

Article IV.—SIZE-VARIATION IN *PYRENESTES*, A GENUS OF WEAVER-FINCHES¹

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The extreme variation in size, especially of the beak, presented by the members of the genus *Pyrenestes* has long puzzled taxonomists. Similar differences may be seen in the genus *Oryzoborus* of tropical America, and in *Geospiza* of the Galápagos Islands. No explanation has been offered, I believe, for the conditions in *Oryzoborus*; but in *Geospiza*, while the nature of the food cannot be demonstrated to have influenced the remarkable diversity among their beaks,² insular segregation is assumed to have facilitated the evolution of the numerous forms. In the case of *Pyrenestes* such physical isolation is lacking, and we must look to other causes for an explanation.

Since returning from Africa I have enjoyed the privilege of studying all the *Pyrenestes* material in thirteen³ other important museums of the United States and Europe, taking careful measurements and color-notes from approximately 200 skins, including all the known forms, and the type specimens of all but *P. sanguineus*. For the many courtesies received in the course of my studies, I beg to express my appreciation to the authorities of all these institutions.

TAXONOMIC REMARKS

After examining so great a part of the existing specimens, I have decided to recognize the following species and subspecies, the known distribution of which is shown in Fig. 1.

¹Scientific Results of the American Museum Congo Expedition. Ornithology, No. 10.

²Snodgrass, 1902, Auk, XIX, pp. 367-381.

³Cambridge (Mass.), Philadelphia, Pittsburgh, Washington, London, Tring, Paris, Brussels, Tervueren, Frankfurt, Berlin, Munich, and Vienna.

Pyrenestes sanguineus sanguineus Swainson

Pyrenestes sanguineus coccineus Cassin

Pyrenestes ostrinus ostrinus (Vieillot)

Pyrenestes ostrinus maximus Chapin

Pyrenestes ostrinus centralis Neumann

Pyrenestes ostrinus rothschildi Neumann

Pyrenestes ostrinus gabunensis Neumann

Pyrenestes minor minor Shelley

Pyrenestes minor frommi Kothe

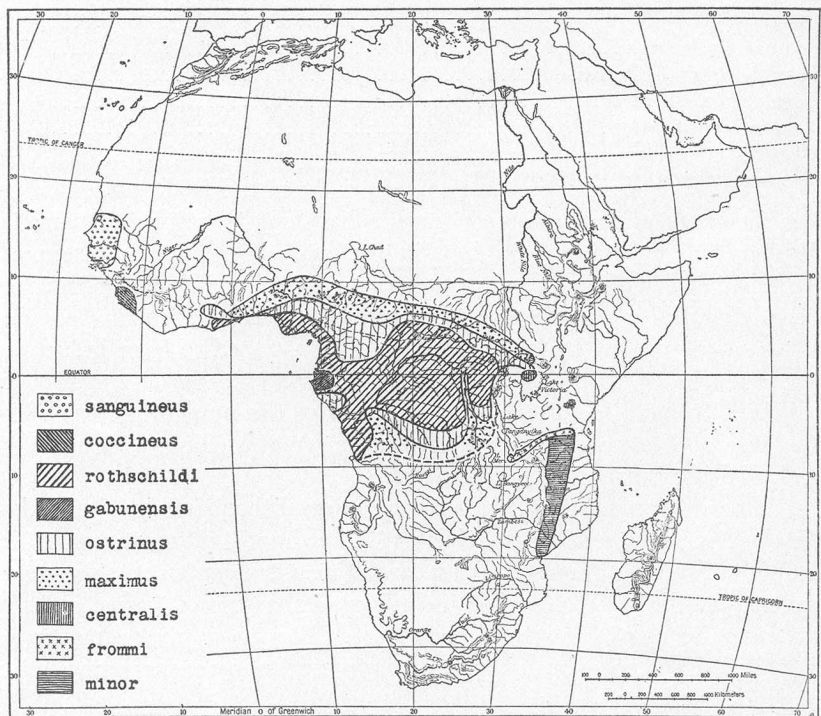


Fig. 1. Approximate distribution of the forms of *Pyrenestes* as recognized in the present paper.

The areas here assigned to the races of *P. ostrinus* and *P. minor* will be found very unlike those in previous revisions of the group, and I propose to show in the present paper not only on what grounds my taxonomic treatment rests, but also the interrelation between size—the most important subspecific attribute—and certain characteristics of the

environment. This in turn may suggest reasons for the curious dispersal of the forms, as well as for their racial variations.

The various forms of *Pyrenestes* in Central and Western Africa are always lowland birds of sedentary habits. They are not known even from the slopes of Mounts Cameroon or Ruwenzori, and it might seem that nothing could prevent the mingling of stocks. It is, nevertheless, significant that no specimens have yet been taken in the forested region of the Ivory Coast. This is just the area that separates two of the best-marked groups, those of the northwest with no black in any plumage, and *Pyrenestes ostrinus*, black-and-red in adult males, occupying Lower Guinea.

Again, in crossing the central Congo basin, Lang and I saw no *Pyrenestes*; and as yet no specimens have come from the middle of that flat, forested area. Farther to the southeast the extension of *P. ostrinus* may be prevented by the rise in elevation toward Lake Tanganyika and its effect upon the vegetation. But, if these are the barriers, they have a more marked effect upon color than upon dimensions, because small birds, as well as larger ones, range almost entirely across the African continent.

Only two species of the genus were recognized by Professor Reichenow in 1904¹; but Captain Shelley in the following year² listed four; and Professor O. Neumann³ has since united them all in a single species, of which, however, he distinguished no less than seven distinct geographic races.⁴

Professor Reichenow had stated that everywhere large and small birds occurred together, as well as the most varied intermediate stages. He believed that adult males were always black-and-red, the females browner, save in the East African species.

Both these errors were corrected by Professor Neumann, who had examined the specimens in many European museums and was able to demonstrate a certain geographic variation in size, besides showing that the adult males of his *P. o. sanguineus*, *P. o. coccineus*, and *P. o. minor* always remained brown-and-red. Yet even this reviewer admitted that the question of the forms with black in the males was not yet settled.

During our long stay in the northeastern Congo, we collected a series of 30 specimens from Isangi and Stanleyville on the Upper Congo

¹1904, 'Die Vögel Afrikas,' III, pp. 105-107.

²1905, 'Birds of Africa,' IV, pp. 281-287.

³1910, Journal für Ornithologie, LVIII, pp. 525-530.

⁴Mr. D. A. Bannerman, in a review which has appeared since the writing of my paper (1922, Revue Zool. Africaine, IX, p. 311), distinguishes the three species of *Pyrenestes*, but in the treatment of subspecies follows Neumann, except that he still recognizes *granti* and adds *frommi* as a race of *ostrinus*.

east and northward to Faradje, near the Lado Enclave. For us there could be no doubt as to the geographic segregation of large, small, and intermediate forms, although intergradation was rather complete. While the beak is the most striking feature with regard to size, its variation is usually correlated with that of the length of wing and even with the dimensions of the bird as a whole. But the measurement which best expresses the development of the beak is not that of the culmen, or from nostril to tip, but the greatest WIDTH of the lower mandible at the base of its sheath (measured with dividers).¹ The maxilla is rather short,

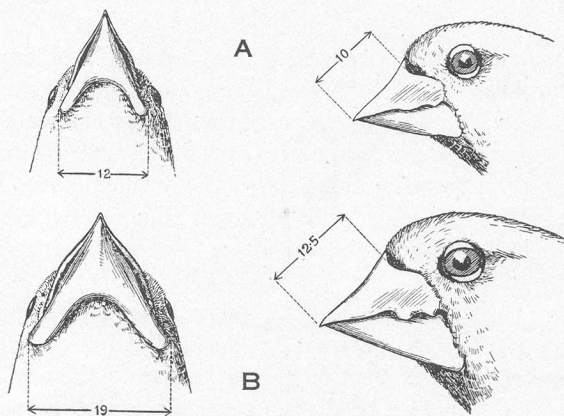


Fig. 2. Subspecific differences in the beak in one species of *Pyrenestes*; and method of measuring "width of mandible" and "bill from nostril."

A, *P. ostrinus rothschildi*, adult male from Avakubi, Ituri district. B, *P. ostrinus maximus*, adult male from Faradje, Upper Uelle district. Natural size.

and the length of its tip seems often to be altered as if by extreme wear of the horny sheath. Even the young, at the time they leave the nest, have the mandible of about the same width as their parents, whereas in length the beak is not yet fully developed.

In width of mandible, then, adult birds of our own small series varied from 10.2 mm. to 20 mm., covering almost the whole range of size throughout the genus, for only *Pyrenestes minor* ever has this measurement less than 10 mm. Specimens of small size, with width of mandible less than 14 mm., had been taken by us only in the region of dense equatorial forest; and those of intermediate dimensions (between 14 and

¹This measurement was first used by Cassin, I believe, in describing *P. coccineus*; but G. L. Bates is the only other writer who has employed it, 1911, *Ibis*, p. 588.

