MALLOPHAGA OF OUR NATIVE BIRDS.

Edwin J. Kohl.

The Mallophaga or biting bird lice constitute a group of insects that apparently excite little curiosity in the average individual. Moreover, lice in general are looked upon with disdain. Nevertheless, they do hold an interest for some individuals, those who do not hold themselves aloof from these minute parasites, and hold no fear of infestation.

The earliest writings in which lice were mentioned and received attention were those of Francesco Redi, an Italian naturalist, in 1668. Other writings followed by such men as Otto Fabricino (1780), De Geer (1778), and Linne (1789). Not much truly scientific work was done by these men; it was rather haphazard. Christian Ludwig Nitzsch, Professor of Zoology in the University of Halle, did the first real work that is recognized today. His descriptions were excellent. He made an attempt at classifying and naming the Mallophaga. This, the beginning of our present day nomenclature, gave an impetus to real work along these lines. Such men as Denny, Giebel, Piaget, Taschenberg and others, continued the work with excellent results.

Most of this early work was along taxonomic lines, that of describing, naming and classifying, but a few men, Kramer, Melnikoff, and Grosse did some work on anatomy. The work of Grosse in itself was not of a high order. No special attention was given to accuracy of description and drawings, consequently the work was crippled somewhat until our modern entomologists revised and improved upon it.

In this country Herbert Osborn and A. S. Packard did the first work of any consequence. Osborn's "Pediculi and Mallophaga affecting man and the Lower Animals" was the first real attempt in this respect. It was by no means complete. Much remained to be done. It was at this point that Vernon Kellogg took up the investigation of Mallophaga. He made extensive collections, aimed at completeness in every respect. He made collections from most of the common birds of North America. Special attention was paid to classification, to accurate descriptions and very accurate drawings. The internal anatomy was completely worked out. Furthermore, the old Nitzschian nomenclature was revised and brought up to date. In every way the work was of a high order and set a new standard in Mallophagan lines.

The position of Mallophaga among the Insecta for a long time was a much-debated question. Each new student quite naturally shifted them from one position to another because little was known then concerning the anatomy and development of these insects. For a long time they were placed coordinate with or under the Pediculidae, for the reason that they were ectoparasites. However, it was discovered that Mallophaga have biting mouth parts, consequently they were placed in the Pseudo-Neuroptera along with various heterogeneous insects. Even the Pseudo-Neuroptera were broken up by Brauer and the Mallophaga now found themselves keeping company with Psocids and Termites under the Corrodentia. Finally, in all this rearrangement of things pertaining to classification, Kellogg

gave the Mallophaga the rank of a full order. Whether or not they are ranked thus makes very little difference, relatively. They are generally placed in a position following the Corrodentia, which seem to be an intergrading group leading up to the Mallophaga. When Kellogg finally did his monumental work on the North American Mallophaga (1896-1899) he took the old Nitzschian classification and key, tore it down and rebuilt it. Subgenera were ranked as genera, and genera became families in the present-day key to the Mallophaga. This key is still intact and widely used and is the last word on keys.

The Mallophaga are purely ectoparasites. As such they live on scales and feathers of the birds. In the case of the mammal-infesting Mallophaga, they devour hair and skin or scales of the skin, and to this there are very few, if any, exceptions. Kellogg notes one instance, where a louse was found attached securely and firmly with its jaws to the skin, evidently having sucked or devoured flesh and blood. If such food as blood were found among the stomach contents when examined, it may have been blood which found its way to the feathers by injury to the host through scratching. In that manner, the louse had probably secured the blood. It is very rare to find blood among the contents of a louse's stomach and no observers record this, except the one just mentioned.

Consequently, lice would not be thought to produce any harmful effect upon the host. Such is not the case. It is noticed among poultry that the presence of lice causes tremendous uneasiness, scratching and disquiet, so much so that the effect produces a modification of habits of the host and causes a loss in weight. In case of pullets, it causes a loss in egg production, due to irritation and harmful effect upon the general habits of the bird. Among the birds the effect is not so noticeable. It is known with certainty that birds do not harbor these parasites without some distress. They dust themselves thus smothering out the lice. In extreme cases of infestation a loss of vitality is occasioned and finally death may ensue.

