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NEW DISTRIBUTIONAL RECORDS OF GREAT PLAINS PSEUDOSCORPIONS (ARACHNIDA: PSEUDOSCORPIONES)

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ABSTRACT—Pseudoscorpions are tiny, oval, brown, flattened arachnids that possess large “pinchers” in front of the body for capturing smaller prey. They generally live in forested habitats in soil litter or beneath loose bark. It has been presumed that pseudoscorpions are scarce in the Great Plains, except for along rivers, due to harsh climatic conditions. However, new records of pseudoscorpions from the Great Plains were derived from identification of specimens obtained from university and college collections, and from specimens collected by the first author. Records provided new revelations about distributions of not only the more commonly known pseudoscorpion species but also species previously not believed to be adaptable to grassland habitats. For example, *Dactylochelifer silvestris* Hoff, a western species, appears to be common throughout the Great Plains, with new state records from Kansas, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. In addition, *Parachernes nubilis* (Hoff) previously was not known from Kansas, Nebraska, or Texas, and *Parachernes virginicus* Hoff, *Apocheiridium stannardi* Hoff, *Hysterochelifer proprius* Hoff, and *Chthonius tetrachelatus* (Preysslner) are newly recorded for Nebraska. Records of *Microbisium parvulum* from Rapp (1978) in Nebraska were bolstered by five more in the state.

Key Words: pseudoscorpion, false scorpion, arthropod records, Great Plains, grasslands, ecology, yucca, sagebrush

INTRODUCTION

The Great Plains is a vast grassland region generally lying west of the Missouri River and east of the Rocky Mountains in the United States and Canada (Wishart 2004). It extends from southern Canada to the Rio Grande along the Mexican border in Texas and is transected by rivers and streams mainly flowing eastward from the Rockies (Fig. 1). Altitude increases east to west from less than 150 m (500 ft) above sea level to more than 1,524 m (5,000 ft). Topography is quite diverse, having alluvial and upland plains, hills, canyons, escarpments, buttes, badlands, and intrusions of much higher mountains.

Formerly this region consisted of immense expanses of tallgrass, mixed-grass, and shortgrass prairies. It now can be described as a complex patchwork of prairies, pastures, rangeland, agricultural cropland, and mostly small rural communities interconnected with transportation routes.

Pseudoscorpions, also referred to as “false scorpions,” are tiny, brown, flattened arthropods that possess large grasping pincers in front, called palps, for seizing and feeding upon smaller prey (Fig. 2). Unlike a scorpion, they have no tail, but like their spider cousins, they produce silk to line their chambers for protection during dormancy or to encase their eggs. Most species are associated with woodland microhabitats such as soil surface litter,



Figure 1. Simplified map of the Great Plains, showing boundaries.

loose bark of trees, rotted logs, rock crevices, beneath stones, and bird and rodent nests. They prefer moist, organic habitats in which other small invertebrates thrive. In their feeding habits, pseudoscorpions are limited to smaller prey, such as tiny insect larvae, springtails, mites, ants, booklice, small worms, and other soft-bodied micro-invertebrates. They are limited in their ability to disperse, but many pseudoscorpions hitchhike great distances by grasping onto beetles, flies, and moths (Weygoldt 1969; Muchmore 1990; Beccaloni 2009).

Biologists do not know much about pseudoscorpions in the Great Plains. Pseudoscorpions frequently have been associated with deciduous forest regions (Nelson 1975). Hoff and Bolsterli (1956) reported several species from deciduous forests along the major streams that transect the Great Plains but did not expect that there would be any in grasslands, due to inhospitable climatic conditions. Hoff (1959) also made reference to the eastern two-fifths of Colorado, which lies in the Great Plains, as an area "occupied by a grassland community, but where

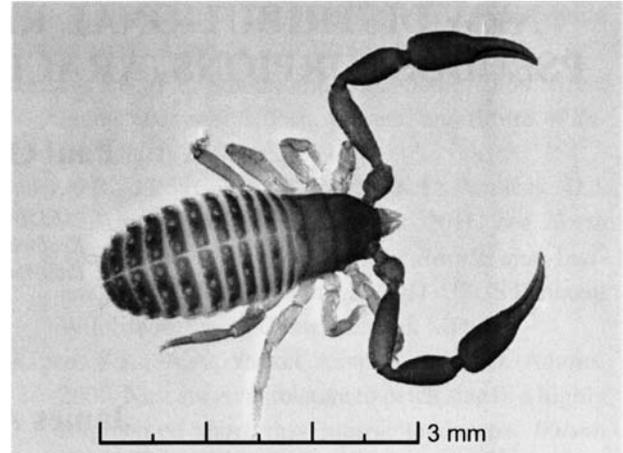


Figure 2. Pseudoscorpion (*Dactylochelifera silvestris*), adult male.

