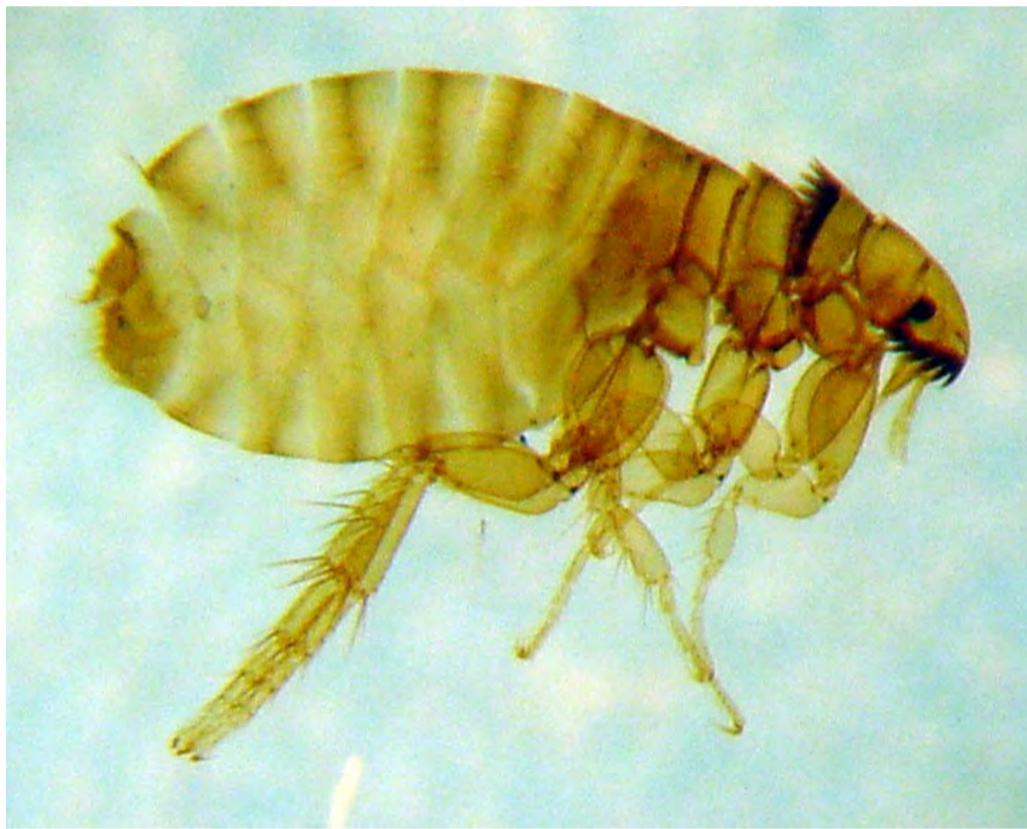


Fleas: C to X

Cediopsylla to Xenopsylla



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A. Study Goals

The principle aim of this e-Book is to assist the beginning reader in gaining a better understanding of basic flea morphology rather than offering discussions on pathogens or epidemiology of pathogens vectored by fleas. There are many genera and species with wide geographic distributions, but it is not the intent of this e-Book to discuss taxonomic issues that are best left to the experienced siphonapteran specialist. Readers are referred to the following reference work for a thorough treatment of these insects, the pathogens they vector, and for an extensive coverage of the literature.

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

A-1. References

Older works can be helpful in flea identifications, along with providing hosts and geographic distributions for many New World species.

Fox, I., 1968. *Fleas of Eastern United States*. Hafner Publ. Co

Furman, D. P. and E. P. Catts. 1970. *Manual of Medical Entomology*, 3rd Ed., National Press Books, Palo Alto, CA.

Harwood, R. F. and M. T. James, 1979. *Entomology in Human and Animal Health*, 7th Ed., Macmillan Publ. Co., New York, NY.

Kettle, D. S., 1994. *Medical and Veterinary Entomology*, 2nd Ed., CAB International, Wallingford, UK.

Lewis, R. E. 1998. Resume of the Siphonaptera (Insecta) of the world. *Journal of Medical Entomology* 35: 377-389.

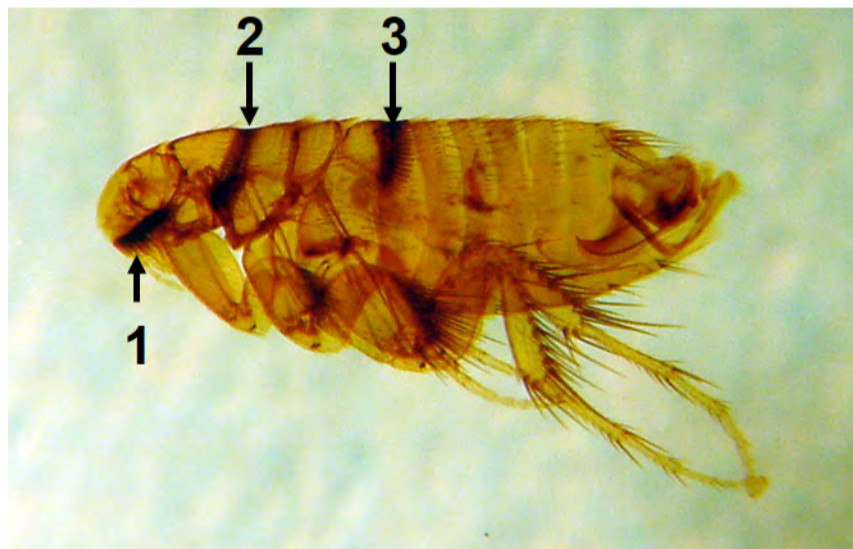
Stark, H. E., 1958. *The Siphonaptera of Utah*. U. S. Department of Health, Education, and Welfare, Public Health Service, Communicable Disease Center, Atlanta, GA.

Traub, R., M. Rothschild, and J. Haddow. 1983. *The Rothschild Collection of Fleas. The Ceratophyllidae: Key to Genera and Host Relationships with Notes on their Evolution, Zoogeography and Medical Importance*. Cambridge University Press, Cambridge, UK.

B. Fleas – General Comments

Most of the 2,500 species and subspecies of fleas are ectoparasites of terrestrial mammals; relatively few species parasitize birds. Lewis, alone and with co-authors, published extensively from 1972 through 2006 on taxonomy and geographic distribution of this assemblage of insects. Fleas are particularly associated with those mammalian hosts that utilize nests, dens, or caves, and thus are most common on rodents, carnivores, bats and rabbits, while seldom observed on free-ranging ungulates, and primates. Moreover, fleas generally exhibit little host specificity (e.g., most species are able to utilize several different host species). This ability to transfer from one host species to another enhances their prospects for transmitting pathogens.

Fleas have relatively simple life cycles, going through the egg, larva, and pupa developmental stages before becoming adults. Flea eggs are large relative to the size of the female and consequently females only deposit from one to six eggs per day. The flea larva hatches from the egg and progresses through three instars (larval stages).



Stenoponia americana, characterized by 3 ctenidia – genal, pronotal and abdominal (1, 2 & 3, respectively). Note: These two individuals, a male to the left and female (with two eggs) to the right, were photographed with the aid of a stereomicroscope at the same magnification. Relative sizes of these individuals were not altered in transfer to this e-Book.

These very active larvae have a distinct head and 13 body segments, but there is no distinction between thoracic and abdominal regions like that seen in mosquito larvae. Flea larvae are vermiform (worm-like), and lack appendages and eyes.



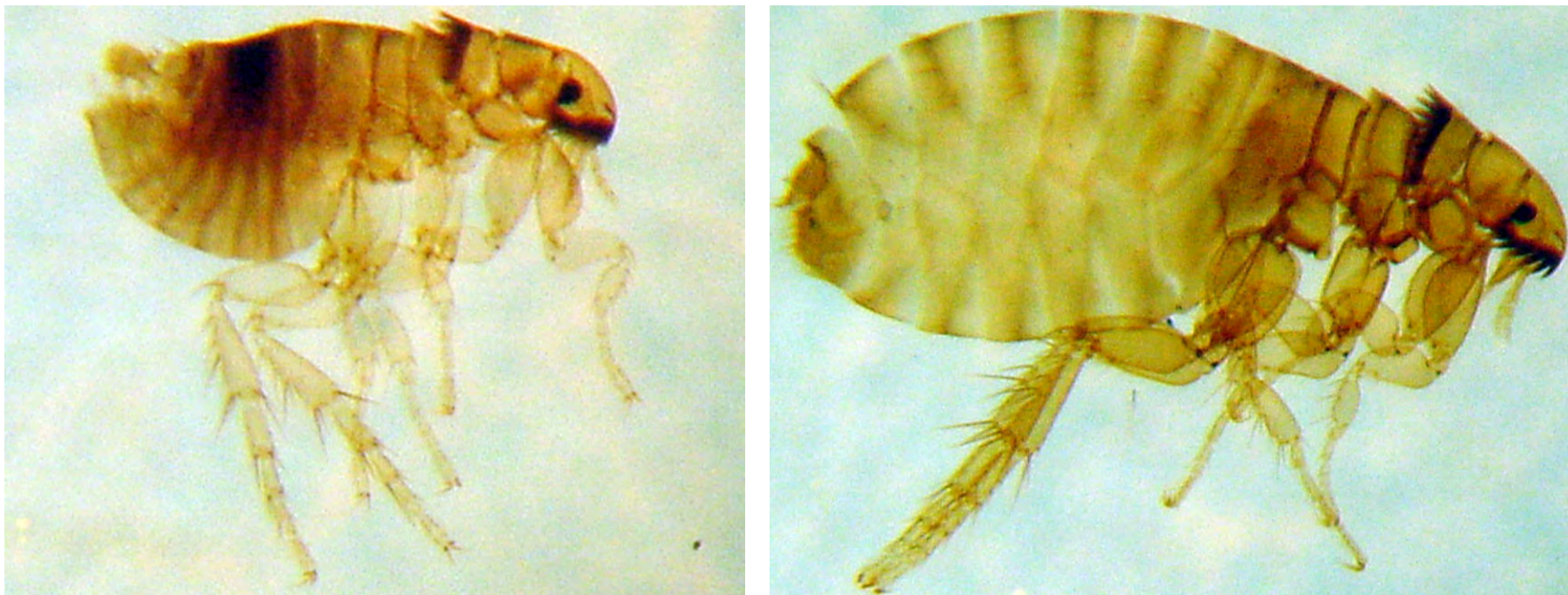
Xenopsylla: larva & engorged adult (left); feeding (right).

Larvae feed on organic debris in the host's nest, including dried blood and urine mixed with debris that may occur in the nest. Curiously, some flea larvae use their mandibles to attach to the posterior of adults to imbibe fecal blood released by those adults. Moreover, larvae may be semi-predatory, and they will attack, and kill, adults that have been damaged in some way. Larval development is dependent on temperature and humidity. The fully developed 3rd instar will develop to the pupal stage by spinning a thin, loose-woven "silky" cocoon. Cocoons become darker in color when minute pieces of debris adhere to the "silk." Adults emerge from the cocoon by using a frontal tubercle on the head to cut through fibers of the cocoon. Females often emerge a few days before the males.

C. Adult Flea Identification – Overall Body Morphology

All fleas have the same basic structure, and exhibit many adaptations to the ectoparasitic mode of existence. Adult fleas are laterally flattened, and the body is covered with backward-pointing spines; both features allowing for ease of movement through the host's pelage, and making it difficult to be removed by grooming activities of the host. The head is relatively immovable, being fixed on the anterior region of the thorax (i.e., the prothorax), and the antennae are recessed in antennal grooves (or antennal fossae), adding to the "streamlining" effect of these laterally flattened insects.

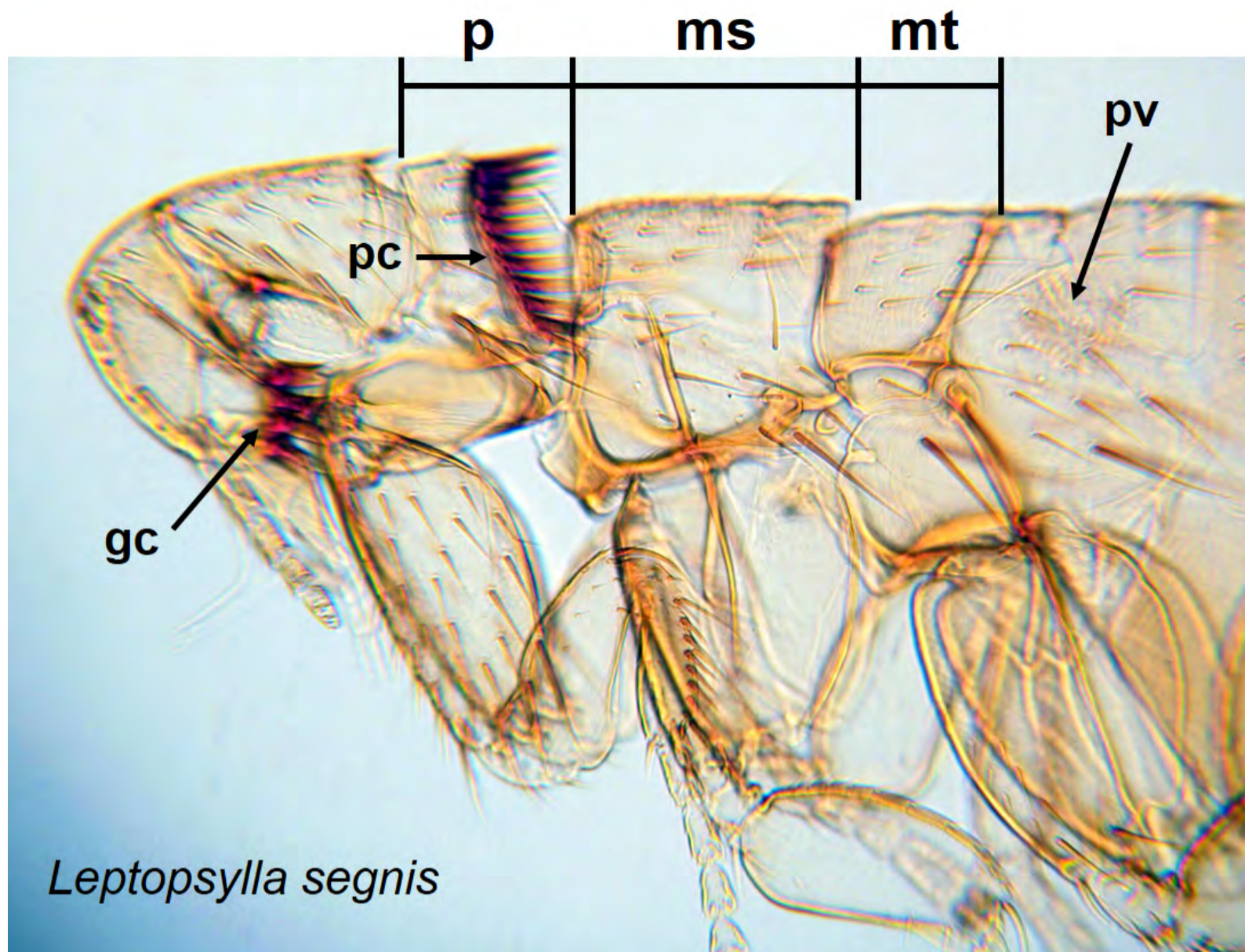
Adult fleas are wingless, laterally flattened ectoparasites with bodies divided into three body regions: the head, the thorax, and the abdomen. The thorax is further subdivided into pro-, meso-, and metathorax.



Ctenocephalides felis; male (left), female (right).



Leptopsylla segnis, male, entire (composite). Head (H), thorax (T) and abdomen (A).



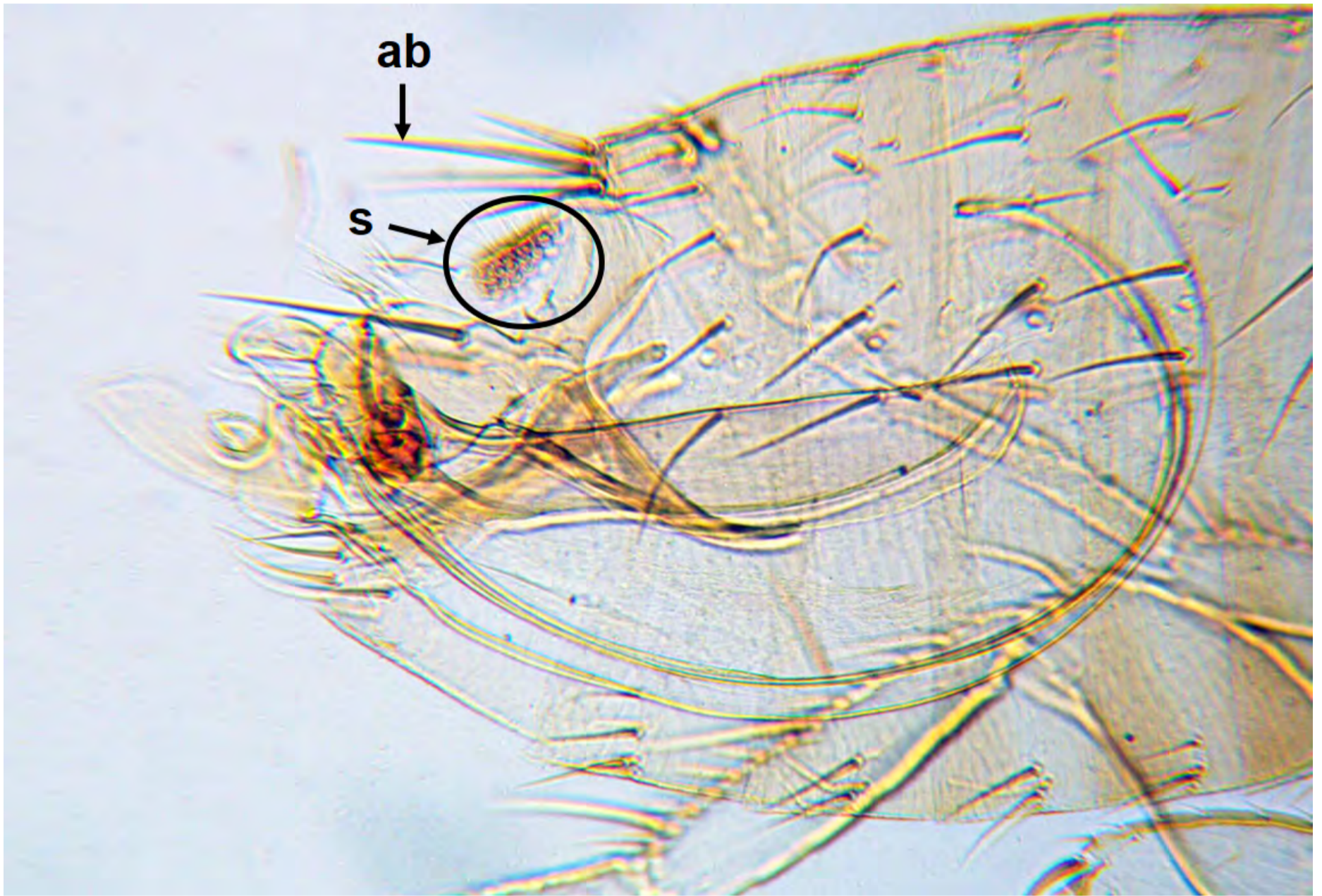
Head and thorax. Legend: gc, genal ctenidium p, prothorax; ms, mesothorax; mt, metathorax; pc, pronotal ctenidium; pv, proventriculus (internal).

Fleas have three pairs of legs, one pair attached ventrally to each thoracic region. Females are generally somewhat larger than males. Although not a definitive characteristic the dorsal abdomen of females is often rounded, or slightly convex, whereas the dorsal abdomen of males tends to be flattened, or concave.



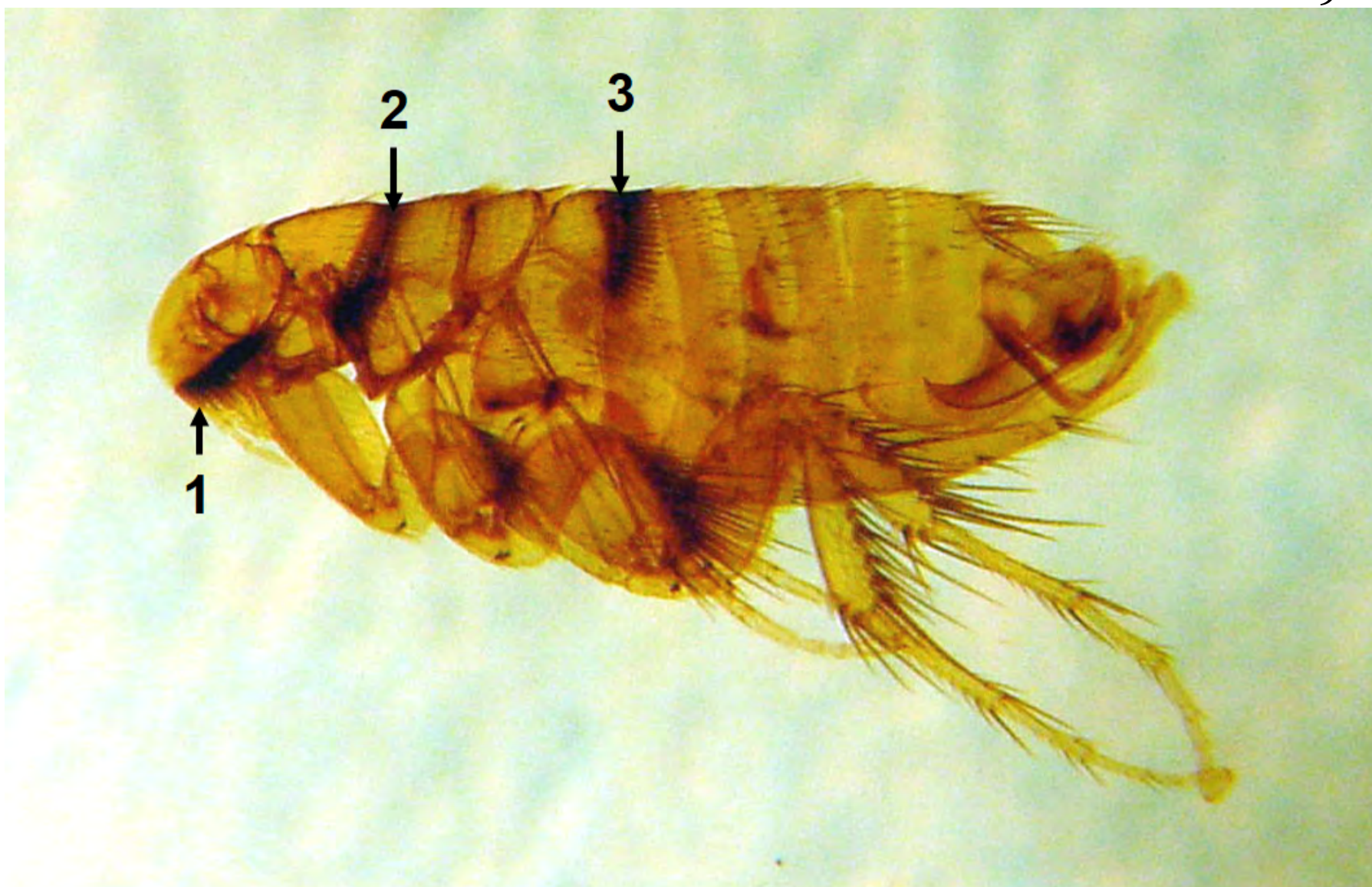
Orchopeas wickhami male (left) and female (right). Photographed at same stereoscopic magnification and transferred to this e-Book without alteration so relative sizes are representative.

Another structure characteristic of fleas is the prominent sensillum, or pygidium located dorsally near the posterior extremity of the abdomen. Just anterior to the sensory sensillum is a pair of stout antesensilial setae, or antepygidial bristles, located on the dorsal (i.e., tergum) posterior margin of the abdomen.



Leptopsyllus segnis, posterior of male with sensillum (s), and antesensilial bristle (ab)

Most fleas also possess broad spines arranged collectively in structures called ctenidia, or combs which, like body spines, enable these ectoparasites to maintain their residence on the host. Ctenidia, if present, may occur on the “cheek” area (i.e., genu) immediately above the mouthparts (a genal ctenidium); on the dorsal posterior part of the first thoracic region, or pronotum (a pronotal ctenidium); or on an abdominal segment (an abdominal ctenidium). Some fleas (e.g., *Pulex*, *Xenopsylla*) lack ctenidia, while others (*Stenoponia*) possesses all three types (i.e., genal, pronotal and abdominal).



Stenoponia americana (male) with 3 ctenidia – genal, pronotal and abdominal (1, 2 & 3, respectively).

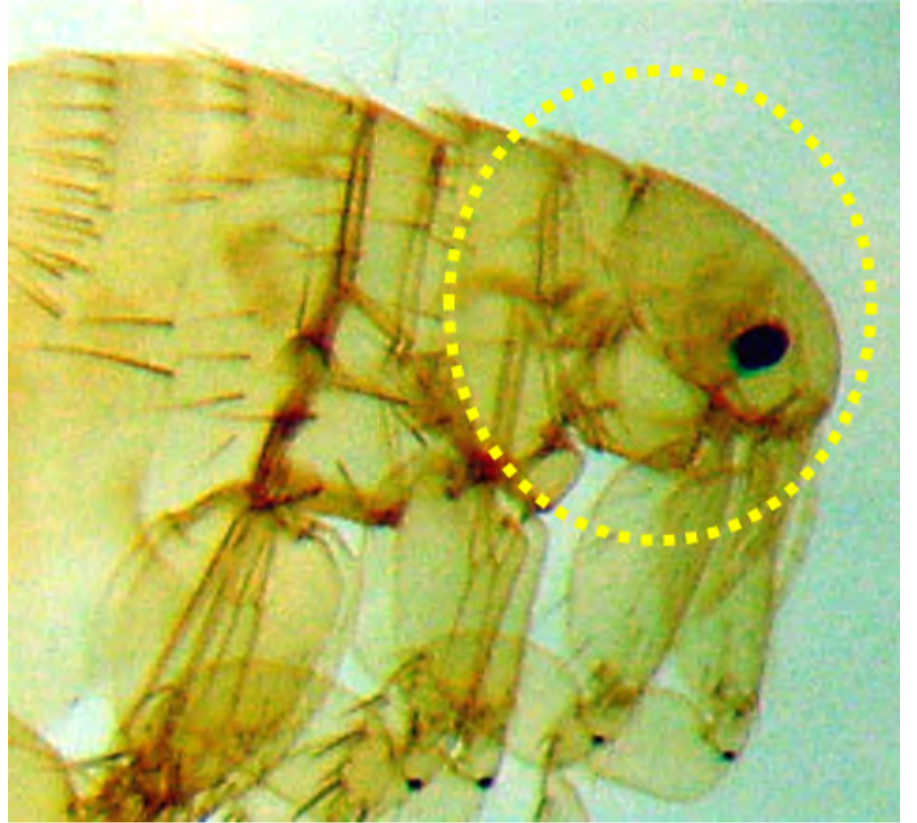


Pulex irritans female. Note the absence of both genal and pronotal ctenidia.

