BioOne COMPLETE

Parasitism of Megacopta cribraria (Hemiptera: Plataspidae) by Paratelenomus saccharalis (Hymenoptera: Platygastridae) in Organic Soybean Plots in Georgia, USA

Authors: Tillman, Glynn, Gaskin, Julia, Endale, Dinku, Johnson, Carroll, and Schomberg, Harry

Source: Florida Entomologist, 99(2) : 300-302

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.099.0223

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

Parasitism of *Megacopta cribraria* (Hemiptera: Plataspidae) by *Paratelenomus saccharalis* (Hymenoptera: Platygastridae) in organic soybean plots in Georgia, USA

Glynn Tillman[1], Julia Gaskin[2], Dinku Endale[3], Carroll Johnson[1], and Harry Schomberg[4]*

The kudzu bug, *Megacopta cribraria* (F.) (Hemiptera: Plataspidae), is a newly invasive, exotic pest of soybean (*Glycine max* [L.] Merr.; Fabales: Fabaceae) in the southeastern United States. This insect is native to Asia, where it tends to be an occasional pest of legumes, but it can be a serious pest at times (Wang et al. 1996; Thippeswamy & Rajagopal 1998). It was first reported in Georgia, where large numbers were discovered feeding on kudzu, *Pueraria montana* var. *lobata* (Willd.) Maesen & S. Almeida (Fabales: Fabaceae), in 9 northeastern counties in the fall of 2009 (Suiter et al. 2010). It spread rapidly from the original 9 Georgia counties to 11 states in 2013 (Megacopta Working Group 2015). The primary reproductive hosts of *M. cribraria* in Georgia are kudzu and soybean (Zhang et al. 2012). In soybean, excessive feeding by *M. cribraria* on stems, petioles, and leaves appears to weaken and stress plants, resulting in fewer pods per plant, fewer seeds per pod, and smaller seed size for infested plants compared with uninfested plants (Greene et al. 2012). In 11 field trials in Georgia in 2010 and 2011, *M. cribraria* populations reduced soybean yield by an average of 20% (Roberts & Whitaker 2012). Parasitism of eggs by native egg parasitoids was not observed in surveys conducted in Georgia in 2010 and 2011 (Ruberson et al. 2012).

In 2013, an exotic egg parasitoid identified as *Paratelenomus saccharalis* (Dodd) (Hymenoptera: Platygastridae) was found in *M. cribraria* eggs in kudzu and soybean in 3 states in the southeastern United States (Gardner et al. 2013). This egg parasitoid is widely distributed throughout the Eastern Hemisphere, and known hosts of the parasitoid are restricted to the family Plataspidae (Ruberson et al. 2012). It has been recorded attacking eggs of *Megacopta* species in various locations throughout Asia, including Japan where overall parasitism rates of eggs in the spring are often high (43–100%) (Takasu & Hirose 1986). In Alabama in 2013, parasitism of egg masses in conventional soybean ranged from 52 to 85% (Gardner et al. 2013). We evaluated parasitism of *M. cribraria* egg masses by *P. saccharalis* in conventional tillage and no-till organic soybean experimental plots in Georgia in 2013.

The study site was located within the University of Georgia Ponder Farm (31.5113889°N, 83.6444444°W) in Tift County, Georgia. The 2 treatments were conventional tillage soybean and no-till soybean. Each experimental plot was approximately 0.1 ha. Each treatment was randomly assigned to a plot within a replicate for each of 4 replicates in a randomized complete block design. Blind cultivation with a tine weeder was used for weed management in conventional tillage soybean. In the no-till treatment, cool-season wheat (Poales: Poaceae) was grown to suppress weeds. Wheat ('Georgia Gore') was planted on 7 Nov 2012. Group VII soybean ('Woodruff' soybean) was planted on 20 Jun 2013, 7 d after wheat had been harvested.

Beginning on 23 Jul 2013, soybean was sampled weekly for a 7 wk period. For each sample, all plants within a 1.83 m length of row were examined for *M. cribraria* egg masses. Twelve random samples were obtained per plot. Egg masses detected during sampling were collected and held in the laboratory for parasitoid emergence. Voucher specimens of all collected *M. cribraria* egg masses and emerged parasitoids were placed in ethanol and deposited at the United States Department of Agriculture, Agricultural Research Service, Crop Protection & Management Research Unit in Tifton, Georgia.