Some importance dare be attached to the study of lice, in that they may be carriers of certain diseases common to birds. We know that Pediculus vestimenti acts as a carrier of Bacillus typhus, and ticks carry and transmit cattle fever, fleas carry plague, etc. So it is safe to assume that in all probability lice of birds have something to do with the transmission of various bird diseases. Such investigations have as yet, not been recorded.

In collecting lice, one must secure the birds, which may be done either by capture of adults or young, or by shooting, but such a procedure may be followed only under state permit. Humanitarian methods are strongly urged, therefore live birds may be secured and released, after thorough examination and removal of its parasites.

In collecting lice, one must develop patience. Haphazard methods with a limited amount of enthusiasm and interest never produce results. At any rate, we generally examine the whole body thoroughly. Every inch of the body must be scrutinized. Feathers, if picked, must be thoroughly gone over and sometimes a hand lens is absolutely necessary. Generally the unaided vision is sufficient to enable one to find them. All birds are likely to have lice at one time or another. Acting on this assumption we must find them. In some cases the birds are so thorough in their dusting that

only a single louse remains (a fertile female) to propogate and continue the species. So, hand picking, however tedious it may be, is the best and surest way. If the bird is overrun with the lice a rapid way may be employed by wrapping the bird in a white cloth, moist with kerosene. According to Dr. H. E. Enders this method is excellent. In the case of animals, if the infestation is great they may be combed out, only the loss of legs of the lice may result. So even if hand picking is tedious, nevertheless, it is the best method.

The regions on the bird in which the lice are found are definite and have some significance attached to them. For instance, a very rapid running louse like Menopon or Colpocephalum will be found in the anal regions or on the back. But such a slow one as a Docophorus will be limited to the head or neck entirely. There are reasons for this orientation. The bird can not easily scratch off a heavy-jawed and heavy-clawed Docophorus from the neck region, nor will a limited amount of dusting do much good in that region. So also will a Colpocephalum escape if the bird attempts to catch it with its bill in a dorsal, anal, or abdominal region. It escapes by running, for which it is adapted extraordinarily. It is therefore necessary that definite regions be examined and their distinct species noted.

In my observations I have found Nirmus associated with the breast region as in the American Robin: likewise in the Purple Grackle. Docophorus, no matter what species, is always restricted to the upper part of the neck and head. Colpocephalum may be found on the back of the bird, or in the anal regions. Physostomum of the kingbird, I found in the rump region and in the Eastern Vesper Sparrow in the nape region. However, in the latter case the louse may have migrated, as the louse was not found for one hour after the bird had been killed. Colpocephalum is also associated with the rump region. Lipeurus quite often is found among the wing and tail feathers. Trinoton, which is very agile and strong of foot infests the back. Whether these observations correspond with those of others, I do not know, for none are recorded.

In collecting lice in the field the usual method employed to preserve them is that of placing them in 75 or 80 per cent alcohol. There is slight shrinkage due to hardening effects of the alcohol, but insufficient to cause any serious damage or to interfere with subsequent study. Lice may also be preserved in a solution of chloral hydrate which will keep them quite soft. From much material one is enabled to make satisfactory studies. Other methods more exacting can be employed if facilities allow. Lice that are preserved by the above named methods can be put through a technique which will yield beautiful preparations.

If it is possible to collect the insects alive, they may be placed in hot water—very nearly boiling. This will have a two-fold effect. When thrown into the water they will float, consequently their legs will be extended very nicely. In this condition they will be killed by the hot water. In subsequent dehydration, from 70 per cent alcohol through 80 and 95 per cent alcohol the extended condition of the legs will be practically unchanged, for they will have become sufficiently hardened in 70 per cent alcohol. From 95 per cent alcohol we transfer them to absolute alcohol. The usual method following this is xylol and balsam, for the permanent mounts. This

will give excellent preparations, which are strikingly clear, if no air or water remain in the insect.

Another method, simpler and decidedly quicker is to mount the louse directly from absolute alcohol into Euparal. Euparal as recommended very highly by Lee, is a mounting medium whose index of refraction varies to such an extent as compared to that of the cleared louse, that it allows very minute structures such as pustulated hairs to be seen very distinctly and advantageously. Another advantage in this technique lies in the fact that xylol is not needed as a final clearing agent and less shrinkage results in the insect. Moreover, the expense of xylol is entirely eliminated.

