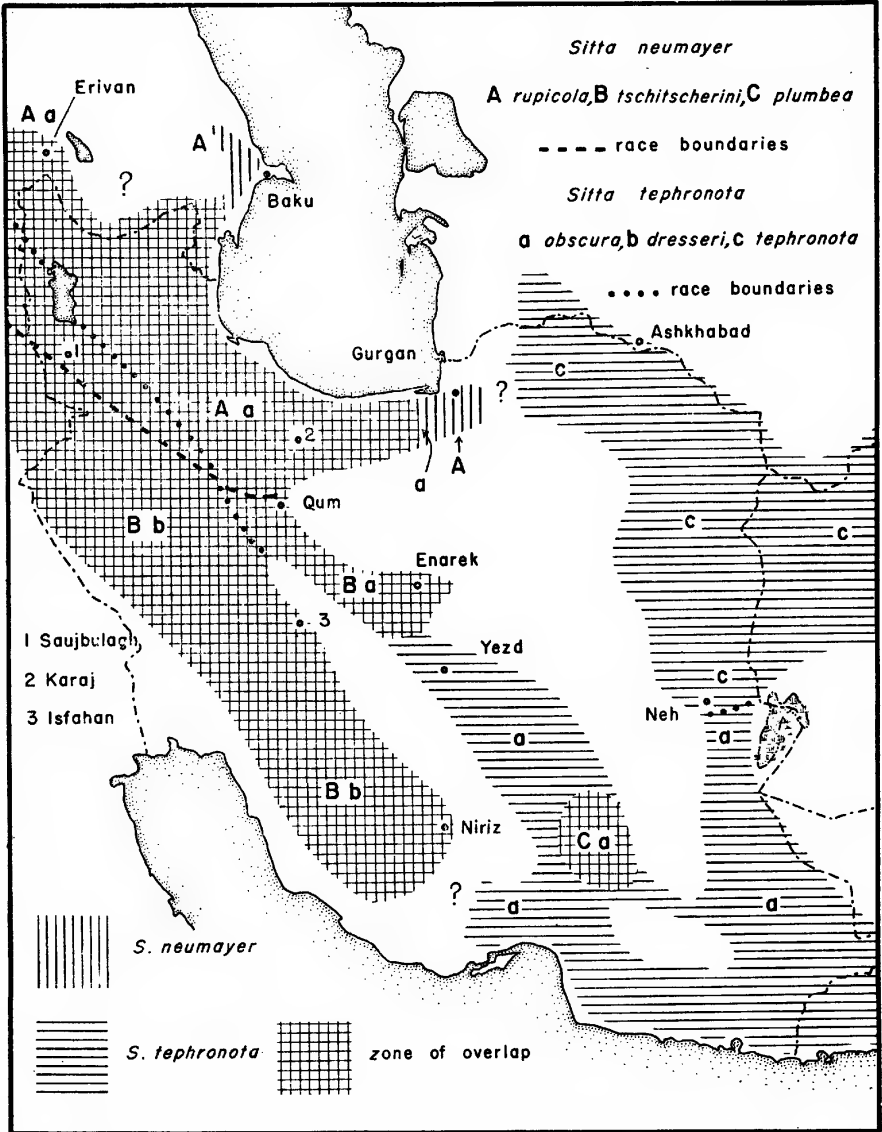


FIG. 1. Distribution and overlap of *Sitta neumayer* and *S. tephronota* in Iran.

population of *S. neumayer*, are apparently equally common. The distribution and overlap in Iran are shown in figure 1.

As these two species outside the zone of overlap are identical in pattern and are either identical or virtually so in size and coloration, the overlapping populations caused much confusion until the publication of the detailed paper by Zarudny and Härms (1923, Jour. Ornith., vol. 71, pp. 398-418). The correct status of the two species as a whole is also set forth in the papers of Jordans (1923, Falco, vol. 19, special no., pp. 18-20), and Stresemann (1925, Ornith. Monatsber., vol. 33, pp. 106-109).

The large amount of material at hand, most of it consisting of the fresh and excellent series collected by Dr. Koelz in Iran and Afghanistan, offers an opportunity for review. This material consists of over 250 specimens, 173 collected by Dr. Koelz and the rest, which include a large share of the original specimens of Zarudny and Härms from eastern Iran, from the collection of the American Museum of Natural History.

As first indicated in the paper of Zarudny and Härms, populations from regions where the two species occur together are easy to separate. The races of *S. tephronota* in these regions are very large and have long and massive bills; conversely, the races of *S. neumayer* are small and have shorter and weaker bills. The size differences are accompanied by unmistakable differences in the development of the black facial stripe. The diverging characters are presented in tabular form (table 4). As the bill size appears to be of much significance, its size variations for the two species as a whole are illustrated in figure 3. The size and shape of the bill and facial stripe are illustrated in figure 2.

ECOLOGICAL SIGNIFICANCE OF THE CONTRAST IN CHARACTERS

David Lack has stated (1944, Ibis, p. 279) that "when two closely related species occupy the same habitat in the same region, they nearly always differ markedly in feeding habits and/or size."

The food habits of the rock nuthatches in Iran are scarcely known, but as far as size is concerned the two species fully support Lack's thesis. In table 4 it was shown that when they occur together they are easily separable by a marked difference in the length of the wing and the size and shape of the bill. There is

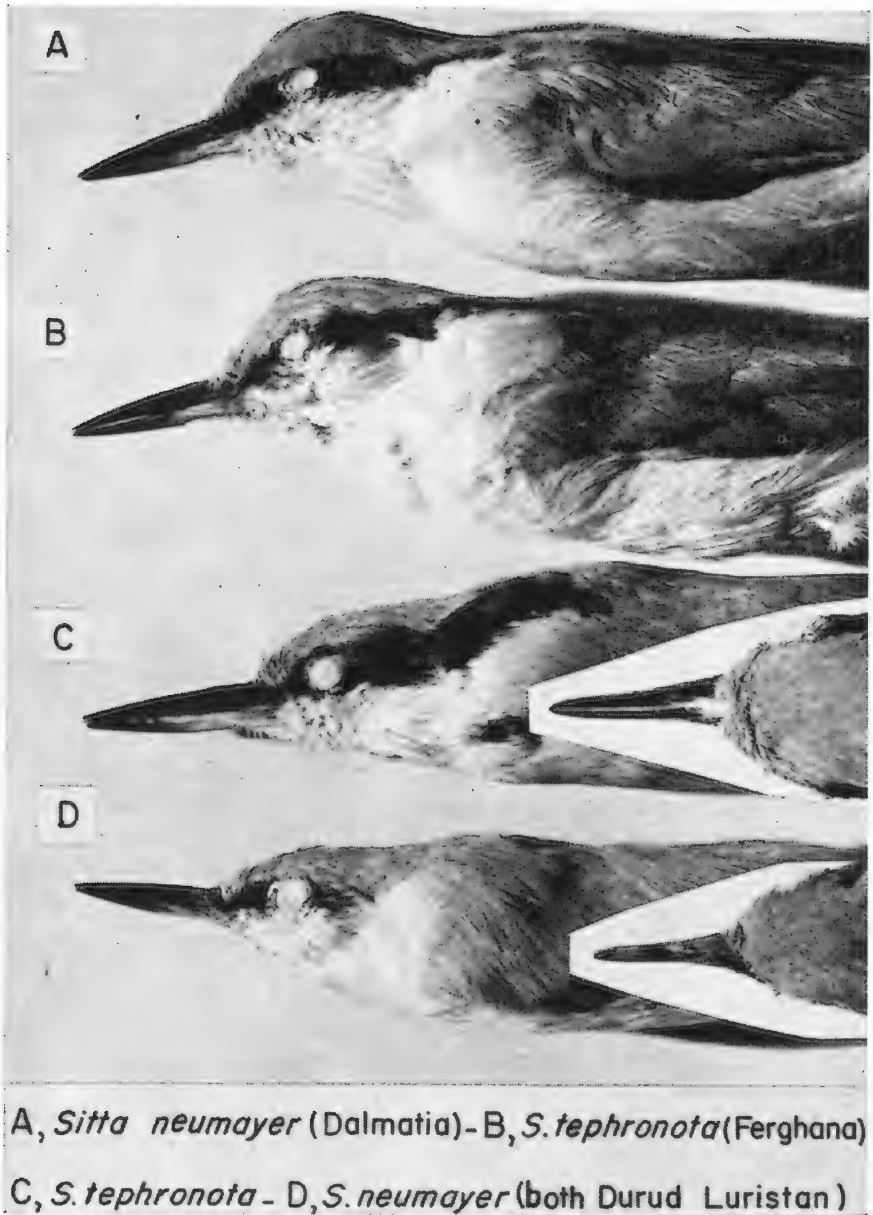


FIG. 2. Shape and size of the bill and facial stripe in *Sitta neumayer* and *Sitta tephronota*.

also a conspicuous difference in the facial stripe, even though the general coloration of the rest of the plumage remains the same.

