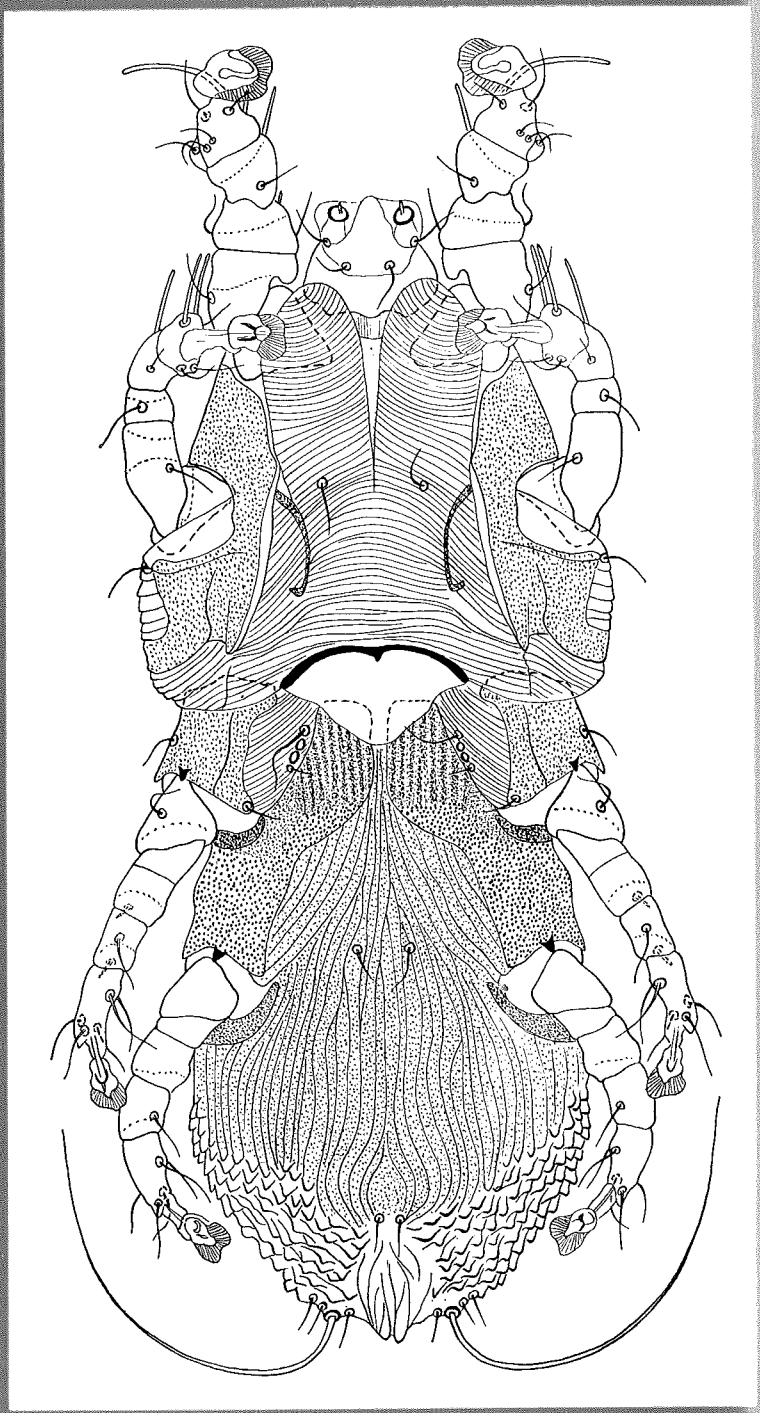
A. FAIN and K. HYLAND



THE LISTROPHOROID MITES IN NORTH AMERICA

II. THE FAMILY LISTROPHORIDAE

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THE LISTROPHOROID MITES IN NORTH AMERICA

II. — The Family *Listrophoridae* MEGNIN and TROUESSART (Acarina : Sarcoptiformes) (1)

BY

A. FAIN (2) and K. HYLAND (3)

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INTRODUCTION

The superfamily Listrophoroidea was redefined by FAIN in 1971. At the present time it is composed of four families : Listrophoridae MEGNIN and TROUESSART, 1884; Myocoptidae GUNTHER, 1942; Atopomelidae GUNTHER, 1942; and Chirodiscidae TROUESSART, 1892. These four families are unevenly represented in North America. FAIN and HYLAND (1970) have reviewed the status of the family Myocoptidae in North America and have described a new species in the genus *Sciurocoptes*.

Recently FAIN (1973a) has revised the Listrophoridae and Chirodiscidae of the Neotropical Region.

The family Listrophoridae is represented by the greatest number of both genera and species. It includes at the present time, counting the taxa discussed herein, 23 species grouped in seven genera. Among these species, twelve have been described recently in four preliminary notes (FAIN,

1970 a, 1970 b, 1972, 1973; FAIN and HYLAND, 1972). The present work gives us the opportunity to complete and to illustrate some of these descriptions. Most of these new species were collected from rodents but certain species come from carnivores and insectivores. A great number of the specimens studied were from the collection of the junior author; others came from the collections of the U. S. National Museum, Washington, D. C., and were kindly loaned to us by Dr. E. W. BAKER. The Types of all the new species have been deposited in the U. S. National Museum of Natural History (U. S. N. M.). Paratypes in the Institut royal des Sciences naturelles de Belgique and in the collections of the authors.

The other two families, Atopomelidae and Chirodiscidae are represented in North America by one and five species respectively. They will be studied in a later paper.

REMARKS ON CERTAIN MORPHOLOGICAL CHARACTERISTICS AND ON THE MEASUREMENTS USED IN THE PRESENT WORK

Length of the postscapular shield. — Maximum length, measured along or near the internal edge of the shields in the genera *Listrophorus* and *Prolistrophorus* and on the median line in the other genera.

Length of the body. — Total length from posterior border to the anterior extremity of the tegmen.

Width of the body. — Maximum width taken at whatever level it occurs.

Length of the posterior legs. — From the most basal point of the femur to the apex of the tarsus (not including the ambulacrum).

Number of transverse dark bands on the postscapular shields in the genera *Listrophorus* and *Prolistrophorus*. — We have counted these bands on a longitudinal line passing slightly exterior to the seta *sc i*.

Setae d5 in the male of the genus *Listrophorus*. — The setae *d 5* are completely lacking in the males of *L. mexicanus* FAIN, *L. phenacomys* FAIN and HYLAND, *L. pitymys* FAIN and HYLAND and *L. dicrostonyx* FAIN and HYLAND. These setae are in the form of hairs (simple or cylindroconical) in the male of *L. dozieri* RADFORD, *L. ondatrae* FAIN *et al.* and *L. kingstownensis* FAIN and HYLAND. In the male of the other species (*L. americanus* RADFORD, *L. validus* BANKS, *L. faini* DUBININA, *L. meridionalis* FAIN, *L. leuckarti* PAGENSTECHER and *L. brevipes* DUBININA) these setae are membranous.

FAMILY LISTROPHORIDAE MEGNIN AND TROUESSART, 1884

SUBFAMILY LISTROPHORINAE MEGNIN AND TROUESSART, 1884

Definition. — Tegmen well formed and sclerotized and covering completely the gnathosoma, palps included. Coxae II not very wide. Sternal region with two large sclerotized and striated membranes which are free and concave anteriorly; when they lie together they form a tube. The legs I are not modified and not curved. Body generally subcylindrical (see FAIN, 1971, p. 13).

Type genus. — *Listrophorus* PAGENSTECHER, 1861.

Genus Listrophorus PAGENSTECHER, 1861

Listrophorus PAGENSTECHER, 1861 : 109.

The first species described in this genus from North America was *Listrophorus validus* BANKS, 1910, from the musquash or muskrat of Canada. Later RADFORD, in 1944, described two new species from the same host : *L. dozieri* and *L. americanus*, but from Cambridge, Maryland, U. S. A.

In 1967, MCDANIEL, SCHOEMAKER and JOY reported the discovery of the European species *Listrophorus leuckarti* PAGENSTECHER on *Microtus p. pennsylvanicus* in Canada and the U. S. In the present work we will show that this species is not represented in North America and that the specimens cited under this name belong actually to a new species which has been described by FAIN (1970 b) under the name of *Listrophorus mexicanus*, from specimens collected on *Microtus mexicanus* from Mexico. FAIN (1970 a) redescribed *Listrophorus validus* BANKS and designated a lectotype female for this species. In the same year FAIN, KOK and LUKOSCHUS described a new species, *Listrophorus ondatrae*, from a Canadian muskrat.

Several other species have been described in the genus *Listrophorus* from North America but they belong to various other genera. The following species are involved : *Listrophorus gibbus* PAGENSTECHER, 1891 (= *Leporacarus gibbus*); *Listrophorus bakeri* RADFORD, 1948 (= *Prolistrophorus bakeri*); *Listrophorus dipodomius* RADFORD, 1953 (= *Geomylichus dipodomius*); *Listrophorus floridanus* RADFORD, 1948 (= *Geomylichus floridanus*); *Listrophorus sparsilineatus* FAIN, 1970 (= *Prolistrophorus sparsilineatus*).

It should be noted that it has been impossible for us to procure specimens of *Listrophorus grassii* RADFORD, 1954, described from *Oryzomys p. palustris* in Georgia. If we base our conclusions on the original description, it would not belong to the genus *Listrophorus* but rather to the genus *Prolistrophorus*. We quote here RADFORD's description : « The dorsum of the male is covered anteriorly by a chitinized shield which appears to be divided by a transverse slit anterior to coxae II. There is a narrow, uncovered portion of the dorsum between the anterior and posterior shields, the latter extending from about the level of coxae III to the posterior end of the body. The female is larger than the male... The anterior part of the dorsum is covered by a chitinized shield which extends from below the level of coxae II to the anterior tip of capitulum. Posterior to this shield the body is uncovered except for a narrow, chitinized transverse band about level with coxae III » (RADFORD 1954, pp. 594-596). This description and the figure of the male do not correspond to the genera *Listrophorus* and *Geomylichus*. They do not differ essentially from the genus *Prolistrophorus* so we will provisionally place this species in this genus.

The muskrat, *Ondatra zibethica*, in North America harbors six different species of *Listrophorus* : *L. validus* BANKS, *L. dozieri* RADFORD, *L. americanus* RADFORD, *L. ondatrae* FAIN *et al.*, *L. faini* DUBININA, and *L. kingstownensis* FAIN and HYLAND. The most widespread of all these species is *L. americanus*, and is followed closely by *L. dozieri*. The other four species are more rare and especially *L. ondatrae* and *L. kingstownensis* which are known only from the type locality of from a very restricted area.

In Europe muskrats are found parasitized only by four species (see DUBININA, 1967 a and FAIN, 1970 a) : *L. americanus*, *L. dozieri*, *L. validus* and *L. faini*. In Europe *L. americanus* is also the dominant species; it is followed closely by *L. dozieri*. *L. validus* and *L. faini* are more rare.

In addition, the species of *Listrophorus* parasitizing the muskrat are very specific for this rodent and only rarely has any one of these six species been found on another host.

The species of *Listrophorus* parasitizing the other North American rodents are five in number : *L. mexicanus* FAIN, 1970 b, *L. dicrostonyx* FAIN and HYLAND, 1972, *L. phenacomys*, FAIN and HYLAND, 1972, *L. pitymys* FAIN and HYLAND, 1972, and *L. neotomae* FAIN and HYLAND, 1973. These species, are very distinct from the three species parasitizing the European murids (*L. leuckarti* PAGENSTECHER, 1861, *L. brevipes* DUBININA, 1967 and *L. meridionalis* FAIN, 1970) because of an important characteristic in that the males lack the membranous hair *d 5*. MCDANIEL, *et al.* (1967) have erroneously reported the presence of *L. leuckarti* in North America because they did not take this character into account.

Key to the genus *Listrophorus* PAGENSTECHER

Males

(N. B. : The male of *L. neotomae* sp. n. is unknown)

1. Posterior lobes of the body bear only simple setae . . . . . 2.

   Posterior lobes of the body bear one pair of membraneous setae (*d* 5) plus simple setae . . . . . 8.

2. Posterior extremity of the body with two pairs of long unequal setae. Opisthosomal plates very narrow . . . *L. dozier*i RADFORD, 1944.

   Posterior extremity of the body with a single pair of long setae . 3.

3. Opisthosomal plates short, stopping far behind the *d* 2. Postscapular shields with nine to ten dark bands. Lateral surfaces of the body between legs II to IV with a scaly striation . . . . . *L. discrotonyx* FAIN and HYLAND, 1972.

   Opisthosomal plates long, bearing setae *d* 2 . . . . . 4.

4. Postscapular shields with seven or eight dark bands separated by clear bands which are two to three times as wide as the dark bands. Posterior lobes of body more or less rectangular with the posterior border straight or slightly irregular. Opisthosomal shields distinctly narrowed in the anterior third . . . . *L. mexicanus* FAIN, 1970.

   Postscapular shields with 12 to 14 dark bands closer together. Other characters variable . . . . . 5.

5. Opisthosomal shields approximately ten times wider in their posterior part than in their anterior third. Shields reach nearly to the anus. Posterior lobes of body slightly longer than wide and extend backwards, and inward to form a conical point. Penis recurved at an angle of 135 to 160 degrees, with a truncated apex. Cuticular scales absent . . . . . 6.

   Opisthosomal shields about two to three times wider in their posterior part than in their anterior third. Posterior lobes of the body with a posterior border more or less straight and without conical postero-internal prolongation. Penis tapered toward tip, or cylindro-conical with a rounded apex; angle of curvature variable . . . 7.

6. Penis recurved at an angle of 135° . . . . . *L. ondatrae* FAIN, KOK and LUKOSCHUS, 1970.

   Penis recurved at an angle of 160° . . . . . *L. kingstownensis* FAIN and HYLAND, 1973.

7. Penis longer, forming a large angle at approximately 135 to 150° and possessing a small chitinous projections on the convex surface of its apical third. Cuticle without scales . . . . . *L. pitymys* FAIN and HYLAND, 1972.

   Penis shorter, recurved at 90°, without chitinous projection of its convex surface. Cuticle scaly on the lateral surfaces of the body between setae *sc e* and coxae IV . . . . . *L. phenacomys* FAIN and HYLAND, 1972.

8. Membranous *d 5* setae rectangular, longer than wide, posterior border incised and terminates in two points, the external one tapering and the internal point rounded. Adanal suckers oval, very large. Postscapular shields with 9 to 11 dark transverse bands which are separated by clear bands approximately one to two and one-half times wider than the dark bands . . . . . *L. meridionalis* FAIN, 1972

   Membranous setae *d 5* not bifurcate . . . . . 9.

9. Membranous *d 5* setae much wider than long and with a straight posterior border . . . . . *L. americanus* RADFORD, 1944.

   Membranous setae *d 5* lanceolate, longer than wide and terminate in a point . . . . . 10.

10. Dark banks of the postscapular shields number 18 to 25; these bands are separated by very thin lines composed of a series of clear points. Opisthosoma very short. Posterior lobes separated by a rather shallow notch . . . . . *L. faini* DUBININA, 1972.

    Dark bands of postscapular shields number seven to 12 and are more widely separated by several rows of clear points. Opisthosoma longer. Posterior lobes separated by a deep notch . . . . . 11.

11. Dark bands of postscapular shields number seven or eight, each band being separated by clear bands which are about three times wider than the dark bands. Adanal suckers well developed . . . . . *L. validus* BANKS, 1910.

    Dark bands of postscapular shields number nine to 12 and are distinctly more condensed. Adanal, suckers smaller . . . . . 12.

12. Some short, round and indistinct scales are present on the lateral aspects of the hysterosoma and sometimes on the ventral and dorsal surface to the opisthosoma. Legs IV no longer than the opisthosoma . . . . . *L. brevipes* DUBININA, 1968.

    Scales on the body are absent. Legs IV definitely longer than the opisthosoma . . . . . *L. leuckarti* PAGENSTECHER, 1861.

Females

1. Median region of the ventral and dorsal surfaces of the opisthosoma completely devoid of scales; lateral or dorso-lateral aspects either without scales or which rounded and malformed scales . . . . 2.

   Median region of the ventral and dorsal surfaces or only the ventral surface with numerous triangular or rounded scales; lateral regions of the opisthosoma with triangular or rounded scales . . . . 4.

2. Postscapular shields with 18 to 25 dark transverse bands which alternate regularly with clear, very narrow transverse lines composed of a single row of small punctae which appear as clear spots under phase contrast . . . . . *L. faini* DUBININA, 1972.

   Postscapular shields with 10 to 12 dark transverse bands separated by clear bands which are wider and composed of several rows of clear points . . . . . 3.

3. Rounded and malformed scales present on the lateral surfaces of the hysterosoma. Dark bands of the postscapular shields relatively wide and very distinct. Striae on the ventral face of opisthosoma curve anteriorly as they reach the lateral aspects of the body. Striae on the median area of the posterior part of the dorsum are directed obliquely and inward. *Bursa copulatrix* opens about 25 microns behind the anus . . . . . *L. dozieri* RADFORD, 1944.

   Scales absent on the hysterosoma. Dark band of the postscapular shields narrow and indistinct. Striae on the mid anterior area of the ventral face of the opisthosoma recurve posteriorly on the lateral aspects of the body while those of the mid posterior area of ventral surface recurve anteriorly. Striae of the median area of the posterior part of the dorsum are parallel. *Bursa copulatrix* opens immediately behind the anus . . . . . *L. americanus* RADFORD, 1944.

4. Posterior two-thirds of the ventral surface of opisthosoma with numerous relatively large scales which are rounded and longer than wide. Postscapular shields with five dark, thin, transverse lines which are distinctly separated. Setae *d5* and *l5* short . . . . . *L. neotomae* FAIN and HYLAND, 1973.

   Posterior two-thirds or entire ventral surface of opisthosoma with smal triangular scales which taper toward the tip. Postscapular shields with a minimum of seven to eight dark transverse lines . 5.

5. Dorsal surface of opisthosoma devoid of scales or with a few scales in the extreme posterior or lateral regions . . . . . 6.

   Dorsal surface of opisthosoma with numerous well formed scales 7.

6. Setae *l 5* definitely longer than other opisthosomal setae. Opisthosomal scales are confined to the posterior two-thirds of the ventral surface and to the posterior third of the lateral faces of the opisthosoma. Postscapular shields with seven or eight dark bands separated by clear bands which are about three times wider than the dark ones. Bases of setae *l 5* and *a 3* separated . *L. validus* BANKS, 1910.

   Seate *l 5* no longer than other opisthosomal setae. Ventral surface of opisthosoma completely covered with scales. Lateral aspects of opisthosoma with numerous scales with the majority being malformed. Postscapular shields with 9 to 12 dark bands separated by clear bands which are two times wider than the dark ones. Bases of setae *l 5* and *a 3* contiguous . . *L. meridionalis* FAIN. 1970.

7. Dorsal face of opisthosoma with a large oval zone on its median third which lacks scales or where they are very sparse; anterior and posterior thirds are covered with scales. All opisthosomal scales are triangular and well formed. Dark bands on the postscapular shields number nine to 12; these bands are slightly narrower than the clear bands separating them. Posterior legs normal . . . . . *L. leuckarti* PAGENSTECHER, 1861.

   Dorsal face of opisthosoma completely and uniformly covered with scales. Other characters variable . . . . . 8.

8. Postscapular shields with eight to 11 transverse dark bands separated by dotted clear bands which are about two to three times wider than the dark ones. Scales on the lateral surface of opisthosoma definitely shorter and more rounded than the dorsal or ventral scales. In the podosomal region and extending to setae *sc e* the lateral aspects of the body possess slightly wavy striations or rounded scales. Posterior legs normally developed . . . . . *L. mexicanus* FAIN, 1970.

   Postscapular shields with 11 to 18 transverse dark bands separated by clearer bands. Scales on the lateral surface of opisthosoma triangular in shape and well formed. Other characters variable . . . 9.

9. Scales on the anterior region of the dorsal face of opisthosoma about two times wider and longer than those of the posterior region of the body. All opisthosomal scales in form of elongate triangles. Scales absent on the lateral aspects of the body in front of opisthosoma. With from 12 to 14 dark bands on postcapular shields . . . . . *L. pitymys* FAIN and HYLAND, 1972.

   All scales on the dorsal face of the opisthosoma equal or subequal. Other characters variable . . . . . 10.

10. Setae *l 5* distinctly stouter and longer (80 microns) than other perianal setae. Lateral surfaces of the body with triangular scales on the posterior three-quarters of opisthosoma and with rounded scales on

the anterior quarter of opisthosoma plus the remaining lateral surfaces of the body up to the level of setae *sc e*. Ventral and dorsal surfaces of opisthosoma completely covered with equal or subequal triangular scales. Postscapular shields with 12 to 15 dark bands separated by punctate bands which are about one and one-half to two times wider than the dark bands. Posterior legs normally developed . . . . . *L. dicrostonyx* FAIN and HYLAND, 1972.

All setae on posterior region of the body thin, equal or subequal, but rarely unequal; maximum length of setae *l 5* is 45 microns. Other characters variable . . . . . 11.

11. Ventral opisthosomal scales distinctly wider and longer than dorsal opisthosomal scales. Lateral surface of body in front of legs III devoid of scales . . . . . 12.

Ventral opisthosomal scales no longer or thicker than dorsal opisthosomal scales. Lateral surface of body from opisthosoma to near setae *sc e* with very short rounded scales . . . . . 13.

12. Postscapular shields 82 to 90 microns wide with 11 to 13 transverse dark bands separated by punctate bands which are approximately two to three times wider than dark bands. Lateral faces of the body with triangular scales continuing from the opisthosoma to the level of trochanters III. Opisthosomal length from 175 to 183 microns (in five specimens). Setae *l 5* thin, 30 to 45 microns long . . . . . *L. ondatrae* FAIN, KOK and LUKOSCHUS, 1970.

Postscapular shields 60 to 65 microns wide with 14 to 18 dark bands separated by punctate bands which are only slightly wider than dark bands. Lateral faces of the body in front of opisthosoma with several occasional triangular scales which do not extend beyond setae *d 2*. Opisthosomal length from 110 to 135 microns (in five specimens). Setae *l 5* from 20 to 30 microns long . . . . . *L. kingstownensis* FAIN and HYLAND, 1973.

13. Legs IV about three times shorter than the length of opisthosoma. Dark bands of postscapular shields close together and number 14 to 16 . . . . . *L. brevipes* DUBININA, 1968.

Posterior legs normally developed, only two times shorter than length of opisthosoma. Dark bands of postscapular shields number 12 to 14 and are separated by punctate bands one and one-half to two times wided than dark bands . . . . . *L. phenacomys* FAIN and HYLAND, 1972.

