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First report of corn leafhopper (Hemiptera: Cicadellidae) in the USA Midwest Suction Trap Network

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First report of corn leafhopper (Hemiptera: Cicadellidae) in the USA Midwest Suction Trap Network

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Abstract. Corn leafhopper, *Dalbulus maidis* (DeLong and Wolcott) (Hemiptera: Cicadellidae), is native to Central and South America, but invasive in the United States. This species is a threat to corn, *Zea mays* L., one of the main crops of economic importance in the US, because it is also a vector of three pathogens responsible for corn stunt diseases complex: corn stunt spiroplasma (CSS), maize bushy stunt phytoplasma (MBSP), and maize rayado fino virus (MRFV). Therefore, monitoring the dispersal of this pest is necessary to document its geographic expansion and anticipate the incidence of corn stunt disease. Based on trap catches obtained from the Midwest Suction Trap Network in 2024, corn leafhopper populations increased late in the growing season in Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, and Wisconsin. We will continue to monitor the dispersal of this invasive species through the Midwest Suction Trap Network to provide information to researchers, extension agents, and producers regarding this agronomically important pest.

Key words. Host plant, corn, corn stunt disease, monitoring, distribution.

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Introduction

The corn leafhopper (*Dalbulus maidis* DeLong and Wolcott; Hemiptera: Cicadellidae) is a threat to corn, *Zea mays* L. (Poaceae), production in tropical America because it is an efficient vector of three pathogens belonging to the corn stunt diseases complex: corn stunt spiroplasma (CSS), maize bushy stunt phytoplasma (MBSP), and maize rayado fino virus (MRFV) (Nault 1980, 1990). Yield losses from diseases spread by this insect have been reported in Central America (El Salvador, Mexico, and Nicaragua) and South America (Argentina, Brazil, and Peru) since the 1990s. However, the losses have increased in Brazil and Argentina since 2015 (Oliveira and Frizzas 2021), and a severe outbreak of corn leafhoppers and corn stunt disease during season 2023 and 2024 was reported in Argentina resulting in corn yield losses of up to 80% (Virla 2024). In the USA, the corn leafhopper was first reported causing injury to field corn in Fresno and Tulare counties in California in 1942 (Frazier 1945) and in 1945 in Texas (Nault and Knoke 1981). Sporadic cases of corn plants showing stunt symptoms were discovered in 1962 in Mississippi and Ohio, and 1963, cases of corn stunt also were reported in Arizona and suspected to be present in other states such as Alabama, Georgia, Indiana, Kentucky, Louisiana, Missouri, South Carolina (Stoner and Ullstrup 1964) and Florida, where a serious outbreak of a disease complex resembling corn stunt occurred on corn between 1979 and 1980 (Tsai and Miller 1995). Research studies showed that corn leafhoppers may be capable of long-distance migratory flight (several hundred kilometers) aided by winds. For example, Bradfute et al. (1981) reported an epidemic of corn stunt disease in southern Florida in 1979 and suggested that it was because of the introduction of corn leafhoppers from the Caribbean Islands by Hurricane David. Also, Nault and Knoke (1981) reported corn leafhoppers in Ohio >1,100 km from the nearest frost-free regions of the Gulf Coast. Since the 1980s, documentation of corn leafhopper occurrence in the US was limited to the occasional migrant in the Southwest and North Central USA (C. Dietrich, unpublished observations). However, in early August of 2024, corn leafhopper and corn stunt disease were reported for the first time in Oklahoma (Faris et al. 2024), with subsequent reports of corn stunt disease from Kansas (Nelson 2024) and Missouri (Geist 2024) occurring in mid-August 2024. In addition, significant infestations of adults and nymphs of corn leafhoppers were detected on V4-V5 stage corn plants for the first time in September 2024 in the St. Paul campus of the University of Minnesota (Wang and Yang 2024) and on 3 October 2024 in Schuyler County, Illinois by N. Seiter.

