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The grasshopper (Orthoptera: Romaleidae: Acrididae) fauna of Black Belt Prairie remnants in Alabama and Mississippi

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Abstract

Extensive areas of prairie were once found in the southeastern United States; however, in the last 200 y much of this habitat type has been destroyed. The largest of these prairie regions, the Black Belt Prairie, extended through portions of Alabama, Mississippi, and Tennessee. Because the grasshopper fauna of these endangered grasslands has not been well documented, a survey of grasshoppers was initiated, and collections made at 23 Black Belt Prairie remnants in Alabama and Mississippi over a seven-year period. A total of 33 grasshopper species, and the *Melanoplus femurrubrum* x *propinquus* intermediate, from two families and six subfamilies were found from the 23 sites. Several notable species, including one with a disjunct or discontinuous distribution, *Pseudopomala brachyptera*, were collected. An annotated list is provided.

Key words

Black Belt Prairie, Orthoptera, grasshoppers, Acrididae, Romaleidae, Mississippi, Alabama

Introduction

Prior to European settlement the southeastern United States had several regions dominated by grasslands or prairie (Peacock and Schauwecker 2003). One such region, called the "Black Belt", extends in an arc from McNairy County, Tennessee, to Russell County, Alabama. Instead of being a continuous swath of open land, the Black Belt was a heterogeneous landscape of prairies and several types of forest (Barone 2005). Surveys conducted by the General Land Office in the 1830's suggest that in the Black Belt region of Alabama and Mississippi, prairies once covered about 144,000 ha (Barone 2005). Since that time, more than 99% of these prairies have been lost to agriculture and urban development (Noss *et al.* 1995). Remaining remnants of prairie are threatened by further development, erosion, and the encroachment of eastern red cedar, *Juniperus virginiana* L., the latter probably as a result of fire suppression. The Mississippi Natural Heritage Program gives Black Belt Prairie remnants a ranking of S1, meaning they are "critically imperiled" within the state, due to extreme rarity or factors making their biota vulnerable to extirpation (Mississippi Museum of Natural Science 2002).

The presence of the prairies is due, at least in part, to the region's distinctive soils. The soils of the Black Belt originate from Selma chalk that was formed from Cretaceous marine deposits laid down when the Mississippi embayment occupied the region (Lowe 1921). These calcareous loamy soils have a pH in the 7.5 to 8.5 range and in some of the more productive areas are dark colored, hence the name "Black Belt". However, much of the land with these rich dark soils has been converted to agriculture, and remaining prairie remnants are often found on marginal light gray soils where the chalk comes to the surface (chalk outcrops).

Today small remnants of these prairies may be found along roadsides, fencerows, gas and powerline right of ways, and on marginal lands not suitable for agriculture. These prairie remnants support a diverse and distinct flora and fauna, including species of plants and insects that otherwise are found primarily in the Great Plains. These "disjunct" distributions, along with endemic species and fossil evidence, suggest that Black Belt prairies may have had a prehistoric link to the Great Plains and served as a refugium for the prairie biota during the last glacial period (Brown 2003).

Floristic surveys of Black Belt prairie remnants have revealed a distinct plant community similar to that of the Great Plains of central North America with several rare or critically imperiled plants (Schuster and McDaniel 1973, Leidolf and McDaniel 1998). This community is dominated by grasses, with *Andropogon gerardii* (Vitman), *Bouteloua curtipendula* (Michx.), *Panicum virgatum* (L.), *Schizachyrium scoparium* (Michx.), *Setaria geniculata* (Lam.), *Sorghastrum nutans* (L.), and *Sporobolus vaginiflorus* (Torr.) being the most common. The most prominent forbs include *Asclepias viridis* (Walter), *Chrysopsis camporum* (Green), *Dalea candida* (Willd.), *D. purpurea* (Vent.), *Liatris* spp., *Ratibida pinnata* (Vent.), *Silphium laciniatum* (L.), and *S. terebinthinaceum* (Jacq.). See Barone and Hill (in press) for a more complete floral description.

