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Occurrence of the Old World bug *Megacopta cribraria* (Fabricius) (Heteroptera: Plataspidae) in Georgia: a serious home invader and potential legume pest

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Occurrence of the Old World bug *Megacopta cribraria* (Fabricius) (Heteroptera: Plataspidae) in Georgia: a serious home invader and potential legume pest

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Abstract. Specimens of *Megacopta cribraria* (Fabricius) were collected in northern Georgia in late October 2009, where they were invading homes in large numbers. This is the first known occurrence of this species and the family Plataspidae in the New World. *Megacopta cribraria* was previously known from Asia and Australia. A key is provided to separate Plataspidae from other families of Pentatomoidea in America North of Mexico. A diagnosis and figures are provided to facilitate recognition of *M. cribraria*. Reported host plants and other aspects of the biology of this species are reviewed. *Megacopta cribraria* is considered a pest of numerous legumes in Asia, has the potential to provide biological control of kudzu, *Pueraria montana* var. *lobata* (Willd.) Ohwi, (Fabaceae) and likely will continue to be a household pest in the vicinity of kudzu fields as well as become a pest of North American legume crops.

Key words. Bean plataspid, stink bug, biological control, kudzu, *Pueraria montana* var. *lobata*, household pest.

Introduction

In mid-October, 2009, specimens and photos of *Megacopta cribraria* (Fabricius) were submitted to the University of Georgia Homeowner Insect & Weed Diagnostics Laboratory in Griffin, GA. The submissions were from several locations in northeast Georgia where this bug reportedly occurred in large numbers on houses. On 28 October, 2009, we visited one of these locations in Hoschton, Jackson Co., GA. There were thousands of *M. cribraria* on two houses at this location as well as on all surrounding vegetation. An examination of vegetation in the vicinity of the houses revealed a field of kudzu, *Pueraria montana* var. *lobata* (Willd.) Ohwi (Fabaceae), located about 30 m from the houses. Sweeping and beating the kudzu vines yielded large numbers of the bug, including a few late instar nymphs. The bugs had apparently developed on kudzu and had moved out of the kudzu field seeking overwintering sites at the houses.

Large numbers of these bugs were present not only on houses, but on vehicles in the area. A shopping center was located nearby, clearly creating a potential for spread of this bug on or in vehicles. We visited a second field of kudzu near Monroe, Walton Co., GA, where additional specimens of *M. cribraria* were found. Results of a survey to delineate the range of this species in Georgia will be published at a later date (Suiter, unpublished data).

This is the first species of the family Plataspidae reported from the Western Hemisphere although another species, *Coptosoma xanthogramma* (White), is established in the Hawaiian Islands (Beardsley and Fluker 1967). In this paper, we provide a key, diagnosis, and figures to facilitate recognition of *M. cribraria* in America north of Mexico, and review the biology and economic status of this species.

Key to Families of Pentatomoidea in America North of Mexico

1. Tarsi two-segmented **2**
– Tarsi three-segmented **3**

2(1). Scutellum greatly enlarged, covering fore wings and most of abdomen (*Megacopta cribraria*) .... **Plataspidae**
– Scutellum small, triangular, not covering fore wings or most of abdomen .... **Acanthosomatidae**

3(1). Pronotum expanded posteriorly, covering base of scutellum ..... **Tessaratomidae**
– Pronotum not expanded posteriorly, base of scutellum exposed **4**

4(3). Tibiae bearing many stout spines in addition to those occurring at apex of tibiae **5**
– Tibial spines, if present, confined to apex of tibiae **6**

5(4). Fore tibiae enlarged, flattened, spines on lateral margins usually stout; scutellum not greatly enlarged, apex narrowly rounded ..... **Cydnidae**
– Fore tibiae cylindrical, spines on lateral margins not larger than others; scutellum enlarged, covering most of abdomen, apex broadly rounded ..... **Thyreocoridae**

6(4). Scutellum not usually enlarged, if enlarged, short frena present ..... **Pentatomidae**
– Scutellum enlarged, frena lacking ..... **Scutelleridae**

***Megacopta cribraria* (Fabricius 1798)**
Figure 1-4.

*Cimex cribraria*Fabricius, 1798: 531.
Tetyra cribraria: Fabricius 1803: 143.
Thyreocoris cribarius [sic]: Burmeister 1835: 384.
Coptosoma cribrarium: Amyot and Serville 1843: 66, pl. 2, fig. 4.
Coptosoma xanthochlora Walker, 1867: 87 (Synonymized by Distant 1899).
Megacopta cribraria: Hsiao and Ren 1977: 21-22, 293, figs. 62, 69, 70, pl. 1, fig. 13.

