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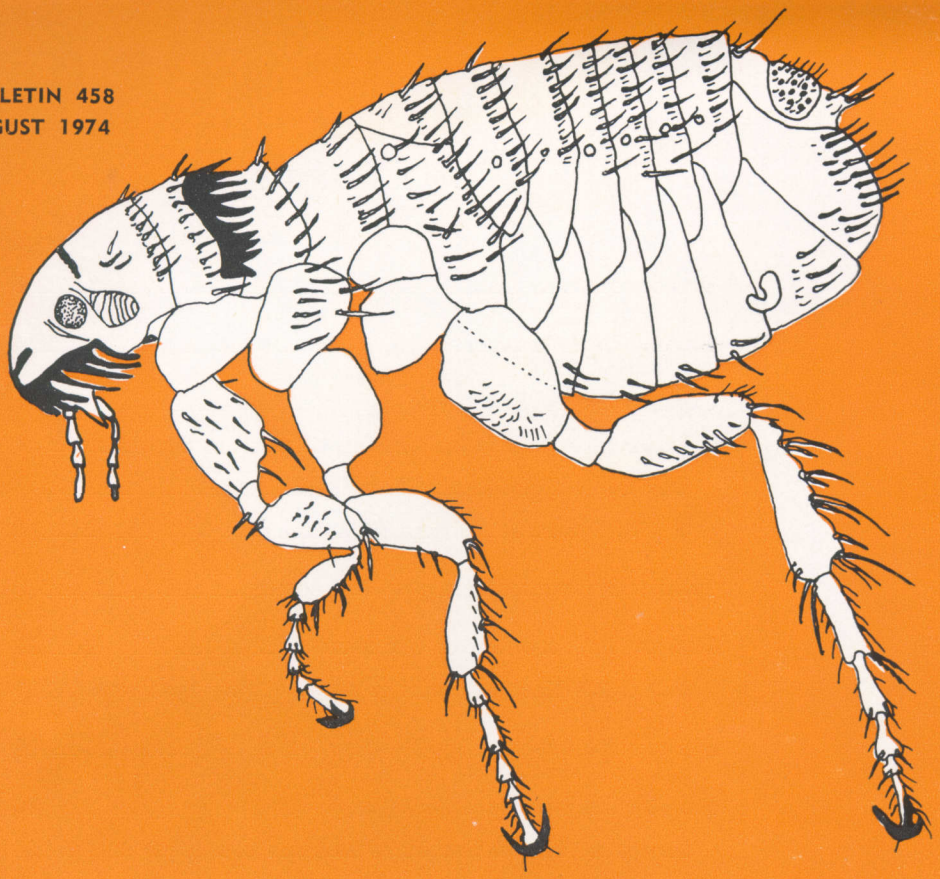

Fleas (Siphonaptera) of Alabama and Their Host Relationships

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FLEAS (Siphonaptera) of ALABAMA and their Host Relationships

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INTRODUCTION

ADULT FLEAS are obligatory parasites, utilizing warmblooded animals as their hosts. They may remain as permanent residents on the host, taking blood meals as frequently as desired, or they may visit their host intermittently, spending the intervening periods in nests, runways, dens, litter, or other components of the host's environment. Eggs are usually deposited in nesting material and larvae are free-living, apodous, cylindrical, and covered with large stiff setae. There are usually three larval instars that feed on organic materials. The third larval instar, when ready to pupate, empties its digestive tract and spins a thin, transparent cocoon which may be reinforced with small bits of organic material, sand, or earth. Newly emerged adults are capable of feeding immediately.

Mammals serve as hosts for most fleas. Only about one hundred species are known to feed on birds, and according to Holland *(16)* these are secondarily adapted to birds. Though fleas commonly exhibit host preference, there is usually a much reduced degree of host specificity involved with this group than with less motile parasites such as the Anoplura. Instances of host-transfer are very common, extending even to the utilization, by some species, of both birds and mammals by a single adult flea.

Fleas are important as vectors of disease organisms and internal parasites of man and animals. Flea bites are annoying and in some instances humans may develop a severe allergy to flea saliva *(4)*.

Fleas, especially *Xenopsylla cheopis,* are vectors of bubonic

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plague, one of the most insidious and devastating diseases in the history of mankind. The etiological agent of the disease is *Yerisina pestis,* normally a bacterial infection of rodents. Under certain conditions, fleas are capable of initiating epidemics of staggering proportions among humans. The disease is spread from rodent to rodent, rodent to man, or man to man by fleas, primarily through flea bites but also by contamination of skin abrasions with flea feces or crushed fleas.

In addition to their ability to serve as vectors for the bubonic plague bacillus, fleas may also transmit other etiological agents of disease. Transmission of *Rickettsia mooseri* (=*R. typhi*), the etiological agent of murine typhus, from domestic rats to man occurs by contamination of skin abrasions with crushed fleas or their feces *(13). Franciella tularensis,* the etiological agent of tularemia, has been transmitted in the laboratory by *Orchopeas leucopus (35).* Fleas also serve as intermediate hosts of helminths e.g., *Dipylidium caninum,* the dog tapeworm, *Hymenolepis diminuta* and *H. nana,* rodent tapeworms, and *Dipetalonema reconditim,* a dog nematode. *Salmonella enteritidis,* a causative agent of acute gastroenteritis, has been experimentally transmitted by fleas in laboratory experiments *(8).*

REVIEW OF LITERATURE

Linnaeus *(30)* recognized only two species of fleas, both of which he assigned to the genus *Pulex.* Almost one hundred years later only two genera were recognized and no general classification of the order had been attempted *(15).* Kolenati *(29)* provided the first comprehensive systematic treatment of the order. He recognized 24 species which he arranged in eight genera. In a paper by Taschenberg in 1880, the number of flea genera was reduced to five.

The systematics of American fleas were largely neglected until Baker *(1)* listed 9 species which were distributed in western America. Baker subsequently published two more important papers in 1904 and 1905 *(2,3).* In the first he catalogued 134 species, 22 of which were descriptions of new species from western America. In the 1905 paper he added about 120 new names to his world list, arranging the total into 8 families.

Paralleling Baker's work in America, Jordan and Rothschild in England and Wagner in Russia (later in Yugoslavia) made im-

portant contributions to studies of American Siphonaptera. In a series of papers, both separately and jointly, the most important of which were Jordan *(19,20,21,22)*, Jordan and Rothschild *(25,26,27)*, and Rothschild *(38,39,40,41)*, these two English workers described approximately 100 species of American fleas. Wagner, though primarily involved with descriptions of Palaearctic fleas, provided two important works on American species in 1929 and 1936 *(50,51)*.

Ogata *(34)* concluded from epidemological evidence that fleas vectored plague and official recognition of plague in San Francisco in 1900 stimulated an intense interest in American fleas. Most of the new workers concerned themselves with fleas of western America. Mitzmain *(31,32,33)*, published on California Siphonaptera and plague studies. Fox, in a series of short publications beginning in 1908 and extending through 1929, described many new western fleas, and in 1931 reported on a rat flea survey in Savannah, Georgia *(10)*.

Stewart, in addition to his work on western fleas *(44,46,48)*, published a number of papers concerned with fleas of eastern America *(43,45,47)*.

Four important publications dealing with fleas of North America appeared during the period of 1940-1950. Fox *(11)* reported a total of 56 species and subspecies east of the 100th meridian. Ewing and Fox *(9)* gave a comprehensive account of the fleas of North America, discussing classification, identification, and geographic distribution of these insects. Hubbard *(18)* listed 246 species and subspecies west of the 100th meridian. Holland *(14)*, in a synopsis of Canadian fleas, recorded 127 species and subspecies from that country.

Twelve species of fleas have been reported from Alabama by Fox *(11)*, Kohls *(28)*, Carpenter *et al. (6)*, Cole and Koepke *(7)*, Pratt and Good *(37)*, and Pratt and Wiseman *(36)*. No one author reported more than 6 species. Most of the fleas reported were taken from domestic rodents, dogs, and cats. This bulletin brings together all the published information as well as the information collected by the authors from an extensive survey of the flea fauna from many Alabama animals.

COLLECTION OF SPECIMENS

Specimens analyzed in this study were generally obtained from wild mammal hosts. Procedures utilized in obtaining the host

mammals include (1) live-trapping, (2) steel-trapping, (3) shooting, and (4) collecting road-killed specimens. The mammal hosts were collected and placed in separate plastic bags, sealed and transferred to the laboratory or field station. Fleas and other ectoparasites were incapacitated by chloroform and removed from the infested mammals with a comb and forceps. Fleas were also collected from mammal nests, dens, and domestic mammals. Hood's solution was used to preserve all ectoparasites until further laboratory preparation was possible.

Specimens of fleas in the Auburn University Entomological Museum provided an additional source of material for this study. Officials at the Communicable Disease Center, U.S. Public Health Service, Atlanta, Georgia also contributed fleas collected in Alabama from their collection.

During the course of this study, 1,794 mammal specimens were collected. These specimens represented 46 species and sub-species in 7 mammalian orders. From these mammals and other sources, a total of 2,718 fleas, of 17 described species and subspecies and a new species were collected.

LABORATORY PREPARATION AND IDENTIFICATION OF SPECIMENS

In addition to external morphological features, characteristics of the internal genitalia are often used as the basis for identification. Consequently, it was necessary to clear and mount the specimens on glass slides. A modified version of Britten's method (5) was satisfactory in making permanent mounts in our laboratory.

The method was as follows: The flea abdomen was punctured with a small pin (minuten nadeln) and the intestinal contents were forced out by pressure. Extreme care was necessary in this step to prevent excessive damage to the chaetotaxy. The specimen was then transferred successively to: (1) a 10 percent potassium hydroxide-water solution for 24 hours, or until the unsclerotized structures were sufficiently dissolved, (2) distilled water and thoroughly washed for 15 minutes, (3) glacial acetic acid for 15 minutes, (4) a solution of two-thirds glacial acetic acid and one-third clove oil for 15 minutes, and (5) a solution of one-half glacial acetic acid and one-half clove oil for 15 minutes or as long as needed. The specimen was then mounted in Euparal on a glass slide with head to the right and dorsal side down. After

the slides were oven-dried at approximately 42° C. for 48-60 hours, labels were affixed. One label was affixed to the left of the mount, on which collection data and name of mounting medium were printed, and one to the right of the mount on which species determinations were printed.

The three most important works utilized in the identification of specimens were *Fleas of Eastern United States (11), The Siphonaptera of Canada (14),* and *Fleas of Western North America (18).* Verifications of a representative sample of identified Alabama fleas were made by Dr. William L. Jellison, Rocky Mountain Laboratory, Hamilton, Montana.

Dichotomous bracket keys for identification of genera and species were constructed. Genera and species were arranged according to Hopkins and Rothschild *(17).* Each species was illustrated. The drawings are not all made to the same scale, but each was made of a size convenient for adequate illustration.

Brief descriptions are presented for each species found. Additional information concerning the number of each species examined, sex, distribution, and host records is included. Only county names were used in defining the Alabama distribution of species, but exact localities were noted on specimen mounts. Currently this collection is the property of Auburn University and is housed in the Entomological Museum. Hosts for each flea species were designated by common name in each species description. However, to make it possible to easily and quickly ascertain the known species of fleas parasitizing each mammal species, a host-flea index including scientific and common names is included. *The Mammals of North America* by Hall and Kelson, Volumes 1 and 2, *(12)* was used as the authority for specific names of hosts.

THE ORDER SIPHONAPTERA LATREILLE

Members of order Siphonaptera, commonly referred to as fleas, are small (1 to 8.5 mm.), apterous, laterally compressed insects with complete metamorphosis. Adults are ectoparasites of warm-blooded vertebrates. Eyes, when present, are always simple and consist of a single pair. They may be vestigial or absent in some genera. Antennae are short, stout, three-segmented, and situated at the sides of the head in antennal grooves; segments beyond the second segment are greatly shortened and formed into a club. Mouth-parts are modified for piercing and sucking. The legs are each composed of a large, long, flattened coxa, a small trochanter,

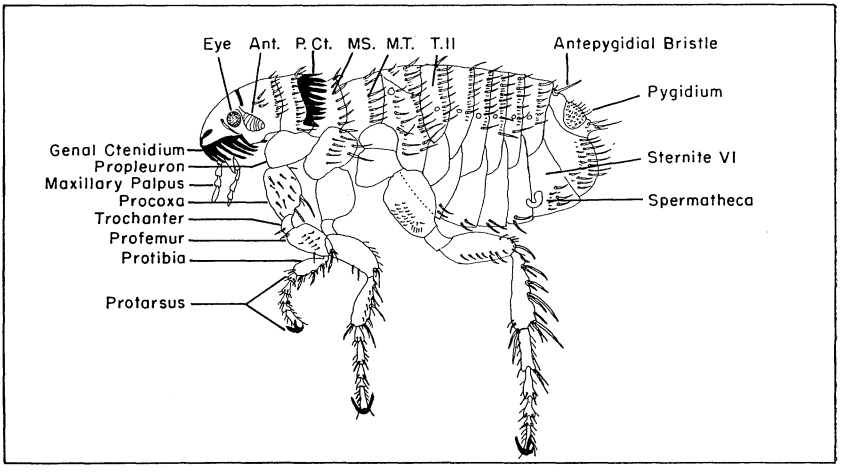

FIG. 1. General anatomy of a female flea, *Ctenocephalides felis* (Bouche).

a large femur, a tibia which is expanded distally, and a 5-segmented tarsus bearing a pair of curved claws on the distal segment. The general anatomy of a female flea and the terminal segments of the male abdomen are shown in figures 1 and 2. Larvae are apodous, eruciform, and free living. Pupae are exarate in cocoons.