Previous faunal surveys of these prairies have been limited to just a few taxa, but have revealed an interesting fauna, including: 1,160 species of moths, with 57 species having disjunct or discontinuous distributions from populations in the Great Plains, and one endemic species; four disjunct species of long-horned beetles (Cerambycidae), two of which feed on milkweed plants (*Asclepias* spp.); an endemic flightless ground beetle (Carabidae); and a disjunct species of bee (Apidae) that only forages on purple prairie clover (*D. purpurea*) (R. L. Brown pers com., Brown 2003, MacGown & Schiefer 1992, Schiefer 1998).

As dominant herbivores, grasshoppers can exert high levels of ecological impact in grasslands and savannahs. They are often in direct competition with other grazing animals for grasses and forbs, and thus should be considered in biological and ecological studies of these biomes (Otte 1981). Unlike the prairies of the central United States, the grasshopper fauna of prairies in the southeastern USA is relatively unknown. To better understand the diversity and ecology of this endangered habitat, the grasshopper fauna of Black Belt Prairie remnants was surveyed with the goal of providing baseline data for conservation and restoration efforts, as well as for future ecological studies.

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Methods

Twenty-three prairie remnants (Fig. 1) were surveyed from December 1999 through November 2006. Two sites, Osborn and Tombigbee, were sampled monthly from December 1999 to December 2000 to examine the temporal occurrences of grasshopper species in the Black Belt. The other study sites were sampled monthly from April to October for at least one year subsequent to their discovery. After the first sampling year of a given site, several visits, across seasons and years were made back to the site to ensure that it had been sampled effectively. Sites throughout the Black Belt were sampled to ensure that a comprehensive knowledge of the fauna was developed. Sites were chosen based on their accessibility and their relative lack of anthropogenic disturbance. Almost all of the sites are within or near the boundaries of known historic prairies, as analyzed by Barone (2005) based on General Land Office plant maps from the 1830's and 1840's. (Fig. 1) During the study, most of the sites experienced relatively little human disturbance, although some of the roadside prairies were mowed, and the site in the Tombigbee National Forest was burned during the early spring of each sample year.

Specimens were collected using a sweep net (30-cm diameter). Sweep transects were taken monthly from 1999 to 2000, but were abandoned in later years for a more efficient "flush and capture" method whereby grasshoppers were collected with a net as they dispersed away from the approaching collector (JGH). This "flush and capture" method is the most common means of conducting grasshopper species-composition studies (Capinera & Sechrist 1982, Evans 1989, Kemp *et al.* 1990, Squitier & Capinera 2002). Due to the nature of the habitat and potential management implications, an effort was also made to collect any species that occurred along the prairie/forest interface. Specimens were killed with either ethyl acetate or potassium cyanide, then pinned, labeled, and identified. Specimens were deposited in the Mississippi Entomological Museum (MEM) and the Philadelphia Academy of Science (ANSP).

Results

A total of 33 grasshopper species and *Melanoplus femurrubrum* x *propinquus*, representing two families and six subfamilies, were collected from the 23 sample sites. The three most diverse subfamilies were the Melanoplinae with ten species, the Oedipodinae with ten and the Gomphocerinae with eight. The most commonly collected species were *Chortophaga viridifasciata* De Geer (19 sites), *Orphulella pelidna* Burmeister (18 sites), *Syrbula admirabilis* Uhler (17 sites), *Hippiscus ocelote* Scudder (17 sites), and *Melanoplus sanguinipes* Gurney & Brooks (17 sites). Eight species and *M. femurrubrum* x *propinquus* were collected at only one site: four of these represent true grassland species, four represent edge or habitat generalists, and one is a wetland species. The remaining 21 species were collected from 2 to 16 sites. See Table 1 for a list of species and the number of sites where they occurred.