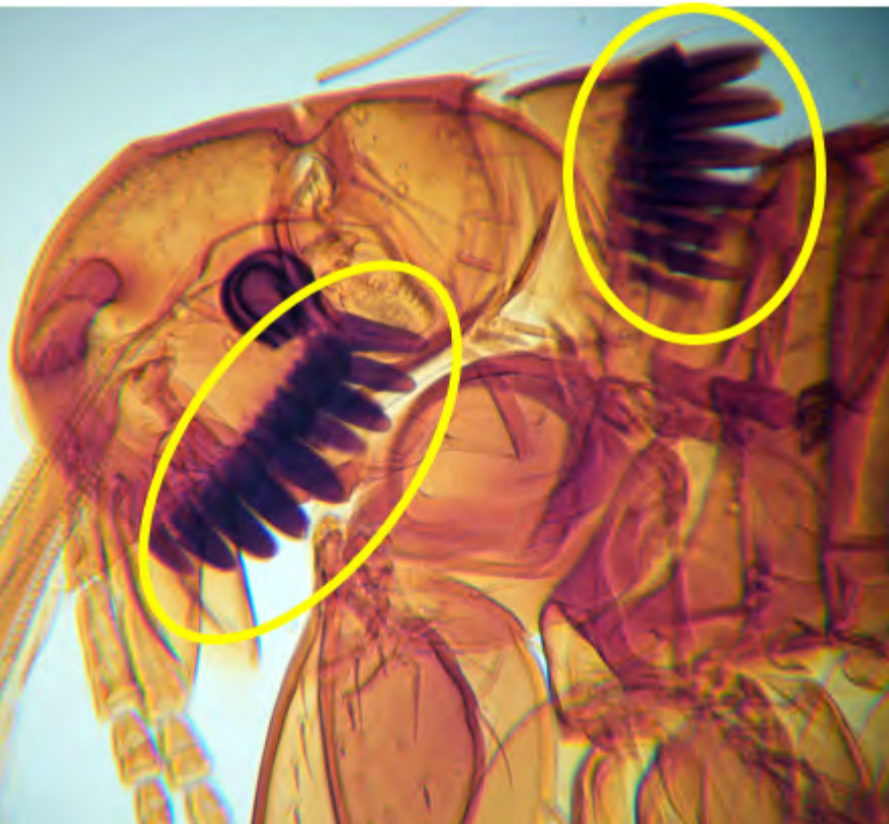
Various combinations of ctenidia occur. The genus *Myodopsylla* possesses stout spines sometimes characterized as “false combs” on abdominal segments, in addition to the genal and pronotal ctenidia.



Orchopeas leucopus, One ctenidium (pronotal)



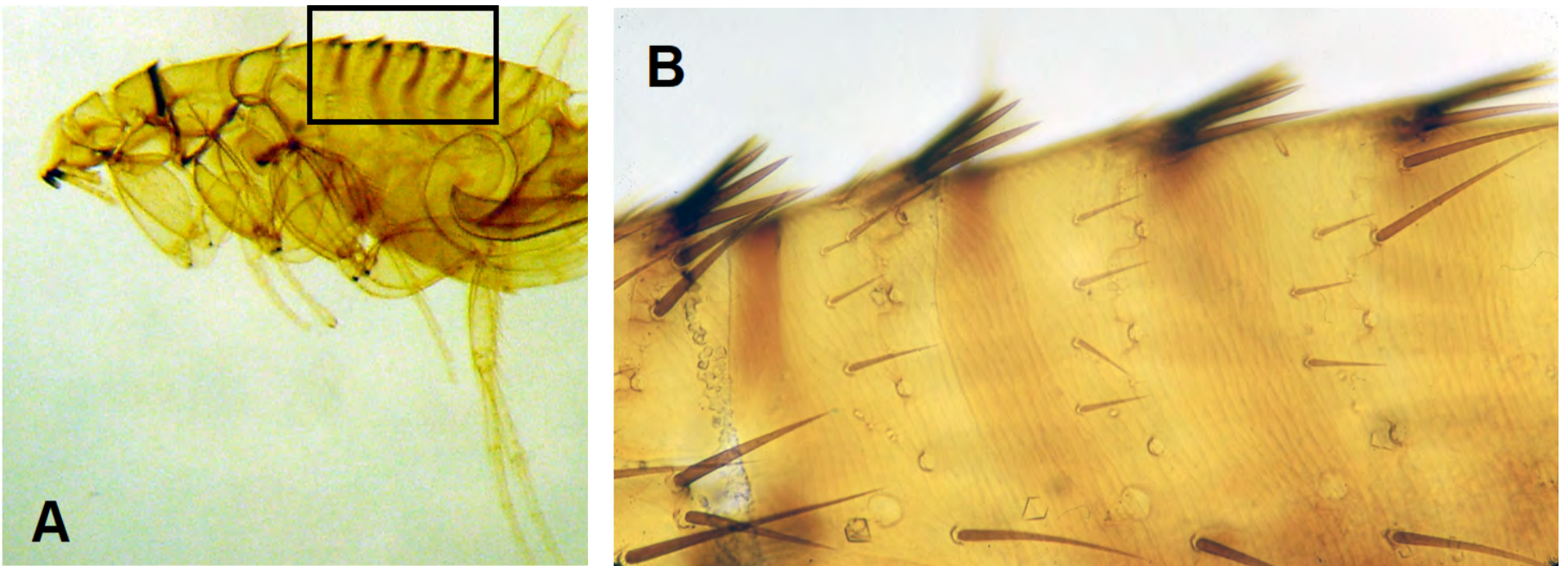
Xenopsylla cheopis, No ctenidia



Spilopsyllus cuniculi, Two ctenidia (genal and pronotal)



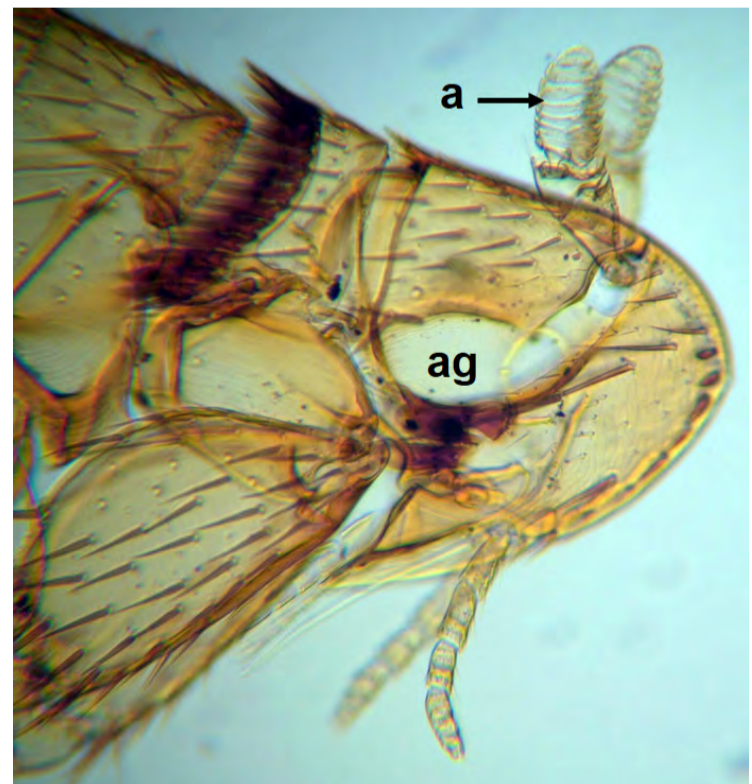
Stenoponia americana, Three ctenidia (genal, pronotal, and abdominal)



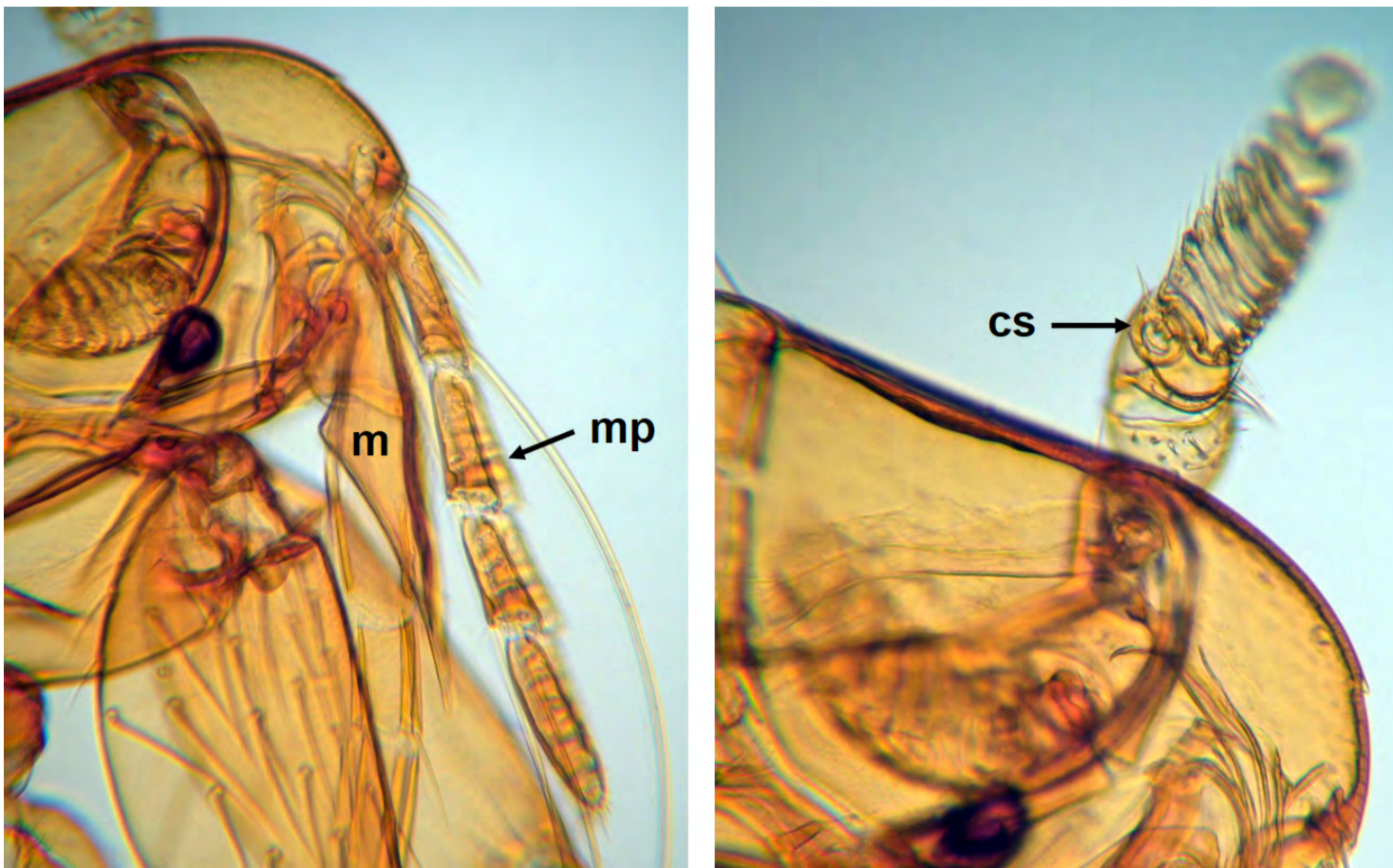
Myodopsylla sp., entire, male. Note the presence of genal (g), pronotal (p), and abdominal (a) ctenidia (= combs). Abdominal ctenidia are sometimes referred to as “false combs.” Box in A enlarged in B.

C-1. Adult Flea Identification – The Head

The head of a flea is a specialized cranial capsule set closely to the thorax (the anteriormost region of the thorax called the prothorax) in such a way that there is only limited movement. The clypeus and frons, head segments clearly demarcated in many insects, are poorly defined in fleas. There are antennal grooves, or antennal fossae, on the side of the head that contain the small knobbed and segmented antenna(e). In males there may be a copulatory sucker, or adhesive disk, on each antenna that is used to hold the female above the male during copulation. This is a sexually dimorphic character (meaning a feature that can be used to differentiate males from females), but it can only be seen if the antennae are extended from the antennal grooves.

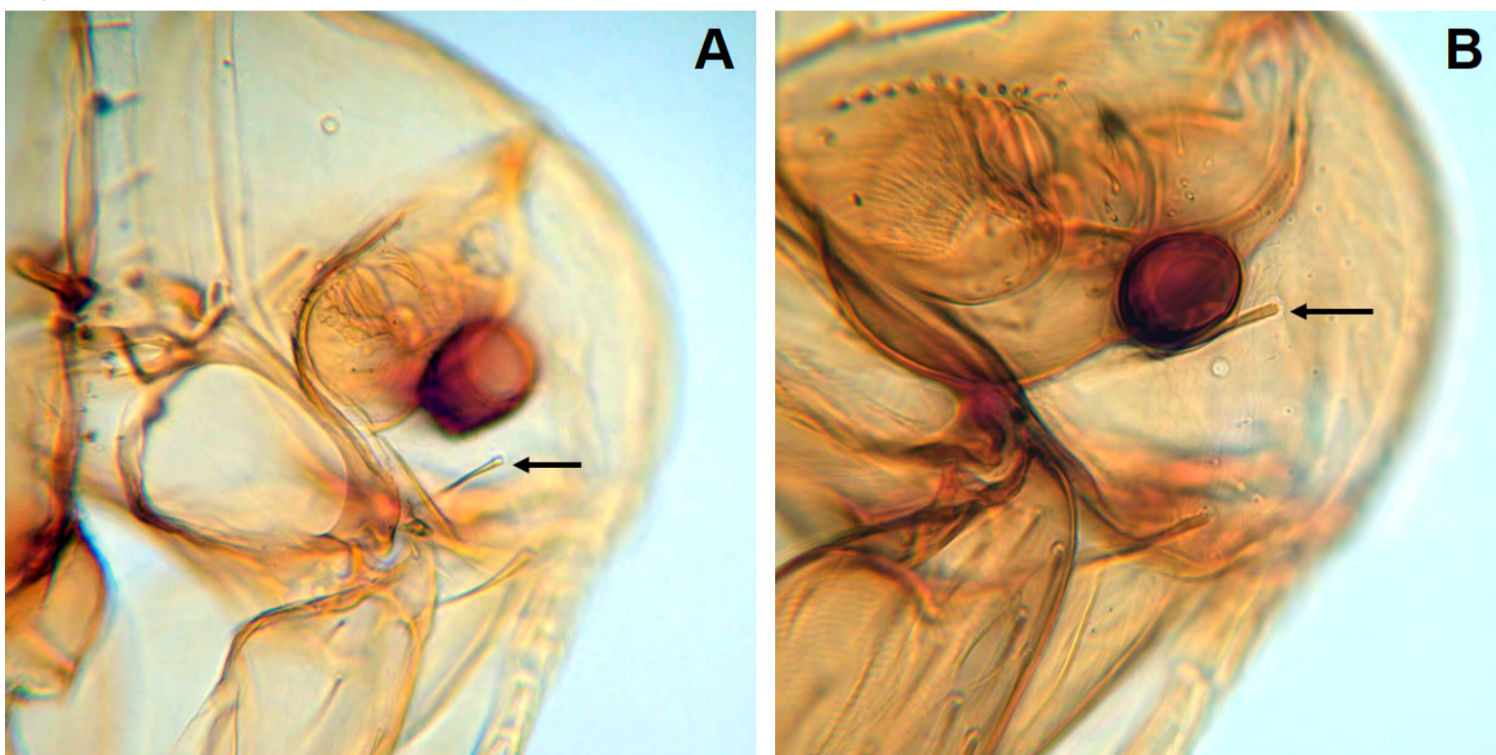


Peromyscopsylla hesperomys head. Legend: a, antenna; ag, antennal groove; dc, dorsal sulcus.



O. arctomys male head showing elongate maxilla and copulatory sucker on inner surface of antenna. Legend: cs, copulatory sucker; m, maxilla (stipes) ; mp, maxillary palp.

In front of the antennae are the inconspicuous eyes. These are not compound eyes, but rather “simple” eyes, or ocelli (singular, ocellus). Ocelli only detect light, they do not form images like compound eyes of many other insects (like flies and mosquitoes, other important insects from a medical and veterinary entomology perspective). In *Pulex* and *Xenopsylla* there is a distinct ocular bristle located immediately in front of the eye. The position of this bristle is used to differentiate between those two genera of importance because they are associated with humans, and rats. Some fleas do not possess eyes.



Note position of ocular bristle (arrows); below eye in *Pulex* (A), and at mid-level of eye in *Xenopsylla* (B). Members of both genera lack genal and pronotal ctenidia.



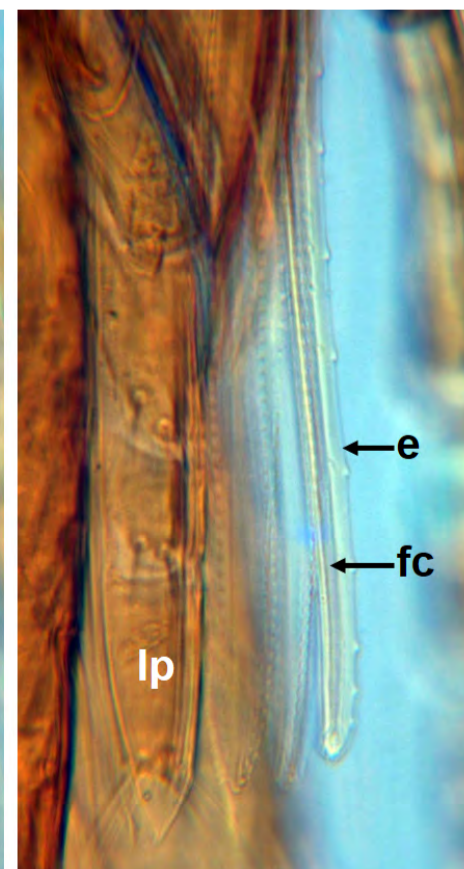
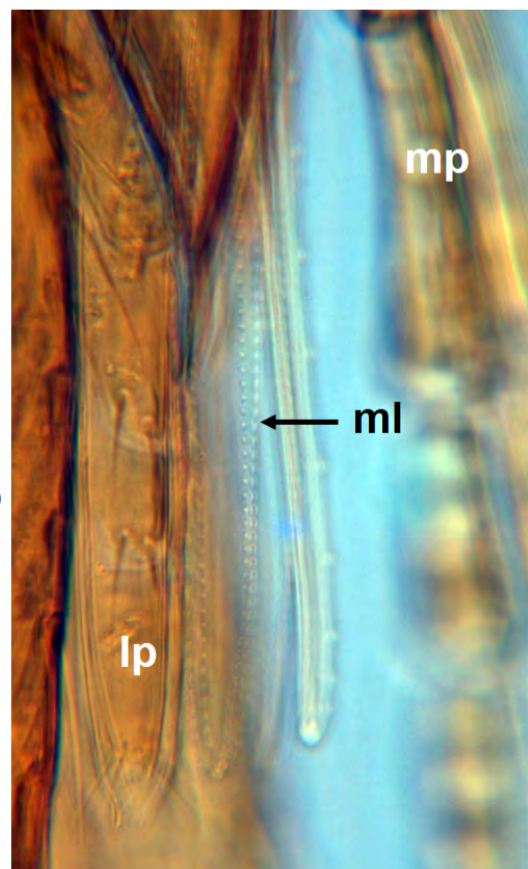
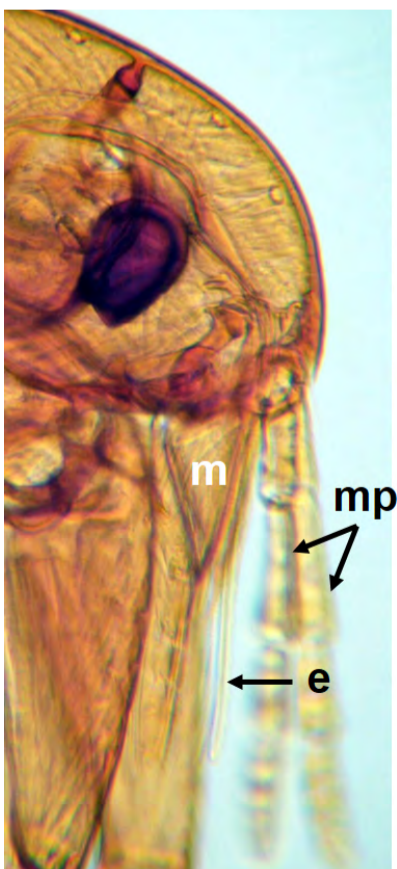
Two species
of fleas that
lack eyes.



Peromyscopsylla hesperomys

Leptopsylla segnis

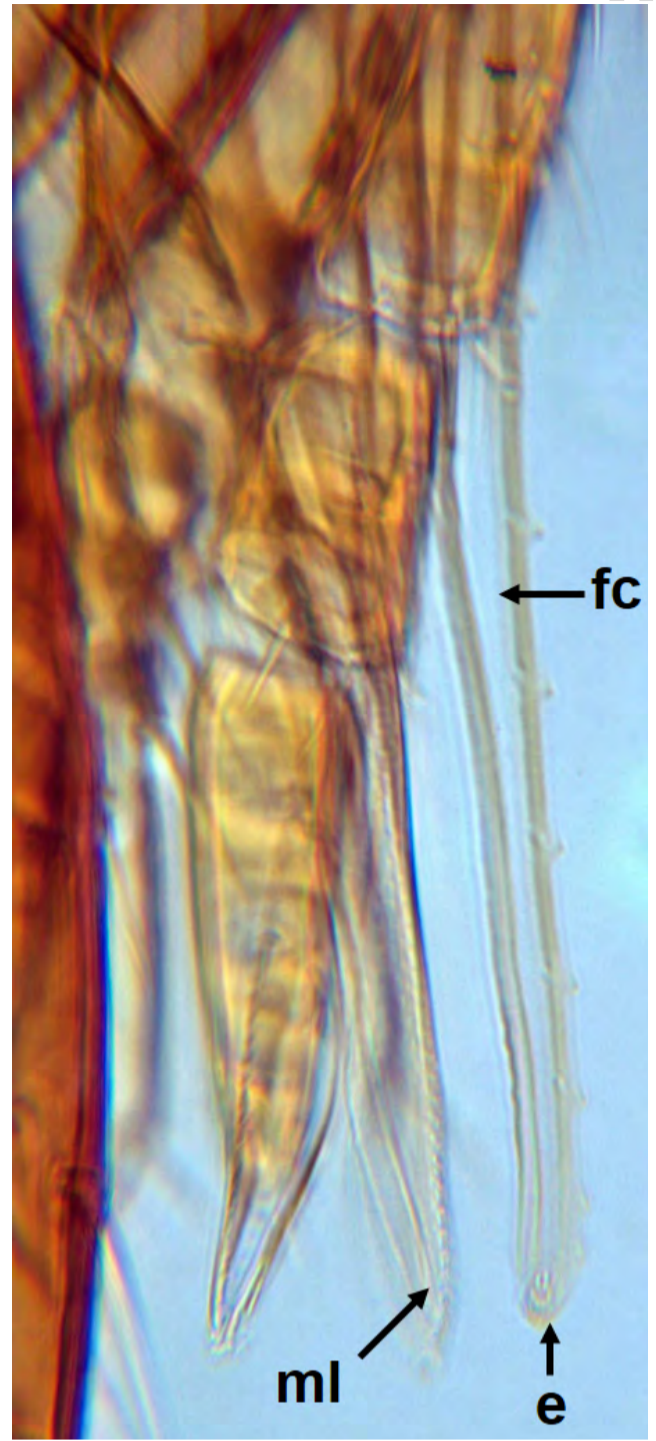
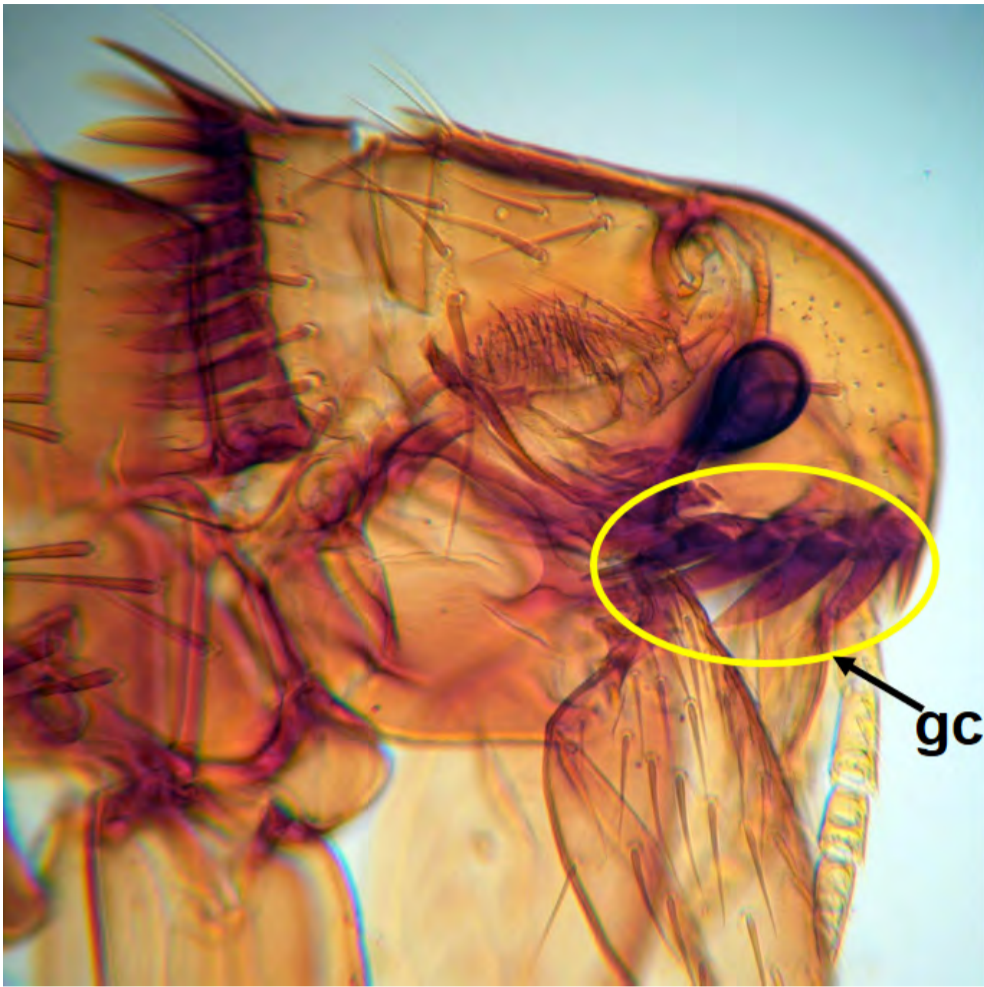
The mouthparts, characterized as of the piercing/sucking type, are located immediately below the genal ctenidium, or the lower margin of the head in those fleas lacking a genal ctenidium. You should be prepared to identify: the maxilla (or stipes, pl. stipites), the maxillary laciniae, the maxillary palps, the labial palps, and the epipharynx. The two serrated maxillary laciniae and the epipharynx, containing the food canal, are the three stylets that pierce the skin of the host to allow feeding. The hypopharynx, a prominent structure that contains the salivary canal in other blood feeding insects, is much reduced in fleas. The saliva of fleas is conveyed into the wound by the laciniae, which are grooved along their inner margins. These grooves form a tube when laciniae are closely opposed, and it is this “tube” that serves as the salivary canal.



