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A new genus and species of delphacid planthopper (Hemiptera: Fulgoroidea: Delphacidae) from Central America with a preliminary regional species list

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Abstract

The new genus *Ampliphax*, assigned to the Delphacini, is described and illustrated with a single new species *A. grandis* from Costa Rica and Panama. *Ampliphax grandis* is a large species with a projected head. DNA barcode data suggest, among currently barcoded taxa, an affinity to the genus *Bostaera*. A checklist of the delphacid species from Costa Rica, Panama, and Nicaragua based on literature and specimen records is provided.

Key words: Delphacidae, Delphacini, Fulgoroidea, Auchenorrhyncha, planthopper, new species, Central America

Introduction

Delphacidae is a diverse group (2,100+ species) of small planthoppers, with several species of economic importance in the Neotropics, including the corn delphacid, *Peregrinus maidis* (Ashmead), the rice-feeding *Tagosodes orizicolus* (Muir) and *T. cubanus* (Crawford), the adventive sugarcane planthopper, *Perkinsiella saccharicida* Kirkaldy, and *Saccharosydne saccharivora* (Westwood), a native sugarcane disease vector (e.g., Arocha *et al.* 2005). Despite their importance, the Neotropical Delphacidae remains poorly investigated. There are no modern faunistic reviews and undescribed species are readily detected amidst new collections, unsorted institutional collections, or among faunistic photographs. Among described species, distributional information remains incompletely reported.

Here, an unusual delphacid in the tribe Delphacini (Delphacinae) is described and illustrated from Costa Rica and Panama. Costa Rica is unusual among Mesoamerican countries in that substantive effort has been made to investigate the insect fauna, and an extensive collection of Hemiptera is available at the National Biodiversity Institute (INBio). A recent project at INBio has DNA barcoded 285 Delphacidae from the INBio collection, putatively representing 44 taxa. These data are available online at Barcode of Life (BOLD; http://www.barcodeoflife.org/; Ratnasingham & Hebert 2007, 2013), and include 3 specimens of the unusual new genus and species described here. As of this writing, BOLD has a total of 1,261 delphacid specimens with barcodes representing 287 species.

This new genus is assigned to the Delphacini (Delphacinae) because the calcar is large, tectiform, and flattened, bearing a row of fine, black-tipped teeth on the posterior margin; the genital diaphragm is well-developed (including a remarkably large armature), and an elongate suspensorium attaches segment X to the base of the aedeagus, which is represented by a simple tubular fused theca. It was originally found in collections from Costa Rica and subsequently Panama. Also, a preliminary list of delphacid species from Nicaragua, Costa Rica, and Panama is provided and discussed.

Materials and methods

Specimens were examined from the following collections (abbreviations following Arnett *et al.* 1993):

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INBio	Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica.
LBOB	Lois O'Brien collection (Green Valley, Arizona; affiliated with the California Academy of Sciences).
NCSM	North Carolina State Museum of Natural Sciences, Raleigh, NC.
NCSU	North Carolina State University, Department of Entomology, Raleigh, NC.
UDCC	University of Delaware, Department of Entomology and Wildlife Ecology, Insect Reference Collection, Newark, DE.
USNM	Smithsonian Institution National Museum of Natural History, Washington DC.

Preparation and clearing of genitalia follows methods described in Wilson & McPherson (1980), Bartlett & Deitz (2000) and Wilson (2005). Morphological terminology follows that of Asche (1985, 1990) and subsequent authors (e.g., Bartlett & Deitz 2000, Gonzon & Bartlett 2008, Bartlett 2010, Bartlett *et al.* 2014). Wing venation follows Kukalová-Peck (1983) as interpreted by Dworakowska (1988), except that the first anal vein is understood as the postcubitus (Fennah 1944, Emeljanov 1977, Bourgoin *et al.* 2015). Roman numerals are used for all counts of segments.

Photographs and measurements of pinned specimens were taken using a digital imagery system consisting of a Nikon SMZ1500 microscope, Nikon Digital Sight DS-U1 camera and NIS Elements Imaging software (version 3.0). Line art was digitally traced from photographs. All measurements are in millimeters (mm). Live photographs were taken in the field using a Canon EOS 450D camera together with the Canon MP-E 65mm macro lens and the Canon MR-14 EX ring flash.

Label data were recorded for all included specimens. For primary types, labels were quoted verbatim using "/" to indicate a line break and "//" to indicate a new label and with supplemental information given in brackets. For other material examined, label data were rewritten to maintain consistency in pattern, beginning with the country, state or province, and more specific locality, followed by the collection date, collector, and lastly the number and gender of specimens (m=male, f=female) and the depository where the specimens are located, given in parentheses. Additional information was included in the same order as seen on the label data. Abbreviations in label data were expanded for clarity, except where the meaning was unclear. Specimens were provided 2D barcode labels (when not already present) and data were captured for online presentation following publication (visualized at www.discoverlife.org) using "Arthropod Easy Data Capture" (Schuh *et al.* 2010, Schuh 2012, Arthropod Easy Capture 2013). Data from specimens from the INBio collection are also available via the INBio information system ATTA (described http://atta.inbio.ac.cr/attaing/atta03.html). The distribution map was created using SimpleMappr (Shorthouse 2010).

