

**MEGAMELANUS BICOLOR BALL (HEMIPTERA: FULGOROIDEA:  
DELPHACIDAE): A SPECIALIST PLANTHOPPER ON SALTGRASS  
(DISTICHLIS SPICATA; POACEAE) IN NEBRASKA'S ALKALINE AND  
SALINE WETLANDS**

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*Abstract.*—Originally described in 1902, *Megamelanus bicolor* Ball is an infrequently collected delphacid planthopper whose host plants have remained unknown. Nymphs and adults were collected on saltgrass, *Distichlis spicata* (L.) Greene (Poaceae), in the critically imperiled saline wetlands of eastern Nebraska, as well as in alkaline wetlands of western Nebraska. We suggest that the planthopper is a saltgrass specialist. In addition to the new state record of Nebraska, we give other new North American records based on examination of museum specimens: Louisiana, Oregon, South Dakota, Texas, and Wyoming in the United States, and British Columbia in Canada. A diagnosis of *M. bicolor* and illustrations and photographs of the male terminalia are provided.

*Key Words:* distribution, new records, host plants, *Distichlis spicata*, saltgrass

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Since its original description from California and Colorado more than 110 years ago (Ball 1902), *Megamelanus bicolor* has remained a seldom-collected species. Subsequent U.S. records are limited to Arizona, Idaho, Kansas, Nevada, New Mexico, and Utah (McDermott 1952). An uncertain Canadian record is Manitoba (Maw et al. 2000). The only record east of the Mississippi River, Florida (McCoy and Rey 1981; Rey and McCoy 1982, 1997), was omitted from the recent list of Floridian Delphacidae (Kennedy et al. 2012). Nymphs and adults in Florida were swept from a mixed-species meadow dominated by saltgrass (*Distichlis spicata* (L.) Greene),

but the specific host used by *M. bicolor* was not determined (Rey and McCoy 1982). We also have examined specimens (3♂, 2♀) from California (Orange Co., Crystal Cove State Park, S. Newport Beach, 17 Nov 1995, S. W. Wilson [S. W. Wilson Collection, University of Central Missouri]) that were collected from *D. spicata*.

In Nebraska, *M. bicolor* first was found in July 2012 during fieldwork (by AGW) intended to add to the knowledge of insect biodiversity in the state's eastern saline wetlands in and near Lincoln. Here we provide the first Nebraska records of the planthopper, establishing saltgrass (*D. spicata*) as its host plant in

eastern and western alkaline-saline wetlands, in addition to six other new North American records (1 Canadian, 5 U.S.) based on museum specimens. We suggest that the planthopper is a saltgrass specialist. Also provided are a diagnosis of the adult male and female, photographs (dorsal, lateral, and front views and terminalia), and illustrations of the aedeagus and left paramere.

The host plant of *M. bicolor*, *Distichlis spicata*, is a perennial, sod-forming, salt-tolerant C<sub>4</sub> grass, 15 to 45 cm tall, but typically shorter (<30 cm) in dense colonies. Aerial stems (culms) of this dioecious chloroid grass can be erect or decumbent (Hauser 2006, Lonard et al. 2013). Anatomical and morphological attributes enable saltgrass to tolerate diverse soil types, salinities, and pH levels (Hansen et al. 1976, Hauser 2006).

#### MATERIALS AND METHODS

*Megamelanus bicolor* was collected (2012–2013) only occasionally from saltgrass by sweep-net sampling. Nymphs and adults were more readily collected from saltgrass by using the flat end of an ax handle to whisk matted stems into a beating net with a shallow bag. Specimens were collected into plastic vials and point mounted. Representative specimens were determined by CRB. Voucher material has been deposited in the U.S. National Museum of Natural History (USNM), Smithsonian Institution, Washington, DC, and University of Delaware Insect Reference Collection, Newark (UDCC). Under specimens examined, the numbers of nymphs are recorded as Arabic numerals, followed by a dash and Roman numerals indicating instars. Specimens were borrowed (or label data obtained; SEMC) from the following institutions: S. W. Wilson Collection (SWWC), University of Central Missouri, Warrensburg; Snow Entomological Museum Collection

(SEMC), University of Kansas Biodiversity Institute, Lawrence; and USNM. All specimens were brachypterous, except as indicated.