Such mounts will allow the internal anatomy to be seen in part. If the internal anatomy is not desired particularly a still clearer specimen can be obtained.

If the louse be placed into caustic potash or caustic soda previous to the final steps in dehydration, all internal structures that cause some opacity will be dissolved. It usually requires from 6 to 12 hours to completely clear the specimens after which they should be well washed in water before the final dehydration is undertaken or certain colloidal precipitates will form later. Moreover, the procedure just described will enable one to straighten out all legs, which had been drawn under the body during killing, whether directly by alcohol or hot water. They become quite soft in the potash and are somewhat easily handled.

Some precautions are necessary in the final mounting into Euparal in order that the air may not enter the legs and abdomen of the louse, and cause it to become entirely opaque. To overcome this requires care not to expose the specimen to air in removal from the absolute alcohol to the mounting medium. If, after some time, such mounts in Euparal develop peculiar polygonal crystals, they can be removed by gently heating the slide over a flame or in an oven. These crystals are camphor which has crystallized out and which was one of the solvents of the resin used in making Euparal, i. e.,—Gum Sandarac.

The species-determining characters in lice are many and varied. In the main, they constitute the greatest difficulty in the study of lice and require considerable attention.

The nomenclature of anatomical parts of lice in this paper is that followed by Kellogg in his New Mallophaga I, (1896).

The head of a louse may be said to consist of two main parts. The front which includes the clypeus, and the large swollen hindpart or occiput. The front and occipital regions are usually separated by a groove or fossa in which are situated the antennae. This is the antennal fossa. The lateral margin of this region is called the temporal margin and the posterior margin adjoining and touching the prothorax is the occipital margin. Within this swollen occipital region are found bands running from the base of the occipital margin to the inner end of the antennal fossa. These are the occipital bands. Those bands running forward, well into the front and arising at the antennal fossa are the antennal bands. The broad colored, chitinized plate between the antennal bands, is the signature. In some genera, as Docophorus and Nirmus, there arise at the lateral margin, and adjoining the antennal fosa, certain large movable spine-shaped structures.

These are called trabeculae. All these structures here named are specific characters in the determination of lice.

There is a uniform number of hairs present in the temporal and occipital margins. These hairs, as well as those of the prothorax, metathorax and abdomen are used as determining characters, as their number is uniform. Whenever these hairs seem to project through a clear space in the colored chitinized parts of the insect, they are said to be pustulated.

Differences in genera involve more than the aforementioned facts. It depends mainly on the shape of the body, the size of the trabeculae, whether movable to any marked degree; upon the size of the front as compared with the occiput; the depth of the antennal fossa or ocular emargination, and the size of the temporal margins or regions of the occiput, generally indicated as swollen temporal regions. Another genus distinguishing character is the similarity or dissimilarity of antennae in both sexes. There are other differences in genera which will be noted in the accompanying key. It is the key as revised and standardized by Kellogg from his New Mallophaga I (1896) pages 61-62.

Key to the Suborders.

A. With filiform 3- or 5-segmented antennae, and no labial palpi. Suborder Ischnocera.

AA. With clavate or capitate 4-segmented antennae, and 4-segmented labial palpi. Suborder Amblycera.

Key to the Genera of the Suborder Ischnocera.

A. With 3-segmented antennae; tarsi with 1 claw; infesting mammals (family Trichodectidae). Trichodectes N.

AA. With 5-segmented antennae; tarsi with 2 claws; infesting birds (family Philopteridae).

B. Antennae similar in both sexes.

C. Front deeply angularly notched. Akidoproctus P.

CC. Front convex, truncate, or rarely with a curving emargination, but never angularly notched.

D. Species broad and short, with large movable trabeculae (at the anterior angle of antennary fossa).

E. Forehead with a broad transverse membranous flap projecting beyond lateral margins of the head in the male, barely projecting in female. Giebelia Kellogg.

EE. Without such membranous flap. Docophorus N.

DD. Species elongate, narrow; with very small or no trabeculae. Nirmus N.

BB. Antennae differing in the two sexes.

