A review of the North American Catallagia Rothschild, 1915, with the description of a new species (Siphonaptera: Ctenophthalmidae: Neopsyllinae: Phalacropsyllini)

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Received 3 August 2000; Accepted 10 October 2000

ABSTRACT: Catallagia duffneri Lewis and Haas is described from the Pinaleno Mountains of southeastern Arizona. The 15 known North American members of the genus are illustrated, a key to them is included and the individual species are discussed with respect to their taxonomic characters, host preferences and geographic distribution. Journal of Vector Ecology 26(1): 51-69. 2001.

Keyword Index: New species, fleas, taxonomy, host preferences, geographic distribution

INTRODUCTION


The genus Catallagia Rothschild, 1915, is 1 of 10 genera currently assigned to the subfamily Neopsyllinae Oudemans, 1909. Six of these belong to the tribe Phalacropsyllini Wagner, 1939. Collectively these 6 genera include 55 species, all but 4 of which are restricted to the Western Hemisphere, and 2 of these are shared with eastern Siberia. All 4 species belong to Catallagia, making it the sole genus in the tribe that is Holarctic in distribution. Catallagia fetisovi Vovchinskaya, 1944, and C. striata Scalon, 1950, are evidently restricted to the eastern Palaearctic Region. Catallagia ioffi Scalon, 1950, and C. dacenkoi Ioff, 1940, are known both from the eastern Palaearctic and the northwestern Nearctic regions. Of the remaining genera assigned here, the 8 species of Strepsylla Traub, 1950, are presently known only from southern Mexico, Guatemala, and S. dalmati Traub and Barrera, 1955, was reported from Panama by Tipton and Mendez (1966).

Barrera (1971) mentions a single female collected above 4000 meters on Mount Popocatépetl from a rodent host, probably a species of Peromyscus or Neotomodon alstoni. This specimen is also listed in Ayala-Barajas et al. (1988). Since females in this genus are difficult if not impossible to identify with certainty, the identity of this specimen must remain obscure until additional collections are made from high elevations in Mexico.

Within the Neopsyllinae, Catallagia and Delotelis Jordan, 1937, may be set aside from the remaining genera by the absence of a genal comb consisting of 2 spines that cross one another. Catallagia species have only 2 rows of setae in the frontal region before the eye, while the species of Delotelis possess 3. The remaining 14 taxa, plus the 1 described below, are native to the area under consideration. A few extend into northern Mexico. All are primarily parasites of microtine and peromycine rodents, although a few occur spasmodically on other rodents. Collections are also known from a number of insectivores, in addition to the usual predator records.

Catallagia duffneri Lewis and Haas, new species (Figures 1-7)

Diagnosis. As is the case in many genera of fleas, all of the reliable diagnostic characters in this genus are associated with the male sex. This species is allied to C. calisheri Eads and Campos, 1997; C. chamberlini Hubbard, 1940; C. charlottensis (Baker, 1898); C. dacenkoi Ioff, 1940; C. decipiens Rothschild, 1915; C. rutherfordi Augustson, 1942 and C. sculeni Hubbard, 1940, in possessing a male movable process that is roughly conical, its cephalic margin lacking a distinct median or submedian angle. It is closest to C. decipiens in having three apical spiniform bristles on the distal arm of the male st IX, but unlike C. decipiens there is a dense cluster of longer setae arising on a subapical bulge on the caudal margin of the segment. Also, unlike C. decipiens, the apicalmost spiniform is much larger than the next, and the third is little more than a heavy seta.
The caudal margin of the male st VIII of the two species is similar in configuration, but the lower caudal lobe of this structure is undivided in *C. decipiens*, while it is distinctly bifid in *C. duffneri*, the upper lobe being narrow and somewhat longer than the ventral lobe. In the allotype female, the sinus in the caudal margin of st VII is somewhat shallower than in *C. decipiens*, but an examination of a series of females of these 2 taxa shows little variation in the depth of the sinus, as well as in the degree of development of the upper lobe, as shown in Figure 7. As may be seen in Figures 50-63, the degree of development and sclerotization of the duct of the bursa copulatrix can hardly be considered diagnostic in this genus.

**Description**

**Holotype Male Head.** Frontal tubercle present but obscure. Frontal setal row of 6 long setae and ocular setal row of 4 long setae each side. In the ocular row the uppermost seta arises well above and on the cephalic margin of the vestigial eye. There are 2 oblique rows of preoccipital setae with 6 and 5 long bristles respectively. Occipital setal row of 5 setae per side. With ~6 smaller bristles along the dorsal margin of the antennal fossa. Antennal clavus extending well on to the prosternosome. *Thorax.* Pronotal comb of 14 stout spines preceded by a single row of 5 long setae per side. Main setal row of mesonotum with 5 long setae per side and 2 pseudosetae per side under the mesonotal collar. Mesepisternum bare, mesepimeron with 6 setae per side. Main setal row of metanotum with 5 long setae per side preceded by 2 rows of shorter bristles of 5 and 9 or 10 per side respectively. Lateral metanotal area with 2 long bristles per side, metepisternum with 1. Metepimeron with 8 long bristles per side arranged in 3 rows of 3, 4 and 1. *Legs.* Forefemur with ~12 fine setae scattered over the outer surface, Caudal margin of foretibia with 5 notches bearing 1, 2, 2, 1, and 3 heavy bristles. Foretarsal segments I-III subequal, segment IV the shortest. Foretarsal segment V with 5 pairs of lateral plantar bristles, the proximal pair strongly shifted on to the plantar surface. Outer surface of midfemur bare, its dorsal apex with a short outer and long inner guard seta. Caudal margin of midtibia with 7 notches bearing 1, 2, 1, 2, 1, 3 strong setae respectively. Midtarsal segment I the longest, II slightly shorter, III still shorter and IV the shortest, little longer than wide. Segment V as with foretarsus. Apical half of hindcoxa setose on outer surface, its inner surface with an irregular submarginal row of ~7 spiniforms. Hindfemur as with midfemur, hindtibia with 7 notches in caudal margin bearing 1, 2, 1, 2, 2, 2 and 3 heavy setae respectively. Hindtarsal segment with 4 pairs of lateral plantar setae, none of which is shifted on to the plantar surface. Unmodified abdominal segments. Tergal marginal spinets on abdominal segments I-IV: 1, 1, 1 and 1, per side. Setae in main row on tergites I-VII: 5, 7, 7, 6/7, 7, 7/6 and 6, the lowermost arising below and at the caudal apex of the spiracle. Three antensensilial setae per side (dorsalmost missing on left side) the median ~2x as long as the lower, ~3x as long as the upper. Sternites III-VIII average 3 setae per side in main row. Modified abdominal segments. (Figures 1, 3, 4). Apex of the conical movable process (Figure 1) reaching but not extending beyond apex of fixed process, its cephalic margin lacking a pronounced median angle. Caudal margin of st VIII (Figure 4) divided into a blunt upper lobe and a deeply incised lower lobe consisting of a long, narrow, caudally-projecting dorsal lobe separated from the shorter, triangular lower lobe by a broad sinus. The upper lobe is very delicate and subject to varying amounts of torsion in most of the males in the type series. As in males of *C. arizonae, C. decipiens* and *C. luski*, the apex of st IX is attenuated and bears 3 apical spiniforms. However, in *C. duffneri* the most apical spiniform is much larger than the one immediately below it and the third, though much longer than the second, is little more than a robust seta. Subapically the caudal margin is produced into a bulge similar to that found in *C. chamberlini* and *C. scalleni*, though less pronounced, which bears a cluster of ~12 setae, 1 or 2 of which are somewhat more robust than the others and are spiralled in appearance. A similar seta is found in *C. decipiens* but it is accompanied by only 3 or 4 other setae on a less pronounced bulge.

