

Rapid Communication

***Brachyplatys vahlii* (Fabricius, 1787), an introduced bug from Asia: first report in the Western Hemisphere (Hemiptera: Plataspidae: Brachyplatidinae)**

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Received: 22 August 2015 / Accepted: 22 October 2015 / Published online: 20 November 2015

Handling editor: John Ross Wilson

Abstract

Brachyplatys vahlii (Fabricius, 1787) (Hemiptera: Plataspidae) was first detected in Panama in 2012. It represents the second introduction of the Plataspidae into the New World, its first report from the Neotropics, and the first introduction of the genus *Brachyplatys* into the New World. The bug was identified using morphological characters and confirmed using molecular techniques. This bug poses a potentially serious threat to several important crops in Panama, including the popular *Cajanus cajan*, known locally as guandú, and peach palm/pixbae palm (*Bactris gasipaes*), widely cultivated throughout the Neotropics.

Key words: *Bactris*, *Cajanus*, Heteroptera, Panama, Plataspidae

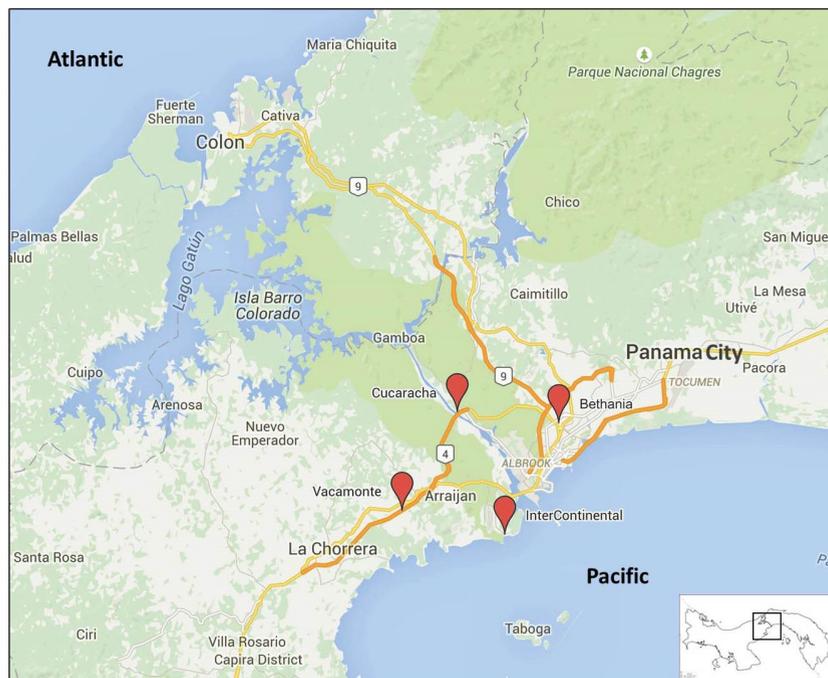
Introduction

Invasive species are among the greatest threats to native biodiversity worldwide (Mooney and Hobbs 2000). Since life began, organisms have found ways to travel and settle in new territories, but the magnitude of these movements in modern times is unprecedented. Increasing human travel and ever-expanding world commerce are providing easy and rapid transportation for vastly more non-native species to invade new areas at unprecedented rates, often with dire consequences for local communities and human agriculture. Famous insect examples include the “red imported fire ant” (*Solenopsis invicta* Buren, 1972, Formicidae), which has caused agricultural and medical misery in the southern United States since the early 1900s (Ascunce et al. 2011); the Brown Marmorated Stink Bug (*Halyomorpha halys* Stål, 1855, Pentatomidae), which pierces and sucks juices from orchard fruits (Hoebeke and Carter 2003); and the Bagrada Bug [*Bagrada hilaris*

(Burmeister, 1835), Pentatomidae)], a major pest of *Brassica oleracea* (Brassicaceae) (Bundy et al. 2012).

