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NOTES ON NATHAN BANKS’ AND HENRY EWING’S
SPECIES OF MOCHLOZETIDAE (ACARI : SARCOPTIFORMES)
WITH THE PROPOSAL OF A NEW GENUS

BY Roy A. NORTON *

TAXONOMY
MOCHLOZETIDAE

ABSTRACT : Seven North American oribatid mite species proposed by Nathan Banks and Henry Ewing are transferred to genera of the family Mochlozetidae. New combinations include Podoribates pratensis (Banks), P. turgidus (Banks), P. minusculus (Banks), P. artiramellatus (Ewing), Mochlozetes maximus (Ewing), and Dynatozetes magnus (Banks). The genus Mochlobates n. gen. is proposed, with Oribata affinis Banks as type-species.

TAXONOMIE
MOCHLOZETIDAE

RÉSUMÉ : On transfère sept espèces américaines d’acariens oribates, décrites par Nathan Banks et Henry Ewing, aux genres de la famille Mochlozetidae. Ces nouvelles combinaisons comprennent Podoribates pratensis (Banks), P. turgidus (Banks), P. minusculus (Banks), P. artiramellatus (Ewing), Mochlozetes maximus (Ewing), et Dynatozetes magnus (Banks). On propose le genre Mochlobates, avec Oribata affinis Banks comme espèce-type.

Members of the oribatid mite family Mochlozetidae are primarily found on the stems and leaves of green plants, but apparently not in highly host-specific relationships (Norton, 1983). Because of their reliance on hand collecting, early American acarologists such as Nathan Banks and Henry E. Ewing apparently encountered these mites with regularity, and these two workers proposed most of the available names for North American representatives of this family. Today general collectors concentrate their efforts on Tullgren-funnel extractions of litter and other decomposing vegetation, from which these mites are recovered rarely and in low numbers. Unfortunately the ten species proposed by Banks and Ewing have long remained unrecognizable and combined with generic names which have since been abandoned or restricted in concept. Three of these species have previously been discussed and reassigned to the genus Mochloribatula (Norton, op. cit.). The purpose of this paper is to recombine the other seven species, to offer brief redescriptions or comparative diagnoses, and to propose a new genus based on Oribata affinis Banks. All measurements and diagnoses refer to adult mites; immatures are as yet undescribed. The excellent papers of Grandjean (1959, 1960, 1963) should be consulted for comparisons.

I. Dynatozetes magnus (Banks 1895) n. comb.

Oribata magna Banks, 1895, p. 6.
Galumna magna : Banks, 1907, p. 611.

* S.U.N.Y. College of Environmental Science & Forestry, Syracuse, New York, USA 13210.

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Notogastral profile high posteriorly, similar to *D. obesus* Grandjean but without dorsal flattening. Pteromorph large, similar to *D. amplus* Grandjean but narrowly rebordered and with dense internal striae. With three to five pairs of circumdorsal porose areas (may differ on two sides of same specimen) in addition to areas A1 and Aa. Notogastral integument inconspicuously granular, without striate microsculpture. Setal alveolus pl within row of circumdorsal porose areas. Profile of prodorsum continuous with curvature of notogaster, except broadly and shallowly depressed near distal third of lamella; not as steep as in *D. obesus*, nor with reflexed rim as in *D. amplus*. Rostrum entire, carina cb absent; distal fenestration with indistinct borders. Lamellar cusp small but distinct (Fig. 1A); sublamella curved slightly ventrad. Tutorium as in *D. amplus*. Rostral (ro) and lamellar (le) setae longer than in *D. amplus* or *D. obesus*. Sensillus (ss) narrowly fusiform in dorsal aspect, sub lanceolate in anterior aspect (Fig. 1B). No tarsi with dorsal porose area. Alveoli of tibial solenidia without posterior spine; alveoli of genual solenidia with spine present. Legs relatively elongate; similar to *D. amplus* except trochanter III with two setae (ν' present). Length of three syntype females 964, 944, 934 μm.

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**Fig. 1 :** *Dynatozetes magnus* (Banks), syntype adult (sex unknown).
A. — Dorsal aspect of prodorsum and anterior part of notogaster.  B. — Bothridium and sensillus.
Remarks.