Other grasses of eastern saline wetlands in Nebraska (Ungar et al. 1969, Kaul et al. 2006), such as big bluestem (*Andropogon gerardii* Vitman), foxtail barley (*Hordeum jubatum* L.), switchgrass (*Panicum virgatum* L.), prairie cordgrass (*Spartina pectinata* Link), and tall wheatgrass (*Thinopyrum ponticum*) (Podp.) Z.-W. Liu & R.-C. Wang also were sampled by beating or sweeping in attempts to determine the host range of *M. bicolor*. Alkali sacaton (*Sporobolus airoides* (Torr.) Torr.) and switchgrass were sampled less extensively in alkaline wetlands of western Nebraska.

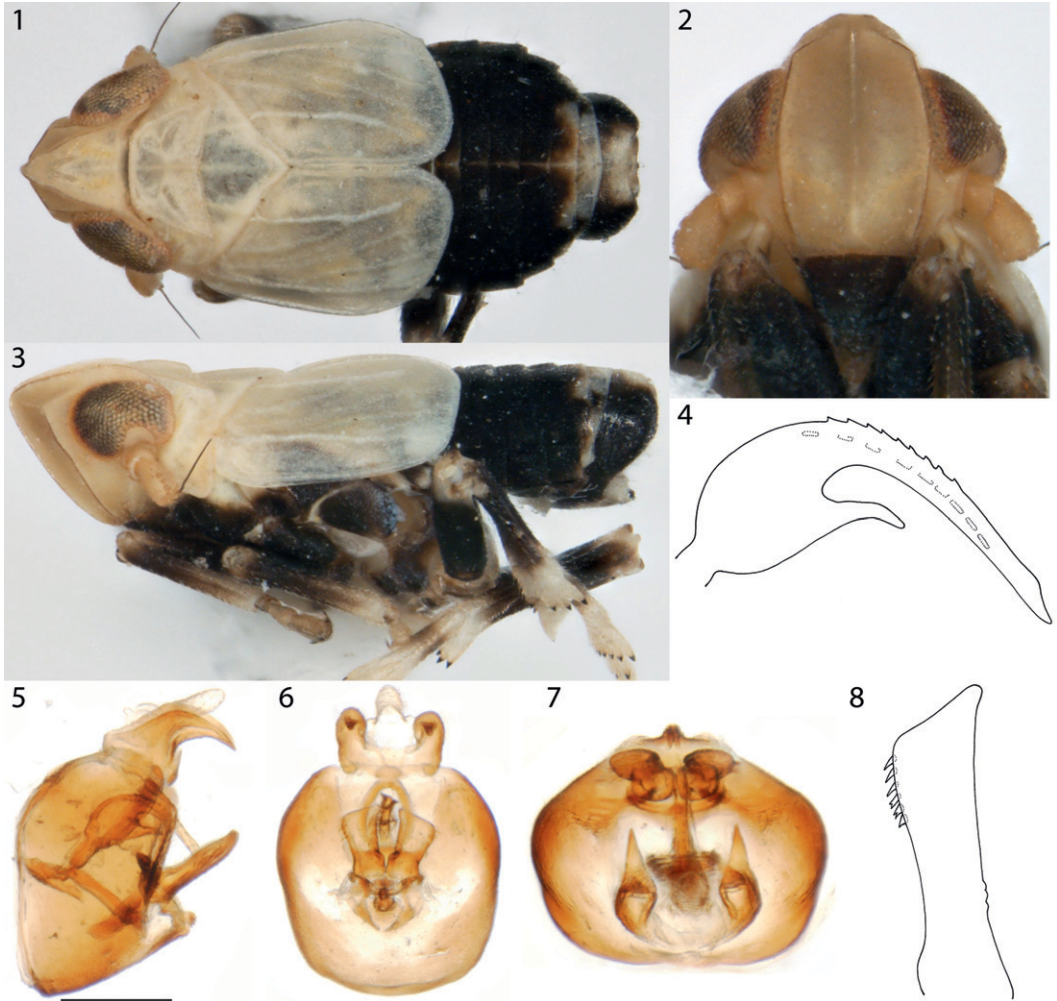
Use of the terms *alkaline* and *saline* in reference to salt-affected wetlands has been inconsistent. For example, saline, rather than alkaline, has been used for soils of pH 8.5 or higher with accumulated soluble salts such as sodium carbonate (Willis 1967, Goodwin and Niering 1975). We follow Steinauer (1994) and Johnsgard (2001) in referring to Nebraska's salt-affected wetlands in the North Platte River Valley and western Sandhills as alkaline and those in the Lincoln vicinity as saline.