1) Listrophorus validus BANKS, 1910

Listrophorus validus BANKS, 1910 : 133, pl. IX; FAIN 1970 a : 125, Fig. 1-2 (lectotype).
Listrophorus grandior DUBININA, 1967 a : 172, Fig. 13-17.

This species was described and roughly drawn by BANKS. In 1967 DUBININA described under the name of *Listrophorus grandior* a species which is inseparable from *L. validus*. In this same work she redescribed, under the name of *L. validus,* a species which was actually new.

Madame DUBININA's error is easily explained because of the insufficiency of BANKS's description. We have had the opportunity to examine the type of *L. validus*, and redescribe and redraw this species. Since the original preparation included several specimens, plus some hypopi of *Dermacarus,* we have designated as the lectotype of *L. validus*, the best preserved specimen and the one which coresponds most closely to BANKS's description. This lectotype is a female, shown in dorso-ventral view (FAIN, 1970 a).

It should be noted that the male of *L. validus* has been well described and drawn by DUBININA (1967) under the name of *L. grandior.*

The lectotype female and the posterior extremity of the male are figured here (Fig. 1, 2, 20).

Hosts and localities :

All the known specimens of this species are from the muskrat, *Ondatra zibethica*. In North America the parasitized hosts are from the following localities :

1) Canada (Guelph, Ontario) : JARVIS Collection (26-IV-1906). Lectotype deposited in the Museum of Comparative Zoology, Harvard University.

2) U. S. A. : We have specimens from eight muskrats in the Acarological Collection at the University of Rhode Island, Kingston, R. I. (K. HYLAND Collection). Since these hosts also harbored other species of *Listrophorus* and in order to avoid repetition we have included a list of the localities were muskrats were taken along with their identification numbers at the end of the work. Hosts parasitized by *L. validus* carried numbers 76, 80, 86, 740 and 1243 (one male mite per host); numbers 744 and 902 (one female per host); and number 650 (two female mites).

We also found one male of this species an O. *zibethica* from Clemson College, S. C. (coll. O. L. CARTWRIGHT, 9-XI-1929) Bish. no. 19921 (U. S. N. M. Collection).

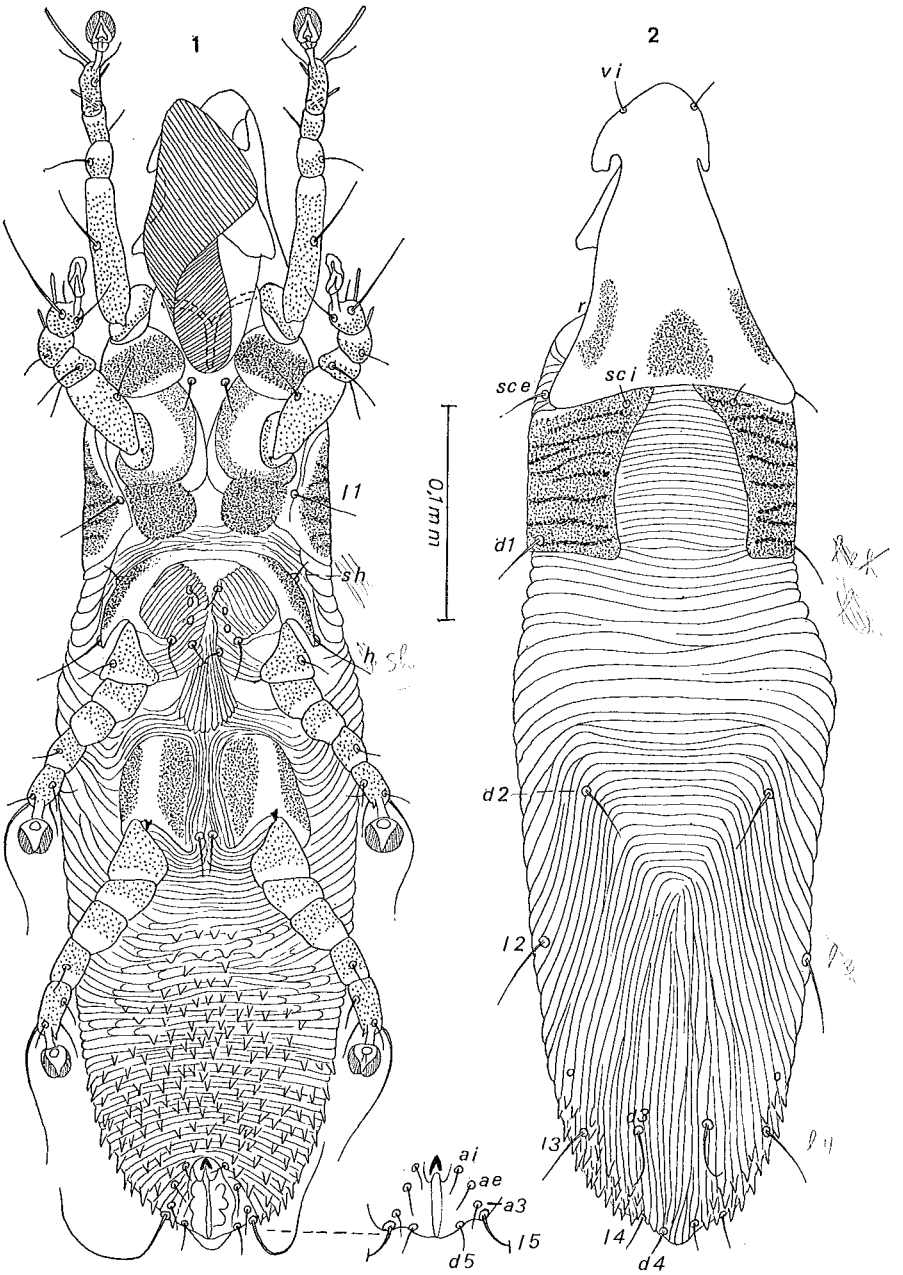

Fig. 1-2. — *Listrophorus validus* BANKS, female lectotype, in ventral (Fig. 1) and dorsal view (Fig. 2).

2) Listrophorus dozieri RADFORD, 1944

Listrophorus dozieri RADFORD, 1944 : 164; Fig. 7-8; DUBININA, 1967 a : 168, Fig. 9-12, 17; FAIN, 1970 a : 131.

This species has been redescribed and drawn by DUBININA (1967). Illustrated here are certain parts of the female (Fig. 3) and the male (Fig. 27).

Hosts and localities :

The type are from *Ondatra zibethica macrodon* from Cambridge, Maryland, June, 1940 (coll. H. L. DOZIER).

Additional specimens are in the collection of K. HYLAND (U. R. I.) and are also from *Ondatra zibethica*. These specimens came from muskrats numbered : 80, 84, 872, 1026 (one female per host); 82, 87 (one male each); 650, 809 (two females each); 740 (one male and two females); 742 (one male and one female); 744 (three females and one male); 796 (three females and five males); 1164 (two females and one male); and 1243 (five females and one male). See list of localities at the end of this work.

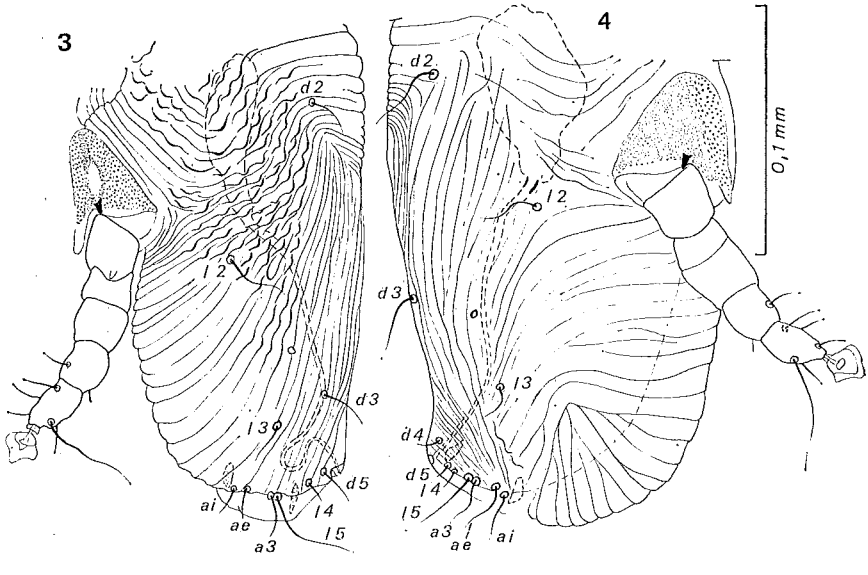

Fig. 3-4. — *Listrophorus dozieri* RADFORD (Fig. 3) and *Listrophorus americanus* RADFORD (Fig. 4). Opisthosoma of females in lateral view.

3) Listrophorus americanus RADFORD, 1944

Listrophorus americanus RADFORD, 1944 : 164, Fig. 9; DUBININA 1967 a : 164, Fig. 5-8, 17; FAIN 1970 a : 131.

This species has been redescribed and drawn by DUBININA (1967), but we wish to figure again certain parts of both the female and male (Fig. 4, 19).

The female of *L. americanus* possesses postscapular shields and a general body plan which is similar to that of *L. dozieri*. It is easily distinguished from the latter by the following characteristics : 1) absence of scales on the lateral faces of the body (which exist in *L. dozieri*); 2) the striae on the anterior half of the ventral surface of the opisthosoma are curved posteriorly in the lateral regions of the body (on the contrary, in *L. dozieri* all the ventral opisthosomal striae curve anteriorly); 3) the bursa opens immediately behind the anus while in *L. dozieri* the bursa opens at 25 microns behind the anus.

Hosts and localities :

The types come from *Ondatra zibethica macrodon* taken in Cambridge, Maryland, June, 1940 (coll. H. L. DOZIER).

Specimens in the collection of K. HYLAND (U. R. I.) are from 16 muskrats, with the following numbers : 74 and 742 (one female each); 80, 809, 810, 1026 (one male each); 85 and 87 (two males and two females each); 902 and 1243 (one male and one female per host); 82 (three males and one female); 86 (two males and five females); 740 (two females and one male); 744 (two males and three females); 796 (fixe males and four females); 1164 (four females). See list of localities at the end of this work.

4) Listrophorus faini DUBININA, 1972

Listrophorus validus, DUBININA, 1967 a : 157, Fig. 1-4, 17, nec BANKS, 1910.

Listrophorus sp. FAIN, 1970 a : 130.

Listrophorus faini DUBININA, 1972 : 192.

DUBININA (1967 a) described under the name of *Listrophorus validus* BANKS a species which was actually new. However, the real *L. validus* was described in the same work under the name of *L. grandior*. While studying the type of *L. validus* we discovered this mistake and proposed to our colleague that she rename this new species (see FAIN 1970 a, Fig. 2).

Listrophorus faini DUBININA is easy to distinguish from the other species parasitizing the muskrat by the structure of the postscapular shields.

This species has been found on ten specimens of *Ondatra zibethica* in the United States. These specimens are in the collection of K. HYLAND (U. R. I.). The parasitized muskrats have the following numbers : 84, 740, 902 and 1164 (one female each); 872 (one male); 524 (two females); 87 (one male and one female); 796 (two males and one female); 650 and 742 (one male and two females per host). See the list of localities at the end of this work.

5) Listrophorus ondatrae FAIN, KOK and LUKOSCHUS, 1970

Listrophorus ondatrae FAIN, KOK and LUKOSCHUS, 1970 in FAIN, 1970 a : 131.

Until now this species was known only from the type locality in Canada, but we have found it in the United States as well. We wish to give a complete description of both male and female as follows :

M a l e (holotype) (Fig. 5, 25, 32). — Total length 384 microns, width 141 microns. Posterior extremity of the body in the form of a rounded cone, with two small postero-ventral lobes slightly longer than they are wide; apically narrowed with the posterior edge prolonged in back into a decidedly cone-shaped point with a rounded tip. In our original description we had confused these two lobes, which are slightly transparent on their border, with membranous setae. Actually there are no membranous setae in *L. ondatrae*. Cuticle completely devoid of scales. Postscapular shields a maximum of 67 microns long (in their internal half), with 12 to 14 dark bands separated by bands consisting of very small clear points (as seen under phase contrast) and slightly wider than the dark bands. Opisthosomal scales forming dotted longitudinal or oblique bands; in their anterior third these bands are about 3-4 microns wide, whereas in their posterior fifth they are 30 microns wide. Setae *d* 2 are located on the anterior extremities of these shields. Very small adanal suckers present. Penis curved at an angle of 135°, with a very small barb on its concave surface and very near its apex. Legs IV are relatively long. Tarsi IV possess two cylindroconical setae in the subapico-dorsal position, one of which arises from a wide flat base.

F e m a l e (allotype) (Fig. 6). — Originally we gave 450 microns as its length and 143 microns as its width. Actually it measures 510 microns by 149 microns (in ventral view). Opisthosoma completely covered with small triangular scales. The ventral scales are slightly larger than the dorsal ones. Anterior dorsal scales are equal or subequal to the posterior dorsal scales. Laterally the scales do not go beyond legs III. Postscapular

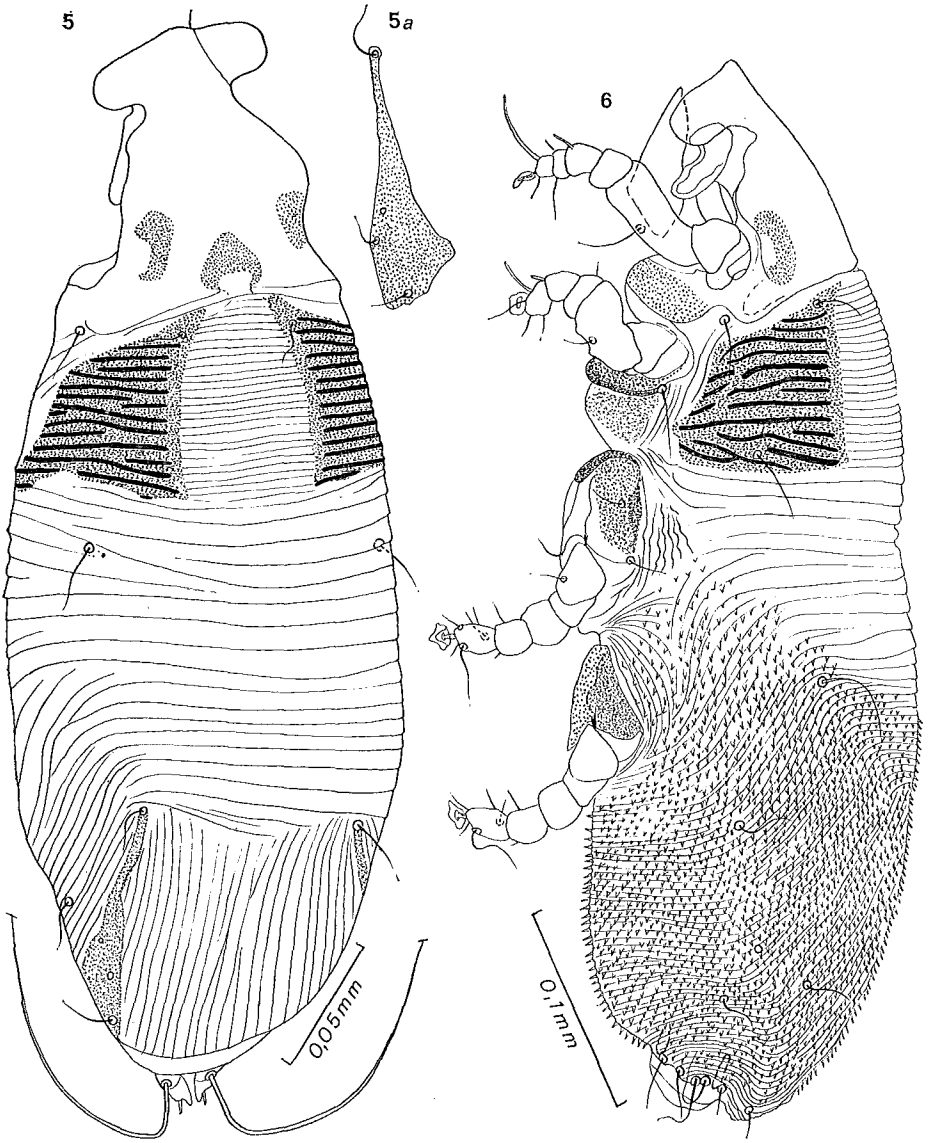

Fig. 5-6. — *Listrophorus ondatrae* FAIN, KOK and LUKOSCHUS.
Holotype male, dorsal view (Fig. 5); opisthosomal shield in lateral view (Fig. 5a).
Paratype female, lateral view (Fig. 6).

shields with 11 to 13 dark bands separated by clear bands about twice as wide as the dark bands; shields are 82 to 90 microns wide. Legs III and IV well developed. Legs IV, 80 microns long. Setae *l 5* very delicate, 30 to 45 microns long.

Hosts and localities :

The types are off *Ondatra zibethica* from Chelmsford, Canada, 19-VI-1969 (coll. KOK) (holotype and seven paratype males, allotype and two paratype females).

Other specimens on the same host in Rhode Island include: South Kingstown: hosts no. 74 and 87 (two female each), no. 84 (one female); Lafayette: no. 875 (one female); Richmond: no. 235 (one female); and Scituate: hosts no. 650, 742, 743, 745 (two females each).

Types are in the Institut royal des Sciences naturelles de Belgique, Brussels.

6) Listrophorus kingstownensis FAIN and HYLAND, 1973

Listrophorus kingstownensis FAIN and HYLAND (in FAIN, 1973).

This species is very close to *L. ondatrae*. In the male it is distinguished by a more definitely curved form of the penis (at about 160°); in the female by the greater number of dark bands on the postscapular shields (about 14 to 18), by the smaller space between these bands which are separated by clear bands of approximately the same width as the dark bands, and by the smaller width of the postscapular shields (60 to 65 microns as opposed to 82 to 90 microns in *L. ondatrae*). It should also be noted that in the female the scales of the ventral face of the opisthosoma are two to three times wider and longer than those of the dorsal face of the opisthosoma, and that the lateral surfaces of the body in front of legs IV are completely devoid of scales. In *L. ondatrae* the scales go as far laterally as the level of legs III. Setae *l 5* are very weak in the female, 20 to 30 microns long.

Holotype female 450 microns long, 150 microns wide (lateral view) (Fig. 7). Allotype male 381 microns long, 140 microns wide (ventral view) (Fig. 26, 33).

Hosts and localities :

On three *Ondatra zibethica* from North Kingstown, R. I., U. S. A. : Host no. 902 (holotype and three female paratypes, allotype and one male paratype); host no. 85 and 86 (two paratype females). See list at end of this study for collection data.

Types are deposited in U. S. N. M.; paratypes in the collections of the authors.

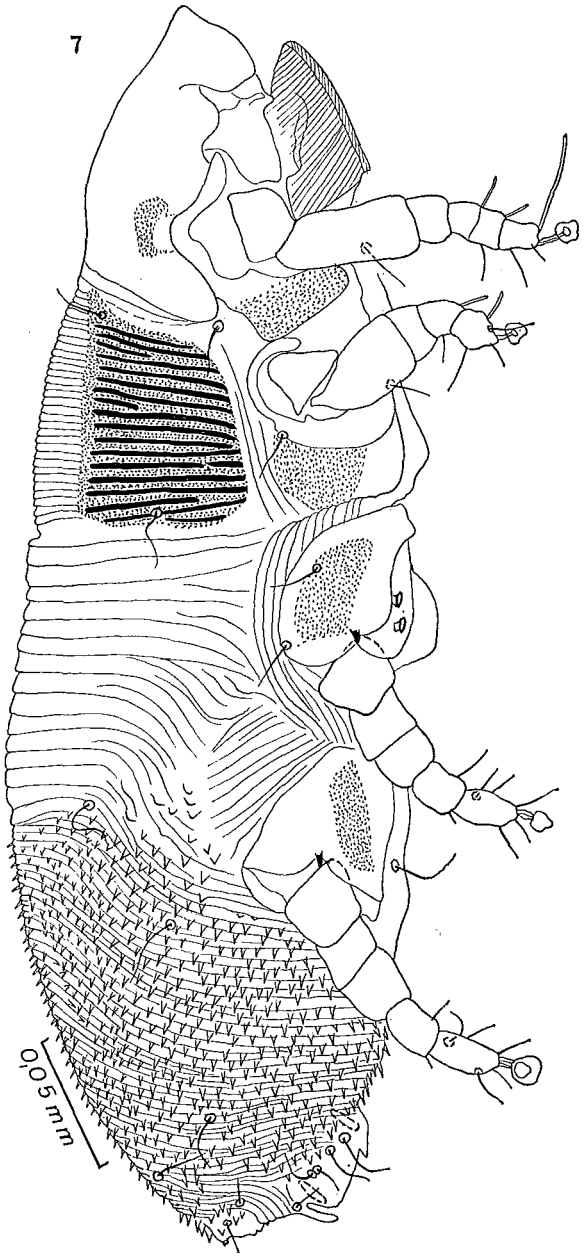

Fig. 7. — *Listrophorus kingstownensis* FAIN and HYLAND. Holotype female in lateral view.

7) Listrophorus mexicanus FAIN, 1970

Listrophorus leuckarti, MCDANIEL *et al.*, 1967 : 340, nec PAGENSTECHER, 1861.

Listrophorus mexicanus FAIN, 1970 b : 274.

This species has been collected off *Microtus mexicanus* from Mexico. We have also found it in North America principally on *Microtus* and *Clethrionomys.* Note that MCDANIEL *et al.* (1967) have reported the presence of *Listrophorus leuckarti* PAGENSTECHER, 1861 from *Microtus p. pennsylvanicus* in the United States and Canada. These specimens actually belong to *L. mexicanus* since PAGENSTECHER's species does not exist in North America.

Male (holotype) (Fig. 8, 9, 28, 29, 40). — Length 369 microns, width 118 microns (in dorso-ventral view). Postscapular shields 65 microns long with seven to eight dark transverse bands widely separated from each other. In one paratype, in lateral view, these shields measure a maximum of 57 microns long and 54 microns wide. Lateral faces of the hysterosoma with only a small number of very short, rounded and badly formed scales. Dorso-lateral opisthosomal shields distinctly narrowed in front and contain the *d 2* setae. Well formed posterior lobes with straight posterior edges. Setae *d 5* absent. Small adanal suckers present. Penis curved at 90°.

