

First report of *Ricolla pallidinervis* and *Rocconota tuberculigera* (Hemiptera: Reduviidae: Harpactorinae) predatory *Oebalus insularis* (Hemiptera: Pentatomidae) in natural reserves of Darien, Panama

Primer reporte de Ricolla pallidinervis (Stål, 1859) y *Rocconota tuberculigera* (Stål, 1872) (Hemiptera: Reduviidae) depredando a *Oebalus insularis* (Stål, 1872) (Hemiptera: Pentatomidae) en reservas naturales de Darién, Panamá

José Alejandro Ramírez Silva¹, Dimitri Forero², Alonso Santos Murgas^{1, 3},
Pedro Osorio⁴, Bruno Zachrisson^{1, 4*}

ABSTRACT

For the first time, *Ricolla pallidinervis* (Stål, 1859) and *Rocconota tuberculigera* (Stål, 1862) (Hemiptera: Reduviidae) were registered feeding on adults of *Oebalus insularis* (Stål, 1872) (Hemiptera: Pentatomidae) in the buffer area of Darien National Park, Darien Province, Panama. Adults and nymphs of *O. insularis* are considered one of the main pests in rice crops in Panama. This study highlights the role of protected areas as environmental services that serve as natural reservoirs for reported Harpactorinae species.

Keywords: agroecosystem preservation, natural biological control, predatory species, rice stink bug.

RESUMEN

Por primera vez, *Ricolla pallidinervis* (Stål, 1859) y *Rocconota tuberculigera* (Stål, 1862) (Hemiptera: Reduviidae) fueron registrados alimentándose de adultos de la especie *Oebalus insularis* (Stål, 1872) (Hemiptera: Pentatomidae) en la zona de amortiguamiento del Parque Nacional Darien, Provincia de Darién, Panamá. Los adultos y ninfas de *O. insularis* son considerados una de las principales plagas en el cultivo de arroz en Panamá. Este estudio destaca el papel de las áreas protegidas como servicios ambientales, y que además sirven como reservorios naturales para las especies de Harpactorinae reportadas.

Palabras claves: preservación de los ecosistemas, control biológico natural, especies depredadoras, chinche hediondo del arroz.

Introduction

The province of Darien, Panama, has an area of 11,892.5 km², and 60% of the total area is destined for agroforestry and livestock production. Twenty-five percent of this province has a natural reserve delimited by Darien National Park, characterized as tropical rainforest (TRF) (Holdridge, 1967). The climatic conditions of this region include rainfall between 1,700 and 2,000 mm and an average annual temperature of 32 °C. In the last decade, agricultural activity in this

area has increased, highlighting the production of rice (*Oryza sativa* L.; Poaceae), which is considered a priority crop for Darien and Panama. The location of cultivated areas of rice close to the buffer zone of Darien National Park could promote natural biological control favoring the dispersion of natural enemies to the surrounding agricultural ecosystems. Some predatory species of the subfamily Harpactorinae (Hemiptera: Reduviidae) stand out as potential agents for the natural biological control of pests (Grundy and Maelzer, 2000a, 2000b; Grundy and Maelzer,

¹ Universidad de Panamá, Programa Centroamericano de Maestría en Entomología. Panamá, Panamá.

² Pontificia Universidad Javeriana, Departamento de Biología, Ecología and Sistemática, Laboratorio de Entomología. Bogotá, Colombia.

³ Universidad de Panamá, Departamento de Biología, Museo de Invertebrados G. B. Fairchild. Panamá, Panamá.

⁴ Instituto de Innovación Agropecuaria de Panamá. Panamá, Panamá.