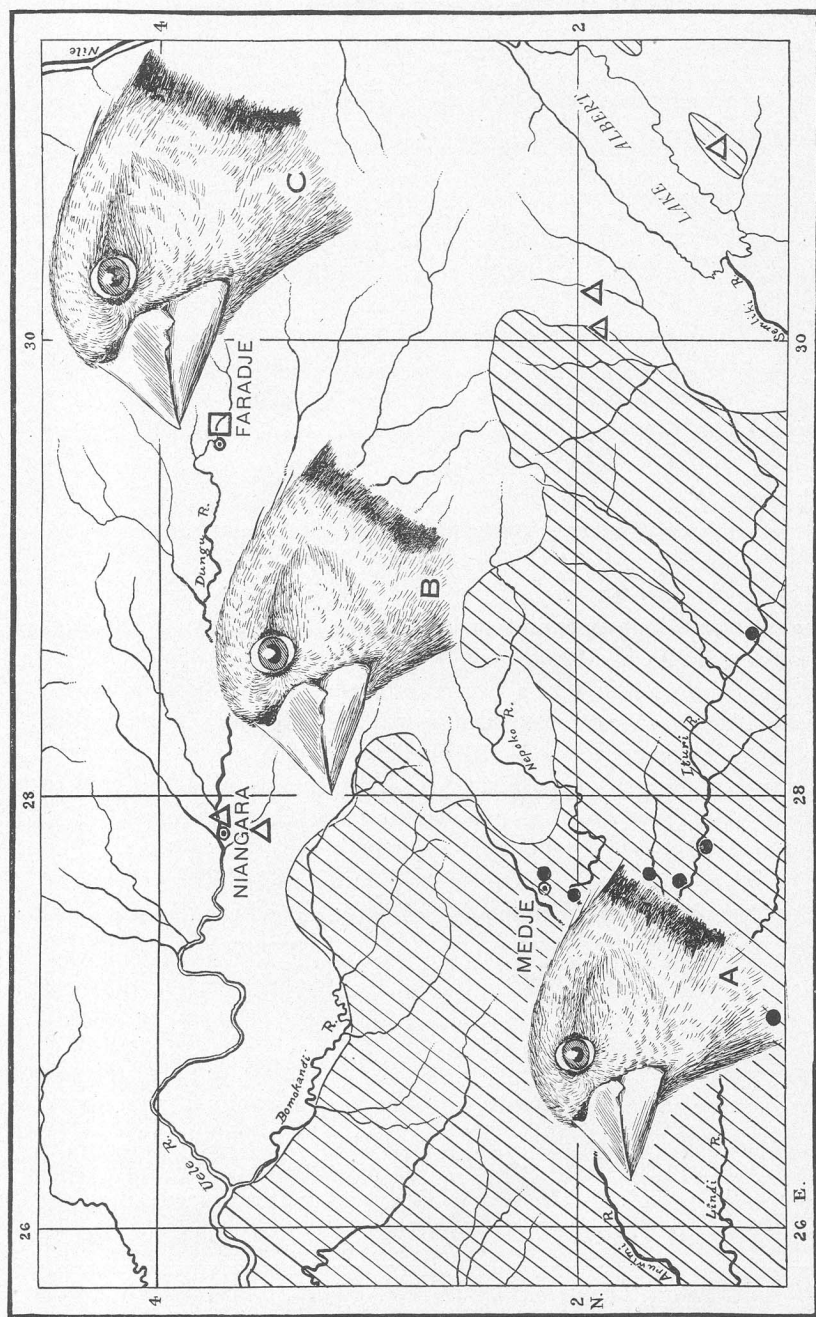


Fig. 3. Map to illustrate the distribution of races of *Pyrenestes ostrinus* in the northeastern Congo basin. The shaded area is unbroken forest, in which *rothschildi* (A) is known from the points marked with dots. Triangles are used to indicate occurrences of *ostrinus* (B), and a square for *maximus* (C). The birds' heads are drawn natural size.

16 mm.) only at Okondo's and at Niangara, along the border of the heavy forest; yet specimens of the largest size (17 to 20 mm.) had been secured not only at Faradje, well out in the northern savanna belt, but also at Stanleyville, on the Congo River, in the middle of the forest districts. In spite of the evident contradiction of my two Stanleyville specimens, it did seem as though the geographic distribution of the subspecies hinged upon the nature of the vegetation. (See Fig. 3.)

THE THREE SPECIES AND THEIR VARIATION

On the basis of the striking color differences of adult males, I conclude that the genus *Pyrenestes* is composed of three distinct species:

- (1) *P. ostrinus*, with adult male largely pure black, but whole head, chest, and tail red. (Gold Coast south to Angola and east to Uganda.)
- (2) *P. sanguineus*, similar in pattern, but the black completely replaced by brown. (Senegal to Liberia.)
- (3) *P. minor*, brown-and-red, but the red of forehead and face (even in adult males) not extending to hind crown. (Tanganyika Territory south to Beira in Mozambique.)

P. sanguineus might in a way be described as a "hen-feathered" representative of *P. ostrinus*. Professor T. H. Morgan's work on this character in a domestic breed of fowls¹ has shown on how few genetic factors such a difference may depend, so *sanguineus* and *ostrinus* may in reality be more closely related, in a genetic sense, than my separation of them as distinct species would seem to indicate.

Of each of these three species there are larger and smaller subspecies, for since Neumann's revision an additional form has been described: *P. frommi* Kothe,² which I now regard as a large race of *minor*. Of the three species, *minor* is the most distinct, not only in color, but also in size.

When my measurements of mandibular width are tabulated according to species and sex (Fig. 4), it is seen that the small forms of *ostrinus* and *sanguineus* agree very closely, but that the small form of *minor* has a distinctly narrower bill. Moreover, the large form of *minor* does not by any means attain the dimensions of its larger cousins. This same chart also shows how slight is the sexual difference in this regard; it might almost have been left out of consideration. We have found, too, among

¹ The Genetic and the Operative Evidence relating to Secondary Sexual Characters, 1919, Carnegie Inst. Wash. Publication No. 285.

² 1911, Orn. Monatsber., XIX, p. 70. (Kitungulu, Urungu.)

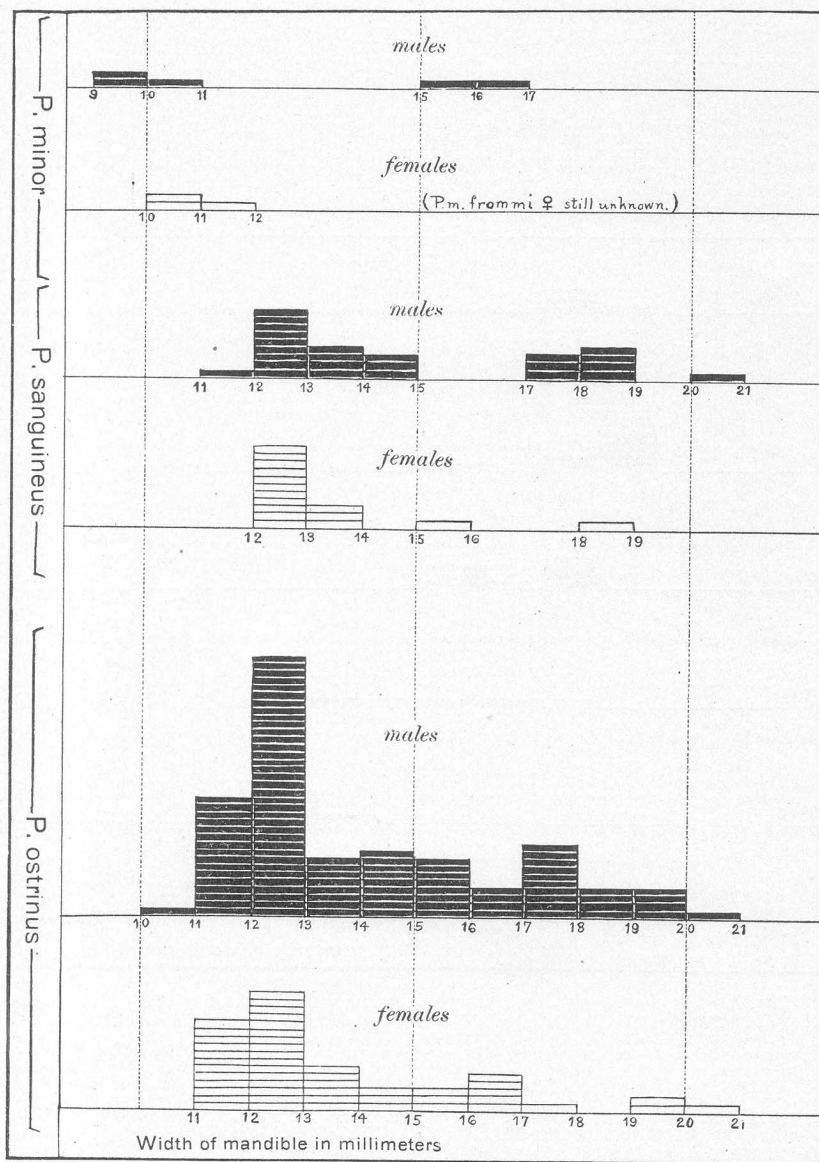


Fig. 4. Variation of mandibular width in the three species of *Pyrenestes*.

The sexes are separated, black polygons indicating males. Note the bimodal or polymodal nature of the polygons, showing that the populations are mixed.

individuals from one locality, that young birds with as yet no red feathers are approximately equal to their elders in width of bill, though not in length.

Further inspection of the combined frequency table will show at once the difficulty of dividing such a population as *P. ostrinus* into subspecies on the basis of size, unless the differences are well-marked geographically.

