

# MALLOPHAGA FROM OHIO BIRDS.\*

HAROLD S. PETERS

*Department of Entomology, Ohio State University.*

## INTRODUCTION.

The following paper comprises a study of the order Mallophaga, which includes the biting lice commonly found on birds and mammals, with special reference to a list of the species found on Ohio birds.

Most of the specimens were collected by myself during the past five years. Also many specimens were collected by M. B. Trautman, C. F. Walker, R. W. Franks, R. M. Geist, and D. G. Hall, whose assistance and encouragement is gratefully acknowledged. I also wish to acknowledge the splendid assistance given by Dr. H. E. Ewing of the United States National Museum.

This paper is a revision of a thesis prepared for the degree of Master of Science at Ohio State University in June 1926. The original work was carried out under the direction and with the assistance of Professor Herbert Osborn of Ohio State University.

## METHODS OF COLLECTING.

Mallophaga are best collected from freshly killed or live birds. Since it is very difficult to capture birds alive it becomes necessary to shoot them. I have used a twelve gauge shotgun for large birds and a .410 shotgun for the smaller birds. Several different sizes of shot and loads were used for the various sizes of birds and for different conditions.

The most satisfactory method is to examine the birds for lice immediately after shooting them. The lice are fairly visible to the unaided eye and may be easily picked from the feathers with a pair of small tweezers or forceps. The lice are put directly into a small vial of seventy per cent alcohol for killing and preserving.

If it is not convenient to examine the birds in the field they should be securely wrapped in paper until time is available for examination. They are best wrapped by using a double sheet

---

\* Contribution Number 84 from the Department of Zoology and Entomology, Ohio State University.

of newspaper, placing the bird in one corner, then rolling it in the paper, securely folding in the ends of the paper, until several thicknesses are around the bird. The paper should be secured by a string or rubber band.

After the death of the host the parasites either attempt to leave the body, usually migrating slowly toward the head, or simply die on the body of the host. The death of those remaining on the host usually ensues in two or three days. I have observed the death of some in four or five hours, and on the other hand, have collected live parasites from a bird skin six or seven days old. The death of the parasites can hardly be caused by starvation, in view of their feeding habits, but rather must be attributed to the lack of animal heat to which they have been accustomed during the life of the host.

Only lice from one individual bird should be placed in each vial. I have found the one dram homeopathic vials to be the best size for handling and filing for future reference. A label with the name of the host, locality, date and name of collector should be placed both in and on the outside of each vial. By keeping lice from individual birds separate it is possible to ascertain to some degree the population on the host. It is always well to preserve a few immature lice with the adults, as well as a few eggs, if any are found. The vials are then filed in a suitable rack until time is available for mounting some of the specimens on glass microscope slides for identification.

It is often possible to obtain Mallophaga from dried skins or mounted birds where they are found dead under the feathers. These skins must be handled carefully to prevent breaking the feathers and consequently ruining the skins for museum purposes. The lice from dried skins may be softened by dropping them into hot water before placing them in seventy per cent alcohol for preserving. Host records on museum specimens may be erroneous owing to the interchange of Mallophaga between hosts placed in the same collecting bag or otherwise associated together. Consequently lice found near the tips of the feathers may have strayed from another host and should not be saved unless similar ones are found next to the skin of the host and can safely be assumed natural parasites of that host. Practically all of the specimens studied in the preparation of this paper were collected from freshly killed birds.

## MOUNTING.

The Mallophaga may be kept in seventy per cent alcohol indefinitely. The alcohol modifies the specimens but little; their hard chitin prevents appreciable shrinking, and the colors are due chiefly to the amount of chitinization on different parts of the body, a coloration not affected by alcohol.

It is best to mount only a few of the lice from each host and to keep the remainder in alcohol for future reference. The final collection is preserved by mounting on glass microscope slides. I have found that mounting in Canada balsam after clearing in potassium hydroxide gives the best results.

One dram homeopathic vials are used as containers throughout the mounting process. Separate vials are used for the various liquids and the lice are transferred between vials by means of a small wire loop which holds the specimen in a drop of the liquid. This prevents injury to the soft specimens which might ensue if tweezers were used.

