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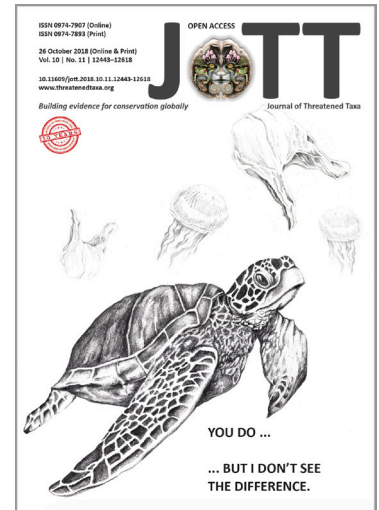
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COMMUNICATION

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NEW KISSING BUG (HEMIPTERA: REDUVIDAE: TRIATOMINAE) RECORDS FROM NAPO AND MORONA-SANTIAGO PROVINCES WITH DISTRIBUTION UPDATES IN ECUADOR

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Abstract: Four species of Triatominae (Hemiptera: Reduviidae) are reported in four localities in Ecuadorian Amazonia. *Eratyrus mucronatus* Stål, 1859, *Rhodnius pictipes* Stål, 1872 & *Panstrongylus geniculatus* (Latreille, 1811) in Napo Province, and *Rhodnius robustus* Larrousse, 1927 in Morona-Santiago Province. Two specimens of *R. pictipes* were found in an urban area of Tena City (capital province). These findings can indicate a risk of Chagas disease transmission in urban and peri-urban areas of the Amazonia.

Keywords: Chagas disease, new records, Rhodniini, Triatomini.

Spanish Abstract: Se reportan cuatro especies de Triatominae (Hemiptera: Reduviidae) en cuatro localidades en la Amazonía ecuatoriana. *Eratyrus mucronatus* Stål, 1859, *Rhodnius pictipes* Stål, 1872 y *Panstrongylus geniculatus* (Latreille, 1811) en la provincia de Napo, y *Rhodnius robustus* Larrousse, 1927 en la Provincia de Morona-Santiago. Dos especímenes de *R. pictipes* se encontraron en el área urbana de la ciudad de Tena (provincia capital). Estos hallazgos pueden indicar un riesgo de transmisión de la enfermedad de Chagas en áreas urbanas y periurbanas de la Amazonía.

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Author Contribution: ASV conducted the Triatominae identification and wrote the first manuscript draft. JL, EV and MH conducted the specimens collections. ASV, JA, SE and JL wrote the final manuscript. SE prepared the specimen photographs. JL elaborated the distribution maps.

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INTRODUCTION

The triatomine bugs are characterized by the hematophagous habit and morphological adaptations associated with the blood feeding. These insects are the main vectors of Chagas Disease or American Trypanosomiasis (Lent & Wygodzinski 1979; World Bank 1993). The Triatominae subfamily comprises five tribes, 17 genera, and 150 species, where *Triatoma* Laporte, 1832 and *Rhodnius* Stål 1859, are the most important vectors. Ecuador currently contains about 17 species such as the following: *Triatoma dimidiata* (Latreille, 1811), *Triatoma carrioni* Larrousse, 1926, *Triatoma venosa* (Stål, 1872), *Triatoma dispar* Lent, 1950, *Eratyrus mucronatus* Stål, 1859, *Eratyrus cuspidatus* Stål, 1859, *Cavernicola pilosa* Barber, 1937, *Panstrongylus geniculatus* (Latreille, 1811), *Panstrongylus rufotuberculatus* (Champion, 1899), *Panstrongylus howardi* (Neiva, 1911), *Panstrongylus chinai* (Del Ponte, 1929), *Panstrongylus lignarius* (Walker, 1873), *Panstrongylus herreri* (Wygodzinsky, 1948), *Rhodnius ecuadoriensis* Lent & León, 1958, *Rhodnius pictipes* Stål, 1872, *Rhodnius robustus* Larrousse, 1927, and was recently described *Rhodnius barretti* Abad-Franch et al. 2013 (Abad-Franch et al. 2001; Galvão et al. 2003; Abad-Franch et al. 2013; Vaca-Moncayo et al. 2017).

