

ON THE SUBGENUS *CERATOPHYLLUS* (*CELEOPHILUS* SMIT 1983),  
WITH A REDESCRIPTION OF ITS TWO SPECIES  
(SIPHONAPTERA: CERATOPHYLLIDAE: CERATOPHYLLINAE)

ROBERT E. LEWIS AND GLENN E. HAAS

(REL) 3906 Stone Brooke Circle, Ames, IA 50010-4174, U.S.A. (e-mail: relewis@iastate.edu); (GEH) 557 California Street PMB#7, Boulder City, NV 89005-2796

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**Abstract.**—The ceratophylline subgenus *Celeophilus* is redefined based upon collections of *Ceratophyllus* (*Celeophilus*) *adustus* Jordan 1932 and *C. (C.) zhovtyii* Yemel'yanova and Goncharov 1966, collected from woodpecker nests in Alaska. The two species are redescribed, the diagnostic characters for both are illustrated, and their host preferences and distribution are discussed.

**Key Words:** *Ceratophyllus*, (*Celeophilus*), redescription, host preferences, geographic distribution

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In his detailed study of the family Ceratophyllidae, Smit (1983) attempted to bring more order to the genus *Ceratophyllus* Curtis 1832 by dividing it into six subgenera. These included the nominate subgenus and *Amonopsyllus* Wagner 1938, *Celeophilus* Smit 1983, *Emmareus* Smit 1983, *Monopsyllus* Kolenati 1857, and *Rosickyiana* Smit 1972. In North America, *Amonopsyllus*, *Monopsyllus* and *Rosickyiana* are each represented by single species. The first two are mainly parasites of squirrels, and the latter is associated with mustelids in the Arctic. The remaining three subgenera contain species that parasitize birds, and these are represented in North America by 22 species (*Ceratophyllus* [17], *Celeophilus* [2] and *Emmareus* [3]). While pulicologists may not agree on the status of some of these taxa, those belonging to *Ceratophyllus* and *Emmareus* are mostly well known and relatively easily identified, at least in the male sex. This has not been the case with the two species assigned to *Celeophilus*.

In addition to the holotype female of *C.*

(*C.*) *adustus*, Smit examined one male and three females from the Haas Collection. It is not clear whether he was able to examine specimens of *C. (C.) zhovtyii*, but we suspect not. In any case, beyond the illustrations in the original descriptions and Smit's (1983) figure 13 of the occipital setal row and figure 178 of the spermatheca and associated ducts, both of *C. (C.) adustus*, no other illustrations exist. While the illustrations of the male clasper and st IX of *C. (C.) zhovtyii* seem accurate, the drawing of the apex of the male st VIII is not complete and does not show one of the diagnostic characters of the species.

Finally, since the male of *C. (C.) adustus* has never been described, and the description of *C. (C.) zhovtyii* was published in an obscure journal series generally unavailable to western workers, it seems appropriate to recharacterize the subgenus and redescribe the two species. Following is a review of the subgenus.

Names of host birds are taken from the A.O.U. Checklist (1998) and Sibley and Monroe (1990).



Subgenus *Celeophilus* Smit 1983

*Ceratophyllus* Curtis 1832—*Celeophilus* Smit 1983: 14 (subgen. n.).

*Ceratophyllus* (*Celeophilus*): Haddow et al. 1983: 70; Smit 1983: 30; Lewis 1990, 44; 1993, 65.

Diagnostic characters.—*Head*: Frontal tubercle extremely small. Eye well developed, slightly oval, well pigmented. Frontal setal row of 0 to 5 setae, usually 3 in males, 2 in females. Ocular setal row of 3 setae. Postocular seta present, with about half its length projecting beyond genal lobe. Postantennal region of head usually with 1 long seta above row of minute setulae extending along dorsal margin of antennal fossa. Occipital setal row widely interrupted above ventralmost seta. Labial palpi extending almost to apex of forecoxae.

*Thorax*: Pronotal ctenidium usually of 28 to 30 spines. Mesepimeron usually with a few small setae. Metepimeron with 4 to 8 slender bristles, usually 5 or 6, arranged in 3 irregular rows. Caudal margin of metanotum usually without spinelets or when present, they are minute.

*Legs*: Forecoxa sparsely setose. Sulcus of midcoxa with a short dorsal interruption. Forefemur with small setae on its outer surface. Striation of mid- and hindfemora and tibiae of medium density. Chaetotaxy of hindtibia reduced. Figs. 15 and 16 show hindfemora of *Ceratophyllus* (*Ceratophyllus*) *hirundinis* (Curtis 1826) and *Ceratophyllus* (*Emmareus*) *columbae* (Gervais 1844) the type species for their respective subgenera. First and third pairs of lateral plantar setae slightly displaced on to plantar surface.