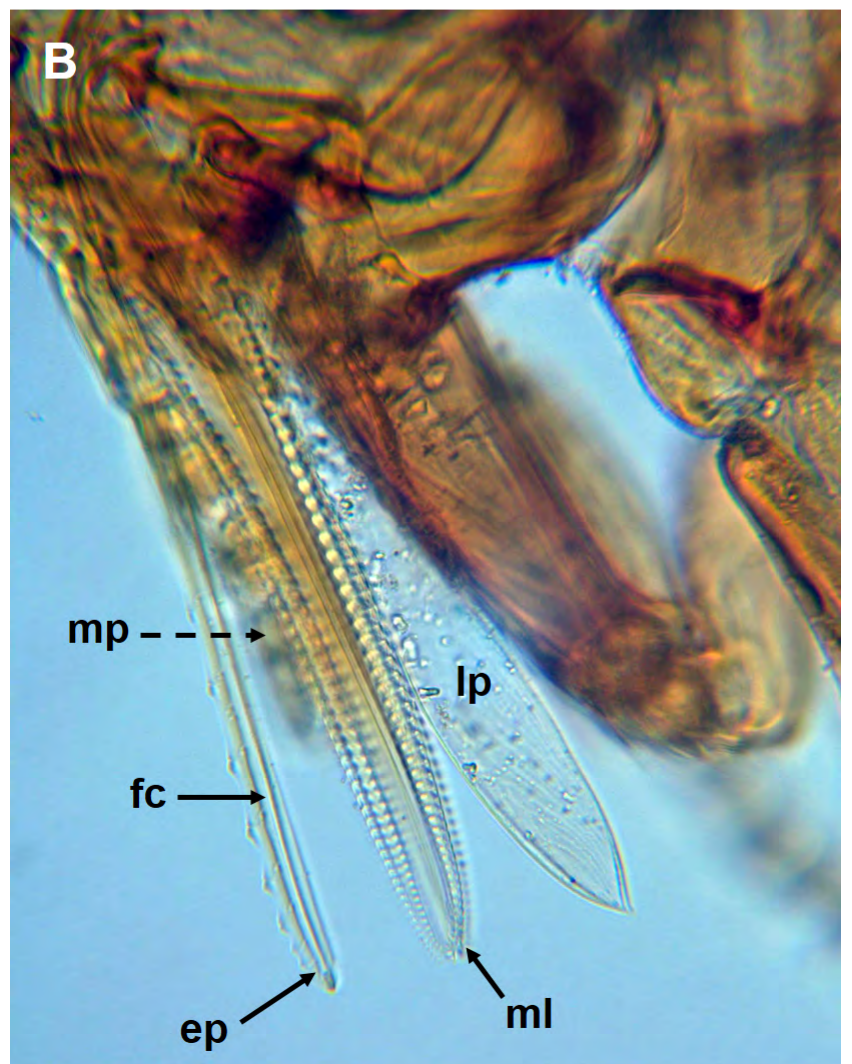
Pulex irritans: female,
mouthparts.

Legend:

e, epipharynx (or
labrum-epipharynx);
fc, food canal;
lp, labial palps; m,
maxilla (stipes); ml,
maxillary laciniae; mp,
maxillary palps

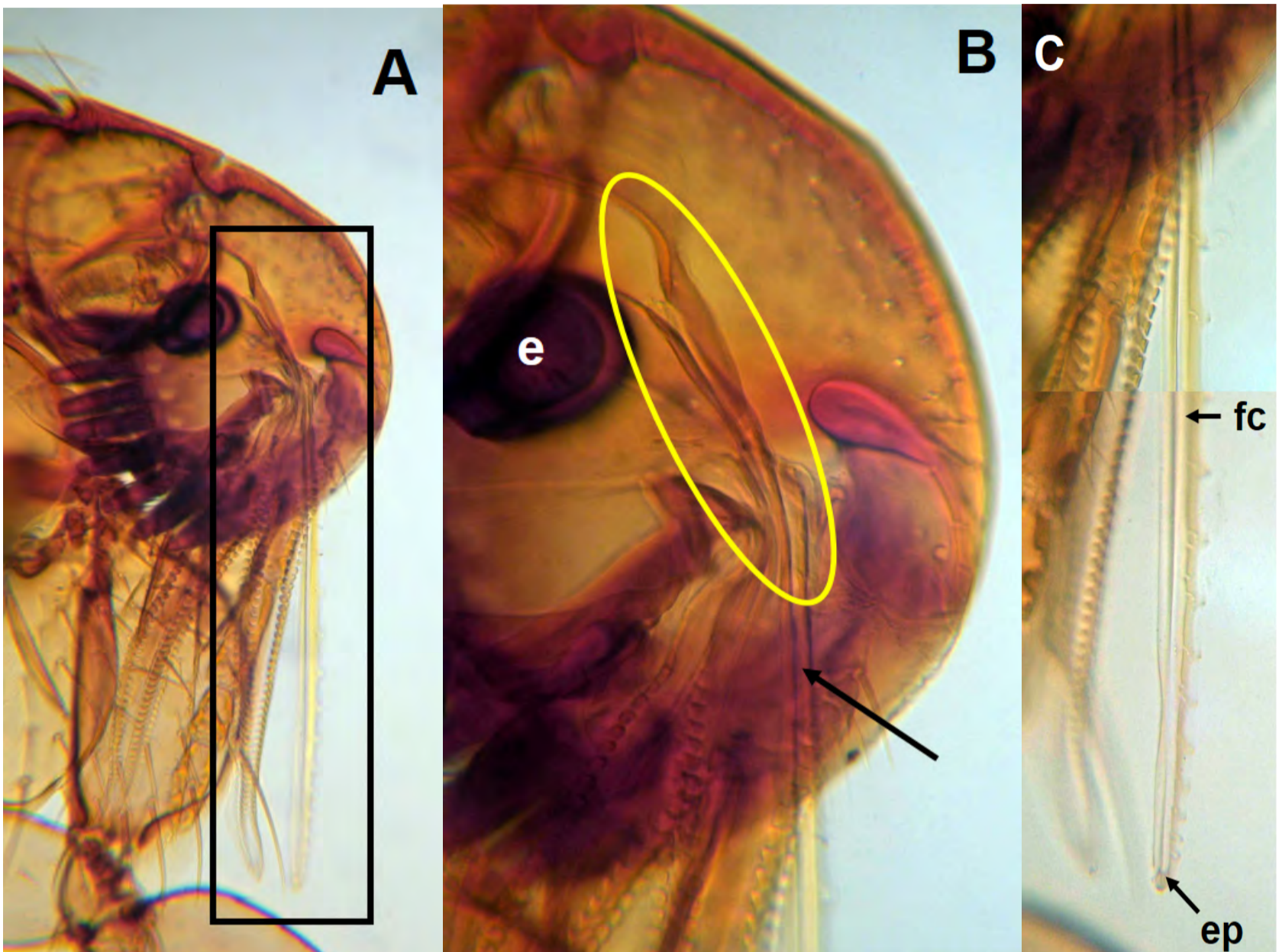


Ctenocephalides canis mouthparts ventral to genal ctenidium. Legend: fc, food canal; e, epipharynx; gc, genal ctenidium; ml, maxillary laciniae.



Echidnophaga gallinacea mouthparts (box in A enlarged in B). Legend: ep, epipharynx (with food canal, fc); lp, labial palp; ml, maxillary laciniae; and mp, maxillary palp

In some fleas there is a dorsal sulcus, or furrow, located immediately above the base of the antennae. The frons and clypeus, so clearly evident in the “generalized” insect, are poorly defined in fleas. Fleas also possess a cibarial pump which draws blood through the food canal into the gut.

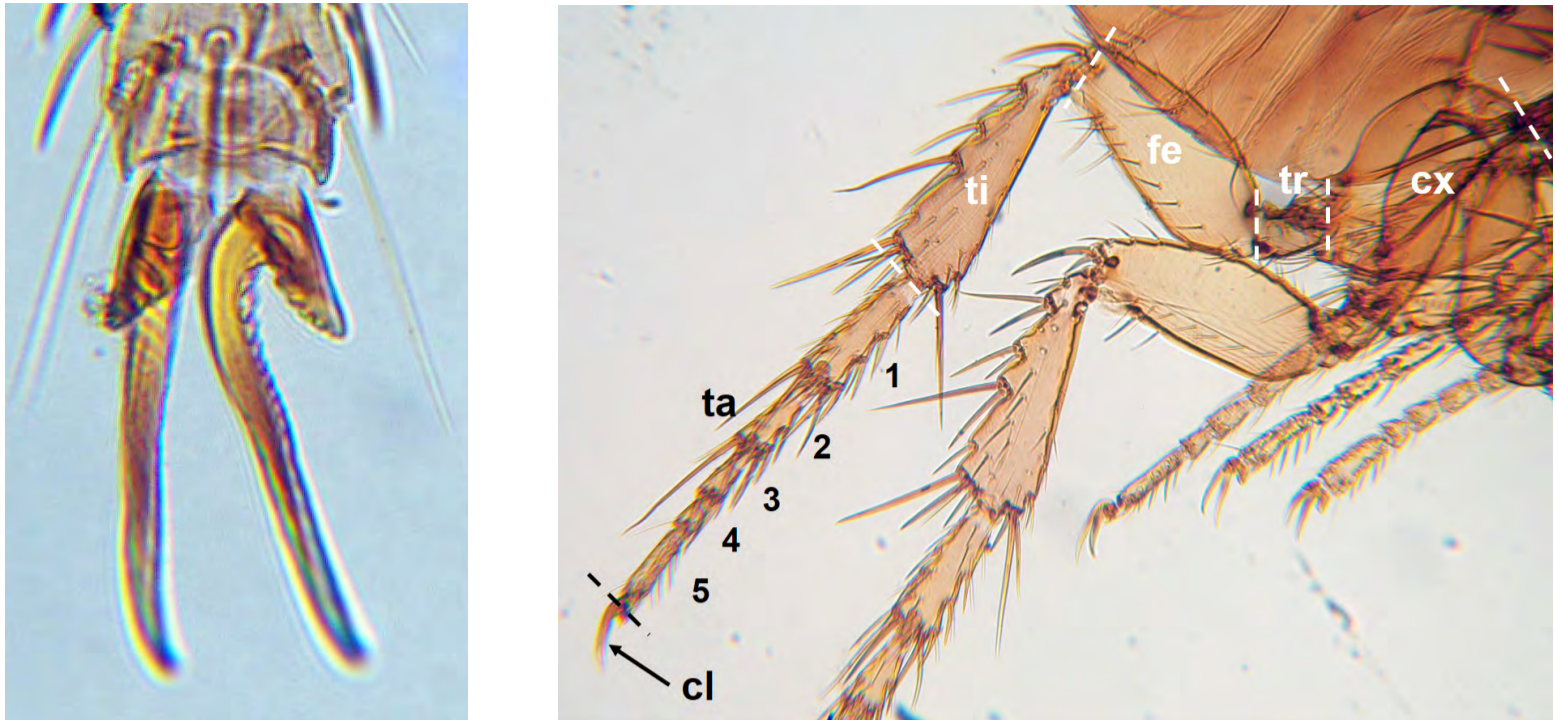


Cediopsylla simplex, cibarial pump (oval in B). Box in A enlarged in B & C.

Legend: e, eye; ep, epipharynx; fc, food canal

C-2. Adult Flea Identification – The Thorax

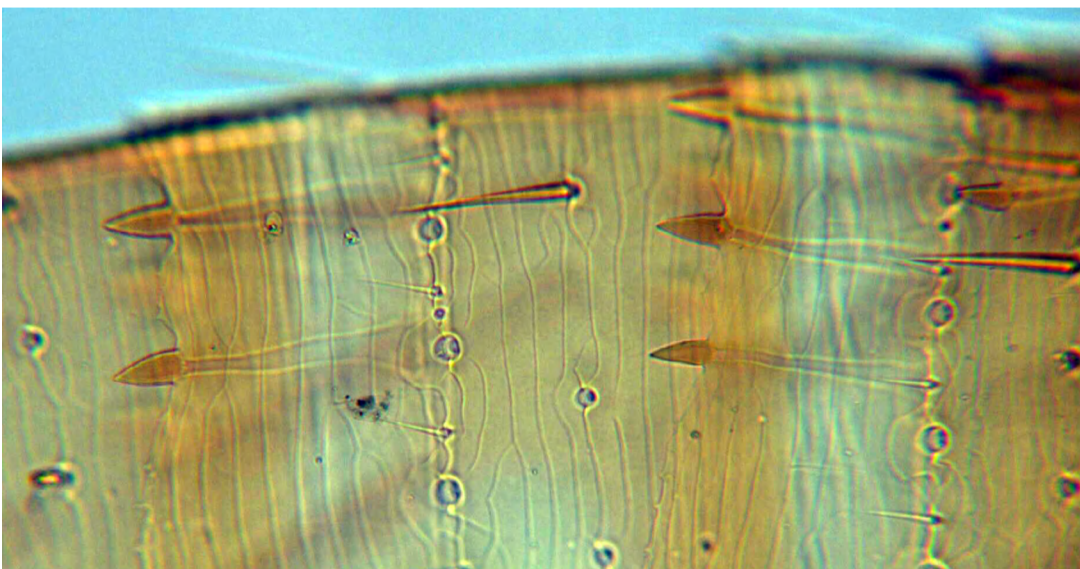
The thorax is divided into three regions (anterior to posterior); the prothorax, the mesothorax, and the metathorax. A pair of legs is attached to each thoracic region with the third pair of legs allowing for an impressive jumping ability in this group of insects. The leg segment that articulates with the body is the coxa. Proceeding distally from the coxa the leg segments are: the trochanter, the femur, the tibia, and the tarsus (made up of 5 tarsal segments). There are stout plantar bristles located on the distal tarsus. The leg terminates in a bifid claw. Identifying leg segments is necessary because some identification keys refer to the distribution of spines or setae on certain leg segments.



Ctenocephalides felis; Leg segments (3rd leg with segments). Legend: cx, coxa; cl, claw; fe, femur, ta, tarsus (5 tarsal segments); ti, tibia; tr, trochanter.

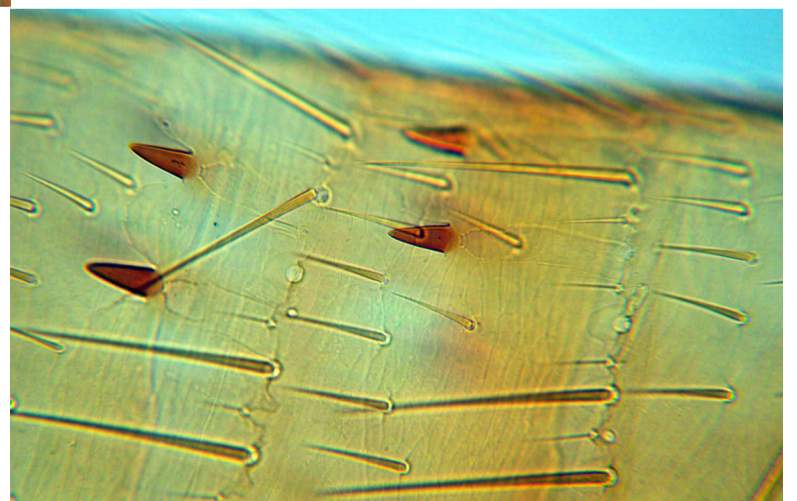
C-3. Adult Flea Identification – The Abdomen

The abdomen is made up of 10 segments bearing numerous backward-pointing bristles that facilitates forward movement of the flea through the host's pelage. Dorsal segments are referred to as tergites, or collectively, the terga. Ventral segments are sternites, or collectively, the sterna. There may be stout, bullet-shaped abdominal spinlets (= apical abdominal spines) present on the abdominal terga in some genera.



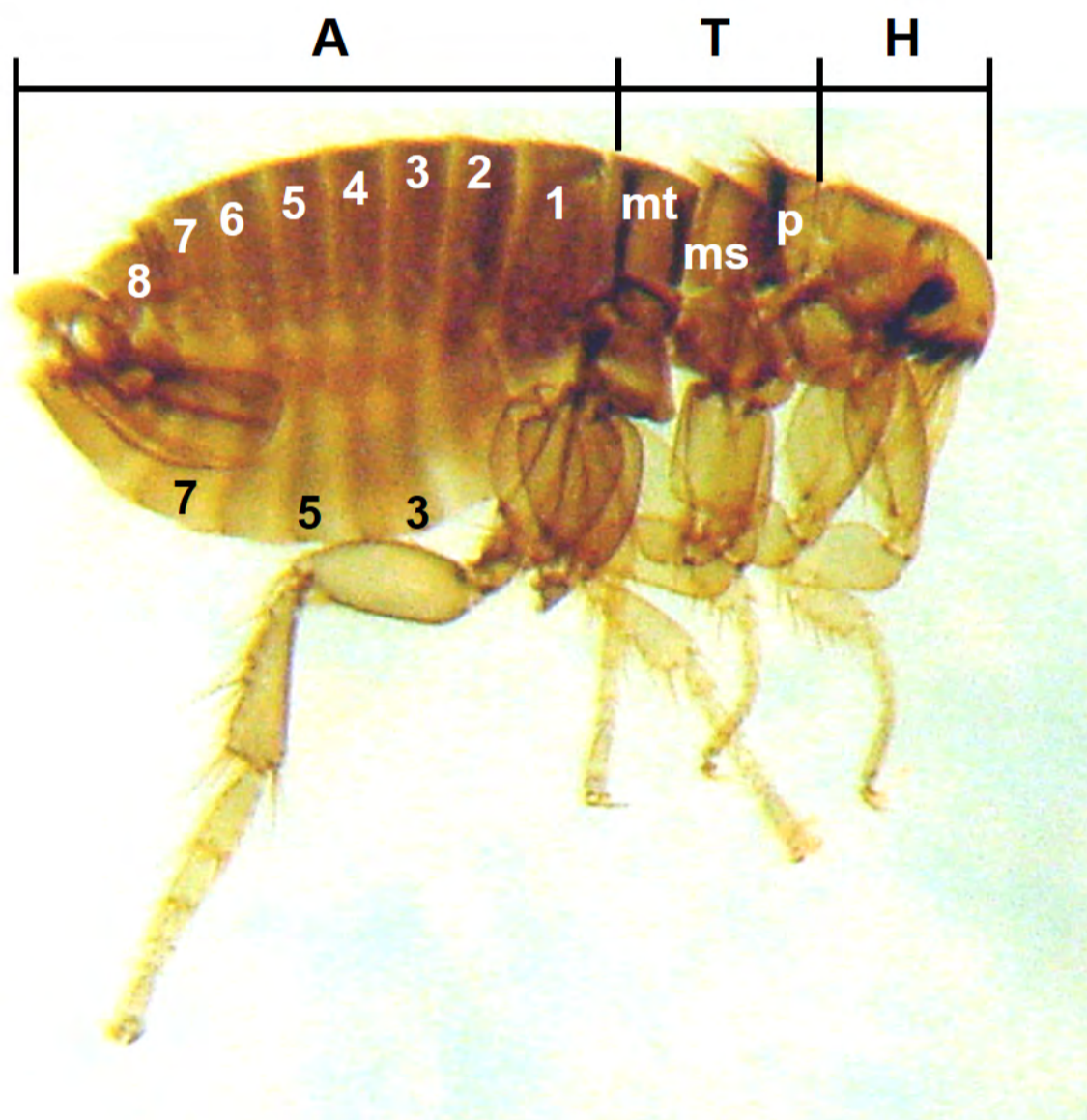
P. hesperomys apical spines, dorsal abdominal segments.

Odontopsyllus dentatus, apical spines (“apical abdominal spinlets” of some authors) on dorsal abdominal segments





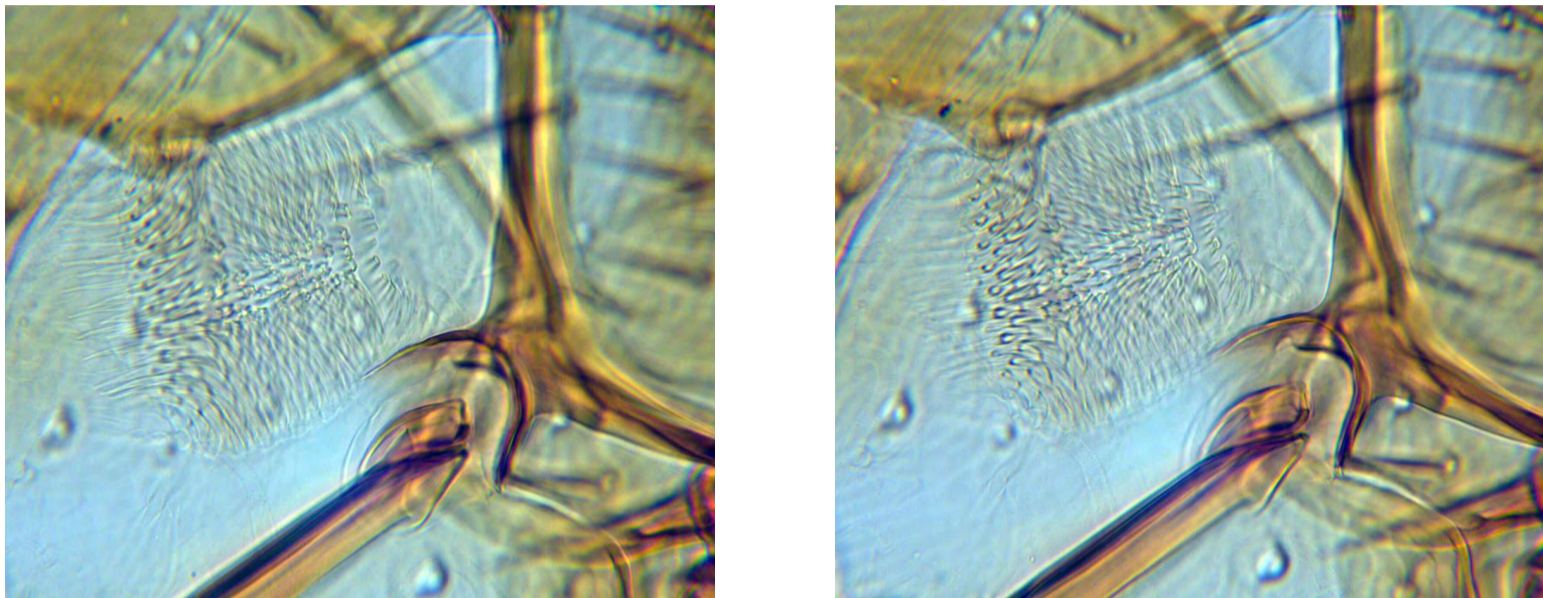
Peromyscopsylla hesperomys, female; abdomen with backward pointing spines.



Ctenocephalides canis, male

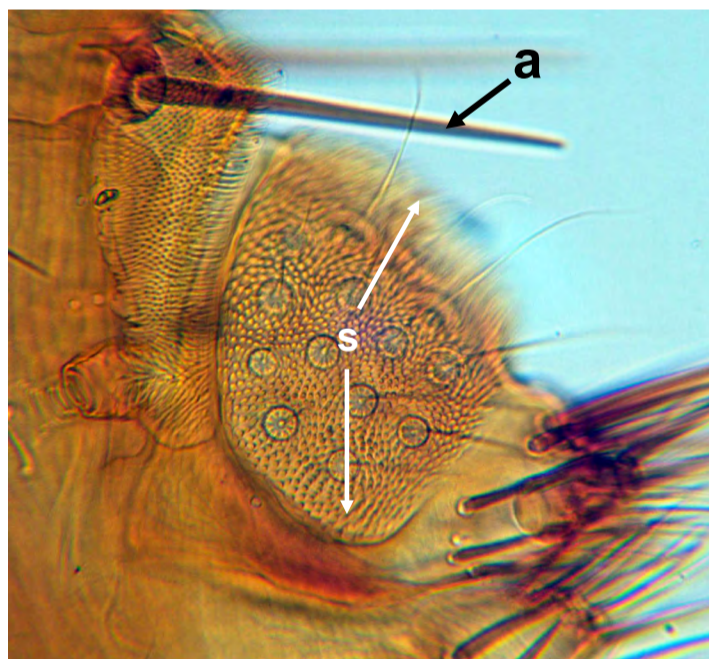
Legend: H, head; T, thorax; A, abdomen; (p, prothorax; ms, mesothorax; mt, metathorax); abdominal tergites (white numbers), sternites (black numbers).

The internal proventriculus can be seen where the thorax and abdomen meet in cleared specimens mounted on glass microscope slides. This unique internal structure, lying at the junction of the esophagus and stomach, consists of many proventricular spines (these spines are considered modified setae by some authors) that prevent the regurgitation of blood from the stomach back into the esophagus. These spines may also aid in lacerating host erythrocytes (Kettle, 1995).



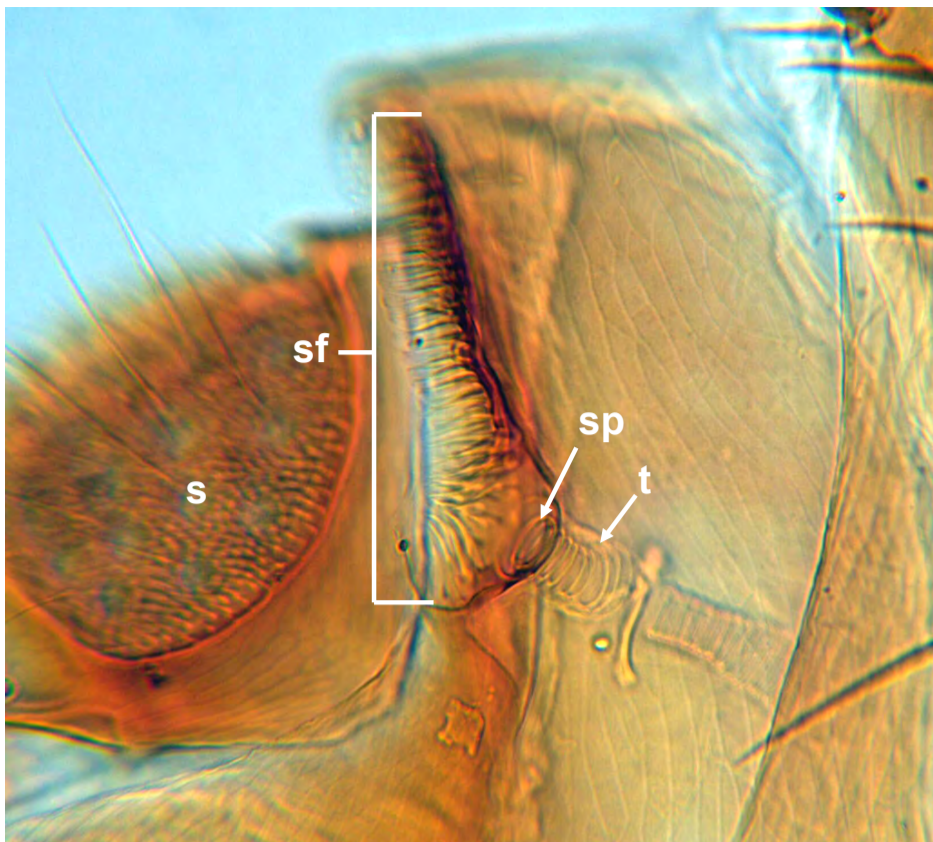
P. hesperomys proventriculus (2 depths of fields to show spines of this internal structure).

