

Chas. J. Brewster

DUPLICATE

APRIL, 1915

BULLETIN 359

CORNELL UNIVERSITY

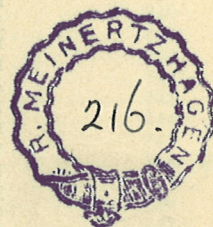
AGRICULTURAL EXPERIMENT STATION OF  
THE COLLEGE OF AGRICULTURE

Department of Entomology

SOME EXTERNAL PARASITES OF POULTRY

WITH SPECIAL REFERENCE TO MALLOPHAGA,  
WITH DIRECTIONS FOR THEIR CONTROL

By GLENN W. HERRICK



ITHACA, NEW YORK  
PUBLISHED BY THE UNIVERSITY

CORNELL UNIVERSITY  
AGRICULTURAL EXPERIMENT STATION

EXPERIMENTING STAFF

BEVERLY T. GALLOWAY, B.Agr.Sc., LL.D., Director.  
 ALBERT R. MANN, B.S.A., Secretary.  
 JOHN H. COMSTOCK, B.S., Entomology.  
 HENRY H. WING, M.S. in Agr., Animal Husbandry.  
 T. LYTTLETON LYON, Ph.D., Soil Technology.  
 JOHN L. STONE, B.Agr., Farm Practice.  
 JAMES E. RICE, B.S.A., Poultry Husbandry.  
 GEORGE W. CAVANAUGH, B.S., Agricultural Chemistry.  
 HERBERT H. WHETZEL, M.A., Plant Pathology.  
 ELMER O. FIPPIN, B.S.A., Soil Technology.  
 G. F. WARREN, Ph.D., Farm Management.  
 WILLIAM A. STOCKING, Jr., M.S.A., Dairy Industry.  
 WILFRED M. WILSON, M.D., Meteorology.  
 RALPH S. HOSMER, M.F., Forestry.  
 JAMES G. NEEDHAM, Ph.D., Entomology and Limnology.  
 ROLLINS A. EMERSON, Ph.D., Plant Breeding.  
 HARRY H. LOVE, Ph.D., Plant Breeding.  
 ARTHUR W. GILBERT, Ph.D., Plant Breeding.  
 DONALD REDDICK, Ph.D., Plant Pathology.  
 EDWARD G. MONTGOMERY, M.A., Farm Crops.  
 WILLIAM A. RILEY, Ph.D., Entomology.  
 MERRITT W. HARPER, M.S., Animal Husbandry.  
 JAMES A. BIZZELL, Ph.D., Soil Technology.  
 GLENN W. HERRICK, B.S.A., Economic Entomology.  
 HOWARD W. RILEY, M.E., Farm Mechanics.  
 CYRUS R. CROSBY, A.B., Entomology.  
 HAROLD E. ROSS, M.S.A., Dairy Industry.  
 KARL MCK. WIEGAND, Ph.D., Botany.  
 EDWARD A. WHITE, B.S., Floriculture.  
 WILLIAM H. CHANDLER, M.S. in Agr., Pomology.  
 ELMER S. SAVAGE, M.S.A., Ph.D., Animal Husbandry.  
 LEWIS KNUDSON, Ph.D., Plant Physiology.  
 KENNETH C. LIVERMORE, B.S. in Agr., Farm Management.  
 ALVIN C. BEAL, Ph.D., Floriculture.  
 MORTIER F. BARRUS, Ph.D., Plant Pathology.  
 CLYDE H. MYERS, M.S., Ph.D., Plant Breeding.  
 GEORGE W. TAILBY, Jr., B.S.A., Superintendent of Live Stock.  
 EDWARD S. GUTHRIE, M.S. in Agr., Ph.D., Dairy Industry.  
 JAMES C. BRADLEY, Ph.D., Entomology.  
 PAUL WORK, B.S., A.B., Vegetable Gardening.  
 JOHN BENTLEY, Jr., B.S., M.F., Forestry.  
 EARL W. BENJAMIN, Ph.D., Poultry Husbandry.  
 EMMONS W. LELAND, B.S.A., Soil Technology.  
 CHARLES T. GREGORY, Ph.D., Plant Pathology.  
 WALTER W. FISK, M.S.A., Dairy Industry.  
 ARTHUR L. THOMPSON, M.S. in Agr., Farm Management.  
 ROBERT MATHESON, Ph.D., Entomology.  
 HORACE M. PICKERILL, B.S., Dairy Industry.  
 MORTIMER D. LEONARD, B.S., Entomology.  
 FRANK E. RICE, Ph.D., Agricultural Chemistry.  
 V. B. STEWART, Ph.D., Plant Pathology.  
 IVAN C. JAGGER, M.S., Plant Pathology (In cooperation with Rochester University).  
 CHARLES H. HADLEY, B.S., Entomology.  
 BRISTOW ADAMS, B.A., Editor.  
 LELA G. GROSS, Assistant Editor.

The regular bulletins of the Station are sent free on request to residents of New York State.

CONTENTS

	PAGE
The Mallophaga, or bird lice . . . . .	233
Structure . . . . .	233
How bird lice injure fowls . . . . .	234
Life history of bird lice . . . . .	235
Species of lice reported as found on fowls . . . . .	236
Summary of the species . . . . .	237
The hen . . . . .	237
The goose . . . . .	238
The duck . . . . .	238
The turkey . . . . .	239
The peafowl . . . . .	239
The pigeon . . . . .	239
The guinea fowl . . . . .	240
The common hen louse . . . . .	240
The common large louse of the hen . . . . .	242
The variable hen louse . . . . .	243
The large louse of the hen . . . . .	243
The lesser chicken louse . . . . .	244
The large chicken louse . . . . .	245
The chicken goniodes . . . . .	245
The common louse of the goose . . . . .	245
The common louse of the duck . . . . .	246
The squalid duck louse . . . . .	247
The large turkey louse . . . . .	247
The slender louse of the turkey . . . . .	248
The peacock goniodes . . . . .	248
The slender louse of the pigeon . . . . .	249
The pigeon louse . . . . .	249
Some other less common lice . . . . .	250
Other parasites of fowls . . . . .	252
The poultry mite . . . . .	252
Distribution and abundance . . . . .	252
Habits and injuries . . . . .	252
Life history . . . . .	253
Control . . . . .	254
The common hen flea . . . . .	254
Life history . . . . .	255
Control . . . . .	255
The southern hen flea . . . . .	256
The harvest mite . . . . .	258
Control . . . . .	260
A tick that infests turkeys . . . . .	260
Control . . . . .	261
Methods of controlling the parasites of domestic fowls . . . . .	261
Necessity of clean surroundings and of light . . . . .	261
Inside of poultry house . . . . .	262
To clear an infested poultry house of mites . . . . .	263
Isolation of poultry house . . . . .	264
Isolation of sitting hens . . . . .	264
Treatment of male birds . . . . .	265
Dust bath for hens . . . . .	265
Dusting fowls . . . . .	266
Cost of dusting fowls . . . . .	267
Dipping fowls . . . . .	267
Mixtures for painting perches . . . . .	267

## SOME EXTERNAL PARASITES OF POULTRY

WITH SPECIAL REFERENCE TO MALLOPHAGA,  
WITH DIRECTIONS FOR THEIR CONTROL

GLENN W. HERRICK

Domestic fowls constitute one of the most important sources of food supply in America. In 1911 the value of poultry in the United States reached a total of \$154,663,220, and the value of the eggs produced in the same year in New York State alone amounted to \$17,102,000. It is thus evident that poultry occupies an important place in the living economies of the American people, and any pests that affect domestic fowls injuriously should be carefully considered. The study of the external parasites of domestic fowls has extended over several years but with many interruptions and delays. It has been difficult to collect the various species infesting fowls, and even as yet it has not been possible to obtain all the species that the writer feels must exist in the United States.

Among the external parasites of domestic fowls the Mallophaga, or lice, hold the greatest interest for the writer. Some of the most interesting questions of development, variation, and relation to environment arise out of a consideration of the geographical and host distribution of these parasites — questions too technical, however, to be discussed here.

### THE MALLOPHAGA, OR BIRD LICE

#### STRUCTURE

The bird lice are wingless, parasitic insects of world-wide distribution. The mouth parts, formed for biting and situated on the under, or ventral, side of the head, are composed of two large, strong mandibles more or less triangular in shape. Each bears one sharp-pointed tooth, and sometimes one or two shorter teeth. The maxillæ are greatly reduced and may probably be considered vestigial. They are very little chitinized and are reduced to mere membranous lobes lying nearly concealed in the cavity of the mouth. The labrum is usually well developed and serves as an organ of prehension. The labium is present but varies in form and structure. In one suborder, the Amblycera, four-segmented palpi are borne by the labium; in the other suborder, the Ischnocera, there are no palpi. There seem to be no structures in the mouth of a bird louse that could be considered as forming a sucking apparatus. The conclusion that bird lice are biting insects and do not live by sucking the blood of the host is therefore justified.



The head is comparatively large and may be variously shaped. In many species it is concave on the posterior margin and sits on the prothorax like a hat (Fig. 97, page 242). The antennæ are always short and inconspicuous and often differ in the two sexes (Fig. 98, page 243). They are three-, four-, or five-segmented and differ greatly in shape. The eyes are simple, two in number, and neutral in color or highly pigmented. The legs of the bird lice that infest fowls are usually stout and conspicuous and terminate in two sharp claws. (The legs of the species of Mallophaga infesting mammals, with a few exceptions, terminate in a single claw.) The forelegs are short, and act as foot-jaws for passing food into the mouth.

The bird lice are permanent parasites spending their entire lives on the bodies of their hosts, the birds. They of course migrate from one host to another when the hosts are in actual contact, as when in copulation, when brooding over the offspring, or when huddling together on perches. Moreover, opportunities certainly occur for the lice of one host to actually migrate to a host of another species. For example, a certain species of louse which is normally a parasite of the hen is sometimes found on the turkey, especially where the two species of fowls are in the same yard. Two species of hen lice have been found also on guinea fowls where the latter were allowed to frequent the perches and the houses of the hens.

#### HOW BIRD LICE INJURE FOWLS

Bird lice have biting mouth parts and do not suck the blood of their hosts. It is doubtful whether any of the Mallophaga parasitic on domestic fowls ever get any blood except in case of a wound or a bruise on the host from which blood may issue; in such cases the parasites may eat the dried scales of blood. Blood has been found in the stomachs of bird lice, probably obtained in this manner. Kellogg<sup>1</sup> notes a species of bird louse that lives inside the pouch of the California brown pelican and clings to the walls of the pouch by its mandibles. Moreover, he has found a small area surrounding the parasites to be raw and bloody. It is a question in this case as to what these particular lice eat for food.

It is generally conceded that the Mallophaga live on bits of feathers and scales of the skin. Theobald speaks of them as constantly biting at the skin and causing serious irritation. Other writers hold that the constant movements of the lice cause irritation to the skin by the sharp claws with which the feet of all these parasites are furnished. The presence of the lice sets up an irritation which eventually weakens the host and gives an opportunity for various diseases to attack the fowl. This

<sup>1</sup> Kellogg, V. L. North American Mallophaga, p. 47. 1896.

seems to be especially true of chicks; if lice are abundant, the growth of the chicks is greatly checked, diarrhea seems to follow, and a generally weakened condition may result.

The losses caused by poultry lice are difficult to estimate, but the total must be large. When badly infested, chickens fail to make anything like their normal growth. Theobald<sup>2</sup> gives results showing that at the end of a year chicks infested with lice weighed one pound less than those that had been kept free from these pests, both having had exactly the same food and otherwise the same care. The loss in egg production through the infestation of laying hens must be very great, although there is no way of getting even an approximation of it. Brood hens are often so irritated by these parasites that many of the failures in hatching must be attributed to their presence. Undoubtedly the presence of lice, by weakening the general constitution of the host, predisposes the fowl to such diseases as gapes, cholera, roup, and similar affections, thus contributing to a considerable indirect loss and injury.



FIG. 95.—Eggs of *Menopon pallidum*

#### LIFE HISTORY OF BIRD LICE

The writer has made no attempt to work out the life history of any species of bird lice. The obstacles have seemed too great, and the time and effort required too extended, to justify the end. It is possible that a study of the life history of these parasites might throw some light on methods of control, but it does not seem probable.