The order is divided into 17 families by Jordan *(in 17)*. Six of these families and 14 genera occur in Alabama.

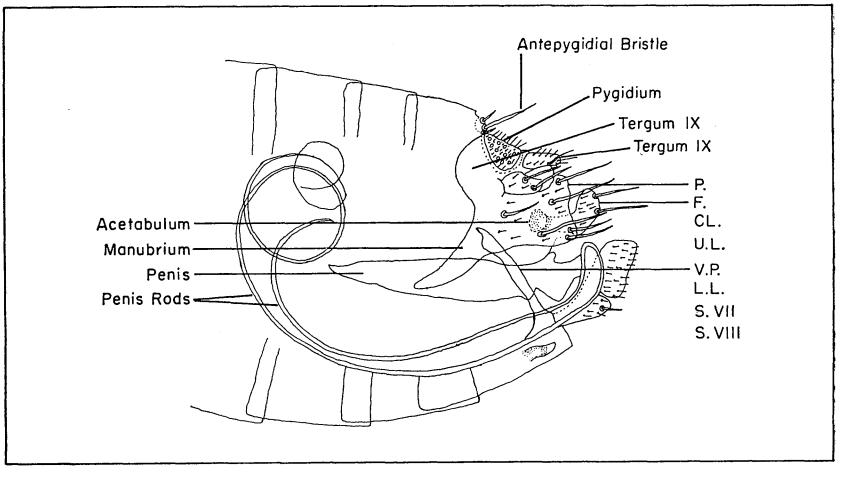

FIG. 2. General anatomy of terminal segments and genitalia of a male flea, *Nosopsyllus fasciatus* (Bosc).

Key to Genera of Alabama Siphonaptera

1. Pronotal ctenidium present 5
   Pronotal ctenidium absent 2
2. Abdominal terga with two rows of setae ..... *Rhopalopsyllus* (p. 25)
   Abdominal terga with one row of setae 3
3. The three thoracic terga combined, shorter than the first abdominal tergum. Front margin of head angular ..... *Echidnophaga* (p. 33)
   The three thoracic terga combined, longer than the first abdominal tergum. Front margin of head rounded 4
4. Mesopleuron with vertical pleural sclerotization. Ocular bristle inserted in front of eye ..... *Xenopsylla* (p. 30)
   Mesopleuron without vertical pleural sclerotization. Ocular bristle inserted below eye ..... *Pulex* (p. 31)
5. Genal ctenidium absent 6
   Genal ctenidium present 8
6. Patch of spiniform bristles on inside of metacoxa (located toward distal end of anterior margin) ..... *Odontopsyllus* (p. 18)
   Metacoxa without spiniform bristles 7
7. Fifth tarsal segment of each leg armed with four pairs of lateral plantar bristles and a basal, ventral, submedian pair ..... *Orchopeas* (p. 21)
   Fifth tarsal segment of each leg armed with five pairs of lateral plantar bristles ..... *Nosopsyllus* (p. 20)
8. First abdominal tergum with ctenidium ..... *Stenoponia* (p. 10)
   First abdominal tergum without ctenidium 9
9. Genal ctenidium with two to four teeth 10
   Genal ctenidium with five or more teeth 13
10. Genal ctenidium with four teeth. Two spiniform bristles along frontal margin ..... *Leptopsylla* (p. 14)
    Genal ctenidium with less than four teeth 11
11. Genal ctenidium with three teeth ..... *Ctenophthalmus* (p. 11)
    Genal ctenidium with two teeth 12
12. Genal teeth separate, not overlapping. Head angulate in front. Anterior margin of clypeus with short spinelets ..... *Peromyscopsylla* (p. 15)
    Genal teeth overlapping. Head not angulate in front. Anterior margin of clypeus without short spinelets ..... *Epitedia* (p. 12)
13. Genal ctenidium horizontal with curved, sharp teeth ..... *Ctenocephalides* (p. 28)
    Genal ctenidium sub-vertical with straight, blunt teeth ..... *Cediopsylla* (p. 26)

FAMILY HYSTRICHOPSYLLIDAE TIRABOSCHI

Eyes present or absent; if present they are usually small and unpigmented. Interantennal suture present or absent. Genal and pronotal ctenidium usually present. Abdominal ctenidium sometimes present. Apical spinelets absent on metanotum but present on anterior abdominal terga. Outer internal ridge present on

both meso- and metacoxae. Two or more rows of setae on abdominal terga. Pygidium convex. Three genera occur in Alabama.

Genus *Stenoponia* Jordan and Rothschild

Eyes absent. Labial palpus short, extending only slightly beyond apex of maxilla. Club of antenna short. Genal, pronotal, and abdominal ctenidia present. Abdominal terga two to five with short stout apical spinelets. Antepygidial bristles present and well developed. Fifth tarsal segment of each leg with four pairs of lateral plantar bristles and a basal ventral pair. Size large in both sexes, 4 to 5 mm. in length.

Stenoponia americana (Baker) (Fig. 3)

Eyes absent. Genal ctenidium with about thirteen teeth on each side. Genal process wide. Six bristles on preantennal region of head; three ar-

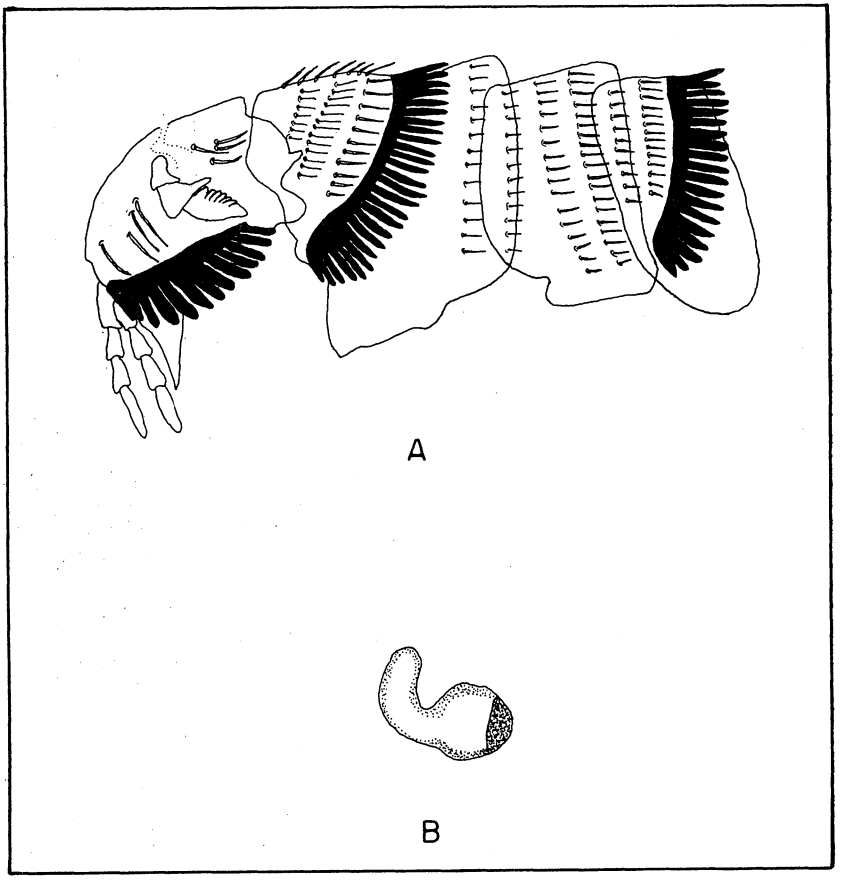

FIG. 3. *Stenoponia americana* (Baker). A. Head, thorax, and first adbominal segment of male, B. Spermatheca.

ranged in an oblique line near the antennal groove and three lower on the gena. Many small setae on frons. Postantennal region of head with about six bristles and several small setae. Pronotal ctenidium of about twenty-five teeth on each side. About four rows of bristles in front of pronotal ctenidium. Meso- and metanotum each with four or five rows of bristles. First abdominal tergum with a ctenidium of about twenty-one teeth on each side. About three rows of bristles on each abdominal tergum. Abdominal terga 2 to 4 with a series of short, stout, apical spinelets. Long and heavily pigmented bristles on posterior margin of tibia. Five antepygidial bristles on each side in female; four in male.

Modified Segments, Male: Process of clasper broad, apically rounded and armed with a series of bristles distally. Movable finger curved, slightly longer than process, and armed with a number of small bristles. Manubrium short, curved. Penis short, blade-like. Ninth sternite expanded apically and armed with many slender bristles. Female: Seventh sternite divided by a deep sinus into two lobes; ventral lobe tapers to a point while dorsal lobe is rounded distally. Head of spermatheca spherical; tail long and curved.

Specimens Examined: 9 males; 14 females.

Distribution: Barbour, DeKalb, Jackson, Lee, Macon, and Walker counties.

Hosts: *Peromyscus* sp., Cotton Mouse, Rice Rat, Eastern Woodrat, Pine Vole, House Mouse.

Genus *Ctenophthalmus* Kolenati

Eyes vestigial. Large, prominent frontal tubercle. Genal ctenidium of three teeth. Labial palpus not reaching apex of fore coxa; distal segment armed with a curved apical bristle. Fifth segment of pro- and mesotarsus with four pairs of lateral plantar bristles and a basal, ventral, submedian pair. Fifth segment of metatarus with three pairs of lateral plantar bristles and a basal, ventral, submedian pair. Pronotal ctenidium present. Three antepygidial bristles present on each side.

Ctenophthalmus pseudagyrtes Baker (Fig. 4)

Genal ctenidium with three teeth directed posteriorly; the first the shortest, the third longest. Two rows of preantennal bristles; the upper with five, the lower with three much longer ones. Maxilla long, acuminate. Many small setae along posterior margin of antennal groove. Postantennal bristles usually in three rows; the first row with two, the second with three, and the third with five to seven. Pronotum with a ctenidium of six or seven teeth on each side and a single row of bristles, weak ones alternating with strong. Three or four rows of irregular bristles on mesonotum. Metanotum and abdominal terga each with two or three rows of bristles. Some abdominal terga also armed with a short, stout, apical tooth on a side.

Modified Segments, Male: Process of clasper bifurcate apically and armed with about six stout bristles. Movable finger longer than process, curved anteriorly, and armed on the posterior margin with four or five short bristles and a number of short hair-like setae. Female: Seventh sternite

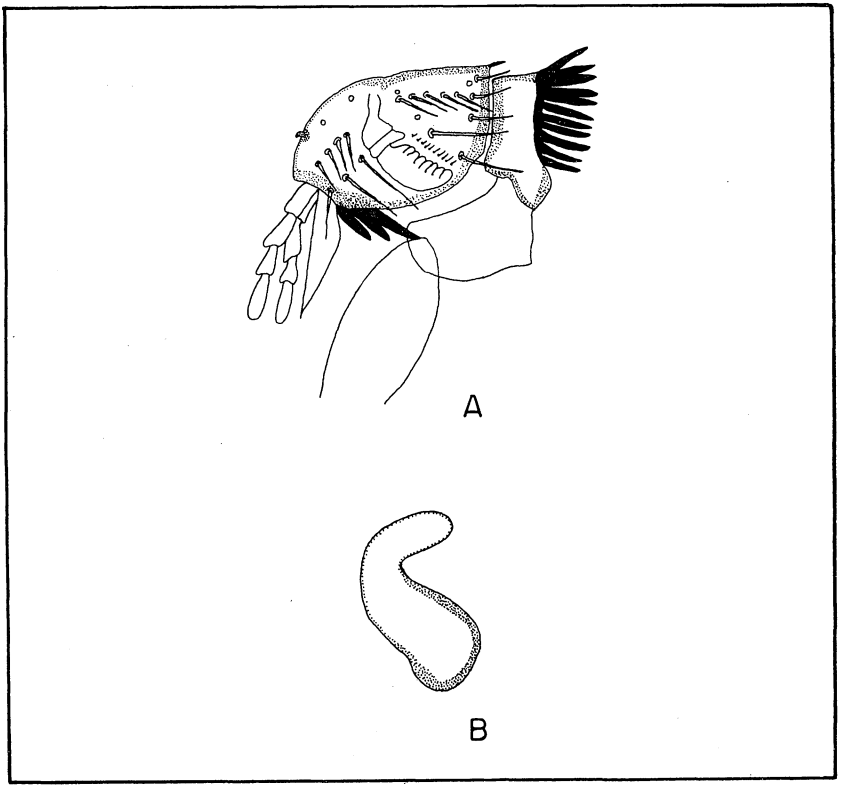

FIG. 4. *Ctenophthalmus pseudagyrtes* Baker. A. Head and pronotum of male, B. Spermatheca.

divided into two rounded lobes by a deep sinus. Head of spermatheca longer than wide; tail shorter than head.

