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NEW FEATHER MITE TAXA (PTEROLICHOIDEA, PTEROLICHIDAE) FROM NEW WORLD IBISES (AVES, THRESKIORNITHIDAE) 1

BY W. T. ATYEO 2 and J. GAUD3

ABSTRACT: Dicranogonus, a new genus of pterolichine feather mites is established. The genus includes six new species from New World Threskiornithidae: D. theristici (type-species) from Theristicus c. caudatus (Brazil, Colombia), D. melanopis from Theristicus m. melanopis (Argentina), D. sculpturatus from Theristicus caerulescens (Paraguay), D. ancoripalpus from Cercibis oxycerca (Brazil), D. phimosi from Phimosus infuscatus berthelotii (Colombia), and D. botryodes from Mesembrinibis cayennensis (Brazil, Bolivia, Colombia).

RÉSUMÉ: Création d’un genre nouveau, Dicranogonus, qui inclut six espèces nouvelles, toutes parasites de Threskiornithidae du Nouveau Monde : D. theristici (espèce-type) de Theristicus c. caudatus (Brésil, Colombie) ; D. melanopis de Theristicus melanopis (Argentine) ; D. sculpturatus de Theristicus caerulescens (Paraguay) ; D. ancoripalpus de Cercibis oxycerca (Brésil) ; D. phimosi de Phimosus infuscatus berthelotii (Colombie) ; D. botryodes de Mesembrinibis cayennensis (Brésil, Bolivie, Colombie).

The avian family Threskiornithidae is divided into the ibises (Threskiornithinae) and the spoonbills (Platalea) (Steinbacher 1979). The 23 species of the Threskiornithinae are about equally divided between the Old and New Worlds, with only the glossy ibis (Plegadis falcinellus (L.)) occurring in both hemispheres. For the Platalea, five species have Old World distributions and one species is restricted to the New World. In previous studies on the feather mites of these birds, only one genus of the Pterolichoidea is known from ibises and spoonbills, Freyanella Dunbinin (Kramerellidae). ATYEO, GAUD, and HUMPHREYS (1972) have shown that the species of Freyanella occur on hosts within both threskiornithid subfamilies and that the mite species are restricted to one or the other hemispheres.

We have recovered numerous species of a new genus of the family Petrolichidae that appear to be restricted to species of the New World genera Phimosus Wagler, Cercibis Wagler, Theristicus Wagler and Mesembrinibis Peters. Although we have numerous collections from the other New World Threskiornithidae, we have never recovered

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specimens of the new genus from *Eudocimus* Wagler, *Plegadis* Kaup, or *Platalea* Linnaeus.

Specimens for this study were taken from study skins in the ornithological collections of Field Museum of Natural History (FMNH), Chicago and the National Museum of Natural History (NMNH), Washington. Types will be deposited in these Institutions and in the collections of the University of Georgia (UGA) and J. Gaud (GAUD). Standard acarological nomenclature is used; signatures for the idiosomal chaetotaxy follow ATYEO and GAUD (1966). Measurements are given in micrometers, leg segments are reported as the longest lengths, and distances between setal pairs are measured center-to-center. The number of teeth (dentations) on the adanal disc are variable, even in the same individual; in the descriptions, the variation is noted in brackets.

**PTEROLICHOIDEA, PTEROLICHIDAE, PTEROLICHINAE**

**Dicranogonus**, new genus

Type-species: *Dicranogonus theristicti*, new species.

Etymology: *Dikros* (G., forked) + *gonus* (Gr., knee) referring to the bifurcated setae on genua I and II.

The systematic position of this new genus is unclear. It is not clearly related to other pterolichids from the order Ciconiiformes, nor does it seem closely related to taxa with which it apparently shares specialized characters, e.g., large branched setae on the anterior genua occur in *Ceratothrix* Trouessart from the Psophiidae.

