

**PROTOMYOBIA INDIANENSIS, N. SP. (ACARI: MYOBIIDAE)  
PARASITIC ON SOREX LONGIROSTRIS  
FROM INDIANA, USA**

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**Abstract.** A new species of Myobiidae, *Protomyobia indianensis* n. sp., is described from a shrew, *Sorex longirostris*, from Indiana, USA. A key is given to the species in this genus. Based upon morphological characteristics, 2 groups of species may be distinguished. One is the *nodosa* group, formed of 3 species parasitic on Oriental Blarinini; the other is the *claparedei* group formed of 6 species, of which 5 are found on Nearctic and Palearctic Soricini and 1 on Nearctic Blarinini.

Four species of myobiid mites in the genus *Protomyobia*, *P. americana* McDaniel, *P. brevisetosa* Jameson, *P. claparedei* (Poppe), and *P. onoi* Jameson & Dusbábek, were previously known from North American mammals (Whitaker & Wilson 1974, Fain & Lukoschus 1976). A new species of this genus is here described from the Southeastern Shrew, *Sorex longirostris*, from Indiana, USA. All measurements are in micrometres ( $\mu\text{m}$ ).

**Protomyobia indianensis** Fain, Whitaker & French,  
new species FIG. 1-8

♀ (Fig. 1-6). Holotype 360 long (including gnathosoma) and 225 wide. In 4 paratypes lengths range from 330-350, widths from 230-250. *Dorsum* (Fig. 2). Setae *v i* 7 long; *v e*, *sc e* and *l 1* strong and long, with a slight ventral thickening of their basal  $\frac{1}{2}$  and 95, 130 and 150 long, respectively. Setae *sc i* 9, more posterior than *sc e*. Setae *d 1*, *d 2*, *l 2* subequal, slightly curved, thin and 6-9 long. Distance between *d 3* and *l 2* greater (42-45) than distance between *l 2* and *d 2*. Setae *d 4* thick, 29-31, curved apically and with apex slightly swollen. Setae *l 3*, *l 4* and *d 5* thin, 6-7. Genital area: lateral vulvar lobes poorly marked; 5 pairs of genitoanal setae (4-12) (Fig. 3). A chitinous structure visible in depth of genital area (Fig. 4). *Venter* (Fig. 1). Setae *ic 1*, *ic 2* and *ic 3* 70, 70 and 75, respectively; setae *ic 4* slightly curved, 10. Gnathosoma 36 long and 33 maximum width; ventral surface with 2 pairs of unequal setae, the anterior and posterior pair 10 and 50, respectively. *Legs*. I-IV with 2-2-1-1 claws, respectively. On leg II claws unequal, 1 forked apically. Leg I: see Fig. 5, 6. Number of setae on legs II-IV: coxae 2-3-0-0; trochanters 2-3-3; femora 5-3-3; genua 6-5-5; tibiae 6-6-6; tarsi 7-6-6.

♂ (Fig. 7, 8). Allotype 262 × 165. *Dorsum* (Fig. 8). Setae *v i* 3. Setae *v e*, *sc e* and *l 1* thick and inflated ventrally in their basal  $\frac{1}{2}$ , and 72, 75 and 100, respectively. Seta *sc i* 6. Setae *d*

*l 11*, *d 2* 18, both thick and curved. Genital orifice at level of *l 1*, flanked by 2 pairs of thin setae 3-4; in front of these setae are 4 pairs of microsetae. Setae *d 4*, *d 5* and *l 4* 6. Penis thick, sinuous, 75 long; its apex twisted, directed posteriorly. *Venter*. Setae *ic 1* as long (9-10) as the internal seta of coxa I. Setae *ic 2* 9-10, setae *ic 3* 35, setae *ic 4* 6. Gnathosoma and legs as in female, except that ventral surface of genu I lacks a striated ovoid seta.