#### RESULTS

##### *Megamelanus bicolor* Ball

Figs. 1–10

The genus *Megamelanus* Ball was described to accommodate the new species *M. bicolor* on the basis of 25 specimens from Colorado and one from California without mention of specific localities (Ball 1902). Crawford (1914) redescribed *M. bicolor*. McDermott (1952) designated a male from Ft. Collins, Colorado, taken July 28, 1898, as lectotype (specimen at USNM). In revising *Megamelanus*, McDermott (1952) placed into two new



Figs. 1-8. *Megamelanus bicolor* Ball (male). 1, Dorsal view. 2, Front. 3, Lateral view. 4, Aedeagus, left lateral view. 5, Male terminalia, left lateral view. 6, Male terminalia, caudal view. 7, Male terminalia, dorsal (caudal portion top). 8, Left paramere, widest view.

genera (*Neomegamelanus* McDermott and *Tumidagena* McDermott) the North American species described in *Megamelanus* after Ball's (1902) original description: *N. elongatus* (Ball 1905); *N. spartini* (Osborn 1905); and *N. dorsalis*, *N. lautus*, and *T. terminalis* (Metcalf 1923). McDermott (1952) did not treat *M. graminicola* (Muir 1928), which was described from Bermuda and transferred to *Neomegamelanus* by Wilson and Hilburn (1991). In addition, *Kelisia salina* (Ball

1902), which Beamer (1945) had placed in *Megamelanus*, and *M. frontalis* (Crawford 1914) were transferred by McDermott (1952) to the new genus *Prokelisoidea* McDermott (since synonymized with *Prokelisia* Osborn; Wilson 1982). Two species originally described in *Megamelanus* recently have been synonymized by Kennedy et al. (2012): *Neomegamelanus spartini* (Osborn 1905) = *N. dorsalis* (Metcalf 1923), and *Saccharosydne saccharivora*

(Westwood 1833) = *M. rufivittatus* (Ball 1905). The latter taxonomic action leaves *bicolor* as the only species remaining in *Megamelanus*.

