

FAMILY PULICIDAE STEPHENS

- 1829 Pulicidae Stephens, Syst. Cat. British Insect, pt. II, p. 328.
 1895 Pulicidae Baker, Can. Ent., 27: 20.
 1904 Pulicidae Baker, Proc. United States Nat. Mus., 27: 377.
 1905 Pulicidae Baker, Proc. United States Nat. Mus., 29: 127.
 1909 Pulicidae Oudemans, Nov. Zool., 16: 157.
 1915 Pulicidae Rothschild, Ent. Mo. Mag., 51: 89.
 1926 Pulicidae Dampf, Ent. Mitt., 15: 379.
 1929 Pulicidae Ewing, Manual External Parasites, p. 160.
 1936 Pulicidae Wagner, Tierwelt Mitteleuropas, Bd. 6, Abt. 17, s. 20.

The members of the family Pulicidae are characterized particularly by the possession of a single row of bristles on each abdominal tergite. These fleas are further distinguished by having large and well-developed eyes. The frontal notch is absent. The club of the antenna is segmented only on one side. A series or patch of small spinelike bristles is present on the inner side of the hind coxa. Four pairs of lateral plantar bristles and a distal submedian pair are present on the fifth tarsal segment of each leg. One long antepygidial bristle is flanked on each side by a much smaller bristle present on a side.

The Pulicidae are represented in the East by five genera which include several species of tremendous medical importance.

Key to the Eastern Genera of Pulicidae

1. Genal ctenidium absent 2
 Genal ctenidium present 4
2. Pronotal ctenidium absent 3
 Pronotal ctenidium present *Hoplopsyllus*, p. 14
3. Mesosternite divided by a distinct vertical rodlike sclerotization
 *Xenopsylla*, p. 16
 Mesosternite not so divided *Pulex*, p. 18
4. Genal ctenidium more or less vertical with straight blunt spines
 *Cediopsylla*, p. 21
 Genal ctenidium more or less horizontal with curved spines tapering
 to sharp points *Ctenocephalides*, p. 24

HOPLOPSYLLUS BAKER

Hoplopsyllus Baker, 1905, Proc. United States Nat. Mus., 29:128.

Genotype: *Pulex anomalus* Baker

Eye bristle not placed higher than the eye itself. Genal ctenidium absent. Pronotal ctenidium present. Mesosternite divided by a distinct vertical rodlike sclerotization.

This genus is represented in the East by two closely related species which are parasitic chiefly on rabbits and hares. The females of these two species are separated by characters which do not lend themselves readily to arrangement in key form. The males may be differentiated by the following key:

Key to the Eastern Species of *Hoplopsyllus* (males only)

Posterior process of the movable finger not more than twice as long as the anterior process*H. affinis*
 Posterior process of the movable finger more than twice as long as the anterior process*H. lynx*

***Hoplopsyllus affinis* (Baker)**

(Plate IV, figs. 12, 14, 15)

1904 *Pulex affinis* Baker, Proc. United States Nat. Mus., 27:382.

1905 *Hoplopsyllus affinis* Baker, Proc. United States Nat. Mus., 27:130.

MALE. Preantennal region of the head with only two bristles, one of which is located near the eye, the other at the base of the maxillary palpus. First segment of the antenna with a number of slender bristles along the posterior edge and apically. Second antennal segment with four or five long bristles. Post-antennal region of the head with but two bristles in addition to the marginal row of four or five bristles. Near the third antennal segment is a group of about seven setae. Pronotal ctenidium consisting of eight or nine spines on a side. Pronotum, meso-, and metanotum each armed with a single row of bristles. MODIFIED SEGMENTS: Clasper with two processes, the anterior broad and lobular, armed with about eight stout bristles; the other much more slender with a broad black tooth apically, usually less than one and one-half times as long as the anterior process. Manubrium small and broad, curved upward. Penis long, slender, and bladelike; spring long, but not completing a turn in the specimens examined. For further details concerning the structure of the male genitalia, see Plate IV, fig. 14.

FEMALE. Chaetotaxy of the head (Plate IV, fig. 12) and gen-

eral structure essentially as in the male. Head of the receptaculum seminis rounded, much shorter than the tail. For further details concerning the structure of the female genitalia, see Plate IV, fig. 15.

RECORDS. IOWA—Ames, 1935, on "house-rat," female; May, 1934, on "cottontail," male; December 6, 1934, on "red fox," male and female (R. L. Roudabush); Hawarden, May, 1938, "in house," male and female. OKLAHOMA—no more specific locality, on "rabbit," male and female.

EASTERN HOSTS. "House-rat," "Cottontail," "Red Fox," "Rabbit."

EASTERN LOCALITIES. Iowa, Oklahoma. (This species is known to occur in several western states. Iowa appears to be its eastern limit.)

TYPE MATERIAL. Male and female from near Grand Canyon, Arizona, on "*Lepus* species," in the United States National Museum.