**Host and locality data.** All type specimens from Southeastern Shrews, *Sorex longirostris*, USA: Indiana: Vigo Co., Thomas W. French. coll. Holotype ♀, 5 paratype ♀ (Ind. State Univ. Coll. #5218), Coal Creek 6 mi. (9.6 km) NW Terre Haute, 30.III.1977. Allotype ♂, 1 ♀ paratype (ISU 5313) 2 mi. (3.2 km) W Terre Haute, 14.VIII.1979. Four ♀ paratypes (ISU 5306), Pseudacris study area, 6 mi. (9.6 km) NE Terre Haute, 11.IV.1978. Holotype in U.S. National Museum of Natural History, Washington, D.C.

**Remarks.** *Protomyobia indianensis*, n. sp., belongs to a group of 3 species parasitic on *Sorex* spp. from Palearctic or Nearctic regions: *P. nipponensis* Ono & Uchikawa, 1975; *P. onoi* Jameson & Dusbábek, 1971; and *P. brevisetosa* Jameson, 1948. It is closest to *P. nipponensis*, described from *Sorex shinto* from Japan. The female differs from this species by the smaller size of the body (average 345 × 238, as opposed to 416 × 280 in *P. nipponensis*), by the more posterior placement of setae *d 3*, which are distinctly separated from the group of *d 1*, *d 2* and *l 2* setae (in *P. nipponensis* the distance *d 3-l 2* is equal to the distance *l 2-d 2*), by the smaller size of *d 1*, *d 2* and *l 2* (6 to 9, compared to 8-13 in *nipponensis*). The male differs in having much shorter setae *ic 2* (9-10) (long in *nipponensis*); moreover the body size is much smaller (262 × 165, vs. 308 × 190 in *nipponensis*). We have compared our specimens with male and female paratypes of *P. onoi* and with specimens of both sexes of *P. brevisetosa* from the typical host.

Our species differs from *P. brevisetosa* in the female by the relatively longer *ic 1* setae, which are equal to *ic 2* (in *P. brevisetosa* these setae are  $\frac{1}{2}$  as long as *ic 2*), longer *d 1* and *d 2* (6-9, 4-5 in *P.*

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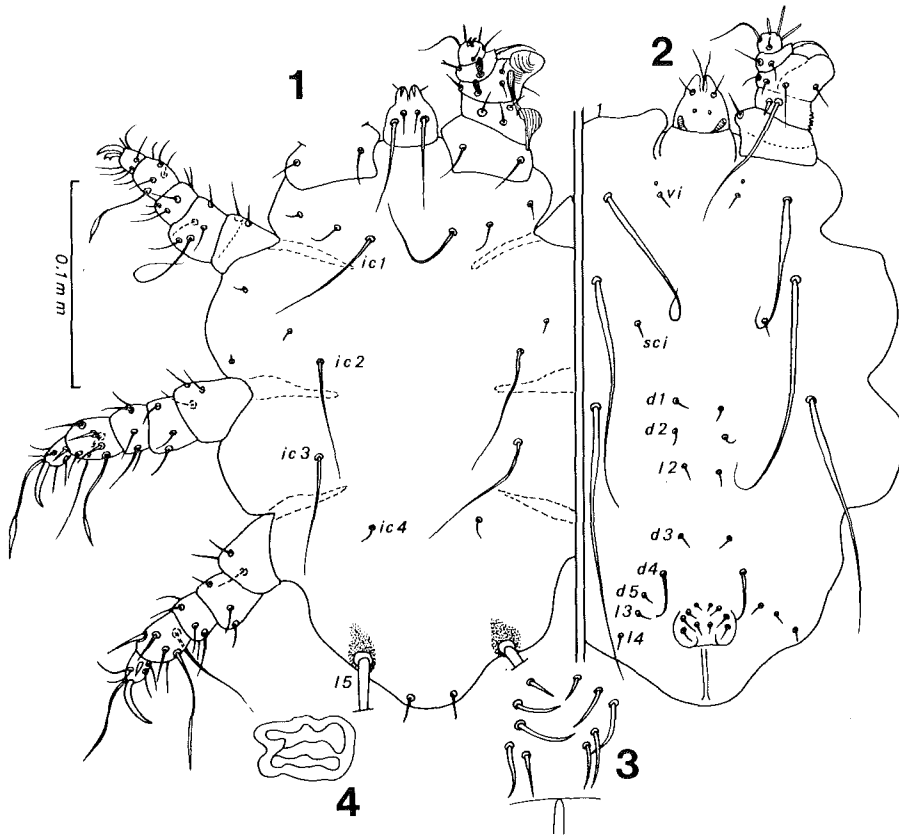


FIG. 1-4. *Protomyobia indianensis*, n. sp. ♀: 1, venter; 2, dorsum; 3, genital-anal area; 4, internal genital sclerite.

