

***Megacocta cribraria*: A New Invasive Insect Pest Threatening U.S. Agricultural Production and Export Markets**

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Megacocta cribraria adult (photo by Phillip Roberts, University of Georgia)

Megacocta cribraria, commonly known as the bean plataspid, lablab bug, globular stink bug, and kudzu bug, was first discovered on kudzu, *Pueraria montana* variety *lobata*, in 9 northeastern Georgia counties in October 2009. This was the first report of this insect or any of its relatives in the taxonomic family Plastipidae (Order Heteroptera) in North America. *M. cribraria* rapidly spread from those 9 Georgia counties into 117 additional Georgia counties, 8 Alabama counties, all of South Carolina, 57 North Carolina counties, and 1 Virginia county by December 2011. Heavy infestations of the insect also were reported on soybean, *Glycine max*, in Georgia, South Carolina and North Carolina in 2010 and 2011. Yield reductions observed in preliminary testing

indicated that losses were linked to lower numbers of pods and reduced pod weight in infested plots compared to plots aggressively protected with insecticide applications. Herein, the current status of the spread and dispersal, biology, and pest potential of *M. cribraria* in its expanded North American range will be reviewed and summarized.

Introduction and Spread. To date, the origin and mode of introduction of *M. cribraria* into Georgia remain unknown. Genetic sequence analyses demonstrate that *M. cribraria* specimens collected from its expanded North American range are from one maternal lineage, thus indicating the 2009 introduction was a single female or her eggs/offspring. Genetic studies have not yet determined the source of the introduction from its native range in Asia and Australia. It is likely that the introduction occurred on a commodity shipment or in baggage. *M. cribraria* and *Coptosoma* (its synonym) have been intercepted previously on a variety of inspected plants including cut flowers in baggage and permit cargo.

In October 2009, several specimens and images of *M. cribraria* were submitted to the University of Georgia Homeowner Insect and Weed Diagnostics Clinic (UGA Griffin Campus, Griffin). A site visit to Jackson County on 28 October 2009 yielded numerous adults of the insect on homes. Inspection of surrounding vegetation revealed large numbers of adults and a few late instars in a field of kudzu

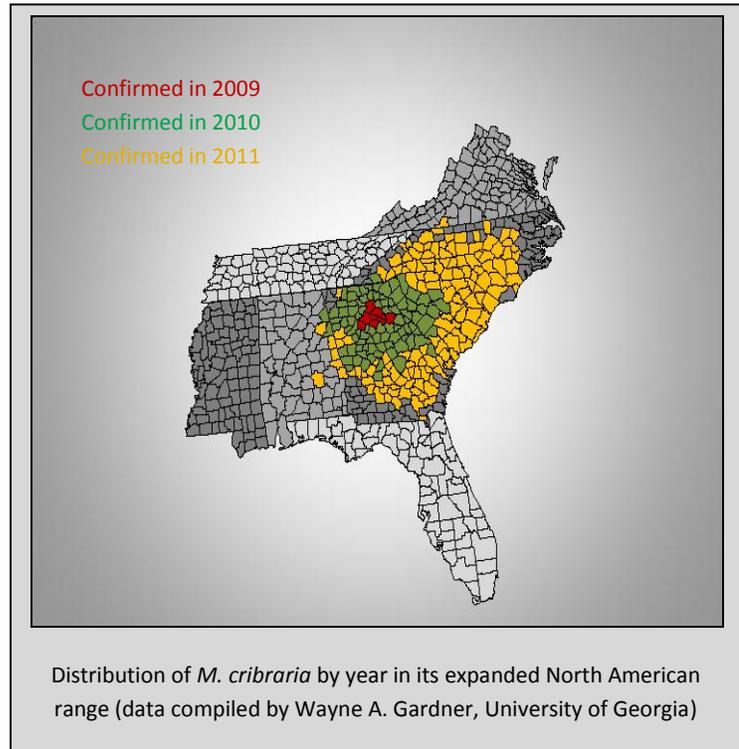
growing in the vicinity. The bugs seen on the homes were presumed to have developed on the kudzu and dispersed from the kudzu in search of overwintering sites. An informal survey targeting kudzu as the host was conducted in several neighboring northeastern Georgia counties over the next few weeks.

These initial surveying efforts confirmed the occurrence of the insect in 9 counties located in northeast Georgia: Barrow, Clarke, Dekalb, Gwinnett, Hall, Jackson, Oconee, Oglethorpe, and Walton.

Surveys of kudzu in 6 other counties during the same period recovered no bugs in those neighboring counties along the western boundary of the area of confirmed occurrence.

