

# The Great Lakes Entomologist

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Volume 27

Number 3 - Fall 1994 *Number 3 - Fall 1994*

Article 4

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October 1994

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### Recommended Citation

Bernard, E. C. and Snider, R. J. (1994) "*Cryptopygus Bipunctatus* (Collembola: Isotomidae) in North America, and *C. Posteroculatus* N. Comb.," *The Great Lakes Entomologist*: Vol. 27 : No. 3 , Article 4.

Available at: <http://scholar.valpo.edu/tgle/vol27/iss3/4>

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CRYPTOPYGUS BIPUNCTATUS (COLLEMBOLA: ISOTOMIDAE) IN NORTH AMERICA, AND *C. POSTEROCULATUS* N. COMB.

E. C. Bernard<sup>1</sup> and R. J. Snider<sup>2</sup>

ABSTRACT

Specimens of *Cryptopygus bipunctatus* are reported and described from North America (Michigan) for the first time. The species is easily recognized by its lack of color, one pair of ocelli on black eyespots, and one pair of ventral manubrial setae. Michigan and European specimens are very similar. A very similar Polish species, *Isotomina posteroculata*, is transferred to *Cryptopygus*.

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*Cryptopygus bipunctatus* (Axelson) (= *Isotoma bipunctata* Axelson) is widely distributed in Europe (Stach 1947, Gisin 1960), but usually has not been considered part of the North American fauna. Hammer (1938) reported *I. bipunctata* from east Greenland, but Agrell (1939) considered her specimens to be *I. notabilis pallida* Agrell. Mills (1939) reported specimens from Manitoba, but Christiansen and Bellinger (1980) believed they probably were *I. notabilis* Schäffer or *I. ekmani* Fjellberg. Dallai (1969) transferred *I. bipunctata* to *Cryptopygus* Willem. In 1972, Michigan specimens identified as *C. bipunctatus* were collected during surveys of Collembola around wastewater treatment sites. Because this taxon has not been reliably described or reported from North America, a detailed description is given of the Michigan specimens, which were compared to European specimens.

MATERIALS AND METHODS

Michigan specimens were extracted with Tullgren funnels from soil collected from grassy areas at the Belding Sewage Treatment Facility, Ionia County, Michigan, then permanently mounted on slides. For comparison, specimens collected in Europe were solicited from several individuals and institutions. All drawings were made with the aid of a drawing tube. In the description, we refer to thoracic and abdominal segments as TH I, TH II, TH III, ABD I, ABD II, ABD III, ABD IV, and for the final two, fused segments, ABD V + VI. Setae in the posterior, transverse row of each segment are designated as p1, p2, etc., where p1 is the seta closest to the dorsomedian line.

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*Cryptopygus bipunctatus* (Axelson)

- Cryptopygus bipunctatus* Dallai, 1969. Redia 51:238.  
 = *Isotoma bipunctata* Axelson, 1903. Acta Soc. Fauna Flora Fenn. 25:9.  
 = *Proisotoma (Isotomina) bipunctata* Gisin, 1943. Rev. Suisse Zool. 50:162.  
 = *Proisotomodes bipunctata* Bagnall, 1949. Ann. Mag. Nat. Hist. 12:84.  
 = *Parisotoma bipunctata* Hazelton and Glennie, 1953. British Caving (C. D. H. Collingford, ed.):273.  
 = *Isotomina bipunctata* Gisin, 1960. Collembolenfauna Europas:200.

Dallai (1969) transferred *Isotomina bipunctata* to *Cryptopygus* on the basis of the synonymization of *Isotomina* Börner and *Cryptopygus* by Massoud and Rapoport (1967), but did not take into account the other combinations proposed for this species over the years. A brief exposition of its history is warranted.