**Allotype female Head.** Frontal tubercle present but almost invisible. Frontal setal row of 7 long setae. Ocular row of 4 setae, the dorsalmost arising above and slightly in front of the vestigial eye. Two oblique preoccipital rows of 7 and 6 setae respectively. Occipital row of 7 setae per side. With 5 or 6 fine setae along the dorsal margin of the antennal fossa. *Thorax.* Pronotal comb of 14 stout spines preceded by 6 long setae per side in main setal row. Mesonotum with 5 long setae in main row and 2 pseudosetae under the mesonotal collar per side. Mesepisternum bare, mesepimeron with 6 long setae per side arranged in 2 irregular rows. Main setal row of metanotum with 5 setae per side preceded by 2 irregular rows of shorter setae. Lateral metanotal area with 2 long setae per side, metepisternum with 1. Metepimeron with 8 long bristles per side arranged in 3 rows of 3, 4 and 1. *Legs.* Outer surface of forefemur with ~10 short setae. Foretibia with 6 notches in caudal margin bearing 1, 2, 2, 1 and 3 heavy setae. Foretarsal segments I-III subequal in length, segment IV shortest. Segment V with 5 pairs of lateral plantar setae, the proximal pair strongly shifted on to the plantar surface.
Midcoxa with ~15 setae along the apical half of the anterior margin on outer surface. Midfemur with outer surface bare. Caudal margin of midtibia with 7 notches bearing 1, 2, 1, 2, 1 and 3 strong setae respectively. Midtarsal segments I-III about equal in length, segment III somewhat shorter, segment IV shortest, segment V as with foretarsal segment V. Apical half of hindcoxae with ~18 setae on outer surface, inner surface with a cluster of ~12 spiniforms midway along cephalic margin. Outer surface of hindfemur bare. Caudal margin of hindtibia with 7 notches bearing 1, 2, 1, 2, 1 and 3 strong setae. Hindtarsal segment I longest, segment II about as long as III and IV combined, segment V with 4 pairs of lateral plantar setae, the proximal pair not shifted on to the plantar surface. *Unmodified abdominal segments.* Marginal tergal spinelets per side on segments I-IV; 1, 1 or 2, 1, and 1. Main setal rows on tergites II-VII; 7, 7, 7, 6, 6, and 4. Three antensensilial bristles per side, the middle the longest, the ventral ~2.3 and the dorsal ~1.3 the length of the median. Long setae in main row on sternites III-VII; 3, 3, 4, 4, and 5 or 6. *Modified abdominal segments.* (Figures 2, 5, 6). None of the structures figured here are particularly diagnostic for this taxon. As shown in the figures of females of other members of the genus, neither the sclerotized duct of the bursa copulatrix, nor the contours of the caudal margin of st VII are particularly useful in separating females in this genus. However, Figure 7 shows the remarkable consistency among the females of a series of *C. duffneri* from the same collection series. Further, although the spermatheca of the new species is shown in Figure 5, this configuration is found so consistently in normal females throughout the genus that it, too, is not diagnostic. Variation in this organ has usually been attributed to the effects of parasitic nematodes in the past and has doubtless led to the description of junior synonyms in this genus. In short, in the absence of accompanying males, geographic distribution would appear to be the best criterion in determining females of this species.

**Type Data** Holotype ♀, allotype ♂, from a vole nest (*Microtus longicaudus*) Arizona, Graham County, ~32.42N 109.56W, 8. IX. 1987, G. E. Haas leg. Deposited in the National Museum of Natural History, Washington, DC, (USNM) along with 3 pairs of paratypes. Paratypes as follows: 3♂1♀, AZ, Graham County, Heliograph Peak, 2768m, 15.IX.1986; 1♂ 1♀, AZ, Graham County, ~32.42N 109.56W, 8.XI.1987; 7♂10♀, ibid., 12.XI.1987; 1♂ 2♀, ibid., 15.V.1990; 4♂5♀, ibid., 16.V.1990; 3♂2♀, ibid., 17.V.1990; 1♂ 2♀, ibid., 18.V.1990; 9♂ 23♀, ibid., 21.V.1990. All from *Microtus longicaudus* and all collected by G. E. Haas. Paratypes also deposited in the Natural History Museum, London, England (BMNH); the Canadian National Collection of Insects, Ottawa, Ontario (CNC); the Field Museum of Natural History, Chicago, IL (FMNH); Bean Life Sciences Museum, Brigham Young University, Provo, UT (BYUC); the California Academy of Sciences, San Francisco, CA (CAS); the Los Angeles County Museum, Los Angeles, CA (LACM) and the collections of the authors.