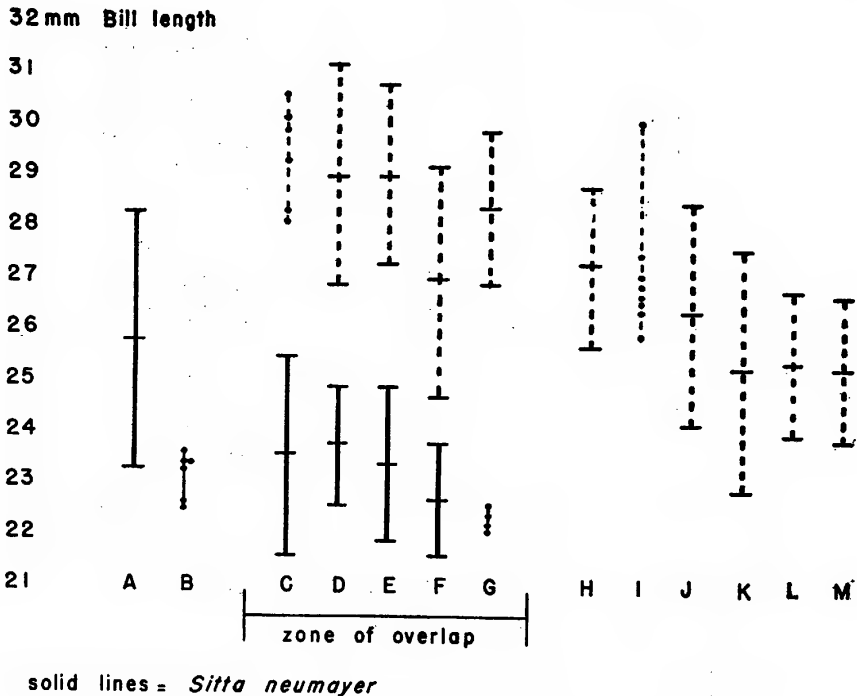


FIG. 3. Graphic illustration of the bill length (measured from skull) in *Sitta neumayer* and *Sitta tephronota*. In the zone where the distribution of the two species overlaps, measurements pull conspicuously apart, but outside this zone, west and east in the case of these two species, measurements are similar. Horizontal markings represent the mean and two standard deviations above and below. Where sample is insufficient, individual specimens are represented by dots.

Populations west of the zone of overlap (*S. neumayer*): A, Dalmatia and Greece; B, Asia Minor. In the zone of overlap: C, Azerbaijan and northern Iran; D, Kermanshah; E, Luristan and Bakhtiari; F, Fars; G, Kirman. East of the zone of overlap (*S. tephronota*): H, Persian Baluchistan; I, southern Afghanistan (mostly Kandahar); J, Khorasan; K, north central Afghanistan north of the Hindu Kush; L, northeastern Afghanistan (Pamirs); M, Ferghana and western Tian Shan.

Presumably, if the two species are not to compete, the difference in the feeding organ should be the most important, as the far heavier and longer bill implies adaptation for the taking of different food.

Figure 3 illustrates conclusively the conspicuous difference in the zone of overlap. Outside this zone bill measurements become similar as the populations pull farther apart. It may also be added that in the more distant populations the difference in shape

TABLE 4
 CONTRASTING CHARACTERS IN OVERLAPPING POPULATIONS OF *Sitta neumayer* AND *S. tephronota*
 (For variations in bill size, see figure 3)

Race and Region	N	Wing and its Length	Bill	Facial Stripe
Elburz and Azerbaijan				
<i>S. n. ruficola</i>	20 ♂ ♀	Short, 75.0-81.0 (78.4)	Short, weaker and more compressed laterally	Well developed
<i>S. t. obscura</i>	2 ♀	Long, 88, 90	Long, massive and more swollen laterally	Very prominent (longer and at least twice as broad)
Elburz (Karaj)				
<i>S. t. dresseri</i>	4 ♂ ♀	Very long, 94-96.5 (95.1)	Still longer and heavier than in <i>S. t. obscura</i>	Still more prominent than in <i>S. t. obscura</i>
Azerbaijan				
Zagros				
<i>S. n. tschitscherini</i>	45 ♂ ♀	Short, 73.0-81.0 (77.2)	As in <i>S. n. ruficola</i> but averaging still shorter	Very poorly developed, blackish instead of pure black
<i>S. t. dresseri</i>	34 ♂ ♀	Very long, 87.0-100.5 (94.0)	Long and massive (as in Azerbaijan)	Very prominent (as in Azerbaijan)
Kirman				
<i>S. n. plumbea</i> ^a	4 ♂ ♀	Short, 75.0-78.0 (76.2)	Shortest and weakest	Very poorly developed (as in <i>S. n. tschitscherini</i>)
<i>S. t. obscura</i>	13 ♂ ♀	Long, 88.0-97.0 (91.5)	Long and massive (as in Karaj)	Very prominent (as in <i>S. t. dresseri</i>)

^a In addition, *S. n. plumbea* differs from all known populations of *S. neumayer* and *S. tephronota* in the color of its throat and breast which are ashy instead of white or creamy.

no longer exists, and, as stated above, the wing length, pattern, and general coloration are identical or virtually so.

SITTA TEPHRONOTA

As *S. tephronota* is quite variable geographically and the variation is bound to be confusing, it is best visualized in tabular form (table 5) and, since measurements have been used so extensively for discrimination, the significant ones (wing and bill) are given individually. As it is not always possible to distinguish between adult and first winter plumage, the measurements given in the literature probably include those of a certain number of specimens that are not fully adult. In this review of the rock nuthatches, therefore, the measurements of all specimens are given, except those obviously juvenal. Capital letters refer to the populations in table 5.

The various populations of *S. tephronota* can be grouped under three forms:

1. *Sitta t. tephronota* Sharpe, 1872 (type locality, Kokand, Ferghana). This form ranges westward from western Tian Shan through Ferghana, Pamirs, and Afghanistan to Khorasan. Its populations vary geographically.

In the specimens examined, the most northern populations (A) from Tian Shan, Ferghana, northeastern Afghanistan, and from the Russian-Iran border in Transcaspia are identical in coloration and have similar measurements. Buturlin separated the population from the "Russian-Persian Frontier in Transcaspia" as *iranica* on the basis of being smaller and of having a shorter bill. The measurements given in this review show that this is not tenable, and "*iranica*" has already been made a synonym of nominate *tephronota* by Dementiev (1934, L'Oiseau, p. 625).

Meinertzhagen (1938, Bull. Brit. Ornith. Club, vol. 58, p. 96) in describing as *subcaeruleus* specimens taken at Haibak in Afghan Turkestan stated that they were paler and bluer on the mantle and less rusty than specimens of nominate *tephronota* "from Russian Turkestan, East Persia, and Beluchistan." My specimens from north central Afghanistan north of the Hindu Kush (B) agree with the differences cited by Meinertzhagen and are also slightly whiter on the throat and upper breast than in the other populations of nominate *tephronota*. But in my material, populations from "Russian Turkestan" (A) and "East Persia" (C) vary in coloration from each other, and from the population of north cen-

TABLE 5
GEOGRAPHICAL VARIATION IN *Sitta tephronota*

Race and Populations	Size (Wing)	Bill	Mantle	Facial Stripe	Under Parts
<i>S. t. tephronota</i> A Tian Shan, Ferghana, N. E. Afghanistan, Transcaspian border	Small	Shorter, less massive (more compressed laterally)	Blue gray (rather dull)	Less prominent, (narrower and not extending so far back)	Throat and upper breast whitish or creamy, abdomen rusty; rust rather dull and pale, not sharply separated from color of breast
B N. central Afghanistan (north of Hindu Kush)	Small (as in A)	As in A	Slightly paler, clearer and slightly bluer than in A	As in A	Throat and upper breast slightly whiter, rust not sharply separated (as in A), rust being perhaps very slightly paler
C Khorasan	Small (as in A and B)	Slightly longer and thicker than in A and B	Slightly darker than in A	Slightly more prominent than in A and B	Throat and upper breast as in A, but more rust and rust darker, not sharply separated (as in A and B)
D S. Afghanistan	Small (as in A, B, C)	As in C	As in C	As in A and B	Throat and upper breast as in A, rust slightly darker than in A, slightly paler than in C, not sharply separated (as in A, B, C)

