

# Lice: A to Z

*Amblycera to zeropunctata*



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## The Lice – (Order Phthiraptera)

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## The Lice – (Order Phthiraptera)

### A. Study Goals

The principle aim of this e-Book is to assist the reader in gaining a better understanding of basic morphology of lice rather than offering discussions on pathogens vectored by these insects. Students will gain an understanding of the different types of lice (e.g., sucking lice vs. biting/chewing lice) and learn how to quickly place a specimen they have collected, or observed, into one of these groups/types. To prepare for quizzes, students should become familiar with terms underlined throughout the narrative, and with those structures pointed out in accompanying PowerPoint presentations. Species names are not underlined, but students need to be familiar with scientific names of lice, as well.

Readers are referred to the following reference work for a thorough treatment of these insects, and for coverage of the literature.

Mullen, G. R. and L. A. Durden (eds.). 2009. Medical and Veterinary Entomology, 2<sup>nd</sup> Ed., Academic Press, 637 pp.

Other helpful works listed below may be consulted.

Durden, L. A. and J. E. Lloyd. 2009. Lice (Phthiraptera). In: Mullen, G. R. and L. A. Durden (eds.), Medical and Veterinary Entomology, 2<sup>nd</sup> ed., Elsevier.

Furman, D. P. and E. P. Catts. 1982. Manual of Medical Entomology, 4<sup>th</sup> ed., Cambridge University Press.

Kettle, D. S. 1995. Medical and Veterinary Entomology, 2<sup>nd</sup> ed., CABI Publishing, 725 pp.

Price, M. A. and O. H. Graham. 1997. Chewing and Sucking Lice as Parasites of Mammals and Birds. USDA, ARS, Tech. Bull. No.1849, 257 pp., plus 56 pp., appendices.

### B. The Lice – General Comments

The Order Phthiraptera may be further divided into four suborders: (1) the Anopleura (sucking lice); (2) the Amblycera; (3) the Ischnocera; and (4) the Rhynchophthirina; the latter three orders collectively known as biting/chewing lice. The sucking lice possess piercing-sucking mouthparts, whereas biting lice possess distinct mandibles.



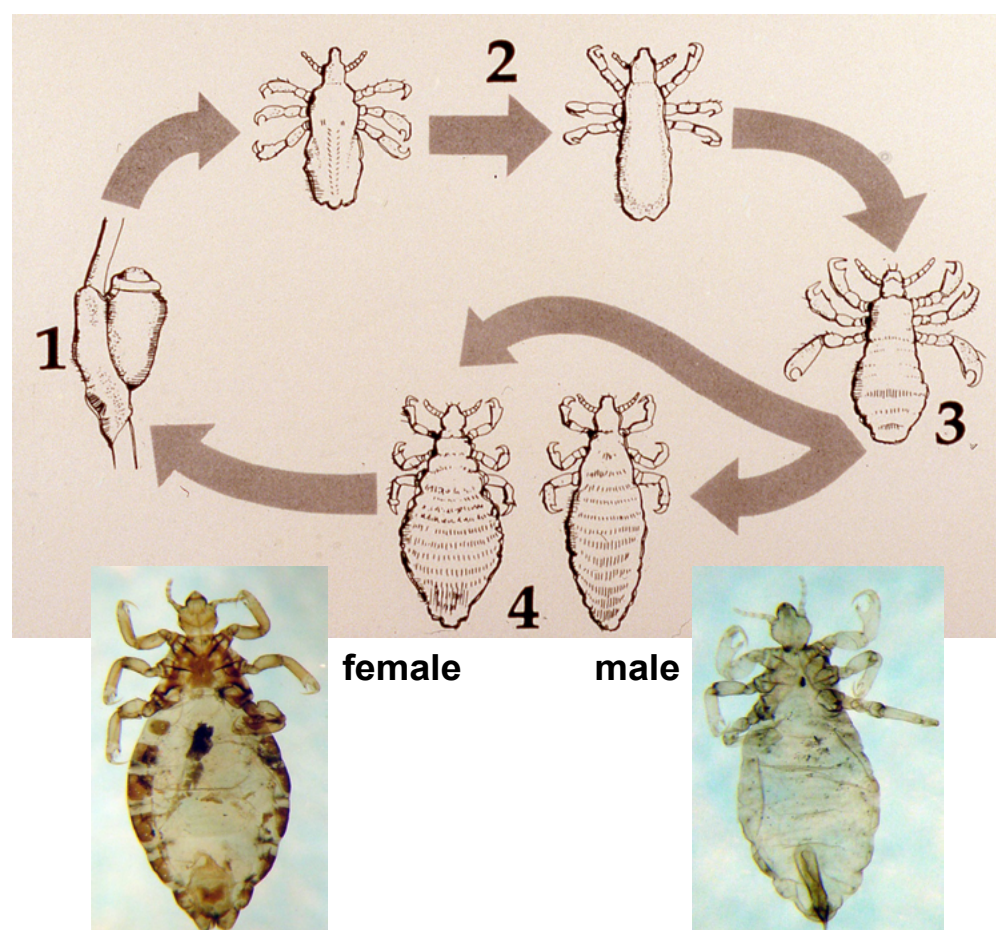
Older classification schemes were based on two orders: (1) the Anopleura (sucking lice); and (2) the Mallophaga (biting/chewing lice) with suborders of Amblycera, Ischnocera and Rhynchophthirina being placed in the Mallophaga. We have no specimens of the Rhynchophthirina, a very small order that contains only one species, *Haematomyzus elephantis*, found on Indian and African elephants. We have no specimens of this species in our collection, thus it will not be included in the remainder of the Phthiraptera narrative. Note: Kettle (1995) mentions two species in this genus, the other being *H. hopkinsi*, found on wart hogs, and Mullen and Durden mention three species in the genus. Both sucking lice, and biting/chewing lice have a high degree of host specificity (i.e., species are often found on a particular host species, seldom moving from one host species to another).

There are something on the order of 5,000 species of lice associated with birds and mammals. Approximately 550 species of these are members of the Anopleura, all of which are ectoparasites of placental mammals. Additionally, there are approximately 4,400 species (and subspecies) of biting/chewing lice, most of them associated with birds, with but 12% found on mammals.

Most species of lice have no known medical or veterinary significance other than irritating the host by their feeding activities. That is not to say, however, that lice are not important in vectoring pathogens. Indeed, the human body louse has been involved with terrible epidemics throughout human history by its transmission of the etiologic agent of epidemic typhus.

### C. The Lice – Life History

Lice are hemimetabolous insects; i.e., they undergo incomplete development in their life cycles. Incomplete development is a developmental process where pre-adult stages (i.e., nymphs) look like the adults only nymphs are smaller and sexually immature. Female lice lay eggs (oviposit). The egg hatches to a 1<sup>st</sup> stage nymph (nymphal instar, or 1<sup>st</sup> instar) followed by two additional instars (three nymph stages in all). The 3<sup>rd</sup> nymphal instar molts to the adult.

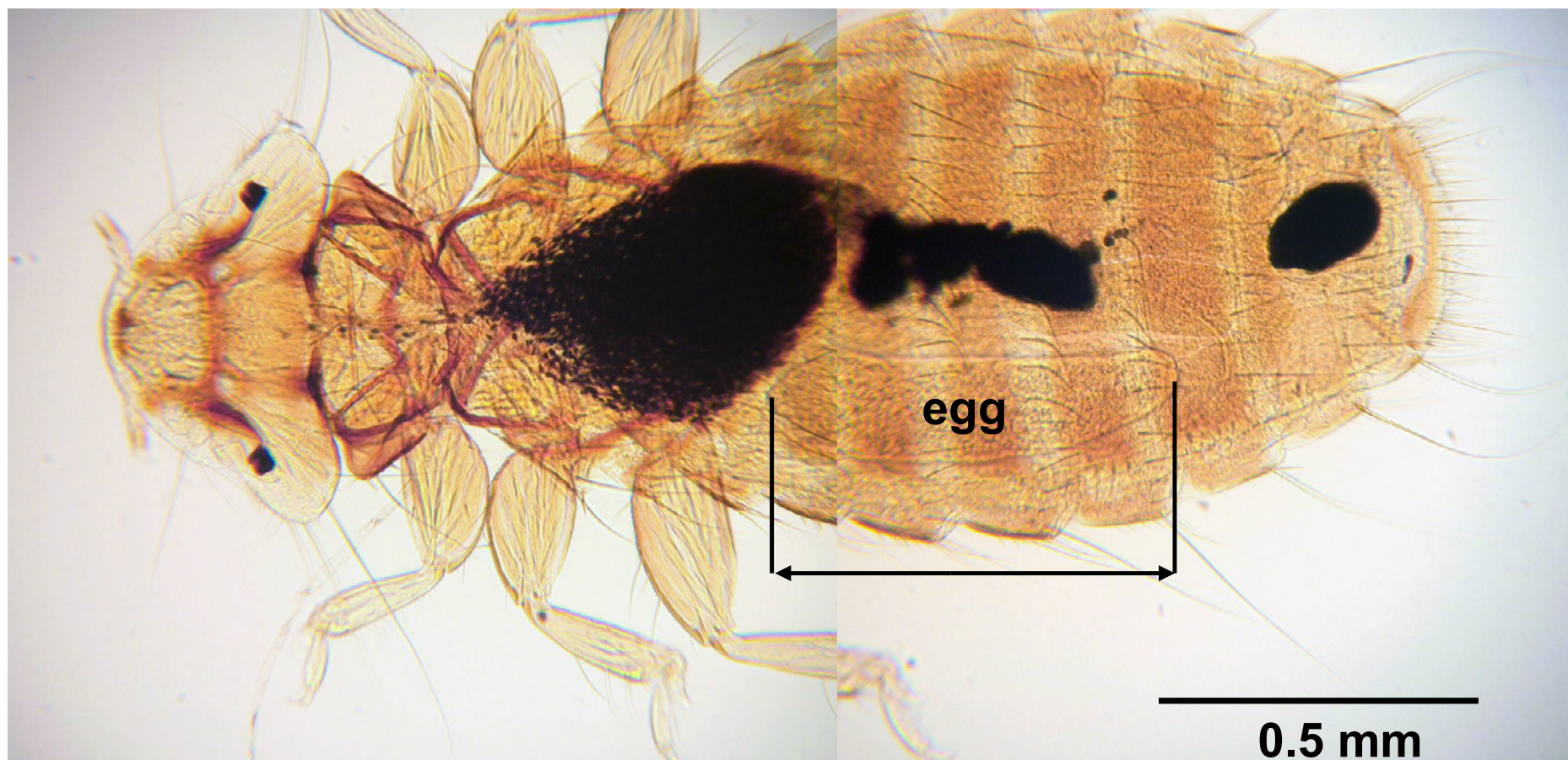


Generalized louse developmental (hemimetabolous) cycle: egg; three nymphal instars; adult female and male.



There is considerable variation in time spent in each stage, but in optimal conditions the egg requires 4 to 15 days to hatch, followed by three to eight days for the development of each nymph stage before molting to the next stage. Adults live up to 35 days.

Eggs of lice are large relative to female body size, consequently fecundity of fertilized females is low (0.2 to 10 eggs per day) when compared to many other insects.



Size of egg relative to female body in the bird louse, *Menacanthus stramineus*.

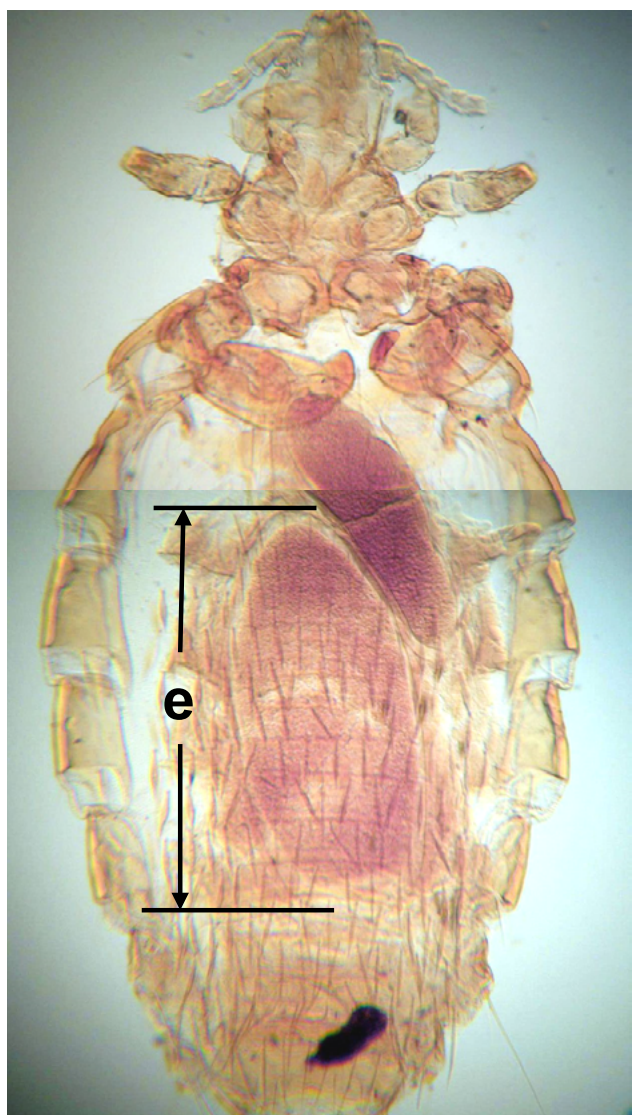
Many lice are host specific; i.e., they parasitize only one species of host. Examples, of highly host specific lice are the hog louse (*Hematopinus suis*), the large turkey louse (*Chelopistes meleagridis*), and horse biting louse (*Bovicola equi*). Other lice are less host specific, especially those familiar to the veterinary practitioner that may observe *Linognathus setosus*, *Trichodectes canis*, and *Heterodoxus spiniger* on dogs. These lice, however, will parasitize closely related hosts like foxes, wolves, and coyotes, and occasionally other carnivores.

