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Authors: Smith, Trevor Randall, Froeba, Jason G., and Capinera, John L.

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## KEY TO THE GRASSHOPPERS (ORTHOPTERA: ACRIDIDAE) OF FLORIDA

TREVOR RANDALL SMITH, JASON G. FROEBA AND JOHN L. CAPINERA  
Department of Entomology and Nematology Box 110620, Natural Area Drive  
University of Florida, Gainesville, FL 32611

## ABSTRACT

A dichotomous key is presented to aid in the identification of the adult stage of the 71 grasshopper species known to occur in Florida. Reflecting recent research one subspecies, *Schistocerca alutacea rubiginosa* (Scudder), has been elevated to species status *Schistocerca rubiginosa* (Harris) in this key.

Key Words: Acrididae, key, Orthoptera, morphology, systematics, taxonomy.

## RESUMEN

Se presenta una clave dicotoma para ayudar en la identificación del estadio adulto de 71 especies de saltamontes conocidos que ocurren en Florida. Una subespecie, *Schistocerca alutacea rubiginosa* (Scudder), ha sido elevada al nivel de especie, *Schistocerca rubiginosa* (Harris) en esta clave.

Grasshoppers comprising the family Acrididae (Orthoptera) are easily identifiable and are quite common in Florida. Seventy-one species of grasshopper belonging to five subfamilies are known to exist in Florida (Table 1). While this group of insects contains some dramatic variation, there are a few morphological features that remain fairly consistent. All acridids have 3-segmented tarsi, short ovipositors, tympana found on the sides of the first abdominal segment, and the antennae are almost always shorter than the body. Adults of some species are winged, while other species are wingless or have extremely reduced wings. Eggs are usually deposited in soil and in clusters or pods with as many as 100 eggs. Grasshoppers are hemimetabolous insects, and therefore go through a gradual metamorphosis. Each instar looks like a smaller version of the adult, with wings not fully formed until adulthood (in the winged species). All grasshoppers are plant feeders, but will occasionally feed on dead insects, leaf litter, or even dung.

Because of their economic importance, grasshoppers have been the subject of thousands of publications, many with identification keys included. One of the most comprehensive of these was attempted by Otte (1981, 1984) in which he developed keys to all the species of North America within the subfamilies Acridinae, Gomphocerinae, and Oedipodinae. However, most identification keys are regional in nature (e.g., Blatchley 1920; Dakin & Hays 1970; Capinera & Sechrist 1982; McDaniel 1987; Richman et al. 1993; Pfadt 1994) and only one was dedicated solely to the grasshoppers of Florida (Capinera et al. 2001). A key to the grasshoppers of Florida is particularly useful considering that 18 species are endemic and six more are found almost exclusively in Florida, with a range also including extreme southern

Georgia or Alabama. Thus, these species are absent from most other regional keys. While adequate for field identification, "Grasshoppers of Florida" (Capinera et al. 2001) does not contain a species-level key.

*Schistocerca rubiginosa* (Harris) has been an enigma in that it has been considered a species (Hubbell 1960; Helfer 1972), a subspecies of *Schistocerca alutacea* (Harris) (Morse 1904; Blatchley 1920), and a color phase of *S. alutacea* (Rehn 1901, 1902; Rehn & Hebard 1916). As mentioned by Blatchley (1920), the authors have found differences in the habitat preferences of *S. rubiginosa* and *S. alutacea* as well as significant morphological differences as mentioned in the key. *Schistocerca rubiginosa* is usually limited to dry sandy areas associated with scrub and turkey oaks whereas *S. alutacea* inhabits both xeric and mesic areas. Recently, a cladistic analysis of the *alutacea* group based on 22 morphological features found that *S. alutacea* and *S. rubiginosa* are, in fact, two separate species (Song 2004). This is a departure from the recent treatment of Florida grasshoppers by Capinera et al. (2001), so this change has been included.

Other species, such as *Melanoplus furcatus* and *M. symmetricus*, warrant additional study. They seem to represent different species based on the shape of the male cercus, normally a reliable character for differentiation of *Melanoplus* species. A related species or subspecies, designated as *M. clypeatus* (Blatchley 1920), has cerci intermediate in form, however, and because its status is uncertain, it is not recognized in this key. Blatchley differentiated *M. clypeatus* principally based on wing length, which often is a variable character in this genus. Suppression of *M. clypeatus* in this key follows Capinera et al. (2001). The other confusing

TABLE 1. GRASSHOPPERS (ORTHOPTERA: ACRIDIDAE) KNOWN TO OCCUR IN FLORIDA ARRANGED BY SUBFAMILY.