C. Species wide, with body elongate-ovate to suborbicular.

D. Temporal margins rounded; last segment of abdomen roundly emarginated; antennae of male without appendage, third segment very long. Eurymetopus Tasch.

DD. Temporal margins usually angulated; last segment of abdomen convex, rarely angularly emarginated with two points.

E. First segment of antenna of male large, sometimes with an appendage; third segment always with an appendage. Goniodes N.

EE. First segment of antenna of male enlarged but always without appendage; third segment without appendage; last segment of abdomen always rounded behind. Goniocotes N.

CC. Species elongate, narrow, sides sub-parallel.

D. Third segment of antenna of male without an appendage. Ornithobius Denny.

DD. Third segment of antenna of male with an appendage.

E. Front deeply angularly notched.

EE. Front not angularly notched.

F. Antennae and legs long; a semicircular oral fossa. Lipeurus N.

FF. Antennae and legs short; oral fossa narrow, elongate, extending as a furrow to the anterior Margin of the head. Onocophorus Rudow.

Key to the Genera of the Suborder Amblycera.

A. Tarsi with 1 claw; infesting mammals (family Gryopidae).

AA. Tarsi with 2 claws; infesting birds (except Boopia?) (family Liotheidae)

B. Ocular emargination distinct, more or less deep.

C. Forehead rounded, without lateral swelling; antennae projecting beyond border of the head. Colpocephalum N.

CC. Forehead with strong lateral swellings.

D. Antennae projecting beyond border of the head; temporal angles projecting rectangularly; eye large and simple. Boopia P.

DD. Antennae concealed in groove on under side of head; temporal angles rounded, or slightly angular; eye divided by an emargination and fleck.

E. Mesothorax separated from metathorax by a suture. Trinoton N.

EE. Meso- and metathorax fused; no suture. Laemobothrium N.

BB. Ocular emargination absent or very slight.

C. Sides of the head straight or slightly concave, with two small laterally-projecting labral lobes. Physostomum N.

CC. Sides of the head sinous; forehead without labral lobes.

D. Body very broad; metathorax shorter than prothorax. Eureum N.

D. Body very broad; metathorax shorter than prothorax. Eureum N.

DD. Body elongate; prothorax shorter than metathorax.
E. Ocular emargination filled by a strong swelling; sternal markings forming a quadrilateral without median blotches. Nitzschia Denny.
EE. Ocular emargination without swelling, hardly apparent or entirely lacking; median blotches on sternum.
F. Very large; with two 2-pointed appendages on ventral aspect of hind-head; anterior coxae with very long lobe-like appendages. Ancistrona Westwood.
FF. Small or medium; without bipartate appendages of hind-head. Menopon N.

The collections of lice discussed in this paper were made in Myerstown, Lebanon County, Pennsylvania, and vicinity. All birds as will be seen, are migratory birds except one, the English sparrow.

A list of species found on a number of birds is given herewith. There was absolutely no straggling of lice from one bird to another as might be the case if the birds were placed in one bag. These lice were collected in the field, that is, as soon as the bird was procured, they were picked and preserved in vials of alcohol. Consequently, there was no danger of migration of parasites from one bird to another.

Parasite	*Host*	
Docophorus communis (Nitz)	Quiscalus quiscalus	—Purple Grackle
	Cyanocitta cristata	—Blue Jay N.H.
	Sturnella magna	—Meadow Lark N. H.
	Toxostoma rufum	—Brown Thrasher N. H.
Docophorus icterodes (Nitz)	Anas boschas	—Mallard Duck
Docophorus fusco-ventralis (Osb.)	Nuttalornis borealis	—Olive-sided Flycatcher
	Cyanosphiza cyanea	—Indigo Bunting
Docophorus jungens (Kell)	Colaptes auratus	—Flicker
	Melanerpes erythro cephalus	—Red-headed Woodpecker.
Docophorus cordiceps (Giebel)	Actitis macularia	—Spotted Sandpiper, N. H.
Nirmus vulgatus (Kell.)	Merula migratoria	—American Robin
	Passer domesticus	—English Sparrow.
	Pipilo erythrophthalmus	Chewink, N. H.
Nirmus illustris (Kell.)	Quiscalus quiscalus	—Purple Grackle, N. H.
Lipeurus squalidus (Nitz)	Anas boschas	—Mallard duck
	Spatula clypeata	—Shoveller Duck
Colpocephalum chrysophaeum(Kell.)	Quiscalus quiscalus	—Purple Grackle
	Toxostoma rufum	—Brown Thrasher
Trinoton luridum,	Anas boschas	—Mallard Duck
	Spatula clypeata	—Shoveller Duck