Female (allotype) (Fig. 10). — Length 450 microns, width 123 microns (in lateral view). Opisthosoma 155 microns long. Postscapular shields 69 microns long, a maximum of 63 microns with 9 dark transverse bands (8 to 10 on the paratype) widely separated from each other. Opisthosoma with the dorsal and ventral faces covered with small triangular scales; the lateral faces have scales which are decidedly shorter and rounded. Lateral faces of the body between the opisthosoma and the *sc e* setae with sligthly wavy striations or bearing very indistinct short, rounded scales. Legs IV 60 microns long.

Systematic position of *L. mexicanus:*

The presence of numerous scales on the opisthosoma of the female makes this species resemble *L. leuckarti* PAGENSTECHER, 1861, and *L. brevipes* DUBININA, 1968. It differs sharply, however, from these species: In the male by the absence of membranous setae on the posterior lobes of the body and in both sexes by the different structure of the postscapular shields (different number of dark transverse bands). Also it differs from the female of *L. leuckarti* because the scales cover the entire dorsal face of the opisthosoma whereas in *L. leuckarti* these scales are lacking on a large part of the dorsal surface of the opisthosoma.

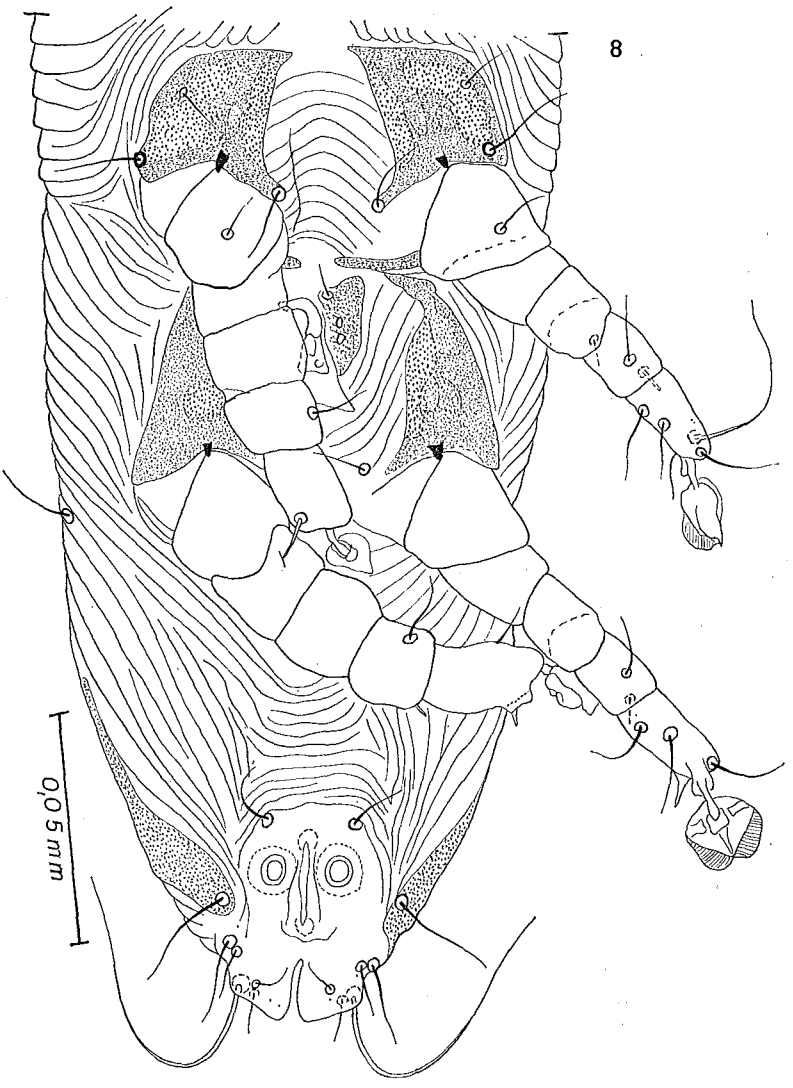

Fig. 8. — *Listrophorus mexicanus* FAIN. Holotype male, opisthosoma in ventral view.

Hosts and localities :

It should be pointed out that the types are off *Microtus mexicanus* from Durango, Mexico. This rodent is preserved in the British Museum (no. 82.3.20.26.27). The acarines were collected by A. FAIN. Types are in the British Museum.

We have found that those specimens collected from the United States and Canada on *Microtus pennsylvanicus*, *Microtus* sp., *Clethrionomys*

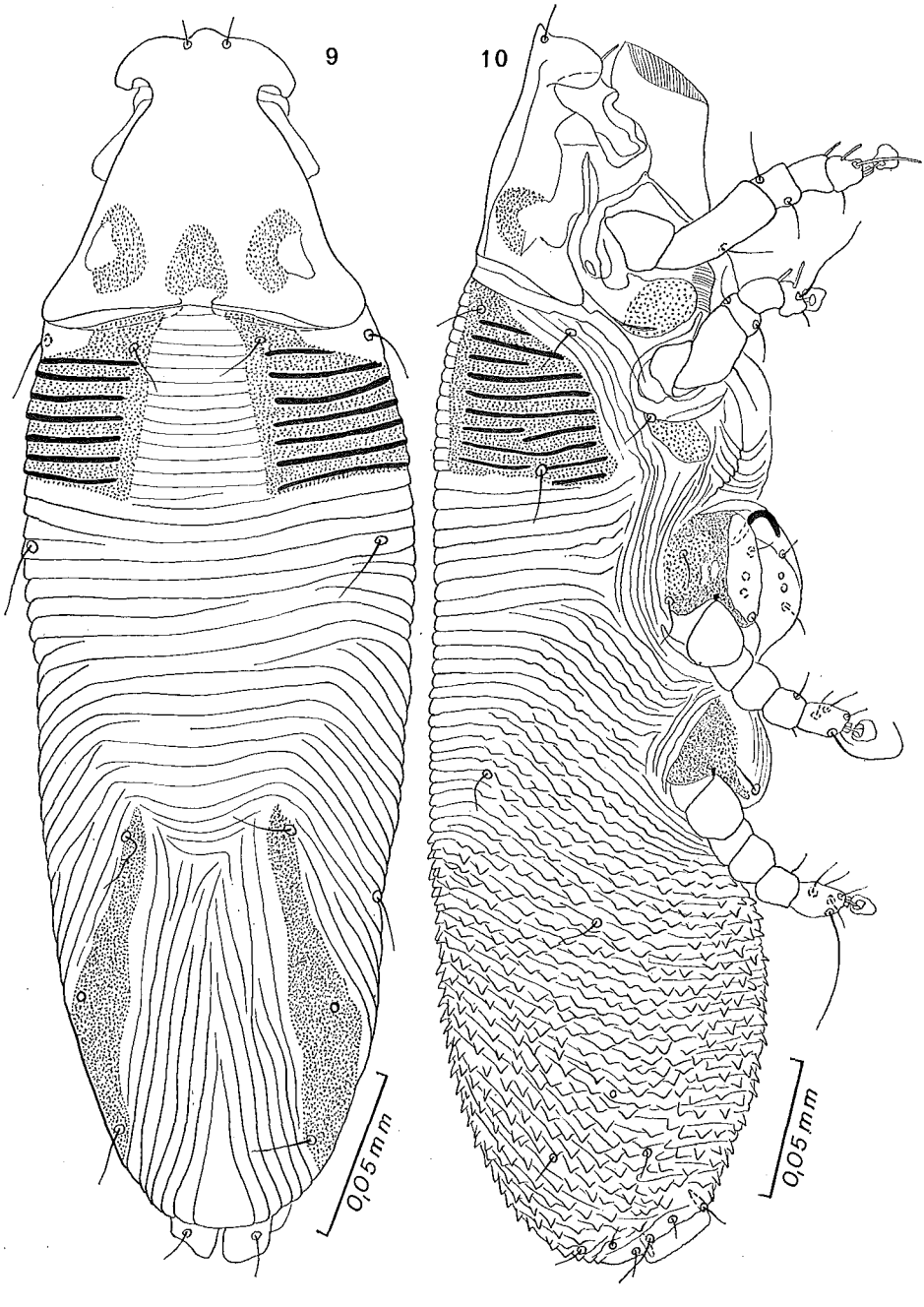

Fig. 9-10. — *Listrophorus mexicanus* FAIN.
Male dorsal view (Fig. 9) and female lateral view (Fig. 10).

gapperi, and *Peromyscus leucopus* should in fact be separated into a new subspecies. The true *L. mexicanus mexicanus* should be restricted to the typical host, *Microtus mexicanus*.

Listrophorus mexicanus squamiferus FAIN and HYLAND, 1972

Listrophorus mexicanus ssp. *squamiferus* FAIN and HYLAND, 1972 (in FAIN, 1972 : 243).

This subspecies is distinguished from the typical form in both sexes by the presence of numerous rounded scales on the lateral surface of the body. These scales extend from the opisthosoma to the propodosomal shield. Other characters same as in the typical form. Holotype male 365 microns long, 117 microns wide in lateral view. Allotype female 425 microns long, 105 wide, in lateral view.

The types (holotype male and allotype female) were collected from *Clethrionomys gapperi* (host no. 1358), West Greenwich, R. I., 27-XII-1956 (coll. L. BARBER), and are deposited in the U. S. National Museum. Two additional females and two nymphs are in the collections of the authors.

We have found *L. m. squamiferus* on the following hosts :

1. *Microtus pennsylvanicus :*
   a) Specimens in the British Museum. — Rodent (no 89.6.16) from New York, 1889 (mites collected by A. FAIN).
   b) Specimens in the U.S. National Museum. — Martha's Vineyard, Massachusetts, 23-IV-1933 (Bish. no 20.910), coll. G. LUNZ; S. W. Keewatin, Canada, 11/12-VI-1947 and 23-VIII-1947 (lot 482864), coll. F. HARPER; Monroe County, Penna., 30-IV-1945 and 7/8-V-1945 (lot 45-17758), coll. F. HARPER; Mouth of Windy River, Keewoten, Canada, 14-VII-1947 and 25-VII-1947 (lot 48-2416), coll. F. HARPER; Edgartown, Mass., 14-VI-1936 (Bish. no 23480, lot. no 36-20473), coll. C. N. SMITH; Nantucket, Mass., 13-VI-1936, coll. C. N. SMITH; Wayne Co., Penna., 13-VII-1945, coll. F. HARPER.
   c) Specimens from the collection of K. HYLAND (U.R.I.). — Hosts are listed by number and the number ot acarines collected is given in parentheses. Collection data are given at the end of this study. Hosts numbers : 92 (two males, three females, two nymphs); 171 (two males, six females, one nymph); 184 (one female); 244 (four males, two females, two immatures); 254 (five males, four females); 444 (three males, three females, one nymph); 459 (one male, two females); 498 (on male, seven females, one nymph); 505 (one male, three females, one nymph); 600 (two females); 637 (one male); 753 (two males); 765 (three males); 771

(one male); 773 (one male); 803 (one male, on female); 931 (six males, three females); 977 (five males, four females, one nymph); 978 (five males, five females, one nymph); 1108 (one female, one nymph); 1112 (two females); 1113 (one male); 1115 (three females); 1144 (two males); 1179 (one female); 1362 (six males, six females); 1382 (two males, eight females); 1457 (two nymphs); 1589 (one male, two females, six immatures).

2. *Microtus* sp. :

   a) Specimens in the U.S. National Museum, Washington :

   Salmon Creek, Alaska, 30-IV-1950 and 1-V-1950, coll. R.B. WILLIAMS; Juneau, Alaska, 3-VI-1949 and 6-IX-1949, coll. R.B. WILLIAMS; Beasley's Point, N.J., 15-IX-1936, coll. F.C. BISHOPP; East Falls Church, Va., 14-IX-1919, H.E. EWING; Menemsha, Mass., 29-VIII-1936, coll. BISHOPP and SMITH.

   b) Specimens in the K. HYLAND collection (U.R.I.). — Hosts numbers : 753 (four females, one nymph); 754 (one female); 755 (three males, three females, one nymph); 759 (six males, two females, one nymph); 765 (two males, three females, two nymphs); 771 (two males); 772 (one male, three females, one nymph); 773 (two females); 804 (one male, on female); 908 (two males, seven females, one nymph).

3. *Clethrionomys gapperi.* — These rodents were captured in Rhode Island and are in the U.R.I. collection. Host numbers : 202 (one nymph); 208 (one male and one nymph); 371 (one male and nine females); 945 (two males); 1047 (two males and one female); 1248 (five females and five nymphs); 1249 (two males, five females, three nymphs); 1255 (three males, four females, three nymphs); 1357 (two males, eight females); 1358 (one male, three females, two nymphs); 1360 (three males, six females, three nymphs); 1458 (three males, four females, three nymphs); 1468 (two males, three females, five nymphs); 1491 (three males, two females, five nymphs). (For localities and dates, see list at the end of paper.)

4. *Peromyscus leucopus.* — A single host record from South Kingstown, R.I.,11-IV-1956, 200 (two males, two females), coll. J. CRONAN.

8) Listrophorus dicrostonyx FAIN and HYLAND, 1972

Listrophorus dicrostonyx FAIN and HYLAND, 1972 : 174.

This species was described preliminarily in our earlier paper. We wish to describe it in more detail and to figure it below. *L. dicrostonyx* is well characterized in the male by the absence of membranous *d 5* setae, and in

the female by the presence of small triangular scales on the entire surface of the opisthosoma and by a pair of long setae *(l 5)* in the perianal region.

It is distinguished from *L. mexicanus* FAIN especially by the greater number of dark bands on the postscapular shields and in the female by the presence of long, heavy *l 5* setae.

F e m a l e (holotype) (fig. 11). — Length 435 microns, maximum width 150 microns (in lateral view). Opisthosoma 158 microns long. Dorsal and ventral surfaces of the opistosoma completely covered with small equal or subequal triangular scales; on the lateral surfaces of the opistosoma the scales are triangular in the posterior three-quarters and rounded in the anterior quarter. These rather indistinct rounded scales continue on the lateral faces of the body up to the *sc e* setae. The postscapular shields are 75 microns long with a maximum width of 60 microns, and have 12 to 15 dark bands. The external border of these shields is slightly convex in the posterior half. The *d 5* setae are much stronger and longer (80 microns) than the other setae of the posterior region of the body. Legs IV 75 microns long.

M a l e (allotype) (fig. 12, 35). — Specimen is in fairly poor condition. Length 354 microns; cuticle with small short and rounded scales on the lateral faces of the hysterosoma; anteriorly these scales continue to near the *sc e* setae. Postscapular shields 54 microns long, a maximum of 48 microns wide, having 9 or 10 well spaced dark transverse bands. Opisthosomal shields showing their greatest width in their anterior part; in front these shields end 30 microns from setae *d 2*. Penis recurved at about 90°. Legs strong. The posterior extremity of the body is damaged and the long *l 5* setae fell off when we remounted the specimen.

H o s t a n d l o c a l i t y :

On *discrostonyx* sp. from Nueltin Lake, Keewatin, Canada, 26-VI-1947, lot. 48-2416, coll. F. HARPER (holotype and three paratype females, allotype male).

9) Listrophorus phenacomys FAIN and HYLAND, 1972

Listrophorus phenacomys FAIN and HYLAND, 1972 : 175.

In this species the male does not possess any foliate setae on the posterior lobes of the body; it is therefore clearly distinguishable from *L. leuckarti, L. brevipes, L. validus, L. americanus, L. meridionalis* and *L. faini.*

It is distinguished from *L. mexicanus* in both sexes by the greater number of dark bands on the postscapular shields, in the female by the more triangular form and greater number of the opisthosomal scales, and in the male by the greater development of legs IV. It is distinguished from *L. di-*

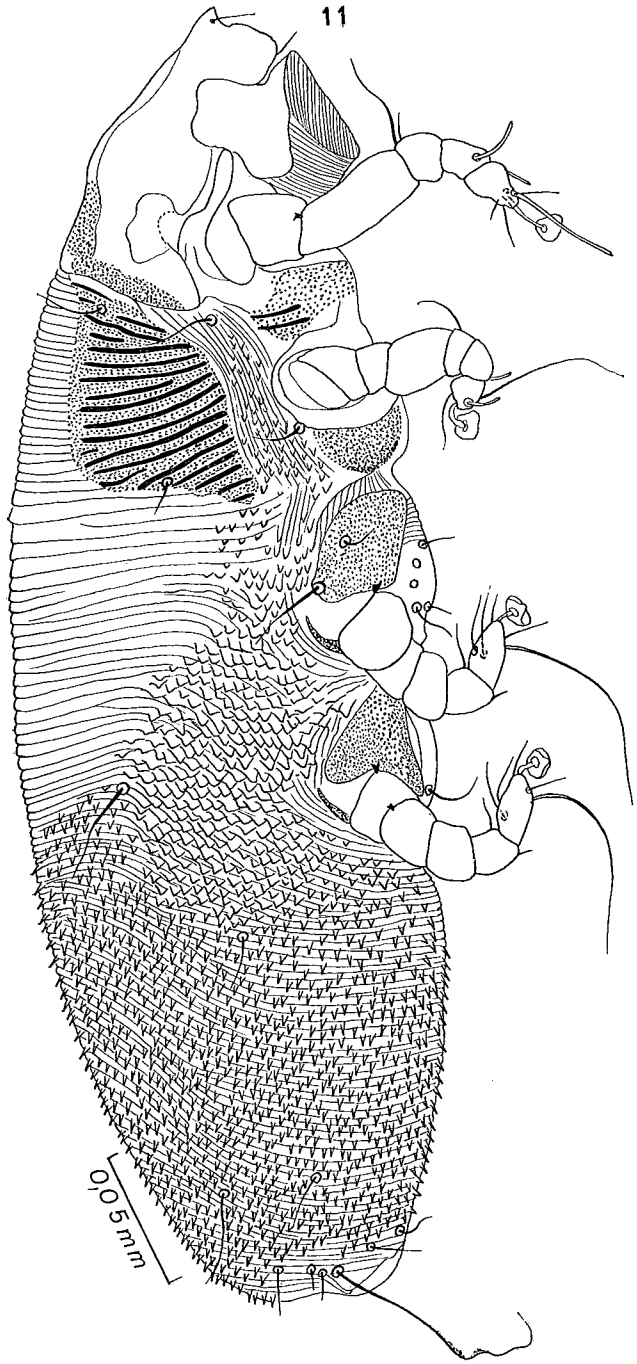

Fig. 11. — *Listrophorus dicrostonyx* FAIN and HYLAND. Female in lateral view.

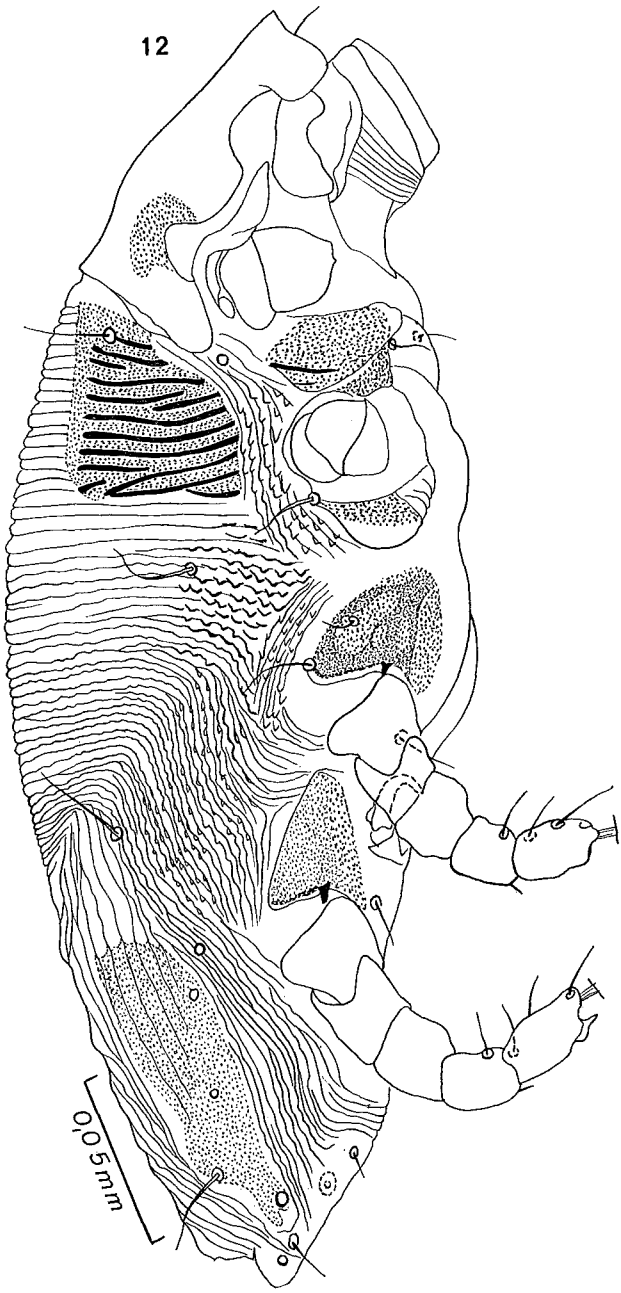

Fig. 12. — *Listrophorus dicrostonyx* FAIN and HYLAND. Allotype male in lateral view.

crostonyx in the female by the absence of long setae in the posterior region of the body, and in the male by the greater length of the opisthosomal shields.

F e m a l e holotype) (fig. 13). — Length 447 microns, width (in lateral view) 123 microns. Opisthosoma 153 microns long. Postscapular shields 66 microns long, a maximum of 54 microns wide; with 12 to 14 well spaced dark tranverse bands (type and paratypes). The entire opisthosoma is covered with small triangular scales which are equal or subequal. Lateral faces of the body in front of the opisthosoma with very short and rounded scales which continue forward to near the *sc e* setae. Legs IV normally developed, 74 microns long.

M a l e (allotype) (fig. 14, 31, 39). — Length 396 microns, width (in lateral view) 120 microns. Postscapular shields 60 microns long, a maximum of 51 microns wide, having 9 to 12 dark transverse bands. Cuticle scaly on its lateral faces from the *sc e* setae to legs IV. Penis curved at 90°. Opisthosomal shields possess the *d 2* setae. Posterior lobes of the body, penis an adanal suckers as in *L. mexicanus*.

H o s t s a n d l o c a l i t i e s :

1. On specimens of *Phenacomys* (sp.) from Canada collected by Francis HARPER, in the following locations :
   — Nueltin Lake, Keewatin, 3-VII-1947 (no. 1052) (Holotype and two female paratypes; allotype and two male paratypes); 19-VII-1947 (no. 1041) (one female and one nymph paratypes);
   — S. W. Keewatin, 23-VII-1947 (no. 1347 and 1348) (four males and two paratypes female); 21-VIII-1947 (no. 1069 and 1070) (two males and four paratypes females); 23-VIII-1947 (no. 1075 and 1076) (one male and two paratype females); 4-IX-1947 (two paratype females).
2. On *Phenacomys intermedius* from Fort Churchill,Manitoba, Canada, 28-V-1956, collector B. FOSTER (three female paratypes; one male paratype).