The species checklist was prepared using published literature and available specimens (including those from the INBio ATTA database). The checklist was intended to be focused on Costa Rica, but Panama and Nicaragua were included because species found in these countries are likely to be found in Costa Rica as well. Specimens not previously databased were data captured using "Arthropod Easy Capture" as above; including 1,066 specimens (53 species) from the target area.

Descriptive taxonomy

The species list presented here compiled for Nicaragua, Costa Rica, and Panama consists of 65 species (in 32 genera), including the species described below, plus 5 species reported to genus only (because the species is undescribed or not determined beyond genus), but excluding 3 species reported in error (Table 1).

Ampliphax new genus

Type species. ***Ampliphax grandis* new species**

Description. Body pale, rather uniformly colored orangish-brown; macropterous wings clear to slightly infuscate. Head narrower than pronotum, in lateral view head anteriorly projecting, appearing slightly upcurved. Lateral carinae of vertex keeled, meeting at fastigium, other vertex carinae obsolete. Frons parallel-sided, narrower

between eyes; median carina forked near fastigium. Vertex much longer than wide. Antennae terete; segment II nearly 2 × longer than segment I; segment II bearing sensory plaques (rhinaria) organized into irregular rows. Lateral ocelli relatively obscure, near ventral anterior margin of compound eye. Lateral carinae of pronotum not reaching hind margin. Hind tibiae with one lateral spine; spinulation of hind leg: tibiae 5 (3+2), basitarsus 7 (5+2), tarsomere II 4. Calcar tectiform with > 25 fine, black-tipped teeth. Male pygofer taller than wide in lateral and caudal view; opening of pygofer weakly keeled, ventral margin with large projection. Diaphragm deeply emarginate, bearing large appendages resting on either side of the aedeagus. Parameres narrow, flattened, and simple, basal angle obscure. Aedeagus simple, flattened and decurved. Suspensorium evident, base elongate and narrowly straplike, distally forked into "Y" to embrace the aedeagus. Anal segment (segment X) conspicuous, quadrate in lateral view bearing a pair of projections at dorsocaudal angle; anal tube (segment XI) elongate, subequal in height to segment X.

Etymology. The genus name is formed from the Latin word '*amplus*' (large) joined as '*ampli*' with '*phax*' (a truncation of *Delphax*), to be treated as masculine in gender.

Remarks. This genus is readily recognized by its large size and projected head. The form of the suspensorium, the armature of the diaphragm, and the ventral projection of the pygofer opening are all unusual features. There are no described Neotropical genera that bear obvious similarities, although *Pareuidella* Beamer, and several species currently misplaced in *Euides* Fieber, bear roughly similar genital diaphragm structures, but have complex, branched parameres. *Neoperkinsiella* Muir are of similar size but have flattened antennae. Because this genus is large and of unusual appearance among the Delphacini, specimens are easily found among undetermined collections in museums; nevertheless, relatively few specimens were available for study.

Ampliphax grandis new species

(Figures 1–4)

Type locality. Costa Rica, Puntarenas Province, Estacion Pittier, near Cerro Gemelo, 1670m

Diagnosis. A large, orange-stramineous species with a projected head, keeled lateral carinae of the vertex and terete antennae. Calcar large, foliaceous, with greater than 25 small, black-tipped teeth on the trailing margin. Male genitalia with simple parameres, a simple decurved aedeagus, and very large curved pair of appendages on the genital diaphragm.