Diagnosis. Small round species, 3.5 to 6.0 mm long; light brown to olive green with dark punctation (Fig. 1). Head flat, juga contiguous in front of tylus; second antennal segment one-third or less length of third segment. Tarsi two-segmented; tibiae setose, lacking stout spines. Scutellum enlarged, width nearly 1.5 times length, truncate or very broadly rounded posteriorly, widest on posterior fourth; base of scutellum with transversely elongate area outlined by distinct impressed line. Venter black, moderately punctate; females with broad pale area laterally on abdomen (Fig. 2), males with broad pale lateral area limited to second and third visible sternites, segments 4-6 black and densely setose laterally (Fig. 3). Fifth-instar nymphs 4-5 mm long, oval, light to dark brown, hirsute; lateral margins of thorax and abdomen somewhat flattened (Fig. 4).

Table 1. Reported leguminous (Fabaceae) host plants of *Megacopta* spp.

Common Name	Scientific Name	Reference
Bean, lablab bean, field bean.	*Lablab purpureus* (L.) Sweet (as *Dolichos lablab* L. and *L. purpureus* var. *lignosus*)	Ahmad and Moizuddin 1975, Fletcher 1921, Hoffmann 1932, Ramakrishna Ayyar 1913, Shroff 1920, Thejaswi et al. 2008, Thippeswamy and Rajagopal 1998, 2005a, 2005b
Kudzu	*Pueraria montana* var. *lobata* (Willd.) Ohwi (also as *P. lobata* Willd. and *P. thungergiana* Bentham)	Hibino and Ito 1983, Hosokawa et al. 2007, Ishihara 1950, Kershaw 1910, Sun et al. 2006, Tayutivutikul and Kusigemati 1992a, 1992b, Tayutivutikul and Yano 1990
Soybean	*Glycine max* Merrill	Ishihara 1950, Kobayashi 1981, Kono 1990, Takagi and Murakami 1997, Tayutivutikul and Kusigemati 1992a, Thippeswamy and Rajagopal 2005b, Wu and Xu 2002, Xing et al. 2006, 2008
Pigeon pea/red gram	*Cajanus indicus* Spreng.	Borah and Dutta 1999, Borah et al. 2002, Fletcher 1921, Hoffmann 1932, Shroff 1920, Ramakrishna Ayyar 1913, Thippeswamy and Rajagopal 2005b
Mung bean	*Phaseolus radiatus* L.	Easton and Pun 1997, Shroff 1920
Kidney beans	*Phaseolus vulgaris* L.	Easton and Pun 1997, Ishihara 1950
Lima bean	*Phaseolus lunatus* L.	Hoffmann 1931
Bean	*Phaseolus* spp.	Hoffmann 1932
Azuki bean	*Vigna angularis* (Willd.) Ohwi and Ohashi	Tayutivutikul and Kusigemati 1992a
Urd-bean	*Vigna mungo* (L.) Hepper (as *Phaseolus mungo* L.)	Fletcher 1921
Agathi	*Sesbania grandiflora* (L.) Pers.	Fletcher 1921, Hoffmann 1932, Ramakrishna Ayyar 1913
Cluster bean	*Cyanopsis tetragonoloba* (L.) Taub. (as *Cyanopsis psoraloides*)	Fletcher 1921, Hoffmann 1932, Ramakrishna Ayyar 1913
Lespedeza	*Lespedeza cyrtobotrya* Miq. (Also as *Lespedeza* spp.)	Hibino and Ito 1983, Tayutivutikul and Kusigemati 1992a
Vetch	*Vicia angustifolia* L.	Hibino and Ito 1983, Easton and Pun 1997
Broad bean	*Vicia faba* L.	Ishihara 1950
Wisteria	*Wisteria brachybotrys* Sieb. et Zucc.	Tayutivutikul and Kusigemati 1992a
Chinese milk vetch	*Astragalus sinicus* L.	Tayutivutikul and Kusigemati 1992a
Indigo	*Indigofera sp.*	Ramakrishna Ayyar 1913
Indian beech tree	*Pongamia pinnata* (*L.*) *Pierre* (*as P. glabra Vent.*)	Hoffmann 1932
Velvet bean, cowitch	*Mucuna pruriens* (*L.*) *DC.*	Rani and Sridhar 2004