All these specimens are deposited in the collections of the U. S. National Museum except a small series of paratypes which are in the collection of the authors.

10. Listrophorus pitymys FAIN and HYLAND, 1972

Listrophorus pitymys FAIN and HYLAND, 1972 : 175.

This species belongs to the *mexicanus* group, characterized by the absence of *d 5* setae (foliate setae) at the posterior extremity of the body in the male. It is characterized in the female by the form of the dorsal opisthosomal scales which are much larger in the anterior region than in

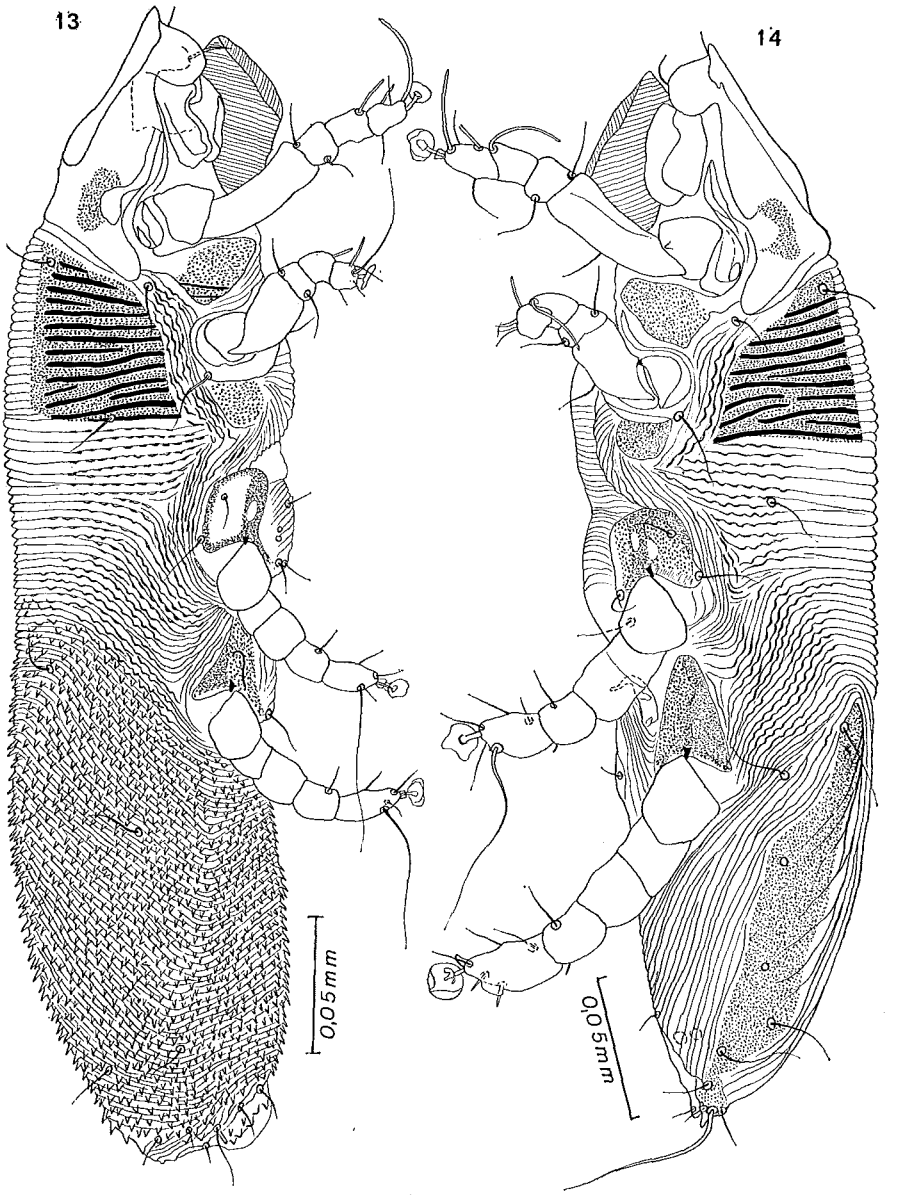

Fig. 13-14. — *Listrophorus phenacomys* FAIN and HYLAND.
Female holotype (Fig. 13) and male allotype (Fig. 14) in lateral view.

the posterior region; in the male by the form of the penis which is curved at an angle of 135 to 150°.

Male (allotype) (fig. 16, 30, 34). — Length 411 microns, width in lateral view 120 microns. Postscapular shields as in the female, and with

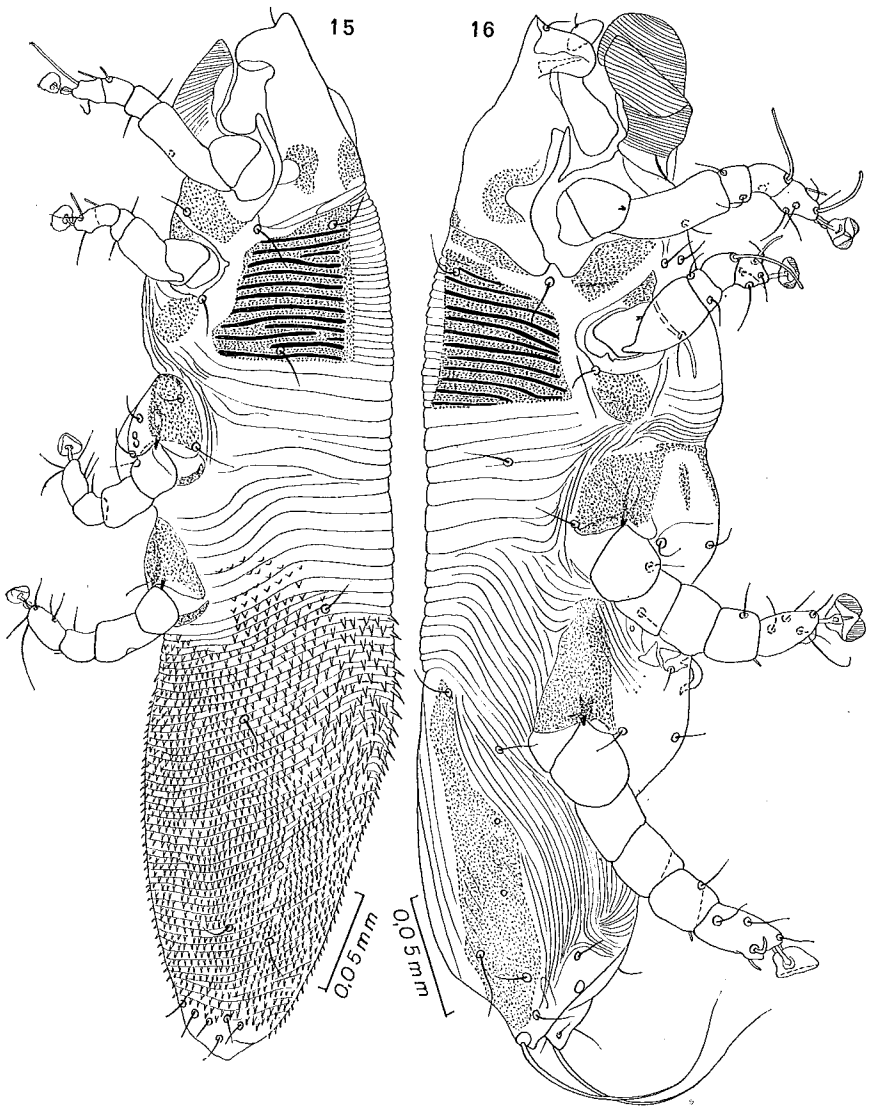

Fig. 15-16. — *Listrophorus pitymys* FAIN and HYLAND.
Female holotype (Fig. 15) and male allotype (Fig. 16), in lateral view.

11 to 12 dark bands. Opisthosoma with two dorso-lateral shields narrowed toward the front and contains the *d 2* setae. Body devoid of scales with a light striation which is not wavy. Penis definitely longer than in *L. discrostonyx, L. mexicanus* and *L. phenacomys,* is curved at 135 to 150° and shows a barb on its convex border near the apex. Strong posterior legs. Small adanal suckers. Posterior lobes divergent and truncate, setae *d 5* absent.

Female (holotype) (fig. 15). — Length 505 microns, width in lateral view 123 microns. Body long and narrow with a rather long opisthosoma (210 microns). Postscapular shields slightly longer (maximum width 78 microns) than wide (68 microns) with 12 to 14 dark tranverse bands, rather widely separated by punctuate bands. Opisthosoma completely covered with well formed and very numerous triangular scales; the scales of the antero-dorsal region are about twice as long and wide as the scales on other parts of the opisthosoma. Body in front of the opisthosoma is devoid of scales. Legs IV well formed, 72 microns long. All setae on the posterior region of the body are short.

Hosts and localities :

1. *Pitymys pinetorum.* — All hosts collected in Rhode Island : East Greenwich, 13-X-1956, no. 736 and 737 (one male and twe females each), coll. L. BARBER; Richmond, 21-IX-1956, no. 844 (one male, four females, one nymph), coll. D. BLAIS; Scituate, 6-IX-1956, no. 924 (seven females) and 15-VIII-1956, no. 1000 (two males, three females and five nymphs), coll. W. MULHEARN; Foster, 16-VIII-1956, no. 943 (one male and two females), coll. W. MULHEARN; Westerly, 30-XI-1956, no. 1126 (one female), coll. L. BARBER.

2. *Blarina brevicauda.* — Narragansett, R. I., 9-XI-1956, no. 764 (one male), coll. L. BARBER.

3. *Microtus pennsylvanicus.* — South Kingstown, R. I., 1-XII-1958, no. 1590 (two males, eight females, two nymphs), coll. D. ZINN.

The holotype is from the *Pitymys pinetorum* no. 844, the allotype from no. 924. All the remaining specimens are paratypes.

11) Listrophorus neotomae FAIN and HYLAND, 1973

Listrophorus neotomae FAIN and HYLAND (in FAIN, 1973).

This species which is known only from the female is distinguished from other species of the genus by the small number of dark lines (five in number) on the postscapular shields, and by the structure of the cuticle which has relatively few thick striations. The cuticle is formed into rather wide short scales on the lateral faces of the body and elongated with rounded ends on the posterior two-thirds of the ventral face of the opisthosoma.

Female (holotype) (fig. 17, 18). — Length 450 microns, width (in dorso-ventral view) 100 microns. Postscapular shields having five rather narrow dark transverse lines which are widely separated from each other. Integument of the lateral region of the body very wavy and forms short

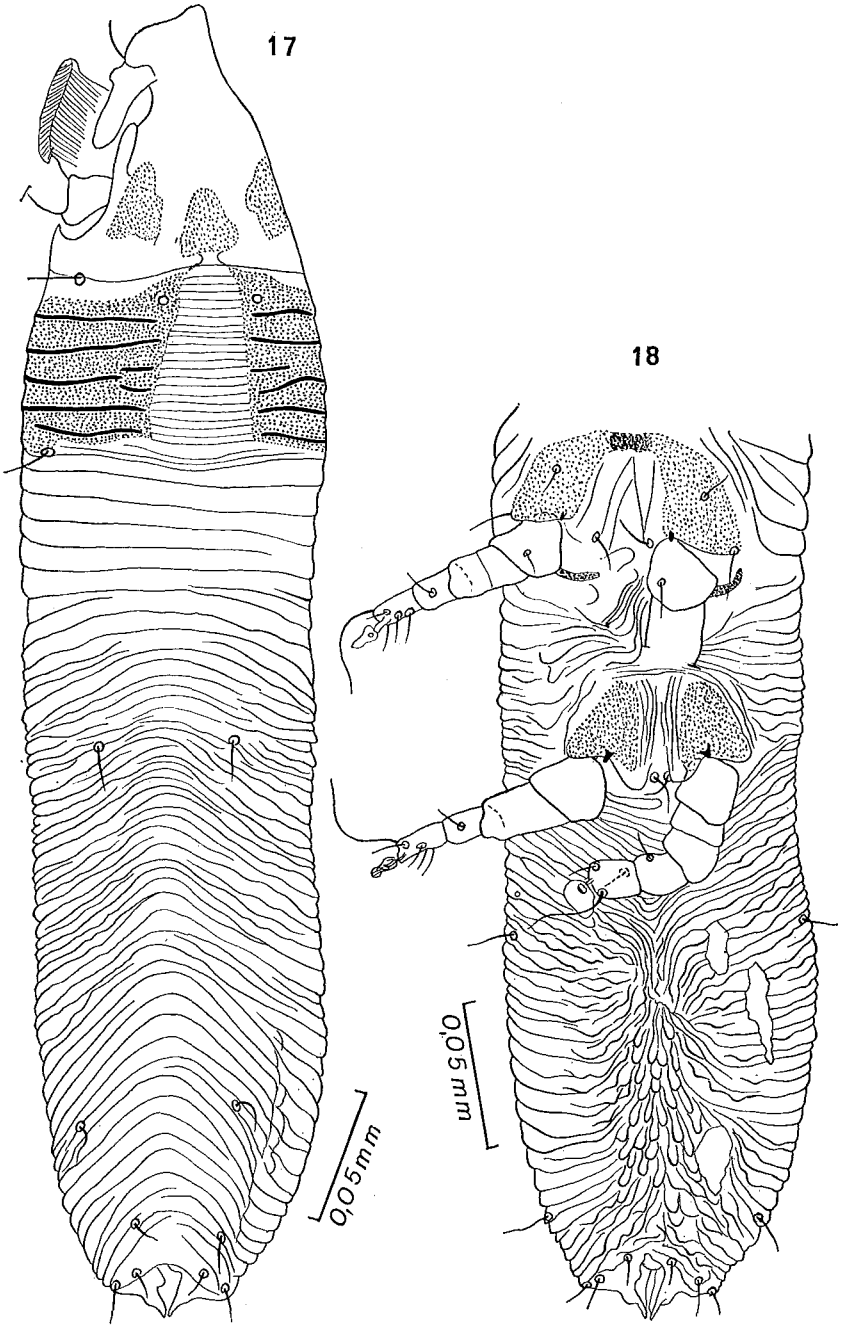

Fig. 17-18. — *Listrophorus neotomae* FAIN and HYLAND.
Female holotype in dorsal view (Fig. 17) and ventral view (Fig. 18).

rounded scales. These scaly bands do not go beyond the base of legs III anteriorly and posteriorly they stop approximately at the juncture of the anterior third and the posterior two-thirds of the opisthosoma. Dorsally, they almost reach the median line. The ventral face of the opisthosoma has better developed scales which are longer than wide, but with the posterior border rounded; these scales are especially well developed on the posterior two-thirds of the opisthosoma. Fine idiosomal setae do not surpass 18 microns in length.

Hosts and localities :

1. *Neotoma m. microtus* BAIRD, from Nueces Co., Texas, U. S. A., 22-X-1943, coll. J. M. ANDERSON (one paratype female).
2. *Neotoma* sp. (Wood rat) from Tallahassee, Florida, U. S. A., XI-1936, coll. B. TRAVIS (Bish. 26856) (lot 37-4334) (holotype and one paratype female).

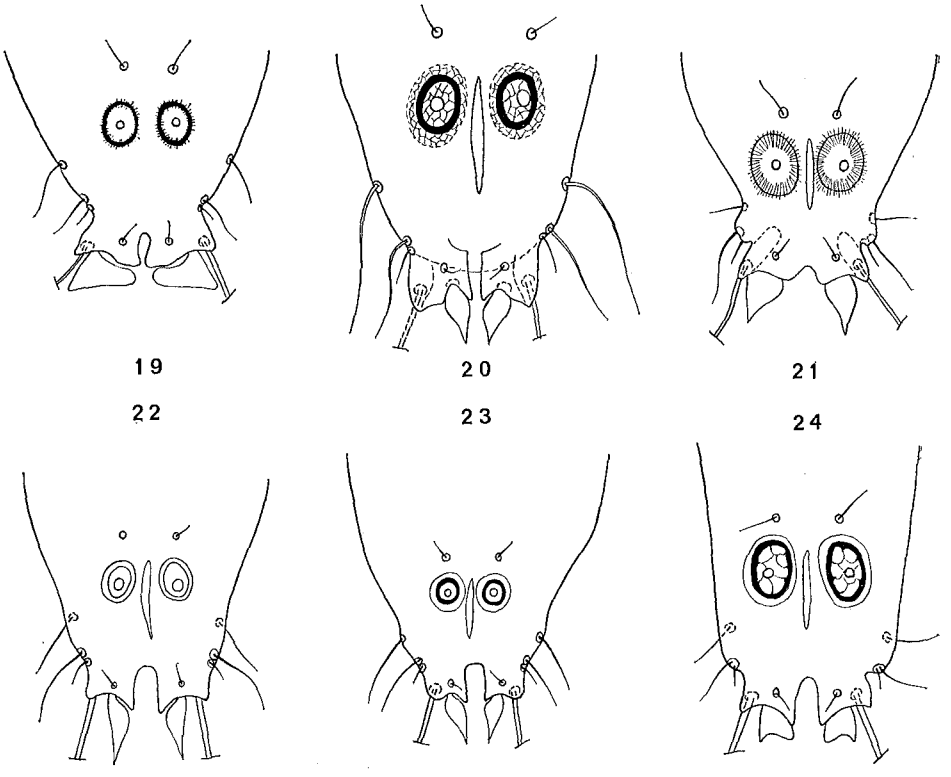

Fig. 19-24. — Posterior extremity of the males in ventral view of *Listrophorus americanus* RADFORD (Fig. 19); *L. validus* BANKS (Fig. 20); *L. faini* DUBININA (Fig. 21); *L. leuckarti* PAGENSTECHER, specimen from *Arvicola terrestris* (Fig. 22); *L. brevipes* DUBININA, paratype (Fig. 23); *L. meridionalis* FAIN, paratype (Fig. 24).

Genus Prolistrophorus FAIN, 1970

Prolistrophorus FAIN, 1970b : 279.

Definition. — This genus is close to the genus *Listrophorus*. It is distinguished from it by the following characteristics : 1) presence of a single postscapular shield which has, towards its center, a more or less developed oval striated zone where the punctuations are lacking. In certain species, this nonpunctuate zone is open either anteriorly or posteriorly; 2) in the female, by the presence of the median shield or of two lateral shields on dorsal face of the hysterosoma; 3) in the male, presence of either two large posterior hysterosomal shields which continue anteriorly beyond the *d* 2 setae or of a large median hysterosomal shield which covers the greater part of the hysterosoma; 4) male with straight posterior extremity or terminated by two rather poorly developed lobes; 5) posterior legs of the male are normal.

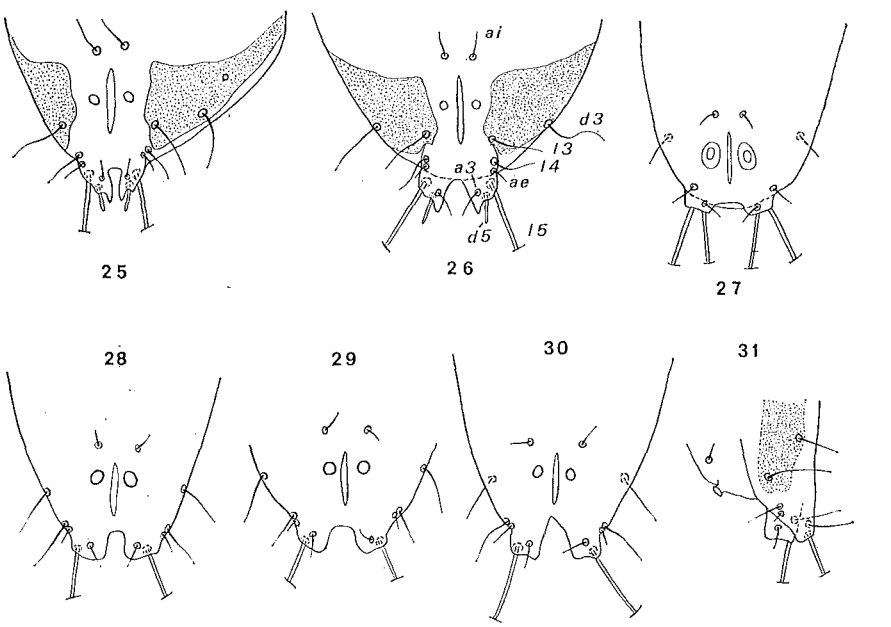

Fig. 25-31. — Posterior extremity of the males in ventral view (except for Fig. 31, in lateral view) of *Listrophorus ondatrae* FAIN, KOK and LUKOSCHUS, holotype (Fig. 25); *L. kingstownensis* FAIN and HYLAND, allotype (Fig. 26); *L. dozieri* RADFORD (Fig. 27); *L. mexicanus* FAIN, paratype (Fig. 28); *L. mexicanus squamiferus* FAIN and HYLAND, specimen from *Clethrionomys* from Block Is., R. I., (Fig. 29); *L. pitymys* FAIN and HYLAND, paratype (Fig. 30); *L. phenacomys* FAIN and HYLAND, paratype (Fig. 31).

Typespecies. — *Listrophorus argentinus* HIRST, 1921.

This genus is distinguished from *Listrophorus* PAGENSTECHER principally by the joining of the two postscapular shields, the presence of shields on the dorsal face of the hysterosoma in the female and the presence of large hysterosomal shields in the male. It is distinguished from *Afrolistrophorus* FAIN by the presence of a large nonpunctuate zone on the postscapular shield and, in the male, by the absence of foliate setae *(d 5)* on the posterior border of the body.