Bird lice have an incomplete metamorphosis. The eggs are elongate-oval, white in color (all those observed), and covered with spinelike projections. The eggs of the common hen louse (*Menopon pallidum*) are usually deposited in clusters (Fig. 95) at the bases of the feathers. These clusters of eggs can usually be found, on badly infested fowls at least, on the feathers about the vent. When magnified, a single egg is seen to be a very characteristic and striking object. It is white and is covered with glasslike spines, many of which terminate in an anchor-

<sup>2</sup> Theobald, F. V. The parasitic diseases of poultry. 1896.

shaped hook. The free end of the egg is furnished with a cap, or lid, which bears at its apex in the center a long, lashlike appendage. This cap is pushed off by the young when it issues from the egg. The eggs are fastened very tightly to the feathers of the fowl.

The incubation period has not been definitely determined. Mr. Bües, in an unpublished thesis on two external parasites of the hen, says that the eggs of *M. pallidum* hatch in from six to ten days. From the context the writer infers that the period was never definitely determined, owing to the fact that no eggs were obtained the age of which was definitely known. At Ames, Iowa, P. H. Rolfs collected eggs of a species of bird lice, *Nitzschia pulicaris*, from the chimney swift. Some of these eggs were kept in a pasteboard box in Mr. Rolfs' vest pocket, while others were placed in glass tubes stopped with cotton and kept underneath a sitting hen. Under these conditions the eggs hatched in from thirteen to twenty days. As in the case first mentioned, the age of the eggs when collected was not known. It is reasonable to suppose that the eggs do not hatch as quickly in winter as in summer; it is certain that lice do not increase as rapidly on fowls in winter as in the warmer seasons. The important point that seems to be established is that the eggs hatch in a few days, and consequently any treatment given to fowls in order to rid them of lice must be repeated in ten days or two weeks.

The young are almost white when they emerge from the eggs; but as they grow older the skin becomes chitinized, brown in color, and in many species bears certain conspicuous brown and black spots and bands, which form rather characteristic markings. The young resemble the parents in shape and appearance, although the head is usually large in proportion to the body and the abdomen is short and stout.

So far as the writer is aware, the number of molts has never been definitely determined for any species. Theobald says, "Some kept by the author molted as many as twelve times, but this surely must be exceptional." The length of the nymphal stages has not been determined. It seems probable that the adult lice live for a considerable time on the hosts. Theobald, using fresh feathers, has kept alive for nine months the species *M. pallidum*, common on the hen.

#### SPECIES OF LICE REPORTED AS FOUND ON FOWLS

The following list of Mallophaga contain, so far as the writer has been able to determine, all the species that have been reported by different authors as infesting the various domestic fowls named. It is doubtful whether all the species here enumerated have actually been taken from the hosts listed. On the other hand, there are probably undiscovered forms on domestic fowls yet to be reported.

#### Summary of the species

##### The hen (*Gallus domesticus*)

<i>Menopon pallidum</i> Nitzsch	<i>Goniocotes gigas</i> Tasch.
<i>Menopon biseriatum</i> Piaget	<i>Goniocotes burnettii</i> Pack.
<i>Lipeurus variabilis</i> Nitzsch	<i>Goniodes dissimilis</i> Nitzsch
<i>Lipeurus heterographus</i> Nitzsch	<i>Goniodes eynsfordii</i> Theobald
<i>Goniocotes hologaster</i> Nitzsch	<i>Goniocotes hologaster</i> Nitzsch var. <i>maculatus</i> Tasch.

Professor V. S. Kellogg informs the writer that *Menopon pallescens* Nitzsch and *Goniodes truncatus* Nitzsch are also parasites on the domestic fowl.

##### The goose (*Anser domesticus*)

<i>Docophorus icterodes</i> Nitzsch var. <i>adustus</i> Bur.	<i>Trinoton lituratum</i> Nitzsch
<i>Lipeurus jejunus</i> Nitzsch	<i>Trinoton conspurcatum</i> Nitzsch
<i>Lipeurus anseris</i> Gurlt	<i>Trinoton conspurcatum</i> Nitzsch var. <i>continuum</i> Piaget

##### The duck (*Anas domestica*)

<i>Docophorus icterodes</i> Nitzsch	<i>Menopon obscurum</i> Piaget
<i>Lipeurus squalidus</i> Nitzsch	<i>Trinoton luridum</i> Nitzsch
<i>Lipeurus heterographus</i> Nitzsch	

##### The turkey (*Meleagris gallopavo*)

<i>Goniodes stylifer</i> Nitzsch	<i>Menopon biseriatum</i> Piaget
<i>Lipeurus polytrapezius</i> Nitzsch	

##### The peafowl (*Pavo cristatus*)

<i>Menopon phaeostomum</i> Nitzsch	<i>Goniodes parviceps</i> Piaget
<i>Goniodes falcicornis</i> Nitzsch	<i>Goniocotes rectangulatus</i> Nitzsch

##### The pigeon (*Columba domestica*)

<i>Menopon biseriatum</i> Piaget	<i>Goniocotes compar</i> Nitzsch
<i>Menopon longicephalum</i> Kellogg	<i>Goniodes minor</i> Piaget
<i>Menopon latum</i> Piaget	<i>Goniodes damicornis</i> Nitzsch
<i>Lipeurus baculus</i> Nitzsch	<i>Colpocephalum longicaudum</i> Nitzsch

##### The guinea fowl (*Numida meleagris*)

<i>Menopon pallidum</i> Nitzsch	<i>Goniodes numidianus</i> Denny
<i>Menopon numidae</i> Giebel	<i>Goniocotes gigas</i> Tasch.
<i>Lipeurus numidae</i> Denny	<i>Goniocotes hologaster</i> Nitzsch

##### The hen (*Gallus domesticus*)

- Menopon pallidum* Nitzsch, in Giebel Ins. Epizoa, p. 291 (1874).  
1668. *Pulex capi* Redi, Experimenta, Tab. 16, Fig. 1.  
1788. *Pediculus gallinae* Linné, Syst. Nat. (13th ed.), Vol. 1, Part 5, p. 2920.  
1815. *Nirmus trigonocephalus* von Olfers, De Veg. et Anim. Corp., p. 90.  
This is the common louse on hens. It has been present, in greater or less numbers, on every fowl the writer has examined, and has a wide geographical distribution.
- Menopon biseriatum* Piaget, Les Pediculines, p. 469 (1880).  
1793. *Pediculus meleagridis* Panzer, Fauna Insect. Germ. 51, Fig. 20.  
1818. *Menopon stramineum* Nitzsch, Germar's Mag. Ent., Vol. 3, p. 300.  
This is perhaps the next species in order of prevalence. It has a wide distribution.
- Lipeurus variabilis* Nitzsch, in Giebel Ins. Epizoa, p. 219 (1874).  
1788. *Pediculus caponis* Linné, Syst. Nat. (13th ed.), Vol. 1, Part 5, p. 2920.  
This is also a fairly common species on the hen and is widely distributed. It is common at Ithaca.
- Lipeurus heterographus* Nitzsch, in Giebel Ins. Epizoa, p. 218 (1874).  
This species has been found at Ithaca and in Mississippi.

5. *Goniocotes hologaster* Nitzsch, in Giebel Ins. Epizoa, p. 184 (1874).  
1778. *Ricinus gallinae* DeGeer, Mémoires des Insectes, Vol. 7, p. 79, Tab. 4, Fig. 15.  
This is not the *hologaster* of Denny. The insect is found at Ithaca and has been collected at Agricultural College, Mississippi. The variety *maculatus* Tasch. also occurs on the hen.
6. *Goniocotes gigas* Tasch., Die Mallophogen, etc., p. 77, Taf. 2, Fig. 1.  
1842. *Goniocotes hologaster* Denny, Monog. Anoplur. Brit., p. 153.  
1880. *Goniocotes abdominalis* Piaget, Les Pediculines, p. 238.  
This species is certainly not common, although the writer has collected it once in Ithaca on the guinea fowl and Bües has found it in Ithaca on the hen.
7. *Goniocotes burnettii* Pack., Amer. Nat., Vol. 4, p. 94 (1870).  
Professor Osborn thinks this species, described by Packard, is *Lipeurus heterographus*. The writer has not seen the type specimen.
8. *Goniodes dissimilis* Nitzsch, in Giebel Ins. Epizoa, p. 201 (1874).  
This species is apparently rare, although Railliet and Neveu-Lemaire say it is "très commun sur les poules." The writer has not collected it.
9. *Goniodes eynsfordii* Theo., Journal S. E. Agr. Coll., No. 5 (1896?).  
This is a comparatively new species, found in England and described by F. V. Theobald.  
*Menopon pallescens* Nitzsch and *Goniodes truncatus* Nitzsch, according to Professor V. S. Kellogg, have been reported as parasites on the hen.

#### The goose (*Anser domesticus*)

1. *Docophorus icterodes* Nitzsch, variety *adustus* Burmeister, Handbuch der Entomologie, Vol. 2, p. 424 (1839).  
Piaget apparently regards *D. adustus* as a synonym of *D. icterodes*, or at most not more than a variety. It is *D. adustus* that has been found on the domestic goose. This species has not been collected at Ithaca.
2. *Lipeurus jejunus* Nitzsch, in Giebel Ins. Epizoa, p. 240 (1874).  
1668. *Pulex anseris sylvestris* Redi, Experimenta, Tab. 10.  
1758. *Pediculus anatis anseris* Linné, Syst. Nat. (10th ed.), p. 612.  
1815. *Nirmus crassicornis* von Olfers.  
The author has collected this species at Ithaca on the goose.
3. *Lipeurus anseris* Gurlt, in Piaget Les Pediculines, p. 350 (1880).  
1842. *Ornithobius anseris* Gurlt, Mag. f. d. ges. Thierheilkunde, Vol. 8, p. 426.  
The writer has not collected this species, but has received it from R. S. Bagnall, who collected it on the domestic goose in England. (Journ. Econ. Biol., Vol. 7, No. 1, 1912.)
4. *Trinoton lituratum* Nitzsch, in Giebel Ins. Epizoa, p. 260 (1874).  
1842. *Trinoton squalidum* Denny, Monog. Anoplur. Brit., p. 235, Plate 22, Fig. 3.  
Denny says he found one specimen on the domestic goose. The writer has not found this species in the United States. The specimen illustrated was loaned by Professor H. Osborn (Fig. 112, page 251).
5. *Trinoton conspurcatum* Nitzsch, in Giebel Ins. Epizoa, p. 258 (1874).  
1776. *Pediculus anseris* Sulzer, Geschichte d. Insecten, Tab. 29, Fig. 4.  
Denny says this species "is a very common parasite on the domestic goose." The writer has not collected it on the goose. The specimen illustrated was from the snow goose and was loaned by Professor H. Osborn (Fig. 111, page 251).  
The variety *continuum* Piaget, Les Pediculines, page 591, also occurs on domestic geese but has not been reported for this country.

#### The duck (*Anas domestica*)

1. *Docophorus icterodes* Nitzsch, in Giebel Ins. Epizoa, p. 115 (1874).  
1763. *Pediculus dentatus* Scopoli, Entomol. Carniol., p. 383.  
This species is common on the duck both at Ithaca and in Mississippi. It must be widely distributed.

2. *Lipeurus squalidus* Nitzsch, in Giebel Ins. Epizoa, p. 241 (1874).  
1805. *Pediculus anatis* Fabr., Systema Ants., p. 345.  
The writer has not been so fortunate as to collect this species from the duck, but there seems to be no doubt about its occurrence on the domestic varieties. It is recorded by Kellogg in his catalogue of Mallophaga, in Genera Insectorum, 66th Fascicule, 1908, p. 44.
3. *Lipeurus heterographus* Nitzsch, in Giebel Ins. Epizoa, p. 218 (1874).  
1870. *Goniocotes burnettii* Pack., Amer. Nat., Vol. 4, p. 94.  
If *G. burnettii* is a synonym of *L. heterographus*, the latter species must be recorded as infesting the domestic duck, because Osborn says specimens from Bruner were from young ducks. It is probable that the lice go from one to another of the fowls when they are in close contact in the same yard.
4. *Menopon obscurum* Piaget, Les Pediculines, p. 497 (1880).  
Neumann records this as occurring on the domestic duck. The writer has not found it on this fowl.
5. *Trinoton luridum* Nitzsch, in Giebel Ins. Epizoa, p. 258 (1874).  
Railliet and Neumann give this species as infesting the domestic duck. The writer has not so found it, but has it from wild ducks. The figure was made from a specimen loaned by the Minnesota Experiment Station.