BANKS' original series is from Sea Cliff, N.Y. (Nassau Co.), which is the only collection data included in the original description. As usual with Banks' material, no type designation was originally placed with the specimens, although A. P. JACOT later slide-mounted three specimens in balsam and labeled them 'cotypes'. Two specimens remain in alcohol in the Museum of Comparative Zoology (MCZ) collection (Harvard University), bearing the labels (in BANKS' handwriting) 'Oribata magna Bks' and 'Sea Cliff N.Y.'. In addition, another slide-mounted 'cotype' specimen is in the U.S. National Museum of Natural History (USNM) collection (Washington, D.C.), labeled by neither BANKS nor JACOT. The original description mentioned only five specimens, but when JACOT mounted three, he added a note to the slide '3 left in vial'; the USNM specimen was apparently removed and mounted later, since only two now remain. All, including the alcoholics, can be considered syntypes. In preparing the above diagnosis the six existing syntypes were studied, but most information was gleaned from the two alcoholics.

I have examined specimens of *D. magnus* from two other localities: Ohio, Hocking Co., Conkles Hollow State Park, 29 July 1978 L. E. WATROUS col., from leaf litter along intermittent stream; and Canada, Ontario, Saint Lawrence Islands National Park, Thwartway Island, September 1976, I. M. SMITH col., from soil beneath moss mat on rock. Despite the above collections, *Dynatozetes magnus* is probably arboricolous like its two known congeners, mentioned above, both of which are neotropical.

II. *Podoribates pratensis* (Banks) n. comb.

*Oribata pratensis* BANKS, 1895, p. 6.
*Galumna pratensis* : BANKS, 1907, p. 612.

*Podoribates* with the following combination of character states. Mean total length of five females 725 μm (range 690-765 μm); mean total length of five males 638 μm (range 620-650 μm). Interlamellar seta *(in)* long, erect (Fig. 2), ca. 1.5 times length of lamellar *(le)*, both strongly barbed to tip. Rostral seta *(ro)* finely attenuate and more densely barbed. Exobothridial seta *(ex)* thin, barbed, visible in dorsal aspect. Sensillus subcapitate, may appear somewhat truncate distally; stalk short, hardly emerging beyond bothridium. Lamella broad, slightly removed from lateral contour of prodorsum in dorsal aspect; with fine ridges on dorsal surface. Cusp extends anteriad beyond translamella, with a distinct late-
Fig. 3: Podoribates pratensis (Banks).
A. — Lateral aspect of female.  B. — Region of porose area Aa and seta la.
ral tooth; medial tooth inconspicuous or absent. Seta le inserted on dorsal surface of cusp, slightly posteriad of margin. Translamella broad, teguiform, usually slightly produced medially as broad angle. Tutorium extends slightly anteriad of ro insertion, distally rounded, without conspicuous cusp, but tip appears toothlike in dorsoventral aspect. Pedoctectum I easily visible in dorsal aspect; with irregular striations on ventrolateral surface. Margin of parietal tectum with scalloped appearance. Notogaster fused to prodorsum between spiniform dorsophragmatic apophyses. Notogastral integument shallowly punctate, with series of shallow longitudinal grooves and ridges anteromedially (Fig. 3A). Pteromorph margin narrowly rebordered. Notogastral setae present, but extremely minute, generally shorter than depth of their alveolar canal (Fig. 3B). Circumventral porose areas represented by single continuous, narrow, ribbon-like porose band. Dorsosejugal porose area (Ad) elongate, extending behind bothridium and confluent with humerosejugal porose area. Four pairs of notogastral porose areas (A2 rarely subdivided); A1 located in circumdorsal alignment (with A2 and A3), well lateroventrad of its usual position. Ad and A1 may be longer than illustrated. Posterior circumpedal carina confluent anteriorly with discidal carina; custodium large, knife-like. Six pairs of genital setae, two pairs of anal setae. Insertion of seta ad3 near lyrifissure iad (may be slightly anteriad or posteriad of it); removed from margin of anal plate approximately same distance as ad2. Seta ps1 inserted slightly ventrad, ps2 and ps3 well ventrad of circumdorsal muscle sigillae. Leg setal formulae (famulus included, solenidia in parentheses) as follows: leg I, 1-5-3(1)-4(2)-20(2); leg II, 1-5-3(1)-4(1)-15(2); leg III, 2-3-1(1)-3(1)-15; leg IV, 1-2-2-3(1)-12. Dorsal porose area of tarsi imperfect and present on both legs I and II. Femora I and II without retrotecta. No anterodorsal apophysis on trochanter IV. Lateral claws usually without distal tooth.