Evolution of the genus *Prolistrophorus.*

Among the three most widespread genera of listrophorids found on rodents, the genus *Listrophorus* seems to be the most evolved, judging by the degree of reduction of the dorsal shields. The most primitive genus, which has kept a well marked scutal covering is *Afrolistrophorus.* In *Prolistrophorus* the shields show an intermediary development between those of the two preceding genera and is decidedly a transitional form between the two. It is interesting to note that the genera *Listrophorus* and *Prolistrophorus* are not represented in Africa south of the Sahara whereas

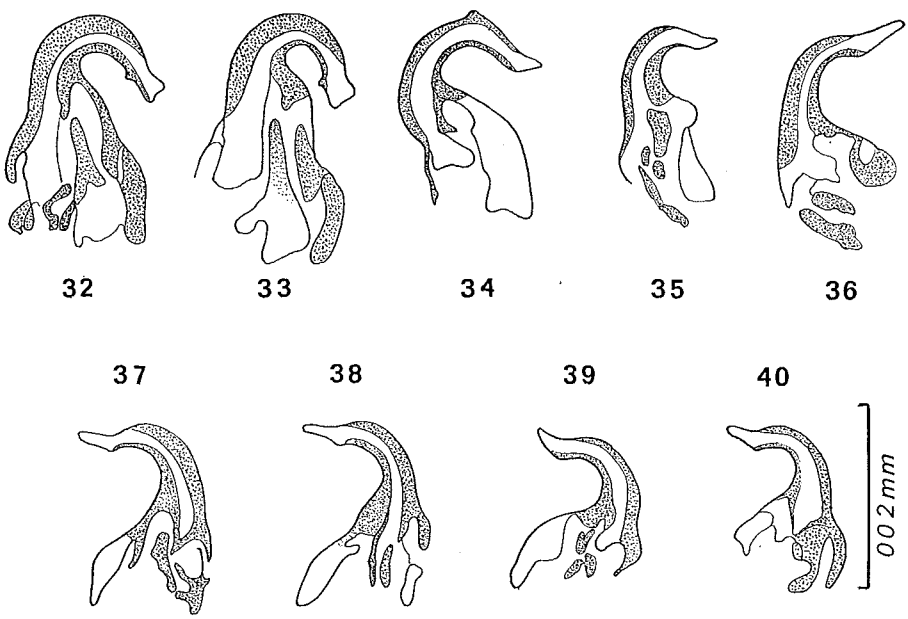

Fig. 32-40. — Penis of the males of *Listrophorus ondatrae* FAIN et al., paratype, (Fig. 32); *L. kingstownensis* FAIN and HYLAND, allotype, (Fig. 33); *L. pitymys* FAIN and HYLAND paratype, (Fig. 34); *L. dicrostonyx* FAIN and HYLAND, allotype, (Fig. 35); *L. meridionalis* FAIN, paratype, (Fig. 36); *L. leuckarti* PAGENSTECHER, specimen from *Arvicola terrestris,* (Fig. 37); *L. brevipes* DUBININA, specimen from *Clethrionomys glareola,* from Belgium, (Fig. 38); *L. phenacomys* FAIN and HYLAND, paratype, (Fig. 39); *L. mexicanus* FAIN (Fig. 40).

Afrolistrophorus is widespread there. In both North and South America, the opposite is observed. The Africans rodents are therefore parasitized by some listrophorids which are less evolved, hence more primitive, than those of the two Americas.

Note also that in Europe the majority of listrophorids from rodents belong to the genus *Listrophorus,* hence to the most evolved genus; in addition, the genus *Afrolistrophorus* is poorly distributed there, and the genus *Prolistrophorus* is completely absent.

In North America the genus *Listrophorus* is very well represented (ten species), whereas the genus *Prolistrophorus* includes only two species and both of the latter are very close to the genus *Listrophorus.* The opposite situation can be observed in South America where the genus *Listrophorus* is absent but where *Prolistrophorus* is represented by about ten very characteristic species.

1. Prolistrophorus bakeri (RADFORD, 1949) comb. nov.

Listrophorus bakeri RADFORD, 1949 : 934, fig. 3-4; McDANIEL, 1965 : 705.

The male of this species was well drawn by RADFORD, 1949.

The female is illustrated here in lateral view plus certain aspects of the male (fig. 41-43) based on specimens collected from the typical host from Georgia. These specimens were kindly sent to us by Dr. McDANIEL.

Hosts and localities :

1. *Sigmodon hispidus texianus* from Thomasville, Georgia, U. S. A., 30-VI-1934, coll. E. V. KOMAREK (types); Statesboro, Georgia, 24-V-1969, coll. McDANIEL; Fort Stewart, Georgia, 5-XII-1956, coll. LARACUENTE and 9-I-1970, coll. McDANIEL; Grady Co., Georgia, 14-IV and 21-VII-1948, coll. H. B. MORLAN; Kleberg Co., Texas, 4-III-1966, coll. McDANIEL; Thomas Co., Georgia, 7-II-1947 (T. M. 40); Brooks Co., Georgia, 21 and 22-VI-1948, coll. H. B. MORLAN.

2. Cotton rat, Tallahassee, Florida, 9 and 10-XI-1936, coll. B. TRAVIS; St. Mark's Refuge, Florida, 30-X-1936, coll. B. TRAVIS; Bonita Springs, Florida, 22-XI-1936, coll. B. TRAVIS; Pinellas Park, Florida, 25-XI-1947, coll. G. F. BAKER.

3. Rice rat, Bull's Island, South Carolina, 29-IV-1943, coll. C. N. SMITH (cited by RADFORD, 1948).

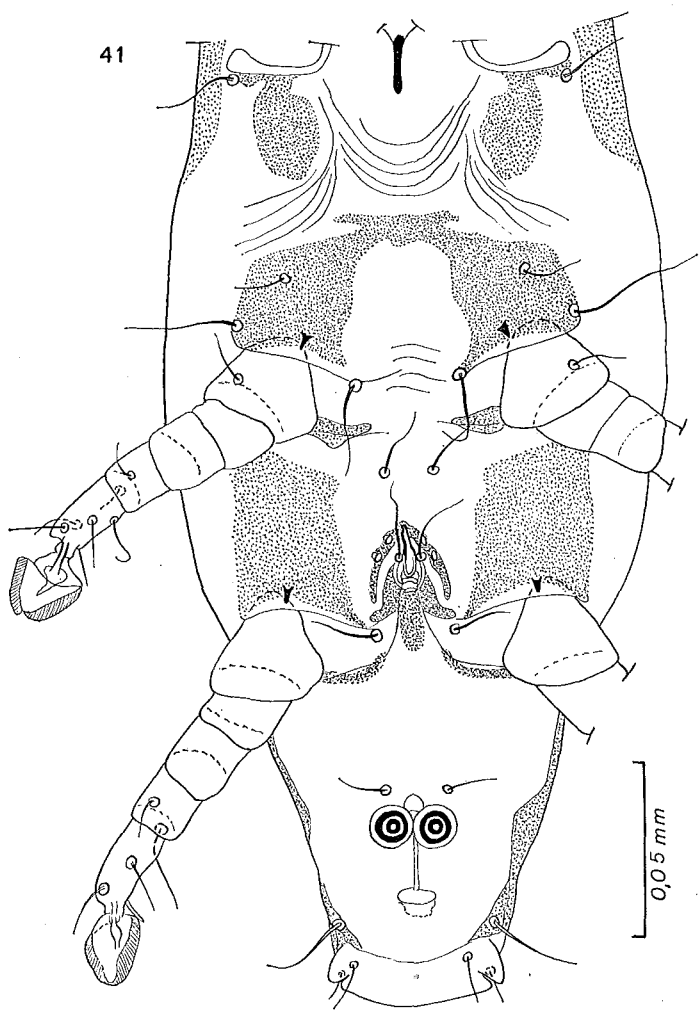

Fig. 41. — *Prolistrophorus bakeri* (RADFORD). Male hysterosoma in ventral view.

2. Prolistrophorus sparsilineatus (FAIN, 1970) comb. nov.

Listrophorus sparsilineatus FAIN, 1970b : 274.

This species is distinguished from *P. bakeri* pincipally by the different form of the postscapular shield (the nonpunctuate zone opens towards the posterior, while in *P. bakeri* it opens anteriorly) and by the form of the posterior extremity of the male which is cut into two small distinct lobes (in *P. bakeri* there are no lobes).

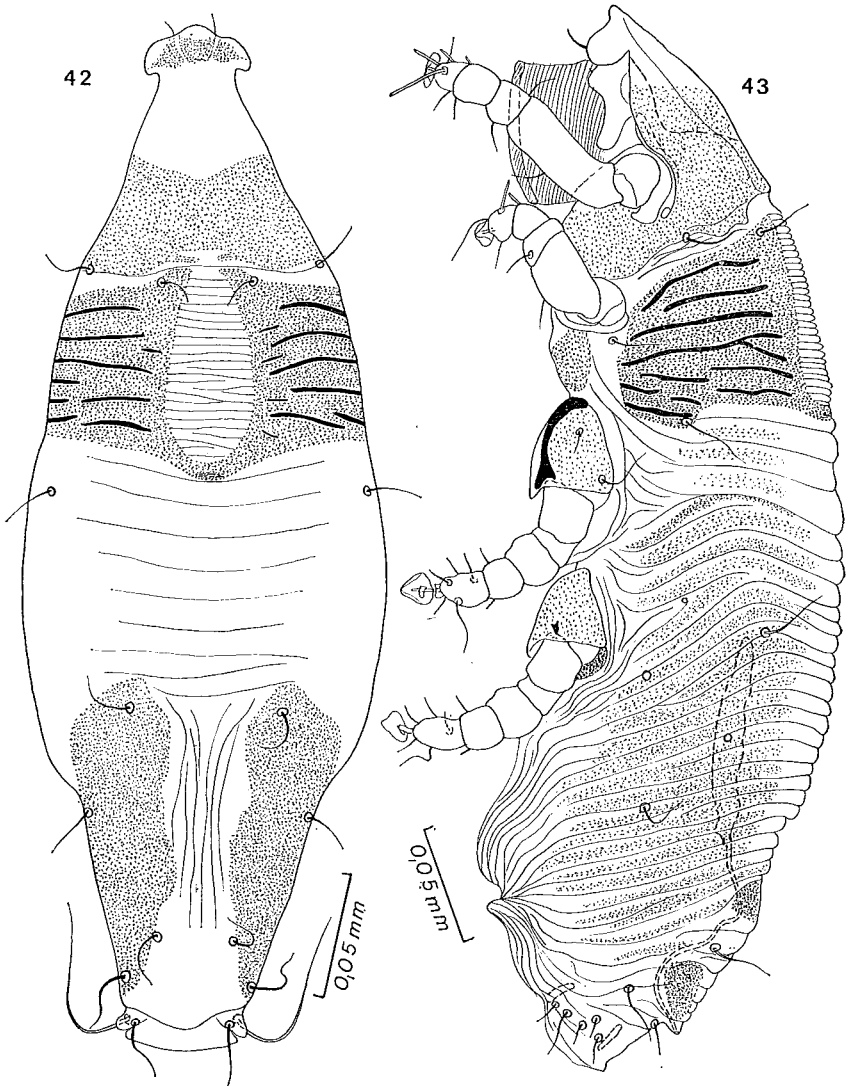

Fig. 42-43. — *Prolistrophorus bakeri.* (RADFORD).
Male dorsal view (Fig. 42) and female lateral view (Fig. 43).

Male (holotype) (fig. 44, 45). — Length 354 microns, width 96 microns. Postscapular shield has four narrow dark lines laterally. There are two large dorso-lateral shields, which go beyond setae *d* 2 in front, and posteriorly nearly to the extremity of the body. Lateral regions of the ventral face of the opisthosoma slightly scaly. Small adanal suckers. Rather well developed posterior lobes which lack membranous setae. Penis

cylindroconical, thin, only slightly curved and relatively long; its base is composed of two well developed divergent arms. Legs IV slightly stronger than legs III.

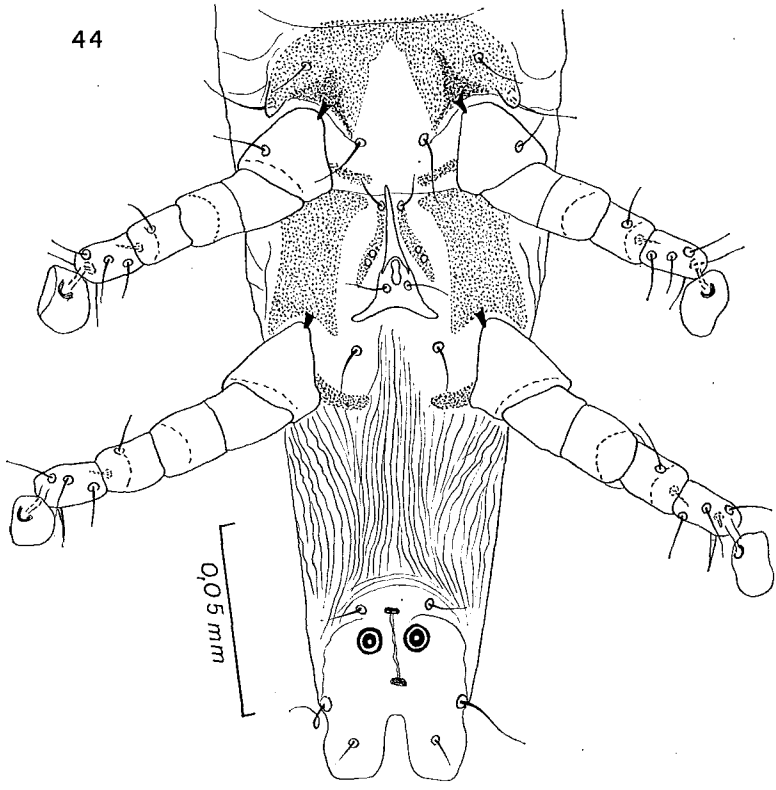

Fig. 44. — *Prolistrophorus sparsilineatus* FAIN.
Male holotype. Hysterosoma in ventral view.

Female (allotype) (fig. 46). — Length 420 microns, width (in lateral view) 95 microns. Dorsal face with postscapular shield as in the male but with five transverse bands. Hysterosoma with a median shield on its posterior half. This shield is only slightly sclerified with the sclerification concentrated especially along transverse bands. Lateral faces of the body with a scaly zone at the level of legs IV. Ventral face of the opisthosoma with only slightly obvious scales. All setae of the posterior extremity of the body delicate and very short. *Bursa* opens slightly behind the anus.

Hosts and localities :

1. *Peromyscus g. gossypinus.* — From Eastern U. S. A. (holotype and three paratype males, allotype female). Types at the Institut royal des Sciences naturelles de Belgique, Brussels; one paratype male in the

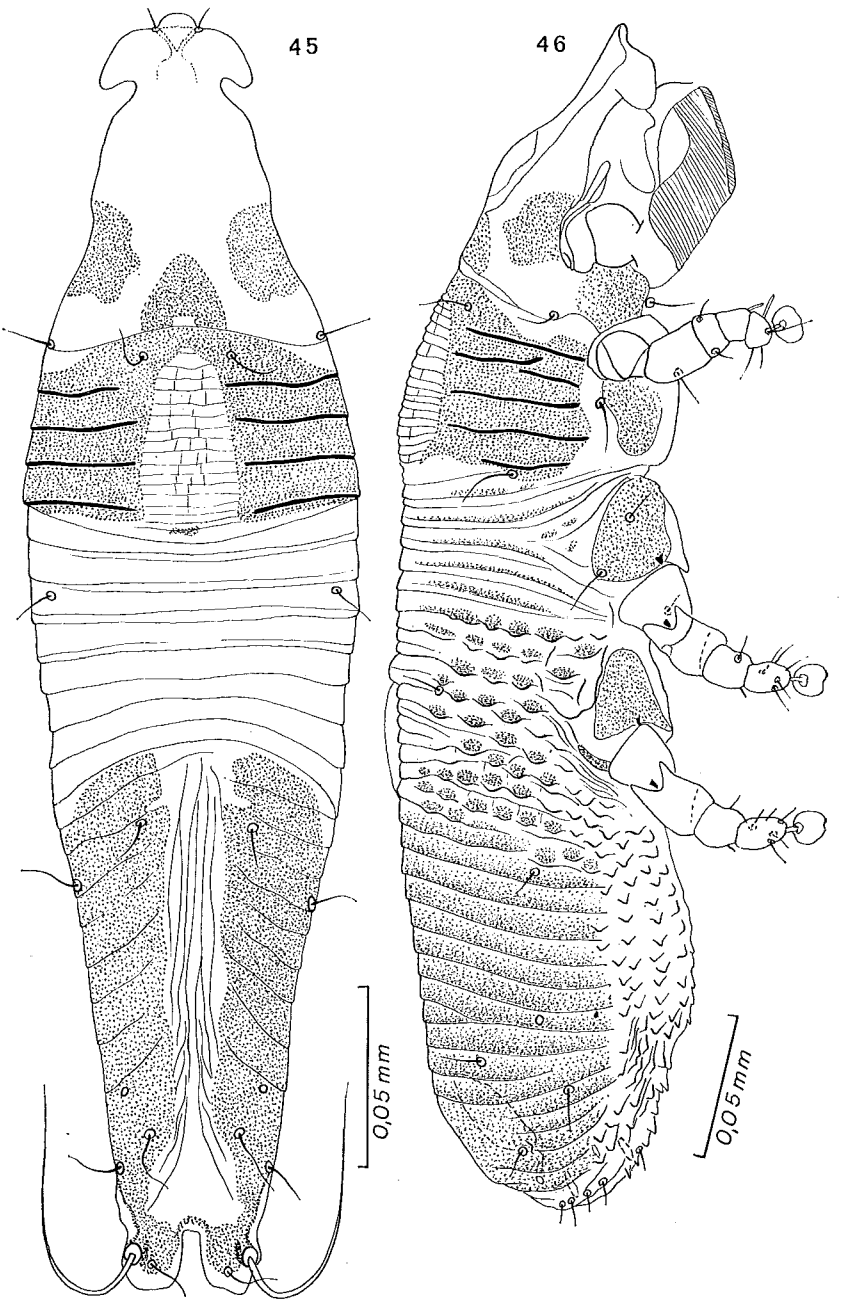

Fig. 45-46. — *Prolistrophorus sparsilineatus* FAIN.
Male holotype in dorsal view (Fig. 45). Female in lateral view (Fig. 46).

U. S. National Museum. Other specimens off the same host from the Okefenokee Swamp, Georgia, 28-I-1936, coll. F. HARPER. Preparation in the U. S. National Museum.

2. Cotton Mouse, from Dale Co., Alabama, 5-IV-1937, coll. R. DYER. Preparation in the U. S. National Museum.

3. Prolistrophorus grassii (RADFORD, 1954) comb. nov.

Listrophorus grassii RADFORD, 1954 : 594, fig. 1.

There are no longer any specimens of this species either in the collections of Dr. RADFORD, in the British Museum, or in the Field Museum of Natural History, Chicago, III. Therefore, one can surmise that the typical series is lost.

It is difficult to say with certainty to what genus this species should be assigned, but if a conclusion is based on the original description it appears that it does not belong to the genus *Listrophorus*. In fact, the female has a median shield on the dorsal face of the hysterosoma at the level of coxae III. The only genus of Listrophoridae in North America which shows this characteristic is *Prolistophorus*. We are provisionally placing this species in the above genus until new specimens are available.

We have been informed by Dr. J. KETLEY, Assistant Curator at the Field Museum of Natural History, Chicago, where the types were supposedly deposited that there is no material of *Listrophorus grassii* RADFORD in the museum nor is there any correspondence from Dr. RADFORD on this subject.

Hosts and localities :

On *Oryzomys p. palustris* from Brady Co., Georgia, 25-II-1948, coll. H. B. MORLAN (types).

Genus Lynxacarus RADFORD, 1951

Lynxacarus RADFORD, 1951 : 104.

Definition. — In both sexes there is a postscapular shield which is wide and complete. The female lacks shields on the hysterosoma; setae *l5* and *d5* are long, equal or subequal and have their bases contiguous. In the male the posterior extremity is divided into two lobes which are poorly developed and lack membranous setae; shields of coxae IV are prolonged laterally (= paracoxal shields IV); posterior legs greatly inflated; there is a strong sclerite surrounding the penis in front; this sclerite has the form of an inverted « Y », or a narrow inverted « U » with the anterior base extending in front by a short longitudinal median sclerite

(like a tuning fork). Note also that the penis is located at the level of legs IV, and that the adanal suckers are well formed.

Type species. — *Lynxacarus morlani* RADFORD, 1951.
This genus is composed of seven species.

Key to the genus *Lynxacarus* RADFORD, 1951

Males

1. Median hysterosomal shield present. Postscapular shield with four transverse lines which become indistinct toward middle of shield . . . . . *L. dubinini* DUBININA, 1969.

   Median hysterosomal shield absent. On each side the coxal plate IV is extended outwardly to form a lateral hysterosomal plate (= paracoxal plate IV). Postscapular shield with at least seven transverse lines in its lateral regions and at least 15 transverse lines in the median area . . . . . 2.

2. One pair of lateral opisthosomal shields present which are separated or united to the paracoxal plates IV . . . . . 3.

   Lateral opisthosomal shields absent . . . . . 4.

3. Postscapular shields bear 20 to 25 dark transverse lines (beginning immediately outside setae *sc i*). Pregenital sclerite with short lateral branches . . . . . *L. mustelae* MEGNIN, 1885.

   Postscapular shields bears 10 to 12 dark transverse lines (immediately outside setae *sc i*). Pregenital sclerite with long lateral branches . . . . . *L. nearcticus* FAIN and HYLAND, 1973.

4. Length of postscapular shield 35 microns along median line and about four times shorter than the length of the postscapular shield (tegmen included). Abdomen conical with a rounded tip. Anterior border of tegmen convex . . . . . *L. morlani* RADFORD, 1951.

   Length of postscapular shield at least 60 microns along median line and at least half as long as the postscapular shield (tegmen included) . . . . . 5.

5. Paracoxal plate IV in the form of a transverse rectangular band 15 microns long. Tarsi IV slightly wider than long. Body thickset with very short opisthosoma (length 65 microns). Postscapular shield 57 microns long (along median line) and bears numerous dark tansverse lines medially and laterally. Epimerites III and IV very long. Epimeres III fused along median line. Postero-ventral lobes poorly developed and located on the posterior extremity of the body *L. lyncodon* FAIN, 1970.

Paracoxal plate IV at least 60 microns long. Opisthosoma at least 90 microns long. Epimerites III and IV short. Postero-ventral lobes situated ventrally and distinctly in front of the posterior of the body . . . . . 6.

6. Posterior lobes of body 13 to 14 microns long, 16 to 17 microns wide and with rounded border. Length of postscapular shield 78 microns along median line, with seven narrow dark transverse lines in the lateral areas and about 20 dark lines medially. Solenidia of tibia I and II 60 and 65 microns long respectively. Pregenital sclerite with very short postero-lateral branches . . . . . *L. tupaiae* FAIN, 1970.

Posterior lobes of body 12 to 13 microns long, 14 to 15 microns wide with the posterior border conical with rounded tip. Postscapular shield 65 microns long with eight dark lines in the lateral areas and 13 dark lines medially. Solenidia of tibiae I and II a minimum of 90 microns in length. Pregenital sclerite in form of inverted « Y » with postero-lateral branches long and widely separated . . *L. semnopitheci* FAIN, 1970.

1) Lynxacarus mustelae (MEGNIN, 1885) comb. nov.

Listrophorus mustelae MEGNIN, 1885 (fide Railliet), 1893, Zool. ed. 2, p. 686; CANESTRINI, 1896 : 892, tav. 87, Fig. 1-5; BERLESE, 1897; fasc. 80 No. 4; CANESTRINI et KRAMER, 1899 : 24.
Listrophorus putorii MEGNIN, 1895 : 120, nom. nud.

