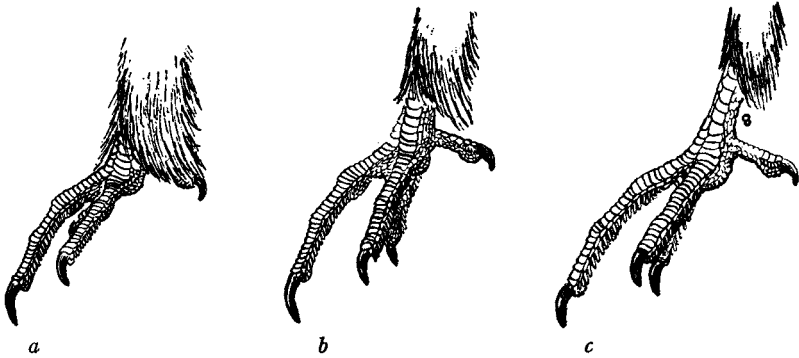


## TARSAL FEATHERING OF RUFFED GROUSE

BY LEONARD J. UTTAL

THE tarsal feathering of the Ruffed Grouse, *Bonasa umbellus*, varies individually, geographically, and subspecifically. The purpose of this paper is to present facts concerning this variation. A few days before the paper was submitted for publication W. E. Clyde Todd (Auk, 57: 390-397, 1940) proposed three new subspecies of Ruffed Grouse: *B. u. monticola* from West Virginia, *B. u. medianus* from Minnesota, and *B. u. canescens* from northern Ontario. Doubtless certain of the writer's statements apply to birds that Todd would include under these names, but he is not at present in a position to borrow the material upon which Todd based his remarks. He strongly feels, however, that in any further study of Ruffed Grouse subspeciation the matter of the tarsal feathering should be closely watched. By the time this paper is published the writer hopes to be investigating this interesting problem further, especially as it concerns the new forms.



TEXT-FIG. 1.—Tarsal feathering of Ruffed Grouse. a, *Bonasa umbellus umbelloides*; b, *B. umbellus togata*; c, *B. umbellus umbellus*. Octavia Bailey, del.

The tarsus of the Ruffed Grouse is feathered on the upper part and more or less bare on the lower part, depending upon the subspecies (Text-fig. 1). There are also subspecific differences in the length and coloration of the tarsal feathers, and the length of the toe pectinations, popularly called 'snowshoes.' Some of these differences are so obvious that I am surprised to find no previously published reference to them. The effect of these differences in living birds makes the more bare-legged forms appear longer-legged than the more

heavily feathered forms. Dr. Arthur A. Allen noticed this when he was experimenting with the artificial propagation of Ruffed Grouse and had the opportunity to observe the heavily feathered tarsus of *B. u. umbelloides* from Alberta side by side with the comparatively bare-legged *B. u. umbellus* from New York State. That the brachypodal appearance of the Alberta birds is illusory is obvious, for in tarsal length they do not differ significantly from New York birds. It was Dr. Allen who introduced me to this phenomenon and his suggestion which inaugurated this study.

Mr. John Trainer has reported on differences in tarsal feathering between three subspecies of Ruffed Grouse, *B. u. togata*, *umbellus*, and *umbelloides*, in an unpublished thesis on the pterylography of the species (MS., Cornell University, 1938). His conclusions, though

