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AN ANNOTATED CHECKLIST OF SOME ORTHOPTEROID INSECTS OF MAPIMI BIOSPHERE RESERVE (CHIHUAHUAN DESERT), MEXICO

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RESUMEN

La fauna de ortopteroideos en la Reserva de la Biosfera Mapimí (RBM), está formada por un total de 60 especies. El suborden Caelifera está representado por 39 especies de la superfamilia Acridoidea, repartidas en: 13 especies de Gomphocerinae, 10 de Oedipodinae, 9 Melanoplinae, dos Cyrthacantacridinae, una Ommatolampinae y una Leptysminae y la familia Romaleidae con tres especies. El suborden Ensifera está representado por 15 especies repartidas entre las superfamilias Tettigoniidae (8 especies), Tettigonoidea (una), Stenopelmatoidea (una), Grylloidea (cuatro) y Gryllotalpoidea (una). Además, se registraron seis especies de Phasmatodea y Dyctioptera. En la RBM, los Acridoidea son el grupo más abundante y conspicuo de insectos herbívoros, entre los que se distinguen tres formas de vida o «guilds»: 1) Los que habitan en el suelo (terrícolas) representados por la especie más común *Trimerotropis pallidipennis* (Burmeister 1883) y por *Cibolacris parviceps* (Walker 1870), que viven y se desarrollan principalmente en el suelo, son herbívoros generalistas que tienden a habitar en tipos de suelo específicos. 2) Los que habitan en hierbas y zacates (graminicolas) de los cuales *Paropomala virgata* Brunner 1899 y *Opeia obscura* (Thomas 1872) son las más comunes, se registraron frecuentes disparos de población de *Boopedon nubilum* (Say 1825), estas especies viven y se alimentan de gramíneas y no tienen hospederos específicos. 3) Los que habitan en arbustos (arbustícolas) grupo morfológica, conductual y tróficamente distinto a los anteriores, algunas especies muestran una alta especificidad alimenticia o de hábitat como *Bootettix argentatus* Brunner 1889, *Ligurotettix planum* (Brunner 1905), *Hesperotettix viridis* (Thomas 1872), *Campylacantha olivacea* (Scudder 1875) y *Clematodes larreae* Cockerell, 1901. La composición de especies y las densidades de población en los distintos ensamblajes de acridoideos, muestran gran variabilidad interanual, varían considerablemente entre unidades de vegetación y ambiente, dependen principalmente de las condiciones del suelo, de los atributos taxonómicos y estructura física de la vegetación y del clima.

Palabras Clave: Orthopteroideos, Orthoptera, Acridoidea, ensamblaje de especies de acrídidos

ABSTRACT

The Orthopteroidean fauna in Mapimi Biosphere Reserve (RBM) is represented by 60 species. Ensifera suborder are represented by 15 species grouped in next superfamilies: Tettigoniidae (8 species), Tettigonoidea (one), Stenopelmatoidea (one), Grylloidea (four) y Gryllotalpoidea (one), and six species recorded of Phasmatodea and Dyctioptera orders. In Caelifera suborder, grasshopper fauna is composed of 39 recognized species. The family Acrididae is represented by the subfamilies Gomphocerinae (13 spp), Oedipodinae (10 spp), Melanoplinae (9 spp), Cyrthacantacridinae (2 spp), Ommatolampinae (1 sp), Leptysminae (1 sp), and Romaleidae family (3 spp). Three major life-form groups or guilds are found at MBR: 1) Ground-dwelling species (terricoles), the most common of which are *Trimerotropis pallidipennis*

(Burmeister 1883) and *Cibolacris parviceps* (Walker 1870). These species live on the soil surface, are generalist feeders and tend to specialize on specific soils associated with different geomorphic surfaces. 2) Grass-dwelling species (graminicoles), the most common being *Paropomala virgata* Brunner 1899, *Opeia obscura* (Thomas 1872), and frequent outbreaks of *Boopedon nubilum* (Say 1825). These species live and feed on grasses but have no specific hosts. 3) Shrub-dwelling species (arbusticoles), which are morphologically, behaviourally, and trophically distinct from ground-dwelling and grass-dwelling species. The most common are *Bootettix argentatus* Brunner 1889, *Ligurotettix planum* (Brunner 1905), *Hesperotettix viridis* (Thomas 1872), *Campylacantha olivacea* Scudder 1875, and *Clematodes larreae* Cockerell, 1901; shrub-dwelling species live and feed on shrubs and are host specific to particular shrub species. In general, the species composition and density of grasshopper assemblages vary with different landscape units (depending on soils type and conditions) and also depend on to the taxonomic and physical structure of vegetation and climate into MBR.
Key Words: Orthoptera, Orthopterans, Acridoidea, Grasshopper‘s assemblies.

INTRODUCTION

The importance of Orthopteroids, has been shown by numerous authors, members of the superfamily Acridoidea are potentially the most important group in grasslands (Hewitt, *et al.* 1974; Hewitt and Onsager 1982, 1983; Onsager and Hewitt 1982; Watts *et al.* 1982). Because of their sensitivity to environmental weather variables, Acridoidea have been considered good weather indicators (Dreux 1979). Kemp and Dennis (1993) have shown that weather is associated with fluctuations in abundance, changes in composition, species diversity and annual outbreak records for population. They are therefore good study subjects for research on prediction models. From an ecological perspective this is functionally the dominant herbivorous insect species that consumes foliage, and it is an important insect group in grasslands ecosystems because it plays an important role in supporting population dynamic theory (Odum *et al.* 1962, Van Hook 1971, Mitchell and Pfadt 1974, Risser *et al.* 1981). They show that spatial dense-dependency (Kemp and Dennis 1993) is closely related to vegetation composition and structure (Anderson 1964). Grasshopper predation is an important factor that stabilizes the mechanisms of ecosystem interactions (Hassell 1985, 1987; Stiling 1988; Walde and Murdock 1988), and consequently yields valuable examples that support the optimal foraging theory (Cook and Hubbard 1977). Chihuahuan Desert Orthopteran fauna have been covered in US Northwestern boundaries of Arizona by Ball *et al.* (1942); in New Mexico by Richman *et al.* (1993); and in Trans-Pecos, Texas by Thinkham (1938 and 1948). There are some isolated Orthopteran species descriptions as well as Rhen and Grant (1961) and Cohn (1965).