Some lice are site specific on the same host; examples being the sheep face louse, *Linognathus ovillus* and sheep foot louse, *Linognathus pedalis*. And on humans there is the “head” louse, *Pediculus humanus capitis*, and the “body” louse, *Pediculus humanus humanus*, along with the “pubic” louse, *Pthirus pubis*.

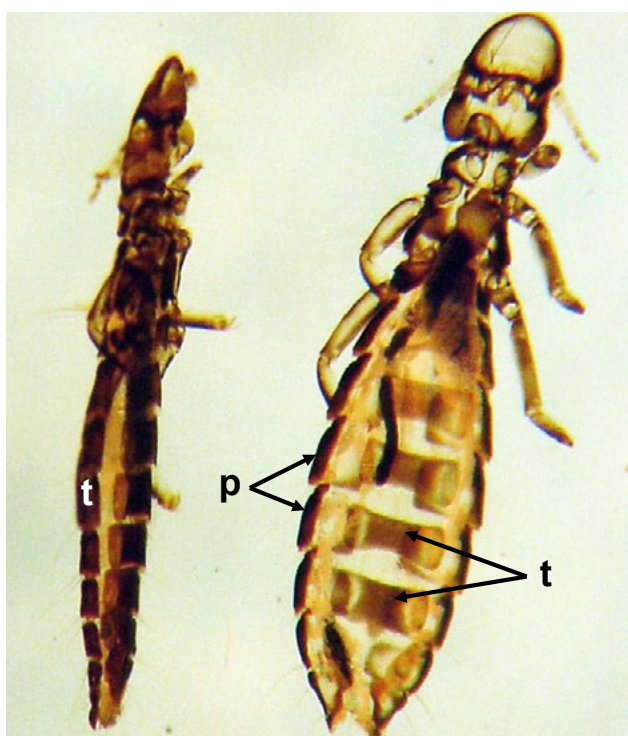
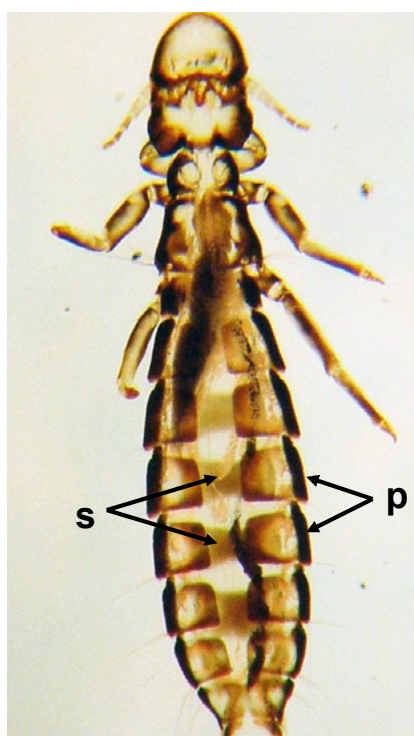


## D. The Lice – General Body Morphology

Lice are small (0.4 to 10.0 mm)  dorsoventrally flattened, wingless, ectoparasites that feed on birds and mammals. The dorsal aspect of an individual is called the tergum, with abdominal segments possessing tergal plates. The ventral aspect is referred to as the sternum, with sternal plates easily observed on abdominal segments. There are also lateral plates called the paratergal plates. Paratergal plates surround spiracles, the openings into the tracheal (breathing) system of these insects.



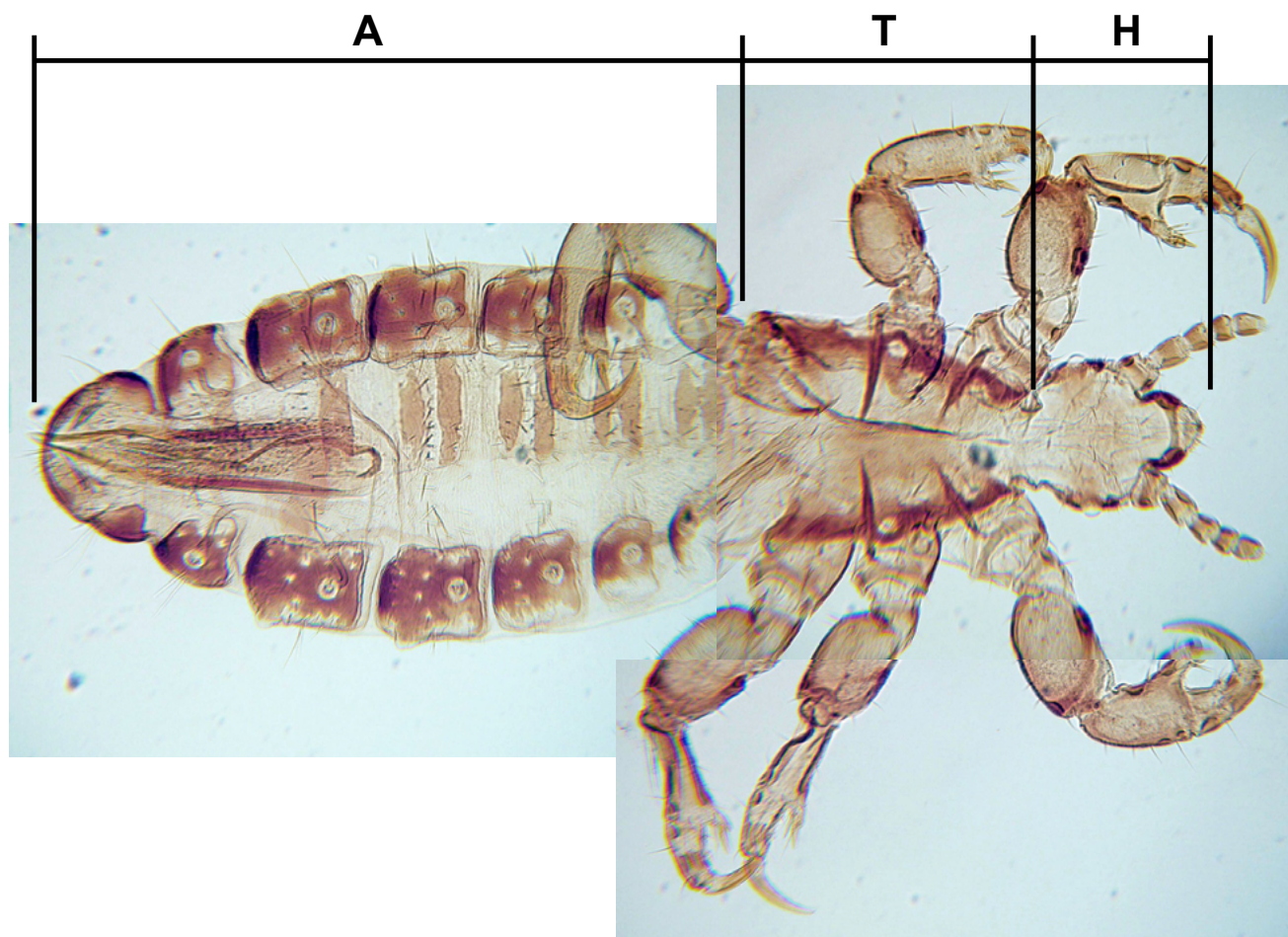
Size of eggs (e) relative to female body size in the Anopleuran (sucking) louse, *Hoplopleura sciuricola*, and the Amblyceran (biting) louse, *Menacanthus stramineus*.



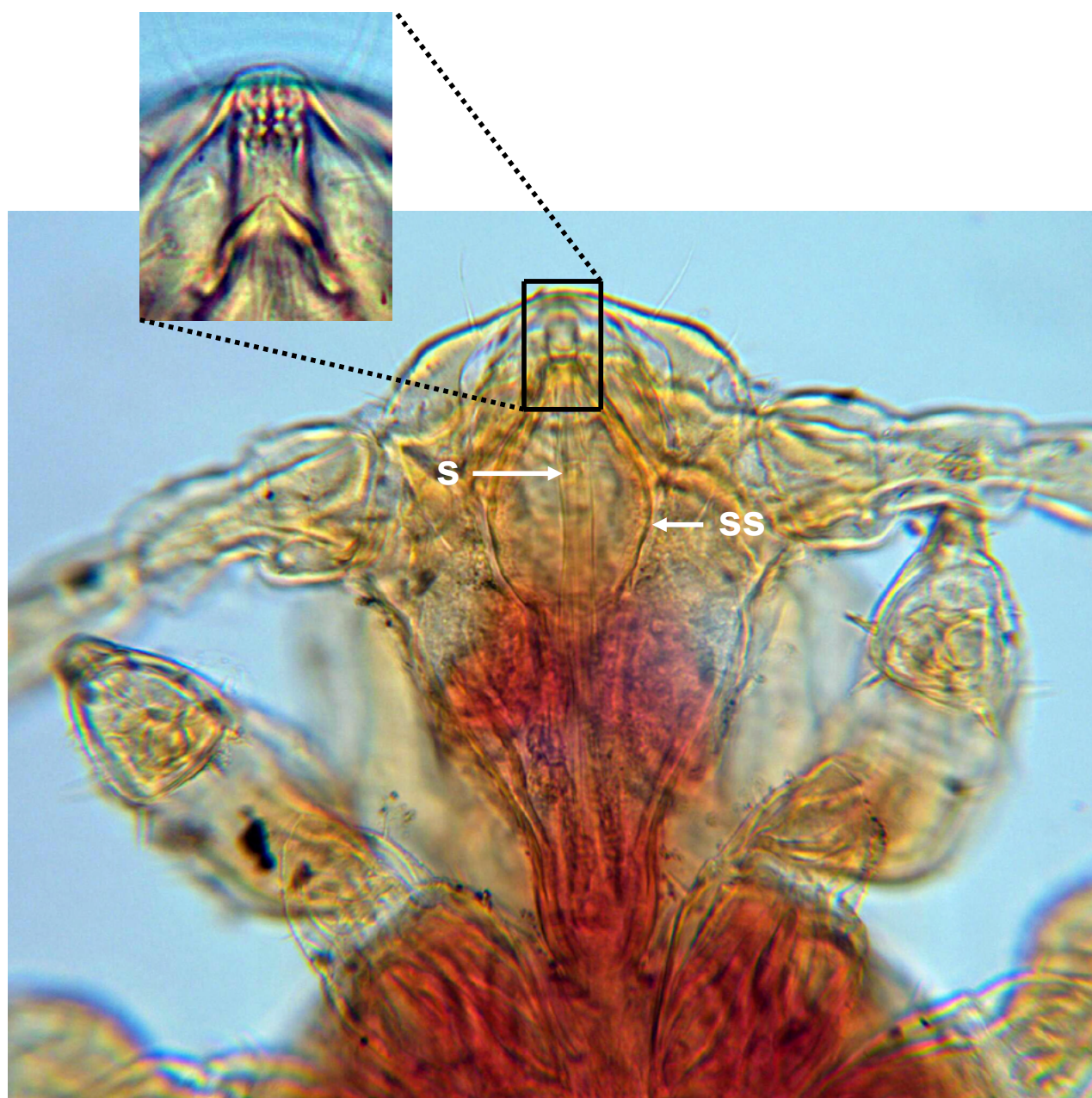
*Oxylipeus polytrapezius*, the slender turkey louse (ex: wild turkey, Raleigh Co., WV); a mallophagan louse. Specimen in center viewed from lateral aspect t



Anopleuran lice possess piercing-sucking mouthparts with stylets and prestomal teeth, whereas biting lice (Mallophagans, or Amblycerans and Ischnocerans) bear opposing, sclerotized, mandibles. Lice have the three general body regions (i.e., head, thorax, and abdomen) and possess six legs, typical of insects.



*Pediculus humanus*, male, entire (composite). Note the three pairs of legs and three body regions (H, head; T, thorax; A, abdomen) that are characteristic for insects.



*Haemodipsus ventricosus*, female. Example of “sucking louse” with piercing-sucking mouthparts. Insert, prestomal teeth. Legend: s, stylet; ss, stylet sac.