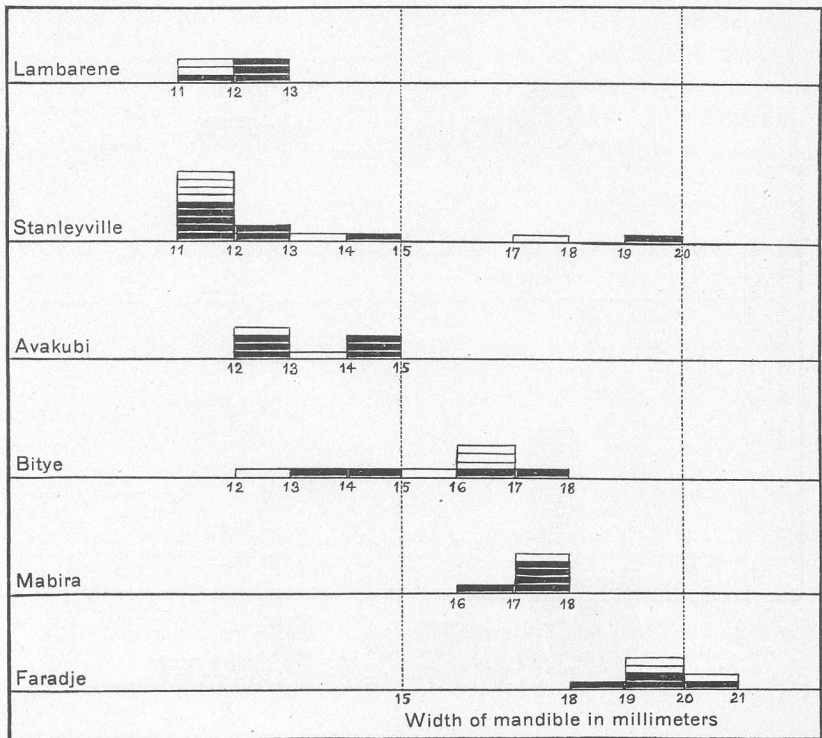


Fig. 5. *Pyrenestes ostrinus*: measurements of mandibular width, arranged according to locality.

Sexes united, but black rectangles indicate male specimens. At Stanleyville and Bitye the populations are mixed, presumably because of clearing of the forest.

Should we recognize races of three different sizes following Neumann, or only two; and, in either case, how are the limits to be fixed?

It is regrettable that no series of *Pyrenestes* exists large enough to render possible a truly statistical study. The largest number I have examined from any single locality is 15, from Stanleyville (Upper Congo), 13 of which were collected by Doctor C. Christy. Of Robin

Kemp's collecting I saw 13 from Bo (Sierra Leone); of G. L. Bates' from Bitye (Cameroon), 9; of Ansorge's from Lambarene (Gaboon), 6; while at Avakubi (Ituri) I collected 8, and at Faradje (Upper Uelle), 7. None of these, surely, is large enough to fix the variability for any single locality. Nowhere is *Pyrenestes* an abundant bird; in the Ituri Forest *P. ostrinus* is found in small numbers only in the clearings; in the Upper Uelle it is met but rarely, around patches of dense scrub near marshes or watercourses.

We do get an inkling, however, of the geographic variation in size for *P. ostrinus* by tabulating the measurements of even such small numbers by separate localities (Fig. 5). We see that in general Professor

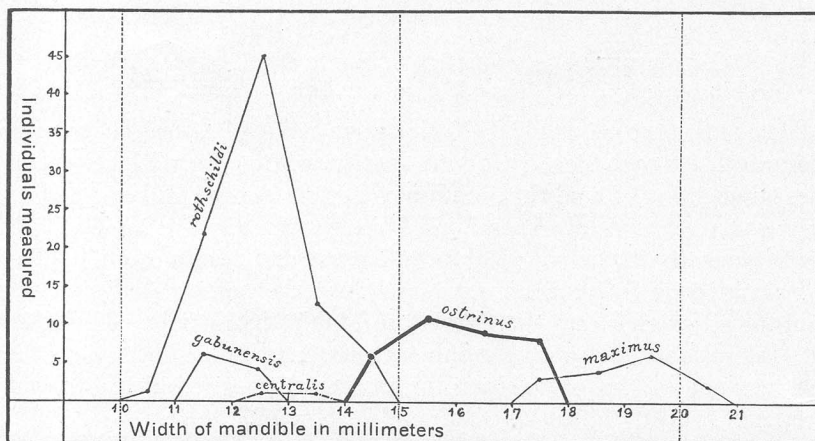


Fig. 6. Mandibular width in the races of *Pyrenestes ostrinus* as here recognized.

Sexes united. Slight overlapping is shown between *rothschildi*, *ostrinus*, and *maximus*, while *gabunensis* is distinguished only on female color pattern, and *centralis* for its relatively larger body with longer wing.

Reichenow was wrong in his assumption that large and small birds occurred together. Nevertheless, at Stanleyville¹ this is what really happens, and an explanation is needed. The two large-billed specimens were a male and a female taken by me, personally, close to the river and the government station, in 1909 and 1914. The thirteen small ones were collected by Doctor Christy in 1913 for the Tervueren museum; and, while they are all labeled Stanleyville, perhaps they were taken a little farther back from the river, where there was more forest. It seems possible that the larger subspecies may have invaded the forest region,

¹Probably also at Bitye, as well as near Stanley Pool and in the Southern Gaboon.

coming down the Lualaba River,¹ whereas the smaller birds represent the indigenous forest stock, which I have found myself a little farther north-west, at Isangi.

The excess of small individuals, on the left of our frequency polygons for *P. ostrinus*, is due simply to the larger area occupied by them, especially near the West Coast, and the consequently greater chances of their falling into collectors' hands.

A frequency table for length of wing in the different species (Fig. 7) shows almost the same sort of variation as in the beak, but proportionately less, so that the bill measurement is more useful. The general correlation between bill and wing in size is also illustrated by the tables of measurements on pages 437 and 438.

GEOGRAPHIC DISTRIBUTION IN WEST AND CENTRAL AFRICA

The statistical method being so ill-adapted to our problem, we must fall back upon the geographic. Noting upon a map of Africa the mandibular width for each locality (or the average width, when I had several measurements), I found that conditions as noted in the Ituri were more or less characteristic of Central and Western Africa. The smaller birds occur generally in the region of great forests and heavy rainfall. The very large ones, living in the savannas along the northern edge of the rain forest, extend from the Gambia to Mabira in Uganda. There are also indications that another group of rather large-billed birds skirts the southern edge of the forests, from the southern Gaboon eastward toward northern Angola. All this is illustrated by Fig. 11.

Pyrenestes sanguineus sanguineus and *P. s. coccineus* of Upper Guinea have been so well treated by Professor Neumann that I have little to add. An adult male of *sanguineus* has since been taken by Ansoerge at Gunnal, Portuguese Guinea, and is now in the British Museum. Between these two races there seem to be few or no intermediates, unlike the case in *P. ostrinus*. Still it is quite possible that future collecting will reveal the connecting links in the region of Konakry (French Guinea).

The boundaries separating the ranges of *P. s. coccineus* and *P. ostrinus* appear to be situated on the Ivory Coast, and not in the grasslands of Togo, as one might have expected. On the forested Ivory Coast no specimens of the genus seem ever to have been taken, and this may be compared with our total lack of specimens from the Central Congo

¹Bishop-birds (*Pyromelana hordacea*) are likewise to be seen in the large clearings about Stanleyville and even farther down the Congo River.

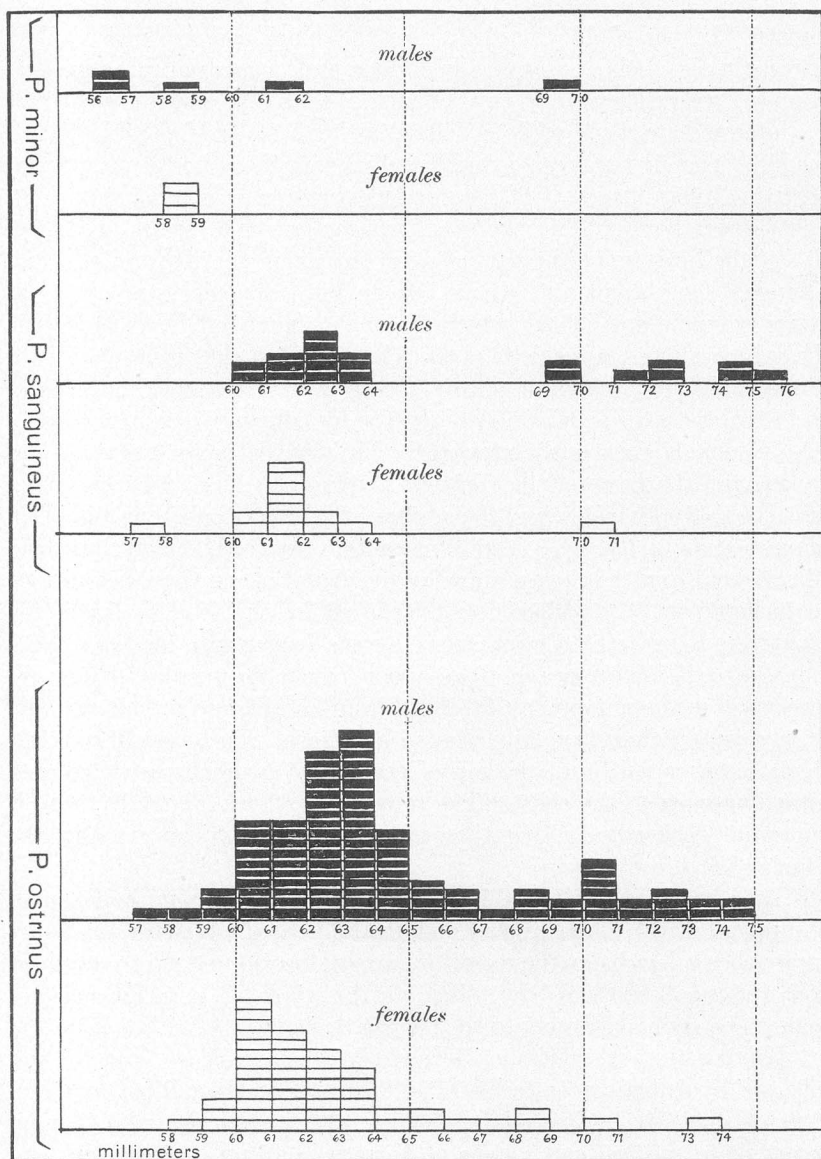


Fig. 7. Frequency table for wing-length in the three species of *Pyrenestes*, for comparison with that for width of mandible (Fig. 4).