This research field work began in 1980; the first results covered aspects relating to biology and descriptive ecology of the most common grasshopper species (the entire Acridoidea superfamily). The present study aims to update and add complementary faunal and taxonomic information to that published by Rivera (1986), considering now general, regional and biological information on the Ortopteroid insect group.

MATERIALS AND METHODS

Study site. The Mapimi Biosphere Reserve (MBR) was established in 1979 but was later expanded (DOF 2000). It includes part of the states of Durango, Chihuahua, and Coahuila in northern Mexico, its irregular polygonal-shaped area is located between parallels 27º 00' and 26º 10' latitude north and meridians 104º 05' and 103º 25' longitude west. The total surface area is over 342 000 hectares, covering parts of the states of Durango (63%), Coahuila (23%) and Chihuahua (14%). The Reserve has two nucleus zones with a surface of 28, 532 hectares (together) and a buffer zone with 313, 855 hectares. At present the MBR is administered by the National Commission of Protected Areas (CONANP SEMARNAT). It is common to observe topographic profiles on the reserve, with dominant SE-NW directions. The study area corresponds to a surface of approximately 25,000 has, and includes a representative topographic gradient that has been considered for other studies. This gradient is located in the central part of the Reserve; it takes as altitudinal references the «Sn. Ignacio» and the floodplains of «La India» stream (locally named «La Vega»). The gradient is composed mainly of four forms of relief properly defined by Montaña and Breimer (1988).

FOOTSLOPES: These correspond to the mountain ranges and high hills up to 540 m asl, with slopes of up to 30% and light rocky grounds. The dominant vegetation is creosote bush scrub (*Larrea tridentata*). Occasionally other species may be observed such as: *Fouquieria splendens*, *Acacia constricta*, *Agave asperrima*, *A. lecheguilla*, *Euphorbia antisyphilitica*, *Cordia parvifolia*, *Castella texana*, *Jatropha dioica*, *Opuntia rastrera*, *O. microdasys* (Ruiz de Esparza 1988).

UPPER BAJADA: These alluvial fans with slopes from 2 to 15%, with a marked gradient in the texture of the deposited material (heavy in high parts and fine in low parts). They display a plant formation of constant composition, and the following plant species are commonly observed: *L. tridentata*, *F. splendens*, *Prosopis glandulosa*, *E. antisyphilitica*, *Lippia graveolans*, *C. parvifolia*, *C. texana*, *O. rastrera*, and *O. microdasys*, (Ruiz de Esparza 1988).

LOWER BAJADAS: There is a continuation of the Upper Bajada. The ground slope never exceeds 1%; the earth has a medium texture or fine gravel, and three important vegetal formations are distinguished there:

1. «Nopaleras». This vegetal formation is characterized by succulents like dominant species, mainly of *O. rastrera*, with bushes like: *A. asperrima*, *Jatropha dioica*, *L. graveolans*, *C. texana*, *P. glandulosa*, *F. splendens*, *Hoffmancegia densiflora* and *Tricloris crinita*.

2. «Mogotes» and «Peladeros». This formation is characterized by dense vegetation arcs whose main axis is perpendicular to the slope of the land. Dominated by *P. glandulosa* and *Hilaria mutica*, these arcs are alternated with zones of bare ground locally refereed to as «Peladeros».

3. «Pastizales». These formation are located in the flood zones within the lower Bajada, are common to observe homogeneous arid grassland composed mainly by *Hilaria*

mutica as the dominant species, but there is also an important spatial heterogeneity in structure and spatial disposition when bushes such as *F. splendens*, *P. glandulosa* and succulents such as *Opuntia* spp. appear.

PLAYA. This environment is characterized by an almost flat slope and irregular micro relief. It generally has a grassland physiognomy with the presence of some bushes scattered throughout the land, and the main plant species are as follows: *H. mutica*, *Sporobolus airoides*, *Atriplex caenecens*, *A. acanthocarpa*, *Suaeda nigresens* and *P. glandulosa*.

To the previous topographic sequence, the DUNE ZONE is added although strictly speaking, it represents a break in continuity. It is an important plant formation within MBR, exhibiting particular characteristics in the Chihuahuan Desert Region. This ecosystem is of special interest and corresponds to one of the nucleus areas of the MBR's. DUNE ZONE is located at approximately 15 km nw of the «Laboratorio del Desierto» (INECOL field station); it is characterized by bare sandy hills or ones with little vegetal cover, sandy soils derived from eolic action, and depressions (locally named «médanos»), in which the soil is more compact and less sandy.

Insect Collections and observations. Most of the Orthopteriods insects were systematically collected by sweep net and direct pick up on the topographic gradient of the work area during the first three years, starting in 1980, and were complemented by isolated sweep net and direct pick up during spring, summer and fall until 1990. Subsequently, many other specimens were collected using the same methods for the following nine years. During the second period, I preserved in wet only a few specimens of the species that did not appear in the first period (1980-1990) in the work area. This material was added to that collected previously, when material collected in other sites within de MBR boundaries, and isolated collections to the time of other studies were made.