TABLE 5--Continued

Race and Populations	Size (Wing)	Bill	Mantle	Facial Stripe	Under Parts
E <i>S. t. obscura</i> Persian Baluchistan	Intermediate	Intermediate (longer, more massive, less compressed laterally)	Darker than in all above	More prominent than in all above (broader and longer)	Throat and upper breast whiter than in all above; rust as in C, but distinctly more separated from color of breast
F Kirman (also 1 specimen from Yezd)	Large	Longer, more massive, less compressed laterally than in all above	Darkest of all	Very prominent (still more so than in E)	Throat and upper breast whiter and rust darker than in all above, white and rusty areas sharply separated
G N. Iran (Karaj), 2 specimens only	Large, as in F	As in F	Darkish (paler and bluer than in E and F)	As in F	As in F
H <i>S. t. dresseri</i> Fars, Bakhtiari, Luristan, Kermanshah (Kurdistan), W. Azerbaijan	Largest (averaging larger than in F)	Longest and most massive (on an average slightly longer and more massive than in F)	Palest and clearest (very pale, whitish blue gray)	Most prominent (averaging still larger than in F)	As in F (rust in northwestern populations slightly darker)

INDIVIDUAL MEASUREMENTS IN *Sitta tephronota**Sitta t. tephronota*

A. Tian Shan: Wing, male, 87.5; female, 86, 90. Bill, male, 25.2; female, 26, 26. Ferghana: Wing, male, 84, 85, 88; female, 85, 86, 86. Bill, male, 24.8, 24.9, 26.7; female, 24.3, 24.8, 25.2. Northeastern Afghanistan (regions of Faizabad and Zebak): Wing, male, 84, 86, 87, 88; female, 84, 85, 87.5, 88. Bill, male, 24.7, 26, 26.1, 26.3; female, 24.3, 25.1, 25.7, 26.3. Transcaspian border (mostly Ashkhabad): Wing, male, 84, 86, 88; female, 85, 85. Bill, male, 25.2, 25.2, 25.8; female, 25.8, 26.6.

B. North central Afghanistan (north of Hindu Kush): Wing, male, 85, 86, 87, 87, 88, 89; female, 85, 86, 88. Bill, male, 24.8, 25, 25.1, 25.2, 25.5, 26.1, 26.7, 26.8, 27.3, 27.6; female, 25, 25.5, 25.5, 25.5, 26.4, 29.3.

C. Khorasan (all but two south of Meshed): Wing, male, 83, 84, 85, 85, 86, 87, 87, 87, 88, 88, 88, 89, 90, 90; female, 84, 84, 84, 85, 86, 86, 86, 87, 88, 88, 89. Bill, male, 25.6, 26.2, 26.2, 26.3, 26.5, 26.5, 26.6, 26.9, 27.1, 27.2, 27.2, 27.5, 27.5, 27.5, 28.2, 29, 29.6; female, 24.5, 24.6, 25.2, 25.5, 25.6, 25.7, 26.2, 26.3, 26.3, 26.3, 26.5, 26.6, 26.8, 27.4, 27.7.

D. Southern Afghanistan: Kandahar: Wing, male, 85, 88, 92; female, 85, 86. Bill, male, 26, 26.7, 27; female, 27.2, 30.2. Near Gardez: Wing, female, 88. Bill, female, 26.5. Shibar Pass: Wing, male, 89.5, 90. Bill, male, 26.8, 27.6.

Sitta t. obscura

E. Persian Baluchistan: Wing, male, 89, 90, 90, 90, 91, 91, 91.5, 92, 92.5, 93.5; female, 92. Bill, male, 26.2, 26.7, 27, 27.3, 27.4, 27.7, 27.7, 27.7, 28.5, 28.7; female, 26.2.

F. Kirman: Wing, male, 88, 89.5, 90, 91, 92, 92, 96.5, 97; female, 88, 88, 89.5, 91, 93. Bill, male, 27.3, 27.5, 28, 28.2, 28.2, 28.5, 28.8, 29.3, 29.8; female, 27.5, 28.2, 28.8, 29.2, 29.5. Yezd (Shir Kuh): Wing, female, 88. Bill, broken.

G. Northern Iran (Karaj): Wing, female, 88, 90. Bill, female, 28.2, 28.4.

Sitta t. dresseri

H. Fars: Wing, male, 93, 94; female, 87+, 87+, 88, 89+, 90, 93. Bill, male, 27.3, 28.3; female, 24.6, 26.3, 27.3, 27.5, 28, 28. Luristan-Bakhtiari: Wing, male, 95, 96, 97, 97, 98, 100.5; female, 93, 93, 94, 94, 95, 96. Bill, male, 27.9, 28.2, 29.4, 30, 30.5, 30.6; female, 28, 28.4, 28.6, 29.2, 29.3, 29.3. Kerman-shah: Wing, male, 92, 92, 94, 95, 96, 97, 98; female, 91, 91, 93, 93, 94, 96, 96.5. Bill, male, 28, 28.5, 28.8, 29, 30, 30.5, 30.8; female, 27.5, 27.5, 28.2, 29, 29.5, 29.7, 30.6. Western Azerbaijan (Saujbulagh): Wing, male, 95, 96.5; female, 94, 95. Bill, male, 30, 30.7; female, 29.4, 30.2.

tral Afghanistan (B) by the same degree of variation that any of the four populations of nominate *tephronota* differs from another. Further, in the population from north central Afghanistan, as well as in the other three populations, there is a certain amount of individual variation. Matching specimens can be found in any of the four populations, although, taken in series, the populations are separable by the differences given in table 5.

I believe therefore that it is wiser not to recognize *subcaeruleus* nomenclatorially. For if this population is formally separated, one should, in order to be consistent, give a name to all the variable populations of the species. Such excessive splitting only obscures the geographical variation and its trends. Moreover, the four populations should be kept together, as they have a great many characters in common such as small size, shorter, less massive bill, less prominent facial stripe, and lack of sharp separation between the white and rust of the under parts, which separate them distinctly as a group from the populations of *obscura* and *dresseri*.

In regard to the range of the pale population in north central Afghanistan, Meinertzhagen found the pale population only at Haibak, and in 1938 (Ibis, p. 672) observed that from there on south to the Dar e shikari Gorge (a gap of 100 miles) he found no rock nuthatches. South of the gorge he found the darker population. However, I have pale specimens from Baligali Pass [Balaghli], about 30 miles north of the gorge, and, from the Shibar Pass, about 15 miles south and east of the gorge, I have two specimens respectively typical of the pale (B) and dark (D) populations. It would appear that where local conditions permit, as along the mountain passes, the populations north and south of the Hindu Kush meet. The range of the pale population is sizable, extending at least as far west as Khami Deh, about 150 miles to the west of the Shibar.

2. *Sitta tephronota obscura* Zarudny and Loudon, 1905 (no type locality, the authors stating that the range of this form extends from Gilan and Mazenderan southeast through the Plateau to Persian Baluchistan). I have no specimens from Gilan and Mazenderan; the most northern specimens of *obscura* examined are from Karaj near Tehran. Southeast of this locality, specimens were examined from Yezd, Kirman, and Persian Baluchistan. In southeastern Iran my specimens of *obscura* show, as stated by Zarudny and Härms, that this form replaces nominate *tephronota* south of Bendan, or at about the level of Neh and northern Seistan. No specimens from Armenia and Baluchistan proper are available, but these populations are probably referable to *obscura*. Populations of *obscura* vary geographically.

In *obscura* the characters of this form are best shown by the population from Kirman and Yezd. This well-marked central population (F) is of course completely isolated from nominate *tephronota* by the great Kavir and deserts to the north and east,

and from *dresseri* by the wide desert plain and kavirs which separate the Zagros from the mountains of Yezd and Kirman. At both extremities where these ranges rejoin the mountains of the northwest and southeast, the two populations are intermediate. That of Persian Baluchistan in the southeast (E) is intermediate in every character between the Khorasan population of nominate *tephronota* (C) and the central population of *obscura* (F); the Persian Baluchistan population also approaches in characters the dark southern Afghanistan population (D) of nominate *tephronota*. The northwestern population of *obscura* (G), judging by only two specimens, is intermediate between *dresseri* and the central population from Kirman and Yezd.