Sexes separate, black polygons designating male specimens. Sexual difference is greater in length of wing than in size of beak.

forests. In the Gold Coast Colony the black-and-red males of *P. ostrinus* make their appearance in Fantee and even sixty miles west of Kumassi, where they already vary in size so as to represent the small and the intermediate races, while but little farther east, at Misahöhe (Togo), the large form first appears, extending thence northeast to the province of Zaria in North Nigeria. At the northwestern corner of the range of *P. ostrinus* we therefore find the same relation between forests and small size of the birds as at the northeastern corner, in the Upper Uelle and Uganda. On this point I should like to put particular stress. It explains why the small form which Neumann named *P. o. rothschildi* is the only one found in the delta of the Niger. This is the race that extends through the West African forests to the Lower Congo (Manyanga), and even eastward nearly to Beni, on the far edge of Congo territory.

Neumann erroneously referred the birds of the Lower Congo (Manyanga) and the Lower Uelle District (Buta) to his *P. o. gabunensis*, because he had only males, and the adults of this sex are indistinguishable in *gabunensis* and *rothschildi*. Our females from the Ituri, like all the others I have seen from the Congo, show by the extent of red that they cannot be included in *P. o. gabunensis*. Since seeing the females (including type) from Lambarene (Lower Ogowé River), I agree with Professor Neumann as to the distinctness of this Gaboon form in the females. There are three such in the museum at Tring, all from Lambarene and all agreeing closely, yet different from any others I have seen. The crown is red only on its anterior half, and the red of the throat is much restricted, not extending even to the chest. The brown of its back and belly, too, is somewhat darker and richer than usual in *rothschildi*, or even in the female of *P. s. coccineus*.

An adult female collected by Aschemeier at Ntyunga in the Fernand Vaz region of the Gaboon (and now in the U. S. Nat. Mus.) certainly approaches *gabunensis*; the red of the throat does not extend to the chest except as small spots or bars. But, on the whole, *P. o. gabunensis* appears to be confined closely to the Ogowé Basin.

Among the six specimens I found labeled simply "Gaboon" and collected by Aubry-Lecomte, Du Chaillu, and Verreaux, all but two were birds of small size. One adult male of Lecomte's measured 14.5 mm. across the mandible, and a male of Verreaux's 15 mm. This last was evidently one of the birds which Neumann thought had been wrongly labeled as to locality. I do not share his view, for not only is the existence of a rather large-billed form at Stanley Pool undoubted, but even in the Fernand Vaz region, at Omboué, Aschemeier has recently collected two

adult males with mandibles 15 and 16 mm. wide. This even tends to bear out my theory, for an arm of the southern savanna does extend northward along the coast of the Gaboon to this point. Near the same spot Aschemeier also collected so typical a savanna bird as a bustard, *Lissotis melanogaster*.

Along the southern edge of the Congo forests conditions are not at all well known. This need not surprise us, for the bird collections thus far made in the Kasai and Manyema districts are very few.¹ Besides specimens of *Pyrenestes ostrinus* of the intermediate and even large size from Stanley Pool, there are two smaller ones collected in "Angola" by Mechow and Schütt. *P. o. rothschildi* extends southward as far as Golungo Alto, like not a few other forest species. No really large examples of *P. ostrinus* are known from Angola or the southeastern Congo, so here a wide gap in the probable range remains to be filled. If my large individuals from Stanleyville did come there from the south, we may expect to find birds of two or three sizes in the neighborhood of Kasongo on the Lualaba.

All this goes to show that three of the races of *Pyrenestes ostrinus*, instead of being restricted to small areas like "Lagos to North Cameroon," have in reality a very extensive distribution in zones roughly concentric around the whole of the Cameroon-Congo forest. The smallest form, *gabunensis*, is confined to the Ogowé basin; but whether we go from there to the north, east, or southeast, we shall always traverse regions where the birds become successively larger, until finally the bill has almost doubled in width, and the wing become 8 to 9 mm. longer.

NOMENCLATURE IN *Pyrenestes ostrinus*

We have shown in this species how variation in size is practically continuous. Neumann, it is true, recognized races of three sizes; and in this I shall follow him. If only a large and a small form were allowed,

¹Since this article went to press we have received from the Reverend R. Callewaert seven specimens of *Pyrenestes ostrinus* collected in the vicinity of the Mission of St. Joseph, near Luluabourg (Kasai District, Congo). Two more from the same locality have been loaned us by Dr. H. Schouteden. This series of seven adult males and two females shows a variation of nearly 5 mm. in the width of mandible, the average (for both sexes) being 13.9. This warrants extension of the range of *rothschildi* south to at least 6° on the Lulua River.

The males from Luluabourg St. Joseph are similar in color to those of *rothschildi* from the Ituri. Their dimensions are: wing 63-66 mm. (average 64.1); tail, 49-51 (50.0); beak from nostril, 10-11.5 (10.5); width of mandible, 12.4-16 (14.0); metatarsus, 18.2-19.8 (19.2).

The two females have bills of very unequal size, but agree in being rather dark brown on the body, like Ituri specimens in fresh plumage, with the red of the face extending back to the hind crown, over the whole of the ear-coverts, the malar region, and throat. There are red tips to the chest feathers, but no red lower down. Measurements: wing, 64 (both); tail, 50, 48; beak from nostril, 9.2, 10.9; width of mandible, 11, 15.8; metatarsus, 18.6, 19.

Fortunately it has been possible to correct the maps of distribution (Figs. 1 and 11) in accordance with this fuller knowledge. The annual rainfall at Luluabourg is known to average 60.7 inches; (see Fig. 10), so here again we have a confirmation of the rule that in a region of heavy rainfall small-billed birds are the rule.

the variation within the subspecies would be far more pronounced than usual for a species among passerine birds; and even the eye alone can readily distinguish three classes.

Thus far we have not decided on the proper names for the intermediate and the largest forms of *P. ostrinus*. Professors Reichenow and Neumann, to be sure, considered the large form, then known only from Nigeria, as typical *ostrinus*, but my personal examination of Vieillot's type, still preserved in the Paris museum, showed it to be of the intermediate size. It is a black-and-red male, labeled "Type. Afrique Occidentale, No. 6479." From the size of the bird and the date of its collecting, it is practically certain that it came either from the eastern Gold Coast or from the Gaboon—in all events from the West Coast. Its measurements are: wing, 64; tail, 48; exposed culmen, 13; bill from nostril, 10; width of mandible, 15; metatarsus, 20.

In Vieillot's colored plate the wing is shown a little longer, about 71 mm., but comparison with specimens shows plainly that its beak is of the intermediate and not the largest dimensions. Inasmuch as his subject was expressly stated to be from the "Muséum d'Histoire Naturelle," I have no doubt as to the authenticity of the type. It might be argued that the name *ostrinus* would supersede *centralis* of Neumann. True it is that the Ituri specimens listed by Neumann as *centralis* are really very close to *ostrinus*—identical, I think,—but his type (♂ ad., Sesse Islands) has a smaller bill (mandibular width, 13) yet a longer wing (69 mm.) than in *ostrinus*. So I am in favor, rather, of regarding *centralis* as a small-billed race, restricted to the Sesse Islands and the adjacent shore of Lake Victoria. At Entebbe, Grauer collected an immature specimen sharing these peculiarities.

The large-billed form of parts of Uganda, the Upper Uelle, and Northern Nigeria, the most distinct of all the races, remained without a name until I described it as *Pyrenestes ostrinus maximus* in American Museum Novitates, No. 56, 1923, p. 8. The type specimen is an adult male from Faradje, on the northeastern edge of the Congo basin, well beyond the border of the rain forest. Its mandible measures 20.1 mm. across the base, and its other dimensions approach those of *P. sanguineus sanguineus*, notwithstanding the radical difference in color of the adult males.

The range of *maximus* includes the Guinean savannas, north of the Congo and Cameroon forests¹ from Lugalambo in Uganda, west to

¹The occurrence of *Pyrenestes o. maximus* in the northeastern Cameroon has since been definitely established. Mr. Hermann Grote writes me from Berlin that in the Tessmann collection there are two males of this large form, with wings of 72 and 74 mm., from Bozum, on the upper Uam River, 6° 25' N. lat.

Misahöhe in Togoland. It must also occur in the savannas south of the Congo Forest, for it has been found at Stanley Falls and Stanley Pool.