All material was identified from the following texts: Alexander (1941); Alexander and Hilliard (1969); Ball *et al.* (1942); Blatchely (1920); Brooks (1958); Brusven (1967, 1972); Capinera and Sechrist (1981); Campbell *et al.* (1974); Cantrall (1943); Cohn (1965); Hubbell and Norton (1978); Otte (1981, 1984); Pfadt (1986); Rhen and Eades (1961); Rhen and Grant (1961); Richman *et al.* (1993); Rivera (1986); Stroecker *et al.* (1968); Thinkham (1938, 1948). All material described is deposited in INECOL-CRD, Durango Mapimí Collection along with 680 other wet preserved (FAA).

The identification was make using like principal Taxonomic reference *Orthoptera Species File Online* (Version 2.2) made by D. Otte, Eades D. C. and Naskerecki P. (http:/ osf2x.orthoptera.org/osf2.2/OSF2X2Frameset.htm) and for descriptions Alexander (1941); Ball *et al.* (1942); Capinera and Sechrist (1981); Richman *et al.* (1993); Rivera (1986) and Thinkham (1938, 1948). Complementary information about the more common species were ordered by Recognition: Species were described in accordance with the principal morphological characteristics that make them easily identified in the field and all complementary information on the biology and habitat for particular species was gleaned from field observation made in MBR.

RESULTS

Approximately 500 grasshoppers (adults and immature stages) and 80 specimens of other Orthopteroids were determined and catalogued. The Orthopteroidean fauna from MBR includes 60 recognized species. Caelifera is the best represented group composed of the superfamily Acridoidea, integrated by subfamilies Gomphocerinae (13 spp), Oedipodinae (10 spp), Melanoplinae (9 spp), Cyrthacantacridinae (2 spp), Ommatolampinae (1 sp), Leptysminae (1 sp). The Romaleidae family is represented by 3 grasshopper species. Ensifera add 15 species from the following superfamilies: Tettigoniidea (8 spp), Tettiiginiidae (1 sp), Stenopelmatoidea (1 sp), Grylloidea (4 spp), Grytalpoidea (1 sp) and six species of other Orthopteroidean orders Phasmatodea and Dictyoptera.

Acridoidea grasshoppers are an abundant, diverse and conspicuous group of herbivorous insects at the MBR. Three major life-form groups or guilds occur in the region:

1) Ground-dwelling species (terricoles) the most common species being *Trimerotropis pallidipennis* and *Cibolacris parviceps*. Ground-dwelling species that live on the soil surface are generalist feeders and tend to specialize on specific soil types associated with different geomorphic surfaces.

2) Grass-dwelling (graminicoles), the most common being *Paropomala virgata*, *Opeia obscura*, and with frequently outbreaks recorded *Boopedon nubilum*. Grass-dwelling species live and feed on grass but are not host species specific.

3) Shrub-dwelling (arbusticoles). They are morphologically, behaviourally, and trophically distinct from ground-dwelling and grass-dwelling species. The most common are the highly specialized *Bootettix argentatus*, *Ligurotettix planum*, *Hesperotettix viridis*, *Campylacantha olivacea* and *Clematodes larreae*. These species live and feed on shrubs and are always host specific to particular shrub species. In general, the species composition and densities of MBR grasshopper assemblages vary considerably among different landscape units (depending upon soil conditions), the taxonomic plant composition and physical structure attributes of vegetation and climate.

GENERALITIES: RECOGNITION, BIOLOGY AND HABITS OF THE MOST COMMON MBR ORTHOPTERAN SPECIES

I. Order: Orthoptera; Suborder: Caelifera; Infraorder: Acridoidea; Superfamily: Acridoidea; Family: Romaleidae; Subfamily Romaleinae. Tribe: Romaleini

Taeniopoda eques (Burmeister 1889)

Recognition: Large size (38–64 mm), short-winged lubber; black with yellow or orange markings; tegminae with network of yellow veins; hind wings rose-red with black borders (aposematic species); hisses when disturbed; often seen crossing highways; males can fly. Exhibits herbicole-arbusticole life form, with typical herbivore mandibular dentition type. Univoltine poliphagous grasshopper species, feed on desert annuals herbs and foliage of some perennial shrubs like mesquite (*P. glandulosa)*. In the region, overwinter eggs are pods in soil and survive, hatching after spring rains, the adult seasonal distribution period is between the months of June and October. It abundance and space occupied depends directly on the

weather condition, with a maximum record (890 ind. /ha) in 1986, with presence of nymphs and adults at the same time.

Tribe: Brachistolini

Brachystola magna (Girard 1853)

Recognition: The Largest grasshopper at MBR, length between 40 and 50 mm in males and 50 and 65 mm in females, antennae slender, brachypterous, tegminae very small and reddish with black spots. Legs robust with tibiae strong spined almost the entire length, each abdominal segment is marked with a row of light dots. Pronotum disk and lateral lobes trapezoidal, median carina distinct, black and entire (uncut), lateral carinae distinct. Polyphagous grasshopper species show a typic herbivore mandibular dentition and present graminicole–arbusticole life form. In MBR is observed in Playa and arid grasslands in the lower bajada, with noticeable preference for mixed scrub. Adults have been observed from September to November during years when the winter is not very cold, they can survive until January. Some outbreaks have been recorded for 1980 and 1999.