*Abdomen*: Abdominal tergites I–IV usually with 1 or 2 marginal spinelets per side. Outer and inner of 3 antesensilial setae minute in males, somewhat longer and slightly subequal in females. Male: Tergum VIII lacking a spiculose area along its dorsocephalic margin. Sternite VIII long and narrow, lacking any stout setae but with a few slender apical and preapical bristles and a

small subapical fimbriated vexillum. Distal arm of st IX slender and curved. Fixed process of clasper rather short and with a triangular apex. Two acetabular setae arising on or above acetabular projection. Movable process long and narrow, lacking any stout or spiniform setae. Apex of penis plate bearing a long tendril that is coiled  $>360^\circ$ . Apophysis of st VIII and penis rods describing at least 1 complete convolution. Female: Genital ducts weakly sclerotized, ductus bursae and ductus obturatus rather short. Basal portion of spermathecal duct wrinkled and somewhat enlarged. Bulga large, cylindrical, with an apical orifice. Hilla rather small, with a slight terminal papilla. Anal stylet normally with a dorsal as well as a ventrolateral seta.

Remarks.—This is a small subgenus with two species, both of which are Holarctic in distribution where they parasitize woodpeckers.

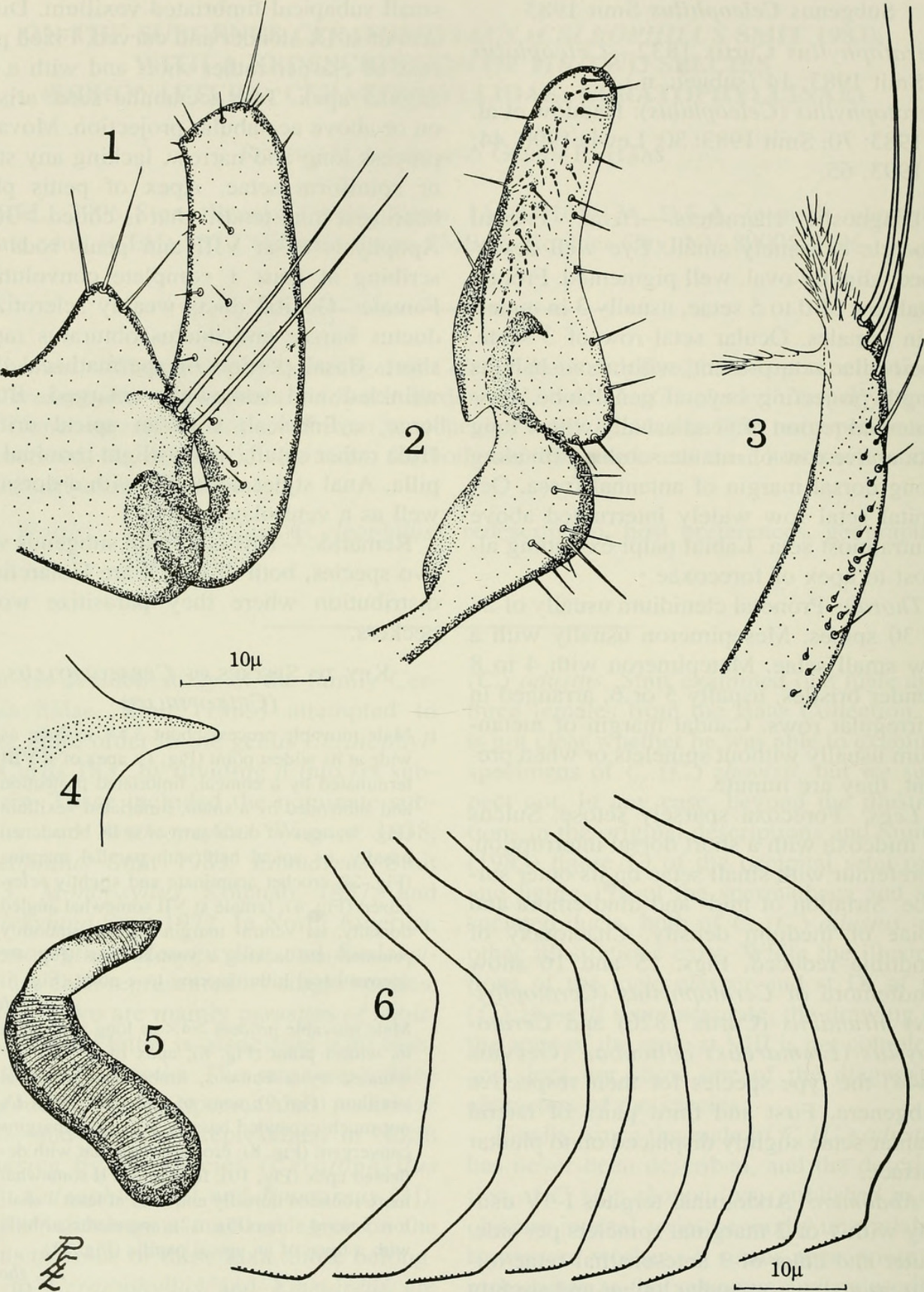
KEY TO SPECIES OF *CERATOPHYLLUS*  
(*CELEOPHILUS*)