The lice are taken from seventy per cent alcohol and placed in several changes of water before being placed in fifteen per cent cold potassium hydroxide. They are kept in this liquid from ten to forty-eight hours, depending on the amount of clearing desired. The heavily chitinized specimens require the longer time to clear satisfactorily. From the potassium hydroxide the lice are placed in several changes of water for about twenty-four hours before being placed in thirty per cent alcohol. After twelve to twenty-four hours they are placed in ninety-five per cent alcohol for at least twenty-four hours. The Mallophaga may be left indefinitely in this liquid before continuing the process. Next the specimens are placed in absolute alcohol for three to six hours then in xylol for a similar length of time. They are taken from the xylol and mounted directly in a drop of rather thin Canada balsam in the center of microscope slides and covered with round (18 mm.) cover glasses. This entire mounting process will require practically a week and should not be shortened. The specimens must be kept covered by one of the various liquids throughout the process, and must not be exposed to the air.

Euparal or diaphane may be used as a mounting fluid by taking the specimens directly from the ninety-five per cent alcohol to the mounting fluid on the slides. Euparal eliminates several steps in the mounting procedure but the slides may not

be as permanent as those mounted in balsam. Some workers have used glycerine jelly as a mounting fluid. In the course of time this evaporates from beneath the cover glass and ruins the specimens for further study.

It is preferable to mount only one individual or a pair of lice on each slide. The specimens are mounted so the cover glass will be in the center of the slide, allowing a label to be placed on each side of the cover glass. On the label to the left I put the common and scientific name of the host, the locality, date and name of collector and the mounting fluid used. On the label to the right of the cover glass I put the name of the louse, the sex and the name of the person who identified the specimen.

#### LIFE HISTORY AND DISTRIBUTION ON THE HOST.

The entire life of the Mallophaga is spent on the body of the host. The eggs are glued singly to the feathers of the host, usually along the shaft of the feather. The Mallophaga have a gradual metamorphosis, the young lice resembling the adult in external appearance and differing only in size, shape and degree of chitinization. The young nymphs moult several times before reaching adult size. The length of life and rapidity of multiplication has not been determined accurately for a single species of these insects since their habits make any such determination a matter of considerable difficulty. It seems evident from my observations as well as those of others that the winter is spent mostly in the egg stage on the body of the host.

The regions on the body of the host in which the different genera of Mallophaga are found are rather definite and have some significance attached to them. For instance a rapid running louse like *Menopon* or *Colpocephalum* will be found in the breast, anal or back regions. But such a slow one as *Philopterus* will be limited to the head or neck entirely. There are reasons for this distribution. The bird can not easily scratch off a heavy jawed and heavy clawed *Philopterus* from the neck region, nor will a limited amount of dusting do much good there. So also will a *Colpocephalum* escape if the bird attempts to catch it with the bill in a dorsal, anal or abdominal region. It escapes by running for which it is extraordinarily adapted.

*Degeeriella* is a fast running form found frequently in the breast region. *Esthiopterum* is a slim and fast genus found on

the feathers of the wing. *Trinoton*, very agile and strong of foot, infests the back and breast of most ducks. *Ricinus* infests the rump and back of many Passerine birds. It is therefore necessary that definite regions on the body of the host be examined and their distinct genera noted.

#### ECONOMIC IMPORTANCE AND ABUNDANCE.

Presence of lice on poultry causes great uneasiness, scratching and nervousness which result in loss of weight and a marked decrease in egg production. Among wild birds the effect is not so noticeable although the hosts certainly can not harbor these parasites without some discomfort. The injury is chiefly caused by the irritation of the skin of the host by the sharp-clawed feet of the parasites, rather than by any direct hurt through the feeding habits of the parasites. The hosts dust themselves frequently in an effort to smother out the lice. They also remove some from their body by picking with the bill and scratching with the feet.

The Mallophaga are purely ectoparasites (except one species which lives on the inside skin of the pelican's pouch) and live on the feathers and epidermal scales of the birds. Since they have biting mouthparts they can not suck blood, although they may feed on blood clots around wounds.

There are many species of Mallophaga which have been recorded from only one species of host while some species have been recorded from several closely related species of host. For example: *Philoferus subflavescens* is recorded from about fifty species of Passerine birds; *Degeeriella vulgata* is also common on many Passerines; *Philoferus melanocephalus* is common on terns while both *Philoferus gonothorax* and *Degeeriella ornata* are found on most gulls. Quite frequently several species of lice may occur on a single species of host: practically all wild ducks have the three species, *Trinoton querquedulae*, *Esthiopterum crassicornis* and *Anatoecus dentatus*; the domestic chicken has six species quite commonly; the coot ten species; the bobwhite five species; etc. Certain genera of Mallophaga are found only on certain closely related birds as *Cuculoecus* on cuckoos, *Anatoecus* on ducks, *Ibidoecus* on ibises and *Dennyus* on swifts. These rather definite host relationships may be used to roughly determine the specimens of Mallophaga in many cases.