pseudoscorpions have not become adapted to grassland conditions, with the exception that species are often found in woody debris and litter of trees along watercourses and near lakes and springs, as well as in the debris of nests of birds and rodents." However, Rapp (1978) in a preliminary study collected *Microbisium parvulum* Hoff from nine of 28 sites in tallgrass and mixed-grass prairies in Nebraska. He postulated that moisture and depth of litter were important factors that limit pseudoscorpions in grasslands or pastures, noting also that overgrazed native pastures in particular are almost devoid of arthropods living in soil and litter, including pseudoscorpions. In conclusion, this earlier literature cited suggests that pseudoscorpions are less abundant in the prairies presumably because of limited microhabitats (litter) and harsh climatic conditions, primarily due to the drying action of the wind and the sun. We report results of our studies to test this idea and to better understand distributions of pseudoscorpion species in the Great Plains.

MATERIALS AND METHODS

Many new records of pseudoscorpions from the Great Plains were derived from our study of specimens obtained by request from university and college collections, with corresponding abbreviations, as follows: Chadron State College (CSCC), Colorado State University (CSUC), University of Kansas Snow Entomological Museum (SEM), University of Minnesota (UMSP), University of Nebraska State Museum (UNSM), University of New Mexico Museum of Southwestern Biology (UNM), North Dakota State University (NDSU), Oklahoma State University (OSEC), South Dakota State

University (SDSU), and West Texas State University (WTSU).

These pseudoscorpions largely came from student collections in field biology courses or as incidental specimens collected during field research projects involving evaluation of other arthropods in soil and litter in specific types of prairie grassland, such as the tallgrass or shortgrass prairie biomes. These specimens were mainly obtained either by extraction from grass or associated soil using a metal funnel and light apparatus called a Berlese funnel or by collection from pitfall traps inserted in the ground.

The remainder of the new records came from pseudoscorpions collected by the senior author at 21 sites while traveling several times across parts of the Great Plains from 1999 to 2009. Sites selected for investigation were those thought to offer protective microhabitats favoring pseudoscorpions and other tiny invertebrates on which they feed. This included litter from bases of yucca plants and sagebrush (Fig. 3), dense tussocks of bunchgrasses, tree bark and organic debris below trees, leaf litter, and objects on the ground. Leaf detritus and rotting yuccas were pulled apart and sifted through a 4.0 mm mesh screen over a white enameled pan. Tree bark was pulled from dead trees or stumps and gently struck against the inside edge of the pan to dislodge arthropods clinging to the bark, and the surfaces of trunks or stumps were carefully examined for specimens. Material collected from bunchgrasses was taken directly from the soil-plant interface by pulling up grass tussocks and sampling associated organic debris. When a tussock was pried from the soil, the roots were pulled apart and these and the rest of the plant were sifted by mesh screen over an enameled pan. Pseudoscorpions were removed from the fine residue and placed in vials containing 70% ethyl alcohol.

Taxonomic keys used for identifications were from publications by Hoff (1949; 1956a, 1956b), Muchmore and Alteri (1973), Nelson (1975), Benedict and Malcolm (1979), and Buddle (2010).

Most of the material collected by the first author in this study will be deposited in the University of Nebraska State Museum except material marked "PCC", which the senior author has retained.

RESULTS

Following is a list of 52 records. Each record includes state, county, location, and collector, if known. Fifteen new state records, as indicated with an asterisk (*), were determined as a result of this study.



Figure 3. Sagebrush (*Artemisia tridentata*), habitat for pseudoscorpions.