*brevisetosa*), relatively shorter *d4* (30) compared to *d1* and *d2* (in *P. brevisetosa* *d4* are 38), distinct ventral thickening of setae *v e*, *s c e* and *l1* close to their bases, narrower gnathosoma, and presence of a striated ovoid seta on ventral surface of genu I (absent in *P. brevisetosa*). The male is distinguished from that of *P. brevisetosa* by the very short *ic2* (9-10, as opposed to 40-45 in *P. brevisetosa*) and the thicker aspect of the aedeagus.

*P. indianensis*, n. sp., differs from *P. onoi* in the female by the shorter *d1*, *d2* and *l2* (6-9, 19-20 in *P. onoi*), while *d4* are about the same length (29-31) in both species; moreover, *v i*, *s c i*, *d1*, *d2*, *d3*, *d5*, *l2*, *l3* and *l4* are subequal in length in the new species, while in *P. onoi* *d1*, *d2* and *l2* are distinctly longer than these other setae. Also, the body is smaller (average for 5 paratypes: length 345 × width 238, vs. 407 × 290 in *P. onoi*). The male differs from that of *P. onoi* by the much shorter *ic2* (10, vs. 45 in *P. onoi*), and the slightly shorter internal seta of coxa I, which is shorter than *ic1*; in *P. onoi* the reverse is true. We conclude that *P. indianensis* is a new species closer to *P. nipponensis* and to *P. onoi* than to *P. brevisetosa*.

#### Division of the genus *Protomyobia*

Two groups of species mainly separated by their chaetotaxy may be distinguished in the genus *Protomyobia*. One, the *nodosa* group, comprises 3 species parasitic on Oriental Blarinini. The other, the *claparedei* group, comprises 6 species, of which 5 are found on Palaearctic and Nearctic Soricini and 1 on Nearctic Blarinini. It is interesting that the male of the last species (*P. americana* McDaniel, 1967) is somewhat intermediate between the 2 groups.

Four species of *Protomyobia* were previously known from North America, all of them in the *claparedei* group. *P. brevisetosa* occurs on most of the western species of *Sorex* and in the east on *Sorex fumeus* (Whitaker & Wilson 1974; Whitaker, unpubl. data). *Sorex fumeus* occurs in southeastern Canada and northeastern U.S. south through the Appalachians to extreme western North Carolina and extreme northeastern Georgia. *P. claparedei* is known from the Eurasian hosts *Sorex araneus*, *S. minutus* and *S. alpinus*, and Jameson & Dusbábek (1971) state that *P. claparedei* probably entered

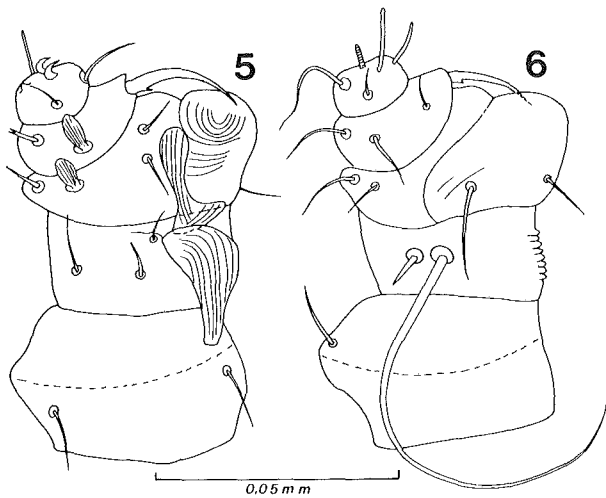


FIG. 5, 6. *Protomyobia indianensis*, n. sp. ♀ leg I: 5, ventral view; 6, dorsal view.