The 7th abdominal tergite bears stout antepygidial bristles or antesensilial bristles (or setae) and the 9th tergite consists of a large pincushion-like structure known as the pygidium, or sensillum.

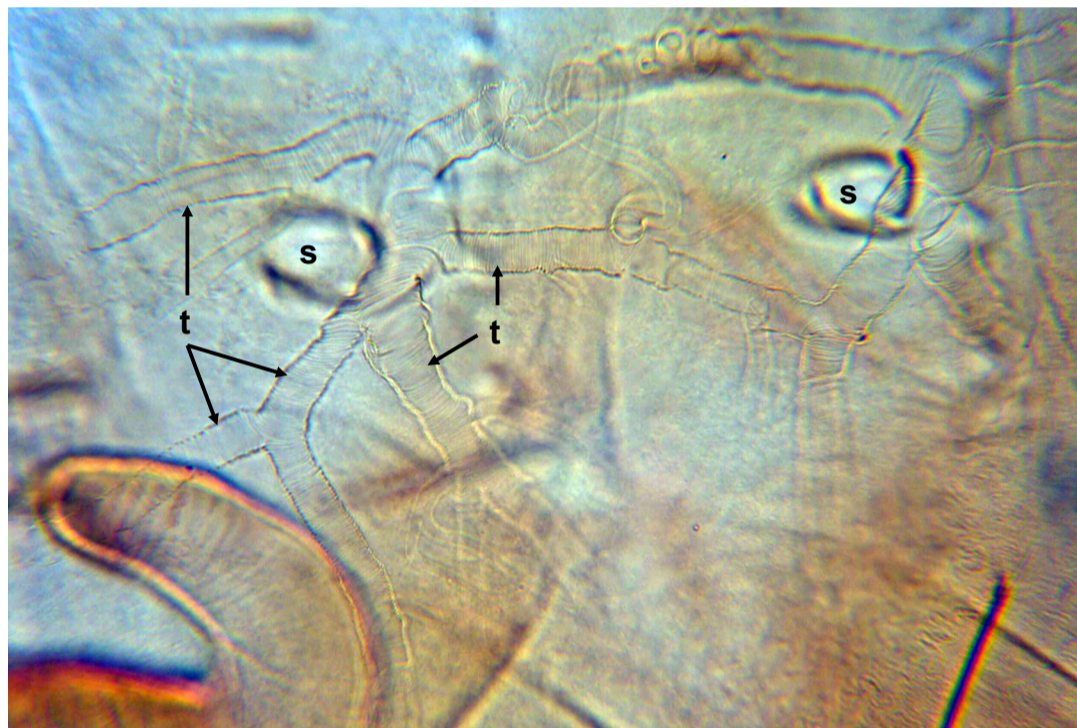


Spilopsyllus cuniculi, posterior.
Legend: a, antesensilial bristle;
s, sensillum;

A funnel or cylindrical-shaped spiracular fossa may be seen in the region anterior to the sensillum in some fleas. At the base of the fossa there is a spiracle which is the opening into the tracheal system. There is a pair of lateral spiracles on each abdominal segment that open into the trachea, as well.

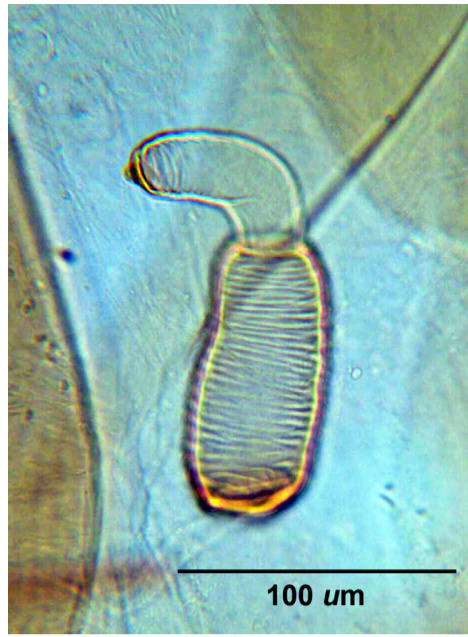


Ct. canis, spiracular fossa. Legend: sf, fossa; s, sensillum; sp, spiracle; t, trachea.



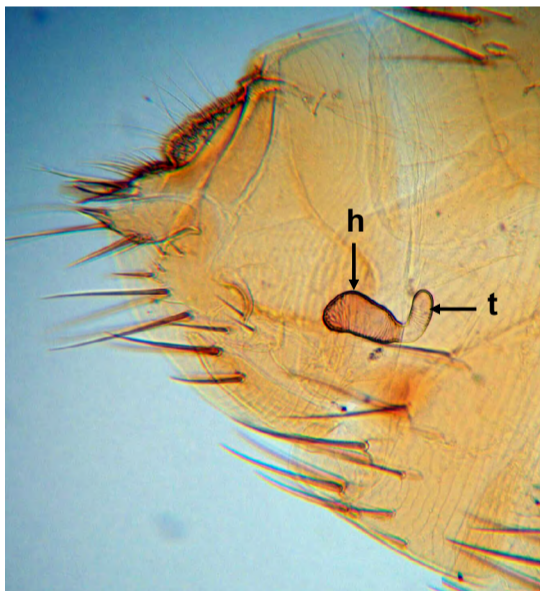
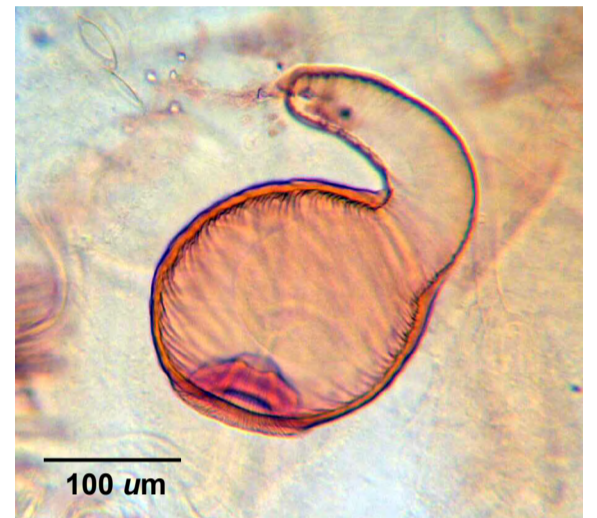
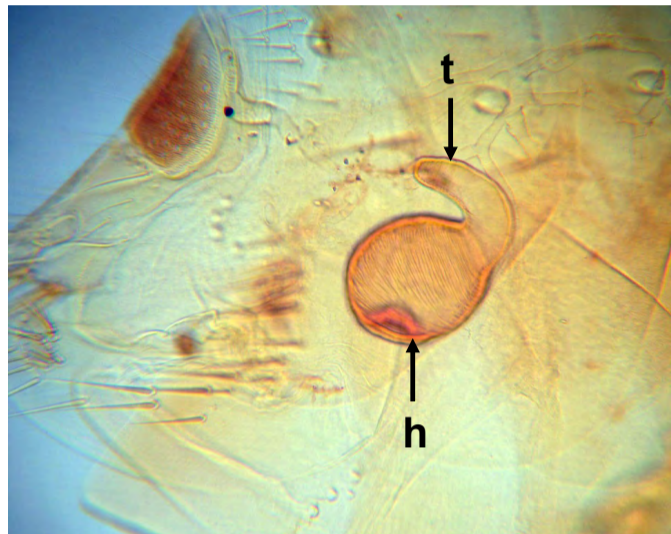
Odontopsyllus dentatus
(female spermatheca lower left), with network of trachea (t) and spiracle openings (s)

Sexual dimorphic characters are readily observed in the posterior abdominal region of cleared specimens mounted on microscope slides. The female possesses a sac-like spermatheca (for sperm storage) located internally in the region of the 8th or 9th abdominal segment. The shape of this structure, subdivided into a head and a tail, is often unique for different fleas and thus can be a useful organ for genus or species identification. Male reproductive structures (i.e., genitalia) are complex, and include obvious spring-like penis rods, penis (aedeagal apodeme), the manubrium, claspers, and movable finger of the clasper. During copulation the male moves underneath the female, holding her anteriorly with the antennae (which in some species bears a copulatory disk), and posteriorly with the claspers and fingers while inserting the penis rods into the female reproductive tract.



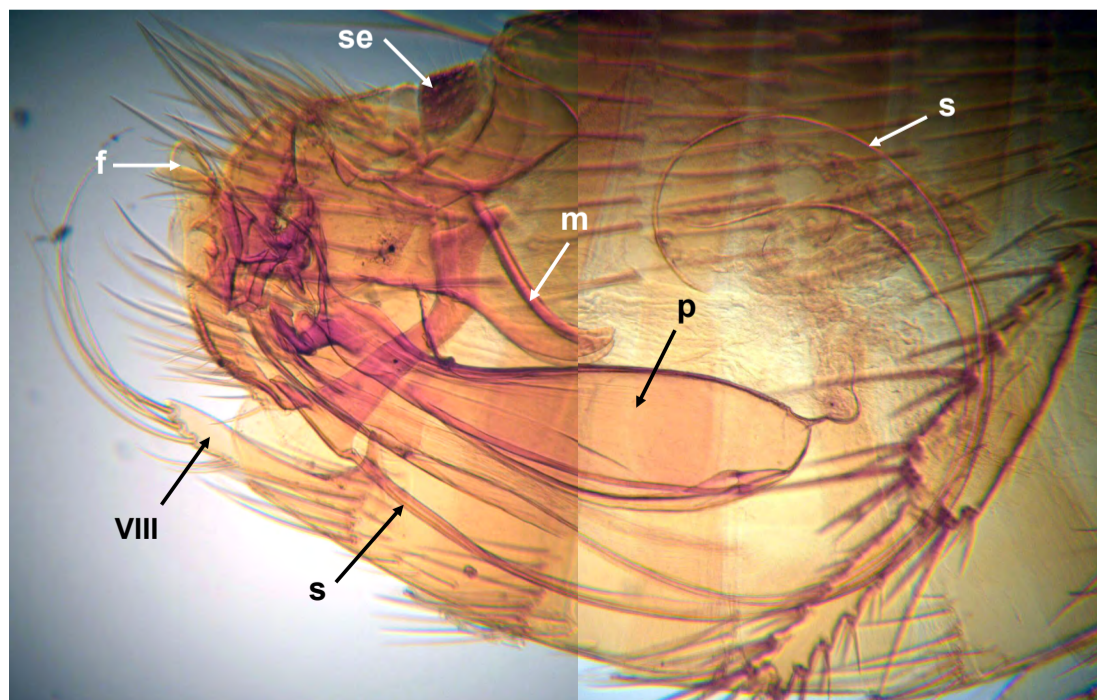
Orchopeas sexdentatus
pennsylvanicus female posterior
(left); spermatheca (right).

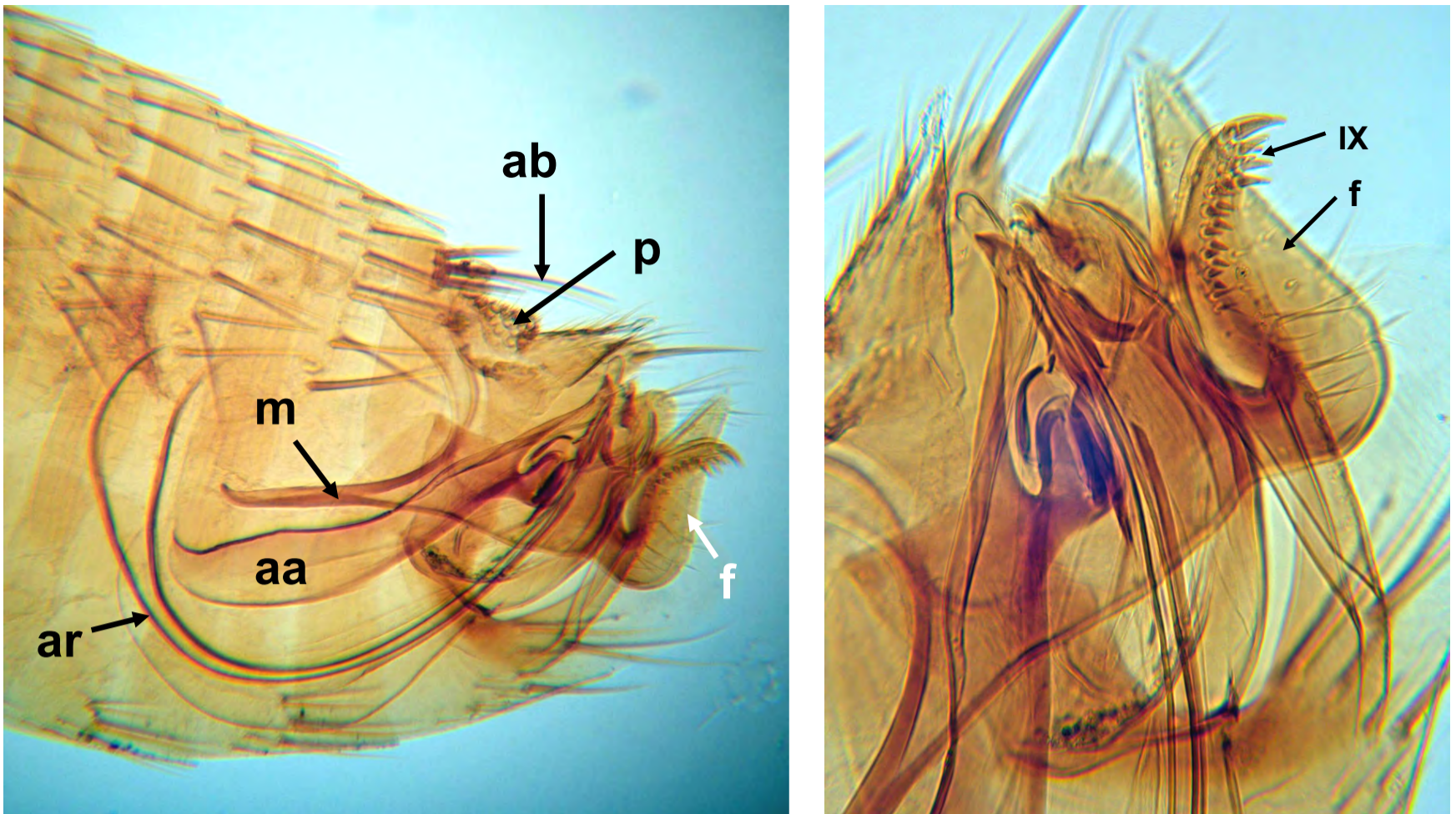
Odontopsyllus dentatus,
female spermatheca
(h, head; t, tail)



Ctenophthalmus
pseudagyrtus,
female, spermatheca
(h, head; t, tail).

Oropsylla arctomys
The abdomen, male. Legend: f, finger;
m, manubrium; p, penis (= aedeagal
apodeme); s, spring; se, sensilium;
VIII, abdominal sternal segment eight.





Leptopsylla segnis, male genitalia

Legend: aa, aedeagal apodeme (penis); ab, antepygidial bristle; ar, accessory apodemal rod (spring); f, finger of clasper lobe; m, manubrium; p, pygidium (sensillum); IX, abdominal sternum nine.

D. Supplemental Materials (PowerPoint Presentations)

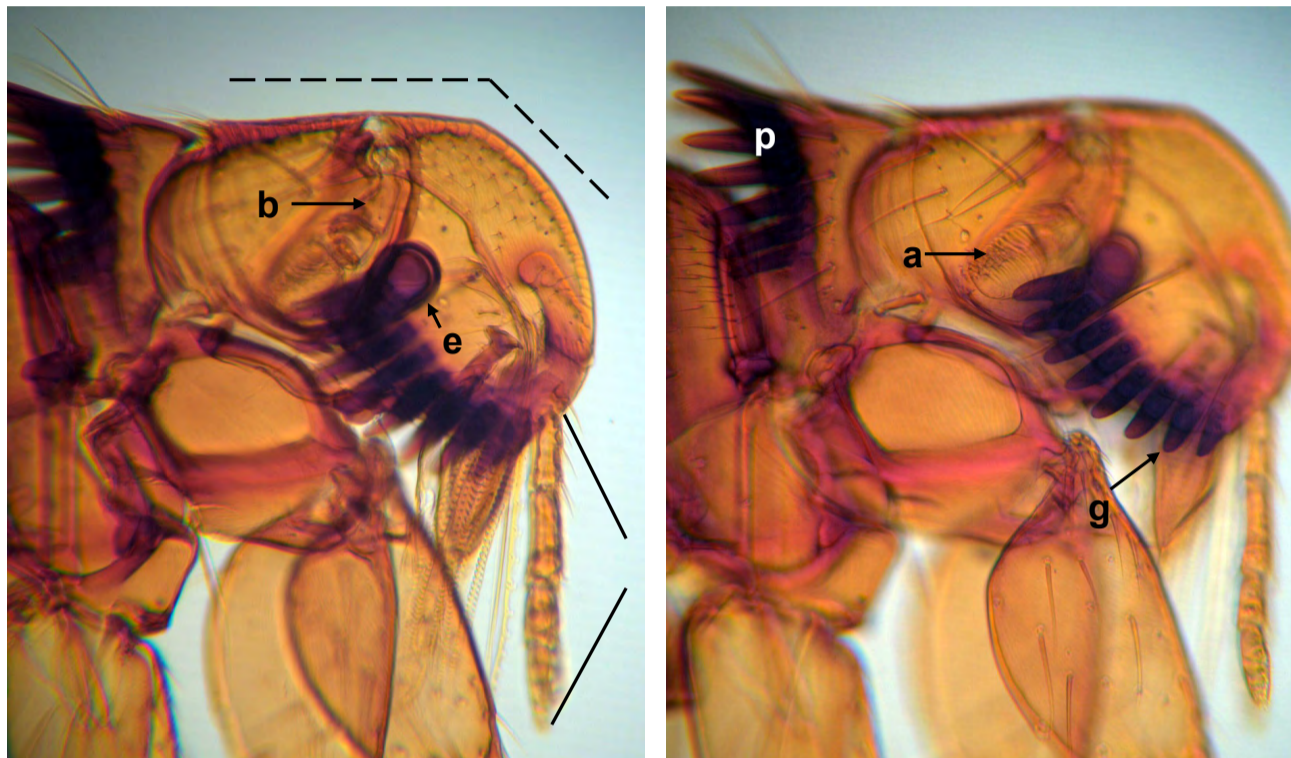
Currently, there are approximately 220 genera of fleas placed in 15 families. Selected species (in alphabetical order) are featured in this e-Book as PowerPoint presentations (i.e., what you might see in a laboratory setting when viewed with a stereomicroscope or compound microscope), so that you can become familiar with important morphological structures of the Siphonaptera.

- *Cediopsylla simplex*
- *Ceratophyllus gallinae*
- *Ctenocephalides canis*
- *Ctenocephalides felis*
- *Ctenophthalmus pseudagyrtes*
- *Doratopsylla blarinae*
- *Echidnophaga gallinacea*
- *Epitedia wenmanni*
- *Leptopsylla segnis*
- *Monopsyllus vison*
- *Myodopsylla insignis*
- *Odontopsyllus dentatus*
- *Orchopeas leucopus* & *O. wickhami*
- *Oropsylla arctomys*
- *Peromyscopsylla hesperomys*
- *Pulex irritans*
- *Spilopsyllus cuniculi*
- *Stenoponia americana*
- *Xenopsylla cheopis*

E. Notes on Flea species

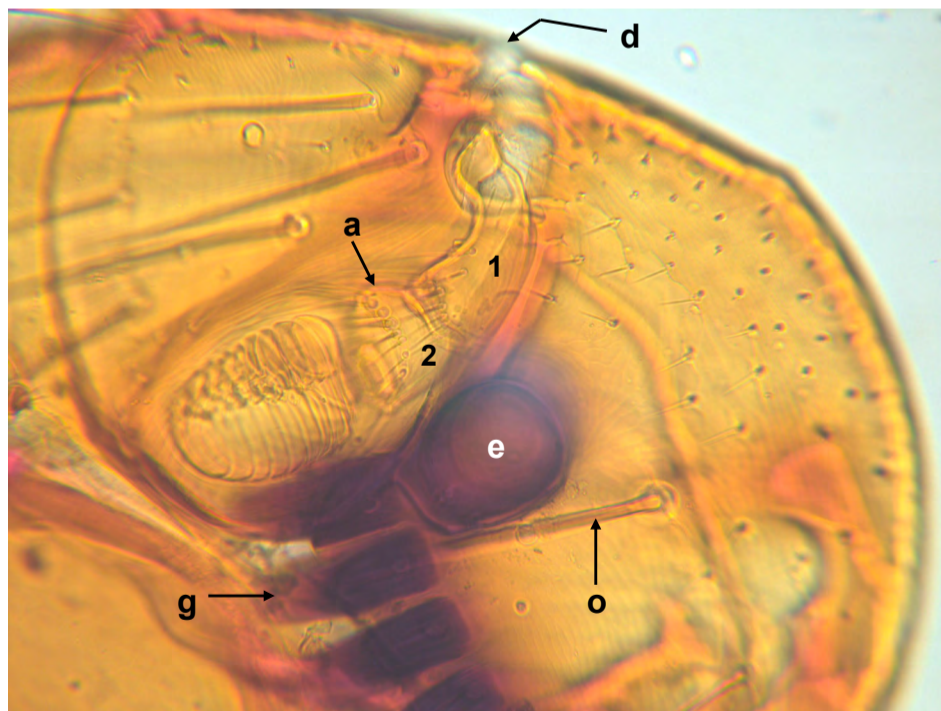
Cediopsylla simplex

Commonly associated with rabbits (e.g., *Sylvilagus*) and their predators (e.g., *Lynx*, *Vulpes*). This flea possesses distinct eyes, and both genal and pronotal ctenidia with robust, blunt-tipped teeth. Characteristically, teeth in the genal ctenidia are positioned obliquely. The head of males is described as “angulate”. Furthermore, thin “subapical” bristles can be seen on the first two antennal segments, and the “pre-antennal” region bears numerous small setae.



Cediopsylla simplex (male); head in two depth of field views.

Legend: a, antenna (in groove); b, antenna base; e, eye; g, genal comb tooth; m, maxillary palp (0.37 mm long); p, pronotal ctenidium (= comb). Note “angulate” head (dashed lines).

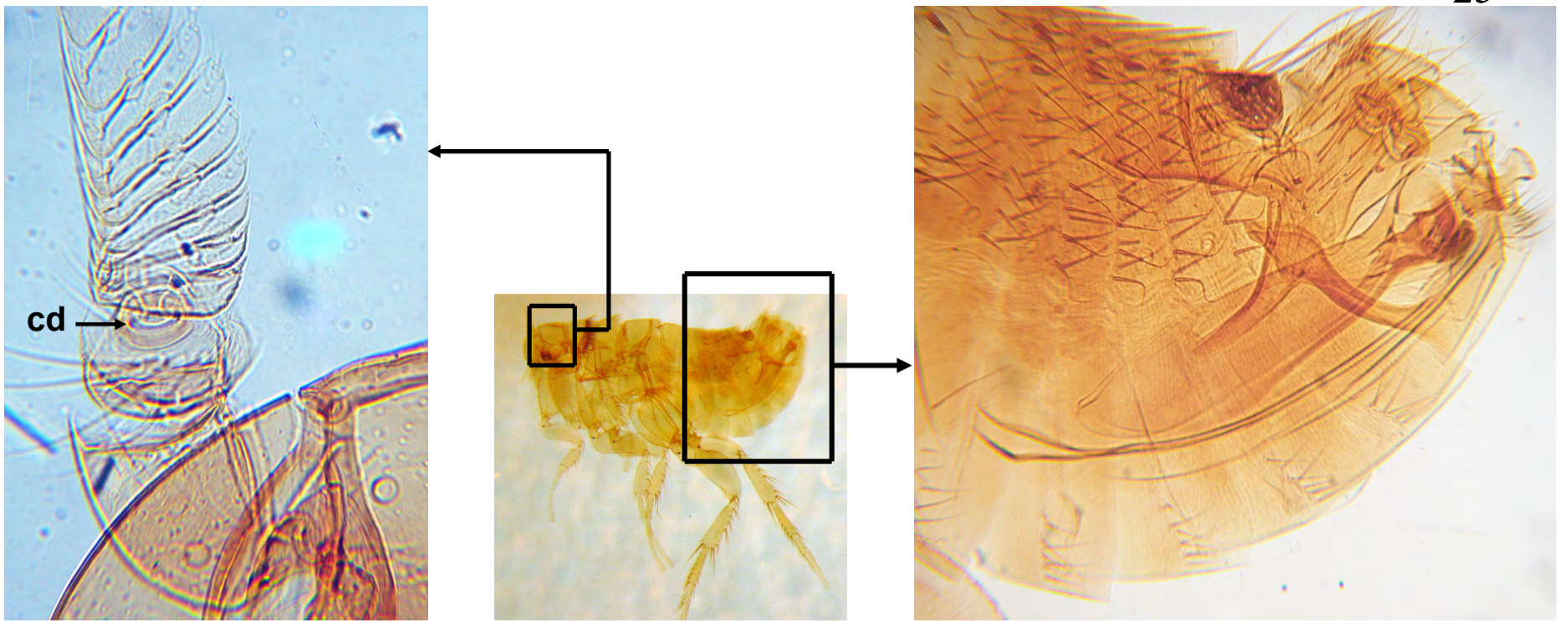


Cediopsylla simplex, head of male. Legend: a, antenna in groove; d, dorsal sulcus; e, eye; g, genal tooth; o, ocular bristle.

Note “subapical” bristles on antennal segments 1 & 2, and small spines on anterior of head.

Ceratophyllus gallinae

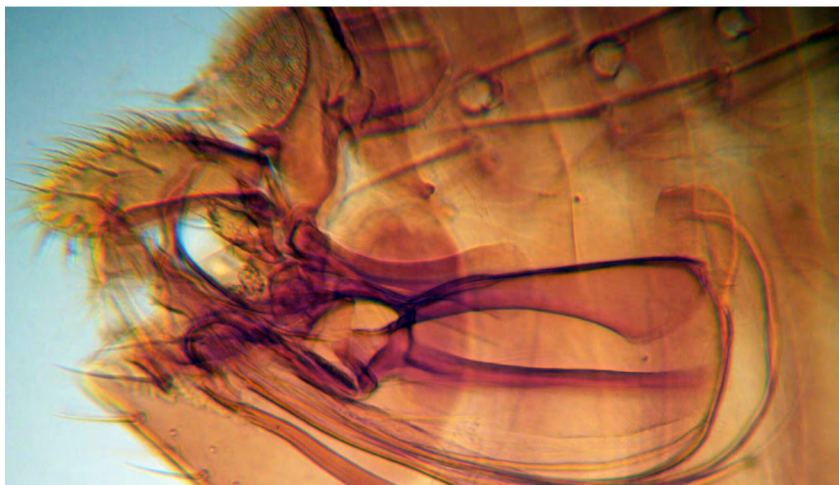
This species is found worldwide on many species of birds, and is economically important because of its presence on domestic fowl, especially chickens. Adults of this highly mobile flea possess a distinct pronotal ctenidium (the genal ctenidium is absent). Males bear distinct copulatory disks on antennae.