All data were analyzed using SAS statistical software (SAS 9.3; SAS Institute 2010). Kudzu bug egg mass count data were modeled by a Poisson distribution. The analyses were done using PROC GLIMMIX. Model fit was evaluated by use of the chi-squared and df statistic provided by PROC GLIMMIX (Littell et al. 2006). Fixed effects were treatment, week, and the treatment by week interaction. Random effects were replicate and residual error. Subsamples (12 per plot) were pooled. Means were back transformed using the ILINK option in the LSMEANS statement and compared using Tukey's honestly significant difference (HSD) test. Data for parasitism rates of kudzu bug egg masses were analyzed using PROC MIXED. Fixed effects were treatment, week, and the treatment by week interaction. Random effects were replicate and residual error. Subsamples were averaged. Arcsine square-root transformation was used to normalize percentage parasitism data. Means were separated using Tukey's HSD test when appropriate.

Megacopta cribraria egg masses were detected on conventional tillage and no-till organic soybean for 7 wk. The treatment by week interaction was significant for density of *M. cribraria* egg masses ($F = 14.55$; df = 6,39; $P = 0.001$). The mean number of *M. cribraria* egg masses per sample was significantly higher in conventional tillage soybean than in no-till soybean in weeks 2 through 5 (Fig. 1A). In conventional tillage soybean, density of *M. cribraria* egg masses was significantly higher in weeks 3 and 4 than in the remaining weeks. In no-till

[1]USDA, ARS, Crop Protection and Management Research Laboratory, PO Box 748, Tifton, Georgia 31793, USA
[2]University of Georgia, Crop & Soil Sciences, 4115B Miller Plant Science Building, Athens, Georgia 30602, USA
[3]USDA, ARS, Southeast Watershed Research Laboratory, PO Box 748, Tifton, Georgia 31793, USA
[4]USDA, ARS, Sustainable Agricultural Systems Laboratory, 10300 Baltimore Ave., Building 001 Barc-West, Beltsville, Maryland 20705, USA
*Corresponding author; E-mail: Glynn.Tillman@ars.usda.gov