Tribe: Phrynotettigini

Phrynotettix robustus (Bruner 1889)

Recognition: Body proportionally robust, in dorsal view «toad-like», head with interocular space, fastigium moderately excavate, pronotum with a dorsum as a whole deplanate. In both sexes, tegminae are short and broad with semi-circular pad-like disk. Male length 27-35 mm, females 36-56 mm. Rhen and Grant (1961) described two subspecies inhabiting in the Chihuahuan Desert, both observed at MBR. This terricole grasshopper show herbivore mandibular dentition with few modifications in morphology; it is widely distributed on the Reserve. Nevertheless, it is not commonly observed in the field and has a marked preference to occupy places compatible with its cryptic coloration. It has, great seasonal variability; adults are frequently observed from September-November, they tend to be rare and have no constant annual presence.

Family: Acrididae: Subfamily Gomphocerinae. Tribe Acrolophitini

Acrolophitus maculipennis (Scudder 1890)

Recognition: Strongly mottled gray-green and ivory point-headed grasshopper, fore wings mottled grey and black, hind wings black, males body length between 23-35 mm, 28-43 mm for females. Present herbivorous mandibular dentition type, with graminicole life form. Its entire life take place in arid grasslands in Playas and it sometimes can be observed on shrubby hills and in the grasslands that surround them in the lower bajada from June to October. They tend to be rare and have no constant annual presence.

Bootettix argentatus Bruner 1889

Recognition: It is a 20-26 mm size grasshopper species, recognized by its yellow-green colour with silvery-white spots on both thorax sides. It has an arbusticole life form, with much modified herbivore mandibular dentition; feeds exclusively on creosote bush (*L. tridentata*). Its spatial distribution depends directly on the presence of this shrub (Rivera 1996); it is always observed on the foliage of this shrub, and females leave the bushes only to lay their eggs in the ground underneath them. It is one of the species with the highest annual consistency, and can be found almost throughout the year (February to November). Nymphs, have been observed in the months of February-March and September-October, suggesting that there are two

overlapping generations. Their great consistency is affected by dramatic drops in abundance in very dry years (1981, 1989 and 1990). Garza (1988); Hermosillo (1989), and Hermosillo *et al.* (1991), report that this species is highly depredated by *Campylorhynchus brunneicapillus* as well as other vertebrates and invertebrates during its life (Rivera, 2004).

Tribe: Amblytropidinni

Boopedon nubilum (Say 1825)

Recognition: This species has a pronounced sexual dimorphism. The male body is always shiny black, fore wings length variable, no longer than first half of abdomen, rarely extended to the end of abdomen, posterior margin of pronotum slightly angulated, body length 24-34 mm to end of femora. Females with body pale brown to straw brown, partly green head, pronotum and femora, occasionally females dark brown or black, forewing length variable, but never reaching the end of abdomen, body length 33-52 mm to end of femora. Show graminicole life form, with graminivore type mandibular dentition, common on Playa and shrubby hills of lower bajada. On MBR it can be observed in July-October, but its seasonal distribution is not constant in terms of annual presence. Frequent outbreaks have been recorded during the summers of 1980, 1981, 1992, 1993, 1998 and 1999. In zones to lack cattle grazing, groupings are not observed and individuals of a population are found dispersed.

Syrbula montezuma (Saussure 1861)

Recognition: Green or dark brown slant-faced grasshopper, white streak along anterior tegminae, hind wings dark, abdomen and hind tibiae often blue in part. Adult body 25-39 mm in length. Graminicole life form, with graminivorous mandubular dentition; it is frequent observed on *H. mutica* grasslands, principally in Playa, although in some wet years it has been observed in Upper and Lower Bajada, showing a bluish black body colour like described one by Otte (1981). Its seasonal period corresponds to the months of August to October, in wet years have been observed since July.

Tribe Aulocarini

Aulocara elliotti (Thomas 1870)

Recognition: Medium size adults (males 17-20 mm, females 20.5-25 mm), body usually grey with dark markings, head with slightly slanted face, spotted forewings extended slightly beyond abdomen. Pronotum disk distinctively marked by light lines with appearance of an «X». Terricole species, with herbivorous mandibular dentition, has been observed abundant in low and salty grasslands in Playa. They feed mainly on the green leaves of grasses and sedges but also on ground litter-cut grass leaves (green or dry). In this region, they tend to develop in the same area as they hatched and were observed frequently from June to October.

Psoloessa texana Scudder 1875

Recognition: Slightly slant-faced grasshopper; pronotal median ridge cut before middle; with slash-like lateral white marking on pronotum; tegminae longer than abdomen; size between 18-25 mm. Terricole life form, with herbivorous mandibular dentition. It is an abundant grasshopper species in the arid grasslands of Texas (Tinkham 1948). In MBR, it shows a clear preference for stony land with less pronouncing slopes, mainly on hillsides and upper bajada. It is commonly found associated with any vegetal species and has not been observed in the ground in gravel and/or rocks. Its seasonal period of presence is observed between May and November, although it is one of the species that appear throughout most of the year.

Tribe: Cibolacrini

Cibolacris parviceps (Walker 1870)
Recognition: A common desert grasshopper, adult size between 20-32 mm, grey or red-gray pale colour, with long, spotted tegminae. Tip of pronotal disk darkened, dorsal hind femora banded, terricole life form; it is closely associated with gravely zones, and it is very rarely observed it on fine-textured grounds, Otte (1981) considers it a ubiquitous species of the SW of the EUA. In MBR adults can be observed from May to October. There is little regional information on this species due to great seasonal variability and yearly variability.

