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NATIVE PRAIRIE GRAMINOID HOST PLANTS OF MINNESOTA AND ASSOCIATED LEPIDOPTERA: A LITERATURE REVIEW

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ABSTRACT. Native grasses act as host plants, providing food and shelter, for numerous Lepidoptera species during their larval stage. As grassland habitat decreases because of conversion to agriculture and urban areas, prairie specialist butterflies and moths have also declined. Addition of native species to urban and agriculture landscapes has been shown to benefit Lepidoptera communities in various ways. Native grasses have grown in popularity as a landscaping plant due to their low nutrient requirements, drought tolerance, and soil stabilization properties. However, the benefits of native grasses to Lepidoptera are not well known to many entomologists or horticulturists, let alone the average consumer. We reviewed the literature that identified native prairie graminoids as host plants for native Lepidoptera in Minnesota, especially plants widely available in the horticultural trade that could be planted for restoration or landscaping purposes. The context of the Lepidoptera and host plant associations found in the literature are described. In total, we found 36 Lepidoptera species that used 17 prairie graminoids as host plants cited in the literature. Three native grasses, *Schizachyrium scoparium* (Michx.) Nash, *Andropogon gerardii* Vitman and *Panicum virgatum* L. and were found to be used by the most Lepidoptera species, 11, 9, and 8, respectively. Most likely there are additional moth species that use these grasses as host plants because butterfly species tend to be better documented than moth species. The specific larval habits and host plant species were unknown for many species of moths that feed or are suspected to feed on graminoids, showing the need for further research in this area. This information can assist horticulturalists, ecologists, landscape planners, land managers, and homeowners in their decisions to buy and plant native grass species. In general, this knowledge provides increased awareness about the larval life stage of butterflies and moths to concerned citizens and green industry and further supports the importance of conserving native prairie to support and maintain Lepidoptera species.

Additional key words: Butterflies, moths, larval host plants, pollinators, sustainable landscapes

Lepidoptera go through a complete metamorphosis from larva to pupa to adult during their life cycle (Scott 1986). The larval and adult stages have different food requirements. Adults often feed on flower nectar and other liquid substrates, while almost all lepidopteran larva are phytophagous (Scoble 1992). Lepidoptera evolved with the flowering plants, initially eating plants from the family Fabaceae (Ehrlich & Raven 1964, Scott 1986). Since then, certain families and species have evolved to eat monocotyledons such as grasses and sedges (Ehrlich & Raven 1964, Scott 1986). In North America, these include the butterfly subfamilies Satyrinae and Hesperiinae (Scott 1986), and various subfamilies, genera, and species of moths (Powell & Opler 2009, Wagner et al. 2011).

Native grasses provide food sources for numerous species of Lepidoptera (Scott 1986). However, native grassland habitats are some of the most endangered in North America (White et al. 2000). Less than 1% of the original tallgrass prairie remains (Samson & Knopf 1994), putting pressure on prairie endemic species of butterflies and moths. Declining populations of prairie-specialist Lepidoptera have been documented in North America for several decades and they are continuing to decline even on prairie preserves (Orwig 1990, Schlict et al. 2009, Swengel et al. 2011, Swengel & Swengel 2015). In Minnesota, of the 19 Lepidoptera species listed as endangered, threatened, or of special concern, nine are prairie dependent, and two are suspected of being prairie dependent (Metzler 2005, MN DNR 2013).

The loss of grasslands in North America is due to conversion to agriculture and urban areas (White et al. 2000), and has significantly altered native habitat, replacing native plant species with non-native species, such as agronomic crops and exotic landscape ornamentals (Burghardt et al. 2008, Tallamy & Shropshire 2009). Host specificity is common in Lepidoptera; non-native species usually support fewer Lepidoptera species as larval hostplants than native species (Tallamy & Shropshire 2009). Planting native species as ornamentals in urban or semi-urban areas has shown to benefit some Lepidoptera (Vickery 1995, Fontaine et al. 2016). Studies in agricultural and urban landscapes have shown that grasslands with higher cover and richness of native species had higher numbers of

uncommon or specialist butterfly species (Collinge et al. 2003) and higher diversity of butterfly and moth larvae (Burghardt et al. 2008).