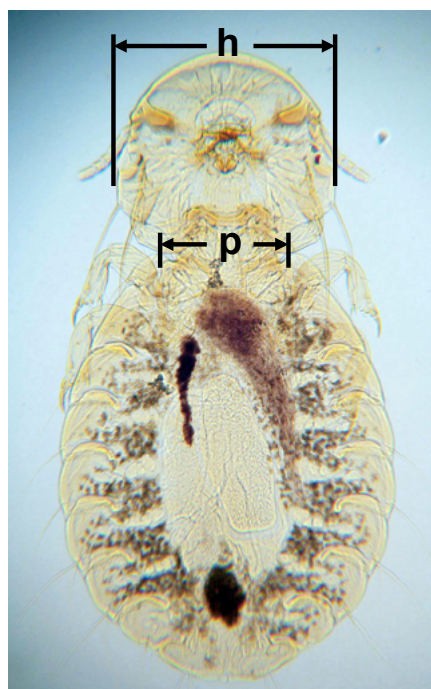
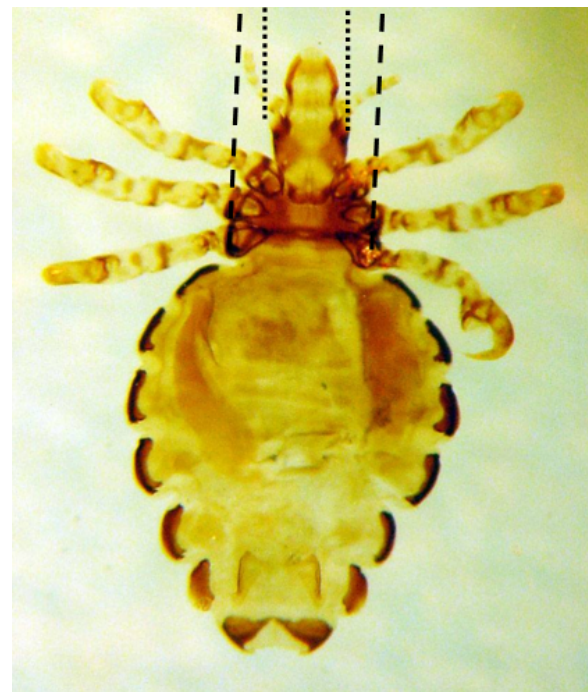


Sucking lice can also be differentiated from biting lice on the basis of head width relative to the width of the thorax (specifically the prothorax, or anteriormost region of the thorax). In sucking lice head width is narrower than the thorax, whereas in biting lice (mallophagans, or amblycerans and ischnocerans) the head is wider than the prothorax.



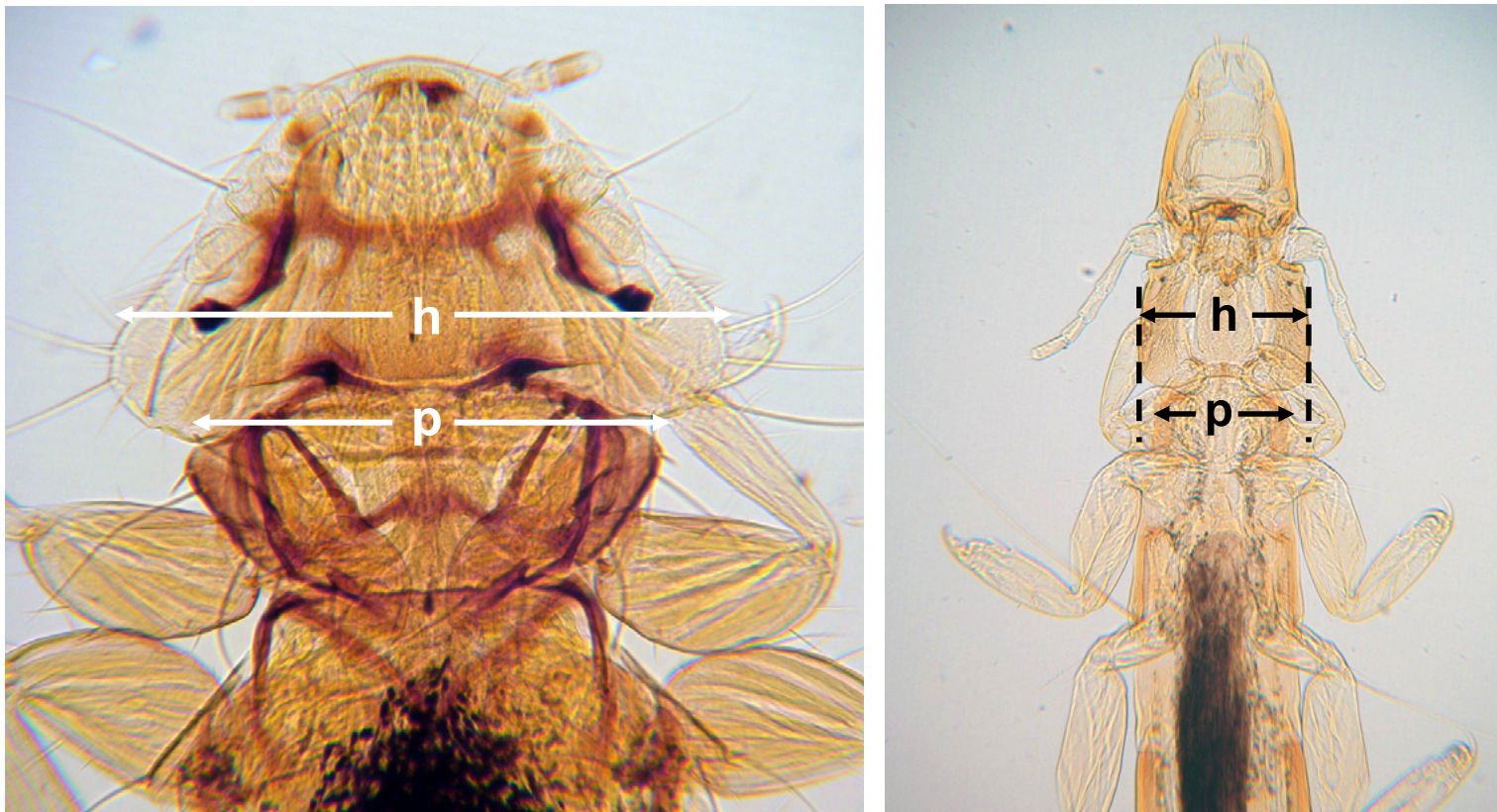
Piercing mouthparts (stylet partially retracted) of sucking louse, *Hoplopleura* sp. (left), compared with serrated mandibles of biting louse, *Bovicola equi* (right).

Differentiating characteristics separating sucking lice and biting/chewing lice. In a sucking louse, *Hematopinus suis* (left), the head width (dotted lines) is narrower than the width of the thorax (dashed lines). Conversely, in the biting louse, *Menacanthus stramineus* (right), the head width (dotted lines) is greater than the width of the prothorax (dashed lines).



Sucking louse, *Pediculus humanus* (left), compared with biting louse, *Goniocotes* sp. (right). Note that the head is narrower than thorax in *Pediculus*; broader than prothorax in *Goniocotes*. Legend: h, head; p, prothorax.





Some mallophagan lice (e.g., *Columbicola columbae*, example to the right) may have narrow heads and bodies, leading one to think this may be a sucking louse. But even here, note that the head is still wider than the prothorax, just as seen in a more robust mallophagan, *Menacanthus stramineus* (pictured left).

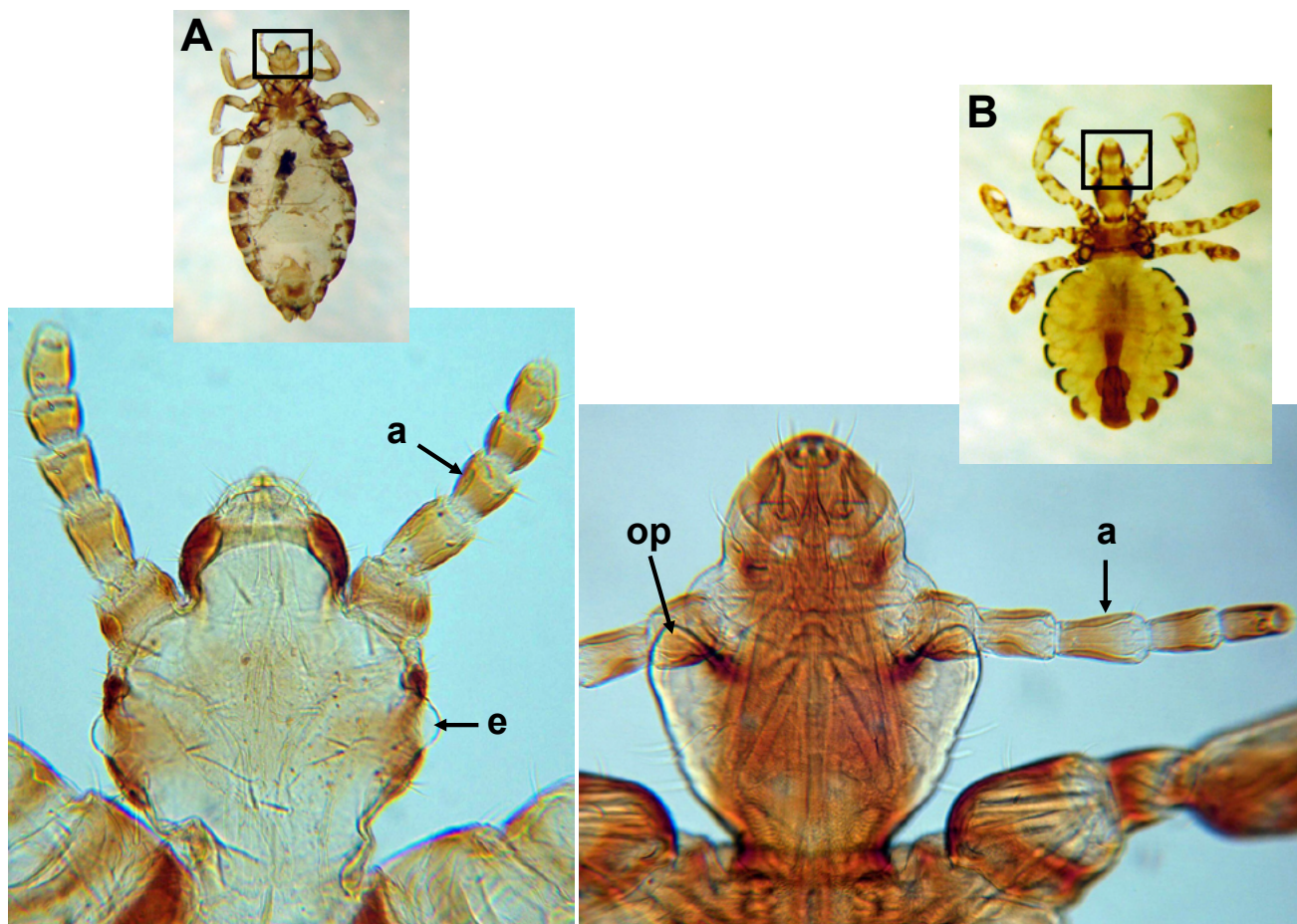
## E. The Lice – Anopleuran (sucking lice) Body Morphology

### E-1. The Anopleuran Head

The slender head of a sucking louse possesses antennae consisting of three to five segments that extend from the head. These lice lack maxillary palps. Eyes are reduced or absent in most lice, but the medically important anopleurans (e.g., *Pediculus* and *Pthirus*) possess simple eyes that are light sensitive, but which do not form images. In the genus *Haematopinus*, there are lateral projections at the base of the antennae that have the appearance of eyes, but these ocular points are merely eyeless projections.

Quick check: comparisons between sucking lice, and biting/chewing lice.	
Sucking lice	Biting/Chewing lice
<ul style="list-style-type: none"> <li>• Head narrower than prothorax.</li> <li>• Possess piercing/sucking mouthparts.</li> <li>• Antennae clearly visible.</li> <li>• Lack maxillary palps.</li> <li>• Parasitize mammals</li> </ul>	<ul style="list-style-type: none"> <li>• Head broader than prothorax.</li> <li>• Possess opposing mandibles.</li> <li>• Antennae filamentous and visible or sometimes concealed in grooves.</li> <li>• Maxillary palps present in some.</li> <li>• Parasitize mostly birds; some on mammals.</li> </ul>

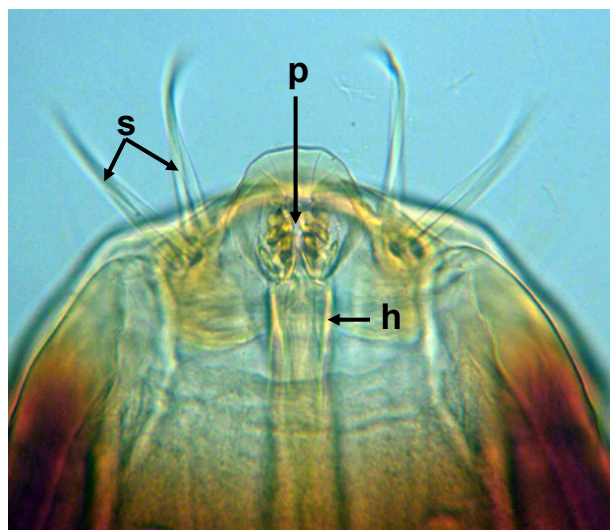




The human body louse, *Pediculus humanus*, shown in A; the pig louse, *Haematopinus suis*, shown in B. Boxes in each enlarged below specimens to show head characteristics. Legend: a, antenna; e, eye; op, ocular point.

