

Chapter 20

Scentless Plant Bugs (Rhopalidae)

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Abstract Rhopalidae are closely related to the much more speciose Coreidae, and like them are plant feeders, although more associated with reproductive tissues and seeds. The two rhopalid subfamilies, Rhopalinae and Serinethinae, occur worldwide, with the latter more restricted to tropical latitudes. About 38 % of the ca. 210 rhopalid species and 38 % of the 21 genera have at least partially Neotropical distributions. The serinethine genus *Jadera* Stål is particularly associated with the Neotropics and like other members of the subfamily feeds on seeds of Sapindaceae (soapberry family). Most Neotropical rhopalid species are unstudied, and few appear to have major economic importance. However, serinethines are important models in insect reproductive life history, behavior, and human-induced evolution. Rhopalids are not scentless, and a more accurate family name is needed.

20.1 Introduction

The rhopalids are a small worldwide family of approximately 200 species of plant-feeding bugs in 21 genera and 209 species (Henry 2009). Formerly treated as a subfamily of the Coreidae, usually with the name Corizinae, Schaefer (1965) ended a century of taxonomic controversy with his definitive elevation of these insects to family Rhopalidae, with subfamilies Rhopalinae and Serinethinae. Chopra (1967)

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Table 20.1 Summary of the known number of Rhopalidae genera and species for the Australian (1), Nearctic (2), Neotropical (3), Palearctic (4) and regions and the world (5)

Australian		Nearctic		Neotropical		Palearctic		World	
Genus	Species	Genus	Species	Genus	Species	Genus	Species	Genus	Species
2	6	10	39	9	81	14	69	21	209

(1) Based on Cassis and Gross (2002)

(2) Based on chapters in Henry (1988)

(3) Based on this chapter

(4) Based on chapters in Aukena and Rieger (1995–2006)

(5) Based on Henry (2009)

extensively revised the tribal classification of the family and included keys to subfamilies, tribes, and genera. Göllner-Scheiding (1983) published a world catalog of the family. In Rhopalinae there are approximately 150 species in six tribes and 17 genera, while the Serinethinae (soapberry bugs) consist of about 65 species in three genera.

For the Neotropical region, four of the six rhopaline tribes are present (Table 20.1), with none of these being exclusive to the New World. Likewise, two of the three serinethine genera are present, and the genus *Jadera* Stål is exclusive to the New World.

Several partial catalogs have been developed for South America: Argentina (five species in two genera, Pennington 1920–1921, and 35 species in five genera, Coscarón 2014), mainland Ecuador (10 species in four genera, Froeschner 1981), the Galápagos Islands (three species in three genera, Froeschner 1985), Nicaragua (12 species in six genera, Maes and Göllner-Scheiding 1993), and Panama (14 species in four genera, Froeschner 1999). In addition, for Brazil, Grazia et al. (2012) refer to five genera with 26 species, namely, the rhopalines *Niesthrea* Spinola (six spp.), *Liorhysus* Stål (one sp.), *Harmostes* Burmeister (eight spp.), and *Xenogenus* Berg (two spp.), and the serinethine *Jadera* (nine spp.).

Only a few species of Neotropical rhopalids have been studied in any detail, and scientific knowledge of the general biology and ecology of this fauna is largely incomplete. In-depth information is available for a few *Jadera* species, though mainly at the margins of the Neotropical region in southern Florida and southern Brazil (e.g., Carroll et al. 2003a, b; Panizzi et al. 2005). To encourage further study, Carroll and Loye (2012) reviewed host associations of *Jadera* with plant species in the soapberry family (Sapindaceae). Much remains to be learned about the systematics of Neotropical rhopalids, as well as their potential economic importance (González 1989). While there are no comprehensive keys for identification of the Neotropical rhopalid species, Pall and Coscarón (2012) have provided one for the Argentinian taxa, along with photographs and range maps. The Web site “Soapberry Bugs of the World” (www.soapberrybugs.org) is a center for information on serinethines.

20.2 General Characteristics and Diagnosis

Rhopalids have four-segmented mouthparts and antennae. They may resemble coreids but are generally narrower and smaller bodied (although a few Neotropical serinethines reach or exceed 15 mm in body length). Most rhopalines are much smaller than most serinethines and generally dull brownish in color. In contrast, many serinethines have contrasting coloration with bright red, orange, and black. Rhopalids are often misidentified, and other insects are likewise mistaken for rhopalids. The distinct paired ocelli between the eyes (Fig. 20.1a) distinguish serinethines from Pyrrhocoridae such as *Dysdercus* Guérin-Ménéville, which lack ocelli. The rhopalid forewing membrane has close to 20 slender parallel veins arising from a transverse basal vein (Fig. 20.1a), further distinguishing serinethines from Pyrrhocoridae and the superficially similar Lygaeine Lygaeidae and rhopalines from the similar Orsillinae Lygaeidae, all of which have just 4–5 major veins in the membrane. Adult rhopalids lack the scent glands on the thorax between the middle and hind coxae present in Coreidae and Lygaeidae and are also unusual in retaining functional dorsal abdominal glands between the 4–5 and 5–6 terga (Fig. 20.1b).

The commonly applied name for this family, “scentless plant bugs,” reflects the absence of metathoracic scent glands in serinethines. However, this name is misleading and inappropriate because these and other rhopalids commonly produce redolent compounds from scent glands (Aldrich et al. 1990a). Members of the more diverse subfamily, Rhopalinae, in fact possess fully functional metathoracic scent glands as adults, in common with other hemipterans (Aldrich et al. 1990a; Davidova-

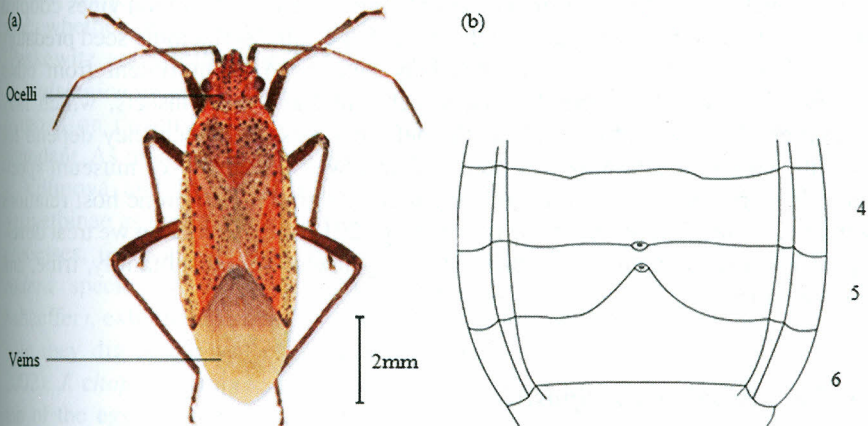


Fig. 20.1 (a) *Jadera choprai* Göllner-Scheiding; the ocelli distinctly raised. The front wing membrane has many veins of similar size. (b) *Liorhyssus hyalinus*. Image adapted from Davidova-Vilímová et al. (2000). The dorsal abdominal glands between 4–5 and 5–6; the terga are unusual among Hemiptera because they remain functional in the adult stage

Vilímová et al. 2000). Moreover, both subfamilies retain the anterior dorsal abdominal gland usually found only in immature Heteroptera (Davidova-Vilímová et al. 2000), and adult males also secrete fragrances from glands in the genitalia (Aldrich 1988; Aldrich et al. 1990a). If the vestigial metathoracic scent glands of Serinethinae indeed indicate a reduced capacity for synthesis of de novo chemical defense, it may have evolved in association with their conversion of toxic cyanogens from the seeds of their host plants (Braekman et al. 1982). They can secrete, excrete, and bleed these toxins to defend against predators (Aldrich et al. 1990b). Ribeiro (1989) found that predatory birds and toads rejected *J. haematoloma* (Herrich-Schäffer) after initially ingesting them. However, glandular secretions may have an additional function in rhopalids. Schwartz et al. (2009) reported that the odorous monoterpene secretions from the dorsal abdominal glands of *Boisea* Kirkaldy, which the insects actively spread across their cuticles with the legs, inhibit the germination and halt the growth of the fungal pathogen *Beauveria bassiana* (Bals.), which is potentially lethal to serinethines (Reinert et al. 1999). Accordingly, the redolent glandular products and vascular toxins of rhopalids likely serve multiple important functions in these insects.

20.3 General Biology and Ecology

To varying extents, rhopalids specialize on particular host plant taxa as food resources for growth and reproduction. In consequence, many aspects of the general biology and ecology may be predicted from knowledge of host plant range, phenology, morphology, and chemical characteristics. In some cases there is evidence of host–rhopalid coevolution, as in the variably inflated fruits of balloon vines coupled with variation in the mouthpart lengths of their specialist serinethine seed predators (e.g., Carroll 1988). Even specialists may take water or nutriment from other sources, however, including flowers, sweet fruits, and dead insects, which may sometimes lead to confusion about the definitive host on which they depend for growth and reproduction. In addition, probably well under 1 % of museum specimens have reliable host records, making it challenging to determine host relations without focused field studies (Carroll and Loye 2012). In this section we treat development and reproduction in further detail, organized around subfamily, tribe, and host relations.

20.3.1 Eggs and Oviposition

Rhopalids typically lay their eggs on or near host plants. The most extensive analysis of rhopalid eggs was undertaken by Vilímová and Rohanová (2010). They found that the differences in egg characteristics between tribes supported Schaefer and Chopra's (1982) treatment of Rhopalidae. Detailed studies of eggs and oviposition have not been made for most Neotropical rhopalids, so that we have included

observations from temperate and subtropical congeners and conspecifics to describe some key attributes.

All rhopaline eggs have two micropylar processes, and this conformation is regarded as the ancestral state by Vilímová and Rohanová (2010). Tribe Rhopalini, with characters such as poorly defined pseudopercula, appears to be the most primitive. The widely distributed rhopaline *Liorhyssus hyalinus* (F.) typically lays eggs on host sepals or nearby stems and leaf midribs.

Until now, contributions on instars included *Arhyssus hirtus* (Torre-Bueno) (Wheeler and Henry 1984), *A. lateralis* (Say) (Paskewitz and McPherson 1983), *Esperanza texana* Barber (Wheeler and Henry 1984), *Harmostes* (*Harmostes*) *reflexulus* (Say) (Yonke and Walker 1970a, b), *Liorhyssus hyalinus* (F.) (Cornelis et al. 2012), *Niesthrea louisianica* Sailer (Wheeler 1977), *Rhopalus* (*Brachycarenum*) *tigrinus* (Schilling) (Wheeler and Hoebeke 1988) and *R. (Rhopalus) parumpunctatus* Schill. (Stroyan 1954), and *Xenogenus gracilis* Reed (Diez and Coscarón 2015).