In 1999, a small brown-speckled bug, *Megacopta cribraria* (Fabricius, 1798) (Hemiptera: Plataspidae), native to Japan, somehow reached the southeastern US and established itself in the state of Georgia, where it began attacking the Kudzu vine (*Pueraria montana* (Lour.) Merr., Fabaceae), itself an Old World invader (Suiter et al. 2010) that grows rapidly and covers anything in its path, including buildings and tracts of forest. Though any form of Kudzu control could be considered a positive event, *Megacopta* also began attacking the soy crop (*Glycine max* (L.) Merr., Fabaceae) which is an undesirable side effect. So far, no effective control measures have been found, and the bug has spread throughout the southern states, as far west as Louisiana, and as far north as Washington D.C. (Jenkins and Eaton 2011; McConaughy 2015). The arrival of *Megacopta* in the New World also marked the first and only New World appearance of the exclusively Old World family Plataspidae.

Figure 1. Localities, cited in Table 1, at which *Brachyplatys vahlii* (Plataspidae) has been encountered in the Republic of Panama.



Though the family name Plataspididae has been argued to be the correct spelling (e.g., Ghahari et al. 2014), we have been advised to follow the most recent catalog of Palearctic Heteroptera (Davidová-Vilímová 2006) and checklist of Chinese plataspids (Liu and Zheng 2006), and are using the family name Plataspidae.

The genus *Brachyplatys* Boisduval, 1835 (Plataspidae) is native to Asia. We recently found *Brachyplatys vahlii* (Fabricius, 1787) in the Republic of Panama on both the eastern and western sides of the Panama Canal, on five plant species at four localities (Table 1, Figure 1). It was first detected in 2012 in Vacamonte, Arraiján District, Panama Oeste Province on pigeon peas/guandú plants (*Cajanus cajan* (L.) Millsp., Fabaceae) and peach palm/pixbae palm (*Bactris gasipaes* Kunth, Arecaceae) in a residential backyard. It was found a second time (photographed only) in 2013 in the Cucaracha section near to Paraiso, Ancon, Panama Province, on a tree, *Leptolobium panamense*, (Benth.) Sch. Rodr. and A.M.G. (Fabaceae) and still was there on that tree in June of 2015. In 2014, it was found again in Vacamonte, this time on umbrella tree (*Schefflera actinophylla* (Endl.) Harms, Araliaceae). The fourth detection was in 2015 in the Bethania section of Panama City, where large aggregations (Figure 2) fed on the stems of guandú plants in a

residential backyard; the plants that had bugs feeding on them, died. It was seen a fifth time, and photographed, in mid-February 2015 on a hand rail at the InterContinental Playa Bonita Resort and Spa, Arraiján District, Panama Oeste Province.

Like *Megacopta*, *Brachyplatys* has an obligate relationship with a bacterial endosymbiont that enables it to feed on legumes (Fabaceae) (Hosokawa et al. 2006), giving it the potential to become an agricultural pest of legume crops. Early detection can help prevent biological introductions from turning into invasions that develop into serious agricultural pests or present medical threats. Here we document this introduction, confirming our identification using both morphological and molecular techniques.

Identification

The domed, smooth, and slightly square appearance of the bugs brought to us from Bethania were reminiscent of *Megacopta cribraria* which one of us had chanced to see specimens of several years earlier. That memory led to an online search for images of the family Plataspidae, and hence to the genus *Brachyplatys*, a tentative identification that later was verified and expanded to species level by a molecular study.

Table 1. Chronology of *Brachyplatys vahlii* (Plataspidae) encounters in the Republic of Panama*. These encounters were opportunistic – no formal surveys of the distribution have been undertaken.