Specimens Examined: 62 males; 53 females.

Distribution: Barbour, Colbert, DeKalb, Jackson, Lawrence, Lee, and Walker counties.

Hosts. Eastern Mole, Mink, Eastern Chipmunk, *Peromyscus* sp.; Cotton Mouse, Rice Rat, Pine Vole, House Mouse.

Genus *Epitedia* Jordan

Eyes vestigial. Frontal notch prominent. Two rows of bristles on frons. Genal and pronotal ctenidium present; former with two teeth, one of which overlaps the other. Fifth segment of pro- and mesotarsus with four pairs of lateral plantar bristles and a basal, ventral, submedian pair. Fifth segment of metatarsus has only four lateral pairs. Abdominal terga with apical spinelets.

Epitedia wenmanni (Rothschild) (Fig. 5)

Frontal tubercle small, acuminate. Genal ctenidium of two teeth; first tooth short, broad, and overlapping the longer, more slender second. Preantennal region of head with two rows of bristles; upper row with five bristles, lower row with four. Labial palpus shorter than procoxa. Eight or nine short setae present along posterior margin of antennal groove. Postantennal bristles in two rows, five or six bristles in each row. Pronotum with a ctenidium of five or six teeth on each side and a row of bristles of variable sizes. Meso- and metanotum each with three or four rows of irregularly arranged bristles. Abdominal terga each with two rows of bristles. Some abdominal terga also with a short, stout, apical tooth on each side. Three antepygidial bristles present on each side.

Modified Segments, Male: Process of clasper bilobed, the lower lobe shortest; both lobes with a long distal bristle and a number of shorter bris-

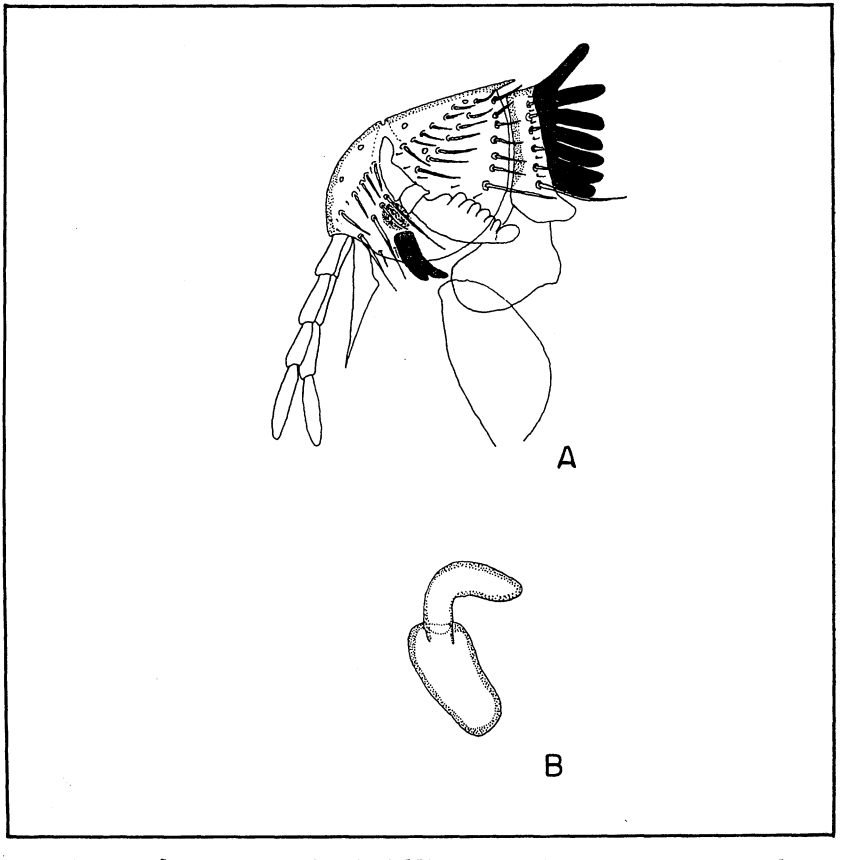

FIG. 5. *Epitedia wenmanni* (Rothschild). A. Head and pronotum of male, B. Spermatheca.

tles. Movable finger rounded ventrally, the posterior margin armed with a number of bristles of various sizes. Manubrium long, tapering distally. Penis broad, curved and pointed distally. Female: Seventh sternite divided into two lobes by a wide sinus; the upper lobe more acuminate and extending further distally than the lower. Head of spermatheca about twice as long as wide; tail projecting into lumen of head.

Specimens Examined: 3 males; 3 females.

Distribution: DeKalb, Jackson, and Lee counties.

Hosts: Oldfield Mouse, Cotton Mouse, Eastern Woodrat.

FAMILY LEPTOPSYLLIDAE ROTHSCHILD

Eyes absent or vestigial in North American species. Interantennal groove present. Head "helmet" shaped and bears spiniform bristles along the frontal margin. Genal and pronotal ctenidium present. Antennal club of male does not reach propleuron when resting in antennal groove. Dorsolateral comb-like bristles on metatibiae. Two genera occur in Alabama.

Genus *Leptopsylla* Jordan and Rothschild

Eyes vestigial. Frontal tubercle absent. Frontal margin armed with a row of bristles, two or three at the vertex spiniforms. Genal ctenidium with four teeth. Pronotal ctenidium of many long slender teeth. Fifth tarsal segment of each leg armed with four pairs of lateral plantar bristles and a basal, ventral, submedian pair. Posterior margin of hind tibia armed with about fourteen bristles, three or four of which are long. Three or four antepygidial bristles present on a side.

Leptopsylla segnis (Schonherr) (Fig. 6)

Head rounded, "helmet" shaped. Anterior margin of frons armed with nine bristles, two of which are spiniforms and five others long and heavy. Numerous other small setae on preantennal region of head. Four teeth in genal ctenidium; the dorsal tooth broadest and the third longest. Postantennal region of head with four rows of bristles. Pronotum with one row of bristles and a ctenidium of about eleven teeth on a side. Meso- and metanotum each with three or four irregular rows of bristles. Each abdominal tergum with two rows of bristles, one row with short bristles and one with long ones. Male usually with three antepygidial bristles on a side; female with four.

Modified Segments, Male: No distinct process of clasper. Dorsal region of clasper rounded. Movable finger rounded posteriorly and armed with six bristles, three of which are long. Manubrium long and distally curved. Broad, blade-like penis. Posterior arm of sternite seven expanded distally, the posterior margin with many hair-like setae. Female: Seventh sternite not bifurcate. Head of spermatheca much longer than wide, tail curved and broadest at base.

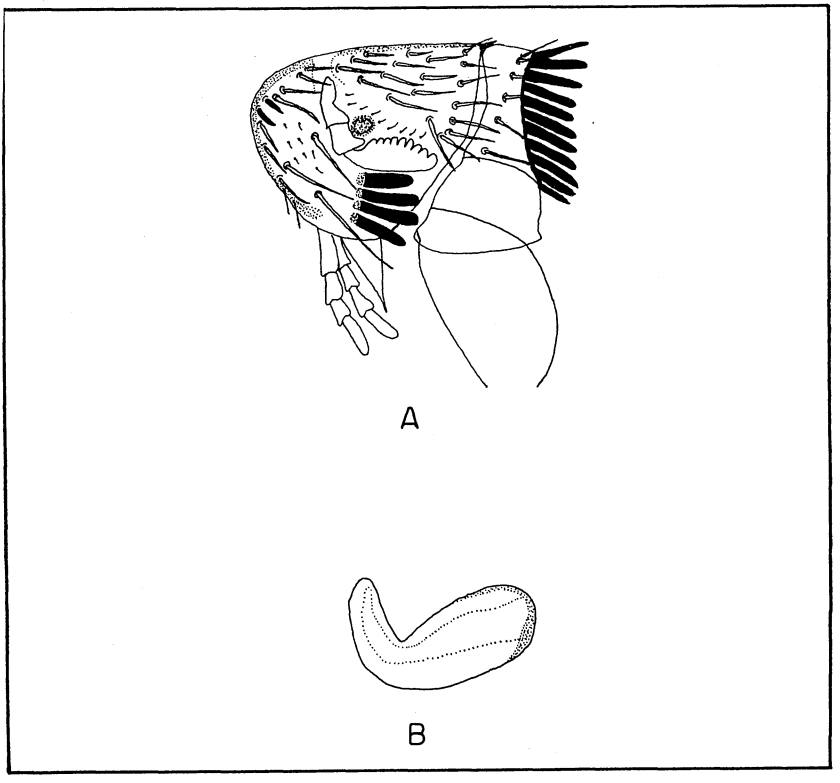

FIG. 6. *Leptopsylla segnis* (Schonherr). A. Head and pronotum of male, B. Spermatheca.

Specimens Examined: 72 males; 135 females.
Distribution: Houston, Montgomery, and Pike counties.
Host: Norway Rat.

Genus *Peromyscopsylla* I. Fox

Eyes vestigial. Head subangulate in front, "bullet" shaped. Frontogenal angle acute. Anterior margin of head with a series of bristles, two, three, or four of which are spiniforms. Genal ctenidium of two horizontal teeth, not overlapping. Short, stout apical spinelets on metanotum and abdominal terga.

Key to the Known Species of Alabama *Peromyscopsylla*

1. Three spiniform bristles at fronto-dorsal angle of head. Seventh sternite of female divided into two lobes by a deep sinus. Movable finger of male not rounded apically ..... *P. hesperomys* (p. 16)
   Two spiniform bristles at fronto-dorsal angle of head. Seventh sternite of female without a sinus. Movable finger of male rounded apically ..... *P. scotti* (p. 17)

Peromyscopsylla hesperomys (Baker) (Fig. 7)

Five to seven medium-sized marginal bristles below the three spiniform bristles at anterdorsal angle of head. Two dorso-submarginal bristles between spiniform and upper margin of antennal groove. Five additional long preantennal bristles and numerous smaller setae. Upper tooth of genal ctenidium much shorter than lower. Postantennal region of head with four or five irregular rows of bristles. Many small setae along posterior margin of antennal groove. Pronotum with single row of five or six long bristles and a genal ctenidium of fourteen or fifteen teeth on a side. Meso- and metanotum each with three or four irregular rows of bristles. Typical abdominal terga with two rows of bristles. Male with three antepygidial bristles; female with three or four, usually four.