Table 2. Reported non-leguminous host plants of *Megacopta* spp.

Common Name	Scientific Name	Family	Reference
Firecracker plant	*Crossandra infundibuliformis* (L.) Nees (as *Crossandra undulaefolia* Salisb.)	Acanthaceae	Srinivasaperumal et al. 1992
Composits	Compositae	Compositae	Hoffmann 1932
Sweet potato	*Ipomoea batatas* Lam.	Convolvulaceae	Hoffmann 1932
Deutzia	*Deutzia crenata* Siebold and Zucc.	Hydrangeaceae	Tayutivutikul and Kusigemati 1992a
Cotton	*Gossypium hirsutum* L.	Malvaceae	Srinivasaperumal et al. 1992
Jute	*Corchorus capsularis* L.	Malvaceae	Hoffmann 1932
White mulberry	*Morus alba* L.	Moraceae	Zhang 1985
Chinese privet	*Ligustrum sinense* Lour.	Oleaceae	Zhang et al. 2008
Rice	*Oryza sativa* L.	Poaceae	Hoffmann 1932
Sugarcane	*Saccharum officinarum* L.	Poaceae	Hoffmann 1932
Wheat	*Triticum aestivum* L.	Poaceae	Tayutivutikul and Kusigemati 1992a
Citrus	*Citrus* spp.	Rutaceae	Tayutivutikul and Kusigemati 1992a
Potato	*Solanum tuberosum* L.	Solanaceae	Hoffmann 1932
Horsenettle	*Solanum carolinense* L.	Solanaceae	Imura 2003

Comments. Among North American Pentatomoidea, this bug is readily distinguished by the two-segmented tarsi and enlarged scutellum that is widest near the posterior margin and relatively truncate posteriorly. Other groups in which the scutellum is enlarged (Scutelleridae, Thyreocoridae, Pentatomidae: Asopinae and Podopinae) have three-segmented tarsi and the posterior margin of the scutellum is more narrowly rounded. Two-segmented tarsi also occur in the family Acanthosomatidae, but North American species of this family have a small triangular scutellum.

Megacopta cribraria, described by Fabricius (1798) as *Cimex cribrarius*, was later transferred to the genus *Coptosoma* (Laporte) by Amyot and Serville (1843). Hsiao and Ren (1977) transferred it to their new genus, *Megacopta*, where it remains today. Montandon (1896) described a closely related species, *M. punctatissima* (as *Coptosoma punctatissimum*). The following year, Montandon (1897) reported that he had seen specimens that were intermediate between *M. cribraria* and *M. punctatissima* but did not formally synonymize the two species. Yang (1934) revised the Chinese species of Plataspidae and considered *M. punctatissima* to be a variety of *M. cribraria*. Both names continue to be used today; however, primarily in Japanese economic literature (e.g. Hasegawa 1965, Hibino and Ito 1983, Himuro et al. 2006, Hirashima 1989, Imura 2003, Ishihara 1950, etc.). In fact, Hosokawa et al. (2007) stated that *Megacopta punctatissima* is found in mainland Japan and is a frequent pest of soybeans, whereas *M. cribraria* is found in the southwestern Japanese islands, rarely causes agricultural problems and is considered harmless to soybeans. They also indicated that the two species are capable of interbreeding and that their offspring reproduce successfully. These two taxa are distinguished primarily by color and size, *M. punctatissima* supposedly being darker and a little larger than *M. cribraria*. There appears to be no difference in morphology and the genitalia are indistinguishable. Specimens from Georgia are variable in size and fall within the range of coloration seen in museum specimens of *M. cribraria*. In addition, Jenkins et al. (2010) found that molecular characters for Georgia specimens are similar to those previously reported for *M. cribraria*. Although there appears to be some disagreement with regard to the taxonomic status of *M. punctatissima*, we are confident that the species found in Georgia is *M. cribraria*. Common names that have been used for this bug include bean plataspid, lablab bug, and globular stink bug.