**Diagnosis**: Petrolichine mites with Tarsi I, II noticeably longer than anterior tibiae; tarsi II longer than tarsi I; setae *cG* on genua I, II, branched; setae *pR* on trochanters I, II, long, usually branched; tarsus I with setae *ba* approximate to solenidion omega I; tarsus II with setae *ba* removed from solenidion omega I. Prodorsal shield not encompassing external scapular setae; internal vertical setae approximate, long, extending beyond palpal apices. Hysterosoma with setae *l1* setiform to spiculiform, not inserted on shield; cupule *ia* posteromesal to setae *l1*; setae *d* 1-3 minute; setae *d* 4 absent; setae *sh* short, anteroventral to elongated setae *h*. Terminal setae *d* 5, 15 subequal in length; diameter of 15 greater than 5. Venter with epimerites I free. Male with opisthosoma narrowing to small, approximate (secondarily fused?) lobes, each bearing small terminal membrane; setae 13 spiculariform to setiform; setae 13, 14, cupule *ip* approximate; setae 14 expanded basally; setae *pa* approximate to 14, positioned lateral to sublateral; setae *pa* approximate; acuminate leaves. Venter with elongate paragenital sclerites extending from setae 2 (? genital setae) posteroventral of setae 2 (? coxal IV setae); genital organ recurved, short; pair irregular sclerotizations anterolateral to adanal disc; adanal disc corolla sclerotized, dentate. Tarsi IV with setae *d*, *e* as short pegs. Female with dorsal hysterosomal shield extending midway between setae 13, 14; setae 13, 14 setiform to spiculiform. Genital discs positioned between anterior and posterior genital setae, c1, c 2 (ga, gp of authors); pregenital apodeme narrow, semicircular, extending to setae c 2.

Among the six species of *Dicranogonus*, two can be defined in part by unique modifications; *D. ancoripalpus* males have palpal expansions on the palpi and *D. botryodes* adults have "beaded" striae and a distinct shield ornamentation. All species exhibit character states that are relative, and as such, differences may not be obvious. We would like to discuss a few of these characters in detail.

Lengths (including gnathosomata) of prepared specimens are variable within a series due primarily to specimen preparation. However, the six species can be separated into two groups by general dimensions of both sexes. *D. botryodes* and *D. phimosi* are smallest; males are 432-455 μm and females are 524-555 μm. The remaining species have males measuring 493-540 μm and females from 571-648 μm. There is no overlap between the size classes of the two groups of species.

If present, ornamentation of the dorsal hystero-
somal shields are of two types. The first and most common consists of irregular, subintegumental polygons (basically hexagons, Fig. 4); this type of pattern is incorporated in the total shield or in females of some species, on the posterior third. The second pattern is found in males and females of D. botryodes; these ornamentations appear as small clusters of circles and are accompanied by a particular type of striae each of which is regularly thickened so as to appear bead-like (Fig. 7).

The setae of trochanters I and II (setae pR) are more developed in males than in females and more developed on trochanters I than on trochanters II; in general the larger of these setae are branched, the smaller are unbranched. The trochanteral setae are most developed in D. ancoripalpus (Fig. 5).

Setae eG of genua I and II have similarly development in all species. The appearances of these setae are dependent on the orientation. Illustrations are from a view that demonstrates the thickness and branching of each seta, but different aspects will create different impressions. The same is true for the terminal setae (pai) of the males which appear as narrow leaves if observed in an "expanded" condition, but often these are seen from an oblique angle and thus appear to be very narrow, even spiculiform.

The longest setae on the dorsal and lateral idiosoma are the external scapular setae (sce) and the humeral setae (h). For males, these setae are similar in lengths according to species. The extremes are illustrated by D. ancoripalpus in which the external scapulars extend to setae d 3 and the humerals extend to midlength of tarsus III. The shortest setae occur on D. botryodes; for this species, the scapulars do not extend to setae d 2 and the basally enlarged humerals extend slightly beyond the apices of femora III.

Setae l 3 of males are different in each species; modifications range from short and spiculiform (D. theristici, Fig. 1), long and thornlike (D. ancoripalpus, Fig. 5) to long and setiform (D. phimost, Fig. 6). Females have these setae setiform to spiculiform, but the lengths are approximately the same in all species.

Males of the Astigmata often have setae d and e of tarsi IV modified as discs or pegs. In Dicranogonus, d and e are short pegs, with seta e ventrolateral and approximate to the proximal ventral setae and seta d dorsolateral at the same level on the tarsus (Fig. 2) or at a level proximal to e.