Survey and monitoring efforts were intensified in 2010. Over the course of the spring, summer and fall months, *M. cribraria* was confirmed in 71 additional counties in Georgia, in 2 counties in Alabama, in 16 counties in South Carolina, and in 1 county in North Carolina.

Surveys were expanded in 2011 and confirmed the insect in 6 additional counties in Alabama (total 8), 46 additional counties in Georgia (total 126), 30 additional counties in South Carolina (total 46; entire state), and 56 additional counties in North Carolina (total 57). It was also confirmed in 1 southern Virginia county (Patrick) that borders North Carolina.



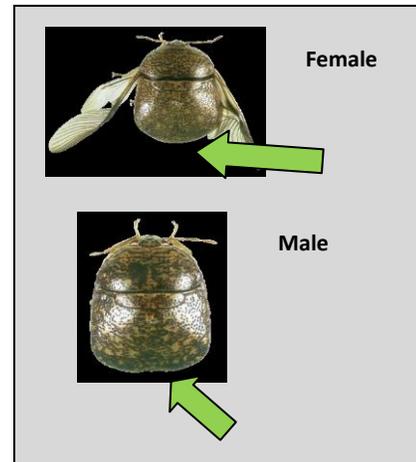
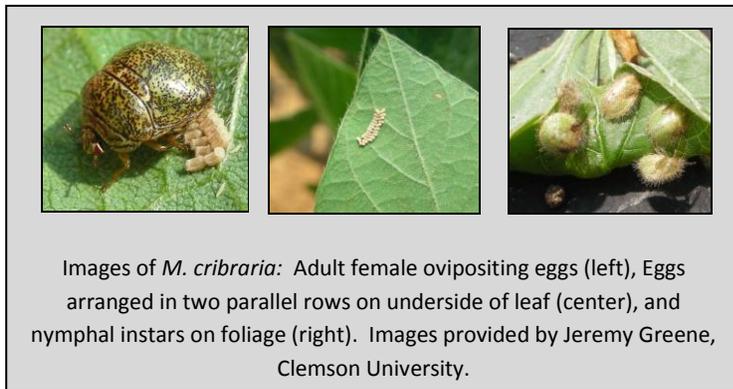
The insect spread approximately 125 linear miles (201 km) in a northeasterly direction from its original 2009 distribution into South Carolina in 2010 and an additional 215 miles (346 km) into North Carolina in 2011 (340 miles [547 km] total in 2 years). The total potential area, as determined from the surface area of individual counties, infested with *M. cribraria* increased 13 fold in 2010 and another 3 fold in 2011 (40 fold increase over 2 years) to a total of approximately 107,990 square miles (279,693 km²).

This represents a truly remarkably rapid spread for any invasive insect pest from a single introduction. Indeed, *M. cribraria* is a strong flyer, and it readily ascends to high altitudes as evidenced in its common occurrence on high-rise dwellings 30+ stories above the street level. Thus, it is likely that the adults are easily dispersed on active weather fronts, especially the active storm fronts that moved across the Southeast with tornadic activity in April of 2011. These insects are also adept hitchhikers that hide within cargo or on transportation equipment.

Biology and Seasonal Activity. In Georgia, eggs of *M. cribraria* are found on the stems and the underside of leaves arranged in 2, and sometimes 3, parallel rows with an average of 15-16 eggs per mass. Eggs are oval in shape measuring 0.8-0.9 mm long and 0.4-0.5 mm wide. When first laid, the eggs are white but turn off-white to pink.

The eggs are attached to the plant substrate in a black-colored substance deposited by the female before she actually lays the eggs. This substance contains gut symbiotic bacteria which aid digestive activities of nymphs and adults. The Proteobacterium *Candidatus Ishikawaella capsulata* is the symbiont that renders the host capable of successfully feeding upon soybean, and it has been confirmed in bugs collected from its expanded North American range. Upon eclosion, neonates feed upon the substance in which the eggs are attached and, thus, acquire the endosymbiont.

M. cribraria has 5 nymphal stages that range in color from reddish-brown (neonates) to yellowish-green (2nd and 3rd instars) to greenish-brown (4th and 5th instars). Adult females are slightly larger than males but are easily separated by the shape of the posterior end. Females have a rounded posterior, while males have an indentation. The morphology of the posterior ventral sternite also differs between male and female.