The taxon described as *Isotoma bipunctata* frequently has been shifted among several genera, due to its unusual morphological features. Axelson (1903) differentiated *I. bipunctata* from other *Isotoma* spp. on the basis of one pair of ocelli on pigmented spots and simple body setae. Other characteristics given by Axelson and important to placement of the species are unguis without teeth, tibiotarsus without clavate tenent hairs, tenaculum corpus with one seta, and two mucronal teeth. Stach (1947), thoroughly redescribing the species, found that the fifth and sixth abdominal segments were fused, the fifth abdominal tergite had one pair of blunt sensilla, and the manubrium possessed one pair of ventrodorsal setae. He considered *I. bipunctata* to be an unusual species for which a new genus eventually would be needed. Gisin (1943) placed the species in *Proisotoma (Isotomina)* and later (1960) in *Isotomina* on the basis of the two ventral manubrial setae, slender dentes, and fused fifth and sixth abdominal segments. Bagnall (1949) established the genus *Proisotomodes*, with *I. bipunctata* as its type and only species. *Proisotomodes* was differentiated by the small size of the body, tenaculum with one seta, manubrium with one pair of ventral setae, and bidentate mucro. Gisin (1960) regarded *Proisotomodes* as a synonym of *Isotomina*. Hazelton and Glennie (1953) listed the species in *Parisotoma* Bagnall, but it is clear from Salmon's discussion (1964) that if *Parisotoma* is a valid genus, it must be restricted to species with 4-6 pairs of eyes. Gisin (1960) considered *Parisotoma* a synonym of *Isotoma*.

Willem (1901) briefly described a new genus and species, *Cryptopygus antarcticus*, separated from other taxa on the basis of the "sixth abdominal segment usually invisible from above, depressed downward by the fifth abdominal segment" (see also Stach 1947). Willem's illustration suggests ankylosed fifth and sixth abdominal segments. Willem also described and illustrated a short furcula with subequal manubrium and dens, and a bidentate mucro. Historically, *Isotomina* Börner 1903 was differentiated from other isotomid taxa by having a partially divided postantennal organ, smooth body setae, fused fifth and sixth abdominal segments, and dens longer than the manubrium. Massoud and Rapoport (1968) considered that both *Cryptopygus* and *Isotomina* had fused fifth and sixth abdominal segments, and thus regarded *Isotomina* as a junior synonym of *Cryptopygus*.

The genus *Cryptopygus* is now defined as Isotomidae with fused fifth and sixth abdominal segments, few ventral manubrial setae, two mucronal teeth, and PAO often constricted or with a median listel (Christiansen and Bellinger 1980). *Isotoma bipunctata* clearly fits this concept of *Cryptopygus*. It is excluded from *Isotoma* because it has only one pair of ventral manubrial setae, not many. The genera *Isotomina* and *Proisotomodes*, to which *I. bipunc-*

*tata* has been referred, are junior synonyms of *Cryptopygus*. The definition of *Parisotoma* as given by Salmon (1964) does not accommodate *I. bipunctata*.

#### DESCRIPTION OF MICHIGAN SPECIMENS

**Color and Size:** White except for black eyespots (Fig. 1). Length = 486–647  $\mu\text{m}$ , mean = 590  $\mu\text{m}$  ( $n = 6$ ).