Description. Color. Uniformly orange-stramineous to orange-tan (some specimens weakly washed anteriorly with grey), paler in median regions of vertex, pro- and mesonotum. Macropterous wings clear to weakly infuscate. **Structure**. Macropter. Body length, male, without wings $\bar{x}$ = 3.11 mm (range 3.03–3.20, n=3), with wings $\bar{x}$ = 5.19 mm (range 5.14–5.27, n=4), forewings 4.12 mm (range 4.02–4.21, n=3); female (without wings) $\bar{x}$ = 3.80 (range 3.61–4.12, n=4), with wings 5.78 (range 5.67–5.85, n=4). *Head*. Head narrower than pronotum. Vertex longer than wide (l:w 1.69:1, n=5). Head narrower than pronotum, in lateral view distinctly anteriorly projecting, appearing slightly upcurved. Carinae of head and thorax conspicuous, except Y-shaped and submedian carinae of vertex obsolete; lateral margins of vertex strongly carinate, meeting at fastigium. Frons rather parallel-sided about 3 × longer than wide (w:l 0.27:1), widest near ventral margin of eyes, narrowed between eyes; carinae sharp, median carina of frons narrowly forked near fastigium. Antennal segment I about twice as long as wide, antennal segment II about 2 × longer than I (ratio I:II 0.45:1) *Thorax*. Prothorax about 1/3 length of mesothorax (length ratio 0.37:1); carinae evident, lateral carinae diverging, not reaching posterior margin. Mesonotum with carinae evident, reaching posterior margin, lateral carinae slightly diverging posteriorly. Forewing venation varying in details among individuals. Forewing with nodal line in distal third; Sc+R arising from leading margin of basal cell, forked into Sc+RA and RP near midlength of clavus, Sc forked from RA at nodal line, RA unbranched; RP unbranched or forked following nodal line; MP forked from SC+R+M (+CuA according to Nel *et al.*, 2012, Bourgoin *et al.* 2015) at basal cell, abruptly angled at nodal line and subsequently to MP_{1+2} and MP_{3+4} at (or after) nodal line, some specimens with MP_{3+4} subsequently branched; CuA arising from trailing margin of basal cell, forked into CuA_1 and CuA_2 distad of Sc+RA and RP fork; with CuA_1 branch often subsequently forked. Calcar large, flattened and foliaceous, narrowed distally, bearing continuous row of more than 28–35 black-tipped teeth on posterior lateral margin, subequal or exceeding length of metabasitarsus. Metabasitarsus slightly more than half length of tarsus (0.55:1, n=5). *Abdomen*. Pygofer in lateral view quadrate, taller than wide in lateral view; anterior margin truncate,

caudal margin sinuate; ventrocaudal margin with elongate, scooplike projection. In caudal view, pygofer opening keeled, taller than wide; ventral margin of opening with prominent projection, ventrolateral margins strongly keeled. Diaphragm deeply emarginate medially, armature consisting of a pair of very large caudally declined scalpriform appendages arising from thickened base; avicephaliform in lateral view, U-shaped in caudal view. Parameres narrow, flattened, parallel-sided, basal angles obscure; diverging in basal two-thirds, angled dorsal in apical third, apex abruptly angled lateral; apex truncate; in lateral view somewhat dorsocaudally directed. Aedeagus simple, decurved, parallel-sided and weakly flattened, bearing small subapical lateral flanges of few teeth. Abdominal segment X quadrate, bearing short, thick sharply-pointed processes on dorsocaudal angles; widely separated at base in caudal view; segment XI subequal to height of segment X.

FIGURE 1. *Ampliphax grandis,* female. **A**. laterodorsal and, **B**. dorsal habitus. Photographs by Gernot Kunz, taken Costa Rica, Rincón del Vieja, National Park Rincón de la Vieja, N10°45′15′′ W85°21′00′′, el. 635m 10 June 2008.