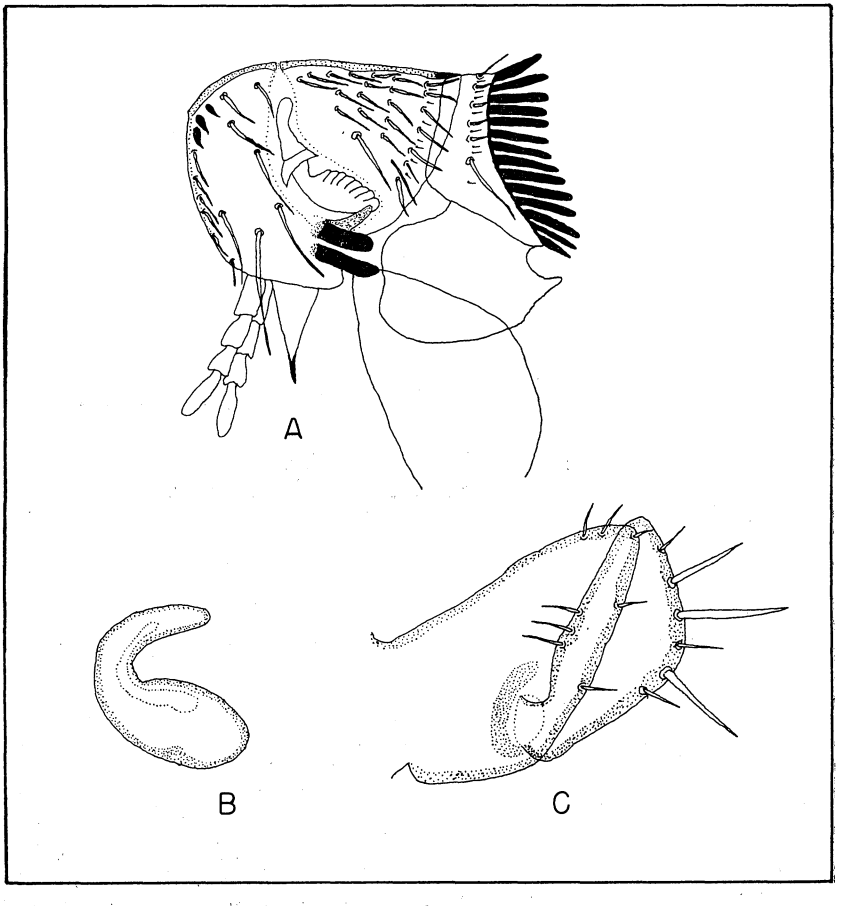

FIG. 7. *Peromyscopsylla hesperomys* (Baker). A. Head and pronotum of male, B. Spermatheca, C. Immovable process and digitoid of male clasper.

Modified Segments, Male: Process of clasper with narrowly rounded apex; dorsal margin at least two times as long as ventral. Movable finger of clasper with posterior margin evenly and broadly convex from base to apex; widest about the middle. Apex of posterior arm of ninth sternite abruptly pointed. Female: Seventh sternite divided into two lobes by a deep, narrow sinus, the upper lobe large, triangular; the lower lobe widest. Spermatheca with evenly oval head; tail narrow, not as long as head.

Specimens Examined: 20 males; 27 females.

Distribution: Jackson County.

Host: Cotton Mouse.

Peromyscopsylla scotti I. Fox (Fig. 8)

Differing from *P. hesperomys* as follows: Only two rather slender spiniform bristles at anterodorsal angle of head. Lower of the two genal teeth

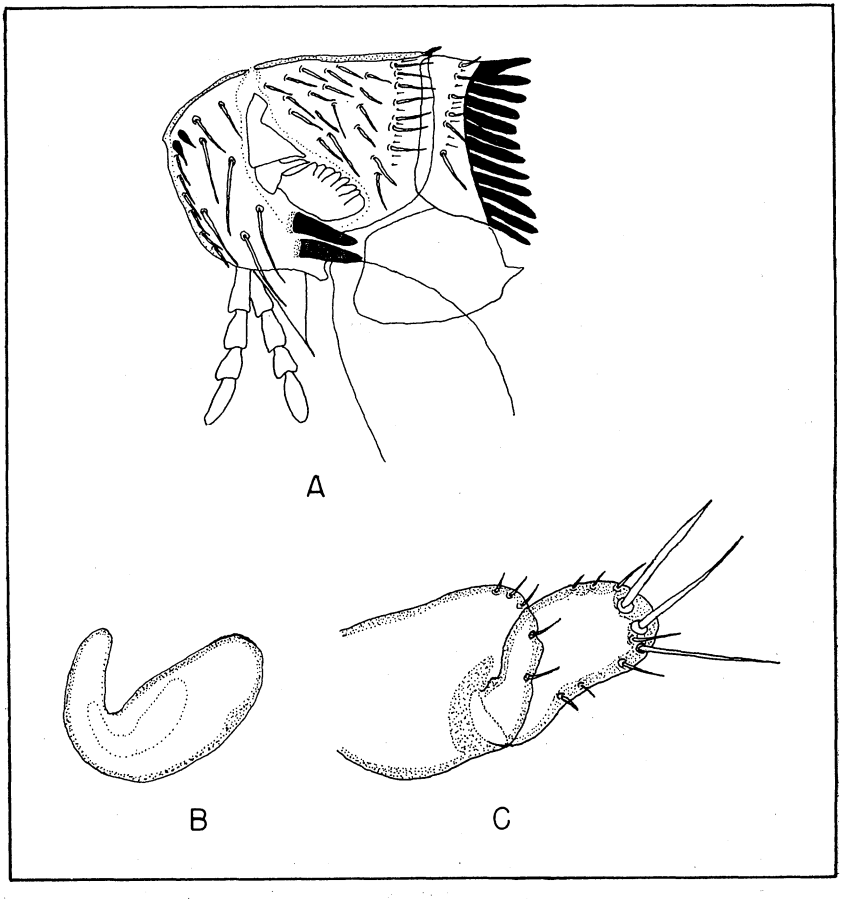

FIG. 8. *Peromyscopsylla scotti* I. Fox. A. Head and pronotum of male, B. Spermatheca, C. Immovable process and digitoid of male clasper.

extending only slightly more distad than the upper. Usually with three antepygidial bristles in both sexes (females may have four).

Modified Segments, Male: Process of clasper broadly rounded at apex; dorsal and ventral margins almost parallel. Movable finger of clasper strongly produced dorsocaudally, twice as long as broad, anterior margin becoming convex. Female: Seventh sternite without a sinus; its posterior margin with broad lobe. Head of spermatheca elongate, oval, as long as, or longer than, tail.

Specimens Examined: 24 males; 43 females.

Distribution: DeKalb, Jackson, Lee, and Morgan counties.

Hosts: Oldfield Mouse, *Peromyscus* sp., Cotton Mouse, Golden Mouse, Rice Rat, Hispid Cotton Rat, House Mouse.

FAMILY AMPHIPSYLLIDAE DAMPF

Eyes present and well developed or reduced. Upper seta of ocular row near margin of antennal fossa and above level of eye. Genal and/or pronotal ctenidium present. Anterior tentorial arms discernible in genal area as a rod-like sclerite. Both abdominal tergum and sternum eight of male greatly enlarged, covering external genitalia, but without modification. No acetabular bristles. Sternum nine with outer arm usually bifurcate and divided into upper and lower lobes. One genus occurs in Alabama.

Genus *Odontopsyllus* Baker

Eyes large, heavily pigmented. Frontal tubercle prominent and acuminate. Labial palpus reaching almost to apex of fore coxa. Pronotal ctenidium with fourteen to nineteen long, apically pointed teeth on each side. Inner surface of metacoxa bears a patch of spinelets. Abdominal terga with apical teeth. Female with three antepygidial bristles on each side, males with two.

Odontopsyllus multispinosus (Baker) (Fig. 9)

Two rows of preantennal bristles; the upper row consisting of four to six, the lower row of three longer and more robust bristles (the bristles of the upper row are weaker in the female). Numerous small setae located along the posterior margin of antennal groove. Postantennal region with three bristles located in the region of the second antennal segment and a marginal row of about eight bristles, two of which are located at the lower angle, and are very stout and prominent. Pronotum with two rows of bristles, anterior row of three and posterior row with alternating stout bristles and weak setae. An additional long, stout bristle on the middle of the lower pronotum. Meso- and metanotum each armed with three or four rows of bristles. Two or three rows of bristles on abdominal terga. Abdominal terga further armed with one or two short, stout teeth on each side.

Modified Segments, Male: No distinct process of clasper. Movable finger of clasper broad, triangular and armed with a row of about five long setae

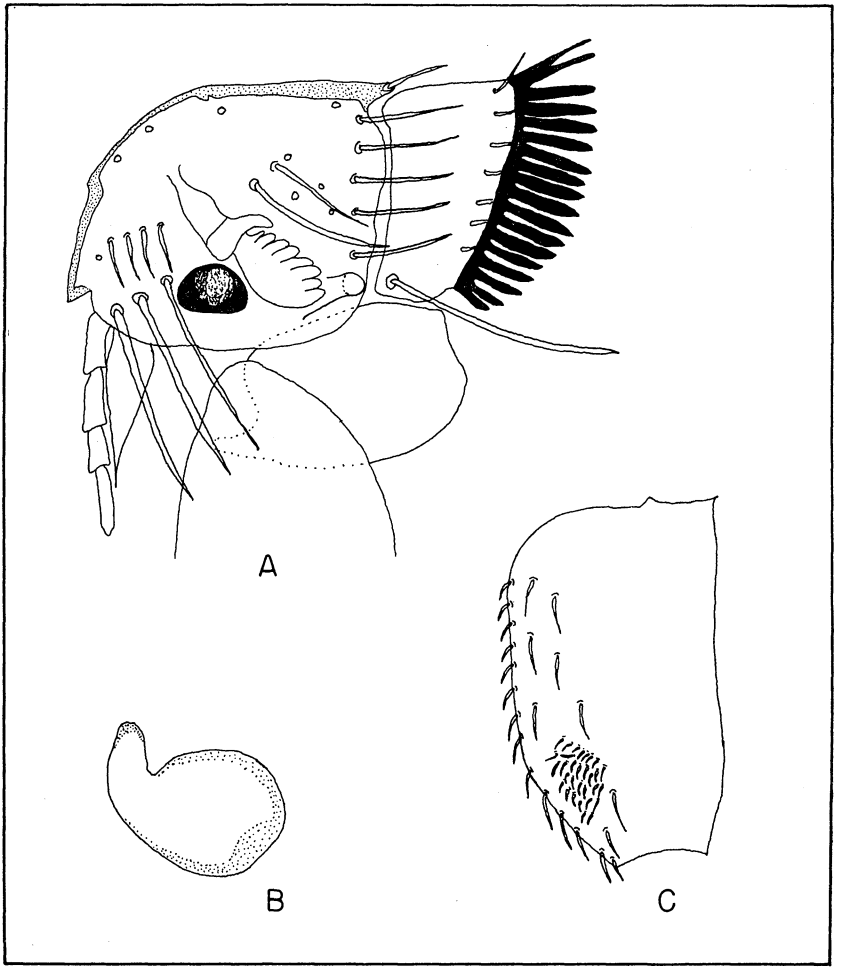

FIG. 9. *Odontopsyllus multispinosus* (Baker). A. Head and pronotum of male, B. Spermatheca, C. Metacoxa of male.

on its lower margin. Manubrium acuminate distally. Posterior arm of sternite nine expanded apically where it is armed with seven or eight short bristles. Female: Seventh sternite not divided by a deep sinus. Head of spermatheca large, globular and striated.

Specimen Examined: 58 males; 66 females.

Distribution: Butler, Chambers, Clarke, Covington, DeKalb, Houston, Jackson, Lee, Macon, Randolph, Talladega, and Winston counties.

Hosts: Raccoon, Mink, Red Fox, Gray Fox, Bobcat, Eastern Cottontail, Swamp Rabbit, Whitetail Deer.

FAMILY CERATOPHYLLIDAE DAMPF

Eyes present, usually well developed. Three ocular setae, the upper one on a level with or slightly above middle of eye (unless eyes are vestigial). Antennal groove open, club of male antenna extended on to propleuron. Trabecula centralis conspicuous, located at anterior margin of antennal fossa. Genal ctenidium absent. Pronotal ctenidium present. Metacoxa without spiniform bristles. Metanotum and anterior abdominal terga with apical spinelets. Two or more rows of setae on anterior abdominal terga. Eighth tergum of male enlarged, covering most of external genitalia. Eighth sternum of male narrow, sometimes vestigial. Pygidium flat, not convex. Two genera occur in Alabama.

Genus *Nosopsyllus* Jordan

Eyes well developed. Frontal tubercle small and acuminate. Labial palpus reaching or slightly exceeding apex of fore coxa. Pronotal ctenidium of nine or ten teeth on each side. Posterior process of ninth sternite of male divided into two lobes by a sinus. Movable finger without spiniform bristles. Tail of spermatheca long and curved about the large head.

Nosopsyllus fasciatus (Bosc) (Fig. 10)

Three ocular bristles and an upper row of about five bristles along anterior margin of antennal groove. Postantennal region of head with a number of small setae along posterior margin of antennal groove plus a single long stout bristle near the second antennal joint and often a smaller bristle dorsal to this. An additional marginal row of four to six bristles also present on postantennal region of head. Pronotum with a ctenidium and a row of bristles. Meso- and metanotum each with two or three rows of bristles. Fifth tarsal segment of each leg with five pairs of lateral plantar bristles. Abdominal terga with two rows of bristles; the anterior three or four terga also armed with one or two short stout teeth on a side. Three antepygidial bristles present on each side in both sexes. In the male the middle bristle is about three times length of the upper one, the lower one much reduced in size. In the female the three are well developed, the upper being much shorter than the two lower ones.

