

THE BIOLOGY OF FIVE NEW SPECIES
OF ORIBATIDS FROM LOUISIANA

BY

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I. *Introduction* : The oribatid fauna of the southeastern United States, and especially Louisiana, has barely been touched. Aside from some works of BANKS and JACOT dealing in part with oribatids of this area, one could consider this area virgin. It is strange that regions of Africa, Java, northern Canada, and South America have been better investigated for oribatids than the easily accessible southcentral United States. This report is planned to be the first of a series on oribatids of Louisiana and surrounding areas.

The species described here all came from pasture-like sod, predominately grass, frequently mowed, and mostly shaded. All specimens were collected in the spring of 1961 from the urban areas of Baton Rouge, Louisiana, and any additional collection records are indicated below. The specimens were extracted from the sod by standard Tüllgren funnel methods. Both alcohol and slide mounted types of all five new species have been deposited in the U. S. National Museum. The number following the name is the U. S. National Museum assigned to it.

The methods of preparation and observations were those of BALOGH (1959) who has elevated the taxonomic study of oribatids to a much higher plane. Earlier descriptions and illustrations based upon permanent balsam or less permanent slide media must be reexamined in light of these new techniques.

It is far easier to later synonymize than to untangle several species masquerading under one name. North American workers should only assign European names to indigineous species if types are available for comparative purposes or in cases of descriptions à la GRANDJEAN.

II. **Galumna confusa** n. sp. Figures 1 A-E & 2 A-C. U.S.N.M. 3108 Galumnidae.

Zetes ithacensis JACOT, 1929, p. 28 ; *Zetes louisianae* JACOT, 1929, p. 28 ; *Zetes elimatus ithacensis* JACOT, 1935 a, pp. 53-7, figs. 1-5 ; *Zetes elimatus louisianae* JACOT, 1935 b,

Acarologia, t. VII, fasc. 3, 1965.

pp. 8-10, figs. 2; *Galumna elimatus ithacensis* (Jacot, 1935 a), SENGBUSCH, 1954, pp. 652-8, figs. 1-27; *Galumna eliminatus* [sic.] *louisianae* WOODRING, 1962 and 1963, p. 395, fig. 3 and p. 103.

A. *Description* : Adults average .68 mm in length and .50 mm in width. Color a very dark reddish-brown becoming black-brown with age. Alar porose area usually L-shaped as in figure 1 A, but varying considerably. Posterior porose areas A_2 and A_3 large and elongate; interlamellar setae minute and smooth; rostral and lamellar setae longer than genital plates, of near equal size, and rough. Pseudostigmatic organ nearly of uniform diameter, throughout length, hardly swelling to a perceptible lance-shape near the tip, and usually pointed. The cuticle is very smooth and usually shiny. Sexual size differences were not apparent. The tritonymph illustrated (figure 1 B) appears to be the same as illustrated by SENGBUSCH (1954), figures 26-7.

B. *Discussion* : The International Code of Zoological Nomenclature adopted by the XVth Congress recommends that a new species partially or wholly based upon another author's specimens incorrectly identified types should come from the previous author's (JACOT) specimens. An exception is taken here because JACOT's specimens are all mounted (and slightly squashed) with balsam, which is a particularly poor medium for mites.

As pointed out by GRANDJEAN (1956), JACOT was confused as to exactly what *G. elimatus* was. Whether *G. elimatus* (Koch, 1841) is synonymus with *G. obvious* Berlese 1914 as VAN DER HAMMEN (1952) believes or not as WILLMANN (1931) believes, I leave to European authors. In either case, what JACOT was calling *elimatus* is neither *elimatus* (Koch, 1841), as described and illustrated by WILLMANN (1931) after BERLESE (1888), BERLESE (1914), and SELLNICK (1928), nor *obvious* (BERLESE, 1914). As BERLESE (1914) illustrated and described *G. elimatus* (Koch, 1841), the species is $.65 \times .45$ mm and has "strictly ovale alar area porosae". *G. obvious* BERLESE (1914) and OUDEMANS (1919) is $.78-.82 \times .58-.60$ mm and has a thin transverse alar area porosae somewhat like figure 2 Cc. Having minute interlamellar setae, L-shaped alar porose areas, and a size not exceeding .7 mm, JACOT's *elimatus* of either subspecies *ithacensis* or *louisianae* could not be *G. elimatus* or *G. obvious*. Why JACOT insisted on trying to relate an American species to KOCH's European types is difficult to understand.

I have examined JACOT's types specimens from the Museum of Comparative Zoology, Harvard University, and found slides labelled *G. elimatus louisianae*, *G. obvious ithacensis*, *G. elimatus*. Comparing JACOT's specimens with my own series of *G. confusa* collected in Louisiana, I came to the conclusion that all specimens called *G. elimatus* of either subspecies by JACOT are the same as *G. confusa*. Since the species name *elimatus* is already in use in the same genus for another species, JACOT's *elimatus* must become a synonym of *confusa*. I have not checked European type slides, but from the descriptions of the above authors, *G. confusa* is distinctly different from *elimatus* (Koch, 1841) as used by European authors.