- 1. Male movable process about  $3.5\times$  as long as wide at its widest point (Fig. 1); apex of st VIII terminated by a conical, fimbriated projection and subtended by a small, fimbriated vexillum (Fig. 3); apex of distal arm of st IX broadened basally, its apical half with parallel margins (Fig. 2); crochet acuminate and slightly sclerotized (Fig. 4); female st VII somewhat angled dorsally, its ventral margin usually smoothly rounded and lacking a ventral sinus (Fig. 6); spermathecal hilla tapering to a point (Fig. 5) ..... *adustus*
- Male movable process  $>4\times$  as long as wide at its widest point (Fig. 8); apex of st VIII terminated by a bulbous, fimbriated, subapical vexillum (Fig. 9); apex of distal arm of st IX not much expanded basally, its apical margins convergent (Fig. 8); crochet triangular with deflected apex (Fig. 10); female st VII somewhat more rounded dorsally and with at least a shallow ventral sinus (Fig. 12); spermathecal hilla with a trace of an apical papilla (Fig. 11) ... *zhovtyii*

*Ceratophyllus* (*Celeophilus*) *adustus*  
Jordan 1932  
(Figs. 1–6, 14, 18, 21)

*Ceratophyllus adustus* Jordan 1932: 253, figs. 10–11. Canada, British Columbia,





Figs. 1-6. *Ceratophyllus (Celeophilus) adustus*. 1, Male clasper. 2, Male st IX. 3, Male st VIII. 4, Male aedeagal crochet. 5, Female spermatheca. 6, Female st VII variation.



Atlin, 59°31'N 133°41'W, from *Erethizon epixanthum* [= *dorsatum*], 3.IX.1931, H. S. Swarth leg. Holotype ♀, BMNH.

*Ceratophyllus adustus*: Holland 1949: 146; Lewis 1975: 660; Smit and Wright 1978: 20; Haas et al. 1980: 105; Haas 1983: 141; Haas and Wilson 1984: 127.

*Ceratophyllus (Ceratophyllus) adustus*: Holland 1985: 267.

*Ceratophyllus (Celeophilus) adustus*: Haddow et al. 1983: 70; Smit 1983: 30; Lewis 1990: 44.

**Description.**—*Head*: Frontal tubercle present but small and inconspicuous. Setae in frontal row 3 to 5 (~60% with 3) in male, 1 or 2 (90% with 2) in female. Setae in ocular row 3 in both sexes, rarely 1 or 4. Eye well developed in both sexes. Postocular seta present, about half of it extending beyond genal lobe. Most of long setae arising on antennal pedicel of female extending well beyond apex of clavus. Minute setulae extending along dorsal margin of antennal fossa 9 to 12 (50% with 12) in male, 9 to 15 (mostly 12 to 15) in female. Preoccipital setae 1 or 2 in both sexes (60% with 2 in male, 80% with 2 in female). When 2 present, they form a horizontal row above and parallel with antennal fossa. Setae in occipital row 4 to 6 per side (60% with 4) in male, 4 or 5 (50% with 4) in female. In both sexes, lowermost seta separated from other members of row by a wide space. Labial palpi extending almost to apex of forecoxae in both sexes. *Thorax*: Spines in pronotal ctenidium, 26 to 30 (70% with 27 to 29) in male, 27 to 30 (50% with 28 or 29) in female. Pseudosetae under mesonotal collar 8 to 10 in both sexes. Usually with 1 seta on mesepisternum in both sexes, occasionally with 2 or even 3. Mesepimeron with 1 or 2 setae (55% with 2, 45% with 1) in both sexes. Metanotal spinelets, when present, minute. Male with ~30% with 1/1 and another 30% with 0/1, while 80% of females were 0/0 and 20% were 0/1. Lateral metanotal setae present in only ~5% of both sexes. Usually only 1