In *obscura* also, it seems wiser, as in nominate *tephronota*, not to separate nomenclatorially the three populations.

Pending confirmation I believe that *armeniaca* should not be recognized. This population, described by Worobiev (1934, L'Oiseau, p. 156) from the region of Erivan in Armenia, was said to be near ("proche") nominate *tephronota* in coloration but larger and with a heavier bill. Worobiev's measurements do not separate the population of Armenia from *obscura*, nor does the heavier bill, and, in view of the geographical variation in coloration discussed above, the color difference does not appear diagnostic.

3. *Sitta tephronota dresseri* Zarudny and Buturlin, 1906 (type locality, Shiraz, Fars; based on Blanford's "large pale variety" whose specimens came from Shiraz, 1876, Eastern Persia, vol. 2, p. 223). This form is restricted to the Zagros, from Fars westward, and the prolongations of the Zagros into Kurdistan in Iraq and western Azerbaijan. Its populations vary little geographically.

The variation is clinal in character and affects the rust of the under parts. The rust gets less dark as the populations range northwest to southeast, or from Saujbulagh in western Azerbaijan through Kermanshah (Kurdistan) and Luristan and Bakhtiari to Niriz in Fars. The cline is very gradual and the difference at both ends much too slight to warrant separating the northwestern population as was done by Ticehurst. In addition to being more rusty, Ticehurst emphasized that his "*kurdistanica*" was the largest of the rock nuthatches, but the measurements of his five specimens fall within the range of variation of all the other populations of *dresseri*.

MOULT, PLUMAGES, AND BREEDING SEASON

Adults have a complete postnuptial moult, and juvenals moult into first winter plumage through a partial postjuvinal moult which involves only the replacement of the body plumage, lesser and median upper wing coverts, and, rarely (one specimen), the top pair of rectrices. Both moults take place at the same time of the year and start rather late, usually around the middle of July, though occasional individuals have started by the first few days of the month while others are starting only around August first. The moult is at its height from the middle of August to the middle of September and is usually over by the middle or latter part of October, but two or three specimens taken in Iran still show a few last traces around the middle of November and even on the first two or three days of December.

Specimens in first winter plumage cannot be distinguished with certainty from adults except in the fall or early winter. At this time of the year the adult wing quills, which are blacker, are fresher; those of first winter specimens, which are browner, are more worn since they were not replaced at the postjuvinal moult. Before the postjuvinal moult specimens in fresh juvinal plumage are tinged with delicate rust on the throat and upper breast and the feathers of the mantle have very narrow buffy terminal edges. Two juvinal males taken on April 25 at Marbirinji in Bakhtiari are in the last stages of the postnatal moult, this postnatal moult being a complete moult.

Sitta tephronota apparently breeds early as well as rather late. In Persian Baluchistan Zarudny took a female with an egg ready to be laid on February 15. Koelz collected laying females on March 9 in Bakhtiari and March 20 in Fars as well as on May 6 in Bakhtiari.

SITTA NEUMAYER

Three well-characterized races occur in Iran:

1. *Sitta n. ruficola* Blanford, 1873 (type locality, Karij Valley, Elburz). In this race the black facial stripe is well developed, the upper surface is distinctly darker than in *tschitscherini*, and bluer and brighter than in *plumbea*. In Iran it is found in Azerbaijan and in northern Iran, in the Elburz as far east as the region of Gurgan from where I have a specimen, and in the region which extends south of the Elburz to the great Kavir and the region to the north of Qum. According to Dementiev (1934, L'Oiseau, p.

624) it also occurs in Transcaucasia, and I have a specimen from Armenia taken at Mahmudie [Hosap] east of Lake Van.

2. *Sitta n. tschitscherini* Zarudny, 1904 (type locality, Isfahan). In this race the facial stripe is very poorly developed, and the upper surface is very pale, almost whitish gray. It is found in the Zagros where I have specimens ranging from Kermanshah to Niriz and Jahrum in Fars. According to Zarudny and Härms (*loc. cit.*) it is common also in the region of Isfahan and occurs in the mountains to the east above the plains of Qum, Kashan, and Ardistan, as well as in the Enarek Massif.

3. *Sitta n. plumbea* Koelz, 1950 (type locality, Guragan, southern Kirman). This recently described race (Amer. Mus. Novitates, no. 1452, p. 9) has the facial stripe poorly developed as in *tschitscherini*, but differs at once from this race, as well as from all other known populations of the species, in the ashy coloration of the throat and breast; above, it is dark like *rupicola* but duller. It is apparently restricted to the mountains of southern Kirman.

There are three other described races of *S. neumayer*: nominate *neumayer* Michahelles, 1830, type locality, Ragusa, Dalmatia; *syriaca* Temminck, 1835, type locality, Syria and Levant; and *zarudnyi* Buturlin, 1907, type locality, Aïdin, Asia Minor. The three Iranian races differ from toptotypical specimens of nominate *neumayer* and *zarudnyi* as follows: *tschitscherini* and *plumbea* in the poorly developed facial stripe, the very pale coloration of the former and the ashy throat and breast of the latter. *Sitta n. rupicola* is closer to nominate *neumayer* and *zarudnyi* but is smaller than the former, with a shorter and thinner bill, and is paler above and below; is paler than the latter, bluer above, less rusty below, and its bill, though of the same size, is slightly thinner. I lack specimens of *syriaca*, but the validity of this form said to be "somewhat paler" than nominate *neumayer* is questioned by Hartert.

GEOGRAPHICAL VARIATION

Geographical variation involves size, principally that of the bill, and coloration.

The variation in size is subtle. The measurements given in table 4 show that the wing length in Iran is very similar, *plumbea* being very slightly smaller. Figure 3 suggests that the bill of *plumbea* is also shorter. It may be objected that the sample of this form is insufficient, consisting of only four specimens. How-

ever, since figure 3 also shows that the mean bill length decreases slightly but steadily from west to east (Kermanshah to Kirman), this decrease may be of evolutionary significance.

It is interesting to note that Kirman represents the easternmost population of the species. In the prolongation of the Kirman mountains to the northwest towards Ardistan in central Iran and to the southeast into Persian Baluchistan, *S. neumayer* is replaced by a long and heavy-billed race (*obscura*) of *S. tephronota*. Since these mountains of central and southeastern Iran are considerably drier than the Zagros one can speculate that the changes in the environment no longer permit successful colonization by the weaker-billed species. The peripheral Kirman population appears to be small in numbers, and this, together with the fact that it is also the most isolated of the species, probably accounts for its diverging character, as shown by the striking difference in coloration.

The variation in coloration is more evident. In *tschitscherini*, as in *S. tephronota dresseri*, there is a very gradual cline of decreasing pigmentation from the northwest to the southeast, or from Kermanshah to Niriz and Jahrum in Fars. This is shown by both the coloration of the upper parts and of the abdomen. Although most of the Fars specimens are worn, specimens that are less worn are paler than comparative specimens from Bakhtiari farther west. The cline is slight but quite perceptible.

In *rupicola* the Azerbaijan population, which was collected in the western part of this region, is paler and intermediate in the coloration of the upper parts and abdomen between the populations of *rupicola* from Karaj and Kuh Pansar and the most northern and western population of *tschitscherini* from Kermanshah. However, as the black facial stripe is well developed in the Azerbaijan population it is clearly referable not to *tschitscherini* but to *rupicola*. I would expect that the two forms would intergrade in the region intervening between Saujbulagh and Kermanshah, but unfortunately I have no specimens from this region.

The lone specimen of *rupicola* from the region of Gurgan is like the Karaj population in coloration, but its bill (22.2) is shorter than the mean of *rupicola* (23.7). Gurgan, like Kirman, also represents a terminal population.

There is no evidence of geographical variation in the facial stripe other than subspecific. The stripe is equally well developed in all the populations of *rupicola* and equally reduced in those of

tschitscherini. In *plumbea* it appears to be still more reduced, but this is more apparent than real owing to the lack of contrast between the blackish stripe and ashy throat. For the same reason the breast and throat appear whiter in populations with darker abdomens.