This species has been described from *Mustela vulgaris* in Europe. CANESTRINI (1896) and BERLESE (1897) have given good drawings of it. One of us (A.F.) has found it on different Mustelidae in Belgium. Until now it had not been reported from North America but its presence in the U.S.A. has just been verified. We have seen specimens (one male and one female) from two different hosts : 1)*Mustela frenata noveboracensis* from Rensselaerville, New York, collected 2-VII-1950 by F. HARPER (preparation no. 1269 in the U.S. National Museum); 2) Ferret, no location given XI-1891 (USNM).

This species is characterized by the large dimensions of the postscapular shield which is long and extends far onto the lateral faces of the body. In addition this shield has many transverse lines very close together which are quite visible on drawing nos. 3 and 4 of CANESTRINI (1896).

2) Lynxacarus morlani RADFORD, 1951

Lynxacarus morlani RADFORD, 1951 : 103-104, Fig. 3; DUBININA, 1969 : 440, Fig. 1-4.

Dr. RADFORD has provided us with two specimens of this species, both from *Lynx rufus floridanus,* collected 24 September 1947 by H. B.

MORLAN in Thomas County, Georgia, U.S.A. One of these specimens has the name « holotype » written in pencil, the other simply the sign ♂.

Since RADFORD dit not designate any holotype in his description we will designate the specimen marked « holotype » as lectotype.

M a l e (lectotype) (fig. 47, 48). — Length 498 microns maximum width 175 microns. This specimen is greatly flattened. Dorsal surface with postscapular shield 35 microns long on the median line, with many transverse lines very close together. Hysterosoma with cross striations on its anterior half; with two paracoxal IV (lateral) shields separated by a longitudinal striation on its posterior half. There are no lateral opisthosomal shields. Ventral surface with coxal shields III and IV widely separated on the median line. Epimera III well developed, not fused.

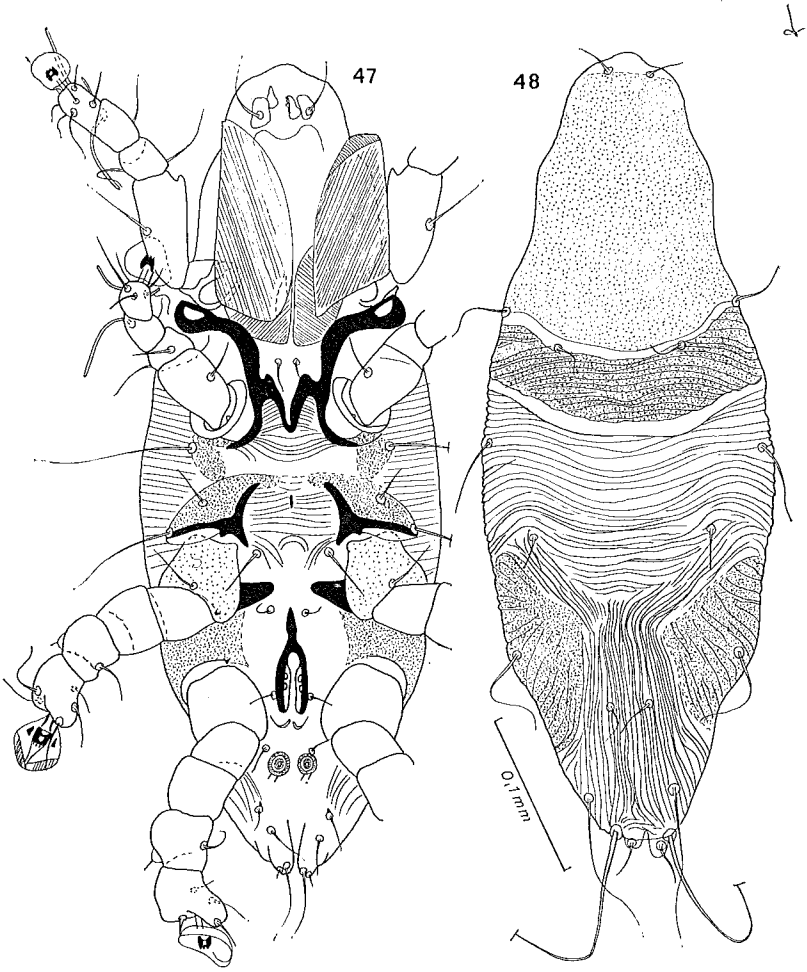

Fig. 47-48. — *Lynxacarus morlani* RADFORD.
Male lectotype in ventral view (Fig. 47) and dorsal view (Fig. 48).

Epimera IV very short. Penis situated between trochanters IV; surrounded laterally and anteriorly by a sclerite in the form of an inverted « U » which is long and narrow and prolonged in its anterior by a single median sclerite. Two well developed adanal suckers situated closer to the penis than to the posterior border of the body. Posterior edge of opisthosoma with two small lobes which have no membranous setae. Legs I much larger than Legs II. Legs IV very strong. All the legs end in a large sucker. Pilose membranes of gnathosoma very well developed.

Hosts and localities :

On *Lynx rufus floridanus* from Thomas County, Georgia, U.S.A., 24-IX-1947, coll. H. B. MORLAN. Lectotype.

Lectotype in the collection of Dr. C. D. RADFORD.

3) Lynxacarus nearcticus FAIN and HYLAND, 1973

Lynxacarus nearcticus FAIN and HYLAND (FAIN, 1973).

This species differs from *L. mustelae* principally by the much smaller number of transverse lines on the postscapular shield. In the male there are 10 to 12 narrow dark lines (counted immediately outside of setae *sc i);* in the female there are 11 or 12 of these lines. In *L. mustelae* these lines number 20-25 in both sexes. The median region of the postscapular shield has very numerous transverse lines which are very close together and are difficult to count.

The male can be distinguished from *L. morlani* RADFORD, *L. lyncodon* FAIN, *L. tupaiae* FAIN and *L. semnopitheci* FAIN primarily by the presence of two lateral opisthosomal shields and from *L. dubinini* DUBININA by the absence of a median hysterosomal shield and by the greater number of lines on the postscapular shield.

Male (holotype) (fig. 49, 51). — Length 460 microns, maximum width in ventral view, 152 microns. Postscapular shield 81 microns long on the median line; its lateral regions possess 10-12 dark, narrow transverse lines and similar but much more numerous lines in its median region. The paracoxal shields IV are well developed, 75 microns long and have eight dark transverse lines. The two lateral opisthosomal shields are well developed (about 100 microns long) and have three wavy and obliquely longitudinal lines; toward the front, these shields come very close to the paracoxal shields IV. There are two only slightly developed and rounded posterior lobes. Adanal suckers well developed. Genital organ with an enveloping sclerite in the form of a tuning fork which is much more developed than in *L. mustelae*. Posterior legs very thick. No membranous setae present on the posterior lobes. Setae *sc e, l 1* and *h,* with a length of 55 microns, 100 microns and 45 microns respectively.

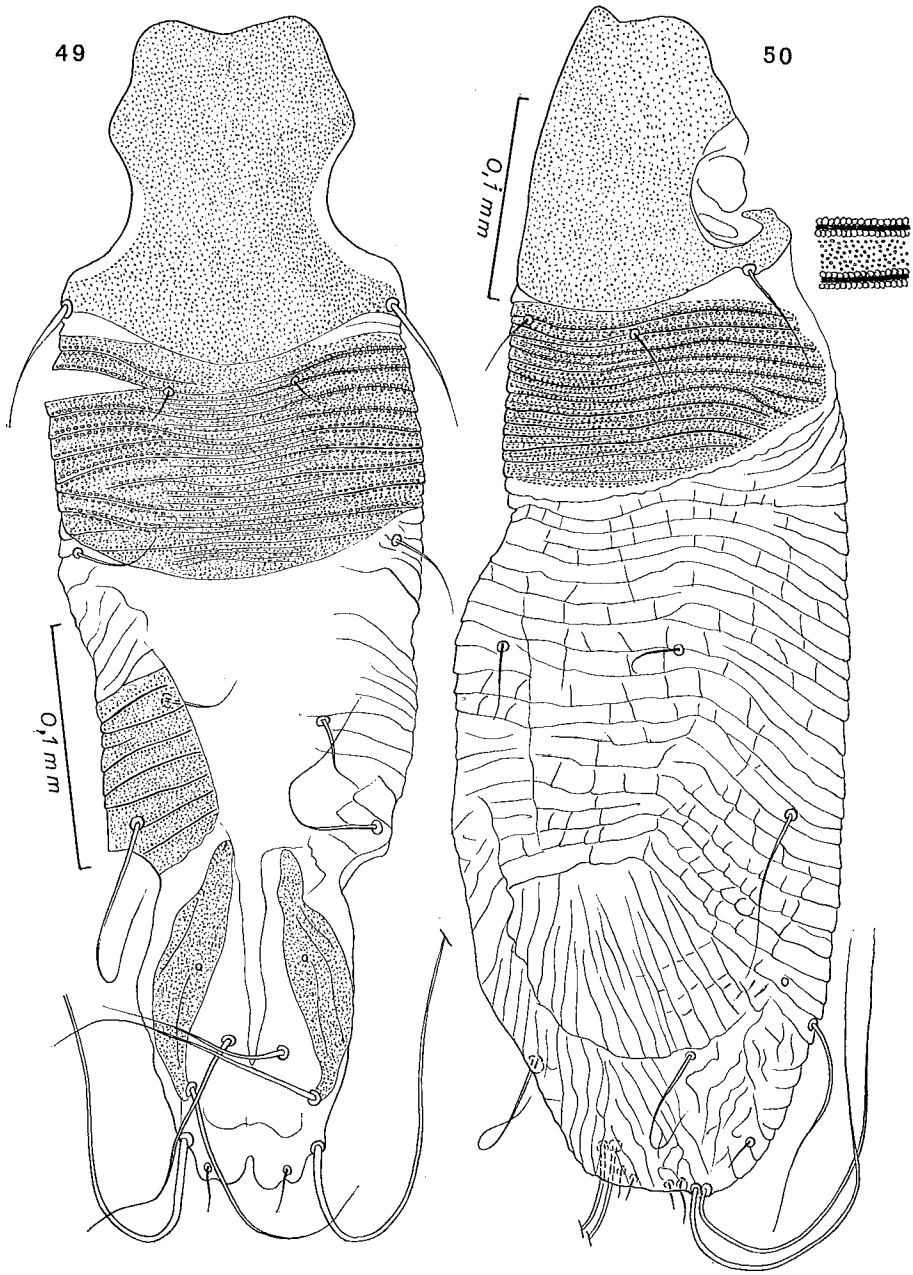

Fig. 49-50. — *Lynxacarus nearcticus* FAIN and HYLAND.
Male holotype (Fig. 49) and female allotype (Fig. 50) in dorsal view.

Female (allotype) (fig. 50). — Length 585 microns, width (in oblique view), 180 microns. Postscapular shield as in the male. Hysterosoma uniformly striated. Epimera III joined on the median line forming a strong chitinous arch. Setae *sc e*, *l 1*, *h*, *l 2*, *l 3*, *l 5*, *d 5* are 55, 90, 45, 90, 105, 250 and 250 microns long respectively. The bases of setae *l 5* and *d 5* are contiguous.

Hosts and localities :

1. On a mink from Patuxent Research Refuge, Bowie, Md., U.S.A. 6-XII-1943 (collectors UHLER and EDINGER). Bish. 32431, Lot 44-4788 (Holotype, 1 paratype male, allotype, and 1 paratype female).

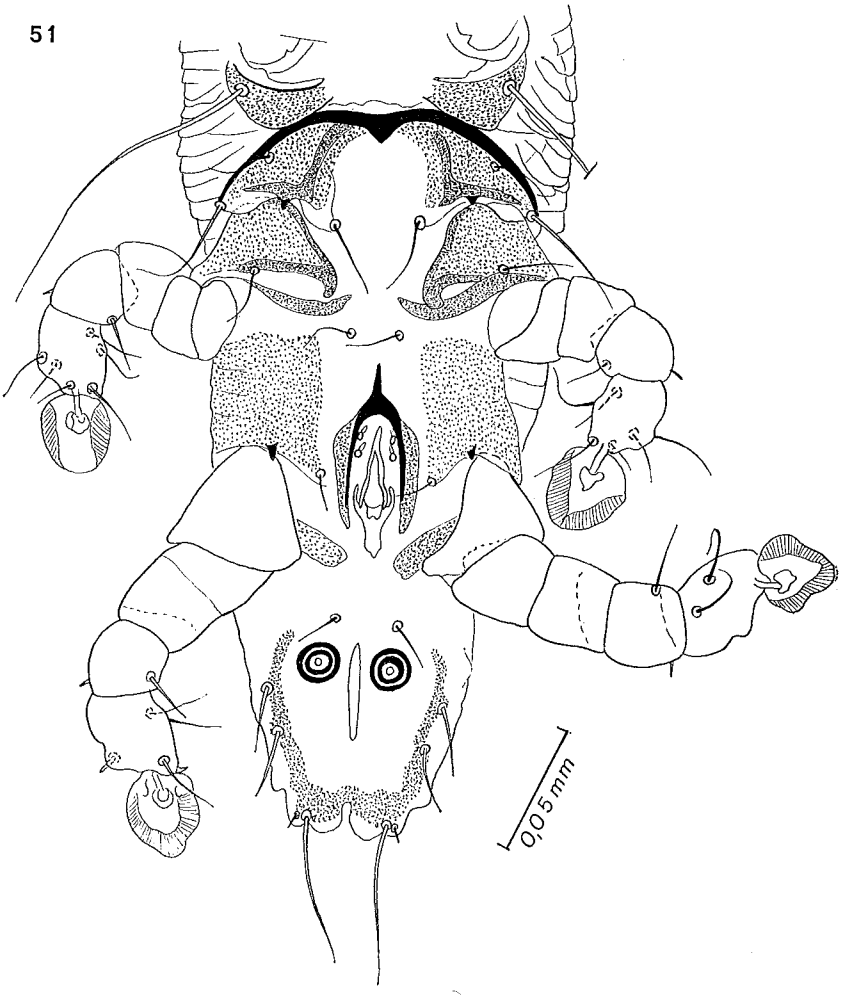

Fig. 51. — *Lynxacarus nearcticus* FAIN and HYLAND.
Hysterosoma of male holotype in ventral view.

2. On *Mustela noveboracensis* from Wayne Co., Penna. U.S.A., 18-VII-1946 (coll. F. HARPER). Lot. 46-15472 (no. 975) (one male and one nymph paratypes). Specimens in the U.S. National Museum.

3. On a chipmunk from Minnetonka, Minnesota, 29-VII-1920 (H.E.E.). Specimens in the U.S. National Museum.

Genus Asiochirus FAIN, 1970

Asiochirus FAIN, 1970b : 275.
Olistrophorus MCDANIEL and WHITAKER, 1972 : 428. Syn. nov.

D e f i n i t i o n . — In both sexes there is a large complete postscapular shield covering the entire width of the body. Hysterosoma in the female without dorsal shield; male with two hysterosomal shields. Absence of an « S » shaped punctuated and sclerified arch in front of coxa II. Male with posterior edge of the body rounded, slightly incised or with poorly developed lobes; adanal suckers present; penis without anterior sclerite; posterior legs not enlarged; setae *d 5* not membranous.

This genus is distinguished from the genus *Lynxacarus* in the two sexes by the absence of an « S » shaped sclerified arch in front of coxa II; in the male by the absence of a pregenital sclerite and the normal form of the posterior legs; in the female by the separation of the bases of setae *d 5* and *l 5*. In the male it is differentiated from the genus *Leporacarus (Leporacaroides)* by the very short and unlobed form of the posterior extremity and by the absence of a sclerified perigenital framework, the absence of posterior lobes, of posterior membranous setae (*d 5*), and the absence of cuticular scales.

T y p e s p e c i e s . — *Listrophorus suncus* RADFORD, ~~1974~~. 1944
The genus *Asiochirus* is represented in North America by two species one of which is very widespread, *Asiochirus blarina* FAIN and HYLAND, 1972. The other *Asiochirus cryptotae* (MCDANIEL and WHITAKER, 1972) has been found only twice.

1. Asiochirus blarina FAIN and HYLAND, 1972

Asiochirus blarina FAIN and HYLAND, 1972a : 175.
Olistrophorus blarinae MCDANIEL and WHITAKER, 1972 : 431. Syn. nov.

This species is near to *Asiochirus suncus* (RADFORD) which is the type for the genus, and was described off a shrew from Ceylon.

The male differs from this species by possessing a continuous posterior extremity of the body and by the form of the penis, which is very short and strongly curved; in the female by the greater development of the scaly zone of the opisthosoma.

Male (holotype) (fig. 52-52a). — Measures 336 microns in length and 150 microns in width (in lateral view). Body thick, short and wide. Striations very widely spaced. Posterior extremity rounded. Postscapular shield short but wide having three to four transversal striae. Opisthosoma with two lateral shields longer than wide and of irregular contours. Small adanal suckers. Penis situated between legs III and IV, strongly curved. Legs relatively strong, ending in large suckers.

Female (allotype) (fig. 53). — Length 405 microns, width 150 microns (in lateral view). Form of the body as in the male but slightly more elongated. Striation very widely spaced in the anterior half of the hysterosoma; in the posterior region of the body the striations are closer together except on a part of the ventral and latéral faces of the opisthosoma which are covered with large triangular scales. Legs narrower than in the male. Postscapular shield as in the male. There is no hysterosomal shield. All the setae of the posterior region of the body are short.

Hosts and localities :

This species has been found on 15 different specimens of *Blarina brevicauda* in various localities in Rhode Island, with the following data :

1. South Kingstown : 8-XII-1955, host no. 62 (four males, two females and one nymph), coll. T. FANNING; 8-II-1956, no. 105 (two males, six females), coll. T. FANNING; 23-II-1956, no. 135 (two males, three females, two nymphs), coll. T. FANINNG; 24-II-1956, no. 148 and 149 (one male, four females, two nymph), coll. T. FANNING; 9-IV-1956, no. 189 (four males, two females, four nymphs), coll. D. ZINN; V-1956, no. 263 (two males, one female, four nymphs), coll. D. ZINN and J. CRONAN; 22-IV-1957, no. 1211 (one male, two females and two larvae), coll. D. ZINN; 20-III-1957, no. 1214 (three males, one female, one nymph), coll. D. ZINN; 19-III-1959, no. 1136 (four males, one female, one nymph), coll. D. ZINN.
2. Ashaway : 16-II-1956, host no. 125 (one female and two nymphs).
3. East Greenwich : 23-X-1956, hosts nos. 991 and 1007 (two males, six females, two nymphs), coll. L. BARBER.
4. Narragensett : 13-III-1957, host no. 1146 (two males, six females, two nymphs), coll. T. FANNING.
5. Canonchet : 27-V-1956, host no. 348 (one female and one nymph), coll. J. CRONAN.
6. Westerly : 30-XI-1956, host no. 815 (one female and one nymph), coll. L. BARBER; 30-V-1956, no. 1450 (one male and two females), coll. T. FANNING; 6-VI-1957, no. 1499 (two males and one nymph), coll. T. FANNING.

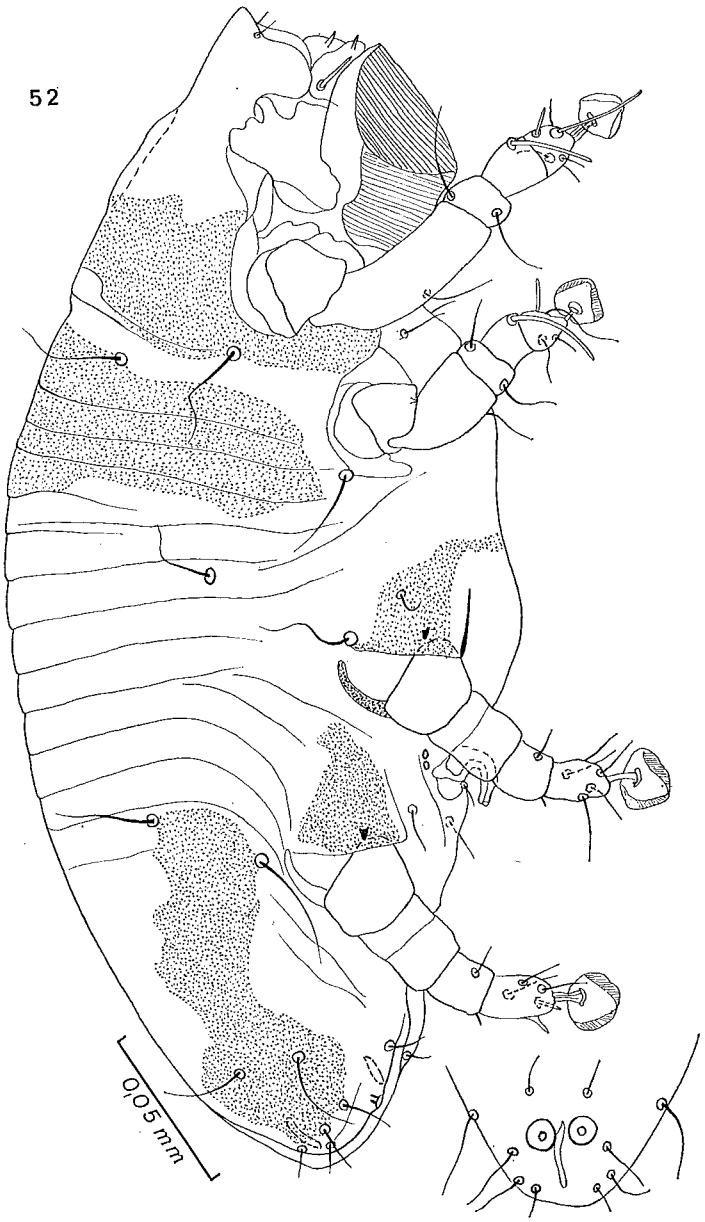

Fig. 52-52a. — *Asiochirus blarina* FAIN and HYLAND. Male holotype, lateral view (Fig. 52); male paratype, posterior extremity in ventral view (Fig. 52a).