## E-2. The Anopleuran Thorax

In sucking lice the three thoracic regions are fused so that from the dorsal aspect the thorax appears as one unit, or region. Ventrally, a sternal plate, lying between the coxae (see leg segment description that follows) may be present. In some anopleurans this plate is helpful in identification by its shape, or number and position of setae. Legs, of course, are attached to the thoracic region. The leg segment that articulates with the body (thoracic region) is the coxa. Proceeding distally from the coxa the other leg segments are the trochanter, femur, tibia and tarsus. The second and third pairs of legs in anopleurans terminate in highly specialize claws called tibio-tarsal claws for grasping hairs of the host. These claws consist of a curved tarsal element that opposes a tibial spur, forming a space that corresponds to the diameter of the host's hair .

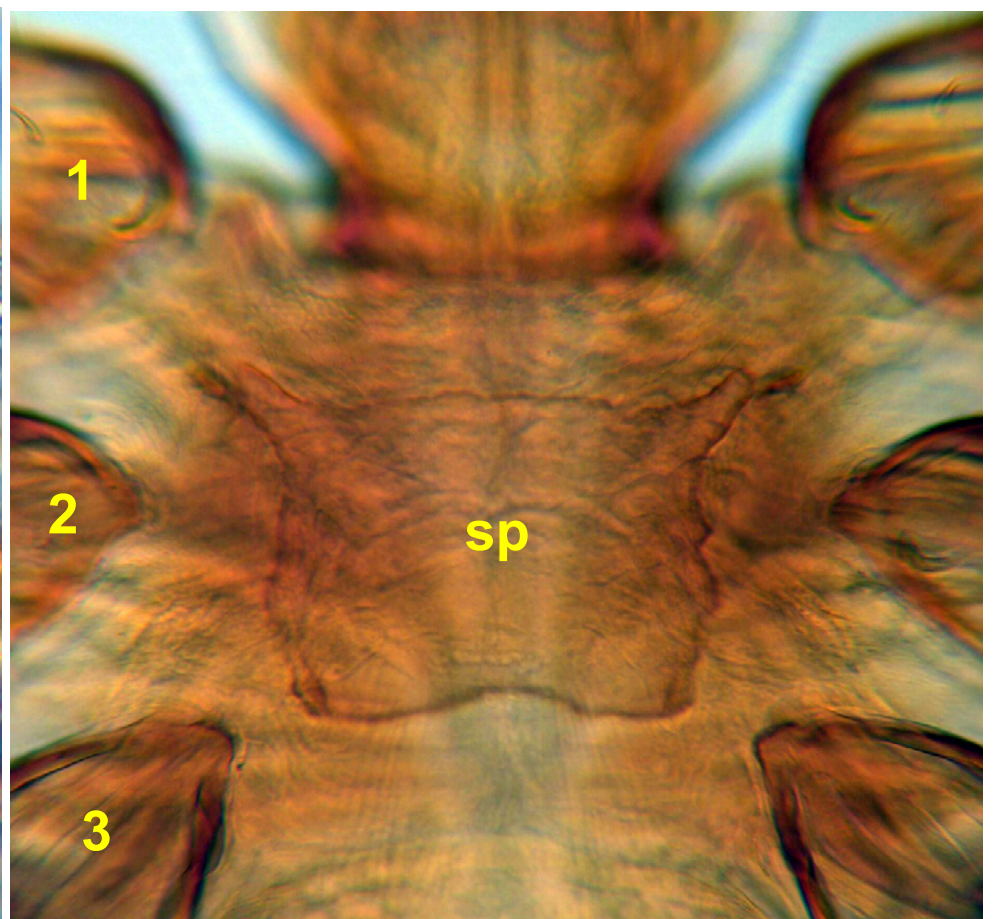


Modified setae of *Haematopinus suis* used for initial attachment to host, prior to attachment of prostomal teeth. Legend: h, haustellum; p, prestomial teeth; s, modified setae.





*Pediculus humanus capitus*, male, entire (composite). Note that segments (pro-, meso-, metathorax) of thorax are fused (oval) so that this region appears as a single unit.  
Legend: a, antenna; e, eye.



Sternal plates of sucking lice: A, *Hoplopleura sciuricola*; B, *Haematopinus suis*. Legend: 1, 2, & 3, first, second and third coxae; sp, sternal plate.

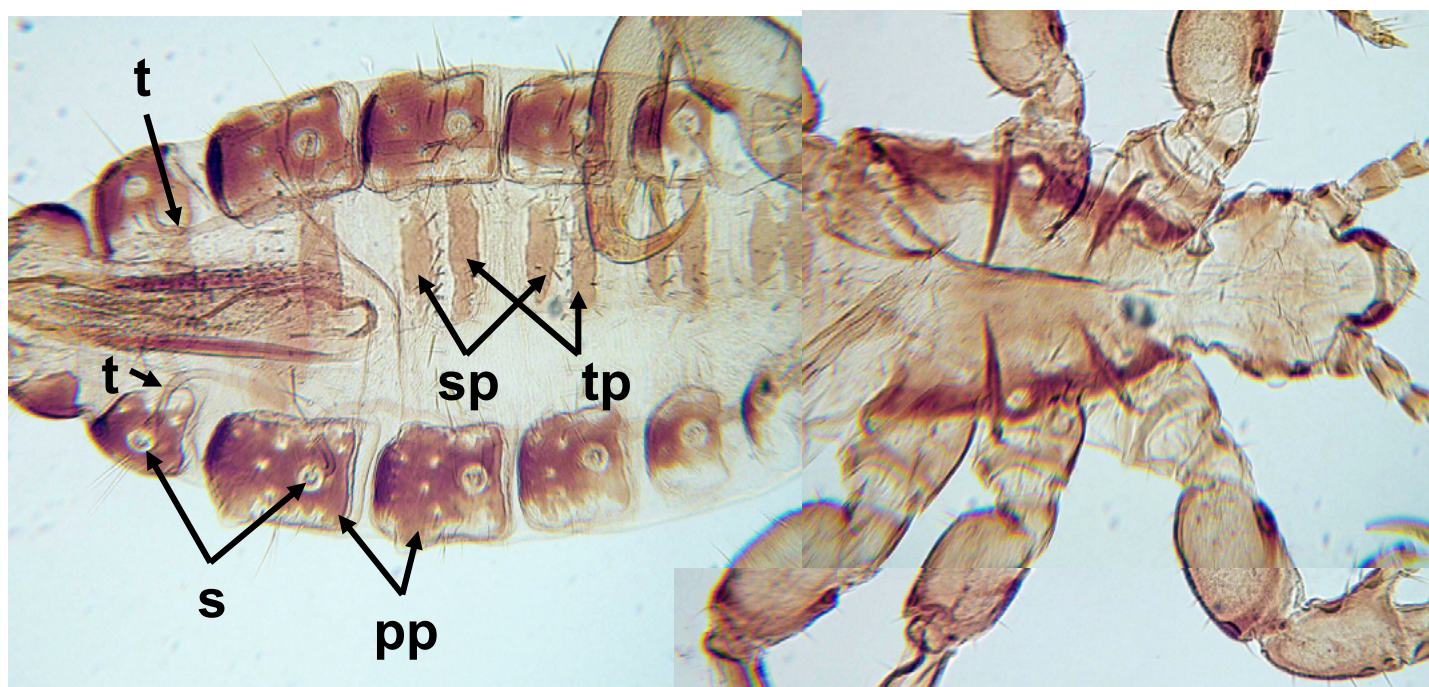
### E-3. The Anopleuran Abdomen

The segmented abdomen features distinct plates; the dorsal tergal plates, ventral sternal plates, and lateral paratergal plates. Paratergal plates surround spiracles which open into highly branched, internal, trachea that function as the “breathing” system of insects. Additional detail of spiracles, and their opening into trachea, can be seen in abdominal segments of the human crab louse. Note: some authors use the terms tergite, sternite and paratergite for the above mentioned plates.





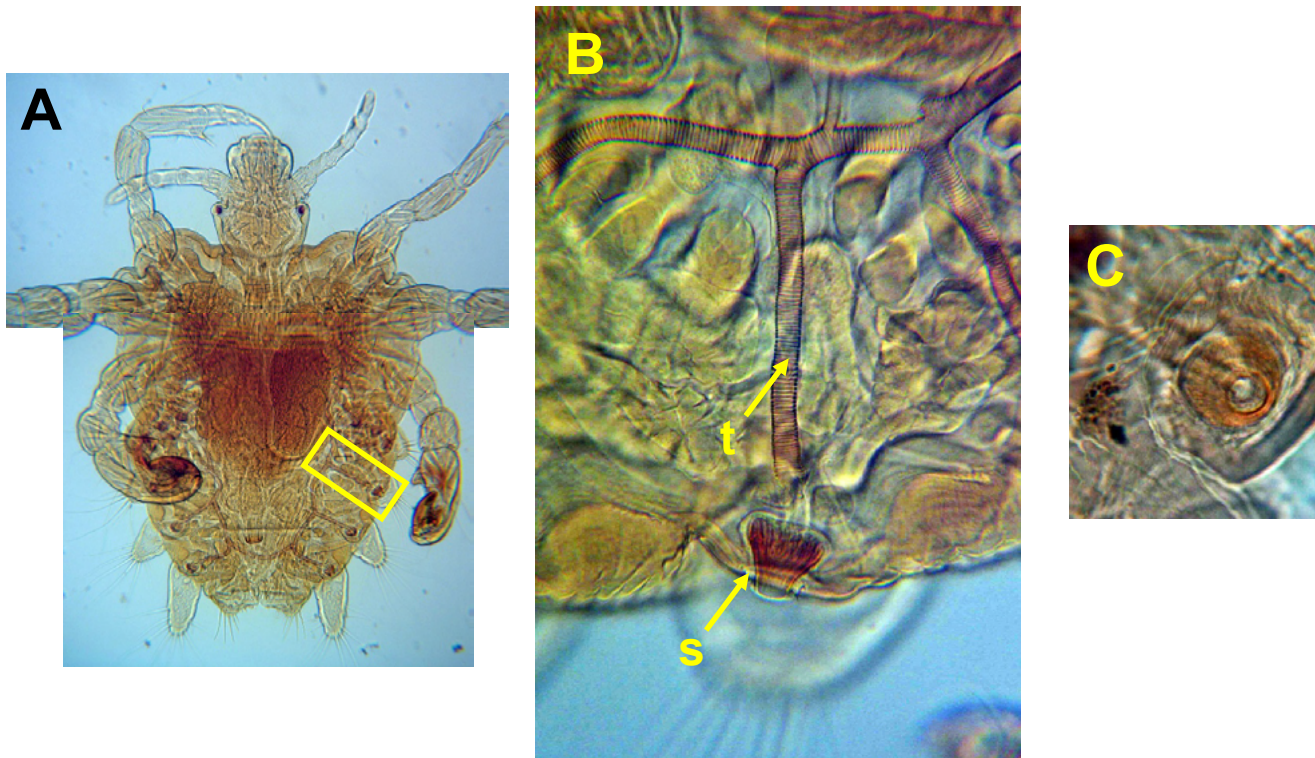
Leg segments of *Haematopinus suis*, an anopleuran louse. Note that the claw (= tarsal element), with minute serrations on inner margin, is extended in photo to right, closed in photo to left. Legend: cl, claw (tarsal element); cx, coxa; f, femur; ta, tarsus; te, tarsal element; ti, tibia (the ta and ti making up the tibio-tarsal element); tr, trochanter; ts, tibial spur.



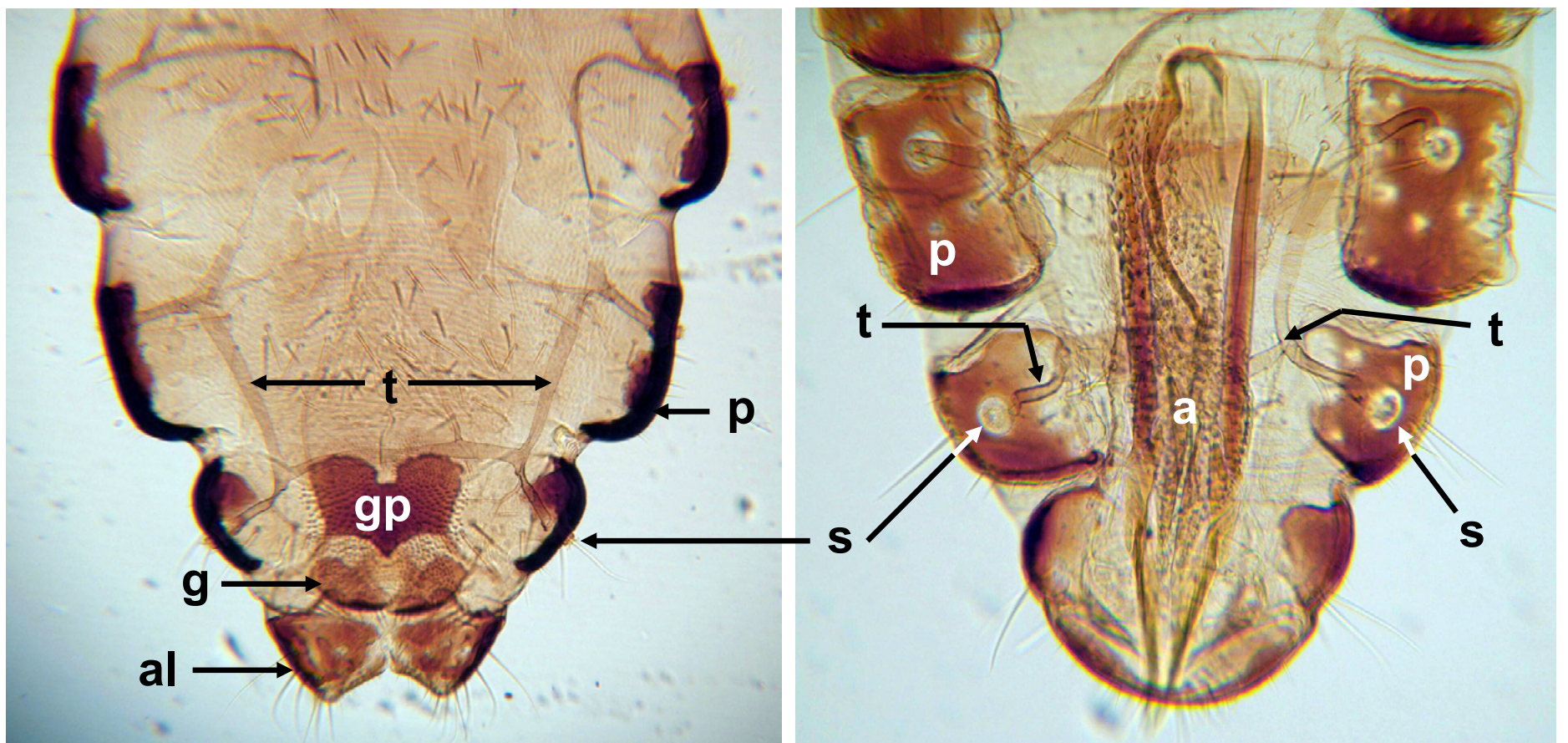
*Pediculus humanus capitus*, male, entire (composite); abdomen highlighted. Legend: pp, paratergal plates; s, spiracles (opening into trachea); sp, sternal plates; t, trachea; tp, tergal plates.