Native grasses have grown in popularity as landscaping plants due to their low nutrient requirements, drought tolerance, and soil stabilization (Meyer 2012). Although the benefits of native flowers to adult Lepidoptera are well known, the food requirements of the larval forms of these same Lepidoptera are much more obscure and undocumented. Many entomologists and horticulturists know little of the feeding habits or preferences of graminoid-feeding Lepidoptera. The purpose of this review is to compile the information known to date about native graminoids that serve as larval host plants for Lepidoptera in Minnesota.

MATERIALS AND METHODS

The literature was reviewed for Lepidoptera species that use native Minnesota prairie graminoids, especially those widely available in the horticultural trade that could be planted for restoration or landscaping purposes. We included graminoid species from the upland prairie, wet meadow/carr, and wetland prairie system descriptions in the Field Guide to the Native Plant Communities of Minnesota (Minnesota Department of Natural Resources 2005), which listed the dominant, characteristic, and distinguishing graminoids for each community. Nomenclature for plant species followed the PLANTS database (USDA, NRCS, 2017). *Carex pensylvanica* Lam. ssp. *heliophila* (Mack.) W.A. Weber (Cyperaceae) which was cited in Scott (1992) as a host plant, was updated to its current synonym in the PLANTS database (USDA, NRCS, 2017), *Carex inops* L.H. Bailey ssp. *heliophila* (Mack.) Crins. This sedge is a dry prairie species which differentiates it from *Carex pensylvanica* Lam., which is primarily a woodland species (Gleason & Cronquist 1963). Only records that identified the host plant by species (not just genus) were included. We included records for Lepidoptera species that occur in Minnesota. If the host plant record was obtained outside of the region, the information was still included in the review. However, host plant records for an adjacent lepidopteran subspecies that did not occur in Minnesota were not included because host plant preferences can differ between adjacent subspecies (MacNeil 1964). Host plant relationships are determined by evidence that feeding has occurred, observations of larvae on a plant, evidence of larval shelters, or oviposition choice of adult butterflies and moths. The validity of host plant relationships can be difficult to determine because some species oviposit indiscriminately. For this reason, the context of the lepidopteran host plant associations found in the literature were included in the review. Nomenclature for butterflies follows Pelham (2008). Nomenclature for moths follows Hodges et al. (1983), except where modified by Lafontaine and Schmidt (2010), Kaila (1999), Metzler and Brown (2014), and Hodges (1978).

RESULTS

Host plant associations. Seventeen native graminoid species occurring in the upland prairie, wet meadow/carr, and wetland prairie systems of Minnesota were found to serve as food for native Lepidoptera species (Table 1). In total, we found 36 Lepidoptera species cited in the literature that used these native prairie graminoids as host plants in Minnesota (Table 2). *Schizachyrium scoparium* (Michx.) Nash (Poaceae) was found to be used by the most species, 11 (Table 3). *Andropogon gerardii* Vitman (Poaceae) served as a host plant for nine species; *Panicum virgatum* L. (Poaceae) for eight species; *Bouteloua gracilis* Willd. ex Kunth (Poaceae) and *Bouteloua curtipendula* Michx. (Poaceae) served as a host plant for six species; *Carex lacustris* Willd. (Cyperaceae), *Carex stricta* Lam. (Cyperaceae), *Elymus canadensis* L. (Poaceae), and *Sporobolus heterolepis* (A. Gray) A. Gray (Poaceae) for five species; *Koeleria macrantha* (Ledeb.) Schult. (Poaceae) and *Carex inops* subsp. *heliophila* (Cyperaceae) for four species and; *Bouteloua hirsuta* Lag. (Poaceae) and *Elymus trachycaulus* (Link) Gould ex Shinners (Poaceae) for three species; *Spartina pectinata* Bosc. ex Link (Poaceae), *Sorghastrum nutans* (L.) Nash (Poaceae), and *Hesperostipa spartea* (Trin.) Barkworth (Poaceae) for two species and *Hesperostipa comata* (Trin. & Rupr.) Barkworth (Poaceae) for one species (Table 3).