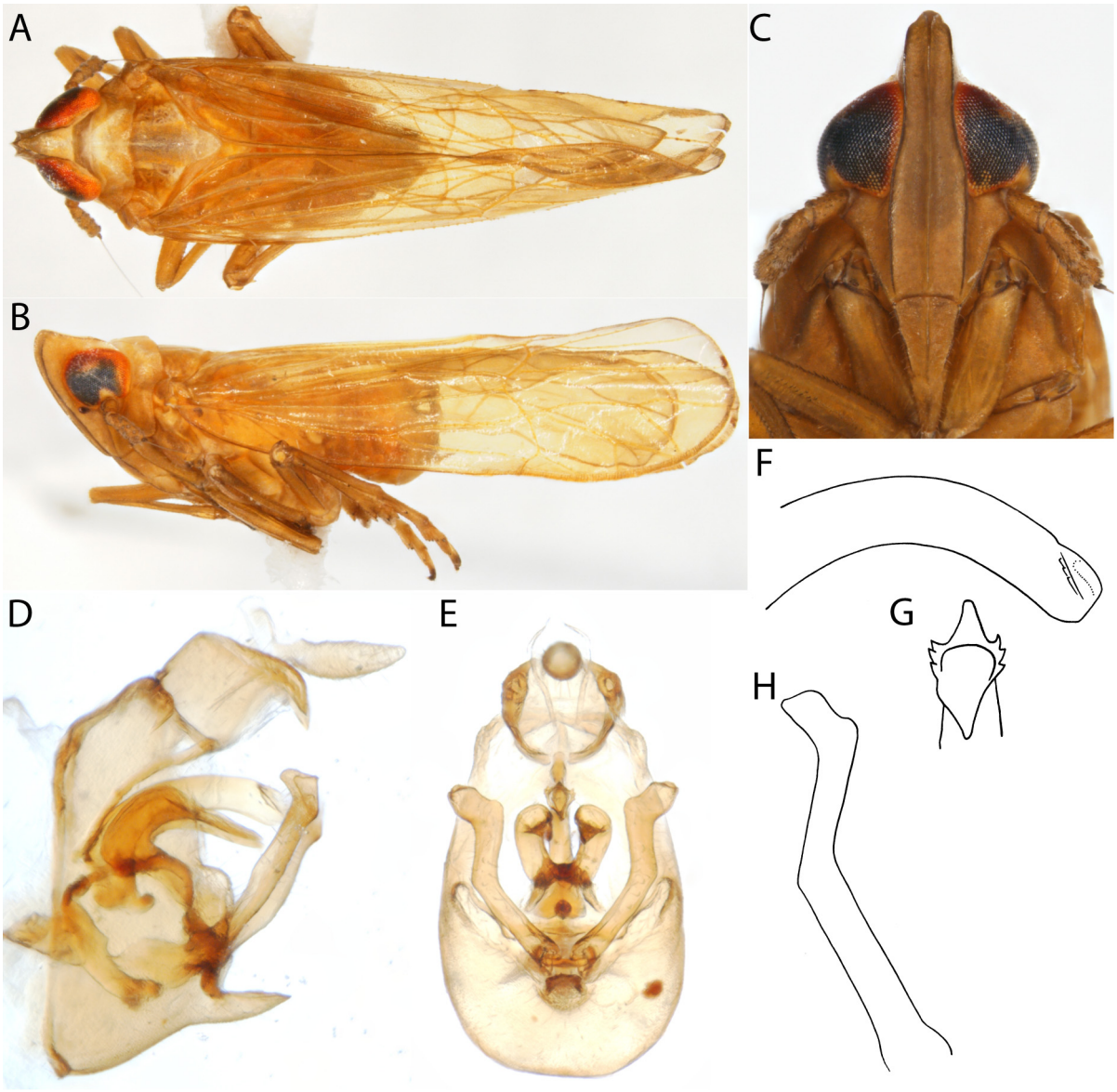

FIGURE 2. *Ampliphax grandis,* male paratype, La Selva, Costa Rica. **A**. dorsal habitus, **B**. lateral habitus, **C.** front, **D**. male pygofer, lateral view, **E**. male pygofer, caudal view, **F**. aedeagus, left lateral view, **G.** aedeagus, caudal view of apex, **H.** left paramere, caudal view.

Remarks. Given its relatively large size and distinctive features, relatively few specimens of *Ampliphax grandis* have been found. Of the 32 specimens of this species recorded here, the sex ratio was highly biased toward females, with 26 females and 6 males. The few specimens with reported collection methods came from lights, although some specimens collected by F. S. Blanton had debris on them suggesting they were obtained from Malaise traps. No host plants have been recorded.

A general zoogeographic pattern found in Costa Rica has been that different, but closely related, species are found among the Pacific tropical dry forest (lowland) region, the higher elevations (especially the Talamanca Mountains), and the Atlantic lowlands. We considered this pattern, but available evidence suggests a single species. However, the available evidence is limited because all the specimens from Guanacaste and Alajuela provinces, Costa Rica (in the northwest), were female, as were available specimens from Panama. The genitalia of the 6 males (from Limon, Puntarenas, and Heredia provinces, Costa Rica) were similar. The most notable differences were that the holotype (from Puntarenas, 1670 m), had a more pointed aedeagus and longer processes on segment X than the specimen illustrated (Heredia, ~60 m). Also, DNA barcodes show that the holotype has less than 1% difference from a specimen from Limon (10 m elevation).