CHTHONIIDAE:

Chthonius tetrachelatus (Preysler)

*Nebraska

— Dawes Co., Brigg's Pond, Berlese funnel, twigs and leaves, 17-IX-04, H.R. Lawson. (UNSM)

CHERNETIDAE:

Microbisium parvulum Hoff

Kansas

— Geary Co., Konza Prairie Research Natural Area, grass litter sample, tallgrass prairie, 16-II-1996, J. Blair. (PCC)
— Kiowa Co., 13 mi. S. of Greensburg, leaf litter, 11-I-2004, G. Salsbury. (UNSM)

Nebraska

— Harlan Co., Harlan County Lake, S. of Alma, under cottonwood log, 4-X-2004, P. Cooney. (UNSM)
— Lancaster Co., Nine-Mile Prairie, W. of Lincoln, vacuum, tallgrass prairie, *Andropogon gerardii*, 1-X-2007, S. Schaeffer. (UNSM)
— Saunders Co., UNL ARDC, S. of Mead, soil plug, *Panicum virgatum*, 20-IX-2007, S. Schaeffer. (UNSM)
— Sheridan Co., Metcalf Wildlife Area, litter sample near water, 25-V-2005, H.R. Lawson. (CSCC)
— Sioux Co., Gilbert-Baker Fishing Pond, litter, Berlese funnel, 18-V-2005, 25-V-2005, H.R. Lawson. (CSCC)

North Dakota

— Grand Forks Co., Inkster, extracted from moss, 26-IX-1959, D. Kuske. (NDSU)

South Dakota

— Edmonds Co., Bowdle vicinity, Lat. 45.47764, Long. 99.519436, grass, 3-VII-2001, C. Noble. (SDSUC)

Parachernes nubilus (Hoff)

Colorado

— Washington Co., Prewitt Reservoir, extracted from bunchgrass, shortgrass prairie, 16-V-1999, P. Cooney. (PCC)

*Kansas

— Kearny Co., Santa Fe Ruts Trailside Area, E. of Lakin, extracted from rotting yuccas, 24-VII-2009, P. Cooney. (SEM)

*Nebraska

— Dawes Co., Fort Robinson, Icehouse Pond, litter sample, 14-VII-2005, H.R. Lawson. (UNSM)

New Mexico

— Union Co., Kiowa National Grassland, S. of Clayton, County Rd. CC, extracted from dead yuccas, 22-VII-2009, P. Cooney. (UNM)

— Union Co., Kiowa National Grassland, S. of Oliver Rd., extracted from grass clump, 23-VII-2009, P. Cooney. (UNM)

— Union Co., Route 406, N. of Goodin Draw, sifted from *Artemisia* litter, 23-VII-2009, P. Cooney. (UNM)

*Texas

— Randall Co., under log, 20-III-1997, D. Sissom. (WTSU)

Wyoming

— Goshen Co., 9 mi. SW of Lingle, mixed-grass prairie, pitfall trap, T24N R64W, 104°29'W, 42°01'N, 24-VI-2002, collector unknown. (PCC)

Parachernes virginicus Hoff

*Nebraska

— Deuel Co., I-80 Chappell rest area, under dead bark on cottonwood, 16-VII-2009, P. Cooney. (UNSM)

CHEIRIDIIDAE:

Apocheiridium stannardi Hoff

*Nebraska

— Deuel Co., Chappell I-80 rest area, under willow bark, 16-VII-2009, P. Cooney. (UNSM)

CHELIFERIDAE:

Dactylochelifer silvestris Hoff

Colorado

— Sedgwick Co., Julesburg, under railroad ties, shortgrass prairie, 25-V-1999, P. Cooney. [det: R. Fagerlund] (PCC)

— Weld Co., IBP-Pawnee Site, 15-XII-1972, J. Leatham. (CSUC)

*Kansas

— Norton Co., Route 383 rest area, extracted from grass tussocks, 17-IX-2003, P. Cooney. (UNSM)

— Wallace Co., Weskan, extracted from grass-weed litter, 17-IX-2003, P. Cooney. (UNSM)

*Montana

— Carter Co., Boyes, Route 212 picnic area, extracted from grass clump, 7-X-2004, P. Cooney. (UNSM)

— Carter Co., as above, but from *Reithrodontomys* nest under *Artemisia*, P. Cooney. (UNSM)

— Dawson Co., I-94 rest area, extracted from grass litter, 7-X-2004, P. Cooney. (UNSM)

— Yellowstone Co., Laurel, under boards in yard, ??-IX-2005, A. Grandpre. (PCC)

*Nebraska

— Cherry Co., 1 mi. N. of Niobrara River, Route 81, extracted from dead *Yucca glauca*, 6-X-2004, P. Cooney. (UNSM)

— Cherry Co., Ponderosa stand near Niobrara River, CDC mosquito trap, 13-IX-2004, H.R. Lawson, Mugo and Schwarting. (CSCC)

— Harlan Co., Harlan Co. Lake, S. of Alma, under cottonwood logs, 4-X-2004, P. Cooney. (UNSM)