Oviposition. Many Lepidoptera oviposit on their host plant, presumably to increase the chances that the larvae will encounter their host plant after hatching, increasing survival rates (Ehrlich & Raven 1964, Celik et al. 2015). However, oviposition "mistakes" have been observed when females accidentally oviposit on the wrong plant (Scott 1986, Thompson & Pellmyr 1991). Non-specific oviposition, or ovipositing indiscriminately on plant species, has also been observed. This behavior is common among graminoid-feeders, such as those in the Satyrinae subfamily (Scott 1992, Tiitsaar et al. 2016, Wiklund 1984). It is hypothesized that these species oviposit at random because their food plants grow abundantly, and so they do not need to target as precisely as other species that feed on less abundant plants (Wiklund 1984).

Less has been published about the Hesperiinae, the graminoid-feeding subfamily of Hesperiidae. Scott

TABLE 1. Graminoids native to the Upland Prairie, Wet Meadow/Carr, and Wetland Prairie systems of Minnesota as defined by Minnesota DNR (Minnesota Department of Natural Resources 2005) that serve as food for Lepidoptera larvae.

Common name	Scientific Name
big bluestem	*Andropogon gerardii* Vitman
sideoats grama	*Bouteloua curtipendula* Michx.
blue grama	*Bouteloua gracilis* Willd. ex Kunth
hairy grama	*Bouteloua hirsuta* Lag.
sun sedge	*Carex inops* ssp. *heliophila* (Mack.) Crins
hairy sedge, lake sedge	*Carex lacustris* Willd.
tussock sedge, upright sedge	*Carex stricta* Lam.
Canada wildrye	*Elymus canadensis* L.
slender wheatgrass	*Elymus trachycaulus* (Link) Gould ex Shinners
needleandthread	*Hesperostipa comata* (Trin. & Rupr.) Barkworth
porcupine grass	*Hesperostipa spartea* (Trin.) Barkworth
Junegrass	*Koeleria macrantha* (Ledeb.) Schult.
switchgrass	*Panicum virgatum* L.
little bluestem	*Schizachyrium scoparium* (Michx.) Nash
Indiangrass	*Sorghastrum nutans* (L.) Nash
prairie cordgrass	*Spartina pectinata* Bosc. ex Link
prairie dropseed	*Sporobolus heterolepis* (A. Gray) A. Gray

(1973) found that *Notamblyscirtes simius* (W. H. Edwards) oviposited only on its host plant, *Bouteloua gracilis*. However, *Hesperia dactoae* (Skinner) has been observed to oviposit on a variety of plant species (McCabe & Post 1977, Dana 1991).

Shelter building. Some caterpillars construct shelters in which they reside during their larval life stage (Scoble 1992). Various families of Lepidoptera exhibit this behavior, including families with graminoid-feeding species such as Tortricidae, Gelechiidae, Pyralidae, Nymphalidae, and Hesperiidae (Greeney & Jones 1998). The moth families, Tortricidae, Gelechiidae, and Pyralidae are leaf rollers, named for the shelters they make by folding or rolling one leaf or multiple leaves together, using silk as a fastener (Lafontaine et al. 2010). While there are nest builders in the Nymphalidae, none of the graminoid-feeding satyrs in this family exhibit this behavior (Scott 1992). However, almost all species in the Hesperiidae family make shelters (Greeny & Jones 1998).

The Hesperiidae may contain the largest diversity of shelter types (Greeny & Jones 1998). Shelters are built at various heights, often changing during the life of the larvae, using different techniques and on different grass species and substrates (MacNeill 1964, Dana 1991, Lafontaine et al. 2010). *H. dactoae* larvae make shelters near the base of bunch grasses, *Schizachyrium scoparium* and *Sporobolus heterolepis*, by weaving together blades of grass and leaf litter (Dana 1991). *Hesperia assiniboia* (Lyman) make nests by rolling or attaching leaves together or sometimes even using dried cattle feces (McCabe & Post 1977, Scott 1986). Early larval instars of *Hesperia ottoe* W. H. Edwards and *Polites origenes* (Fabricius) make aerial nests, by weaving grass leaves together above the soil surface, using bunch grass species *Andropogon gerardii* (Scott 1992) or *Schizachyrium scoparium* (Dana 1991). *Polites themistocles* (Latreille) larvae are suspected of making silk tunnels in the litter and/or soil (Scott 1992). *Amblyscirtes oslari* (Skinner) larvae make conventional rolled leaf tube nests (Scott 1992). The placement of larval nests determines the vulnerability of larval species to different kinds of land management, such as prescribed burning or haying, throughout the year (Dana 1991).