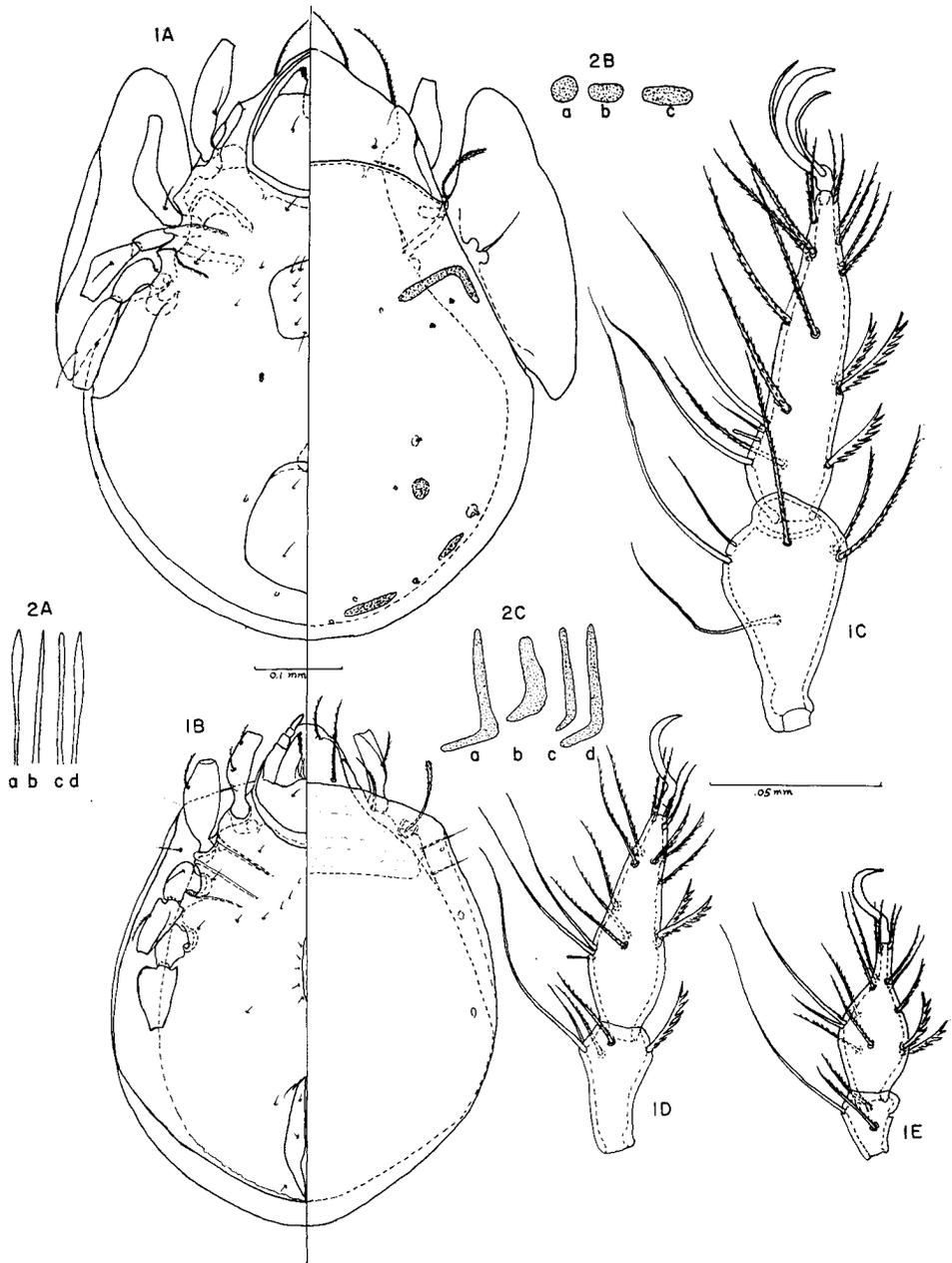


FIG. 1. — *Galumna confusa* n. sp.

A. Adult, B. Tritonymph, C. Postaxial adult leg I, D. Postaxial tritonymphal leg I, E. Postaxial leg I.

FIG. 2. — Variation of *Galumna confusa*.

- A. Pseudostigmatic organ of : a. *G. elimatus louisiana* Jacot 1935 a, b. *G. elimatus ithacensis* Jacot 1935 b, c. & d. *G. confusa* from Louisiana.
- B. Area porosae posterior (A_2 & A_3) : a. *G. elimatus ithacensis* Jacot 1935 a, b. *G. elimatus louisiana*, c. *G. confusa* from Louisiana.
- C. Alar area porosae of : a. *G. elimatus louisiana* Jacot 1935 a, b. & c. *G. elimatus ithacensis* Jacot 1935 b, d. *G. confusa* Louisiana.