Year	Host	Location	Coordinates
2012	<i>Cajanus cajan</i> (Fabaceae) <i>Bactris gasipaes</i> (Arecaceae)	Vacamonte, Arraiján District, Panama Oeste	8.924889, -79.696528
2013 & 2015	<i>Leptolobium panamense</i> (Fabaceae)	Cucaracha, near to Paraiso, Ancon	9.033972, -79.63475
2014	<i>Schefflera actinophylla</i> (Araliaceae)	Vacamonte, Arraiján District, Panama Oeste	8.924889, -79.696528
2015	<i>Cajanus cajan</i> (Fabaceae)	Bethania section of Panama City	9.021808, -79.521006
2015	hand rail	InterContinental Playa Bonita Resort & Spa, Arraiján District, Panama Oeste	8.898239, -79.581667

*Since this manuscript was accepted, a thriving colony of *Brachyplatys vahlii* has been reported by Juan Ignacio Pérez, on *Cajanus cajan* (Guandú) in Panama (11 November 2015): La Chorrera (8.879833, -79.751194), several miles farther west than reported herein.

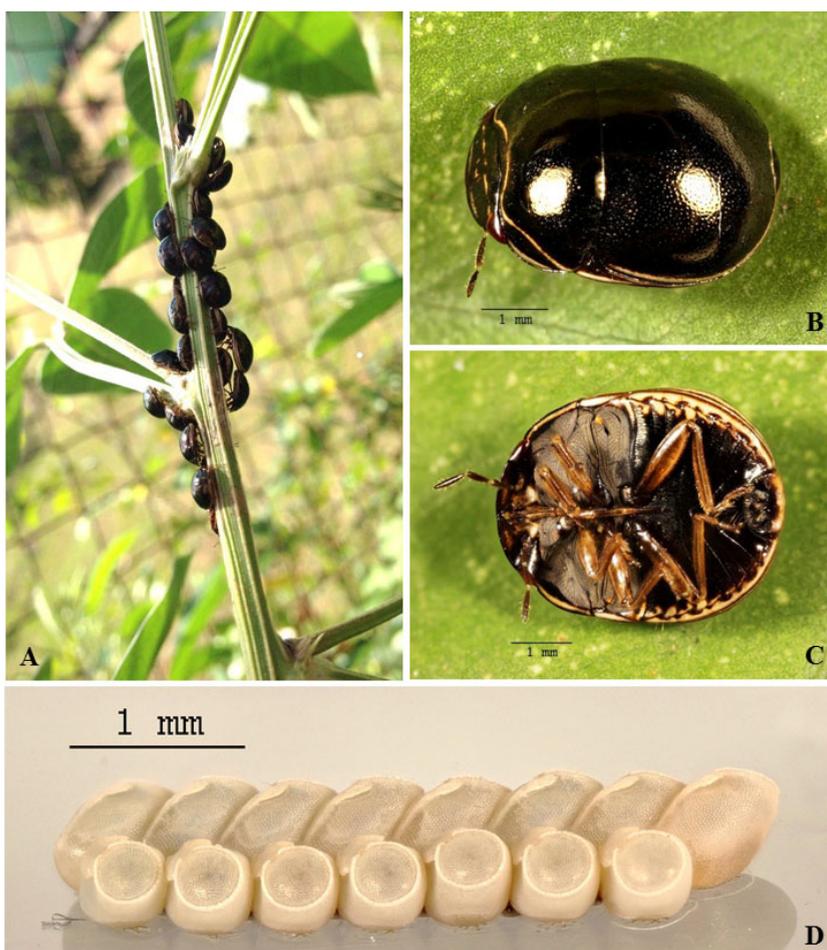


Figure 2. *Brachyplatys vahlii*. A. adults feeding on *Cajanus cajan* stem; B. adult, dorsolateral view; C. adult, ventral view; D. egg mass. Photograph “A” taken by Ana Patricia Betancourt.