Subfamily	Genus	Species	
Acridinae	<i>Metaleptea</i>	<i>brevicornis</i> (Johannson)	
Cyrtacanthacridinae	<i>Aptenopedes</i>	<i>aptera</i> Scudder <i>sphenarioides</i> Scudder	
	<i>Eotettix</i>	<i>palustris</i> Morse <i>pusillus</i> Morse <i>signatus</i> Scudder	
	<i>Gymnoscirtetes</i>	<i>morsei</i> Hebard <i>pusillus</i> Scudder	
	<i>Hesperotettix</i>	<i>floridensis</i> Morse <i>osceola</i> Hebard <i>viridis</i> (Thomas)	
	<i>Leptysma</i>	<i>marginicollis</i> (Serville)	
	<i>Melanoplus</i>	<i>adelogyrus</i> Hubbell <i>apalachicola</i> Hubbell <i>bispinosus</i> Scudder <i>davisi</i> (Hebard) <i>forcipatus</i> Hubbell <i>furcatus</i> Scudder <i>gurneyi</i> Strohecker <i>impudicus</i> Scudder <i>inducifer</i> Hubbell <i>keeleri</i> (Thomas) <i>nanciae</i> Deyrup <i>ordwayae</i> Deyrup <i>propinquus</i> Scudder <i>puer</i> (Scudder) <i>punctulatus</i> Scudder <i>pygmaeus</i> Davis <i>querneus</i> Rehn and Hebard <i>rotundipennis</i> Scudder <i>sanguinipes</i> (Fabricius) <i>scapularis</i> Rehn and Hebard <i>scudleri</i> (Uhler) <i>strumosus</i> Morse <i>symmetricus</i> Morse <i>tepidus</i> Morse <i>tequestae</i> Hubbell <i>withlacocheensis</i> Squitier and Deyrup	
	<i>Paroxya</i>	<i>atlantica</i> Scudder <i>clavuliger</i> (Serville)	
	<i>Schistocerca</i>	<i>alutacea</i> (Harris) <i>americana</i> (Drury) <i>ceratiola</i> Hubbell and Walker <i>damnifica</i> (Saussure) <i>obscura</i> (Fabricius) <i>rubiginosa</i> (Harris) <i>vitreipennis</i> (Marschall)	
	<i>Stenacris</i>		
	Gomphocerinae	<i>Achurum</i>	<i>carinatum</i> (F. Walker)
		<i>Amblytropidia</i>	<i>mysteca</i> (Saussure)
		<i>Dichromorpha</i>	<i>elegans</i> (Morse) <i>viridis</i> (Scudder)
		<i>Eritettix</i>	<i>obscurus</i> (Scudder)
		<i>Mermiria</i>	<i>bivittata</i> (Serville) <i>intertexta</i> Scudder
			<i>picta</i> (F. Walker)
		<i>Orphulella</i>	<i>pelidna</i> (Bermeister)

TABLE 1. (CONTINUED) GRASSHOPPERS (ORTHOPTERA: ACRIDIDAE) KNOWN TO OCCUR IN FLORIDA ARRANGED BY SUBFAM-

Subfamily	Genus	Species
	<i>Syrbula</i>	<i>admirabilis</i> (Uhler)
Oedipodinae	<i>Arphia</i>	<i>granulata</i> (Saussure) <i>sulphurea</i> (Fabricius) <i>xanthoptera</i> (Burmeister)
	<i>Chortophaga</i>	<i>australior</i> (Rehn and Hebard)
	<i>Dissosteira</i>	<i>carolina</i> (Linnaeus)
	<i>Hippiscus</i>	<i>ocelote</i> (Saussure)
	<i>Pardalophora</i>	<i>phoenicoptera</i> (Burmeister)
	<i>Psinidia</i>	<i>fenestralis</i> (Serville)
	<i>Spharagemon</i>	<i>bolli</i> Scudder <i>crepitans</i> (Saussure) <i>cristatum</i> (Scudder) <i>marmorata</i> (Scudder)
	<i>Trimerotropis</i>	<i>maritima</i> (Harris)
Romaleinae	<i>Romalea</i>	<i>microptera</i> (Beauvois)

species complex needing further study is *Gymnoscirtetes morsei* and *G. pusillus*. These relatively rare grasshoppers are difficult to distinguish.

Having fresh specimens is helpful because much of the key involves the color of grasshoppers. Grasshopper specimens tend to lose much of their color, with the green colors turning brown after drying and preservation. However, wing color remains fairly distinct, with only slight fading after preservation. In the Oedipodinae, the left wing should be spread immediately after capture; however, very old specimens can be relaxed and the wings spread. While occasionally the abdomen will shrivel, this is relatively unimportant because the abdomen usually is not an important taxonomic feature. The cerci, supra-anal plate, and the sub-genital plate, which are very important in identification, are usually unaffected by this shriveling. Many of the melanopline species, and some others, are only identifiable based on male genitalia. For this reason, it is very important that males be collected from each population to associate with the females of the same species.

The following key only treats adult acridids, but can be used to identify all species currently known to occur in the state of Florida. Females are not always identifiable, so it is important to acquire males and identify females by association. In this key, length, when not specified otherwise, refers to the distance from the front of the head to the tip of the wings in long-winged species. In short-winged species, length refers to the distance from the front of the head to the tip of the abdomen. If the abdomen is shrunk or curved, the tips of the femora can be used instead, as this approximates the abdomen length.

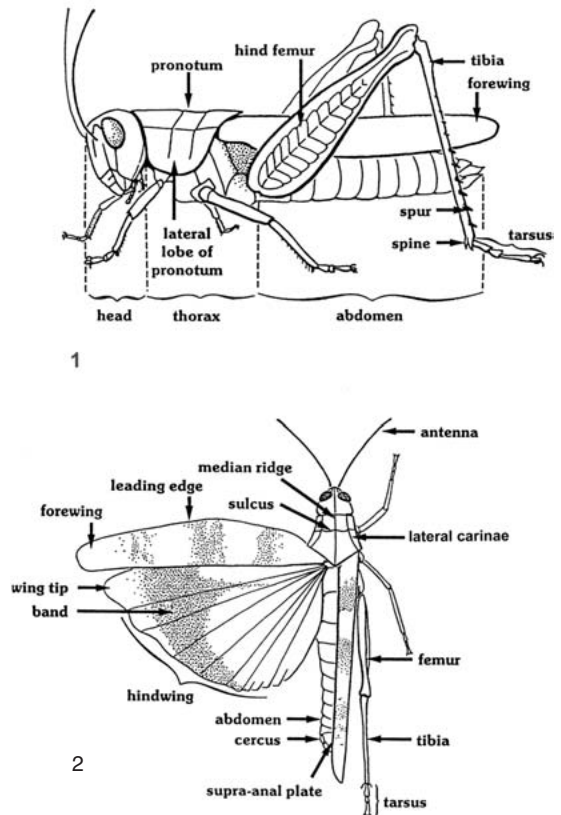


Fig. 1. Lateral view of a typical grasshopper.  
Fig. 2. Dorsal view of a typical grasshopper.