***Hoplopsyllus lynx* (Baker)**

(Plate IV, figs. 11, 13)

1904 *Pulex lynx* Baker, Proc. United States Nat. Mus., 27:383, Pl. X, figs. 7-11, Pl. XI, figs. 1, 2.

1905 *Hoplopsyllus lynx* Baker, Proc. United States Nat. Mus., 29:130.

1929 *Hoplopsyllus glacialis lynx* Jordan, Nov. Zool., 35:175.

1937 *Hoplopsyllus glacialis lynx* Jordan, Nov. Zool., 40:283.

MALE. Chaetotaxy of the head and general structure essentially as in *H. affinis*. The species differs particularly in the posterior process of the clasper which is much longer than in *H. affinis*. The anterior process bears about twelve long stout bristles. For further details, see Plate IV, fig. 13.

FEMALE. Chaetotaxy and general structure essentially as in the male. Receptaculum seminis differing from that of *H. affinis* particularly in the shape of the head, which is more or less oval and longer than wide, rather than rounded and about as long as wide. For further details concerning the structure of the female genitalia, see Plate IV, fig. 11.

EASTERN HOSTS. American Varying Hare ("*Lepus americanus*"), Canada Lynx ("*Lynx canadensis*").

EASTERN LOCALITIES. Maine and New Hampshire.

TYPE MATERIAL. Male and two females from Moscow, Idaho, on "*Lynx canadensis*" in the United States National Museum.

XENOPSYLLA GLINKIEWICZ

Xenopsylla Glinkiewicz, 1907, Sitzber. Ak. Wiss. Wien, 116: 385.

Genotype: *Pulex cheopis* Rothschild

No genal or pronotal ctenidium present. Ocular bristle situated above the eye. Mesosternite broad, divided by a vertical, rodlike sclerotization. Posterior margin of the head with several bristles.

This genus is represented in the East by a single species, the oriental rat flea, which is an important transmitter of several diseases.

***Xenopsylla cheopis* (Rothschild)**

(Plate V, figs. 16, 18, 20)

- 1903 *Pulex cheopis* Rothschild, Ent. Mo. Mag. (2nd ser.), 14: 85, Pl. I, figs. 3, 9; Pl. II, figs. 12, 19.
- 1908 *Loemopsylla cheopis* Rothschild, Parasitology, 1: 42, Pl. I; Pl. II, fig. 8; Pl. IV, fig. 8; Pl. VI, fig. 1.
- 1909 *Xenopsylla cheopis* Rothschild, Nov. Zool., 16: 132.
- ✓ 1910 *Loemopsylla cheopis* C. Fox, United States Public Health and Mar. Hosp. Ser., Bull. 30, p. 138, Pl. III, figs. 1-4.
- 1914 *Xenopsylla cheopis* C. Fox, United States Public Health Hyg. Lab., Bull. 97, Pl. XIV, fig. 22; Pl. XXI, fig. 62.
- 1925 *Xenopsylla cheopis* Wallace, Dept. Conser. Indiana, Div. Ent. Rep., p. 14.
- 1925 *Xenopsylla cheopis* C. Fox, United States Public Health Ser., Rep. 40: 1917.
- 1925 *Xenopsylla cheopis* C. Fox, Insects and Disease of Man, p. 133, figs. 61, 62.
- 1928 *Xenopsylla cheopis* Stewart, Cornell Univ. Agric. Exp. Sta., Mem. 101, p. 868.
- ✓ 1929 *Xenopsylla cheopis* Hasseltine, United States Public Health Ser., Rep. 44: 583.
- ✓ 1929 *Xenopsylla cheopis* Jordan, Nov. Zool., 35: 176.
- ✓ 1929 *Xenopsylla cheopis* Ewing, Manual External Parasites, p. 163, fig. 90.
- 1933 *Xenopsylla cheopis* Stewart, Jour. New York Ent. Soc., 41: 254.
- ✓ 1934 *Xenopsylla cheopis* Shaftesbury, Jour. Elisha Mitchell Sci. Soc., 49: 249.
- ✓ 1934 *Xenopsylla cheopis* Roudabush and Becker, Science, 80: 97.
- 1935 *Xenopsylla cheopis* Vogel and Cadwallader, United States Public Health Ser., Rep. 50: 1953.
- 1936 *Xenopsylla cheopis* Riley, Journal-Lancet, 56: 591.
- ✓ 1938 *Xenopsylla cheopis* Ewing and Fox, Science, 88: 427.
- ✓ 1939 *Xenopsylla cheopis* Roudabush, Science, 89: 79.