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

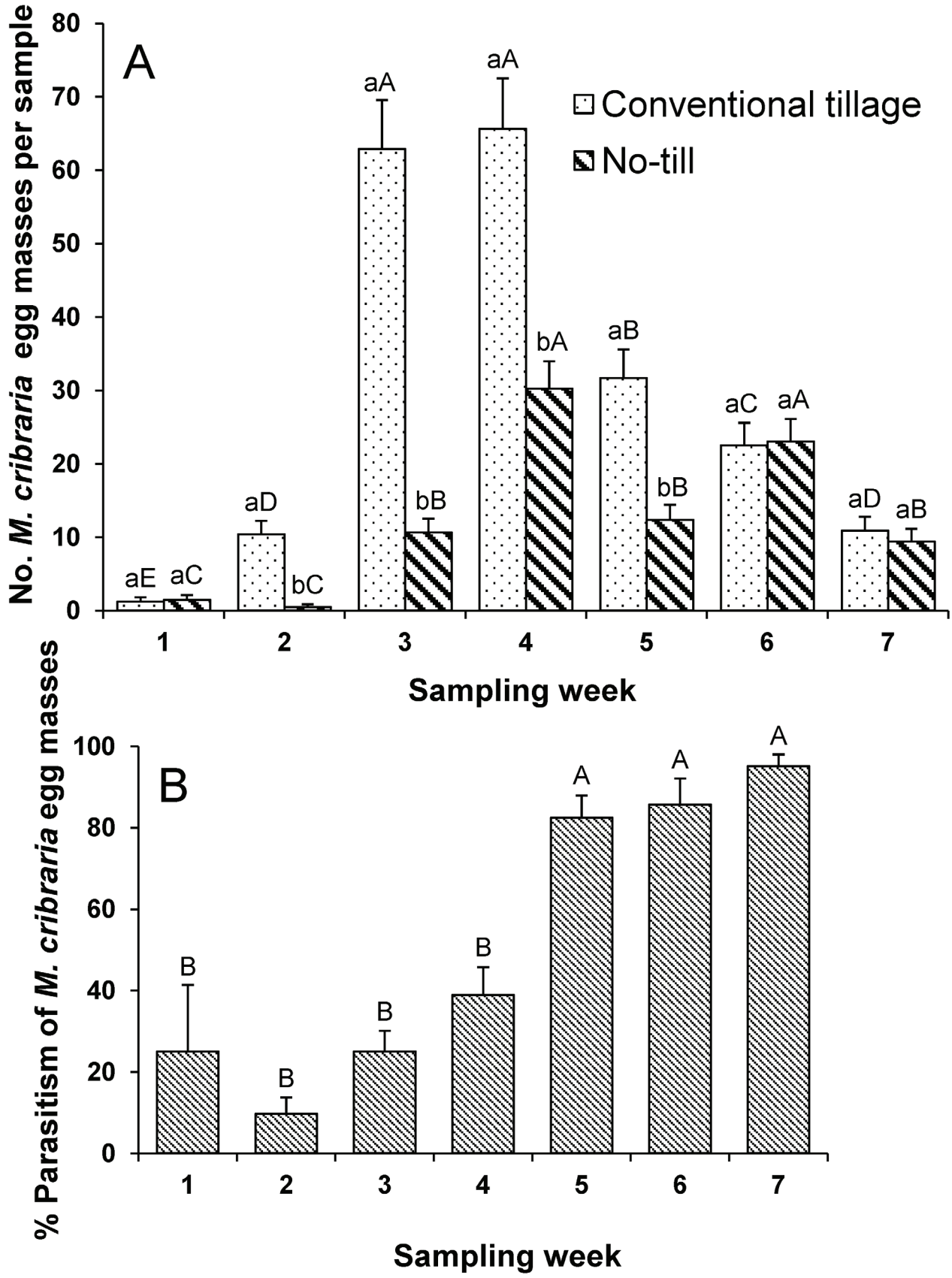


Fig. 1. A) Density of *Megacopta cribraria* egg masses (mean ± SE) in organic soybean in 2013. Means with the same lowercase letter are not significantly different between treatments per week, and means with the same uppercase letter are not significantly different among weeks per treatment (Tukey's HSD test, $P > 0.05$). B) Percentage of parasitism (mean ± SE) of *M. cribraria* egg masses by *Paratelenomus saccharalis* over time in organic soybean in 2013. Means with the same uppercase letter are not significantly different (Tukey's HSD test, $P > 0.05$).

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

soybean, density of *M. cribraria* egg masses was significantly higher in weeks 4 and 6 than in the remaining weeks. *Megacopta cribraria* may have been able to colonize conventional tillage soybean more easily than no-till soybean with wheat stubble.

Paratelenomus saccharalis parasitized *M. cribraria* egg masses during the time eggs were present on soybean. Percentage of parasitism of *M. cribraria* egg masses by *P. saccharalis* was influenced by treatment (F = 8.44; df = 1,39; P = 0.006) and week (F = 19.38; df = 6,39; P = 0.0001), but the treatment by week interaction was not significant (F = 2.26; df = 6,39; P = 0.0574). Percentage of parasitism of *M. cribraria* egg masses by *P. saccharalis* was significantly higher in conventional tillage soybean (58.4%) than in no-till soybean (44.9%). Parasitism rates of egg masses were high (82–95%) the last 3 wk of the study and were significantly higher in these last 3 wk than in the previous weeks (Fig. 1B). In general, parasitism rates of egg masses were higher in conventional tillage soybean, where *M. cribraria* egg mass density was higher, than in no-till soybean.

Summary

Megacopta cribraria (F.) (Hemiptera: Plataspidae) is a newly invasive, exotic pest of soybean (*Glycine max* [L.] Merr.; Fabales: Fabaceae) in the southeastern United States. In 2013, the exotic egg parasitoid *Paratelenomus saccharalis* (Dodd) (Hymenoptera: Platygastridae) was discovered parasitizing eggs of this pest in kudzu (*Pueraria montana* var. *lobata* [Willd.] Maesen & S. Almeida; Fabales: Fabaceae) and soybean in 3 states in this region of the United States. We evaluated parasitism of *M. cribraria* egg masses by *P. saccharalis* in conventional tillage and no-till organic soybean experimental plots in 2013. Density of *M. cribraria* egg masses was significantly higher in conventional tillage soybean than in no-till soybean in weeks 2 through 5 for the 7 wk period *M. cribraria* egg masses were detected on soybean. Percentage of parasitism of *M. cribraria* egg masses by *P. saccharalis* was significantly higher in conventional tillage soybean (58.4%) than in no-till soybean (44.9%). In general, parasitism rates of egg masses were higher in conventional tillage soybean, where *M. cribraria* egg mass density was higher, than in no-till soybean.