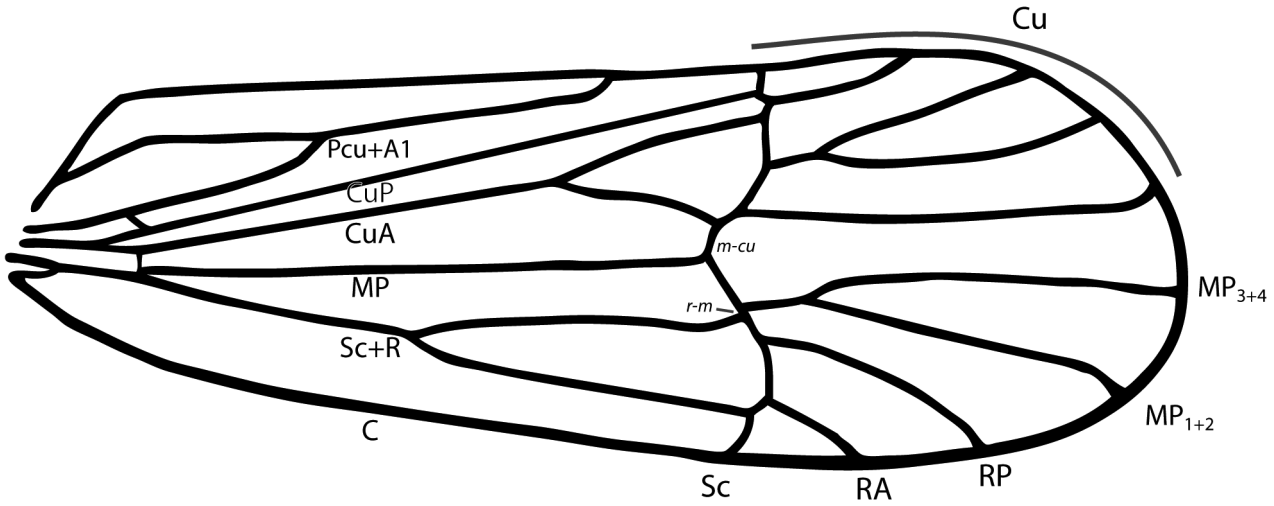

FIGURE 3. Left wing venation of *Ampliphax grandis* (from paratype, La Selva biological station, Costa Rica). Abbreviations: A = anal vein, C = costa, CuA = anterior cubitus, CuP = posterior cubitus, *m-cu* = m-cu crossvein, MP = posterior media (anterior media absent), Pcu = postcubitus, *r-m* = r-m crossvein, RA = anterior radius, RP = posterior radius; Sc = subcostal (understood as posterior subcostal).

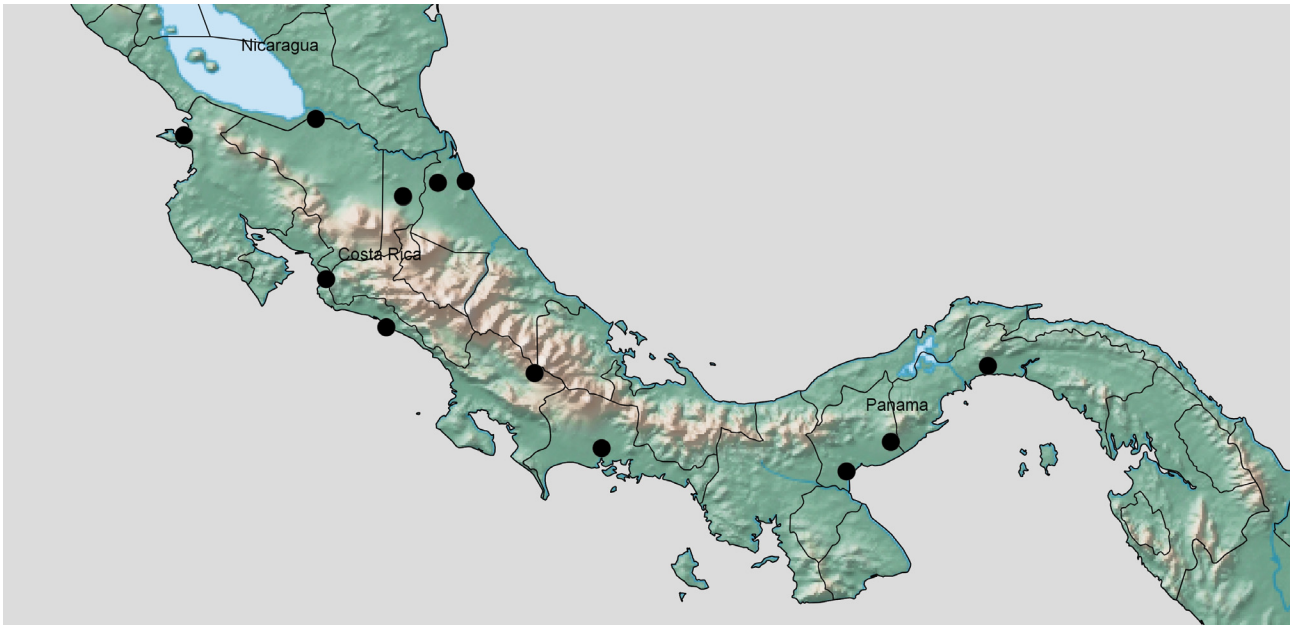

FIGURE 4. Distribution of *Ampliphax grandis* in Costa Rica and Panama.

A single female specimen from the Dominican Republic was excluded from the paratype series because of its disjunct range. A specimen from Laguna Medio Queso, Costa Rica was excluded because it was in poor condition.

The holotype has been DNA barcoded with the full 658 bp sequence available on BOLD (process id ASIHE1471–12, BIN URI ABZ9263).

Reported hosts. None.

Distribution. Costa Rica, Panama (Fig. 4); also tentatively from Dominican Republic.

Etymology. The specific epithet is from the Latin word *grandis* (large, great, magnificent), and has a common termination in masculine and feminine form.