Lice are sexually dimorphic, that is females and males can easily be distinguished on the basis of certain morphological features. In females the posterior tip of the abdomen is bifurcated (the bifurcation delineated by a pair of apical lobes). In addition, females possess gonopods armed with numerous elongate setae, and a sclerotized genital plate.



The human crab louse, *Pthirus pubis*, female. Entire (composite) view in A; rectangle in A enlarged in B to show lateral view of spiracle. Photo in C shows opening of spiracle (which is 18  $\mu\text{m}$  in diameter) as if you were “looking into” it. Legend: s, spiracle; t, trachea.

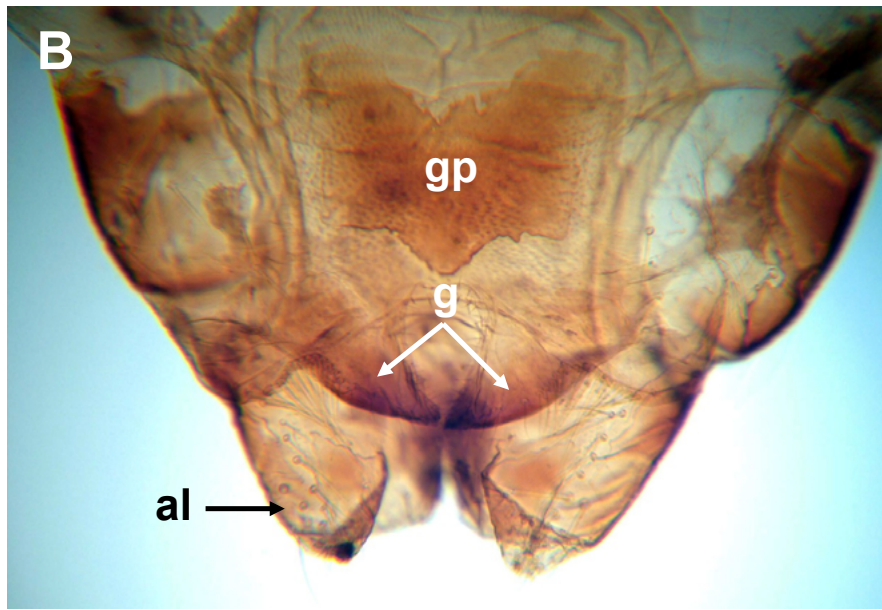


bifurcated posterior ← sexually dimorphic character → blunt posterior

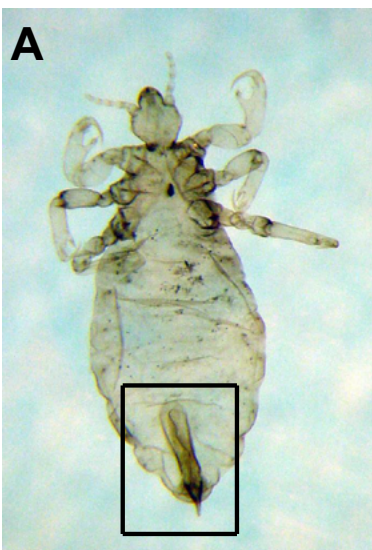
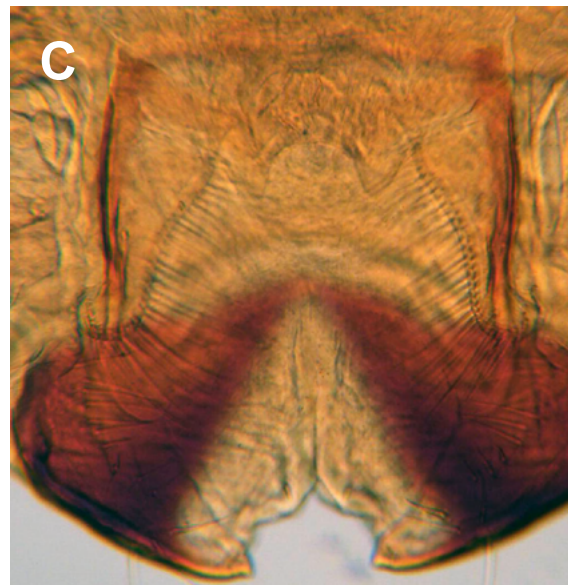
*Pediculus humanus capitus*, sexual dimorphism, posterior abdominal region. Note the bifurcated posterior characteristic of females (left) and the blunt posterior of males (right). Note too, the prominent aedeagus (= penis) of the male. Legend: a, aedeagus; al, apical lobe; g, gonopod; gp, genital plate; p, paratergal plate; s, spiracle; t, trachea.



The posterior abdomen of males, however, is blunt, and there is a prominent copulatory, or intromittent, organ, the aedeagus (= pseudopenis). Accessory structures in the male genital complex are the parameres situated lateral to the aedeagus, and the basal apodeme that supports the aedeagus.



The human body louse, *Pediculus humanus*, female, A & B. Note bifurcated posterior end formed by apical lobes. Box in A enlarged in B. Legend: al, apical lobe; g, gonopods; gp, genital plate. Note; gonopods of the female pig louse, *Haematopinus suis*, armed with numerous setae, shown in C.



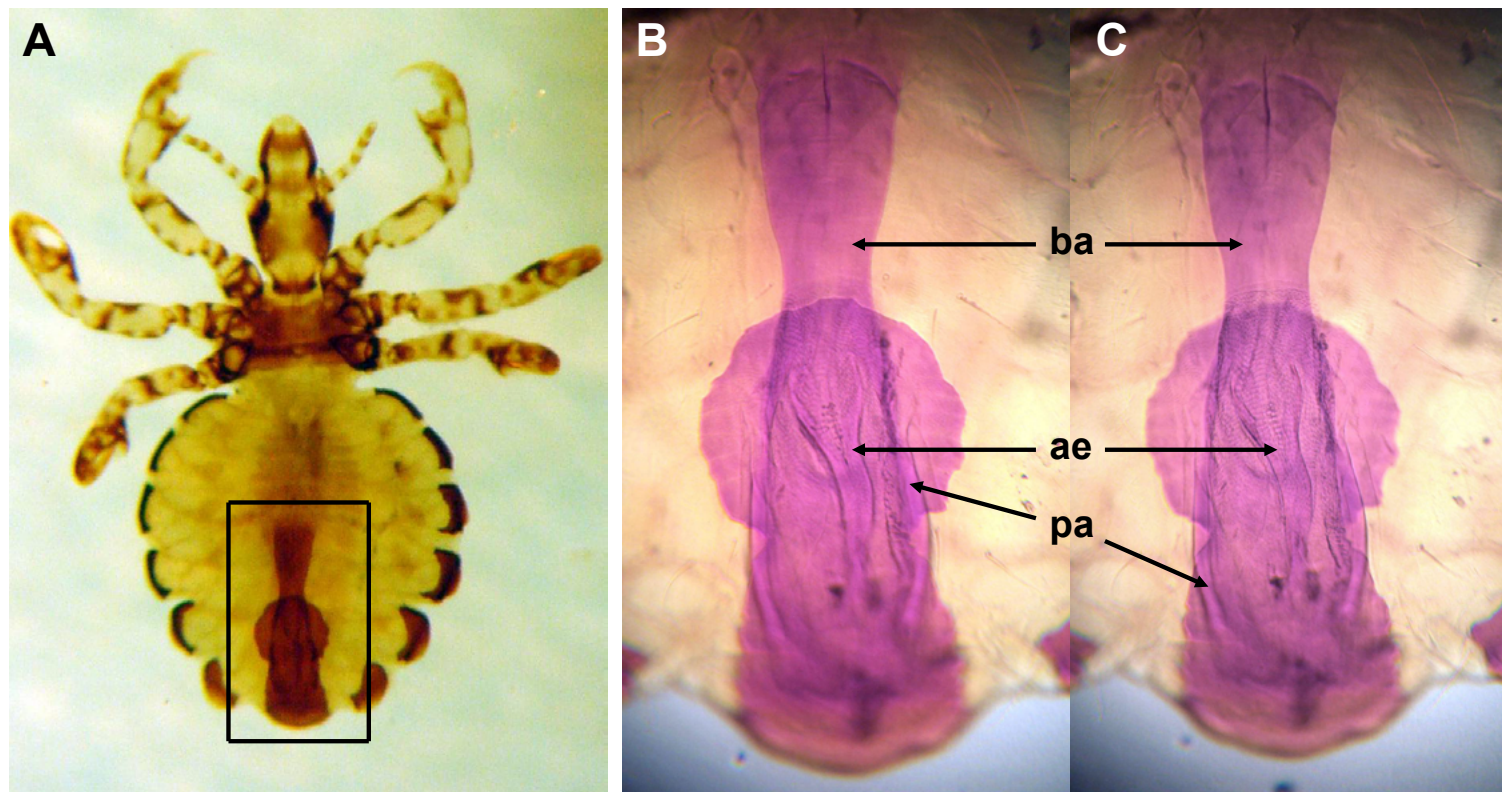
The human body louse, *Pediculus humanus*, male. Note blunt-tipped abdomen, and prominent copulatory organ. Box in A enlarged in B.



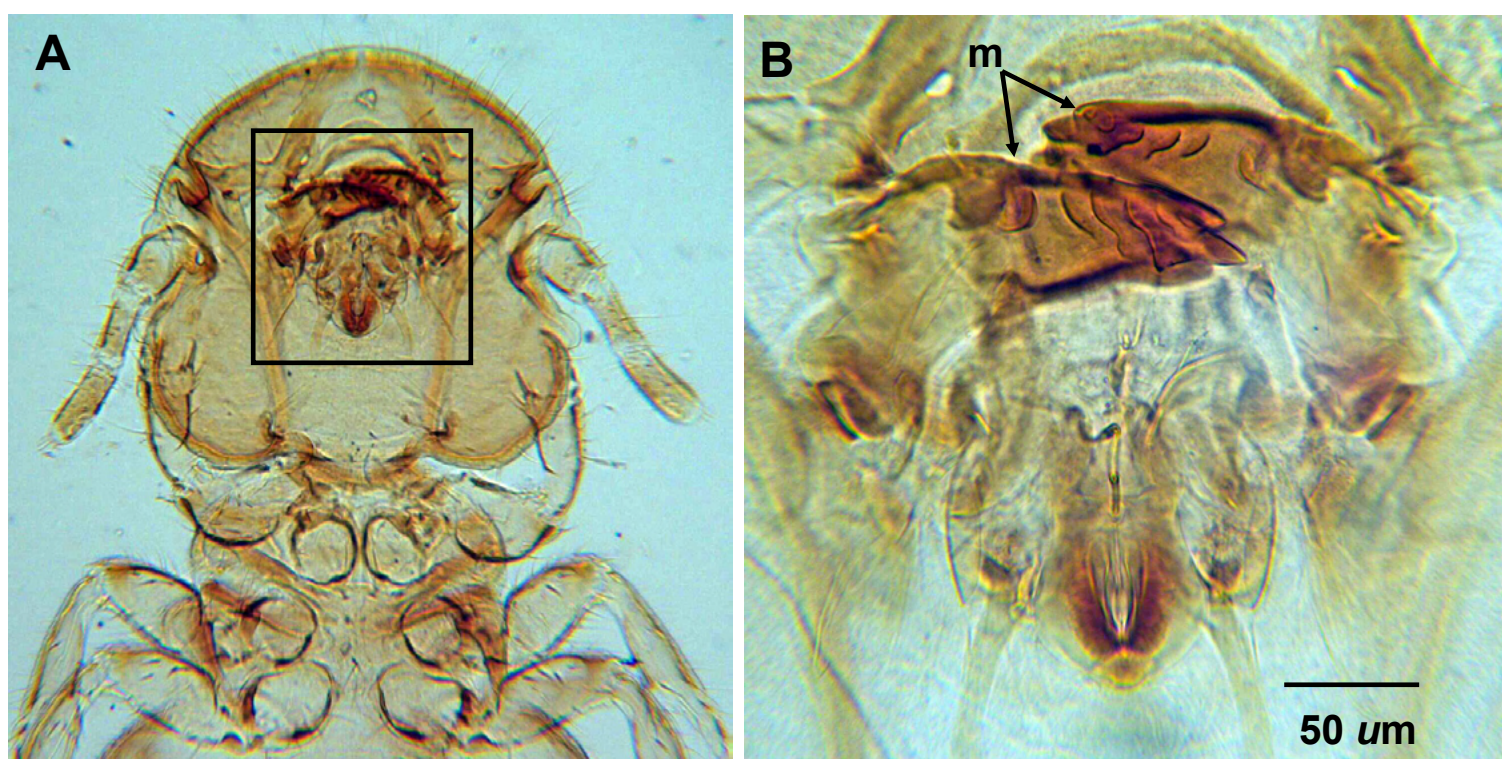
## F. The Lice – Mallophagan (biting/chewing lice) Body Morphology

### F-1. The Mallophagan Head

The head of a mallophagan louse is broad relative to the width of the body, sometimes nearly as broad as the body. Biting/chewing lice also possess distinctly sclerotized mandibles that sometimes bear ridges for the scraping of host integument. Simple non-image forming eyes may be seen in some mallophagans.