C. *Biology* : *G. confusa* is a fairly difficult species to culture, but at least 6 generations were cultured for each of 4 different starting sets of field-collected specimens using the techniques outlined by WOODRING and COOK (1962). SENGBUSCH (1934) found that a green alga (a *Protococcus* sp.) was necessary for the feeding and growth of immature stages of *G. confusa*. He states that almost any organic matter is suitable for feeding the adults. Using a combination of crustose lichen and ground, dried mushroom (with the resultant fungal growth in the moist culture tubes) I have found that both immature stages and adults feed quite readily. Some algae may be required by the immature stages, which they could get from the lichen, but I have observed them feeding mostly on the mushroom and fungal hyphae. An animal food, lyophilized cricket powder, was not fed upon when provided.

My survival percentages for the various stages was no better than those of SENGBUSCH (1954) for this species. About 30-40 % survived from egg hatch to adult. This compares poorly with the virtually 100 % survival of immature stages of *Ceratozetes*, *Oppia* and *Scheloribates* species I have cultured. Either the low survival rate of *G. confusa* is normal (unlikely), or something is lacking in the culturing techniques for this species. In general, those cultures that fed best developed more quickly, but what was responsible for better feeding in near identical cultures could not be determined with certainty. It appeared that the greater the concentration of immature (greater percentage) stages in a culture the better all stages fed.

The number of eggs deposited at one time varied from 2-9, averaging 6. The adults survived from 2-6 months, and no accounting for the wide variation in adult longevity could be found. The average time from egg hatch to the molt to adult for surviving specimens was 48 days with the extreme variation of 46-50 days at 23° C. SENGBUSCH'S (1954) average from egg hatch to adult emergence for this species was 72.4 days, with a variation of 51-94 days.

Length of time in days at 23° C for each stage of G. confusa.

(37 specimens used for detailed life cycle)

(---p. = ---pers ; ---n. = ---nymph)

<i>egg</i>	<i>larvae</i>	<i>larvap.</i>	<i>proton.</i>	<i>protop.</i>	<i>deuton.</i>	<i>deutop.</i>	<i>triton.</i>	<i>tritop.</i>
7-14	3-5	2-3	5-8	2-5	8-11	3-4	8-10	4-7

The cuticle hardening period was 12-24 hours.

No one specimen consistently had the shortest or longest time for all stages, so that the total time from egg hatch to adult emergence was amazingly constant — 46-50 days. The first female to emerge laid eggs 28 days later. The shortest time between the presence of a male and oviposition by a virgin female was 21 days.

It was noticed in this study that isolated eggs allowed to develop 4-6 at a time in a culture, so that each specimen could be kept track of, resulted in the life cycle for the resultant immature stages being longer than in a culture with many (50 or more) individuals. This phenomenon has since become apparent in cultures of

all oribatids examined. This was checked by two means. First, occasionally in a large culture there would be a break in generations where just a few larvae would be developing with no other specimens close to them in age would be present. Second, a large culture was started with about 50 or more adults, and the time from the first appearance of larvae to the appearance of a second generation adult (distinguished by their very light color in comparison to the first generation adults) was accurately determined. Under these more populous conditions, the life cycle averaged 40-44 days. Isolation obviously introduces extraneous factors and produces unreal life cycles. The suspected reason individuals in large colonies have a faster life cycle than individuals in very small colonies or when completely isolated is that with fewer specimens the mites are unable to keep the fungal growth cropped, and the resultant uncontrolled growth impedes the movements and feeding of the mites.

For future work, marking methods for individual specimens were investigated. HUNTER (1960) had excellent results with plastic paints of various hues on mesostigmatic mites. No laquer or plastic paint tried on pterogasterine oribatids was successful. If the paint is fast drying, it dries before it can be applied; if slow drying it runs on the mite and accumulates debris. Ordinary asphaltum, diluted with kerosene to desired consistency, can be applied in very small spots with needles. Tested on adults, it has lasted for months and is non-toxic.

III. *Galumna parva* n. sp. Figures 3 A-E. U.S.N.M. 3108 Galumnidae.

A. *Description* : Adults average .37 mm in length and .28 mm in width, with very little variation. Color is light reddish-brown becoming deeper reddish-brown with age. The area porosae are all circular when viewed perpendicular from area porosae, with alar a.p. being the largest; L line very faint, especially when viewed from above; interlamellar setae minute; and dorsal-sejugal suture slightly curved posteriorly in the midline. The tubular marking in the pteromorph common in many Galumnids appears very clearly in this species. This species is quite globular in form, but not to the extreme shown in figure 3 A (due to compression of coverslip). Considering the normal variation of hysterosomal overhang upon the prosoma of galumnid nymphs, the nymphs of *G. parva* have very little overhang. Tritonymphal notogastral setae c_1 and c_2 are over 3 times the length and weight of other notogastral setae.