Physostonum angulatum (Kell.)	Tyrannus tyrannus	—Kingbird
Physostomum diffusum (Kell.)	Poecetes grammineus	—Eeaster Vesper sparrow, N. H.
Menopon incertum	Galeoscoptes carolinesis	—Catbird

This list of species of parasites as related to the hosts upon which they were found is a new one in distribution. Many species (marked *N.H.*—New Host) here noted were not observed upon these same hosts by other observers. It will be noticed upon comparison with Kellogg's list that generally they are the same genera of birds but a different species.

Docophorus communis is a widely distributed species. Besides those hosts indicated by Kellogg and others, I have found it on Cyanocitta cristata. Nirmus vulgatus is recorded for Merula migratoria and for a number of species of western Pipilo. I have found it in addition on Passer domesticus and Pipilo erythropthalmus. Colpocephalum chrysophaenm, I found on Toxostoma rufum and Quiscalus quiscalus, whereas Kellogg observed it upon Melosphiza fascinata samuelis in California. Physostomum diffusum, I found on Poecetes grammineus and Kellogg noted it on Zonotrichia coronata, a related species. Lastly, Menopon incertum was found on Galeoscoptes carolinensis and other observers found it on the Gold Finch and the Russet-backed Thrush (Spinus tristis and Turdus ustulatus).

This distribution indicates clearly that even though a certain species of louse is observed on a host different than that of another observer, it is a host very closely related. Sometimes there are exceptions and for these Kellog has no other explanation than that of migration from one bird to another when in close quarters, in roosting on trees during migration of the birds, or huddling together of certain water birds on floating weeds and wreckage at sea. One interesting fact remains, that closely related genera of parasites infest closely related genera of hosts.

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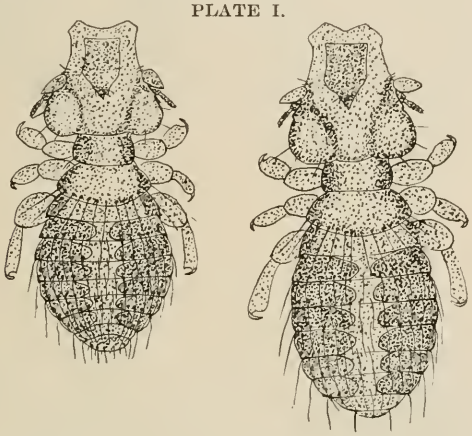
EXPLANATION OF PLATES.

Plate I.—Docophorus fusco-ventralis Osb., Male and female.
Plate II.—Docophorus icterodes Nitz., female.
Plate III.—Docophorus jungens Kell., female.
Plate IV.—Docophorus cordiceps. Giebel, male and female.
Plate V.—Docophorus communis Nitz., male and female.
Plate VI.—Nirmus illustris Kell., female.
Plate VII.—Nirmus vulgatus Kell., male and female.
Plate VIII.—Lipeurus squalidus Nitz., male and head of female.
Plate IX.—Colphocephalum chrysophaeum Kell., female.
Plate X.—Trinoton luridum Nitz., female.
Plate XI.—Physostomum angulatum Kell., female.
Plate XII.—Physostomum diffusum Kell., female.
Plate XIII.—Menopon incertum Kell., male.

PLATE I.



