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The Auk

under parts is a quite unique character. I would therefore designate the Turkeys as follows:

Meleagris fera. Northern Turkey. Pennsylvania to Florida, west to Wisconsin and Texas.

Meleagris fera osceola. Florida.

Meleagris intermedia. Southern Texas; Eastern Mexico below 2000 feet.

Meleagris gallopavo. Western Texas to Arizona. Tablelands of Mexico.

Under these names the Turkeys will appear in the third edition of 'Game Birds.'

SOME PARASITES OF BIRDS.

BY VERNON L. KELLOGG, PROFESSOR OF ENTOMOLOGY, LELAND STANFORD JR. UNIVERSITY.

ALL collectors of birds have noticed, and some have been made uncomfortable by, certain small flat, wingless, quickly-running insects which infest, in varying degree of abundance, the outside of birds' bodies. These insects are known as Mallophaga and are of such peculiar and unusual structural condition, differing so markedly from any other insects, that they have been constituted an independent order of insects, although in number of species they are insignificant compared with the better known insectan orders.

Yet small as is the group, the number of known species in it, a thousand, approximately, may seem surprisingly large to those unacquainted with the systematic exploitation of the order.

The Mallophaga are external, wingless parasites of birds and mammals which feed exclusively on the feathers, hairs and dermal scales of their hosts. They are not lice, if by lice be meant those better known Hemipterous parasites which with piercing beak thrust into the flesh of the host, suck its blood. The Mallophaga have mouth parts fitted for biting and chewing, with

strong biting and masticatory mandibles. The order includes four families, comprising 21 genera. Of these, two families, represented each by a single genus, and including altogether not more than 50 species, are restricted to mammals, while the other two families with their numerous genera are found on birds alone.

To ornithologists the Mallophaga will have no special interest except as parasites of birds. That is, their peculiarities of structure or of development, or their systematic isolation among insects will be of but secondary interest compared to the facts of their parasitic relations to their hosts, the birds. And, indeed they are those facts about the Mallophaga which are, perhaps, of first importance to entomologists. For it is because of their parasitic habits that they have come to depart widely from their racial type.

I shall endeavor, then, to state briefly some of the ascertained facts regarding the relations of the Mallophaga to their hosts, and to indicate certain interesting moot points, to whose settlement the aid of ornithologists needs to be invoked.

Nearly one thousand species of Mallophaga have been described by three or four European entomologists from European and Asiatic birds. In this country 262 species of Mallophaga have been recorded from 257 species of North American birds. Of these species 105 have been determined to be identical with species previously described from birds of Europe or other foreign country, while the remaining 157 have been described as new species. An important problem is immediately before us: how come Mallophagan species to be common to foreign and to American hosts? First, must be eliminated those hosts common to the two continents either by reason of circum-polar range or importation. Then must be eliminated the few possible cases of the meeting on mid-ocean islands of related maritime birds of strong flight from the two continents. Finally there remains a large number of instances in which a Mallophagan species is common to American and foreign hosts of distinct species, and distinct genera frequently, who have no possible chance for that contact which might allow the parasites to migrate directly from one host to the other. This problem of

distribution is also presented to us in a less striking, perhaps, but no less real phase among the hosts of our own continent. A Mallophagan species is by no means certainly limited to one American host species. Indeed a majority of North American Mallophagan species have been recorded from two or more American host species. How does this condition come to exist?

We have to do with a wingless parasite but a parasite with good legs. Our parasites can migrate from host to host when this migration can be performed on foot. But as a matter of fact this migration does not take place unless the host bodies are close together or in actual contact. Such actual contact takes place between male and female and between old and young. Thus is explained the perpetuity of the parasites upon a single host species. Among gregarious birds the parasites may migrate from individual to individual of the same species, thus breaking up too much close breeding. But several species of birds of gregarious habits may roost or perch together: so the parasite may spread among several Gull species or Duck species or Alcine species, conditions which actually exist as shown by our records of occurrence. And there may be other rare opportunities for migration from host species to distinct host species, as in cases of hybridization, or where the Mallophaga might be carried by winged parasites of birds, like the Hippoboscidae. After all, however, the majority of instances in which a parasitic species is common to two or more host species or host genera cannot be so simply explained. The instances in which actual contact and hence direct migration is possible are few.