#### The turkey (*Meleagris gallopavo*)

1. *Goniodes styliifer* Nitzsch, in Giebel Ins. Epizoa, p. 200 (1874).  
1781. *Pediculus meleagris* Schrank, En. Ins. Aust., p. 504.  
A common species on the turkey at Ithaca.
2. *Lipeurus polytrapezius* Nitzsch, in Giebel Ins. Epizoa, p. 218 (1874).  
1788. *Pediculus meleagridis* Linné, Syst. Nat. (13th ed.), Vol. 1, Part 5, p. 2920.  
This species also is common on turkeys at Ithaca.
3. *Menopon biseriatum* Piaget.  
The writer has examined material collected by C. Curtice and named *M. stramineum* which is certainly *M. biseriatum*. This material was loaned by the United States Bureau of Animal Industry. The species has been collected at Ithaca on turkeys.

#### The peafowl (*Pavo cristatus*)

1. *Menopon phaeostomum* Nitzsch, in Giebel Ins. Epizoa, p. 292 (1874).  
The writer has not collected this species, but at the University of Minnesota there are several specimens collected by O. Lugger. Lugger says, "it seems to be very common."
2. *Goniodes falcicornis* Nitzsch, in Giebel Ins. Epizoa, p. 198 (1874).  
1668. *Pulex pavonis* Redi, Experimenta, Tab. 14.  
1788. *Pediculus pavonis* Linné, Syst. Nat. (13th ed.), Vol. 1, Part 5, p. 2919.  
1815. *Nirmus tetragonocephalus* von Olfers.  
1817. *Ricinus pavonis* Kirby and Spence, Introd. to Ent., Vol. 2, Plate 5, Fig. 3.
3. *Goniodes parviceps* Piaget, Les Pediculines, p. 277 (1880).  
The writer has not collected this species. Piaget found it on the peacock in great numbers.
4. *Goniocotes rectangulatus* Nitzsch, in Giebel Ins. Epizoa, p. 185 (1874).  
The writer incorrectly ascribed this species to Piaget in a list published in the Journal of Economic Entomology, Vol. 6, p. 84, 1913. So far as the writer knows, this species has not been taken in America, but it probably occurs here.

#### The pigeon (*Columba domestica*)

1. *Menopon biseriatum* Piaget.  
Neumann says this species occurs on the pigeon. The writer has not collected it on this bird.
2. *Menopon longicephalum* Kellogg, New Mallophaga, Part 2, p. 535 (1896).  
Kellogg collected a male and a female of this species from the domestic pigeon at Lawrence, Kansas.

3. *Menopon latum* Piaget, Les Pediculines, p. 457 (1880).  
Piaget records this species on the domestic pigeon and says it is probably the same as *M. giganteum* of Denny (1842).
4. *Lipeurus baculus* Nitzsch, in Giebel Ins. Epizoa, p. 215, 216 (1874).  
1668. *Pulex columbae majoris* Redi, Experimenta, Tab. 2.  
1788. *Pediculus columbae* Linné, Syst. Nat. (13th ed.), Vol. 1, Part 5, p. 2920.  
1815. *Nirmus filiformis* von Olfers, De Veg. et Anim. Corp., p. 90.  
1861. *Lipeurus bacillus* Nitzsch (ed. Giebel), Zeitschr. f. ges. Naturwiss., Vol. 23, p. 305.  
1870. *Lipeurus angustus* Rudow, Zeitschr. f. ges. Naturwiss., Vol. 36, p. 137.  
1874. *Lipeurus antennatus* Giebel, Ins. Epizoa, p. 213.  
A very common species on the domestic pigeon. Collected at Ithaca and at Agricultural College, Mississippi.
5. *Goniocotes compar* Nitzsch, in Giebel Ins. Epizoa, p. 183 (1874).  
1763. *Pediculus bidentatus* Scopoli (?), Entomol. Carniol, p. 385.  
1847. *Philopterus compar* Nitzsch, Walckenaer Hist. Nat. Ins. Apt., Vol. 3, p. 358.  
This is a common species found at Ithaca on pigeons nesting about barns and dovecots, generally called domestic pigeons.
6. *Goniodes minor* Piaget, Les Pediculines, p. 256 (1880).  
The writer has not collected this species.
7. *Goniodes damicornis* Nitzsch, in Giebel Ins. Epizoa, p. 197 (1874).  
Kellogg reports this species on domestic pigeons in the United States.
8. *Colpocephalum longicaudum* Nitzsch, in Giebel Ins. Epizoa, p. 268 (1874).  
1842. *Colpocephalum turbinatum* Denny, Monog. Anoplur. Brit., p. 209.  
This species was reported by Piaget on the domestic pigeon. Specimens from the pigeon were loaned to the writer by Dr. H. T. Fernald.

*The guinea fowl (Numida meleagris)*

1. *Menopon pallidum* Nitzsch.  
The writer has collected this species at Ithaca on the guinea fowl. It is probable that the insect migrated from hens, with which the guinea fowls were in close relation.
2. *Menopon numidae* Giebel, Ins. Epizoa, p. 292 (1874).  
This species has not been collected at Ithaca. The writer incorrectly ascribed this species to Denny in a list published in the Journal of Economic Entomology, Vol. 6, p. 84, 1913.
3. *Lipeurus numidae* Denny, Monog. Anoplur. Brit., p. 115 (1842).  
1842. *Nirmus numidae* Denny, Monog. Anoplur. Brit., p. 115.  
This species has not been collected by the writer.
4. *Goniodes numidianus* Denny, Monog. Anoplur. Brit., p. 163 (1842).  
This species has not been collected by the writer.
5. *Goniocotes gigas* Tasch.  
The writer has collected this species at Ithaca.
6. *Goniocotes hologaster* Nitzsch.  
The writer has collected this species from guinea hens that roamed among domestic fowls. It was probably a straggler from the latter.

THE COMMON HEN LOUSE (Fig. 96)

(*Menopon pallidum* Nitzsch)

The common hen louse is the species most commonly seen on the hen, and therefore is the best known. It can be found, in greater or less numbers, on almost any hen at any season of the year. Moreover, it passes readily to other domestic fowls that come in contact with the hen, and

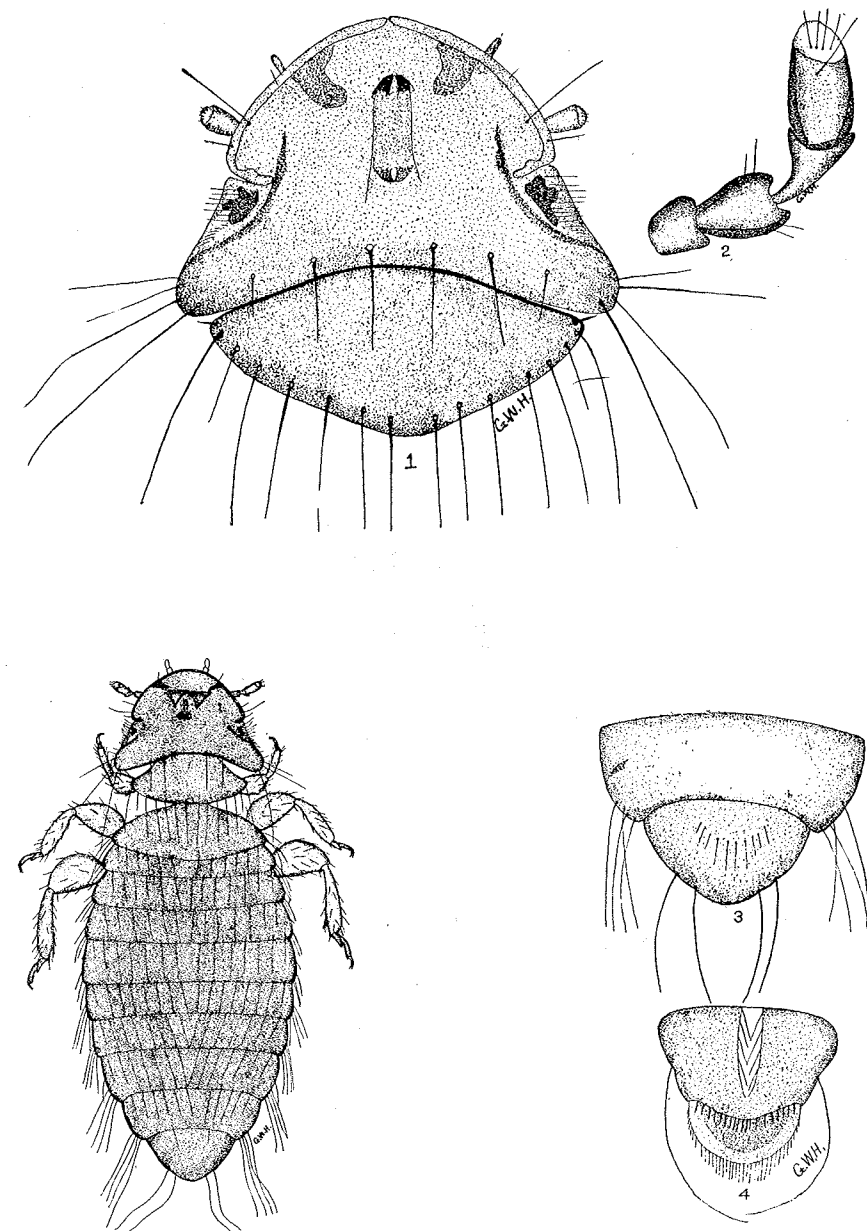


FIG. 96.— Common hen louse (*Menopon pallidum*). Male below, at left; 1, head and prothorax; 2, antenna; 3, end of abdomen of male; 4, end of abdomen of female

instances are recorded in which it has infested horses stabled near hen roosts.

The louse is plainly visible to the eye, being about one-sixteenth of an inch in length. It is of a pale straw color and very active, moving rapidly among the feathers of the fowl. The drawings (Fig. 96) show the main difference between the male and the female insect. In the male the last segment of the abdomen is sharply rounded and bears four long hairs, while the last segment of the abdomen of the female bears a fringe of short hairs. The head of the louse is wider than the thorax, and the eyes are conspicuous.

This insect seems to live on all parts of the fowl's body, but the writer has found it most abundant among the feathers around the vent. It probably causes more injury to hens than does any other species of louse.

THE COMMON LARGE LOUSE OF THE HEN (Fig. 97)

(*Menopon biseriatum* Piaget)

In the experience of the writer, the next commonest louse on the hen

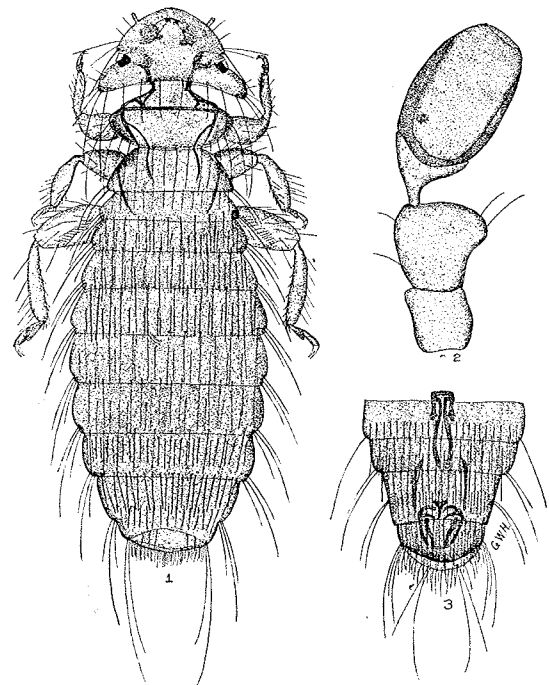


FIG. 97.—Common large louse of the hen (*Menopon biseriatum*). 1, Female; 2, antenna; 3, end of abdomen of male

This species also is active, and apparently passes readily to other hosts for it is found on the turkey and other fowls. It has been present on most of the hens that the

is the species called the common large louse. It is much larger than the species first described, and somewhat darker in color. This louse is one-tenth of an inch in length, sometimes slightly longer. The male is larger than the female. It is yellowish in color but is more hairy than *M. pallidum*, there being two transverse rows of hairs on the dorsal side of each abdominal segment. It is usually found in company with *M. pallidum* but is easily recognized by its larger size. The terminal segments of the male differ from those of the female, as shown in

the drawings.

writer has examined, and must cause considerable annoyance and injury because of its size and abundance.