Feeding behavior. Caterpillars feed on grasses using various techniques. Some caterpillars feed in the open, exposed on the plant on which they are feeding (Scoble 1992), while others are concealed feeders, feeding internally in the plant or hiding themselves in shelters (Lafontaine et al. 2010). Shelter-builders often feed from inside or near their shelter. Dana (1991) observed larvae of *H. dacotae* leaving shelters to forage, cutting off blades of grass, and then returning to their shelter with the blade to eat it. Species that do not build shelters, like those in the Satyrinae, protect themselves by camouflage or hiding at the base of plants during the day and then feeding at night (Scott 1992).

Graminoid-feeding moths exhibit multiple concealed feeding behaviors. Many fall into the borer category. Borers drill into either the stem or roots of plants using specialized mouth parts (Wagner et al. 2011). Graminoid-feeders in the moth family Elachistidae are leaf miners, eating the chlorophyll between the outer layers of the leaf (Braun 1948). Graminoid-feeding moths from the Gelechiidae family are leaf-rollers, feeding from the inside of their shelter (Lafontaine et al. 2010). Like butterflies, moths that are exposed feeders employ camouflage and nocturnal eating behaviors to

TABLE 2. Lepidoptera recorded to use the native prairie graminoids in Table 1, and their native ranges in the Upper Midwest (Minnesota, South Dakota, North Dakota, Iowa, Illinois, Wisconsin, Michigan). Ranges are not listed for some subspecies.

Lepidoptera Species	MN	SD	ND	IA	IL	WI	MI	Reference
Aethes spartinana (Barnes & McDunnough, 1916)	x	x	x	x	x	x		Ainslie 1917; Prasifika 2012
Amblyscirtes hegon (Scudder 1863)	x			x	x	x	x	Scott 1986
Amblyscirtes vialis (W. H. Edwards 1862)	x	x	x	x	x	x	x	Scott 1986
Anatrytone logan (W. H. Edwards, 1863)	x	x	x	x	x	x	x	Scott 1986
Anatrytone logan logan (W. H. Edwards,1863)								-
Anicla tenuescens (Smith, 1890)	x	x	x	x		x		Lafontaine 2004
Atrytone arogos (Boisduval & Leconte, [1837])	x	x	x	x	x	x		Scott 1986
Atrytone arogos iowa (Scudder, 1868)								-
Atrytonopsis hianna (Scudder, 1868)	x	x	x	x	x	x	x	Scott 1986
Atrytonopsis hianna hianna (Scudder, 1868)								-
Blastobasis repartella (Dietz, 1910)	x	x	x	x	x	x	x	Adamski et al. 2010
Cercyonis pegala (Fabricius, 1775)	x	x	x	x	x	x	x	Scott 1986
Cercyonis pegala nephele (W. Kirby, 1837)								-
Deltote bellicula (Hübner, 1818)	x	x	x	x	x	x	x	Beadle & Leckie 2012
Euphyes conspicua (W. H. Edwards, 1863)	x			x	x	x	x	-
Euphyes dion (W. H. Edwards, 1879)	x	x	x	x	x	x	x	Scott 1986
Euphyes vestris (Boisduval 1852)	x	x	x	x	x	x	x	Scott 1986
Faronta diffusa (Walker, 1856)	x	x	x	x	x	x	x	Beadle & Leckie 2012
Faronta rubripennis (Grote & Robinson, 1870)	x	x		x	x	x	x	Beadle & Leckie 2012
Hesperia assiniboia (Lyman, 1892)	x	x	x					Dana & Huber 1988
Hesperia comma (Linnaeus, 1758)	x	x	x			x	x	Scott 1986
Hesperia dacotae (Skinner, 1911)	x	x	x					Scott 1986
Hesperia leonardus T. Harris, 1862	x	x	x	x	x	x	x	Scott 1986
Hesperia leonardus leonardus T. Harris, 1862	x				x	x	x	Scott 1986
Hesperia leonardus pawnee Dodge, 1874	x	x	x	x				Scott 1986; Metzler et al. 2005
Hesperia metea Scudder, 1863	x			x	x	x	x	Scott 1986
Hesperia ottoe W. H. Edwards, 1866	x	x	x	x	x	x	x	Scott 1986
Hesperia sassacus T. Harris, 1862	x				x	x	x	Scott 1986
Hesperia uncas W. H. Edwards, 1863	x	x	x	x				Scott 1986
Hesperia uncas uncas W. H. Edwards, 1863								-
Lethe appalachia R. Chermock, 1947	x	x		x	x	x	x	Scott 1986
Lethe eurydice (Linnaeus, 1763)	x	x	x	x	x	x	x	Scott 1986
Meropleon ambifusca (Newman, 1948)	x	x	x	x	x	x	x	Wagner et al. 2011; Beadle 2012
Mocis texana (Morrison, 1875)	x			x	x	x	x	Wagner et al. 2011
Oarisma garita (Reakirt, 1866)	x	x	x					Scott 1986
Oarisma poweshiek (Parker, 1870)	x	x	x			x	x	Scott 1986
Papaipema cataphracta (Grote, 1864)	x			x	x	x	x	Wagner et al. 2011
Papaipema nebris (Guenee, 1852)	x	x		x	x	x	x	Beadle & Leckie 2012
Poanes massoit (Scudder, 1863)	x	x	x	x	x	x	x	Scott 1986
Poanes viator (W. H. Edwards, 1865)	x	x	x	x	x	x	x	Scott 1986
Poanes viator viator (W. H. Edwards, 1865)								-
Polites origenes (Fabricius, 1793)	x	x	x	x	x	x	x	Scott 1986
Polites themistocles (Latreille, [1824])	x	x	x	x	x	x	x	Scott 1986
"Resapamea" stipata (Morrison, 1875)	x	x	x	x	x	x	x	Metzler et al. 2005

