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New Records of Insect Predators of Invasive Fluted Scales (Hemiptera: Monophlebidae: Iceryini) in Ecuador

Nuevos registros de insectos depredadores de cochinillas acanaladas (Hemiptera: Monophlebidae: Iceryini) invasoras en Ecuador

 Myriam Arias de López ¹  Natalia Molina-Moreira ^{1*}  Dimitri Forero ²
 Guillermo González F. ³  Takumasa Kondo ⁴

¹ Universidad Espíritu Santo, Guayas, Ecuador.

² Universidad Nacional de Colombia, Bogotá, Colombia.

³ Sociedad Chilena de Entomología, Santiago, Chile.

⁴ Corporación Colombiana de Investigación Agropecuaria [AGROSAVIA], Palmira, Colombia.

* Corresponding Author: Natalia Molina-Moreira. Universidad Espíritu Santo, Av. Samborondón 5, Samborondón 09230, Guayas, Ecuador. natimolina@uees.edu.ec

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Abstract: Population outbreaks of invasive fluted scales in urban areas of Ecuador have become frequent in recent years. Despite the negative impact that these scale insects cause on the native flora, little is known about the natural enemies that control their populations in Ecuador. During collections and observations carried out between July and October 2021 in the province of Guayas, in western Ecuador, high infestations caused by the invasive pests *Crypticeria genistae* (Hempel, 1912), *Crypticeria multicastrices* Kondo & Unruh, 2009, and *Icerya purchasi* Maskell, 1879 (Hemiptera: Coccothorax: Monophlebidae: Iceryini) were found. Hence, this study aimed to determine the natural enemies of these fluted scales using taxonomic keys based on their morphological characteristics. As a result, five species of predators were identified, i.e., *Novius punicus* (Gordon, 1972), *Novius cardinalis* (Mulsant, 1850) (Coleoptera: Coccinellidae), *Syneura cocciphila* (Coquillett, 1895) (Diptera: Phoridae), *Ceraeochrysa* sp. (Neuroptera: Chrysopidae), and *Cardiastethus* sp. (Hemiptera: Anthracoridae); the latter is reported preying on *C. multicastrices* for the first time. Knowledge of natural enemies is crucial for developing more effective, eco-friendly pest management strategies that could help mitigate the adverse effects of these invasive scale insects.

Keywords: Anthracoridae, biological control, Chrysopidae, Coccinellidae, fluted scales, predators, monophlebs, urban pests.

Resumen: en los últimos años, los brotes poblacionales de cochinillas acanaladas invasoras en zonas urbanas del Ecuador se han vuelto frecuentes. A pesar del impacto negativo que estos insectos escama causan a la flora nativa, poco se conoce sobre los enemigos naturales que controlan sus poblaciones en el Ecuador. Durante las colectas y observaciones efectuadas entre julio y octubre de 2021 en la provincia del Guayas, en el occidente del Ecuador, se encontraron altas infestaciones causadas por las plagas invasoras *Crypticeria genistae* (Hempel, 1912), *Crypticeria multicastrices* Kondo & Unruh, 2009, e *Icerya purchasi* Maskell, 1879 (Hemiptera: Coccothorax: Monophlebidae: Iceryini). De ahí que el objetivo de este estudio fuera determinar los enemigos naturales de estas cochinillas acanaladas mediante claves taxonómicas con base en sus características morfológicas. Como resultado, se identificaron cinco especies de depredadores, a saber, *Novius punicus* (Gordon, 1972), *Novius cardinalis* (Mulsant, 1850) (Coleoptera: Coccinellidae), *Syneura cocciphila* (Coquillett, 1895) (Diptera: Phoridae), *Ceraeochrysa* sp. (Neuroptera: Chrysopidae) y *Cardiastethus* sp. (Hemiptera: Anthracoridae); esta última especie se reporta por primera vez como depredador de *C. multicastrices*. El conocimiento sobre los enemigos naturales es crucial para desarrollar estrategias de manejo de plagas más efectivas y ecológicas que podrían ayudar a mitigar los efectos negativos de estos insectos escama invasores.