Male pig louse, *Haematopinus suis*, genitalia. A, entire individual; rectangle in A enlarged in B and C (two different depths of fields). Legend: ae, aedeagus (= pseudopenis); ba, basal apodeme; pa, paramere.



*Bovicola equi*, female, head. Box in A highlights mandibles (m) enlarged in B.



We need, however, to recognize that there are two types of biting/chewing (“mallophagan”) lice; namely those biting lice in the Order Amblycera and those in the Order Ischnocera. Lice in the former order possess maxillary palps and club-shaped (i.e., clavate) antennae, consisting of four segments, that are concealed in grooves in the head. Lice in the latter order lack maxillary palps, and possess filiform (i.e., thin) antennae of three to five segments that extend from the head reminiscent of sucking lice.



Heads of *Falcoliperus* sp., and *Menacanthus stramineus*, with simple eyes.

There are two orders of biting/chewing lice; the Amblycera, and the Ischnocera.	
The Amblycera	The Ischnocera
<ul style="list-style-type: none"> <li>• Possess maxillary palps.</li> <li>• Possess clavate antennae that are concealed in grooves in the head.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack maxillary palps.</li> <li>• Possess filiform antennae that extend from the head.</li> </ul>

Remember, however, the head of a sucking louse is narrow, while the head of the biting mallophagan is wide. In some ischnocerans the antennae are sexually dimorphic characters; the first antennal segment in males being greatly enlarged while that first segment appears “normal” sized in females.





Examples of the two orders of biting/chewing lice: the amblyceran (head of *Ricinus australis*, left) and the ischnoceran (head of *Bruelia zeropunctata*, right). Note that in the former the antenna(e) is/are concealed in antennal grooves (oval), whereas in the latter the antennae extend from the head (there are no antennal grooves). Moreover, palps are present in amblycerans, but absent in ischnocerans. Legend: a, antenna; e, eye; md, mandibles; mp, maxillary palp.

## F-2. The Mallophagan Thorax

Viewed dorsally, the thorax of biting/chewing lice appears to have two, or occasionally, three segments. Leg segments are much like those of sucking lice (see: D-2. The Anopleuran Thorax), except that the legs terminate distally in one or two simple claws (as opposed to the specialized tibio-tarsal claws in many anopleurans). Those mallophagan species that parasitize birds generally possess two claws, those parasitizing mammals often have but a single claw. Ventrally, between the coxae, there is often a distinct sternal plate that may be used to identify species based on its shape and the position of setae on the plate.

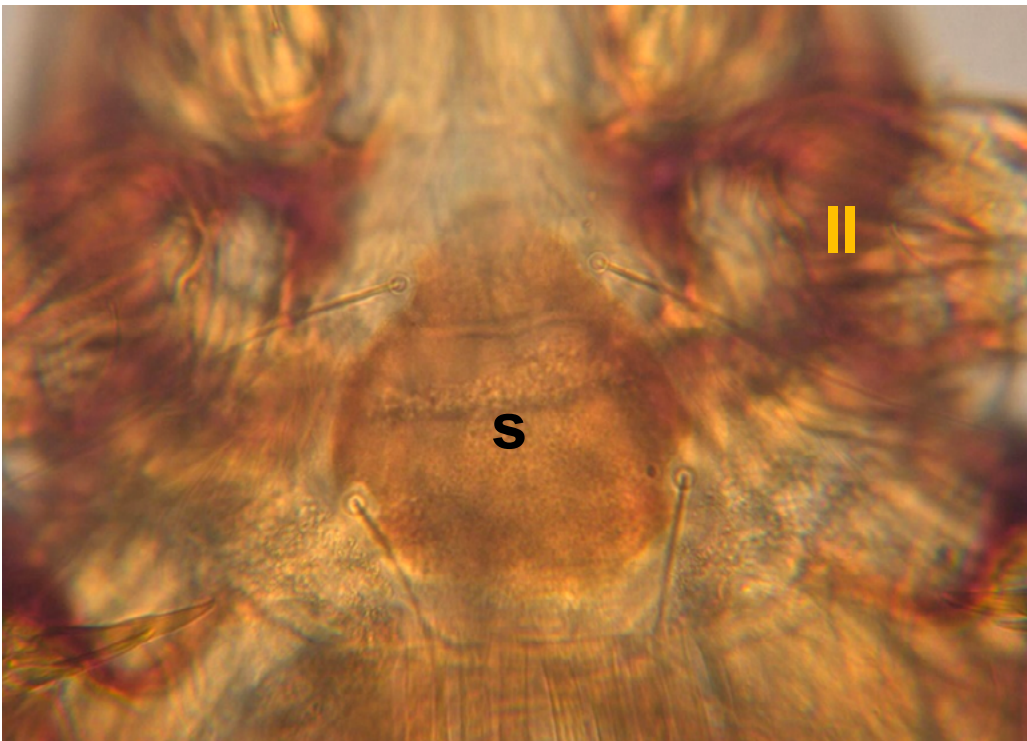


*Cuclotogaster heterographus*: male (A); female (B). Note that basal antennal segment in the male is enlarged (arrow), a sexually dimorphic character.





Thorax (oval) of *Liperus caponis* appears as two segments, typical of mallophagans



Sternal plate of female *Cuclostogaster heterographus* with plate setae. Legend; II, second coxa; s, sternal plate.

### F-3. The Mallophagan Abdomen

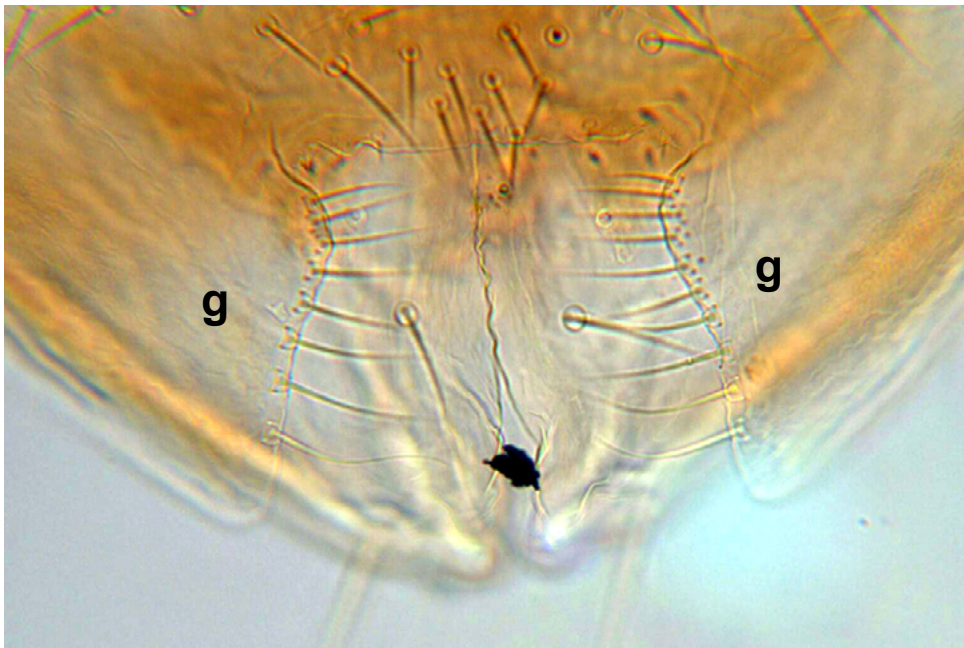
Like sucking lice, there is a distinct sexual dimorphism in the abdomen of mallophagans; the posterior abdomen being (usually) bifurcated in females, blunt in males. Females often possess well developed gonopods armed with numerous, elongate, setae.



Simple bifid claw (arrow in A) on 1<sup>st</sup> leg of *Menacanthus stramineus* (a bird mallophagan); and single claw (arrow in B) on 2<sup>nd</sup> and 3<sup>rd</sup> legs of *Bovicola equi* (a mammalian mallophagan).

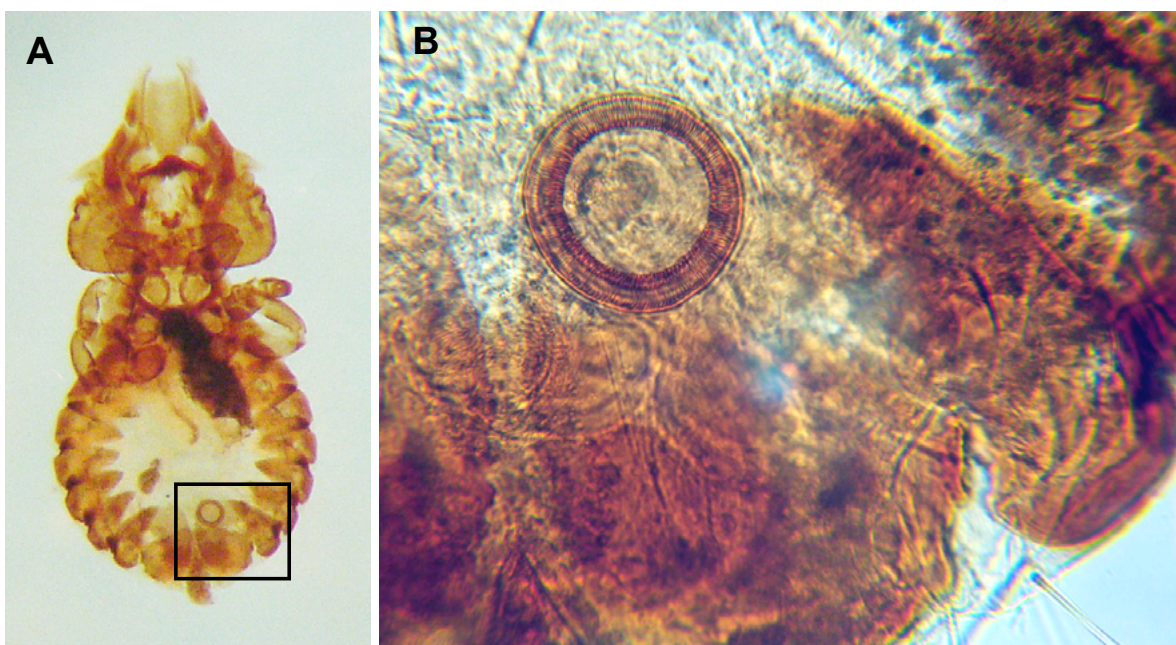
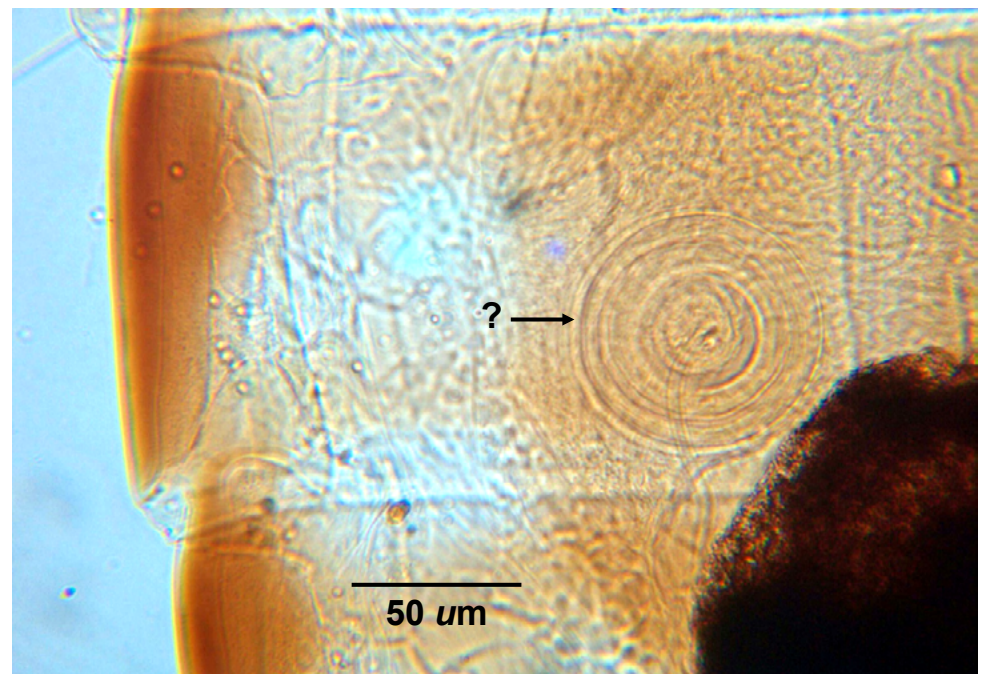


Mycetomes (or bacteriomes of some authors) can often be observed in the posterior region of females at the junction between the internal ventriculus and hindgut. These rounded structures contain symbiotic microorganisms which synthesize B vitamins that are lacking in the blood meal. The prominent male copulatory apparatus is made up of an intromittent organ, the aedeagus, and lateral parameres. Additionally, prominent plates – tergal, sternal and paratergal – are often present on the abdomen of mallophagans (e.g., *Oxyliperus* sp.).