seta on metepisternum in both sexes. Setae on metepimeron variable, 5 to 9 in male, 7 to 9 in female and not arranged in well defined rows. *Legs*: Forefemur with 4 to 8 fine setae on outer surface. Foretibia with 5 notches in caudal margin, including apical notch, bearing stout setae. With a submarginal row of 4 to 6 setae in inner surface in both sexes. Foretarsal segments I–III approximately equal in length, segment IV  $\sim \frac{4}{5}$  length of each of preceding 3. Segment V with 5 pairs of lateral plantar bristles, pairs I and III slightly shifted on to plantar surface. Midfemur with a submarginal row of 4 to 6 setae on inner surface. Midtibia with 6 notches in its caudal margin bearing stout setae, a submarginal row of ~6 to 8 setae on outer surface and 6 to 8 more on inner surface. Midtarsal segments I and II approximately equal in length, segment III  $\sim \frac{1}{2}$  length of each of preceding segments, segment IV  $\sim \frac{3}{4}$  length of III. Segment V as with segment V of foretarsus. Hindfemur with a submarginal row of 4 or 5 fine setae on inner surface. Hindtibia (Fig. 14) with 5 notches in its caudal margin bearing strong setae, a submarginal row of ~8 setae on outer surface and ~6 on the inner surface. Hindtarsal segment II  $\sim \frac{2}{3}$  length of segment I, segment III  $\sim \frac{1}{2}$  length of segment II, segment IV slightly  $> \frac{1}{2}$  length of segment III, segment V as with other legs. *Abdomen*: Tergal spinelets in male: t I (60% with 1/1, 40% with 3 or 4); t II (30% with 1/1, 70% with 3 or 4); t III (40% with 1/1, 60% with 3 or 4); t IV (90% with 1/1, 10% with 1/2); t V (20% with 0/1, 80% with 0/0). Tergal spinelets in female: t I (70% with 1/1, 30% with 3 or 4); t II (60% with 1/1, 40% with 3 or 4); t III (90% with 1/1, 10% with 0/1); t IV (20% with 0/0, 60% with 0/1, 20% with 1/1); t V (100% with 0/0). Median bristle of male antepygial setae well developed, bordered dorsally and ventrally by single minute setulae. Median bristle of female antepygial setae well developed, bordered dorsally and ventrally by single setae about  $\frac{1}{5}$  length of median. Remaining abdominal characters sexual in nature.



Male: Wagner's organ present but small and barely visible in some males. Penis rods coiled  $>360^\circ$  but not as long as in *C. (C.) zhovtyii*. Apex of penis plate with a pronounced tendril that is coiled  $\sim 360^\circ$ . Spiculose area on t VIII absent. Anal tergum blunt, shorter than conical anal sternite. Movable process of clasper (Fig. 1)  $\sim 3.5\times$  as long as wide at its widest point, its cephalic incrassation arising  $\sim \frac{2}{3}$  down from apex. Dorsal apex of fixed process broadly triangular. Apex of st VIII (Fig. 3) terminating in a fimbriated, cone-shaped, membranous projection subtended by a few long setae and a fimbriated mesal vexillum. Distal lobe of apical arm of st IX (Fig. 2) expanded basally, cephalic and caudal margins of apical half roughly parallel. Crochet (Fig. 4) narrowly pointed and lightly sclerotized. Female: (Figs. 5–6, 18, 23). Spermatheca large and well sclerotized, its duct arising apically, its hilla with a slight apical projection. Fig. 6 illustrates variation in caudal margin of st VII. Anal stylet as in Fig. 18. Ventral anal lobe similar to that of *C. (C.) zhovtyii* but with a slightly more squared and angular apex. In absence of accompanying males, females difficult to separate from many members of subgenus *Ceratophyllus*.

Remarks.—This is the type species for the subgenus. As is frequently the case with rare species, much of the literature about it refers to previous references without adding materially to our knowledge. Originally described from a single female from an unusual host for a member of this genus, additional material was not published until Haas et al. (1980) reported 1 female and Haas and Wilson (1984) reported 66 males and 102 females. These collections came from various localities in Alaska, and until now the male has not been illustrated. However, it is now beyond doubt that this species is not a parasite of porcupines, as originally thought, but rather is a woodpecker flea infesting the nests of the flicker, *Colaptes auratus* Linnaeus 1758, the three-toed woodpecker, *Picoides tridactylus* (Linnaeus

1758) and probably other members of this genus in the extreme northwestern part of North America. Other members of the genus or their nests have yet to be reported as hosts.

In his treatment of morphological anomalies in fleas, Haas (1983) described the presence of a vestigial second spermatheca in five of the 103 females he examined. While such anomalies are uncommon in ceratophyllid adults, they are not unknown, and over 25% of female *Nosopsyllus medus* Jordan 1938, from Iraq in the Lewis Collection have similar vestigial second spermathecae.