Ligurotettix planum (Bruner 1905)
Recognition: Gray-brown grasshopper, hind tibia brownish-gray; wings yellowish at base, brown toward tip, size between 11-28 mm. Common in creosote-tarbush communities, with arbusticole life form, with graminivorous mandibular dentition, substantially modified to feed on preferred shrubs *Flourencia cernua* and *Cordia parvifolia.* Locally, it is restricted to inhabit in that shrubs, and is occasionally observed, perhaps in traffic on *L. tridentate* stems. It has been found in the upper and lower bajada, shrubby hills and occasionally in dune zones, but always on *F. cernua* or *C. parvifolia*. Its period of presence is considered from May to November, with the possibility of more than one generation per year.

Tribe: Eritettigini

Eritettix simplex (Scudder 1889)
Recognition: Adult body length 15-17 mm in males, 22-24 mm in females, head with a median carinae on fastigium, lateral faveola no visible from above, pronotum with black stripes visible from above, tegmen with basal white streak, male wings extend beyond abdomen, female wings do not quite reach the end of abdomen, graminicole life form, graminivorous mandibular dentition, feed exclusively on grasses and sedges, adult presence from July to Octuber.

Opeia obscura (Thomas 1872)
Recognition: Small to medium size grasshopper (male length, 16 mm; female, 25 mm), slanted back face, Vertex rounded sword-shaped antennae. Coloration variable; typically, the back is brown or green and nearly flat. Sometimes a dark streak runs along the median carina of the pronotum. The grasshopper's sides have a progressively darker stripe running backward from the point where the eye widens to the back, becomes more obscure. Graminicole life form, with graminivorous mandibular dentition, on the MBR the two coloration forms described by Otte (1981) were recorded. This species tends to show preference by *H. mutica* grasslands, but can be observed in lower bajada and in low dune zones always in shrub land grasses. It is observed from July to October, although during wet years has been observed before of July (1981 and 1986), while during others it has been observed in late November or even in December (1980, 1986).

Tribe: Paropomalini

Paropomala virgata Scudder 1899
Recognition: Extreme slant-faced grasshopper with distinct lateral dark and white bands; tegmina just reaching tip of abdomen, size between 22-32 mm. Graminicole life form, with graminivorous mandibular dentition. This species shows preference for grasslands composed of *H. mutica* alone or accompanied by *Sporobolus* sp, although it has been observed in flooded grassy areas and is sometimes observed in upper bajada and on and in shrubby

hills. Its period of appearance is from June to September, although nymphs have been observed after spring rains in March or April.

Acantherus piperatus Scudder and Cockerell 1902
Recognition: Slant-faced grasshopper, adult size between 20-30 mm, body gray brown on top, yellow on the sides, top of lateral lobes with a dark band in the upper third, yellowish in the lower thirds, antennae ensiform, hind femora orange or red, arbusticole life form, with herbivorous mandibular dentition. Frequent observed in the upper and lower bajada on dark stemmed shrubs, especially on the low stems of *L. tridentata*, *F. cernua*, *Castela texana*, *Lippia graveolans*, and *P. glandulosa* and less frequent on the ground, is not very abundant, annual presence of adults the period between August and October.

Tribe: Mermirini

Mermiria bivitatta (Serville 1839)
Recognition: Medium to large size grasshopper (male length, 38 mm, female 51 mm), face strongly slanted, head vertex cone-shaped, antennae long, sword-shaped, pronotum slender and without lateral carinae, body brownish to greenish, yellowish-brown underneath. Sides of head and pronotum have a broad, dark stripe. Forewings are clear. Graminicole life form, with graminivorous mandibular dentition.
On MBR it lives in tall grasses (playa and lower bajada, always associated with tall grasses). In wet years, macropterism is commonly observed locally in different zones at the same time. Seasonal presence from May to October, show a single generation per year.

Subfamily: Oedipodinae; Tribe: Anconiini

Anconia hebardi Rhen 1919
Recognition: Terricole species, with herbivorous mandibular dentition, adult size 27-42 mm, hind wings sky-blue, becoming transparent distally; hind tibiae banded grey and ivory; has been observed in low and salty in Playa grasslands, and prefers host plant of Chenopodiaceous family. It can be observed from June to October, and adults have been recorded on the ground before the rainy season.

Tribe: Arphini

Arphia conspersa Scudder 1875
Recognition: Medium size grasshopper (male 25 mm, female 30 mm), dark greyish-brown colour, vertex rounded, top of head and pronotum finely textured, antennae slender, gradually widening toward the tip, dorsal posterior margin of pronotum forms a rounded right angle, median carinae of pronotum slightly notched near the middle, tegminae often have a pale, dorsal stripe, wings are red or yellow with black border, abdomen yellow, hind femora robust, inner face black on basal half and yellow with a black band on distal half, hind tibiae light yellow to blue. Terricole life form, with herbivorous mandibular dentition, observed in bare grassland areas, it prefers sandy or fine, gravely soils, less abundant in vegetation units on slops, with mixed feeding habits. It can be found from June to October on MBR.

Arphia pseudonietana (Thomas 1870)
Recognition: Medium size grasshopper (male 25 mm, female 30 mm), male is sometimes black, both sexes often greyish-brown with many spots on back, vertical face, vertex rounded, slender antennae with dorsal posterior margin of pronotum forming a rounded angle, wings

bright-orange, hind tibiae blackish with a pale ring near the knee. Usually dark abdomen with pale vertical stripes. It often clicks in flight, in which case, flight is irregular; without clicking, its flight is direct and controlled, followed by rapid crawling on the ground. Terricole life form, with herbivorous mandibular dentition. It can be observed in dry areas with little plant cover, especially sandy or gravely hills and slopes in upper bajada, principally in «nopalera». It is a mixed feeder preferring grasses.