Gonopods (g) of female *Bovicola equi*.

*Bruelia* sp., female; structure (mycetome?) in 6<sup>th</sup> abdominal segment.



*Craspedorahynchos* sp. female with mycetome. Box in A enlarged in B.



## G. Supplemental Materials (PowerPoint Presentations)

### G-1. The Anopleura

*Haematopinus suis*

*Hemodipsus ventricosus*

*Hoplopleura sciuricola*; *H. hesperomydis*

*Linognathus* sp.

*Pediculus humanus*

*Pthirus pubis*

*Polyplax auricularis*

### G-2. The Mallophaga / Amblycera

*Machaerilaemus* sp.

*Menacanthus stramineus*

*Menopon gallinae*

*Myrsidea antique*

*Pseudomenopon* sp.

*Ricinus australis*

*Trinoton querquedulae*

### G-3. The Mallophaga / Ischnocera

*Bovicola equi*

*Bruelia zeropunctata*

*Chelopistes meleagridis*

*Columbicola columbiae*

*Craspedorhynchus* sp.

*Cuclotogaster heterographus*

*Falcolipeurus* sp.

*Goniocotes maculatus*

*Goniodes pavonis*

*Lipeurus caponis*

*Oxylipeurus* sp.

*Pegeeriella fulva*

*Phlopterus migratorii*

*Picicola snodgrassi*

*Strigiphilus* sp.

*Trichodectes canis*



## H. E-Book Species Summaries

### H-1. The Anopleura

#### *Haematopinus suis*

Large pig louse that is so distinctive because of its heavily sclerotized plates. The head is narrower than the thorax, much narrower than abdomen, and bears 5-segmented filamentous antennae (i.e., each antennal segment approximately same size), and prostomal teeth for attachment to the host. There are no eyes in this species, ocular points (in place of eyes) are positioned at the base of each antennae. Leg segments are easily demarcated in this large species, and there is a highly specialized tibio-tarsal claw. Males possess a well sclerotized aedeagus (= pseudopenis), flanked by the lateral parameres, and a basal apodeme. The posterior abdominal region of females is distinctly bifurcated, and possesses well formed gonopods with long setae.

#### *Hemodipsus ventricosa*

This squirrel ectoparasite possesses very unusual “thorn-like” paratergal plates (= paratergites). Otherwise this species very much conforms to the anopleuran body form. Prosomal teeth, associated with the tube-like haustellum, are small, but can be distinctly seen at high magnifications, as can be a stylet that pierces the skin for feeding. Nymphs of this species have an integument covered by “bumps”, or “mammillations.”

#### *Hoplopleura sciuricola*; *H. hesperomydis*

Another species that parasitizes squirrels. One of the most pronounced features of “hoplopleurans” is the dense covering of spines (setae) covering the abdomen. Bodies are typical anopleuran in form, and the tibio-tarsal claw, so specialized in anopleurans, is well equipped for grasping hairs of the host. Oral stylets and a haustellum with prostomial teeth are evident at high magnifications. Hoplopleurans also have a pronounced sternal plate on the venter between the coxae. Also characteristic are the two robust setae (or bristles) on the margin of the second abdominal sternite. Moreover, this sternite is drawn out laterally so that it articulates with the paratergal plate on each side of the abdomen. Paratergal plates, themselves, are well sclerotized with long drawn out margins directed posteriorly.

#### *Linognathus* sp.

Species of the genus are important ectoparasites of cattle, sheep, goats, and deer; some of horses and dogs. General body form of these lice very much like the pig louse, except that *Linognathus* spp. are only lightly sclerotized; with membranous abdomen lacking tergal or sternal plates. Paratergal plates are absent as well, or at



most represented by small tubercles anterior to each spiracle. Species of this genus are also recognized by their five-segmented antennae and absence of eyes. Females may pull several hairs together and attach their eggs, which accounts for the matting of hairs or wool sometimes seen in heavy infections of sheep and goats.

### *Pediculus humanus*

The human louse, sometimes regarded as subspecies depending on where it is found on the host; e.g., *P. h. capitis* (on the head), or *P. h. corporis* (on the body). Sometimes called the “cootie”, this species is far less common today, especially in developed nations. Outbreaks of this species in human populations is closely associated with wars, or famines, or natural disasters that bring people closer together, often in unsanitary conditions. Actively feeding lice often causes intense irritation, and infections over long periods may result in a desensitization of the host to bites. Chronic infestations may lead to skin thickening and discoloration, a condition known as “Vagabond’s” or “Hobo’s” disease. Typically “anopleuran” in body form, these lice possess distinct sucking mouthparts; although small and only seen at high magnifications. Adults have distinct eyes, simple eyes that do not form images, and 5-segmented filamentous antennae. The tibio-tarsal claws, and accompanying tibial spurs, of these lice are very well developed. The reader should note the serrated inner edge of the claw (i.e., tarsal element) which enhances this louse’s ability to grasp the host’s hair. Females often lay eggs (4 or 5 per day) on clothing, especially along stitching seams and in creases.

### *Pthirus pubis*

The human pubic louse, or crab louse because of its squat “crab-like” appearance, is a medium-sized louse ranging in size from 1.1 to 1.8 mm in length. This species possesses robust tibio-tarsal claws for grasping thick hairs in the pubic region of the body; along with coarse hairs of armpits, eyebrows, or eyelashes. These lice are transmitted primarily by contact. They may be transferred through bed linens, towels, etc. but this latter route is uncommon because these lice can survive off the host for only a few hours. Crab lice cause intense itching, which is frequently accompanied by lesions at the bite sites. Spots of blood or louse feces may appear on the host’s undergarments. These lice are not known to vector pathogens.

### *Polyplax auricularis*

Another louse of squirrels, and other rodents, that has the appearance of *Hoplopleura* spp. because of the dense covering of abdominal setae. In this genus, however, the second abdominal sternite does not extend laterally to articulate with the paratergal plate (as it does in *Hoplopleura*).



## H-2. The Mallophaga / Amblycera

### *Menacanthus stramineus*

This chicken body louse is the most common, and most pestiferous, louse of domestic chickens and turkeys, worldwide. Infested birds are restless, and the resulting loss of body weight (or low weight-gain rates) and lowered egg production result in significant economic losses. These lice move rapidly over the body feeding on sloughed epithelial cells, and blood. In heavy infestations birds exhibit patches of skin with small blood clots, sloughing scabs, and oozing tissue exudate. Most individuals are found around the vent of the host where feathers are short and sparse, but in heavier infestations these lice may be found in just about any part of the body. Mandibles are placed near the anterior margin of the head. The 5-segmented palps, and club-shaped antennae (lying in grooves in lateral margins of the head) are easily seen in properly mounted microscope specimens. Perhaps the most notable feature of this relatively large (3.0 to 4.0 mm in length) louse is the dense covering of setae over the body. Fecundity is low, averaging 1.6 eggs per day, for a total of about 20 eggs per female. In spite of this low fecundity rate, louse populations can increase rapidly under optimal conditions.

### *Menopon gallinae*

This species is known as the shaft louse, an appropriate name as individuals are often observed in “single-file” along the shafts of feathers. In North America, the principal host is the domestic chicken, but guinea fowl are often infested, as well. Turkeys, pheasants, ducks and pigeons have also been listed as hosts. These lice feed on feather and shaft particles, although there are reports of small percentages of lice containing red blood cells in their gut. These lice are less injurious to their hosts than *M. stramineus*, but lowered egg production is often associated with their presence. Mandibles are located close to the anterior head margin, and 5-segmented, filamentous, palps and clavate antennae are easily observed. This species is further characterized by prominent lateral patches of setae/spines on the 3<sup>rd</sup> abdominal segment.

### *Myrsidea antiqua*

This small ( $\approx$  1.4 mm) species is found on the American crow. The head is broad in region of temporal lobes. Mandibles are placed anteriorly, near head margin. Maxillary palps and club-shaped antennae (in grooves) typical of amblycerans. A distinct triangular sternal plate lies in prothoracic region between 1<sup>st</sup> coxae. Posterior abdomen of females is blunt, rather than bifurcated, with long lateral setae and distinct gonopods bearing numerous fine setae.



*Machaerilaemus* sp.

Another small species (males may be 1.0 mm, females somewhat larger) species is an ectoparasite of . Very thin mandibles are placed far forward on broadly rounded head. Eyes are distinct, antennae and maxillary palps typical for amblyceran lice. Thorax appears to be divided into two regions (i.e., the prothorax is well defined, meso- and metathorax appear fused when viewed in dorsal aspect). Posterior abdominal margin of female rounded rather than bifurcated, with fine setae.

*Pseudomenopon* sp.

This species is an ectoparasite of fowl. The head is typically amblyceran. With small mandibles placed very far anteriorly. Eyes are present in members of this genus.

*Ricinus australis* & *Ricinus frenatus*

This two species parasitize small song birds worldwide, the latter being found on the indigo-bunting. The head is elongated, almost conical, with a bluntly rounded apex, and small, but distinct, eyes. Mandibles of these lice are quite small, sharply pointed, and anteriorly placed on the head. Maxillary palps and antennae are prominent. Mouthparts appear modified for taking blood meals, and some authors believe blood is the only food for “ricinids” because bits of feathers and skin have not been found in the digestive tract. Indeed, the sharply pointed mandibles seem ideal for penetrating the host’s skin. Apparently, males are seldom found, a number of species being described solely on the basis of female specimens. Fecundity is low, with females producing one egg every 3.5 days, with a lifetime production of about a dozen eggs.

*Trinoton querquedulae*

Known hosts for members of this genus are waterfowl in the Order Anseriformes. Some authors divide *Trinoton* spp. into four groups, of which the “querquedulae” group, found on ducks, teals, and geese, is one. This is a relative large louse measuring 5.0 to 6.0 mm in length. These lice are distinctly sclerotized, but perhaps the most striking feature is the robust spines located on the dorsal mid-region of the head, the dorsal thorax, and anterior abdominal segments. These same large spines are located on posterior margins of paratergal plates (= paratergites), and distributed around the spiracles. Mandibles are placed near the margin of the head, and palps and antennae (in grooves) are easily observed. Legs terminate in powerful bifid claws. That these lice feed, at least in part, on blood has been verified in a study showing that 66% of the individuals had blood in their digestive tract. One species, *T. anserinum*, has been incriminate as a vector of the filarial heartworm, *Sarconema eurycerca*, in the myocardium of swans.



### H-3. The Mallophaga / Ischnocera

#### *Bovicola equi*

The genus *Bovicola* is a large one with about 30 known species from mammals in four families worldwide. Most species ( $\approx 20$ ) are from bovines. *Bovicola bovis* has been extensively studied because of its economic importance in the beef and dairy industries. Curiously, *B. bovis* commonly reproduces parthenogenically because studies where unfertilized females were isolated from males have shown those females to produce eggs that hatch normally. Nymphs from those eggs develop normally to adults. In addition, several investigators have found that the percentage of males on a host varies from 0 to only 10%, another indicator of parthenogenesis. In either case these lice are not reproductively prolific, with females only producing one egg every 1.5 days for a total of 20 to 30 eggs in her lifespan. *Bovicola equi*, as the name indicates, is an ectoparasite of domestic and wild horses, occasionally donkeys. It is found worldwide. This species is most commonly found on the neck, flanks and at the base of the tail. These lice are not debilitating to the host in small numbers, but in large numbers (i.e., several thousand) horses are irritable, stamping their feet and rubbing hair from infected areas. The head of *B. equi* is broadly rounded anteriorly. Mandibles are prominent, and possess distinct “ridges”, presumably to aid in scraping the skin surface. Legs terminate in a single claw. Females have prominent gonopods bearing long setae.

#### *Bruelia zeropunctata*

Specimens presented here were obtained from the wood thrush. Other species in the genus are ectoparasites of sapsuckers, meadowlarks, red-winged blackbirds, and robins. These small lice ( $\approx 1.7$  mm) are often heavily sclerotized, with distinct tergal, sternal and paratergal plates on the abdomen. Mandibles are small, but distinctly sclerotized, and the 5-segmented, filamentous, antennae are easily seen projecting from the head. In well cleared, microscope slide mounted female specimens, the mycetome may be seen. This structure harbors symbiotic microorganisms.