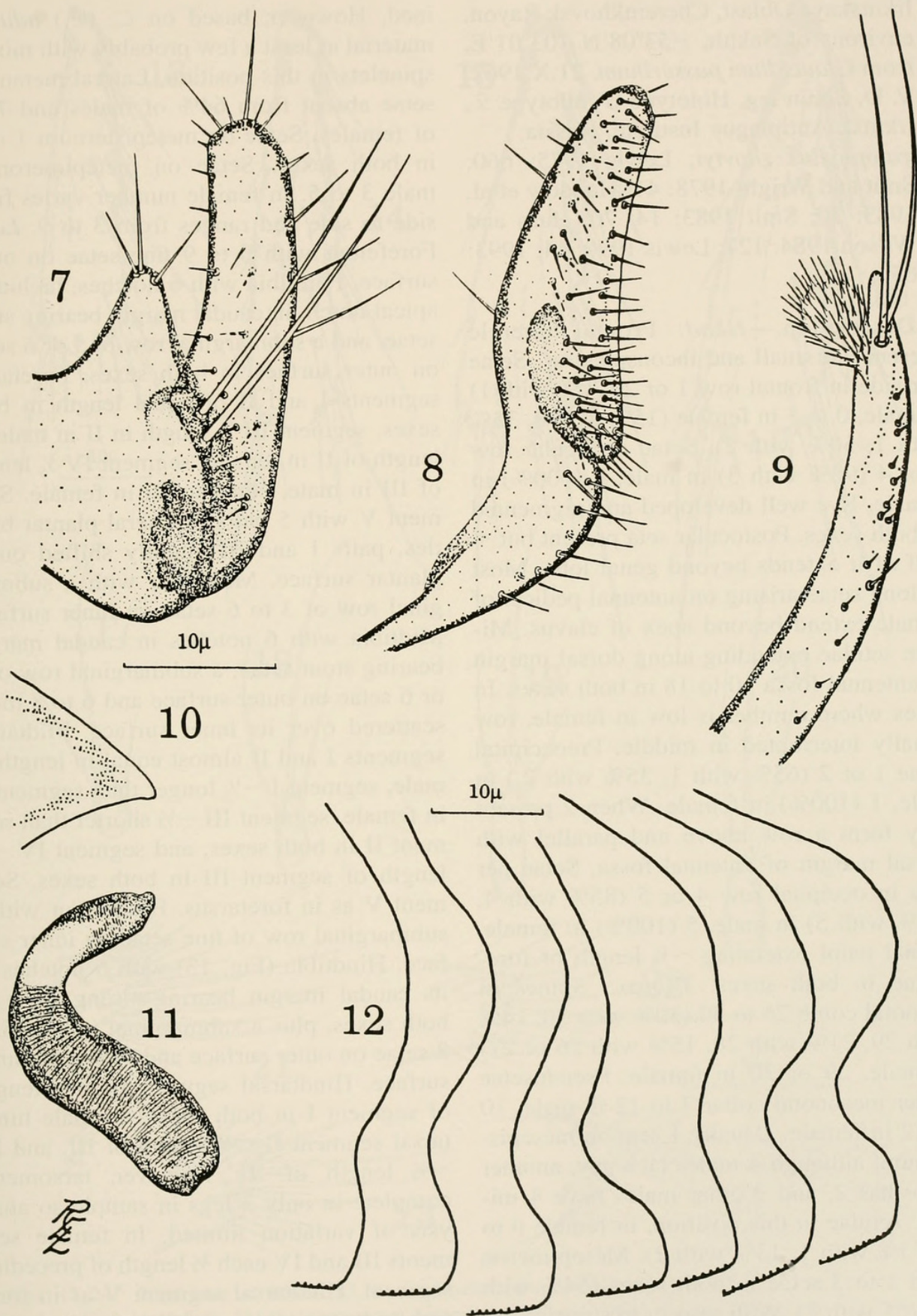
Distribution.—Collection records as cited in Haas and Wilson (1984) include the following localities: 4.8 km NE Cantwell; 22.5 km SW Chistochina; mile 10 Edgerton Highway; 3 km SE Eklutna Lake; 53 km W Glennallen; mile 119 Glenn Highway; 4.5 km NE Palmer; Knik River Road nr. Fox Lake; N shore Skilak Lake; 7.2 km NW Sterling; 2.9 km SE Talkeetna; 4.6 km E Wasilla and Lakeview Road nr. Kings Lake. All came from nests of *Colaptes auratus* or *Picoides* spp. in dead stubs of birch, spruce and poplar.