Palabras claves: Anthracoridae, Chrysopidae, Coccinellidae, cochinillas acanaladas, control biológico, depredadores, monoflébidos, plagas urbanas.



Introduction

Fluted scales belong to the tribe Iceryini (Hemiptera: Monophlebidae), which includes about 80 species in five genera: *Crypticerya* Cockerell, *Gigantococcus* Pesson & Bielenin, *Icerya* Signoret, *Echinicerya* Morrison, and *Gueriniella* Fernald (Unruh & Gullan, 2008) worldwide. In Ecuador, three fluted scale species are recorded: *Crypticerya genistae* (Hempel, 1912), *Crypticerya multicastrices* Kondo & Unruh, 2009, and *Icerya purchasi* Maskell, 1879. Regarding their area of origin, *C. genistae* is probably native to Brazil and has been reported from 22 countries in North America (USA: Florida), Central America (Mexico and Panama), the Caribbean islands, South America (Brazil, Colombia, and Ecuador) (García Morales et al., 2016) and has been accidentally introduced to West Africa (Kondo & Watson, 2022). *Crypticerya genistae* is polyphagous and known to feed on more than 100 plant species. On the other hand, *C. multicastrices* is native to continental Colombia and is a polyphagous pest known to feed on more than 150 plants (Kondo et al., 2014; Kondo et al., 2016). The third species, *Icerya purchasi*, is native to Australia and was introduced to the United States in 1868 and then spread to all the Americas (Elton, 2020). It was recorded in continental Ecuador between 1977 and 1978 on fruit trees, ornamentals, and weeds in the surroundings of Quito (Molineros, 1984). *Icerya purchasi* is highly polyphagous and is known to feed on plants in 85 families and 213 genera (García Morales et al., 2016). The first report of *I. purchasi* on the Galapagos (Ecuador) is dated 1983, with 80 species of host plants, of which 31 are endemic (Calderón Álvarez et al., 2012).

The most successful classical biological control program was recorded more than a hundred years ago in 1889, when *Novius cardinalis* (Mulsant) (Coleoptera: Coccinellidae) was introduced from Australia to California to control *I. purchasi* (González, 2015). In Ecuador, its introduction to control *I. purchasi* had the same success in Quito (Molineros, 1984). Also, in the Galapagos Islands between 2002 and 2005, *N. cardinalis* successfully controlled *I. purchasi*, which threatened the extinction of native and endemic plants; this represented the first case of a successful classical biological control program in the archipelago (Calderón Álvarez et al., 2012; Causton, 2009; Hoddle et al., 2013). A list of natural enemies of *I. purchasi* worldwide can be found in García Morales et al. (2016), Kondo et al. (2016), and Watson and Kondo (2022).

With regards to *C. multicastrices*, previous studies have reported that the coccinellid *Novius puniceus* (Gordon) (Coleoptera: Coccinellidae) successfully controlled population outbreaks on San Andrés Island, Colombia, within eight months of its introduction (González & Kondo, 2014; Kondo et al., 2014). Several other natural enemies of *C. multicastrices* include the fungus *Isaria* sp. (Fungi: Eurotiales: Trichocomaceae) on San Andres island (Kondo et al., 2012), and *Delphastus quinculus* Gordon, *Diomus seminulus* (Mulsant) (Coleoptera: Coccinellidae) (González et al., 2012), *N. cardinalis* (Pinchao et al., 2015), *Syneura cocciphila* (Coquillett) (Diptera: Phoridae) (Gaimari et al., 2012), *Brethesiella* cf. *abnormicornis* (Girault) (Hymenoptera: Encyrtidae) (Montealegre et al., 2016), and two lacewing species, *Chrysoperla* sp. and *Ceraeochrysa* sp. (Neuroptera: Chrysopidae) in mainland Colombia (Kondo et al., 2014). Further, the following species have been reported as natural enemies of *C. genistae*, namely, *Novius circumclusus* (Gorham) (Coleoptera: Coccinellidae) in Puerto Rico (Ciomperlik, 2010) and *S. cocciphila* (Diptera: Phoridae) in Puerto Rico (Ciomperlik, 2010) and Colombia (Gaimari et al., 2012), *N. puniceus* in Colombia (Kondo et al., 2016), and *N. cardinalis* on Guadeloupe (Coleoptera: Coccinellidae) (Étienne & Matile-Ferrero, 2008).