* Corresponding author: bazsalam@gmail.com

2003; Nishi *et al.*, 2004; Grundy, 2007; Ishikawa *et al.*, 2007; Sahayaraj 2007; Navarrete *et al.*, 2014; Sahayaraj, 2014; Sahayaraj and Balasubramanian, 2016; Jamian *et al.*, 2017). In Brazil, *Cosmoclopius nigroannulatus* (Stål, 1860) (Hemiptera: Reduviidae) has been reported to prey on *Nicotiana tabacum* L. (Solanaceae) (Jahnke *et al.*, 2002; da Rocha and Redaelli, 2004) and on *Cajanus cajan* (L.) Millsp. (Leguminosae) (Azevedo and Do Nascimento, 2009). Zanuncio *et al.* (1994) reported adults of *Apiomerus* Hahn (Hemiptera: Reduviidae), *Arilus* Hahn (Hemiptera: Reduviidae) and *Montina* Amyot and Serville (Hemiptera: Reduviidae) preying on defoliating pests in *Eucalyptus* L'Hér (Myrtaceae). Other species of Harpactorinae, including *Atopozelus opsimus* Elkins, 1954 (Hemiptera: Reduviidae), and *Apiomerus nigrilobus* Stål, 1860 (Hemiptera: Reduviidae), were found preying on individuals of *Lagria villosa* (Fabricius 1781) (Coleoptera: Lagriidae) (Gil-Santana, 2002) and *Glycaspis brimblecombei* Moore, 1964 (Hemiptera: Aphalaridae) (Dias *et al.*, 2012). In rice crops in Maranhão, Brazil, the predators *Atrachelus cinereus crassicornis* (Burmeister, 1835) (Hemiptera: Reduviidae), *Doldina carinulata* Stål, 1859 (Hemiptera: Reduviidae) and *Zelus mattogrossensis* Wygodzinsky, 1947 (Hemiptera: Reduviidae) (de Souza *et al.*, 2015) were reported for the first time. In Panama, *Oebalus insularis* (Stål, 1872) (Hemiptera: Pentatomidae), considered a key pest for rice, feeds during the phenological stage, when the grain is milky and favors the entry of the disease complex into the grain (Zachrisson *et al.*, 2014). The condition called grain spotting causes significant reductions in the production of this crop (Zachrisson *et al.*, 2014). However, to date, only the use of *Telenomus podisi* (Ashmead, 1893) (Hymenoptera: Platygasteridae) stands out as a main biological control agent (Zachrisson *et al.*, 2014). Therefore, the function of the predatory species does not show evidence of regulatory activity on the population of *O. insularis*, although the incorporation of other compatible management options into biological control programs would promote the reduction of the population of this pest. This research reports the interaction between Harpactorinae predator species (Hemiptera: Reduviidae) and *Oebalus insularis* (Hemiptera: Pentatomidae), in nature reserves in Darien, Panama. The link between ecosystem and environmental services and natural biological control programs, in areas with reduced anthropocentric intervention, was observed. Therefore, the distribution

of the Harpactorinae predator complex feeding on *O. insularis* was identified, reported, determined in the buffer zone of Darien National Park, Darien, Panama.

Materials and methods

The study area included two localities of Darien Province with little anthropogenic intervention that are close to the rice cultivated areas. The sampled localities were located near the buffer zone of Darien National Park (8° 1' 11.604" N, 77° 43' 56.748" W-98 m), and the collection area was Quebrada Honda, Darién (8° 37' 18.984" N, 78° 7' 54.012" W-45 m). Sampling was performed between February and March 2020 at weekly intervals, with ten collection points per location. At each collection point, 20 sweeps net were performed. The collected insects were preserved in alcohol (90%), and subsequently, the species of Harpactorinae were separated. These species were identified using taxonomic keys related to the target group (Stål, 1859, 1862; Champion, 1901; Fracker, 1912). A total of 102 specimens of Harpactorinae (Hemiptera: Reduviidae) and their geographical distribution were reviewed using the reference collection of the GB Fairchild Invertebrate Museum of the University of Panama, Panama (Figure 1, Table 1). The identification of *Ricolla pallidinervis* and *Rocconota tuberculigera* was performed by Dimitri Forero.

Results and discussion

- *Ricolla pallidinervis* (Stål, 1859) and *Rocconota tuberculigera* (Stål, 1862).

Diagnosis

- *Ricolla pallidinervis*, (Stål, 1859).
- *Ricolla pallidinervis*, Stål, Öfv. Vet-Ak. Förh. 1859, p. 367; Enum. Hemipt. ii. p. 78.
- Hab. Panama, near the city (J.J. Walker).
- *Ricolla pallidinervis* have a short conical tubercle at each of the anterior angles of the pronotum; the marginal spines of the abdomen are also longer than in the females of that insects (Champion, 1901) (Figure 2).
- *Rocconota tuberculigera* (Stål, 1862).
- *Repipta tuberculigera*, Stål, Stett. Ent. Zeit. 1862, p. 447.
- *Rocconota tuberculigera*, Stål, Enum. Hemipt. ii. p. 79.