THE VARIABLE HEN LOUSE (Fig. 98)

(*Lipeurus variabilis* Nitzsch)

The variable hen louse has been present in small numbers on many of the hens examined by the writer. It seems never to be abundant, but is usually present. In the experience of the writer it probably stands in abundance next to the two Menopons just discussed. Theobald says, "It is a very abundant species in most breeds of fowl."

This species has a long, narrow body, with a well-rounded head and prominent antennae. It is about one-twelfth of an inch in length. It is conspicuous on the body of the hen and can hardly be overlooked. The body of the female is more robust than that of the male. The species is rather darker in color than the two common species previously described. The edges of the body are dark brown in color and there is a dark band down the middle of the abdomen. The antennae of the male differ strikingly from those of the female (Fig. 98, 3 and 4); in addition, the last segment of the abdomen of the female is bilobed (Fig. 98, 6), while that of the male is bluntly rounded and bears four long, slender, conspicuous hairs.

This louse frequents the primary and the secondary wing feathers of the fowl, although it may be found also on the body. It can move rapidly and is likely to dodge about through the feathers.

THE LARGE LIPEURUS OF THE HEN (Fig. 99)

(*Lipeurus heterographus* Nitzsch)

The large lipeurus can well be called the head louse of the hen. The writer has found it to be fairly common at Ithaca and at Agricultural

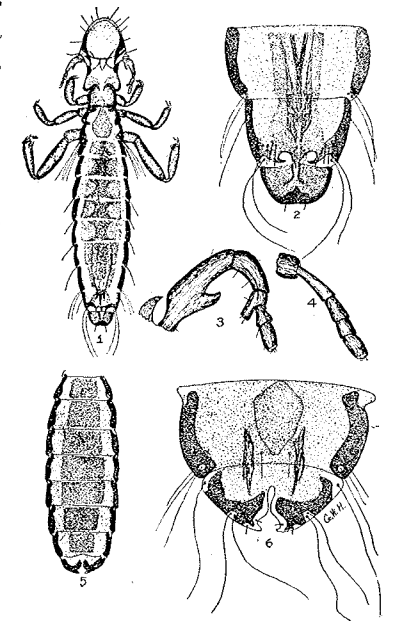


FIG. 98.—Variable hen louse (*Lipeurus variabilis*). 1, Male; 2, posterior end of abdomen of male; 3, antenna of male; 4, antenna of female; 5, abdomen of female; 6, last two segments of abdomen of female



College, Mississippi, and most of the specimens that he has collected have been taken from the heads of the fowls. A correspondent sent several fine specimens taken from the head of a cockerel. He said, "They seem to be on the head only, and on the feathers rather than on the skin." Theobald says this species lives in exactly the same manner as the preceding, *L. variabilis*. The writer has collected this species from chickens also, but has been unable to determine definitely whether it constitutes the so-called "head louse" of chickens.

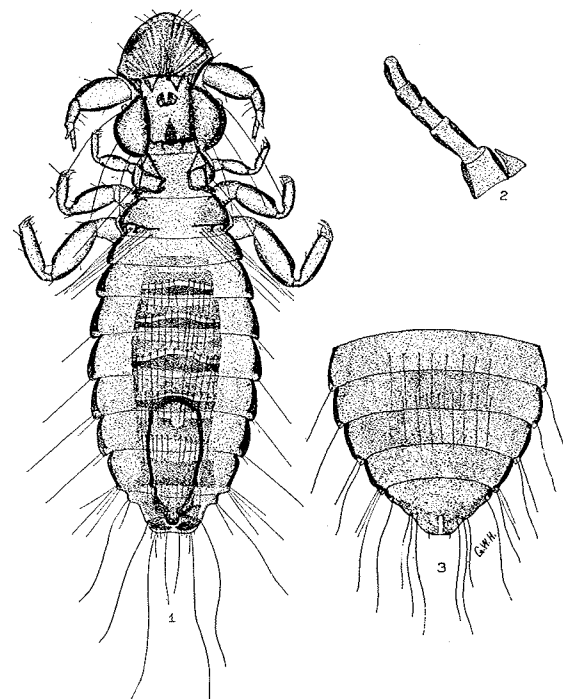


FIG. 99.—Large louse of the hen (*Lipeurus heterographus*). 1, Male; 2, antenna of female; 3, posterior end of abdomen of female

particularly, although it may be seen on almost any part of a hen's body. The writer has collected the species on hens at Ithaca and at Agricultural College, Mississippi.

The louse is small, scarcely one-twenty-fifth of an inch in length. The body is short and more or less circular in outline. The markings on the segments of the abdomen are conspicuous but do not extend deeply inward. The posterior segments of the abdomen of the male and the female differ, as shown in the drawings.

This species is much larger than the variable louse, and is striking in appearance. The abdomen of the female is large and the bodies of both sexes do not appear as long and narrow as those of typical specimens of this genus. The male differs markedly from the female in shape of body, antennæ, and the last segment of the abdomen.

#### THE LESSER CHICKEN LOUSE (Fig. 100)

(*Goniocotes hologaster* Nitzsch)

The lesser chicken louse, which is usually present in small numbers on hens, is found on the back and the rump particularly,

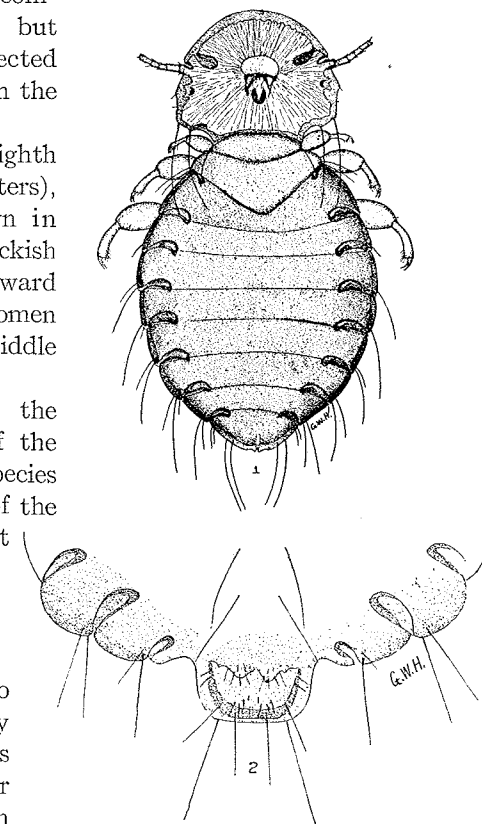
#### THE LARGE CHICKEN LOUSE (Fig. 101)

(*Goniocotes gigas* Tasch.)

The large chicken louse has been confused with the preceding species, but it is nearly, if not quite, three times as large and is a very striking species. It is certainly not so common as *Menopon pallidum*, but the writer has specimens collected in Ithaca from hens and from the guinea fowl.

The insect is nearly one-eighth of an inch in length (3 millimeters), and the male is yellowish brown in color with conspicuous blackish transverse bands extending inward from the margins of the abdomen and a dark band down the middle of the back.

The specimen found on the guinea fowl was on the side of the body, and whether this species frequents any particular part of the fowl's body the author does not know.



#### THE CHICKEN GONIODES (*Goniodes dissimilis* Nitzsch)

The chicken goniodes is also a large species, but is apparently not common. The writer has never collected it, and, so far as he knows, it has not been reported in America although

it probably can be found here. Denny in 1842 considered it of rare occurrence, but Theobald in 1896 says that in England it is an "abundant species on most varieties of fowls, and is especially located under the wings and on the rump." Both Railliet and Neveu-Lemaire say this species is "très commun sur les poules."

#### THE COMMON LOUSE OF THE GOOSE (Fig. 102)

(*Lipeurus jejunus* Nitzsch)

The common louse of the goose here described has been collected by the writer at Ithaca in considerable numbers, thirty specimens having been

taken from one goose, representing all stages from young to adult. These lice are found among the primary and the secondary wing feathers of geese. They have the habit of gliding sidewise and dodging from one side of the feather to the other through spaces between the barbs.

The louse is long, narrow, slender, and pale yellowish in color with dark margins. The male differs from the female in the form of the antennæ and the last segment of the abdomen. The length of the female's body is over one-eighth of an inch (3.48 millimeters), while the width is only about one-fortieth of an inch (.66 millimeter).

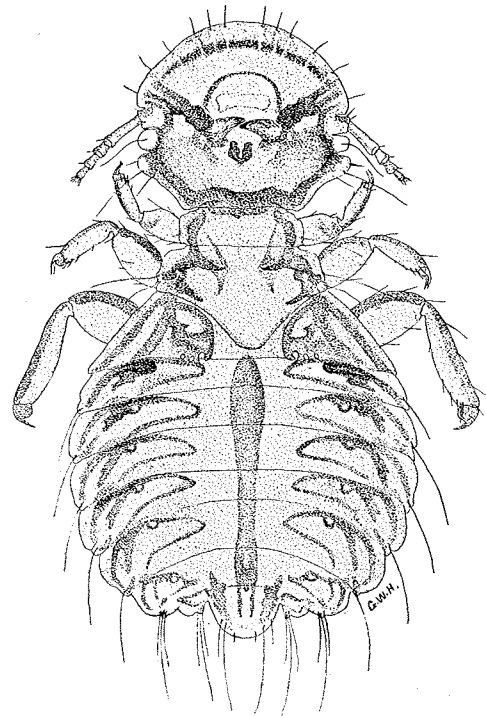


FIG. 101.—Large chicken louse (*Goniocotes gigas*), male

(*Lipeurus anseris* Gurlt)

The writer has received some specimens of *Lipeurus anseris* from R. S. Bagnall, of England. This species has not been collected in America, nor can the writer find any distinctive characteristics which differentiate it from *L. jejunus*.

THE COMMON LOUSE OF THE DUCK (Fig. 103)

(*Docophorus icterodes* Nitzsch)

The common louse of the duck has been collected by the writer both at Ithaca and at Agricultural College, Mississippi. It has been found principally on the head of the duck, although it is sometimes seen on the

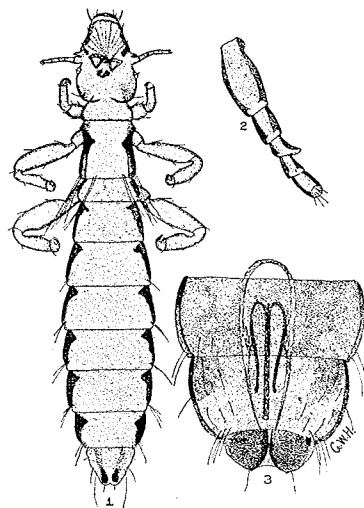


FIG. 102.—Common louse of the goose (*Lipeurus jejunus*). 1, Male; 2, antenna of male; 3, posterior end of abdomen of male

body. At one time the writer found eight specimens, of which six were females and two were males, on the head of a white peking duck.

The female louse is about one-sixteenth of an inch long. It is rather dark-colored, with dark transverse bands on the abdomen.

THE SQUALID DUCK LOUSE (Fig. 104)

(*Lipeurus squalidus* Nitzsch)

The species known as the squalid duck louse is common on many varieties of ducks, and there seems to be no doubt that it lives on the domestic varieties of ducks although the writer has been unable to find it on this host. Railliet records it as "très commun sur le canard domestique." Kellogg (66th fascicule, *Genera Insectorum*, page 44) records it as occurring on *Anas domestica*.

The squalid duck louse is very characteristic in appearance. It is long and slender, with a pale abdomen marked along the edges with more or less quadrangular dark patches, each patch with a light spot in the center. The body of the female is fully an eighth of an inch in length (3.4 millimeters). The particular specimen illustrated was from a mallard duck and was loaned from the collection of the Minnesota Experiment Station.