There seems to be two chief ways in which this peculiar distribution of parasitism may have come about. In the case

of genera of wide distribution such as *Philopterus*, *Degeeriella* and *Colpocephalum* it is entirely reasonable to suppose that the insects have been transferred from one host to another in comparatively recent times, that is since the differentiation on the present host forms. In other cases there may have been a differentiation of the insect along with the host form. This idea seems to have some support in the occurrence of markedly differing species exclusively on different species of host. Owing to their uniformity of food and habit and the absence of any apparently marked struggle for existence, the stimulus to a rapid differentiation among Mallophaga is wanting.

Mallophaga are found rather abundantly on birds which nest in colonies or which are otherwise closely associated. Migration of parasites probably occurs only when the bodies of the hosts come into contact. Kellogg states that on such a likely place as an ocean rock from which he had just scared away hundreds of perching sea birds, no Mallophaga could be found.

All water and shore birds seem to be rather heavily infested with Mallophaga. The lice which infest swimming and diving birds are not furnished with special contrivances for their pseudo-aquatic life. They never come, necessarily, into contact with the water since they live at the base of the feathers where the water never penetrates, and where they have a constant and sufficient supply of air for the longest submergence possible to the host. Hawks, owls, crows and other large land birds are usually infested while the smaller land birds are much less commonly infested, except those gregarious ones.

Some cases of straggling may be found in nature. Birds of prey may be found with lice which have undoubtedly come from some of their victims. Kellogg reports several cases where Mallophaga typical of water birds were found on land birds on small oceanic islands. This may be explained by the fact that land and water birds are frequently observed perching close together on the rocks so it would be very easy for some migration of parasites to occur.

#### CLASSIFICATION OF THE ORDER MALLOPHAGA.

The order Mallophaga includes the biting lice infesting birds and mammals. They are small, wingless, flat-bodied, active insects ranging in size from about 0.5 mm. to about 10 mm. They are entirely adapted for an ectoparasitic mode of

life and feed on the hair, feathers and epidermal scales of their hosts. Kellogg divides the order into two suborders as follows:

Suborder Amblycera—with clavate or capitate four segmented concealed antennæ; with four segmented maxillary palpi; mandibles horizontal.

Suborder Ischnocera—with filiform three or five segmented exposed antennæ; no maxillary palpi; mandibles vertical.

Harrison divides the Amblycera into six families: Boopidæ, Trimenoponidæ, Gyropidæ, Menoponidæ, Læmobothriidæ and Ricinidæ. He divides the Ischnocera into three families: Trichodectidæ, Nesiotinidæ and Philopteridæ.

The classification will not be discussed further in this paper since the works of Kellogg and Harrison may easily be consulted. In this list I follow the sequence used in Harrison's list so far as possible.

There are about 1700 described species falling in some 70 genera of Mallophaga in the world. In this list I have recorded 94 species of Mallophaga in 24 genera from 114 species of birds, all collected in the state of Ohio and practically all in my personal collection.

#### LIST OF MALLOPHAGA FROM OHIO BIRDS.

#### Order MALLOPHAGA Nitzsch.

#### Suborder AMBLYCERA Kellogg.

#### Family *Menoponidae* Mjoberg.

#### MENOPON Nitzsch.

- M. FULVOMACULATUM Denny. Ring-neck pheasant, Columbus.  
 M. GALLINÆ (Linn.). Chicken, all parts of Ohio.  
 M. LOOMISII Kellogg. Mallard, *Anas platyrhyncha* Linn., Columbus.

#### EOMENACANTHUS Uchida.

- E. STRAMINEUM (Nitzsch). Chicken, all parts of Ohio.