MOULT: The moult and plumages in *S. neumayer* are the same as in *S. tephronota*, and the moult takes place at the same time. Some adults and first winter birds still show a few last traces of moult in the middle of November and early December in Azerbaijan and northern Iran and in one case on a December 25 specimen from Kermanshah as well. In two specimens moulting into first winter plumage on November 15 in Azerbaijan the top pair of rectrices are moulting also. Two juvenal males taken on April 30 at Siachal in Bakhtiari are in the last stages of a complete post-natal moult. Breeding specimens were collected from March 12 to April 8 in Fars.

Sitta tephronota tephronota Sharpe

IRAN: Khorasan: Kotaliyekchinar, August 3-6, 1940, 1 imm. ♂, 1 ad. ♀; Bardu and Bardu Forest, August 16-18, 1 ad. ♂, 1 subad. ♂, 2 ad. ♀; Khaur, September 5-6, 1 ad. ♂, 1 ad. ♀, 1 unsexed subad.

AFGHANISTAN: South of the Hindu Kush: Nozi, June 22, 1937, 2 imm. ♂, 1 ad. ♀; Kandahar, October 18-24, 1 ad. ♂, 1 subad. ♂, 2 ad. ♀. Shibar Pass: November 10, 1939, 2 ad. ♂. North central Afghanistan (north of Hindu Kush): Baligali Pass [Balaghli], August 30, 3 ad. ♂, 2 ad. ♀; Chesmaegawan, September 9, 1 subad. ♂, 1 ad. ♀; Aq Kupruk, September 11, 1 ad. ♂, 1 subad. ♂; Bai, September 19, 1 ad. ♂; Sufak, September 27-28, 2 ad. ♂, 3 ad. ♀; Khami Deh, September 30, 1 ad. ♂. Northeastern Afghanistan: Gumbaz (Kishm), July 7, 1937, 2 ad. ♂; Faizabad, July 15, 2 ad. ♀; Tirgaran, July 19, 1 ad. ♂; Zebak, July 21, 1 subad. ♂, 1 subad. ♀; Iskatul, July 23, 1 ad. ♀.

Sitta tephronota obscura Zarudny and Loudon

IRAN: Region of Karaj: Karaj, February 5, October 30, 1945, 2 ad. ♀. Yazd: Shir Kuh, Dehibala, February 22, 1940, 1 ad. ♀. Kirman: Madenu, December 27, 1939, 1 ad. ♀; Balvard, December 30, 1 ad. ♂; Dehibakri, January 28-29, 1940, 1 ad. ♂, 1 ad. ♀, 1 unsexed ad.; Ushturu Pass, January 30, 1 subad. ♂, 1 ad. ♀; Dehidisk, January 31, 1 ad. ♀; Guragan, February 9-10, 1 ad. ♂, 1 ad. ♀; Maskun, February 11-13, 3 ad. ♂, 1 subad. ♂.

Sitta tephronota dresseri Zarudny and Buturlin

IRAN: Western Azerbaijan: Saujbulagh, December 3, 1940, 2 ad. ♂, 2 ad. ♀. Kermanshah: Kermanshah, December 25-January 13, 1941, 3 ad. ♂, 5 ad. ♀; Qasr i Shirin, January 3-4, 4 ad. ♂, 2 ad. ♀. Luristan: Durud, January 23-25, 1 ad. ♂, 4 ad. ♀, March 1-13, 2 ad. ♂, 1 ad. ♀, May 23-June 7, 1 imm. ♂, 1 imm. ♀, November 12, 1 ad. ♂; Garun, January 29, 1 ad. ♂. Bakhtiari:

Imarat, February 14, 1 ad. ♂; Marbirinji, April 25, 1940, 2 imm. ♂; Labisufed, May 15, 1 ad. ♀. Fars: Jahrum, March 20–22, 3 ad. ♀; Niriz, March 29, 2 ad. ♂, 1 ad. ♀.

***Sitta neumayer rupicola* Blanford**

IRAN: Azerbaijan: Livan, November 15–17, 1940, 1 ad. ♂, 1 subad. ♂, 2 ad. ♀, 1 subad. ♀, 1 unsexed ad.; Saujbulagh, December 4, 1 subad. ♂, 1 ad. ♀; Dashagli, December 5, 1 ad. ♂, 1 ad. ♀. Mazenderan (region of Gorgan): Shah Kuh, July 16, 1 subad. ♀. Northern Iran, Kondor: Kuh Pansar, October 2–11, 1944, 3 ad. ♂, 1 subad. ♂; Karaj, December 16, 1943, 1 ad. ♂, 1 ad. ♀, December 28, 1944, 1 ad. ♀; March 29, 1945, 1 ad. ♂, December 9, 1 ad. ♂.

***Sitta neumayer tschitscherini* Zarudny**

IRAN: Kermanshah: Kermanshah, December 25, 1940–January 13, 1941, 6 ad. ♂, 4 ad. ♀; Bisitun, January 15, 1 ad. ♂, 1 subad. ♂. Luristan: Durud, January 24–25, 3 ad. ♂, 2 ad. ♀; Garun, January 29–30, 1 ad. ♂, 1 ad. ♀; Beshedalan, June 15, 1 imm. ♀. Bakhtiari: Ti, February 1–13, 3 ad. ♂, 1 ad. ♀, 1 subad. (?) ♀, May 31–June 4, 1940, 2 subad. ♂, 1 imm. ♂, 1 imm. ♀; Imarat, February 15–20, 1941, 7 ad. ♂, 2 ad. ♀, 1 subad. ♀; Siachal, April 30, 1940, 2 imm. ♂; Taze, May 6, 1 ad. ♂. Fars: Persepolis, March 12, 1 ad. ♀; Jahrum, March 20–21, 2 ad. ♂; Niriz, March 29, 2 ad. ♂, 1 ad. ♀; Dastarjin, April 7–8, 2 ad. ♂.

***Sitta neumayer plumbea* Koelz**

IRAN: Kirman: Guragan, February 9, 1940, 1 ad. ♂, February 10, 1 ad. ♂ (the type of *S. n. plumbea*), February 10, 2 ad. ♀.

SUBFAMILY TICHODROMADINAE

***Tichodroma muraria muraria* Linnaeus**

SYNONYM: *Tichodroma muraria longirostra* Gmelin.

IRAN: Azerbaijan: Rezaieh, December 6, 1940, 1 subad. ♂; Khoi, December 10, 1 subad. ♂. Region of Tehran: Karaj, February 4, 1945, 1 ad. ♂. Kermanshah: Kermanshah, December 25, 1940, 1 ad. ♀. Luristan: Durud, January 22, 1941, 2 subad. ♀.

***Tichodroma muraria nepalensis* Bonaparte**

IRAN: Khorasan: Bardu Forest, August 18, 1940, 1 subad. ♂, 1 imm. ♂.

AFGHANISTAN: Southwest: Farah, November 8–9, 1937, 2 ad. ♂. Western: Herat, November 12, 1 ad. ♀; Maimana, November 18–19, 2 ad. ♂; Safedsang, September 21–25, 1939, 1 subad. ♂, 2 subad. ♀; Khami Deh, September 29, 1 ad. ♂; Burchao Pass, October 10–12, 1 ad. ♂, 1 ad. ♀, 1 subad. ♀. North central: Balkh, November 27–30, 1937, 1 ad. ♂, 2 ad. ♀, 1 ad. [♀]; Binimang, September 1, 1939, 1 ad. ♂; Pul i Khumri, November 7, 1 ad. ♂.

INDIA: Kashmir, Ladak: Tog Nulla, August 18, 1931, 1 imm. ♂, 1 imm. ♀; Leh, September 16, 1936, 1 ad. ♀. Kashmir, Zanskar: Reru, September 18,

1931, 1 subad. ♀; Char, September 28, 1 subad. ♀. Kashmir, Baltistan: Tale Valley, August 23, 1 ad. ♂; Karzong, September 12, 1936, 1 subad. ♂. Northern Punjab, Kulu: Kulu, November 3-5, 1936, 2 ad. ♂; Shim, November 18, 1948, 1 subad. ♀. Northern Punjab, Kangra: Kotla, January 8, 1 ad. ♂. Kumaon: Rilkot, June 13, 1 ad. ♀.