Key to males of Dicranogonus

1. Striae between prodorsal and hysterosomal shields simple; ornamentation of hysterosomal shield absent or in form of irregular polygons

2. Striae between prodorsal and hysterosomal shields with regular expansions making the striae appear beaded; hysterosomal shield ornamented with clusters of "small circles"........... botryodes, n. sp.

3. Palpus simple........................................... ancoripalpus, n. sp.

4. Idiosoma length exceeding 500 µm; setae l 3 thornlike, not extending to apices of internal postanal setae

5. Hysterosomal shield ornamented, each adanal disc corolla with 11-13 teeth........... sculpturatus, n. sp.

5. Total length, 493-524 µm; distance between external scapular setae, 90-94 µm........... melanopis, n. sp.

Total length, 532-540 µm; distance between external scapular setae, 90-94 µm........... melanopis, n. sp.

Key to females of Dicranogonus

1. Striae between prodorsal and hysterosomal shields simple; ornamentation of hysterosomal shield absent or in form of irregular polygons

2. Striae between prodorsal and hysterosomal shields with regular expansions making the striae appear beaded; hysterosomal shield ornamented with clusters of "small circles"........... botryodes, n. sp.

3. Hysterosomal shield totally ornamented with irregular polygons; opisthonotal gland approximately equidistant from setae d 2, d 3...........
DICRANOGNOSUS THERISTICI, new species
(Figs. 1-3)

The males of this species have the greatest length to width ratio (measured as the distance between the humeral setae) of all Dicranogonus species. The ratio is 2.6 : 1, whereas other species regardless of overall dimensions, have the ratios between 2.30 : 1 to 2.35 : 1. D. theristici and D. melanopis appear to be sibling species; both are closely related to D. sculpturatus as both have fine trochanteral setae pR, short spiculiform setae l3. Males of D. theristici and D. melanopis lack hysterosomal ornamentation and females have irregular polygons on the posterior third of the shield; adults of D. sculpturatus have the hysterosomal shields completely ornamented with irregular polygons.

MALE (holotype). Length, including gnathosoma, 517; width as distance between setae h, 200. Gnathosoma with simple, unexpanded palpi, setiform supracoxal setae. Prodorsal shield incised at level of scapular setae, not including external scapulars; external scapular setae extending to setae l2; internal scapular minute, fine. Striae between prodorsal and hysterosomal shields simple. Hysterosomal shield glabrous; weakly sclerotized anterior to setae d1; setae l3 spiculiform, not extending to apices of terminal lobes. Idiosomal venter as figured; adanal discs each with 12 [11-13] dentations. Tarsus IV with setae d, e at same level. Measurements of setae, distances between setae: see : sce, 79 ; sci : ski, 53 ; d l : d l, 35 ; l l : l l, 177 ; d l : d 2, 82 ; d 2 : d 3, 106 ; l 2 : l 2, 116 ; d 2 : gland, 41 ; gland : d 3, 104 ; l 1, 35 ; l 3, 53 ; cG 1, 31. Adanal disc diameter, 24. Leg segments, femur, genu, tibia, tarsus (not including pretarsus): I, 63, 45, 46, 51 ; II, 61, 41, 41, 71 ; IV, 51, 47, 43, 94.


TYPE DATA. From Theristicus c. caudatus (Boddaert, 1783) (Threskiornitidae) : σ holotype, 4 σ, 2 ♀♀ paratypes, Ihla Pirica (= Ihla Urucurituba), Rio Amazonas, Pará, Brazil, September 2, 2058, A. M. Olalla (FMNH 257,755 ; UGA 12,332) ; 12 σ, 8 ♀♀ paratypes, same data as holotype except September 9, 1958 (FMNH 257, 756 ; UGA 12,331) ; 3 σ, 4 ♀♀ paratypes, Monte Alegro, Pará, Brazil, January 1929, A. Lako (FMNH 73,913 ; UGA 12,330) ; 7 σ, 5 ♀♀ paratypes, 15 km south Cali, Cauca, Colombia, April 19, 1949, Father A. Olivares (NMNH 12,331).