Type material examined. HOLOTYPE (male, INBio). COSTA RICA. Puntarenas, Est. / Pittier, 4.2 Km SO. del Cerro / Gemelo 1670m, 8–20 JUL 1997. / M. M. Moreaga. Red de Golpe / L_S_330900_577400 #47390 // [inverted barcode label] COSTA RICA / INBio / CRI002 / 567442 // DNA Barcoding / E. Ulate / CCDB–11593 D10 // HOLOTYPE /*Ampliphax* / *grandis* / Bartlett & Kunz [red paper]."

PARATYPES. **COSTA RICA: Guanacaste:** Rio Pedregal, Murcielago, A.C.G., P.N. Santa Rosa, 100 m, Nov 1993, F. Munoz, L N [Lambert north] 320300 347200 #2506 (4f INBio); Rincón del Vieja, National Park Rincón de la Vieja, N10°45´15´´; W85°21´00´´, 635m, 10 June 2008, G. Kunz (1f, photographs, Fig. 1); **Heredia:** La Selva, 50 m, 01 Sep 1998, C. W. & L. B. O'Brien, at light (1f, LBOB). near Puerto Viejo, La Selva Biological Station, 10.41667°N 84°W, 55 m, 17 Aug 2003, C.R Bartlett, J. Cryan and J. Urban (1f, UDCC); same, 23 Feb 2004–02 Mar 2004 (1f, UDCC); same, 25–26 Feb 2004, C. R. Bartlett (1f, UDCC); same, 29 Feb 2004, C. R. Bartlett, mercury vapor light, Voucher NCSM tissue collection 09–11–20–35 (1m, UDCC, 1f, NCSM, in alcohol); **Limon:** Est[acion] Cuatro Esquinas, P. N. Tortuguero, Jun 1990, E. Quesada, L N 280000, 590500 (1f, INBio); Sector Cedrales de la Rita, 3 km N del Puente Rio Suerte, Ruta Puerto Lindo, 10 m, Jan 1997, E. Rojas, L N 278600, 566500 (2f, INBio, CRI002545535 DNA barcoded); same, Feb 1997 (1f, 2m INBio); same, Apr 1997 (3f, 1m INBio); **Puntarenas:** Estacion Pittier, 4.2 Km SW del Cerro Gemelo, 1670 m, 08–20 Jul 1997, M. M. Moreaga, Red de Golpe, L S [Lambert south] 330900, 577400 (1m, INBio); Estacion Quebrada Bonita, Res. Biol. Carara, 50 m, May 1990, R. Zuniga, [L S?] 194500, 469850 (1f, INBio); Quepos, P.N. Manuel Antonio, 80 m, Feb 1991, R. Zuniga, L S 370900, 448800 (1f, INBio, CRI000312790 barcoded). **PANAMA: Chiriqui:** David, Oct 1959, N. L. H. Krauss (1f, USNM); **Cocle:** El Retiro, 10 Nov 1952, F. S. Blanton (1f, USNM); Pt. [Port of] Aguadulce, 21 Nov 1952, F. S. Blanton (1f, USNM); **Panama:** Tocumen, 20 Dec 1951, F. S. Blanton (3f, USNM).

Other material examined. COSTA RICA: Alajuela: Laguna Medio Queso, 0–100 m, 01 Sep 2005, Y. Cardenas, J. Azofeifa, M. Moraga, Red Noyes, L N [Lambert north] 334350, 461100, #84534 (1f, INBio). **DOMINICAN REPUBLIC:** San Cristóbal Province, San Cristóbal, July 1969, J. Maldonado C. (1f, USNM) (excluded from paratypes).

Molecular data. Three specimens of this species from Costa Rica (viz. CRI000312790, CRI002567442, CRI002545535) have been DNA barcoded by INBio (a 648 base-pair region in the mitochondrial cytochrome c oxidase 1 gene) with data reported in the Barcode of Life Database (BOLD, www.boldsystems.org; Ratnasingham & Hebert 2007, 2013) as part of the Delphacidae Costa Rica INBio Collection (DELCR) project. The sequences differ from each other with a p-distance of less than 1%. The nearest neighbor in BOLD is *Bostaera balli* with a p-distance statistic given at 13.96%, indicating that no taxon closely related to *Ampliphax* has been barcoded. *Pareuidella* and '*Euides*' were among the taxa with barcode data in BOLD (but not *Neoperkinsiella* among specimens with determinations). BOLD has barcode data for 1,261 specimens, barcodes representing 287 species, in comparison to approximately 576 currently described New World delphacid species (2100+ species worldwide, Bourgoin 2014), suggesting that the closest relatives to *Ampliphax* may not be barcoded to date.

Discussion

The new genus *Ampliphax* is unusual in both size and structure and is readily recognized among described Neotropical Delphacidae. *Ampliphax* is sufficiently distinct that its closest relative is not immediately apparent. Available DNA barcode data gives its nearest neighbor as *Bostaera*, albeit with a low level of relatedness, at minimum indicating that its nearest neighbor is not yet DNA barcoded.