Host associations.—Only the flicker and the three-toed woodpecker have been identified with certainty as hosts. However, as Haas and Wilson (1984) point out, the downy (*Picoides pubescens* Linnaeus 1766), the hairy (*Picoides villosus* Linnaeus 1766) and the black-backed (*Picoides arcticus* (Swainson 1832)) woodpeckers also occur in the area where these fleas were collected. Of these, the downy and the hairy were considered to be the most likely preferred hosts, since they nest in dead tree stubs of birch, poplar and spruce similar to the recorded hosts while the latter species of woodpecker prefers to nest in living trees.

*Ceratophyllus (Celeophilus) zhovtyii*  
Yemel'yanova and Goncharov 1966  
(Figs. 7–12, 13, 17, 21)

*Ceratophyllus zhovtyii* Yemel'yanova & Goncharov 1966: 309, figs. 1–4. USSR,





Figs. 7–12. *Ceratophyllus (Celeophilus) zhovtyii*. 7, Male clasper. 8, Male st IX. 9, Male st VII. 10, Male aedeagal crochet. 11, Female spermatheca. 12, Female st VII variation.



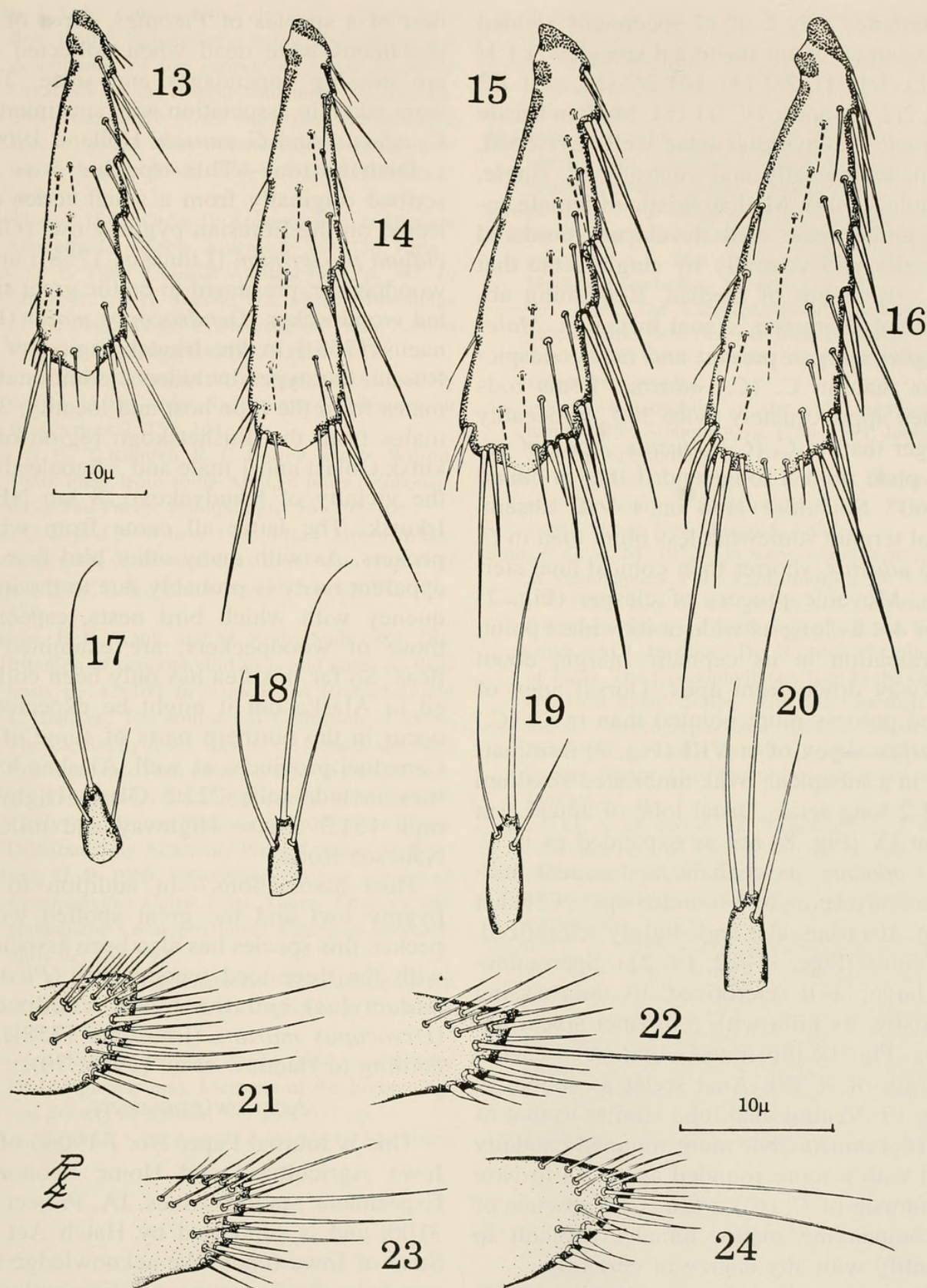
Irkutskaya Oblast, Cheremkhovsk Rayon, environs of Sakhir,  $\sim 53^{\circ}08'N$   $103^{\circ}01'E$ , from *Glaucidium passerinum*, 21.X.1962, V. D. Sonin leg. Holotype ♂, allotype ♀, Irkutsk Antiplague Institute, Russia.