The sudden presence of this invasive species raised many questions about its dispersal in the upper US Midwest US in 2024. Researchers and extension specialists turned to the USA Midwest Suction Trap Network (STN) (https://suctiontrapnetwork.org/) for data on the distribution and abundance of corn leafhoppers. The STN has operated since 2005 and continues generating data mainly for agricultural services (Lagos-Kutz et al. 2020). The tall vacuums of about 20.5 feet built with PVC pipes and fan motors were initially installed at research stations of universities throughout the midwestern USA to monitor the distribution and migratory patterns of soybean aphid (*Aphis glycines* Matsumura), a pest that was first detected in the United States in 2000 (Schmidt et al. 2012; Bahlai et al. 2014; Crossley and Hogg 2015). The STN has also been used to monitor the activity of other aphids (Crossley et al. 2020, 2021, 2022), and was used to document newly invasive species such as the cannabis aphid (*Phorodon cannabis* Passerini: Aphididae), and sugar cane aphid (*Melanaphis sacchari* Zehntner: Aphididae) (Lagos-Kutz et al. 2018a, b, 2021). In addition to aphids, the traps also have captured insects from a variety of taxa, including agriculturally important pests such as soybean thrips (*Neohyadatothrips variabilis* Beach: Thripidae) (Keough et al. 2018) and potato leafhoppers (*Empoasca fabae* Harris: Cicadellidae) (Lagos-Kutz et al. 2024), vectors of plant pathogens (Thekke-Veetil et al. 2020, 2024) and human diseases (mosquitoes) (Muturi et al. 2018). The suction traps routinely catch a wide variety of insect taxa, with small beetles, flies, and wasps being the most abundant. In this brief report, we present records of corn leafhoppers collected in the Midwest Suction Trap Network in 2024.

Materials and Methods

The suction traps samples were collected weekly from 17 May 2024 to 18 October 2024. The traps were in operation daily between 7:00 AM and 8:00 PM Central Standard Time (Lagos-Kutz et al. 2020). Trapped insects preserved in a mix of water and propylene glycol were mailed to Lagos-Kutz at the University of Illinois at Urbana-Champaign for sample processing, identification, and enumeration. We compiled corn leafhopper counts from 28 suction traps distributed across 10 states in the central USA.

Corn leafhoppers were initially separated from other leafhoppers in suction trap samples based on their coloration (pale yellow overall with a distinctive pair of black spots on the crown of the head) and forewing venation (presence of only two anteapical cells). The identity of female specimens was confirmed based on the distinctive shape of the pregenital (seventh) abdominal sternite (Triplehorn and Nault 1985: fig. 42). Males were identified by removing and soaking the abdomen in 10% KOH solution overnight, then rinsing it several times with water and immersing it in glycerin for observation and photography. The male genitalia of this species are distinctive (Triplehorn and Nault 1985). Photos of leafhopper terminalia were taken with a Jenoptik Gryphax digital camera mounted on an Olympus BX41 microscope. Images of corn leafhopper adults were taken with a Keyence Digital Microscope.