Here we provide the first checklist (Table 1) of delphacids from southern Central America since the early reports of Crawford (1914), Muir (1926) and Metcalf (1938). While this checklist provides a useful starting point, many species remain to be added, both known (but unreported) and undescribed. It is likely that the true diversity of delphacids in this region may be twice that presented here when all species are accounted for. We did not attempt to fully account for undescribed forms, although we are aware of 3 undescribed Tropidocephalini (including at least 1 new genus), and 3 new genera of Delphacini. In addition to describing new taxa, a full consideration of the Mesoamerican fauna would also involve revision of polyphyletic genera, especially *Delphacodes* Fieber and *Euides* (see Urban *et al.* 2010, Bartlett *et al.* 2014).

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Erratum

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CHARLES R. BARTLETT & GERNOT KUNZ (2015) A new genus and species of delphacid planthopper (Hemiptera: Fulgoroidea: Delphacidae) from Central America with a preliminary regional species list. *Zootaxa*, 3946(4): 510–518.

Table 1 was inadvertently omitted from the text. It is provided as follows.

Table 1. List of delphacid species found in Costa Rica and adjacent countries (L = literature record, S = specimen record, E = error).

Species	Nicaragua	Costa Rica	Panama	References and Comments
Delphacidae				
Asiracinae: Asiracini				
Copicerus irroratus Swartz, 1802	L, S	L, S	L, S	Metcalf 1943, Maes & O'Brien 1988, Maes & Tellez Robleto 1988, Bartlett et al. 2014
Asiracinae: Idiosystanini				
Pentagramma bivittata Crawford, 1914	L, S	L, S		Metcalf 1943, Maes & Tellez Robleto 1988, Hedrick-Zeller & Wilson 2010; Bartlett et al. 2014
Asiracinae: Tetrasteirini				
Tetrasteira solata Barringer & Bartlett, 2011			L, S	Barringer & Bartlett 2011
Tetrasteira trimaculata Barringer & Bartlett 2011		L, S	L, S	Barringer & Bartlett 2011
Asiracinae: Ugyopini				
Ugyops brunneus (Fowler, 1905)			L	Fowler 1905, Metcalf 1943
Ugyops godmani (Fowler, 1905)		L	L, S	Fowler 1905, Metcalf 1943
Ugyops palliatus Fennah, 1964			L	Fennah 1964
Ugyops stigmatus (Crawford, 1914)			L, S	Crawford, 1914, Metcalf 1938, 1943
Ugyops sp.		S		
Plesiodelphacinae				
Burnilia pictifrons (Stål, 1864)	L			Crawford, 1914, Maes & O'Brien 1988
Burnilia n. sp.		S		
Delphacinae: Saccharosydnini				
Neomalaxa flava Muir, 1918		S	S	
Saccharosydne saccharivora (Westwood, 1833)	L	L, S	S	Maes & O'Brien 1988, Maes & Tellez Robleto 1988, Bartlett et al. 2014
Delphacinae: Tropidocephalini				
Malaxa sp.		S		
Delphacinae: Delphacini				
Ampliphax grandis ***g & sp. nov.***		S	S	
Anchidelphax havanensis (Crawford, 1914)	L			Maes & O'Brien 1988
Caenodelphax teapae (Fowler, 1905)	L, S	L, S	L, S	Metcalf 1943, Maes & O'Brien 1988, Maes & Tellez Robleto 1988, Bartlett et al. 2014
Chionomus balboae (Muir & Giffard, 1924)		L, S	L, S	Bartlett et al. 2014

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Table 1 (continued)