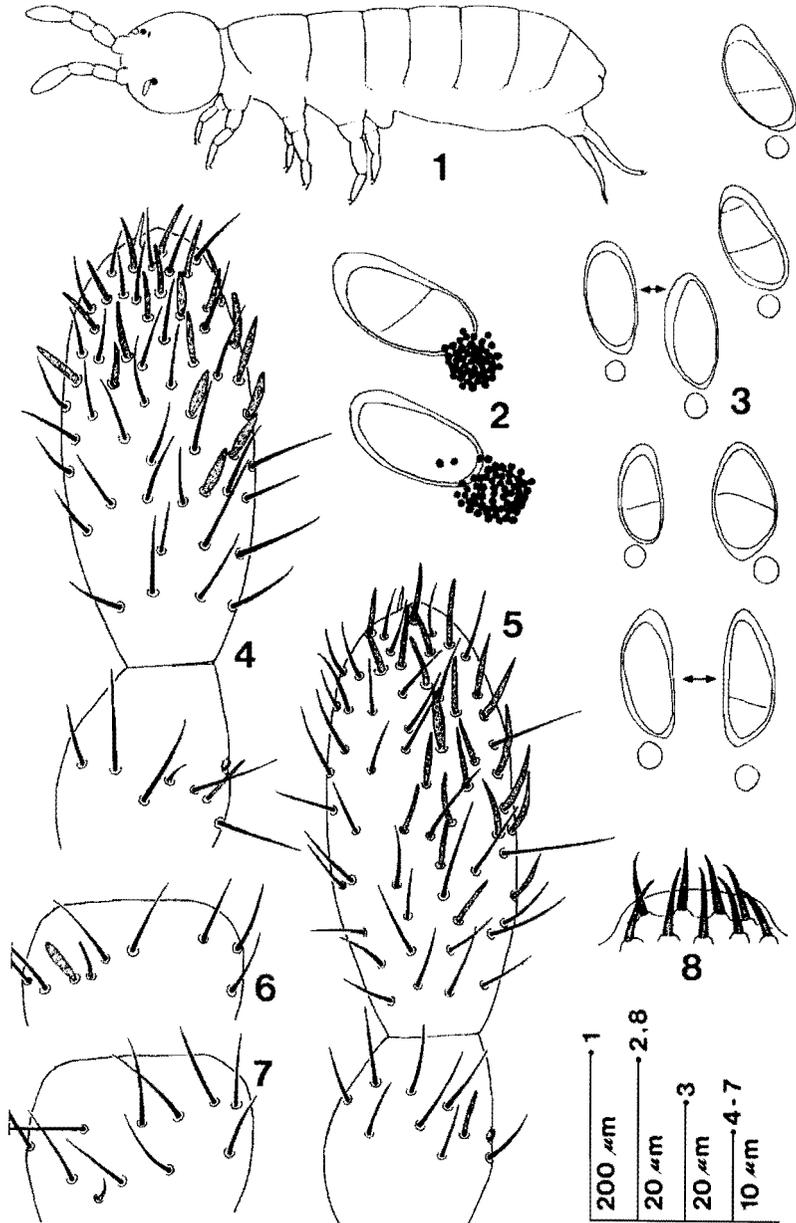
**Head:** Postantennal organ (PAO) oval, length 3.5–5  $\times$  the width of the ocellus, wall irregularly thickened, median listel present or absent (Figs 2, 3). One ocellus on each side of the head, adjacent to the PAO, pigment granules large and distinct, frequently spreading onto PAO (Fig. 2). Antenna slightly longer than length of head, ratio of segments I:II:III:IV as 1:1.5:1.6:2.9. Segment I with short, thorn-like seta dorsally (Fig. 7), one large and one small sensilla ventrally (Fig. 6); segment II without differentiated sensilla; segment III with one thorn-like seta, and sense organ consisting of two small club-shaped sensilla in pits, flanked on each side by a longer sensillum (Figs. 4, 5); segment IV with numerous pointed and blunt sensilla, pin seta simple, bluntly pointed (Figs. 4, 5); subapical pit and sensory rod not seen. Labrum with five subapical and four apical setae, anterior margin smooth (Fig. 8); mandible of typical isotomid form, apically truncated (Fig. 9), with four anterior teeth and large molar region; maxilla with tridentate capitulum and apparently six fringed lamellae (Fig. 9); maxillary outer lobe with trifurcate maxillary palpus, the apical digit the longest, and two basal setae; sublobal plate apically smooth, basally with three seta-like projections (Fig. 9).

**Legs:** Unguis and unguiculus untoothed, pretarsus with one pair of setae, clavate tenent hairs absent. All leg setae smooth and acuminate. Foreleg (Figs. 10, 11) with two long, precoxal setae, coxa without setae; trochanter with two exterior and two interior setae; tibiotarsus with a subapical whorl of seven setae. Mesoleg precoxae I and II with two and six setae, respectively; coxa with nine setae; trochanter with nine setae (Figs. 12, 13); tibiotarsus ventrally with five pairs of setae, dorsally with three longitudinal rows of setae (Figs. 14, 15). Metaleg (Figs. 16, 17) precoxae I and II with four and five setae, respectively; coxa with nine setae, most of them in a transverse row; trochanter with nine setae; femur with many exterior setae, few interior setae; tibiotarsus with four pairs of ventromedian setae.