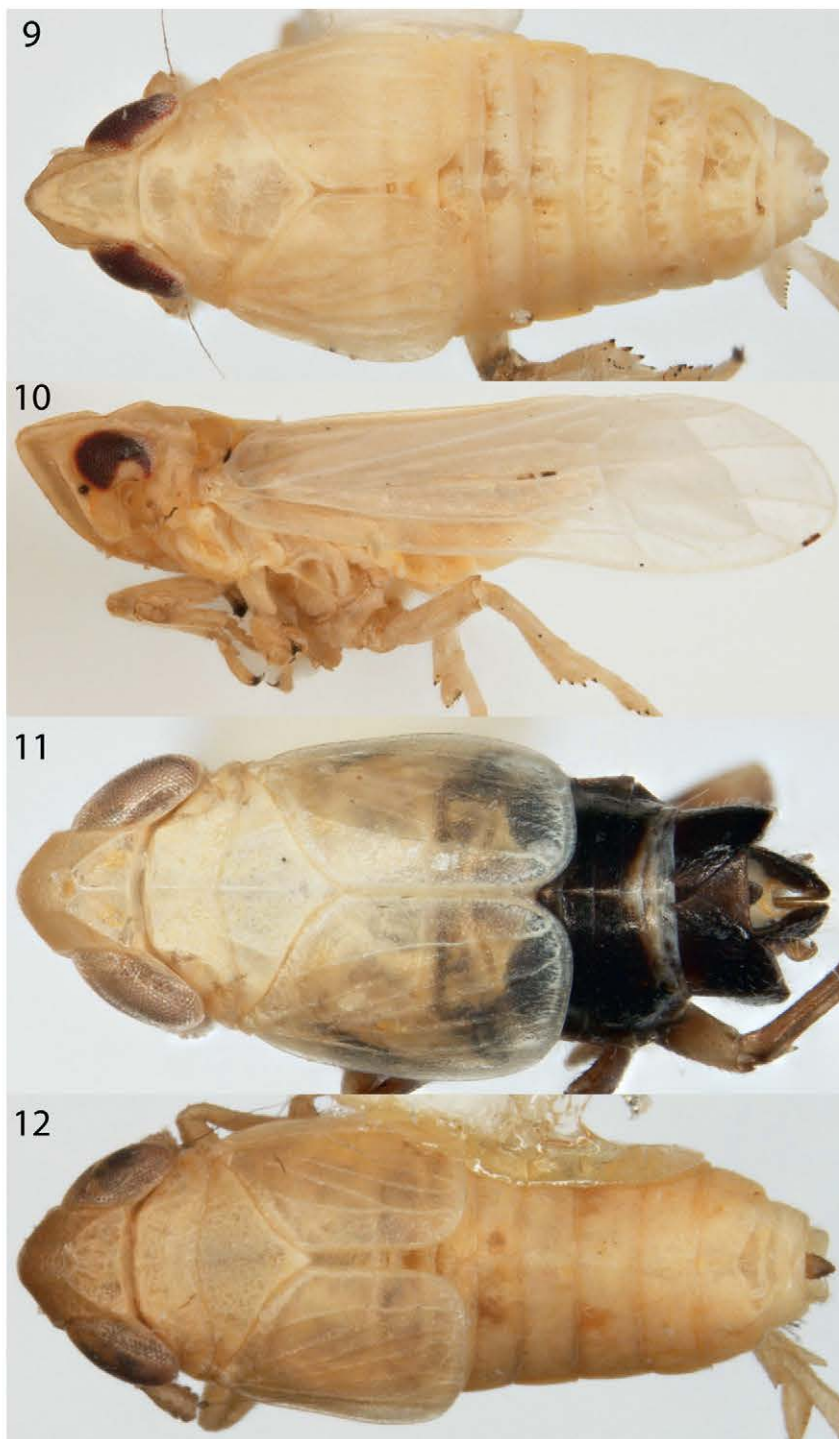
**Diagnosis.**—*Megamelanus bicolor* is easily recognized by color and form. Males (Figs. 1-3) are strongly bicolored (front contrasting with clypeus; abdomen contrasting with thorax and head); stramineous on dorsal portions of head, pro- and mesonotum, and brachypterous wings; brown (with irregular diffuse paler regions) on clypeus, pleural and ventral regions of thorax, and abdomen. Females (Figs. 9-10) are uniformly stramineous. *Megamelanus bicolor* is small (males 1.6–1.8 mm; females 2.4–2.5 mm, macropter, including wings, 3.11 mm), slightly dorsoventrally compressed, with the head slightly but distinctly projected in front of eyes (the lateral carinae of frons and vertex removed from the eye at fastigium). The carinae of the head are distinct. The lateral margins of the frons are arched and widest in the lower portion of the eye, and the median carina is forked at the fastigium. The submedian carinae of the vertex are keeled, forming conspicuous “V” (with arms at posterior margin of head and base projecting at fastigium), giving the vertex a triangular appearance. The lateral carinae of the pronotum reach the posterior margin. The male pygofer (Figs. 5-7) in lateral view has a deep notch near the base of the parameres and small, median, serrulate projection near the ventral margin of the opening of the pygofer. The parameres (Fig. 8) are simple and flattened, with the inner angle projected dorso-medially and a row of fine serrulations on the dorsal lateral margin. The aedeagus (Fig. 4) is broad and flattened basally, with a large ventral projection in the basal fourth, then abruptly constricted to a narrow, decurved blade bearing dorsal and right lateral rows of

teeth. The suspensorium is conspicuous and “O” shaped, and segment 10 bears a pair of widely separated stout, tapering projections on the dorsolateral portion of the caudal margin.

Among the North American fauna, *Megamelanus* is most similar to the *Spartina*-feeding genera *Neomegamelanus* and *Tumidagena* but is readily separated by male coloration and features of the head and genitalia. Also, McDermott (1952) provided a key and descriptions of these genera, and a key to all North American delphacid genera was provided by Bartlett et al. (2014). *Megamelanus* superficially is much more similar to the Palearctic genus *Delphacinus* Fieber. The European *D. mesomelas* (Boheman) (Figs. 11-12) is of similar size (brachypterous male 2.0–2.3 mm, female 2.7–3.0 mm) and essentially the same color pattern, but differs in features of the head (carinae not prominent, lateral carinae of front and vertex near eye as fastigium), and in many details of the male genitalia. *Delphacinus mesomelas* feeds on fescue (*Festuca ovina* L. group and *F. rubra* L.) (Holzinger et al. 2003, Nickel 2003). The similarities between *Delphacinus* and *Megamelanus* invite phylogenetic investigation.