#### COLPOCEPHALUM Nitzsch.

- C. FLAVESCENS Nitzsch. Bald eagle, *Haliaetus leucocephalus leucocephalus* (Linn.), Columbus and New Bremen.  
 C. LATICEPS Kellogg. Black-crowned night heron, *Nycticorax nycticorax navius* (Boddært), Buckeye Lake; great blue heron, *Ardea herodias herodias* Linn., Columbus and Fredericktown; little blue heron, *Florida carulea* (Linn.), Columbus.  
 C. SUBPACHYGASTER Piaget. Barn owl, *Tyto alba pratincola* (Bonaparte), Fredericktown.

## MENACANTHUS Neumann.

- M. CHRYSOPHÆUM (Kellogg). Brown thrasher, *Toxostoma rufum* (Linn.), Buckeye Lake; meadowlark, *Sturnella magna magna* (Linn.), Sandusky; Pipit, *Anthus rubescens* (Tunstall), Columbus.

## MYRSIDEA Waterston.

- M. AMERICANA (Kellogg). Crow, *Corvus brachyrhynchos brachyrhynchos* Brehm., Columbus and Lancaster.  
 M. CUCULARIS (Nitzsch). Starling, *Sturnus vulgaris* Linn., Columbus and New Bremen.  
 M. DISSIMILIS (Kellogg). Bank swallow, *Riparia riparia* (Linn.), Sandusky; purple martin, *Progne subis subis* (Linn.), Sandusky.  
 M. INCERTA (Kellogg). Catbird, *Dumetella carolinensis* (Linn.), Buckeye Lake; dickcissel, *Spiza americana* (Gmel.), Sandusky; fox sparrow, *Passerella iliaca iliaca* (Merr.), Columbus.

## ACTORNITHOPHILUS Ferris.

- A. AEGIALITIDIS (Durrant). Killdeer, *Oxyechus vociferus* (Linn.), Sandusky and Columbus.  
 A. AFFINE (Nitzsch). Spotted sandpiper, *Actitis macularia* (Linn.), Columbus.  
 A. FUNEBRE (Kellogg). Bonapart gull, *Larus philadelphia* (Ord.), Buckeye Lake; herring gull, *Larus argentatus* Pont., Buckeye Lake; Sabine's gull, *Xema sabini* Sabine, Buckeye Lake.  
 A. PUSTULOSUS (Piaget). Pectoral sandpiper, *Pisobia maculata* (Vieill.), Sandusky and Buckeye Lake.  
 A. MINUS (Kell. & Chap.). Sanderling, *Crocethia alba* (Pallas), Buckeye Lake and Sandusky.  
 A. TIMIDUS (Kellogg). Black-bellied plover, *Squatarola squatarola cynosuræ* Thayer and Bangs, Sandusky; golden plover, *Pluvialis dominica dominica* (Muller), Buckeye Lake.

## TETROPTHALMUS Grosse.

- T. INCOMPOSITUS (Kell. & Chap.). Double-crested cormorant, *Phalacrocorax auritus auritus* (Lesson), Buckeye Lake.  
 T. TITAN (Piaget). White pelican, *Pelecanus erythrorhynchos* Gmel., New Bremen.

## DENNYUS Neumann.

- D. DUBIUS (Kellogg). Chimney swift, *Chatura pelagica* (Linn.), Columbus.

## TRINOTON Nitzsch.

- T. QUERQUEDULÆ (Linn.). Baldpate, *Mareca americana* (Gmel.), Columbus and New Bremen; blue goose, *Chen caerulescens* (Linn.), Franklin County; American merganser, *Mergus americanus* Cassin, Buckeye Lake; European widgeon, *Mareca penelope* (Linn.),



Columbus; gadwall, *Chaulelasmus streperus* (Linn.), Columbus; horned grebe, *Colymbus auritus* Linn., Buckeye Lake; lesser scaup, *Marila affinis* (Eyton), Buckeye Lake; mallard, *Anas platyrhyncha* Linn., Columbus; pintail, *Dafila acuta tzitzihoa* (Vieill.), Buckeye Lake; red-breasted merganser, *Mergus serrator* Linn., Buckeye Lake and Columbus; shoveller, *Spatula clypeata* (Linn.), New Bremen; white-winged scoter, *Oidemia deglandi deglandi* Bonapart, Buckeye Lake.

#### EUREUM Nitzsch.

- E. CIMICOIDES Nitzsch. Chimneyswift, *Chatura pelagica* (Linn.), Columbus.