There are certain data at hand which should be known to anyone attempting a solution of this problem in distribution. Most important is this fact: where a single Mallophagan species is recorded from two or more North American host species, the host species are, in almost all cases, closely related. That is, the hosts may represent two or more species of a single genus, or, as less frequently is the case, of two or more allied genera. Only in a few cases do we find a parasite common to genera representing different families of birds. Similarly, in those numerous instances of commonness of parasite to European and American hosts, the hosts are always or nearly always allied forms. As

for example, the case of the Mallophagan species *Nirmus signatus* and *Nirmus pileus* found in Europe on *Recurvirostra avocetta* and in America on *Recurvirostra americana*. The instances in which the parasites are common to hosts of different genera in America and Europe are not infrequent but the genera are, in almost all cases, allied ones.

I have suggested elsewhere the only explanation of this problem in the distribution of the Mallophaga which seems to me possible, and that is that the Mallophagan species common to hosts of different species, in instances where all possibility of direct migration is precluded, have persisted unchanged from a host which was the common ancestor of the present distinct host species. The influences, climatic and geographic, which have resulted in effecting the founding of the new bird species have had no effect on the parasitic species. The food and environment of the parasite are essentially the same on one bird as on another. A paling of plumage, a shortening of legs, a development of crest feathers, or whatever new characters might be fostered and fixed by a change of environment of the host, resulting in the production of a new bird species, would have, apparently, no necessary influence on the parasite. Does some more probable explanation of the facts of distribution of these bird parasites suggest itself to any member of the A. O. U.?

It may be of interest to append a few notes regarding the relative abundance or rarity of the parasites on their hosts, and regarding the constancy or irregularity with which a specific parasite is found upon its special host. A host species may have several parasitic species infesting it; I have taken ten species of Mallophaga, representing six genera, from *Puffinus opisthomelas*, and twelve species representing five genera from *Fulica americana*. Or, the host species may have but one or two or three species of parasites, as is the case with the Ducks and Gulls. A parasitic species may be constant in its appearance on the individuals of its host, as with *Docophorus lari* Denny, almost certain to be found on any Gull shot, or it may be found on but few individuals of its host species, as with *Docophorus quadraticeps* Kellogg, found rarely on *Fulica americana*. There may be many individuals of a parasitic species always present on

the body of its host, as with *Lipeurus celer* Kellogg of the Fulmars, of which parasite I have collected nearly one hundred specimens from a single bird, and which is always abundantly present on its host. Or the individuals may be few although the parasite is a constant one, *i. e.*, almost always to be found on any specimen of the host examined. *Trinoton luridum* Nitzsch of the Ducks is rarely numerous on its host although sure to be present on any Duck specimen examined.

With these scattered observations I close my paper, only hoping that some bird collectors may derive from these notes an interest in the Mallophaga sufficient to induce them to collect these parasites, as their collection can be made more conveniently by bird collectors than by entomologists. The preservation of the specimens is a simple matter. Drop all of the parasites obtained from a host individual (from a single bird, not bird species), into a vial of 85% alcohol, and label the vial with name of bird, locality, date and name of collector. I shall be glad to receive specimens to examine, determine and return, or, if permitted, to add to my collection.

THE PROTHONOTARY OR GOLDEN SWAMP WARBLER
(*PROTONOTARIA CITREA*) A COMMON SUMMER
RESIDENT OF SOUTHEASTERN
MINNESOTA.

WITH PHOTOGRAPHS FROM NATURE BY THE AUTHOR.

THE apology that I feel to be due for appearing before the Union¹ with a local paper of this kind, dealing as it does with a bird about which so much that is excellent has been written, is that the facts to be presented establish in no uncertain way a remarkable northward extension of the breeding range of a bird hitherto commonly regarded as of much more southern distribution.

¹This paper was read at a meeting of the American Ornithologists' Union held in Washington, Nov. 15, 1898.