Tribe: Psinidiini

Mestobregma plateii (Thomas 1873)
Recognition: Medium sized grasshopper, brown body, large head, eyes rather small, face vertical with a dark band running across it face below slender antennae, dorsal posterior margin of pronotum at a right angle, lateral lobes of pronotum have curved dark bands, median carinae of pronotum moderately high with two deep notches, long tegminae and wings yellow or pink, tegminae have two broad black bands that often fade posterior, wings with a spurred black band and clear apex. Hind tibiae yellow-brown or blue, male length 25 mm, female 28 mm. Terricole life form, with herbivorous mandibular dentition, and less frequently on eastern plains. It can be found from June to October.

Mestobregma terricolor Rhen 1919
Recognition: Medium size grasshopper, male length 23-28, female 30-36, similar to *M. plattei* but paler in colour and lacking black band between eyes and frontal ridge, basal area of hind wing red or orange, hind tibiae blue. Terricole life form, with herbivorous mandibular dentition, can be found in the norwestern plains of MBR from June to October.

Tribe: Tropidolophini

Tropidolophus formosus (Say 1825)
Recognition: Body green often with yellow-ringed brown spots, high pronotal aserrated crest, hind wings orange; this grasshopper species is easily distinguished from any other on MBR. Graminicole-Herbicole life form, with herbivorous mandibular dentition, lives in grasslands, their principal host are Malvaceae, mostly *Spharalcea* and *Malvastrum*. Its seasonal presence regularly corresponds to periods of increased humidity, seen rarely in some dry years (1989 and 1990).

Tribe: Sphingonotini

Trimerotropis pallidipennis (Burmesiter 1838)
Recognition: Adults slender, male length 32 mm, females 44 mm, body gray marked with brown, vertical face, vertex rounded, antennae slender, dorsal posterior edge of pronotum at a right angle, median carina of pronotum cut by two sulci, with irregular bands on tegminae, wings pale yellow with a narrow black band beyond the middle and short spur reaching over half the distance to the wing attachment, hind femora with two bands and a black knee on the inner face, hind tibiae yellow. Terricole grasshopper species, with herbivorous mandibular dentition, feeds on herbs and grasses, lives in waste area of thin soils and sparse vegetation. On MBR, it can be found throughout the year except from November to February, with variable abundance between years.

Trimerotropis pistrinaria Saussure 1884
Recognition: Median sized grasshopper, body robust, male length 28-33 mm, females 35-49 mm, body tannish-gray to reddish-brown with dark brown markings, dorsal posterior edge of pronotum at a right angle, outer and inner surfaces of hind femora with prominent bands on the apical third.

Terricole species, with herbivorous mandibular dentition, feeds on herbs and in sparse vegetation. On MBR, it can be found from June to October.

Trimerotropis latifaciata Scudder 1881
Recognition: Large and robust grasshopper, male body length 30-41 mm, females 35-49 mm, body gray or brown to blackish, antennae dark and slender, vertical face, pronotum delicately textured, wing disk yellow to whitish with a black band. Terricole species with herbivorous mandibular dentition adapted to mixed feeding habits can be found from June to October.

Trimerotropis californica Bruner 1889
Recognition: This grasshopper is easily confused with *T. latifaciata.* It has a protuberance on lower margin of lateral lobes of pronotum, with low bands on tegminae, inner hind femora orange marked with black and white alternated wing bands, band of wing with a short spur, male body length 25-43 mm, females 30-43 mm. Terricole life form, with herbivorous mandibular dentition, mixed feeding habits, can be observed on MBR from June to October.

Conozoa texana (Bruner 1889)
Recognition: Male body length males 19–28 mm, females 25–37 mm, basal area of hind wings pale yellow, sometimes colourless, with subtle dark markings on tegminae, hind tibiae yellow orange, crepitating pattern resembles ticking. Terricole species with herbivorous mandibular dentition can be found exclusively in dunes between June to October.

Subfamily: Melanoplinae; Tribe: Dactylotini

Campylacantha olivacea (Scudder 1875)
Recognition: Green, brown or blackish, male cerci flattened at tip, wings short, body fuzzy, adult size 19-31 mm. Herbicole-arbusticole life form, with typical herbivorous mandibular dentition, closely associated with *F. cernua* and *Parthenium incanum*, can be found from September to November in «nopaleras» of lower bajada, sometimes observed in wooded hills and dunes from September to November.

Hesperotettix viridis (Thomas 1872)
Recognition: Male length 16–20 mm, females around 25 mm, body green, face somewhat slanted back, vertex rounded and very narrow between eyes, antennae slender, pronotum long and slender, with sides almost parallel when viewed from above, tegminae pale green, wings transparent, front and middle femora often tinted with orange, hind femora with orange band near knee, hind tibiae light blue-green colour. Arbusticole species with typical herbivorous mandibular dentition, oligophagous feeder, is always found from July to September in zones with high floristic richness.

Tribe: Melanoplini

Netrosoma nigropleura Scudder 1897
Recognition: Males whitish grey body colour with dark brownish post ocular stripe on head, thorax and base of abdomen 10–12 mm. Females longer than males, and body violet gray colour 20–25 mm long, hind tibiae coral pink in both sexes. Terricole species with herbivorous mandibular dentition can be found from July to October in gravely soils on slopes of up 5%.