#### PSEUDOMENOPON Mjoberg.

- P. PACIFICUM (Kellogg). Coot, *Fulica americana* Gmel., Buckeye Lake; Florida gallinule, *Gallinula chloropus cachinnans* Bangs, Buckeye Lake; horned grebe, *Colymbus auritus* Linn., Buckeye Lake; pied-billed grebe, *Podilymbus podiceps* (Linn.), Columbus.
- P. TRIDENS (Nitzsch). Sora rail, *Porzana carolina* (Linn.), Buckeye Lake.

#### Family Laemobothriidae Mjoberg.

##### LÆMOBOTHRION Nitzsch.

- L. NIGRUM Burmeister. Coot, *Fulica americana* Gmel., Buckeye Lake; Florida gallinule, *Gallinula chloropus cachinnans* Bangs, Buckeye Lake.

#### Family Ricinidae Neumann.

##### RICINUS Degeer.

- R. ANGULATUS (Kellogg). Fox sparrow, *Passerella iliaca iliaca* (Merr.), Columbus; kingbird, *Tyrannus tyrannus* (Linn.), Sandusky; red-eyed vireo, *Vireosylva olivacea* (Linn.), Buckeye Lake.
- R. DIFFUSUS (Kellogg). Vesper sparrow, *Poocetes gramineus gramineus* (Gmel.), Columbus and Sandusky.
- R. MELOSPIZÆ (McGregor). Song sparrow, *Melospiza melodia melodia* (Wils.), Buckeye Lake.
- R. PALLENS (Kellogg). Northern yellowthroat, *Geothlypis trichas brachidactyla* (Swainson), Buckeye Lake; Tennessee warbler, *Vermivora peregrina* (Wils.), Lancaster.
- R. PALLIDUS (Kellogg). Slate-colored junco, *Junco hyemalis hyemalis* (Linn.), Columbus.
- R. SUCINACEUS (Kellogg). Least flycatcher, *Empidonax minimus* Baird, Columbus; wood pewee, *Myiochanes virens* (Linn.), Sandusky.

## Suborder ISCHNOCERA Kellogg.

Family *Phlopteridae* Burmeister.

## GONIODES Nitzsch.

- G. MAMMILLATUS Rudow. Bobwhite, *Colinus virginianus virginianus* (Linn.), Columbus and Sandusky.  
 G. MELEAGRIDIS (Linn.). Domestic turkey, Columbus.  
 G. PAVONIS (Linn.). Peacock, Columbus.  
 G. ZENAIDURÆ McGregor. Mourning dove, *Zenaidura macroura carolinensis* (Linn.), Sandusky.

## GONIOCOTES Burmeister.

- G. BIDENTATUS (Scopoli). Pigeon, Sandusky.  
 G. GIGAS Taschenberg. Domestic chicken, Columbus.  
 G. HOLOGASTER Nitzsch. Domestic chicken, Columbus.

## LIPEURUS Nitzsch.

- L. ABERRANS McGregor. Bobwhite, *Colinus virginianus virginianus* (Linn.), Columbus.  
 L. CAPONIS (Linn.). Domestic chicken, Columbus.  
 L. DISSIMILIS Piaget. Bobwhite, *Colinus virginianus virginianus* (Linn.), Columbus.  
 L. HETEROGRAPHUS Nitzsch. Domestic chicken, Columbus.

## PHILOPTERUS Nitzsch.

- P. AGELII (Osborn). Red-winged blackbird, *Agelaius phæniceus phæniceus* (Linn.), Buckeye Lake and Columbus.  
 P. CORVI (Osborn). Crow, *Corvus brachyrhynchos brachyrhynchos* Brehm., all parts of Ohio.  
 P. CURSOR (Nitzsch). Long-eared owl, *Asio wilsonianus* (Lesson), Columbus; saw-whet owl, *Cryptoglaux acadica acadica* (Gmel.), Fredericktown; screech owl, *Otus asio asio* (Linn.), Columbus; short-eared owl, *Asio flammeus* (Pont.), Fredericktown.  
 P. DOMESTICUS (Kellogg). Purple martin, *Progne subis subis* (Linn.), Sandusky; tree swallow, *Iridoprocne bicolor* (Vieill.), Columbus.  
 P. EVAGENS (Kellogg). Yellow-bellied sapsucker, *Sphyrapicus varius varius* (Linn.), Columbus.  
 P. GONOTHORAX (Giebel). Bonapart gull, *Larus philadelphia* (Ord.), Buckeye Lake; herring gull, *Larus argentatus* Pont., Columbus and Lakewood; ring-billed gull, *Larus delawarensis* Ord., Buckeye Lake.  
 P. JUGANS (Kellogg). Flicker, *Colaptes auratus luteus* Bangs, Buckeye Lake; red-headed woodpecker, *Melanerpes erythrocephalus* (Linn.), Sandusky.