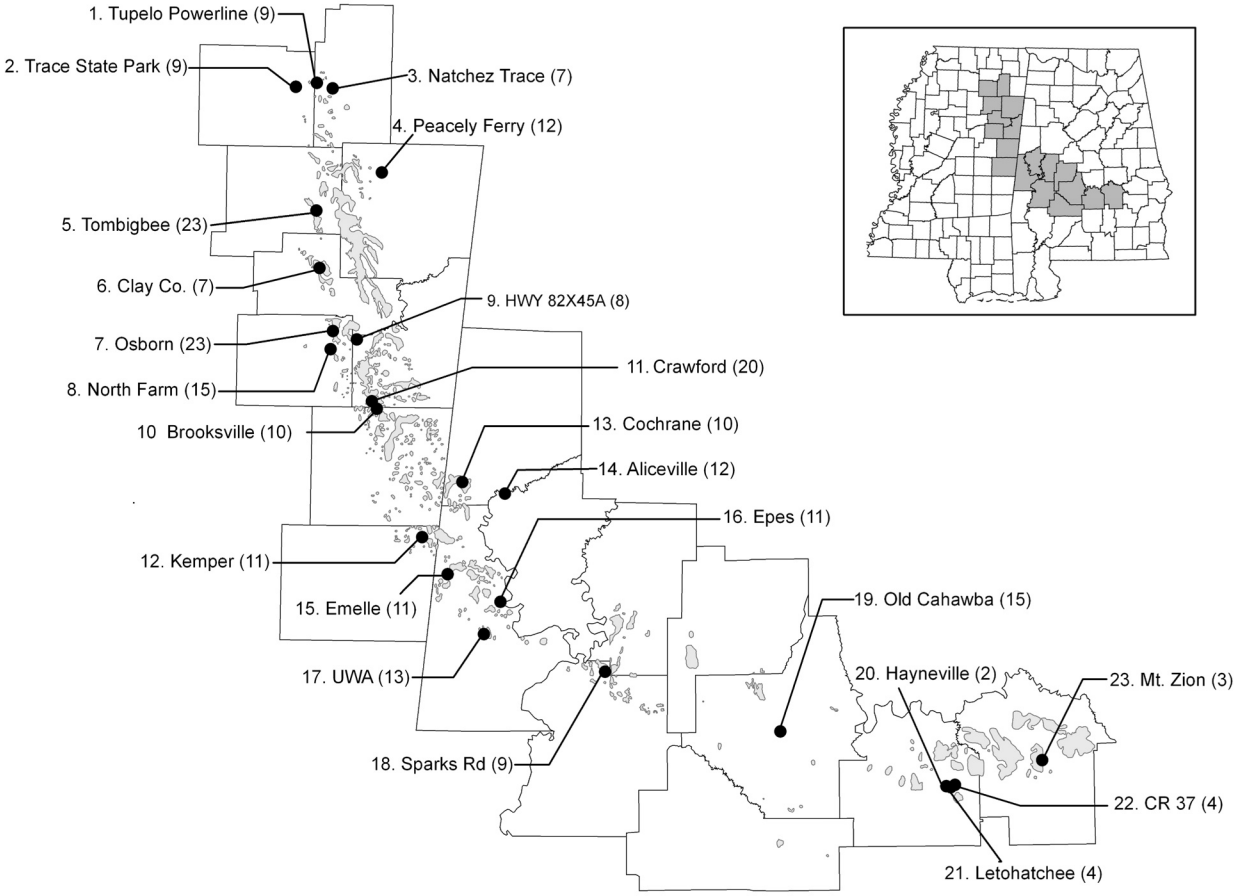


Fig. 1. Map showing historical prairie remnants in Alabama and Mississippi based on General Land Office Surveys in the 1930's (from Barone 2005) and location, site number, and number of grasshopper species collected during this survey.

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The number of species at sites ranged from a low of two at Haynesville, a small (0.002 ha) roadside remnant, to a high of 23, represented by the Osborn (approx. 12 ha) and Tombigbee (6.4 ha) sites. All three of these remnants are large and protected. The mean number of species per site was 10.6, and 12 of the sites contained at least that many.

