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Abstract

The Enicocephalomorpha of North Dakota is documented with the report of the unique-headed bug, *Systelloderes biceps* (Say, 1832) from North Dakota for the first time. We also discuss the geographic distribution of *S. biceps* and *Systelloderes culicis* (Uhler, 1892), provide color photographs, provide diagnoses for the separation of these species from all other North American species, and designate a lectotype for *S. culicis*.

Keywords: Diagnosis, Distribution, Lectotype, Systelloderes Blanchard

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This paper is the second in a series of papers regarding the Heteroptera of North Dakota initiated and supported by years of collecting specimens and literature. Rider (2012) documented the Pentatomoidea fauna of North Dakota, totaling 62 species, and described the two historic expeditions that passed through the region. Despite years of searching for Heteroptera in southeastern North Dakota (i.e., 1992 to the preparation of this publication) multiple specimens of the family Enicocephalidae had not been collected until relatively recently. One previous unpublished record, included herein, is now substantiated by the discovery of additional specimens.

The unique-headed bugs are an understudied group of insects with scant biological information known in the literature. These true bugs live in leaf litter, soil, river beds, or under bark where they prey on small invertebrates and insects (Kritsky 1977a). Enicocephalomorpha are the only infraorder of Hemiptera that exhibit mating swarms (Wygodzinsky and Schmidt 1991) and they may be comprised of hundreds or thousands of males with only a few females (Schuh 1970). The infraorder is divided into two families, Aenictopecheidae and Enicocephalidae, both of which are broadly distributed, but the latter is more diverse and better known. Enicocephalidae are divided into five subfamilies, with two found in North America north of Mexico, Alienatinae, found in Arizona and Florida, and Enicocephalinae, widespread in the eastern, southern, and western United States (Froeschner 1988, Wygodzinsky and Schmidt 1991). The Enicocephalinae are represented by five genera in the United States: *Brevidorsus* Kritsky 1977b, *Hymenocoris* Uhler 1892, *Lysenicocephalus* Wygodzinsky and Schmidt 1991, *Systelloderes* Blanchard 1852, and *Urnacephala* Wygodzinsky and Schmidt 1991. *Systelloderes* is the most commonly encountered genus of the Enicocephalidae in the United States, with six described species (Kritsky 1978, Wygodzinsky and Schmidt 1991). *Systelloderes biceps* (Say) has the broadest geographic distribution and has been reported from eastern Canada, the eastern and southern United States, and south to Panama, including several Caribbean islands (Jeannel 1942, Froeschner 1988).

Materials and Methods

Specimens from four collections were examined for this study: the North Dakota State Insect Reference Collection (NDSU), the personal collection of Alexander H. Knudson (AHKC), the personal collection of David A. Rider (DARC), and the United States National Museum of Natural History, Smithsonian Institution (USNM). Specimens were examined using a Nikon SMZ645 stereo microscope with 10× eyepieces and illuminated with fiber optic lights. Multiple photographs were taken using a Canon EOS 7D camera with an Automatic Extension Tube Set (Model DG. Kenko Tokina Co.

Ltd., Tokyo, Japan) and a macro photo lens (Model MP-E 65mm, Canon Inc. Tokyo, Japan) attached to a Stack Shot motorized rail (Cognisys Inc., Traverse City, Michigan). Photographs were then montaged and edited in Adobe Photoshop CS 6.

ENICOCEPHALOMORPHA Stichel, 1955

ENICOCEPHALIDAE Stål, 1860

Systelloderini Jeannel, 1942

Systelloderes Blanchard, 1852

Systelloderes is the most speciose genus of Enicocephalidae in the Americas, even with many species from Latin America still undescribed (Wygodzinsky and Schmidt 1991). It can be separated from all other genera of Enicocephalomorpha by the combination of the following characteristics: pronotum divided into three distinct lobes; foretarsus with two claws; posterior margin of the pronotum not straight; basal cell of each hemelytron open; and discal cell absent (Kritsky 1977b, Wygodzinsky and Schmidt 1991). Kritsky (1978) revised the North American and Caribbean species of *Systelloderes*, described four new species from Virginia, Oregon, and Jamaica, and enumerated 12 species, including *S. biceps*. Despite being a more recent treatment of Enicocephalidae in the Americas, Wygodzinsky and Schmidt (1991) did not specifically revise the species of *Systelloderes*; thus, Kritsky's (1978) treatment is the most recent revision for the genus.

