Four New State Records of Delphacid Planthopper Species (Hemiptera: Fulgoroidea) from Illinois, USA

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The planthopper (Hemiptera: Fulgoroidea) fauna of Illinois has been relatively well documented, largely thanks to extensive insect inventories conducted by the Illinois Natural History Survey (Ross 1958) and research by Wilson and McPherson (1980b), who published the first comprehensive keys for Illinois species. Nevertheless, more recent sampling, particularly by vacuuming native prairie vegetation, has continued to yield additional records, especially for the family Delphacidae, most US species of which specialize on grasses, sedges or other herbs and occur in grasslands (prairies) or wetlands (Wilson and McPherson 1980a, 1980b, 1980c; Bartlett and Hamilton 2011). The most recent summary of state-level distributional data for US planthoppers is that of Bartlett et al. (2014).

Several planthopper species have been recorded in Illinois despite otherwise apparently being restricted to more southern and eastern regions of the USA. These seemingly disjunct populations are of potential conservation significance because they may be genetically distinct due to isolation and separation. Such species include *Pissonotus aquaticus* Morgan and Beamer, 1949 which has been recorded in Florida, North Carolina, New Hampshire, and Illinois; and *Javesella dolera* (Spooner, 1912) which has been recorded in New York, Virginia, and Illinois (Bartlett et al. 2014). A grass-specialist species of the related auchenorrhynchan family Cicadellidae, *Deltella decisa* (DeLong, 1926) also has a similar disjunct distribution, having been recorded only from Florida and southern Illinois (DeLong 1948).

Among the delphacids of Illinois, Wilson and McPherson (1980a, 1980b, 1980c) recorded two *Bakerella* Crawford, 1914 species and eleven *Pissonotus* Van Duzee, 1897 species. Subsequently, one species of *Pissonotus* (*P. aquilonius* Morgan and Beamer, 1949) was removed from this list due to misidentification of specimens collected in Illinois (Bartlett et al. 2014). During collecting in the summers of 2005 and 2022, four delphacid planthopper species that previously had not been recorded in Illinois were collected and identified. All four species belong to Delphacidae, the most diverse planthopper family north of Mexico. Delphacidae are the most economically important family of planthoppers, representing numerous species that cause damage to agricultural crops through their...
phytophagy and ability to transmit plant pathogens (Bartlett et al. 2014). Two of the species collected also represent new cases of seemingly disjunct planthopper populations, both of which differ morphologically from their previously known populations. Here, we report new state records of Aethodelphax aetoccephalus (Beamer, 1948), Bakerella cinea Beamer, 1945, Bakerella minuta Beamer, 1950, and Pissonotus aphidioides Van Duzee, 1897 in Illinois.

Materials and Methods

Newly collected specimens were obtained using standard entomological sweep nets and a gas-powered leaf blower (Stihl SH56, Stihl, Waiblingen, Germany) modified by taping a fine-mesh net to the end of the intake nozzle to vacuum arthropods from vegetation. These two methods were utilized in prairies and wetlands throughout Illinois to collect arthropods. Collection during summer 2022 consisted of two sweep net and two vacuum samples taken over approximately 100 meters at each site from the months of June to September. Each site was visited three times, with visits occurring approximately one month apart. Collected samples were transferred to a photo tactic optimal insect extractor (PTOIE) (Fig. 1) that separates photo-sensitive arthropods from plant debris. Arthropods attracted to light emerge from debris placed in the larger opaque bottle and are captured in a Whirl-Pak attached to the PTOIE containing 95% ethyl alcohol to preserve them for later identification.

Specimens were identified using external morphology and male genitalia (Beamer 1950, Wilson and McPherson 1980b, Bartlett and Hamilton 2011, Bartlett et al. 2014, Bartlett and contributors 2020). Male abdomens were removed from specimens, soaked in a 10% Potassium hydroxide solution for 24 hours, rinsed with deionized water, and preserved in glycerin to prepare them for viewing.