Key Words: kudzu bug; conventional tillage; no-till

Sumario

Megacopta cribraria (F.) (Hemiptera: Plataspidae) es una nueva plaga exótica invasiva de soja (*Glycine max* [L.] Merr .; Fabales: Fabaceae) en el sureste de los Estados Unidos. En el 2013, se descubrió un parasitoide exótico de los huevos, *Paratelenomus saccharalis* (Dodd) (Hymenoptera: Platygastridae), que parasita los huevos de esta plaga en el kudzu (*Pueraria montana* var. *lobata* [Willd.] Maesen y S. Almeida; Fabales:. Fabaceae) y soja en 3 estados en esta región de los Estados Unidos. En parcelas experimentales en 2013 se evaluó el parasitismo de masas de huevos de *M.cribraria* por *P. saccharalis* en soya de labranza convencional y de soja orgánica sin labranza. La densidad de masas de huevos de *M. cribraria* fue significativamente más alta en soja de labranza convencional que en la soja sin labranza en las semanas 2 a 5 del período de 7 semanas que se detectaron las masas de huevos de *M. cribraria* en la soja. El porcentaje de parasitismo de las masas de huevos de *M. cribraria* por *P. saccharalis* fue significativamente mayor en la labranza de soja convencional (58,4%) que en la no-labranza de soja (44,9%). En general, la tasa de parasitismo de las masas de huevos fue mayor en soja de labranza convencional, donde la densidad de masas de huevos de *M. cribraria* fue mayor, que en la soya sin-labranza.

Palabras Clave: bug kudzu; labranza convencional; sin labranza

Acknowledgments

The authors thank Kristie Graham, Jacob Barrett, and Chance Myers (United States Department of Agriculture, Agricultural Research Service, Crop Protection & Management Research Unit, Tifton, Georgia) for their technical assistance.

References Cited

Gardner WA, Blount JL, Golec JR, Jones WA, Hu XP, Talamas EJ, Evans RM, Dong X, Ray Jr CH, Buntin GD, Gerardo NM, Couret J. 2013. Discovery of *Paratelenomus saccharalis* (Dodd) (Hymenoptera: Platygastridae), an egg parasitoid of *Megacopta cribraria* F. (Hemiptera: Plataspidae) in its expanded North American range. Journal of Entomological Science 48: 355–359.

Greene JK, Roberts PM, Gardner WA, Reay-Jones F, Seiter N. 2012. Kudzu Bug Identification and Control in Soybeans. United Soybean Board, Chesterfield, Missouri.

Littell RC, Milliken GA, Stroup WW, Wolfinger RD, Schabenberger O. 2006. SAS for Mixed Models, 2nd ed. SAS Institute, Cary, North Carolina.

Megacopta Working Group. 2015. Kudzu bug. http://www.kudzubug.org/ (last accessed 9 Feb 2016).

Roberts P, Whitaker J. 2012. Kudzu bug management. http://www.kudzubug.org/docs/GA_1-2012_SBGrow.pdf (last accessed 20 Dec 2013).

Ruberson JR, Takasu K, Buntin GD, Eger Jr JE, Gardner WA, Greene JK, Jenkins TM, Jones WA, Olson DM, Roberts PM, Suiter DR, Toews MD. 2012. From Asian curiosity to eruptive American pest: *Megacopta cribraria* (Hemiptera: Plataspidae) and prospects for its biological control. Applied Entomology and Zoology 48: 3–13.

SAS Institute. 2010. SAS 9.3 for Windows. SAS Institute, Cary, North Carolina.

Suiter DR, Eger Jr JE, Gardner WA, Kemerait RC, All JN, Roberts PM, Greene JK, Ames LM, Buntin GD, Jenkins TM, Douce GK. 2010. Discovery and distribution of *Megacopta cribraria* (Hemiptera: Heteroptera: Plataspidae) in northeast Georgia. Journal of Integrated Pest Management 1: 1–4.

Takasu K, Hirose Y. 1986. Kudzu-vine community as a breeding site of *Ooencyrtus nezarae* Ishii (Hymenoptera: Encrytidae), an egg parasitoid of bugs attacking soybean. Japanese Journal of Applied Entomology and Zoology 30: 302–304.

Thippeswamy C, Rajagopal BK. 1998. Assessment of losses caused by the lablab bug, *Coptosoma cribraria* Fabricius (Heteroptera: Plataspidae) to the field bean, *Lablab purpureus* var. *lignosus* Medikus. Karnataka Journal of Agricultural Science 11: 941–946.

Wang ZX, Wang HD, Chen GH. 1996. Occurrence and control of *Megacopta cribraria* (Fabricius) on soybean. Plant Protection 1996: 7–9.

Zhang Y, Hanula JL, Horn S. 2012. The biology and preliminary host range of *Megacopta cribraria* (Heteroptera: Plataspidae) and its impact on kudzu growth. Environmental Entomology 41: 40–50.

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use