Triatoma dimidiata is the main vector in Ecuador associated with the Chagas disease transmission in Guayas and Manabí provinces; this species is distributed in Los Ríos, El Oro, Pichincha and Bolívar provinces. On the other hand, *R. ecuadoriensis* is associated with the transmission in Loja and El Oro provinces and is reported in Manabí, Guayas and Los Ríos too. Finally, *T. carrioni* is reported in Azuay, Cañar, Loja, El Oro, Zamora Chinchipe, and recently in Pichincha (Grijalva et al. 2003). Other species with less importance are *P. rufotuberculatus*, *P. chinai*, *P. geniculatus*, *P. lignarius*, *P. howardi*, *T. venosa*, *T. dispar*, *E. mucronatus*, *E. cuspidatus* and *C. pilosa*; however in the Amazonia *R. pictipes* and *R. robustus* are sylvatic vectors (Aguilar et al. 1999; Abad-Franch et al. 2001; Galvão et al. 2003; Vaca-Moncayo et al. 2017). Due to this, we reported new triatomine records in two Ecuadorian Amazonia Provinces with update distribution in Ecuador.

MATERIAL AND METHODS

This study is based on, one male specimen of *E. mucronatus*, three males specimens of *R. pictipes* and one female specimen of *P. geniculatus*, found dead

in the main entrance of the Universidad Regional Amazónica Ikiám (0.954°S & 77.862°W); more recently, two dead female specimens of *R. robustus* were found in the Universidad Regional Amazónica Ikiám (same coordinates). Later, two additional dead female specimens of *R. pictipes* were found in two houses of the urban area of Tena City (0.989°S & 77.827°W and 0.987°S & 77.812°W). The first specimen was found inside the house in the living room close to the kitchen, and the second specimen was found outside the house on the third floor in the department entrance. Houses are surrounded by secondary forest patches at 20–125 m and 200–278 m to the Tena River. All the insects were pinned, mounted and the identification was determined using taxonomic keys of Lent & Wygodzinsky (1979), Carcavallo et al. (1998a) and Soto-Vivas (2009). In *R. pictipes*, the male genitalia were dissected following the morphological description of Bérenger & Pluot-Sigwalt (2002). The triatomine specimens were deposited at the entomological collection of Instituto de Investigación en Salud Pública y Zoonosis in the Universidad Central del Ecuador: “Colección Nacional de Referencia de Artrópodos de Importancia en Zoonosis (CONRAZ)”. Finally, the four specimens of *R. robustus* collected in Yuwientza (2.067°S & 77.883°W), a Shuar community located in Morona Santiago Province was verified by CONRAZ.

RESULTS AND DISCUSSION

The list of species with diagnostic characters, distribution and medical importance are given below:

Family Reduviidae

Subfamily Triatominae

Tribe Triatomini

Eratyrus mucronatus Stål, 1859 (Image 1)

Diagnostic characters: Rostrum with first and second segments larger (subequal in length), third segment short; anterior process of scutellum form a sharply pointed spine (the spine as long as the entire scutellum); fore lobe of pronotum with 1+1 strong discal spines; humeral angles distinctly spinose; subapical reddish spot of corium comparatively small, anteriorly not attaining level of m-cu cross-vein; free portion of vesica flattened apically in side view; abdomen dorsally with five prominent tubercles along each urotergites (Lent & Wygodzinsky 1979; Soto-Vivas 2009).

Material examined: EC-N-M-T25, 01.ix.2016, 1 male, Campus Universidad Regional Amazónica Ikiám (7km to Muyuna), Napo, 0.954°S & 77.862°W, 600m, coll. Conraz.

Distribution (Carcavallo et al. 1999; Galvão et al. 2003; Chávez 2006; Guhl et al. 2007; Bérenger et al. 2009; Morocoima et al. 2010; Meneguetti et al. 2011; Obara et al. 2013; Hiwat 2014; Galvão 2014; Ceccarelli et al. 2018): Bolivia (Beni, La Paz, Chuquisaca, Oruro, Potosí); Brazil (Acre, Amazonas, Goiás, Maranhão, Mato Grosso, Pará, Rondonia, Tocantins); Colombia (Antioquia, Boyacá, Casanare, Cundinamarca, Meta, Norte Santander, Vaupés); Ecuador (Esmeraldas, Loja, Napo, Orellana, Sucumbíos), Guatemala, Guiana, French Guiana (Cayenne, Grand Santi, Montsinéry-Tonnegrade, Mana, Régina, Roura, Saul, Kourou, Sinnamary); Panama, Perú (Junín, Madre de Dios, Loreto, Ucayali, San Martín), Suriname (Brokopondo, Paramaribo, Para, Sipaliwini); Trinidad (Tunapuna-Piarco, San Juan-Laventille); Venezuela (Anzoátegui, Aragua, Amazonas, Barinas, Carabobo, Cojedes, Guárico, Falcón, Lara, Mérida, Monagas, Portuguesa, Sucre, Táchira, Trujillo, Yaracuy, Zulia).