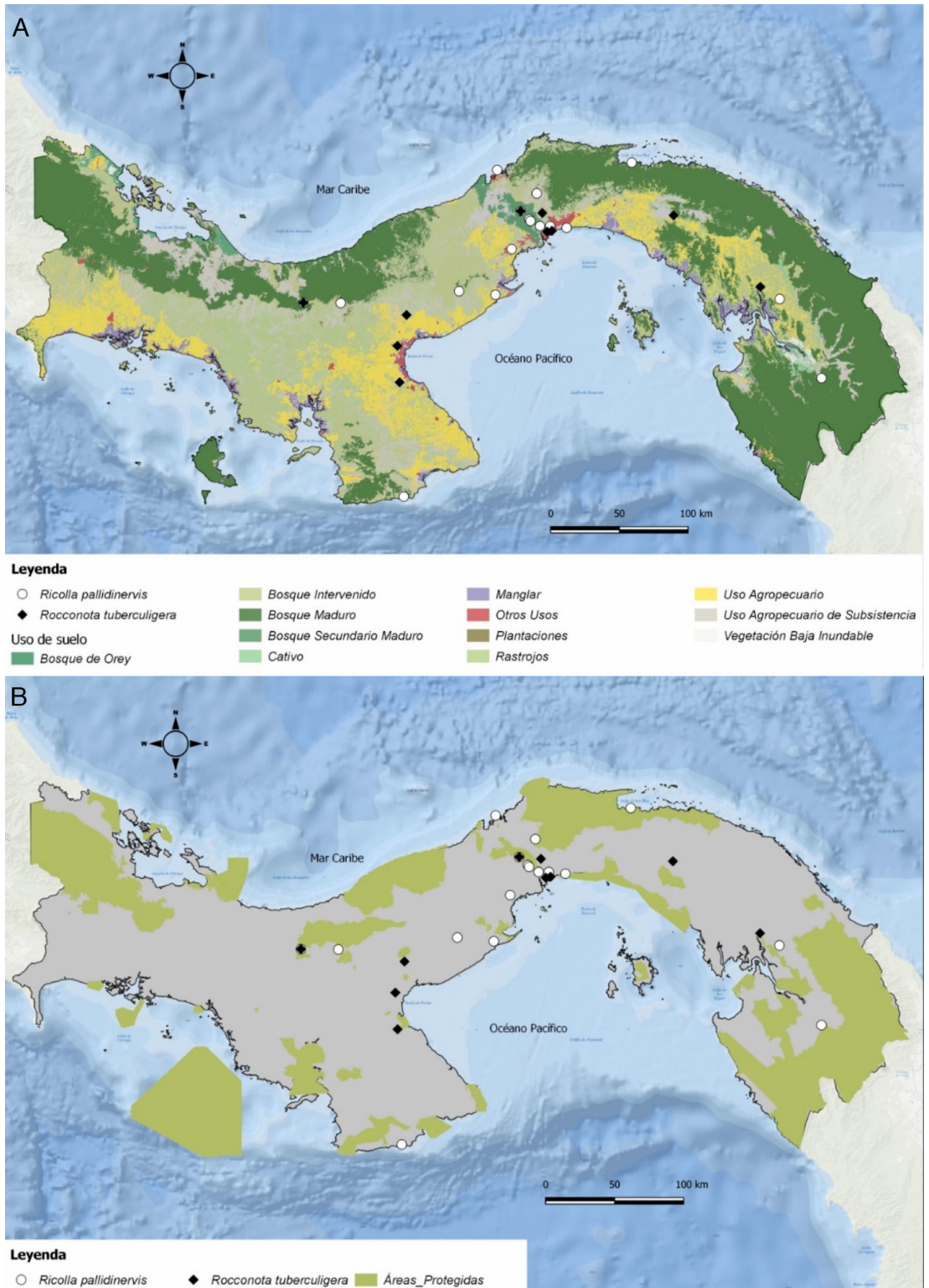


Figure 1. Distribution of *Ricolla pallinivernis* and *Rocconota tuberculigera* (Hemiptera: Reduviidae: Harpactorinae) in the life zone (A) and natural reserves and protected areas (B), in Panama.