North America on *Sorex cinereus* or its progenitor. In North America, *P. claparedei* presently occurs on *Sorex cinereus* and *Sorex palustris*. *P. americana* is closely related to *P. claparedei* (Poppe, 1896) and was originally described as a subspecies of that species. In North America *P. americana* occurs on *Blarina brevicauda* and *Cryptotis parva* (Jameson & Dusbábek 1971, Whitaker & Wilson 1974).

Both *Protomyobia claparedei* and *P. brevisetosa* have been taken on *Sorex palustris* (Whitaker & Wilson 1974, Whitaker et al. 1975), which occurs through much of northern and western North America, and south in the Appalachians to western North Carolina and eastern Tennessee.

*Protomyobia onoi* was described from *Sorex araneus*, *S. unguiculatus* and *S. caecutiens* from Europe and Japan. At the time it was described, *P. onoi* had not yet been found in the Nearctic region, but Jameson & Dusbábek (1971) said that it could reasonably be expected to occur on *S. arcticus*, the northernmost New World shrew, which is closely related to *S. araneus* and probably the most recent shrew to arrive from the Old World. About the same time the above paper appeared, Whitaker & Pascal (1971) reported *P. brevisetosa* on *Sorex arcticus* from Minnesota. However, both Jameson and Dusbábek independently suggested (pers. commun.) that the specimens be reexamined and compared to the newly described *P. onoi*; the specimens did prove to be *P. onoi*. *Sorex arcticus* presently occurs in much of southern Canada from Labrador and Newfoundland to northwestern British Columbia and north into Northwest Ter-

ritories and most of Alaska. In the U.S. it occurs in northern North Dakota, Minnesota, Wisconsin, and the upper peninsula of Michigan.

Thus in the eastern U.S., 4 forms of *Protomyobia* exist: *P. onoi* on *Sorex arcticus*, barely reaching south into the U.S.; *P. brevisetosa* on *Sorex fumeus* and *S. palustris* in the northeast and south through the Appalachians; *P. americana* on *Blarina* and *Cryptotis* occurring throughout the eastern U.S.; and *P. claparedei* on *Sorex cinereus* and *S. palustris* occurring through much of northern North America.

*Sorex longirostris*, the Southeastern Shrew, occurs in the southern U.S. east of the Mississippi and north to southern Illinois, Indiana and Maryland, and west of the Mississippi in western Arkansas (Sealander 1960, 1977, Graham 1976), southwestern Missouri (Brown 1961), and northeastern Missouri (Mock & Kivett 1981). This species is presumably most closely related to and arose from *Sorex cinereus*; the 2 are often confused, and at times have been thought to represent but 1 species.

We would have hypothesized, then, that the *Protomyobia* from *Sorex longirostris* would have been *P. claparedei*, which occurs commonly on *Sorex cinereus*. However, this was not the case. We have examined a total of 26 females of *Protomyobia* from *S. longirostris*, 23 of them from Vigo and 2 from Spencer Co., Indiana, and 1 from Marion Co., Georgia. All were *Protomyobia indianensis*, n. sp., which is closely related to and probably derived from *P. onoi*. At the same time a total of 91 females of *Protomyobia* from *Sorex cinereus* was examined, 78 from Vigo, 10 from Wabash and 1 from Vanderburgh Co., Indiana, and 2 from Quebec, Canada. All were *P. claparedei*.

The ranges of *Sorex longirostris* and *S. arcticus* are now separated by perhaps 370 km from north-central Indiana and Illinois to south-central Wisconsin and Minnesota. There would seem to be 2 hypotheses that would best explain the disjunct distribution of *Protomyobia onoi* on *S. arcticus* and the closely related *P. indianensis* on *S. longirostris*: (1) The ranges of the 2 species of shrews overlapped at some time, allowing transmission of a *P. onoi* type from *S. arcticus* to *S. longirostris*, or (2) *S. longirostris* evolved originally from *Sorex arcticus* rather than from *S. cinereus*. Other than the occurrence of the similar mite species on both shrews, there is little evidence that *S. longirostris* and *S. arcticus* had a common ancestry. On the other hand, *Sorex arcticus* earlier occurred much farther to the south. It has been found in Pleistocene deposits within