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3. Total length less than 610 μm ; distance between setae l 2 less than 150 μm........... theristici, n. sp.
   Total length more than 630 μm ; distance between setae l 2 more than 165 μm........... melanopis, n. sp.
4. Setae l 3 spiculiform, with greater diameter than setiform l 2 ; setae l 4 spiculiform, with greater diameter than minute pai ; total length greater than 575 μm. 5 Setae l 2, l 3 setiform, of equal diameters; setae l 4, pai spiculiform, but l 4 longer than pai, total length less that 550 μm........... phimosi, n. sp.
5. Distances between external scapular setae, 96-110 μm ; between internal scapulars, 43-55 μm........... sculpturatus, n. sp.

Distances between external scapular setae, 110-116 μm ; between internal scapulars, 61-69 μm........... ancipalipalpus, n. sp.
Dicranogonus melanopis, new species

The length to width ratio for males of Dicranogonus theristiei is about 2.6 : 1; for all other species, including D. melanopis, this ratio is approximately 2.3 : 1. These two species are so similar that differences relate to sizes, especially of the females, e.g., comparing theristiei to melanopis, total lengths are respectively, less than 590 μm and over 630 μm and widths measured between the humeral setae, less than 260 μm and over 275 μm. The males differ in general size and other measurements with theristiei being smaller than melanopis.


FEMALE (paratype). Length, including gnathosoma, 632 ; width as distance between setae h, 278. Prosoma similar to male. Hysterosomal shield glabrous on anterior 2/3, irregular polygons on posterior 1/3; setae l2-4, pa1 setiform. Measurements of setae, distances between setae: sce : sce, 112 ; sci : sci, 59 ; d 1 : d 1, 39 ; l1 : l1, 231 ; d 1 : d 2, 118 ; d 2 : d 3, 127 ; l2 : l2, 167 ; d 2 : gland, 65 ; gland : d 3, 94 ; l1, 29 ; cG 1, 33. Leg segments, femur to tarsus: I : 67, 47, 43, 63 ; II, 61, 44, 41, 78 ; IV, 47, 45, 41, 116.

ETYMOLOGY. The specific epithet is derived from the specific epithet of the host, Theristicus.

Dicranogonus sculpturatus, new species

The two previously described species and D. sculpturatus are more closely related to each other than to the species to be named. Each is characterized in part by unmodified palpi, large size, and relatively short setae l3 in males. The males
of *D. sculpturatus* differ those of the related species in having the hysterosomal shield fully patterned and seta *d* of tarsus IV proximal to the ventral setae and seta *d*. Females of *D. sculpturatus* differ from the previous species by having the hysterosomal shields fully ornamented rather than only the posterior third; however, this character state is shared with the new species, *D. ancoripalpus*.

**MALE (holotype).** Length gnathosoma, 493; width as distance between setae *h*, 208. Gnathosoma, prosoma, idiosomal venter similar to *D. theristici*; external scapular setae with diameters greater than internal scapulars, extending to level of opisthonotal gland; setae *pR* 1 thick, branched. Striae between prodorsal and hysterosomal shields simple. Hysterosomal shield patterned with weak, irregular polygons; setae 13 spic-


TYPE DATA. From Theristicus caerulescens (Vieillot, 1817): σ holotype, 10 σσ, 12 φφ paratypes, Gran Chaco, Puerto Casado km. 83, Alto Paraguay, Paraguay, June 20, 1945, [collector: WILLIM] (FMNH 252,815; UGA 12, 329). Holotype and paratypes deposited FMNH, paratypes UGA, GAUD.

ETYMOLOGY. The specific epithet is from sculplo (L., carved, engraved) and refers to the complete ornamentation of the hysterosomal shields in both sexes.

Dicranogonus ancoripalpus, new species

(Fig. 5)

The males of this new species are easily identified by the lateral expansions of the basal podomere of the palpus and the massive, branched setae pR on trochanters I. Females are distinguished from those of the related Dicranogonus sculpturatus by the greater distances between pairs of setae, e.g., 110-118 μm versus 96-108 μm between the external scapular setae.