Medical importance: *Eratyrus mucronatus* has been found naturally infected with *Trypanosoma cruzi* (Chagas 1909); It was reported in small domestic colonies attracted to light in Andean areas of Bolivia. Also, it was recorded in domiciliation process, invading urban and rural areas near fragmented forests (Soto-Vivas et al. 2001; Abad-Franch et al. 2009).

***Panstrongylus geniculatus* (Latreille, 1811) (Image 2)**

Diagnostic characters: Length more than 20mm; head comparatively short and stout, in lateral view; posterior process of scutellum elongate subcylindrical, narrowly tapering apically; pronotum with extensive, conspicuous black markings; all connexival segments with light and dark marking; abdomen light colored ventrally, with longitudinal series of black spots (Lent & Wygodzinsky 1979; Soto-Vivas 2009).

Material examined: EC-N-M-T34, 22.viii.2018, 1 female, Campus Universidad Regional Amazónica Ikiam (7km to Muyuna), Napo, 0.954°S & 77.862°W, 600m, coll. Conraz.

Distribution (Carcavallo et al., 1999; Galvão et al. 2003; Chávez 2006; Guhl et al. 2007; Leite et al. 2007; Bérenger et al. 2009; Morocoima et al. 2010; Meneguetti et al. 2011; Obara et al. 2013; Hiwat 2014; Galvão 2014; Ceccarelli et al. 2018): Argentina (Chaco, Corrientes, Entre Ríos, Formosa, Misiones, Santa Fe, Santiago Del Estero); Bolivia (Beni, Cochabamba, Santa Cruz, Tarija); Brazil (Acre, Amapá, Amazonas, Bahia, Ceará, Distrito Federal, Espírito Santo, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraná, Piauí, Rio de Janeiro, Rondônia, Roraima, São Paulo, Tocantins); Colombia (Antioquia, Amazonas, Bolívar, Boyacá, Cauca, Casanare, Cesar, Cundinamarca, Magdalena, Huila, Meta, Norte de Santander, Putumayo, Santander, Sucre, Tolima, Valle del Cauca); Costa Rica (Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José); Ecuador (Esmeraldas, Imbabura, Manabí, Napo, Orellana, Pastaza, Pichincha, Sucumbíos); French Guiana (Cayenne, Saint-Laurent-du-Maroni); Guatemala, Guyana (Cuyuni-Mazaruni); Mexico (Chiapas, Veracruz, Yucatán); Nicaragua (Atlántico Norte, Atlántico Sur, Managua, Río San Juan); Panama (Bocas del Toro, Colón, Los Santos, Panamá); Paraguay (Alto Paraná, Boquerón, Caaguazú, Concepción, Paraguari); Peru (Amazonas, Ayacucho, Cajamarca, Cusco, Huánuco, Junín, Madre de Dios, Loreto, Pasco, San Martín, Ucayali); Suriname (Brokopondo, Commewijne, Para, Paramaribo, Saramacca, Sipaliwini, Wanica); Trinidad & Tobago (Diego Martín, San Juan-Laventille, Sangre Grande, Siparia, Tunapuna-Piarco); Uruguay; Venezuela (Anzoátegui, Amazonas, Aragua, Barinas, Bolívar, Carabobo, Delta Amacuro, Distrito Capital, Falcón, Guárico, Lara, Mérida, Miranda, Monagas,



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Image 1. Dorsal view of *Eratyrus mucronatus* (male) collected at Campus Universidad Regional Amazónica Ikiam, Napo.

Trujillo, Táchira, Yaracuy, Vargas, Zulia).