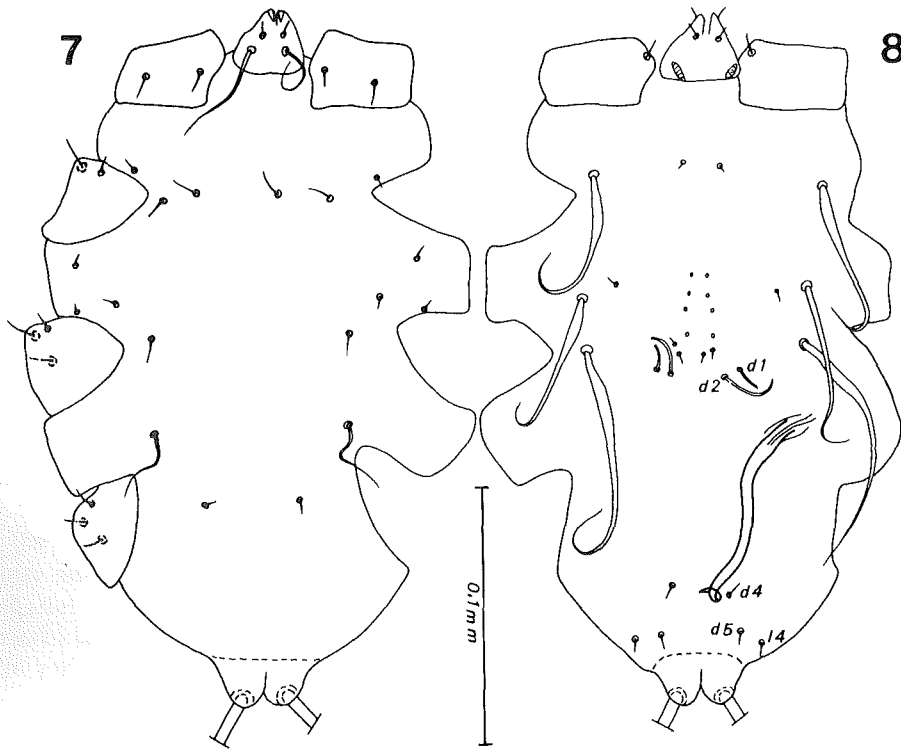


FIG. 7, 8. *Protomyobia indianensis*, n. sp. ♂: 7, venter; 8, dorsum.

the present-day range of *S. longirostris* in Augusta Co., Virginia (Guilday 1962), and in Jefferson Co., Missouri (Oesch 1967). It has also been found in Pleistocene deposits in Oklahoma (Stephens 1960). These records suggest that the ranges of these 2 shrews overlapped in the south during the Pleistocene.

KEY TO THE GENUS *Protomyobia*

♀

1. Setae *sc i* 30–60 and strong, with a ventral thickening on its basal 1/2 or at its middle ... on Asiatic Blarinini ..... *nodosa* group ... 2
- Setae *sc i* very short and thin ... on Nearctic and Palearctic Soricini, except for *P. americana*, which is found on Nearctic Blarinini ..... *claparedei* group ... 4
2. Tarsi III–IV ending in a thick, short claw with a blunt apex ..... 3
- Tarsi III–IV ending in a normal, nonmodified claw ... on *Soriculus caudatus soluensis* (Blarinini); Nepal ..... **P. kounickyi** Dusbábek & Daniel, 1975
3. Setae *ic 4* as long as *ic 3*, both thickened

- basally. Setae *d 2* and *l 2* distinctly more lateral than *d 1* and *d 3*. Setae *d 5* and *l 3* thick ... on *Episoriculus fumidus* (Blarinini); Taiwan ..... **P. nodosa** Jameson, 1970
- Setae *ic 4* very thin and 6× shorter (ca. 15 long) than *ic 3*. Setae *d 1*, *d 2*, *d 3* and *l 2* on an approximately longitudinal line. Setae *d 5* and *l 3* very thin and short ... on *Soriculus nigrescens* (Blarinini); Nepal ..... **P. nepalensis** Fain & Lukoschus, 1980
4. Setae *d 1*, *d 2* and *l 2*, 4–20 and very thin ..... 5
  - Setae *d 1*, *d 2* and *l 2*, 25–60, inflated ventrally in their basal 1/3 or in their middle ..... 8
  5. Setae *ic 1* ca. 2–3× shorter than *ic 2*. Setae *d 1* and *d 2* < 5. Absence of an ovoid striated seta on central surface of genu I ... on *Sorex fumeus*, *S. palustris* and western North American *Sorex* (Sorici-ni); USA ..... **P. brevisetosa**
  - Setae *ic 1* as long as *ic 2*. Setae *d 1* and *d 2* 8–20. Ventral surface of genu I with an ovoid striated seta ..... 6