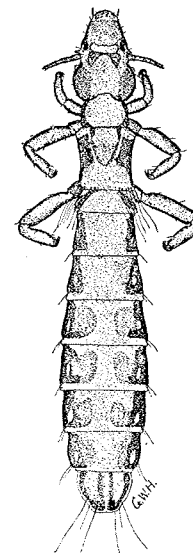


FIG. 104.—Squalid duck louse (*Lipeurus squalidus*)

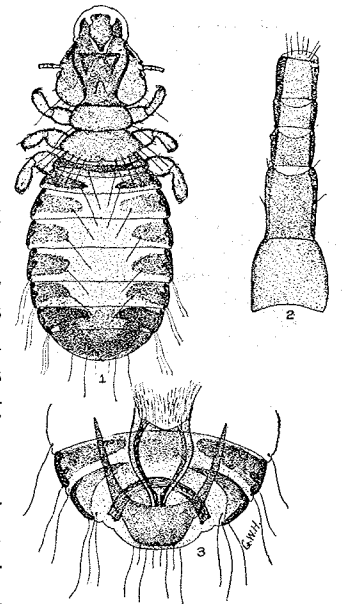


FIG. 103.—Common louse of the duck (*Docophorus icterodes*). 1, Female; 2, antenna of female; 3, posterior end of abdomen of male

THE LARGE TURKEY LOUSE (Fig. 105)

(*Goniodes styliifer* Nitzsch)

Of all the lice that infest the turkey, the large turkey louse has been found by the writer oftenest and in greatest numbers. It is a striking species in appearance, both in shape and in size. The female is fully an eighth of an inch (3.4 millimeters) in length, chestnut-yellow, and with the hind angles of the head projecting backward to an extraordinary length in the shape of hornlike extensions. The sexes differ from each other in the shape of the antennæ and of the last abdominal segments.

This species frequents the head, the neck, and the breast of the turkey.

THE SLENDER LOUSE OF THE TURKEY (Fig. 106)

(*Lipeurus polytrapezius* Nitzsch)

The slender louse also is common on the turkey, having been found in considerable numbers on the fowls examined. It is a long, slender insect, fully one-eighth of an inch in length (3.46 millimeters). The sides of the abdomen are edged with black, although the general color of the louse is yellowish white.

These lice are found on the primary wing feathers and are adroit in dodging from one

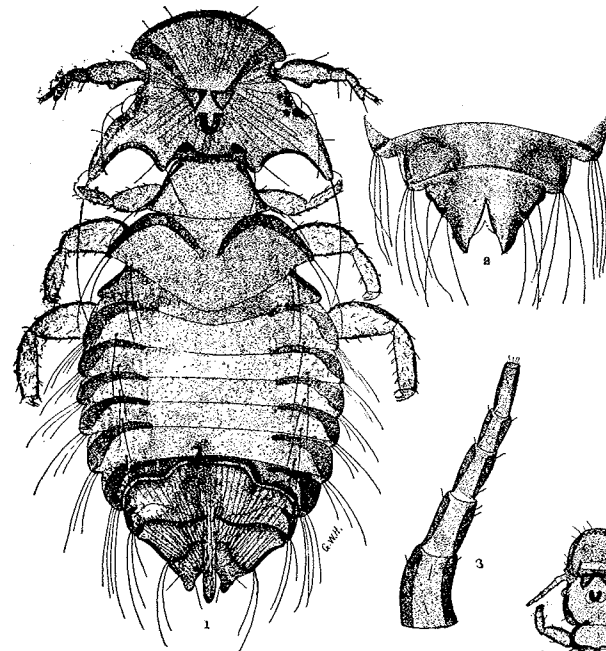


FIG. 105.—Turkey louse (*Goniodes stylifer*). 1, Male; 2, posterior end of abdomen of female; 3, antenna of female

side of a feather to the other. Denny describes their mode of progression well when he says: "They slide as it were sideways extremely quick from one side of the fiber of a feather to the other, and move equally well in a forward or retrograde direction, which, together with their flat polished bodies, renders them extremely difficult to catch or hold."

THE PEACOCK GONIODES (Fig. 107)

(*Goniodes falcicornis* Nitzsch)

The peacock goniodes is apparently a common species on the peacock. It is a large louse, being fully one-eighth of an inch in length. The ab-

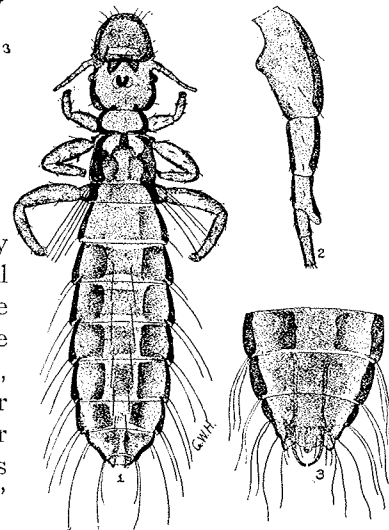


FIG. 106.—Slender louse of the turkey (*Lipeurus polytrapezius*). 1, Female; 2, antenna of male; 3, posterior end of abdomen of male

domen is short, wide, and rounded. It is marked with dark bands extending inward from the edges of the segments. This species has been found in America, but the writer has had no opportunity to examine the host fowl.

The drawing was made from a specimen loaned by Professor H. Osborn.

THE SLENDER LOUSE OF THE PIGEON (Fig. 108)

(*Lipeurus baculus* Nitzsch)

The slender louse of the pigeon is found in abundance on at least "nineteen of the forty pigeon host species." It

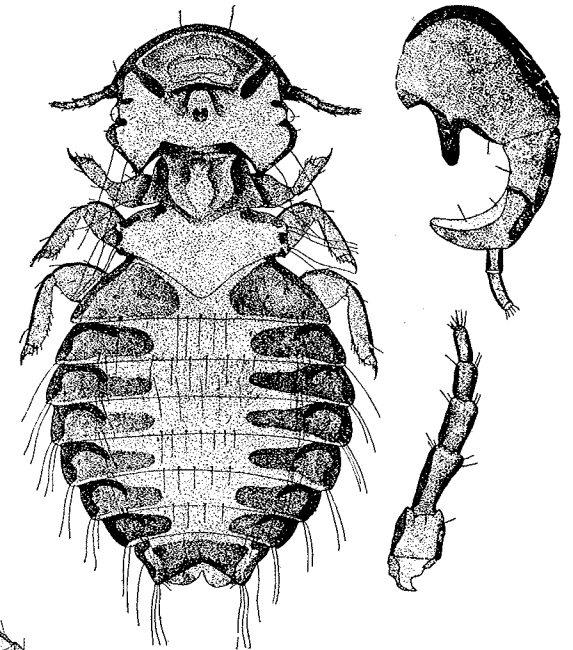


FIG. 107.—Peacock goniodes (*Goniodes falcicornis*), female. Antenna of male above, at right; antenna of female below

has been seen on every domestic pigeon that the writer has examined or that has been examined by his students.

The body of this louse is long and narrow, and edged with a dark border on each side. It is only about one-twelfth of an inch in length. It is nearly of the same width throughout the length of the abdomen, although it may be slightly wider near the middle.

This species seems to be confined to pigeons and apparently does not spread to other fowls.

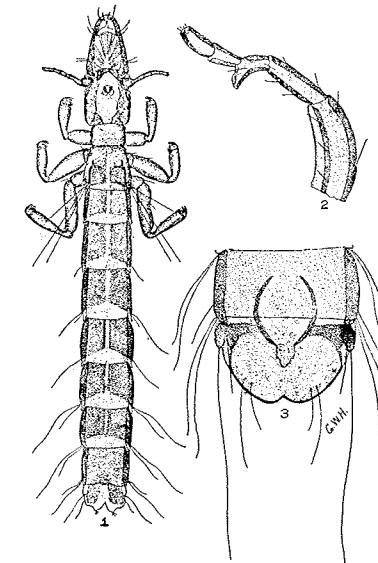


FIG. 108.—Slender louse of the pigeon (*Lipeurus baculus*). 1, Female; 2, antenna of male; 3, posterior end of abdomen of male

THE PIGEON LOUSE (Fig. 109)

(*Goniocotes compar* Nitzsch)

Denny reports the pigeon louse as "a common parasite on all varieties of domestic pigeons." Osborn says it is a species that has been familiar

for a long time, and is generally common on domestic pigeons. It has been found at Ithaca on pigeons that were generally considered domestic; at least, the specimens were taken from pigeons nesting and living about barns and dovecots.

The insects are small, about one-twentieth of an inch in length. The sexes differ markedly in the form of the last abdominal segment. This species somewhat resembles the small *G. hologaster* of the hen.

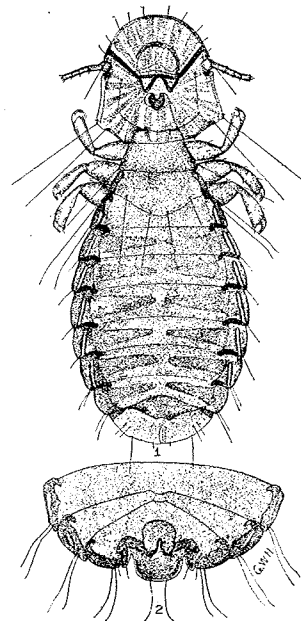


FIG. 109.—Pigeon louse (*Goniocotes compar*). 1, Female; 2, posterior end of abdomen of male

#### SOME OTHER LESS COMMON LICE

The large bird louse shown in figure 110 is said to infest domestic ducks, but the writer has not yet found it on these fowls. It occurs on many of the wild ducks and has been found on the mallard. There seems to be every reason why it should be found on the domestic duck in America. It is a striking species, being nearly a fifth of an inch in length (4.95 millimeters). The abdomen is marked by conspicuous transverse dark bands.

The large species illustrated in figure 111 is said to occur on the domestic goose. The specimen shown was taken from the snow goose. It is larger than the species just described, measuring over one-fifth of an inch in length (6.25 millimeters). It is very darkly colored, and has large, strong legs and a prominent head.

The pale louse of the goose (Fig. 112) is a parasite of the domestic goose, but evidently not a very abundant one. It is difficult to find among the thick feathers and the down on the body of its host. It is pale in color, almost transparent, and small, measuring only about one-thirty-fifth of an inch in length.

The common louse of the peafowl is shown in figure 113. It closely resembles the common louse of the hen, but is shorter and broader.

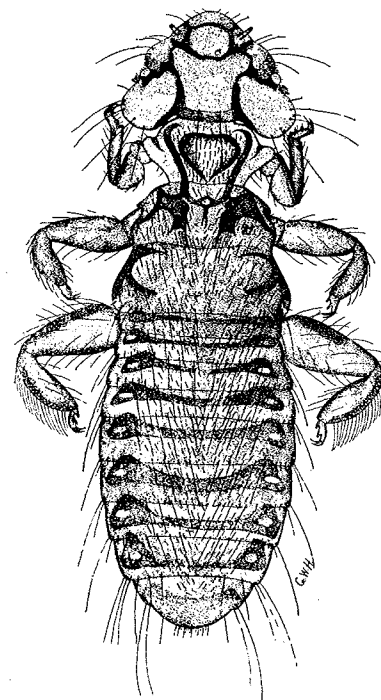


FIG. 110.—A large louse of the duck (*Trinoton luridum*)

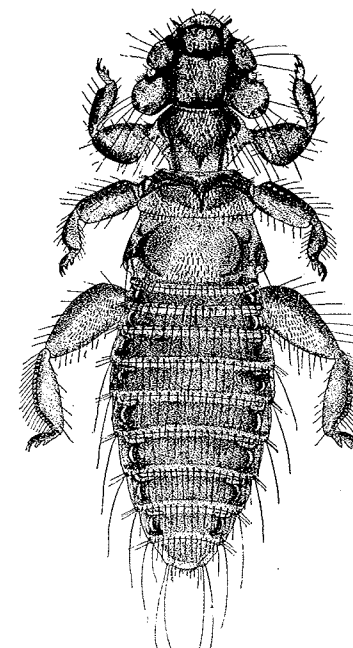


FIG. 111.—A large louse of the goose (*Trinoton conspurcatum*)

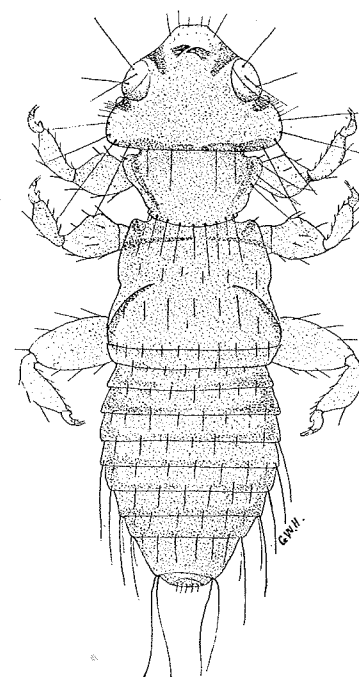


FIG. 112.—The pale louse of the goose (*Trinoton lituratum*)

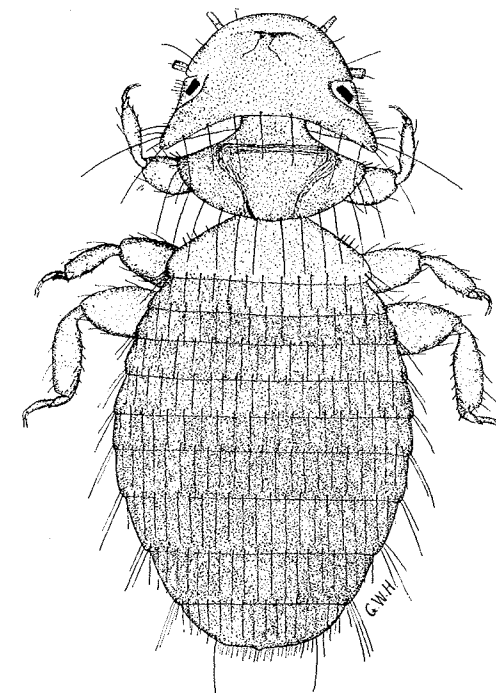


FIG. 113.—A common louse of the peafowl (*Menopon phaeostomum*)

## OTHER PARASITES OF FOWLS

## THE POULTRY MITE

*(Dermanyssus gallinae* DeGeer)

There are at least eighteen different species of mites parasitic on fowls. Some of these species are merely blood-sucking insects, while others cause affections of the skin. Not more than three or four of them become serious pests, as a usual thing. The species known as the poultry mite is one of the blood-sucking forms and one of the larger species.