- P. MAJOR (Waterston). Wilson's snipe, *Gallinago delicata* (Ord.), Buckeye Lake and Columbus.
- P. MELANOCEPHALUS (Nitzsch). Black tern, *Chlidonias nigra surinamensis* (Gmel.), Sandusky; caspian tern, *Sterna caspia imperator* (Coues), Sandusky; common tern, *Sterna hirundo* Linn., Buckeye Lake and Sandusky; Forster's tern, *Sterna forsteri* Nuttall, Buckeye Lake.
- P. MIRINOTATUS (Kell. & Chap.). Long-billed marsh wren, *Telmatodytes palustris palustris* (Wils.), Buckeye Lake.
- P. PERTUSUS (Nitzsch). Coot, *Fulica americana* Gmel., Buckeye Lake; Florida gallinule, *Gallinula chloropus cachinnans* Bangs, Buckeye Lake; horned grebe, *Colymbus auritus* Linn., Buckeye Lake.
- P. QUISCALI (Osborn). Bronzed grackle, *Quiscalus quiscula æneus* Ridgway, Buckeye Lake.
- P. ROSTRATUS (Nitzsch). Barn owl, *Tyto alba pratincola* (Bonaparte), Buckeye Lake.
- P. SIALII (Osborn). Bluebird, *Sialia sialis sialis* (Linn.), Columbus.
- P. SUBFLAVESCENS (Geoffroy). Brown thrasher, *Toxostoma rufum* (Linn.), Sandusky; cardinal, *Cardinalis cardinalis* (Linn.), Groveport; field sparrow, *Spizella pusilla pusilla* (Wils.), Columbus; fox sparrow, *Passerella iliaca iliaca* (Merr.), Columbus; indigo bunting, *Passerina cyanea* (Linn.), Columbus; kingbird, *Tyrannus tyrannus* (Linn.), Sandusky; prairie horned lark, *Otocoris alpestris praticola* Henshaw, Columbus; robin, *Planesticus migratorius migratorius* (Linn.), Columbus; scarlet tanager, *Piranga erythromelas* (Vieill.), Buckeye Lake; slate-colored junco, *Junco hyemalis hyemalis* (Linn.) Columbus; swamp sparrow, *Melospiza georgiana* (Lath.), Buckeye Lake.
- P. SYRNII (Packard). Barred owl, *Strix varia varia* Barton, Columbus.
- P. TAUROCEPHALUS (Kellogg). Red-tailed hawk, *Buteo borealis borealis* (Gmel.), Tiffin.

## ANATÆCUS Cummings.

- A. DENTATUS (Scopoli). Black duck, *Anas rubripes tristis* Brewster, Columbus; hooded merganser, *Lophodytes cucullatus* (Linn.), Columbus; lesser scaup, *Marila affinis* (Eyton), Indian Lake; mallard, *Anas platyrhynchos* Linn., Columbus and Danville; old-squaw, *Clangula hyemalis* (Linn.), Buckeye Lake and Columbus; pectoral sandpiper, *Pisobia maculata* (Vieill.), Sandusky; pintail, *Dafila acuta tzitzihoa* (Vieill.), Buckeye Lake; red-breasted merganser, *Mergus serrator* Linn., Buckeye Lake; ruddy duck, *Erismatura jamaicensis* (Gmel.), Indian Lake; scaup, *Marila marila* (Linn.), New Bremen.
- A. FERRUGINEUS (Giebel). Lesser scaup, *Marila affinis* (Eyton), Buckeye Lake.

## CUCULÆCUS Ewing.

- C. COCCYGI (Osborn). Yellow-billed cuckoo, *Coccyzus americanus americanus* (Linn.), Sandusky.

## EUSTRIGIPHILUS Ewing.

- E. BUBONIS (Osborn). Great horned owl, *Bubo virginianus virginianus* (Gmel.), Berea.
- E. CEBLEBRACHYS (Nitzsch). Snowy owl, *Nyctea nyctea* (Linn.), Fredericktown.