Modified Segments, Male: Process of clasper broad, with a prominent posterior angle, and armed at apex with two or three small bristles. Movable finger evenly rounded posteriorly; two stout bristles present on the posterior margin, between which is a much smaller bristle. One or two other bristles occur at the apex of movable finger. Manubrium about two-thirds length of the blade-like penis. Female: Seventh sternite without a sinus, apical margin irregularly rounded or slanting. Head of spermatheca globular; tail about one and one-half times as long as head and curving around it.

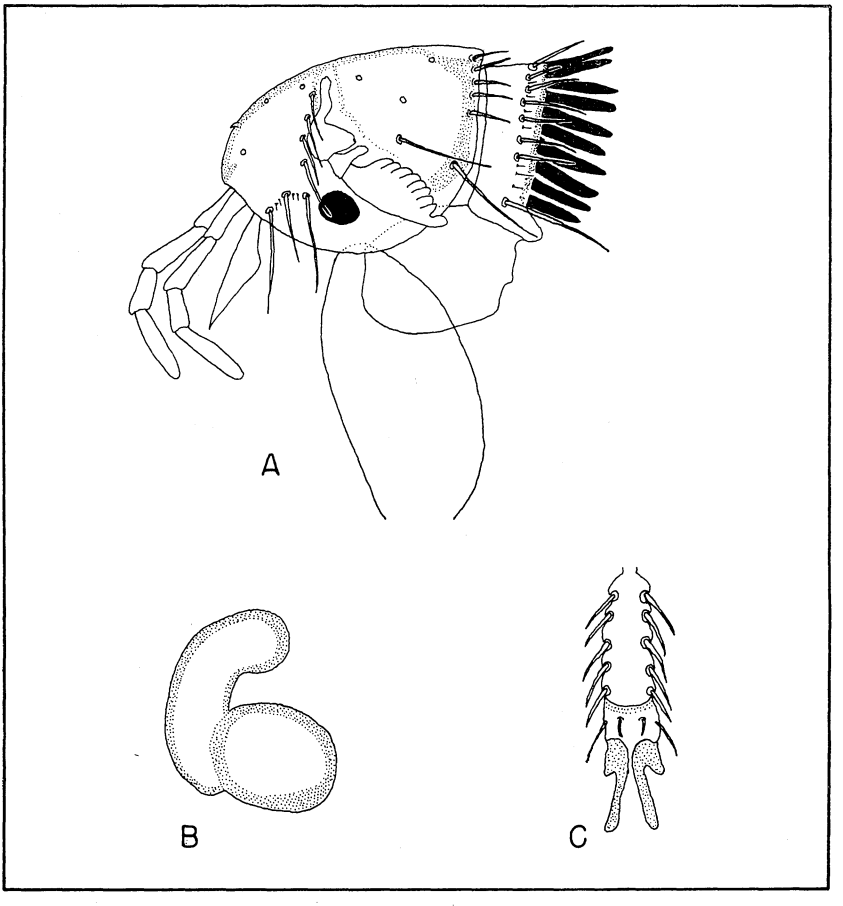

FIG. 10. *Nosopsyllus fasciatus* (Bosc). A. Head and pronotum of male, B. Spermatheca, C. Fifth segment of male metatarsus.

Specimens Examined: 12 males; 3 females.
Distribution: Houston and Talladega counties.
Host: Norway Rat.

Genus *Orchopeas* Jordan

Eye well developed. Frontal tubercle small. Labial palpus reaching to apex of fore coxa or slightly beyond. Preantennal region of head with one or two rows of bristles. Postantennal region with one row of setae, the marginal row. Other setae may be present in variable numbers but not arranged in a row. Pronotal ctenidium with nine or ten teeth on each side. Fifth tarsal segment of each leg with four pairs of lateral plantar bristles and a basal, ventral, submedian pair. Males with two stout and one minute ante-

pygidial bristles on each side; females with three stout ones on each side, the middle one the longest. Movable finger of clasper ham-shaped with four to seven heavy spiniform bristles. Head of spermatheca barrel-shaped.

Key to the Known Species of Alabama *Orchopeas*

1. Preantennal region of head with one distinct row of bristles. Movable finger of clasper armed with four heavy, black spiniform bristles ..... *O. howardii* (p. 22)
   Preantennal region of head with two distinct rows of bristles. Movable finger of clasper armed with more than four heavy, black spiniform bristles 2
2. Process of male clasper long, broadly rounded at apex. Seventh sternite of female with a deep sinus ..... *O. sexdentatus pennsylvanicus* (p. 22)
   Process of male clasper short, narrowly rounded at apex. Seventh sternite of female without a sinus ..... *O. sp. novum* (p. 23)

Orchopeas howardii (Baker) (Fig. 11)

Preantennal region of head with three or four short bristles above the three forming the ocular row. Labial palpus reaching apex of fore coxa. Several small setae along posterior margin of antennal groove. Postantennal region with a marginal row of about six bristles plus a stout bristle and two or three short ones anterior to marginal row. Pronotum with a row of alternating weak and strong bristles in addition to the ctenidial teeth. Meso- and metanotum, as well as abdominal terga, armed with two rows of bristles. Metanotum and four anterior abdominal terga with one or two apical spinelets on a side.

Modified Segments, Male: Process of clasper triangular, very slender in the middle and wide distally. Movable finger heavy, with four spiniform bristles, a long bristle, and one or two shorter ones. Lower lobe of ninth sternite with one black spiniform bristle. Female: Seventh sternite divided into three lobes by two sinuses; dorsal lobe least distinct. Head of spermatheca twice as long as wide, longer than tail.

Specimens Examined: 252 males; 345 females.

Distribution: Barbour, Chambers, Conecuh, DeKalb, Houston, Jackson, Lawrence, Lee, Macon, and Winston counties.

Hosts: Virginia Opossum, Raccoon, Mink, Striped Skunk, Eastern Gray Squirrel, Eastern Fox Squirrel, Southern Flying Squirrel, *Peromyscus* sp.; Cotton Mouse, Hispid Cotton Rat.

Orchopeas sexdentatus pennsylvanicus (Jordan) (Fig. 12)

Two rows of bristles on preantennal region of head; lower row of three stout bristles, upper row with three medium-sized bristles plus three or four at the anterior margin of antennal groove (bristles of upper row weaker in the female). Postantennal region with only two bristles in addition to the marginal row of five or six.

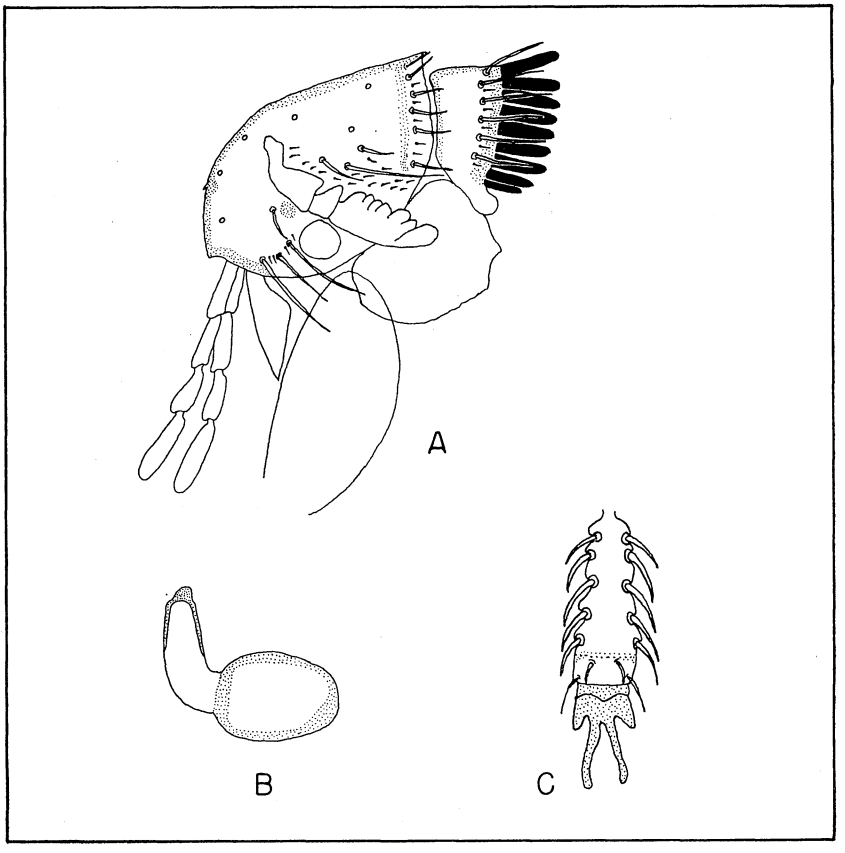

FIG. 11. *Orchopeas howardii* (Baker). A. Head and pronotum of male, B. Spermatheca, C. Fifth segment of male metatarsus.

Modified Segments, Male: Process of clasper broadly rounded at apex, extending dorsally as far, or nearly as far as movable finger. Movable finger armed at posterior margin with five heavy, dark spiniform bristles, the two dorsal ones widely separated. Female: Seventh sternite divided into two lobes by a deep sinus, upper lobe long, truncate; lower lobe distally rounded or acuminate.

Specimens Examined: 132 males; 119 females.

Distribution: Jackson County.

Host: Eastern Woodrat.

Orchopeas sp. novum

A description of this new species is now being prepared by Dr. Robert Traub, Colonel, U.S. Army (Ret.) and the senior author. It will be published at a future date.

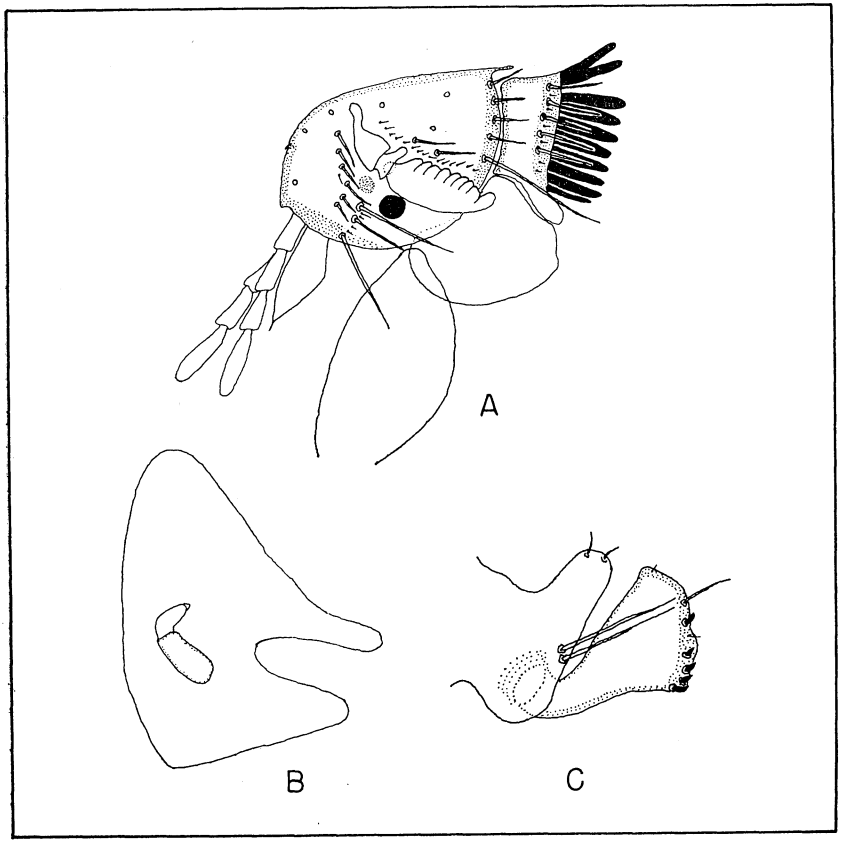

FIG. 12. *Orchopeas sexdentatus pennsylvanicus* (Jordan). A. Head and pronotum of male, B. Seventh sternite and spermatheca of female, C. Movable finger and process of male clasper.

Specimens Examined: 43 males; 34 females.
Distribution: Barbour County.
Host: Eastern Woodrat.