MALE. Preantennal region of the head with but two widely separated bristles, one of which is located above the eye, while

the other is situated at the base of the maxilla. Several small setae situated between the two bristles. Labial palpus reaching almost to the apex of the fore coxa. First antennal segment with about ten bristles of various sizes; second antennal segment with about four long bristles. Posterior to the third antennal segment is a series of about twelve small setae. Bristles of the postantennal region arranged in three rows; first and second row reduced to one bristle each, the third row consisting of five long bristles which alternate with four small setae (Plate V, fig. 20). Each segment of the thorax armed with a single row of long bristles alternating with small setae. MODIFIED SEGMENTS: Clasper with two processes; one narrow and curved outward, the other more or less in the form of a flap, its upper margin with a number of bristles. Penis bladeliike ending in a sharp point; spring long but not completing a single turn in the specimens examined. Posterior arm of sternite IX expanded apically and armed with a number of bristles. For further details concerning the structure of the male genitalia, see Plate V, fig. 16.

FEMALE. Chaetotaxy of the head and general structure essentially as in the male. Receptaculum seminis large and conspicuous; basal portion of the tail almost as wide as the head. For further details of the structure of the female genitalia, see Plate V, fig. 18.

RECORDS. DISTRICT OF COLUMBIA—Washington, September 17, 1902, on "*Mus domestica*," male (H. S. Barber); August 29, 1935, on "rats," male, three females (C. N. Smith). FLORIDA—Jacksonville, January 25, 1934, on *Rattus norvegicus* (Erxleben), numerous specimens; Tallahassee, June 15, 1937, on "*Rattus alexandrinus*," female, two males; January 16, 1937, on "*Rattus rattus*," male. GEORGIA—Thomasville, July 18, 1934, on *Sigmodon hispidus hispidus* Say and Ord, three females (E. V. Komarek); Newton, May 24, 1937, on "wharf rat," numerous specimens (B. V. Travis); Valdosta, December 20, 1935, on "*Rattus alexandrinus*," male, two females; November 29, 1935, on "roof rat," female (H. Hixson). IOWA—Ames, September 27, 1934, on "cottontail rabbit," three males, three females (E. F. Knipling). LOUISIANA—New Orleans, on "rats," two females (Hobenhoffer). MARYLAND—Berwyn, "in flour," July, 1937, male, two females; Baltimore, on *Rattus norvegicus* (Erxleben), numerous specimens. RHODE ISLAND—Providence, November 27, several specimens (S. H. Robinson).

EASTERN HOSTS. House-mouse ("*Mus domestica*"), House-rat (*Rattus norvegicus* (Erxleben)), Roof-rat ("*Rattus alexandrinus*"), Black Rat ("*Rattus rattus*"), Cotton-rat (*Sigmodon hispidus hispidus* Say and Ord), "Cottontail Rabbit," "Man."

EASTERN LOCALITIES. District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Minnesota, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Virginia.

TYPE MATERIAL. A large series of both sexes from Shendi, Egypt, on "*Acomys witherbyi*," "*Gerbillus robustus*," "*Arvicanthis testicularis*," "*Dipodillus watersi*," "*Dipus jaculus*," and "*Genetta dongolana*" in the N. C. Rothschild Collection (British Museum).

This species resembles in superficial structure *Pulex irritans* Linnaeus, but may be distinguished readily from it by the arrangement of the head bristles, the presence of a divided mesosternite, and the character of the genitalia. These points of difference are illustrated in Plate V.

By far the most important species in our fauna from the medical standpoint is the oriental rat flea which is known to transmit bubonic plague and endemic typhus fever, and is suspected of being among the transmitters of the causative agents of several other diseases. For many years it was known in the United States only from the large port cities. Its occurrence in the interior was not made known until 1925 when it was mentioned in a report of the State Entomologist of Indiana (Wallace, 1925), as occurring on rats in Indianapolis. Although some further records of the species from the interior have been made, it is known to be permanently established only at Ames, Iowa.

PULEX LINNAEUS

Pulex Linnaeus, 1758, *Systema Natura*. 10th Ed., p. 614.

Genotype: *Pulex irritans* Linnaeus

No genal or pronotal ctenidium present. Ocular bristle situated near the middle or below the middle of the eye. Mesosternite not divided by a vertical rodlike sclerotization.

This genus is represented in the East by a single species which sometimes becomes a nuisance to man and domesticated animals.

***Pulex irritans* Linnaeus**

(Plate V, figs. 17, 19, 21)

- 1758 *Pulex irritans* Linnaeus, Systema Naturae, p. 614.
1761 *Pulex irritans* Linnaeus, Fauna Suecica, No. 1965, p. 479.
1895 *Pulex irritans* Baker, Can. Ent., 27: 67.
1896 *Pulex irritans* Osborn, United States Dept. Agric. Div. Ent., Bull. V (n.s.), p. 147, fig. 80.
1904 *Pulex irritans* Baker, Proc. United States Nat. Mus., 27: 379, Pl. XI, figs. 3-6.
1905 *Pulex irritans* Baker, Proc. United States Nat. Mus., 29: 129.
1910 *Pulex irritans* C. Fox, United States Public Health and Mar. Hosp. Ser., Bull. 30, p. 142, Pl. V, figs. 1-4.
1914 *Pulex irritans* C. Fox, United States Public Health Ser. Hyg. Lab., Bull. 97, Pl. XIV, fig. 21; Pl. XXI, fig. 64.
1925 *Pulex irritans* C. Fox, Insects and Disease of Man, p. 132, fig. 60.
1928 *Pulex irritans* Stewart, Cornell Univ. Agric. Exp. Sta., Mem. 101, p. 868.
1929 *Pulex irritans* Jordan, Nov. Zool., 35: 176.
1929 *Pulex irritans* Ewing, Manual External Parasites, p. 164, fig. 91.
1931 *Pulex irritans* Ewing, Amer. Nat., 65: 363.
1933 *Pulex irritans* Stewart, Jour. New York Ent. Soc., 41: 254.
1934 *Pulex irritans* Shaftesbury, Jour. Elisha Mitchell Sci. Soc., 49: 250.