Stresemann (1937, Jour. Ornith., vol. 85, p. 511) has stated that the eastern populations of the Wall Creeper from western Tibet and Sikkim to Kansu are long winged and short billed, while those of Europe are short winged and long billed. The populations from Tian Shan to the Caucasus, he states, are unusually variable, but may perhaps, as a long-winged and long-billed race (*longirostra* Gmelin, type locality, "mountains of Persia"), be separable from the European populations. Meinertzhagen, however, comments (1938, Ibis, p. 671) that in large series the measurements may overlap "to such an extent that recognition of races can serve no useful purpose," though the trends may be confirmed. Since the specimens collected by Koelz and those in the collection of the American Museum of Natural History represent every part of the range and form a sizable series (88 specimens), this opportunity to review the question has been taken.

This material shows that the species is easily separable into two forms: a paler and shorter-winged race (nominate *muraria*, type locality, southern Europe) for the populations from Europe to the Caucasus and northern and western Iran; and a darker, longer-winged race (*nepalensis* Bonaparte, type locality, central Asia) for the populations from Khorasan eastward. As stated by Kipp (1928, Anz. Ornith. Gesellsch. Bayern, p. 129), the eastern populations also have larger white apical spots on the outer rectrices and a tendency to have the base of the tail feathers pinkish.

It is impossible to recognize a third race. Specimens from the Caucasus and northern and western Iran are not separable in either coloration or size from European specimens of nominate *muraria*, while those from Transcaspia, Khorasan, and western Afghanistan are larger and have the same coloration as the populations from farther east. Since Gmelin apparently never reached into this region but did travel in Gilan and Mazenderan (Stresemann, 1928, Jour. Ornith., vol. 76, p. 314), I consider *longirostra* to be a synonym of nominate *muraria*.

The differences in coloration have been ignored or have not received sufficient attention. Greschik (1929, Kócsag, vol. 2, p. 29) mentioned that a specimen east of Ferghana was darker, and

Schäfer (1938, Proc. Acad. Nat. Sci. Philadelphia, vol. 90, p. 214) supported Kipp, adding that he found "that the apex of the outer tail feathers is much wider (9.5–12) mm in Asiatic specimens, as against only 7–10 in European representatives." I find, however, that I cannot confirm this last, so-called character. Schäfer does not give the number of specimens examined. The width in my specimens, in which the tip of the feather is not too badly worn or disarranged, is given in table 6. This table also shows that the presence or absence of pink on the base of the tail feathers is too variable.

TABLE 6

VARIATIONS IN *Tichodroma muraria* IN THE PRESENCE OR ABSENCE OF PINK AT THE BASE OF THE TAIL FEATHERS AND IN THE WIDTH OF THE WHITE APICAL SPOT OF THE OUTER RECTRICES

Region	Pink Present	Pink Absent	N	Width of Apical Spot
S. Europe	2	7	9	9–12 (10.1)
Caucasus	0	3	3	9, 10, 10
N. and W. Iran	1	5	4	9–10 (9.3)
Transcaucasia, Khorasan, and Afghanistan	16	7	18	8–12 (10.0)
Himalayas	14	12	22	8–12 (9.9)
Turkestan	3	8	11	8–12 (9.8)
China	8	2	8	9–11 (9.8)

The only two color characters that can, despite a slight amount of individual variation, be reliably used for separating nominate *muraria* from *nepalensis* are the larger white apical spots of the latter and its darker coloration. This last is not striking, but in series, specimens in comparative plumage are, sex for sex, consistently and distinctly paler above and below (on the head, mantle, and from the breast down) in the western populations of southern Europe and northern and western Iran. In the darker eastern populations from Transcaspia and Khorasan eastward the darkest are those of Sikkim and China (Kansu, Szechwan, Shensi, and Hopeh).

As figure 4 shows, the mean wing length in the eastern populations gradually increases as the populations go eastward. There is a certain amount of overlap, but the trend is well marked. For instance, in 18 specimens of nominate *muraria* the mean wing length (98.5) is below the smallest measurement (99) in 14 speci-

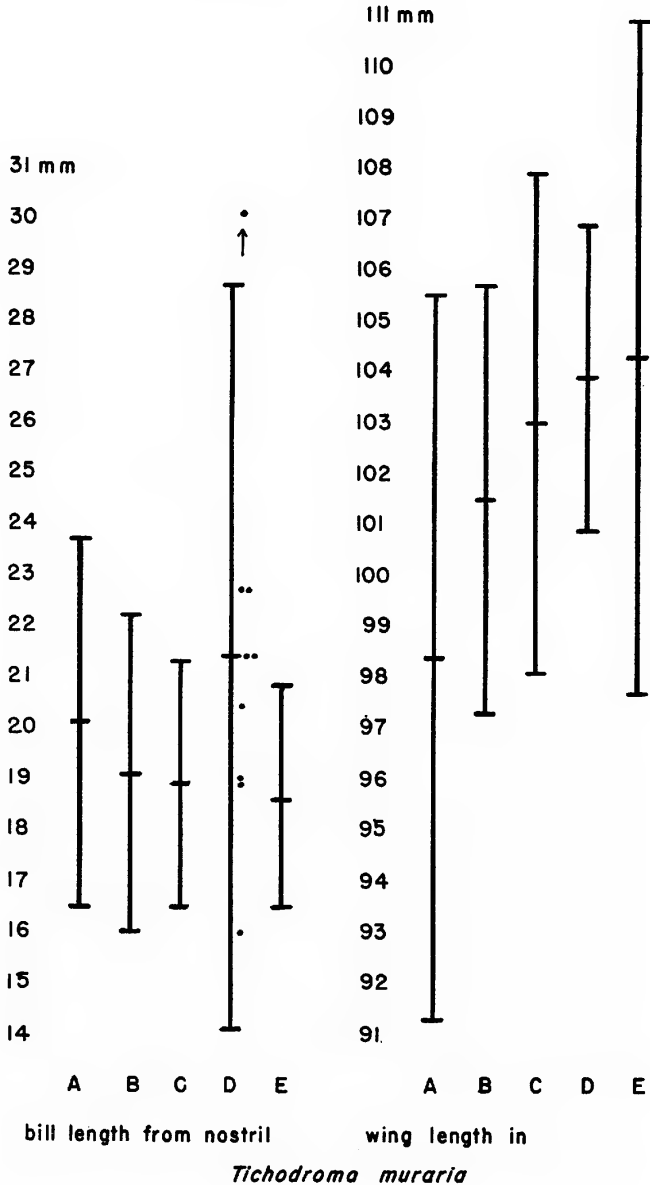


FIG. 4. Variations in bill and wing lengths in *Tichodroma muraria*: A, Europe to western and northern Iran; B, Khorasan, Ashkhabad, and Afghanistan; C, Kashmir and northern Punjab; D, Russian Turkestan; E, Sikkim and China. In D, where the sample may be insufficient, individual measurements are also indicated. Horizontal markings represent the mean and two standard deviations above and below.

mens of *nepalensis* from Sikkim and China. Taken in combination with the differences in coloration, the size difference appears to be of taxonomic significance. As this figure also shows, the overlap in bill measurements is virtually complete and the means are similar, except in population D from Russian Turkestan. In this population, where individual measurements are indicated, the number of measurements may be insufficient, or, as noted by Stresemann, the bill length may be unusually variable. The extraordinary bill length of one of the specimens may be noticed; in this specimen, a male, the full bill length is 42 mm.

The individual measurements are given below. Capital letters refer to the populations in the graph. The bill was measured from the skull with a pair of dividers. It was also measured from the nostril, in tenths of a millimeter, with a caliper, the point of the instrument being inserted through the nostrils and pulled forward firmly against their anterior border. As this last measurement is the more accurate it was used in the graph. Since adults and first winter birds seem to have similar measurements, and in any case cannot always be distinguished, the measurements of all the specimens are used, except of course those obviously juvenal.

Tichodroma muraria muraria

A. Southern Europe: Wing: males, 99, 99, 99, 102, 102; females, 96, 98, 99; unsexed, 96. Bill from skull: males, 30, 30, 30.5, 31.5, 34; females, 30, 30.5, 33.5; unsexed, 37. Bill from nostril: males, 17.2, 18.9, 19.4, 21.5, 21.6; females, 19.6, 19.7, 22.5; unsexed, 25.3. Caucasus: Wing: males, 94, 98, 99. Bill from skull: males, 29, 32, 32. Bill from nostril: males, 19.2, 20, 21.1. Northern and western Iran: Wing: males, 96, 101, 101; females, 94, 95, 101. Bill from skull: males, 31, 32, 32; females, 32, 33, 34. Bill from nostril: males, 20, 20.2, 20.4; females, 22, 22.2, 23.4.