Since June 2021, a high infestation of three species of fluted scales, namely, *C. genistae*, *C. multicastrices*, and *I. purchasi*, were found affecting native and introduced plants in the urban green areas of northern and central Guayaquil city, as well as in the neighboring cantons of Samborondón and Daule, where the first records were reported (Arias de López et al., 2022). During the collections and laboratory observations, immatures, pupae, and adults of some predatory natural enemies of invasive fluted scales in urban areas from the province of Guayas were found. This study aimed to identify these predators, which constitute the main natural enemies of these insect pests. In the current study, we recorded some parasitoid wasps from *C. genistae* and *C. multicastrices*, but they are not included here pending further identification.

Materials and Methods

The study was carried out in urban green areas in three cities in the Guayas province, which is located on the Ecuadorian Coast: Guayaquil City (79°52'W, 02°10'S, ca. 11 m a.s.l.), Samborondón (79°43'W, 01°57'S, ca. 23 m a.s.l.), and Daule (79°58'W, 01°52'S, ca. 9 m a.s.l.). The studied area has a climate with an average annual rainfall of 1,030 mm, average relative humidity of 85 %, and average annual temperature of 26 °C (Castillo et al., 2011). The rainy season occurs from January to April, while the dry season occurs from May to December. The predominant natural vegetation is tropical dry forest, semi-arid scrub, and mangroves. In the green areas of the city, exotic and native plants are present (Molina-Moreira et al., 2015). Samples were taken in 29 urban green areas, i.e., gardens, natural reserves, city parks, urban trees, and hedges, in Guayaquil, Samborondón, and Daule. The locations where the fluted scales and their natural enemies were collected are shown in Figure 1. The map of the studied area was prepared using ArcGIS (version 10.4). The sampling points were georeferenced with GPS Garmin and Trex 10 and digitized in the ArcGIS 10.8 software along with layers provided by the National Boundary Council (CONALI; <https://www.gob.ec/conali>) for 2015 and the layer of rivers made official by the Military Geographic Institute (<http://www.geografimilitar.gob.ec/>). The study area is represented on the map by a yellow-shaded square.

Sample Collecting and Species Identification

Natural enemies of *C. genistae*, *C. multicastrices*, and *I. purchasi* were recorded during a monitoring study carried out during July and October 2021 on infested plants in the green areas of Guayaquil and neighboring cantons (Arias de López et al., 2022) by selecting highly infested plants. The adults of the natural enemies found in the field were collected by random sampling using brushes and kept in 70 % alcohol for posterior identification. The larvae and pupae collected on the plants were confined in plastic boxes measuring 18 × 13 × 7 cm, covered with fine mesh with their prey insects until adulthood. The rearing to the adult stage was conducted in the Universidad de Especialidades Espíritu Santo laboratory, Ecuador. The natural enemies were identified by M. Arias de López (Chrysopidae), D. Forero (Anthocoridae), G. González (Coccinellidae), and T. Kondo (Phoridae), based on published taxonomic keys and diagnoses (Carayon, 1972; Champion, 1900; Gaimari et al., 2012; González, 2015; González & Kondo, 2014; Péricart, 1972; Schuh & Weirauch, 2020; Valencia Luna et al., 2006). For the photographs

of each species of natural enemy, a scale bar in millimeters (mm) and centimeters (cm) was provided.