Discussion

The Black Belt Prairie supports one of the most diverse acridid faunas for a particular habitat type in the southeastern United States, similar to that of sandhill habitats in Florida which contain 34 species (Squitier & Capinera 2002). A survey of the Orthoptera of Alabama conducted by Dakin and Hays (1970) found a total of 72 acridid species in the entire state, almost half of which are associated with Black Belt prairie remnants.

One species, *Pseudopomala brachyptera* Scudder, found during the course of this study, is considered disjunct from populations in the prairies of the central and western United States. *Pseudopomala brachyptera*, reported previously from the Jackson Prairie region of Mississippi (Hill 2005), was subsequently discovered on a Black Belt prairie remnant in Kemper County, Mississippi.

Another species with an interesting distribution is *Campylacantha olivacea*. This species is widely distributed in the Western United States, and has been known from east of the Mississippi River since the early 20th century, and was reported previously from the Black Belt by Hill (2005). Rehn and Hebard (1916) first reported this species from near Macon, Georgia, and noted that the "intrusion of this essentially Sonoran genus as far east as central Georgia is of peculiar interest".

Recently, blackland prairie remnants were discovered in Twigg and Houston Counties immediately to the east and south of Bibb County, Georgia where Rehn and Hebard collected *C. olivacea* "in weeds and tall grass adjacent to woods". This location is in line with, and may prove to have once been connected to, the Black Belt. Dakin and Hays (1970) reported two specimens of *C. olivacea* from Marengo County, Alabama, which historically contained 4,150 ha of prairie (Barone 2005). Other Black Belt records of *C. olivacea* were found in the ANSP for Selma and Montgomery, Alabama, both of which are in the Black Belt. Blatchley (1920) lists *C. olivacea* as being in the Davis Collection from Mississippi, but the collection locality is not given. *Campylacantha olivacea* is reported here from prairie remnants in Sumter County, Alabama and Oktibbeha, and Chickasaw Counties in Mississippi. Though this species has a large overall range, in the southeastern United States it occurs rather sporadically and appears to be limited to open habitats like prairies and sandhills (J. G. Hill, M. E. Dakin unpub. data).

Other notable species include, *Mermiria bivittata* (Serville), *M. picta* (Walker), *Hesperotettix viridis* (Thomas), and *Trachyrhachis kiowa* (Thomas). *Mermiria bivittata* and *M. picta* are uncommon species in the southeastern United States, and usually are found only in higher quality grasslands and savannahs (J. G. Hill pers obs.) *Mermiria bivitatta* was collected at only the three highest quality remnants (based on area and plant diversity) surveyed, and *M. picta* was found at only one of these. There is also one historic specimen of *M. picta*, a species that inhabits tall grasses, labeled "A and M College, MS (now Mississippi State University), grass" in the MEM. One of the sampling sites in this study was located on the MSU's North Experiment Farm, which is located at the edge of the Black Belt; however, *M. picta* was not found during the survey of this site. One additional specimen of *M. picta* from the Black Belt collected from one mile south of Booneville in Prentiss County, Mississippi, is housed in the ANSP collection. *Hesperotettix viridis* is also an uncommon species in the southeastern USA and is usually found in grasslands, sandhills, and savannahs. *Trachyrhachis kiowa*, another uncommon species in the southeast, prefers areas of bare ground or rocky outcroppings, and was reported from Mississippi (Agricultural College) by Blatchley (1920) under its synonym *Mestobregma thomasi*. There is one historic specimen in the MEM from this location as well. Unlike *M. picta*, *T. kiowa* was subsequently found to occur at the prairie remnant on the MSU North Experiment Farm where it inhabits areas of bare soil and outcrops of the Selma chalk.

Today most prairie remnants are found on poor and marginal soils. Mohr (1901) noted that even in the early 1900s, prairies in the Alabama Black Belt with deep soils were cultivated and that "only the poorest spots remain in the original state". Agricultural and urban development since 1901 would have only exacerbated this, and prairies with deeper, moister, or sandier more produc-

Table 1. Species and the number of prairie remnants where they occurred.