Eggs may be parasitized by Hymenoptera in the *Telenomus podisi* (Ashmead) group (Cornelis et al. 2012).

In tribe Harmostini, the attachment stalk is not developed. *Harmostes reflexulus* (Say) lays one to four eggs on the floral pappi of Asteraceae. Eggs require about 8 days to hatch over an average month-long oviposition period (Yonke and Walker 1970a, b).

The ovoid eggs of Niesthreini are deposited in small loose clusters (Vilímová and Rohanová 2010) and have hexagonal surface reticulation on the chorion (Paskewitz and McPherson 1983). Within this group the pseudoperculum ranges from well defined (e.g., *Niesthrea louisianica* Sailer) to poorly defined [e.g., *Arhyssus* Stål and *N. sidae* (F.)]. Each egg is attached by a thin, short strand protruding from the dorsal side; whether this is homologous with egg stalks in Chorosomatini is uncertain (Paskewitz and McPherson 1983; Vilímová and Rohanová 2010). Overwintered *N. louisianica* oviposit on the undersides of leaves in spring; successive generations oviposit on flower pedicels as buds develop and fruits and seeds become more abundant. As many as 1,000 eggs may be laid by a single female (Wheeler 1977).

Vilímová and Rohanová (2010) regard the egg characteristics of subfamily Serinethinae as derived relative to the Rhopalinae. Rather than just two micropylar processes, 6–45 are present, arranged in one or two broad circles. At least two *Jadera* species, *J. chopraei* Göllner-Scheiding and *J. haematoloma* (Herrich-Schaeffer), exhibit a rare oviposition behavior, burying their nearly round eggs in a hole they dig in the soil using their forelegs (Carroll 1988, 1991; Panizzi et al. 2002). *J. chopraei* nymphs are able to emerge even when extra soil is deposited on top of the eggs (Panizzi et al. 2002). These authors speculated that burying may deter predation and prevent desiccation. Burying eggs may be more widespread within the genus, but is not universal. For example, *J. obscura* (Westwood) and *J. coturnix* (Burmeister) feeding on host vines in the canopy drop their eggs to the ground. This oviposition coincides with the dehiscence of host seeds from the canopy to the forest floor [Wolda and Tanaka 1987; Tanaka and Wolda 1987 (as *J. aeola*)].

20.3.2 Nymphal Feeding and Development

Little is known about the biology of juvenile tropical rhopalines. In the Nearctic, bivoltine *Arhyssus lateralis* (Say) develops during the summer months and requires about 40 days to mature (Paskewitz and McPherson 1983). *Niesthrea louisianica* matures in about 25 days (Wheeler 1977), and *Harmostes reflexulus* requires 22 days to eclose after hatching, with most time in the 1st and 5th instars (4.7 and 6.7 days, respectively; Yonke and Walker 1970a, b).

More is known about nymphal feeding and development in Neotropical serinethines. Nymphs of *Jadera choprai* in southern Brazil feed and develop on the sapindaceous weedy balloon vine, *Cardiospermum halicacabum* (L.) (Panizzi and Hirose 2002; Panizzi et al. 2002, 2005), which is common among row crops (Lorenzi 2000). In the laboratory more than 75 % of nymphs complete development on mature balloon vine seeds, with nymphs reared in groups surviving better. Group rearing also speeds development time (average 35 days in groups, 40 days alone; Panizzi et al. 2005). Often, groups of nymphs are found feeding on a single seed, forming a cluster around the seed; the many stylet sheaths left behind after each feeding session are visible on the seed surface (Fig. 20.2a, b). These authors also provide a detailed description of the eggs and nymphs of this species. Similarly, *J. obscura* on Barro Colorado Island in Panama develop over a 5–6-week span, feeding on seeds of sapindaceous canopy and light gap lianas in aggregations that may exceed a million individuals in number (Wolda and Tanaka 1987; Carroll and Loye 1987). Wolda and Tanaka (1987) described nymphal development of this species in detail.

Jadera haematoloma, which ranges from the United States to South America and has been accidentally introduced to Hawaii and Taiwan, develops on ten or more native and introduced sapinds (Carroll and Loye 2012). Development time is similar

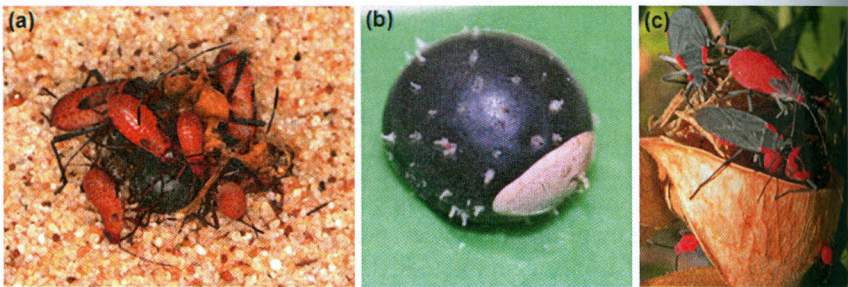


Fig. 20.2 Rhopalid bug nymphs and adults feeding on a single mature host fruit or seed: (a) nymphs of *Jadera choprai* feeding on a mature seed of the balloon vine *Cardiospermum halicacabum*; (b) mature seed of *C. halicacabum* showing stylet sheaths left on the seed integument after each feeding session (Photos AR Panizzi); (c) nymphs and adults of *Jadera haematoloma* on the dehiscent fruit of the balloon vine *Cardiospermum corundum*. Clusters of feeding nymphs may completely cover a seed, forming a bright red “ball of bugs” around it (Photo SP Carroll)

to that reported for other *Jadera*. In Florida, USA, this native insect, after adopting an invasive Asian ornamental tree as a host in Florida in the mid-twentieth century, has evolved to a remarkable degree in many traits, including egg size, developmental ability, and the length of mouthparts used in feeding on host seedpods (Carroll and Boyd 1992; Carroll et al. 1997, 1998, 2003a). Experiments rearing bugs from both hosts on either native or nonnative host seeds indicate that the offspring of early colonists from the native balloon vine host probably survived and developed poorly on the introduced tree at the time they first colonized it but now exploit that host with an efficiency similarly to which their ancestors from the native host showed on the native host. The derived population on the tree has, however, lost its ability to perform well on the native host (Carroll et al. 1998). Ironically, the most detailed description of the nymphal stadia of this species is in a beautifully complete review of the species by Tsai et al. (2013), based on observations of the recently introduced population in Taiwan. Nymphs and adults of *J. haematoloma* cluster on seeds of the balloon vine *Cardiospermum corundum* (L.) forming a bright red "ball of bugs" around it (Fig. 20.2c).

20.3.3 Adult Feeding and Reproduction

In contrast to rhopalines, fewer serinethines enter temperate latitudes, although the two New World *Boisea* are largely temperate (Carroll and Loye 2012). *Boisea trivittata* (Say) enters tropical latitudes in eastern Mexico, where its patchy highland distribution matches that of its otherwise north temperate host tree, *Acer negundo* L. Globally, sapinds in the widely distributed balloon vine genus *Cardiospermum* L. are the most commonly used, though many others among the over 150 sapind genera and close to 2,000 species are also exploited, particularly in the Paleotropics, by the third serinethine genus *Leptocoris* Hahn (Carroll and Loye 2012). The Neotropical sapind flora is distinctive in that the 500 species of sapind lianas in the five genera *Cardiospermum*, *Paullinia* L., *Serjania* Mill., *Thinouia* Planch. & Triana, and *Urvillea* Kunth constitute 60 % of regional family diversity and >25 % of the world family diversity (Acevedo-Rodríguez et al. 2011). The majority of the native host records for *Jadera* (the principal Neotropical serinethine) are from these genera, suggesting that much of the diversification of *Jadera* has occurred in association with these host radiations (Carroll and Loye 2012).

Adult feeding and reproduction of *J. choprai* has been extensively studied. In the laboratory, on mature seeds of the balloon vine *C. halicacabum*, males lived on average for 86.6 days, while females lived for 47.7 days; average fecundity (number of eggs/female) was 146.4 eggs and egg hatchability 85.3 % (Panizzi et al. 2005). *J. haematoloma* in Florida has similar vital statistics, but lays about twice as many eggs in captivity (Carroll et al. 1998, 2003b). Both species are flight and wing polymorphic. In *J. haematoloma*, there are four types, which in females are long-

winged flyers that retain the flight muscles after mating (and presumably feeding), long-winged flyers that histolyze the muscles after feeding and mating, long-winged bugs that do not develop flight muscles, and short-winged bugs that do not develop flight muscles (Dingle and Winchell 1997). The flight morphs differ in life history, with flying individuals, which tend to be larger, having a much later age of first reproduction, while flightless bugs become reproductive within a few days of eclosion if food is present. Histolyzing bugs represent an intermediate state in terms of reproductive options, and flight morph frequencies appear to be evolving in populations on introduced hosts that differ from the native hosts in the spatial and temporal availability of seeds (Carroll et al. 2003b).

A risk of flightlessness in *J. haematoloma* and likely other *Jadera* is that flightless individuals are not capable of physiological diapause in the absence of food (Carroll et al. 2003b). Thus, the reproductive life span of congenitally flightless individuals depends on the persistence of seeds within a highly circumscribed locale. Temperate populations of this species in the central United States enter a photoperiodic diapause as day length declines in advance of the winter season. In subtropical Florida, seeds of *Cardiospermum* are available most of the year but are locally sporadic depending on plant phenology and the activities of the multi-taxon community of seed predators (Carroll et al. 2003b; Carroll and Loye 2006). Flight-capable adults there do not diapause in response to shortening day length but, in addition to being able to fly in search of more productive sites, are also able to enter a starvation-based diapause that will be advantageous during periods of low seed availability at local and regional scales (sensu Dingle 1972; Dingle and Arora 1973).