***Systelloderes biceps* (Say, 1832)**

This species was described as *Reduvius biceps* by Say (1832) and subsequently transferred to the genus *Hymenodectes* Uhler, 1892 by Bergroth (1913). Van Duzee (1916) transferred this species to *Systelloderus* [sic] (Van Duzee 1916).

Diagnosis: This species can be separated from all other species of *Systelloderes* by the weakly rounded or mostly parallel sided posterior lobe of the head, which is not as long as its width and not as wide as the anterior lobe; the shorter total length not more than 4 mm; the small ocelli; the males having slender forelegs; the large curved spine of the tibia; and the small intermediate lobe of the pronotum (Kritsky 1978).

Distribution: Canada: Nova Scotia (Torre-Bueno 1934), Ontario (Maw et al. 2000), and Quebec (Walley 1935). United States: Arkansas (Kritsky 1977c), Connecticut (Parshley 1923), Florida (Blatchley 1926), Illinois (Usinger 1932, Kritsky 1976), Indiana (Blatchley 1926), Iowa (Drake and Harris 1927), Kansas (Rittenmeyer 1961), Kentucky (McClure 1943), Louisiana (Glick 1939), Michigan (Swanson 2015), New York (Barber 1928), North Carolina (Brimley 1942), Ohio (Swanson 2015), Oklahoma (Drew and Van Cleave 1962), Pennsylvania (Say 1832), Virginia (Van Duzee 1917), and Wisconsin (Krauth and Young 1994). The western North American records of this species refer to *Systelloderes culicis* (Uhler, 1892) (see comments below). The southeastern records of this species (Blatchley 1926, Glick 1939, Brimley 1942, McClure 1943) might correspond to *Systelloderes inusitatus* Drake and Harris, which was described from Mississippi (Drake and Harris 1927) and later reported from Florida (Hussey 1955) and South Carolina (Ulyshen et al. 2012). The aforementioned records may also correspond to *Systelloderes lateralus* Kritsky, which was described from Arlington, Virginia (Kritsky 1978) but has also been reported from Mexico (Romero-Nápoles and Lomelí-Flores 2019, Revelo-Tobar and Valdez-Carrasco 2023). Kritsky (1977c) suggested that *S. biceps* was restricted to eastern and central United States and not found in the southeastern United States. He did not list the material he examined of described species, which authors had previously misidentified this insect, or which authors failed to use the name *Systelloderes biceps* for eastern records, as it was largely forgotten until Bergroth (1913) synonymized *S. culicis* with *Reduvius biceps.* Two accounts of "the same or another species" from Maryland and Tennessee (Barber 1908) were seemingly conflated with those of [or "assumed to be"] *S. biceps* by Froeschner (1988), and subsequently by Swanson (2015). *Systelloderes biceps* may occur in Maryland and Tennessee, however these records should be substantiated with voucher material. This species may also occur outside of Canada and the United States, but the records from Costa Rica (Jeannel 1942), Cuba (Alayo 1967, Grillo Ravelo 2012), and Mexico (Jeannel 1942, Coscarón & Dellape 2002) should be verified. Both Jeannel (1942) and Froeschner (1988) suggested *S. biceps* occurs in Panama, however, Froeschner (1999) did not include this species in his catalogue of Panamanian Heteroptera.

Specimens Examined: NORTH DAKOTA [NEW STATE RECORD]: ***Cass Co.:*** N.D.S.U.—Fargo, 6-VII-1965, G. Ehni, Suction Trap, Heating plant (1♀ NDSU). Fargo, NDSU Campus, 46.893741, –96.811649, Lindgren Trap, Lineatin lure #2, 21-VIII–4-IX-2015, G. M. Fauske & A. H. Knudson (1♂ NDSU). Fargo, Comm. Garden 46.914678°, –96.797359° 6-VII-2018, Colls. A. H. Knudson, V. Calles Torrez (4♂ NDSU, 2♂ DARC, 3♂ AHKC, 4♂ USNM) (Fig. 1).