MALE. Preantennal region of the head with but two long bristles, one situated near the eye, the other at the base of the maxilla. Dorsal region of the head with numerous minute setae. First antennal segment with three or four bristles of various sizes; second antennal segment with five or six long bristles. Mandible distinctly serrated. Labial palpus reaching beyond one-half the length of the anterior coxa. A series of small setae situated posterior to the third antennal segment; remainder of the postantennal region with but a single bristle. Each segment of the thorax with a row of bristles consisting of alternating long and short bristles. **MODIFIED SEGMENTS:** Clasper with two movable processes arranged to form pincers; about these processes is a broad conspicuous flap supplied with numerous slender curved bristles along the margins. Posterior movable process of the clasper with four or five small bristles; anterior process without distinct bristles. Manubrium rather short, distally curved and finger-like. Penis not wide, blunt and rounded anteriorly; spring long, completing at least one turn. For further details concerning the structure of the male genitalia, see Plate V, fig. 17.

FEMALE. Chaetotaxy of the head (Plate V, fig. 21) and general structure essentially as in the male. Sternite VII without

a distinct sinus. Head of the receptaculum seminis round, tail finger-like, somewhat wider distally than proximally. For further details concerning the structure of the female genitalia, see Plate V, fig. 19.

RECORDS. ARKANSAS—Imboden, 1928, no host given, two females (B. C. Marshall). DISTRICT OF COLUMBIA—Washington, June 13, 1933, on "woman" (C. Ford). FLORIDA—Little River, November 30, 1912, no host given, numerous specimens (Knab and Mosier); same locality, December 20, 1913, on "man," male (C. A. Mosier). GEORGIA—Griffin, April 25, 1935, on "dog," two females (T. L. Bissell). ILLINOIS—Elmwood, July 2, 1914, on "hogs," numerous specimens (J. M. Morey). INDIANA—Frankfort, April 29, 1914, no host given, four males, two females (Mrs. F. R. Davis). IOWA—Fairfield, April, 1934, no host given, male and female (C. J. Drake); Ottumwa, July, 1931, on "man," female, two males (G. Hazen); Henry County, May 21, 1936, no host given, male (M. Jaques); Lineville, December, 1936, on *Vulpes regalis* Merriam, numerous specimens (E. Sanders). LOUISIANA—Tallulah, July 1, 1929, collected by airplane, 200 feet, female (P. A. Glick). MARYLAND—Laurel, June 16, 1931, on "dog," male, two females (E. B. Marshall). MISSOURI—Columbia, June 20, 1932, in "house," female; May 24, 1937, on "hogs," male and female (L. Haseman); Gilliam, August, 1914, on "man," numerous specimens (A. Cramer). NEW JERSEY—New Brunswick, September 18, 1916, on "dog," female. NORTH CAROLINA—Halifax, August 14, 1931, on "dog," two females; July 10, 1935, on same host, female (E. B. Marshall). PENNSYLVANIA—Oxford, June, 1912, in "house," male, three females (Mrs. W. R. Woolf); Chaddis Ford, April, 1921, no host given, several specimens (W. W. Betts). VIRGINIA—South Richmond, July 6, 1914, no host given, numerous specimens (Mrs. E. A. Hawthorn); Blacksburg, October, 1938, on "hogs," numerous specimens (J. M. Grayson).

EASTERN HOSTS. "Man," "Dog," "Hog," "Cottontail Rabbit," "Cat," "Gray Squirrel," Opossum (*Didelphis virginiana*), Rabbit (*Lepus species*), Red Fox (*Vulpes regalis* Merriam).

EASTERN LOCALITIES. Arkansas, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Texas, Virginia.

TYPE MATERIAL. From man, the type locality apparently

Sweden. ("Habitat in hominibus, praesertim feminis, autumnovulgaris; in nidis hirundinum ripariarum copiosissima. In Lapponia non vidi.") Location of type not ascertained.

Although *Pulex irritans* probably occurs in every state of the Union, it is seldom found in large cities and is doubtless absent from many forested and swamp areas. Man, dogs, and hogs seem to be its most favored hosts.