## KEY TO THE ADULT GRASSHOPPERS OF FLORIDA

1. Wings lacking, or apparently no wings . . . . . 2
- 1'. Wings present . . . . . 5
- 2(1). Small in size (12-22 mm in length); black stripe running along the sides of the body from the eyes to the tip of the abdomen; gold or brown in color; eyes round . . . . . 3
- 2'. Medium in size (15-33 mm in length), green or brown in color, eyes oval . . . . . 4
- 3(2). Males with dorsal edge of cerci strongly curved (Fig. 4B); tubercle at tip of subgenital plate about twice as high as wide (Fig. 4C) . . . . . *Gymnoscirtetes morsei*
- 3'. Males with dorsal edge of cerci not strongly curved (Fig. 5B); tubercle at tip of subgenital plate about as wide as high (Fig. 5C) . . . . . *Gymnoscirtetes pusillus*
- 4(2). No evidence of wings . . . . . *Aptenopedes aptera*
- 4'. Wings extremely reduced to small linear pads (If body is exceptionally long and narrow see *Achurum carinatum*) . . . . . *Aptenopedes sphenarioides*
- 5(1). Wing length short; wings distinct but less than, or about equal to, length of pronotum . . . . . 6
- 5'. Wing length longer than length of pronotum. . . . . 32
- 6(5). Body form exceptionally long and narrow (Fig. 6) (If body is not long and narrow see *Aptenopedes sphenarioides*) . . . . . *Achurum carinatum*
- 6'. Body form not long and narrow . . . . . 7
- 7(6). Body usually with a bold white stripe dorsally on pronotum or abdomen, or with distinct white lines running along the lateral ridges of pronotum . . . . . 8
- 7'. Body does not have a bold white stripe on pronotum and abdomen . . . . . 9
- 8(7). Body green in color; all antennal segments rounded; depression in the middle of vertex; small spine present ventrally between the forelegs (Fig. 7A) . . . . . *Hesperotettix osceola*
- 8'. Body color brown; first 9-10 segments of antennae flattened; vertex extending out beyond head to form a rounded point; spine not present between the forelegs. . . . . *Eritettix obscurus*
- 9(7). Body color uniformly bright green with, at most, a weak red stripe dorsally on pronotum . . . . . 10
- 9'. Body color other than bright green. . . . . 11
- 10(9). Heavy-bodied species with large pronotum; texture of pronotum rough; no stripes on wings . . . . . *Hesperotettix floridensis*
- 10'. Body form normal; texture of pronotum smooth; bold stripe running down the center of each wing; white and red stripe running along dorsal portion of the abdomen. . . . . *Hesperotettix osceola*
- 11(9). Small spine not present ventrally between forelegs . . . . . *Eritettix obscurus*
- 11'. Small spine present ventrally between base of forelegs (Fig. 7A) . . . . . 12
- 12(11). Body color iridescent yellowish, gold, or brown, sometimes with a black spot on pronotum; frontal costa raised and very pronounced all the way to the edge of the clypeus, frontal sutures also very pronounced (Fig. 8); uncommon. . . . . 13
- 12'. Body color indistinct brownish, reddish, or grayish, and with a black stripe or spot on side of pronotum; frontal costa not very pronounced and not running all the way to the edge of the clypeus, frontal sutures not pronounced . . . . . 15
- 13(12). Forewings slightly longer than pronotum, tibiae bright red. . . . . *Eotettix signatus*
- 13'. Forewings shorter than pronotum, tibiae orange, yellow, or pinkish . . . . . 14
- 14(13). Forewings nearly round. . . . . *Eotettix pusillus*
- 14'. Forewings oval. . . . . *Eotettix palustris*
- 15(12). Male with distinct conical structure (pallium) pointing upward near tip of abdomen (Fig. 9C, 10C) . . . . 16
- 15'. Male without distinct conical structure at tip of abdomen . . . . . 17
- 16(15). Cerci expanding at tip but flattened, lacking ventral point (Fig. 9B) . . . . . *Melanoplus rotundipennis*
- 16'. Cerci expanded and swollen at tip, with small ventral point (Fig. 10B) . . . . . *Melanoplus withlacoocheensis*
- 17(15). Tip of cerci forked with at least one branch or with tooth. . . . . 18