Females of *M. cribraria* and related species of Plataspidae deposit small brown capsules on the underside of the egg masses. These capsules contain gut symbiotic bacteria ((-Proteobacterium *Candidatus Ishikawaella capsulata*) (Fukatsu and Hosokawa 2002, Hosokawa et al. 2006). As mentioned previously, Hosokawa et al. (2007) reported that *M. punctatissima* is a pest of soybeans whereas crop legumes are not suitable hosts for *M. cribraria*. When these authors transferred symbiotic bacteria from the 'pest' species *M. punctatissima* to the 'non-pest' species *M. cribraria*, soybeans became a suitable host for the latter species. Thus, differences between these two 'species' of *Megacopta* may be attributed to the symbiotic bacteria. Jenkins et al. (2010) confirmed the presence of this bacterial symbiont in bugs collected in Georgia.

Because *M. cribraria* and *M. punctatissima* are closely related and likely conspecific, the following sections contain information on both 'species.' Reports from Japanese authors usually refer to *M. punctatissima*, whereas all others refer to *M. cribraria*.

Distribution *Megacopta* spp. have been reported from Australia, China, India, Indonesia, Japan, Korea, Macao, Malaysia, Myanmar, New Caledonia, Pakistan, Sri Lanka, Taiwan, Thailand and Vietnam (Montandon 1896, 1897; Distant 1902; Kirkaldy 1910; Matsumura 1910; Shroff 1920; Esaki 1926; Hoffman 1931, 1935; Yang 1934; Ishihara 1937; Esaki and Ishihara 1951; Ahmad and Moizuddin 1975; Hsiao and Ren 1977; Lal 1980; Ren 1984; Hirashima 1989; Easton and Pun 1997). Prior to this discovery in Georgia, the family Plataspidae was restricted to the Old World (Froeschner 1984).

Host Plants and Pest Status *Megacopta* spp. have been reported most commonly from legumes (Fabaceae). Table 1 lists the leguminous plants reported as hosts for these bugs. Many of these are reported by multiple authors and numerous additional references to kudzu and soybean could be added. Additional references simply stated that these bugs feed on legumes, confirming that legumes are evidently the primary hosts of *Megacopta* spp. Non-leguminous hosts reported for *Megacopta* spp. are given in Table 2. Few are given by more than one author and those references that provided data on abundance or life stages for non-leguminous plants generally listed *Megacopta* spp. as uncommon or rare and the life stage encountered was usually adults. Most of these records probably represent incidental collections. However, Srinivasaperumal et al. (1992) report that *M. cribraria* survived and reproduced on firecracker plant, *Crossandra infundibuliformis* (L.) Nees (Acanthaceae) and cotton, *Gossypium hirsutum* L. (Malvaceae). Nymphs took longer to complete development and female fecundity was lower on these plants than on the legume *Sesbania grandiflora* (L.) Pers., but *M. cribraria* was able to complete development on these two non-legume plants.

Many of the host records in Tables 1 and 2 are simply records of *Megacopta* spp. on the plant and do not indicate pest status. Ahmad and Moizuddin (1975), Rekha and Mallapur (2007), Sujithra et al. (2008), Thejaswi et al. (2008) and Thippeswamy and Rajagopal (1998) reported that *M. cribraria* is a pest of field or lablab bean, whereas Ramakrishna Ayyar (1913) and Srinivasaperumal et al. (1992) stated that it was a serious pest on *Sesbania* spp. Hasegawa (1965), Lal (1980), Ren (1984), and Yang (1934) reported that *Megacopta* spp. are pests of legumes in general. A number of authors report that *Megacopta* spp. are pests of soybeans (Hosokawa et al. 2007, Ishihara 1950, Kobayashi 1981, Kono 1990, Wang et al. 1996, Wu and Xu 2002, and Xing et al 2008). Soybean yield loss ranged from 1-50% depending on density of the bugs (Wang et al. 1996). The reported pest status ranges from minor to severe. As an introduced species, this bug appears to have potential to be a pest of legume crops in the United States.