Medical importance: *Panstrongylus geniculatus* is a widely distributed species occupying natural habitats like burrows; this species shows association with *Dasypus novemcinctus* Linnaeus, 1758 and *Didelphis marsupialis* Linnaeus, 1758 (Abad-Franch et al. 2001) and rodents. It is believed that it is responsible for maintaining the enzootic cycle of *T. cruzi*.

Tribe Rhodniini

Rhodnius pictipes Stål, 1872 (Image 3)

Diagnostic characters: Head laterally behind the eyes with callosities setiferous tubercles; antenna inserted proximal to head; anteocular region of the head at least 2.7 times as long as postocular; pronotum very granulate, rugose; femora yellowish, mottled with dark brown; tibiae of all pairs of legs with dark submedian annulus; corium brownish, irregularly spotted with black; rectangular dark spots of dorsal connexival segments with conspicuous pointed projection posteriorly, at least on segments 3 to 5; process of pygophore bispinous with short base (Lent & Wygodzinsky 1979; Bérenger & Pluot-Sigwalt 2002; Soto-Vivas 2009).

Material examined: EC-N-M-T26, EC-N-M-T27, EC-N-M-T28, 03.iii.2016, 3 males, Campus Universidad Regional Amazónica Ikiam (7km to Muyuna), Napo, 0.954°S & 77.862°W, 600m, coll. CONRAZ. EC-N-T-T29, 23.iii.2018, 1 female, Barrio El Dorado (Tena City), Napo, 0.987°S & 77.812°W, 500m, CONRAZ. EC-N-T-T30, 20.v.2018, 1 female Barrio San Antonio (Tena City), Napo, 0.989°S & 77.827°W, 517m, coll. CONRAZ.

Distribution (Carcavallo et al. 1999; Abad-Franch

et al. 2001; Galvão et al. 2003; Chávez 2006; Cortez et al. 2007; Guhl et al. 2007; Hiwat 2014; Galvão 2014; Ceccarelli et al. 2018): Bolivia (Cochabamba, Santa Cruz, Beni, Pando); Belize, Brazil (Amapá, Amazonas, Goiás, Maranhão, Mato Grosso, Pará, Piauí, Roraima, Tocantins); Colombia (Amazonas, Boyacá, Caquetá, Cundinamarca, Guaviare, Meta, Norte Santander, Putumayo, Vaupés); Ecuador (Azuay, Morona Santiago, Napo, Orellana, Sucumbíos); Guiana, French Guiana (Cayenne, Saint-Laurent du Maroni); Peru (Ayacucho, Cusco, Huánuco, Madre de Dios, Loreto, Ucayali, San Martín, Junín); Suriname (Brokopondo, Commewijne, Coronie, Marowijne, Paramaribo, Para, Saramacca, Sipaliwini, Wanica); Trinidad (Diego Martín, Rio Claro-Mayaro, Siparia, Tanapuma-Piarco); Venezuela (Anzoátegui, Amazonas, Apure, Aragua, Bolívar, Carabobo, Cojedes, Delta Amacuro, Falcón, Mérida, Miranda, Monagas, Portuguesa, Táchira, Trujillo, Sucre, Yaracuy, Zulia).

Medical importance: Occasionally attracted to light in human dwellings. It has been found naturally infected with *T. cruzi*. (Carcavallo et al. 1999; Feliciangeli et al. 2004a; Abad-Franch et al. 2009).

Rhodnius robustus Larrousse, 1927 (Image 4)

Diagnostic characters: Head laterally behind the eyes with callosities setiferous tubercles; antenna inserted proximal to the head apex; anteocular region about four times as long as postocular; distance between eyes dorsally smaller than, or equal to, width of eye; head distinctly longer than pronotum (1:0.65–0.80); median process of pygophore narrow, pointed apically and with narrow triangular base; larger species, length of males



Image 2. Dorsal view of *Panstrongylus geniculatus* (female) collected at Campus Universidad Regional Amazónica Ikiam, Napo.

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20–23.5 mm, of females 23–26 mm (Lent & Wygodzinsky 1979; Soto-Vivas 2009).

Material examined: EC-MS-Y-T17, EC-MS-Y-T18, EC-MS-Y-T19, EC-MS-Y-T20, 14.xi.2009, 3 males and 1 female, Yuwientza “Shuar community”, Morona Santiago, 2.067°S & 77.883°W, 1,126m, coll. Conraz; EC-N-M-T32, 12.vii.2018, 1 female, Campus Universidad Regional Amazónica Ikiám (7km to Muyuna), Napo, 0.954°S & 77.862°W, 600m, coll. Conraz; EC-N-M-T33, 23.viii.2018, 1 female, Campus Universidad Regional Amazónica Ikiám (7km to Muyuna), Napo, 0.954°S & 77.862°W, 600m, coll. Conraz.