Maps showing the distributions of each newly recorded species in Illinois (Fig. 2) and in the contiguous USA (Fig. 3, 5, 7, 9) were created using QGIS 3.30.1. Polygon and line formats of the Illinois state boundary and Illinois county boundaries were obtained from the Illinois Geospatial Data Clearinghouse website (Illinois Natural History Survey, Prairie Research Institute, Illinois State Geological Survey, University of Illinois at Urbana-Champaign). A shape file of all US state boundaries was obtained from the ArcGIS Hub website (Esri, Redlands, Ca, USA). Occurrence records in states other
Images of whole specimens were obtained using a Canon DX1 SLR camera (Canon Inc., Tokyo, Japan) with a Canon MP-E 65mm macro zoom lens (Canon Inc., Tokyo, Japan) mounted to a motorized lift, with photos taken at different focal planes combined using Zerene Stacker (Zerene Systems, Richland, WA, USA) (Fig. 4a,b; 6a,b; 8a,b; 10a,b). Images of male genital capsules were taken using a Jenoptik Gryphax Arktur microscope camera (Jenoptik Optical Systems GmbH, Jena, Germany) attached to an Olympus BX41 microscope (Olympus Corporation, Tokyo, Japan) and processed using Jenoptik Gryphax software (Jenoptik Optical Systems GmbH, Jena, Germany) (Fig. 4c-e; 6c,d; 8c,d; 10c,d). Point-mounted specimens of each species were deposited into the Illinois Natural History Survey Insect Collection.

Results

**Aethodelphax aetocephalus**

(Beaner, 1948)

Illinois: Mason Co.: Long Branch Sand Prairie Nature Preserve, 40°13′40.0″N than Illinois were obtained from Bartlett et al. 2014.

Figure 2. Newly recorded distributions of *Aethodelphax aetocephalus*, *Bakerella cinerea*, *Bakerella minuta*, and *Pissonotus aphidioides* in Illinois.
Figure 3. Known distribution of Aethodelphax aetocephalus in the contiguous USA. Presence denoted by shaded states.

Figure 4. Aethodelphax aetocephalus male; A. Left lateral view, B. Dorsal view C. Left lateral view of male genital capsule, D. Caudal view of male genital capsule, E. Left lateral view of aedeagus.
Previously, two species of Bakerella—B. muscotana Beamer, 1945 and B. rotundifrons Beamer, 1945—were thought to occur in Illinois, though their presence could not be confirmed using genitalic morphology due to a lack of male specimens at the time (Wilson and McPherson 1980b). Since then, males of B. rotundifrons have been collected and we have consequently confirmed its presence in Illinois in addition to the two newly recorded species. Although the two specimens of B. muscotana deposited in the Illinois Natural History Survey are missing from their points, we are confident in their identification as they were both identified by Beamer following his description of the species (Beamer 1946).

**Bakerella cinerea Beamer, 1945**

Illinois: Fayette Co.: US Rt. 37, 0.5 mi NE Farina, 38°51’ 18.6” N 88°44’ 42.2” W, 2 June 2022, vacuuming [1 ♂]; US Rt. 37, 0.7 mi SW LaClede, 20 June 1996, vacuuming, grasses and sedges [1 ♀]. Ford Co.: US Rt. 45, N Pit Road, 40°25’ 47.3” N 88°06’ 31.4” W, 16 June 2022, vacuuming [1 ♂, 3♀]. Iroquois Co.: US Rt. 45, CR 300 N, 40°31’ 54.6” N 88°03’ 58.0” W, 22 June 2022, vacuuming [1 ♂]. Johnson Co.: US Rt. 146, 2 mi E Grantsburg, Franklin La Prairie, 37°23’ 36.7” N 88°42’ 52.8” W, 22 May 2007, vacuuming [4 ♂, 2 ♀]. Lee Co.: Richardson Wildlife Foundation, 41°43’ 12.0” N 89°11’ 02.4” W, 25 July 1996, vacuuming, native prairie [1 ♂, 1 ♀]. Mason Co.: Matanzas Prairie Nature Preserve, 6 miles SW Havana, 40°12’ 59” N 90°6’ 45” W, 22 June 2005, vacuuming, wet prairie [1 ♂]. Marion Co.: US Rt. 37, 1.5 mi SW Farina, 38°49’ 23.5” N 88°47’ 05.0” W, 30 August 2022, vacuuming [1 ♀]. Will Co.: S Arsenal Rd. refinery, 41°24’ 11.1” N 88°11’ 22.1” W, 26 August 2003, vacuuming [1 ♂, 1 ♀]; S Arsenal Rd. refinery, 41°24’ 05.4” N 88°11’ 09.6” W, 26 August 2003, vacuuming, Eleocharis [1 ♂, 2 ♀].

**Bakerella minuta Beamer, 1950**

Illinois: Fayette Co.: US Rt. 37 0.5 mi NE Farina, 38°51’ 18.6” N 88°44’ 42.2” W, 30 August 2022, vacuuming [1 ♀]. Mason Co.: Matanzas Prairie Nature Preserve, 40°12’ 45.5” N 90°07’ 09.4” W, 13 September 2022, vacuuming [1 ♂].