— Frontier Co., Red Willow Reservoir, extracted from dead *Yucca glauca*, 5-X-2004, P. Cooney. (UNSM)

— Frontier Co., as above, but from *Andropogon scoparius* clump, P. Cooney. (UNSM)

*North Dakota

— South Unit, Theodore Roosevelt National Park, extracted from sod, 24-VI-1965, G. Thompson. (NDSU)

*Oklahoma

— Garfield Co., Carrier, KB trap, 3-VII-1995 LT. (OSEC)

— Ottawa Co., Afton, KB trap, 6-VII-1995, LT. (OSEC)

*South Dakota

— Charles Mix Co., Snake Creek Lakeside Usage Area, extracted from dead *Yucca glauca*, 9-X-2004, P. Cooney. (SDSU)

*Texas (The following Texas material borrowed from WTSU collection.)

— Donley Co., 6 mi. W. of Clarendon, under boards, 20-IX-1994, M. Curry.

— Hutchinson Co., Lake Meredith National Recreation Area, no other data.

— Hutchinson Co., Lake Meredith National Recreation Area, Spring Canyon, NE end of lake, 20-IX-1994, D. Sissom and B. Johnson.

— Kleberg Co., Kingsville (junction of US 77 and TX 242), 10-IX-2000, Capes-Hendrixson.

— Lipscomb Co., 5 mi. E, 1 mi. N. of Follett, 4-X-2000, J. Babitake.

— Potter Co., Lake Meredith National Recreation Area, McBride Canyon, 20-IX-1994, DS/WP.

— Potter Co., as above, except 29-VII/8-VIII and 19-X/26-X-1995, T. Rothblatt.

— Potter Co., Lake Meredith National Recreation Area, Mullinaw Canyon, under log, 9-X-1994, DS/WP.

— Potter Co., Lake Meredith National Recreation Area, Chicken Creek, under log, 28-X-1994, DS/WP.

— Potter Co., N. of Amarillo on US 287 at Canadian River bridge, 27-IX-2000, A. Miller.

— Randall Co., Ceta Canyon, FM 1721, 2.5 mi. N. of junction FM 285, 7-X-2000, anonymous.

*Wyoming

— Converse Co., about 2 mi. W. of Fort Fetterman, *Artemisia* litter, 21-VII-2009, P. Cooney. (UNSM)

— Converse Co., 1 mi. N. of Glenrock, *Artemisia* litter, 21-VII-2009, P. Cooney. (UNSM)

Hysterochelifer proprius Hoff

*Nebraska

— Hooker Co., Mullen, camping area, phoretic on *Alaus occulatus*, 13-VII-2004, R. Wall. (UNSM)

Parachelifer longipalpus Hoff

Nebraska

— Lancaster Co., Lincoln, extracted from bark of rotten logs, 18-IX-2000, F. Baxendale. (UNSM)

DISCUSSION

Information obtained from identifications of specimens in this study indicates clearly that some common species of pseudoscorpions have the ability to adapt to a wider variety of habitats than previously known. For example, Hoff's (1961) Colorado records for *D. silvestris* are from collections taken in forested habitats under logs and rocks, under pieces of bark lying on the ground, debris and litter at base of a yellow pine, in aspen litter, and mixed cottonwood and box elder litter at elevations from 1,676 m (5,500 ft) to 2,804 m (9,200 ft). Hoff's (1963) survey of the Black Hills for pseudoscorpions did not detect *D. silvestris*, and records were chiefly from wooded areas, suggesting a closer affinity with the Rocky Mountains than the Great Plains. However, in this study, *D. silvestris* was found at various exposed grassland locations such as in grass clumps, beneath sagebrush litter, in dead yucca, and at elevations lower than those reported by Hoff. And proximity of collection locations to the Black Hills, as indicated in Figure 4, suggests that this species would be