B. *Discussion* : *G. parva* is very closely related to *G. minuta* (Ewing, 1909) as described by JACOT in 1935 a and 1935 b. JACOT collected *minuta* throughout Florida and EWING collected one specimen in Illinois. JACOT (1935 a) confirms EWING'S *Oribata minuta* as *G. minuta*. All these specimens of *minuta* are mounted in Balsam, and are difficult to diagnose. *G. parva* is distinctly different from *G. minuta* in being consistently larger (especially in width), darker in color, and the area porosae are larger and more round. The relative position of A_1 - A_3 are

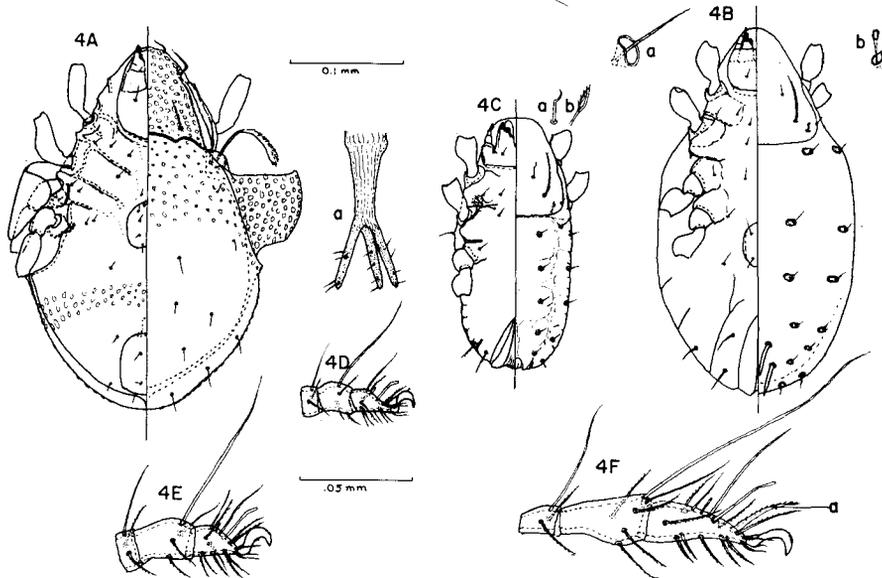
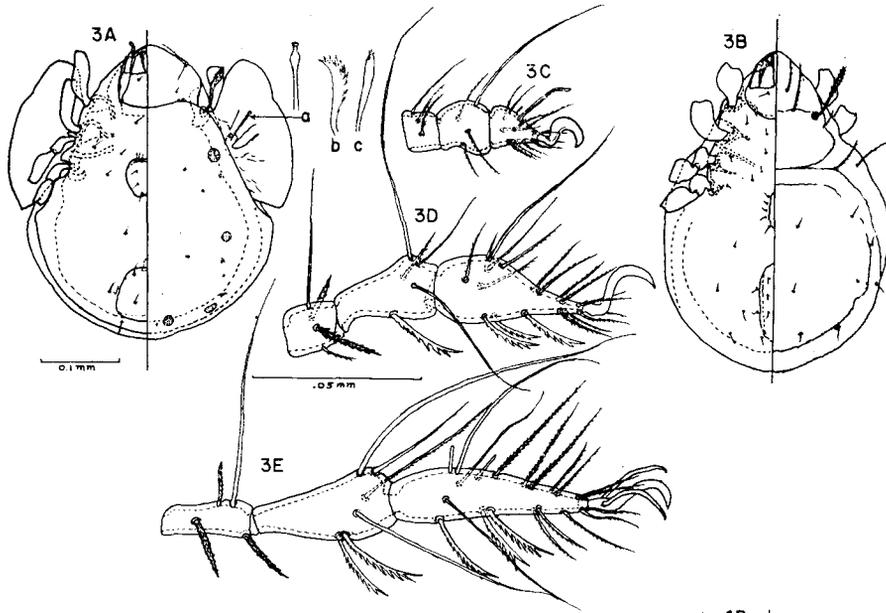


FIG. 3. — *Galumna parva* n. sp.

- A. Adult : a. hemocoel leading to setal socket ta, b. & c. Lateral & dorsal view of pseudo-stigmatic organ.
 B. Tritonymph, C. Postaxial larval leg I, D. Preaxial tritonymphal leg I, E. Preaxial adult leg I.

FIG. 4. — *Rostrozetes flavus* n. sp.