The full-grown mites are plainly visible to the unaided eye. It would take about thirty-six of the females to reach an inch, they being .70 millimeter long; the males are slightly smaller, being .60 millimeter long. The color of the mites varies from whitish yellow normally, to blood red when fully engorged. In the female the mouth parts are elongated in the form of long stylets, and are thus fitted for piercing the skin and sucking the blood of the host; in the male the mouth parts are more jaw-like, similar to those of spiders.

*Distribution and abundance*

The poultry mite is widely distributed over the globe. It has been reported from England, France, Italy, South Africa, Brazil, and all parts of the United States. The writer has found the mite more abundant in the Southern States than in the northern part of the United States. This is probably due to the long and warm summer seasons, with mild winters, which give an opportunity for the mites to survive in greater numbers and increase with greater rapidity.

The abundance of the mites, under certain conditions, almost passes belief. They have the habit of congregating in bunches, like bees settling on a limb when swarming. The writer has seen them hanging in festoons from the nest boxes of sitting hens. In such cases they spread over the perches and become abundant everywhere in the poultry house. There are probably few poultry houses in this country that are entirely free from these mites during the summer months.

*Habits and injuries*

In contrast with the lice, poultry mites are temporary, not permanent, parasites. They are nocturnal in habit, attacking the fowls at night but forsaking their hosts in the morning and hiding in cracks and crevices of the perches, the nest boxes, and the walls of the poultry house during the day. During the night the mites swarm over the fowls, gorge themselves with blood, and cause serious irritation to their hosts, with an accompanying loss of rest and sleep.

There is no question but that the food of these mites consists largely, if not wholly, of blood. They are often found in great numbers among chicken droppings, but there is no clear evidence to show that they can live on this material or on the juices extracted from it. They can live for a long time without food. Bües kept them alive in a pill box for three months, and Neri maintained them without food for two months. There seems to be authentic proof of their having existed in unoccupied poultry houses throughout a single season at least.

The effect of the mites on fowls is serious and far-reaching. Repp says<sup>3</sup>:

"My observations have demonstrated that chickens infested with mites are exceedingly unprofitable. The cost of keeping them is increased and the income from them is very much reduced. Indeed, when very badly infested they are totally incapacitated for performing work.

"The hens will cease laying. The ovaries undergo atrophy and on autopsy will be found shrunken and in a condition unsuitable for work. In several flocks on which I made observation I found that egg production was greatly reduced or altogether prevented during the spring and summer when, under normal conditions, it would have been at its height."

Almost invariably, the nest of a hen set after the first of May in the latitude of Mississippi will in a few days be found swarming with multitudes of these tiny mites.<sup>4</sup> If the mites are left undisturbed the hen will leave the nest in sheer desperation. This is a sufficient indication of the ability of the mites to cause trouble, for when a sitting hen leaves a nest of her own accord there must be great provocation.

Sitting hens occasionally succumb to the attacks of these mites, from impoverishment of the blood. Repp mentions three cases in which sitting hens died on the nest from no other cause, so far as he could find, than the attacks of mites. Newly hatched chicks are likely to suffer severely in cases of such infestations, and chickens both young and old will become weakened and unthrifty and subject to the attacks of various disorders.

*Life history*

The following brief notes on the life history of the poultry mite are based on the observations of Bües<sup>5</sup> in New York and of the writer in Mississippi.

The eggs are laid in the hiding places of the mites and mixed with the exuviae and other debris in the cracks and crevices. Sometimes several eggs are piled together in a bunch. The egg is white, slightly iridescent, and oval in shape. It varies much in size. Bües says the eggs are laid

<sup>3</sup> Repp, John J. The chicken mite. Iowa State College Exp. Sta. Bul. 69. 1903.

<sup>4</sup> Herrick, G. W. The chicken mite. Mississippi Agr. Exp. Sta. Bul. 78. 1902.

<sup>5</sup> Bües, C. R. A. Two external parasites of poultry. Unpublished thesis, Cornell University. 1906.



singly, at the rate of about one a day. His records show that the period of incubation when the eggs were carried in his pocket was from three to three and a half days. In a warm room in the insectary, the incubation period in November varied from four to five days.

The young mite when it hatches from the egg is white in color, and is delicate in appearance but active. It has six legs in this stage but after the first molt the fourth pair of legs appears. Bües believes there is but one molt before the eight-legged stage is reached and several after that stage, although he was unable to determine the exact number. The length of time from egg to adult varies, apparently according to the supply of food. There are several generations in the warm season and they increase with exceeding rapidity.

#### Control

The poultry mite, like the hen flea, prefers dark, filthy, crowded hen-houses, where it can remain undisturbed and increase without hindrance. Measures to be taken against this pest are discussed at length on pages 261 to 264.

#### THE COMMON HEN FLEA (Fig. 114)

(*Ceratophyllus gallinae* [Schrank] Wagner)

Heretofore the common hen flea seems to have been definitely recorded but once in the United States. That was by C. F. Baker,<sup>6</sup> who had a single specimen, taken at Ames, Iowa, by Professor Herbert Osborn. The host was not mentioned. This flea has been reported from Bryan, Texas, as common and troublesome on chickens.<sup>7</sup> Baker, however, believes this determination "an erroneous one, the record probably referring to *Sarco-  
psylla gallinacea*."

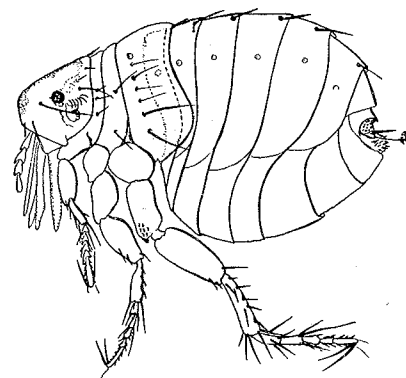


FIG. 114.—The common hen flea, *Ceratophyllus gallinae*

Curiously enough, the writer has received specimens of the common hen flea from two different localities within the last two years. In 1912 specimens were received from a correspondent in Abington, Massachusetts, with the following comments: "It made its appearance on our premises last summer, several weeks after we bought some pullets from a neighbor-

<sup>6</sup> Baker, C. F. Preliminary studies in Siphonaptera.—III. Can. ent. 27:111. 1895.  
<sup>7</sup> Francis, M. Veterinary science: IV. Notes on parasites. Texas Agr. Exp. Sta. Bul. 30:452. 1894.

who had returned from California three or four years previously. We had never seen anything of the kind up to that time." The specimens sent were caught on the walls and the ceiling inside the henhouse. They were submitted to the Honorable N. Charles Rothschild, of London, England, who identified them as *Ceratophyllus gallinae*.<sup>8</sup> In the following year specimens of the fleas were received from Barker, New York. These were collected from "a hen's nest in the henhouse where these fleas live and breed." There are thus two definite records of the appearance of this flea in the United States, and doubtless it may be found in other localities. Both correspondents state that it is a very annoying pest, especially to human beings. One says: "They have certainly bitten me severely and my husband also. They poison me so that the bite will be troublesome for two or three weeks afterwards." The other says: "When one gets an opportunity to bite it will bite several times in a short distance. The bites soon become much swollen, are red, and itch intolerably."

#### Life history

The life history of this flea, according to Theobald, seems to be about as follows: The female lays her small, white eggs in the nests of fowls; the eggs are sometimes found also among the droppings on the floor. In a week or ten days the eggs hatch into the slender, whitish larvæ, which finally attain a length of from one-sixth to one-fourth of an inch. The larval life seems to extend over a period of from ten days to three weeks, the length of this period depending on the temperature and other surrounding conditions. When full-grown the larva finds a crack or a crevice, and there spins a pale silken cocoon which is often covered more or less with dirt. Within this cocoon the larva undergoes its change to the pupa, in a period occupying from ten to twenty-one days. At the end of this stage the pupa transforms to the adult flea, thus completing the life history. There may be successive generations during the season, but the insects probably do not breed through the winter, at least in open poultry houses.

#### Control

It should be borne in mind that these fleas love dirt, dark places, and generally filthy, unsanitary conditions. The larvæ probably live on the organic matter that they find in cracks and crevices of nests, floors, and walls of the poultry house.

The same methods of control that are practiced against hen lice and mites will prevail against these fleas.

<sup>8</sup> Herrick, G. W. Some external insect parasites of domestic fowls. Journ. econ. ent. 6:84. 1913.

THE SOUTHERN HEN FLEA  
(*Echidnophaga gallinaceus* Olliff)  
(*Xestopsylla gallinacea* Baker)

The southern hen flea is apparently an introduced form, for it was first described from Ceylon. It is now a common pest from Florida to Texas, and Baker states that it has been found in large numbers on horses at Orangeburg, South Carolina. It has been reported by Judge Lawrence C. Johnson as infesting hens, turkeys, cats, dogs, cattle, horses, and children<sup>9</sup>; but Judge Johnson probably had in mind the true jigger flea, or chigoe — *Dermatophilus penetrans*. The writer has met with the southern hen flea in Mississippi, where it was found attacking sitting hens.<sup>10</sup>

In the summer of 1907 the ground beneath one of the dwelling houses on the campus of the Mississippi Agricultural College became infested with fleas to such an extent that the occupants were greatly annoyed by the pests. On examination the writer found that two species were present beneath the house, the hen flea and the dog flea. The house stood on brick pillars some distance above the ground, and thus gave opportunity for hens to go under, where they would lay eggs and rear chickens. Dogs and cats also had free access to the space beneath the house. In order to obtain relief the space under the house was treated with a thorough dusting of slaked lime, and nothing more was heard from the occupants of the house until the summer of 1908, when the fleas again became troublesome. On investigation a hen was found sitting under the house, and both hen and nest were literally alive with the southern hen flea.

The writer does not mean to say positively that these fleas were annoying the occupants of the house, for no specimen of this species was ever found in the rooms. In fact, the writer was unable to get hold of any of the specimens in the house that were actually causing the trouble.

The fleas on the hen were confined to the face, the ear lobes, and the wattles. These parts of the fowl were almost black with them. By actual count there were one hundred and sixty-four fleas on the right wattle and sixty-five on the right ear lobe, and by estimate there were two hundred or more on the right side of the face. The fleas stood at right angles to the surface, with their heads embedded in the skin, and were not at all easy to remove. They could not be brushed off or scraped off with a knife without hurting the hen. Some were removed by tweezers, but even with the use of these instruments they came off with difficulty.

The fowl was placed in a large box containing some sawdust and kept

<sup>9</sup> Johnson, L. C. Ent. Soc. Washington. Proc. 1: 59, 203-205. 1886 and 1889.

<sup>10</sup> Herrick, G. W. Notes on the hen flea (*Xestopsylla gallinacea*). Journ. econ. ent 1: 355-358. 1908.

there for several days. During this time she managed to free herself from a large number of the fleas by scratching her head with her toes, and it is probable that some of the older, engorged females dropped off to deposit eggs.