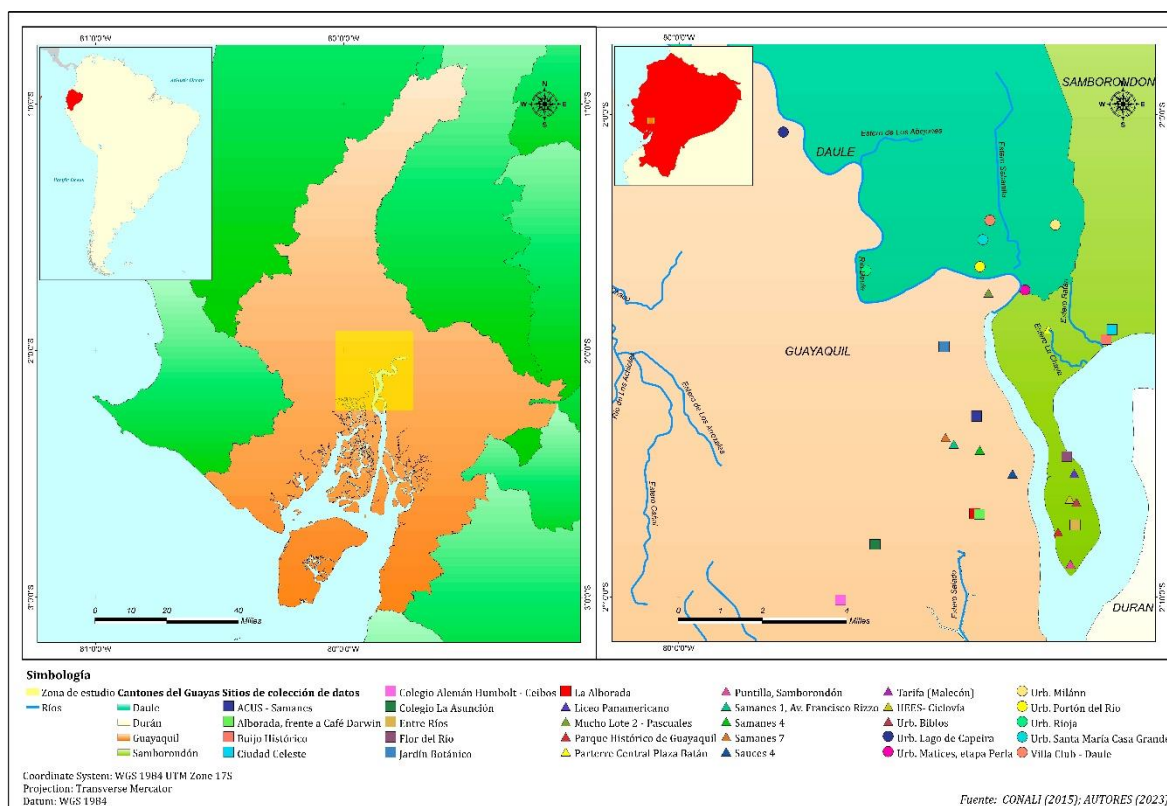


Figure 1. Study area and sampling points of the natural enemies of *Crypticerya multivittata*, *C. genistae* and *Icerya purchasi*. The study area is represented on the map by a yellow-shaded square. Source: Prepared by the authors.

Specimen Depositories

INABIO: Instituto Nacional de Biodiversidad [National Institute of Biodiversity], Entomological Collection, Pasaje Rumipamba N. 341 y Av. de los Shyris (Parque La Carolina), Quito, Ecuador. Codes: INABIOEC, MECN-EN; INABIO 21017-2103.

ICN: Colección Nacional de Insectos, Instituto de Ciencias Naturales Universidad Nacional de Colombia, Bogotá, Colombia.

Results and Discussion

Coleoptera: Coccinellidae

Novius punicus (Gordon, 1972)

Larvae (Figure 2A-C), pupae (Figure 2D), and adults (Figure 2E-G) of *N. punicus* were collected from *Triplaris cumingiana*, *Mangifera indica*, *Adonidia merillii*, *Samanea saman*, *Albizia pistaciifolia*, *Annona muricata*, *Handroanthus pallida*, *Mammea americana*, *Citrus x aurantiifolia* (Christm.) Swingle, *Phoenix roebellini*, *Roystonea oleracea*, *Codiaeum variegatum*, *Areca catechu*, *Portulaca grandiflora*, and *Jacaranda mimosifolia* plants infested by *C. multicatrides*, *Caesalpinia glabrata* infested by *C. genistae*, and *Albizia pistaciifolia*, *Citrus x aurantiifolia*, and *Samanea saman* infested by *I. purchasi*.