CEDIOPSYLLA JORDAN

Cediopsylla Jordan, 1925, Nov. Zool. 32:103.

Genotype: *Pulex simplex* Baker

Ocular bristle placed higher than the eye. Frons angulate in front, with a distinct incassation. Genal ctenidium obliquely vertical, consisting of straight robust blunt spines. Pronotal ctenidium present.

This genus is represented in the East by a single species which is an important parasite of rabbits.

Cediopsylla simplex (Baker)

(Plate III, figs. 6, 7, 10)

- 1895 *Pulex inaequalis* var. *simplex* Baker, Can. Ent., 27:164.
1896 *Pulex inaequalis* var. *simplex* Osborn, United States Dept. Agric. Div. Ent., Bull. V, p. 153, fig. 84.
1904 *Ctenocephalus simplex* Baker, Proc. United States Nat. Mus., 27:385.
1905 *Spilopsyllus simplex* Baker, Proc. United States Nat. Mus., 29:131.
1925 *Cediopsylla simplex* Jordan, Nov. Zool., 32:103.
1928 *Spilopsyllus simplex* Stewart, Cornell Univ. Agric. Exp. Sta., Mem. 101, p. 868.
1928 *Cediopsylla simplex* Jordan, Nov. Zool., 34:182.
1929 *Cediopsylla simplex* Jordan, Nov. Zool., 35:176.
1933 *Cediopsylla simplex* Stewart, Jour. New York Ent. Soc., 41:254.
1928 *Spilopsyllus cuniculi* Schwartz and Shook, United States Dept. Agric., Farm. Bull. 1568, p. 10.
1934 *Cediopsylla simplex* Shaftesbury, Jour. Elisha Mitchell Sci. Soc., 49:252.
1937 *Cediopsylla simplex* Jordan, Nov. Zool., 40:283.

MALE. Head angulate. Frons with a long, rounded, dorsally directed incassation. Preantennal region of the head with two long bristles and numerous small setae. Genal ctenidium consisting of eight spines. Mandible broad, prominent, deeply serrated, reaching to four-fifths the length of the anterior coxa. First segment of the antenna with about seven subapical bristles; second antennal segment similarly armed but the

bristles longer. Postantennal bristles arranged in three irregular rows; first row consisting of two or three bristles, the second of two, and the third of four or five. Pronotum with a single row of bristles and a ctenidium of six or seven spines on a side. Meso- and metanotum each armed with a single row of bristles. MODIFIED SEGMENTS: Clasper with two movable processes which, together with the apical portion of the posterior arm of sternite IX, are more or less enclosed in a membranous flap the margin of which is dorsally provided with hairlike setae. Anterior movable process of the clasper more or less straight, about as long as the curved posterior process; the latter with five or six small bristles along the posterior margin. Manubrium finger-like, its termination rounded. Penis blade-like, broader distally than posteriorly; spring long and prominent, but not completing a single turn in the specimens examined. Posterior arm of sternite IX broadly expanded apically where it is armed with a conspicuous patch of dark setae. Sternite VIII tapering to a point apically where it is curved outward and armed with three or four bristles on the outer margin. For further details concerning the structure of the male genitalia, see Plate III, fig. 7.

FEMALE. Chaetotaxy of the head (Plate III, fig. 10) and general structure essentially as in the male. Mandible longer than in the male, reaching beyond the apex of the fore coxa. Sternite VII without a distinct sinus. Head of the receptaculum seminis slightly longer than broad, much broader than the tail. For further details concerning the structure of the female genitalia, see Plate III, fig. 6.

RECORDS. ARKANSAS—Imboden, March, 1925, on "rabbit," male, three females (B. C. Marshall). CONNECTICUT—No specific locality, September 3, 1936, on "New England cottontail," male, four females (J. E. Shillinger). DISTRICT OF COLUMBIA—Washington, January 29, 1931, on "cottontail," male (Alva Nye). FLORIDA—Monticello, May 2, 1937, on *Lynx rufus floridanus* (Rafinesque), male and female (E. V. Komarek). GEORGIA—Four miles west of Folkstown, April 13, 1936, on *Sylvilagus floridanus mallurus* (Thomas), two males (F. Harper); Newton, April 28, 1937, on same host, two females; April 1, 1937, on *Vulpes fulva* (Desmarest), male and female; July 26, 1937, on "wharf rat," two females (B. V. Travis). IOWA—Osceola, December 21, 1935, on "cottontail rabbit," female; August 3, 1936, on "rabbit," male and female (G. S. Cantonwine); Ames, November 5, 1934, on "cottontail