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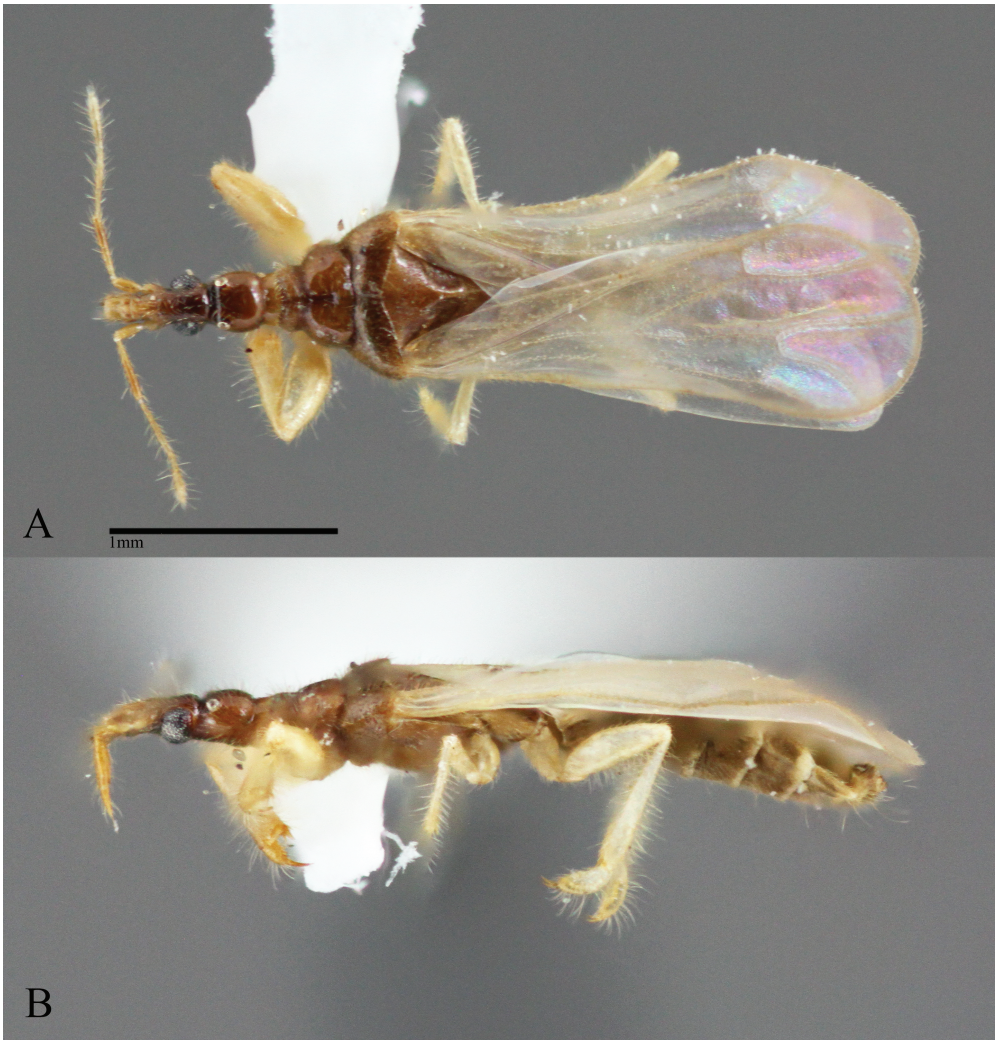

Figure 1. *Systelloderes biceps* (Say) collected in Fargo community garden. A. Dorsal habitus. B. Lateral habitus.