Distribution: (Carcavallo et al. 1999; Abad-Franch et al. 2001; Galvão et al. 2003; Chávez 2006; Cortez et al. 2007; Guhl et al. 2007; Bérenger et al. 2009; Hiwat, 2014; Galvão 2014; Ceccarelli et al. 2018): Bolivia (Cochabamba, Beni, La Paz, Santa Cruz, Pando); Brazil (Acre, Amapá, Amazonas, Goiás, Maranhão, Mato Grosso, Pará, Rondonia, Roraima, Tocantins); Colombia (Amazonas, Arauca, Bolívar, Cundinamarca, Norte Santander, Santander, Tolima); Ecuador (Napo, Morona Santiago, Sucumbíos, Orellana); French Guiana (Cayenne, Macouria, Matoury, Grand-Santi, Regina), Perú (Amazonas, Cajamarca, Junín, Madre de Dios, Loreto, San Martín, Ucayali); Suriname (Brokopondo, Marowijne, Para, Saramacca, Sipaliwini); Venezuela (Apure, Barinas, Bolívar, Cojedes, Falcón, Mérida, Monagas, Sucre, Táchira, Trujillo, Yaracuy).

Medical importance: This species is closely related to *R. prolixus*, and has been associated to sylvatic habits and infected with *T. cruzi*. In northern South America, they were found migrating from palms to the houses, occurring where *R. prolixus* was eliminated by Chagas disease control programs (Monteiro et al. 2003; Guhl et al. 2007; Longa & Scorza 2007).

Epidemiological significance

The Amazonian Chagas disease transmission has increased in recent years; the first reports were in Brazil by Coura et al. (1994, 1995, 2002) and Albajar et al. (2003); recently Santalla et al. (2011), stated a case from Bolivian Amazonia. In Ecuador, the first records were registered by Aguilar & Yépez (1995) in three Amazonian Provinces: Sucumbíos, Napo, and Pastaza. More recently, Amunárriz et al. (2010), reported a population infected by *T. cruzi* located between the margins of Napo and Aguarico rivers. These authors mentioned three triatomine species involved: *P. geniculatus*, *R. pictipes* and *R. robustus*. Abad-Franch & Monteiro (2007) stated that all Amazonian triatomine species comprises four tribes: Rhodniini, Bolbolderini, Cavernicolini, and Triatomini (with *Eratyrus*).

Eratyrus mucronatus is a sylvatic species responsible for the enzootic Chagas transmission (Morocoima et al. 2010) and reported occasionally in the peridomicile with a synanthropic trend (Noireau et al. 1995; Carcavallo et



Image 3. Dorsal view of *Rhodnius pictipes* (male) collected at Campus Universidad Regional Amazónica Ikiám, Napo.