**Etymology** This species is named after Otto C. Duffner (1875-1944). A long-time resident of Paradise, AZ, he collected an important series of undescribed fleas in the Chiricahua Mountains during 1913-1914 for N. C. Rothschild, the founder of the Rothschild Collection of fleas, now in the British Museum of Natural History, London, England.

### SYSTEMATICS

We have indeed been fortunate to be able to examine material belonging to all but 1 of the known members of this genus, including those not occurring in North America. Though it is generally agreed that females in this genus lack sufficient diagnostic characters for accurate taxonomic discrimination, we are including a few female characters in the key, as well as illustrations, although the key itself is based mainly on male characters.

Although the shape of the movable process of *C. arizonae*, *C. borealis*, *C. neweyi* and *C. wymani* is quite diagnostic, in the remaining taxa this organ is conical or subrectangular and other structures must be examined for accurate identification. Paramount among these is the shape and chaetotaxy of the apical portion of the distal arm of the male st IX. In all cases this organ is provided with 1 or more blunt, peg-like, modified setae that are referred to as spiniforms or spiniform setae in the following key. In addition to the unmodified subapical setae scattered along the caudal margin of the sternite, there is another type of bristle to be found in some species. It takes the form of a longer seta that is thickened basally and tapers to a sharp point apically. The term subspiniform is applied to this type of bristle in the following key and it is found in *C. arizonae*, *C. chamberlini*, *C. decipiens*, *C. duffneri*, *C. mathesoni* and *C. sculleni* (Figures 3, 22, 25, 28, 31 and 34). These, in combination with the shape of the apical portion of this organ are highly diagnostic at the species level. Finally, although it is difficult or impossible to see in some specimens, and may be distorted in others, the contours of the caudal margin of the male st VIII, when visible, add a further dimension to the taxonomic characters in males. Unfortunately, as shown in Figures 7 and 50-63, the contours of the caudal margin of st VII in females...
tend to be so similar among different species and variable within species as to be of little utility in taxonomic discrimination

Within these limitations, following is a key to the North American species of the genus.

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**Key to the North American species of *Catallagia***

1. Movable process of male clasper with 2 spiniform or subspiniform setae on the inner surface near the cephalic margin with a distinct median cusp, the structure more triangular in form (Figures 16, 17); apex of male st IX curved caudally, its ventral margin with 3 large spiniforms (Figure 32); caudal margin of st VIII with a long, pointed projection below an open, triangular sinus (Figure 46); caudal margin of female st VII with a shallow sinus (Figure 60) (Utah, Colorado and New Mexico) ........................................... 3

Caudal margin of movable process slightly convex, its cephalic margin with a distinct, angular incassation, its cephalic margin with 2 well developed spiniform setae on its inner surface (Figure 18); apex of male st IX curved caudally, its ventral margin with 3 large spiniforms (Figure 32); caudal margin of st VIII with a long, pointed projection below an open, triangular sinus (Figure 46); caudal margin of female st VII with a shallow sinus (Figure 60) (Utah, Colorado and New Mexico) ........................................... 5

Movable process of male clasper with 2 spiniform or subspiniform setae on inner surface; female st VII variable ........................................................... 2

2. Caudal margin of movable process concave, its apex and cephalic area both pointed, the latter region with 2 well developed spiniform setae on its inner surface (Figure 18); apex of male st IX curved caudally, its ventral margin with 3 large spiniforms (Figure 32); caudal margin of st VIII with a long, pointed projection below an open, triangular sinus (Figure 46); caudal margin of female st VII with a rounded lobe above a well defined sinus (Figure 60) (Utah, Colorado and New Mexico) ........................................... 3

Apex of male st IX not bent caudally and bearing only a single apical spiniform (Figures 25, 35); ventral margin of male movable process with a pronounced projection (Figures 9, 21); caudal margin of female st VII with at least a slight dorsal lobe above a shallow sinus ............................................................. 4

Movable process of male clasper quadrato, triangular or conical; apex of male st IX at least slightly bent caudad, with more than 1 spiniform; caudal margin of male st VIII and female st VII variable .............................................................. 5

3. Ventral margin of both movable and fixed process with a conspicuous ventral projection below the acetabulum (Figure 9); apex of male st IX with subparallel margins, pointed apically (Figure 23); caudal margin of male st VIII convex, lacking an incision and lobe (Figure 37); caudal margin of male st IX unique in the genus in bearing a sinus subtended by a projecting lobe (Figure 51); caudal margin of female st VII with a rounded lobe subtended by a distinct sinus (Figure 51) (Eastern United States and Canada) ................. borealis

Ventral margin of movable process with a conspicuous lobe which is missing from the fixed process (Figure 21); apex of male st IX with subparallel margins, ending in a rounded point and lacking projection and sinus (Figure 35); caudal margin of male st VII with a rounded lobe above a deep incision above a long, pointed, caudal lobe (Figure 49); caudal margin of female st VII almost straight, with a shallow sinus (Figure 63) (Environments of San Francisco, California) ........................................... wymani

5. Movable process of male triangular, its caudal margin concave and produced into a rounded caudodorsal point (Figure 8); dorsocaudal apex of fixed process straight (Figure 8); male st IX tapering to a slightly deflexed apex bearing 3 subequal spiniforms that are subtended by 1 longer and a few unmodified setae on both the inner and outer surfaces (Figure 22); caudal margin of male st VIII with a deep incision above a blunt lobe (not clearly visible in the holotype) (Figure 36); caudal margin of female st VII with a rounded lobe above a shallow sinus (Figure 50) (Arizona and probably into New Mexico and northern Mexico) ...... arizonae

Movable process more rectangular or conical, usually not extending beyond the dorsal apex of the fixed process; apex of male st IX usually with 3 or more spiniforms near the dorsocaudal angle; contours of male st VIII and female st VII variable ................................. 6