avoid predators (Lafontaine et al. 2010). Other tactics include physical defenses, like spines, and coloration warning of toxicity (Lafontaine et al. 2010).

Although most Lepidoptera specialize in feeding on just one or few species, others are generalist feeders (Scott 1992, New 1997). Graminoid-feeding butterflies are suspected of being able to eat numerous species of grass, making them graminoid specialists (Scott 1992). The grass skippers (Hesperiinae) range from preferring a certain species, growth-form, or genus of grass to eating grass and sedge species (Scott 1986, Scott 1992). Their limitations to certain species are suspected to be determined by their preference for shelter building and not necessarily nutrition requirements (MacNeil 1964). Butterflies in the Satyrinae subfamily, which do not build above-ground shelters, are polyphagous, feeding on a variety of grass species and sometimes grass and sedge species (Scott 1992). Moth species range from very host-specific, eating only one or two species of grass, to extremely polyphagous, feeding on species from multiple families (Wagner et al. 2011).

Discussion

Additional grass skipper species that feed on native Minnesota grasses were not included here because either their host plants were listed only to genus, or were not listed in the plant community reference that defined the scope of our study. Further research on grass skippers may reveal additional species that feed on the native grasses listed.

In general, butterfly species are better documented than moth species because they are larger, showier, and fly during the day, making them easier to study (Thompson & Pellmyr 1991). Although many moth species are known to eat grass, the specific larval habits and host plants of individual species are often unknown. Forty-six additional native moth species that occur in Minnesota were suspected or confirmed to feed on grasses or sedges but could not be added to the list because their larval food preferences were unknown (Hodges 1978, Lafontaine & Poole 1991, Landry 1995, Lafontaine 2004, Metzler et al. 2005, Mikkola et al. 2009). This large number demonstrates the need for further research and documentation of larval moth habits and host plants.

The host plants and larval habits of some moth species have been documented in detail because they are considered as pests. These tend to be polyphagous species that in addition to eating the native grasses on our list, feed on many additional graminoid, forb, shrub species, and/or cultivated grass species such as corn, wheat, and barley (Decker 1930, Decker 1931, Reddy & Antwi 2016). *Papaipema nebris* (Guenee) (Noctuidae), *Papaipema cataphracta* (Grote) (Noctuidae), *Faronta diffusa* (Walker) (Noctuidae), and "*Resapamea*" *stipata* (Morrison) (Noctuidae) are all native moth species included in this review that have been documented as occasional pests of agricultural crops (Decker 1930, Decker 1931, Solomon 1995, Reddy & Antwi 2016). *P. nebris* has also been documented as an occasional pest of gardens (Decker 1931).