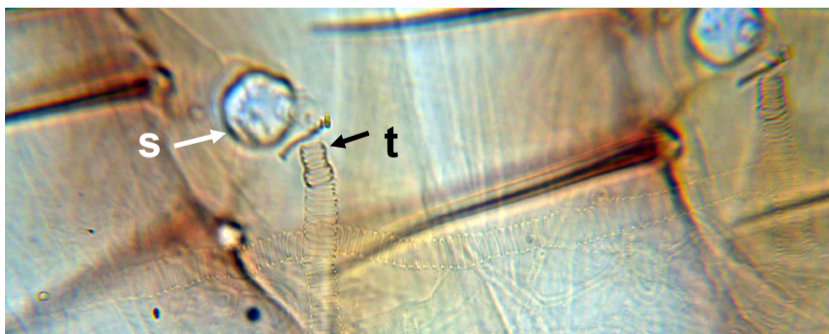
Ceratophyllus sp., male. (Left) Antenna with copulatory disk (cd). (Right) genitalia.

Ctenocephalides canis

This species is commonly referred to as the “dog flea”, but it is not very host specific, being associated with other canines (wolves, coyotes, foxes) and mammals like opossums. It will attack humans. This common species is a good ectoparasite for study because of its prominent abdominal tergites and sternites; the distinct spiracular fossa, spiracles and trachea; internal proventriculus, and spermatheca in females. Note too, the well defined food canal lying in the epipharynx. The dog flea possesses both genal and pronotal ctenidia.

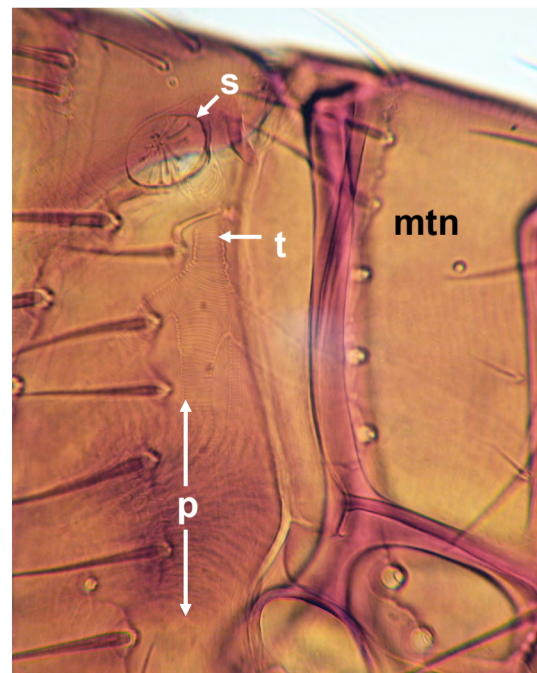


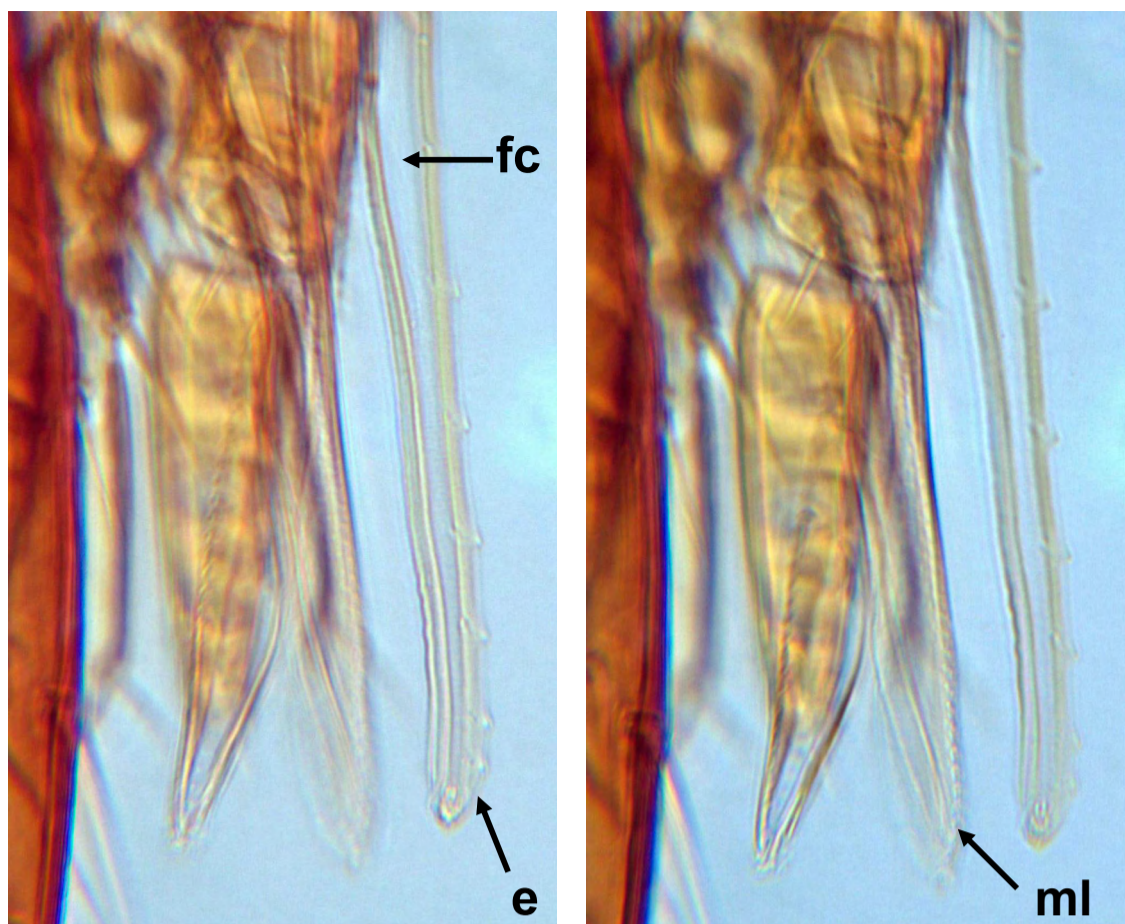
Ct. canis, male genitalia.



Ctenocephalides canis, tracheal system.

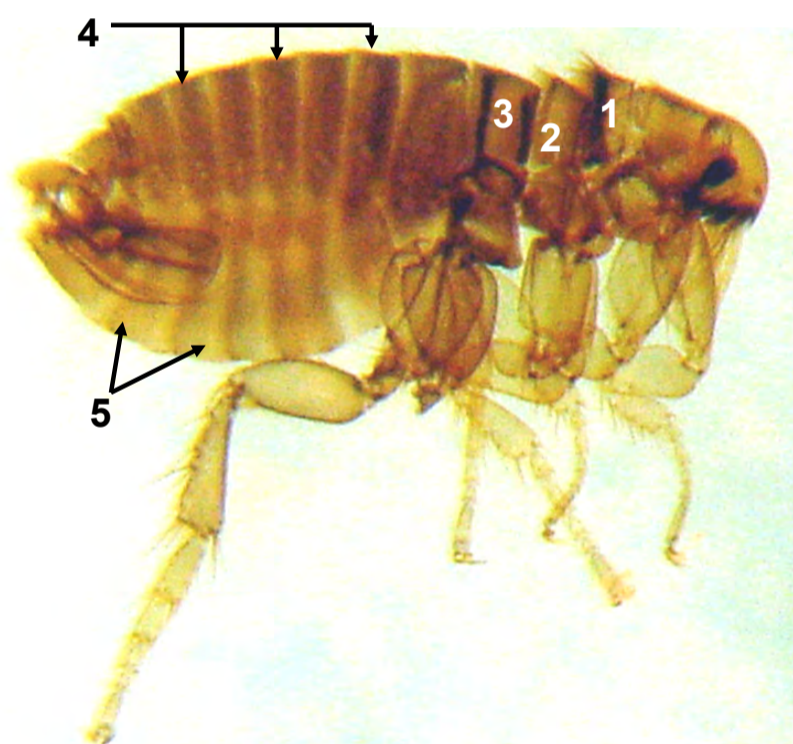
Legend: mtn, metanotum;
p, proventriculus; s, spiracle;
t, trachea.





Ctenocephalides canis,
mouthparts.

Legend: e, epipharynx;
fc, food canal; ml, maxillary
laciniae.

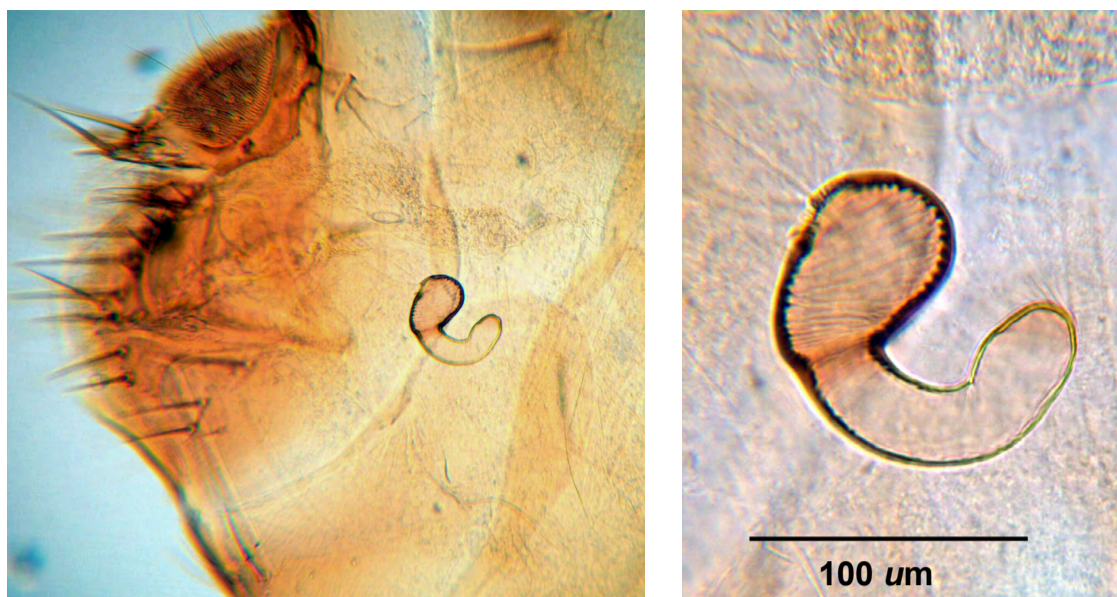


Match the term below with its
appropriate number on the photo.

- A. abdominal tergites
- B. prothorax
- C. metathorax
- D. mesothorax
- E. abdominal sternites

Ctenocephalides felis

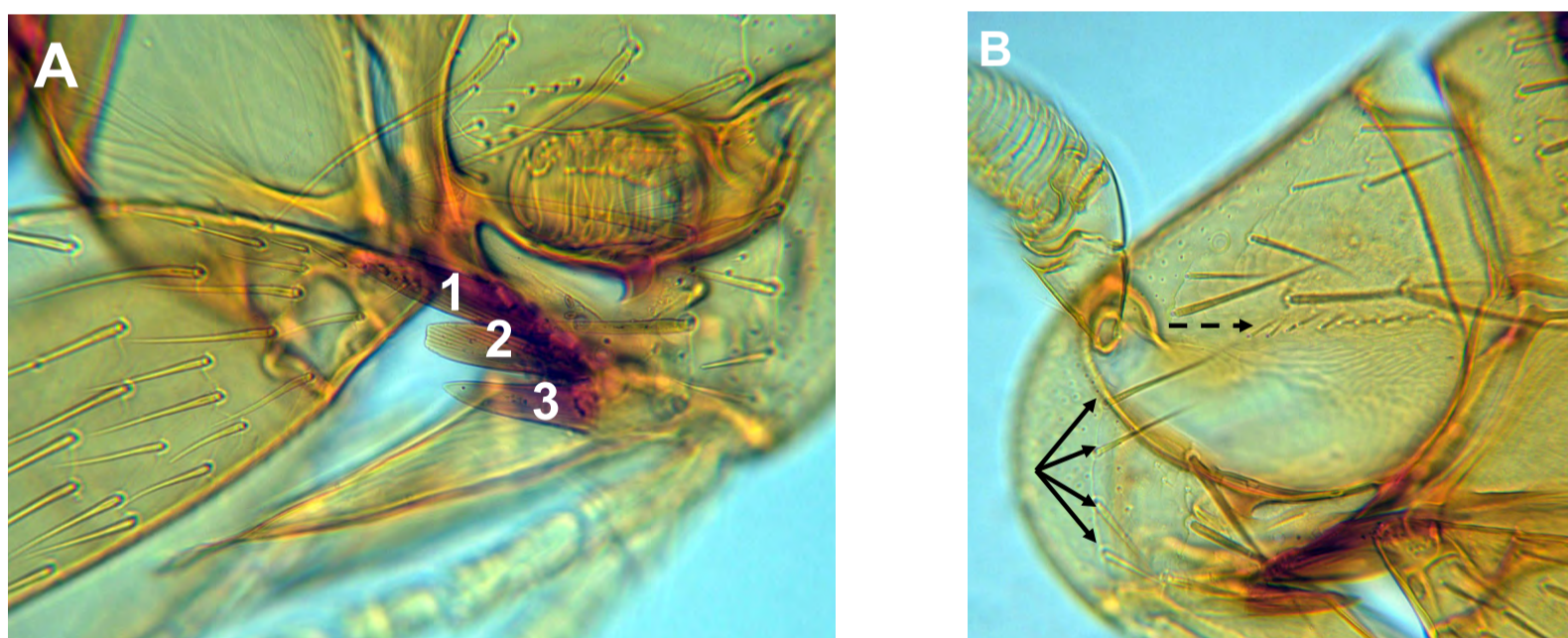
This very common species occurs world wide and although it is called the “cat flea” it is the most important ectoparasite pest species on a wide array of mammals (domesticated and wildlife). It readily attacks humans. Cats may be considered “preferred” hosts, however, because females of this species produce greater numbers of fertile eggs when fed on cats as opposed to other species. Like the dog flea, this species possesses both genal and pronotal ctenidia. Differences in genal ctenidia between cat and dog fleas are evident with close observation. Moreover, the head of the cat flea is somewhat more elongate than the head of a dog flea. This is also a good lab study animal because of the distinct leg segments, typical of fleas, and the spermatheca of females.



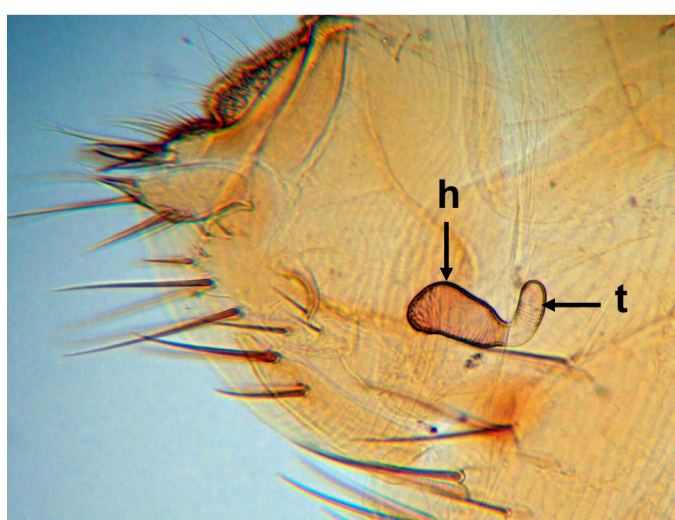
Ct. felis; female,
spermatheca.

Ctenophthalmus pseudagyrtes

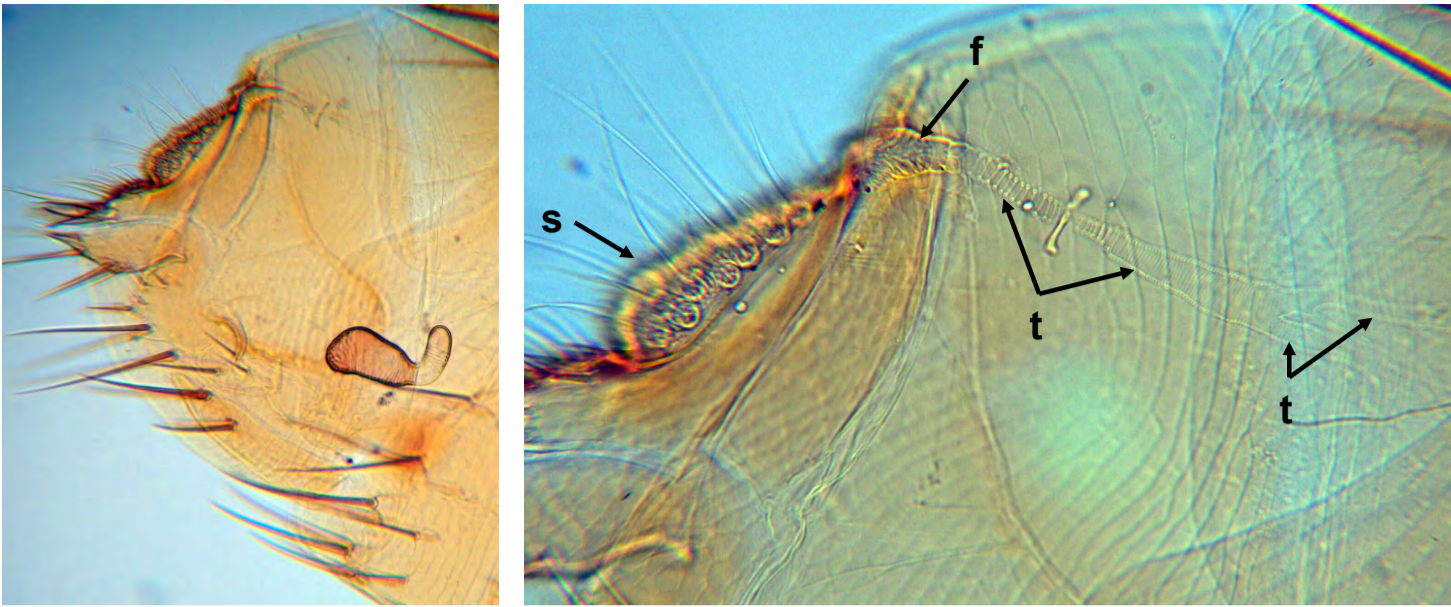
This flea, often found on small rodents (e.g., *Blarina*, *Microtus*, *Peromyscus*) possesses both genal and pronotal ctenidia, the former with only three spines. This flea can also be recognized by the vertical row of spines on the front of the head, a series of small spines dorsal to the antennal groove, and the lack of eyes. Other prominent features are the spermatheca of females, the sensillum, and the tracheal system. In males the “spring” (= apodemal rod) is relatively short, not completing a full turn dorsally, and the penis (= adeagal apodeme) is slender.



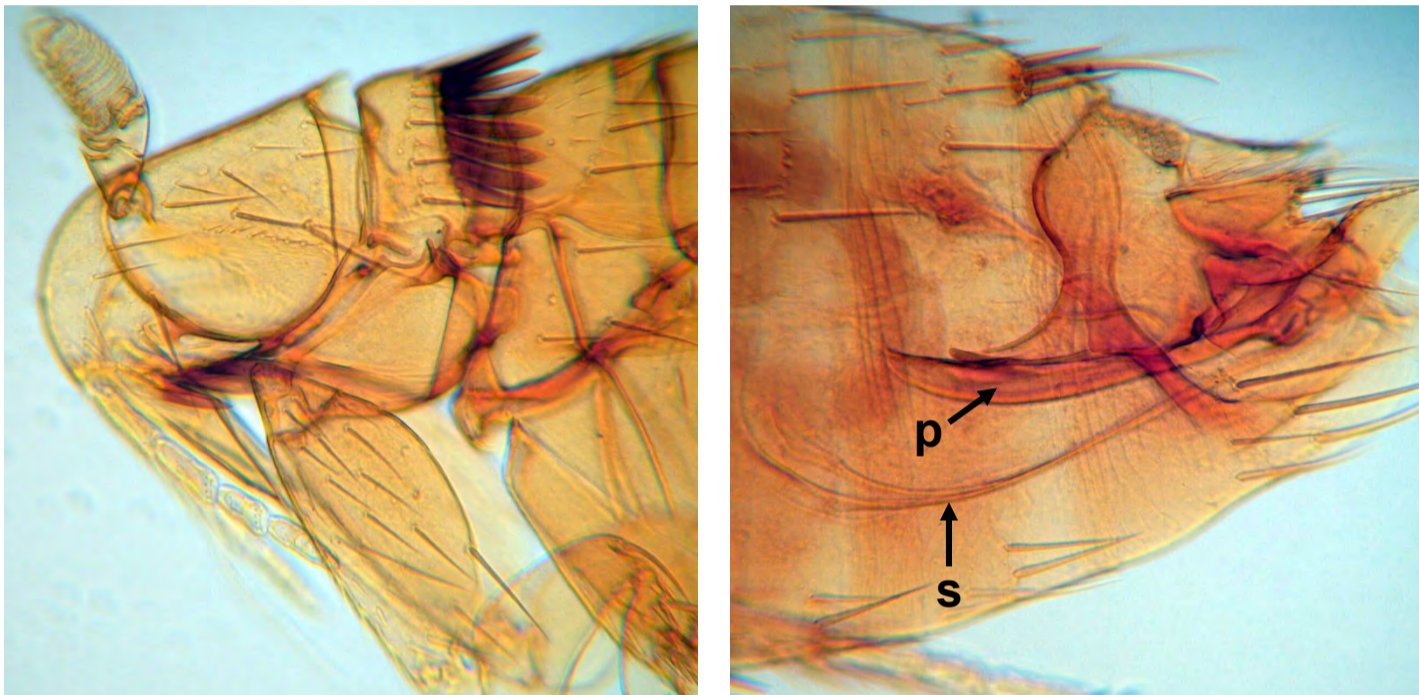
Ctenophthalmus pseudagyrtes. Note: (A) eyes vestigial, 3 teeth in genal ctenidium; and (B) characteristic spines near front of head (solid arrows) and small spines above antennal groove (dashed arrow).



Ctenophthalmus pseudagyrtes,
female,
spermatheca
(h, head; t, tail).



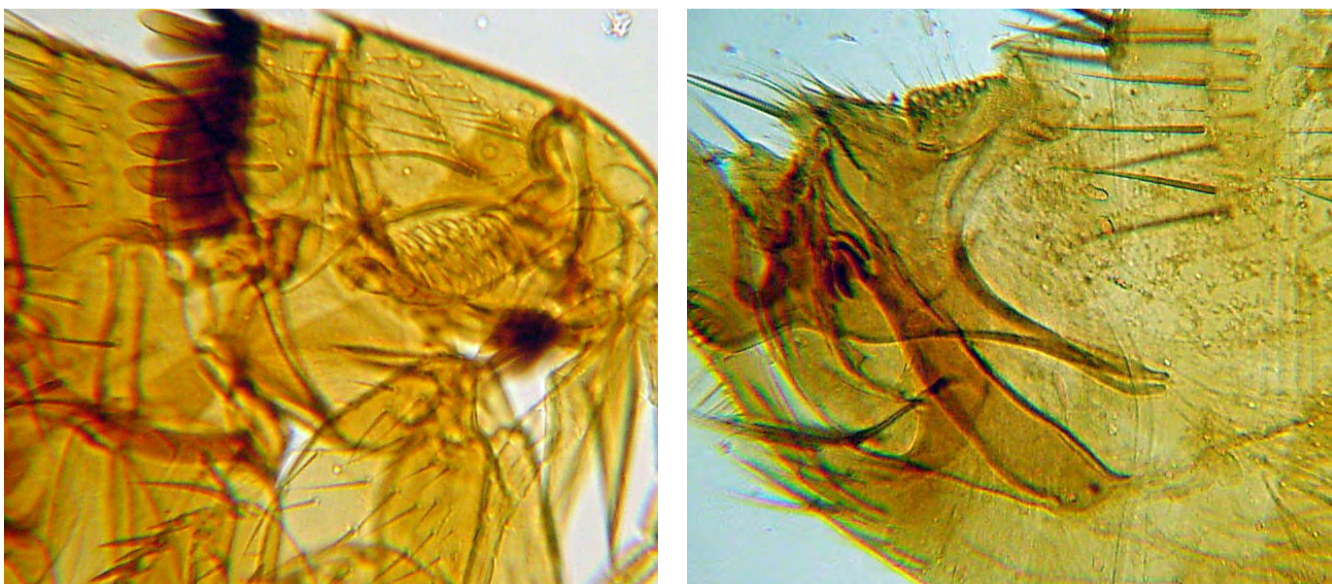
Ctenophthalmus pseudagyrtis, posterior of female with fossa (f), sensillum (s), and trachea (t).



Ctenophthalmus pseudagyrtis: male head (left), genitalia (right). Legend: p, penis; s, “spring.”