## DEGEERIELLA Neumann.

- D. ACTOPHILA (Kell. & Chap.). Buff-breasted sandpiper, *Tryngites subruficollis* (Vieill.), Sandusky; least sandpiper, *Pisobia minutilla* (Vieill.), Sandusky; sanderling, *Crocethia alba* (Pallas), Sandusky; semi-palmated sandpiper, *Ereunetes pusillus* (Linn.), Sandusky.
- D. AMERICANA (Kell. & Chap.). Horned grebe, *Colymbus auritus* Linn., Buckeye Lake.
- D. BŒPHILA (Kellogg). Killdeer, *Oxyechus vociferus* (Linn.), Columbus and Sandusky.
- D. COMPLEXIVA (Kell. & Chap.). Baird sandpiper, *Pisobia bairdi* (Coues), Sandusky; least sandpiper, *Pisobia minutilla* (Vieill.), Delaware County; pectoral sandpiper, *Pisobia maculata* (Vieill.), Sandusky; sanderling, *Crocethia alba* (Pallas), Sandusky; semi-palmated sandpiper, *Ereunetes pusillus* (Linn.), Buckeye Lake; stilt sandpiper, *Micropalma himantopus* (Bonaparte), Buckeye Lake.
- D. EUPREPES (Kell. & Chap.). Ruddy turnstone, *Arenaria interpres morinella* (Linn.), Sandusky.
- D. FUSCA (Nitzsch). Cooper hawk, *Accipiter cooperi* (Bonaparte), Columbus and New Bremen; red-shouldered hawk, *Buteo lineatus lineatus* (Gmel.), New Bremen.
- D. GRACILIS (Nitzsch). Purple martin, *Progne subis subis* (Linn.), Sandusky.
- D. INTERPOSITA (Kellogg). Gray-cheeked thrush, *Hylocichla aliciaë aliciaë* (Baird), Sandusky.
- D. MARGINATULA Harrison. Flicker, *Colaptes aurates luteus* Bangs, Columbus.
- D. NEBULOSA (Burmeister). Starling, *Sturnus vulgaris* Linn., Columbus, Lakewood and New Bremen.
- D. NORMIFER (Grube). Parasitic jæger, *Stercorarius parasiticus* (Linn.), Sandusky.
- D. OPACA (Kell. & Chap.). Semi-palmated plover, *Charadrius semipalmatus* Bonaparte, Sandusky.
- D. ORARIA (Kellogg). Golden plover, *Pluvialis dominica dominica* (Muller), Sandusky.
- D. ORNATA (Grube). Bonapart gull, *Larus philadelphia* (Ord.), Buckeye Lake; herring gull, *Larus argentatus* Pont., New Bremen; kittiwake, *Rissa tridactyla tridactyla* (Linn.), Ohio; ring-billed gull, *Larus delawarensis* Ord., Buckeye Lake; Sabine's gull, *Xema sabini* Sabine, Buckeye Lake.

- D. PRÆSTANS (Kellogg). Black tern, *Chlidonias nigra surinamensis* (Gmel.), Sandusky; caspian tern, *Sterna caspia imperator* (Coues), Sandusky; common tern, *Sterna hirundo* Linn., Sandusky.
- D. RAVA (Kellogg). Spotted sandpiper, *Actitis macularia* (Linn.), Sandusky.
- D. ROTUNDATA (Osborn). Crow, *Corvus brachyrhynchos brachyrhynchos* Brehm., Buckeye Lake.
- D. SIMPLEX (Kellogg). Catbird, *Dumetella carolinensis* (Linn.), Columbus.
- D. VULGATA (Kellogg). Cardinal, *Cardinalis cardinalis* (Linn.), Columbus; robin, *Planesticus migratorius migratorius* (Linn.), Columbus, Lakewood and Sandusky.

RALLICOLA Johnston & Harrison.

- R. BISETOSA (Piaget). Sora rail, *Porzana carolina* (Linn.), Buckeye Lake and Sandusky; Virginia rail, *Rallus virginianus* Linn., Buckeye Lake.

ORNITHOBIUS Denny.

- O. GONIOPLEURUS Denny. Hutchin's goose, *Branta canadensis hutchinsi* (Richardson), Buckeye Lake.

ESTHIOPTERUM Harrison.