Species	Nicaragua	Costa Rica	Panama	References and Comments
Chionomus havanae (Muir & Giffard, 1924)		L, S	L, S	Bartlett et al. 2014
Delphacodes arcuata Beamer, 1948		S	L, S	Bartlett et al. 2014
Delphacodes aterrima Muir, 1926		S	S	
Delphacodes atrior (Fowler 1905)		S		
Delphacodes gluciophila Muir, 1926		S		
Delphacodes koebelei Muir & Giffard, 1924		S		
Delphacodes nigrinota Beamer, 1951	L			Bartlett et al. 2014
Delphacodes pacifica (Crawford, 1914)			L, S	Bartlett et al. 2014
Delphacodes quadrispinosa Muir & Giffard, 1924	L, S	L, S		Metcalf 1943, Maes & O'Brien 1988, Bartlett et al. 2014
Delphacodes rectangularis (Crawford, 1914)	L	S		Crawford, 1914, Metcalf 1943, Maes & O'Brien 1988
Delphacodes sagata (Fowler, 1905)			L, S	Metcalf 1938, 1943
Delphacodes vaccina Caldwell, 1951		S		
Euides afasciata (Caldwell, 1951)		S		
Euides fasciatella (Osborn, 1935)	S	L, S	L, S	Bartlett et al. 2014
Euides grossa (Van Duzee, 1933)		L		Van Duzee 1933, Metcalf 1943
Flavoclypeus nigrifacies (Muir, 1918)		L, S	L, S	Metcalf 1943, Kennedy & Bartlett 2014, Bartlett et al. 2014
Matutinus fuscipennis (Muir, 1919)	S	S		
Megamelus iphigeniae Muir, 1926			S	
Megamelus n. sp.		S		
Metadelphax dentata Gonzon & Bartlett, 2008	L	L, S	L	Gonzon & Bartlett 2008
Metadelphax propinqua (Fieber 1866)	L	L, S	L	Metcalf 1943, Maes & O'Brien 1988, Maes & Tellez Robleto 1988, Maes 2004, Gonzon & Bartlett 2008, Bartlett et al. 2014
Metadelphax wetmorei (Muir & Giffard, 1926)	E			Crawford 1914, Gonzon & Bartlett 2008, Bartlett et al. 2014
Neoperkinsiella testacea (Fowler, 1905)			L	Metcalf 1943
Nicetor pallidinervis (Muir, 1926)		S		
Nilaparvata caldwelli Metcalf, 1955		S		
Nilaparvata serrata Caldwell, 1951	L	L, S		Maes & O'Brien 1988, Bartlett 2007, Bartlett et al. 2014
Nilaparvata wolcotti Muir & Giffard, 1924		S		
Pareuidella n. sp.		S		
Pareuidella magnistyla (Crawford, 1914)		L,S	L,S	Bartlett et al. 2014
Parkana costa Bartlett 2014		L,S		Bartlett 2014
Peregrinus maidis (Ashmead, 1890)	L	L, S	L, S	Metcalf 1943, Maes & O'Brien 1988, Maes & Tellez Robleto 1988, Bartlett et al. 2014

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Table 1 (continued)

Species	Nicaragua	Costa Rica	Panama	References and Comments
Perkinsiella saccharicida Kirkaldy, 1903		L, S		Bartlett et al. 2014
Phrictopyga contorta (Muir, 1926)		S		
Pissonotus abdominalis (Crawford, 1914)	L	L		Bartlett & Deitz 2000
Pissonotus albivultus Morgan & Beamer, 1949	L	L, S	S	Bartlett & Deitz 2000, Bartlett et al. 2014
Pissonotus muiri Metcalf, 1943	L	L	L	Maes & O'Brien 1988, Bartlett & Deitz 2000
Pissonotus piceus (Van Duzee, 1894)	L	L, S	L	Maes & O'Brien 1988, Bartlett & Deitz 2000, Bartlett et al. 2014
Pygospina spinata Caldwell, 1951		S	S	
Pygospina reducta Caldwell, 1951		S		
Sogatella kolophon (Kirkaldy, 1907)	L	L, S	L	Metcalf 1938, 1943; Maes & O'Brien 1988 (as *furcifera* in error), Maes & Tellez Robleto 1988, Maes 2004, Bartlett et al. 2014
Sogatella furcifera (Horváth, 1899)	E	E	E	Metcalf 1938, Maes & O'Brien 1988, Asche & Wilson 1990, Bartlett et al. 2014
Sogatella molina (Fennah, 1963)	L	S		Bartlett et al. 2014
Stobaera azteca Muir, 1913	L, S	S		Kramer 1973, Maes & O'Brien 1988
Stobaera tricarinata (Say, 1825)	E			Crawford 1914, Bartlett et al. 2014
Syndelphax dissipatus (Muir 1926)		S	S	
Syndelphax fulvidorsum (Metcalf, 1923)	L		L	Maes & Tellez Robleto 1988, Maes 1992, Bartlett et al. 2014
Syndelphax humilis (Van Duzee, 1907)	L, S		S	Metcalf, 1943, Bartlett et al. 2014
Syndelphax nigripennis (Crawford, 1914)	L, S		L	Metcalf, 1943, Maes & O'Brien 1988, Bartlett et al. 2014
Tagosodes albolineosus (Fowler, 1905)	L, S		L	Bartlett et al. 2014
Tagosodes approximatus (Crawford, 1914)	L,S	L, S		Metcalf, 1943, Asche & Wilson 1990
Tagosodes cubanus (Crawford, 1914)	L, S	L, S	L, S	Maes & Tellez Robleto 1988, Maes 2004, Bartlett et al. 2014
Tagosodes orizicolus (Muir, 1926)	L	L, S	L, S	Maes & O'Brien 1988, Maes & Tellez Robleto 1988, Bartlett et al. 2014
Tagosodes wallacei (Muir & Giffard, 1924)		S	L, S	Bartlett et al. 2014
Toya idonea (Beamer, 1947)			L	Gonzon & Bartlett 2008, Bartlett et al. 2014
Toya nigra (Crawford, 1914)	L	L	L	Maes & O'Brien 1988, Gonzon & Bartlett 2008, Bartlett et al. 2014