**New North American records.**—In addition to recording *M. bicolor* from Nebraska (see “Specimens examined” for collection data), we provide other new provincial and state records (number and gender of specimens and museum abbreviations are indicated parenthetically). CANADA: British Columbia, Oliver, 6 Aug 1931, J. Nottingham (1♂; SEMC). UNITED STATES: LOUISIANA: Plaquemines Par., Rt. 23 Venice, 7 Dec 1990, S. Wilson & R. Denno (2♂; SWWC); OREGON: Hot Lake, 13 Jul 1931, R. H. Beamer (5♂; SEMC); SOUTH DAKOTA: Vayland, 23 Jul 1935, P. W. Oman (1♂, 1♀; USNM). TEXAS: Bay City, 4 May 1953, R. H.





Figs. 9-12. *Megamelanus bicolor* Ball and *Delphacinus mesomelas* (Boheman). 9, Female brachypter *M. bicolor*, dorsal view. 10, Female macropter *M. bicolor*, lateral view. 11, Male *D. mesomelas*, dorsal view. 12, Female *D. mesomelas*, dorsal view.

Beamer (3♂; SEMC): WYOMING: Laramie, 23 Jun 1935, R. H. Beamer (1♂; SEMC).

Host plants, seasonality, and wing dimorphism.—*Megamelanus bicolor* was found in Nebraska on *D. spicata* in three eastern saline wetlands in the floodplain of Salt Creek and its tributaries in the city of Lincoln. It also was found on saltgrass in western Nebraska (panhandle): an alkaline wetland in the western Sandhills of southern Sheridan County and three alkaline meadows of the North Platte River Valley (Garden, Morrill, and Scotts Bluff counties; see "Specimens examined" for collection data). The planthopper was not found on other grasses that were sampled in alkaline-saline wetlands in Nebraska.

Nymphs and adults were collected in late June and early July and from early to late September, indicating that *M. bicolor* is at least bivoltine. All adult males (n = 90) were brachypterous; females (n = 20) were brachypterous, except for one macropter (Fig. 10).

Specimens examined (all taken from *Distichlis spicata* by AGW).—NEBRASKA: Garden Co., Rt. 26, 2.4 km W of Oshkosh, 41°25.063'N102°22.213'W, 1 July 2013, 32♂, 2♀, 3–V. Lancaster Co., Lincoln Saline Wetlands Nature Center, E of Capitol Beach (formerly Salt) Lake, 40°49.400'N 96°43.849'W, 4 July 2012, 1♂ & 9 July 2013, 5♂, 4♀ [nymphs observed]; Pfizer Saline Wetlands, W Cornhusker Hwy. & N 1st St., Lincoln, 40°50.051'N 96°43.352'W, 3 July 2012, 29♂, 7♀ (incl. 1 macropter), 2–V & 26 Sep 2012, 2♀ & 9 July 2013, 12♂, 1♀, 2–V & 1 Sep 2013, 4♂, 1♀, 1–V; Whitehead Saline Wetlands, S of I-80 E of 27th St., Lincoln, 40°52.933'N 96°40.812'W, 28 June 2013, 1♂ & 8 July 2013, 1♂ & 2 Sep 2013, 3♀ [nymphs observed]. Morrill Co., jct. Rts. 26 & 92, 4.3 km S of Bayard, 41°42.966'N103°19.424'W, 4 July 2013,

3♂, 1–V. Scotts Bluff Co., Rt. 26, 7.5 km E of Scottsbluff, 41°49.923'N103°34.781'W, 3 July 2013, 1♂, 1–V. Sheridan Co., Rt. 250, 0.3 km N of Lakeside, 42°03.451'N102°25.373'W, 7 July 2013, 1♂, 1–V.

#### DISCUSSION

*Megamelanus bicolor* apparently has been reported from only one study of insects of coastal or inland salt marshes and other alkaline-saline communities. Nymphs (n = 39) and adults (n = 6) were swept from a *Distichlis spicata* meadow in St. Marks National Wildlife Refuge (Wakulla County) in the Florida panhandle; the delphacid's host in a meadow of diverse plant species was not established (McCoy and Rey 1981, Rey and McCoy 1982). An adult (cited incorrectly as a nymph; see McCoy and Rey 1981: table 1) swept from needlegrass rush (*Juncus roemerianus* Scheele; Juncaceae) at St. Marks was considered merely a dispersing individual (Rey and McCoy 1982). An occasional incidental occurrence of *M. bicolor* might be expected on *J. roemerianus* because the rush is syntopic with saltgrass in plant communities along the Atlantic and Gulf coasts (Hauser 2006, Lonard et al. 2013). This planthopper was not recorded in several other studies of coastal salt marshes where *D. spicata* was noted as present: Maryland (Bickley and Seek 1975), New Jersey (Tallamy and Denno 1979), and North Carolina (Davis and Gray 1966, Davis 1978).