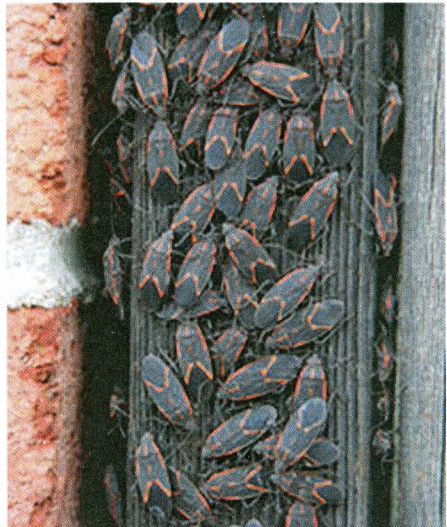
On Barro Colorado Island in Panama, *J. obscura* and *J. coturnix* diapause during much of the year due to rather synchronous seed predation in their primary liana hosts (Wolda and Tanaka 1987; Tanaka and Wolda 1987). During this period, *J. obscura*, which is entirely volant, travels the understory in swarms that may exceed 100,000 individuals, taking moisture from the leaves of small nonhost trees. *J. coturnix* (which is often referred to by the invalid name *J. aeola*) similarly diapauses and then produces two generations during the late dry season (Tanaka and Wolda 1987). The first generation is produced by volant adults coming out of a 10-month dormancy. They aggregate on newly mature host seeds and oviposit around those hosts. The developing offspring then consume much of that year's seed crop, and upon emerging as adults many fly to sheltered locations, aggregating beneath understory leaves to await for the next year's seeds. A subset of the bugs however emerges as small, short-lived, but highly fecund flightless and short-winged individuals that will neither migrate nor diapause, but instead quickly feed on remnant seeds, mate, and oviposit. All resulting offspring in laboratory trials were long winged, suggesting that the risky tactics of producing a subset of obligatorily reproductive individuals that are incapable of diapausing are coordinated to produce diapausing offspring (Tanaka and Wolda 1987). Circumstances permitting lineages that succeed in completing

this extra cycle could potentially greatly out-reproduce lineages constrained to the more conservative tactic with a single annual generation.

In summary, diapausing aggregations that may reach enormous numbers are a common feature of volant adult serinethines, whether the diapause is induced by photoperiod in cold winter areas, by predictable food shortages when host seed production is highly seasonal, or during periods of food shortage that are not as predictable (Fig. 20.3). Both New World *Jadera* and Old World *Leptocoris* commonly cluster beneath the green leaves of hosts or other nearby plants for weeks to many months in advance of the next period of seed production (Tanaka and Wolda 1987; Wolda and Tanaka 1987; Tanaka et al. 1987; Carroll et al. 2005; Zych 2010). Densities may reach up to 500 bugs/leaf (Wolda and Tanaka 1987). These and especially the third soapberry bug genus, *Boisea*, are renowned nuisance pests in many regions based on their propensity to aggregate and to enter homes in large numbers (e.g., Schowalter 1986, Fig. 20.3). This behavior of serinethines may not have been reported in the Neotropics.

While diapause is less well studied in the subfamily Rhopalinae, there is evidence of diapause in temperate populations of rhopalines with partially Neotropical ranges. In the Niethreini, this includes *N. louisianica* Wheeler (1977) and *A. lateralis*, Readio (1928), and in the Harmostini *H. reflexulus* (Yonke and Walker 1970a).

Fig. 20.3 Adult *Boisea trivittata* aggregate during nonreproductive periods and may inhabit buildings in large numbers (Photo courtesy of Jodi Green under Creative Commons <https://creativecommons.org/licenses/by-nc-nd/2.0/>)



20.4 Classification and Diversity

A key to the subfamilies, tribes, and genera of Rhopalidae in the Neotropics is shown below (Chopra (1967), revised by Froeschner (1981) and used by Pall and Coscarón (2012); authors have added *Stictopleurus*).

- 1 Lateral margin of the pronotum with a distinct notch delimiting the collar posteriorly. Suture between visible abdominal segments III and IV as strong and deep as suture between sternites IV and V. Subfamily Serinethinae *Jadera* Stål
 Lateral margins of the pronotum not notched immediately posterior to collar. Suture between visible abdominal segments III and IV much shallower and weaker than other sutures. Subfamily Rhopalinae Amyot and Serville.....2
- 2(1) Posterior femur thicker than the median or anterior femora, ventrally with several strong spines.....3
 Posterior femur not thicker than the anterior or median femora, no spines ventrally.....4
- 3(2) Anterolateral angle of the pronotum produced anteriorly as an acute tooth. Clypeus acutely projecting beyond the juga. Tribe Harmostini Stål *Harmostes* Burmeister
 Anterolateral angle of the pronotum not produced. Clypeus bluntly rounded apically, not or slightly (less than own width) surpassing the juga. Tribe Chorosomini Douglas and Scott..... *Xenogenus* Berg
- 4(3). Phragma at junction of the first and second abdominal terga poorly developed in males, absent in females; the apodeme of the seventh sternum very small in males, absent in females. Phallus with one dorsomedian lobe on theca. Rhopalini Amyot and Serville5
 Phragma at junction of the first and second abdominal terga moderately developed in males, absent in females; the apodeme of the seventh sternum well developed in males, absent in females. Phallus with a pair of dorsolateral lobes on the theca. Niesthreini Chopra.....6
- 5(4) Metapleura divided and metathoracic scent gland openings not reduced. Three pairs of asymmetrical, sclerotized, lateral, conjunctival appendages *Liorhyssus* Stål
 Metapleura undivided and reduced metathoracic scent gland openings, absence of the left distal lateral conjunctival appendage..... *Stictopleurus* Stål
- 6(5) Last connexival segment dorsally with an inconspicuous oblique suture setting off lateral basal angle (generally, the membrane must be lifted to see this suture). Labium not surpassing the posterior coxae *Arhyssus* Stål
 Last connexival segment without a dividing suture. Labium reaching or surpassing the third abdominal sternite *Niesthrea* Spinola

The number of rhopalid species in the different ecoregions is referred on Table 20.1 (Göllner-Scheiding 1997). For the Neotropics, the following eight genera and 80 species are recorded (Table 20.2 lists references and resident countries for each species below):

Table 20.2 References and resident countries for nine genera and 81 species and three subspecies of rhopalids from the Neotropics

Subfamily: Rhopalinae
Tribe: Chorosomatini (Fieber)
Genus: <i>Xenogenus</i> Berg
<i>gracilis</i> (Reed)
<i>Distribution:</i> Argentina, Chile, South America
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012), Pall et al. (2013), Diez and Coscarón (2015)
<i>picturatum</i> Berg http://heteroptera.myspecies.info
<i>Distribution:</i> Argentina, Bolivia, Cuba, Mexico, Nicaragua, Puerto Rico, Saint Vincent, Uruguay, Central and South America
<i>References:</i> Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993), Coscarón (1998), Carpintero and De Biase (2011), Dellapé and Carpintero (2012), Pall and Coscarón (2012), Pall et al. (2013), Diez and Coscarón (2015)
Tribe: Harmostini
Genus: <i>Aufeius</i> Stål
<i>impressicollis</i> Stål
<i>Distribution:</i> Guatemala, Mexico
<i>References:</i> Göllner-Scheiding (1983)
Genus: <i>Harmostes</i> Burmeister
Subgenus: <i>Harmostes</i> Burmeister
<i>angustatus</i> Van Duzee
<i>Distribution:</i> Mexico
<i>References:</i> Göllner-Scheiding (1983), Henry (1988)
<i>bilobatus</i> Melo & Montemayor
<i>Distribution:</i> Argentina
<i>References:</i> Melo and Montemayor (2011)
<i>brevispinus</i> Blöte
<i>Distribution:</i> Argentina, Bolivia
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>disjunctus</i> Barber
<i>Distribution:</i> Ecuador
<i>References:</i> Göllner-Scheiding (1983)
<i>dorsalis</i> Burmeister
<i>Distribution:</i> Argentina, Guatemala, Mexico, Nicaragua, Peru, from British Columbia to Argentina/Peru

(continued)

Table 20.2 (continued)

<i>References:</i> Blöte (1934), Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993), Pall and Coscarón (2012)
<i>enatus</i> Brailovsky & Soria
<i>Distribution:</i> Mexico
<i>References:</i> Brailovsky and Soria (1981)
<i>formosus</i> Distant
<i>Distribution:</i> Mexico
<i>Reference:</i> Göllner-Scheiding (1983)
<i>fraterculus</i> (Say)
<i>Distribution:</i> Mexico, Central and South America
<i>References:</i> Göllner-Scheiding (1983), Henry (1988)
<i>fusiformis</i> Harris
<i>Distribution:</i> Peru
<i>References:</i> Göllner-Scheiding (1983)
<i>gravidator</i> (F.)
<i>Distribution:</i> Argentina, Mexico, Central and South America (Argentina, Bolivia, Brazil, Colombia, Peru, Venezuela)
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>incisuratus</i> Distant
<i>Distribution:</i> Brazil, Chile, Colombia, Peru
Göllner-Scheiding (1983)
<i>nebulosus</i> Stål
<i>Distribution:</i> El Salvador, Guatemala, Mexico, Nicaragua, Panama, Central America
<i>References:</i> Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993)
<i>parafraterculus</i> Göllner-Scheiding
<i>Distribution:</i> Argentina, Brazil
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>paraproxilus</i> Göllner-Scheiding
<i>Distribution:</i> Bolivia
<i>References:</i> Göllner-Scheiding (1998)
<i>prolixus</i> Stål
<i>Distribution:</i> Argentina, Bolivia, Brazil, Mexico, Paraguay, Peru, Uruguay, South America (Argentina, Bolivia, Brazil, Paraguay, Peru, Uruguay)
<i>References:</i> Göllner-Scheiding (1983), Melo et al. (2011), Dellapé and Carpintero (2012), Pall and Coscarón (2012), Pall et al. (2013)
<i>reflexulus</i> (Say)
<i>Distribution:</i> Cuba, Mexico
<i>References:</i> Göllner-Scheiding (1983)
<i>rubrum</i> Melo & Montemayor http://heteroptera.myspecies.info
<i>Distribution:</i> Argentina
<i>References:</i> Melo and Montemayor (2011)
<i>serratus</i> (F.)