The specimens reported by van Someren¹ as *P. coccineus* from Bale and Mubendi, in Uganda, can hardly be anything except *P. o. rothschildi*, there at the eastern extremity of its range. At Tring I did not see any of these small birds; but Dr. van Someren has kindly sent me the following measurements of a male in his collection: wing, 63 mm.; bill from nostril, 9.5; width of mandible, 12; tarsus, 18. The wing is not long enough to agree with the type of *centralis*. In Uganda, wrote van Someren in the Ibis, this small form "is found in the forests."

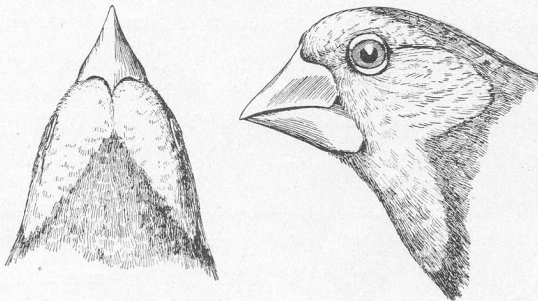


Fig. 8. Head of *Pyrenestes minor frommi*, adult male from the Uluguru Mts., Tanganyika Territory.

Crown and side views, to illustrate the distinctive color pattern of the species. Natural size, from a specimen in Lord Rothschild's museum.

GEOGRAPHIC DISTRIBUTION IN EAST AFRICA

Pyrenestes minor of East Africa is so rare in collections that its distribution must be very discontinuous. I cannot attempt to explain the reasons therefor, the region is one with which I am not familiar. There are, however, a small race, *minor*, and a larger one, which we shall call *frommi*.

The type of *P. frommi*² is in the Berlin museum, but my examination showed it to be so young as to give almost no information save as to size. It is still in complete juvenal plumage, without even a red feather about the face; but it does show that it represents a form far larger than *P. m. minor*, for its mandible is 16 mm. wide, and the wing 69 mm. in length.

¹1916, Ibis, p. 414; 1922, Nov. Zool., XXIX, p. 145.

²1911, Kothe, Orn. Monatsber., XIX, p. 70.

On purely geographic grounds one might associate it with the East African species; and the existence of a large form of *minor* is now proved by an adult male specimen recently collected in the Uluguru Mountains, Tanganyika Territory, by Mr. Arthur Loveridge, which I saw at the Tring museum. It has the mandible 15 mm. wide, the wing 62 mm. long, and is thus a little smaller than the type of *frommi*. Fig. 8, drawn from the head of this adult specimen, illustrates the restricted amount of red, even in the males, of the East African species.

But *P. m. minor* likewise occurs in the same mountains, as shown by a young bird also secured by Loveridge. So the distribution of these two races of the East African species offers a problem at least as complex as in the case of *P. ostrinus*.¹ That the small-billed race here again inhabits the more wooded districts is probable at least, for Claude Grant, who collected it near Beira, tells us: "It frequents densely wooded localities, spending all its time amongst the lower branches and undergrowth, and greatly resembles in all its actions *Lagonosticta niveoguttata*. The call is a loud 'zit.'"²

FOOD OF *Pyrenestes*

From the great size of the jaw muscles in *P. ostrinus maximus* and the stout pyramidal form of the bill throughout the genus, one might be led to suppose that the birds' diet would be restricted to some very hard seeds, difficult to crush. Certainly the birds are largely granivorous, but the seeds found in the stomachs are frequently quite soft, so that, if there was a stout husk, it was entirely removed.

In six stomachs of the small-billed *P. o. rothschildi*, seeds were found in every case, sometimes soft white ones such as I found in stomachs of *Spermospiza*, but once recognizable as grains of rice, still green. Two of these same specimens of *rothschildi* had eaten three or more small spiders apiece, and another had swallowed small bits of green leaves. Their diet certainly does not consist altogether of hard seeds. Rice is probably well liked, for at Gamangui we saw them rather commonly in fields of mountain rice, a variety grown not in marshes but on upland clearings.³ In Sierra Leone, Robin Kemp tells us⁴ *P. sanguineus coccineus* is snared in the rice fields. This again is a small-billed form.

¹If further collecting at the southern end of Lake Tanganyika should reveal only adults of the *ostrinus* coloration, then *frommi* would probably become a synonym of *ostrinus* or replace *maximus*, and the large race of *minor* would require renaming.

²1911, *Ibis*, (9) V, p. 227.

³A more slender-billed weaver-finch, *Pytilia schlegeli*, is extremely fond of this mountain rice.

⁴1905, *Ibis*, (8) V, p. 239.

The larger *P. o. ostrinus*, nevertheless, is said to make use of its somewhat stouter beak in cracking hard seeds. Mr. G. L. Bates¹ writes that at the River Ja it "is found in swampy places overgrown with the sedges which the people used formerly to cut and burn to obtain salt from the ashes, and it feeds on their hard seeds."

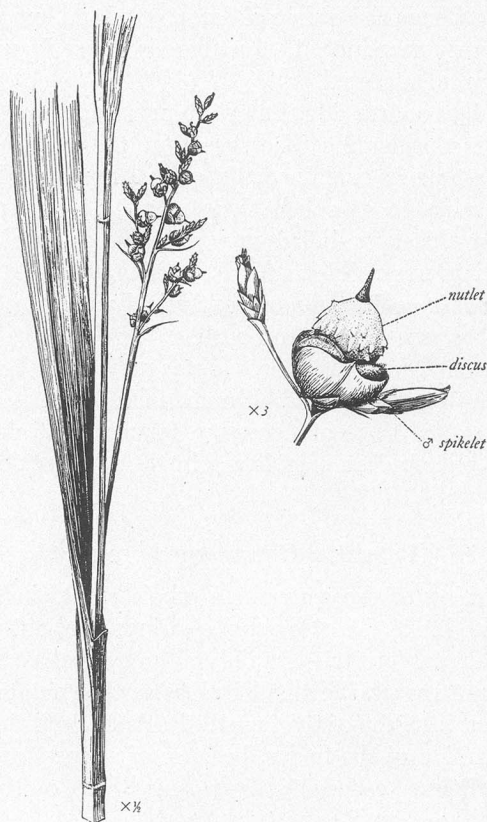


Fig. 9. *Scleria verrucosa* Willdenow, one of the group of hard-seeded sedges on which *Pyrenestes* feeds.

The nutlet has a heavy, stony shell. From a specimen collected at Malela, lower Congo River, by Dr. J. Bequaert. One-half natural size, the fruit three times enlarged.

In this connection it may be added that the sedges cannot be those of the common genus *Cyperus*, but belong rather, thinks Dr. Joseph Bequaert, to *Scleria*, a group commonly known as the razor

¹1911, *Ibis*, (9) V, p. 588.

grasses, which have extraordinarily hard, nut-like fruits. One of them is shown in Fig. 9.

Although represented by numerous species in tropical Africa, these troublesome plants, according to my recollection, are anything but common in the central Ituri, yet more so along the northern edge of the forest, just where the larger-billed forms of *ostrinus* were found. The razor grass grows along the borders of damp woods on low ground, where the shade is not very pronounced. Just here is where *Pyrenestes ostrinus ostrinus* is usually encountered.

I cannot fully confirm Mr. Bates' observations for *P. o. maximus*. There is likewise considerable razor grass in the places it frequents; but in the three stomachs examined, although I found seeds and nothing else, I was not able to establish their identity. It is very probable nevertheless that this large-billed race does use its beak to good advantage in feeding upon *Scleria* seeds. About Faradje, in the Uelle District, *P. o. maximus* was almost exclusively a swamp bird, usually found near small groups of trees and bushes.

The large-beaked races of the savannas may thus be able to crack seeds too stout for the small-billed birds of forest districts. They would do so by choice rather than of necessity, for many species of Ploceidæ with far weaker bills find an easy living in the same regions.

POSSIBLE ORIGIN OF FORMS

The distribution of the genus as a whole would indicate a group plainly adapted to life in the occasional clearings or about the borders of the lowland equatorial forests—certainly not a typical savanna or plains group. We cannot regard the smaller races as degenerate in size, perhaps from a recent invasion of the forest. Rather would they be counted as the more primitive of the forms, because of a closer agreement with most other Estrildinæ, especially *Cryptospiza*, one of the few genera showing a resemblance to *Pyrenestes*.

The huge-billed *sanguineus* and *maximus* must certainly be regarded as the most specialized of the genus, offshoots perhaps of the forest-dwelling stock, profiting by some more favorable condition just beyond the edges of the great forests. Their apparent adaptation for feeding on the seeds of razor grasses seems to fit them for life along these border regions. If their distribution represents the area originally occupied by the genus, it must be that the more primitive survivors have been crowded into the forest region.

No great changes in the past distribution of the genus can be demonstrated, and I am inclined to believe that the factors governing size in the various subspecies are in operation today. Whatever favorable conditions may exist in the savannas of Nigeria and the Uelle District, they evidently do not obtain in the really open plains of Africa, for there the genus is quite lacking, nor has it any close representative among the Estrildinæ.

The changing outline of the equatorial forest belt in the past has doubtless exercised a marked influence, through a sort of isolation, over the development of color forms which we now call species. The presence of one species in East Africa may perhaps be attributed to an earlier extension of the equatorial forest, later isolated through climatic changes along the western "rift valley." But the correlation between vegetation and the size of the birds is certainly independent of effective isolation.

Any suspicion that altitude may be responsible for the increase of size culminating in *P. s. sanguineus* and *P. o. maximus* will be immediately dispelled by a comparison of my charts of distribution in *Pyrenestes* (Figs. 1 and 11) with an orographic map of tropical Africa. The latter will show not one point of similarity.