FAMILY RHOPALOPSYLLIDAE OUDEMANS

Frontal notch and frontal tubercle present. Frontoepicranial groove usually poorly developed. Eyes usually present; may vary markedly in size and pigmentation. Genal and pronotal ctenidium absent. Mesopleural rod not bifurcate. Four pairs of lateral plantar bristles present on all fifth tarsi. Antepygidial bristles present. One genus occurs in Alabama.

Genus *Rhopalopsyllus* Baker

Eyes well developed and heavily pigmented. Frontal tubercle large, acuminate at apex, and directed dorsad. Labial palpus five segmented, variable in length. Many small setae at upper margin of antennal groove. Two or three rows of preantennal bristles. Three rows of postantennal bristles plus a row of small spiniform bristles along posterior margin of antennal groove. One long antepygidial bristle present on a side.

Rhopalopsyllus gwyni C. Fox (Fig. 13)

Labial palpus extending beyond fore coxa in female; not reaching apex of fore coxa in male. Preantennal region of head with two rows of bristles, upper row with six bristles of which the one closest to antenna is small and weak while the other five are long and stout, lower row with three long stout bristles. Two additional long preantennal bristles, one below, one be-

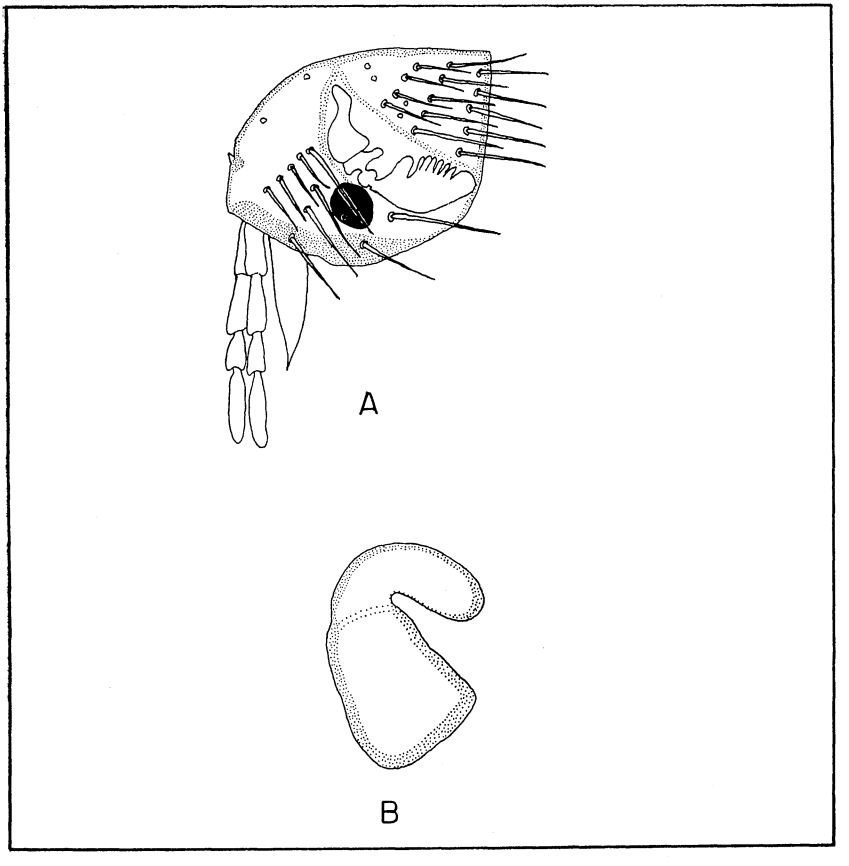

FIG. 13. *Rhopalopsyllus gwyni* C. Fox. A. Head of male, B. Spermatheca.

hind eye. Several small setae present along anterior margin of antennal groove. Postantennal region of head with three rows of bristles; first row with five, second with six, and third with seven long, stout bristles. Pro- and mesonotum with two rows of bristles. Metanotum with three rows of bristles. Abdominal terga with two rows of bristles.

Modified Segments, Male: Dorsal margin of clasper with several heavily pigmented bristles. Movable finger curved with several small setae on margins. Manubrium shorter than penis, truncate. Penis broad, truncate. Numerous apical bristles on posterior arm on ninth sternite. Female: Seventh sternite without sinus, its posterior rounded. Tail of spermatheca longer than head, head slightly longer than broad.

Specimens Examined: 65 males; 72 females.

Distribution: Barbour, Henry, Jackson, Lee, Macon, and Talladega counties.

Hosts: Virginia Opossum, Eastern Gray Squirrel, Rice Rat, Hispid Cotton Rat.

FAMILY PULICIDAE STEPHENS

Eyes well developed in Alabama species. No frontal tubercle. Genal ctenidium present or absent. Pronotal ctenidium present or absent. Trabecula centralis absent. No pseudosetae on mesonotum. Metanotum and abdominal terga without apical spinelets. An outer internal ridge is present in metacoxa, absent in mesocoxa. Metepimeron extends far dorsally. Spiracles circular. First abdominal spiracle placed well above the metepisternum. Only one row of bristles on each abdominal tergum. Males usually have two movable processes on clasper. Five genera occur in Alabama.

Genus *Cediopsylla* Jordan

Anterior margin of frons angulate. Labial palpus four segmented. Preantennal region of head with two large bristles and numerous small setae. Genal and pronotal ctenidium present. Genal ctenidium with large, heavily pigmented, blunt spines arranged almost vertically. Process of clasper has a spiniform bristle at apex.

Cediopsylla simplex (Baker) (Fig. 14)

Frons with a long dorsally directed incrassation. Preantennal region of head with two long setae, the upper seta in front of eye. Additional small setae numerous on preantennal region. Eight heavy, dark, blunt teeth in genal ctenidium. Broad, prominent mandible reaching apex of fore coxa in female, about four-fifths length of fore coxa in male. Postantennal region of head with three rows of bristles; first row with two or three, second with two, and third with four or five bristles. One row of bristles on pronotum. Pronotal ctenidium with six or seven heavy, dark teeth on each side. A single row of bristles on meso- and metanotum.

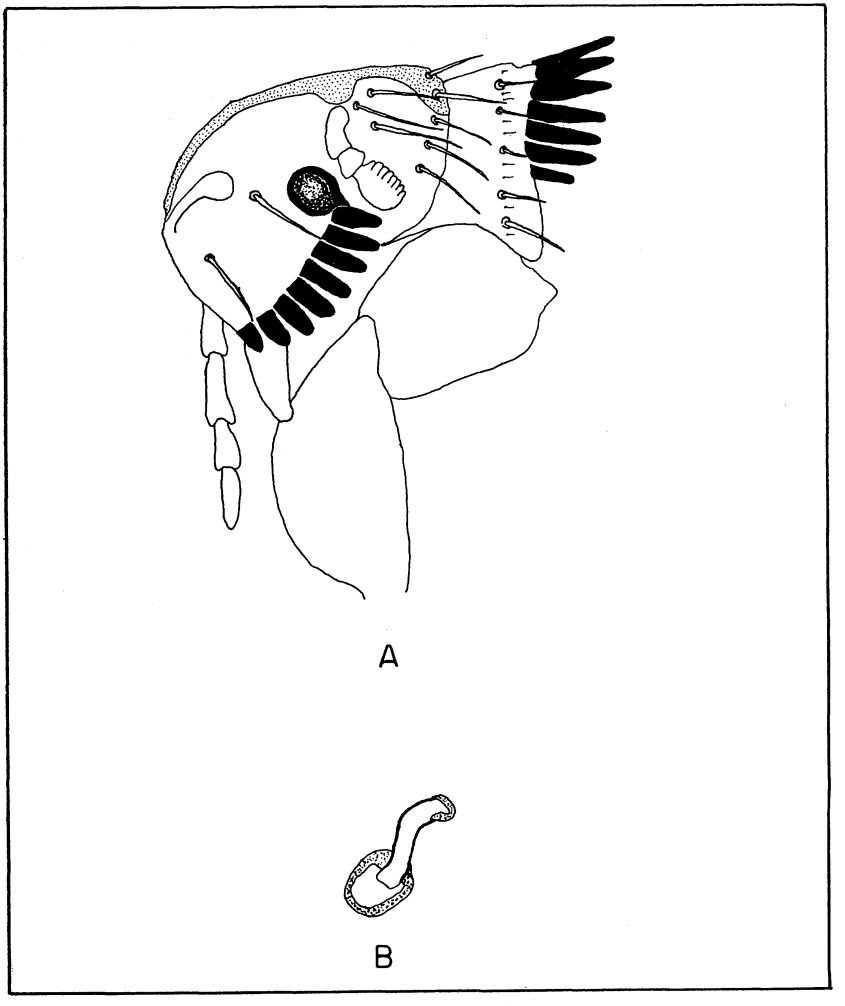

FIG. 14. *Cediopsylla simplex* (Baker). A. Head and pronotum of male, B. Spermatheca.

Modified Segments, Male: Two movable processes of clasper; anterior process more or less straight; posterior process curved, with six small bristles on its posterior margin; the two about equal in length. Manubrium rounded terminally. Penis blade-like. Sternite nine with apically expanded posterior arm possessing a patch of dark setae. Eighth sternite apically curved and pointed, with three or four bristles on the outer margin. Female: No sinus in sternite seven. Head of spermatheca about same length as, but much broader than, the curved tail. Head of spermatheca slightly longer than broad.

Specimens Examined: 278 males; 489 females.

Distribution: Barbour, Butler, Calhoun, Chambers, Clarke, Cleburne, Colbert, Covington, DeKalb, Elmore, Henry, Houston, Jackson, Lawrence, Lee, Macon, Randolph, Talladega, and Winston counties.

Hosts: Raccoon, Mink, Red Fox, Gray Fox, Domestic Cat, Bobcat, Eastern Woodrat, Eastern Cottontail, Swamp Rabbit, Whitetail Deer.

Genus *Ctenocephalides* Stiles and Collins

Anterior margin of frons rounded, with distinct incrassation. Frontal tubercle absent. Two long bristles on preantennal region of head, upper bristle placed on a level with or above the eye. Preantennal region additionally armed with several small setae. Postantennal region of head with a marginal row of bristles plus two or three additional ones. Genal ctenidium almost horizontal, extending entire length of lower margin of head, and made up of pigmented, apically pointed teeth. Pronotal ctenidium composed of heavily pigmented spines that are apically pointed. Fifth segment of each tarsus with four pairs of lateral plantar bristles.

Key to the Known Species of Alabama *Ctenocephalides*

1. Interval between postmedian and apical long bristles of dorsal margin of hind tibia containing two small notches, each with a short, stout bristle (upper one may be reduced in size, seta-like)....*C. canis* (p. 29)
   Interval between post median and apical long bristles of hind tibia containing two small notches the upper notch without a bristle or with a hair; the lower notch with a bristle.....*C. felis* (p. 28)

Ctenocephalides felis (Bouche) (Fig. 15)

Head two times as long as high, "forehead" low and sloping. Upper of the two long preantennal bristles placed in front of eye; lower one near the base of third genal tooth. Genal ctenidium with seven or eight long, curved, apically pointed teeth on each side, the first two teeth about equal in length. Postantennal region with two or three bristles in addition to the four or five that make up the marginal row. Pronotal ctenidium consisting of about eight teeth on each side. Pro- meso- and metanotum each with a single row of long bristles. Interval between postmedian and apical long bristles of posterior margin of metatibia with only one short stout bristle.

Modified Segments, Male: Process of clasper indistinct. Movable finger lobular, armed marginally with many bristles. Manubrium finger-like, slightly expanded distally. Penis truncate, wide, and heavy. Female: Head of spermatheca one and one-half times as long as broad, much shorter than tail.

Specimens Examined: 21 males; 60 females.

Distribution: Calhoun, Clarke, Conecuh, DeKalb, Houston, Jackson, Jefferson, Lee, Macon, Russell, and Walker counties.

Hosts: Virginia Opossum, Raccoon, Striped Skunk, Domestic Dog, Red Fox, Gray Fox, Domestic Cat, Bobcat, Eastern Gray Squirrel, Eastern Cottontail.