MALE (holotype). Length, including gnathosoma, 517; width as distance between setae h, 239. Gnathosoma with palpi laterally expanded, setiform supracoxal setae. Prodorsal shield, hysterosomal shield, venter similar to D. theristici; external scapular setae extending to setae d 3; internal scapulars fine. Striae between prodorsal and hysterosomal shields simple. Hysterosomal shield glabrous; setae l 3 thornlike, extending beyond apices of terminal lobes. Adanal discs each with 7 [6-8] dentations. Tarsus IV with seta e at level midway between d, s. Measurements of setae, distances between setae: sce: sce, 104; sci: sci, 63; d l: d l, 65; l l: l l, 208; d l: d 2, 69; d 2: d 3, 61; l 2: l 2, 150; d 2: gland, 61; gland: d 3, 104; l l, 61; l 3, 96; cG I, 49. Adanal disc diameter, 22. Leg segments, femur, genu, tibia, tarsus (not including pretarsus): I, 82, 53, 56, 65; II, 82, 48, 53, 78; IV, 65, 57, 55, 104.

FEMALE (paratype). Length, including gnathosoma, 586; width as distance between setae h, 251. Prosoma similar to male. Hysterosomal shield completely ornamented with irregular polygons; setae l 2-4, pai setiform. Measurements of setae, distances between setae: sce: sce, 116; sci: sci, 69; d l: d l, 78; l l: l l, 239; d l: d 2, 80; d 2: d 3, 96; l 2: l 2, 174; d 2: gland, 80; gland: d 3, 80; l l, 37; cG I, 43. Leg segments, femur to tarsus: I, 82, 51, 51, 76; II, 80, 49, 49, 78; IV, 47, 51, 51, 135.

TYPE DATA. From Cercibis oxy cerca (Spix, 1825): σ holotype, 13 σσ, 27 φφ paratypes, Boa Vista, Serra da Lua, Amazonas, Brazil, February 20, 1913, M. P. ANDERSON, R. H. BECK (FMNH 44,931; UGA 12,328); 4 σσ, 7 φφ paratypes, same data as holotype (FMNH 44, 930; UGA 12,327). Holotype and paratypes deposited FMNH, paratypes UGA, GAUD.

ETYMOLOGY. From ancora (L., anchor) + palpus, the specific epithet calls attention to the lateral hoolike projects of the male palpi.
Dicranogonus phimosi, new species (Fig. 6)

The smallest species of Dicranogonus are *D. phimosi* and *D. botryodes*. The males of these new species are about 430-450 μm in total length and for the same measurement, the females are 525-555 μm. *D. phimosi* is similar to all preceding species, although generally smaller for most measurements. The males have setae *l* 3 long and relatively flexible; females have setae *l* 2 and *l* 3 fine and setiform and setae *l* 4 and *pai* spiculiform.

**MALE** (holotype). Length, including gnathosoma, 447; width as distance between setae *h*, 200. Gnathosoma, prodorsum, venter, hysterosomal shield similar to *D. theristici*; external scapular setae extending to setae *l* 2; internal scapular minute, fine. Striae between prodorsal and hysterosomal shields simple. Hysterosomal shield glabrous; setae *l* 3 setiform extending beyond apices of terminal lobes. Idiosomal venter as figured; adanal discs each with 9 [9-11] dentations. Tarsus IV with setae *d* near mid-length of segment, distant from setae *e*. Measurements of setae, distances between setae: *see*: *see*, 82; *sci*: *sci*, 39; *d* 1 : *d* 1, 63; *l* 1 : *l* 1, 177; *d* 1 : *d* 2, 69; *d* 2 : *d* 3, 92; *l* 2 : *l* 2, 120; *d* 2 : gland, 37; gland : *d* 3, 82; *l* 1, 29; *l* 3, 118; *cG* I, 39. Adanal disc diameter, 24. Leg segments, femur, genu, tibia, tarsus (not including pretarsus) : *l*, 69, 43, 47, 61; *II*, 67, 43, 47, 69; *IV*, 67, 49, 49, 110.

**FEMALE** (paratype). Length, including gnathosoma, 540; width as distance between setae *h*, 247. Prosoma similar to male. Hysterosomal shield completely ornamented with irregular polygons; setae *l* 2-3 setiform; *l* 1, *l* 4, *pai* spiculiform. Measurements of setae, distances between setae: *see*: *see*, 98; *sci*: *sci*, 45; *d* 1 : *d* 1, 78; *l* 1 : *l* 1, 208; *d* 1 : *d* 2, 88; *d* 2 : *d* 3, 94; *l* 2 : *l* 2, 157; *d* 2 : gland, 69; gland : *d* 3, 71; *l* 1, 31; *cG* I, 39. Leg segments, femur to tarsus : *l*, 79, 49, 46, 65; *II*, 76, 49, 46, 73; *IV*, 73, 53, 49, 133.