- A. Adult : a. ovipositor.
 B. Tritonymph ; a. typical dorsal seta of immature stages, b. tritonymphal pseudostigmatic organ.
 C. Larva : a. sickle-shaped seta la, b. pseudostigmatic organ.
 D. Postaxial larval leg I, E. Postaxial deutonymphal leg I, F. Preaxial adult leg I.

quite different, as are the positions of the genital setae. The lamellar and intermellar setae are smaller in *G. parva* than in *G. minuta*. The *G. minuta* recorded by ROCKETT and WOODRING (1963) and WOODRING (1963) is actually *G. parva*.

C. *Biology* : *G. parva* is also a fairly difficult species to culture, but at least 5 generations were carried through from 2 starts from field collected specimens. Survival percentages from egg hatch to adult emergence was 30-50 %, depending upon concentration of specimens per culture tube. Using the same methods as described for *G. confusa*, the more concentrated the population (within reasonable limits) the higher the survival rate. The average time from egg hatch to adult emergence for surviving specimens at 23° C was 37 days with a variation of ± 4 days.

Length of time in days at 23° C for each stage of G. parva

(13 specimens used for detailed life cycle).

<i>egg</i>	<i>larva</i>	<i>larvap.</i>	<i>proton.</i>	<i>protop.</i>	<i>deuton.</i>	<i>deutop.</i>	<i>triton.</i>	<i>tritop.</i>
7-8	3-8	1-2	6-8	2	7-8	2-3	6-9	3-4

Again, no one specimen had consistently the longest or shortest time in any one stage. The hardening period for this species is about 4-8 hours ; that is, the adult must harden the cuticle for this amount of time just after emergence from the tritopers or when partially emerged before moving actively about. Specimens forcibly made to emerge quickly from the tritonymphal exuviae and move about had the legs crumble and harden in the crumbled position. These individuals seldom survived long thereafter. Normal adults survive from 2-4 months in culture, and most females under these conditions lay but 1 batch of eggs consisting of 6-8 eggs. In culture, the larvae fed exclusively on translucent fungal hyphae. The nymphal stages fed mostly on mushroom, lichen, etc., but would consume some hyphae. Adults eat virtually no hyphae, and 2-3 weeks after emergence ate very little of anything.

IV. ***Rostrozetes flavus*** n. sp. Figures 4 A-F. U.S.N.M. 3110 Haplozetidae.

A. *Description* : Adults average .32 mm in length and .21 mm in width at their widest point. As with all the oribatids described here, the male was generally slightly smaller than the female, particularly when the female was gravid. Color an opaque yellow-orange, more yellow than orange. Cuticle covered completely with medium to small sized punctations except for the legs, gnathosoma, and underside of pteromorphs ; punctations larger and more dense on the dorsal pteromorph than elsewhere ; spacing of punctations on the notogaster as in figure 4 A ; and on ventral plate punctations become larger towards lateral edges. Three-arched dorsal-sejugal suture typical of genus. Rostral and lamellar setae distinctly elbowed ; interlamellar setae shorter than lamellae ; anterior notogastral setae lacking ; and no area porosae are visible. Anal plates twice the distance of genital

plate length from genital plates. Anal setae 2, adanal 3, genital 5, adgenital 1, and ventral podosomal setal formula 3-2-2-2. Podosomal apodemes conspicuous and continuous with a wide medial band from gnathosoma to genital plate. Kappa setae at junction of proximal and distal ovipositor lacking. All legs monodactyl in all stages (figures 4 D-F).

Immature stage cuticle frequently patterned as in figure 4 C, or with just posterior grooves as in figure 4 B. Most notogastral setae sunk in depressions (figure 4 Ba), but nymphs in addition have a pair of short and very thick setae on posterior notogaster. Sensillus of immature stages extremely minute, and differing in form between the larva and nymphs (figures 4 Bb and 4 Cb).

B. *Discussion* : In BALOGH's (1961) key to world genera of oribatids, both *Rostrozetes* and *Trachyribates* are stated to have a 3-arched dorsal-sejugal suture ; but the former is monodactylus and the latter tridactylus (though the lateral claws may be very thin). SELLNICK (1925) in describing *Rostrozetes* n. gen. says *Rostrozetes* is similar to *Trachyribates* but differs in that the former has but 1 claw per tarsus. Comparisons of BERLESE's (1905) (not 1904) illustration of *Oribates ampulla*, which was the designated type of *Trachyribates* Berlese, 1908, with the illustration of *Rostrozetes* Sellnick, 1925 indicates a great difference. Though both genera appear to have a punctate cuticle, *R. foveolatus* Sellnick, 1925 has a 3-arched dorsal-sejugal suture and 1 claw per tarsus, while *T. ampulla* (Berlese, 1925) has an evenly rounded dorsal-sejugal suture and more than one claw per tarsus.