***Systelloderes culicis* (Uhler, 1892)**

This species was originally described as *Hymenodectes culicis* by Uhler (1892) from Arizona, District of Columbia, Florida, Utah, and Cuba. Uhler (1892) stated that most specimens he observed were not adequately prepared for observation and only listed the specific collection data for two specimens sent to him by E. A. Schwarz, which were collected on 14 June 1891 from the vicinity of the Great Salt Lake, Utah. Ashmead (1892) independently discovered a new species that year and intended to name it "*schwarzi*", but (in a footnote) he indicated that "The specific name proposed by me must fall" because it was the same as Uhler's *H. culicis*. Ashmead also stated that the types of his intended "*schwarzi*" were collected near Utah Lake, Utah and were deposited in Ashmead, now in the USNM (Henry, pers, comm. 2023) and Heidemann collections.

Bergroth (1913) synonymized *H. culicis* with *Reduvius biceps*, but he did this based on comparison of original descriptions, without examining specimens of *culicis*. Usinger (1945) restored *S. culicis* as a valid species based on examination of type specimens of *culicis*. Later, Kritsky (1978) provided a differential diagnosis to separate it from the North American species of the genus. He did not designate a lectotype and listed only

Figure 2. Lectotype specimen of *Systelloderes culicis* (Uhler). A. Dorsal habitus. B. Lateral habitus. C. Labels.

the type locality of this species. Froeschner (1988) listed this species as a synonym of *S. biceps*, but according to Usinger (1945) and Wygodzinsky and Schmidt (1991), *S. culicis* is a valid species, separate from *S. biceps*. Due to the historic taxonomic confusion of this species with *S. biceps* and the inconsistent reporting of this species in the literature, we are providing a diagnosis of this species, the designation of a lectotype, and a discussion of the species' distribution.

Diagnosis: This species can be separated from all other North American species of *Systelloderes* by the combination of the following characteristics: mostly parallel sided posterior lobe of the head which is not as long as its width, but as wide as the anterior lobe; the total length not more than 4 mm; the moderately sized ocelli; the males with slightly stouter forelegs; the large curved spine of the tibia; and the small intermediate lobe on the pronotum (Kritsky 1978).

Distribution: United States: Utah (Uhler 1892, Ashmead 1892), Arizona (Schwarz 1908), California (Kritsky 1977c); Mexico (Champion 1898, Knab 1908). This species is likely widely distributed in the western United States (and northern Mexico (Champion 1898); however, additional records of this species need to be verified. The eastern North American records of this species (i.e. Uhler 1892, Wirtner 1904, Barber 1908, Johansson 1909, Bradley 1912) probably correspond to *S. biceps, S. inusitatus,* or *S. lateralus*, and Uhler's (1892) record from Cuba might correspond to other species.

Lectotype designation: Salt lake 14-6. 91 UT; PR Uhler Collection; Property USNM; *Hymenodectus culicus* Uhler, Utah, Det UHLER; *Systelloderes culicis* (Uhler) Wygodzinsky det. '67; LECTOTYPE selected by Usinger and Wygodzinsky, 1967; [label here added] Lectotype: *Hymenodectes culicis* Uhler designated by Knudson, Calles, and Rider. Deposited in the USNM. (Fig. 2).

Note: The single specimen mentioned above was labeled as lectotype by Usinger and Wygodzinsky however, this designation was never published.

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Results and Discussion

In North America north of Mexico, there are several other species of *Systelloderes* that can be easily confused with both *S. biceps* and *S. culicis,* but can be separated by the following characters as diagnosed by Kritsky (1978). *Systelloderes crassatus* (Usinger, 1932) is known from California and can be separated from *S. culicis* by the anterior lobe of the head, which is broader than the posterior lobe. Males of *S. crassatus* can be separated from *S. biceps* by the large intermediate lobe of the pronotum and the stouter fore femora, whereas females of *S. crassatus* can be separated from *S. biceps* by the posterior lobe of the head longer than its width. *Systelloderes grandes* Kritsky, 1978, known only from Oregon, can be separated from all other species by the anterior lobe of the head, which is broader than the posterior lobe and by the larger size, near 5 mm. *Systelloderes iowensis* Drake and Harris, 1927, known only from Ames, Iowa, is most similar to *Systelloderes angustatus* Champion, 1898, which can be separated from all other species found in Canada and the United States by the lack of a large curved spine on the fore femora (Drake and Harris 1927, Kritsky 1978). *Systelloderes inusitatus* can be separated by the pear-shaped posterior lobe of the head and the middle lobe of the pronotum with a slight sulcus. *Systelloderes lateralus* can be easily separated by the large ocelli which are laterally directed.