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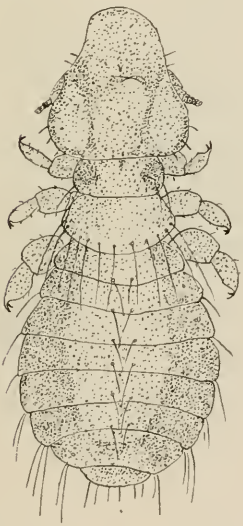

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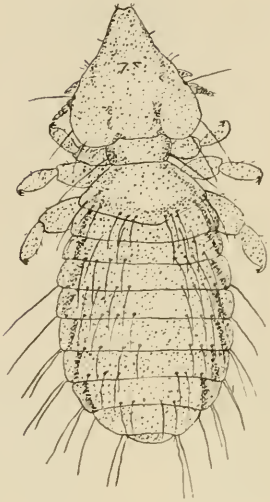

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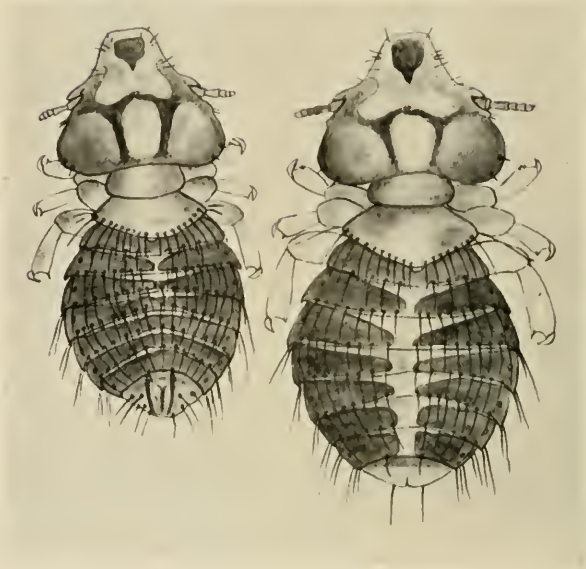

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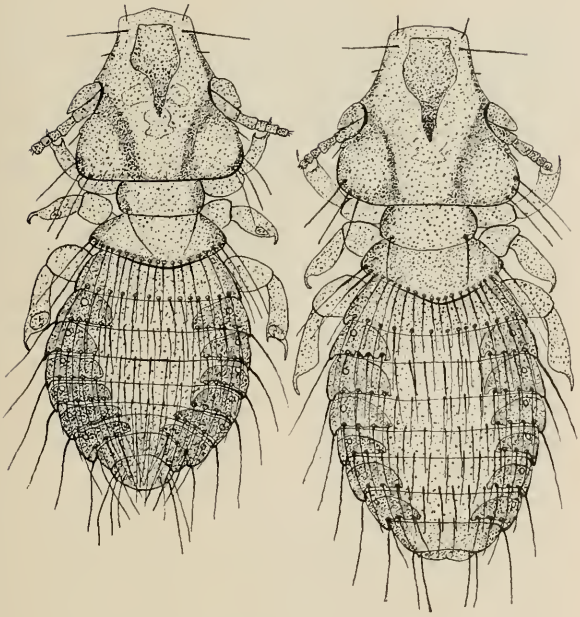

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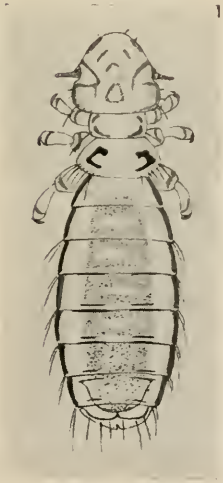

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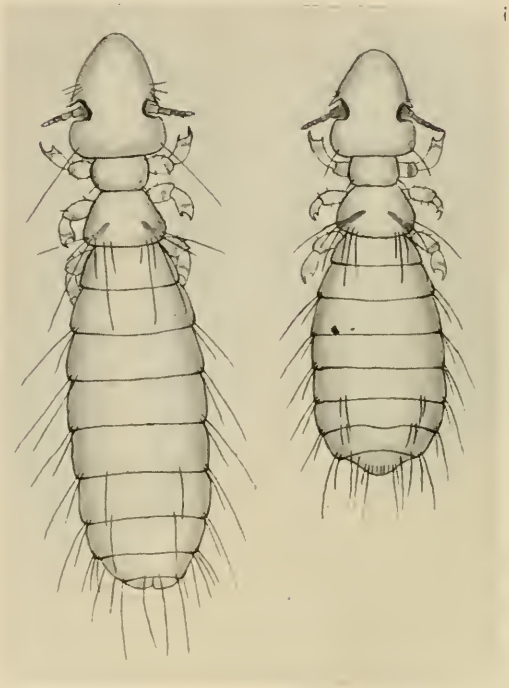