(continued)

Table 20.2 (continued)

<i>Distribution:</i> Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Lesser Antilles, Mexico, Nicaragua, Panama, Paraguay, Puerto Rico, Venezuela, West Indies, Central and South America
<i>References:</i> Blöte (1934), Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993), Melo et al. (2011), Dellapé and Carpintero (2012), Pall and Coscarón (2012)
<i>signoreti</i> Reed
<i>Distribution:</i> Argentina, Chile
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>splendens</i> Harris
<i>Distribution:</i> Argentina, Bolivia, Brazil, Paraguay
<i>References:</i> Göllner-Scheiding (1983) (Melo and Montemayor, personal communication)
Subgenus: <i>Neoharmostes</i> Göllner-Scheiding
<i>apicatus</i> Stål
<i>Distribution:</i> Mexico, South America (Argentina, Bolivia, Brazil, Chile, Paraguay, Uruguay)
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>bergi</i> Göllner-Scheiding
<i>Distribution:</i> Argentina, Bolivia
<i>References:</i> Göllner-Scheiding (1998), Melo and Montemayor (personal communication)
<i>confinis</i> Harris 1942
<i>Distribution:</i> Chile
<i>References:</i> Göllner-Scheiding (1983)
<i>corazonus</i> Distant
<i>Distribution:</i> Argentina, Chile, Ecuador, Peru
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>corizoides</i> Jensen-Haarup
<i>Distribution:</i> Argentina, Uruguay
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>imitabilis</i> Harris
<i>Distribution:</i> Argentina
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>insitivus</i> Harris
<i>Distribution:</i> Argentina, Chile
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>marmoratus</i> (Blanchard)
<i>Distribution:</i> Argentina, Bolivia, Chile, Peru
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>minor</i> (Spinola)
<i>Distribution:</i> Argentina, Chile
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>petulans</i> Harris
<i>Distribution:</i> Argentina, Bolivia, Peru, Uruguay

(continued)

Table 20.2 (continued)

<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>procerus</i> Berg http://heteroptera.myspecies.info
<i>Distribution:</i> Argentina, Brazil, Peru, Uruguay, Patagonia
<i>References:</i> Göllner-Scheiding (1983), Coscarón (1998), Marrero et al. (2008), Carpintero (2009), Carpintero and De Biase (2011), Melo et al. (2011), Cava et al. (2012), Dellapé and Carpintero (2012), Pall and Coscarón (2012)
Tribe: Niesthreini
Genus: <i>Arhyssus</i> Stål
<i>confusus</i> Chopra
<i>Distribution:</i> Mexico
<i>References:</i> Göllner-Scheiding (1983)
<i>lateralis</i> (Say)
<i>Distribution:</i> Guatemala, Mexico
<i>References:</i> Göllner-Scheiding (1983), Henry (1988)
<i>parvicornis</i> (Signoret)
<i>Distribution:</i> Costa Rica, Mexico, Paraguay, Utah to Costa Rica
<i>References:</i> Nickel (1958), Göllner-Scheiding (1983), Henry (1988)
<i>peruensis</i> Chopra, 1968
<i>Distribution:</i> Peru
<i>References:</i> Göllner-Scheiding (1983)
<i>pilosus</i> (Signoret)
<i>Distribution:</i> Venezuela
<i>References:</i> Göllner-Scheiding (1983)
<i>punctatus</i> (Signoret)
<i>Distribution:</i> Guatemala, Honduras, Mexico, Nicaragua, Panama, Colorado to Honduras
<i>References:</i> Göllner-Scheiding (1983), Henry (1988), Maes and Göllner-Scheiding (1993)
<i>slateri</i> Chopra
<i>Distribution:</i> Mexico
<i>References:</i> Göllner-Scheiding (1983)
<i>tricostatus</i> (Spinola)
<i>Distribution:</i> Argentina, Chile
<i>References:</i> Göllner-Scheiding (1983), Melo and Montemayor (personal communication)
<i>validus</i> (Uhler)
<i>Distribution:</i> Mexico
<i>References:</i> Göllner-Scheiding (1983)
Genus: <i>Niesthrea</i> Spinola
<i>agnes</i> Chopra
<i>Distribution:</i> Argentina
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>ashlocki</i> Froeschner

(continued)

Table 20.2 (continued)

<i>Distribution:</i> Ecuador
<i>References:</i> Froeschner (1989), Henry and Wilson (2004)
<i>brevicauda</i> Chopra
<i>Distribution:</i> Peru
Göllner-Scheiding (1983)
<i>dentatus</i> Chopra
<i>Distribution:</i> Brazil
<i>References:</i> Göllner-Scheiding (1983)
<i>dignus</i> Chopra
<i>Distribution:</i> Brazil
<i>References:</i> Göllner-Scheiding (1983)
<i>fenestratus</i> (Signoret)
<i>Distribution:</i> Chile
<i>References:</i> Göllner-Scheiding (1983)
<i>josei</i> Göllner-Scheiding
<i>Distribution:</i> Argentina
<i>References:</i> Pall and Coscarón (2012)
<i>louisianica</i> Sailer
<i>Distribution:</i> Mexico
<i>References:</i> Göllner-Scheiding (1983)
<i>pictipes</i> (Stål)
<i>Distribution:</i> Argentina, Brazil, Ecuador, Mexico, Paraguay
<i>References:</i> Froeschner (1981), Göllner-Scheiding (1983), Carpintero and De Biase (2011), Dellapé and Carpintero (2012), Pall and Coscarón (2012)
<i>pictipes casinii</i> Göllner-Scheiding
<i>Distribution:</i> Argentina, Uruguay
<i>References:</i> Göllner-Scheiding (1984)
<i>sidae</i> (F.)
<i>Distribution:</i> Columbia, Ecuador, Mexico, Nicaragua, Panama, Puerto Rico, Venezuela, Caribbean, Central America, South America, and West Indies
<i>References:</i> Blöte (1934), Göllner-Scheiding (1983), Maes and Tellez (1988), Henry (1988), Maes and Göllner-Scheiding (1993), Henry and Wilson (2004)
<i>similis</i> Chopra
<i>Distribution:</i> Argentina, Brazil
<i>References:</i> Göllner-Scheiding (1983), Melo et al. (2011), Pall and Coscarón (2012)
<i>ventralis</i> (Signoret)
<i>Distribution:</i> Guatemala, Mexico, Nicaragua, Texas to Guatemala
<i>References:</i> Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993)
<i>vincentii</i> (Westwood)
<i>Distribution:</i> Argentina, Brazil, Paraguay, Venezuela, West Indies
<i>References:</i> Blöte (1934), Göllner-Scheiding (1983), Pall and Coscarón (2012)

Tribe: Rhopalini

Genus: *Liorhyssus* Stål

(continued)

Table 20.2 (continued)

<i>hyalinus</i> (F.)
<i>Distribution:</i> Argentina, Chile, Cuba, Guatemala, Mexico, Nicaragua, Venezuela, Patagonia, all the world
<i>References:</i> Dallas (1852) as <i>Rhopalus ruber</i> Dallas, Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993), Hernandez (1994), Cermeli et al. (2004), Werner (2009), Carpintero and De Biase (2011), Dellapé and Carpintero (2012), Pall and Coscarón (2012)
<i>kaltenbachi</i> Göllner-Scheiding
<i>Distribution:</i> Bolivia, Brazil, Paraguay
<i>References:</i> Göllner-Scheiding (1983)
<i>lineatovenstris</i> (Spinola)
<i>Distribution:</i> Argentina, Chile, Ecuador
<i>References:</i> Göllner-Scheiding (1983), Pall and Coscarón (2012)
Genus: <i>Stictopleurus</i> Stål
<i>knighti</i> Harris
<i>Distribution:</i> Mexico
<i>References:</i> Göllner-Scheiding (1983)
<i>punctivenstris</i> (Dallas)
<i>Distribution:</i> Mexico
<i>References:</i> Henry (1988)
Subfamily: Serinethinae
Genus: <i>Jadera</i> Stål
<i>aeola</i> (Dallas)
<i>Distribution:</i> Brazil, Antilles, from Mexico to Argentina
<i>References:</i> Göllner-Scheiding (1983), Barcellos et al. (2008), Pall and Coscarón (2012)
Note: see <i>coturnix</i>
<i>aeola aeola</i> (Dallas)
<i>Distribution:</i> Argentina, Guatemala, Mexico, Nicaragua, Caribbean, from Mexico to Argentina
<i>References:</i> Göllner-Scheiding (1979), no distributional information Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993), Carpintero and De Biase (2011), Melo et al. (2011), Pall and Coscarón (2012)
<i>aeola rufoculis</i> (Kirby, 1890)
<i>Distribution:</i> Brazil
<i>References:</i> Göllner-Scheiding (1983)
<i>antica</i> (Walker)
<i>Distribution:</i> Dominican Republic, West Indies
<i>References:</i> Göllner-Scheiding (1983)
<i>bayardae</i> Göllner-Scheiding
<i>Distribution:</i> British Honduras, Guatemala, Mexico, Panama, from Mexico to Panama
<i>References:</i> Göllner-Scheiding (1983), Henry (1988), Colombia SPC personal observation (2011)
<i>choprai</i> Göllner-Scheiding
<i>Distribution:</i> Argentina, Bolivia, Brazil, Paraguay, Uruguay, South America

(continued)

Table 20.2 (continued)

<i>References</i> : Göllner-Scheiding (1979), Göllner-Scheiding (1983), Carpintero and De Biase (2011), Pall and Coscarón (2012)
<i>coturnix</i> (Burmeister)
<i>Distribution</i> : Brazil, Uruguay
Note: According to Göllner-Scheiding (1979) <i>coturnix</i> (Burmeister) is a synonym of <i>aeola</i> (Dallas). Henry (1988) lists each as separate species; we have followed Henry (1988) and the Coreoidea Species File which consider <i>coturnix</i> a valid species
<i>decepiens</i> Göllner-Scheiding
<i>Distribution</i> : Argentina, Brazil, West Indies
<i>References</i> : Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>diaphona</i> Göllner-Scheiding
<i>Distribution</i> : Mexico, Nicaragua, Panama
<i>References</i> : Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993)
<i>golbachii</i> Göllner-Scheiding
<i>Distribution</i> : Argentina, Bolivia, Ecuador
<i>References</i> : Göllner-Scheiding (1983), Pall and Coscarón (2012)
<i>haematoloma</i> (Herrich-Schäffer)
<i>Distribution</i> : Argentina, Belize, Cuba, Colombia, Guatemala, Mexico, Nicaragua, Uruguay, from Central America to Colombia and Venezuela, West Indies
<i>References</i> : Göllner-Scheiding (1983), Maes and Téllez (1988), Maes and Göllner-Scheiding (1993), Bressa et al. (2001), Pall and Coscarón (2012)
<i>harrisi</i> Göllner-Scheiding
<i>Distribution</i> : Bolivia, Brazil
<i>References</i> : Göllner-Scheiding (1979)
<i>obscura</i> (Westwood)
<i>Distribution</i> : Argentina, Brazil, Costa Rica, from Mexico to Argentina/Peru
<i>References</i> : Blöte (1934), Göllner-Scheiding (1983), Carroll and Loye (1987), Pall and Coscarón (2012)
<i>parapectoralis</i> Göllner-Scheiding
<i>Distribution</i> : Argentina, Brazil
<i>References</i> : Göllner-Scheiding (1983), Schaefer (2001), Carpintero and De Biase (2011), Pall and Coscarón (2012)
<i>pectoralis</i> Stål
<i>Distribution</i> : Bolivia, Brazil, Uruguay
<i>References</i> : Göllner-Scheiding (1983)
<i>peruviana</i> Göllner-Scheiding
<i>Distribution</i> : Peru
<i>References</i> : Göllner-Scheiding (1983)
<i>pyrrholoma</i> Stål
<i>Distribution</i> : Bolivia, Brazil, Colombia, Ecuador
<i>References</i> : Göllner-Scheiding (1983)
<i>sanguinolenta</i> (F.)
<i>Distribution</i> : Argentina, Belize, Cuba, Ecuador, Nicaragua, Paraguay, Puerto Rico, St. Croix, Culebra, St. John, St. Thomas, Uruguay
<i>References</i> : Heidemann (1901), Barber (1923) as <i>Jadera rubrofusca</i> , Göllner-Scheiding (1983), Maes and Göllner-Scheiding (1993), Bressa et al. (2001), Carpintero (2009), Pall and Coscarón (2012), personal observation Scott Carroll (1987)