Megacopta spp. have also been investigated as a potential biological control agents for kudzu (Sun et al. 2006, Tayutivutikul and Kusigemati 1992a, Tayutivutikul and Yano 1990). Ishihara (1950) reported that kudzu is the preferred host for this species. However, there is no record of *Megacopta* spp. being imported to the U.S. for classical biological control of kudzu.

Thippeswamy and Rajagopal (2005b) reported that *M. cribraria* feeds on leaves, stems, flowers and pods, but prefers tender new growth to older growth. They also noted that white 'patches' developed at the site of feeding and later turned brownish, gradually coalescing into a necrotic area and that shoots withered with heavy infestations and bean pods did not develop normally.

Development The reported numbers of eggs deposited by females of *Megacopta* spp. ranged from 26 to 274; the development time from egg to adult was 24 to 56 days; and adult longevity was 23 to 77 days,

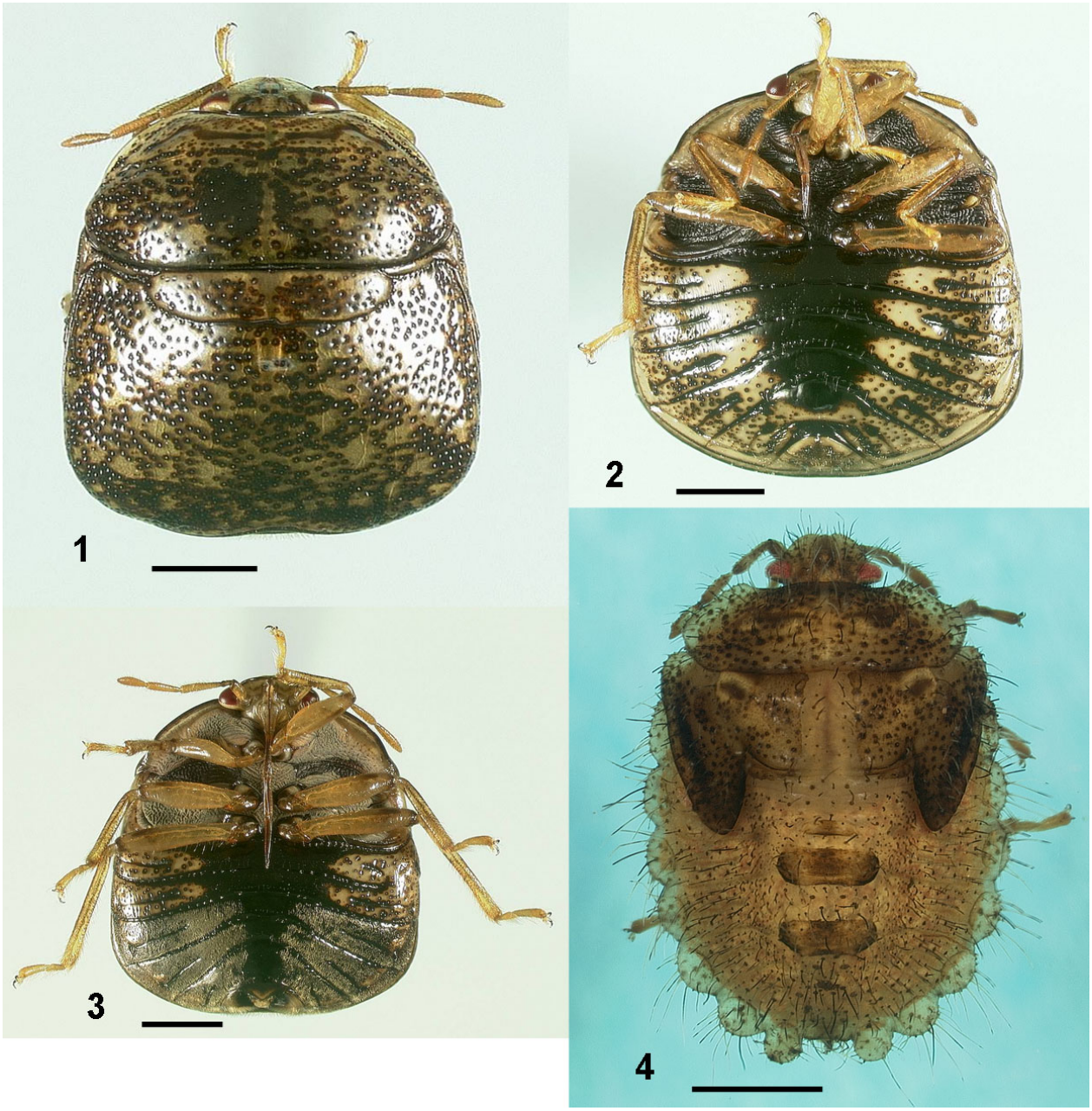

Figure 1-4. *Megacopta cribraria*. **1)** Male, dorsal view. **2)** Female, ventral view. **3)** Male, ventral view. **4)** Fifth instar nymph, dorsal view. Dimensional line equals 1.0 mm.

depending on location, temperature and other conditions (Ahmad and Moizuddin 1977, Ramakrishna Ayyar 1913, Srinivasaperumal et al. 1992, Tayutivutikul and Kusigemati 1992b, Tayutivutikul and Yano 1990, Thippeswamy and Rajagopal 2005b). There are one to three generations a year in China and Japan and *Megacopta* spp. overwinter as adults (Hibino and Ito 1983, Tayutivutikul and Kusigemati 1992b, Wu et al. 2006). Moizuddin and Ahmad (1979) described, figured and keyed the different immature stages of *M. cribraria*.

Megacopta spp. colonize crop fields in April to July and are present until August to October, depending on location and crop (Hibino and Ito 1983, Takagi and Murakami 1997, Tayutivutikul and Yano 1990, Thejaswi et al. 2008). In warmer areas, they may be active all year (Thippeswamy and Rajagopal 1998).