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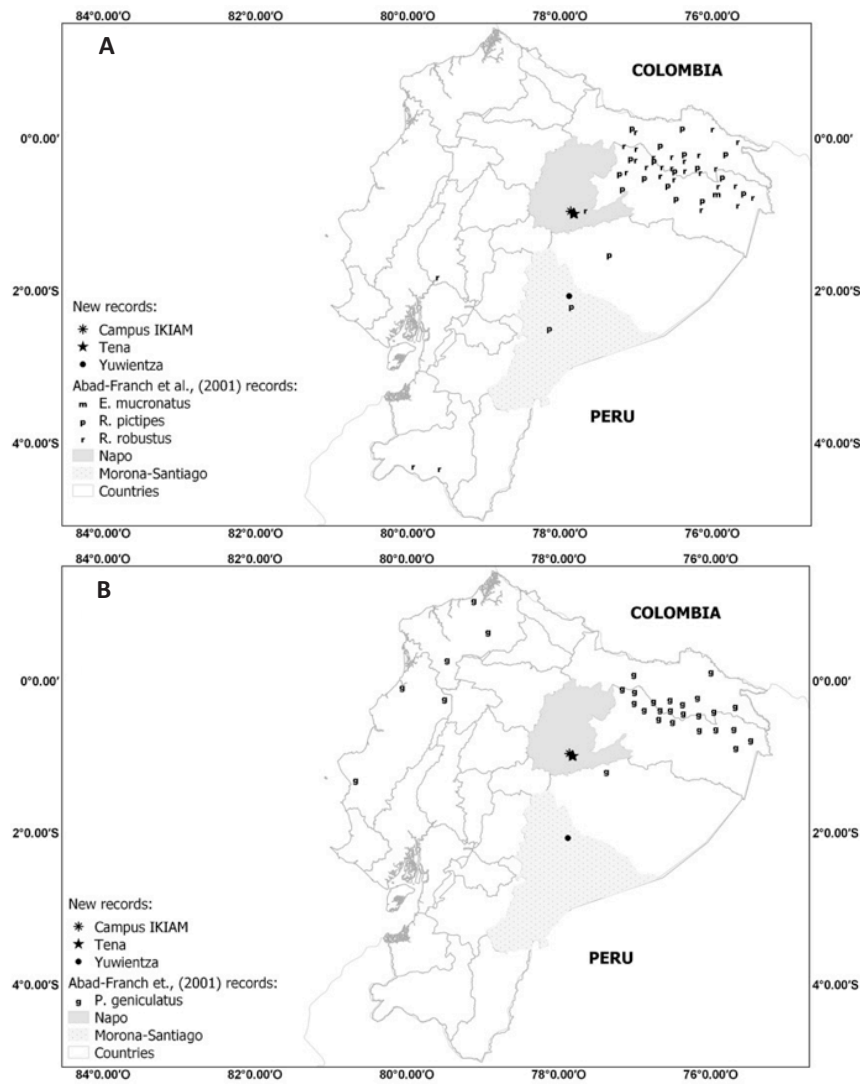


Figure 1. New records from Napo and Morona Santiago Provinces and distribution in Ecuador based on Abad-Franch et al. (2001): A - *E. mucronatus* (m), *R. pictipes* (p) and *R. robustus* (r), and B - *P. geniculatus* (g).



Image 4. Dorsal view of *Rhodnius robustus* (male) collected at Yuwientza “Shuar community”, Morona Santiago.

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al. 1998b; Soto-Vivas et al. 2001).

Panstrongylus geniculatus is a sylvatic species associated with animal burrows and trees that provide microclimate conditions for their survival (Herrera & Urdaneta-Morales 1992; 1997). In the last decade, this species has been associated with domiciliated environments, frequently found in chicken coops and invading homes attracted by light or in search of food (Felicangeli et al. 2004b). Also, it has been found colonizing *Rattus rattus* Linnaeus, 1758 burrows in precarious dwellings (Reyes-Lugo 2009). Although it is true that in urban environments this species prefers to feed on chickens, dogs, cats, and synanthropic rodents, it is important to keep the entomological vigilance and its possible implication in the transmission of *T. cruzi*. (Herrera et al. 2003).

Sylvatic *Rhodnius* species distribution is related to the Arecaceae (Palms), and their feeding habits are associated with birds; this triatomine species are specialized to explore the Palm microhabitats (Lent & Wygodzinsky 1979; Abad-Franch et al. 2009). Also, several authors stated the association between *Rhodnius* and birds nest of *Phacellodomus rufifrons* (Wied-Neuwied, 1821) and other Furnariidae species (Lent & Jurberg 1975; Abad-Franch & Monteiro 2007).

Abad-Franch et al. (2001) studied the biogeography of Ecuadorian triatomine based on distribution maps for each species. We georeferenced all Orellana/Napo records for *E. mucronatus*, *R. pictipes* and *P. geniculatus*, and the entire records correspond only to Orellana based on the Provinces boundaries (Fig. 1 A,B); also, we checked all triatomine records found in the Zoology Museum (QCAZ) on-line data base at the Pontificia Universidad Católica del Ecuador (QCAZ 2018). Due to this it was recorded for the first time that three species in Napo, and also the *R. robustus* distribution has spread out to Morona Santiago Province.

Finally, the land use changes, the wild source feed availability and triatomine species competence, can be a risk of disease transmission in urban and peri-urban areas of the Ecuadorian Amazonia. Due to this it is relevant to implement programs for entomological vigilance for the Chagas disease.

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