The range of *sanguineus* is mostly if not entirely below 1600 feet elevation. That of *maximus* from a few hundred feet in Nigeria rises to about 4000 feet in Uganda; and *rothschildi* is found from sea-level on the west coast to about 2800 feet in the Ituri. In East Africa the very small billed *P. minor* is found both at Beira on the coast and in the highlands of Zomba and Mlanji.

In examining a map of the mean annual rainfall of Africa,¹ I have been struck by the fact that the few localities where *Pyrenestes minor* has been taken coincide exactly with certain small areas of exceptionally heavy rainfall (over 60 inches), which are shown in the vicinity of Beira, of Zomba, and of Mahenge. Even the record from the Uluguru Mountains is within a country of over 40 inch rains, and one is tempted to predict that this small-billed *Pyrenestes* will some day be found at the north end of Lake Nyasa, where the annual precipitation attains 80 inches. There can be no doubt that the vegetation there reflects the character of the rainfall. My rainfall map in Fig. 10 is based on Knox's plate. As for the areas of heavy forest, it will be sufficient to note that they are generally similar to the region of over 60 inches rain, but slightly more restricted in size.

¹A. Knox, 1911, 'The Climate of the Continent of Africa,' Pl. I.

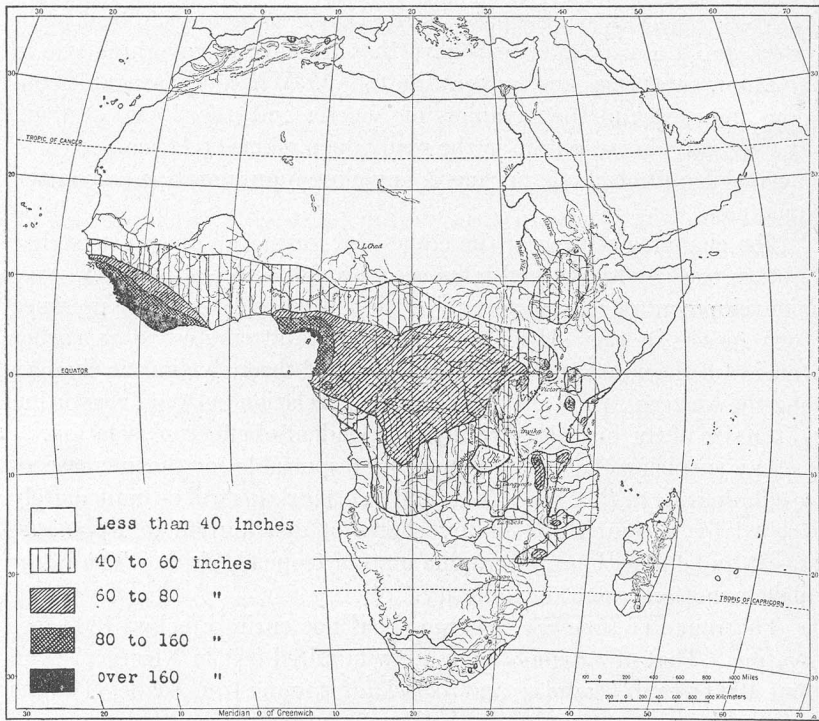


Fig. 10. Annual rainfall in continental Africa (after Knox).

A well-known African kingfisher, *Halcyon senegalensis*, varies geographically in color much as *Pyrenestes* does in size. Throughout the forests of the central Congo and Cameroon, as well as in those of Upper Guinea, in Sierra Leone at least, we find a subspecies with dark crown, *fuscopileus* of Reichenow, which is replaced along the border regions of the forest, from Senegambia to Uganda, by typical *senegalensis*. Still farther out in the open grass countries, both of the Sudan and of southern Africa, there is a lighter, brighter race known as *cyanoleucus*.

CONCLUSIONS

(1) Isolation is probably responsible for the color differences between the three species of *Pyrenestes*, but variation in size is dependent upon some other factor.

(2) In at least two of the species, *P. sanguineus* and *P. ostrinus*, the smallest individuals inhabit those regions where there are heavy rain-forests, the largest ones usually the more open savannas of the West

African subregion. They are connected by birds of intermediate size, these being found especially along the border regions of the forest country.

(3) The average size of the birds' bills in any locality can be shown to give a rough index of the nature of the vegetation, or of the rainfall.

(4) It seems likely that a correlation exists between the greater size of the bill and a more restricted diet of hard seeds of certain sedges.

(5) *Pyrenestes minor* of Eastern Africa has likewise a larger and a smaller form, very similar to each other in coloration; but a corresponding difference in their habitats remains to be demonstrated.

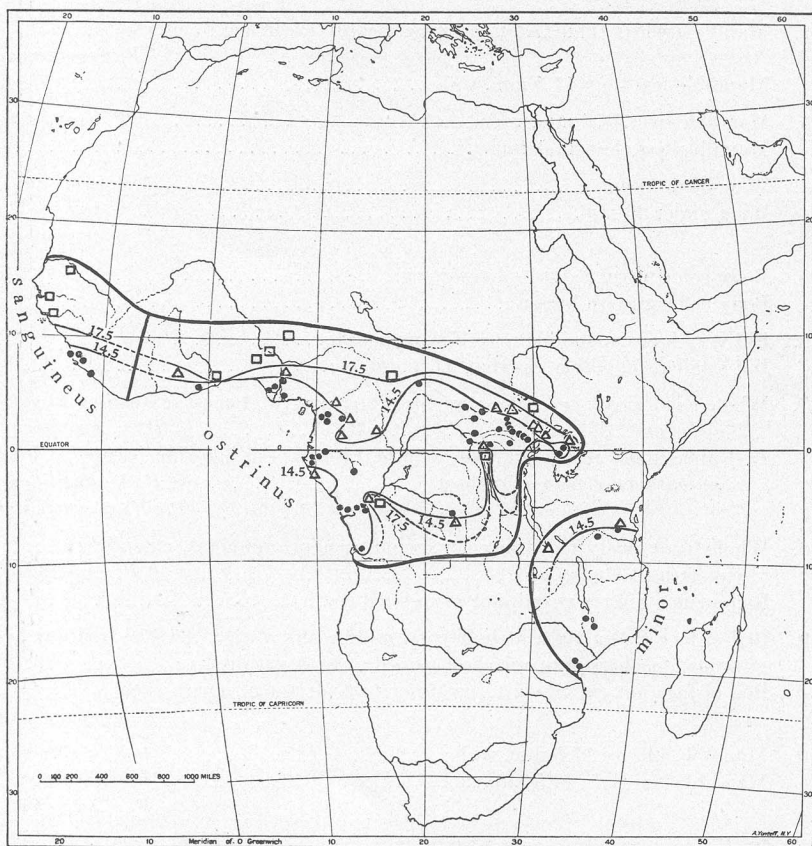


Fig. 11. Geographic variation in size of beak for all three species of *Pyrenestes*.

Points where birds occur with mandible averaging less than 14.5 mm. wide are marked with a round dot. Triangles indicate localities for specimens with beak from 14.5 to 17.4 mm. wide; and squares those of 17.5 mm. or over. Most of the known occurrences are represented. Note the parallel variation in different species, and compare this map with that for rainfall in Fig. 10, also with a botanical map of Africa, as in Bull. Amer. Mus. Nat. Hist., XXXIX, 1918, p. 19.

AIDS TO IDENTIFICATION

Modifying Professor Neumann's key, especially by the use of mandibular width in place of length of culmen, we offer the following table for adult birds only. Young birds in plain brown juvenal dress can only be determined if the locality is known whence they come.

Even among normal adults of *P. ostrinus*, a small proportion of intermediate specimens may be expected that cannot satisfactorily be referred to any one subspecies.

1. Body color largely black.....2.
Body color without black.....5.
2. Mandible wider than 17.5 mm., wing usually exceeding 67 mm.
♂ *P. o. maximus*.
Mandible less than 17.5 mm. wide.....3.
3. Mandible over 14.5 mm. wide.....♂ *P. o. ostrinus*.
Mandible less than 14.5 mm.....4.
4. Wing over 66 mm.....♂ *P. o. centralis*.
Wing under 66 mm..... $\left\{ \begin{array}{l} \text{♂ } P. o. rothschildi. \\ \text{♂ } P. o. gabunensis. \end{array} \right.$
5. Body color warm reddish olive-brown.....6.
Body color grayish brown.....11.
6. Bill very large, mandible over 17.5 mm. wide.....7.
Bill smaller, mandible less than 17.5 mm.....8.
7. Whole head glossy red, this color including nape and chest, extending to sides of breast.....♂ *P. s. sanguineus*.
Red areas more restricted, less definite, brown color showing basally at least on feathers of nape and chest..... $\left\{ \begin{array}{l} \text{♀ } P. s. sanguineus. \\ \text{♀ } P. o. maximus. \end{array} \right.$
8. Whole head glossy red, this color including nape and chest, extending to sides of breast.....♂ *P. s. coccineus*.
Red areas more restricted, not so well defined.....9.
9. Red of face extending a little beyond middle of crown, at least as red feather tips; feathers of upper chest tipped at least with red.....10.
Red of face not extending to posterior part of crown, nor to chest.
♀ *P. o. gabunensis*.
10. Mandible 14.5 to 17.5 mm. wide.....♀ *P. o. ostrinus*.
Mandible less than 14.5 mm..... $\left\{ \begin{array}{l} \text{♀ } P. s. coccineus.^1 \\ \text{♀ } P. o. rothschildi. \end{array} \right.$
11. Beak larger, mandible over 13 mm. wide.....♂, ♀ *P. m. frommi*.
Beak smaller, mandible usually under 12 mm. wide.....♂, ♀ *P. m. minor*.