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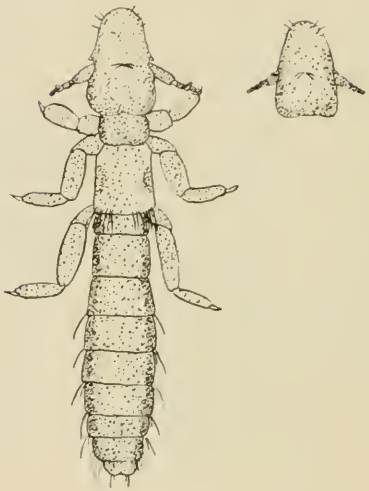

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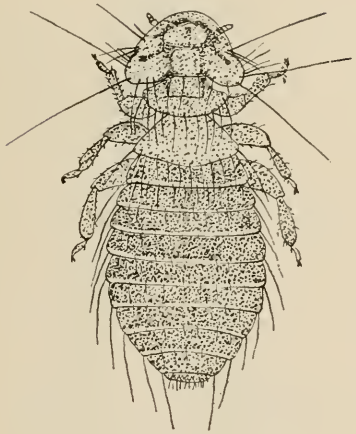

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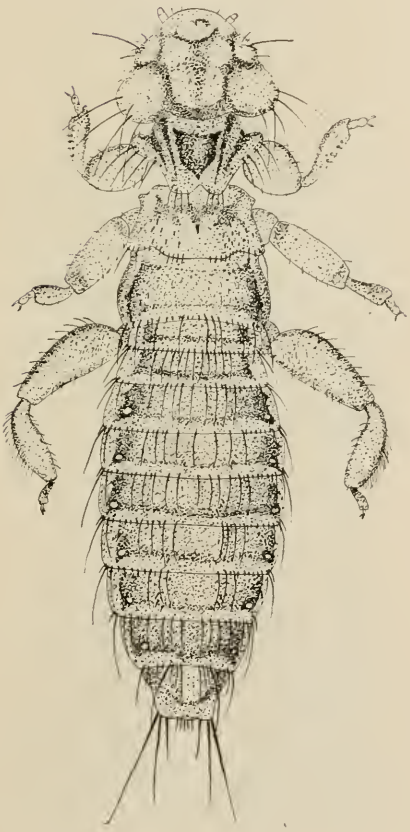

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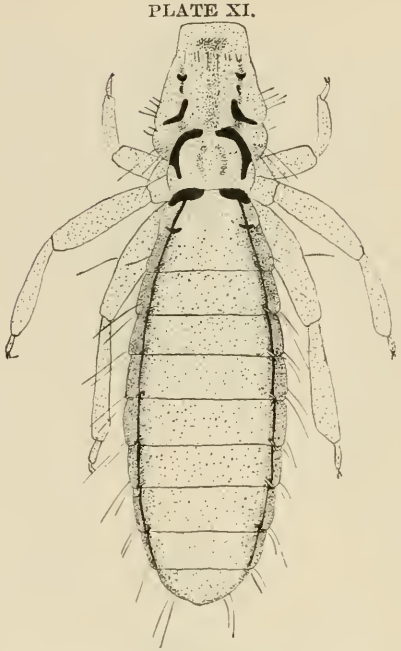

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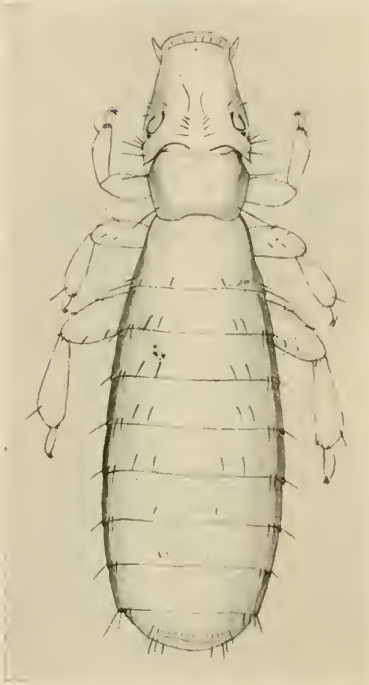

PLATE XIII.