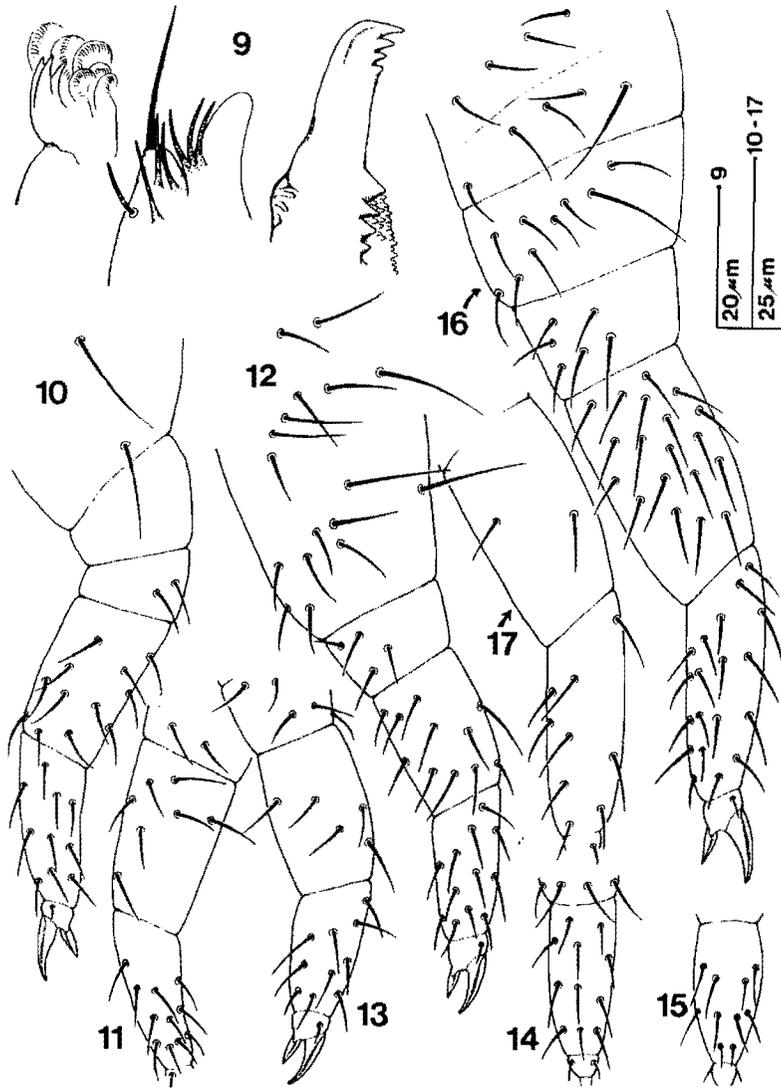
**Abdomen:** Ventral tube with four pairs of lateral setae and one pair of caudal setae (Fig. 21). Each tenaculum ramus with four teeth, tenaculum corpus with one anterior seta. Furcula (Fig. 18) well developed, dens about twice the length of the manubrium; manubrium with 16 pairs of dorsal setae and one pair of ventral setae setae, apically with two small teeth; dens crenulate, with three rows of setae; subterminal seta extending slightly past furcula terminus; mucro bidentate, apical tooth larger than antepical tooth.

**Chaetotaxy:** All common setae smooth and acuminate (Figs. 19, 20). Seven unpaired dorsomedian setae on head; seta p1 shorter than p2. All body sensilla thin except on ABD V+VI. Each side of TH II tergum with three anteriolateral sensilla; TH III tergum with two posterior sensilla and one anteriolateral sensillum; TH III sternum with two setae. ABD I with one sensillum between p4 and p5, and another between p9 and p10; ABD II with one sensillum between p4 and p5, and another near the lateral margin; ABD III with a sensillum between p4 and p5, and another near the posteriolateral margin; ABD IV with two sensilla, one between p2 and p3, another between p4 and p5; ABD V+VI on each side with one plump laterodorsal sensillum and one thin ventrolateral sensillum.

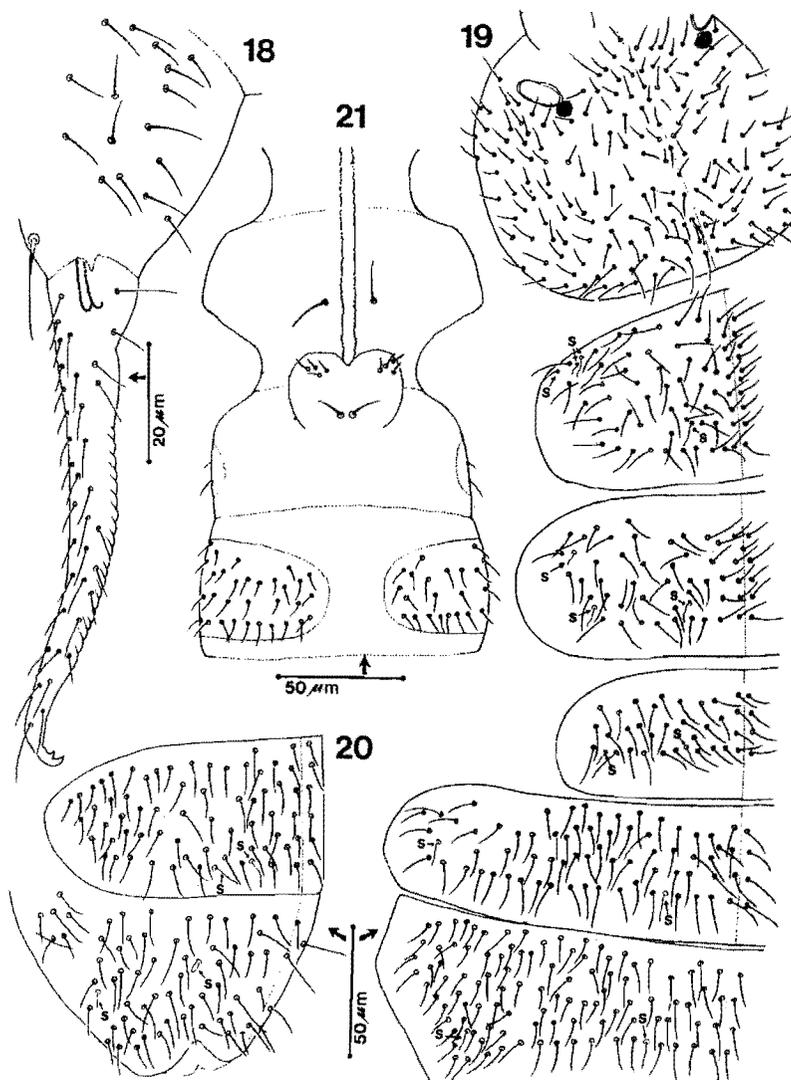
**Collection Data:** Six female and late subadult specimens collected from