The information in this review can assist horticulturalists, ecologists, landscape planners, land managers, and homeowners in their decisions to buy and plant native grass species to benefit Lepidoptera. This important attribute of native grasses can be used in garden center promotion and to educate the general public. In general, this knowledge provides increased awareness about the larval life stage of butterflies and moths for both concerned citizens and horticultural and ecological businesses and further supports the importance of conserving native prairie to maintain these Lepidoptera.

As Lepidoptera populations decline, it is important to maximize the ecological benefits of anthropogenic landscapes that are replacing their native habitat. However, native grass use in landscaping should not detract from the importance of conserving native habitat. Rather, the purpose of this literature review is to provide information on the values of native grasses to Lepidoptera.

Additional research is needed to fully understand the benefits of native landscaping in suburban and urban areas to Lepidoptera communities and rare species. While the addition of native nectar flowers into human dominated landscapes has shown to be successful in providing nectar to butterflies (Vickery 1995), there is debate surrounding the efficacy of butterfly gardens as breeding habitat (Di Mauro et. al. 2007; Cutting & Tallamy 2015). The main benefit of residential butterfly gardens may be as stepping stones between larger natural areas, where Lepidoptera can obtain nectar before continuing on to permanent habitat (Vickery 1995; Di Mauro et. al. 2007). Studies differ in their findings on the influence of patch characteristics, such as habitat quality, versus landscape characteristics, such as surrounding matrix, on butterfly diversity (Collinge et al. 2003; Di Mauro et al. 2007; Olivier et al. 2016). The influence of these factors also differs for individual species due to species-specific traits such as habitat preference and mobility (Olivier et al. 2016). Olivier et al. (2016) found a stronger negative correlation between urbanization and habitat specialists than between urbanization and habitat generalists. Considering this information, further research is needed to understand how much the landscape context influences the

TABLE 3. List of native graminoids species and associated Lepidoptera, references for individual associations, and the context of the host plant record in the literature. No notes were added if the species was listed as a host plant or food plant with no additional context.

Larval Plants	Lepidoptera	References	Notes
Andropogon gerardii	*Anatrytone logan*	Layberry et al. 1998; Scott 1986	-
	Anatrytone logan logan	McCabe & Post 1977	-
	Atrytone arogos	Scott 1992	Field observations of shelters in Colorado
		Metzler et al. 2005	Field observations of feeding
		Opler & Krizek 1984	Listed as host plant in Missouri
		Scott 1986; Opler & Malikul 1992	-
		Pyle 1981	Listed as a species used for oviposition
	Atrytone arogos iowa	McCabe & Post 1977	-
	Atrytonopsis hianna	Layberry et al. 1998; Scott 1986; Opler & Krizek 1984	-
	Atrytonopsis hianna hianna	McCabe & Post 1977	-
	Faronta diffusa	Godfrey 1972	Larvae collected from this plant species in the field
		Wagner et al. 2011	Field observation of oviposition
	Hesperia dacotae	Dana 1991	Field observations of feeding
		McCabe 1981	Accepted by confined first instar larvae
		Scott 1986	Listed as a species used for oviposition
	Hesperia metea	Scott 1986; Opler & Krizek 1984	-
	Hesperia ottoe	Scott 1992	Field observations of shelters and oviposition in Colorado
		Dana 1991	Accepted grass during no choice experiment; field observations of shelters
		Scott 1986; Metzler et al. 2005	-
	Hesperia sassacus	Opler & Malikul 1992	-
	Meropleon ambifusca	Wagner et al. 2011	Field observations of feeding
Bouteloua curtipendula	*Atrytone arogos*	Scott 1992	Field observations of shelters and oviposition in Colorado
	Hesperia assiniboia	Scott 1992	Field observations of oviposition in Colorado
	Hesperia dacotae	Dana 1991	Field observations of feeding
	Hesperia leonardus pawnee	Scott 1986	-
	Hesperia ottoe	Scott 1986	-
		Dana 1991	Accepted during a no choice experiment; field observations of shelters in MN
	Oarisma poweshiek	Selby 2005	Field observations of feeding
Bouteloua gracilis	*Hesperia assiniboia*	Layberry et al. 1998	-
		Scott 1992	Field observations of oviposition in Colorado
	Hesperia comma	Scott 1986	-
	Hesperia leonardus	Layberry et al. 1998; Opler & Malikul 1992	-
	Hesperia leonardus pawnee	Scott 1992	Field observations of oviposition in Colorado
	Hesperia ottoe	Scott 1986	-

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TABLE 3. (Continued) List of native graminoids species and associated Lepidoptera, references for individual associations, and the context of the host plant record in the literature. No notes were added if the species was listed as a host plant or food plant with no additional context.