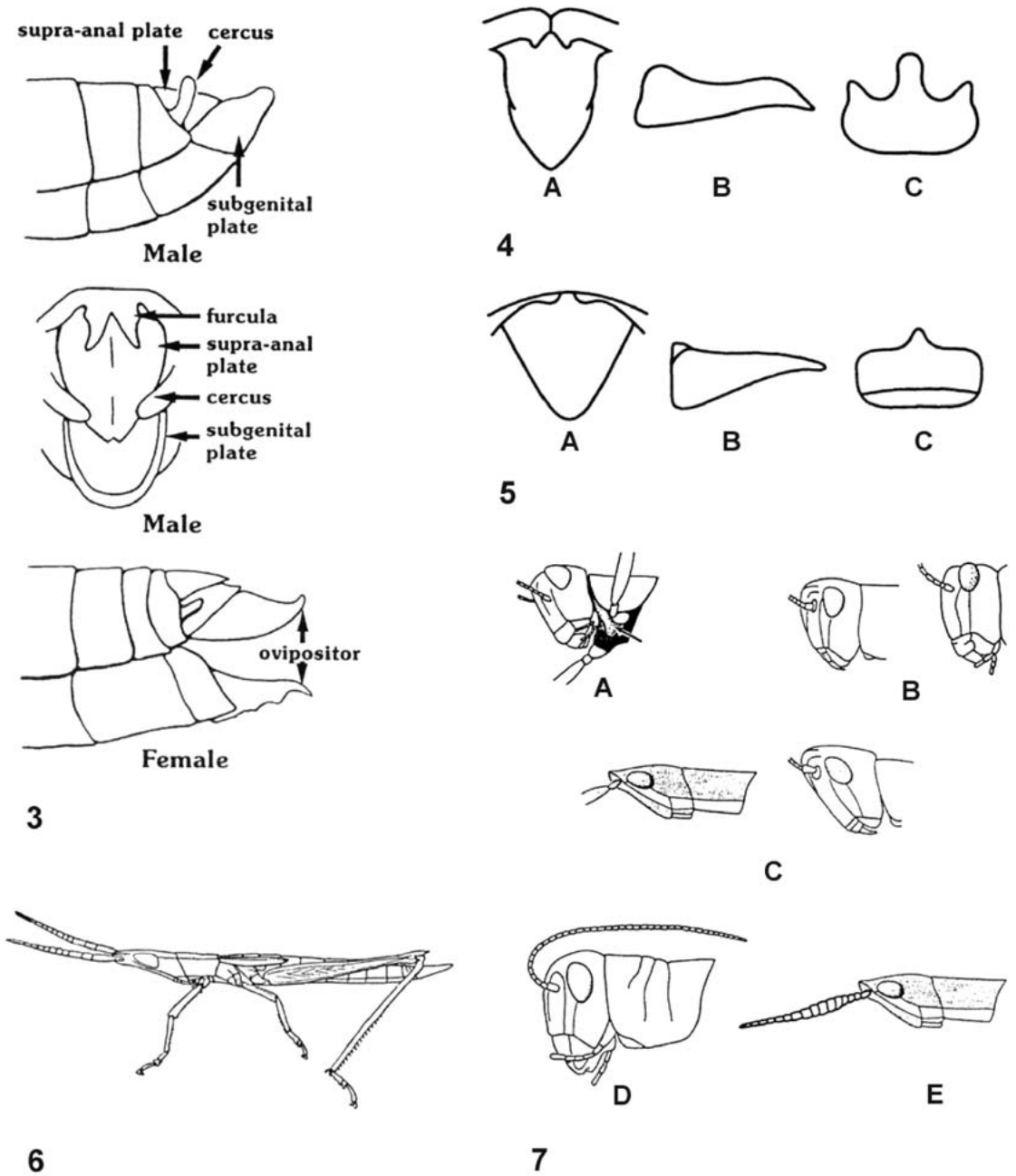


Fig. 3. Tip of abdomen in adult male and female grasshoppers.

Fig. 4. Male *G. morsei*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

Fig. 5. Male *G. pusillus*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

Fig. 6. *Achurum carinatum*.

Fig. 7. Ventral view of grasshopper showing spine between front legs (A), examples of grasshoppers with face not strongly slanted (B), examples of grasshoppers with a strongly slanted face (C), examples of threadlike antenna (D) and sword-shaped antenna (E).

17'. Tip of cerci not forked or branched ..... 22

18(17). Cerci forked or split, with branches pointed dorsally and ventrally. .... 19