Novius punicus is widespread in Colombia and also recorded in Peru (González & Kondo, 2014; González et al., 2024), Venezuela (Aragua, Carabobo, Lara), Ecuador (González, 2015; González et al., 2024), Honduras, Panama, the Antilles (Trinidad) and Venezuela (González, 2016; González et al., 2024; Gordon, 1972).

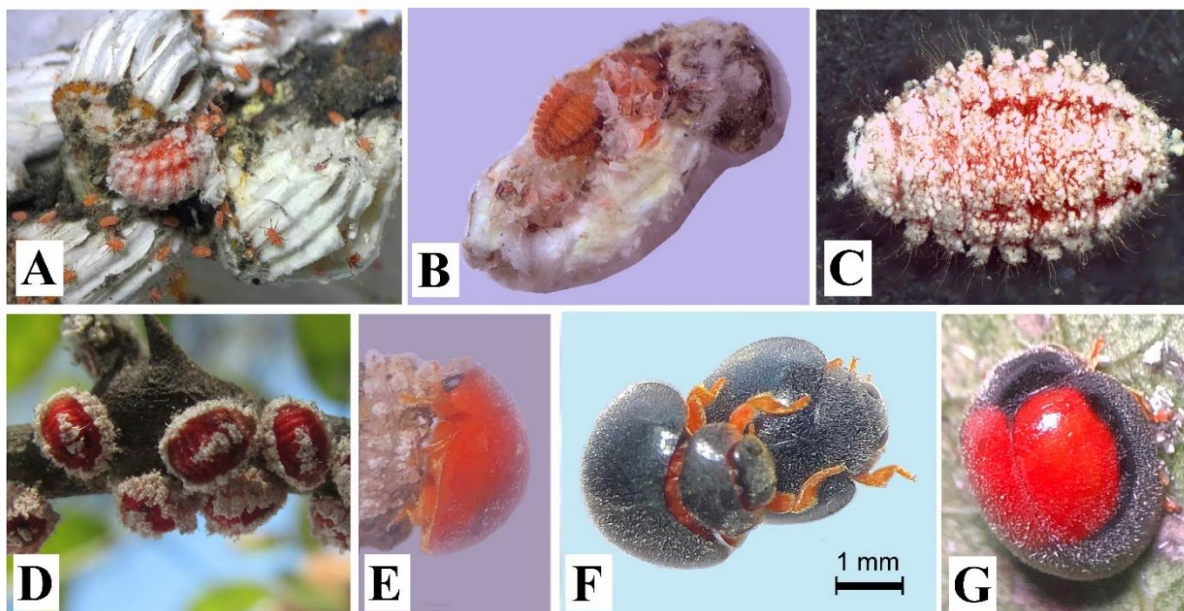


Figure 2. *Novius punicus*. **A.** Larva feeding on *Icerya purchasi*. **B.** Larva inside ovisac of *Crypticerya genistae*. **C.** Larva covered with white mealy wax. **D.** Several pupae on a twig. **E.** Teneral adult. **F.** Adults in copula; dark elytra color morph. **G.** Adult; black color morph with a red circle that covers approximately half of the elytra.

Source: C taken by E.C. Pinchao, D by T. Kondo, and the remaining by M. Arias.

Novius punicus is known to have many different color morphs, including the two types shown in Figure 2F and G (González, 2016; González & Kondo, 2014; Pinchao et al., 2017). *Novius* is a genus endemic to the New World with six species, three known from South America: *N. cardinalis*, *N. peruvianus* (Gordon, 1972), and *N. punicus* (González et al., 2024).

Material Examined

***Novius punicus* (Gordon, 1972).** Ecuador: Parque Histórico-Samborondón, 02°08'43"S, 79°52'12"W, 7 m a.s.l., 04-10-2021, coll. Myriam Arias, *ex* feeding on *C. multicastrices* on *Triplaris cumingiana*, Code INABIOEC, MECN-EN, INABIO 21017-21021, five specimens (INABIO).