(continued)

Table 20.2 (continued)

<i>schuhi</i> Göllner-Scheiding
<i>Distribution:</i> Venezuela
<i>References:</i> Göllner-Scheiding (1983)
<i>silberliedi</i> Froeschner
<i>Distribution:</i> Galápagos Islands
<i>References:</i> Froeschner (1985)
<i>similaris</i> Göllner-Scheiding
<i>Distribution:</i> Ecuador
<i>References:</i> Göllner-Scheiding (1983)
Genus: <i>Boisea</i> Stål
<i>trivittata</i> (Say)
<i>Distribution:</i> Mexico
<i>References:</i> Scott Carroll personal observation (2011) (new record for the Neotropical region)

Note: Geographic distribution was taken into account from Göllner-Scheiding (1983) and posterior publications. The classification follows Coreoidea Species File (<http://Coreoidea.SpeciesFile.org/>)

Family: Rhopalidae

Subfamily: Rhopalinae

Tribe: Chorosomatini (Fieber)

Genus: *Xenogenus* Berg*gracilis* Reed*picturatum* Berg

Tribe: Harmostini

Genus: *Aufeius* Stål*impressicollis* StålGenus: *Harmostes* BurmeisterSubgenus: *Harmostes* Burmeister*angustatus* Van Duzee*bilobatus* Melo & Montemayor*brevispinus* Blöte*disjunctus* Barber*dorsalis* Burmeister*enatus* Brailovsky & Soria*formosus* Distant*fraterculus* (Say)*fusiformis* Harris*gravidator* (F.)*incisuratus* Distant*nebulosus* Stål*parafraterculus* Göllner-Scheiding

(continued)

paraprolixus Göllner-Scheiding

prolixus Stål

reflexulus (Say)

rubrum Melo & Montemayor

serratus (F.)

signoreti Reed

splendens Harris

Subgenus: *Neoharmostes* Göllner-Scheiding

apicatus Stål

bergi Göllner-Scheiding

confinis Harris

corazonus Distant

corizoides Jensen-Haarup

imitabilis Harris

insitivus Harris

marmoratus (Blanchard)

minor (Spinola)

petulans Harris

procerus Berg

Tribe: *Niesthreiini*

Genus: *Arhyssus* Stål

confusus Chopra

lateralis (Say)

parvicornis (Signoret)

peruensis Chopra

pilosus (Signoret)

punctatus (Signoret)

slateri Chopra

tricastatus (Spinola)

validus (Uhler)

Genus: *Niesthrea* Spinola

agnes Chopra

ashlocki Froeschner

brevicauda Chopra

dentatus Chopra

dignus Chopra

fenestratus (Signoret)

josei Göllner-Scheiding

louisianica Sailer

pictipes (Stål)

pictipes casinii Göllner-Scheiding

sidae (F.)

similis Chopra

ventralis (Signoret)

(continued)

vincentii (Westwood)

Tribe: Rhopalini

Genus: *Liorhyssus* Stål

hyalinus (F.)

kaltenbachi Göllner-Scheiding

lineatoventris (Spinola)

Genus: *Stictopleurus* Stål

punctiventris (Dallas)

knighti Harris

Subfamily: Serinethinae

Genus: *Jadera* Stål

aeola (Dallas)

aeola aeola (Dallas)

aeola rufoculis (Kirby)

antica (Walker)

bayardae Göllner-Scheiding

choprai Göllner-Scheiding

coturnix (Burmeister)

decipiens Göllner-Scheiding

diaphona Göllner-Scheiding

golbachi Göllner-Scheiding

haematoloma (Herrich-Schäffer)

harrisi Göllner-Scheiding

obscura (Westwood)

parapectoralis Göllner-Scheiding

pectoralis Stål

peruviana Göllner-Scheiding

pyrrholoma Stål

sanguinolenta (F.)

schuhi Göllner-Scheiding

silbergliedi Froeschner

similaris Göllner-Scheiding

Genus: *Boisea* Stål

trivittata (Say)

20.4.1 Main Species

Harmostes reflexulus (Say)

This is considered the most common *Harmostes* in the Nearctic by Blatchley (1926). In Göllner-Scheiding's (1978) revision of the genus, she lists its range as extending into Mexico and Cuba.

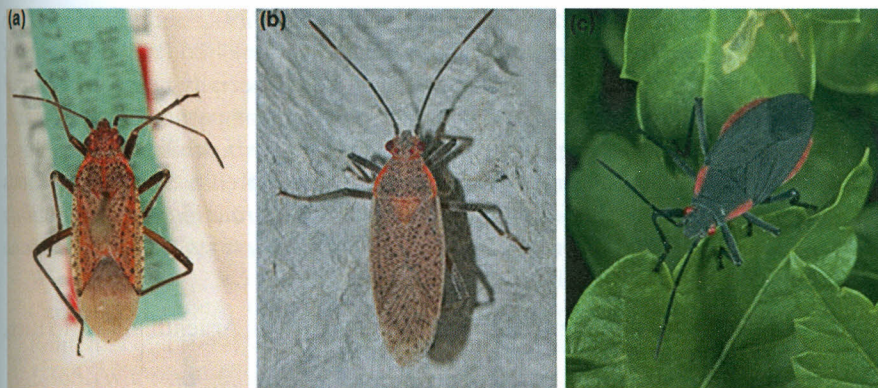


Fig. 20.4 (a) Adult of *Jadera choprai*, (b) *Jadera coturnix*, and (c) *Jadera haematoloma*

In Missouri it is a bivoltine species that feeds on many Asteraceae, and its seasonal migration follows a procession of maturing blooms throughout the summer (Yonke and Walker 1970a). Of their field-captured adults, 15.7 % were parasitized by the fly *Leucostoma acirostre* Reinhard.

Relevant literature: Van Duzee (1909) distribution in Florida, Yonke and Walker (1970a) life history, and Yonke and Walker (1970b) description of the egg and nymphs.

Jadera choprai Göllner-Scheidig (Fig. 20.4a)

An abundant species in the Neotropics. Many museum specimens have been misidentified as *J. sanguinolenta*. About 8–12 mm in length. They are larger and more orange in color than *J. sanguinolenta*, *J. decipiens*, and *J. goldbachi*. They are recognized by ocher-orange dorsal sides marked with irregular spots. The head and scutellum are orange (the head sometimes brown). The ventral side is ocher. Appendages are dark brown.

J. choprai preys on the seeds of *Cardiospermum corindum* as well as *Cardiospermum halicacabum* var. *halicacabum*. Like *J. haematoloma*, they have been observed carrying seeds (Panizzi and Hirose 2002).

Distribution: Argentina, Bolivia, Brazil, Paraguay, and Uruguay.

Relevant literature: Göllner-Scheidig (1979) description, Panizzi et al. (2002) oviposition, and Panizzi and Hirose (2002) seed-carrying behavior.

Jadera coturnix (Burmeister) (Fig. 20.4b)

Most twentieth-century literature refers to this species as *aeola* after being designated by Kirby in 1852. However, Burmeister had already named it *coturnix* in 1835, giving the latter name priority. Göllner-Scheidig considers this species to be

the most widely distributed *Jadera* (Göllner-Scheiding 1979). *J. coturnix* varies in size and color, typically brown with numerous dark spots and red lateral margins of the head and pronotum. Spots may form vertical lines, especially near the center of the head. Spots may be bigger on veins of hemelytra and on part of the membrane. About 8–13 mm in length. Appendages are brown. *J. coturnix* ocelli are much closer together than those of *J. hinnulea*. *J. coturnix* is a seed predator of sapindaceous vines and has been observed feeding on *Cardiospermum grandiflorum* L., *Paullinia sessiliflora* Radlk., *P. turbacensis* Kunth, *Serjania decaplueria* (Croat), *S. mexicana* L., and *Thinouia myriantha* (Tr. & Planch.).

Distribution: Mexico, Nicaragua, Panama, Ecuador, Brazil, Argentina, Puerto Rico, and Virgin Islands.

Relevant literature: Göllner-Scheiding (1979) description, (1983) general catalog, Tanaka and Wolda (1987) flight and life history polymorphism, and Carroll and Loye (2012) host records.

***Jadera haematoloma* (Herrich-Schäffer) (Fig. 20.4c)**

This rhopalid is about 10–14 mm in length. It has a charcoal dorsal ground color with broad red lateral stripes on the sides of the head and pronotum (most distinct on the pronotum); the eyes are also red. The ventral side is dark except for margins of the abdomen and posterior segment, which are red. Appendages are black.

The red lateral margins on the pronotum and black dorsum resemble *J. diaphona* and *J. pyrholoma*. The head of *J. haematoloma* is relatively wider than *J. pyrholoma*. *J. haematoloma* is intermediate in size between these two species. Its charcoal and red abdomen help distinguish it from the uniformly orange-red abdominal venter of *J. diaphona*. The best diagnostic feature is the male genitalia, illustrations and descriptions for which are provided by Göllner-Scheiding (1979).

In addition to feeding on seeds, *J. haematoloma* also feeds opportunistically on vulnerable conspecifics (Carroll and Loye 1987). Comprehensive tables of host records are provided by (Carroll and Loye 2012). *J. haematoloma* aggregates in large numbers around hosts, competing for food and mates. Males guard their mates, by copulating until the onset of oviposition. During oviposition a male may stand on top of a female, fending off other males and re-copulating after all eggs are laid (Carroll 1988). Some populations are rapidly evolving in adaptation to introduced host plants (discussed above).

Distribution: Mexico, Guatemala, Nicaragua, Belize, Panama, Colombia, Venezuela, Uruguay, Argentina, Cuba, Puerto Rico, United States, Hawaii, and Taiwan (Tsai et al. 2013).