Worth noting, Jeannel (1942) synonymized *S. angustatus* and *S. iowensis* with *S. moschatus* Blanchard. Jeannel (1942) also synonymized *S. crassatus* with *Systelloderes spurculus* (Stål, 1860). However, Kritsky (1978) provided diagnoses for most species of the New World *Systelloderes* except *S. iowensis*, *S. spurculus*, and *Systelloderes tenuis* Jeannel 1942, as well as recognized *S. moschatus* and *S. angustatus* as separate species. Wygodzinsky and Schmidt (1991) provided a checklist of *Systelloderes* species of the Western Hemisphere, which included all species synonymized by Jeannel (1942) as valid taxa.

With the report of *S. biceps* recently from Michigan and Ohio (Swanson 2015), as well as North Dakota herein, this species is now known from a broader geographic range including the North Central Region of the United States. It is clear that *S. biceps* is broadly distributed across eastern and north-central North America. However, this species might not be found outside of Canada and the United States. The records of *S. biceps* from Cuba (Alayo 1967, Grillo Ravelo 2012) were originally listed with doubt. Also, Jeannel (1942) and Froeschner (1988) suggested *S. biceps* can be found in Canada, United States, and Mexico south to Panama, but both Jeannel (1942) and Froeschner (1988) included *S. culicis* as a synonym. Therefore, the records from Mexico and Central America might refer to *S. culicis* or other species.

Furthermore, the record listed in Knab (1908) included his account of *S. culicis* identified by Heidemann, from a mating swarm outside of Cordoba, Veracruz, Mexico. The records in the February 13th meeting minutes immediately following Knab included accounts by E. A. Schwarz (1908) near Washington D.C., Utah Lake, Utah, a joint account with Barber in Arizona (Schwarz 1908); and two accounts by Barber. Barber and Schwarz found *S. culicis* in Hot Springs, Yavapai County, Arizona (Schwarz 1908), and Barber (1908) found "the same or another species" under the bark of dead oaks in Tennessee and Dorchester County, Maryland. It is possible that the accounts mentioned after Knab (1908) correspond to three or even four species: individuals collected near Washington D.C. (Schwarz 1908) and Maryland might have been *S. biceps*; Tennessee populations could have been *S. biceps*, *S. inusitatus,* or *S. lateralus*; the Arizona record might correspond to *S. culicis*; and the Knab (1908) account near Cordoba, Mexico might correspond to a different species, e.g., *S. angustatus*, *S. lateralus*, or an undescribed species.

The localities of the specimens newly reported from North Dakota are from two different habitats: a shelterbelt near mixed use agricultural and horticultural land at North Dakota State University and a community garden (Yunker Farm) in north Fargo near North Dakota State University. The series of specimens are from mating swarms that were observed on 6 and 8 July 2018. Both swarms occurred on mostly sunny days from 14:00–18:00, and most were flying between 1–3 m above the vegetation canopy. Some individuals were observed higher, but they were still near the periphery of swarms. We collected the only voucher specimens on 6 July (see material examined) and no females were captured.

Enicocephalids are not commonly encountered in the United States or Canada. It should be noted that two reports of *Systelloderes* species came from non-natural settings. Drake and Harris (1927) described *S. iowensis*, from a concentration cage where the enicocephalids were apparently feeding on hessian flies. They also described *Systelloderes terrenus* Drake and Harris 1927, which is now considered to be a synonym of *S. biceps*, from a truck garden, a similar habitat to that in which we observed the mating swarms of *S. biceps* in North Dakota.

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