**Bakerella muscotana Beamer, 1945**

Illinois: Vermillion Co.: Muncie, 17 July 1951 [1 ♀, 1 unknown sex, both specimens missing from point].

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**Figure 5.** Known distribution of *Bakerella cinerea* in the contiguous USA. Presence denoted by shaded states.
**Bakerella rotundifrons** Beamer 1950


**Pissonotus aphidioides** Van Duzee, 1897

Wilson and McPherson (1980b) suggested that *P. aphidioides* may occur in Illinois due to its presence in Wisconsin. Bartlett et al. (2014) listed the species as occurring in Illinois, though none of the cited...
references mention any specimens observed from Illinois. We are now able to confirm its presence in Illinois.

Illinois: Champaign Co.: Urbana, Busey Woods, 40°07’40.1”N 88°12’45.0”W, 24 June 2005, sweeping [1 ♂].

Discussion

Aethodelphax aetocephalus. This species was initially described as Delphacodes aetocephala (Beamer 1948) prior to recent revisions (Bartlett and Hamilton 2011). Aethodelphax aetocephalus has previously been recorded as occurring in Florida, Louisiana, Mississippi, and Texas. The species has no recorded host plants but is known to occur in prairies (Bartlett and Hamilton 2011).

Our specimens were collected from Long Branch Nature Preserve and Sand Prairie-Scrub Oak Nature Preserve, both located in Illinois River sand deposits. Both preserves are primarily composed of dry sand prairie with characteristic vegetation such as little bluestem (Schizachyrium scoparium (Michx.) Nash (Poaceae)) and other perennial prairie grasses (Phillippe et al. 2004, McClain et al. 2008).

Specimens of A. aetocephalus collected in Illinois differ from specimens from Gulf Coast populations in genitalic morphology. Compared to a Gulf Coast specimen photographed by Bartlett and Hamilton (2011), individuals collected in Illinois have fewer teeth on the dorsal surface of the aedeagus (Fig. 4e), a longer median distal style projection (Fig. 4d), and numerous denticles on the basal lobe of the style (Fig. 4e).

After identifying the specimens collected in 2022, we re-examined previously collected samples obtained from Long Branch Nature Preserve in 1998 and discovered previously unidentified specimens of A. aetocephalus. This indicates that the species has been present in Illinois for at least 25 years.

Bakerella cinerea and Bakerella minuta. Bakerella cinerea has previously been recorded in Arkansas, Kansas, Missouri, and Pennsylvania (Bartlett et al. 2014) and feeds on Eleocharis palustris (L.) Roem. and Schult. (Cyperaceae) and Juncus spp. L. (Juncaceae) (Beamer 1945, Wilson et al. 1994). Bakerella minuta has previously only been recorded in Florida and Georgia. Although B. minuta does not have a recorded host plant, all species of Bakerella are presumed to feed on Eleocharis spp. R.Br. and other sedges (Bartlett et al. 2014).

Our records of B. cinerea occurring in Johnson Co., Lee Co., Mason Co., and Will Co. before 2022 were obtained as a result of re-examination of previously collected samples in which specimens were initially identified as only Bakerella sp.

Our specimens of B. minuta differ slightly in male genital anatomy from a specimen from the southern population photographed by Bartlett and contributors (2020). The aedeagus of the Illinois specimen has a dorsal hump (Fig. 8c) that seems to be

Figure 7. Known distribution of Bakerella minuta in the contiguous USA. Presence denoted by shaded states.
absent in the southern specimen. Additionally, the vertex of our specimens is as long as it is wide in dorsal view (Fig. 8b), while the vertex of southern specimens is longer than wide. These morphological differences may be due to divergence resulting from the apparent disjunction of the known populations.

From our recent statewide sampling in many sites supporting native prairie vegetation in Illinois, we observed that species of *Bakerella* are usually associated with stands of *Eleocharis* spp. Nearly pure stands of *Eleocharis* are often found in low, seasonally wet areas, e.g., along ditches or in clay pans, that are often interspersed with mesic or even dry prairie in Illinois. Our sampling sites in Fayette and Marion Counties focused on a portion of Twelve Mile Prairie, a railroad prairie consisting of a variety of prairie communities. *Bakerella cinerea* was collected from both counties but *B. minuta* was collected only in a portion of the prairie in Fayette County. The mesic and wet mesic prairie habitats present at these sites

![Figure 8. *Bakerella minuta* male; A. Dorsal lateral view, B. Left lateral view, C. Left lateral view of male genital capsule, D. Caudal view of male genital capsule.](image)
were previously reported to harbor *Juncus torreyi* Coville, *J. brachycarpus* Engelm., *J. interior* Wiegand, and *J. biflorus* Elliot and pure stands of *Eleocharis* spp. were also recorded in claypan prairie communities that occur sporadically along the railroad prairie (Handel 1991). We sampled areas of mesic to wet prairie that included patches of *Eleocharis* spp. at Twelve Mile Prairie. Samples collected from Twelve Mile Prairie in 1996 revealed one female specimen that resembles *B. cinerea*, suggesting that the species has been present at the site for at least 27 years. No specimens of *B. minuta* were discovered in previous samples.