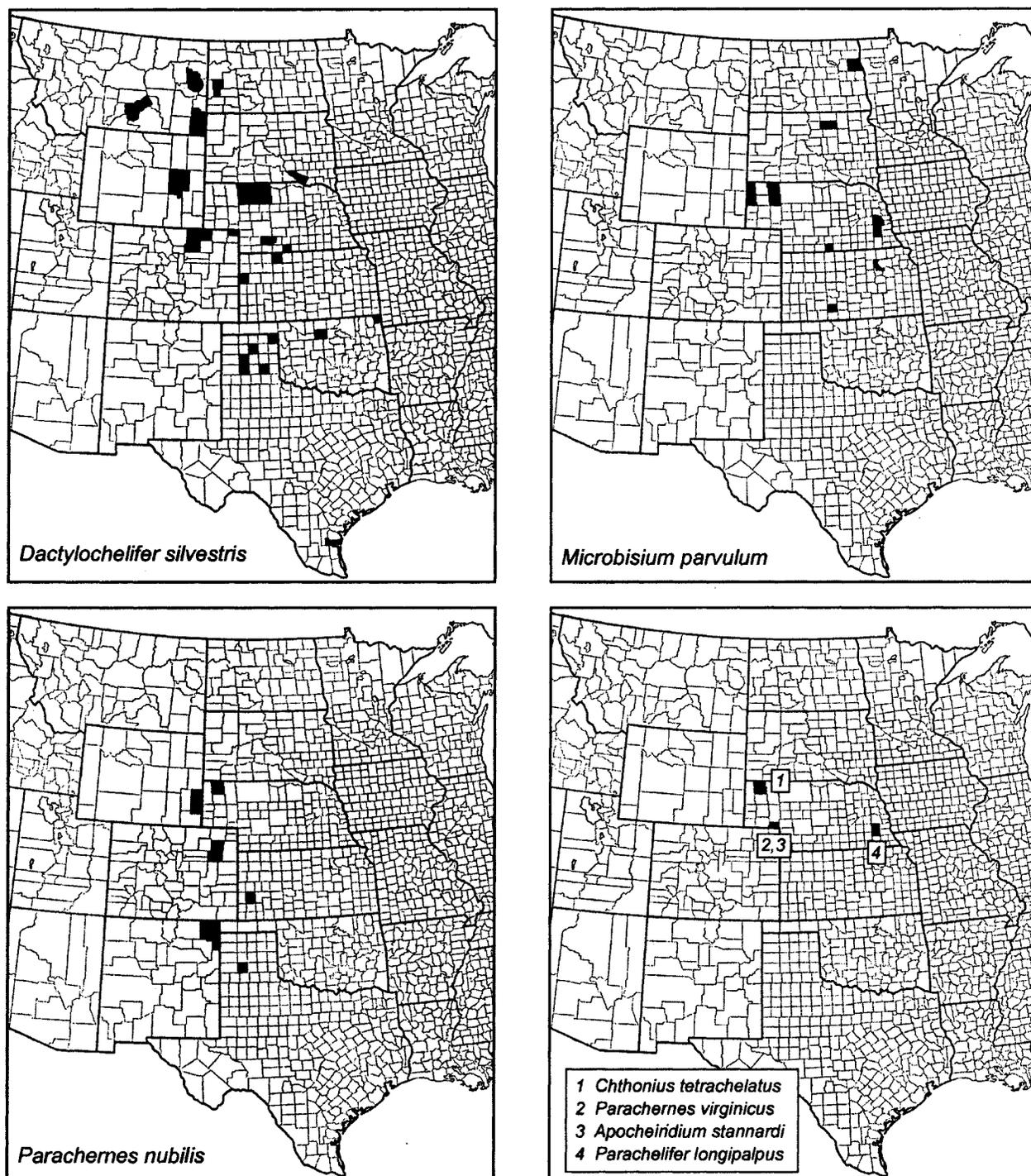


Figure 4. Locations of pseudoscorpion species identified in this study. Shaded counties represent new records.

found there as well. In summary, therefore, *D. silvestris* not only is known to be adapted to mountainous and grassland conditions, but it also has a greater distribution than previously realized.

Specimens from South Dakota and most, if not all, of the Nebraska and Kansas specimens were collected at elevations below 914 m (3,000 ft), and the Oklahoma specimens were collected from sites below 610 m (2,000 ft).

Eight pseudoscorpion species were identified and are listed in this study. Other species may also be found in the Great Plains. Based on records, *Dactylochelififer silvestris* is a species that appears to be common throughout the Great Plains, with new state records from Kansas, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, Texas and Wyoming. In addition, *Parachernes nubilis* was not previously known from Kansas, Nebraska, or Texas, and *Parachernes virginicus*, *Apocheiridium stannardi*, *Hysterochelififer proprius*, and *Chthonius tetrachelatus* are newly recorded for Nebraska. Records of *Microbisium parvulum* from Rapp (1978) in Nebraska were bolstered by five more from the state. Additional surveys are needed to determine more thoroughly the distributions of pseudoscorpions adapted to Great Plains microenvironments.

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