18'. Cerci not forked, tooth pointed ventrally ..... 21

19(18). Cerci expanding from base before dividing into dorsal and ventral projections (Fig. 11B) . . . . .	
. . . . .	<i>Melanoplus scapularis</i>
19'. Cerci tapering slightly before dividing into dorsal and ventral projections. . . . .	20
20(19). Cerci divided into dorsal and ventral projections near the tip (Fig. 12B) . . . . .	<i>Melanoplus furcatus</i>
20'. Cerci divided in the center into a long spine dorsally and a rounded lobe ventrally (Fig. 13B) . . . . .	<i>Melanoplus nanciae</i>
21(18). Cerci with large ventral tooth and small dorsal teeth on upper and inner surfaces (Fig. 14B); found in scrub habitats throughout central Florida. . . . .	<i>Melanoplus forcipatus</i>
21'. Cerci with ventral tooth slender, lacking teeth on inner surface (Fig. 15B); found only in sandy habitats along the southeastern coast of Florida, north of West Palm Beach . . . . .	<i>Melanoplus indicifer</i>
22(17). Cerci tapering to a point . . . . .	23
22'. Cerci not tapering to a point . . . . .	28
23(22). Furcula visible (Fig. 3) . . . . .	24
23'. Furcula not visible (Fig. 20A, 21A) . . . . .	27
24(23). Cerci tapering rapidly, and triangular (Fig. 16B) . . . . .	<i>Melanoplus davisii</i>
24'. Cerci very narrow and not triangular . . . . .	25
25(24). Stripe on lateral lobe of pronotum narrows posteriorly; dorsal surface of subgenital plate with a triangular point (Fig. 17C) . . . . .	<i>Melanoplus puer</i>
25'. Stripe on lateral lobe of pronotum expands posteriorly; dorsal surface of subgenital plate rounded . . . . .	26
26(25). Cerci taper abruptly on dorsal margin (Fig. 18B) . . . . .	<i>Melanoplus apalachicola</i>
26'. Cerci taper equally on dorsal and ventral margins (Fig. 19B) . . . . .	<i>Melanoplus gurneyi</i>
27(23). Found only in north-central Florida in Putnam and Clay counties; cerci longer than supra-anal plate (Fig. 20A,B) . . . . .	<i>Melanoplus ordwayae</i>
27'. Found only in south-central Florida, from Orlando south to Lake Okeechobee; cerci about as long as supra-anal plate (Fig. 21A,B) . . . . .	<i>Melanoplus tequestae</i>
28(22). Cerci broad, tapering only slightly (Fig. 22B) . . . . .	<i>Melanoplus scudderii</i>
28'. Cerci expanding slightly beyond middle or spoon shaped (Fig. 23B) . . . . .	29
29(28). Furcula short and rounded, or not visible . . . . .	30
29'. Furcula evident and pointed . . . . .	31
30(29). Furcula very short (Fig. 24A) . . . . .	<i>Melanoplus adelogyrus</i>
30'. Furcula not visible (Fig. 25A) . . . . .	<i>Melanoplus pygmaeus</i>
31(29). Furcula large, about 1/2 the length of the supra-anal plate (Fig. 26A) . . . . .	<i>Melanoplus strumosus</i>
31'. Furcula short, about 1/4 the length of the supra-anal plate or less (Fig. 23A) . . . . .	<i>Melanoplus tepidus</i>
32(5). Wing length intermediate; wings appreciably longer than pronotum but not attaining tip of abdomen . . . . .	33
32'. Wing length long; wings nearly attaining tip of abdomen or extending beyond the tip . . . . .	37
33(32). Size small (16-28 mm); color usually grass green . . . . .	34
33'. Size medium to large (typically >28 mm); not green . . . . .	36
34(33). Purple or purple and white dorsal stripe present on pronotum . . . . .	<i>Hesperotettix viridis</i>
34'. Dorsal stripe normally absent from pronotum; if present, stripe is brownish . . . . .	35
35(34). Lateral carinae on the pronotum cut by a single sulcus; head enlarged (Fig. 27B) . . . . .	<i>Dichromorpha elegans</i>
35'. Lateral carinae on the pronotum cut by two sulci; head not enlarged (Fig. 27A) . . . . .	<i>Dichromorpha viridis</i>
36(33). Size medium (22-40 mm); color usually grayish or brownish; hindwings transparent; subgenital plate deeply notched (Fig. 28C) . . . . .	<i>Melanoplus querneus</i>
36'. Size large (43-70 mm); forewing color some combination of black, yellow, and reddish; hindwings brilliant red . . . . .	<i>Romalea microptera</i>
37(32). Hindwings distinctly pigmented, usually brightly colored with transverse black band . . . . .	38