#### *Chelopistes meleagridis*

This heavily sclerotized species is an ectoparasite of domestic and wild turkeys. It has a worldwide distribution. Individuals are most commonly found on feathers of the neck and breast. The head is a prominent feature of these lice, having distinct mandibles, eyes, and pronounced projections (i.e., temporal lobes) drawn out laterally, and posteriorly, that bear very long setae directed posteriorly from those projections. Moreover, the head is considerably wider than the prothorax. The head also bears antennae that are sexually dimorphic; that is the 1<sup>st</sup> antennal segment of males is considerably enlarged, whereas in females that 1<sup>st</sup> segment is essentially the same as



other segments. The sternal plate (ventral thorax) is well sclerotized, and bears large setae. Gonopods, with elongate setae, are well developed in females, and a mycetome is often visible, as well. Males have a well developed aedeagus (= pseudopenus) and parameres lateral to the aedeagus that can be seen in both ventral and lateral aspects. Spiracles (openings into the tracheal system) are surrounded by heavily sclerotized paratergites in both males and females.

### *Columbicola columbae*

These small ( $\approx 2.0$  mm) very slender lice, are known as “slender pigeon lice. They are host specific, being found primarily on the feathers on the undersides and upper wings of pigeons. This species exhibits a long slender head with distinctly sclerotized mandibles. Antennae are 5-segmented and filiform, and the first antennal segment is somewhat enlarged in both sexes. The 3<sup>rd</sup> antennal segment of males has a small appendage making this a sexually dimorphic character. Lateral, pre-antennal margins of the head are straight, and there are small lateral projections positioned just anterior to the antennal bases. A key feature of the head is the rounded clypeus with two pairs of spines; one pair flattened and projecting anteriorly, the other pair recurved. The slender abdomen has heavily sclerotized paratergal plates.

### *Craspedorhynchos* sp.

These small ( $\approx 2.2$  mm) lice parasitize red-tailed hawks. The head is quite large relative to the rest of the body (nearly one third as long as the total body length) and is has a long “oral passage” leading to robust mandibles placed near the center of the head. There are distinct projections extending laterally from the head at the level of the mandibles. The base of antennae lie immediately posterior to these projections. Females have a large mycetome in the posterior abdomen.

### *Cuclotogaster heterographus*

This species is known as the chicken head louse, but it has also been recorded from ring-necked pheasants, guinea fowl, and other birds, especially if raised in close association with chickens. Individuals of this species are usually found near the base of feathers on the head and neck, but may spread to other body regions in heavily infested birds. This louse feeds on barbules of feathers by cutting the barbules into short pieces and using the front legs to manipulate the bits through the mandibles. These lice thrive on the down of young chicks subjecting these young birds to greater injury than older ones. Like *C. meleagridis*, the antennae are sexually dimorphic structures, with the 1<sup>st</sup> antennal segment greatly enlarged compared with the “normally” sized 1<sup>st</sup> segment of females. Also, in males, the 3<sup>rd</sup> antennal segment has a distinct extension, or “spur”, projecting inwardly.



*Falcolipeurus* sp.

This species parasitizes turkeys. The head is described as “circumfasciate”, possessing typical ischnoceran 5-segmented antennae, and eyes. Antennae are sexually dimorphic structures, with the 1<sup>st</sup> antennal segment considerably larger in males than females. Males have distinctly sclerotized genota;oa with characteristic patches of setae near posterior margin of abdomen lateral to the genitalia. Posterior of abdomen in females distinctly bifurcate, with gonopods bearing numerous long setae.

*Goniocotes maculatus*

There are six species of this genus in North America, *G. gallinae*, the fluff louse of chickens being the most important, from an economic standpoint. *Goniocotes maculatus* parasitizes guinea fowl. These are small ( $\approx$  1.0 to 1.5 mm in length) lice with shortened, oval, bodies. The head possesses small, well sclerotized mandibles and 5-segmented antennae. Long setae, projecting posteriorly from the temporal lobes, are characteristic of the genus. Lateral margins of the prothorax are extended. Paratergites are only lightly sclerotized.

*Goniodes pavonis*

Members of this genus are cosmopolitan ectoparasites of gallinaceous birds, with *G. pavonis* being found on peafowl. There are approximately 20 species known from North America, but there may be some question of species numbers because this genus is closely related to *Goniocotes* and, historically, certain species have been moved back and forth between the two genera. *Goniodes* lice, however, are usually considerably larger than those in the genus *Goniocotes*. (In one species *Goniodes gigas*, the large chicken louse, females average 4.2 mm in length, males 3.3 mm). The heads of these lice are large (relative to overall body size), and have heavily sclerotized mandibles centrally positioned. The heavily sclerotized abdomen is distinctly rounded. Antennae are sexually dimorphic; the 1<sup>st</sup> antennal segment of males is greatly enlarged, whereas the 1<sup>st</sup> antennal segment of females is similar in size to the other segments. Additionally, there is a pronounced “thumb-like” process extending from the posterior margin of the male 1<sup>st</sup> antennal segment. Males have large, well sclerotized, genitalia; females possess typical bifurcated posterior abdomen, well defined gonopods. Paratergal plates, surrounding the spiracles, are also very well developed with extensions toward the midline of the body.

*Lipeurus caponis*

This species, known as the poultry feather or wing louse, reaches a body length of 2.3 mm. Other species of the genus parasitize ring-necked pheasants, peafowl, and guinea fowl. Bodies are elongate, narrow, with a “circumfasciate” head appearing as wide as the abdomen. Abdominal plates sclerotized, paratergal plates especially so.



Females exhibit a distinctly bifurcate (posterior) abdomen with distinct gonopods bearing numerous elongate setae.

### *Oxylipeurus polytrapezius*

This louse, known as the slender turkey louse, is a common ectoparasite of both domestic and wild turkeys. Other species in the genus are associated with chickens, quail, and ring-necked pheasants. The head is elongate, nearly the same width as the thorax and abdomen. The antennae are sexually dimorphic structures, with the 1<sup>st</sup> antennal segment in males being considerably larger than the 1<sup>st</sup> antennal segment of females. These lice have heavily sclerotized tergal, sternal, and paratergal plates on the abdomen.

### *Pegeeriella fulva*

The head of this species is typically ischnoceran with 5-segmented antennae and robust mandibles placed near the center of the head. Antennae are not sexually dimorphic in this species. Small lateral cephalic projections can be seen immediately anterior to the base of the antennae. The thorax, viewed dorsally, has three distinct regions; the pro-, meso-, and metathorax. The abdomen is distinctly sclerotized, and a mycetome can frequently be seen (internally) in the posterior abdominal region of females.

### *Philopterus migratorii*

These are small lice (1.4 to 1.5 mm) with the head exhibiting heavily muscularized temporal lobes. These muscles, apparently, operate the mandibular apparatus. Funnel-shaped “vestibular” region leading into mandibles that possess small ridges to aid in scraping host tissues. Antennae 5-segmented and filiform. At the base of antennae there are prominent lateral projections. The thorax is divided into three distinct regions; the pro-, meso-, and metathorax. The abdomen has distinctly sclerotized paratergal plates surrounding spiracles. These plates extend medially giving them a triangular appearance. Females, possess a mycetome in the posterior abdominal region.

### *Piscicola snodgrassi*

This species is an ectoparasite of the red-bellied woodpecker. Other species in the genus may be found on rough-winged swallows. Typical ischnoceran head with 5-segmented antennae and well sclerotized mandibles located centrally. This species also has small eyes.

*Strigiphilus* sp.

Owls serve as hosts for species of this genus. These lice have well sclerotized, ridged, mandibles, and powerful muscles in the temporal lobes of the head. Eyes are small, and small lateral projections extend from the head immediately in front of the antennal bases. Females have patches of setae placed laterally on the last abdominal segment.

*Trichodectes canis*

This species is a member of the Trichodectidae, a large family that includes some 21 genera of lice. Estimates of the number of species in the family vary from 220 to over 300. Individuals of *T. canis* parasitize dogs and other canines, where they are usually found on the head, neck, and tail regions. These lice use their claws mandibles to attach to the bases of hairs. The heavily sclerotized, and distinctly ridged, mandibles are placed near the anterior head margin. Members of the Trichodectidae are distinguished from other Ischnocera by having three antennal segments, rather than five, and a single prominent tarsal claw on each leg. Antennae are sexually dimorphic structures with the first antennal segment in males being much larger than that of the females. Males possess large genitalia with a distinct aedeagus and parameres. Spination of the aedeagus is especially evident when this structure is extended.

## I. Review (Quiz Samples)

## I-1. Review -- Matching

1. Order of sucking lice.

a. Ischnocera b. Anopleura c. Amblycera d. Trichodectidae

2. Another term for “incomplete development.”

a. dichoptic b. oviposit c. holoptic d. hemimetabolous

3. Genus of human pubic louse.

a. Pediculus b. Piscicola c. Pthirus d. Pegeeriella

4. Term for “club-shaped.”

a. clavate b. fasciate c. filiform d. dimorphic

5. Leg segment that attaches to body.

a. paratergite b. coxa c. cephalic d. sternal



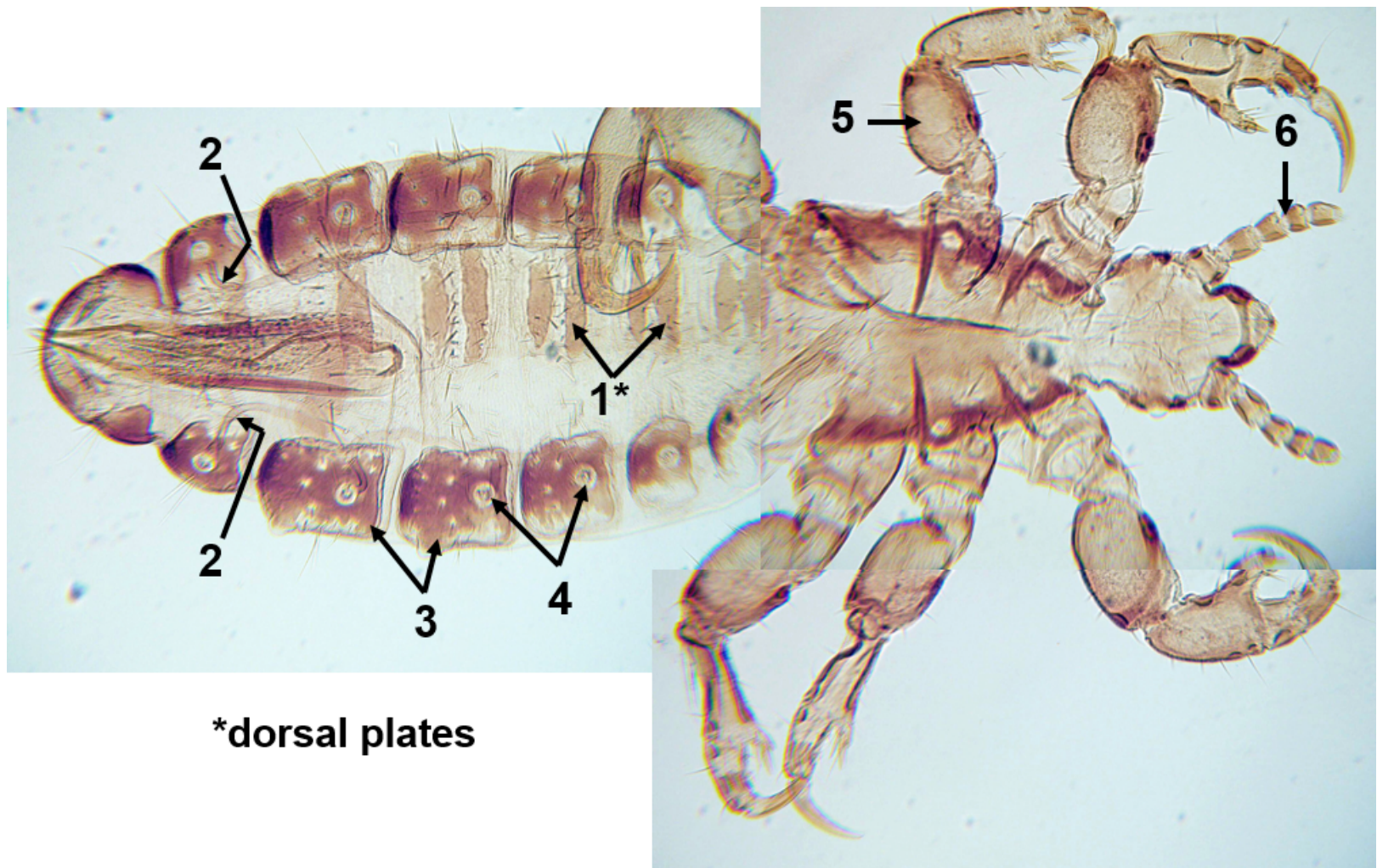
6. Mandibles are NOT present in this genus.

a. Polyplax   b. Pegeeriella   c. Pseudomenopon   d. Philopterus

7. Sclerotized plate that surrounds the spiracle.

a. clypeus   b. sternal   c. paramere   d. paratergite

I-2. Review -- Lab



**\*dorsal plates**

Identify any five of the six structures indicated by numbers.