Tichodroma muraria nepalensis

B. Ashkhabad: Wing: male, 101; unsexed, 102. Bill from skull: male, 29.5; unsexed, 29. Bill from nostril: male, 16.5; unsexed, 16.7. Khorasan: Wing: males, 101, 103. Bill from skull: males, 28, 29. Bill from nostril: males, 17.3, 18.4. Western and north central Afghanistan: Wing: males, 99, 100, 101, 102, 103, 103, 104, 104, 104, 104; females, 98, 99, 99, 99, 99, 100, 101, 105. Bill from skull: males, 29.5, 30, 30, 30.5, 30.5, 31, 31, 31.2, 31.5, 32; females, 28, 29.5, 30.5, 31.5, 31.5, 32, 32.5, 34. Bill from nostril: males, 17.4, 17.7, 17.9, 18, 18.4, 18.8, 19, 20.4, 20.6, 21; females, 18, 19.4, 19.5, 19.6, 20, 20, 20.8, 22.7.

C. Kashmir: Wing: males, 102, 103, 106, 106; females, 99, 99. Bill from skull: males, 27, 28.5, 30, 32; female, 29. Bill from nostril: males, 16.3, 17.9, 18, 21.1; female, 18.4. Northern Punjab (9), Kangra (1), Kumaon (1): Wing: males, 101, 103, 103, 104, 105, 105, 106, 106, 106; females, 100, 101. Bill from

skull: males, 29.5, 30, 30.5, 30.5, 30.5, 31.5, 31.5, 32, 33; females, 30.5, 31.5. Bill from nostril: males, 17.9, 18, 18.9, 19.1, 19.4, 19.5, 20, 20.2, 20.7; females, 18.4, 20.

D. Russian Turkestan: Tashkent: Male, respectively, 102, 31.5, 20.5. Ferghana: Wing: males, 105, 106; female, 104; unsexed, 103. Bill from skull: male, 30.5; female, 29; unsexed, 31. Bill from nostril: male, 19; female, 16.1; unsexed, 19.1. Djarkent, all males: Wing: 102, 102, 104, 105, 106. Bill from skull: 33, 33, 35, 35, 42. Bill from nostril: 21.5, 21.5, 22.8, 22.8, 30.2.

E. Sikkim: Wing: male, 108; unsexed, 99, 104, 104. Bill from skull: male, 32.5; unsexed, 29, 29, 32.5. Bill from nostril: male, 18.9; unsexed, 17.6, 18.4, 20.2. China: Northern Kansu: Female, respectively, 101, 29, 18.1. Szechwan: Wing: males, 105, 111; unsexed, 105. Bill from skull: males, 30, 30; unsexed, 29. Bill from nostril: males, 18.6, 19.1; unsexed, 17.7. Shensi (southern): Wing: males, 103, 104, 105; female, 100. Bill from skull: males, 28.5, 29; female, 29. Bill from nostril: males, 17.8, 18.7; female, 17.8. Northern Hopeh: Male, respectively, 106, 33, 21.2. Western China (no locality): Unsexed, respectively, 110, 29.5, 19.8.

MOULT: Adults have a double moult, a complete postnuptial moult, and a partial prenuptial moult which involves only the replacement of the feathers of the head, throat, neck, and some feathers of the mantle, the forehead and crown becoming gray and the lores, chin, and throat black. The complete moult is almost over in specimens taken on August 23 in Kashmir, September 1 in north central Afghanistan, and September 6 in Sikkim. The partial moult is just starting on a specimen taken on February 4 at Karaj in northern Iran, is more advanced on specimens taken on February 27–28 at Djarkent, and is almost over on specimens taken on March 4 and 14 at Ashkhabad.

Juvenals moult into first winter plumage through a partial postjuvenile moult which involves the replacement of the body feathers, lesser, and middle (?) upper wing coverts. This moult is just starting or well advanced on specimens taken on August 18 in Khorasan and is ending on specimens taken from September 16 to 28 in northwestern Afghanistan and Ladak. Specimens in first winter plumage are like adults except that usually the white of the throat feathers is not quite so pure. In fall and early winter their wing quills are browner and more worn than those of the adults which are blacker and fresher. Whether or not first winter birds go through the partial spring moult of the adult I cannot tell. All my spring specimens are either moulting or in breeding plumage, and, through the palpation of the skull, appear to be fully adult.

CERTHIIDAE

***Certhia familiaris persica* Zarudny and Loudon**

IRAN: Mazenderan (region of Gurgan): Dimalu, July 23, 1940, 2 imm. ♂, 1 imm. ♀; Kherat, July 24, 1 imm. ♂.

Stresemann (1928, Jour. Ornith., vol. 76, p. 364) states that this race is extremely similar in coloration to nominate *familiaris* but differs in its much longer bill. I lack immature specimens of nominate *familiaris* and adults of *persica*. In my three immature specimens of the latter with a complete bill, the bill measures 18.5 in two males, and 16 in the female. In adult nominate *familiaris* the "Handbook of British birds" (1938, vol. 1, p. 238) gives the bill length from the skull as 14–16 in 12 males, and 13–16 in an unspecified number of females.

***Certhia familiaris hodgsoni* Brooks**

INDIA: Northern Punjab, Lahul: Tsokang Nulla, October 19, 1936, 2 ad. ♂, 2 ad. ♀; Muling, October 24, 1 ad. ♀.

Only one specimen from an unspecified locality in Kashmir is available for comparison. The Lahul specimens match it in coloration and measurements. Wing: Kashmir, unsexed adult, 67; Lahul, males, 66, 70; females, 63, 63.5, 63.5. Tail: Kashmir, 62; Lahul, males, 60, 65; females, 57+, 59, 60. Bill: Kashmir, 17.5; Lahul, males, 19, 21; females, 17, 17.5.

***Certhia familiaris mandellii* Brooks**

INDIA: Tehri: Chitona, September 28, 1948, 1 subad. ♀; Bhujeka, October 12, 1 ad. ♂. Kumaon: Sundum, July 4, 1 imm. ♀.

These specimens, and an adult male in the collection of the American Museum of Natural History taken on October 4, 1930, at Nandukital in Kulu, are similar to specimens of *mandellii* from Sikkim, but average perhaps slightly paler and duller. Stuart Baker (1922, Fauna of British India, vol. 1, p. 434) gives the distribution of *hodgsoni* as "Garhwal to North-West Kashmir." However, if my specimens from Tehri and Kulu are not fall migrants, the range of the unmistakably darker and more richly colored *mandellii* apparently extends farther west, the two races replacing each other in northern Punjab, *mandellii* to the south in Kulu, and *hodgsoni* to the north in Lahul.

MEASUREMENTS: Kulu: Adult male, wing, 63; tail, 58; bill,

16. Tehri: Wing: adult male, 71; subadult female, 65. Tail: male, 63; female, 60. Bill: male, 18.5; female, 17. Sikkim: Unsexed adults, wing, 64, 67, 68.5, 69, 69, 69.5, 71; tail, 60, 60, 61, 62, 65, 66, 67; bill, 16, 16.5, 17, 17, 17.2, 17.5, 18; unsexed subadult, wing, 70; tail, 62; bill, 17.

CERTHIA HIMALAYANA

The specimens collected by Koelz and those in the collection of the American Museum of Natural History support Meinertzhagen's division of this species (1922, Bull. Brit. Ornith. Club, vol. 42, pp. 140–141) into three races: *C. h. taeniura* Severtzow, 1873 (type locality, Turkestan), *C. h. limes* Meinertzhagen, 1922 (type locality, Gilgit), and *C. h. himalayana* Vigors, 1831 (type locality, Garhwal or Kumaon, according to Meinertzhagen). On the basis of the material available so far, Koelz' *cedricola* from eastern Afghanistan (1939, Proc. Biol. Soc. Washington, vol. 52, p. 65; type locality, Jalalabad) appears to be a synonym of *limes*.

The three races differ in their degree of saturation. In my specimens, those from western Afghanistan, which are identical with specimens of *taeniura* from Samarkand and Ferghana, are distinctly paler and grayer above and below than specimens from eastern Afghanistan and Gilgit eastward to Kumaon. In the latter, I lack sufficient specimens from Gilgit and Kashmir (*limes*), but specimens from Chamba eastward (nominate *himalayana*) differ from specimens from eastern Afghanistan, Gilgit, and Kashmir by being less "smoky," brighter and buffy below, and, above, by being darker and more rufous as they go eastward. But this cline in the increased pigmentation of the upper parts is slight, and the more western specimens in nominate *himalayana* are hardly separable from *limes*. On the other hand the difference between these two races and *taeniura* is clear cut and is supported by a difference in the length of the bill which is longer in *taeniura* (see measurements below).