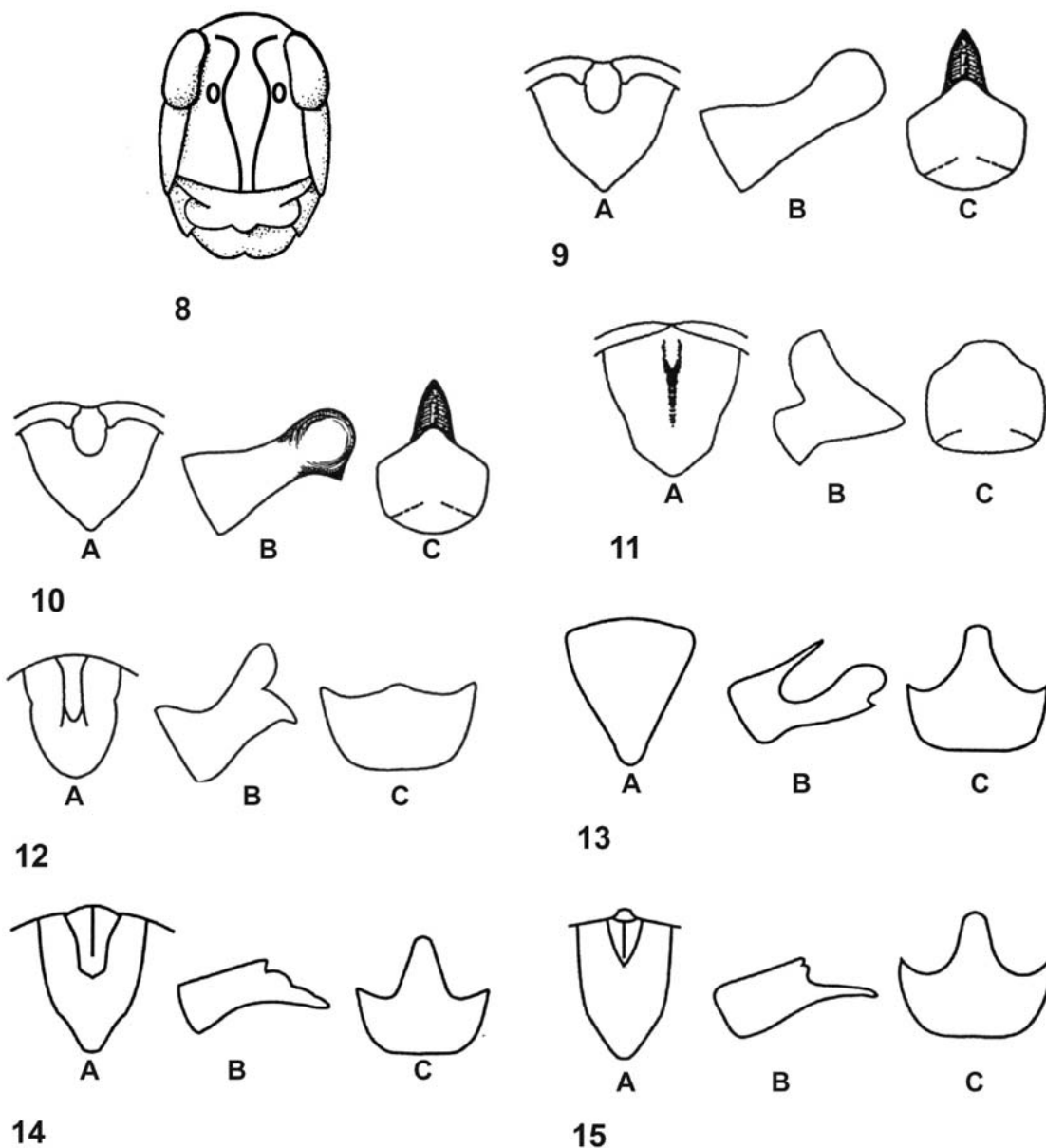


Fig. 8. Face of *Eotettix* spp.

Fig. 9. Male *M. rotundipennis*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

Fig. 10. Male *M. withlacoocheensis*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

Fig. 11. Male *M. scapularis*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

Fig. 12. Male *M. furcatus*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

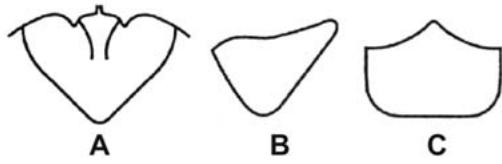
Fig. 13. Male *M. nanciae*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

Fig. 14. Male *M. forcipatus*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

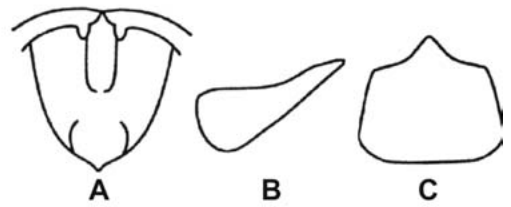
Fig. 15. Male *M. indicifer*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

- 37'. Hindwings not distinctly pigmented, usually transparent except for wing veins . . . . . 53
- 38(37). Hindwings orange or pinkish . . . . . 39
- 38'. Hindwings other than orange or pink . . . . . 42
- 39(38). Transverse black band of hindwings wide, about 1/3 the width of the wing, and crossing near the center of the wing . . . . . 40

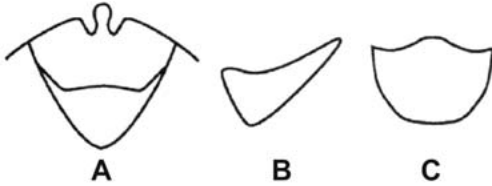




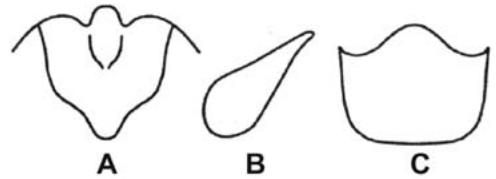
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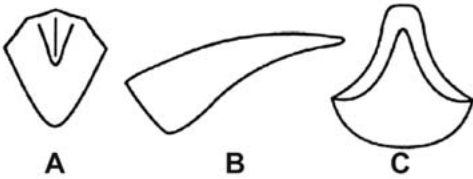
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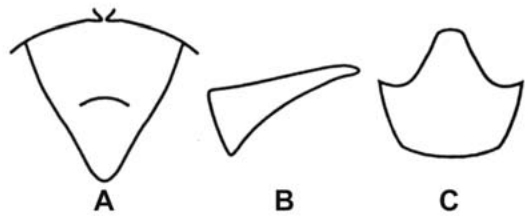
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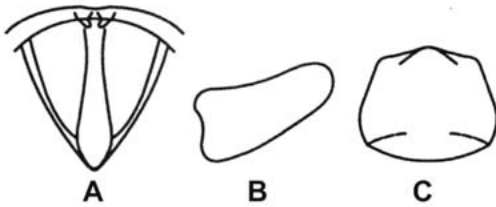
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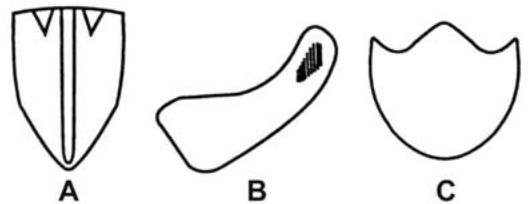
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21



22



23

- Fig. 16. Male *M. davisi*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 17. Male *M. puer*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 18. Male *M. apalachicola*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 19. Male *M. gurneyi*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 20. Male *M. ordwayae*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 21. Male *M. tequestae*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 22. Male *M. scudderi*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).
- Fig. 23. Male *M. tepidus*; supra-anal plate and furcula (A), cercus (B) and subgenital plate (C).