Table 1. Locations reported with the presence of *Ricolla pallidinervis* and *Rocconota tuberculigera* (Hemiptera: Reduviidae: Harpactorinae) in Panama, previously of this study.

| <i>Ricolla pallidinervis</i> | | | <i>Rocconota tuberculigera</i> | | |
|------------------------------------|----------------|-----------------|-------------------------------------|----------------|-----------------|
| Locality | Latitude | Longitude | Locality | Latitude | Longitude |
| Villa Darién (Darién) | 8° 32' 29.76"N | 78° 00' 16.92"W | Panama | 8° 59' 33.36"N | 79° 32' 22.56"W |
| Camino de Plantaciones (Panama) | 9° 04' 33.96"N | 79° 39' 29.16"W | Parita (Herrera) | 8° 00' 18.00"N | 80° 31' 06.24"W |
| Parque Nacional Soberanía (Panama) | 9° 07' 44.25"N | 79° 42' 54.36"W | Panama (San Francisco, Panama) | 8° 59' 56.04"N | 79° 30' 30.60"W |
| Punta Galeta (Colon) | 9° 24' 01.80"N | 79° 52' 11.28"W | Guarumalito (Alcalde Díaz, Panama) | 9° 06' 59.40"N | 79° 34' 18.48"W |
| Chame (Panama) | 8° 34' 44.76"N | 79° 53' 01.32"W | Agua Dulce, (Cocle) | 8° 14' 40.20"N | 80° 31' 58.08"W |
| Camino de Cruces (Panama) | 9° 01' 50.16"N | 79°35'13.56"W | Lago Bayano, (Panama) | 9° 05' 46.32"N | 78° 42' 06.84"W |
| Chorrera (Panama) | 8° 52' 48.39"N | 79° 46' 31.44"W | Río Grande (Cocle) | 8° 26' 51.72"N | 80° 28' 20.28"W |
| Chitra (Panama) | 8° 31' 37.74"N | 80° 54' 27.36"W | Parque Nacional Soberanía, (Panama) | 9° 07' 44.40"N | 79° 42' 54.36"W |
| Lago Alajuela (Colon) | 9°14' 44.52"N | 79° 36' 28.44"W | Santa Fé (Darién) | 8° 31' 46.20"N | 81° 09' 16.20"W |
| Las Nubes (Colon) | 9° 01' 06.60"N | 79° 24' 38.88"W | Chepo (Panama) | 8° 37' 20.28"N | 78° 07' 53.76"W |
| Cambutal (Veraguas) | 7° 15' 08.28"N | 80° 29' 31.56"W | | | |
| El Valle (Panama) | 8° 36' 13.68"N | 80° 07' 27.84"W | | | |
| Tumba Muerto (Panama City) | 9° 01' 47.64"N | 79° 30' 12.72"W | | | |
| San Blas | 9° 26' 43.08"N | 78° 58' 40.08"W | | | |
| Canal Zone (Panama) | 9° 03' 52.20"N | 79° 39' 00.36"W | | | |
| Rancho Frio (Darién) | 8° 01' 10.92"N | 77°43'56.64"W | | | |

- *Rocconota tuberculigera* have the spines on the pronotum which are quite short, and the two posterior lobes on the pronotum are occasionally absent; but in others species of the group are very elongate (Champion, 1901) (Figure 2).

The identification of *Ricolla pallidinervis* (Stål, 1859) (Hemiptera: Reduviidae) (two adults) and *Ro. tuberculigera* (three adults) is considered the first record in the province of Darién, Panama. In addition, the trophic interaction between *R. pallidinervis* and *Ro. tuberculigera* prey adults of *O. insularis* on Piperaceae species and *Echinochloa colona* (L.) Link (Poaceae) (Figure 3) was confirmed for the first time. The presence of *R. pallidinervis* and *Ro. tuberculigera* in areas close to the evaluated rice plots could regulate the population of *O. insularis*. The observation of *E. colona* in the rice agroecosystem favors the biological and reproductive development of *O. insularis*, which confirms the trophic interaction reported in the study area (Zachrisson *et al.*, 2014). The natural predation of *O. insularis* by *R. pallidinervis* and *Ro. tuberculigera*, associated with the natural parasitism of *Telenomus podisi* (Hymenoptera: Platygasteridae) (Zachrisson *et al.*, 2014), would strengthen management programs aimed at this pest. The use of different compatible biological control agents can significantly reduce the insect pest population in crops of economic importance. Other