Capture and monitoring data indicate that 2 generations, and maybe a partial 3rd, occur in Georgia. There are 3 distinct periods of adult flight activity with the first being the adults that emerge from overwintering early in the spring in search of host plants upon which to feed and oviposit. First generation adults begin emerging in late-June. Adult abundance continues to increase through the summer and peaks in late-September. Numbers remain high until frost. Some first-generation adults leave the early-season kudzu host to find new hosts. The trigger(s) for this dispersal behavior are not known, but high population density may be a factor. At least some of these adults move to soybeans where they feed, reproduce and successfully complete a generation. This pattern also has been observed on soybean in China. Second-generation adults overwinter and emerge in early-spring to deposit eggs on newly-sprouting kudzu vines.

Host Plants. Leguminous (Fabaceae) plants are the primary host of *M. cribraria*; those reported as hosts are as follows:

Lablab bean, <i>Lablab purpureus</i>	Kudzu, <i>Pueraria montana</i> var <i>lobata</i>
Soybean, <i>Glycine max</i>	Wisteria, <i>Wisteria</i> spp.
Lespedeza, <i>Lespedeza</i> spp.	Vetch, <i>Vicia angustifolia</i>
Broad bean, <i>Vicia faba</i>	Chinese milk vetch, <i>Astragalus sinicus</i>
Pigeon pea, <i>Cajanus indicus</i>	Bean, <i>Phaseolus</i> spp.
Mung bean, <i>Phaseolus radiates</i>	Kidney bean, <i>Phaseolus vulgaris</i>
Lima bean, <i>Phaseolus lunatus</i>	Azuki bean, <i>Vigna angularis</i>
Cluster bean, <i>Cyanopsis tetragonoloba</i>	Urd-bean, <i>Vigna mungo</i>
Agathi, <i>Sesbania grandiflora</i>	Indigo, <i>Indigofera</i> sp.
Indian beech tree, <i>Pongamia pinnata</i>	Velvet bean, <i>Mucuna pruriens</i>

Several non-leguminous plants also have been reported as hosts; however, these are usually single citations and are likely to be observations of incidental occurrence of the insect on these plants. Indeed, we have observed adult *M. cribraria* congregated on a number of plants, but they are not feeding or ovipositing on those plants. These are presumed to be resting sites for the large numbers of first or second generation adults as they disperse from their host plants. Some economically-important plants on which *M. cribraria* adults have been incidentally observed and reported, but are likely not true hosts, include:

Cotton, <i>Gossypium hirsutum</i>	Sweet potato, <i>Ipomea batatas</i>
Rice, <i>Oryza sativa</i>	Sugarcane, <i>Saccharum officinarum</i>
Wheat, <i>Triticum aestivum</i>	Potato, <i>Solanum tuberosum</i>
Citrus, <i>Citrus</i> spp.	Corn, <i>Zea maize</i>
Composit flowers	

Individuals conducting surveys for *M. cribraria* in Georgia, South Carolina, North Carolina, Virginia and Alabama report either (1) adults feeding, (2) presence of eggs, and/or (3) presence of nymphal stages on the following plants: kudzu, soybeans, wisteria, lespedeza, *Phaseolus* spp. beans growing in home gardens, American yellowwood tree (*Cladrastis kentukea*), fig trees (*Ficus*), and black locust trees (*Robinia pseudoacacia*). Host range studies recently conducted in Georgia reported that kudzu is the primary host of *M. cribraria* in this expanded range. Furthermore, other than kudzu, soybean was the only host on which *M. cribraria* successfully developed from egg to adult.

Summary. *M. cribraria* impacts kudzu growth, reducing biomass by 33% over one growing season. The insect, therefore, might be of benefit in reducing the impact of this invasive weed in southern forests. However, in soybean, *M. cribraria* has thus far caused an average yield loss of 37% in tests conducted in several locations in Georgia in which yields from untreated plots were compared to yields from plots protected from the insect. The insects also produce a defensive chemical when disturbed that produces a strong odor. This chemical is reported as causing stains on clothing or fabrics and etching of plastic

surfaces following extended exposures to the bugs or chemical. The insect is also a nuisance pest to humans, especially in those areas where humans reside near fields of kudzu infested with the insect. The primary nuisance problem arises in the fall of the year when adult abundance peaks, flight activity is high, and second generation adults are seeking overwintering sites. Several individuals report that the bugs cause allergic skin reactions resulting in localized skin wheals that are reddish-brown in color. The future spread of the insect beyond its current range is likely, but the extent of that expansion is conjectural. Its observed dependence upon kudzu as a primary host in its current expanded range may limit its successful spread and establishment to those areas where kudzu grows.

Resources.

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