- 39'. Transverse black band of hindwings not wide, about 1/4 the width of the wing or less, and not located centrally ..... 41
- 40(39). Hind tibiae yellowish with black band; basal segments of antennae strongly flattened. .... *Psidinia fenestralis*
- 40'. Hind tibiae orange or red, yellow basally; basal segments of antennae weakly flattened ..... *Spharagemon marmorata*

41(39). Hind tibiae yellow; inner face of hind femora yellow and black . . . . .	<i>Hippiscus ocelote</i>
41'. Hind tibiae orange; inner face of hind femora orange, blue, and black . . . . .	<i>Pardalophora phoenicoptera</i>
42(38). Hindwings yellow . . . . .	43
42'. Hindwings black or largely transparent . . . . .	52
43(42). Hindwings pale yellow basally, tips usually cloudy . . . . .	44
43'. Hindwings pale yellow basally, tips usually transparent . . . . .	48
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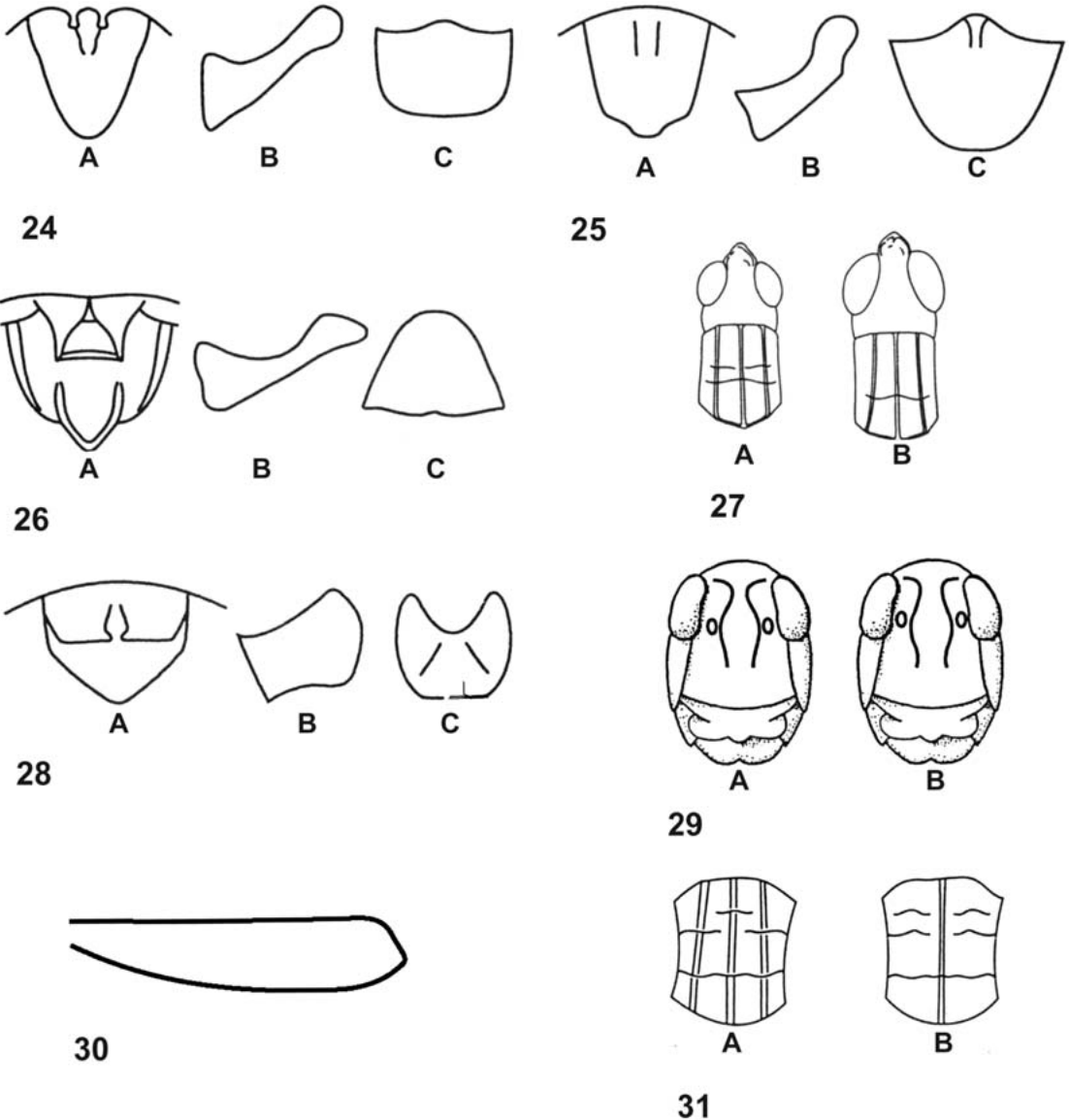