Our sampling sites in Ford and Iroquois Counties focused on Route 45 Railroad Prairie, situated between US Route 45 and the adjacent railroad. *Bakerella cinerea* was collected from portions of the prairie in Ford and Iroquois Counties. Species of *Eleocharis* and *Juncus* were not recorded as occurring within this prairie in a survey conducted in 2001 (Handel 2002) but we noted that *Eleocharis* sp. occurs sparsely in a ditch at our Pit Road sampling site as well as in a larger clay pan at our Iroquois County site.

In southern Illinois, *B. cinerea* was collected from Franklin Lane Prairie in Johnson
County. *Eleocharis* sp. occurs in a ditch running through the middle of the prairie.

In west central Illinois, both *B. cinerea* and *B. minuta* were collected from Matanzas Sand Prairie Nature Preserve in Mason County, which includes mesic to wet prairie as well as sedge meadow habitats. *Eleocharis acicularis* (L.) Roem. and Schult., *E. elliptica* Kunth, *E. palustris*, and *E. tenuis* var. *verrucosa* (Svenson) Svenson occur within the preserve (Feist et al. 2008).

In northeastern Illinois, *B. cinerea* was collected from *Eleocharis* sp. in a clay pan area of dolomite prairie on a site adjacent to the Midewin National Tallgrass Prairie in Will County.

In north central Illinois, *B. cinerea* was collected in native mesic to wet prairie remnants at Richardson Wildlife Foundation in 1996. This private preserve is composed of a wide variety of native prairie vegetation and suitable hosts, including *E. palustris*, *Juncus acuminatus* Michx., *J. canadensis* J. Gay ex Laharpe, *J. effusus* L., *J. interior* Wiegang, and *J. tenuis* Willd. (Handel et al. 2001).

**Pissonotus aphidioides.** *Pissonotus aphidioides* has been presumed to occur in Illinois due to its occurrence in Wisconsin, though no prior specimens have been observed (Wilson and McPherson 1980a, 1980b, 1980c). Bartlett and contributors (2020) report *Castilleja coccinea* (L.) Spreng. (Orobanaceae) as the only recorded host of *P. aphidioides*, though the authors note that this host is unlikely as most species of *Pissonotus* are known to specialize on members of Asteraceae (Bartlett and Deitz 2000). *Castilleja coccinea* has not been recorded as occurring in Busey Woods. Some species of Asteraceae have been recorded, including *Erigeron* spp. L. and *Solidago* spp. L. which are reported hosts of *P. brunneus* Van Duze, 1897 and *P. dorsalis* Van Duze, 1897 respectively (Bartlett and contributors 2020). Both *P. brunneus* and *P. dorsalis* have been recorded in Illinois (Bartlett et al. 2014).

**Possible Disjunct Populations.** The discovery of *A. aetocephalus* and *B. minuta* in Illinois extends the previously known ranges of both species by at least a few hundred kilometers northward. Although the apparent geographic disjunction between the Illinois populations and their southern counterparts may be due to inadequate sampling in intervening areas, morphological differences (noted above) between specimens from the Illinois and southern populations in both species suggest that there is little or no gene flow between these populations. Further studies incorporating both morphological and molecular data are needed to elucidate the full extent of morphological and genetic variation within and among populations of these two delphacid species.

The possibility that presence of the latter two species in Illinois may be a result of northward range expansion due to climate change should also be considered. Such range expansions have been observed in many insect taxa (Parmesan 2001, Musolin and Fujisaki 2006), including the planthopper *Acanalonia conica* (Say, 1830) (Pechuman and Wheeler 1981). Whether these delphacid species have been present in Illinois and have simply gone unnoticed until recently, or have recently populated Illinois due to climate-driven range expansion remains unknown. More research is needed to better understand the origin of these delphacids in Illinois, their relationships to other populations and their conservation status.

**Literature Cited**


Crawford, D. L. 1914. A contribution toward a monograph of the homopterous insects of the family Delphacidae of North and South