Figures 1-8. *Cryptopygus bipunctatus*. 1. Habitus. 2. Postantennal organs (PAO's) and eyespots. 3. Variation in shape of postantennal organ, and location of ocelli. Arrows indicate PAO's from the same specimen. 4. Antennal segments III+IV, exterior view. 5. Antennal segments III+IV, interior view. 6. Antennal segment I, ventral view. 7. Antennal segment I, dorsal view.



Figures 9-17. *Cryptopygus bipunctatus*. 9. Mouthparts (l.-r.): apex of maxilla; maxillary palpus and sublobal plate; apex of mandible. 10. Foreleg, exterior view. 11. Foreleg, interior view. 12. Mesoleg, exterior view. 13. Mesoleg, interior view. 14. Mesotibiotarsus, dorsal view. 15. Mesotibiotarsus, ventral view. 16. Metaleg, exterior view. 17. Metaleg, interior view.



Figures 18–21. *Cryptopygus bipunctatus*. 18. Furcula. 19. Chaetotaxy of head, thorax, and abdominal segments I–III, left side (sensilla indicated by s and arrow). 20. Chaetotaxy of abdominal segments IV–V+VI (sensilla indicated by s and arrow). 21. Venter of metathorax and abdominal segments I–II.

sandy, moist soil at the edge of deciduous secondary forest, Belding Sewage Treatment Facility, Ionia County, Michigan, 25 July 1972, Renate M. Snider and Ernest C. Bernard, collectors.

**Diagnosis:** The combination of one pair of ocelli on black eyespots, one pair of plump sensilla on ABD V+VI, one pair of ventral manubrial setae, and bidentate mucro distinguishes *C. bipunctatus* from most other Collembola. The species described by Stach (1947) as *Isotomina posteroculata* has each ocellus distant from the PAO and has a toothed unguis. Other *Isotoma*-like taxa with only one pair of ocelli have numerous ventral manubrial setae and tridentate or quadridentate mucrones.

**Discussion:** Specimens of European *C. bipunctatus* from Vienna, Austria; Puglia, Italy; Tjøme, Norway; and Budleigh, Salterton, England, were all very similar in structure and sensillar chaetotaxy to the Michigan specimens, and to the description given by Stach (1947).

*Isotomina posteroculata* is so similar to *C. bipunctatus* that the two could be considered the same species. However, the wide separation of the PAO and ocellus, and the toothed unguis, serve to separate the two taxa. Because of the great similarity, *I. posteroculata* is transferred to *Cryptopygus*:

***Cryptopygus posteroculatus* (Stach) n. comb.**

*Isotomina posteroculata* Stach, 1947. Polish Acad. Sci. Lett., p. 278.

#### ACKNOWLEDGMENTS

We are grateful to Dr. Erhard Christian, Vienna, and Ms. Suzanne Lewis, British Museum (Natural History), for kindly lending us specimens of *C. bipunctatus*, and to Dr. Arne Fjellberg, Tjøme, Norway, for sending freshly collected specimens from Norway. We also thank Dr. Peter Bellinger for his assistance with the literature.

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