6. Cephalic margin of male movable process with a distinct median cusp causing it to appear roughly rectangular in form (Figures 16, 17); apex of st IX flexed slightly caudad and bearing 3 short spiniforms subtended by a few (3-5) unmodified setae (Figures 24, 30); caudal margin of st VIII bearing a long, tapered lobe (Figures 44, 45); caudal margin of female st VII with a lobe and shallow sinus (Figures 58, 59) ........................................... 7

Cephalic margin of male movable process not bearing a distinct median cusp, the structure more triangular in shape; apex of male st IX variously shaped and bearing from 3 to 8-9 spiniforms; caudal margin of female st VII variable .............................................................. 8
7 Movable process of male with caudal and cephalic margins parallel below the cusp in the cephalic margin (Figure 16); apex of male st IX fairly flexed caudad, its ventral margin with 3 spiniforms subtended by 2-3 unmodified setae (Figure 30); margin of male st VIII undulate above the caudal projection (Figure 45); caudal margin of female st VII almost straight below the dorsal lobe (Figure 58) (Southwestern California) ....luski

Movable process of male with a more rounded caudal margin (Figure 17); apex of male st IX barely flexed and bearing 3 spiniform setae subtended by 3-4 normal bristles, the dorsal-most of which is slightly subspiniform (Figure 31); caudal margin of male st VIII with a pronounced lobe above the caudal projection (Figure 45); caudal margin of female st VII with a well developed lobe above a shallow sinus (Figure 59) (Northern California to southern British Columbia) ...

........................................................................mathesonii

8 Apex of male st IX flexed caudad, its ventral margin bearing 6-8 spiniforms (Figures 24, 27); caudal margin of male st VIII with a lobe but lacking a deep incision (Figures 38, 41); caudal margin of female st VII with a distinct lobe (Figures 52, 55)................. 9

Apex of male st IX not so strongly flexed caudad, its ventral margin never with more than 4 blunt spiniforms, although some of the subapical setae may be subspiniform or otherwise modified .......... 10

9 Conical movable process of male extending to the pointed dorsal apex of the fixed process (Figure 10); apex of male st IX flexed caudally, forming a distinct angle on the dorsal margin and bearing 6-7 blunt spiniforms (Figure 24); caudal margin of male st VIII with a distinct lobe but no sinus (Figure 38); caudal margin of female st VII with a rounded lobe subtended by a shallow sinus (Figure 52) (Rocky Mountain N. P., Colorado) .................. calisherii

Apex of male movable process not nearly reaching the apex of the rounded fixed process (Figure 13); apex of male st IX more flexed caudally, but smoothly rounded and not forming a dorsal angle (Figure 27); caudal margin of male st VIII undulate, lacking an incision (Figure 41); caudal margin of female st VII with a squared dorsal lobe subtended by a shallow sinus (Figure 55) (Manitoba, west to British Columbia and north into Alaska and Siberia) .................. dacekoi

10 Apex of male st IX with 3 spiniforms. Note: Beyond this point in the key female characters are unreliable and distribution is the best guide .................. 11

Apex of male st IX with 4 spiniforms .......... 12

11 Apex of male st IX flexed caudad, almost forming a right angle, the ventral margin with 1 large spiniform subtended by a much smaller spiniform which in turn is subtended by a subspiniform seta and a cluster of ~10-12 unmodified bristles, one of which is somewhat subspiniform (Figure 3); margin of male st VIII with a blunt caudal lobe above a deep, closed incision above a caudally projecting ventral lobe bearing a smoothly rounded sinus (Figure 4) (Southeastern Arizona) ........

........................................................................duffnerii

Apex of male st IX less strongly flexed caudad, its ventral margin with 3 subequal, blunt spiniforms subtended by 2-3 unmodified bristles and at least 1 subspiniform seta, but lacking the cluster of normal bristles (Figure 28); margin of st VIII with a squared, slightly concave lobe above a more open incision, above a broad, pointed ventral lobe which lacks a deep sinus (Figure 42) (Western North America east of the Cascades, north to Alaska) ........decipiens

12 Apex of male movable process not extending to the apex of the fixed process (Figure 12); apex of male st IX with a few unmodified subapical setae (Figure 26); male st VIII with an open incision subtended by a long caudal projection (Figure 42); female st VII with a shallow sinus in caudal margin (Figure 56) (Western North America from California to southern Alaska west of the Cascades and other north/south mountain ranges) .................. charlottensis

Apex of male movable process extending to or beyond apex of dorsal lobe of fixed process; caudal margin of male st VIII virtually identical in all 3 taxa; likewise for the female st VII .................. 13

13 Apex of male movable process extending at least slightly beyond apex of fixed process (Figure 19); cephalic and caudal margins of male st IX subparallel, tapering slightly apically (Figure 33); none of the subapical setae spiniform or subspiniform (Sierra Nevada) .................. ruthefordii

Movable process extending to apex of fixed process; male st IX with a subapical bulge in its caudal margin bearing at least 1 subspiniform seta plus a number of unmodified setae .................. 14
14. Bulge in caudal margin of male st IX pronounced, its caudal margin below the subapical spiniform setae with at least 1 subspiniform seta (Figure 25); caudal margin of male st VIII with a deep incision below a blunt dorsal lobe, subtended by a narrow caudal lobe (Figure 39) (Extreme northern California, north to southern British Columbia) .................................. chamberlini

Bulge in caudal margin of male st IX less pronounced, its margin below the subapical spiniform setae with a short spiniform seta above a cluster of unmodified bristles (Figure 34); lobe in caudal margin of female st VII less well developed (Figure 48) (Northern California to southern British Columbia) .......................... sculleni

There are many references to this species in the literature. It is restricted to northeastern United States and southeastern Canada as far west as Manitoba according to Buckner and Blasko (1969) and Holland (1985). The eastern Minnesota records are cited in Benton and Timm (1980). Its range also extends south through West Virginia and eastern Tennessee in the mountains. Its preferred host is Clettronomys gapperi, but strays have also been taken on Microtus pennsylvanicus and Peromyscus maniculatus. Collection records suggest that it is a winter flea since most adults have been collected during the colder months.