**TYPE DATA.** From *Phimosus infuscatus bellepisci* Hellmayr, 1903 : ♀ holotype, 7 ♀♂ paratypes, El Dificil, Magdalena, Colombia, December 17, 1946, M. A. CARRIKER, Jr. (NMNH 391,826; *UGA* 2077). The holotype and paratypes at NMNH, paratypes at UGA, GAUD.

**ETYMOLOGY.** The specific epithet is derived from *Phimosus*, the genus of the type host.

Dicranogonus botryodes, new species (Fig. 7)

Among the *Dicranogonus* species, this new species has a number of distinctive character states. For both sexes, the hysterosomal shields are ornamented with small clusters of connected circles, the humeral setae are short and basally expanded, the striae between the prodorsal and hysterosomal shields are beaded, the internal scapular setae have greater diameters than the external scapulars, and the external scapular setae do not extend to setae *d* 2.

**MALE** (holotype). Length, including gnathosoma, 432; width as distance between setae *h*, 220. Gnathosoma, prodorsum, venter as *D. theristici*; external scapular setae not extending to setae *d* 2; internal scapular spiculiform. Striae between prodorsal and hysterosomal shields beaded. Hysterosomal shield ornamented with clusters of circles; setae *l* 3 spiculiform, not extending to apices of terminal lobes. Adanal discs each with 6 [7] dentations. Tarsus IV with setae *d*, *e* at same level. Measurements of setae, distances between setae: *see*: *see*, 90; *sci*: *sci*, 55; *d* 1 : *d* 1, 63; *l* 1 : *l* 1, 189; *d* 1 : *d* 2, 71; *d* 2 : *d* 3, 110; *l* 2 : *l* 2, 169; *d* 2 : gland, 75; gland : *d* 3, 88; *l* 1, 29; *l* 3, 57; *cG* I, 31. Adanal disc diameter, 19. Leg segments, femur, genu, tibia, tarsus (not including pretarsus) : *l*, 61, 35, 41, 47; *II*, 55, 33, 39, 57; *IV*, 59, 39, 41, 86.
FEMALE (paratype). Length, including gnathosoma, 540; width as distance between setae h, 224. Prosoma, hysterosomal shield similar to male except with punctate striae in pygidial area; setae l3-4, pai spiculiform. Measurements of setae, distances between setae: sce : sce, 98; sci : sci, 59; d l : d l, 61; l l : l l, 193; d l : d 2, 78; d 2 : d 3, 98; l 2 : l 2, 163; d 2 : gland, 80; gland : d 3, 82; l l, 33; cG 1, 37. Leg segments, femur to tarsus: I, 69, 41, 45, 63; II, 67, 39, 41, 71; IV, 61, 43, 43, 112.

TYPE DATA. From Mesembrinibis cayennensis (Gmelin, 1789): ♂ holotype, 8 ♂♂, 6 ♀♀ paratypes, Ilha Pirica (= Ilha Urucurituba), Rio Amazonas, Pará, Brazil, August 28, 1958, A. M. Olalla (FMNH 257,760; UGA 12,335); 1 ♂, 3 ♀♀ paratypes, Buena Vista, Sant Cruz, Bolivia, July 7, 1938, F. Steinbach (FMNH 178,610; UGA 12,336); 2 ♂, 4 ♀♀ paratypes, Norosi, Bolivar, Colombia, March 4, 1947, A. Carriker, Jr. (NMNH 391,823; UGA 2076); 8 ♂♂, 4 ♀♀ paratypes, El Real, Rio Nechi, Antioquia, Colombia, March 4, 1943, M. A. Carriker, Jr.
ETYMOLOGY. The name *botryodes*, derived from *botrys* (Gr., grape cluster), refers to the "cluster of grapes" ornamentation on the adult hysterosomal shields.

REMARKS. *Dicranogonus botryodes* and *D. theristici* were collected on the Ilha Pirica in the summer of 1958 by A. M. ÜLLALA from their respective hosts. To have examples of sympatric threskiornithid hosts harboring congeners is rare. It should be noted that the internal scapular setae of *D. botryodes* are fine; although each is 12 μm in length, it is difficult to ascertain if the setae are present or absent.

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