6. Setae *d 1* and *d 2* 19–20 and distinctly longer than *v i*, *sc i*, *d 3*, *d 5*, *l 3* and *l 4* ... on *Sorex araneus* (Europe), *S. unguiculatus* and *S. caecutiens* (Japan), and *Sorex arcticus* (North America) (Soricini) ..... **P. onoi**  
 Setae *d 1* and *d 2* 9–13 and not distinctly longer than *v i*, *sc i*, *d 3*, *d 5*, *l 3* and *l 4* ..... 7
7. Average body size (length × width) 417 × 280. Setae *d 1*, *d 2* and *l 2* 8–13 ... on *Sorex shinto* (Soricini); Japan ..... **P. nipponensis**  
 Average body size (length × width) 345 × 238. Setae *d 1*, *d 2* and *l 2* 6–9 ... on *Sorex longirostris* (Soricini); USA ..... **P. indianensis, n. sp.**
8. Setae *d 1*, *d 2* and *l 2* 25–30 long, inflated in their middle and shorter than *d 4* (40) ... on *Sorex araneus* (Europe) and *S. cinereus* and *S. palustris* (USA) (Soricini) ..... **P. claparedei**  
 Setae *d 1*, *d 2* and *l 2* 50–60 long, inflated in their basal ½ and twice as long as *d 4* (30–35) ... on *Cryptotis parva* and *Blarina brevicauda* (Blarinini); USA ..... **P. americana**
- ♂
1. Setae *ic 1*, *ic 2* and *ic 3* long and subequal (75–90) ..... *nodosa* group ... 2  
 Setae *ic 1* very short (<10), except in *P. americana* where these setae are ½ as long as *ic 2* ..... *claparedei* group ... 4
2. Sexual orifice at level of setae *sc i* ..... **P. nodosa** Jameson, 1970  
 Sexual orifice at or behind level of setae *l 1* ..... 3
3. Setae *v e*, *sc e* and *l 1* with a ventral inflation in their basal ½. Setae *ic 4* short but stout. Penis without sheath ..... **P. kounickyi** Dusbábek & Daniel, 1975  
 Setae *v e*, *sc e* and *l 1* cylindrico-conical. Setae *ic 4* very short and thin. Penis with a sheath 110 ..... **P. nepalensis** Fain & Lukoschus, 1980
4. Setae *ic 1* ½ as long (50) as *ic 2* and *ic 3* ..... **P. americana**  
 Setae *ic 1* very short (5–9) ..... 5
5. Setae *ic 2* much shorter (9–10) than *ic 3* (35–40) ..... **P. indianensis, n. sp.**  
 Setae *ic 2* as long or subequal to *ic 3* ... 6
6. Setae *d 1* 12–15; setae *d 2* 27–33 ..... 7  
 Setae *d 1* 11; setae *d 2* 18–25 ..... **P. nipponensis**
7. The 3 pairs of opisthonotal setae 5–6 ..... **P. brevisetosa**  
 The 3 pairs of opisthonotal setae 10–14 ... 8
8. Body length 325–351 (average 349) .. **P. onoi**  
 Body length 310–315 (specimens from typical host) ..... **P. claparedei**
- Remarks concerning Protomyobia claparedei and P. americana*
- A. F. has restudied specimens of *Protomyobia claparedei* from the typical host (*Sorex araneus*) from Germany, England and The Netherlands. In all of these specimens (females), setae *d 1*, *d 2* and *l 2* are shorter (25–30) than the *d 4* (40) and they are inflated in their middle. On the contrary, in females of *P. americana* from *Cryptotis parva* and *Blarina brevicauda*, seta *d 1*, *d 2* and *l 2* are longer (50–60) than the *d 4* (30–35) and they are inflated in their basal ½.
- The drawing of Jameson (1948, fig. 1A) for *P. claparedei* corresponds to *P. americana* McDaniel, 1967.
- In the U.S., J. W. collected several specimens from *Sorex cinereus* and *Sorex palustris* that agree with *P. claparedei* except for minor differences. These specimens will be further studied.