Relevant literature: Schaefer (1965), 10 (morphology, genitalia, figures); Göllner-Scheiding (1979), 57 (redescription, lectotype, genitalia, figures, distribution); Schaefer and Chopra (1982), 226 (morphology, host plants); Schaefer and Mitchell (1983), 593 (host plants); Mead (1985) (diagnostic characters, wing polymorphism, larva, photos, host plant, distribution, map, phenology, aggregation, impact on human, control); Carroll and Loye (1987), 373 (host plants, feed-

ing, coevolution with host plants, aggregation, ecology, distribution, map); Carroll (1988), 54 (records, distribution, host plants, phenology, development, reproductive behavior, and ecology); Ribeiro (1989), 466 (records, host plant, aggregation, aposematism, development); Aldrich et al. (1990a), 200 (laboratory rearing, chemical ecology); Carroll (1991), 510 (reproductive behavior and ecology); Carroll and Boyd (1992), 1,053 (intraspecific variability, evolution); Carroll (1993), 156 (reproductive ecology); Carroll and Dingle (1996), 210 (records, host plants, feeding, intraspecific variability, evolution); Dingle and Winchell (1997), 365 (genetic and physiological control of wing polymorphism); Carroll et al. (1998), 956 (records, host plants, reproductive ecology, adaptation); Reinert et al. (1999), 469 (pest status, biological control); Winchell et al. (2000), 1,365 (wing polymorphism, physiology); Carroll et al. (2003b), S80 (genetic variation, selection); Carroll et al. (2003a), 135 (host plants, records, polymorphism); Dingle et al. (2009), 2,031 (genetic architecture, intraspecific variability, selection); Carroll and Loye (2012), 675 (host plants); Zych et al. (2012) (stridulation); and Tsai et al. (2013) (the most comprehensive review of the species and the source of this redacted reference list).

Liorhyssus hyalinus (F.) (Fig. 20.5a)

Worldwide and throughout the Neotropics (Göllner-Scheiding 1983), this species is distinguished by a hyaline membrane of the hemelytra extending beyond the abdomen. Its length is 5.5–6.5 mm and width 1.8–2.5 mm. Eggs are usually deposited in groups of 20–30 (Vilímová and Rohanová 2010). Early instars aggregate. Cornelis et al. (2012) detail nymphs, parasites, and hosts.

All life stages of *L. hyalinus* feed on *Sorghum vulgare* Pers., damaging crops in Venezuela (Cermeli et al. 2004). Cage experiments showed no significant damage to lettuce seed yield and germination until unnatural numbers of insects (400) and their nymphs fed on a single plant (Carlson 1959).

Distribution: Mexico, Guatemala, Nicaragua, Colombia, Venezuela, Ecuador, Chile, Argentina, Cuba, Grenada, and Puerto Rico.

Relevant literature: Readio (1928) (eggs, life history, host plants), Cermeli et al. (2004) (sorghum crop damage), Cornelis et al. (2012) (life history, nymphs, host plants, parasites), Davidova-Vilímová et al. (2000) (scent glands, systematics), and Carlson 1959 (effects on lettuce seed production).

Harmostes serratus F. (Fig. 20.5b)

Primarily a Neotropical species with range extending into the Southern United States (Göllner-Scheiding 1978, 1983). When viewed laterally it can be distinguished from other *Harmostes* by ventrally indented antenniferous tubercles. It can be distinguished from other *Harmostes* by the crenulate to serrate lateral margins of the thorax. The head is long with lateral spinous processes between the eyes and antennae, size 7–8 mm. long, and width 2.3–2.5 mm (Gibson 1917).

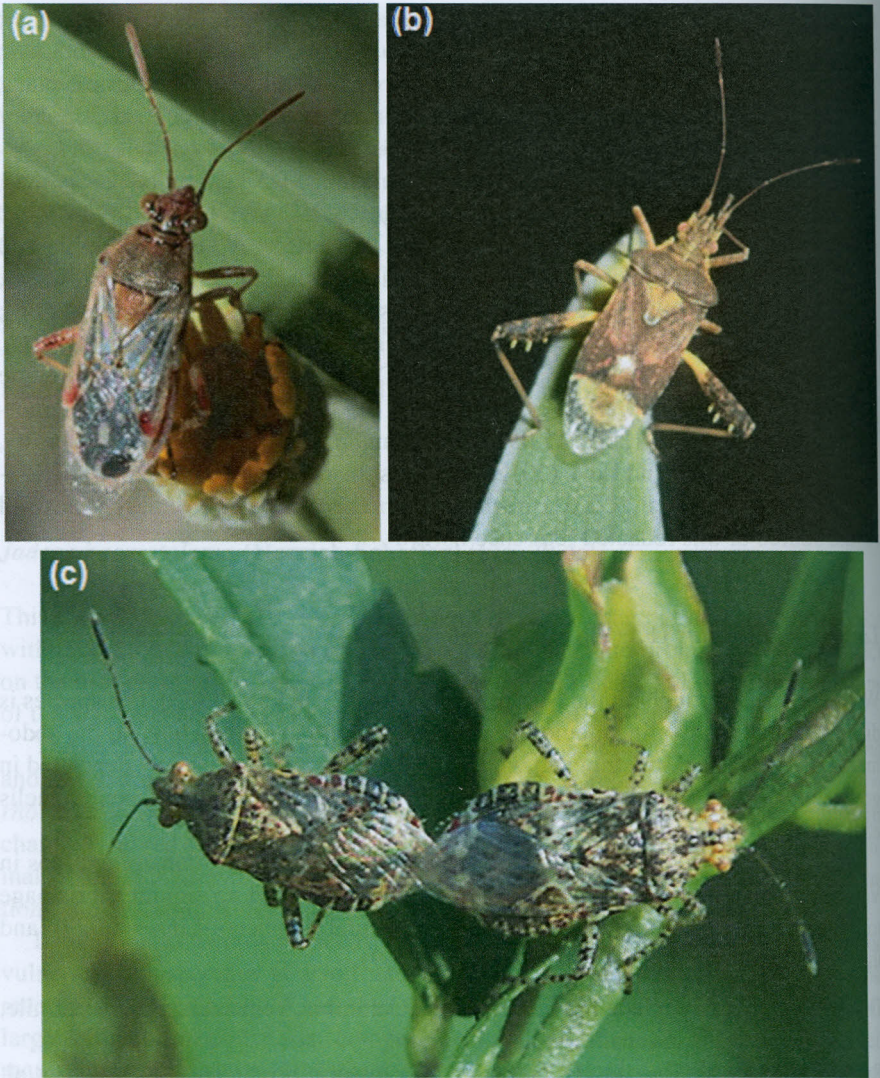


Fig. 20.5 (a) Adult of *Liorhyssus hyalinus* (Photo courtesy of L. Brehmer and E. Flores-Guevara), (b) *Harmostes serratus*, and (c) *Niesthrea sidae* (Courtesy of Hannah Mason)

H. serratus has been found feeding on *Dahlia* Cav. in several locations in Puerto Rico (Wolcott 1948).

Distribution: Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Brazil, Peru, Bolivia, Paraguay, Argentina, Cuba, Dominican Republic, Puerto Rico, Jamaica, and Trinidad and Tobago.

Relevant literature: Göllner-Scheiding (1978) (revision of the genus) and Gibson (1917) (the genus *Harmostes* Berm).

***Niesthrea sidae* (F.) (Fig. 20.5c)**

This is the most widespread species in the genus and widely distributed in the Neotropics (Henry and Wilson 2004). Sailer (1961) first identified *N. sidae* and established it as the type specimen for the genus. He noted many museum specimens, and descriptions in the literature erroneously identify with *N. louisianica*, to which it is very similar. Chopra (1973) considers it a complex of highly variable local populations, which may contribute to the confusion. It is distinguished from *N. ashlocki* by the shorter parameres, by the less deeply convex apex of the medioventral lobe, and by the longer, denser pubescence of the head, pronotum, and legs (Sailer 1961; Henry and Wilson 2004).

It has been observed feeding on the malvaceous plants *Abutilon* Mill. and *Sida* L. (Wheeler 1977; Schaefer and Chopra 1982), as well as the fruit of the euphorb *Jatropha curcas* L. (Grimm and Führer 1998). Collections of *N. sidae* have been made on the leaves of *Lantana* L. and *Prosopis* L. (Palmer and Pullen 1995; Smith and Ueckert 1974), though these may be coincidental landings and not hosts.

Distribution: Mexico, Nicaragua, Panama, Colombia, Venezuela, Ecuador, Galápagos Islands, Brazil, Peru, Bolivia, Paraguay, Puerto Rico, and Grenada.

Relevant literature: Sailer (1961) designated lectotype, Chopra (1973) revised genus, Henry and Wilson (2004) description, and Galápagos record.

20.5 Concluding Remarks

Rhopalids belong to a small but widespread family that is important in both applied and basic entomology. Yet very little is known about the biology of most of its approximately 200 species. Ironically, while members the subfamily Serinethinae are commonly noted as nuisance pests because many species form large aggregations in domestic settings (e.g., Mead 1985), they are little studied from a practical perspective and instead are more commonly the subject of theoretically motivated studies in evolution and ecology (reviewed by Tsai et al. 2013). Genus *Jadera* is speciose and common throughout the Neotropics but has not been actively studied at low latitudes since the 1980s. In addition to the value that might derive from more pragmatically motivated studies of serinethines, investigations of contemporary evolution on introduced sapindaceous host plants, for which *Jadera* is well known in North America, could be logically expanded to South America.

Subfamily Rhopalinae is more diverse than Serinethinae at higher levels of classification (Chopra 1967), and four of the six rhopaline tribes occur in the Neotropics: Harmostini, Chorosomini, Rhopalini, and Niesthreini. Many of the species feed on reproductive tissues of Asteraceae, and others are associated with Malvaceae and Poaceae. In contrast to Serinethinae, none of the Rhopalinae are known to use sapindaceous plants as hosts.

The negative economic impacts of rhopalids appear to be limited. In Serinethinae they are related mainly to the nuisance of diapausing aggregations entering structures and occasional fruit spotting. Panizzi et al. (2002) suggested that the seed predation by *Jadera* species on weedy *Cardiospermum halicacabum* in cultivated soybean could be beneficial, and Carroll (2011) suggested that adaptation to this same plant in northern Australia wildlands by the serinethine *Leptocoris tagalicus* (Burmeister) could supply genotypes for the control of the congeneric Neotropical environmental weed *C. grandiflorum* in eastern Australia. Such considerations would benefit from further development. In Rhopalinae, *Liorhyssus* has been recognized as a pest of sorghum in Venezuela (Cermeli et al. 2004). Many rhopalines are small, cryptically colored, and furtive. It is possible that their presence on crops is underappreciated, and this too deserves additional consideration in field agriculture in the Neotropics.