rabbit," male and female; November 14, 1934, on same host, female, two males (E. V. Knipling); Waukon, November 12, 1937, on *Blarina brevicauda brevicauda* (Say), male (T. Scott); Lineville, December, 1936, on *Vulpes regalis* Merriam, male and three females (E. Sanders); Boone, November, 1938, in scat of same host, female (T. Scott); Mt. Pleasant, November 28, 1927, male and female, no host given (McCrory); Story City, December 10, 1938, on *Sylvilagus* species, numerous specimens (B. B. Morgan). MARYLAND—Silver Spring, June 26, 1938, on "cat," male (P. W. Oman); Bowie, April 12, 1924, on *Sylvilagus floridanus mallurus* (Thomas), six specimens (A. Hassall); Montgomery County, October 30, 1928, on "cottontail rabbit," female (E. Francis); Plummer Island, August 5, 1915, on "man" (H. S. Barber). MASSACHUSETTS—W. Tisbury, on *Sylvilagus transitionalis* (Bangs), June 9, 1936, two females (F. C. Bishopp); Needham, March 17, 1927, on same host, female, two males (J. D. Smith); Harvard, April 11, 1912, on "cottontail rabbit," female (J. L. Peters); Hardwich, December 15, 1926, on "wildcat," female (F. E. Beissig). NEW JERSEY—Burlington County, April, 1934, on "cottontail rabbit," female (R. J. Sim). NORTH CAROLINA—Halifax, February 15, 1936, on "cottontail rabbit," male, two females; December 11, 1935, on same host, female, two males; January 11, 1936, on same host, two females (E. B. Marshall); Pisgah National Forest, Asheville, May 11, 1936, on "gray fox," male and female (F. J. Ruff); March 11, 1936, on "raccoon," male and female (J. H. Stone). TENNESSEE—Greenbriar, April 1, 1931, on *Sylvilagus floridanus mallurus* (Thomas), four females; Smoky Mountains, March 30, 1931, on same host, male, three females (R. L. Boke). VIRGINIA—Hawlin, December, 1922, on "rabbit," nine specimens (M. T. Van Horn); Elliott Knobb, May 30, 1934, on "cottontail rabbit," male (A. H. Howell); Clifton, June 11, 1933, "in net sweepings," female (J. C. Bridwell); East Falls Church, May 24, 1925, on "rabbit," female (E. A. Chapin). WISCONSIN—Babcock, October 10, 1932, on *Canis latrans* Say, female (J. W. Schmidt).

EASTERN HOSTS. Bobcat (*Lynx rufus floridanus* (Rafinesque)), Cottontail Rabbit, (*Sylvilagus floridanus mallurus* (Thomas), etc.), Red Fox (*Vulpes fulva* (Desmarest), etc.), Short-tailed Shrew (*Blarina brevicauda brevicauda* (Say)), Coyote (*Canis latrans* Say), "Cat," "Gray Fox," "Raccoon," "Wharf-rat," "Man."

EASTERN LOCALITIES. Arkansas, Connecticut, District of Co-

lumbia, Florida, Georgia, Iowa, Maryland, Massachusetts, New Jersey, North Carolina, Tennessee, Virginia, Wisconsin.

TYPE MATERIAL. Male holotype on "*Lepus* species" from Michigan in the United States National Museum.

CTENOCEPHALIDES STILES AND COLLINS

Ctenocephalides Stiles and Collins, 1930, United States Public Health Rep., 45:1308 (new name for *Ctenocephalus* Kolenati, preoccupied).

Genotype: *Pulex canis* Curtis

Both a genal and a pronotal ctenidium present. Genal ctenidium more or less horizontal, consisting of long sharp spines. Frontal incassation distinct. Ocular bristle placed on a level with or above the eye.

This genus is represented in the East by two exceedingly common species, the dog flea and the cat flea. Typical forms of these two species may be separated by the following key:

Key to the Eastern Species of *Ctenocephalides*

- First genal spine much shorter than the second; head about one and one-half times as long as high *C. canis*
 First genal spine about as long as the second or only slightly shorter; head about twice as long as high *C. felis*

Ctenocephalides felis (Bouché)

(Plate VI, figs. 22, 23, 25)

- 1835 *Pulex felis* Bouché, Nov. Act. Acad. Leop. Carol., 17:505.
 1901 *Pulex felis* Rothschild, Ent. Rec., 13:126, Pl. III, fig. A.
 1905 *Pulex felis* Rothschild, Nov. Zool., 12:192, fig. B.
 1910 *Ctenocephalus felis* Banks, United States Public Health and Mar. Hosp. Ser., Bull. 30, p. 75.
 1925 *Ctenocephalus felis* C. Fox, United States Public Health Rep., 40:1917.
 1925 *Ctenocephalus felis* C. Fox, Insects and Disease of Man, p. 136.
 1928 *Ctenocephalus felis* Stewart, Cornell Univ. Agric. Exp. Sta., Mem. 101, p. 868.
 1929 *Ctenocephalus felis* Ewing, Manual External Parasites, p. 165, figs. 89, 92.
 1929 *Ctenocephalus felis* Jordan, Nov. Zool., 35:176.
 1930 *Ctenocephalides felis* Stiles and Collins, United States Public Health Rep., 45:1308.
 1933 *Ctenocephalides felis* Stewart, Jour. New York Ent. Soc., 41:254.
 1934 *Ctenocephalides felis* Shaftesbury, Jour. Elisha Mitchell Sci. Soc., 49:252.
 1937 *Ctenocephalides felis* Jordan, Nov. Zool., 40:283.