Doratopsylla blarinae

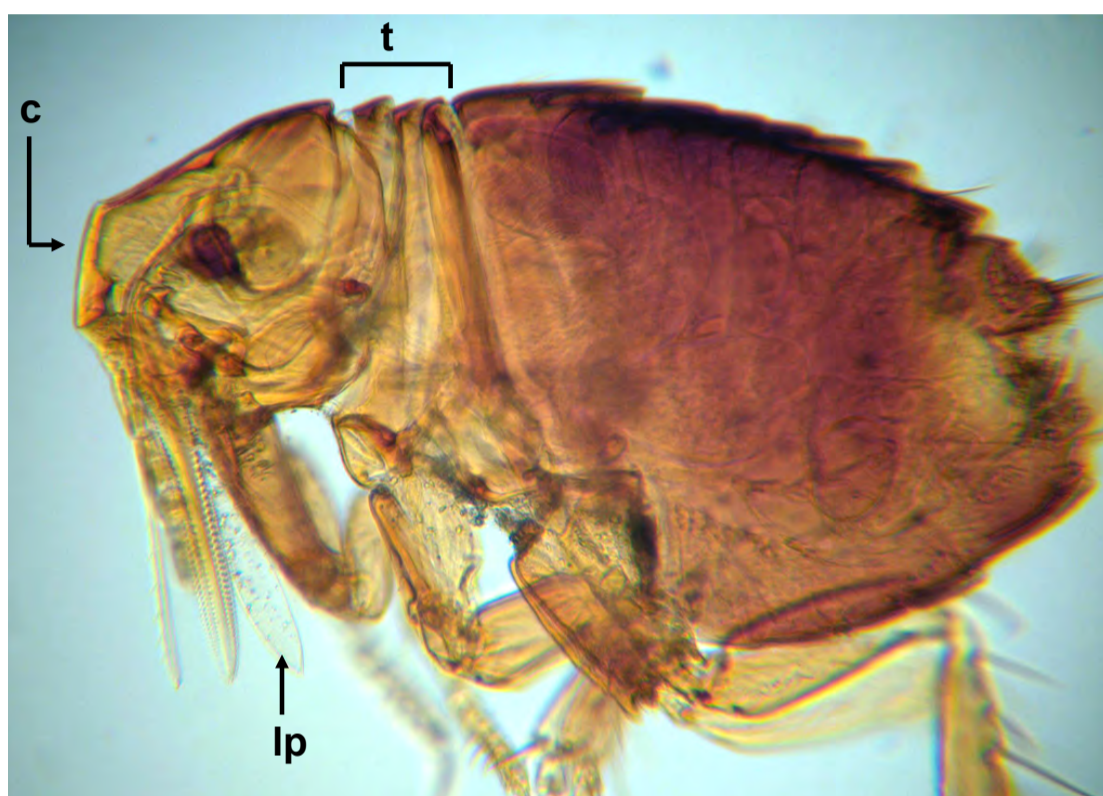
This flea may be a “nest” species, spending more time in the nest of shrews (*Blarina brevicauda*, its “preferred” host), than actually on the host. It has both genal and pronotal “combs”, the former with but two small comb spines



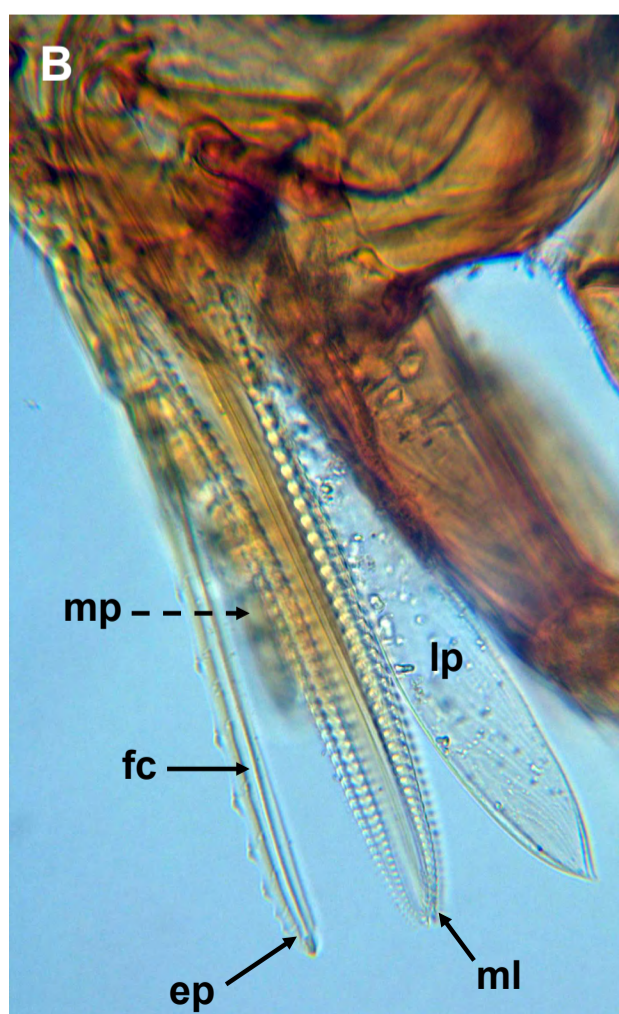
Doratopsylla blarinae, male.

Echidnophaga gallinacea

This is commonly known as the “sticktight flea” of poultry (especially chickens and turkeys), although it may be associated with other fowl, and is occasionally found on rats, dogs, and cats. It is not mobile on the host, but rather attaches semipermanently around the head and neck regions. Morphologically, this species has several unusual features; most notably the “flat” or “squared-off” clypeal (i.e., front of head) area, and the compressed thoracic regions (i.e., pro-, meso-, and metathorax). Moreover, this flea species lacks ctenidia. The labial palps are unusual in that they are not segmented. The groove on inner margins of the maxillary laciniae that form the salivary canal can also be seen in this species.



Echidnophaga gallinacea, (“sticktight” flea) female. Note the absence of ctenidia, angular head with flattened clypeal area (c), compressed thoracic segments (t), and unsegmented, membraneous, labial palp (lp).

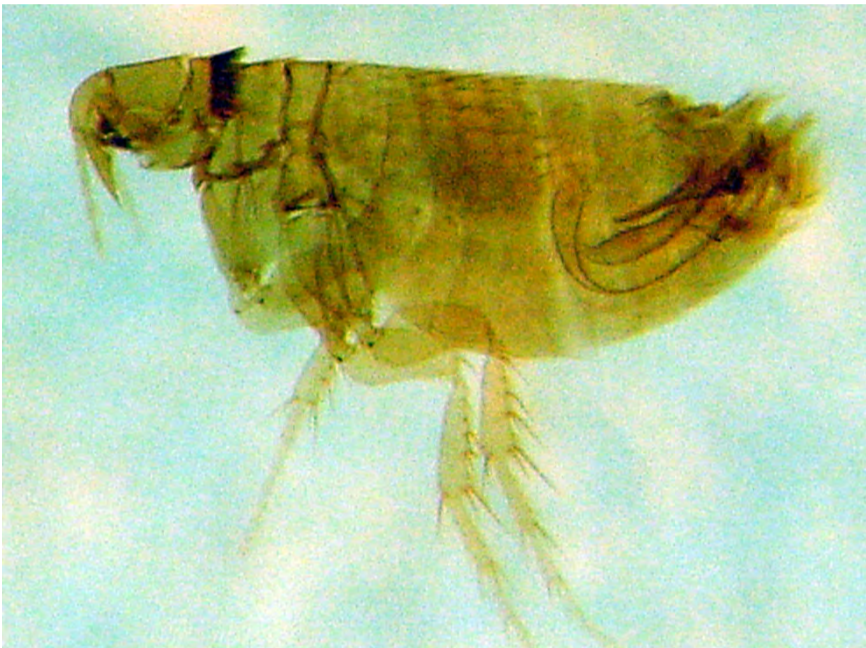


Echidnophaga gallinacea mouthparts (box in A enlarged in B).

Legend: ep, epipharynx (with food canal, fc); lp, labial palp; ml, maxillary laciniae; and mp, maxillary palp

Epitedia wenmanni

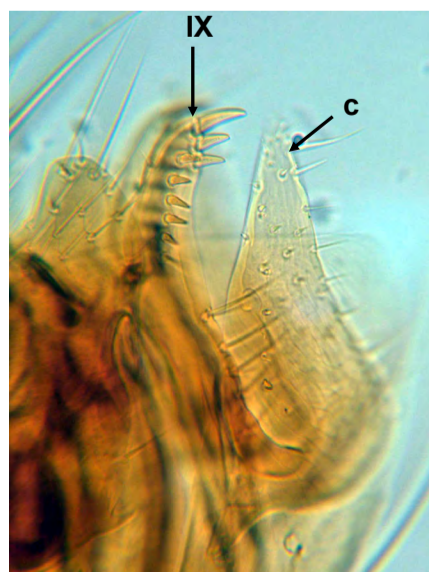
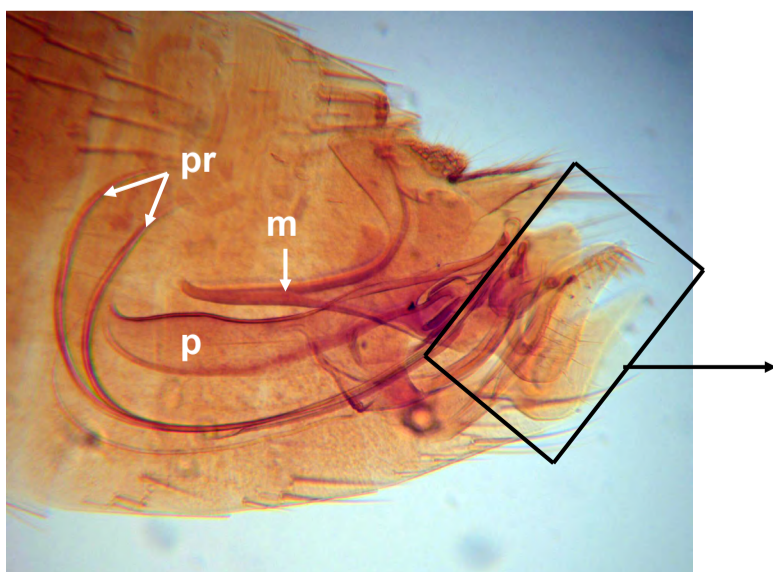
Males of this rodent flea have a “flat” dorsum (abdomen), whereas the dorsal abdomen of females is convex. This is not unique to this species, but rather a common, but not universal, feature of fleas in general. These fleas have both genal and pronotal ctenidia, but the former possesses only two spines (or “teeth”). The spermatheca of females is somewhat unusual in that the tail of this structure projects, characteristically, into the spermatheca head. For instructional purposes the male genitalia have been labeled for this species. This species is most likely to be found on white-footed mice, *Peromyscus leucopus*, although it has been collected from a variety of small rodents.



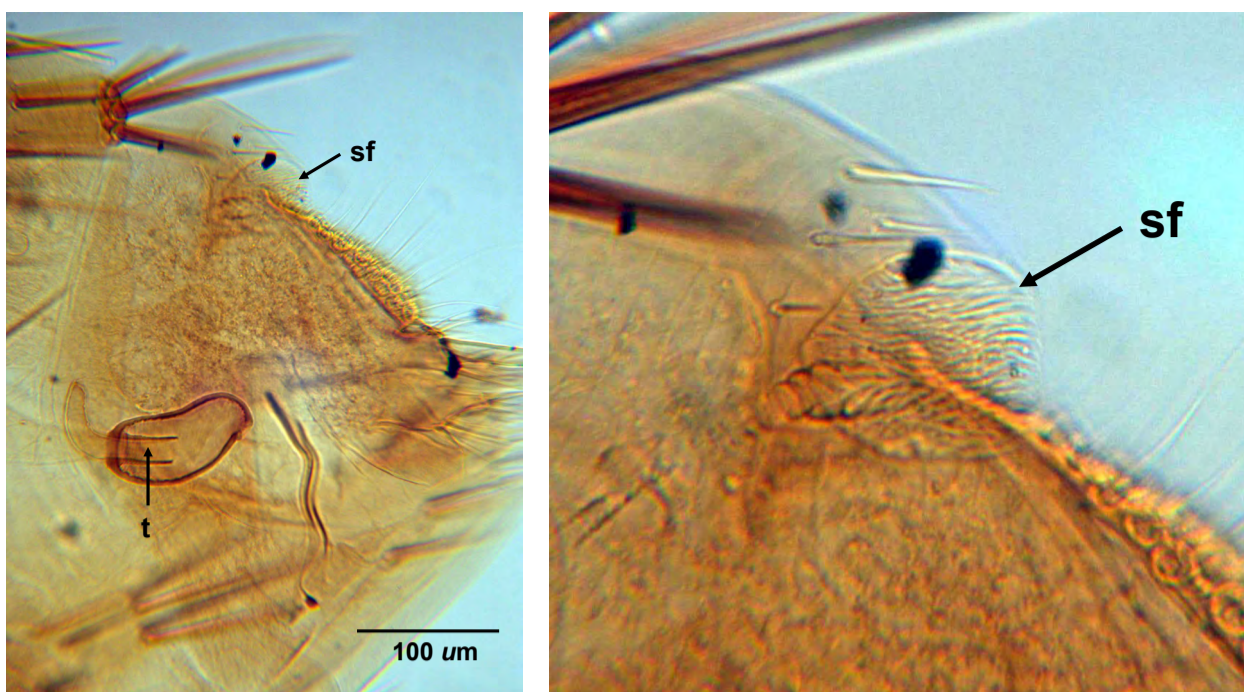
Epitedia wenmanni: male (above); female (below).



Epitedia wenmanni;
characteristic genal ctenidium
with 2 teeth.



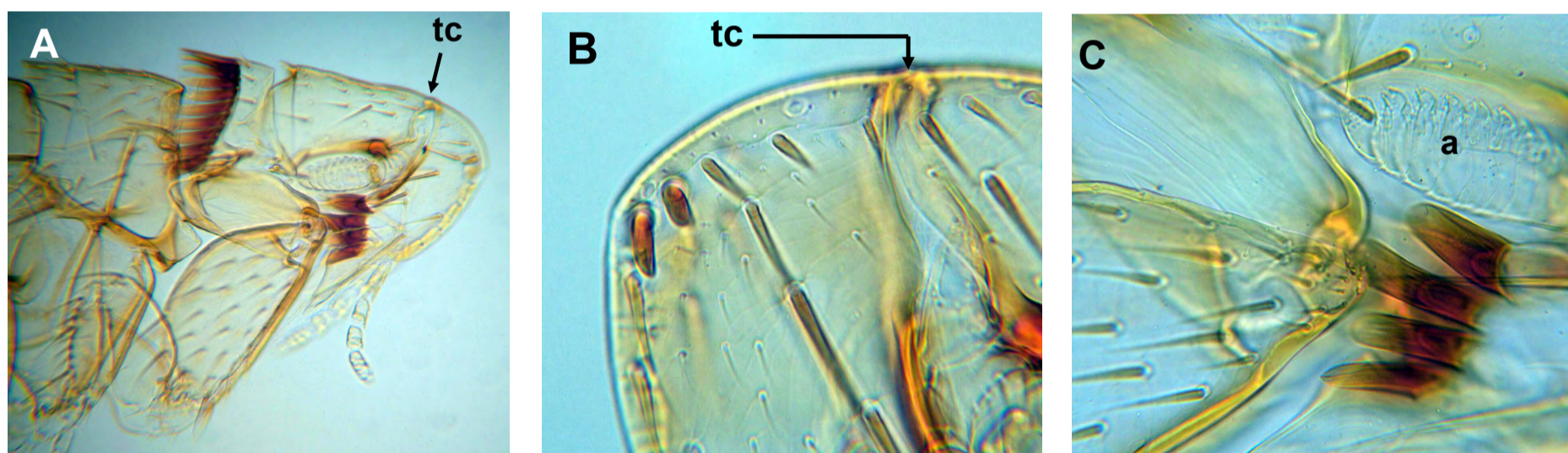
Epitedia wenmanni male
genitalia. Legend: c, clasper;
m, manubrium; p, penis; pr,
penis rods; IX, sternum IX
with heavy bristles



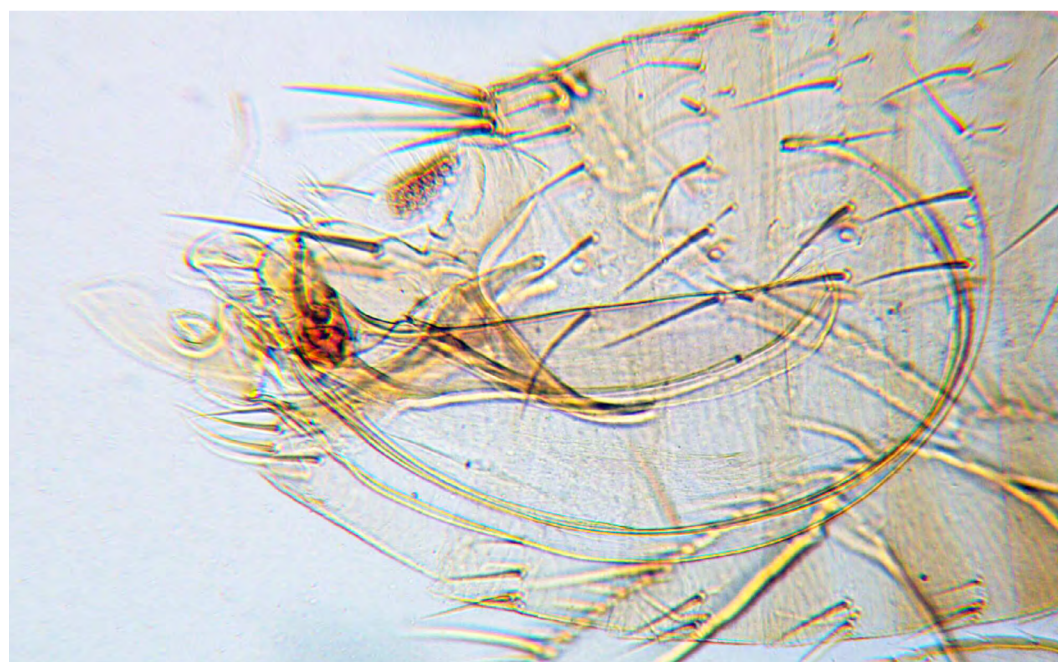
Epitedia wenmanni female. Note that in this species tail of spermatheca (t) projects deeply into lumen of body. Note also: spiracular fossa (sf).

Leptopsylla segnis

Commonly known as the mouse flea, occurring on both mice (*Mus musculus*) and domestic rats (*Rattus* spp). Clear demarcation between head, thorax and abdomen with pro-, meso-, and metathoracic regions easily observed. This species possesses both genal and pronotal ctenidia, the former with only 4 “vertically” positioned spines. Eyes vestigial, and there are two heavy, spiniform, bristles at the apex of the head. Male genitalia clearly evident in cleared, microscope slide mounted specimens.



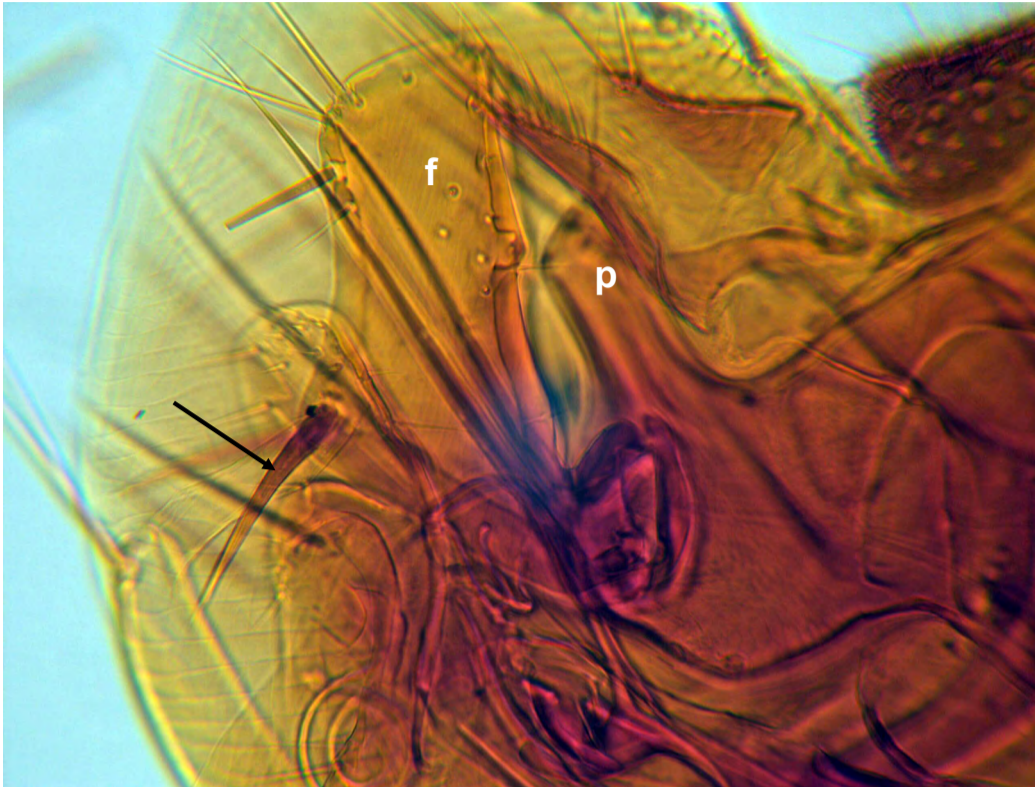
Leptopsylla segnis, head (A). Characteristic of this genus are the trabercula centralis (tc) and 2 stout bristles on anterior margin of head (B), antenna (a) and 4 genal comb teeth (C).



L. segnis, male, posterior.

Monopsyllus vison

Hosts for this flea are squirrels (*Tamiasciurus hudsonicus*) and weasels (*Putorius vison*). These fleas have eyes, and a pronotal comb, but there is no genal comb. Clasper of males have a slender process and broad finger, the latter bearing a stout bristle.



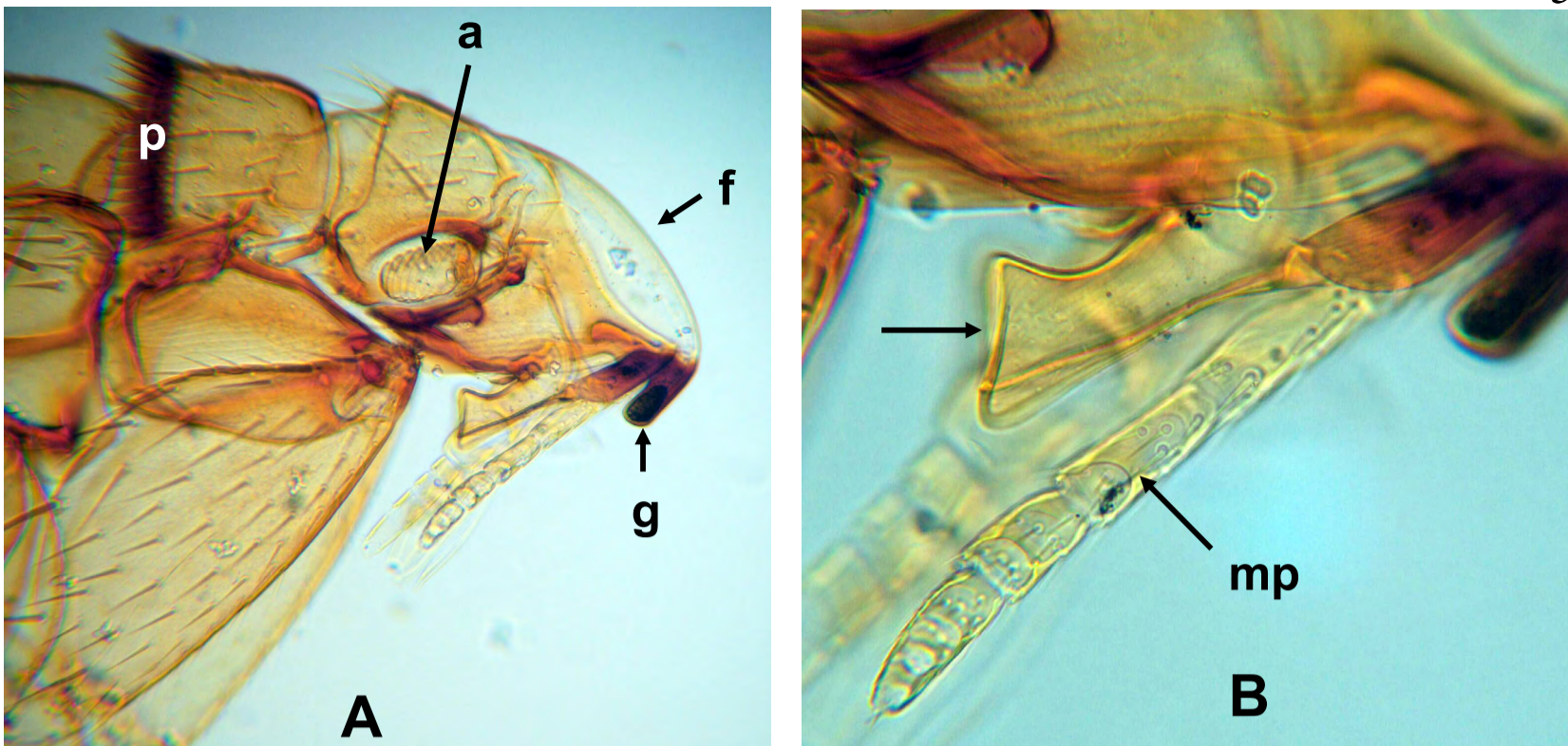
M. vison, male genitalia.
 Legend: f, finger of clasper;
 p, process of clasper.
 Note that process (p) of clasper
 slender, with broad finger
 displaying “stout” bristle (arrow).

Myodopsylla insignis

The common bat (*Myotis* spp.) flea characterized by possessing genal, pronotal, and abdominal ctenidia (= “false” combs). This flea is also identified by the wide clear area occupying most of the anterior head region, and a unique truncated maxilla.



Myodopsylla sp.,
 entire, male. Note the presence of genal, pronotal, and abdominal ctenidia
 (= “false” combs).



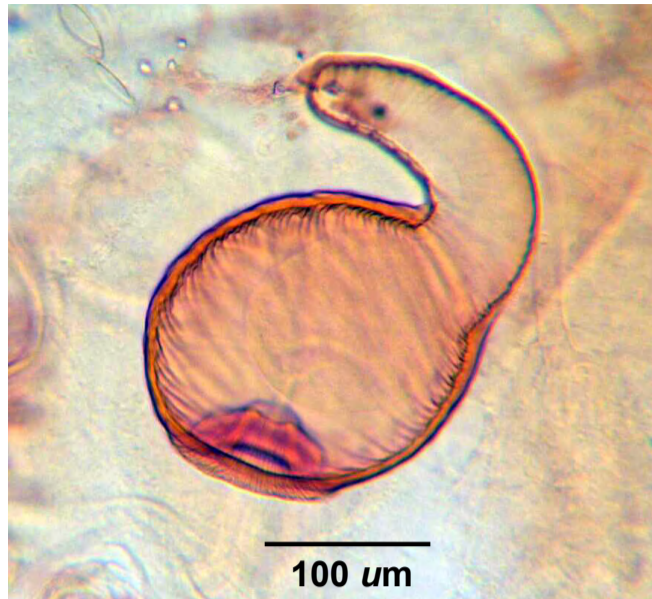
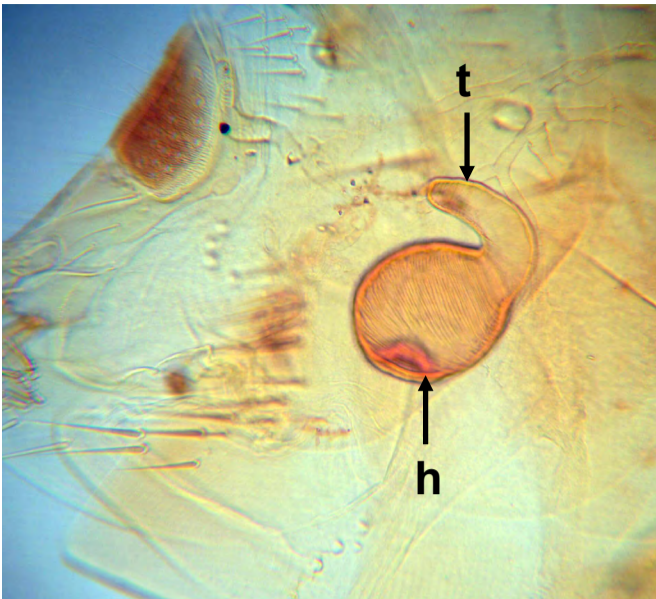
Myodopsylla sp.: anterior with genal and pronotal combs (A); truncated maxilla, arrow (B). Legend: a, antenna; g, genal ctenidium (with 2 teeth); f, frons; mp, maxillary palp, p, pronotal ctenidium. Note wide clear area occupying most of the anterior region of the head above genal teeth..