References

- Acevedo-Rodriguez P, Van Welzen PC, Adema F, Van Der Ham RWJM (2011) Sapindaceae. In: Flowering plants. Eudicots. Springer, Heidelberg, pp 357–407
- Aldrich JR (1988) Chemical ecology of the Heteroptera. *Annu Rev Entomol* 33:211–238
- Aldrich JR, Carroll SP, Oliver JE, Lusby WR, Rudmann AA, Waters RM (1990a) Exocrine secretions of scentless plant bugs; *Jadera*, *Boisea*, *Niesthrea* species (Hemiptera: Heteroptera: Rhopalidae). *Biochem Syst Ecol* 18:369–376
- Aldrich JR, Carroll SP, Lusby WR, Thompson MJ, Kochansky JP, Waters RM (1990b) Sapindaceae, cyanolipids, and bugs. *J Chem Ecol* 16:199–210
- Aukema B, Rieger C (eds) (1995–2006) Catalogue of the Heteroptera of the Palaearctic Region, vol 4 and 5, Pentatomomorpha. Netherlands Entomological Society, Amsterdam
- Barber HG (1923) A preliminary report on the Hemiptera-Heteroptera of Porto Rico collected by the American Museum of Natural History. *Am Mus Novit* 75:1–13
- Barcellos A, Schmidt LS, Brailovsky H (2008) Abundance and richness of Coreoidea (Hemiptera: Heteroptera) from Parque Estadual do Turvo, Southern Brazil. *Neotrop Entomol* 37:406–412
- Blatchley WS (1926) Heteroptera or true bugs of Eastern North America, with especial reference to the faunas of Indiana and Florida. Nature Publishing, Indianapolis
- Blöte HC (1934) Catalogue of the Coreidae in the Rijksmuseum van Natuurlijke Historie: Part I. Corizinae, Alydinae. *Zool Meded* 17:253–285
- Braekman JC, Dalozé D, Pasteels JM (1982) Cyanogenic and other glucosides in a neo-guinean bug *Leptocoris isolata*: possible precursors in its host-plant. *Biochem Syst Ecol* 10:355–364
- Brailovsky H, Soria F (1981) Contribución al estudio de los Hemiptera-Heteroptera de México: XVIII. Revisión de la tribu Harmostini Stål (Rhopalidae) y descripción de una nueva especie. *An Inst Biol Univ Nac Auton Mex (Zool)* 51:123–168
- Bressa MJ, Papeschi AG, Mola LI, Larramendy ML (2001) Autosomal univalents as a common meiotic feature in *Jadera haematoloma* (Heteroptera: Rhopalidae: Serinethinae). *Eur J Entomol* 98:151–157
- Carpintero DL (2009) Insecta: Hemiptera: Heteroptera. In: Athor J (ed) Parque Costero del Sur: Naturaleza, conservación y patrimonio cultural. Fundación de Historia Natural “Félix de Azara”, Ciudad Autónoma de Buenos Aires, pp 295–305
- Carpintero DL, De Biase S (2011) Los Hemiptera Heteroptera de la Isla Martín García (Buenos Aires, Argentina). *Historia Nat Tercera Serie* 1:27–47

- Carroll SP (1988) Contrasts in reproductive ecology between temperate and tropical populations of *Jadera haematoloma*, a mate-guarding hemipteran (Rhopalidae). *Ann Entomol Soc Am* 81:54–63
- Carroll SP (1991) The adaptive significance of mate guarding in the soapberry bug, *Jadera haematoloma* (Hemiptera: Rhopalidae). *J Insect Behav* 4:509–530
- Carroll SP (1993) Divergence in male mating tactics between two populations of the soapberry bug: guarding versus nonguarding. *Behav Ecol* 4:156–164
- Carroll SP (2011) Conciliation biology: the eco-evolutionary management of permanently invaded biotic systems. *Evol Appl* 4:184–199
- Carroll SP, Boyd C (1992) Host race radiation in the soapberry bug: natural history with the history. *Evolution* 46:1052–1069
- Carroll SP, Dingle H (1996) The biology of post-invasion events. *Biol Conserv* 78:207–214
- Carroll SP, Loye JE (1987) Specialization of *Jadera* (Hemiptera: Rhopalidae) on the seeds of Sapindaceae (Sapindales), and coevolutionary responses of defense and attack. *Ann Entomol Soc Am* 80:373–378
- Carroll SP, Loye JE (2006) Invasion, colonization, and disturbance; historical ecology of the endangered Miami blue butterfly. *J Insect Conserv* 10:13–27
- Carroll SP, Loye JE (2012) Soapberry bug (Hemiptera: Rhopalidae: Serinethinae) native and introduced host plants: biogeographic background of anthropogenic evolution. *Ann Entomol Soc Am* 105:671–684
- Carroll SP, Dingle H, Klassen SP (1997) Genetic differentiation of fitness-associated traits among rapidly evolving populations of the soapberry bug. *Evolution* 51:1182–1188
- Carroll SP, Klassen SP, Dingle H (1998) Rapidly evolving adaptations to host ecology and nutrition in the soapberry bug. *Evol Ecol* 12:955–968
- Carroll SP, Dingle H, Famula TR (2003a) Rapid appearance of epistasis during adaptive divergence following colonization. *Proc R Soc Lond B (Suppl)* 270:580–583
- Carroll SP, Marler M, Winchell R, Dingle H (2003b) Evolution of cryptic flight morph and life history differences during host race radiation in soapberry bug *Jadera haematoloma*. *Ann Entomol Soc Am* 96:135–143
- Carroll SP, Loye JE, Dingle H, Mathieson M, Zalucki MP (2005) Ecology of *Leptocoris* Hahn (Hemiptera: Rhopalidae) soapberry bugs in Australia. *Aust J Entomol* 44:344–353
- Carlson EC (1959) The effect of *Lygus* and Hyaline grass bugs on lettuce seed production. *J Econ Entomol* 52:242–244
- Cassis G, Gross GF (2002) Hemiptera: Heteroptera (Pentatomomorpha). In: Houston WWK, Wells A (eds) Zoological catalog of Australia. CSIRO, Melbourne, pp 1–737
- Cava MB, Corronca JA, Coscarón MC (2012) Composition and structure of Heteroptera communities (Hemiptera) in high altitude habitats of a national protected area in Argentina. *Mun Entomol Zool* 7:1214–1226
- Cermeli M, Sánchez J, Morales P, Godoy F (2004) *Liorhyssus hyalinus* (F.) (Hemiptera: Rhopalidae) nueva plaga del sorgo en Venezuela. *Entomotropica* 19:101–103
- Chopra NP (1967) The higher classification of the family Rhopalidae (Hemiptera). *Trans R Entomol Soc Lond* 119:363–399
- Chopra NP (1973) A revision of the genus *Niesthrea* Spinola (Rhopalidae: Hemiptera). *J Nat Hist* 7(4):441–459
- Cornelis M, Quirán E, Coscarón M (2012) The scentless plant bug, *Liorhyssus hyalinus* (F.) (Hemiptera: Heteroptera: Rhopalidae): description of immature stages and notes on its life history. *Zootaxa* 3525:83–88
- Coscarón MC (1998) Los ejemplares tipo de Coreoidea (Heteroptera) depositados en la colección del Museo de La Plata. *SerTéc y Did, Museo de La Plata* 34:1–5
- Coscarón MC (2014) Rhopalidae. In: Catalogue of the Heteroptera or true bugs of Argentina. *Zootaxa* (in press)
- Dallas WS (1852) List of the specimens of hemipterous insects in the collection of the British Museum, vol 2. Taylor & Francis Incorporated, London

- Davidova-Vilfmová J, Nejedla M, Schaefer CW (2000) Dorso-abdominal scent glands and metathoracic evaporatoria in adults of central European Rhopalidae (Hemiptera: Heteroptera), with a discussion of phylogeny and higher systematics. *Eur J Entomol* 97:213–222
- Dellapé PM, Carpintero DL (2012) Relevamiento de los Heteroptera (Insecta: Hemiptera) de las sierras de Tandil, provincia de Buenos Aires, Argentina. *Rev Mus Argentino Cienc Nat Nova Serie* 14:125–134
- Diez F, Coscarón MC (2015) Contribution to the knowledge of Patagonia, Argentina: redescription of the genus *Xenogenus* Berg 1883 (Hemiptera: Heteroptera: Rhopalidae) and description of immature stages of *Xenogenus gracilis* Reed, 1899. *Zootaxa* 3919(3):573–582
- Dingle H, Carroll SP, Famula TR (2009) Influence of genetic architecture on contemporary local evolution in the soapberry bug, *Jadera haematoloma*: artificial selection on beak length. *J Evol Biol* 22:2031–2040
- Dingle H (1972) Migration strategies of insects. *Science* 175:1327–1335
- Dingle H, Arora G (1973) Experimental studies of migration in bugs of the genus *Dysdercus*. *Oecologia* 12:119–140
- Dingle H, Winchell R (1997) Juvenile hormone as a mediator of plasticity in insect life histories. *Arch Insect Biochem Physiol* 35:359–373
- Froeschner RC (1981) Heteroptera or true bugs of Ecuador: a partial catalog. *Smithson Contrib Zool* 322:55–57
- Froeschner RC (1985) Synopsis of the Heteroptera or true bugs of the Galápagos Islands. *Smithson Contrib Zool* 407:39–40
- Froeschner RC (1989) A small collection of Heteroptera from the Galapagos Islands, with the description of the new species *Niesthrea ashlocki* and a list of *Niesthrea* species (Rhopalidae). *Proc Biol Soc Wash* 102:609–612
- Froeschner RC (1999) True bugs (Heteroptera) of Panama: a synoptic catalog as a contribution to the study of Panamanian biodiversity. *Am Entomol Inst* 61:1–393
- Gibson EH (1917) The genus *Harmostes* Burm. *Entomol News* 28:439–450
- Göllner-Scheiding U (1978) Revision der Gattung *Harmostes* Burm., 1835 (Heteroptera, Rhopalidae) und einige Bemerkungen zu den Rhopalinae. *Mitt Mus Nat kd Berl Zool Reihe Mitt Zool Mus Berlin* 54:257–311
- Göllner-Scheiding U (1979) Die Gattung *Jadera* Stål, 1862 (Heteroptera, Rhopalidae). *Dtsch Entomol Z* 26:47–75
- Göllner-Scheiding U (1983) General-kataloge der Familie Rhopalidae (Heteroptera). *Mitt Zool Mus Berlin* 59:37–189
- Göllner-Scheiding U (1984) Ergänzungen zu den Gattungen *Liorhyssus* STAL, 1870, *Niesthrea* SPINOLA, 1837, und *Rhopalus* SCHILLING, 1827 (Heteroptera, Rhopalidae). *Mitt zool Mus Berlin* 60:115–121
- Göllner-Scheiding U (1997) Die Rhopalidae der afrotropischen Region unter besonderer Berücksichtigung der Fauna der Republik Namibia (Insecta: Heteroptera, Coreoidea). *Mitt Mus Nat kd Berl Zool Reihe* 73:291–308
- Göllner-Scheiding U (1998) Three new species of Rhopalidae: *Harmostes* (*Harmostes*) *paraprolixus* spec. nov. and *Harmostes* (*Neoharmostes*) *bergi* spec. nov. from Bolivia, and *Peliochrous thomasi* spec. nov. from Uganda (Insecta: Heteroptera: Coreoidea). *Reichenbachia* 32:175–179
- González RH (1989) Insectos y ácaros de importancia agrícola y cuarentenaria en Chile. Editora Ograma, Santiago
- Grazia J, Cavichioli RR, Wolff VRS, Fernandes JAM, Takiya DM (2012) Hemiptera. In: Rafael JA, Melo GAR, Carvalho CJKB, Casari AS, Constantino R (eds) *Insetos do Brasil. Diversidade e Taxonomia*. Ed. Holos, Ribeirão Preto, pp 347–405
- Grimm C, Führer E (1998) Population dynamics of true bugs (Heteroptera) in physic nut (*Jatropha curcas*) plantations in Nicaragua. *J Appl Entomol* 122:515–521
- Harris HM (1942) Notes on *Harmostes*, with descriptions of some new species (Hemiptera: Corizidae). *J Wash Acad Sci* 32:28–32