## LITERATURE CITED

- Brown, L. N. 1961. *Sorex longirostris* in southwestern Missouri. *J. Mammal.* **42**: 527.
- Dusbábek, F. & M. Daniel. 1975. Two myobiid mites (Myobiidae, Trombidiformes) from the great Himalay Mountains. *Folia Parasitol.* **22**: 369–74.
- Graham, G. L. 1976. A western extension of the southeastern shrew, *Sorex longirostris* (Soricidae). *Southwest. Nat.* **21**: 405.
- Guilday, J. E. 1962. The Pleistocene local fauna of the Natural Chimneys, Augusta County, Virginia. *Ann. Carnegie Mus.* **36**: 87–122.
- Fain, A. & F. S. Lukoschus. 1976. Observations sur les Myobiidae parasites d'insectivores avec description de taxa nouveaux (Acarina: Prostigmates). *Acta Zool. Pathol. Antwerp.* **66**: 121–88.
1980. *Protomyobia nepalensis* n. sp. (Acari: Myobiidae) from *Soriculus nigrescens* in Nepal. *Int. J. Acarol.* **6**: 59–62.
- Jameson, E. W., Jr. 1948. Myobiid mites (Acarina: Myobiidae) from shrews (Mammalia: Soricidae) of eastern North America. *J. Parasitol.* **34**: 336–42.
1970. Notes on some myobiid mites (Acarina: Myobiidae) from Old World insectivores (Mammalia: Soricidae and Talpidae). *J. Med. Entomol.* **7**: 79–84.
- Jameson, E. W., Jr & F. Dusbábek. 1971. Comments on the myobiid mite genus *Protomyobia*. *J. Med. Entomol.* **8**: 33–36.
- Mock, O. B. & V. K. Kivett. 1981. The southeastern shrew,

- Sorex longirostris*, in northeastern Missouri. *Trans. Mo. Acad. Sci.* (In press.)
- Oesch, R. O.** 1967. A preliminary investigation of a Pleistocene vertebrate fauna from Crankshaft Pit, Jefferson County, Missouri. *Natl. Speleol. Soc. Bull.* **29**: 163-85.
- Ono, Z. & K. Uchikawa.** 1975. Two new myobiid mites (Acarina: Myobiidae) parasitic on *Sorex shinto* (Insectivora, Soricidae) from central Honshu, Japan. *Annot. Zool. Jpn.* **48**: 49-54.
- Sealander, J. A., Jr.** 1960. Some noteworthy records of Arkansas mammals. *J. Mammal.* **41**: 526.
1977. New marginal records for the eastern harvest mouse and southeastern shrew in Arkansas. *Southwest. Nat.* **22**: 148-49.
- Stephens, J. J.** 1960. Stratigraphy and paleontology of a late Pleistocene basin, Harper County, Oklahoma. *Bull. Geol. Soc. Am.* **71**: 1675-702.
- Whitaker, J. O., Jr, G. S. Jones & D. D. Pascal, Jr.** 1975. Notes on mammals of the Fires Creek area, Nantahala Mountains, North Carolina, including their ectoparasites. *J. Elisha Mitchell Sci. Soc.* **91**: 13-17.
- Whitaker, J. O., Jr & D. D. Pascal, Jr.** 1971. External parasites of arctic shrews (*Sorex arcticus*) taken in Minnesota. *J. Mammal.* **52**: 202.
- Whitaker, J. O., Jr & N. Wilson.** 1974. Host and distribution lists of mites (Acari), parasitic and phoretic, in the hair of wild mammals of North America, north of Mexico. *Am. Midl. Nat.* **91**: 1-67.