Species	Number of sites
Romalea microptera	1
Orphulella pelidna	18
Orphulella speciosa	1
Amblytropidia mysteca	15
Syrbula admirabilis	17
Mermiria bivittata	3
Mermiria picta	1
Archurum carinatum	4
Pseudopomala brachyptera	1
Arphia sulphurea	13
Arphia xanthoptera	12
Chortophaga viridifasciata	19
Hippiscus ocelote	17
Pardalophora phoenicoptera	4
Spharagemon boli	4
Dissosteira carolina	8
Trimerotropis maritima	3
Trachyrhachys kiowa	7
Leptysma marginicollis	1
Schistocerca americana	13
Schistocerca damnifica	5
Schistocerca obscura	4
Campylacantha olivacea	3
Hesperotettix viridis	7
Melanoplus bivittatus	5
Melanoplus differentialis	6
Melanoplus femurrubrum	7
Melanoplus femurrubrum x *propinquus*	1
Melanoplus keeleri	10
Melanoplus primaestivus	1
Melanoplus cf. nigrescens	1
Melanoplus sanguinipes	17
Melanoplus scudderi	15
Melanoplus tepidus	1

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tive soils, are the most likely to have disappeared (Barone & Hill, forthcoming). As a consequence, it is expected that most of the Black Belt prairies in existence today contain only a subset of the original grasshopper fauna of the region, represented only by those species that can survive on thinner or more clayey soils or under drier conditions.

One such example is the MSU North Experiment Farm site, which is a small area of prairie with very thin soils on a hillside. On the adjacent flat land is an area used for row-crop experiments with thick (>0.75m), productive, mesic prairie soils. The plowing of such productive sites removed habitat for prairie species such as *M. picta*, which is now missing from the remaining hillside prairie at this site, whereas *T. kiowa*, which prefers bare or sparsely vegetated ground, still persists. This is in keeping with Barone and Hill's (forthcoming) theory, based on current and historical plant data, that several plant species that occurred on either deeper, mesic, or sandier soils, which would have been more productive and easily plowed and thus more likely to have been used for agriculture, have been lost from the flora of the prairie remnants. Whether these more productive sites supported additional grasshopper species, or if rarer species were once more common, may never be known as there appear to be no historical records of the overall grasshopper fauna of this region.

In conclusion, the faunal list produced in this study should provide some baseline data on the grasshopper species composition of prairies for current and future conservation and restoration efforts. Such efforts are very important given the endangered status of Black Belt Prairie remnants. However special attention should be made to locate and preserve any existing remnants that are on mesic or sandy soils, as these sites may contain additional species and help conserve the biodiversity of this ecosystem. The overall diversity of the grasshopper fauna of Black Belt Prairie remnants is another piece of an interesting biotic puzzle about the natural history of this region, which begs to be better understood. Future investigations will focus on relatedness of individual remnants, how various habitat variables (*e.g.*, plant diversity and remnant size) influence grasshopper assemblages, and the relationship of grasslands in the southeastern United States to those of the Great Plains.

Species Notes: The following list is annotated with behavior, microhabitats, and site records. Temporal occurrence is also noted, but as the remnants were scattered over a large geographical scale, the dates given are rather general. Subfamilies in this annotated list are arranged taxonomically following Otte (1997). At the genera and species level the Gomphocerinae and Oedipodinae are arranged taxonomically following Otte (1981,1984), while the Cyrtacanthacridinae and Melanoplinae are arranged alphabetically. Site records are numbered as follows: 1 Tupelo Powerline, 2 Trace State Park, 3 Natchez Trace, 4 Peacely Ferry, 5 Tombigbee, 6 Clay Co., 7 Osborn, 8 North Farm, 9 HWY 82 x 45A, 10 Brooksville, 11 Crawford, 12 Plum Creeke, 13 Kemper, 14 Cochrane, 15 Aliceville, 16 Emelle, 17 Epes, 18 UWA, 19 Sparks Rd., 20 Old Cahawba, 21 Haynesville, 22 Letohatchee, and 23 CR 37.