Results

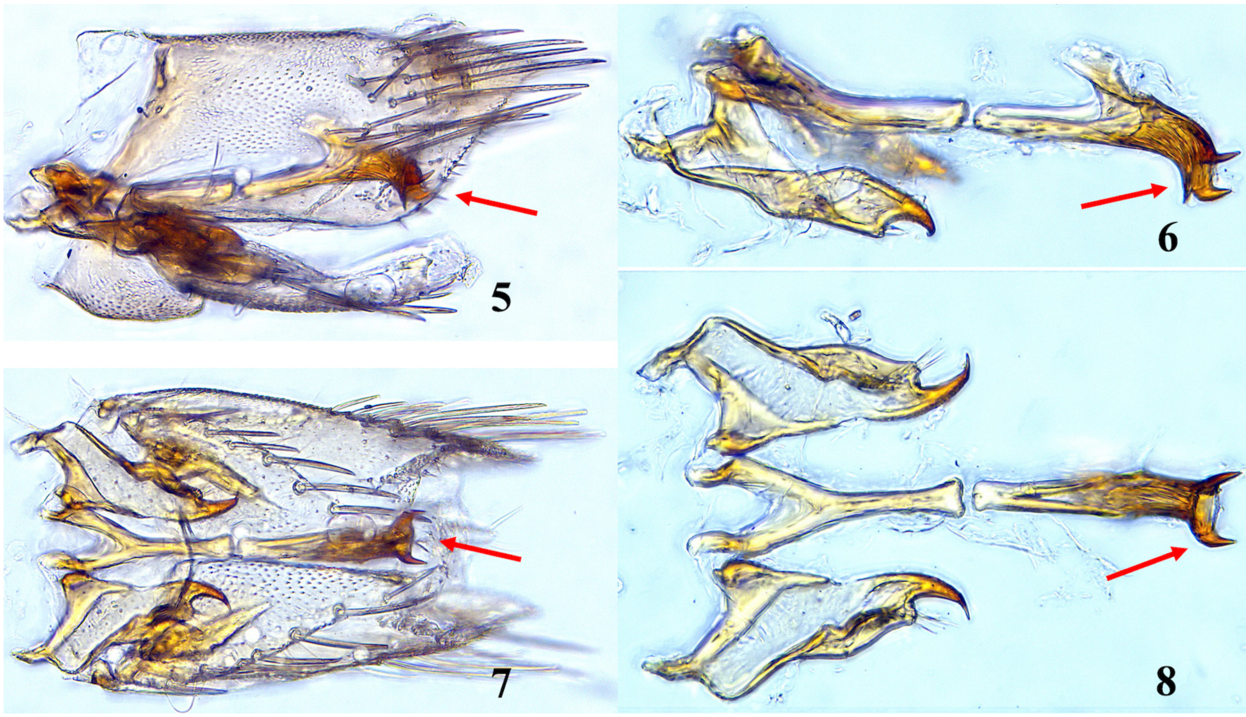
External morphological characters, especially the two distinct black spots on the forehead (Fig. 1–4) were used to rough-sort potential corn leafhoppers. Dissection of male genitalia, showing the two hooks on the aedeagus, was used to confirm the diagnosis (Fig. 5–8). Females were identified based on their similarity to males in size and coloration, association with males in the same samples, and the distinctive shape of the pregenital abdominal segment. Examination of specimens captured in the STN in 2024 revealed that corn leafhopper was present in at least one suction trap location in all states, including Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, and Wisconsin (Table 1). The first detection of corn leafhopper (a male individual) was on 9 August in Princeton, Kentucky. Populations increased between 20 September and 11 October with the most notable peak in Manhattan, Kansas (no sample was collected on 18 October because the suction trap was turned off) (Fig. 9). Beyond the STN, this insect was found on volunteer corn at V5 and V7 growth stages in Schuyler County, near Rushville, Illinois, and late-planted demonstration plots at the Agronomy Education Center near Kansas State University in Manhattan, Kansas in early and late October, respectively. A selection of corn leafhopper specimens caught in the STN and in the field were deposited in the Illinois Natural History Survey-Insect Collection (INHS) (Table 2). Corn leafhoppers not archived in INHS-Insect Collection have been stored at -20°C for future molecular screening for the presence of pathogens, including CSS (*Spiroplasma kunkelii* Whitcomb, Chen et al.; Mollicutes: Mycoplasmatales: Mycoplasmataceae), causative of corn stunt disease.

Discussion

The establishment of corn leafhoppers in California and Texas, sporadic records in other USA states, and new ones of this insect in 2024 raised many questions about the dispersal and migratory patterns of this threat to corn production in the years ahead. The mid-August records of corn leafhopper from suction traps in the Midwest coincide with the records of corn leafhopper and corn stunt disease reported in the southern USA (Oklahoma, Kansas, and Missouri). However, field observations of active development of corn leafhopper populations started in July in Kansas, and corn stunt disease was confirmed in 26 counties by the end of the field season (Onofre et al. 2024). These events suggest that environmental parameters were favorable for corn leafhopper to spread out up

Figures 1–4. Dorsal view of adults of corn leafhopper, *Dalbulus maidis,* caught in USA Midwest Suction Trap Network in 2024. **1)** Corn leafhopper caught in Wanatah (PPAC), Indiana on 6 September. **2)** Corn leafhopper caught in Concord, Nebraska on 20 September. **3)** Corn leafhopper caught in Princeton, Kentucky on 27 September. **4)** Dorsal view of head showing the two distinct black spots on forehead of corn leafhopper caught in Wanatah (PPAC), Indiana. Photographs: I. Plasencia.

north, and strong wind was found to be one of the factors that benefit this invasive species phenomenon (Bradfute et al. 1981) stated that strong winds can carry corn leafhoppers north. Further monitoring and population genetic studies are needed to identify the sources and pathways of the migratory individuals. Peaks in abundance in late September and October, revealed by suction trap samples, may reflect fall migration into the upper Midwest but may also reflect a larger fall population of corn leafhoppers resulting from breeding over the summer. We will review suction trap samples collected and stored before 2024 to determine whether corn leafhoppers were present in previous years across the Midwest and will continue monitoring the dispersal of corn leafhopper



Figures 5–8. Male genitalia of corn leafhopper, *Dalbulus maidis*. **5)** Lateral view of the last abdominal segment showing male genitalia. **6)** Lateral view of male genitalia without skin tissue. **7)** Ventral view of the last abdominal segment showing male genitalia. **8)** Ventral view of male genitalia without skin tissue showing aedeagus, styles, and connective). The two hooks in the male are one of the diagnostic characters to identify corn leafhopper. Photographs: C. Dietrich.