Odontopsyllus dentatus

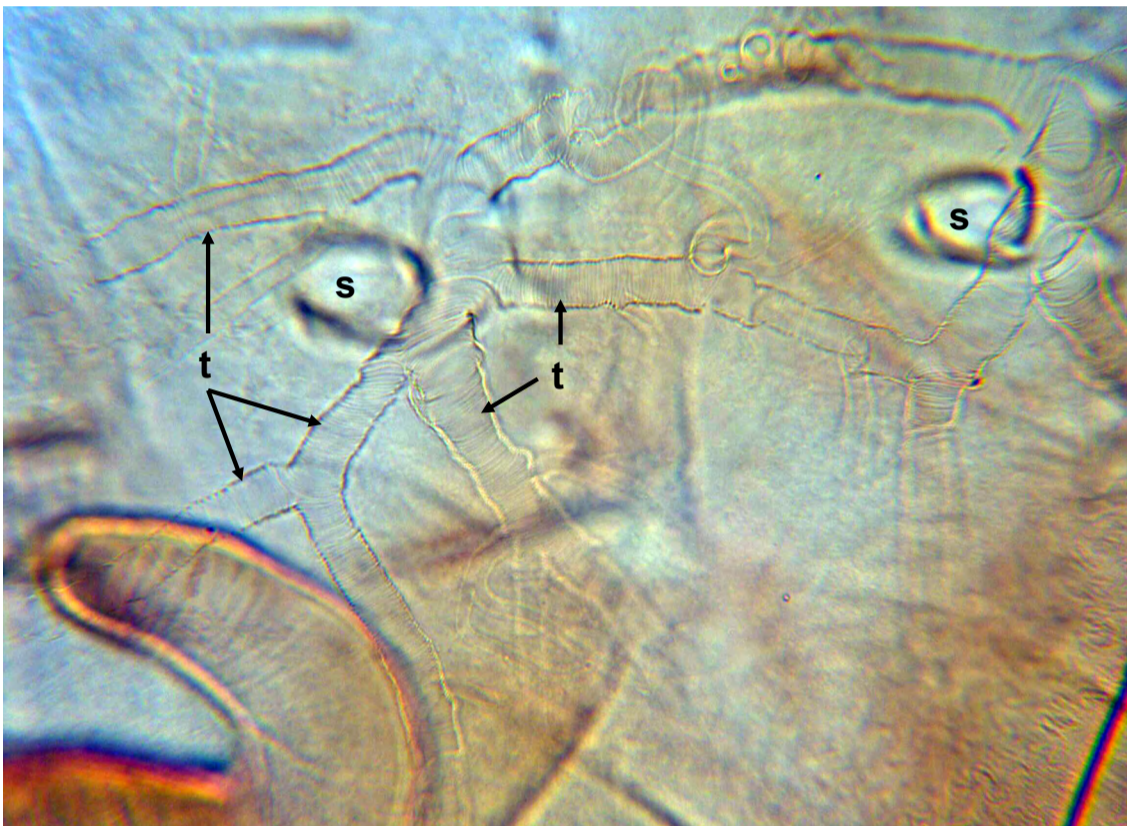
This species is an ectoparasite of rabbits (*Lepus* spp., *Sylvilagus* spp.), and in some instances the carnivores that prey on them. Members of this species have only the pronotal ctenidium, and they possess prominent eyes. There is a vertical row of spines immediately anterior to the eye, and a minute series of spines immediately dorsal to the distinctly visible antennae. The female spermatheca has a large globular head and long tail that curves dorsally. Network of trachea visible in well cleared, slide-mounted, specimens. Distinct apical spines (“apical abdominal spinlets” of some authors) can be seen on dorsal abdominal segments.



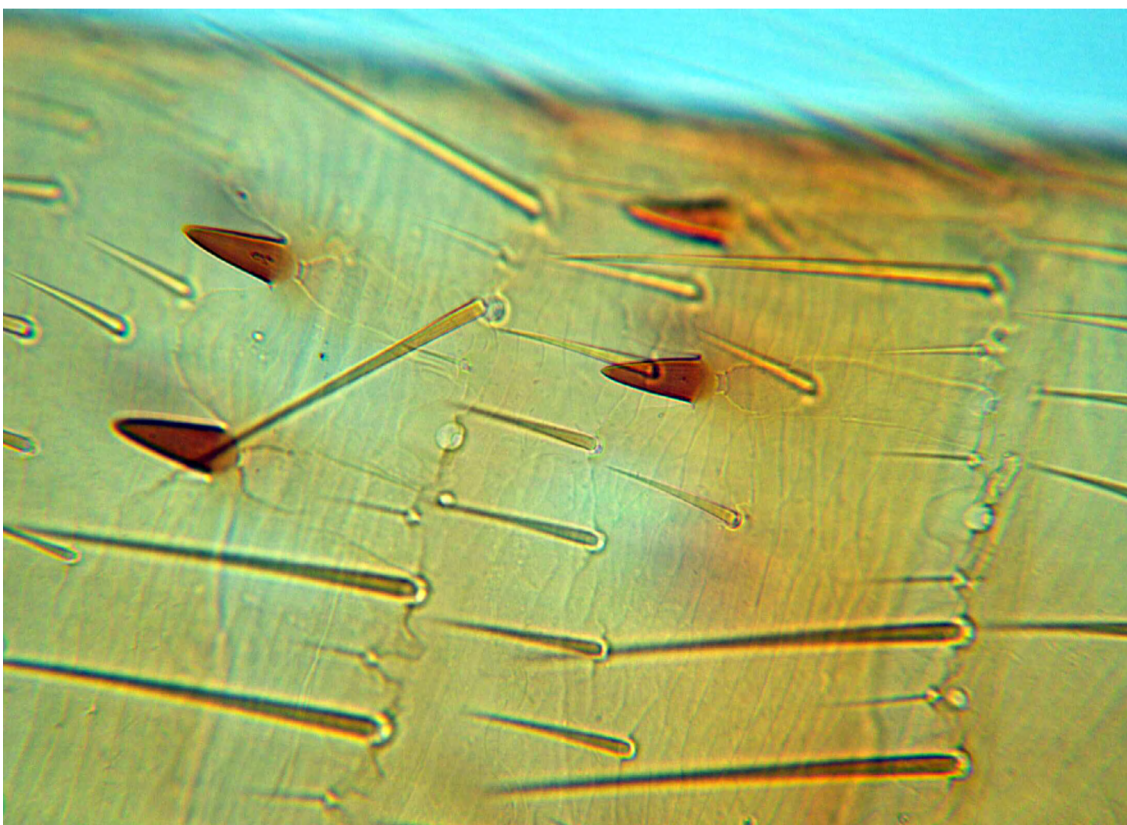
Odontopsyllus dentatus: head with prominent eye (e) and antennae (a). Note small spines dorsal to antenna (dashed arrow) and row of spines anterior to eye (solid arrow). Pronotal ctenidium also identified (p).



Odontopsyllus dentatus,
female spermatheca
(h, head; t, tail).



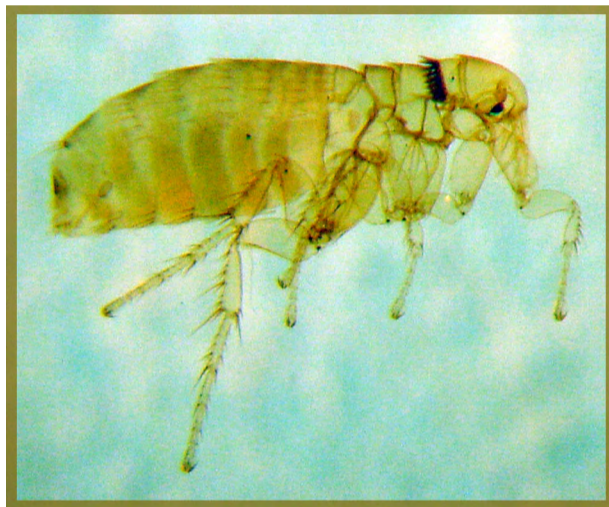
Odontopsyllus dentatus,
female spermatheca
lower left (see previous
slide); network of trachea
(t) and spiracle openings (s).



Odontopsyllus dentatus,
apical spines (“apical
abdominal spinlets” of some
authors) on dorsal abdominal
segments.

Orchopeas leucopus & *O. wickhami*

Common ectoparasitic species found on many small mammal species, especially squirrels (*Sciurus* spp.), rats (*Rattus* spp.) and white-footed mice (*Peromyscus leucopus*). Females somewhat larger than males, with convex dorsal abdomen versus “flat” dorsal abdomen of males. Head with prominent eyes, but no genal ctenidium. A pronotal ctenidium is present. Male genitalia particularly characteristic; with a “ham-shaped” moveable finger much narrower basally than distally where it is armed with four to seven stout spiniform setae. Spermatheca of females with barrel-shaped body (or head) and narrower curved tail. Mouthparts with segmented maxillary palps, file-like teeth on maxillary laciniae, and long epipharynx with distinct food canal. Remember, the three stylets of fleas that pierce the host’s skin are the two laciniae and the single epipharynx.



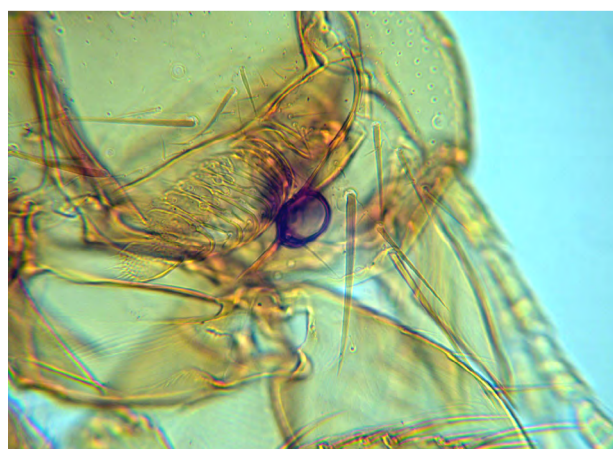
Orchopeas wickhami male (left) and female (right).

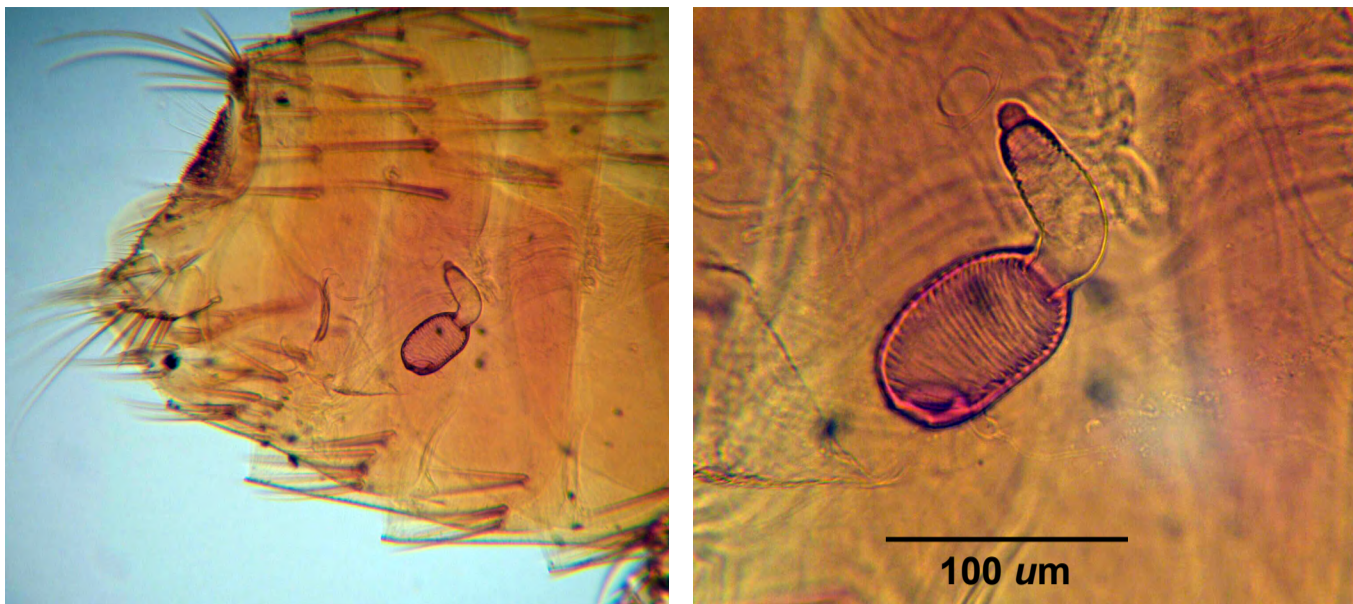
Photographed at same stereoscopic magnification and transferred to this page without alteration so relative sizes are representative.



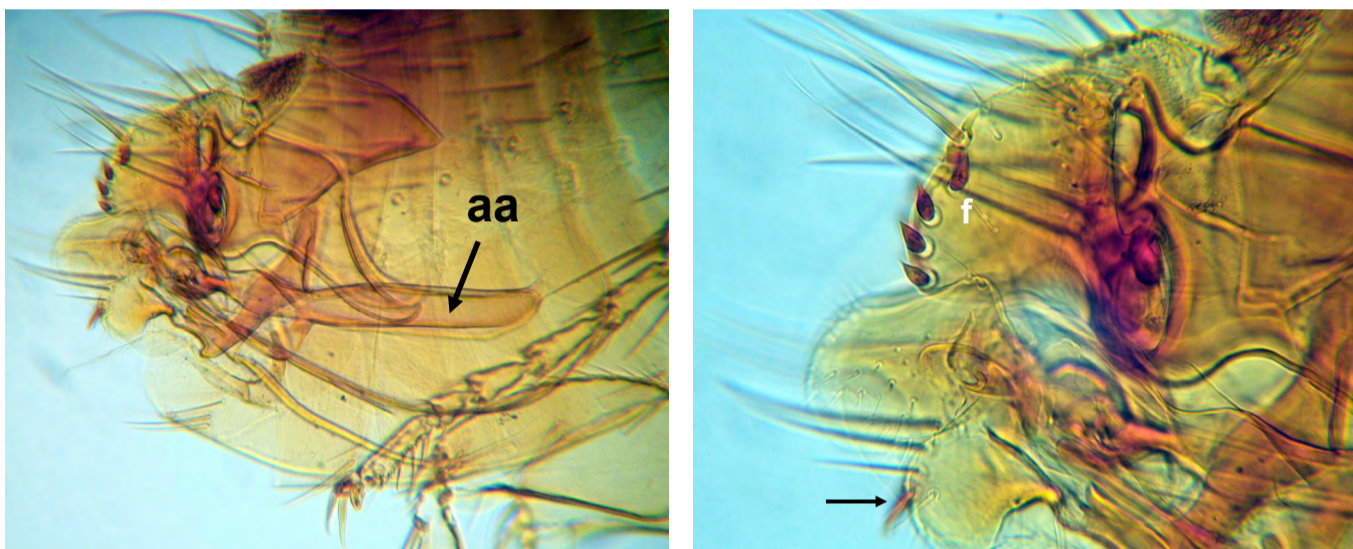
Orchopeas leucopus, male genitalia. Note 4 prominent black pointed “spiniform” bristles on “finger” of clasper.

Orchopeas leucopus, male. Head with prominent eye; lacking genal ctenidium. Pronotal ctenidium present.





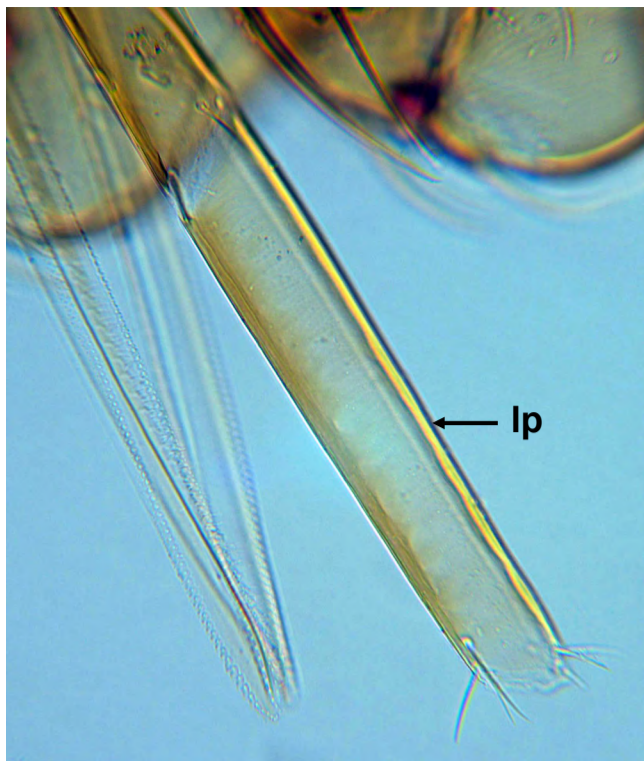
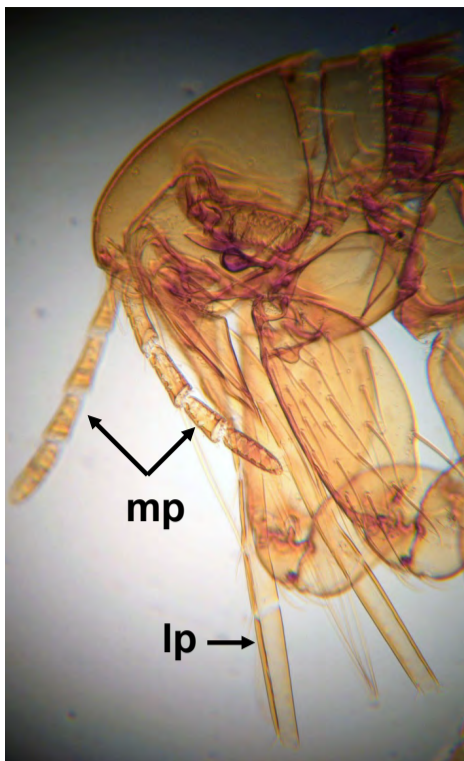
Orchopeas wickhami (= *O. howardi*) female posterior (left)
spermatheca (enlarged, right).



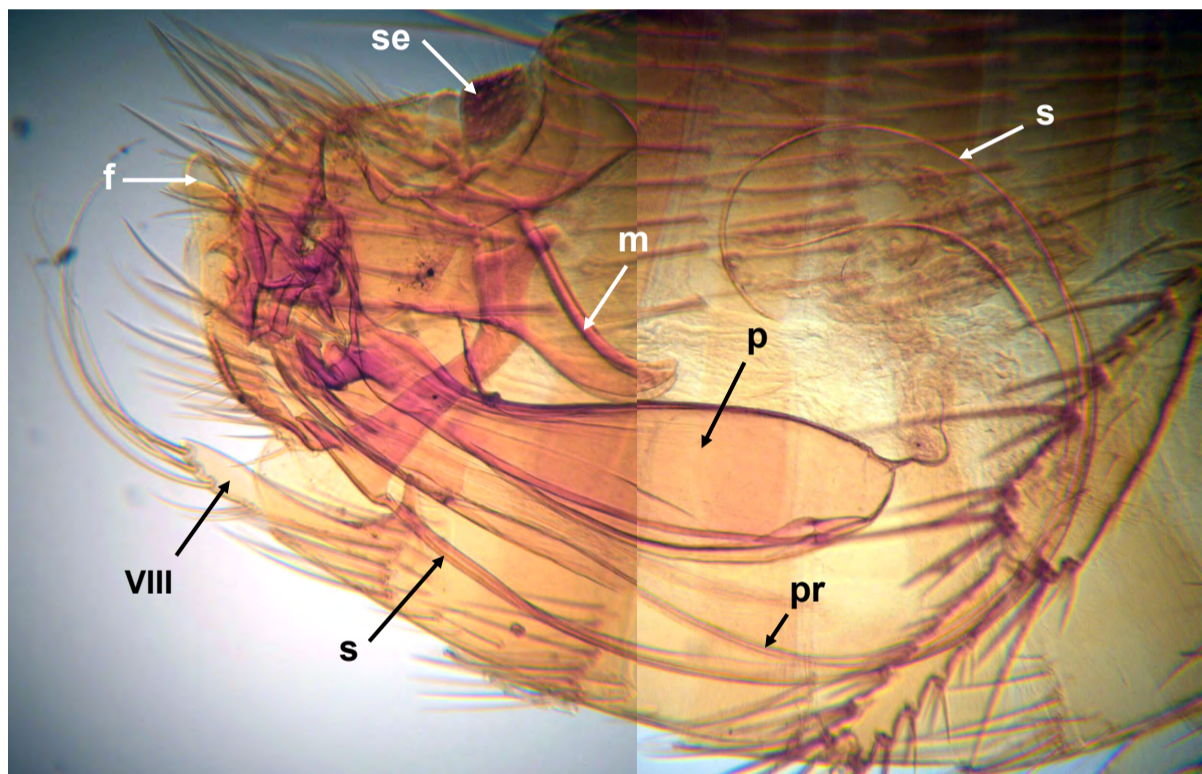
O. wickhami male posterior showing genitalia (left); enlarged (right).
Note 4 prominent black pointed “spiniform” bristles on “finger” (f) of
clasper; lower lobe of IX st. (ninth abdominal segment) with 1 dark
spiniform (arrow). Aedeagal apodeme (aa).

Oropsylla arctomys

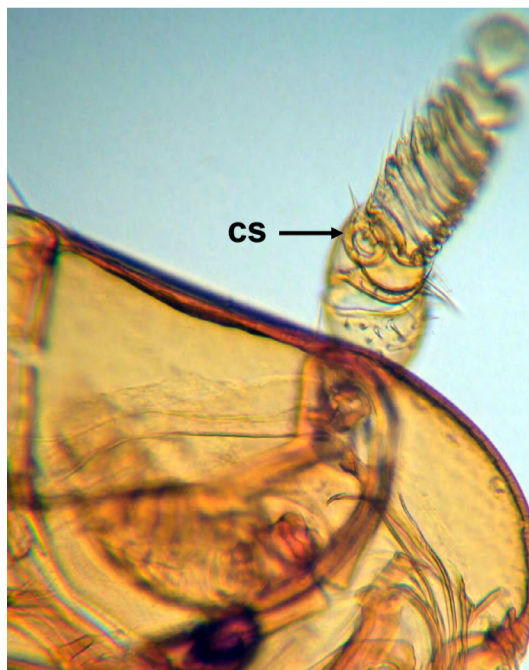
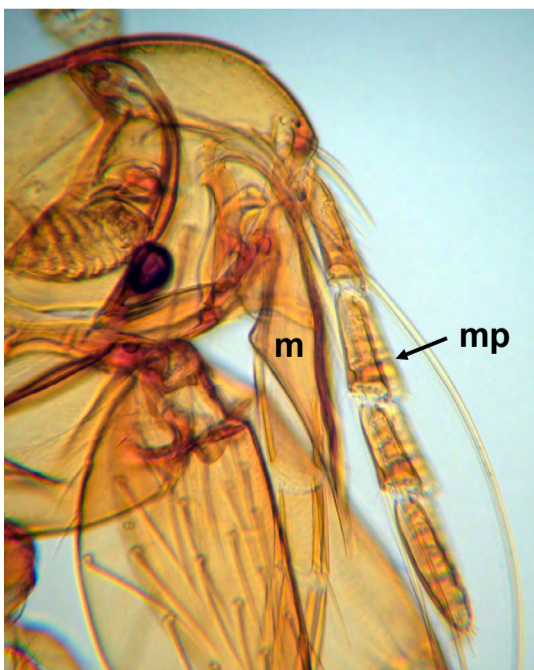
This species is found on a variety of mammalian hosts. Woodchuck’s (*Marmota*) are considered the “normal” host, but the species is also known from squirrels (*Sciurus*), skunks (*Mephitis*), opossums (*Didelphis*), foxes (*Urocyon*) and white-tailed deer (*Odocoileus*). Reports too, of this species parasitizing the barred owl (*Syrnium*). These fleas have distinct eyes and possess a pronotal ctenidium but no genal ctenidia. One feature setting this flea apart from others is the very long labial palps. Also, in males, sternum VIII possesses long bristles, the aedeagal apodeme (i.e., penis) is broad and heavy, the “spring” (= apodemal rod) long, completing a full turn, with a penis rod somewhat shorter than the spring. Males also possess distinct copulatory disks on their antennae. Females have a well-defined spermatheca. Mouthparts of these fleas provide for convenient study. In addition to the characteristic labial palps, the “file-like” maxillary laciniae are easily observed. And remember the inner margins of these laciniae are grooved to serve as a salivary canal. The epipharynx, enclosing the food canal, is also easily seen.