Some of the engorged females were dissected and found to contain apparently well-developed eggs. In one were found three white, oval eggs; in another were five. On June 22 two engorged fleas were placed in each of three vials. At half past eight o'clock on the morning of June 23 five eggs were found in vial a, five in vial b, and three in vial c. The eggs were white, oval, and considerably longer than broad. They measured from .35 to .4 millimeter in length.

It appeared to be so easy to obtain the eggs that a more extended observation seemed worth while. Accordingly, on the morning of June 23 one large, apparently engorged, female flea was placed in each of fifteen vials, in order to ascertain their egg-laying capacities. Eggs were obtained in every case but one, and in most cases the larvæ hatched readily, as shown by the following table:

OVIPOSITION RECORD OF HEN FLEA

Fleas placed in vials on June 23	June 24	June 25	June 26
	Number of eggs	Number of eggs	Number of larvæ hatched
Vial a.....	2	2	2
Vial b.....	2	2	1
Vial c.....	1	1	0
Vial d.....	3	3	3
Vial e.....	4	4	0
Vial f.....	7	7	5
Vial g.....	3	3	0
Vial h.....	1	1	1
Vial i.....	4	4	1
Vial j.....	4	4	2
Vial k.....	5	5	3
Vial l.....	4	4	1
Vial m.....	2	2	0
Vial n.....	1	1	0
Vial o.....	3	3	2

It will be seen from the table that the fleas laid all their eggs on the day following their placement in the vials, and that the larvæ hatched within forty-eight hours after the eggs were deposited. At half past nine on the morning of June 26 most of the larvæ were found just wriggling out of the eggshells. Some had not yet got clear of the shells.

The larvæ were white, very active, and from 1.5 to 1.8 millimeters in length. They were nearly of the same diameter throughout, with the thorax slightly larger than the remainder of the body. They were placed in separate vials, containing sawdust, feathers, and filth, but, very likely owing to unfavorable conditions of moisture and temperature, none of them developed.

Judge Johnson says regarding southern hen fleas that "Of the females, however, it is certain they bury themselves in the skin of their victims. From the first, they hold on with such tenacity that no ordinary brushing will remove them. It seems to be at this stage in their existence that impregnation takes place. The males now are often seen in copula with them, and so remain apparently for days, or until the tumefaction of the skin excited by the imbedded female closes around her so as to shove him off. Here ends about all actually known of this history." From the writer's observations this account is very probably accurate, except for the latter part. The males were found present on the head of the fowl, but were not actually observed in copulation with the females, although fecundation may have taken place under these conditions. So far as the writer's observations go, however, no tumefactions of the skin of the fowl take place. Judge Johnson further says: "From analogy, we may infer that, the period of gestation being completed, the gravid female lays her eggs in this well-prepared *nidus*, or, more particularly, that they remain and are hatched in her distended stomach, after which the larvæ crawl out and drop to the ground."

From the ease with which the females were induced to lay eggs in the vials, the writer believes they merely drop off from the host when engorged, as a cow tick does, and lay their eggs among the débris in the nests of the fowls. At no time was there a tumefaction of the skin or a so-called *nidus* formed. It seems that Judge Johnson must have ascribed the disease known as the wart disease to this flea, or possibly confused it with that caused by *Dermatophilus penetrans*.

#### THE HARVEST MITE

(*Trombidium* sp.)

The young, or larval, forms of the mites commonly known as harvest mites sometimes attack young chickens. Railliet<sup>11</sup> mentions attacks by the larval forms of *Trombidium holosericeum* on late-hatched chickens, and states that they sometimes produce high mortality. He says the parasites fix themselves at the bases of the feathers, where they insert their rostrums and set up an irritation that produces an epileptiform

<sup>11</sup> Railliet, A. *Traité de zoologie médicale et agricole*, p. 703. 1895.

affection resulting in death. These young forms of harvest mites are generally known in this country as redbugs, or chiggers.

The writer had opportunity in 1908 to observe the attacks of redbugs on young chickens in Mississippi. The young chickens in the poultry yards of the Agricultural College were attacked in two successive summers by these insects. On May 28, 1908, two young chickens that were evidently diseased were examined, and on the sides of the bodies beneath the wings, where the feathers were scarce, were found here and there rather large red nodules, or tubercles. The nodules were usually capped, around the edges of the top at least, with a hard scab or crust. In the center of the crust of each nodule were found the red, distended abdomens of numerous mites, with their heads buried in the tissues. When the scab was removed the mites came with it, leaving a comparatively large cavity in the center of the nodule.

The mites were evidently gregarious and their presence in such numbers had stimulated the tissues until the nodule had been formed. Within the nodules were masses of whitish, fatlike tissue, composed of long, tapering cells. The mites were almost buried in these masses. Occasionally one isolated mite was found, especially between the secondary quill feathers of the wings. In each case the head of the mite was buried in the flesh of the fowl, as in the case of the ticks.

On June 17 other chickens from the same brood were examined. These were of course somewhat larger than those first examined. On chick 1 several healing nodules were found from which the mites had evidently escaped. Fresh nodules were found, however, on the sides of the body, with mites in them, and there were also isolated mites on the undersides of the wings. On chick 2 there were two large nodules on the right side of the abdomen. One of these contained the bodies of seventeen mites closely packed together like red berries, with their heads embedded in the tissues of the tubercle. On chick 3 a large tubercle was present containing the bodies of nine mites, and on chick 4 a large tubercle contained nineteen mites. On all these chickens there were other smaller clusters of mites, and a few isolated ones on the undersides of the wings.

Specimens of these mites were submitted to Banks for identification. He wrote that they were "Leptus, that is, the larvæ of *Trombidium*. No species have as yet been bred in this country, so it is impossible to tell to what species your material belongs."

Professor Kerr, of the poultry department at the Mississippi College, observing the effect of these mites on young chickens, says the chicks soon succumb to the attacks of the mites. The chicks seem to contract a diarrhea, grow weaker and weaker, and finally die. Professor Kerr thinks the mites are responsible for a high mortality among chickens in the South.

### Control

It is quite probable that harvest mites breed in weeds and tall grass, where the sun's rays cannot penetrate and where moisture conditions are favorable. Young chicks liable to attacks from these mites should be confined to areas kept clear from weeds and tall grass. The mites are not likely to breed in closely cropped grass and in an absence of shade. The heat of the sun would probably prevent their development.

#### A TICK THAT INFESTS TURKEYS

(*Haemaphysalis chordeilis* Pack.)

Within the past year the following letter, accompanied by specimens, was received from a correspondent in Warren County, New York: "I am sending you a few specimens of bugs. We find them on the turkeys and have found one on a wild partridge. Can you tell us what they are and how to keep them off our turkeys?"

The specimens proved to be a species of tick which Banks identified as *Haemaphysalis chordeilis* Pack. Banks reports but two species of this genus from the United States.<sup>12</sup> One of these, *H. leporis-palustris* Pack., has been reported commonly from the Southern States; the other, *H. chordeilis* Pack., has been reported by Banks from Milton, Massachusetts, and Taftsville, Vermont. The specimen from Vermont was taken from a turkey, and that from Massachusetts was from a nighthawk. In 1909 Hadley<sup>13</sup> reported an infestation of turkeys at Norwich, Vermont, with the same species. He states that at the time of the report of the infestation the turkeys were dying as a result of injuries from the ticks. The ticks were first observed on the young turkeys in the latter part of May, when the turkeys were about one week old. The ticks seemed to cling mostly to the region of the neck. The birds that were infested bore from seventy to eighty mature ticks and as many more immature forms. The owner tried insect powders, lard, and kerosene oil, but without success. He was finally obliged to pick the ticks off by hand.

It is of interest to observe that Norwich is only about twenty miles from Taftsville, where this species on the turkey had already been reported by Banks. Moreover, Bolton Landing in New York is in Warren County and almost directly west of Norwich and Taftsville, at a distance, judging from scale measurements made on a map, of about fifty miles. The writer has been unable to find out whether the correspondent at Bolton Landing, New York, had ever bought turkeys from the vicinity of Windsor or Taftsville, Vermont. In case he had, it would not be difficult to ex-

<sup>12</sup> Banks, Nathan. A revision of the Ixodoidea, or ticks, of the United States. U. S. Agr. Dept., Ent. Bur. Bul. 15, Tech. ser. 1908.

<sup>13</sup> Hadley, Philip B. Notes on the parasitism of *Cytodites nudus* and *Haemaphysalis chordeilis*. Science 30:605-606. 1909.

plain the westward distribution. In case he had not, the westward distribution would have to be explained by the supposition that these ticks are already widely distributed in that latitude or that they are gradually diffusing themselves from farm to farm. If the tick found on the partridge (ruffed grouse) was really of this species, the fact would be significant; for if this tick is a parasite of the grouse it might easily find its way to turkeys, since these fowls range widely over field and forest. Unfortunately, the correspondent did not say whether he included among the specimens sent the one collected from the partridge.

This tick is a rather large one, the full-grown female being from one-quarter to five-sixteenths of an inch in length. The body is reddish brown and is almost as wide as it is long.

### Control

The introduction of infested fowls from tick-infested areas should be avoided by carefully quarantining and examining all turkeys purchased from other localities before turning them in with the home flock.

If fowls once become infested, hand-picking will probably prove to be the most feasible method of control.

#### METHODS OF CONTROLLING THE PARASITES OF DOMESTIC FOWLS

The measures of control here recommended are the result of experiments through several years, more especially with the chicken mite in the Gulf States, where it is especially prominent as a pest of domestic fowls.<sup>14</sup> It does not seem desirable to give details of these experiments, but rather to make definite recommendations based on their results.

Lice, chicken mites, and hen fleas are all responsive to much the same line of control treatment. What is effective for one is, broadly speaking, effective for all, though the lice may call for additional and special treatment. The suggestions given cover the methods whereby the parasites discussed in this bulletin may be held in check.

#### NECESSITY OF CLEAN SURROUNDINGS AND OF LIGHT

From work with the poultry mite and the hen flea extending over several years, the writer is convinced that the most potent cause of the presence and increase of these parasites is filth—under which may be including droppings, decaying and decayed eggs, and bits of decayed material of all kinds. Mites especially are found in great numbers in the filth that has sifted through the straw and that lies in the bottom, in the corners, and in the cracks, of the nest. If a partly hatched egg happens

<sup>14</sup> Herrick, G. W. The chicken mite. Mississippi Agr. Exp. Sta. Bul. 78. 1902.

to be broken in the nest the mites literally swarm over it. The filthier the nest becomes from droppings and broken eggs, the more abundant become the mites.

Lack of light is another cause of the presence and increase of mites and other parasites. Many persons believe that almost anything will answer for a poultry house. The only light that enters many poultry houses is what filters in through cracks and through a small door, which may or may not be allowed to stand open.

Such a house as the one shown in figure 115, facing the south, is almost ideal so far as obtaining the maximum amount of sunshine and air is concerned. The open windows should be fitted with cloth curtains fastened to wooden frames hung on hinges. During the day in pleasant

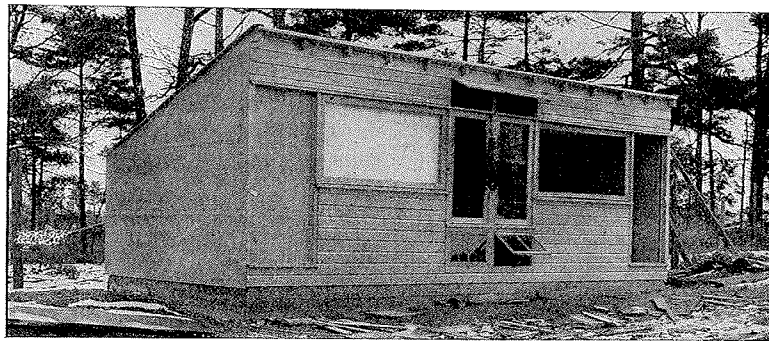


FIG. 115.— Poultry house providing abundance of light and air

weather the curtains may be swung up out of the way. At night they may be let down to close the windows, thus making the house warmer but allowing sufficient air to enter for ventilation.

#### *Inside of poultry house*<sup>15</sup>

The poultry house should be high enough and roomy enough inside so that one can go in and walk about with some degree of comfort and pleasure. It is a place that should be visited every day in order that it may receive proper attention. A poultry house built in such a way that one has to crawl through a small door in order to enter, and then go groping around in semidarkness, half bent to the ground for fear of bumping the head against the roof, will receive few visits and scant attention.