***Novius cardinalis* (Mulsant, 1850)**

We found several larvae and adults of *N. cardinalis* (Figure 3A-C) feeding on *C. multicastrices* on *Samanea saman* in Samborondón and many specimens of *Citrus sinensis* feeding on *I. purchasi* in the Guayaquil Historical Park. In Colombia, Pinchao et al. (2015) reported *N. cardinalis* as a predator of eggs and nymphs of *C. multicastrices* for the first time. A subsequent study clarified that *N. cardinalis* feeds primarily on the first-instar nymphs of *C. multicastrices* (Brochero et al., 2022). This confirms our observations made in Ecuador.



Figure 3. *Novius cardinalis*. **A.** Larva of *N. cardinalis* with little wax (yellow arrow) in search of first-instar nymphs under the body of an adult of *Crypticeria multicastrices*. **B.** A mature larva of *N. cardinalis* searching for first-instar nymphs under the body of a third-instar nymph of *C. multicastrices*. **C.** Two adults of *N. cardinalis*.

Source: Taken by E.C. Pinchao.

Material Examined

***Novius cardinalis* (Mulsant, 1850).** Ecuador: Parque Histórico-Samborondón, 02°08'43"S, 79°52'12"W, 7 m a.s.l., 10-09-2021, coll. Myriam Arias, *ex* feeding on *Icerya purchasi* on *Citrus sinensis*, Code INABIOEC, MECN-EN, INABIO 21022-21023, two specimens (INABIO).

Diptera: Phoridae

***Syneura cocciphila* (Coquillett, 1895)**

The predatory fly *S. cocciphila* (Figure 4A, B) feeds on species of the tribe Iceryini, such as *C. multicastrices*, *Crypticeria montserratensis* (Riley & Howard, 1890) and *C. genistae* (Gaimari et al., 2012). In the green areas of Guayaquil, larvae and pupae of *S. cocciphila* (Figure 4A) were collected from inside the ovisacs of *C. genistae* found on trees of *Caesalpinia glabrata*, and from the ovisacs of *C. multicastrices* found on *Adonidia merrillii*, *Albizia pistaciifolia* and *Codiaeum variegatum* plants (Figure 4A). Adult specimens were recovered from these samples (Figure 4B). Rosero Herrera

(2017) reported various genera of Phoridae in Ecuador but did not mention the genus *Syneura*; therefore, this is the first record of the genus *Syneura* for Ecuador. In Colombia, the larvae of *S. cocciphila* have been reported to feed on *C. multicatrices* (Muñoz et al., 2018), and in Puerto Rico, Barbados, and Florida are known to feed on *C. genistae* (Gaimari et al., 2012).

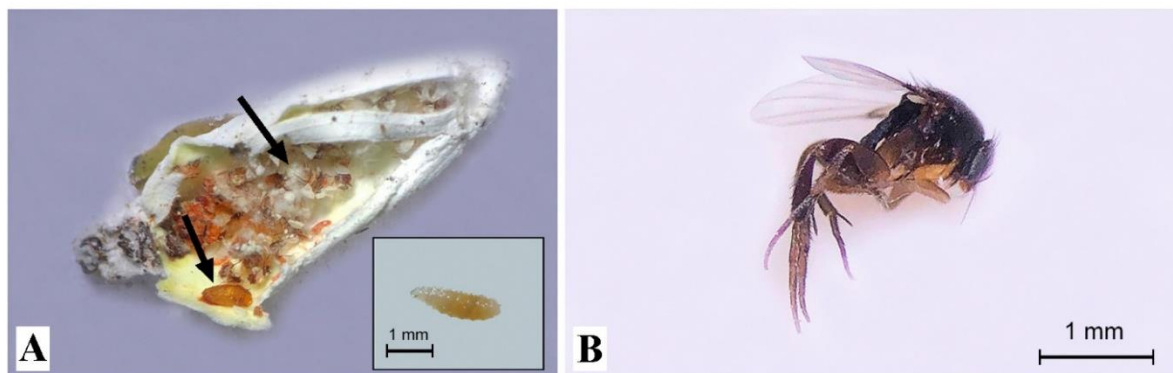


Figure 4. *Syneura cocciphila*. **A.** Pupae and larvae inside an ovisac of *C. multicatrices* (black arrows). Inset. Close-up of a larva. **B.** Adult.

Source: A, B taken by M. Arias. Inset in A taken by K. Muñoz.