Romaleidae
Romaleinae

***Romalea microptera* (Beauvois)**.— This species was only collected at one site during this study in Sumter County, Alabama on a high bluff overlooking the Tombigbee River. Dakin and Hays (1970) state that adults are active from July to September. Site 16.

Acrididae
Gomphocerinae

***Orphulella pelidna* Burmeister**.— This species was collected at the second largest number of sites (18) and is often one of the most abundant species at a site. It was found in both well-vegetated areas and less sparsely vegetated areas. Adults: from May to November. Sites 2, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, and 23.

***Orphulella speciosa* (Scudder)**.— One specimen of this species was collected on 20 August 2005 from a prairie in Sumter County, Alabama, on a high bluff overlooking the Tombigbee River. Dakin and Hays (1970) list collection dates as June to August for other areas in Alabama. Site 16.

***Amblytropidia mysteca* (Saussure)**.— This species is often quite abundant during the cooler months of the year in areas with short to tall grasses. During the present study it was observed eating *Schizachyrium scoparium* (Michx.) (Poaceae), starting near the apex of the leaf, consuming just the edge while working its way to the base. Adults: September to June. Sites 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 15, 17, 18, 19 and 20.

***Syrbula admirabilis* Uhler**.— This species is a common inhabitant of prairie remnants, and was found at 17 of the 23 sites. It will inhabit any area that is well vegetated at varying heights. Adults: July to November. Sites 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19.

***Mermiria bivittata* (Serville)**.— This species seems to be restricted to higher quality remnants, as it was found only at the three largest and most intact sites. It favors areas with species of taller growing grasses such as *Andropogon geradii*, *Panicum virgatum*, *Schizachyrium scoparium*, and *Sorghastrum nutans*. Adults: June to September. Sites 5, 7 and 11.

***Mermiria picta* (Walker)**.— This species, like *M. bivittata*, favors areas with species of taller growing grasses such as *A. geradii*, *P. virgatum*, *S. scoparium*, and *S. nutans*. However, it seems to be more restricted in its habitat requirements, as it was only found at one site. It matures later in the year than *M. bivittata*, with adults present from August to November. Site 5.

***Achurum carinatum* (Walker)**.— This species was only found in prairies in the southern half of the Black Belt, from Sumter County, Alabama eastward. Adults: May to July. Sites 14, 15, 17 and 19.

***Pseudopomala brachyptera* Scudder.**— This species was only collected at one site, where it was not very common. Only one voucher specimen, a male, was collected to limit the harm to this population. Thus far, it has been found only at one other site in Mississippi, a remnant of the Jackson Prairie in Scott County (Hill 2005). This is apparently a prairie-remnant dependant species in Mississippi, and should be considered for listing as rare within the state. *Pseudopomala brachyptera* overwinters in the nymphal stage, a fact that should be taken into account when planning winter burns, given its rare status. Adults: June to August. Site 12.

Oedipodinae

***Arphia sulphurea* Fabricius**.— This is usually either the second or third species to reach maturity in the spring. It can be found in various microhabitat types in the prairie and will occasionally also take refuge in eastern red cedar, *Juniperus virginiana*. or shrubs to evade capture. Adults: May to July. Sites 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 19 and 20.

***Arphia xanthoptera* Burmeister**.— This species matures in late summer, usually about a month after *A. sulphurea* has disappeared.

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Similar to *A. sulphurea*, it inhabits every type of microhabitat on the prairie from tall grasses to bare ground. When disturbed it typically flies to either bare ground or grassy areas, but will occasionally take refuge in *J. virginiana* or various shrubs. Its loud creptitation can be heard throughout the adult life span, which is August to November. One female was observed femur-raising as a male *Chortophaga viridifasciata* approached her. Sites 1, 3, 5, 7, 8, 9, 11, 12, 13, 14, 16 and 17.