Remarks.

BANKS’ original collection of this species was from Sea Cliff, New York (Nassau Co.) where it was ‘swept from grass in great numbers’. A series of about 50 specimens is in alcohol in the MCZ collection, with two labels, ‘Oribata pratensis Banks’ and ‘Sea Cliff N.Y.’ in BANKS’ handwriting; no type label is included, but these are undoubtedly part of his original series. Also in the MCZ are an approximately equal number of specimens mounted in balsam on six slides, four of which were labeled by A. P. JACOT (some labeled ‘Sphaerobates’) and designated ‘cotypes’ whereas the other two were labeled by BANKS and designated ‘paratypes’; all slides and type designations were clearly made after the description, since BANKS neither made slides nor designated types in his early works with oribatid mites. Also, a single slide with six ‘cotypes’ (no. 932) is in the USNM collection. All of the above should be considered syntypes. I have also examined specimens from an old-field community in Jamesville (Onondaga Co.) New York, collected with pit-fall traps by D. SILLMAN, 11 August 1980.

Along with the type-species of Podoribates, P. longipes Berlese (and its South American subspecies P. longipes platensis Berlese), P. pratensis, and two other BANKS’ species discussed below (Sections III and IV), the following species seem to form a closely related group: P. cuscensis (Hammer) n. comb.; P. cuspidatus Sakakibara and Aoki, and P. joveolatus (Hammer). This species group, which can be called the ‘longipes group’, can be recognized by the short, subcapitate sensillus and the peripheral, circumdorsal alignment of porose area A1. At least the latter is synapomorphic; in all other members of the family A1 has the normal dorsal position. Other character states which might be used to define this group are not known for all included species.

Podoribates pratensis seems similar in habits to the European P. longipes, as discussed by GRANDJEAN (1963) (under the synonym Sphaerobates gratus Sellnick). Both are epigeal species and are locally abundant in grasslands where, as indicated by gut content analysis, they apparently feed predominantly on fungi associated with grasses, along with pollen, when it is available.
III. Podoribates turgidus (Banks) n. comb.

*Galuanna turgida* BANKS, 1906, p. 493.  

*Podoribates turgidus* and *P. pratensis* are very possibly synonyms. Four specimens, three alcoholic and one mounted in balsam, are housed in the MCZ, all labeled ‘types’; they should be considered syntypes. All are males, from Palm Springs, California, with total lengths between 598-697 μm. They fit the above redescription of *P. pratensis*, except that the medial angle of the translamella is not exhibited. In its place at most a slight undulation is recognizable. Because of this and the fact that the two are known only from opposite sides of the country, it seems prudent not to claim synonymy without the study of specimens from additional populations.

IV. Podoribates minusculus (Banks) n. comb.

*Oribata minuscula*: EWING, 1909, p. 359.

This is yet another member of the *P. longipes* group. A redescription would be identical to that proposed for *P. pratensis*, with exceptions as follow. Size smaller (holotype female 487 μm, total length). Outer tooth of lamellar cusp proportionally somewhat larger. Translamella gently curved (Fig. 4A) without medial angle. Sensillus (Fig. 4D) barbed, with fusiform head and long stalk, dorsolaterally recurved. Lamellar cusps widely separated, short but distinctly bicuspid, with inner point shorter. Lamellae removed from lateral contour of prodorsum in dorsal aspect; pedotectum I easily visible. Translamella without medial angle. Notogastral setae not distinguishable. Four pairs of notogastral porose areas; Aa and A1 circular, A2 and A3 somewhat elongate. Area A1 with normal position, well anterodorsal of A2 and A3 (not in circumdorsal alignment with the latter two). Palp atypical of Mochlozetidae, thinner and more elongate. Chelicera also atypical, elongate, with small chela, subpelopsiform (but subcapitulum diarthric, with normal rutellum). Six pairs of genital and two pairs of anal setae.

Remarks.