The wetlands of the Lincoln vicinity where we found *M. bicolor* are the only saline wetlands in eastern Nebraska (Johnsgard 2001: map 13). Critically imperiled (S1 conservation status), these wetlands have been substantially destroyed or degraded by agricultural practices, commercial and residential development, road construction, and stream channelization (Farrar and Gersib 1991, Gersib and

Steinauer 1991, LaGrange 2005, Rolfsmeier and Steinauer 2010). Nebraska's eastern saline wetlands might have served as refugia for insects during the Pleistocene (Willis 1967) and harbor the only known populations of the federally endangered Salt Creek tiger beetle (*Cicindela nevadica lincolniiana* Casey) (Spomer and Higley 1993, Cochnar and Harms 2005). Except for additional species of tiger beetles (Hoback et al. 2000, 2001), relatively few other saline-adapted insects of Nebraska's eastern saline wetlands have received attention from entomologists (Hoback et al. 1999, Wheeler 2013; AGW, unpub. data).

Nymphs and adults of *M. bicolor* were found on saltgrass in consecutive years in Lincoln and in 2013 were observed on this grass in four of Nebraska's western saline wetlands. The male-biased sex ratios reflect not only an emphasis on collecting males but also the females' drab (stramineous) coloration. In an insect net, the bicolored males are more conspicuous than the females.

The five delphacids reported previously from *Distichlis spicata*—*Delphacodes detecta* (Van Duzee), *Megamelus lobatus* Beamer, *Neomegamelus spartini* (Osborn) (as *N. dorsalis*), *Prokelisia salina* (Ball), and *Tumidagena minuta* McDermott—apparently are not saltgrass specialists. They also develop on cordgrasses (*Spartina* spp.) (Davis and Gray 1966, Denno 1977, Raupp and Denno 1979, McCoy and Rey 1981, Wilson and Hilburn 1991, Kennedy et al. 2012), except *P. salina*, which is associated with species of other grass genera (Wilson et al. 1994, Wilson and Wheeler 2010). We suggest that *M. bicolor*, like several leafhopper species (Hamilton and Whitcomb 2010, Hamilton 2012), specializes on *D. spicata*. Saltgrass is able to grow in low-saline soils but cannot compete well with other graminoids; rather than an obligate halophyte,

it should be considered a plant found primarily in saline communities where most other plants cannot grow (Ungar 1966). The architecturally complex, thatch-forming *D. spicata* can be expected to support a more diverse planthopper fauna than less structurally complex salt marsh grasses such as *Spartina alterniflora* Loes. (Tallamy and Denno 1979). *Megamelanus bicolor*, however, was the only delphacid we found on *D. spicata* in alkaline-saline wetlands of Nebraska.

Attempts to recollect *M. bicolor* in Nebraska's eastern saline wetlands sometimes were unsuccessful even when the timing seemed likely to yield specimens. The planthopper was not encountered when saltgrass was sampled in certain alkaline wetlands in western Nebraska, or in salt-affected wetlands in Kansas (Quivira National Wildlife Refuge, West Talmo Marsh = Tuthills Marsh; Ungar 1967), Oklahoma (Salt Plains National Wildlife Refuge), North Dakota (Oakville Prairie), and South Dakota. Failure to find *M. bicolor* at additional sites might be due to low planthopper densities, in addition to the difficulty of collecting individuals from mats of saltgrass. The use of vacuum sampling (Wilson et al. 1993, Holzinger et al. 2003, Hamilton 2012) might prove a more effective means of detecting *M. bicolor*.

*Megamelanus bicolor* probably is more common and widespread in North America than published records suggest. We anticipate additional records from coastal saline communities in the eastern and western United States, as well as from alkaline flats, desert playas, saline seeps, salt meadows, and other inland communities of the West. Wet alkaline and saline soils are particularly common in arid and semiarid regions of high evapotranspiration, such as the western United States (Boettinger 1997, Boettinger and Richardson 2001, Brady and Weil 2008:

fig. 10.11). In eastern states (Minnesota to Louisiana), the planthopper seems less likely to be found inland. Salt-affected soils are uncommon in the East (Brady and Weil 2008), with saltgrass generally restricted to the Atlantic and Gulf coasts (Hauser 2006).

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