***Chortophaga viridifasciata* De Geer**.— This species occurred at the most sites (19 of 23). Overwintering typically takes place in the nymphal stage, with the nymphs being active on warm days during the winter; however, some adults may live throughout the winter. Adults are most common March to November. Sites 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 21, 22 and 23.

***Hippiscus ocelote* Scudder**.— This is another common species, occurring at 17 of the 23 sites. Variation in the hindwing color of this species was observed as several different sites. The dark and light yellow forms were the most common; however at three sites the orange form was also present, along with both yellow forms. On 8 September 2004 at the Crawford site, all three color varieties were present in seemingly equal numbers. This species seems to prefer areas with short to medium-length grass, but occasionally can be found inhabiting tall grasses. Adults: July to November. Sites 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19.

***Pardalophora phoenicoptera* (Burmeister)**.— This species occurs less commonly on the prairies, and was found at 4 of the 23 sites, although its habitat preferences are similar to *H. ocelote*. Adults May to July. Sites 5, 7, 8 and 19.

***Spharagemon bolli* Scudder**.— This species seems to favor edges of prairie remnants and the open oak-hickory forests of the region, and in the case of smaller remnants is found out in the open prairie. Adults: June to October. Sites 3, 7, 8 and 14.

***Dissosteira carolina* L.**.— This species inhabits areas of sparse vegetation and chalk outcrops. It is a strong flier when disturbed, and after landing, will walk a short distance, then remain motionless and rely on its camouflage to evade detection. Adults: May to October. Sites 5, 7, 8, 10, 11, 13, 16 and 19.

***Trimerotropis maritima* (Harris)**.— This species inhabits areas of sparse vegetation and chalk outcrops. Similar to *D. carolina*, it is a strong flier and will often fly not only longer distances, but also to greater heights than most other species. Adults: June to November. Sites 4, 6 and 11.

***Trachyrhachys kiowa* (Thomas)**.— This species inhabits areas of sparse vegetation and chalk and is well camouflaged on the grayish-white soils. Along with the previous two, *D. carolina* and *T. maritima*, *T. kiowa* makes up the predominant fauna inhabiting the chalk outcrops on the prairie. Adults: June to November. Sites 5, 6, 7, 8, 11, 13 and 16.

Leptysminae

***Leptysma marginicollis* (Serville)**.— This is typically a wetland species. However one adult male was collected on 13 October 2006 in a prairie remnant in a patch of *S. scoparium*. There was a lake in the area that was separated from the prairie by a small stretch of forest. Given its typical habits, it is probable that this species landed accidentally in the remnant, especially as none were found in earlier surveys of the site. Adults: April to September. Site 2.

Cyrtacanthacridinae

***Schistocerca americana* (Drury)**.— This species inhabits the open prairie of almost any grass height. It is a strong flier and when disturbed will often fly to a nearby tree as is typical for the genus. It can often be found sunning itself, up on vegetation or on bare ground, early in the morning. Several specimens roosting on a *Silphium* spp. at night were collected by R. L. Brown on 29 September 2001. Two nymphs of this species were observed consuming the tail of a dead mouse. Adults: year round. Sites 2, 3, 4, 5, 7, 8, 10, 11, 12, 15, 17, 18 and 19.

***Schistocerca damnifica* (Saussure)**.— This species inhabits much of the same habitat as *S. americana* and displays similar flight habits. It occurred at five of the 23 sites, but was only common at the three largest sites. Adults: year round. Sites 5, 7, 11, 17 and 19.

***Schistocerca obscura* (Fabricius)**.— This species seems to prefer the edges of the prairie, unlike the other two members of the genus. It is a late summer to fall species with adults occurring from August to November. Sites 1, 5, 7 and 10.

Melanoplinae

***Campylacantha olivacea* Scudder**.— This species is late summer-fall occurring and has only been collected in patches of western ragweed, *Ambrosia psilostachya* DC. See the Discussion for more information. Adults: August to November. Sites 5, 7 and 17.