- Heidemann O (1901) Papers from the Hopkins Stanford Galapagos Expedition, 1898–1899.1. Entomological results (1): Hemiptera. Proc Wash Acad Sci 3:363–370
- Henry TJ (1988) Family Rhopalidae Amyot and Serville, 1843. In: Henry TJ, Froeschner RC (eds) Catalog of the Heteroptera, or true bugs, of Canada and the continental United States. Brill, Leiden, pp 652–664
- Henry TJ (2009) Biodiversity of Heteroptera. In: Footitt R, Adler P (eds) Insect biodiversity: science and society. Blackwell, Chichester
- Henry TJ, Wilson MR (2004) First records of eleven true bugs (Hemiptera: Heteroptera) from the Galápagos Islands, with miscellaneous notes and corrections to published reports. J N Y Entomol Soc 112(1):75–86
- Hernandez LM (1994) Hemiptera Heteroptera of the sugarcane agroecosystem in Cuba Hemiptera Heteroptera del agroecosistema de caña de azúcar en Cuba. Cienc Biol Acad Cienc Cuba 27:12–17
- Livermore LJR, Lemaître VA, Dolling WR, Webb MD (2014) Coreoidea species file online. Version 5.0/5.0. [retrieval date]. <http://Coreoidea.SpeciesFile.org>
- Lorenzi H (2000) Plantas daninhas do Brasil, 3rd edn. Instituto Plantarum de Estudos da Flora Ltda, Nova Odessa
- Maes PJ, Göllner-Scheiding U (1993) Catálogo de los Coreoidea (Heteroptera). Rev Nica Entomol 25:1–19
- Maes PJ, Tellez RJ (1988) Catalogo de los insectos y artrópodos terrestres asociados a las principales plantas de importancia económica en Nicaragua. Rev Nica Entomol 5:1–95
- Marrero HJ, Carpintero DL, Zalba SM (2008) Relevamiento de la diversidad de Heteroptera (Hemiptera) terrestres del cerro Cura Malal, provincia de Buenos Aires, Argentina. Rev Museo Argentino Ciencias Naturales, Nueva Serie 10:29–35
- Mead FW (1985) *Jadera* scentless plant bugs in Florida (Hemiptera: Rhopalidae). Florida Department of Agriculture and Consumer Service, Entomology Circular 277, Gainesville, FL, USA
- Melo MC, Montemayor SI (2011) Two new species of *Harmostes* (*Harmostes*) Burmeister (Hemiptera: Heteroptera: Rhopalidae) from Argentina. Stud Neotrop Fauna Environ 46:131–136
- Melo MC, Dellapé PM, Carpintero DL, Montemayor SI (2011) Heteroptera (Hemiptera) from the Chaco National Park (Argentina). Zootaxa 2999:1–19
- Nickel JL (1958) Agricultural Insects of the Paraguayan Chaco 1. J Econ Entomol 51:633–637
- Pall JL, Coscarón MC (2012) The Rhopalidae (Hemiptera: Heteroptera) of Argentina. J Nat Hist 46:1441–1465
- Pall JL, Quirán E, Coscarón MC (2013) New records of the family Rhopalidae (Heteroptera) in the province of La Pampa (Argentina). Mun Ent Zool 8:382–386
- Palmer WA, Pullen KR (1995) The phytophagous arthropods associated with *Lantana camara*, *L. hirsuta*, *L. urticifolia*, and *L. urticoides* (Verbenaceae) in North America. Biol Contib 5:54–72
- Panizzi AR, Hirose E (2002) Seed-carrying and feeding behavior of *Jadera choprai* Göllner-Scheiding (Heteroptera: Rhopalidae). Neotrop Entomol 31:327–329
- Panizzi AR, Hirose E, Chocorosqui VR (2002) Unusual oviposition behavior by a seed feeding bug (Heteroptera: Rhopalidae). Neotrop Entomol 31:477–479
- Panizzi AR, Schaefer CW, Hirose E (2005) Biology and descriptions of nymphal and adult *Jadera choprai* (Hemiptera: Rhopalidae). Ann Entomol Soc Am 98:515–526
- Paskewitz SM, McPherson JE (1983) Life history and laboratory rearing of *Arhyssus lateralis* (Hemiptera: Rhopalidae) with descriptions of immature stages. Ann Entomol Soc Am 76:477–482
- Pennington MS (1920) Lista de los Hemípteros Heterópteros de la República Argentina. Printed by the author at Brasil street, # 1045, Buenos Aires, Argentina
- Radio PA (1928) Studies on the biology of the genus *Corizus* (Coreidae, Hemiptera). Ann Entomol Soc Am 21:189–201

- Smith LL, Ueckert DN (1974) Influence of insects on mesquite seed production. *J Range Manag* 27:61–65
- Sailer RI (1961) The identity of *Lygaeus sidae* Fabricius, type species of the genus *Niesthrea*. *Proc Entomol Soc Wash* 63:293–299
- Schwarz J, Gries R, Hillier K, Vickers N, Gries G (2009) Phenology of semiochemical-mediated host foraging by the western boxelder bug, *Boisea rubrolineata*, an aposematic seed predator. *J Chem Ecol* 35:58–70
- Reinert JA, Knauf TA, Maranz SJ, Bishr M (1999) Effect of *Beauveria bassiana* fungus on the boxelder and red shouldered bugs (Hemiptera: Rhopalidae). *Fla Entomol* 82:469–474
- Ribeiro ST (1989) Group effects and aposematism in *Jadera haematoloma* (Hemiptera: Rhopalidae). *Ann Entomol Soc Am* 82:466–475
- Schaefer CW (2001) Variation in *Jadera parapectoralis* Göllner-Scheiding (Hemiptera: Rhopalidae). *Neotrop Entomol* 30:473–474
- Schaefer CW (1965) The morphology and higher classification of the Coreoidea (Hemiptera-Heteroptera). Part III. The families Rhopalidae, Alydidae, and Coreidae. *Misc Publ Entomol Soc Am* 5:1–76
- Schaefer CW, Mitchell PL (1983) Food plants of the Coreoidea (Hemiptera: Heteroptera). *Ann Entomol Soc Am* 76:591–615
- Schaefer CW, Chopra NP (1982) Cladistic analysis of the Rhopalidae, with a list of food plants. *Ann Entomol Soc Am* 75:224–233
- Schowalter TD (1986) Overwintering aggregation of *Boisea rubrolineatus* (Heteroptera: Rhopalidae) in western Oregon. *Environ Entomol* 15:1055–1056
- Stroyan HLG (1954) Notes on the early stages of *Rhopalus parumpunctatus* Schill. (Hemiptera: Coreidae). *Proc R Entomol Soc Lond Ser A Gen Entomol* 29:32–38
- Tanaka S, Wolda H (1987) Seasonal wing length dimorphism in a tropical seed bug: ecological significance of the short-winged form. *Oecologia* 73:559–565
- Tanaka S, Wolda H, Denlinger DL (1987) Seasonality and its physiological regulation in three neotropical insect taxa from Barro Colorado Island, Panama. *Insect Sci Appl* 8:507–514
- Tsai JF, Hsieh YX, Rédei D (2013) The soapberry bug, *Jadera haematoloma* (Insecta, Hemiptera, Rhopalidae): first Asian record, with a review of bionomics. *ZooKeys* 297:1–41
- Van Duzee EP (1909) Observations on some Hemiptera taken in Florida in the spring of 1908. *Bull Buffalo Soc Nat Sci* 9:149–230
- Vilimová J, Rohanová M (2010) The external morphology of eggs of three Rhopalidae species (Hemiptera: Heteroptera) with a review of the eggs of this family. *Acta Entomol Musei Natioalis Pragae* 50:75–95
- Werner DJ (2009) Nachweise von *Liorhyssus hyalinus* (Heteroptera: Rhopalidae) in Schleswig-Holstein und anderswo. *Heteropteron* 31:35–36
- Wheeler AG (1977) Life history of *Niesthrea louisianica* (Hemiptera: Rhopalidae) on rose of Sharon in North Carolina. *Ann Entomol Soc Am* 70:631–634
- Wheeler AG Jr, Henry TJ (1984) Host plants, distribution, and description of fifth-instar nymphs of two little-known Heteroptera, *Arhyssus hirtus* (Rhopalidae) and *Esperanza texana* (Alydidae). *Fla Entomol* 67:521–529
- Wheeler AG Jr, Hoebeke RE (1988) Biology and seasonal history of *Rhopalus* (Brachycarenum) *tigrinus*, with descriptions of immature stages (Heteroptera: Rhopalidae). *J NY Entomol Soc* 96:381–389
- Winchell R, Dingle H, Moyes CD (2000) Enzyme profiles in two wing polymorphic soapberry bug populations (*Jadera haematoloma*: Rhopalidae). *J Insect Phys* 46:1365–1373
- Wolcott GN (1948) Insects of Puerto Rico. *J Agric Univ Puerto Rico* 32:749–975
- Wolda H, Tanaka S (1987) Dormancy and aggregation in a tropical insect *Jadera obscura* (Hemiptera: Rhopalidae). *Proc Koninklijke Nederlandse Akademie van Wetenschappen Series C Biol Med Sci* 90:351–356

- Yonke TR, Walker DL (1970a) Field history, parasites, and biology of *Harmostes reflexulus* (Say) (Hemiptera: Rhopalidae). J Kans Entomol Soc 4:444–450
- Yonke TR, Walker DL (1970b) Description of the egg and nymphs of *Harmostes reflexulus* (Hemiptera: Rhopalidae). Ann Entomol Soc Am 63:1749–1754
- Zych AF (2010) Seasonal group behavior of adult *Jadera haematoloma* (Hemiptera: Rhopalidae) in central Florida following host seed exhaustion. Fla Entomol 93:644–646
- Zych AF, Mankin RW, Gillooly JF, Foreman E (2012) Stridulation by *Jadera haematoloma* (Hemiptera: Rhopalidae): production mechanism and associated behaviors. Ann Entomol Soc Am 105:118–127