**Catallagia borealis** Ewing, 1929
(Figures 9, 23, 37, 51)

The type series included 1 male and 6 female paratypes and at least 1 additional female that was not designated a paratype. The only other mention of the species in the literature besides that of Eads and Campos (1983: 168) is its inclusion in the key by Schwan and Nelson (1983).

**Catallagia calisher** Eads and Campos, 1979
(Figures 10, 24, 38, 52)

Catallagia calisher. Eads and Campos, 1979, USA, Colorado, Larimer County, Rocky Mountain National Park, Trail Ridge Road, 1.5 km above Rainbow Curve, ~40.22N 105.48W, 3500 m, from Peromyscus maniculatus, 26.X.1974, R. B. Eads and E. G. Campos leg. Holotype male, allotype female, USNM No. 104596.
The type series included 1 male and 6 female paratypes and at least 1 additional female that was not designated a paratype. The only other mention of the species in the literature besides that of Eads and Campos (1983: 168) is its inclusion in the key by Schwan and Nelson (1983).

**Catallagia charlottensis** (Baker, 1898)
(Figures 12, 26, 40, 54)

Typhlopsylla charlottensis. Baker, 1898, Canada, British Columbia, Queen Charlotte Islands, Graham Island, Massett, 54.00N 132.09W, from mouse nest, no date

This species ranges from northern California to Alaska. While it seems to be mainly a parasite of *Peromyscus* species, there are literature reports from over 30 other hosts including the nests of woodpeckers, doubtless occupied by flying squirrels or some other rodent.

There are 3 literature records that probably refer to some other species, likely *C. decipiens*. These are: Rothschild (1905) from Alberta; Dunn and Parker (1923) from Montana; and Baird and Saunders (1992) from Idaho. If these 3 records are ignored, the known range of the species extends uniformly from California, west of the Cascades and other north/south mountain ranges of the species to Alaska. There it is distributed widely across southern coastal areas, partly sympatric with the following species in the south-central region (Hopla 1965, Holland 1985, Haas et al. 1989).

**Catallagia dacenkoi** Ioff, 1940
(Figures 13, 27, 41, 55)

Catallagia dacenkoi. Ioff, 1940, Russia, Kazakhstan, East Kazakhstan Oblast, environs of Katon-Karagai, ~49.15N 85.33E, Altai Mountains, from *Evotomys [=Clethrionomys] rutilus*, from collection of W. Dazenko. Type status and deposition unknown to us. Probably in the collection at Stavropol’.


The validity of this subspecies has been discussed by Smit (1967) and Holland (1985) and need not be expanded upon further. To be sure, there are minor differences between the Palaearctic and Nearctic populations, but these seem to fall well within the range of individual variation. Preferred hosts are all microtine rodents and the adults are evidently winter nest fleas. The species is primarily a parasite of microtines but has been reported from other rodents and a few insectivores.

Holland’s 1985 Map 16 shows this (as *C. d. fullerii*) from Manitoba, west to British Columbia and north to Alaska. However, Holland (1951) reported that material from Anchorage, Alaska, and Atlin, British Columbia was *C. jellisoni*. *Catallagia jellisoni* Holland, 1954, is here considered a junior synonym of *C. ioffi* Scalon, 1950.

**Catallagia decipiens** Rothschild, 1915
(Figures 14, 28, 42, 56)


Catallagia moneris. Jordan, 1937, USA, Montana, Ravalli County, from *Marmota flaviventris*, V.1932. Holotype female, by monotypy, said to have been returned to the Rocky Mountain Laboratory, Hamilton, Montana, but we have been unable to trace it. Synonymized by Hubbard (1947).

This species enjoys a wide distribution in the western half of North America and ranges from New Mexico, Arizona and California north to southern Alaska (which record may be erroneous since it is based on a female), Yukon, British Columbia, Alberta, Saskatchewan and Manitoba, south to Montana, South Dakota and eastern Nebraska. As Holland (1985: 92) points out, the species is almost allopatric with *C. charlottensis* since its distribution is east of the Cascade Mountains of western North America. It too is a parasite of various species of mice, but it shows a strong preference for *Peromyscus maniculatus*.

**Catallagia ioffi** Scalon, 1950
(Figures 15, 29, 43, 57)

Catallagia ioffi. Scalon, 1950, Russia, Siberia, Yakutii, South Sakkyr, right bank of Lena River opposite mouth of Vilyuy River, ~64.20N 126.41E, from *Evotomys [=Clethrionomys] rutilus* and *rufocanus*, type deposition unknown to us. Also reported from *Sorex, Sciurus, Eutamias* and *Microtus* species.


According to Holland (1985) *C. jellisoni* is a species closely allied to the Palaearctic *Catallagia ioffi* Scalon, 1950, and also shows affinities with *Catallagia fetisovi* Vovchinskaya, 1944. Although it has been said to be similar to *C. dacenkoi* because of the number of spiniform setae on the apex of the distal arm of the male st IX, it is easily separated from this species on the basis...
of the form of the movable process of the clasper and the shape of the spiracular fossae in the latter. Females differ in the configuration of the caudal margin of st VII, and both sexes possess sharply pointed spiracles on the unmodified abdominal segments rather than rounded as in *C. dacenkoi*. This, too, appears to be a parasite of microtines, though not nearly as commonly as *C. dacenkoi*. It has also been taken on species of *Peromyscus* and *Neotoma*.

**Catallagia luski** Schwan and Nelson, 1983  
(Figures 16, 30, 44, 58)


This recently described species seems to be the southern equivalent of *Catallagia mathesoni*, and perhaps could be treated as a subspecies of it. The map accompanying the description shows collection records from 8 localities south of the San Francisco Bay area. There is also one report of the species from Nye County, Nevada, given as an addendum to the description and there are 2 pairs in the Lewis Collection from Lyon County, Nevada. Little is known about this taxon other than that it appears to be a nest flea and is probably a winter species, as seems to be the case with most members of this genus. It is mainly a parasite of *Peromyscus* species but there are records from *Sciurus griseus*, *Spermophilus beecheyi* and *Neotoma* species. The species is dealt with further in the discussion section.