*Ceratophyllus zhovtyi*: Lewis 1975: 660; Smit and Wright 1978: 41; Haddow et al. 1983: 70; Smit 1983: 14, 70; Haas and Wilson 1984: 127; Lewis 1990: 44; 1993: 65.

**Description.**—*Head*: Frontal tubercle present but small and inconspicuous. Setae per side in frontal row 1 or 2 (70% with 1) in male, 0 to 3 in female (15% with 0, 35% with 1, 50% with 2). Setae on ocular row 3 or 4 (92% with 3) in male, 3 (100%) in female. Eye well developed and pigmented in both sexes. Postocular seta present but < half of it extends beyond genal lobe. Most of long setae arising on antennal pedicel of female extend beyond apex of clavus. Minute setulae extending along dorsal margin of antennal fossa 10 to 18 in both sexes. In cases where number is low in female, row usually interrupted in middle. Preoccipital setae 1 or 2 (65% with 1, 35% with 2,) in male, 1 (100%) in female. When 2 present they form a row above and parallel with dorsal margin of antennal fossa. Setae per side in occipital row 4 or 5 (85% with 4, 15 % with 5) in male, 5 (100%) in female. Labial palpi extending  $\sim \frac{4}{5}$  length of forecoxae in both sexes. *Thorax*: Spines in pronotal comb 26 to 30 (50% with 30, 14% with 29, 21% with 28, 15% with 26 or 27) in male, 29 or 30 in female. Pseudosetae under mesonotal collar 7 to 12 in male, 10 to 12 in female. Usually 1 seta on mesepisternum, although 4 males lack any, another male has 2, and 2 other males have 4 minute setulae in this position, in female 0 to 2 (73% with 1, 13% with 2). Mesepimeron with 1 to 3 setae in both sexes (54% with 1, 38% with 2). With respect to spinelets on metanotal margin, all material was dead when collected and most specimens are damaged or contracted to extent that metanotal margin cannot be properly exam-

ined. However, based on *C. (C.) adustus* material at least a few probably with minute spinelets in this position. Lateral metanotal setae absent from 64% of males and 73% of females. Setae on metepisternum 1 or 2 in both sexes. Setae on metepimeron in male 3 to 5. In female number varies from side to side and ranges from 3 to 9. *Legs*: Forefemur with 6 to 9 fine setae on outer surface. Foretibia with 6 notches, including apical notch, in caudal margin bearing stout setae, and a submarginal row of 5 or 6 setae on outer surface in both sexes. Foretarsal segments I and II of equal length in both sexes, segment III  $\frac{5}{6}$  length of II in male,  $\frac{5}{8}$  length of II in female, segment IV  $\frac{4}{5}$  length of III in male, equal to III in female. Segment V with 5 pairs of lateral plantar bristles, pairs I and III slightly shifted on to plantar surface. Midfemur with a submarginal row of 3 to 6 setae on inner surface. Midtibia with 6 notches in caudal margin bearing stout setae, a submarginal row of 5 or 6 setae on outer surface and 6 to 8 more scattered over its inner surface. Midtarsal segments I and II almost equal in length in male, segment I  $\sim \frac{1}{5}$  longer than segment II in female, segment III  $\sim \frac{1}{3}$  shorter than segment II in both sexes, and segment IV  $\sim \frac{3}{4}$  length of segment III in both sexes. Segment V as in foretarsus. Hindfemur with a submarginal row of fine setae on inner surface. Hindtibia (Fig. 13) with 5 notches in its caudal margin bearing strong setae in both sexes, plus a submarginal row of 6 to 8 setae on outer surface and 7 or 8 on inner surface. Hindtarsal segment III  $\sim \frac{2}{3}$  length of segment I in both sexes. In male hindtarsal segment II  $\sim \frac{3}{4}$  length of III, and IV  $\sim \frac{2}{3}$  length of III. However, tarsomeres complete in only 3 legs in sample so analysis of variation limited. In female segments III and IV each  $\frac{2}{3}$  length of preceding segment. Hindtarsal segment V as in fore- and midtarsi. *Abdomen*: Tergal spinelets in male: t I (83% with 2/2, 17% with 1/2); t II (100% with 2/2); t III (83% with 2/2, 17% with 1/2); t IV (50% with 2/2, 17% with 1/2, 33% with 1/1). Due to condition