Large mating aggregations are common and females tend to accept copulation more frequently when males court in aggregations than when they court alone (Hibino 1985, 1986, 1989, Hibino and Ito 1983).

Natural Enemies Ahmad and Moizuddin (1976) reported *Reduviius* [sic!] sp. (Heteroptera: Reduviidae) feeding on adults and fifth-instar nymphs of *M. cribraria*. Parasitoids (Hymenoptera) reported from eggs of *Megacopta* spp. were *Ablerus* sp. (Aphelinidae) in India (Rajmohan and Narendran 2001); *Dirphys boswelli* (Girault) (Aphelinidae) in India (Polaszek and Hayat 1990); *Ooencyrtus nezarae* Ishi (Encyrtidae) in China and Japan (Hirose et al. 1996, Takasu and Hirose 1991a, 1991b, Tayutivutikul and Yano 1990, Wu et al. 2006); *Ooencyrtus* sp. (Encyrtidae) and *Trissolcus* sp. (Scelionidae) in China (Zhang et al. 2003); *Paratelenomus saccharalis* (Dodd) (Scelionidae) in China, India and Japan, (Hirose et al. 1996, Rajmohan and Narendran 2001, Takagi and Murakami 1997, Wall 1928, Watanabe 1954, Wu et al. 2006, Yamagishi 1990); *Telenomus latisculcus* Crawford (Scelionidae) in India (Mani and Sharma 1982); and *Telenomus* sp. (Scelionidae) in Pakistan (Ahmad and Moizuddin 1976). Synonyms for *P. saccharalis* are *Asolcus minor* (Watanabe), *Archiphanurus minor* and *Paratelenomus minor* (Johnson 1996). Borah and Dutta (2002) and Borah and Sarma (2009) reported that the fungal pathogen *Beauveria bassiana* (Balsamo) Vuillemin attacks *M. cribraria* in India.

The large numbers of *M. cribraria* found on kudzu suggests that this bug may provide some biological control of kudzu. The tendency of *M. cribraria* to aggregate on and in houses suggests that it may become an even greater household pest. Because there are few crops in the area around the current infestation, the potential impact of this species on crops in the United States is unknown. Continued surveillance to determine the distribution and spread of *M. cribraria* is needed, as is research to determine the host range of the population in Georgia and the efficacy of various control measures.

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