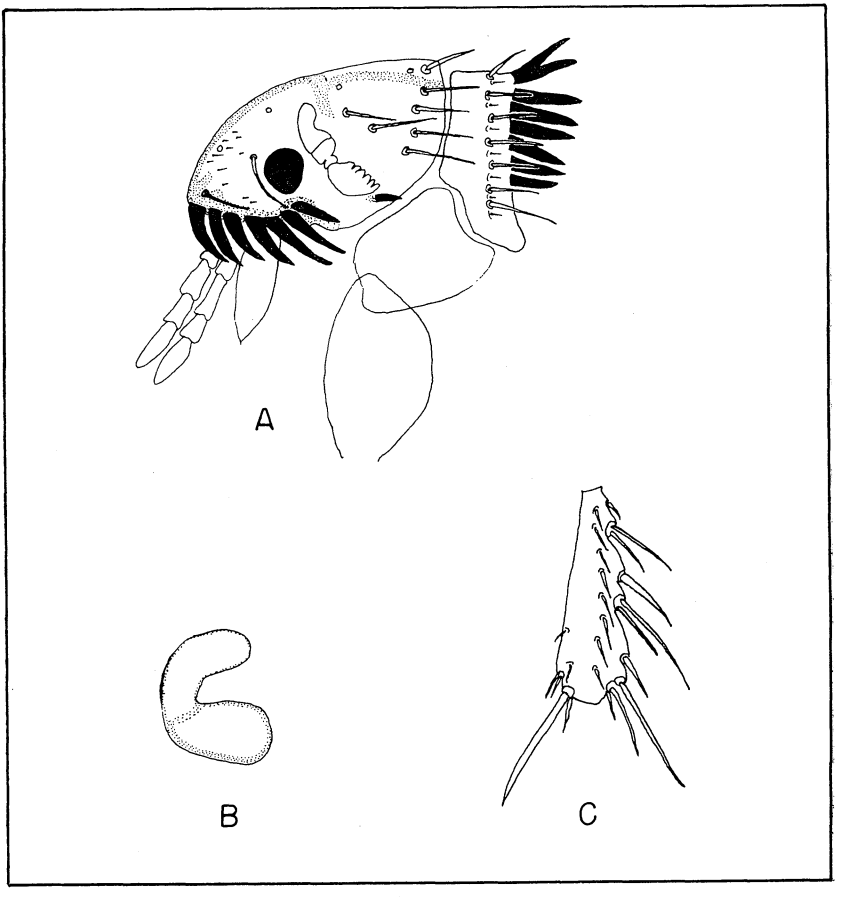

FIG. 15. *Ctenocephalides felis* (Bouche). A. Head and pronotum of male, B. Spermatheca, C. Hind tibia of male.

Ctenocephalides canis (Curtis) (Fig. 16)

Distinguished from *C. felis* as follows: Head shorter (length about one and one-half that of height). "Forehead" with less slope, much higher and rounder. First tooth of genal ctenidium shorter than the second. Interval between postmedian and apical long bristles of posterior margin of metatibia with two short, stout bristles.

Specimens Examined: 8 males; 9 females.

Distribution: Jackson, Lee, and Walker counties.

Hosts: Virginia Opossum, Striped Skunk, Domestic Dog, Domestic Cat, Eastern Cottontail.

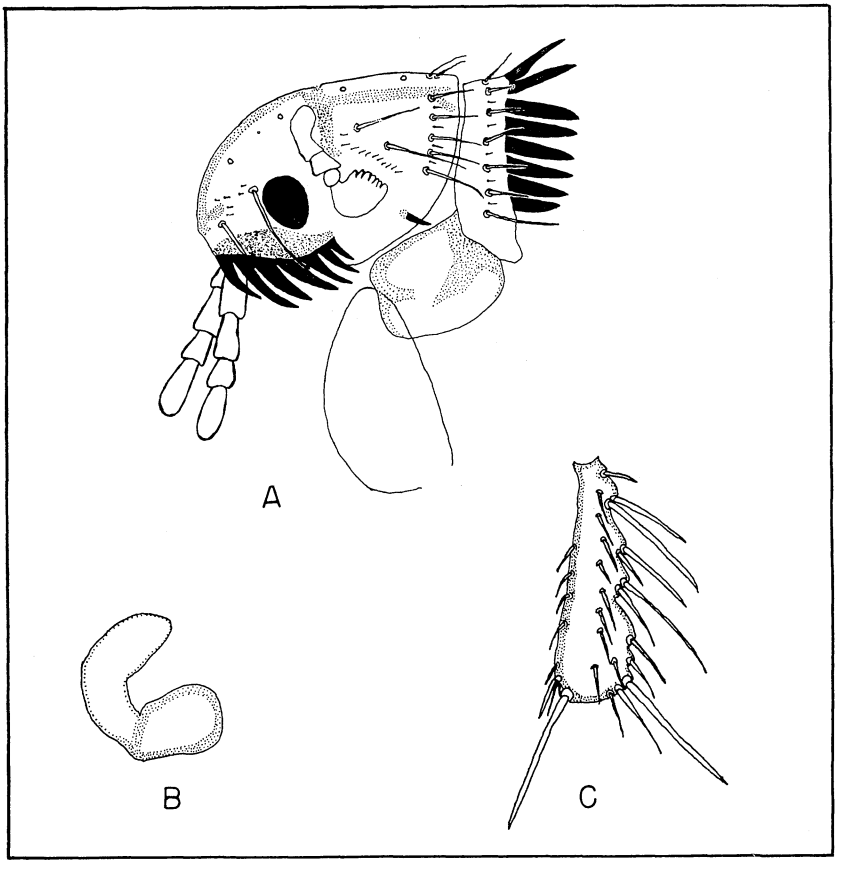

FIG. 16. *Ctenocephalides canis* (Curtis). A. Head and pronotum of male, B. Spermatheca, C. Hind tibia of male.

Genus *Xenopsylla* Glinkiewicz

Eyes large and deeply pigmented. Head broadly rounded. Frontal tubercle absent. Two large bristles and several setae on preantennal region of head. Postantennal region of head with several bristles. Genal and pronotal ctenidium absent. Pronotum with one row of bristles. The broad mesosternite divided by a vertical, rod-like sclerotization. Metacoxa with a row or patch of spinelets on inner surface. Fifth tarsal segment of each leg with four pairs of lateral plantar bristles.

Xenopsylla cheopis (Rothschild) (Fig. 17)

Upper of the two large preantennal bristles situated near upper, anterior margin of eye; lower situated at base of maxilla. Three rows of postanten-

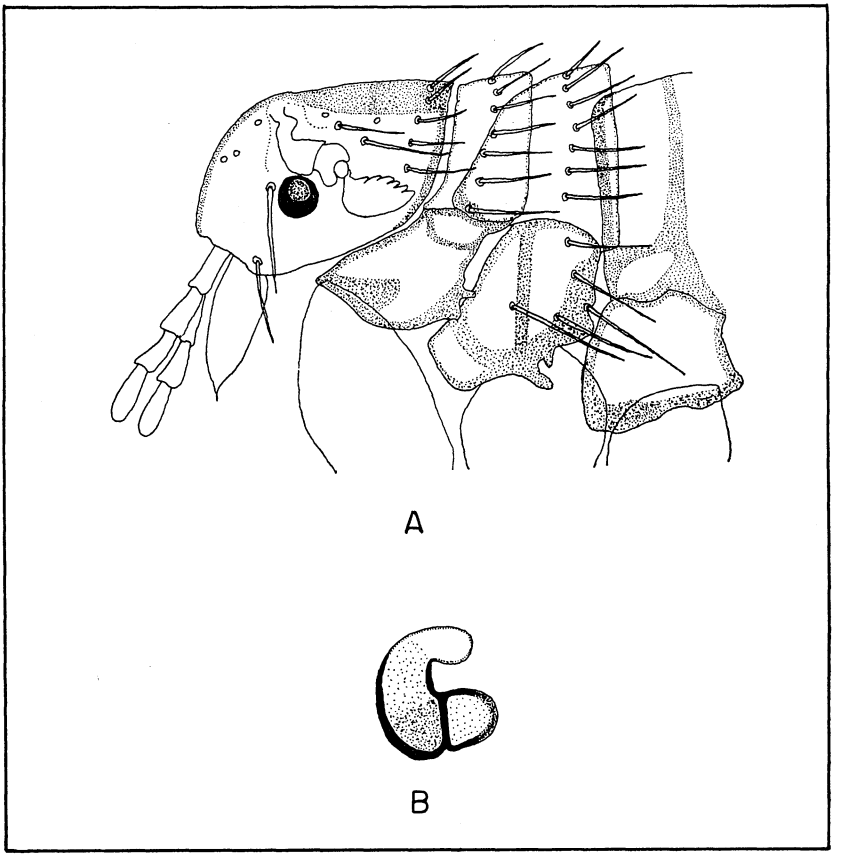

FIG. 17. *Xenopsylla cheopis* (Rothschild). A. Head and thorax of male, B. Spermatheca.

nal bristles, row one and two each with only one bristles, row three with five bristles and four setae alternately placed. Pro- meso- and metanotum each with one row of bristles alternating with small setae.

Modified Segments, Male: Clasper with two processes, one process narrow, curved outward, the other flat with a row of bristles on its upper margin. Posterior arm of sternite nine apically expanded and armed with several bristles. Female: Head of spermatheca much shorter than tail; basal part of tail about as wide as head.

Specimens Examined: 25 males; 51 females.

Distribution: Dale, Houston, and Pike counties.

Host: Norway Rat.

Genus *Pulex* Linnaeus

Eyes well developed and heavily pigmented. Frontal tubercle absent. Anterior margin of head smoothly rounded. Two preantennal bristles plus

a number of small setae on dorsal region of head. Labial palpus four segmented. Genal ctenidium absent (rarely represented by a vestigial tooth). Postantennal region of head with one bristle. Pronotal ctenidium absent. Pro- meso- and metanotum each with one row of bristles, long alternating with short. Mesosternite not divided by a vertical rod-like sclerotization.

Pulex simulans Baker (Fig. 18)

This species was originally described by Baker *(1)* and later reduced to synonomy with *P. irritans* by Jordan and Rothschild *(24)*. Smit *(42)* revised the status of *P. simulans* and advanced the hope that authors who have recorded *P. irritans* from North America would restudy their material and

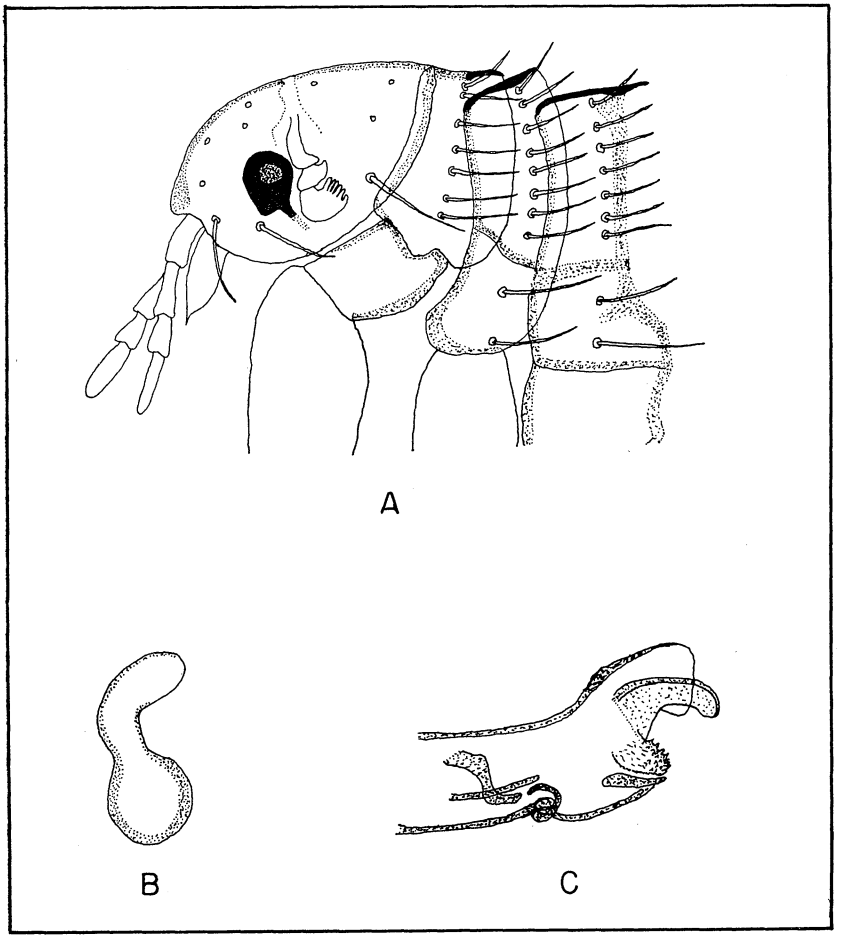

FIG. 18. *Pulex simulans* Baker. A. Head and Thorax of male, B. Spermatheca, C. Aedeagus.

publish notes stating whether any of their records refer to *P. simulans.* Alabama specimens of *Pulex* recorded in this study belong to *P. simulans.*

Maxillary palpus composed of four segments; first, second, and fourth segments about equal in length (second slightly the longest); third segment shortest. Upper of the two preantennal bristles inserted near the lower anterior margin of eye, lower bristle at base of maxilla. Labial palpus reaching from one-half to three-fourths length of fore coxa. Genal and pronotal ctenidium absent.