In addition to the type locality for *T. ampulla* of Buitenzorg, New Guinea, SELLNICK (1925) identified 2 specimens as *T. ampulla* from Forte de Kock, Sumatra. These are the only clearly *Trachyribates* specimens I know of. SELLNICK (1925) stated that possibly *Trachyribates ovulum* Berlese, 1908 from North America could actually be a species of *Rostrozetes*, but that he could not (nor could I) say for sure on the basis of BERLESE's description (without illustration).

BECK (1960) mentioned 5 new species of *Rostrozetes* from Peru, and describes the genus as circumtropical. SELLNICK (1925) mentioned a Brazilian species and described *foveolatus* from Sumatra. HAMMER (1958) described *nodosus* from Bolivia, and later from other parts of South America. BALOGH (1958) and (1960) described 4 new species of *Trachyribates* from Africa, which are clearly *Rostrozetes*. *R. flavus* occurs farther to the north than any other species of *Rostrozetes* described, except for *R. foveolatus appalachicola* Jacot, 1938, which taken in North Carolina. I believe Jacot had a new species, which should be named *R. appalachicola*.

C. *Biology* : This is a rather sluggish species in all stages that prefers high moisture and cover of some sort. The immature stages seem to do best in a medium similar to that preferred by anoetids. This species does not eat fungal hyphae to any great extent, but showed a real preference for the punky exterior of plant roots. They rapidly ate the decomposing outer sheath of roots, leaving the hard fibrous centers. In roots and stems with soft centers and hard fibrous outer covers,

these mites burrowed into the roots and stems and fed vigorously. Dried, powdered mushroom, when presented in not excessive amounts, was rapidly consumed, and allowed easier observation of the postembryonic development. A slight excess of mushroom powder resulted always in fungal growth before the mites could feed on the mushroom. The mites could not contend with the sticky, dense hyphae. Two complete generations gave the following picture of their life cycle. Total time from egg hatch to adult was 35-45 days with an average of 38 days. The duration of the stages (below) is in days, again with no one individual being consistently slow or fast in all stages.

Length of time in days at 23° C for each stage of R. flavus
(17 specimens used for detailed life cycle).

<i>egg</i>	<i>larva</i>	<i>larvap.</i>	<i>proton.</i>	<i>protop.</i>	<i>deuton.</i>	<i>deutop.</i>	<i>triton.</i>	<i>tritop.</i>
8-9	4-6	2-3	6-7	2-3	6-9	3-4	6-9	4-5

The hardening period was about 12 hours, and the adult lived 3-7 months. The females laid but 1 egg at a time, and the most eggs observed to be deposited by one female was 6 over a period of 3 weeks. This I believe to be far short of the true number of eggs matured and deposited in nature. The spermatophore is typical for oribatids, but has a very short stalk.

An explosion of nematode populations in several cultures of this species did not interfere or modify the habits or even alter the duration of the life cycle.

V. **Scheloribates parabilis** n. sp. Figures 5 A-F. U.S.N.M. 3112 Scheloribatidae.

A. *Description* Adults average .51 mm long and .35 mm wide. Color typically orange brown or mahogany, with young adults more yellowish and old adults (2-3 months) almost reddish-brown. Notogaster oval; dorsal-sejugal suture a flat, even curve; typical triangular pteromorphs; rostum rather long; lamellae distinctly broader in basal half; dorsal propodosomal setae as in figure 5 A; no trace of trans-lamella; lamella with small laterally bent tip beyond insertion of lamellar seta; pseudostigmatic organ lanceolate and very sharp, with setules principally on posterior margin; notogaster smooth and shiny; ventral podosomal plate cheatotaxy 3-2-2-3; ventral podosomal apodemes complete to midline; podosoamal setae long and naked; genital setae 1 over twice the length of other 3 genital setae; in over 70 % of all specimens there were 2 pairs of aggenital setae (ag); all legs tridactylus; leg I tarsus with dorsal medial seta almost as thick as medial claw and densely covered with spinules.

Tritonymphal propodosomal shield averages .14 × .14 mm at longest and widest points. Hysterosomal setae d_1 , e_1 , and e_2 distinctly longer than others; hysterosomal setae d_2 arising from a distinct sclerotized, oval area; interlamellar setae less than 1/3 length of rostral and lamellar setae; sensillus lanceolate, not sharply pointed and completely covered with spinules.

B. *Discussion* : There are relatively few North American species of *Scheloribates* described, even though this genus is one of the largest in the Cryptostigmata. In both Minnesota and Louisiana, this genus is the dominant oribatid to be found in sod and leaf litter.