¹*P. o. centralis* ♀, though still unknown, would probably fall in this group, but could be distinguished presumably by its longer wing, over 66 mm.

Measurements¹ of All Type Specimens in the Genus *Pyrenestes*

	WING	TAIL	BILL (FROM NOSTRIL)	WIDTH OF MANDIBLE	META- TARSUS
<i>coccineus</i> (male)	61.5	49.0	8.8	12.5	18.8
<i>personatus</i> (female)	70.5	57.0	11.0	18.0	20.5
<i>sanguineus</i> (male)	71.1	63.5	19.0
<i>gabunensis</i> (female)	60.0	46.4	9.8	11.8	18.7
<i>rothschildi</i> (male)	63.0	48.0	8.5	12.2	19.1
<i>centralis</i> (male)	66.5	54.0	10.1	13.0	20.0
<i>ostrinus</i> (male)	64.0	48.0	10.0	15.0	20.0
<i>maximus</i> (male)	73.0	55.5	12.0	20.1	22.5
<i>granti</i> (male)	58.0	49.2	9.4	17.5
<i>minor</i> (apparently female)	58.0	52.0	8.0	10.5	18.0
<i>frommi</i> (juv.)	69.0	56.5	9.6	16.0	21.0

DISTRIBUTION OF FORMS, AND LIST OF SPECIMENS EXAMINED

***Pyrenestes sanguineus sanguineus* Swainson**

Pyrenestes sanguineus SWAINSON, 1837, 'Birds W. Africa,' I, p. 156, Pl. ix and p. 159, fig. 1 (type locality: Senegal).

Pyrenestes personatus DU BUS, 1855, Bull. Ac. Brux., p. 151 (type locality: Senegal).

FIGURES.—One of the adult male, in color, and another of its beak accompany Swainson's original description. The first of these has been copied by Reichenbach, 1862, 'Die Singvögel als Fortsetzung der vollständigsten Naturgeschichte,' Pl. xxi, fig. 179.

RANGE.—Senegal to Portuguese Guinea.

SPECIMENS EXAMINED.—Philadelphia: 1 ♂ ad., "West Africa."

London: 2 ♂ ad., R. Gambia (Whitely); 1 ♂ ad., Gunnal, Port. Guinea (Ansorge); 1 ♂ ad., "W. Africa"; 2 ♂ ad., without locality.

Tring: 1 ♂ ad., "W. Africa."

Brussels: 1 ♀ ad., Senegal (type of *personatus* Du Bus).

***Pyrenestes sanguineus coccineus* Cassin**

Pyrenestes coccineus CASSIN, 1848, Proc. Phil. Acad., p. 67 (type locality: Sierra Leone and Monrovia, Liberia).

FIGURE.—The adult male, in color, Cassin, 1849, Journal Acad. Nat. Sci., Philadelphia, I, Pl. xxxi, fig. 2.

RANGE.—Sierra Leone and Liberia.

SPECIMENS EXAMINED.—Philadelphia: 1 ♂ ad., "W. Africa" (type of *coccineus* Cassin).

¹Those for *sanguineus* were given in inches by Swainson (1837), the remainder were all taken by the author from the actual specimens.

Measurements (Extremes and Average) for All Recognized Forms of *Pyrenestes*

		WING	TAIL	BILL (FROM NOSTRIL)	WIDTH OF LOWER MANDIBLE	METATARSUS
<i>P. s. sanguineus</i>	8 ♂ 1 ♀	69 -74.5(72.1) 70.5	53.5-61.5(57.6) 57	11.1-12.5(12.0) 11	17.5-20 (18.2) 18	20.5-22.5(21.2) 20.5
<i>P. s. coccineus</i>	17 ♂ 15 ♀	60 -63 (61.7) 57 -63 (60.9)	46.6-50 (48.0) 44 -51 (47.4)	8.6-10 (9.2) 8.5-10.3(9.2)	11.9-14.4(12.8) 12 -15 (12.6)	17 -19.8(18.3) 18 -20 (18.7)
<i>P. o. maximus</i>	11 ♂ 3 ♀	65 -74 (70.6) 68 -70	50 -61 (56.1) 54 -57	12 -13.3(12.4) 12.6-13	17.5-20.1(18.6) 19 -20	20 -23 (21.2) 19 -22
<i>P. o. ostrinus</i>	24 ♂ 13 ♀	62 -73 (66.3) 62.5-73 (64.9)	47 -59 (52.0) 47.8-58 (51.9)	10 -12.5(11.1) 10 -12 (10.9)	14.5-17.6(15.9) 14.5-17 (15.7)	18.5-22 (20.1) 19 -22 (19.9)
<i>P. o. centralis</i>	2 ♂ No ♀	66.5, 70	54, 56	10.1, 9.1	13, 12.6	20, 22
<i>P. o. rothschildi</i>	54 ♂ 36 ♀	58.6-67 (61.9) 58 -68 (61.1)	42 -53 (47.9) 43 -52 (47.3)	8.4-11 (9.2) 8.4-10.2(9.1)	10.2-14.5(12.3) 11 -14 (12.2)	17.5-20.5(18.8) 17.4-20 (18.7)
<i>P. o. gabunensis</i>	8 ♂ 3 ♀	57.5-63 (61.2) 60 -61	43.5-50 (46.9) 45.5-47	8.3- 9.7(9.1) 9 - 9.8	11.3-12.8(11.9) 11.5-11.8	17 -19.2(18.4) 18.5-18.7
<i>P. m. minor</i>	3 ♂ 3 ♀	56 -58 58 -58.5	49 -50.4 52 -53	7 - 7.5 7.5- 9	9.4-10.2 10 -11	17.5-18.7 18 -19
<i>P. m. frommi</i>	2 ♂ No ♀	62, 69	54, 56.5	11, 9.6	15, 16	20, 21

London: 5 ♂ ad., 4 ♀ ad., Bo, Sierra Leone (Kemp); 2 ♂ ad., Freetown (W. P. Lowe); 1 ♀ ad., Sierra Leone (W. P. Lowe); 1 ♂ ad., Rotifunk, S. Leone (Kelsall); 1 ♀ ad., Grassfields, S. Leone (Kelsall).

Tring: 1 ♀ ad., Sierra Leone (Bower); 2 ♂, 2 ♀, Bo, S. Leone (Kemp); 2 ♀, Freetown (Kelsall); 1 ♂, 1 ♀, Grassfields, S. Leone (Kelsall); 1 ♂, Clive Town, S. Leone; 1 ♂, Jagbamah, S. Leone (Kemp); 1 ♀, Whitefield, Liberia (Stampfli); 1 juv., Grand Cape Mount, Liberia; 2 ♂, Robertsport, Liberia (Demery).

Berlin: 1 ♂, 1 ♀, Liberia (Stampfli).

Munich: 1 ♀, Golaland, Liberia (Sherer).

***Pyrenestes ostrinus maximus* Chapin**

Pyrenestes ostrinus maximus Chapin, 1923, Amer. Mus. Novitates, No. 56, p. 8,

Fig. 5 (type locality: Faradje, N. E. Belgian Congo).

FIGURES.—The head of the young bird is shown by Chapin, 1917, Bull. Amer. Mus. Nat. Hist., XXXVII, Pl. vi, fig. 3. For the beak of the adult male see p. 418 of the present paper.

RANGE.—Across the northern Guinean savannas from Togoland and Northern Nigeria eastward to the Upper Uelle District and Uganda. Likewise to be expected in the southern Guinean savanna, inasmuch as it is known from Stanley Pool and Stanleyville on the Upper Congo.

SPECIMENS EXAMINED.—American Museum: 4 ♂ ad., 1 ♂ juv., 2 ♀ ad., 2 ♀ im., Faradje, Upper Uelle Distr., 1 ♂ ad., Stanleyville (Congo Exp.).

London: 1 ♂ ad., Shonga, Niger R. (Forbes).

Tring: 1 ♂ ad., Kaduna R., N. Nigeria (Poggiolini); 1 ♂ ad., Illorin, N. Nigeria (Bryan); 1 ♂ ad., Lugalambo, Uganda (van Someren).

Berlin: 1 ♂ ad., Misahöhe, Togo (Baumann); 1 ♂ ad., Stanley Pool (Teusz).

***Pyrenestes ostrinus ostrinus* (Vieillot)**

Loxia ostrina VIEILLOT, 1805, 'Oiseaux Chanteurs,' p. 79, Pl. XLVIII (type localities: "Africa and India"; I propose restriction to southern Gaboon coast).

FIGURES.—The original description is accompanied by a colored plate of the adult male. Reichenbach, 1862, 'Die Singvögel als Fortsetzung der vollständigsten Naturgeschichte,' Pl. XXI, fig. 178, again figured in color the same sex of this bird.

RANGE.—From the interior of the Gold Coast eastward along the northern edge of the Cameroon and Congo forests to the Lendu Plateau, and the Bugoma and Mabira Forests in Uganda. Also along the southern edge of the great forest, from the Fernand Vaz region eastward to Stanley Pool and Angola, while a rather large female has been taken at Stanley Falls.