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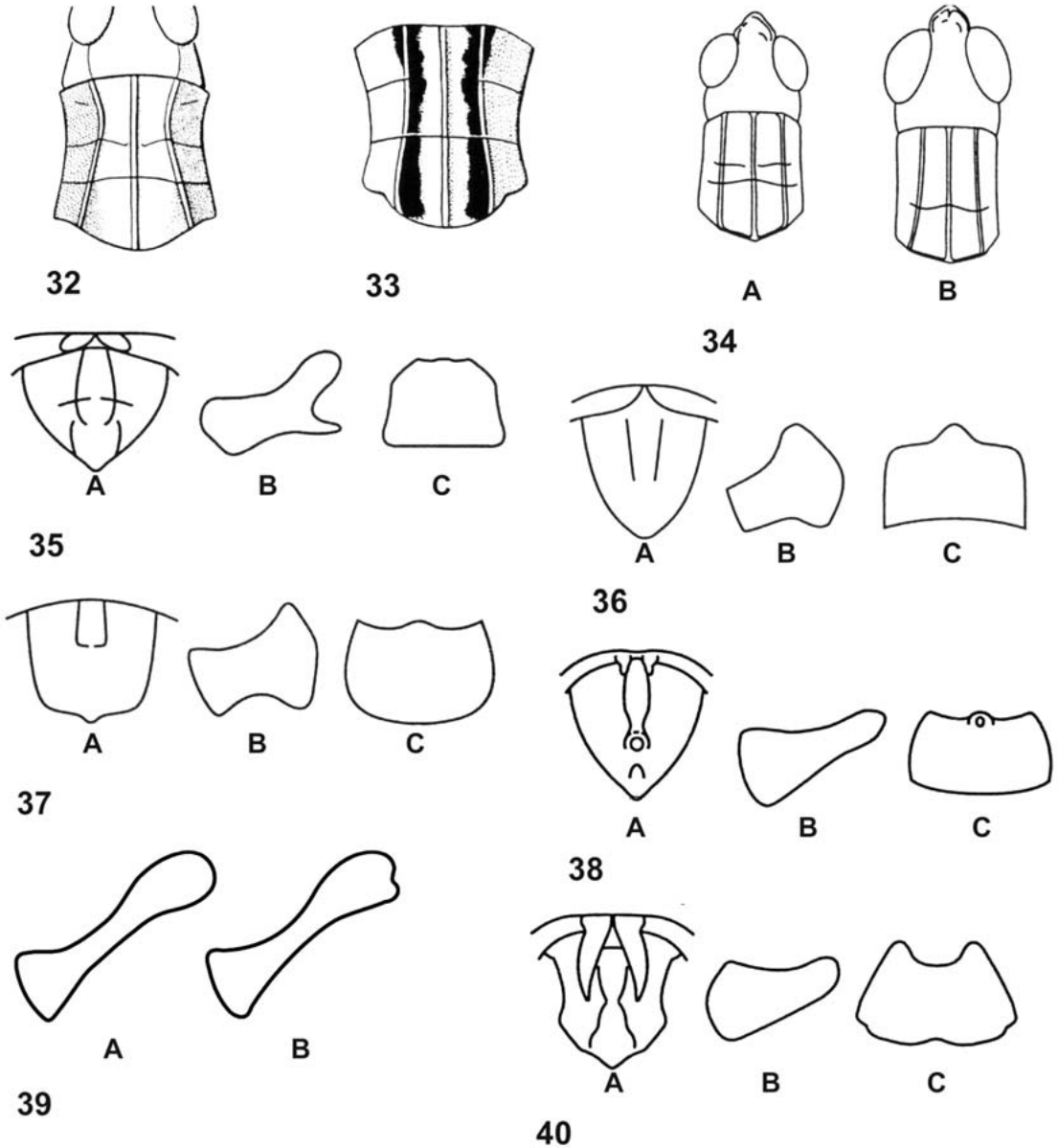


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79'. Pronotum lacking elevated medial ridge; antennae much longer than head and pronotum, especially in males; body size large; males 30-46 mm, females 42-67 mm . . . . . 80

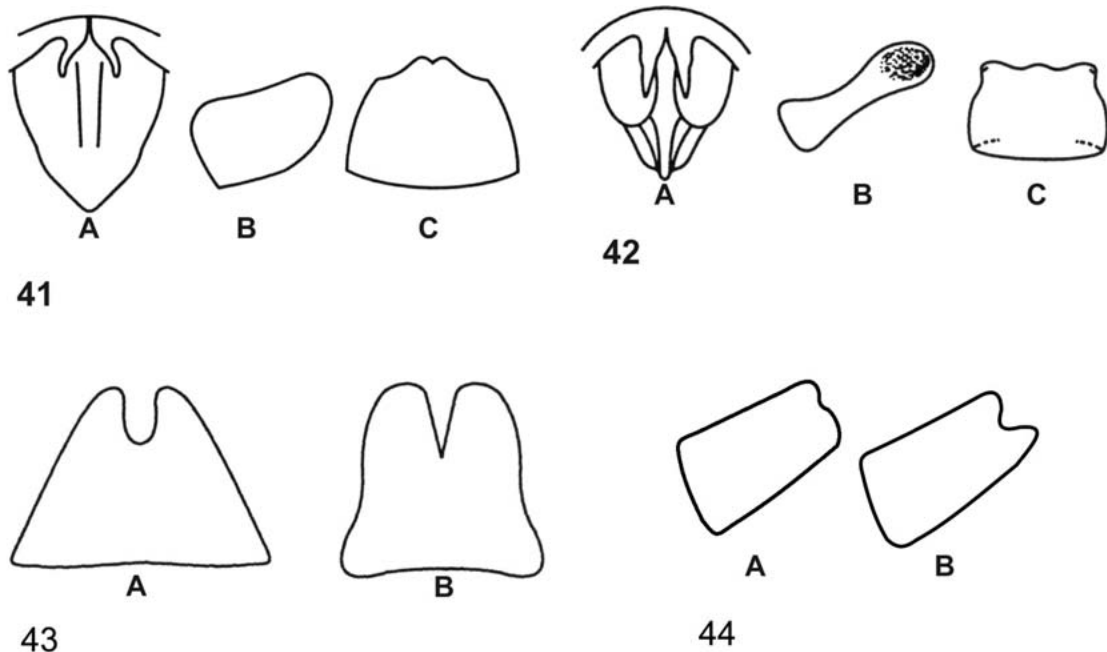


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