***Hesperotettix viridis* (Thomas)**.— Although range maps for this species show it as occurring in Mississippi and much of continental United States, there are no published records for this species in Mississippi. All of the specimens observed during this study were of the short-winged form. It occurred at seven sites, but was more common on the larger remnants. Adults: June to September. Sites 1, 2, 5, 6, 7, 11 and 14.

***Melanoplus bivittatus* Say**.— Dakin and Hays (1970) state that this species does not occur in the southern half of Alabama, and range maps for this species in Capinera et al. (2004) show it as being absent from the southern three-fourths of Mississippi and Alabama. During this study it was found inhabiting five prairie remnants from near Tupelo, Mississippi southward to near Montgomery, Alabama: this extends its range further southward. However, the absence of this species (or the absence of records) in the southern halves of these states outside of prairie remnants, suggests it has more specific habitat requirements in the more southern regions of its range. Several specimens of this species were found roosting on a *Silphium* spp. at night by R. L. Brown on 29 September 2001. Adults: May to September. Sites 5, 7, 11, 15 and 21.

***Melanoplus differentialis* Thomas**.— This species seems to prefer areas with taller vegetation on the prairies. Adults July to September. Sites 1, 5, 7, 11, 17 and 19.

***Melanoplus femurrubrum* DeGeer**.—This species was collected at seven sites where it was more common in the short to midlength vegetation. See also the notes under *Melanoplus femurrubrum* x *propinquus* below. Adults: June to October. Sites 5, 7, 8, 11, 19, 22 and 23.

Melanoplus femurrubrum* x *propinquus.— This hybrid or intermediate form was only collected at one site, although typical *M. femurrubrum* and *M. propinquus* were not collected. The site was on the campus of the University of West Alabama in Livingston, AL, and was undergoing a restoration effort that involved plantings and burning as part of a graduate project. It inhabited short to midlength grasses similar to *M. femurrubrum*. For more information on this intermediate see Dakin (1985). Adults: June to August. Site 17.

***Melanoplus keeleri* Thomas**.— This species can be found in short to tall vegetation in areas ranging from dense to sparsely covered. Several specimens were collected by R. L. Brown as they roosted on a *Silphium* spp. on the night of 29 September 2001. Sites 4, 5, 6, 7,

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8, 11, 13, 14, 18 and 21.

***Melanoplus* sp. *cf. nigrescens* (Scudder).**— This is another forest or edge-inhabiting species, and often only occurs a couple of meters away from that edge into the open prairie. This species was only collected at one site and this on 28 August 2006. Dakin and Hays (1970) give June to November as the dates for adults. Site 4.

***Melanoplus primaestivus* Dakin.**— This is another forest or edge-inhabiting species. It only was found at one site, in a patch of grasses and *Ascelpias verticillata* L. (Asclepidaceae) between two *J. virgianiana*. There have been very few collections of this species, and this record from Greene County, Alabama, is the southernmost (M. E. Dakin pers. comm.). The one adult male was collected on 20 July 2005. Dakin and Hays (1970) give June to August as the dates for adults. Site 14.

***Melanoplus sanguinipes* Gurney & Brooks.**— This species occurred at 17 of the 23 sites and was usually found in the more disturbed sections of the prairie in areas with short to mid-length vegetation and often sparse ground cover. Adults occur throughout most of the year. Sites 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14 15, 16, 18, 19 and 22.

***Melanoplus scudderi* Uhler.**— This species occurs in almost all the habitats on the prairie, from the sparsely vegetated areas to those with tall grasses, with the exception of chalk outcrops. It was one of the more common species, occurring at 15 sites. Several specimens roosting on a *Silphium* spp. at night, were collected by R. L. Brown on 29 September 2001. Copulating pairs have been seen as late as 4 November. Adults from August to January. Sites 1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 15, 16, 17 and 18.

***Melanoplus tepidus* Morse.**— This is a forest or edge-inhabiting species, and often occurs only a couple of meters away from the transition into open prairie. Adults June to September. Site 4.

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