Modified Segments, Male: Dorsal aedeagal sclerite broad throughout (in *P. irritans* it is relatively longer and more slender). Aedeagal crochets small, elongate, slender, and rod-like (in *P. irritans* they are larger and greatly expanded apically). In *P. simulans* the two movable processes of the clasper are shorter than in *P. irritans.* Female: Usually more setae (7 to 10) on each side of seventh sternite than in *P. irritans* (usually 4 or 5).

Differences in size between the two species are: *P. simulans* male 1.5-2 mm, female 2-3 mm; *P. irritans* male 2-2.5 mm, female 2.5-3.5 mm.

Specimens Examined: 13 males; 58 females.

Distribution: Calhoun, Conecuh, Jefferson, Lee, Russell, and Winston counties.

Hosts: Domestic Dog, Red Fox, Domestic Cat, Woodchuck.

Genus *Echidnophaga* Olliff

Anterior margin of head angulate. Frontal tubercle absent. Labial palpus unsegmented. Preantennal region of head with two large bristles; postantennal region also with two bristles. Genal and pronotal ctenidium absent. Hind coxa expanded apically into a broad tooth. Hind coxa additionally armed with a patch of spinelets on inner surface. Fifth tarsal segment of each leg with three pairs of lateral plantar bristles, anterior to which may be one or two pairs of more slender bristles. Thoracic terga much reduced.

Echidnophaga gallinacea (Westwood) (Fig. 19)

Eyes deeply pigmented, oval. Upper of the two preantennal bristles inserted in front of eye. Maxilla short, triangular. Mandibles serrate, long, and tapering. Combined thoracic terga shorter than first abdominal tergum. Pro- and mesonotum each with one row of long bristles. At least one long bristle on dorsal margin of each abdominal tergum.

Modified Segments, Male: Two processes of clasper; one long with several bristles along the anterior margin, the other shorter and more narrow. Movable finger rounded apically, curved toward smaller process, and armed with one long bristle and several smaller ones. Manubrium long and slender. Penis long and broad, terminally curved and pointed. Female: Head of spermatheca very broad, longer than tail. Ventral breadth of spermatheca greater than dorsal breadth.

This is the smallest flea found in Alabama. Males are less than 1 mm in length.

Specimens Examined: 2 males; 38 females.

Distribution: Dale, Houston, Lee, Russell, and Talladega counties.

Hosts: Virginia Opossum, Raccoon, Domestic Dog, Red Fox, Domestic Cat, Norway Rat, Eastern Cottontail.

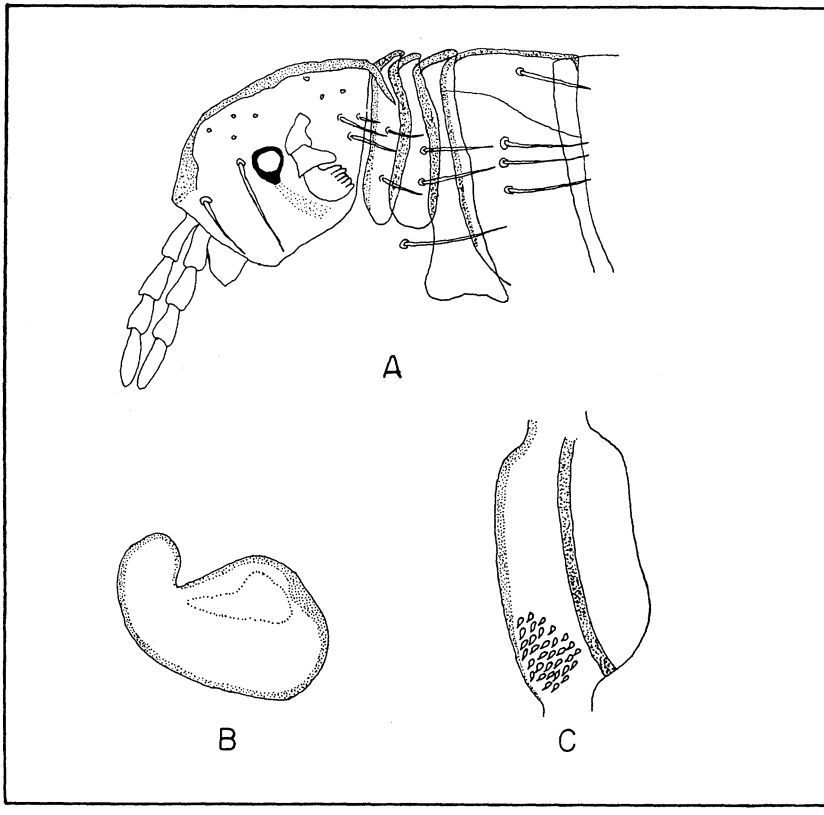

FIG. 19. *Echidnophaga gallinacea* (Westwood). A. Head, thorax, and first abdominal tergite of male, B. Spermatheca, C. Hind coxa of male.

ALABAMA HOST-FLEA INDEX

Host and Number Examined	Flea
Virginia Opossum, *Didelphis virginiana* (56)	*Orchopeas howardii* *Rhopalopsyllus gwyni* *Ctenocephalides felis* *Ctenocephalides canis* *Echidnophaga gallinacea*
Eastern Mole, *Scalopus aquaticus* (5)	*Ctenophthalmus pseudagyrtes*
Southeastern Shrew, *Sorex longirostris* (2)	None
Least Shrew, *Cryptotis parva* (2)	None
Shorttail Shrew, *Blarina brevicauda* (13)	None
Little Brown Myotis, *Myotis lucifugus* (2)	None
Gray Myotis, *Myotis grisescens* (116)	None
Eastern Pipistrel, *Pipistrellus subflavus* (9)	None
Evening Bat, *Nycticeius humeralis* (9)	None
Red Bat, *Lasiurus borealis* (6)	None
Raccoon, *Procyon lotor* (52)	*Odontopsyllus multispinosus* *Orchopeas howardii* *Cediopsylla simplex* *Ctenocephalides felis* *Echidnophaga gallinacea*
Longtail Weasel, *Mustela frenata* (1)	None
Mink, *Mustela vision* (45)	*Ctenophthalmus pseudagyrtes* *Odontopsyllus multispinosus* *Orchopeas howardii* *Cediopsylla simplex*
River Otter, *Lutra canadensis* (2)	None
Spotted Skunk, *Spilogale putorius* (6)	None
Striped Skunk, *Mephitis mephitis* (11)	*Orchopeas howardii* *Ctenocephalides felis* *Ctenocephalides canis*

Domestic Dog, *Canis familiaris* (16)	*Ctenocephalides felis* *Ctenocephalides canis* *Pulex simulans* *Echidnophaga gallinacea*
Red Fox, *Vulpes fulva* (9)	*Odontopsyllus multispinosus* *Cediopsylla simplex* *Ctenocephalides felis* *Pulex simulans* *Echidnophaga gallinacea*
Gray Fox, *Urocyon cinereoargenteus* (13)	*Odontopsyllus multispinosus* *Cediopsylla simplex* *Ctenocephalides felis* *Echidnophaga gallinacea*
Domestic Cat, *Felis domestica* (8)	*Cediopsylla simplex* *Ctenocephalides felis* *Ctenocephalides canis* *Pulex simulans* *Echidnophaga gallinacea*
Bobcat, *Lynx rufus* (8)	*Odontopsyllus multispinosus* *Cediopsylla simplex* *Ctenocephalides felis*
Woodchuck, *Marmota monax* (8)	*Pulex simulans*
Eastern Chipmunk, *Tamias striatus* (20)	*Ctenophthalmus pseudagyrtes*
Eastern Gray Squirrel, *Sciurus carolinensis* (280)	*Orchopeas howardii* *Rhopalopsyllus gwyni* *Ctenocephalides felis*
Eastern Fox Squirrel, *Sciurus niger* (15)	*Orchopeas howardii*
Southern Flying Squirrel, *Glaucomys volans* (12)	*Orchopeas howardii*
Southeastern Pocket Gopher, *Geomys pinetis* (7)	None
Beaver, *Castor canadensis* (12)	None
Eastern Harvest Mouse, *Reithrodontomys humulis* (1)	None
Oldfield Mouse, *Peromyscus polionotus* (48)	*Epitedia wenmanni* *Peromyscopsylla scotti*
Peromyscus sp. (24)	*Stenoponia americana* *Ctenophthalmus pseudagyrtes* *Peromyscopsylla scotti* *Orchopeas howardii*

Cotton Mouse, *Peromyscus gossypinus* (177)	*Stenoponia americana* *Ctenophthalmus pseudagyrtes* *Epitedia wenmanni* *Peromyscopsylla hesperomys* *Peromyscopsylla scotti* *Orchopeas howardii*
Golden Mouse, *Peromyscus nuttalli* (19)	*Peromyscopsylla scotti*
Rice Rat, *Oryzomys palustris* (77)	*Stenoponia americana* *Ctenophthalmus pseudagyrtes* *Peromyscopsylla scotti* *Rhopalopsyllus gwyni*
Hispid Cotton Rat, *Sigmodon hispidus* (333)	*Ctenophthalmus pseudagyrtes* *Peromyscopsylla scotti* *Orchopeas howardii* *Rhopalopsyllus gwyni*
Eastern Woodrat, *Neotoma floridana illinoensis* (6)	*Stenoponia americana* *Cediopsylla simplex* *Orchopeas* sp. novum.
Eastern Woodrat, *Neotoma floridana magister* (17)	*Epitedia wenmanni* *Orchopeas sexdentatus pennsylvanicus*
Pine Vole, *Pitymys pinetorum* (9)	*Stenoponia americana*
Muskrat, *Ondatra zibethica* (37)	None
Norway Rat, *Rattus norvegicus* (26)	*Leptopsylla segnis* *Nosopsyllus fasciatus* *Xenopsylla cheopis* *Echidnophaga gallinacea*
Black Rat, *Rattus rattus* (8)	None
House Mouse, *Mus musculus* (104)	*Stenoponia americana* *Ctenophthalmus pseudagyrtes* *Peromyscopsylla scotti*
Nutria, *Myocastor coypus* (5)	None
Eastern Cottontail, *Sylvilagus floridanus* (145)	*Odontopsyllus multispinosus* *Cediopsylla simplex* *Ctenocephalides felis* *Ctenocephalides canis* *Echidnophaga gallinacea*
Swamp Rabbit, *Sylvilagus aquaticus* (9)	*Odontopsyllus multispinosus* *Cediopsylla simplex*
Whitetail Deer, *Odocoileus virginianus* (4)	*Odontopsyllus multispinosus* *Cediopsylla simplex*

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LIST OF FIGURES

INDEX TO GENERA AND SPECIES OF FLEAS

Abbreviations Used in Illustrations

Ant.	Antenna
CL.	Clasper
F.	Movable Finger of Clasper
L.L.	Lower Lobe of Distal Arm of Ninth Sternite
MS.	Mesonotum
MT.	Metanotum
P.	Process of Clasper
P.CT.	Pronotal Ctenidium
S.VII	Seventh Sternite
S.VIII	Eighth Sternite
T.II	Second Tergum
U.L.	Upper Lobe of Distal Arm of Ninth Sternite
V.P.	Vertical Process of Ninth Sternite

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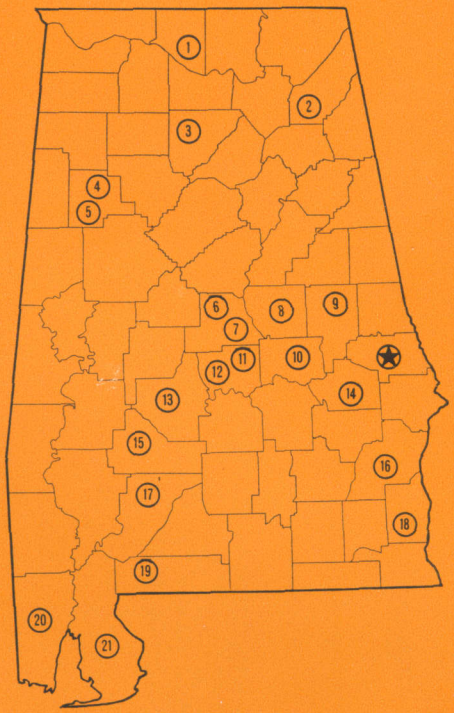

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.