**Catallagia mathesoni** Jameson, 1950  
(Figures 17, 31, 45, 59)

*Catallagia mathesoni*. Jameson, 1950, USA, California, Plumas County, Quincy, 93.56N 120.56W, 1097 m, from *Peromyscus boylil*, 18.II.1949, E. W. Jameson, Jr., leg. Holotype male, allotype female, USNM No. 59371.

Unlike some members of the genus, this species has been taken on a broad range of rodent and insectivore hosts, but it still shows a preference for *Peromyscus boylil*, *P. crinitus*, *P. maniculatus* and *P. truei*. It ranges from the northern half of California to extreme southern British Columbia, but appears to become increasingly rare as one progresses northward. All of the material in the Lewis Collection (18 males, 9 females) is from California and Oregon. Schwan and Nelson (1983) report the species from the inner North Coastal, Cascade and northern Sierra Nevada ranges in California north of ~39.30N. Jameson and Brennan (1957) claim the species is "virtually confined" to mice in brush habitat in California.

**Catallagia neweyi** Holland and Loshbaugh, 1958  
(Figures 18, 32, 46, 60)

*Catallagia neweyi*. Holland and Loshbaugh, 1958, USA, Utah, Tooele County, 16 km E. Gold Hill, 40.10N 113.50W, from *Peromyscus maniculatus*, 7.X.1953, E. A. Shippie leg. Holotype male, allotype female, USNM No. 65660.

In addition to the type series this species has also been taken in the Rocky Mountain National Park, Larimer County, Colorado and there is an unpublished record of a male in the Lewis Collection from Colfax County, New Mexico, on *Spermophilus tridecemlineatus*. Four specimens are also reported in Parker and Howell (1959) from the Great Salt Lake Desert. The type series consisted of 11 males and 3 females, but it is not clear from the literature whether these 4 specimens were part of the type series. Preferred hosts appear to be *Peromyscus crinitus*, *P. difficilis* and *P. maniculatus*.

**Catallagia rutherfordii** Augustson, 1942  
(Figures 19, 33, 47, 61)

*Catallagia rutherfordii*. Augustson, 1942, USA, California, Fresno County, Tully’s Hole, from *Microtus montanus*, 15.VIII.1941, Rutherford and Augustson leg. Holotype female, Los Angeles County Museum, Los Angeles, CA. [LACM] The few literature references to this species are restricted to collections from Fresno, Mono, Plumas and Sierra counties in California. *Peromyscus maniculatus* is evidently its preferred host. The species is also treated further in the discussion.

**Catallagia sculleni** Hubbard, 1940  
(Figures 20, 34, 48, 62)

*Catallagia sculleni*. Hubbard, 1940, USA, Oregon, Washington County, 4.8 km NE Forest Grove, 45.32N 123.07W, from deer mouse, date and collector not given, but probably C. A. Hubbard. Holotype male, deposited in the Academy of Natural Sciences, Philadelphia, PA. [ANSP].

*Catallagia vonbloekeri*. Augustson, 1941, USA, California, Santa Barbara County, Santa Rosa Island, 34.00N 120.05W, from *Peromyscus maniculatus*, 8.VIII.1939, J. C. von Bloeker leg. Holotype male, allotype female, one pair paratypes, deposited in the Los Angeles County Museum, Los Angeles, CA. [LACM] No. 1939-1120. Hubbard (1947) considered *C. vonbloekeri* to be a
synonym of *C. sculleni chamberlini*, but Hopkins and Rothschild (1962) placed it as a junior synonym of *C. sculleni*.

Members of this complex are parasites of small rodents and insectivores with a preference being shown for species of *Peromyscus*. Lewis et al. (1988) indicated that 44.18% [really 43%] of the 215 specimens examined by them came from hosts belonging to this genus, while the remaining 52.82% [really 57%] were collected from 20 other host species belonging to 12 genera in 3 mammalian orders. They also showed population peaks of adults, at least for what was then considered the nominate subspecies, during August and September.

The only diagnostic characters separating what have frequently been treated as the subspecies of this species are the shape and chaetotaxy of the apical arm of the male ninth sternum, as shown in Figures 33 and 34. *Catallagia rutherfordi* is treated here as a full species, as is *C. chamberlini*, based on the shape of this structure, but we have been able to examine only 3 males attributed to *C. rutherfordi* and it is elevated to full species rank with reluctance on the basis of such limited material. Variation in the marginal contours of the female seventh sternite preclude identification of this sex in the absence of accompanying males.

This is certainly one of the commonest members of the genus within its range in western North America and can probably be taken in even larger numbers from excavated rodent and insectivore nests. It and its congeners are treated in more detail in the discussion section of this study.

*C. wymani* (C. Fox, 1909)

(Figures 21, 35, 49, 63)

*Odontopsyllus wymani*. C. Fox, 1909, USA, California, San Francisco County, San Francisco, 37.45N 122.27W, from *Microtus californicus*, summer of 1908, [C.] Fox leg. Lectotype male, USNM No. 13131.

The name *Odontopsyllus wymani* was first mentioned by Mitzmain (1909) and is a *nomen nudum* until published by Fox (1909) later that year.

The type series of the species consisted of 3 males and 10 females from *Microtus californicus*, all collected in the San Francisco area during the summer of 1908, presumably by Fox or his associates. There are also records from *Peromyscus* and *Reithrodontomys* species. It is not clear when or how all or part of this series came to reside in the United States National Museum, but 1 male and 5 females were borrowed from that institution during this study. The single male, although very much over cleared, has been remounted. One of the females was evidently collected from Ashland, Alameda County, California, from the nest of a wood rat. In addition, we have examined 23 males and 18 females belonging to this species, all from *Microtus californicus*, collected in Marin, San Francisco and San Mateo counties. Some of these are mentioned in Miles et al. (1957) and Stark and Miles (1962) and some are not. The reader is referred to these studies for further information on host preferences and ecology. To our knowledge no other published records exist and one must assume the species to be limited to the San Francisco Bay area where it may be an endangered species due to real estate development.