Melanoplus differentialis (Thomas 1865)
Recognition: Large yellow adult grasshopper, some individuals are melanistic (black), size variable (18–30 mm, both sexes), front of head green, yellow or tan, with dark spots, pronotum with a pale yellow horizontal stripe at the top of lateral lobe and a brown band along pronotal disk, a median pale yellow stripe along mesonotum, metanotum and continuing to abdomen. Arbusticole–herbicole life form with herbivorous mandibular dentition is a polyphagous feeder, inhabit in areas of tall herbaceous vegetation in wet meadows, near creek beds and bottom lands, and can be observed from June to September.

Melanoplus femurrubrum (De Geer 1773)
Recognition: Medium sized adults (males' length 17–23 mm, females 24–28), underside a bright yellow colour, bright red hind tibiae, subgenital plate bulbous shape of the cercus characteristic of this species, hind femora with black stripe complete, uninterrupted by pale band. Arbusticole–herbicole life form, with herbivorous mandibular dentition, polyphagous species that feed on a wide variety of forbs and several kinds of grasses, can be found from July to August.

Melanoplus glandstoni Scudder 1897
Recognition: Adult sized females between 22–28 mm long, male cerci broadly expanded, subgenital plate rectangular, wider than high, with disctinctive lateral pronotal dark stripes, hind tibiae greenish-blue, tegminae as long as abdomen. Arbusticole–herbicole life form, with herbivorous mandibular dentition, eats a mixed diet, can be found in mixed grasslands and wooded hills from July to August.

Melanoplus lakinus (Scudder 1878)
Recognition: Males body length 17.5–19.5 mm, females 19–23 mm, brown with fuscous and yellow markings, short wings, and hind tibiae blue with yellow or pale tan. Herbicole-arbusticole life form, with herbivorous mandibular dentition with some morphological modifications for feeding on mixed plants to feeds on mixed plants, principally Chenopodiaceae, can be found from June to October.

Melanoplus thomasi Scudder 1897
Recognition: Adult size 25–40 mm for both sexes, hind femora with blackish markings on upper half, pronotum and tegmina with a conspicuous stripe on each side, body colour green, hind tibiae always red. Arbusticole life form, with typical herbivorous mandibular dentition is commonly found in dense vegetation sites in upper and lower bajada from August to October.

Subfamily: Cyrtacanthacridinae; Tribe: Cyrtacanthacridini

Schistocerca americana (Drury 1773)
Recognition: Adults have fully developed wings with distinctive brown spots on them, body colour changes from the nymphal green to reddish brown with a light yellow mid-dorsal stripe extending from the head to midway on the tegminae. Male length 39-42 mm, females 48-55 mm. Life form arbusticole, with herbivorous mandibular dentition. Only recorded on MBR from August to September, rarely found every year.

Schistocerca nitens (Thunberg 1815)
Recognition: Very large species (40-70 mm), body colour gray or brown, with some spots,

hind tibiae brown to black, first nymphal stages are pale green with a black middorsal stripe running along the body, arbusticole life form, with herbivorous mandibular dentition, can be observed in diverse plant formations, principally on *P. glandulosa.* On MBR adults can be found from August to November.

Subfamily: Ommatolampinae; Tribe: Clematodini

Clematodes larreae Cockerell 1901

Recognition: Minute and slender adults 20-28 mm long, colour light to dark striped gray, frontal sulcus strongly bowed out in front eyes, face strongly receding, wingless with tegminae barely visible, strongly linked to creosote bush (*L. tridentata*), arbusticole life form, with herbivorous mandibular dentition with some modifications. Its seasonal appearance is during May–August period.

Subfamily: Leptysminae; Tribe: Leptysminae

Leptysma margicolis Serville 1839

Recognition: Rare, slender grasshopper, adult size between 25-38 mm, face quite flat straightforward, pronotum cylindrical, median carinae absent, surface of metazona more intensely pitted than prozona, prosternal spine laterally compressed, graminicole life form with graminivorous mandibular dentition, has been observed in wooded hills with high values of grass cover. On MBR adults can be found from August to October.

Suborder: Ensifera; Infraorder: Tettiginiidea; Superfamily: Tettigoniidae; Family: Tettigoniidae; Subfamily: Phaneropterinae

Amblycorypha insolita Rhen and Hebard 1914

This species is not abundant and is closely associated with *Bacharis sp*, on the borders of «La Vega.» It can also been observed in water reservoirs for cattle raising, but always on the same plant. Adults can be found from July to October.

Dichopetala oreoeca Rhen and Hebard 1914

Dichopetala brevihastata Morse 1902

These two species have nocturnal habits, always associated with shrub vegetation; both species can be observed on slopes, the latter being more common in wooded areas. During the day both take refuge on the higher density leaves of the host shrub branches. Both species lay their eggs in grasses and can be found from August to November.

Tribe: Insarini

Insara covillae Rhen and Hebard 1914

Insara elegans (Scudder 1900)

Neither species is abundant. Both can be observed in all the scrubs in which creosote bush (*L. tridentata*) appears; there is an apparent association between this plant and both species, which can be found in the summer rainy season.

Subfamily: Pseudophyllinae; Tribe: Pterophyllini

Paracyrtophyllus excelsus (Rhen and Hebard 1914)

This species is not abundant. It is associated to legume bushes in the region and is frequently found in wooded hills and areas covered by *P. glandulosa.* Adults can be observed from July to October.

Subfamily: Tettigoniinae; Tribe: Tettigoniini

Capnobotes fuliginosus (Thomas 1872)

This species is rare and always associated with *L. tridentata* and *Atriplex* sp. It shows a discontinuous spatial distribution on the gradient, from the wooded hills to arid grasslands; nymphs and adults are observed from May to October on *P. glandulosa*, *Cercidium* sp., *Hymenoclea*, and *Haplopapus*.