The breeding specimens collected by Koelz in eastern Afghanistan are a little paler and grayer than the specimens I have from Gilgit and Kashmir, but the latter are too few, and the Koelz specimens collected on June 3 to 19 are too badly worn. In view of the decrease of pigmentation from east to west, it is possible that adequate breeding specimens will show the population of eastern Afghanistan to be distinct enough to warrant separation.

Whistler (1944, Jour. Bombay Nat. Hist. Soc., vol. 44, p. 518) questions Baker's statement (1922, Fauna of British India, vol. 1, p. 431) that *taeniura* occurs in Afghanistan. However, as stated above, the specimens collected by Koelz in western Afghanistan are identical with others from Samarkand and Ferghana. To base, as Whistler does, the identification of *taeniura* on the bill length is to overlook the obvious, this race being so much paler. Further, it is misleading, for, as my measurements show, Turkestan birds can also have short bills, while long-billed birds occasionally occur in *limes* and nominate *himalayana*.

MOULT: Adults have a complete postnuptial moult which probably starts at the end of June or early July, to end in early September. Specimens taken on June 17 to 19 in eastern Afghanistan, June 26 in Lahul, and July 4 in Chamba, although extremely worn, show no signs of moult, but on July 20–August 4 specimens from Kumaon this moult is far advanced. In two adults from Baltistan, taken on August 19 to 20, one is in the midst of the moult, while it is almost over in the other. Juvenals moult into first winter plumage through a partial postjuvinal moult involving only the replacement of the body feathers, lesser and middle upper wing coverts. This moult probably takes place at the same time as the complete moult of the adult, but in my specimens, while adults no longer show signs of moult by the middle of October, first winter birds from the same regions still show traces of moult from October 9 to 20 in Lahul and October 30 in Kumaon. However, this moult is completely over in first winter specimens taken on September 21 and October 14 in western Afghanistan.

The following measurements are of adults only:

Certhia himalayana taeniura

Western Afghanistan: Males, wing, 72.5, 73; tail, 69, 70; bill, 24.5, 26. Samarkand: Male, wing, 74; tail, 68; bill, 26. Ferghana: Wing: males, 72.5, 73, 73; females, 69+, 70; unsexed, 70. Tail: males, 63, 68, 68; females, 59+, 62+; unsexed, 63+. Bill: males, 24, 25, 26; females, 22, 26; unsexed, 22.

Certhia himalayana limes

Eastern Afghanistan: Wing: males, 69+, 71, 71.5+, 72+; females, 66, 67, 67+, 68+; unsexed, 68, 71.5. Tail: males, 56+, 57+, 67, 67+; females, 57+, 58, 62, 62+; unsexed, 61+, 65. Bill: males, 22.3, 22.5, 24; females, 19.5, 19.5, 20.5, 21.5; unsexed, 20, 22. Baltistan: Wing and tail moulting; bill, male, 22. Gilgit: Females, wing, 68, 71.5; tail, 63+; bill, 20, 25.

Certhia himalayana himalayana

Chamba: Males, wing, 71.5+, 73+; tail, 60+; bill, 22. Lahul and Kulu: Wing: males, 68, 69.5, 72, 73, 73.5, 75; females, 67, 68+, 69, 71. Tail: males, 59+, 61+, 66, 67, 68, 68+, 70; females, 61, 61+, 66+, 66+. Bill: males, 21, 22, 22, 22.5, 22.5, 23, 23.5; females, 19, 20.2, 20.5, 23.2. Simla and Rampur: Wing: males, 72, 73; females, 68, 69, 70, 71; unsexed, 67, 67, 70, 72.5. Tail: males, 64, 68; females, 58+, 61+, 67, 68; unsexed, 62+, 63, 65, 68. Bill: males, 23.5, 24.5; females, 21, 22; unsexed, 20, 21, 22, 22. Kumaon: Males, wing and tail moulting in two; in one, wing, 72, tail, 72; bill, 22, 22.3, 24.

***Certhia himalayana taeniura* Severtzow**

AFGHANISTAN: North central: Terak, September 5, 1939, 1 subad. ♀. Northwestern: Safedsang, September 21, 1 subad. ♂; Burchao Pass, October 12-14, 2 ad. ♂, 1 subad. ♀.

***Certhia himalayana limes* Meinertzhagen**

EASTERN AFGHANISTAN: Kail, June 3, 1937, 1 ad. ♂; Farajghan Pass, June 6, 1 ad. ♂; Sirotai, June 17-19, 1 ad. ♂, 2 ad. ♀; Jalalabad, December 18, 1 ad. ♀ (the type of *C. h. cedricola*), December 18-19, 1 ad. ♂, 1 ad. ♀, 2 unsexed ad.

INDIA: Kashmir: Tragbal, August 1, 1936, 1 imm. ♂, 1 imm. ♀. Kashmir, Baltistan: Shigar, August 19-20, 2 ad. ♂.

***Certhia himalayana himalayana* Vigors**

INDIA: Chamba: Kukti, July 4, 1936, 2 ad. ♂, 1 imm. ♂. Northern Punjab, Lahul: Kyelang, June 26, 1 ad. ♂, October 22, 1 ad. ♂; Tinnu, September 9 1930, 1 subad. ♂; Dartse, October 9, 1936, 1 unsexed subad.; Jalma, October 18, 1 ad. ♂; Tsokang, October 20, 1 subad. ♀; Muling, October 24, 1 ad. ♂; Gundla, October 24, 1 ad. ♀. Northern Punjab, Kulu: Jagatsuk, October 27, 1 ad. ♂; Kulu, November 4-8, 3 ad. ♂; Seobagh Nulla, November 16, 1 ad. ♀. Northern Punjab, Kangra: Kotla, January 5, 1948, 1 ad. ♀; January 26, 1946, 1 subad. ♀. Tehri: Kurihan, September 18, 1948, 1 subad. ♂; Tila, October 2, 1 subad. ♂. Kumaon: Gunji, July 18-20, 1 ad. ♂, 1 imm. ♀; Shankola, July 24, 1 unsexed imm.; Sanandiu, August 4, 1 ad. ♂, 2 subad. ♂, 1 imm. ♂, 1 subad. ♀; Lechiwala, October 30-31, 1 ad. ♂, 1 subad. ♀.

***Certhia discolor discolor* Blyth**

INDIA: Kumaon: Bona, June 28, 1948, 1 imm. ♂. Nepal: Chitlang, April 23, 1947, 1 ad. ♂. Northern Bengal: Darjeeling, December 23, 1936, 1 ad. ♂, 1 ad. ♀.

These specimens extend the range of this form considerably farther west. The specimen from Kumaon is an immature which had probably bred locally, while the specimen from Nepal was actually taken while "breeding." Hitherto the occurrence of this

form as far west as Nepal had been questioned, for according to Kinnear (1937, *Ibis*, p. 250) the only record for Nepal was based on an unpublished drawing of Hodgson, the depicted specimen probably coming from Sikkim. The Darjeeling specimens of Koelz and others from Sikkim in the collection of the American Museum are darker on the crown than the adult male from Nepal, but the difference may be due to wear, as the Nepal bird is very worn while the plumage is fresh in the others.

MEASUREMENTS: Wing: Nepal, male, 72; Darjeeling, male, 70.5; female, 70. Tail: Nepal, 77+; Darjeeling, male, 77; female, 80. Bill: Nepal, male, 17.5; Darjeeling, male, 17.5; female, 16.

***Salpornis spilonotus spilonotus* Franklin**

INDIA: Surguja: Ramanujganj, October 6-9, 1947, 1 ad. ♂, 3 ad. ♀; November 8, 2 ad. ♂.

No comparative material is available. The population of Rajputana has been separated as *rajputanae* by Meinertzhagen (1926, *Bull. Brit. Ornith. Club*, vol. 46, p. 83) on the basis of being less heavily marked below and grayer above.

MOULT: The October specimens still show a few last traces of moult in the body plumage.

MEASUREMENTS: Wing: males, 88.5, 90, 90; females, 87, 88, 93. Tail: males, 52, 54, 55; females, 48, 53, 56. Bill: males, 25.5, 26.5, 27.5; females, 26.2, 27, 27.