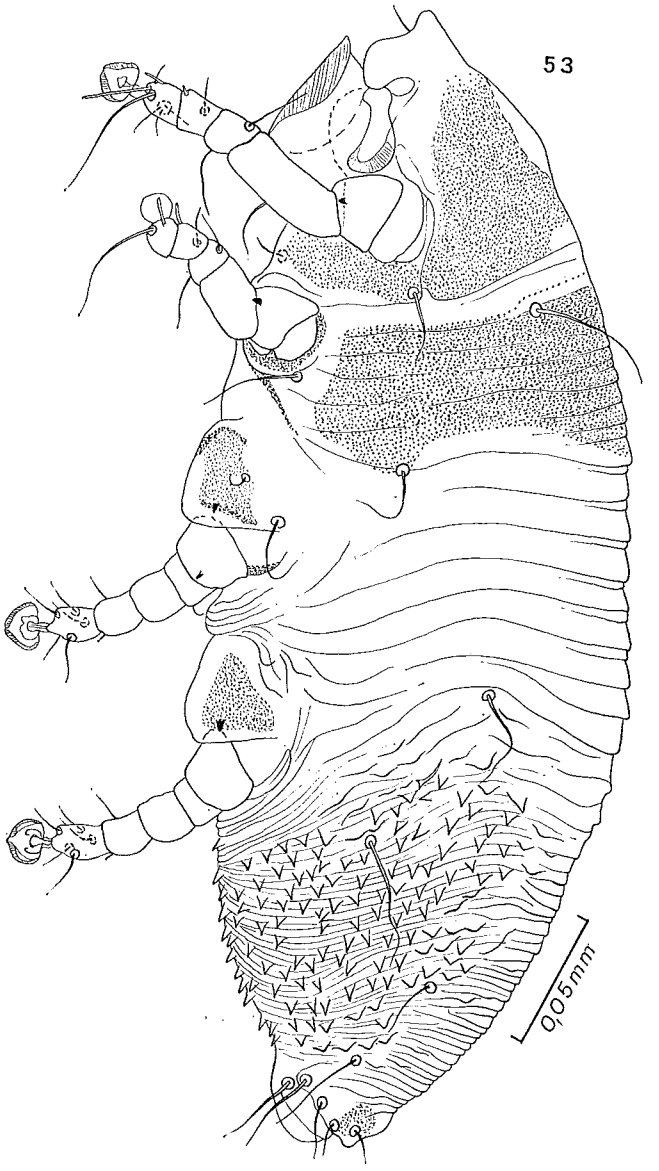

Fig. 53. — *Asiochirus blarina* FAIN and HYLAND. Female allotype.

7. Hopkinton : 30 and 31-III-1957, hosts nos. 1213 and 1460 (two males, six females and eight nymphs), coll. T. FANINNG; 22-IV-1957, no. 1462 (one male, five females, five nymphs), coll. T. FANNING.
8. Charlestown : 2 and 3-IV-1957, hosts nos. 1188 and 1454 (four males, four females and two nymphs), coll. T. FANNING.

9. Coventry : 17-IV-1957, host no. 1451 (two males, two females, six nymphs), coll. T. FANNING.

The holotype male is from South Kingstown, R. I. (host no. 1214, 2-III-1957), the allotype female was taken in Hopkinton, R. I. (host no. 1213, 31-III-1957).

McDANIEL and WHITAKER (1972) have found this species (= *Olistrophorus blarinae*) on the same host in Indiana, U. S. A.

2. Asiochirus cryptotae (McDANIEL and WHITAKER, 1972) comb. nov.

Olistrophorus cryptotae McDANIEL and WHITAKER, 1972 : 428.

We have not seen the specimens described by McDANIEL and WHITAKER but in the collection of mites that we received on loan from Dr. E. BAKER we found 5 specimens (4 females and one male) collected on the same host. These specimens were in poor condition and it was not possible to make a specific identification. As far as we could determine these mites belonged to the genus *Asiochirus* and were very close to *A. blarinae*. They are probably *A. cryptotae*.

According to McDANIEL and WHITAKER, *A. cryptotae* differs from *O. blarinae* in the male by the different shape of the penis, and in the female by the greater size of the body, the absence of the enlarged setae between the epimera IV, and in both sexes by the different shape of the propodosomal shield.

Host :

Cryptotis parva from Kleberg, Texas, U.S.A. (typical series).

From the same host, from Thomasville, Georgia, U.S.A., 13-I-1957. Coll. E. KOMARAK. Bish. no. 26947 (lot 37-5396) (specimens loaned by Dr. E. BAKER).

Types in the U.S. National Museum, Washington.

Genus Leporacarus FAIN, 1970

Leporacarus FAIN, 1970 : 277.

1. Leporacarus gibbus (PAGENSTECHER, 1861)

Listrophorus gibbus PAGENSTECHER, 1861 : 156, pl. 17, fig. 1-4; McDANIEL, 1965 : 706.
Leporacarus gibbus, FAIN, 1970b : 277 comb. nov.

McDANIEL (1965) has reported this species in the United States on *Lepus californicus.*

In the collections of the U.S. National Museum we have found two preparations which contain specimens of this species as follows: 1) Chinchilla rabbit, New Orleans, Louisiana, 1-IV-1933; 2) Rabbit, Ft. McPherson, Georgia, 20-V-1948.

Genus Geomylichus FAIN, 1970

Geomylichus FAIN, 1970b : 282.

Definition. — Postscapular shield as in the genus *Lynxacarus* RADFORD, without notches and nonpunctate median zone. A median hysterosomal shield is present in the male, and variable in the female. Setae *sc e* transformed into strong, short spines. In the male the body is separated into two well developed lobes each of which has simple setae and long membranous setae at the external reinforced edge (setae *d 5*). The penis is not surrounded in front by a sclerite in the form of a tuning fork.

This genus is separated from the genus *Lynxacarus* in both sexes, by the thorny aspect of the *sc e* setae, and, in the male, by the modified *d 5* setae, the absence of a pregenital sclerite in the form of a tuning fork, the normal form of the posterior legs, and the great elongation of the body. The male is definitely longer than the female.

Type species. — *Listrophorus dipodomius* RADFORD, 1953.

1. Geomylichus dipodomius (RADFORD, 1953)

Listrophorus dipodomius RADFORD, 1953 : 214, fig. 15.
Geomylichus dipodomius FAIN, 1970b : 282.

This species has been described on *Dipodomys spectabilis,* from Santa Fe, New Mexico, U.S.A., 11-X-1951, coll. H. MORLAN (types). ELZINGA (1964) also reported this species on *Dipodomys microps* and *Dipodomys ordii* from Lake Utah, Utah.

MCDANIEL (1965) collected it on *Dipodomys ordii* from Mustang Island, Nueces County, Texas.

Additional drawings of this species are given here. The male which is illustrated (fig. 55, 56) is from *Dipodomys ordii* (no. 1320), from Santa Fe, N. M., 10-VII-1952. It is part of Dr. Radford's collection. The female from *D. spectabilis* (fig. 54) is the type of this species and is located in the U.S. National Museum.

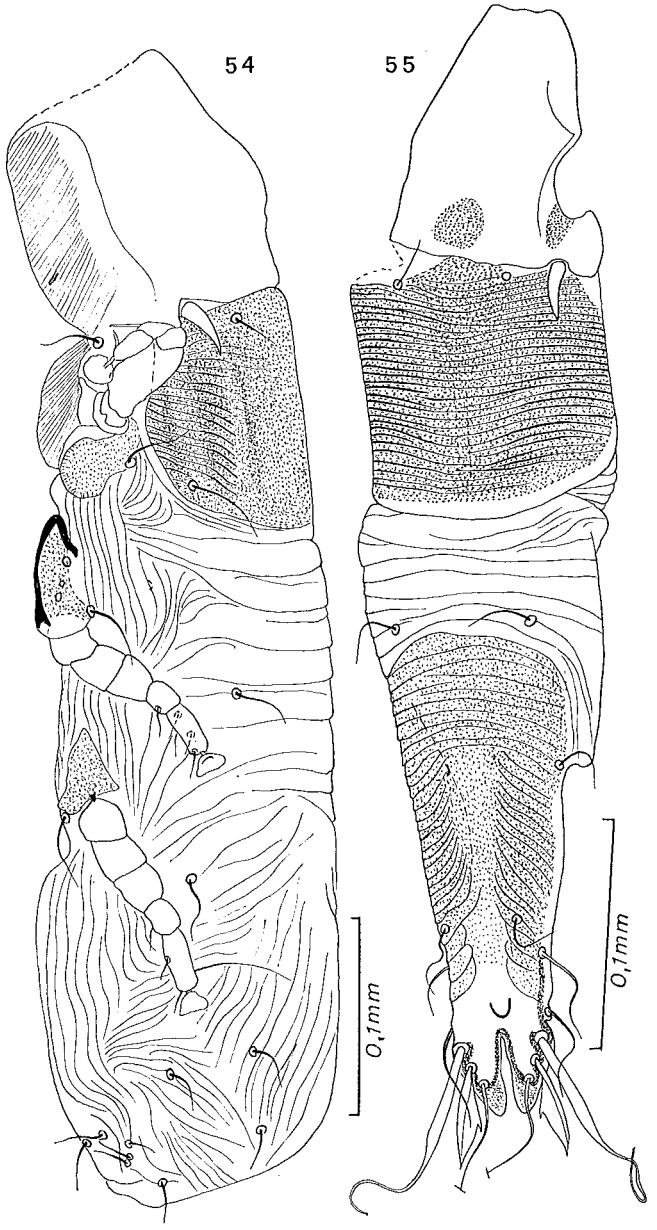

Fig. 54-55. — *Geomylichus dipodomius* (RADFORD). Female (Type from *Dipodomys spectabilis* 3020, Santa Fe, N. M., 11 oct. 1951, coll. H. B. MORLAN) (Fig. 54). Male (from *Dipodomys ordii,* Santa Fe, N. M., 11 July 1952) (Fig. 55). Both in dorsal or dorso-lateral view.

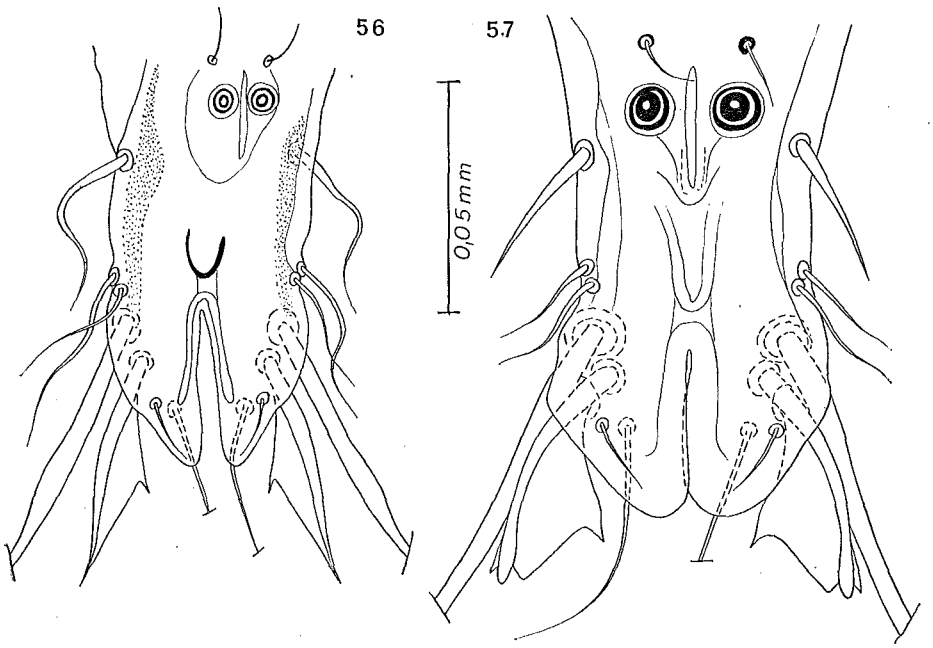

Fig. 56-57. — Ventral surface of opisthosoma of male *Geomylichus dipodomius* (RADFORD) from *Dipodomys ordii*, Santa Fe, N. M. (Fig. 56), and male *Geomylichus floridanus* (RADFORD) from *Geomys floridanus austrinus*, Falmouth, Florida, 1 Jan. 1938 (Fig. 57).

2. Geomylichus floridanus (RADFORD, 1949) comb. nov.

Listrophorus floridanus RADFORD, 1949 : 936, fig. 5; MCDANIEL, 1965 : 705.

This species is distinguished from *Geomylichus dipodomius*, in the female, by the presence of a hysterosomal shield and the great length of the *l 5* setae which measure about 250 microns (these setae are missing on the type specimen); and in the male by the different form of the foliate setae (*d 5*) whose thickened external edge has a small rounded lobe at its apex, by the greater development of the dorsal hysterosomal shield which almost entirely covers the hysterosoma, and by the greater dimensions of both the adanal suckers and the posterior lobes of the body.

Some new drawings are given here : the female (based on the type female) (fig. 58) and the male (paratype collected by E. V. KOMAREK on *Geomys floridanus austrinus* at Falmouth, Florida) (fig. 57, 59). The type female is in poor condition : the dorsal striation has become indistinct and the long posterior setae (*l 5*) have broken off.

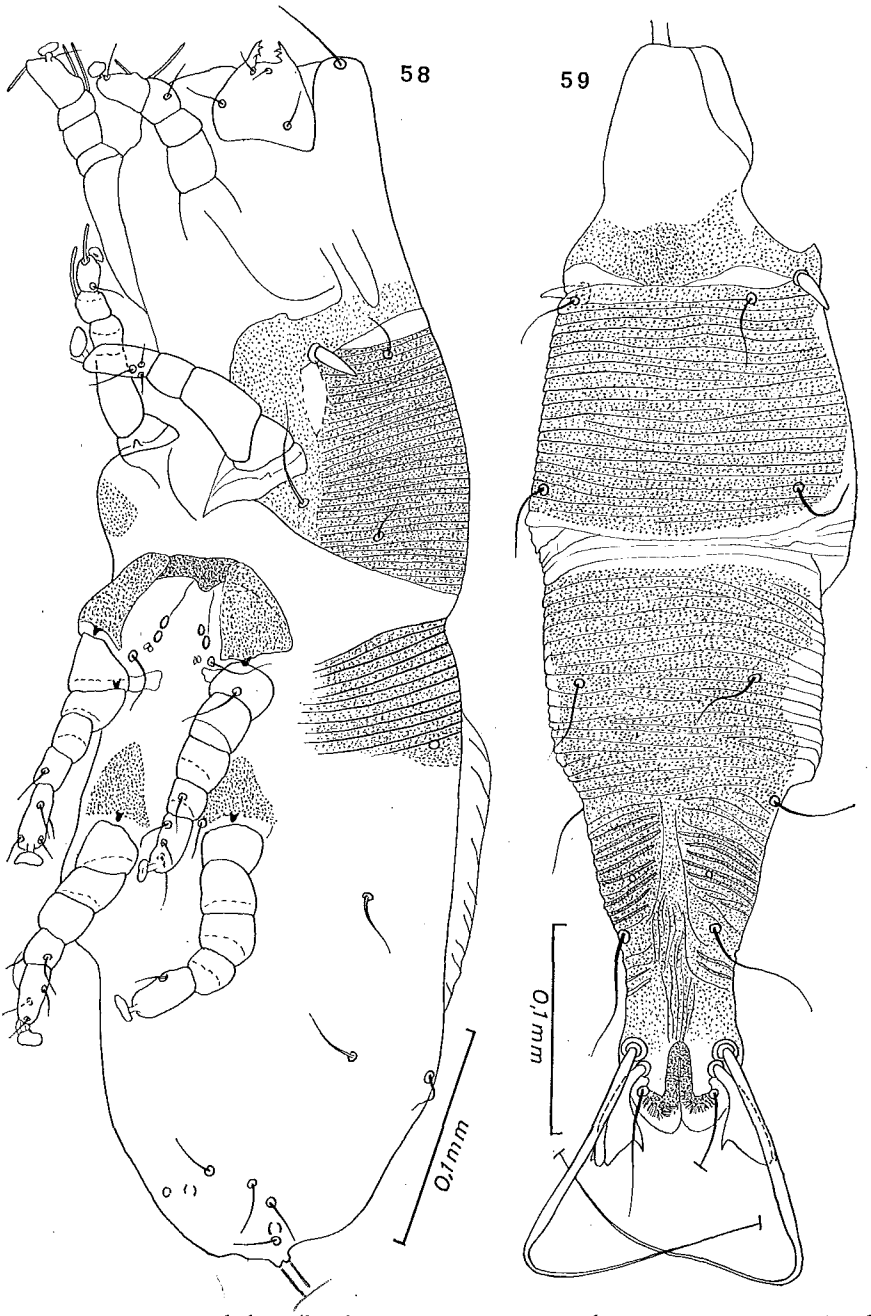

Fig. 58-59. — *Geomylichus floridanus* (RADFORD). Female type (in U. S. National Museum, Washington). (N. B. : the specimen is in bad condition, the long setae *l 5* are lost and the cuticular striations are indistinct) (Fig. 58). Male from *Geomys floridanus austrinus*, Falmouth, Florida, 1 Jan. 1938) (Fig. 59).

Hosts and localities :

1. *Geomys tuza tuza,* from Folkston, Georgia, U.S.A., 20-II-1936 (coll. F. HARPER) (types). We have seen three specimens (two females and one male) of the typical series and they are completely crushed and in very bad condition (U.S. National Museum collection).
   Other specimens of this same host, but from other localities include : Mayo, Florida, 1-I-1938, coll. E. V. KOMAREK (one female); Allapoha A. and H'way 84, Georgia, 11-XI-1937, coll. E. V. KOMAREK (two. nymphs); Ellaville, Florida, 1-I-1938, coll. E. V. KOMAREK (one female). These specimens are in the U.S. National Museum.
2. *Geomys floridanus austrinus :* St. Marks, Florida, 7-II-1935, coll. E. V. KOMAREK (one male); Dowling Park, Florida, 1-I-1938, coll. E. V. KOMAREK (two females); Falmouth, Florida, 1-I-1938, coll. E. V. KOMAREK (one female); Gainesville, Florida, 30-X-1951, coll. A. TISSOT (two males, one female) and 30-V-1938, coll. E. V. KOMAREK (one female); Wakalla, Florida, 7-II-1935, coll. E. V. KOMAREK (one female). All these specimens are in the U.S. National Museum.
3. Pocket Gopher : Tallahassee, Florida, XI-1936, coll. B. TRAVIS (four females, two males). Specimens in the U.S. National Museum.

3. Geomylichus klebergi (McDANIEL, 1965) comb. nov.

Listrophorus klebergi McDANIEL, 1965 : 706, fig. 1-6.

This species is probably distinguished from the two other species of the genus, in the female, by the absence of a combined hysterosomal shield, and by the presence of very long *l 5* setae. The male seems very near to *G. dipodomius.*

It should be noted that McDANIEL, in his original description, omitted giving the dimensions (length, width) of his specimens. We have not seen specimens of this species.

Hosts and localities :

Sigmodon hispidus texianus, near Kingsville, Texas, 22-IV-1963 (types). Types in the U.S. National Museum.

SUBFAMILY APLODONTOCHIRINAE FAIN and HYLAND, 1972

Definition. — This subfamily is distinguished from the subfamily Listrophorinae by the following characteristics :

1. Tegmen flat, slightly sclerotized and not covering the anterior extremity of the palps.

2. Coxae II widely separated from each other. The sternal region is very wide and completely covered with chitinous striated membranes which extend from the epigynium to the gnathosoma. These membranes become free towards the front and cover the posterior third of the gnathosomal base; nevertheless, these membranes remain flat and are not curved to form grooves as one observes in the Listrophorinae.
3. Palps enveloped by large membranes.
4. Legs I stronger than legs III and modified into an organ of attachment : they are sinuous and form an « S » with tibia curved outward and the tarsus and ambulacrum curved inward.
5. Body very flattened.

Type genus. — *Aplodontochirus* FAIN and HYLAND, 1972.

The mites of this subfamily are intermediary between the Atopomelidae and the Listrophoridae. Affinities with the former include the flattening of the body, the manner of fixation for legs I, and the absence of a chitinous gnathosomal groove. Similarities with the latter are the presence of a tegmen and the normal form of legs III and IV with the tibia and the tarsus free. They are difficult to classify with certainty. Nevertheless, we think they have greater affinity with the Listrophoridae.

Genus Aplodontochirus FAIN and HYLAND, 1972

Aplodontochirus FAIN and HYLAND, 1972 : 176.

1. Aplodontochirus borealis FAIN and HYLAND, 1972

Aplodontochirus borealis FAIN and HYLAND, 1972 : 176.

Female (holotype) (fig. 60, 63, 64). — Length 336 microns, maximum width 141 microns. Body very flattened.

Dorsal face. — Tegmen punctuate only on its posterior half. There is a large postscapular shield which has transverse striations some of which are incomplete. Hysterosoma with a large shield on its anterior three-quarters which is striated transversaly. Posterior to this shield the cuticle bears scales.

Ventral face : Legs inserted laterally. The anterior legs are widely separated, and the sternal region is covered with large striated chitinous membranes. Medial to coxae II there is a chitinous edge which delimits, externally, the pilicolous groove. Opisthosoma striated, punctate on its anterior who-thirds and scaly on its posterior third. Legs well developed, and terminate in large suckers. The ambulacra of legs I and II are curved on the inside.

Male (allotype) (fig. 61, 62, 65). — Length 310 microns, width 134 microns.

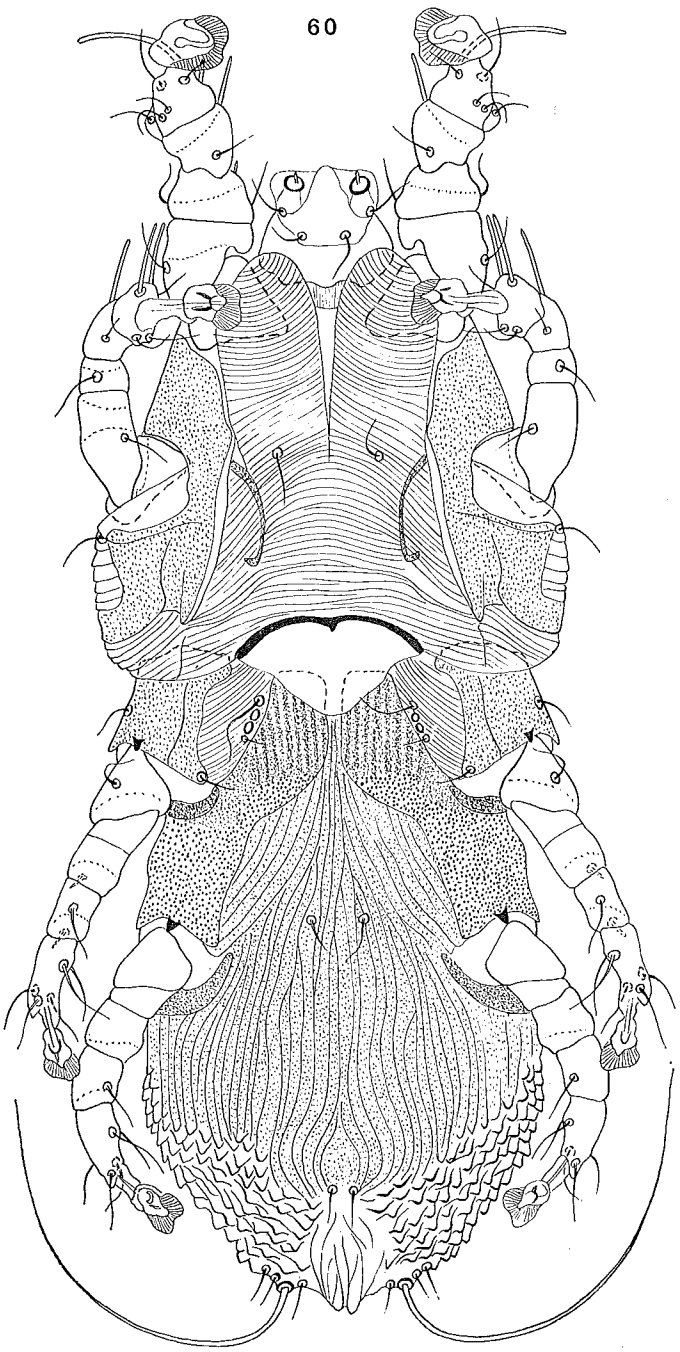

Fig. 60. — *Aplodontochirus borealis* FAIN and HYLAND.
Female holotype in ventral view (Fig. 60).