MALE. Preantennal region of the head with but two bristles, one located near the eye, the other at the base of the third genal

spine. Genal ctenidium consisting of seven or eight curved spines on a side; the first slightly smaller than the second, and the most posterior very small. First antennal segment with four or five bristles, second with six or seven bristles. Post-antennal region of the head with two or three bristles in addition to the four or five that make up the marginal row (Plate VI, fig. 23). Pronotal ctenidium consisting of about eight spines on a side. Pronotum, meso-, and metanotum each armed with a single row of long bristles. MODIFIED SEGMENTS: Process of the clasper not distinct. Movable finger lobular, armed with numerous bristles along the margins. Manubrium finger-like, somewhat wider distally than basally. Penis truncate, wide and heavy; spring not completing a single turn. For further details concerning the structure of the male genitalia, see Plate VI, fig. 25.

FEMALE. Head longer and narrower than in the male (Plate VI, fig. 22). Chaetotaxy of the head and general structure essentially as in the male. First genal spine as long as, or longer than, the second. Head of the receptaculum seminis half again as long as wide; much shorter than the tail.

RECORDS. ALABAMA—Dale County, March 30, 1937, on "rabbit," female. CONNECTICUT—Storrs, no host given, male and female (J. A. Monter); Arcadia, October 24, 1913, on "cat," male and female (Bigelow). DISTRICT OF COLUMBIA—Washington, July, 1912, no host given, female, two males (K. Knab); August 3, 1933, "in house," three females (A. Howell). FLORIDA—Orlando, May 28, 1922, on "man," male; Immokalee, February 7, 1937, on "raccoon," female (B. V. Travis). GEORGIA—Fort Valley, May 27, 1935, no host given, male, four females (O. I. Snapp); Savannah, June 25, 1935, no host given, female; Camden County, April 25, 1933, on "*Urocyon cinereoargenteus*," two females (F. Harper). IOWA—Iowa City, 1933, no host given, female; Sioux City, November 8, 1928, on "fur coat," male and female (C. N. Ainslie); Rogers, October 26, 1936, in "house," two males, two females; Mt. Pleasant, March 19, 1929, on "cat," two females (H. E. Jaques); Ames, October, 1938, on "dog," numerous specimens (H. H. Knight); December, 1933, on "cat," male, two females (R. L. Roudabush). ILLINOIS—Urbana, July 5, 1935, on "cat," three females (O. Mohr). LOUISIANA—New Orleans, August 20, 1917, no host given, male and female (H. E. Hubert); May 19, 1924, on "man," male (H. K. Plank); Jeanerette, on "dog," four females (Dikeman). MASSACHUSETTS—Am-

herst, October, 1931, in "house," male, four females (A. J. Bourne); Springfield, July 24, 1903, two females (G. D. Dimmock); Framingham, October 1, 1934, on "man," female (C. A. Frost). MARYLAND—Cumberland, two females; Beltsville, August 9, 1937, on "cat," male and female (Billings). MISSOURI—Carson City, August, 1936, on "cat" (E. Sanders). NEW JERSEY—Moorestown, no host given, female (J. L. King). NEW YORK—Caroline, July 18, 1934, on "man," male (A. Stone); Ithaca, December 14, 1910, on "cat," two females (H. E. Ewing). OHIO—Brunswick, May 27, 1929, on "cat and man," male and female; Akron, September 18, 1936, in "lumber yard," two males, two females (H. Graves). PENNSYLVANIA—Hazelton, July 1, 1937, on "man," two females (R. Morgan). RHODE ISLAND—Kingston, April, 1928, "from among pupal cases and cast off larval skins of gypsy moth," two females (A. E. Steene). SOUTH CAROLINA—Anderson, December, 1939, on "fox," two females (R. B. Casey). VIRGINIA—Hollins, on "cat," numerous specimens; Waverly, August 9, 1931, on same host, male, two females (E. B. Marshall).

EASTERN HOSTS. "Cat," "Dog," "Rabbit," "Man," "Rats," "Raccoon," "Opossum," "Flying Squirrel," Red Squirrel ("*Sciurus hudsonicus*"), Skunk ("*Spilogale ambarvalis*").

EASTERN LOCALITIES. Generally distributed throughout the inhabited areas of the East.

TYPE MATERIAL. From "housecat"; type locality not given. Location of type not ascertained.