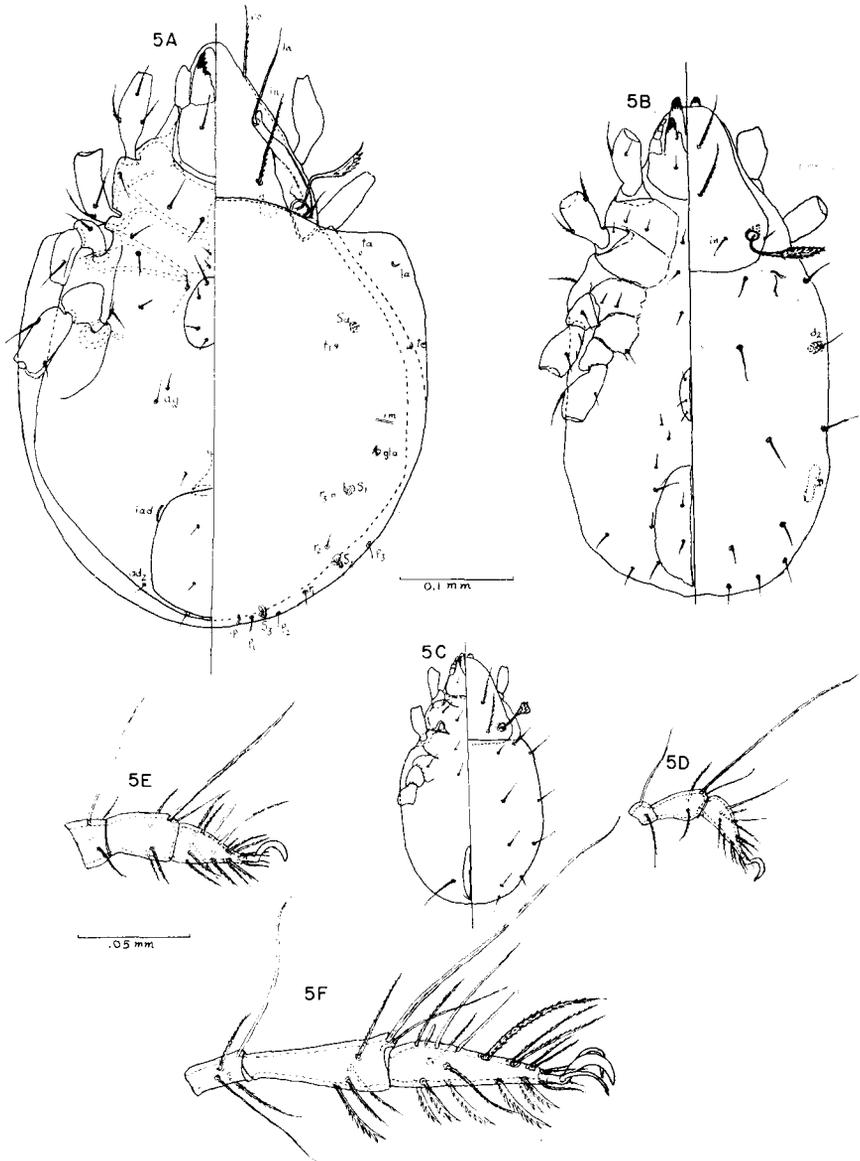


FIG. 5. — *Scheloribates parabilis* n. sp.

A. Adult, B. Tritonymph, C. Larva, D. Postaxial larval leg I, E. Postaxial tritonymphal leg I, F. Postaxial adult leg I.

C. *Biology* : This is a very active and easily cultured species, which has been in culture continuously for 5 years. They will feed on practically any plant remains, lichen, or fungus. For ease of culturing and for faster life cycles an artificial diet, as described by WOODRING and COOK (1962), was used for maintaining stocks. The immature stages tend to eat themselves into burrows, while adults mostly surface feed. Young, light colored adults feed voraciously, while older and darker adults feed sparingly. Females mature about 8-10 eggs at a time and deposit them in batches of 2-3 within 2 days. Experiments are inconclusive, but females, it is suspected, then mature more eggs and pick up 1 or more spermatophores before further oviposition. The males produce spermatophores in great abundance, and most spermatophores are destroyed by being rubbed off by passing mites or eaten. Males about to deposit spermatophores seem to be seeking and move slowly and erratically. Once deposited, the male moves off very rapidly, and is quite agitated for a long time. These spermatophores are indistinguishable from those of *S. nudus* (below) and *S. laevigatus* (see WOODRING and COOK, 1962). The average time from egg hatch to adult emergence was 17 days with extremes of 14 to 24 days.

Length of time in days at 23° C for each stage of S. parabilis.

egg	larva	larvap.	proton.	protop.	deuton.	deutop.	triton.	tritop.
8-11	2-4	1-2	2-5	1-2	2-5	1-2	2-5	1-3

Hardening period is 6-24 hours. Adult females commence laying fertile eggs 11 days after emergence from tritopers. Spermatophores appeared in a colony of adult males only (placed therein as they emerge from the tritopers in other colonies) for the first time 2-4 days ; that is, the first spermatophore appeared 2-4 days after the oldest males were introduced. Though not proven conclusively, it appeared that females would mature and deposit at least a second batch of eggs within 3 weeks.