Tribe: Platycleidini

Eremopedes (Eremopedes) scuderi Cockerell 1898

A rare species, mainly observed on slopes, although associated with creosote bush, sometimes observed on *Yucca* sp.

Superfamily: Tettigonioidea; Family: Tettigoniidae; Subfamily: Saginae; Tribe: Terpandrinii

Neobarretia spinosa (Caudell 1907)

This species has been observed associated with mesquite shrubs and creosote bush, in the Northeastern region of MBR. Abundance is low, and they are predators although they consume plants in small amounts.

Superfamily: Stenopelmatoidea; Family: Rhaphidophoridae; Subfamily: Ceuthophilinae; Tribe: Ceuthophilini

Ceuthophilus variegatus Scudder 1894

A troglodytic species closely associated with hollows, caves, cracks between rocks on hills, and animal burrows (mainly tortoise and rodent), can be found throughout most of the region with no defined seasonality.

Infraorder: Gryllidea; Superfamily: Grylloidea; Subfamily: Gryllinae; Tribe: Gryllini

Acheta domestica (Linaeus 1775)

Gryllus asimilis (Fabricius 1775)

Both species are widely distributed throughout MBR and the surrounding region; the latter species is very common and the former rare, restricted to dark and wet habitats, with no defined seasonality.

Subfamily: Nemobinae; Tribe: Nemobiini

Nemobius sp. (Serville 1839)

Very rare species, associated with black or very dark stems in wooded hills and slopes, has only been collected twice in shrub vegetation in fall.

Family: Oecanthidae; Subfamily: Oecanthinae; Tribe: Oecanthini

Oecanthus sp. Serville 1831

This rare species can be observed in slopes, on shrub stems, accumulations of vegetal detritus and into organic materials and near to ephemeral streams. Its seasonality is not well defined, but can be found in wet season.

Superfamily: Gryllotalpoidea; Family: Gryllotalpidae; Subfamily: Gryllotalpinae; Tribe: Scapteriscini
Scapteriscus borelli Giglio-Tos 1894
This species is frequently observed in deep streams on slopes and in grassland flood zones. Its abundance is variable and seasonality not defined.

Apart to the previous species, the following Orthopteriodeans (Walking sticks insects, Mantids and Cockroaches) have been recorded.

Order: Phasmatodea; Superfamily: Phasmanimoidea; Family: Phasmatidae; Subfamily: Heteronemiinae; Tribe: Heteronemiini
Diapheromera covillae Rehn and Hebard
This little abundant species is associated with shrub vegetation, mainly creosote bush, and can be observed on host plants *Gutierrezia*, *Haplopapus*, and *Chrysothamus*. In wet years on MBR, it is observed in groups on high creosote bush.

Order: Dictyoptera; Suborder: Mantodea; Family: Mantidae; Subfamily: Amelinae
Yersiniops sophronicum (Rhen and Hebard)
This species is frequently observed in all types of shrub land. It is a very effective predator, although not abundant. On MBR, lone individuals have been observed from July to October.

Superfamily: Blattoidea; Family: Blattellidae; Subfamily Blatellinae
Blatella germanica (Linaeus)
Supella longipalpa (Fabricius)
Family: Blattidae; Subfamily: Blattinae
Periplaneta Americana (Linaeus)
All three cockroaches are cosmopolitan species. They are not abundant and are rare in the field, generally inhabiting shady places. They are easily found near to farms and associated principally with garbage.

Family: Polyphagidae; Subfamily: Polyphaginae
Arenivaga sp
This cockroach species (perhaps two species) lives in dunes, digging in sand under the shade of small shrubs, with nocturnal activity. It is found mainly in accumulations of vegetal detritus and organic matter under several shrubs and is sometimes associated with *Neotoma albigula* burrows.

DISCUSSION

The greatest Orthopteran species richness was recorded in high vegetation cover. Grasshoppers were best represented in lower bajada with little difference between vegetation units. Extreme parts of the topographic gradient (slope and dunes) had low species richness (17 and 14 species respectively) with only three grasshopper species in common (*Phrynotettix robustus*, *Bootettix argentatus*, and *Trimerotropis pallidipennis*). Ensiferan fauna only share two species (*Gryllus asimilis* and *Acheta domesticus*) and

the cockroach *Arenivaga* sp. was only recorded on dunes. *B. argentatus* and *T. pallidipennis* showed themselves to be the most common grasshoppers on MBR, the former closely related to creosote bush presence (high host specificity), and the latter always on the bare ground patches. The Acridoidea superfamily (Caelifera) was the best represented group (39 species), followed by the Ensiferans (15 species), showing the great Neartic influence on MBR fauna. A close relationship has been demonstrated between orthopteran fauna, especially grasshoppers, and plant vegetation richness and soil surface texture along the topographic gradient, principally grasshoppers. The species recorded on MBR is lower than reported (around 100 species) by Tinkham (1948) in the Big Bend region (Trans-Pecos, Texas), the low species richness recorded at MBR (60 species) were due by altitude (average 1100 m) with high monotony on the physiognomic plant species composition (Montaña 1988). Grasshoppers offer a great biomass to be consumed by a wide variety of animals in MBR, principally vertebrates; they are therefore an important meal factor that stabilizes feeding interactions (Hassel 1985, 1987; Stiling 1988). In the MBR ecosystem, grasshoppers have many predators and parasites from spring to fall (Rivera 2004 and Rivera in press), sometimes with a great synchronization between the breeding season of some avian predators with grasshopper abundance (Garza 1988; Hermosillo 1989). This demonstrates the effect of prey availability on foraging patch choice by *Campylorhynchus brunneicapillus* (Hermosillo *et al.* 1991).

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