Although the original description mentioned ‘several specimens’, a single cotype specimen, mounted in balsam and somewhat crushed, is present in the USNM collection. No collection data, other than ‘c. Arcola, Illinois, VI-2106’ is available, either from the original description or slide labels. Due to the condition of the specimen, the above redescription is incomplete, but two misleading statements can still be identified in the original description. First, EWING gave the length of his specimens as 0.70 mm; even allowing for its broken condition, the available cotype

V. Podoribates artilamellatus (Ewing) n. comb.

*Oribata artilamellata*: EWING, 1909, p. 360.

*Podoribates* with the following combination of character states. Rostrum evenly rounded. Interlamellar seta long, erect; all prodorsal setae barbed (Fig. 4C). Sensillus (Fig. 4D) barbed, with fusiform head and long stalk, dorsolaterally recurved. Lamellar cusps widely separated, short but distinctly bicuspid, with inner point shorter. Lamellae removed from lateral contour of prodorsum in dorsal aspect; pedotectum I easily visible. Translamella without medial angle. Notogastral setae not distinguishable. Four pairs of notogastral porose areas; Aa and A1 circular, A2 and A3 somewhat elongate. Area A1 with normal position, well anterodorsal of A2 and A3 (not in circumdorsal alignment with the latter two). Palp atypical of Mochlozetidae, thinner and more elongate. Chelicera also atypical, elongate, with small chela, subpelopsiform (but subcapitulum diarthric, with normal rutellum). Six pairs of genital and two pairs of anal setae.
FIG. 4: A. — *Podoribates minusculus* (Banks), holotype female, lamellar region. B. — Same, bothridium and sensillus. C. — *Podoribates arillamellatus* (Ewing), syntype female, dorsolateral aspect of prodorsum. D. — Same, bothridium and sensillus.
(a gravid female) would have had a total length closer to 750 μm when intact. Second, Ewing described the pteromorph as 'rudimentary', but it is in fact moderately well developed, similar to that illustrated for *P. pratensis* (Fig. 3).

The tapered, subpelopsiform chelicerae distinguish this species from other *Podoribates* and in fact all other known Mochlozetidae. Among the described species, *Podoribates javensis* Willmann seems most similar to *P. artilamellatus*, but Willmann (1935) did not describe its palp or chelicerae, nor did Jacot (1940) when he proposed the subspecies *P. javensis africanus*. A reevaluation of the generic position of *P. artilamellatus* should be made upon the discovery of additional specimens.

VI. *Mochlozetes maximus* (Ewing) n. comb.


This species differs from the other three described species (*M. penetrabilis* Grandjean, *M. flatus* Grandjean, *M. officiosus* Grandjean) as follows. Lamellar cusps poorly developed (Fig. 5), only slightly extending anteriad of translamella. Seta le inserted laterally on lamella, at level of translamella. Lamellar width relatively uniform, not tapering posteriorly. Dorsosejugal porose area (*Ad*) somewhat elongated. Pteromorphs more strongly developed. Adalar porose areas (*Aa* and *Aa'*) and area *A1* circular, or nearly so; posterior adalar area (*Aa') located midway between setae *l1m* and *la*. Areas *A2* and *A3* elongated, but relatively short, less than half as long as distance between setae *h2-h3* and *h1-h2*, respectively. Ventral plate setae of normal size.

The type series was collected from under bark and in moss at Urbana, Illinois; none of these could be located and they probably no longer exist. There is, however, a non-type specimen determined and labeled by Ewing in the USNM collection. It is a male, 735 μm total length, which Ewing collected from under bark at Ames, Iowa, October 14, 1909, and is the specimen on which the above diagnosis was based. Since it is a dor-sal mount in balsam, and poorly cleared, characters of the ventral and lateral surfaces and legs could not be closely studied; setal row *p* and lyri-fissures *ih* and *ips* thus were not observed.

The poor optical properties of balsam could account for discrepancies with the original description regarding the sensillus (finely barbed, not smooth as Ewing illustrated) and rostral seta, or ‘lateral hair’ (more densely barbed than Ewing indicated); phase contrast microscopy allows these barbs to be more easily seen. Ewing’s length measurement of 0.80 mm probably referred to a female. Microsculpture of the notogastral

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FIG. 5 : *Mochlozetes maximus* (Ewing), dorsal aspect of male.
integument was not discernable under any illumination.

VII. Mochlobates n. gen.

Type-species: Oribata affinis Banks, 1895.