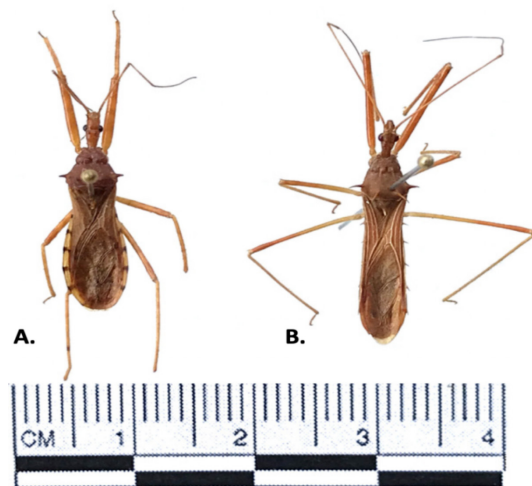


Figure 2. Dorsal View of (A) *Rocconota tuberculigera* and (B) *Ricolla pallidinervis* (Hemiptera Reduviidae: Harpactorinae).

species of Harpactorinae, *Repipta taurus* (Fabricius, 1803) (Hemiptera: Reduviidae) (two females and one male), *Sinea caudata* (Champion, 1899) (Hemiptera: Reduviidae) (two females), *Apiomerus pictipes* (Herrich-Schaeffer, 1848) (Hemiptera: Reduviidae) (one male) and *Apiomerus* sp. Hahn, 1831 (Hemiptera: Reduviidae) (a female) were also found in natural reserves near the rice production areas. The present study highlights the function of natural reserves or areas that are poorly degraded by anthropocentric activity as reservoirs of predatory insects, among other natural enemies. In addition, it confirms

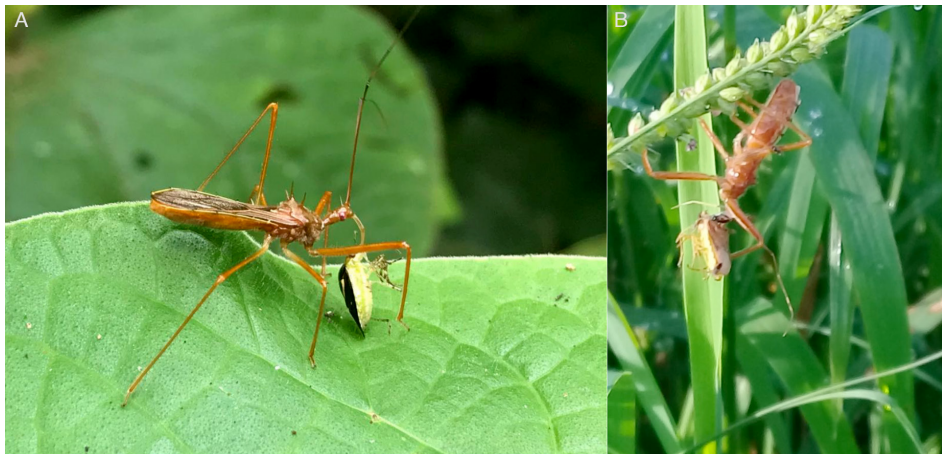


Figure 3. *Ricolla pallidinervis* preying on *Oebalus insularis* on Piperaceae (A); *Rocconota tuberculigera* in *Echinochloa colona* (B), in the buffer zone of Darien National Park, Darien, Panama.

the importance of the environmental services for the rational and sustainable management of pests in priority agricultural crops in the region. The adaptation of *R. pallidinervis* and *Ro. tuberculigera* in the buffer zone of Darien National Park and in agricultural ecosystems close to rice production areas will determine the benefit of environmental services in the protected areas of Darien, Panama.

Conclusions

Natural reserves are considered reservoirs of natural enemies, contributing to the natural biological control of insects-pest, in crops of economic importance such as rice. The reported trophic association between *R. pallidinervis* and *Ro. tuberculigera* predatory *O. insularis*, in buffer zones of Darién National Park, confirms the ecosystem and environmental role of protected areas in the natural biological control of insects-pest in the

environmental and economic sustainability of agricultural production. Therefore, projects focused on the bioprospection of natural enemies in these areas with little anthropocentric activity, would strengthen the programs of increased biological control, incorporating other control agents.

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