Material Examined

***Syneura cocciphila* (Coquillett, 1895).** **Ecuador:** Parque Histórico-Samborondón, 02°08'43"S, 79°52'12"W, 7 m a.s.l., 03-09-2021, coll. Myriam Arias, *ex* feeding on *C. genistae* on *Caesalpinia glabrata*, Code INABIOEC, MECN-EN, INABIO 21034-21035, two specimens (INABIO).

Neuroptera: Chrysopidae

Ceraeochrysa sp.

In the field, eggs, larvae, and pupae (Figure 5A-C) of *Ceraeochrysa* sp. were found on plants infested by fluted scales. Adult lacewings (Figure 5D) were recovered in the laboratory. The larvae of *Ceraeochrysa* sp. were observed feeding on nymphs and adults of *C. multicatrices* on *Mangifera indica*, *Adonidia merrillii*, *Cassia siamea*, *Cordia alliodora*, *Piscidia cartaginensis*, *Mammea americana*, *Gustavia angustifolia*, *Ficus benjamina* and its varieties, *Citrus reticulata*, *Passiflora suberosa*, *Psidium guajava*, *Samanea saman*, and *Triplaris cumingiana*. Some larvae of *Ceraeochrysa* sp. were found preying on *C. genistae* on *Caesalpinia glabrata* and *I. purchasi* on *Caesalpinia* sp., *Cordia alliodora*, *Ficus benjamina*, *Ficus* sp., *Gustavia angustifolia*, and *Psidium guajava*.

Ceraeochrysa spp. prey on different arthropod pests on fruit trees (Gitirana Neto et al., 2001; Ramírez-Delgado et al., 2007). Adams (1982), Penny (1997), and Tauber and de León (2001) described some species from the New World. The larvae are cryptic, and some species cover their bodies with debris that they remove from the prey on which they feed (Figure 5B).



Figure 5. *Ceraeochrysa* sp. **A.** Eggs. **B.** Larva covered with white wax from a fluted scale. **C.** Pupa. **D.** Adult.

Source: A-C taken by M. Arias and D by J. Goya.

Material Examined

***Ceraeochrysa* sp. Ecuador:** Parque Histórico-Samborondón, 02°08'43"S, 79°52'12"W, 7 m a.s.l., 30-09-2021, coll. Myriam Arias, *ex* feeding on *C. genistae* on *Caesalpinia glabrata*, Code INABIOEC, MECN-EN, INABIO 21024-21027, four specimens (INABIO).

Hemiptera: Anthocoridae

Cardiastethus sp.

Cardiastethus is an anthocorid genus with cosmopolitan distribution (Lattin & Stanton, 1992; Péricart, 1972). The delimitation of the genera within the tribe Cardiastethini is unsatisfactory, making their identification difficult (Carpintero & Dellapé, 2008). Species of the genus *Cardiastethus* have never been reviewed, making identification extremely difficult, particularly for Neotropical species (K. Yamada, pers. comm.). In the present study, some nymphs and adults (Figure 6A and B) of *Cardiastethus* sp. were collected feeding on *C. multicastrices* on *Adonidia merrillii*, *Citrus sinensis*, *Phaseolus* sp., *Phoenix roebellini*, and *Samanea saman* trees, and preying on *I. purchasi* on *Citrus sinensis*, *Samanea saman*, and *Sapindus saponaria*.

The biology of *Cardiastethus* species is little known, although they appear to have arboreal habits. Many *Cardiastethus* species are potentially interesting as biological control agents (e.g., Yamada et al., 2008), and at least a few species feed on scales. For example, *Cardiastethus nazarenus* Reuter feeds on *I. purchasi* (Awadallah et al., 1976) and *Marchalina hellenica* (Gennadius) (Kondo & Gullan, 2022; Ülgentürk et al., 2013). *Cardiastethus exiguus* Poppius feeds on the cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero (Fabres & Matile-Ferrero, 1980) and the papaya mealybug [probably *Paracoccus marginatus* Williams & Granara de Willink] (Ballal & Yamada, 2016). *Cardiastethus* sp. has been used to control the citricola scale, *Coccus pseudomagnoliarum* (Kuwana) (Kondo et al., 2022; Ülgentürk et al., 2013).