S. parabilis is the first oribatid that I have cultured that would eat appreciable amounts of organic matter of animal origin. They will eat cricket powder (crickets are broken up in a Waring Blender, lyophilized, powdered, and stored in freezer), but would not survive on this material alone. The cricket powder was consumed most readily when fresh, which indicated that the mites were not simply relying on microorganisms and fungi growing on the cricket powder. When the cricket powder became quite decomposed, the oribatids avoided it.

VI. **Schelorbates nudus** n. sp. Figures 6 A-F. U.S.N.M. 3111 Scheloribatidae.

A. *Description* : Adults average .4 mm long and .28 mm wide. Color usually lighter than *S. parabilis*, being yellow-brown to orange-brown. Notogaster oval ; dorsal-sejugal suture broadly curved ; pteromorphs long, reaching back to the level of the anterior of anal plate ; pteromorph curved (rather than strictly triangular) when viewed from above ; rostrum triangular and rather pointed ; lamellae evenly

tapering towards tip, with a bend near tip (figure 6 Aa) ; lamellar setae at end of bent tip of lamellae ; a pair of thin transverse sclerotic bar from the lamellar tip resembling the beginnings of a translamella (figure 6 Aa) ; pseudostigmatic organ club shaped, with spinules evenly distributed ; notogaster smooth and shiny ; notogaster chaetotaxy as in figure 6 A ; ventral podosomal setae 3-2-2-3 and very long ; ventral podosomal apodemes incomplete ; area around base of leg I greatly enlarged ; all legs tridactylus ; genital plate wider at anterior edge than posterior edge.

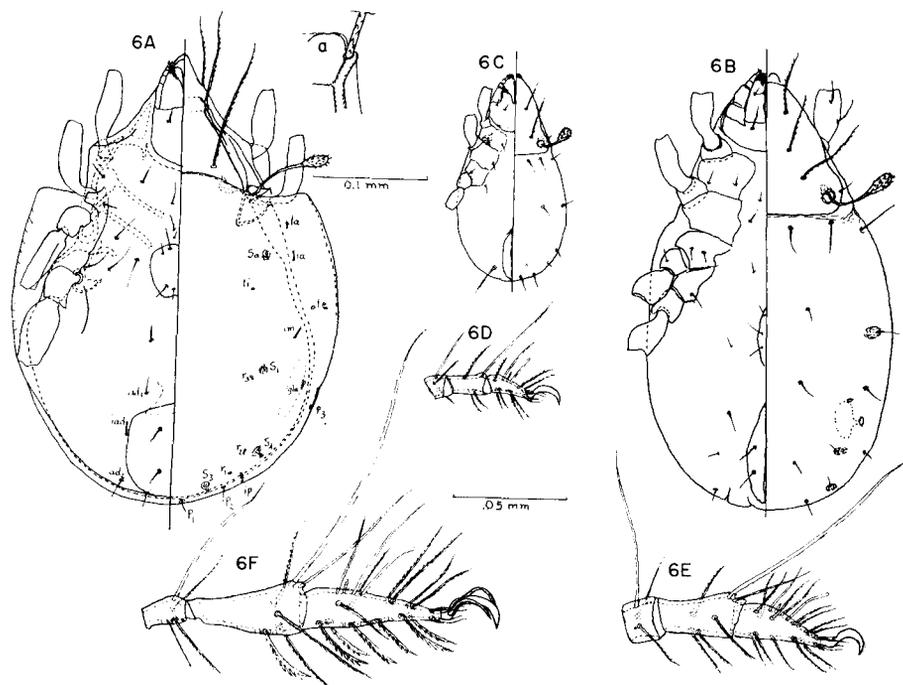


FIG. 6. — *Schelorbates nudus* n. sp.

A. Adult ; a. Detail of rostral setae and lamellar tip. B. Tritonymph, C. Larva, D. Preaxial larval leg I, E. Preaxial tritonymphal leg I, F. Preaxial adult leg I.

Tritonymphal propodosomal shield averages $.11 \times .13$ mm ; sensillus like adult sensillus ; c row of hysterosomal setae much longer than other hysterosomal setae ; setae d_2 , f_2 and h_2 only with lightly sclerotized oval base plates.

B. Biology : This species is found in essentially the same environment as *S. parabilis* and is rather difficult to separate from *S. parabilis* with a dissecting microscope. Only rarely was *S. nudus* taken without *S. parabilis*, but the reverse was not true. *S. nudus* fed on the same materials as did *S. parabilis*, except the cricket powder. The life history and habits of *S. nudus* in culture were indistinguishable from those of *S. parabilis* in culture.

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