Figs. 13–24. Hindtibiae of males. 13, *Ceratophyllus (Celeophilus) zhovtyii*. 14, *C. (C.) adustus*. 15, *C. (Ceratophyllus) hirundinis*. 16, *C. (Emmareus) columbae* (Gervais 1844). 17–20, Female anal stylets. 17, *C. (C.) zhovtyii*. 18, *C. (C.) adustus*. 19, *C. (Emmareus) columbae*. 20, *C. (Ceratophyllus) hirundinis*. 21–24, Female ventral anal lobes. 21, *C. (C.) zhovtyii*. 22, *C. (C.) adustus*. 23, *C. (Emmareus) columbae*. 24, *C. (Ceratophyllus) hirundinis*.



of females only 5 of 12 specimens yielded an accurate count for tergal spinelets: t I 1/2 (1), 1/1 (1), 2/2 (3); t II 2/2 (5); t III 1/2 (3), 2/2 (2) and t IV 1/1 (5). Median bristle of male antepygidial setae well developed, bordered dorsally and ventrally by single, minute setulae. Median bristle of female antepygidial setae well developed, bordered dorsally and ventrally by single setae that are  $\sim 1/5$  length of median. Remaining abdominal characters sexual in nature. *Male*: Wagner's organ present and more conspicuous than in *C. (C.) adustus*. Penis rods coiled approximately twice  $360^\circ$ , noticeably longer than in *C. (C.) adustus*. Apex of penis plate with a long tendril that is coiled  $\sim 360^\circ$ . Spiculose area on t VIII absent. Anal tergum somewhat less blunt than in *C. (C.) adustus*, shorter than conical anal sternite. Movable process of clasper (Fig. 7) over  $4\times$  as long as wide at its widest point, incrassation in its cephalic margin about halfway down from apex. Dorsal apex of fixed process more pointed than in *C. (C.) adustus*. Apex of st VIII (Fig. 9) terminating in a subapical, oval, fimbriated vexillum and 2 long setae. Distal lobe of apical arm of st IX (Fig. 8) not as expanded as in *C. (C.) adustus*, its cephalic and caudal margins converging to a rounded apex. Crochet (Fig. 10) triangular and slightly sclerotized. *Female*: (Figs. 11–12, 17, 21). Spermatheca large, well sclerotized, its duct arising apically, its hilla with a distinct apical papilla. Fig. 12 illustrates variation in caudal margin of st VII. Anal stylet as shown in Fig. 17. Ventral anal lobe similar to that of *C. (C.) adustus* but more rounded caudally and with a more rounded apex. As in case of female of *C. (C.) adustus*, in absence of accompanying males, females difficult to identify with any degree of certainty.

*Remarks*.—The Haas and Wilson (1984) reference to this species is the only mention of its occurrence in the Western Hemisphere. The series of 28 specimens came from 3 woodpecker nests in 3 different localities in Alaska. Two collections came from flicker nests and the third from the

nest of a species of *Picoides*. Most of the specimens were dead when collected and are missing appendages and setae. They were taken in association with specimens of *C. adustus* and *C. rauschi* Holland 1960.

*Distribution*.—This species was described originally from a small series collected on the Eurasian pygmy owl (*Glauucidium passerinum* (Linnaeus 1758)) and a woodpecker, presumed to be the great spotted woodpecker (*Dendrocopos major* (Linnaeus 1758)) in the Irkutsk region of the Russia. Paratypes included 2 additional females from the type host and locality, 3 females from the Taishetskogo region of Irkutsk Oblast and 1 male and 3 females from the vicinity of Khudyakovo, 8 km NE of Irkutsk. The latter all came from woodpeckers. As with many other bird fleas, its apparent rarity is probably due to the infrequency with which bird nests, especially those of woodpeckers, are examined for fleas. So far this flea has only been collected in Alaska but it might be expected to occur in the northern parts of some of the Canadian provinces as well. Alaskan localities include mile 222.5 Glenn Highway; mile 151.3 Steese Highway and mile 31 Nabesna Road.

*Host associations*.—In addition to the pygmy owl and the great spotted woodpecker, this species has also been associated with the three-toed woodpecker (*Picoides tridactylus*) and the black woodpecker (*Dryocopus martius* (Linnaeus 1758)) according to Haddow et al. (1983: 70).

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