- E. BOTAURI (Osborn). American bittern, *Botaurus lentiginosus* (Montagu), Buckeye Lake and Columbus; great blue heron, *Ardea herodias herodias* Linn., Delaware County.
- E. COLUMBÆ (Linn.). Pigeon, Sandusky.
- E. COMSTOCKI (Kell. & Chap.). Sora rail, *Porzana carolina* (Linn.), Buckeye Lake; Virginia rail, *Rallus virginianus* Linn., Buckeye Lake.
- E. CRASSICORNE (Scopoli). Baldpate, *Mareca americana* (Gmel.), Ohio; black duck, *Anas rubripes tristis* Brewster, Columbus and Delaware County; blue-winged teal, *Querquedula discors* (Linn.), New Bremen; European widgeon, *Mareca penelope* (Linn.), Granville; gadwall, *Chaulelasmus streperus* (Linn.), Columbus; lesser scaup, *Marila affinis* (Eyton), New Bremen; mallard, *Anas platyrhyncha* Linn., Columbus and Danville; red-breasted merganser, *Mergus serrator* Linn., Buckeye Lake and Columbus; shoveller, *Spatula clypeata* (Linn.), Columbus; american merganser, *Mergus americanus* Cassin, Buckeye Lake.
- E. INFUSCATUM (Osborn). Woodcock, *Rubicola minor* (Gmel.), Delaware County.
- E. LINEATUM (McGregor). Bobwhite, *Colinus virginianus virginianus* (Linn.), Columbus and Sandusky.
- E. LURIDUM (Nitzsch). Coot, *Fulica americana* Gmel., Buckeye Lake.
- E. TOXOCERUM (Nitzsch). Double-crested cormorant, *Phalacrocorax auritus auritus* (Lesson), Buckeye Lake.

## BIBLIOGRAPHY.

Only those publications found most helpful in determining the material collected in Ohio are listed here. For a more complete list see Harrison (1916).

- DENNY (1842).  
*Monographia Anoplurorum Britanniae*, London.
- GIEBEL (1874).  
*Insecta Epizoa*, Leipsic.
- PIAGET (1880).  
*Les Pediculines, Essai Monographique*, Leyden.
- PIAGET (1885).  
*Les Pediculines, Supplement*, Leyden.
- TASCHENBERG (1882).  
*Die Mallophagan, etc. Nova Acta*, Halle, XLIV, pp. 1-244.
- OSBORN (1896).  
*Mallophaga*. Bull. 5 (n. ser.) Div. of Ent., U. S. D. A. pp. 189-249.
- KELLOGG (1896).  
*New Mallophaga I*. Proc. Calif. Acad. Sci. VI, pp. 31-168.
- KELLOGG (1896).  
*New Mallophaga II*. Proc. Calif. Acad. Sci. VI, pp. 431-548.
- KELLOGG (1899).  
*New Mallophaga III*. Occ. Papers Calif. Acad. Sci. VI, pp. 1-142.
- KELLOGG (1899).  
*A List of the Mallophaga Taken from Birds and Mammals of North America*. Proc. U. S. Nat. Mus. XXII, pp. 39-100.
- KELLOGG (1908).  
*Mallophaga*, in Wytzman's *Genera Insectorum*, Fasc. 66, Brussels.
- DURRANT (1908).  
*Descriptions of New Mallophaga*. Ohio Naturalist, VIII, pp. 355-358.
- MJOBORG (1910).  
*Studien uber Mallophagen und Anopluren*. Arkiv. f. Zool. VI, pp. 1-296.
- CUMMINGS (1916).  
*Studies on the Anoplura and Mallophaga*. Proc. Zool. Soc. London, Part I, pp. 253-295, Part II, pp. 643-693.
- FERRIS (1916).  
*Some Generic Groups in the Mallophagan Family Menoponidae*. Canadian Ent. XXXVIII, pp. 301-311.
- HARRISON (1916).  
*Genera and Species of Mallophaga of the World*. Parasitology, IX, pp. 1-154.
- UCHIDA (1926).  
*Studies on the Amblycerous Mallophaga of Japan*. Jour. of Coll. of Agr., Imp. Univ. of Tokio, IX, pp. 1-56.
- EWING (1926).  
*Generic Derivatives of the Mallophagan Genus Philopterus*. Proc. Ent. Soc. of Wash. XXVIII, pp. 145-150.

Received for publication, May 11, 1928.