The inside of the house should be planned so that nearly, if not quite, everything — perches, dropping board, and nest boxes — can be removed,

<sup>15</sup> Herrick, G. W. The chicken mite. Mississippi Agr. Exp. Sta. Bul. 78. 1902.

leaving nothing but the four bare walls. It would be advantageous to have the floor made of concrete. This would aid in insuring dryness, cleanliness, and freedom from parasites. As few pieces of timber as possible should be nailed permanently to the walls of the house, the object being to eliminate everything possible that might afford a hiding place for the parasites and protect them from whatever insecticides might be used. In such a house every part of the walls can be thoroughly treated with kerosene oil, carbolic acid, or any other insecticide. Perches, nest boxes, and other fixtures are also much more easily cleaned and treated if removed from the house than if they are in place.

#### *To clear an infested poultry house of mites*

It often happens that a poultry house becomes infested with mites from floor to roof and in every nook and cranny. If the house is of the older type and not too valuable, it may be justifiable to burn it and build anew. In any case the perches and nests should be torn out, in order to facilitate the application of insecticides. The next thing to do is to clean the walls and floors by giving them a thorough sweeping. The inside of the house should then be sprayed with kerosene or crude petroleum. It is best to begin at a certain place and go over walls and floor with the oil, applying it with considerable force by means of a pump and not stopping until every square inch has been covered. The liquid should be forced into cracks and crevices between the boards. The oil will kill all the eggs that are hit, but some eggs will surely escape being touched. As it takes from four to five days for the eggs to hatch, the walls should be gone over again in about a week in order to kill the young mites that appear in the meantime. In another week a third application may be necessary.

If it is thought preferable, the kerosene or crude petroleum may be made into an emulsion<sup>16</sup> and diluted to ten or fifteen per cent, which will kill all the mites actually hit. The emulsion is made as follows: One-half pound of laundry soap or whale-oil soap is shaved fine and dissolved in 1 gallon of water. The soap is best dissolved if the water is nearly or quite at the boiling point. When the soap is dissolved and the water is hot it is removed from the fire, 2 gallons of kerosene oil is added, and the mixture is agitated or churned violently until a white, creamy emulsion is formed. The best way to produce the emulsion is to pump the liquid back into itself through the pump until the mixture becomes creamy. To make a ten-per-cent emulsion 17 gallons of water is added to the 3 gallons of stock mixture; to make a fifteen-per-cent emulsion 10½ gallons of water is added to the 3 gallons of stock mixture.

<sup>16</sup> Repp, John J. The chicken mite. Iowa State College Exp. Sta. Bul. 69. 1903.



It is advisable to follow the application of the oil to the walls of the house with a dusting of dry air-slaked lime 3 parts and sulfur 1 part. The windows and doors of the house should be closed and the lime-sulfur should be thrown up to the roof and against the walls until the air is full of the particles. The powder will gradually settle everywhere, much of it entering cracks and crevices.

#### *Isolation of poultry house*

It is a well-known fact that the poultry mite sometimes attacks horses, causing sores on the skin and a consequent falling-out of the hair, thus making bald spots at points of infestation. Such attacks on horses by poultry mites occur only when infested fowls have roosted near the stable. Sometimes poultry houses are built adjoining the horse stable, and sometimes fowls are allowed to roost over the horses or even about the mangers. In such cases there is danger of an attack on the horses by mites. For this reason poultry houses should be built at some distance from other farm buildings, especially from horse and cow stables.

#### ISOLATION OF SITTING HENS<sup>17</sup>

It is customary on many farms to place sitting hens on eggs in the same house with the other fowls. Mites are likely to infest brooding fowls and to increase enormously in the nests of the fowls. It is therefore desirable to have sitting hens apart by themselves, in a separate room or a separate building. It seems not to be a good practice, however, to set hens in boxes and barrels here and there about the grounds, as this often exposes the fowls to the injurious effects of rain and storms. A woman living in Missouri, writing for an agricultural paper, says: "Hens should be set in a room fitted up for that purpose with nests like those in which they lay. When one is ready to sit, and her service is wanted, a clean box should be obtained, treated with kerosene and carbolic acid, and sprinkled with lime, after which a good soft nest should be built therein."

It must be remembered also that sitting hens need some attention. Not infrequently an egg is broken in the nest. When this happens, the egg should be removed and the others with which it has come in contact should be carefully washed with warm water and wiped dry. If there are droppings in the nest they should be removed. It is of advantage to dust fresh insect powder on the hen occasionally while she is brooding. To facilitate the care and handling of a brooding fowl, some attention and thought should be given to the selection of the right kind of a hen.

<sup>17</sup> Herrick, G. W. The chicken mite. Mississippi Agr. Exp. Sta. Bul. 78. 1902.

A quiet, motherly, easily handled hen should be chosen. The idiosyncracies and character of a hen have much to do with her success as a mother.

#### TREATMENT OF MALE BIRDS

An infested rooster is a fruitful source of distribution of lice and other parasites throughout a whole flock. Particular attention should be paid to ridding male birds of these parasites. It would be well to dust the males occasionally in a thorough manner with the Cornell (Lawry) powder. Moreover, when a new cockerel is introduced into the flock it is a good practice to isolate him for a few days and make two or three thorough applications of the powder, being sure that the bird is free from all parasitic affections and diseases before allowing him to be with the flock.

#### DUST BATH FOR HENS

Rice says that "a dust wallow is as essential to a fowl's health and happiness as a water bath is to the health of a human being."<sup>18</sup> It is a common thing to see hens and chickens wallowing in dry dust. They make a hollow place in the ground to conform with the body, and in this they lie, scratching with the feet, fluttering the wings, and elevating the feathers until they stand all fluffy and loose over the body. By scratching, the fowls loosen and pulverize the soil, which is worked down in among the feathers. This is not done wholly for pleasure, although the fowls apparently enjoy it; the fine dust is an excellent insecticide and aids in controlling mites and lice.

There are days and seasons of the year when fowls cannot find dry, dusty places in which to wallow. Moreover, where fowls are kept in a pen or a yard they are not always able to find a satisfactory dust bath. In view of these facts a dust bath should be provided and made accessible at all times and seasons.

The finer, lighter, and drier the dust, the more satisfactory it will be. Some kinds of light road dust are good; fine sandy loam is excellent. Whatever soil is used, it is well to lighten it by mixing it with finely sifted coal ashes. It is also advantageous to add now and then small quantities of snuff, sulfur, or dry slaked lime, or all three of these.

The box containing the dust should be set near a window, where the dust will be kept dry and warm and where the sunlight will reach it for a considerable part of the day. The mixture may be kept in an open box, but in this case the fowls that are not dusting are compelled more or less to inhale the particles of dust. Because of the dust's rising, it is of advantage to keep the fine soil in a covered box with a lid on top

<sup>18</sup> Rice, J. E., and Rogers, C. A. Building poultry houses. Cornell Univ. Agr. Exp. Sta. Bul. 274:30. 1910.

for easy filling; a small opening in one side of the box should be provided for the entrance of the fowls (Fig. 116).

DUSTING FOWLS

The measures of control thus far outlined are more especially applicable to the poultry mite, although most of the measures discussed are of value in controlling hen lice also. The lice, as has been pointed out,

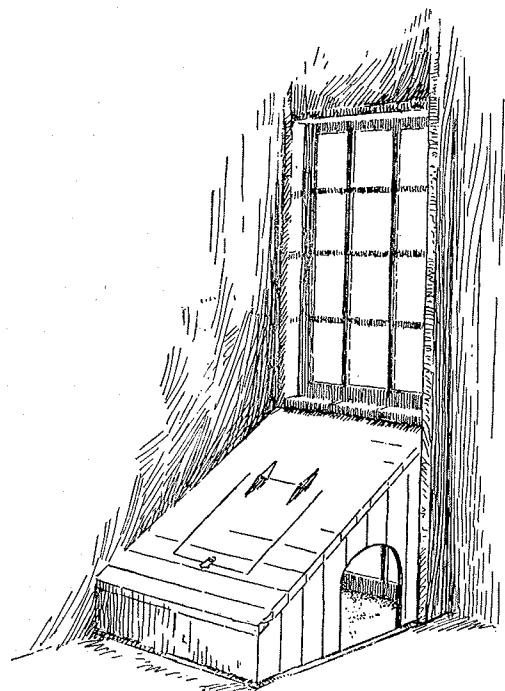


FIG. 116.—Box for the dust bath.

are permanent parasites and rarely leave their hosts. Therefore applications of oil to the walls of the house, the perches, and other fixtures do not reach the lice on the hens. Light, cleanliness, fresh air, and dust baths are of great value in fighting lice, but it sometimes becomes necessary to actually hit the lice with an insecticide in order to check or destroy them. For this purpose dust insecticides are usually recommended and applied. The best dust insecticide that the writer has ever known is the Cornell (Lawry) powder. It is made in the following way<sup>19</sup>: Two and one-half pounds of plaster of paris is spread in a shallow pan or tray. One-fourth

<sup>19</sup> Circular letter, Department of Poultry Husbandry, Cornell University.

pint of crude carbolic acid is poured into a cup, and into this is poured three-fourths pint of gasoline. The mixture of acid and gasoline is poured over the plaster of paris and thoroughly mixed. It is then rubbed through a wire window screen on a piece of paper and allowed to stand for from one and one-half to two hours or until thoroughly dry. *It must not be placed near a flame or any heat.* The powder should be kept in a closed can or jar, where it will retain its strength for a long time. The powder is applied by means of an ordinary sifter or with the finger, and is worked in among the feathers about the vent, in the fluff, and under the wings. In extreme cases

the application should be repeated in about two weeks. A small pinch of the powder is sufficient for a fowl.

the application should be repeated in about two weeks. A small pinch of the powder is sufficient for a fowl.

Cost of dusting fowls

It seemed desirable to ascertain the approximate cost of dusting hens with the Cornell powder. Several extensive trials were made in cooperation with the Department of Poultry Husbandry. The work of dusting was performed by students, who proved fairly skillful after a little practice. The results of these trials are shown in the table:

COST OF DUSTING FOWLS

Pen no.....	7	8	8	11	9	11
Number of fowls.....	367	175	220	401	228	232
Number of students.....	7	5	4	4	5	5
Time (in minutes).....	82	64	53	70	51	47.5
Powder used (in pounds)....	3.7	2.3	4.2	5.3	2.3	3.5
Cost of powder.....	\$.13	\$.08	\$.15	\$.19	\$.08	\$.09
Cost of labor.....	\$.45	\$.56	\$.53	\$.70	\$.64	\$.59
Total cost.....	\$.58	\$.64	\$.68	\$.89	\$.72	\$.68
Cost per one hundred hens..	\$.43	\$.37	\$.31	\$.22	\$.32	\$.29

It is seen from this table that the average cost of dusting was a little over 32 cents for each one hundred fowls. This is a little less than one-third of a cent for each fowl. Considering the effectiveness of the powder, this is not an excessive amount to spend for controlling lice.

DIPPING FOWLS

The writer has had no experience in dipping fowls, and on general principles would not advise it. The effect on the fowl is rather severe and the shock must be considerable. The following dips have been used: (1) Pure carbolic acid, 1¼ ounces in 1 gallon of hot water. After the solution has cooled, the fowl should be immersed in it for *one minute only*. (2) Creolin at the rate of 2½ ounces to a gallon of water may be used instead of carbolic acid.

MIXTURES FOR PAINTING PERCHES

One of the most convenient mixtures for painting perches, nest boxes, or walls of a poultry house, is a combination of crude carbolic acid and kerosene. Three parts of kerosene and one part of *crude* carbolic acid make an effective mixture for killing eggs, mites, lice, fleas, and any parasites that may be present in cracks and crevices of the house. There is no objection, other than that of the expense, to using this mixture for spraying walls and perches.

Another mixture for painting perches and nest boxes is known as *cresol soap*.<sup>20</sup> It is made by shaving "one ten-cent cake of laundry soap into one pint of soft water. Heat or allow to stand until a soap paste is formed. Stir in one pound of commercial cresol and heat or allow to stand until the soap paste is dissolved. Stir in one gallon of kerosene. Cresol is a coal tar product and may be obtained from the druggist at about 30 cents per pound. Care should be taken not to get any of it upon the hands or face as it will cause intense smarting. For use as a lice paint, apply undiluted."

<sup>20</sup> Pierce, H. C., and Webster, R. L. Lice on fowls. Iowa State College Exp. Sta. Press bul. No. 18. 1909.

Submitted for publication February 15, 1915.