through the Midwest Suction Trap Network in 2025. These observations are needed to confirm previous records of corn leafhoppers in the upper Midwest, correlate all suction trap data with weather parameters, and understand the factors that benefit its dispersal, build local populations, and spread corn stunt disease. Establishing the timing, frequency, and population dynamics of this insect in the Midwest will be critical to determine if and to what extent it is a potential threat to corn production and to alert researchers, extension agents, and producers about this agronomically important pest.

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Table 1. Total counts of corn leafhoppers (*Dalbulus maidis*) caught in the Midwest Suction Trap Network between 17 May and 18 October 2024.

Suction Trap Location	Research Station	Collector	Corn Leafhopper
ILLINOIS: University of Illinois at Urbana-Champaign			
Champaign II	SOYFACE, USDA-U of I	D. Lagos-Kutz	44
Monmouth	NW Ag. Res. and Dem. Center	G. Steckel	34
Morris	Private Farm	R. Higgins	9
Orr	Orr Ag. Res. & Dem. Center	L. Merritt	7
INDIANA: Purdue University			
Butlerville (SEPAC)	SE Purdue Ag. Center	D. Bauerle	26
Columbia City (NEPAC)	NE Purdue Ag. Center	C. Lake	0
Farmland (DPAC)	Davis Purdue Ag. Center	J. Boyer	3
Lafayette (TPAC)	Throckmorton Purdue Ag. Center	P. Illingworth	3
Wanatah (PPAC)	Pinney Purdue Ag. Center	S. Boyer	4
IOWA: Iowa State University			
Ames	Bio Century Farm	G. VanNostrand	3
Kanawha	Northern Res. Farm	M. Schnabel	31
Nashua	NE Res. and Dem. Farm	K. Pecinovsky	8
Sutherland	NW Res. and Dem. Farm	A. Weaver	10
KANSAS: Kansas State University			
Manhattan	North Agronomy Farm	N. Clark	202
KENTUCKY: University of Kentucky			
Princeton	Res. & Education Center	R. Villanueva	15
MICHIGAN: Michigan State University			
Hickory Corners	Kellogg Biol. Station,	S. VanderWulp	1
Kalkaska	Seed Potato Private Farm	D. Iott	6
MINNESOTA: University of Minnesota			
Lamberton	SW Res. & Outreach Center	T. Vollmer	8
MISSOURI: University of Missouri			
Columbia	University Campus	D. Finke	27
NEBRASKA: University of Nebraska			
Concord	Haskel Ag. Lab	N. Luhr	27
Keith	Cedar Point Biol. Station	J. Garbisch	10
WISCONSIN: University of Wisconsin-Madison			
Arlington	Arlington Ag. Res. Station	S. Chapman	6
Eau Claire	Pioneer Hi-Bred International	S. Spranger	3
Hancock	Hancock Ag. Res. Station	A. Walker	4
Lancaster	Lancaster Ag. Res. Station	D. Wiedenbeck	21
Langlade	Langlade Ag. Res. Station	K. Gallenberg	16
Rhinelander	Rhinelander Ag. Res. Station	M. Hall	8
Seymour	Private Farm	D. Lawkowski	4