SPECIMENS EXAMINED.—American Museum: 2 ♀ ad., 2 ♀ juv., Niangara, Uelle Distr.; 1 ♀ ad., Stanleyville (Congo Exp.); 1 ♀ im., Gaboon (Verreaux).

Toronto: In the collection of Mr. J. H. Fleming, 1 ♀ ad., Mabira, Uganda (Hughes).

Washington: 2 ♂ ad., Omboué, Fernand Vaz region (Aschemeier).

London: 1 ♂ ad., Bibiani, Gold Coast; 1 ♂ ad., Agouleri, Nigeria (Kemp); 2 ♂ ad., 1 ♀ ad., River Ja, S. Cameroon (Bates); 1 ♂ ad., Gaboon (Verreaux); 1 ♀ juv., Pompari, R. Uelle (Alexander); 1 ♂ ad., Tingasi, Uelle Distr. (Emin); 1 ♂ ad., Mpumu, Uganda (Seth-Smith).

Tring: 1 ♂ ad., Agouleri, Nigeria (Kemp); 1 ♂ im., 3 ♀ ad., River Ja (Bates); 1 ♂ ad., Ituri Forest, near Irumu (Camburn); 3 ♂ ad., Mabira, Uganda (van Someren).

Paris: 1 ♂ ad., "Afrique Occidentale" (type of *ostrinus*); 1 ♂ ad., West Africa (Brazza and Pecile); 1 juv., Brazzaville (Dybowski).

Frankfort: 1 ♂ ad., Molundu, S. Cameroon (Schultze); 1 ♀ ad., Angu, Uelle R. (Schubotz).

Berlin: 1 ♀ ad., Yaunde, S. Cameroon (Zenker); 1 ♂ im., Nkolentangan, Sp. Guinea; 1 ♂, Angola (Schütt); 1 ♀ ad., Duki R., Eastern Ituri Distr. (Stuhlmann).

Dr. V. G. L. van Someren sends me measurements of: 1 ♀ ad., Bugoma Forest; 1 ♂ ad., Kyetume, Uganda; 2 ♂ ad., Mabira Forest, Uganda.

***Pyrenestes ostrinus centralis* Neumann**

Pyrenestes ostrinus centralis O. NEUMANN, 1910, Journal für Ornithologie, p. 529 (type locality: Sesse Islands, Lake Victoria).

FIGURE.—None.

RANGE.—Sesse Islands and adjacent portion of Uganda.

SPECIMENS EXAMINED.—Tring: 1 ♂ juv., Entebbe (Grauer).

Berlin: 1 ♂ ad. (type of *centralis*), Sesse Islands (Stuhlmann).

***Pyrenestes ostrinus rothschildi* Neumann**

Pyrenestes ostrinus rothschildi O. NEUMANN, 1910, Journal für Ornithologie, p. 528 (type locality: Warri, Southern Nigeria).

FIGURE.—For head and beak, see p. 418 of the present paper.

RANGE.—Fantee (Gold Coast), eastward through forests of S. Nigeria, Cameroon, and Congo to Mawambi in Upper Ituri. Southward also to the Lower Congo and Northern Angola.

SPECIMENS EXAMINED.—American Museum: 2 ♂ ad., Isangi, Distr. Aruwimi; 1 ♂ im., Boyulu, Distr. Stanley Falls; 1 ♀ im., Ngayu, Ituri Distr.; 6 ♂ ad., 1 ♂ im., 2 ♀, Avakubi, Ituri Distr.; 1 ♂ ad., Gamangui, Nepoko R.; 1 ♂ ad., Medje, Ituri Distr. (Congo Exp.).

Cambridge (Mass.): 1 ♂ ad., Sakbayeme, Cameroon (G. Schwab).

Philadelphia: 1 juv., River Camma, Gaboon (Du Chaillu).

Pittsburgh: 2 ♀ ad., Lolodorf, S. Cameroon; 1 ♀ ad., Efulen (Reis).

Washington: 2 ♂ ad., Efulen (Bates); 2 ♀ ad., Fernand Vaz region (Aschmeier).

London: 1 ♂ ad., Fantee (Swanzy); 2 ♀ ad., Gold Coast (Kirby); 1 ♀ ad., Fantee (Gardner); 1 ♂ ad., Agouleri, Nigeria (Kemp); 1 ♀ ad., Abutschi, S. Nigeria (Kemp); 1 ♀ ad., Burutu, S. Nigeria (Kemp); 1 ♂ ad., 1 ♀ ad., River Ja, S. Cameroon (Bates); 1 ♀ ad., Gaboon (Verreaux); 1 ♂ im., Gaboon (Du Chaillu); 1 ♀ ad., Leopoldville, Congo (Bohndorff); 2 ♂ ad., Yambuya, Aruwimi R. (Jameson); 1 ♂ ad., Bosobangi, Ituri R. (Christy); 1 ♂ ad., Mawambi, Ituri R. (Woosnam).

Tring: 3 ♂ ad. (including type of *rothschildi*), 2 ♀ ad., Warri, S. Nigeria (Roth); 1 ♂ ad., Abutschi, S. Nigeria (Kemp); 2 ♂ ad., 1 ♀ im., Degama, S. Nigeria (Ansorge); 2 ♂ ad., 4 ♀ ad., Buguma, S. Nigeria (Ansorge); 1 ♂ im., Manyanga, Lower Congo (Bohndorff); 1 ♂ ad., Golungo Alto, Angola (Ansorge); 1 ♂ ad., Buta, Lower Uelle Distr. (Val. Meregaglia).

Paris: 1 ♀ ad., Gaboon (Du Chaillu); 1 ♂ ad., Gaboon (Aubry-Lecomte); 1 ♂ ad., Franceville, Gaboon (Schwébisch); 1 ♂ ad., Upper Kemo River, near Ubangi (Dybowski).

Tervueren: 1 ♀ ad., Lower Congo (Schouteden); 1 ♀ im., Kisantu (Goosens); 1 ♂ im.; Leopoldville (Christy); 9 ♂ ad., 4 ♀ ad., Stanleyville (Christy); 1 ♂ ad., Bosobangi, Ituri R. (Christy).

Frankfort: 1 ♀ ad., Bondo, Uelle R. (Schubotz).

Berlin: 1 ♂, 1 ♀, Cameroon (Zeuner); 1 ♂ ad., Elododo, Cameroon; 1 ♂ ad., 1 ♂ im., Bipindi, Cameroon; 1 ♂ im., Molundu, S. Cameroon (Schultze); 1 ♂ ad., Gaboon; 1 ♂ ad., Chinchoxo (Falkenstein); 1 ♂ ad., 1 ♀ im., Manyanga (Bohn-dorff); 1 ♂, Angola (Mechow); 1 ♀, Angola (Schütt).

Vienna: 1 ♀, Mawambi, Ituri R. (Grauer); 1 ♀, Mawambi-Beni (Grauer).

***Pyrenestes ostrinus gabunensis* Neumann**

Pyrenestes ostrinus gabunensis O. NEUMANN, 1910, Journal für Ornithologie, p. 528 (type locality: Lambarene, Lower Ogowé River).

FIGURE.—Reichenbach's colored figure, 1862, 'Die Singvögel,' Pl. xxi, fig. 180, may well be of the male of this form, for a specimen collected by Verreaux in the Gaboon, he said, was in the Dresden Museum. On the other hand, it cannot of course be distinguished from the male of *rothschildi*.

RANGE.—Confined to Gaboon, particularly the basin of the Ogowé.

SPECIMENS EXAMINED.—Tring: 4 ♂ ad., 3 ♀ ad. (including type of *gabunensis*), Lambarene, Gaboon (Ansorge); 3 ♂ ad., Abanga River, Gaboon (Ansorge).

Paris: 1 ♂ ad., Achouka, Lower Ogowé R. (Dybowski).

***Pyrenestes minor minor* Shelley**

Pyrenestes minor SHELLEY, 1894, Ibis, p. 20 (type locality: Zomba and Milanji Plains, Nyasaland).

Pyrenestes granti SHARPE, 1908, Bull. Brit. Orn. Club., XXI, p. 67 (type locality: Beira, Mozambique).

FIGURE.—The adult female is shown in color by Shelley, 1905, 'Birds of Africa,' IV, Pl. xxxv, fig. 1.

RANGE.—Scattered localities from Uluguru Mts. (Tanganyika Terr.) south to Beira in Mozambique.

SPECIMENS EXAMINED.—London: 1 ad. [in ♀ plumage], Zomba (Whyte); 1 ad., [in ♀ plumage], Milanji Plateau (Whyte) (types of *minor*); 1 ♂ ad. (type of *granti*), Beira (C. Grant); 1 ♂ im., Masambeti, Port. E. Afr. (C. Grant).

Tring: 1 ♂ im., Uluguru Mts. (Loveridge).

Berlin: 1 "♀," Sanji, Mahenge, E. Afr. (Münzner). Professor O. Neumann agrees with me in thinking this specimen to be wrongly sexed.

***Pyrenestes minor frommi* Kothe**

Pyrenestes ostrinus frommi KOTHE, 1911, Ornithologische Monatsberichte, p. 70 (type locality: Kitungulu, Urungu, E. Africa).

FIGURE.—For head and beak of the male, see p. 429 of the present paper.

RANGE.—Urungu, at south end of Lake Tanganyika, and Uluguru Mts., Tanganyika Territory.

SPECIMENS EXAMINED.—Tring: 1 ♂ ad., Uluguru Mts. (Loveridge).

Berlin: 1 ♂ im. (type of *frommi*), Kitungulu (Fromm).