Brachyplatys vahlii bugs are quite small, 5 mm long and 4 mm wide, shiny black, with a rust-colored border (Figure 2), and they emit a typical unpleasant stink-bug odor when handled. At first glance they resemble beetles, but closer inspection reveals that they have sucking mouthparts, with which they pierce the stems of

the host to feed on plant juices. They occur in large numbers and gradually kill the plant. The only eggs we have seen are similar to those of *Megacopta* (as shown in Poplin and Hodges 2012, 2013) in that they were laid in two rows (Figure 2) and are barrel-shaped with a crown of small projections at the apical end. They differ from the

Table 2. *Brachyplatys vahlii* (Fabricius, 1787) native range information taken from literature.

Native Range/Distribution	Reference
India	Ramakrishna (1920)
Okinawa (=? Okinawa-jima) (Japan); Philippines; Malay; Burma; India	Takara (1957)
Hilir Perak (Malaysia)	Azhar et al. (1984)
Fujian, Jiangxi, Guangdong, Guangxi, Hainan (China)	Liu and Zheng (2006)
Malaysia	Ruberson et al. (2012)

Table 3. Host plants for 11 species of *Brachyplatys* (Plataspidae), assembled by Rider (2014). Numbers represent numbers of plant genera and species. See NDSU website for details: http://www.ndsu.nodak.edu/ndsu/rider/Pentatomoidea/Hosts/plant_Plataspidae.htm

<i>Brachyplatys:</i>	Cannabaceae	Convolvulaceae	Euphorbiaceae	Fabaceae	Malvaceae	Mimosaceae	Poaceae	Solanaceae	Tiliaceae
<i>advenus</i> Linnavuori			1_1						
<i>aethiops</i> Dallas			1_1						
<i>liturifrons</i> Walker [incl. <i>silphoides</i>]							1_1		
<i>pacificus</i> Dallas				4_4	1_1		1_1		
<i>papuus</i> (Guérin-Méneville)				1_1					
<i>punctipes</i> Montandon				1_1					
<i>subaeneus</i> (Westwood)	1_1	1_1		9_10		1_1		1_1	1_1
<i>testudonigra</i> (DeGeer)			2_2	13_29	1_1		2_2	1_1	
<i>truncaticeps</i> Montandon			1_1						
<i>vahlii</i> (Fabricius)				1_1					
unidentified species				3_3					
Totals:	1_1	1_1	5_5	32_49	2_2	1_1	4_4	2_2	1_1

eggs of *Megacopta* in being shorter and proportionately wider and in having the crown projections much more numerous and distinctly shorter. They also have a double wing-like structure on one side that is not seen in the photographs of *Megacopta* eggs in Poplin and Hodges (2012, 2013). Information on the native range of *Brachyplatys vahlii* can be found in Azhar et al. (1984), Liu and Zheng (2006), Ramakrishna (1920), Ruberson et al. (2012), and Takara (1957) (see Table 2).

Genomic DNA was extracted from three whole bugs, from the Bethania location, using a DNeasy Blood and Tissue kit (Qiagen). The insect mitochondrial COI and 16s loci were amplified using the primer pairs LCO1490–HCO2140 (Folmer et al. 1994) and 16sA1–16sB1 (Hosokawa et al. 2006) respectively. PCRs were conducted using Qiagen Taq with a thermal cycling profile of 94° C for 3 min, 30 cycles of 94° C for 1 min, 50° C for 1 min, and 72° C for 2 min, followed by a final extension at 72° C for 5 min. Products were cleaned using gelase and sequenced on an ABI 3500XL using BigDye chemistry. Sequences were aligned and

corrected using Sequencer 5.1 and a GenBank BLASTn search was done to determine similarity with sequence in the database.

An 832 bp fragment was detected at the 16s locus (GenBank No. KT447151) and 623 bp at COI (GenBank No. KT447152). Both fragments were identical in all three individuals. At the 16s locus, the sequence showed a 99% similarity to a *Brachyplatys vahlii* (Fabricius, 1787) specimen collected in Onna, Okinawa (GenBank No. AB240167), differing at only 4 positions. The next closest match was to *Brachyplatys subaeneus* (Westwood, 1837) (GenBank No. AB240167), to which it showed only an 85% similarity. While COI was less definitive, the sequence showed 83–86% similarity to other members of the infraorder Pentatomorpha at the COI locus.