PERCENTAGES OF UNFEATHERED PORTION TO TOTAL LENGTH OF TARSUS

Percentage class	♂ <i>B. u. yukonensis</i> ♀	♂ <i>B. u. umbelloides</i> ♀	♂ <i>B. u. sabini</i> ♀	♂ <i>B. u. brunnescens</i> * ♀	♂ <i>B. u. togata</i> ♀	♂ <i>B. u. thayeri</i> ♀	♂ <i>B. u. umbellus</i> ♀
15-18%.....	1	1					
19-22.....		1 1					
23-26.....		4 1	1		1 2		
27-30.....	2	4 4	1		9		
31-34.....		4 1			12 14		4 1
35-38.....		2 1	1 2	3 1	6 10		6 4
39-42.....		2 2	2 1	2 5	6 7	2 1	8 9
43-46.....		1	1	1	2 4	2 3	8 7
47-50.....					4 5	1 1	8 8
51-54.....			1		1		1 4
55-58.....			1		1	1	3 2
59-62.....						1	5 3
63-66.....					1	1	2 1
67-70.....							3
Total (230)	3 0	19 10	5 6	6 6	42 33	6 7	48 39
Minimum %	17	15 20	27 26	37 37	26 26	40 41	34 33
Mean % (to unit)	24	30 31	38 41	39 40	36 40	47 49	46 47
Maximum %	28	43 39	44 55	44 72	56 63	63 60	70 65

\* Eight specimens kindly measured by Mr. H. B. Conover, the author of the subspecies, following my directions.

accurate, are only indicative as his material was scant and his treatment of the problem merely incidental to a much larger investigation. Mr. Trainer's manuscript, however, was very helpful to me, and I am grateful to the author for allowing me free access to it.

In working out the tarsal-feathering characteristics of the Ruffed Grouse races as arranged in Peters's 'Check-list,' plus *B. u. brunnescens* Conover, I compared percentages of the total length of the entirely unfeathered portion of the tarsus. I obtained these percentages by dividing the distance from the point of insertion of the most distal tarsal feather (always on the inside of the tarsus) to the tip of the lowest frontal tarsal scute by the total tarsal length (the diagonal from the outside of the ankle joint to the tip of the afore-mentioned scute). The percentages of 230 specimens thus obtained are listed by subspecies and sex in the comparative table on page 75.

This table graphically shows the fundamental racial character of the variation in amount of tarsal feathering in Ruffed Grouse. The difference in some cases is substantial and taxonomically useful; in others it is negligible. The genetic nature of this tarsal-feathering character is over and above the individual variation and overlapping apparent in the table, as was attested biometrically.

Standard deviations and standard errors of the mean percentages obtained are (excepting *yukonensis*, of which there was insufficient material):

<i>Subspecies</i>	<i>Sex</i>	<i>No.</i> <i>examined</i>	<i>Mean (%)</i>	<i>Standard</i> <i>deviation</i>	<i>Standard</i> <i>error</i>
umbelloides.....	♂	19	29.6	6.4	1.4
	♀	10	30.9	6.2	2.0
sabini.....	♂	5	38.1	5.4	2.4
	♀	6	41.2	10.7	4.5
brunnescens.....	♂	6	39.2	5.0	2.1
	♀	6	39.8	1.5	0.6
togata.....	♂	42	36.3	7.2	1.1
	♀	33	39.8	7.5	1.3
thayeri.....	♂	6	47.2	8.1	3.3
	♀	7	48.5	0.0	0.0
umbellus.....	♂	48	46.4	10.8	1.6
	♀	39	46.5	7.3	1.2

The characteristics of the tarsal feathering of the subspecies of *Bonasa umbellus* may be summed up as follows:

*B. u. yukonensis* (Canadian Northwest and interior of Alaska) and *B. u. umbelloides* (Rocky Mountains):—About a quarter of the tarsus is unfeathered. Individual feathers long and well developed (shafts

of most distal feathers from nine birds averaged 13 mm.), covering bare part of tarsus, usually the hind toe, and sometimes the first phalanges of the fore toes. Thus the tarsus *appears* completely feathered. Feathers pearly, ashy, or mouse-colored, and generally indistinctly barred. Toe pectinations nearly twice as long as those of *umbellus*. Speculatively, *yukonensis* might reveal an even-heavier development of tarsal feathering than *umbelloides* on the examination of more specimens. These two subspecies can be recognized collectively by the very hoary, bushy character of the tarsal feathering, due more than anything else to the prolonged length of the individual barbs (Text-fig. 1, a).

*B. u. sabini* (Cascade Ranges of northern British Columbia to northern California) and *B. u. brunnescens* (Vancouver Island):—Averaging one-third of the tarsus unfeathered. Feathers fairly long, the most distal occasionally reaching to the hind toe. Feathers less bushy (barbs shorter) than in *umbelloides*, dark rusty-brown and usually indistinctly barred. *B. u. sabini* and *brunnescens* are not separable on the basis of tarsal feathering, but are otherwise distinct.