Larval Plants	Lepidoptera	References	Notes
Bouteloua gracilis (continued)	*Hesperia uncas*	Scott 1992	Field observations of oviposition in Colorado
		Scott 1986; Opler & Krizek 1984; Layberry et al. 1998	-
	Hesperia uncas uncas	McCabe & Post 1977	Listed as a food plant, but only observed oviposition
	Oarisma garita	Scott 1992	Field observations of oviposition in Colorado
		Scott 1986	-
Bouteloua hirsuta	*Hesperia uncas*	Dana & Huber 1988	Listed as a host plant in Minnesota
	Hesperia ottoe	Dana 1991	Field observations of shelters
	Hesperia leonardus pawnee	Scott 1986	-
Carex inops ssp. *heliophila*	*Hesperia dacotae*	Dana 1991	Field observations of feeding
	Euphyes vestris	Scott 1986; Layberry et al. 1998	Listed as host plant with no additional context
		Pyle 1981	Listed as a host plant in Colorado
	Hesperia assiniboia	Scott 1992	Field observations of oviposition in Colorado
	Oarisma garita	Scott 1992	Field observation of oviposition in Colorado; larvae readily accepted in lab
Carex lacustris	*Euphyes dion*	Scott 1986; McCabe & Post 1977	-
	Euphyes vestris	Scott 1986	-
	Lethe eurydice	Scott 1986	-
	Lethe appalachia	Scott 1986	-
	Poanes viator	Scott 1986	-
	Poanes viator viator	McCabe & Post 1977	-
Carex stricta	*Deltote bellicula*	Wagner et al. 2011	Raised on plant in lab
	Euphyes conspicua	Scott 1986	-
	Lethe appalachia	Scott 1986	-
	Lethe eurydice	Scott 1986	-
	Poanes masassoit	Scott 1986	-
Elymus canadensis	*Amblyscirtes vialis*	Scott 1992	Field observations of larval shelters in Colorado
	Faronta diffusa	Godfrey 1972	Eggs were found on the plant
	"Resapamea" stipata	Tietz 1972	-
	Papaipema cataphracta	Tietz 1972	-
	Poanes zabulon taxiles	Scott 1986	-
Elymus trachycaulus	*Amblyscirtes vialis*	Scott 1992	Field observations of larval shelters in Colorado
	Poanes zabulon taxiles	Scott 1986	Listed as host plant for this subspecies
	Faronta diffusa	Tietz 1972	-

continued on next page

TABLE 3. (Continued) List of native graminoids species and associated Lepidoptera, references for individual associations, and the context of the host plant record in the literature. No notes were added if the species was listed as a host plant or food plant with no additional context.