**DISCUSSION**

Although females of this genus are difficult, if not impossible, to determine with any degree of accuracy in the absence of accompanying males, there are a few male genitalic structures that are useful in identifying the various species. In most cases these are based on combinations of characters involving the male clasper, st VIII and st IX. In 5 species the males are so distinct that they may be easily identified, even from single specimens.

In *C. arizonae*, the concave caudal margin of the movable process, combined with the shape and chaetotaxy of st IX are quite distinctive. Unfortunately the contours of st VIII are not visible in their entirety in the holotype, and Figure 36 may not be a completely accurate representation of this structure. Females share a slightly concave caudal margin of st VII with a number of other members of the genus.

*C. borealis* has a distinctly shaped movable and fixed process of the clasper, a uniquely shaped st IX and an eastern distribution that easily separates it from other members of the genus. The male st VIII lacks an incision and its caudal margin is entire. The deep sinus in the caudal margin of the female st VII seems to be constant, and is shared only with females of *C. neweyi*, but male characters and its eastern distribution easily set it aside from other members of the genus.

*C. ioffi* males, although somewhat similar to *C. luski* and *C. mathesoni*, may be immediately separated from these by the presence of 2 small, sharp, spiniform setae on the inner surface of the movable process on the caudoventral angle. In addition, st VIII lacks a long caudal projection and st IX is broad apically and bears a double row of 8 or 9 spiniforms. Females are similar to a number of other taxa, although the sclerotized duct of the bursa copulatrix has a well-developed bend in the middle that is more pronounced than in some other females.

*C. neweyi* has a uniquely shaped movable
Figures 22-35. Apical chaetotaxy of distal arm of male st IX.
Figures 36-49. Contours of caudal margin of male st VIII.
Figures 50-63. Sclerotized duct of female bursa copulatrix and caudal margin of st. VII.
process that has a concave caudal margin and bears 2 well developed spiniform setae on the acute caudoventral angle on the inner surface as shown in Figure 18. The apex of the fixed process is also much more acute and pointed than in any other member of the genus. Sternite VIII is drawn out into a pointed ventral lobe, although we do not consider Figure 46 to be particularly diagnostic. However, the deflexed apex of st IX is strongly clavate and bears 3 massive spiniforms on its ventral margin. We have not seen sufficient material to known whether the lobe and subtending sinus shown in Figure 60 are characteristic for females of this species.

Finally, C. wymani possesses a large ventral lobe on the movable process shared by no other species. The caudal margin of the fixed process is also conspicuously concave. This is another species in which st VIII is drawn out into a long, pointed, usually twisted, ventrocaudal lobe below a blunt upper lobe and deep incision. Sternite IX is gradually tapered apically and bears a single blunt spiniform. Again, females of this species are not distinct. However, the species is restricted to the San Francisco Bay area where it parasitizes Microtus californicus and it has been taken to the exclusion of all others in this restricted area.

This leaves the following species to be discussed: C. calisheri, C. chamberlini, C. charlottensis, C. dacenkoi, C. decipiens, C. duffneri, C. luski, C. mathesoni, C. rutherfordi and C. sculleni. Two of these can be dispensed with quickly, leaving the remaining taxa in what we here tentatively refer to as the charlottensis species-group.

The clasper of C. calisheri is not particularly distinct. However, the combination of a lobed st VIII and st IX, the apex of which is set off from the proximal portion by a distinct angle, its ventrocaudal margin bearing a row of ~6 blunt spiniforms, is quite characteristic for the species. Figure 52 shows st VIII of the female, but so few have been examined that we cannot attest that this is the norm for the species.

The other species is C. dacenkoi. Here again, the shape of the clasper is not particularly diagnostic, although the movable process is strikingly shorter than the fixed process. However, this species is immediately separable from other members of the genus by the presence of exceptionally large spiracles. The fossae on the unmodified terga form ovoid chambers that are almost 2x as wide as the atrium and lined with many minute spines. In this species st VIII lacks a long caudal lobe but its caudal margin is undulate as shown in Figure 41. The apical portion of st IX is clavate, with a slightly deflexed apex, the ventral margin of which bears a row of ~8 blunt spiniforms. From the number of females examined by us it seems that the squared lobe on the caudal margin of st VII shown in Figure 55 is probably diagnostic for this species, especially when the collections come from the far northern parts of North America.

The 8 remaining species have much more in common morphologically and our current knowledge concerning the role of host ecological specificity permits little more than speculation concerning the relationships among these taxa. Fortunately the work of Jameson and Brennan (1957) provides some interesting observations on both C. sculleni and C. mathesoni. It can generally be stated that, based upon available evidence, the major hosts for Catallagia species are Peromyscus species or members of the microtine genera Microtus and Clethrionomys, the northern taxa preferring hosts of the latter genera. Southern species are most commonly found on Peromyscus maniculatus and less so on some other members of the genus. Jameson and Brennan’s observations were made during their study of ectoparasites of small forest mammals in the Sierra Nevada Mountains of California. The species involved were C. mathesoni and C. sculleni, without mention of the subspecies of the latter. They pointed out that these fleas are more common as adults during the winter months and are most frequently found in abundance in the nest of the host. In the case of C. mathesoni and C. sculleni, their distribution seemed to be determined by the habitat of their hosts. Thus, C. mathesoni was common on P. maniculatus and P. boylli in the brushfields, while P. sculleni occurred in forested areas on forest-dwelling mice of the same species. They went on to point out that this type of segregation prevailed, even when brushfield and coniferous forest were adjacent. They concluded that the distribution of at least these 2 species of Catallagia depended as much on the habitat of the host as on the host itself.