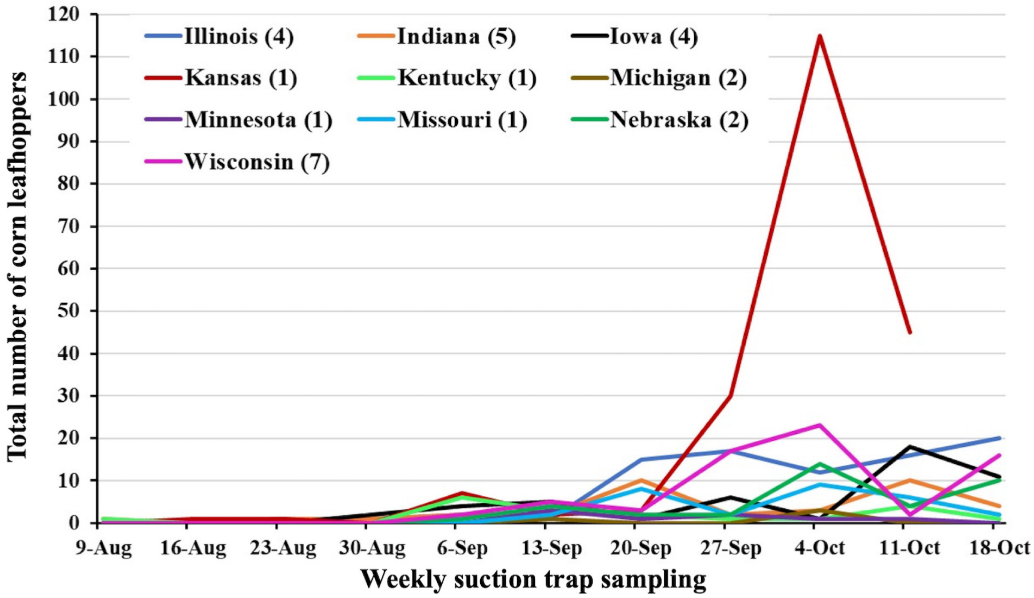

Figure 9. Population dynamics of corn leafhopper, *Dalbulus maidis*, caught in suction traps between 9 August (single specimen of corn leafhopper caught in Princeton, Kentucky) to 18 October 2024 in the USA Midwest Suction Trap Network. Numbers in parentheses represent the number of suction traps located per state.

Table 2. Specimens of corn leafhoppers deposited at Illinois Natural History Survey Insect Collection.

Location	Date	INHS Insect Collection Archival Number
Illinois		
Orr, Pike County; 39.8056°N, 90.8239°W	6.ix.2024	♀1070006
Champaign County; 40.0419°N, 88.2318°W	27.ix.2024	♀1070004, ♂1070010
Schuyler County; 40.0762°N, 90.6191°W	3.x.2024	♀1070201, ♀1070206-0220, ♂1070202-0205, ♂1070221–0229
Monmouth, Warren County; 40.9336°N, 90.7232°W	4.x.2024	♂1070043, ♂1070045
Morris, Grundy County; 41.3352°N, 88.3836°W	11.x.2024	♀1070009, ♂1070003
Indiana		
Lafayette (TPAC), Boone County; 40.1750°N, 86.5940°W	4.x.2024	♀1070044
Butlerville (SEPAC), Jennings County; 39.0350°N, 85.5291° W	11.x.2024	♀1070032, ♂1070034
Iowa		
Nashua, Floyd County; 42.9315°N, 92.5743°W	27.ix.2024	♂1070042
Sutherland, O'Brien County; 42.9262°N, 95.5390°W	4.x.2024	♀1070016
Kanawha, Hancock County; 42.9308°N, 93.7951°W	11.x.2024	♂1070036, ♂1070037
Kansas		
Manhattan, Riley County; 39.2081°N, 96.5901° W	27.ix.2024	♀1070023, ♂1070028
	4.x.2024	♂1070011, ♀1070012 ♀1070013, ♂1070017 ♀1070018, ♂1070019 ♀1070021, ♀1070022
Kentucky; Princeton, Caldwell County; 37.0988°N, 87.8412°W	11.x.2024	♀1070027, ♂1070030
Michigan; Kalkaska County; 44.6588°N, 85.0800°W	10.x.2024	♀1070020, ♀1070025

Table 2. Continued.

Location	Date	INHS Insect Collection Archival Number
Minnesota; Lamberton, Redwood County; 44.2397°N, 95.3153°W	13.ix.2024	♀1070026, ♂1070001
Missouri; Columbia, Bone County; 38.9073°N, 92.2805°W	4.x.2024	♀107008, ♂1070014
Nebraska		
Concord, Dixon County; 42.3860°N, 96.9582°W	4.x.2024	♀1070039, ♀1070051
Keith County; 41.2105°N, 105.6502°W	10.x.2024	♀1070031
Wisconsin		
Eau Claire County; 44.7543°N, 91.5886°W	27.ix.2024	♀1070041
Lancaster, Grant County; 42.8308°N, 90.7887°W	27.ix.2024	♀1070015, ♀1070040
Langlade County; 45.1610°N, 89.1140°W	4.x.2024	♀1070005, ♀1070033
Rhinelander, Oneida County; 45.8310°N, 89.2695°W	27.ix.2024	♀1070029, ♀1070035
Arlington, Columbia County; 43.3174°N, 89.3279°W	18.x.2024	♀1070038, ♂1070002
Hancock, Waushara County; 44.1184°N, 89.5337°W	18.x.2024	♀1070007, ♀1070024

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