With character states of the Mochlozetidae (GRANDJEAN, 1963), except genital plates each with five setae. Interlamellar setae well developed, longest of the prodorsal setae. Translamella absent. Lamellae narrow, widely separated, hiding lateral contour of prodorsum and most of pedotectum I in dorsal aspect. Lamellar cusps small, only slightly projecting. Pteromorphs present, but not strongly developed. Posterior circumpedal carina independent from discidial carina; custodium absent. Fusion of prodorsum and notogaster extends well laterad of dorsophragmatic apophysis, almost to bothridium. Notogaster with 10 pairs of minute setae. Dorsosejugal porose area (Ad) narrow, short. Porose area Aa doubled. Female with five pairs of notogastral porose areas; areas A2 and A3 narrow, discrete, moderately elongate. Male with four pairs; A2 and A3 usually represented by single elongated ribbon-like area (divided into two highly elongated areas on one side of one male observed). Dorsal porose area of tarsus I imperfect, plugged; absent on tarsi II-IV. Femora I and II without retrotectum (crispin); femur II with distinct ventral blade. No anterodorsal apophysis on trochanter IV.

VIII. Mochlobates affinis (Banks) n. comb.

Oribata affinis: BANKS, 1895, p. 6.
Calumna affinis: BANKS, 1904, p. 72.

With character states of the genus. Mean total length of five females 1114 µm (range 1060-1160 µm); mean total length of four males 965 µm (range 940-1000 µm). Notogastral profile highly arched, similar to that of Mochlozetes penetrabilis (GRANDJEAN, 1930, Fig. 12); prodorsum rather flat in anterior half. Integument granular in lateral regions of podosoma, otherwise without distinct microsculpture. Rostrum entire. Lamellar cusp without lateral tooth (Fig. 6A). Tutorium narrow, without cusp, greatest width in middle; rostral seta inserted at distal end. Posteriorly, tutorium and sublamella appear in lateral aspect to join in broad U-shape, due to strong concavity between them. Sensillus clavate, barbed, sharply reflexed dorsolaterad by single bend near base. Interlamellar setae erect, very slightly curved posteriad (artificially depressed laterad in Fig. 6A to show shape). Seta ex of moderate

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FIG. 6: Mochlobates affinis (Ewing).
A. — Dorsal aspect of syntype female. B. — Right postero-lateral region of syntype male notogaster, showing compound porose area A2 + A3.
size, attenuate, barbed; le and ro as illustrated. Notogaster anteriorly with about ten or twelve indistinct longitudinal grooves, ending at prodorsum and visible only in reflected light and at low angle. Notogastral setae minute, shorter than length of their alveolar canals; setae of row ps all inserted ventrad of circumdorsal muscle sigillae. Notogastral porose area Aa elongate, occasionally oval and shorter than illustrated; Aa' small, subcircular, close to seta la. Area A1 elongated in dorsoventral direction, often irregular in form. Female area A3 may be up to 50% longer than illustrated; male area A2 + A3 curved slightly ventrad at medial extremity (Fig. 6B). Marginoventral porose areas of ventral plate of diverse shape, circular to ribbon-like, usually 6-8 on each side, ending in sejugal region. Discidium large, broadly triangular to subquadrate in ventral aspect. Ventral characters as in Mochlozetes penetrabilis (Grandjean, 1930, 1959) except for five genital setae and seta ad3 placed twice as far from margin of anal plate as ad2. Leg form and setation similar to that of M. penetrabilis except femur II with strong ventral blade and genu II with three setae (v' present). Distal tooth of lateral claws small, occasionally absent.

Remarks.

Banks' original series was collected from under loose tree bark in Washington, D.C. Nine alcoholic specimens are present in the MCZ collection in a vial which contains the labels 'Oribata affinis Bks ' (in Banks' handwriting) and 'Washington D.C. ' (printed). In addition, six specimens, mounted in balsam, are present on cotype slide no. 929 in the USNM collection. The MCZ specimens are undoubtedly part of syntype series and should be so labeled. Another vial, with seven specimens of this species containing a similar printed label and (in Banks' handwriting) the label 'Galumna affinis Bks ', are also syntypes, probably separated when Banks' recombined the name in 1904. Pearse (1946) has recorded representatives of this species (determined by Banks) from the Duke Forest, Durham Co., North Carolina.

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