A similar situation may obtain involving P. mathesoni and P. luski further south in California. After describing the latter taxon, Schwan and Nelson (1983: 560) discussed its distribution relative to that of C. mathesoni. Palomar Mountain State Park is woodland consisting of black oak (Quercus kelloggii) and a number of conifer species. Catallagia luski was taken from 4 species of Peromyscus, but mainly P. boylli. The authors pointed out that C. luski was 4x more abundant on P. boylli in November than it was during the previous March. Based on their information, C. luski is known to occur above 1000m in the western Great Basin of California, the southern Sierra Nevada, and the Transverse and Peninsular mountain ranges. They concluded that C. luski is the southern analogue of C. mathesoni in California, occurring in the northern Sierra Nevada and Cascades in the inner north central ranges.
Both C. luski and C. mathesoni have a distinct angle in the cephalic margin of the subrectangular movable process, although the ventral portion of this structure is more gibbose in C. mathesoni than in C. luski. In both species the male st VIII is drawn out into a long, tapering caudal lobe as shown in Figures 44 and 45. Also the apex of st IX is similar in shape, though somewhat more curved in C. luski, and there are 3 blunt apical spiniforms in both. The caudal margin of the female st VII bears a lobe in both species, but one species is well within the degree of variation shown for the other species.

Catallagia charlottensis and C. decipiens show similarities in the clasper, but the apex of the fixed process of C. charlottensis is more acutely pointed than in C. decipiens, and the latter lacks the caudoventral lobe on the movable process present in C. charlottensis. Although the caudal margin of st IX in males in these 2 species is similar in shape, there are usually 4 subapical spiniforms in the former and only 3 in the latter. In addition, the subapical bulge in the caudal margin of this segment bears a few unmodified setae in both species, at least 1 of which is subspiniform in C. decipiens. Females of these 2 taxa are essentially inseparable on morphological grounds. Distribution records show C. charlottensis restricted to a narrow band along the coast and coastal mountains from California to southern Alaska. Catallagia decipiens on the other hand has a broad distribution in the interior of western North America as far east as Nebraska.

Catallagia duffneri is morphologically most similar to C. decipiens, but differs in the characters set out in the diagnosis. Both of these usually have 3 apical spiniforms but the comparative size of these is quite different. In C. decipiens the most apical spiniform is noticeably the largest while the remaining 2 are smaller but relatively equal in size. In C. duffneri the most apical seta is much larger than the second and the third is almost a normal seta, although somewhat spiniform. The number of subapical setae on the caudal margin of st IX is reduced to 3 or 4 in C. decipiens, 1 of which is subspiniform. The number of these in C. duffneri is ~12, 1 or 2 of which is slightly subspiniform as shown in Figure 3. Again, females of both species are similar but the caudal margin of st VII in C. decipiens bears a distinct dorsal lobe subtended by a shallow sinus, as opposed to the more or less straight caudal margin in C. duffneri.

Adults of C. duffneri were, on the average, more abundant in nests of Microtus longicaudus than on trapped voles. This congregating of fleas is normal and expected because the genus Catallagia is one of several related genera that Traub (1972: 324) categorized as nest fleas.

Nests of M. longicaudus, the only vole in the Pinaleno Mountains, are likely the most suitable rodent nests there for breeding by C. duffneri. The Pinaleno vole is known as a subspecies (M. l. leucophaeus) that inhabits grassy meadows with trickling or standing water (Hoffmeister, 1956). Therefore, as a corollary, C. duffneri is a hygrophilous flea. Its larvae have become adapted to nests with a high moisture content.

The remaining 3 taxa have been treated as subspecies by some authors. Of the 3, C. sculleni and C. chamberlini are the most similar with respect to the shape of the movable process. However, the apex of the fixed process is much more blunt in the latter than in the former. In both species the apex of the movable process does not extend beyond the apex of the fixed process. In contrast, the ventral margin of the movable process in C. rutherfordi is somewhat more angular and its apex does extend slightly beyond the apex of the fixed process. The caudal margin of st VIII in all 3 species is almost identical, involving a rounded dorsal lobe, subtended by an open incision and a blade-like ventral lobe. All 3 species have 4 blunt apical spiniforms on st IX but the bulge in the caudal margin is absent in C. rutherfordi and of the few setae arising in this area none is modified, while 1 or 2 of these are in both C. sculleni and C. chamberlini. Indeed, there is a high likelihood that the two are in reality a single species. The only character that we can find to separate the taxa is the degree of development of the subapical spiniforms. At least 1 of these is short, heavy and curved in C. sculleni while they are longer, less thickened and slightly curved in C. chamberlini.

A review of the distribution records available to us shows C. rutherfordi from 4 eastern counties in central California, i.e. Fresno, Mono, Plumas and Sierra. On the other hand, records for C. sculleni start as far south in California as Santa Barbara County and extend into southern British Columbia. Records for C. chamberlini start in Siskiyou County in northern California and also extend north into southern British Columbia. Many counties in Oregon and Washington states have yielded both taxa. However, no counties east of Klamath, Deschutes and Jefferson in Oregon, and Klickitat County in Washington have yielded either. This would seem to suggest that all 3 taxa are limited to the more mesic areas of those states and replaced by other species in the more arid regions. Elevation may also factor into the distribution of these taxa but such data are not available in sufficient numbers to permit analysis.

Based on morphological similarity and distribution these 3 taxa may, in fact, constitute a single species, but much additional data are required to bring this matter to a satisfactory resolution.
Acknowledgments

This is Journal Paper No. J-1899 of the Iowa Agricultural and Home Economics Experiment Station, Ames, IA, Project 3100, and is supported by Hatch Act and State of Iowa funds.

We wish to thank Dr. Philip J. Clausen, Department of Entomology, University of Minnesota, St. Paul, MN [MSUC] for the loan of the primary types of C. arizonae. Dr. Thomas G. Schwan, currently of Rocky Mountain Laboratory, Hamilton, MT loaned us paratypes of C. luski. We are especially beholden to Ms. Nancy E. Adams of the United States National Museum of Natural History, Smithsonian Institution, Washington, DC for the extended loan of specimens from the Communicable Diseases Center now residing in the USNM. We also thank the 2 anonymous referees who spotted our most egregious errors. The Arizona Game and Fish Department facilitated field work in the Pinaleno Mountains. Journal Paper No. J-18993 of the Iowa Agricultural and Home Economics Experiment Station, Ames, IA, Project No. 3100, and supported by Hatch Act and State of Iowa funds.

REFERENCES CITED

Marginal Media. Fredonia.
Hopla, C. E. 1965. Alaskan hematophagous insects, their feeding habits and potential as vectors of pathogenic organisms. I. The Siphonaptera of