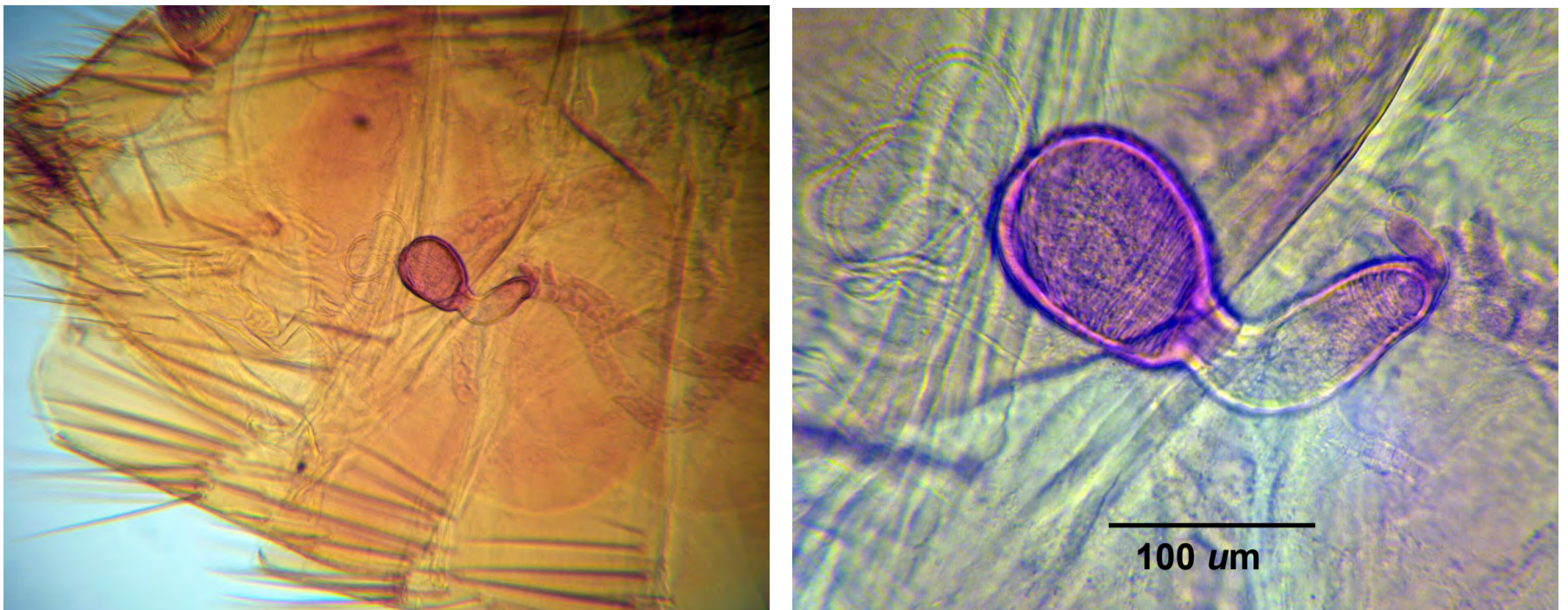
O. arctomys female showing head and mouthparts. Legend: lp, labial palp; ml maxillary laciniae; mp, maxillary palp



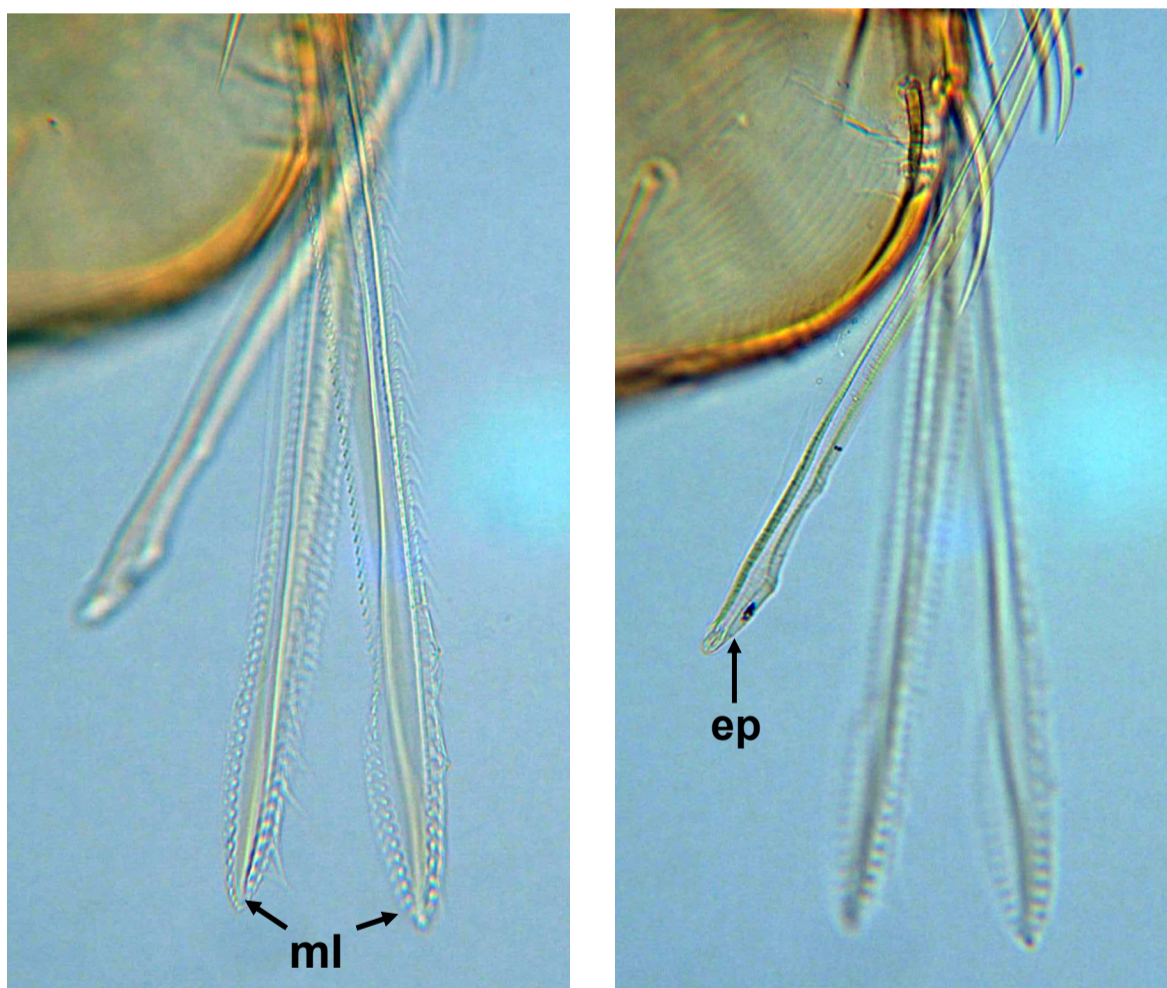
Oropsylla arctomys, the abdomen, male. Legend: f, finger; m, manubrium; p, penis (= aedeagal apodeme); pr, penis rod; s, spring (= apodemal rod); se, sensillum; VIII, abdominal sternal segment eight.



O. arctomys male head showing elongate maxilla and copulatory sucker on inner surface of antenna. Legend: cs, copulatory sucker; m, maxilla (stipes); mp, maxillary palp.



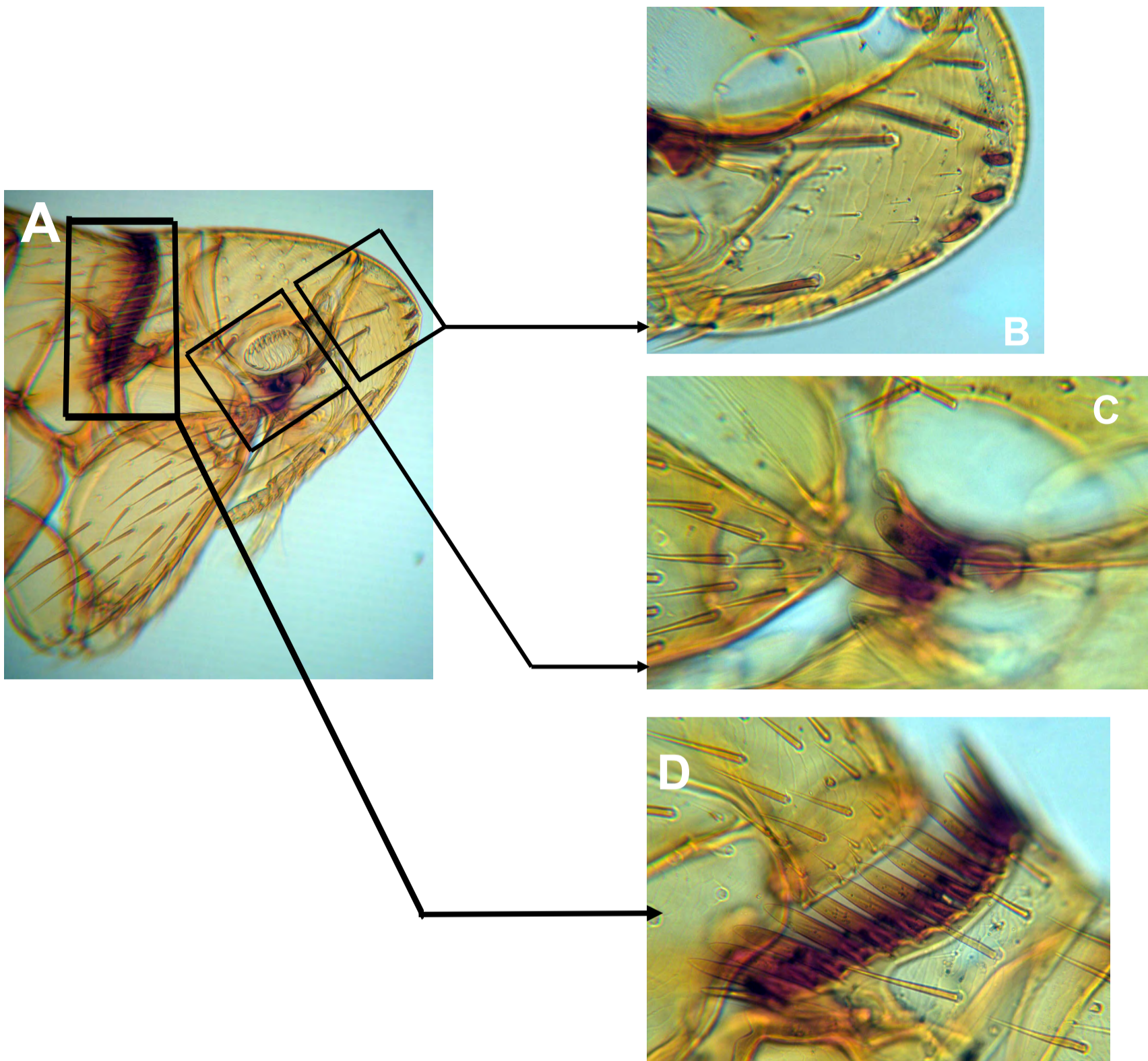
Oropsylla arctomys female. Posterior with spermatheca (left), spermatheca enlarged (right).



O. arctomys male showing epipharynx (ep) and maxillary laciniae (ml).

Peromyscopsylla hesperomys

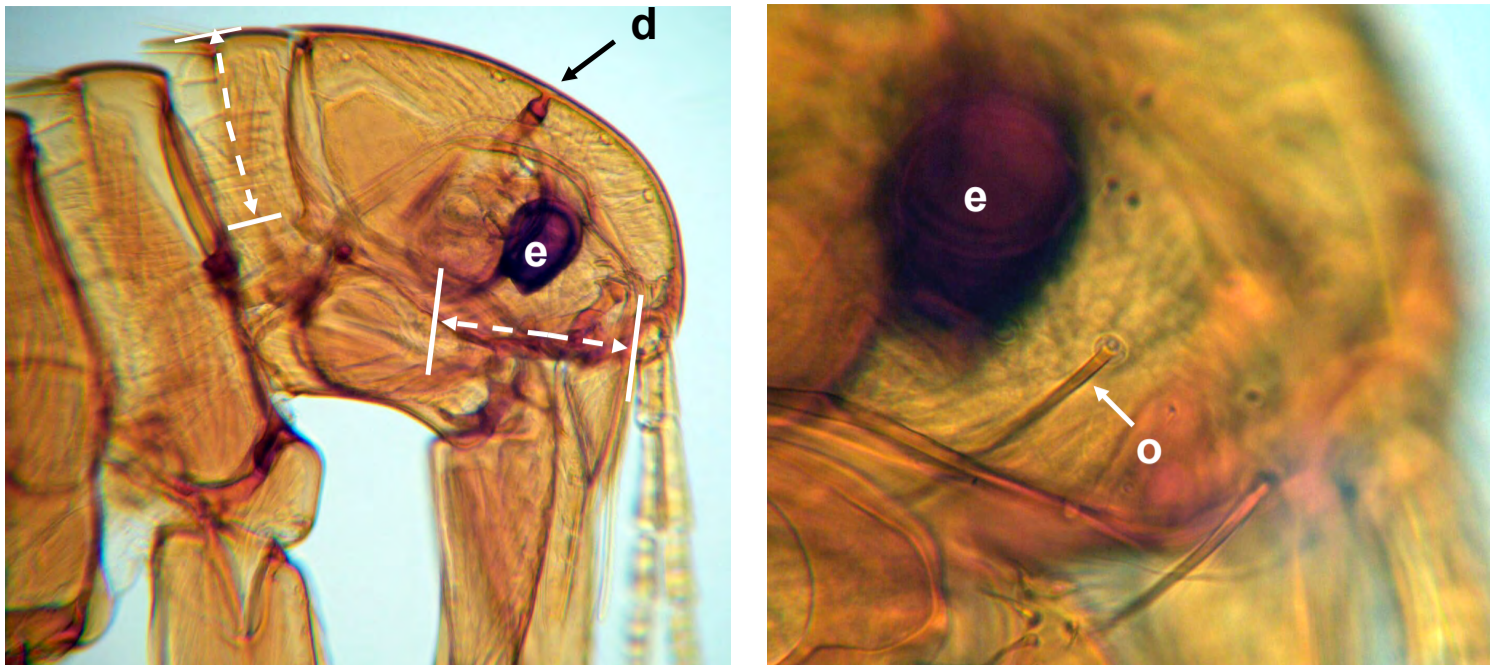
This species commonly occurs on small rodents like deer mice (*Peromyscus* spp.) and meadow mice (*Microtus* spp.). Adults possess both genal and pronotal ctenidia, the former with only two teeth. Stout bristles present on anterior margin of head, the two or three toward the vertex of the head thicker than others. Apical spines on dorsum of abdomen characteristic of this species, as well. Moreover, the proventriculus can easily be seen in well cleared microscope slide preparations.



Peromyscopsylla hesperomys head (A). Thick bristles on anterior margin of head (B) and genal ctenidium of 2 teeth (C) are characteristic features of this genus. Pronotal ctenidium enlarged (D).

Pulex irritans

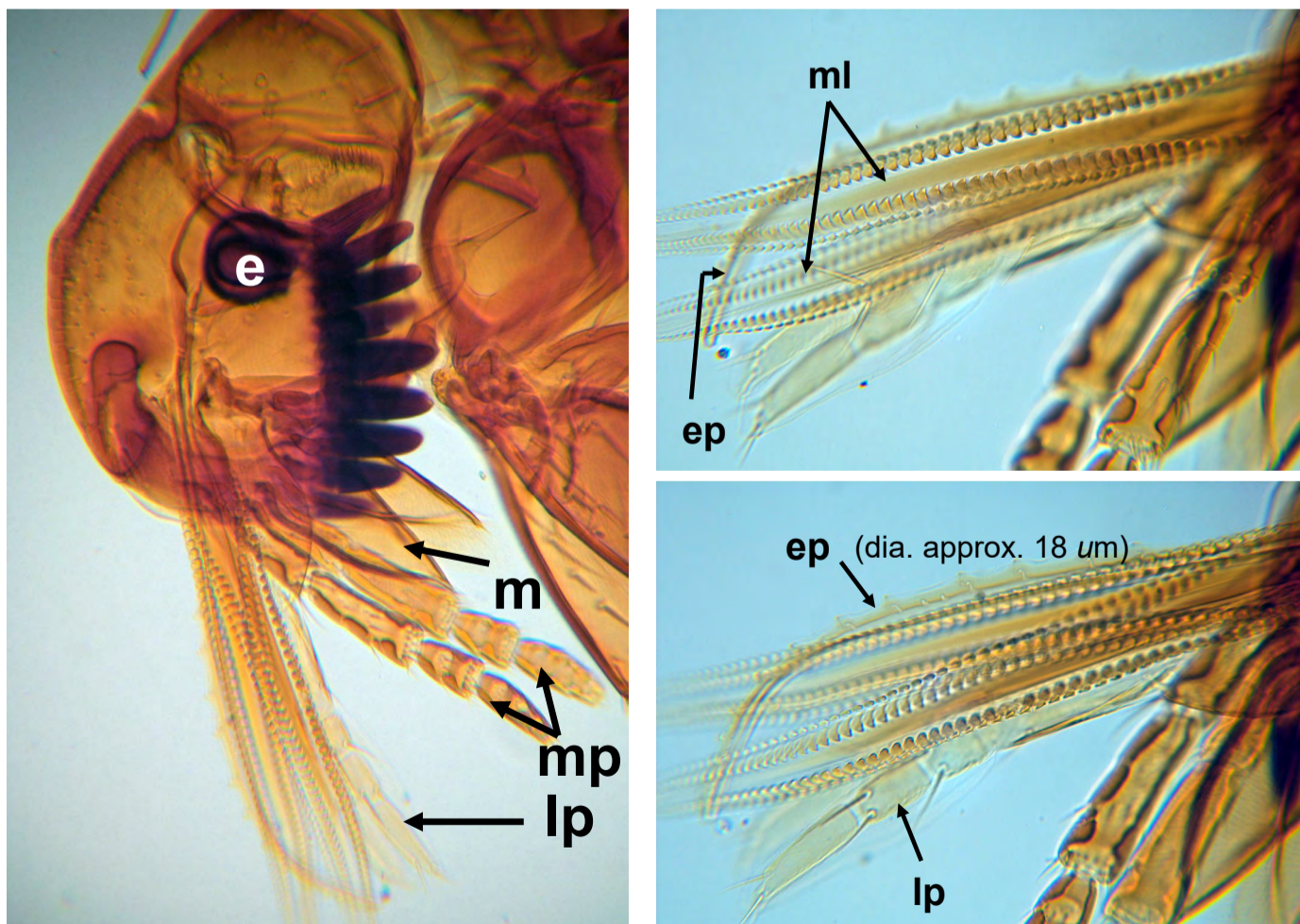
This species, often referred to as the human flea, commonly occurs on swine and dogs throughout most of the world. Adults lack both genal and pronotal combs and there is a distinct ocular bristle near the lower margin of the eye. A similar flea genus, *Xenopsylla*, also possess an ocular bristle which is nearer the mid-level of the eye. Mouthparts of this species are useful for the study of these structures. Note the elongate labrum-epipharynx which contains the food canal, the serrated maxillary laciniae used to cut host tissue, the segmented labial and maxillary palps, and the triangular-shaped maxilla (or stipes) which is the lateral-most of the mouthparts. This flea species is capable of transmitting pathogens to humans.



Pulex irritans: female, anterior. Note the absence of genal and pronotal ctenidia (regions of dashed arrows), and presence of ocular bristle at lower portion of eye. Legend: d, dorsal sulcus; e, eye; o, ocular bristle.

Spilopsyllus cuniculi

This is the rabbit flea, and it is found on rabbits throughout the world. This flea is sedentary, attaching to its host for long periods with its elongated mouthparts which feature distinctly serrated maxillary laciniae. Adults possess both genal and pronotal ctenidia, and a prominent eye. The spiracular fossa, leading into the tracheal system, and sensory sensillum with accompanying antesensilial bristle are also prominent in this species.



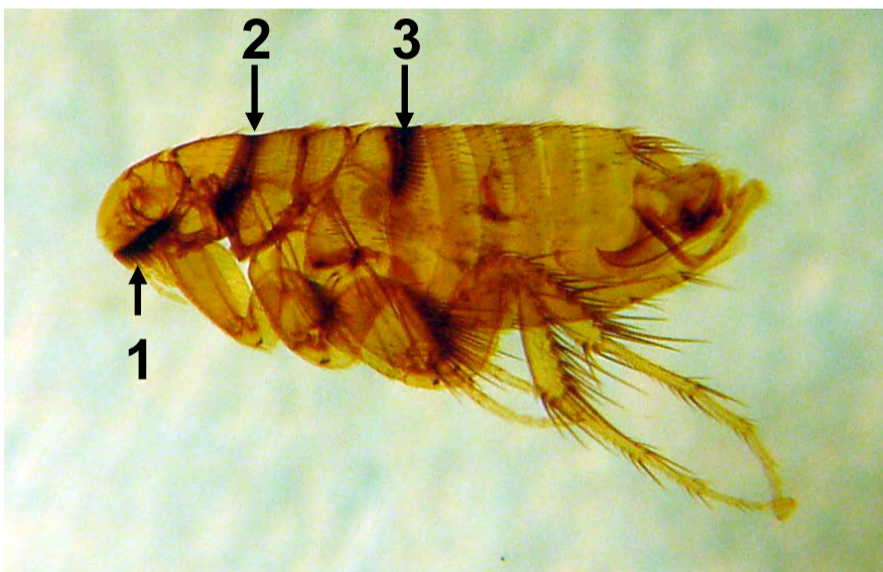
S. cuniculi, mouthparts. Legend: e, eye; ep, epipharynx; lp, labial palp, m, maxilla (stipes), ml, maxillary laciniae; mp, maxillary palp.



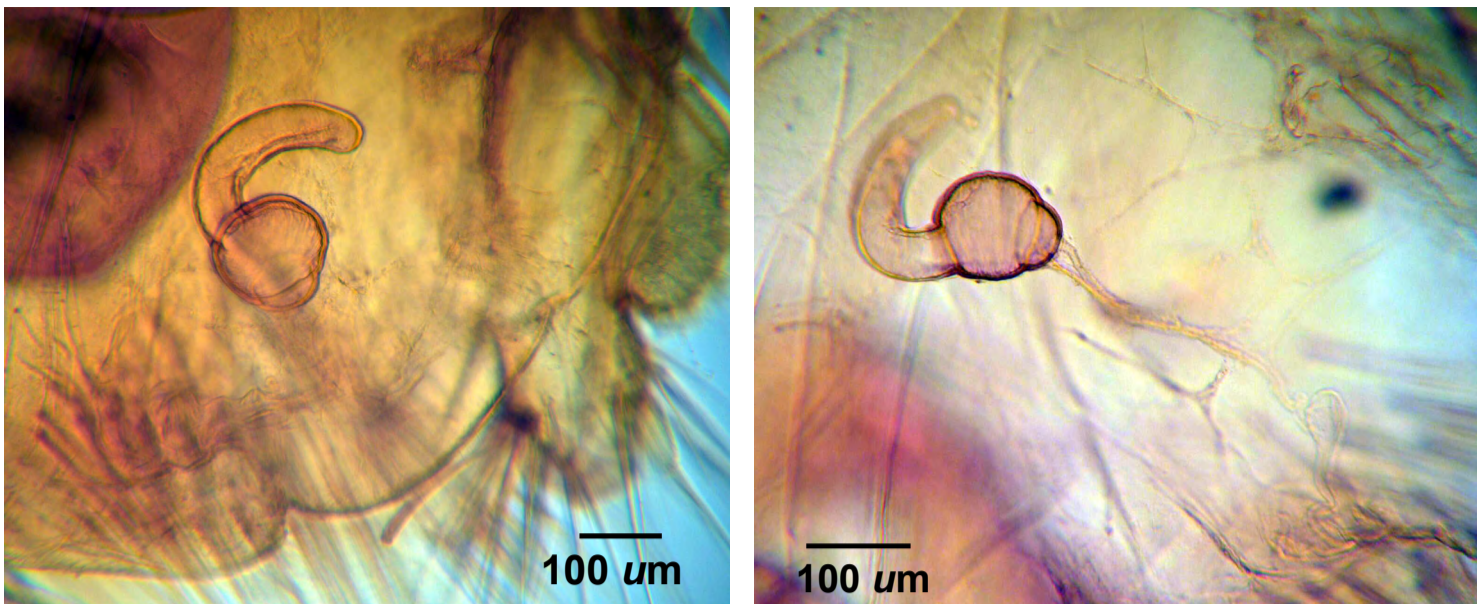
S. cuniculi; genal and pronotal ctenidia (A); sensillum (B). Legend: a, antesensilial bristle; s, sensillum; sf, spiracular fossa; t, trachea.

Stenoponia americana

This relatively large flea, ranging from 4 to 5 mm in both sexes, is an ectoparasite of white footed mice, *Peromyscus leucopus*. This flea species is notable because it possesses three types of ctenidia; genal, pronotal, and abdominal. Note the large eggs in females of this species, and well defined spermathecal.



Stenoponia americana, characterized by 3 ctenidia – genal, pronotal and abdominal (1, 2 & 3, respectively). Note: These two individuals, a male to the left and female to the right, were photographed with the aid of a stereomicroscope at the same magnification. Relative sizes of these individuals were not altered in transfer to this PowerPoint slide.



Stenoponia americana, spermathecae of 2 different females.

Xenopsylla cheopis

This flea, commonly known as the Oriental rat flea, is most often associated with rats, but it will feed on humans, dogs, cats, chickens, and other hosts. Such catholic feeding habits make this flea a potential vector of several pathogens, most notably etiologic agents of plague and murine typhus. Like *Pulex irritans* (the “human” flea), this species lacks both genal and pronotal ctenidia. It is separated from *P. irritans* on the basis of the ocular bristle, which is positioned below the level of the prominent eye in *Pulex*, but at the mid-level of the eye in *Xenopsylla*. The spermatheca of females has a relatively small head and a sharply curved tail. Males have long penial rods making a full turn dorsally. These fleas also have well defined spiracular fossae and easily seen tracheal system in well cleared microscope slide preparations.

F. Review (Terms and Sample Lab Quiz(es))

Structures / terms underlined throughout the previous narrative may be used for testing purposes. As a result, you should be prepared to match those terms with their descriptions as seen in the following sample questions. You should be able to select the one correct term in each numbered statement for multiple choice quizzes, and be able to identify those structures labeled in lab quizzes based on PowerPoint presentations. The following are examples of each quiz type.

1. A copulatory disk in males is found on the:

- a. sensillum b. antenna c. manubrium d. anterior leg

2. Term synonymous with sensillum:

- a. pygidium b. fossa c. antenna d. ctenedium

3. Posterior-most region of the thorax:

- a. metathorax b. mesothorax c. prothorax d. megathorax

4. Term synonymous with ctenedium:

- a. sensillum b. pygidium c. comb d. clypeus

5. Flea genus lacking ctenidia:

- a. *Ctenocephalides* b. *Epitedia* c. *Myodopsyllus* d. *Pulex*

6. Term synonymous with stipes:

- a. mandible b. maxilla c. epipharynx d. palp

7. Leg segment immediately distal to the trochanter:

- a. coxa b. femur c. tarsus d. tibia

8. Term for dorsal abdominal segment:

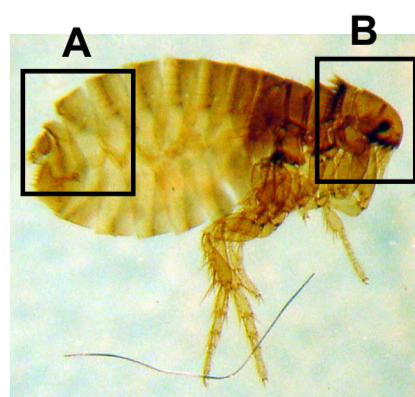
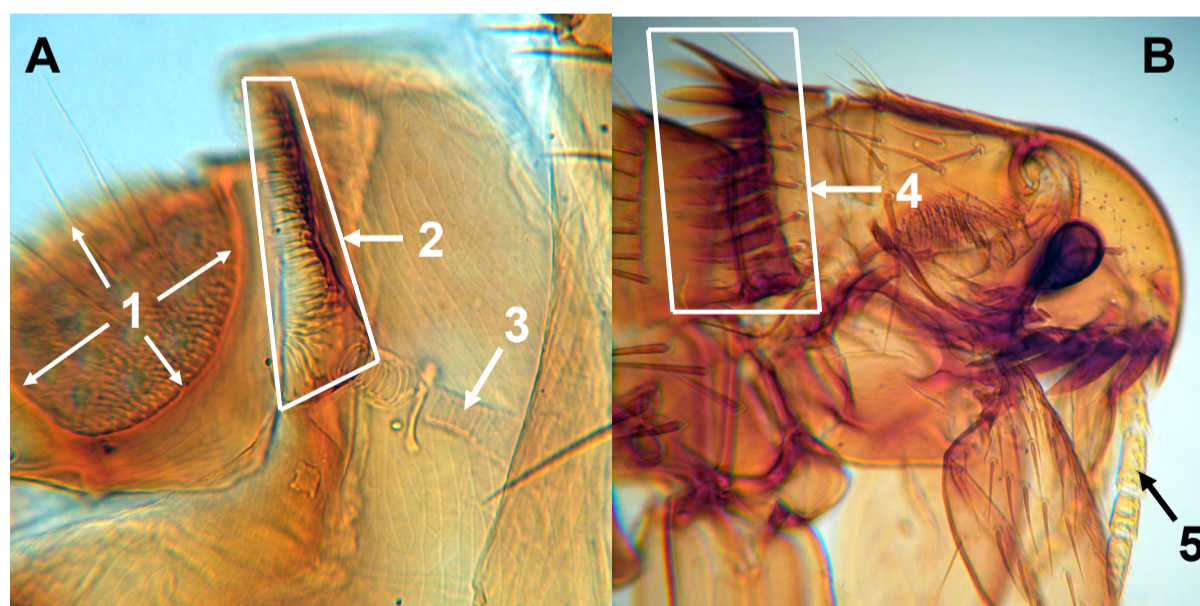
- a. terga b. frons c. sterna d. pleura

9. Opening into tracheal system:

- a. proventriculus b. cibarium c. dorsal sulcus d. spiracle

10. Leg segment immediately proximal to the trochanter:

- a. coxa b. femur c. tarsus d. tibia



Match structures indicated by arrows with their appropriate terms listed below. Three terms will not be used.

- a. pronotal ctenidium b. sensillum
 c. spiracular fossa d. antenna
 e. genal ctenidium f. trachea
 g. maxillary palp h. spiracle