*B. u. togata* (northeastern United States and Canada east of the prairies):—This may perhaps be a composite form. The tarsal feathering is very variable, showing characteristics ranging between those of *umbelloides* and *umbellus*, but averaging, like *sabini* and *brunnescens*, about one-third of the tarsus bare. Most distal feathers often reach to the hind toe or are often fairly short. Color: varying shades of gray (never approaching white), often indistinctly barred. Toe pectinations between those of *umbelloides* and *umbellus* in length (Text-fig. 1, b).

*B. u. thayeri* (Nova Scotia and eastern New Brunswick):—Lower half of tarsus unfeathered. Most distal feathers short and tuft-like, like those of *umbellus* except that they are dark grayish-brown in color. I cannot agree with Todd (Auk, 57: 391, 1940) in relegating this subspecies to the synonymy of *togata*; the tarsal feathering is too radically different. The specimens which I have seen seem consistently sootier (blacker) and more heavily barred on the belly than those of *togata* (including practically topotypes) examined.

*B. u. umbellus* (eastern United States):—Lower half of tarsus devoid of feathers. Most distal feathers very short and tuft-like; usually light gray-brown to dirty white in gray- and brown-phase birds, and extremely pale orange-white in red-phase birds. Toe pectinations about half the length of those of *umbelloides* (Text-fig. 1, c).

On the whole, females seem to have the tarsus slightly less feathered

than do the males, but insignificantly so. Tarsal-feathering characteristics do not hold during the molt. Of course, the toe-pectination characteristics are useful only when these appendages are fully developed, from fall till spring. The amount of tarsal feathering present is as constant in the chicks as it is in the adults. This fact was learned by measuring a large series of known (captive) *umbellus* chicks ranging in age from eight to sixty-four days. The means obtained were gratifyingly close to the means for adults. Of course, material of other races must be examined before this fact becomes fully acceptable.

The variation in the tarsal-feathering development of Ruffed Grouse seems to coincide with the amount and duration of snow which the birds experience. Thus it is to be expected that *yukonensis* and *umbelloides*, coming from regions of deep and lasting snows, would have the greatest development of tarsal feathering and toe pectination. *B. u. togata* lives under climatic conditions more or less intermediate between those experienced by *umbellus* and *umbelloides*, and shows intermediate characters of tarsal feathering. The race experiencing the mildest snow conditions, *umbellus*, shows the least development of tarsal feathering.

In Eurasia there is a genus, *Tetrastes*, which is very closely related to our *Bonasa*. It contains two species, one of which is divided into several subspecies. It has a tarsus similar to that of *Bonasa*. It would be interesting to see if this bird displays geographical variation in its tarsal feathering as does *Bonasa*.

#### ACKNOWLEDGMENTS

I am grateful to many people, who, through their help and cooperation, greatly facilitated my approach to this study. Dr. Arthur A. Allen, of Cornell University, as I have already mentioned, suggested the problem and aided me in the study. Dr. George M. Sutton, Curator of the Louis Agassiz Fuertes Bird Collection at Cornell University, allowed me free access to the collection, offered abundant valuable suggestions, borrowed material, and helped immensely with the manuscript. Others who assisted were Mr. William Montagna, Mr. John Trainer, and Miss Octavia Bailey, who furnished me with a drawing of Ruffed Grouse tarsi.

I thank the officials of the American Museum of Natural History and the New York State Museum for access to their collections. Mr. H. B. Conover aided in submitting measurements of his *B. u. brunnes-cens*. Mr. James L. Peters offered suggestions in correspondence, and

incidentally, about ten years previously had identified about two-thirds of the material available to me, an unintentional aid which was of particular importance. Professor J. R. Livermore, of Cornell University, gave me a private introduction to biometry which was of great value.

*Laboratory of Ornithology*  
*Cornell University*  
*Ithaca, New York*