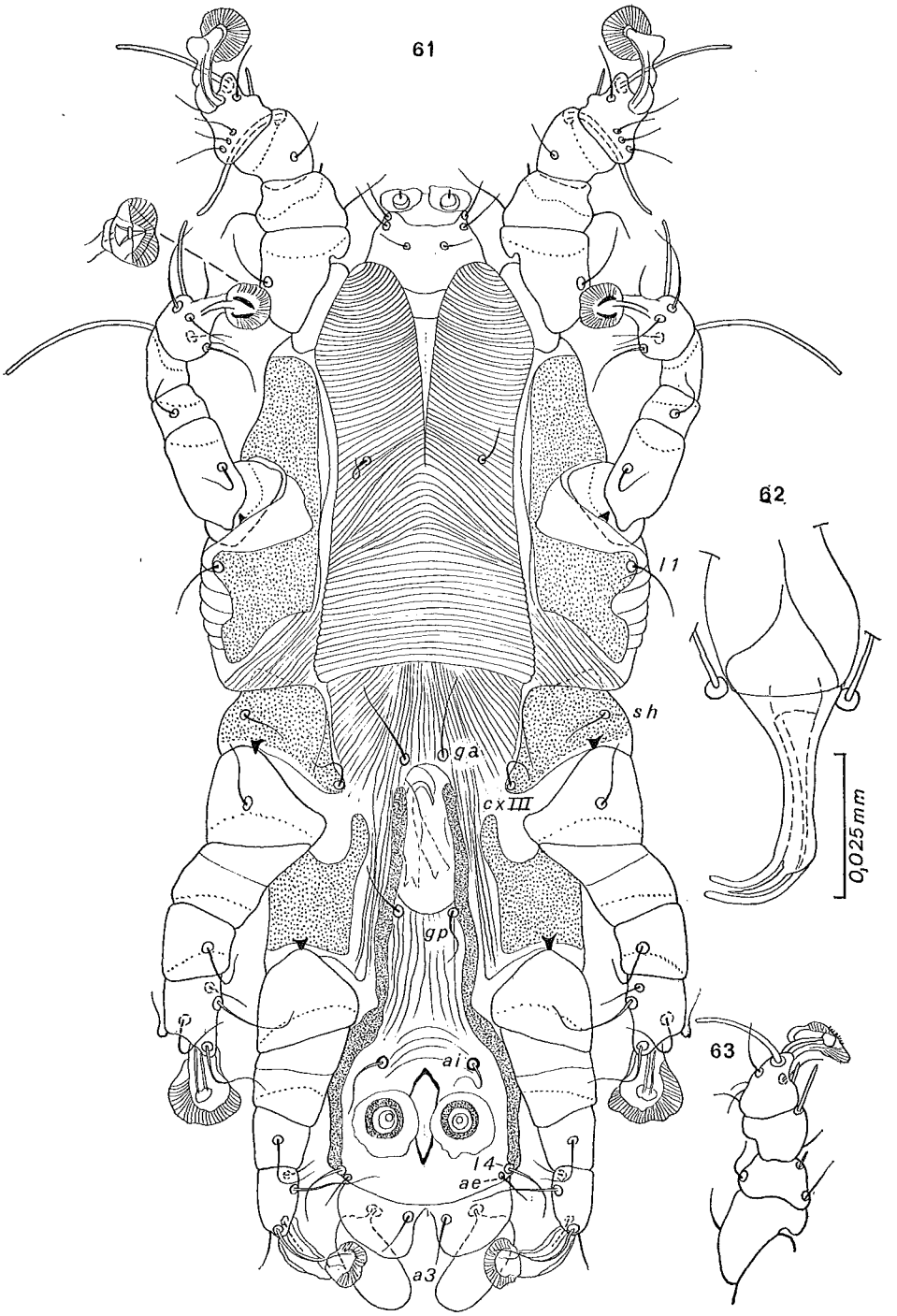

Fig. 61-63. — *Aplodontochirus borealis* FAIN and HYLAND. Male allotype in ventral view (Fig. 61); penis (Fig. 62). Female, leg I in dorsal view (Fig. 63).

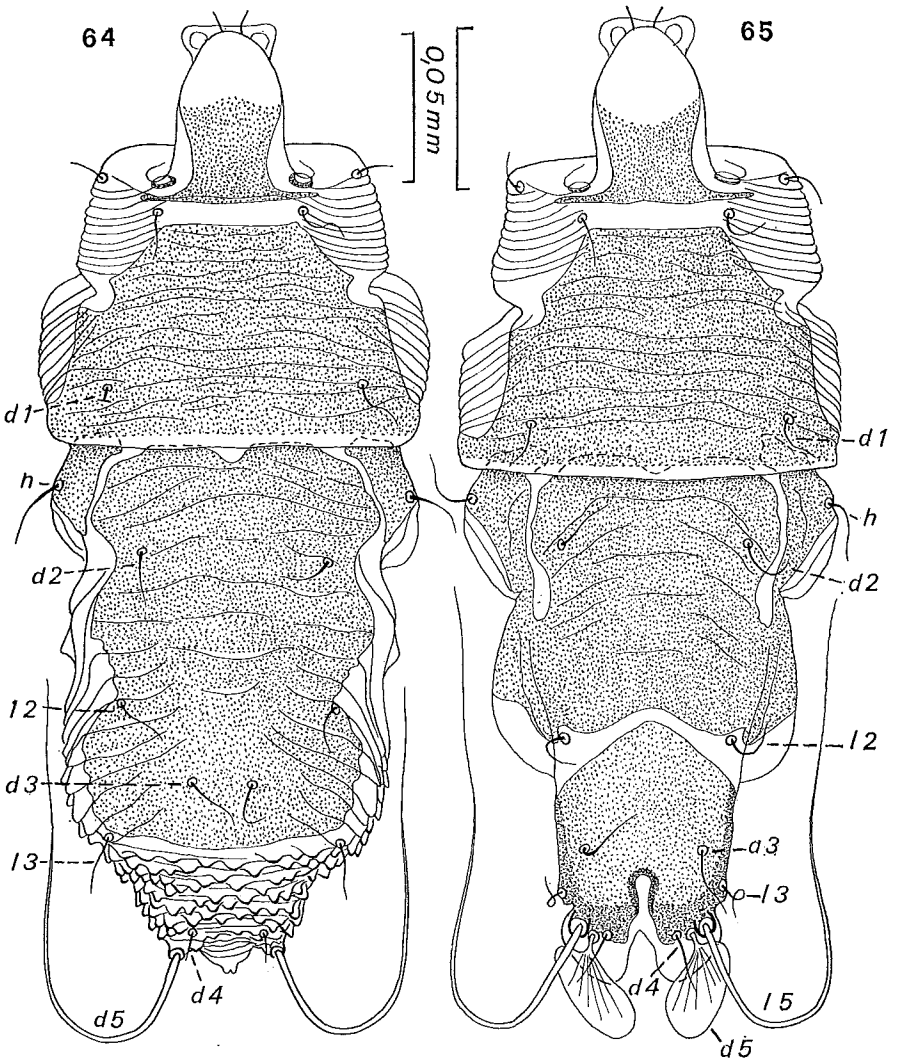

Fig. 64-65. — *Aplodontochirus borealis* FAIN and HYLAND.
Female (Fig. 64) and male (Fig. 65) in dorsal view.

Dorsal face as in the female but the hysterosoma is almost entirely covered with two unequal shields. Posterior extremity separated into two fairly well developed lobes. Ventrally : anterior region as in the female. Posterior legs strong, legs III stronger than legs IV. Penis ending in three cylindrical lobes. The region of the penis is flanked on either side by two sclerified bands which continue backwardly as far as the posterior extremity of the body. Setae *d 5* are membranous and wide.

Hosts and localities :

On *Aplodontia rufa rufa* from Seattle, Washington, 3-IV-1940, coll. W. W. DALQUEST (no. 22. lot. 40-13773). Holotype and six female paratypes plus allotype and two male paratypes. Types in the U. S. National Museum.

COLLECTION DATA FOR PRINCIPAL RHODE ISLAND RODENTS HARBORING LISTROPHORID MITES

1) *Ondatra zibethica*

— South Kingstown : Host no. 74, coll. D. ZINN, 2-I-1956; Host no. 76, coll. J. SULLIVAN, 6-I-1956; Host no. 80, coll. J. SULLIVAN, 9-I-1956; Host no. 82, 84, 85, 86, coll. J. SULLIVAN, 11-I-1956; Host no. 87, coll. J. SULLIVAN, 13-I-1956; Host no. 796, 809, 810, coll. R. GUGUIERE and J. SULLIVAN, 29-XI-1956.

— North Kingstown : Host no. 902, coll. J. ABRAMS, 12-XII-1956.

— Manville: Host no. 524, coll. J. CRONAN, 1-VIII-1956.

— Scituate : Host no. 650, coll. W. MULHEARN, 29-VIII-1956.

— Scituate Reservoir : Host no. 742, coll. W. MULHEARN, 28-VIII-1956.

— Burrillville : Host no. 740, 744, 1026, coll. W. MULHEARN, 14-VIII-1956.

— East Providence : Host no. 872, coll. W. MULHEARN, 4-VIII-1956.

— Newport : Host no. 1164, 1243, coll. L. BARBER, 22-XII-1956.

2) *Microtus pennsylvanicus*

— Kingston : Host no. 1144, coll. T. FANNING, 12-III-1956; Host no. 254, coll. C. HOUSTON, 1-V-1956.

— South Kingstown : Host no. 1589, coll. D. ZINN, 21-XI-1958; Host no. 1590, coll. D. ZINN, 1-XII-1958.

— Richmond : Host no. 92, coll. T. FANNING, 20-I-1956.

— Jamestown : Host no. 171, coll. T. FANNING, 3-IV-1956; Host no. 184, coll. T. FANNING, 4-IV-1956; Host no. 1179, coll. L. BARBER, 30-XII-1956.

— Greenville: Host no. 244, coll. T. FANNING, 19-IV-1956.

— Narragansett : Host no. 444, coll. W. MULHEARN, 11-VII-1956.

— Patience Island : Host no. 459, coll. T. FANNING, 13-VI-1956.

— Dutch Island : Host no. 498 and 505, coll. T. FANNING and J. CRONAN, 14-VI-1956.

— Block Island : Host no. 753, 765, 771, 773, coll. K. HYLAND, J. CRONAN and J. ABRAMS, 25-X-1956; Host no. 803, 931, coll. E. FIELDER, 26-X-1956.

— Newport : Host no. 1108, 1112, 1113, 1115, coll. L. BARBER, 20-XII-1956.
— Coventry : Host no. 1382, coll. L. BARBER, 16-XI-1956.
— Barrington : Host no. 600, coll. H. GIBBS, 13-VII-1956.
— Cumberland : Host no. 613, coll. W. MULHEARN and L. BARBER, 3-VIII-1956.
— Scituate : Host no. 637, coll. W. MULHEARN and L. BARBER, 28-VIII-1956.
— Portsmouth : Host no. 977 and 978, coll. L. BARBER, 21-XII-1956.
— West Greenwich : Host no. 1362, coll. L. BARBER, 27-XII-1956; Host no. 1457, coll. T. FANNING, 20-II-1957.

3) *Microtus* sp.

— Block Island : Host no. 753, 754, 755, 759, 765, 771, 772, 773, coll. J. ABRAMS et al, 25-X-1956; Host no. 804 and 908, coll. A. BROOKS, 26-X-1956.

4) *Clethrionomys gapperi*

— Hopkinton : Host no. 202, coll. T. FANNING, 10-IV-1956; Host no. 208 and 209, coll. T. FANNING, 12-IV-1956; Host no. 1491, coll. J. CRONAN, 3-XII-1956.
— Burrillville : Host no. 371, coll. T. FANNING, 22-VI-1956; Host no. 1047 and 1049, coll. W. MULHEARN and L. BARBER, 14-VIII-1956.
— Foster : Host no. 945, coll. W. MULHEARN and L. BARBER, 16-VIII-1956.
— West Warwick : Host no. 1248 and 1249, coll. L. BARBER, 24-XI-1956; Host no. 1360, coll. L. BARBER, 27-XII-1956.
— Scituate : Host no. 1255, coll. W. MULHEARN and L. BARBER, 31-VIII-1956.
— East Greenwich : Host no. 1357, coll. L. BARBER, 30-X-1956; Host no. 1458, coll. L. BARBER, 6-XI-1956.
— West Greenwich : Host no. 1358 and 1359, coll. L. BARBER, 27-XII-1956.
— North Kingstown : Host no. 1468, coll. T. FANNING, 12-IV-1957.

5) *Pitymys pinetorum scalopsoides (=Microtus pinetorum scalopsoides)*

— East Greenwich : Host no. 736, 737, coll. L. BARBER, 13-X-1956.
— Richmond : Host no. 844, coll. D. BLAIS, 21-IX-1956.
— Scituate : Host no. 924, coll. W. MULHEARN, 6-IX-1956; Host no. 1000, coll. W. MULHEARN, 15-VIII-1956.
— Foster : Host no. 943, coll. W. MULHEARN, 16-VIII-1956.
— Westerly : Host no. 1126, coll. L. BARBER, 30-IX-1956.

ACKNOWLEDGMENTS

We wish to thank our colleagues who kindly sent us on loan, types, paratypes or specimens from their collections. Especially we wish to thank Dr. E. W. BAKER, U. S. National Museum of Natural History; Madame H. DUBININA, Academy of Science, Leningrad; Mr. K. H. HYATT, British Museum (Natural History); Dr. H. LEVI, Harvard University; Dr. B. MC DANIEL, South Dakota State University, Brookings; Dr. J. O. WHITAKER Jr, Indiana State University and the late Dr. C. D. RADFORD, Torquay, England. We wish to thank also Dr. S. K. NAGAR, Delhi College, Delhi, India, for his assistance in the preparation and identification of the material in the University of Rhode Island collection.

HOST LIST OF THE LISTROPHORIDAE IN NORTH AMERICA

N. B. : * = type host; ** = type species

Species	Host	Order, family and subfamily of the host	Locality and reference No. (p. w. = present work)
FAMILY LISTROPHORIDAE MEGNIN and TROUESSART, 1884			
SUBFAMILY LISTROPHORINAE MEGNIN and TROUESSART, 1884			
Genus *Listrophorus* PAGENSTECHER, 1861			
		RODENTIA :	
L. validus BANKS, 1910	* *Ondatra zibethica zibethica* (L.)	Cricetidae, Microtinae	Canada (1) U. S. A. (p. w.)
L. dozieri RADFORD, 1944	* *Ondatra zibethica macrodon* (MERRIAM)	Cricetidae, Microtinae	U. S. A. (26)
L. americanus RADFORD, 1944	* *Ondatra zibethica macrodon* (MERRIAM)	Cricetidae, Microtinae	U. S. A. (26)
L. ondatrae FAIN, KOK and LUKOSCHUS, 1970	* *Ondatra zibethica zibethica* (L.)	Cricetidae Microtinae	Canada (18) U. S. A. (p. w.)
L. faini DUBININA, 1972	* *Ondatra zibethica* (L.)	Cricetidae, Microtinae	U. S. A. (p. w.)
L. kingstownensis FAIN and HYLAND, 1973	* *Ondatra zibethica* (L.)	Cricetidae, Microtinae	U. S. A. (15)
L. mexicanus mexicanus FAIN, 1970	* *Microtus mexicanus* (SAUSSURE)	Cricetidae, Microtinae	Mexico (12)
L. mexicanus squamiferus FAIN and HYLAND, 1972	* *Clethrionomys gapperi* (VIGORS)	Cricetidae, Microtinae	U. S. A. (14)
	Microtus p. pennsylvanicus (ORD.)	Cricetidae Microtinae	Canada U. S. A. (19)
	Microtus pennsylvanicus (ORD.)	Cricetidae Microtinae	U. S. A. (p. w.)
	Microtus sp.	Cricetidae Microtinae	U. S. A. (p. w.)
	Peromyscus leucopus (FISCHER)	Cricetidae Cricetinae	U. S. A. (p. w.)
L. phenacomys FAIN and HYLAND, 1972	* *Phenacomys* sp.	Cricetidae, Microtinae	Canada (17)

HOST LIST OF THE LISTROPHORIDAE IN NORTH AMERICA *(continued)*

Species	Host	Order, family and subfamily of the host	Locality and reference No. (p. w. = present work)
	Phenacomys intermedius MERRIAM	Cricetidae, Microtinae	Canada (p. w.)
L. pitymys FAIN and HYLAND, 1972	* *Pitymys pinetorum scalopsoides* (AUDUBON and BACHMAN) (= *Microtus p. scalopsoides)*	Cricetidae, Microtinae	U. S. A. (17)
	Microtus pennsylvanicus (ORD.)	Cricetidae, Microtinae	U. S. A. (p. w.)
		INSECTIVORA :	
	Blarina brevicauda (SAY)	Soricidae Soricinae	U. S. A. (p. w.)
		RODENTIA :	
L. dicrostonyx FAIN and HYLAND, 1972	* *Dicrostonyx* sp.	Cricetidae, Microtinae	Canada (17)
L. neotomae FAIN and HYLAND, 1973	*Neotoma micropus* BAIRD	Cricetidae, Cricetinae	U. S. A. (15)
	* *Neotoma* sp.	Cricetidae, Cricetinae	U. S. A. (p. w.)
L. Synaptomys	* Synaptomys cooperi	Microtidae	USA
	Genus *Prolistrophorus* FAIN, 1970		
		RODENTIA :	
P. bakeri (RADFORD, 1949)	* *Sigmodon hispidus texianus* (AUDUBON and BACHMAN)	Cricetidae Cricetinae	U. S. A. (27, 17)
	Rice rat	Cricetidae	U. S. A. (p. w.)
P. sparsilineatus FAIN, 1970	* *Peromyscus g. gossipinus* (LE CONTE)	Cricetidae Cricetinae	U. S. A. (12; p. w.)
	Cotton mouse	Cricetidae	U. S. A. (p. w.)
P. grassii (RADFORD, 1954)	* *Oryzomys palustris* (HARLAN)	Cricetidae Cricetinae	U. S. A. (30)
	Genus *Lynxacarus* RADFORD, 1951		
		CARNIVORA :	
** *L. morlani* RADFORD, 1951	* *Lynx rufus floridanus* RAFINESQUE	Felidae	U. S. A. (28)

HOST LIST OF THE LISTROPHORIDAE IN NORTH AMERICA *(continued)*

Species	Host	Order, family and subfamily of the host	Locality and reference No. (p. w. = present work)
L. mustelae (MEGNIN, 1885)	*Mustela frenata noveboracensis* (EMMONS)	Mustelidae Mustelinae	U. S. A. (p. w.)
L. nearcticus FAIN and HYLAND, 1973	* Mink	Mustelidae	U. S. A. (15)
	Mustela noveboracensis	Mustelidae Mustelinae	U. S. A. (p. w.)
	Chipmunk	Sciuridae Sciurinae	? (p. w.)
	Genus *Asiochirus* FAIN, 1970 (= *Olistrophorus* MCDANIEL and WHITAKER, 1972)		
		INSECTIVORA :	
A. blarina FAIN and HYLAND, 1972	* *Blarina brevicauda* (SAY)	Soricidae Soricinae	U. S. A. (17, 21)
Asiochirus cryptotae (MCDANIEL and WHITAKER, 1972)	* *Cryptotis parva* (SAY)	Soricidae Soricinae	U. S. A. (21, p. w.)
	Genus *Leporacarus* FAIN, 1970		
		LAGOMORPHA :	
** L. *gibbus* (PAGENSTECHER, 1861)	*Lepus californicus* GRAY	Leporidae Leporinae	U. S. A. (19)
	Chinchilla rabbit (sic.)	Leporidae Leporinae	U. S. A. (p. w.)
	Rabbit	Leporidae	U. S. A. (p. w.)
	Genus *Geomylichus* FAIN, 1970		
		RODENTIA :	
** *G. dipodomius* (RADFORD, 1953)	* *Dipodomys spectabilis* MERRIAM	Heteromyidae, Dipodomyinae	U. S. A. (29, 19)
	Dipodomys microps (MERRIAM)	Heteromyidae, Dipodomyinae	U. S. A. (19)

HOST LIST OF THE LISTROPHORIDAE IN NORTH AMERICA *(continued and end)*

Species	Host	Order, family and subfamily of the host	Locality and reference No. (p. w. = present work)
	Dipodomys ordii WOODHOUSE	Heteromyidae, Dipodomyinae	U. S. A. (19)
G. floridanus (RADFORD, 1949)	* *Geomys tuza tuza* BARTON (= *G. p. pinetis* RAF.)	Geomyidae Geomyinae	U. S. A. (27)
	Geomys floridanus austrinus BANGS (= *G. pinetis austrinus*)	Geomyidae Geomyinae	U. S. A. (27)
G. klebergi (MCDANIEL, 1965)	* *Sigmodon hispidus texianus* (AUDUBON and BACHMAN)	Cricetidae Cricetinae	U. S. A. (19)
SUBFAMILY APLODONTOCHIRINAE FAIN and HYLAND, 1972			
Genus *Aplodontochirus* FAIN and HYLAND, 1972			
		RODENTIA :	
** *A. borealis* FAIN and HYLAND, 1972	* *Aplodontia r. rufa* (RAFINESQUE)	Aplodontiidae	U. S. A. (17)

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