Ctenocephalides canis (Curtis)

(Plate VI, figs. 24, 26, 27)

- 1826 *Pulex canis* Curtis, British Entomology, Vol. III, No. 114, figs. A-E, 8.
- 1895 *Pulex serraticeps* Baker, Can. Ent., 27:164.
- 1896 *Pulex serraticeps* Osborn, United States Dept. Agric. Div. Ent., Bull. V (n.s.), p. 150, fig. 83.
- 1901 *Pulex canis* Rothschild, Ent. Rec., 13:126, Pl. III, figs. B-C.
- 1904 *Ctenocephalus canis* Baker, Proc. United States Nat. Mus., 27:384.
- 1905 *Pulex canis* Rothschild, Nov. Zool., 12:192, fig. A.
- 1905 *Ctenocephalus canis* Baker, Proc. United States Nat. Mus., 29:131.
- 1910 *Ctenocephalus canis* C. Fox, United States Public Health and Mar. Hosp. Ser., Bull. 30, p. 143, Pl. VI, figs. 1-4.
- 1925 *Ctenocephalus canis* C. Fox, United States Public Health Ser., Rep. 40:1917.
- 1925 *Ctenocephalus canis* C. Fox, Insects and Disease of Man, p. 135, fig. 63.
- 1928 *Ctenocephalus canis* Stewart, Cornell Univ. Agric. Exp. Sta., Mem. 101, p. 868.
- 1929 *Ctenocephalus canis* Ewing, Manual External Parasites, p. 165.
- 1929 *Ctenocephalus canis* Jordan, Nov. Zool., 35:176.

- 1930 *Ctenocephalides canis* Stiles and Collins, United States Public Health Ser., Rep. 45:1308.
1933 *Ctenocephalides canis* Stewart, Jour. New York Ent. Soc., 41:254.
1934 *Ctenocephalides canis* Shaftesbury, Jour. Elisha Mitchell Sci. Soc., 49:252.

The common occurrence of forms intermediate in structure between *C. felis* and *C. canis* make the two species exceedingly difficult to separate. The points of separation, as regards typical forms, are to be found particularly in the shape of the head and in the genal ctenidium. In *C. canis* the head is much rounder and higher than in *C. felis* and is about one and one-half times as long as high (Plate VI, figs. 24, 26), while in the latter species the head is about twice as long as high. In *C. canis* the first genal spine is much shorter than the second, while in *C. felis* it is as long as, or at least not much shorter than, the second. The manubrium in the male of *C. canis* is much broader apically than proximally, while in *C. felis* this structure is only slightly expanded distally. The receptaculum seminis in the female of *C. canis* has essentially the same structure as that of *C. felis* (Plate VI, fig. 27).

RECORDS. ARKANSAS—Imboden, 1928, no host given, female (B. C. Marshall). DISTRICT OF COLUMBIA—Washington, July, 1931, in "house," male (J. G. Pratt). FLORIDA—Tallahassee, June 14, 1936, on "gray fox," three males. GEORGIA—Fort Valley, May 28, 1935, no host given, male (O. I. Snapp). ILLINOIS—Chicago, July 20, 1915, in "house," three males, three females (S. Lukes); Paris, November 28, 1937, no host given, numerous specimens; Egan, July 20, 1935, on "cat," two females, two males; Ottawa, November 7, 1935, in "house," male. IOWA—Sioux City, October 7, 1922, no host given, male (C. N. Ainslie); Ames, 1934, on "silver fox," two males, two females (E. F. Knipling); Lineville, December, 1936, on *Vulpes regalis* Merriam, male (E. Sander). INDIANA—Elkhart, on "cat," numerous specimens (R. J. Weith). MAINE—Camden, July 18, 1916, in "stable," numerous specimens (H. B. Foster). MARYLAND—Takoma Park, August, 1920, on "man," numerous specimens. MASSACHUSETTS—Wenham, May 14, 1926, on "woodchuck," two females (J. C. Phillips); South Swansea, in "house," male, four females (J. N. Sullivan). MICHIGAN—Alpena, September 27, 1909, on "dog," numerous specimens. MISSOURI—St. Louis, in "house," numerous specimens (T. Patterson). NORTH CAROLINA—Pisgah National Forest, Asheville, May 11, 1936, on "gray fox," female (F. J. Ruff).

NEW HAMPSHIRE—Canobie Lake, July, 1892, on "cat," female (G. Dimmock). NEW JERSEY—Rivertown, June 25, 1934, in "grass," male, three females (M. R. Osburn); Hammon-ton, "in house," numerous specimens. NEW YORK—Middle-town, numerous specimens (C. C. Young). OHIO—Akron, September 18, 1936, two females, two males (H. Graves). PENNSYLVANIA—Scranton, October, 1912, in "house," male, two females (D. H. Edelson). VIRGINIA—Richmond, August, 1937, in "house," two males (E. B. Marshall); Lynch-burg, July 22, 1935, no host given, three males (M. G. Perron).

EASTERN HOSTS. "Dog," "Cat," "Rabbit," "Rats," "Gray Fox," "Man," "Woodchuck," Red Fox (*Vulpes regalis* Merriam).

EASTERN LOCALITIES. Generally distributed throughout the inhabited areas of the East.

TYPE MATERIAL. No type host or locality given. Location of type not ascertained.