Larval Plants	Lepidoptera	References	Notes
Hesperostipa spartea	*Hesperia dacotae*	McCabe 1981	Accepted by confined larvae
		Dana 1991	Feeding observed in the field, but only by older larvae. Early instars did not feed on this species under captive feeding situations.
	Cercyonis pegala	Scott 1986	-
Hesperostipa comata	*Hesperia leonardus pawnee*	McCabe & Post 1977	-
Koeleria macrantha	*Polites themistocles*	Scott 1992	Field observations of oviposition
	Hesperia assiniboia	Layberry et al. 1998	-
	Hesperia dacotae	McCabe 1981	Accepted by confined larvae. Dana (1991) found that confined early instar larvae did not accept
	Oarisma garita	Scott 1992	Field observations of oviposition in Colorado
Panicum virgatum	*Aethes spartinana*	Adamski et al. 2010	Larvae were collected from the plant in the field
	Anatrytone logan	Layberry et al. 1998; Scott 1986; Opler & Krizek 1984	-
	Anatrytone logan logan	McCabe and Post 1977	Field observations of oviposition
	Blastobasis repartella	Adamski et al. 2010	Field observations of feeding
	Faronta rubripennis	Metzler et al. 2005	Field observations of feeding
		Wagner et al. 2011	Listed as a host plant in New Jersey
	Hesperia leonardus	Layberry et al.1998; Opler & Krizek 1984	-
	Hesperia leonardus leonardus	Scott 1986	-
	Mocis texana	Wagner et al. 2011	Listed as a host plant in New Jersey
	Papaipema nebris	Prasifika et al. 2011	Field observations of feeding within stem
	Polites themistocles	Scott 1986	-
Schizachyrium scoparium	*Atrytone arogos*	Scott 1986	-
		Scott 1992	Field observations of oviposition; Listed as a popular host in Kansas and E. US
	Atrytonopsis hianna	Layberry et al. 1998; Scott 1986; Opler & Krizek 1984; Opler & Malikul 1992	-
	Cercyonis pegala nephele	Scott 1992	Field observations of oviposition; considered rare host plant in Colorado
	Hesperia comma assiniboia	Scott 1992	Field observations of oviposition in Colorado

continued on next page

TABLE 3. (Continued) List of native graminoids species and associated Lepidoptera, references for individual associations, and the context of the host plant record in the literature. No notes were added if the species was listed as a host plant or food plant with no additional context.

Larval Plants	Lepidoptera	References	Notes
Schizachyrium scoparium (continued)	*Hesperia dacotae*	Opler & Krizek 1984; Opler & Malikul 1992; Pyle 1981	-
		Scott 1986	Field observations of larvae on the plant
		Dana 1991	Field observations of feeding
		Layberry et al. 1998	Field observations of larvae on the plant
	Hesperia leonardus	Opler & Krizek 1984	Associated with stands of little bluestem
		Layberry et al. 1998; Opler & Malikul 1992	-
	Hesperia leonardus pawnee	Scott 1986	-
	Hesperia metea	Scott 1986; Opler & Krizek 1984	-
	Hesperia ottoe	Dana 1991	Accepted during no-choice experiment; Field observations of shelters
		Opler & Malikul 1992; Scott 1986	-
		Layberry et al. 1998; Opler & Krizek 1984	Listed as a species used for oviposition
		McGuire 1982	Field observations of oviposition
	Hesperia sassacus	Layberry et al. 1998; Scott 1986	-
		Scott 1986	-
	Oarisma poweshiek	Metzler et al. 2005; Swengel & Swengel 1999	-
		Selby 2005	Field observations of oviposition
	Polites origenes	Scott 1986; Robinson et al. 2002; Layberry et al. 1998	-
Sorghastrum nutans	*Amblyscirtes hegon*	Opler & Krizek 1984; Scott 1986; Layberry et al. 1998; McCabe & Post 1977	-
	Faronta diffusa	Godfrey 1972; Robinson et al. 2002	Larvae of the species were collected from the plant
Spartina pectinata	*Aethes spartinana*	Barnes & McDunnough 1916; Ainslie 1917; Prasifka et al. 2012.	Field observations of feeding
		Metzler et al. 2005	Listed as a host plant in Ohio
	"Resapamea" stipata	Decker 1930	Field observations of larvae on the plant
		Crumb 1956; Tietz 1972	-
		Metzler et al. 2005	Field observations of larvae on the plant
Sporobolus heterolepis	*Anicla tenuescens*	Lafontaine 2004; Metzler et al. 2005	Field observations of feeding
	Hesperia dacotae	Dana 1991	Field observations of feeding
	Hesperia leonardus pawnee	Scott 1986	-
	Hesperia ottoe	Dana 1991	Accepted in a no choice experiment
	Oarisma poweshiek	Metzler et al. 2005; Swengel & Swengel 1999	-
		Selby 2005	Field observations of oviposition

effectiveness of native plantings in attracting and benefiting specialist species with low mobility such as prairie skippers. General recommendations to maximize the benefits native plantings provide to Lepidoptera include increasing the size of the planting, increasing the number of blooming nectar plants, and strategically positioning the planting to better connect corridors or areas of suitable habitat (Di Mauro et al. 2007).

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