Mounted vouchers of the bugs collected in Panama City have been deposited in the collections of the Smithsonian Tropical Research Institute, Panama (STRI) (five specimens, Symbiota database numbers STRI-ENT 0124178–0124182), and the Museo de Invertebrados "G.B. Fairchild," Universi-

dad de Panamá, República de Panamá (MIUP) (two specimens). Additional specimens will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM) once the paperwork has been completed.

Plant associations

At least eleven species of *Brachyplatys* are found across Asia where they have been reported feeding on 56 plant species belonging to 30 genera and 9 families (Rider 2014) (Table 3) and often are considered as pests (Tauthong et al. 1979–1980; Waterhouse 1997; Shine et al. 2003). The plants most attractive to them belong to the bean family, Fabaceae, which, in addition to guandú and soy, includes other widely cultivated beans (*Phaseolus* L. spp.): lima beans, green or string beans, red beans, kidney beans, black beans, and black-eyed peas. Another plant family preferred by some species of *Brachyplatys* is the grass family, Poaceae, which includes corn (*Zea mays* L.), rice (*Oryza sativa* L.), and sugar cane (*Saccharum officinarum* L.). Ramakrishna (1920) provided the earliest published host association for *B. vahlii*, on *Sesbania* Scop. (Fabaceae) in India: “The black oval shining Pentatomid, *Brachyplatys vahlii*, is often found in numbers in company with the common *Coptosoma cribraria* on *agathi* (*Sesbania*).” Since then it has been reported as an occasional pest on cocoa, *Theobroma cacao* L. (Malvaceae; formerly Sterculiaceae), in Malaysia (Azhar et al. 1984).

As of this report, host plants of *B. vahlii* in Panama include *Cajanus cajan*, cultivated across the country; *Schefflera actinophylla*, an ornamental tree; *Leptolobium panamense* a Neotropical tree used in agroforestry, rural construction, and traditional medicine; and *Bactris gasipaes*, the most important domesticated palm in the Neotropics, native to and widely cultivated throughout South and Central America for its nutritious fruits and heart of palm (palmito) (Graefe et al. 2013).

Conclusion

Brachyplatys vahlii is already established on both sides of the Panama Canal, on a variety of plants, and has the potential to spread into areas of the country with agricultural activity and present a serious threat to several valued crops. Continued surveillance to determine the extent of its distribution and possible spread is needed, as is research on the efficacy of various control measures.

Acknowledgements

Many thanks to Vanessa Bernal and Ana Patricia Betancourt for bringing the bugs from Bethania and for the photograph of them on guandú, to Mark Torchin for his good advice and comments, to Edwin Domínguez for photographing the adult and the eggs, to Carmen Galdames for identification of the plant from Cucaracha, Ancon, and to Angel Aguirre, STRI Library, for tracking down obscure references. We are grateful to the two anonymous reviewers whose thoughtful and helpful comments greatly improved the manuscript.

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Appendix 1. Abstract in Spanish.

Resumen:

En el año 2012 se encontró *Brachyplatys vahlii* (Fabricius, 1787) (Hemiptera: Plataspidae) por primera vez en Panamá. Este hallazgo representa la segunda introducción de la familia Plataspidae en el Nuevo Mundo, el primer reporte en el Neotrópico y la primera introducción del género *Brachyplatys* en el Nuevo Mundo. El chinche se identificó utilizando características morfológicas y se confirmó a través de técnicas moleculares. Este chinche tiene el potencial de amenazar seriamente importantes cultivos en Panamá, incluyendo el popular *Cajanus cajan*, conocido localmente como guandú y también la palma de pixbae (*Bactris gasipaes*), ampliamente cultivada en el Neotrópico.