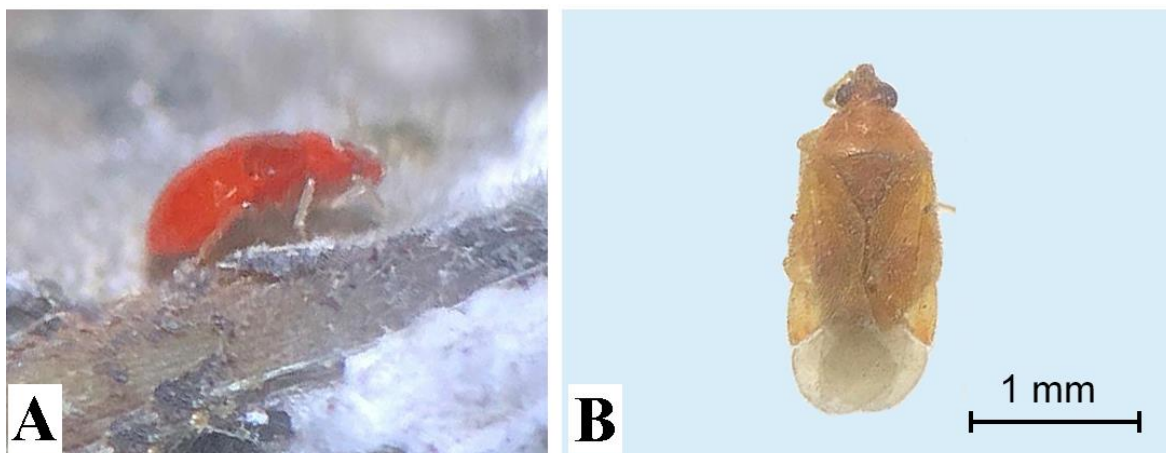


Figure 6. *Cardiaastethus* sp. (Hemiptera: Anthocoridae). **A.** Nymph. Note its bright red color. **B.** Adult.

Source: Taken by M. Arias.

Material examined

***Cardiaastethus* sp. Ecuador:** Parque Histórico-Samborondón, 02°08'43"S, 79°52'12"W, 7 m a.s.l., 06-08-2021, coll. Myriam Arias, *ex* feeding on *C. multicastrices* and *I. purchasi* on *Samanea saman*, Code INABIOEC, MECN-EN, INABIO 21029-21031, three specimens (INABIO); same data, nine adults, nine nymphs (ICN).

Discussion

Here, we list various predatory species that control three invasive species of fluted scale, namely, *C. genistae*, *C. multicastrices*, and *I. purchasi* in Guayaquil, Ecuador. Information was focused on their morphological characteristics, distribution, and iceryine host and plant on which they were collected. Two species of the genus *Novius*, i.e., *N. cardinalis* and *N. punicus*, are important coccinellid predators and have a notable impact on the control of invasive iceryine scales. *Novius punicus*, with its wide distribution across Colombia, Peru, Venezuela, Ecuador, and the Antilles, exhibits considerable adaptability and regional variation, and its many color morphs suggest a high level of phenotypic plasticity, which might be an evolutionary response to diverse environmental pressures across its range. On the other hand, *N. cardinalis* is an important predator of the cottony cushion scale, *I. purchasi*, but also attacks *C. genistae* and *C. multicastrices*. The observations in Ecuador corroborate earlier findings and highlight the important role of *N. cardinalis* in managing populations of iceryne scales.

The phorid fly *Syneura cocciphila* (Diptera: Phoridae) is a good predator of *C. multicastrices* and *C. genistae*. The finding of this new species record in Ecuador enriches our understanding of local biodiversity and predator-prey dynamics. *Syneura cocciphila*'s ability to prey on multiple species of fluted scales across different regions underlines its potential utility in integrated pest management programs. However, this species has not been able to be mass-reared under laboratory conditions. According to Muñoz et al. (2018), rearing *S. cocciphila* under laboratory conditions has not been feasible because of the lack of understanding of their copulation behavior, which

has so far failed to be observed under artificial conditions. The species probably requires wide open spaces for copulation to occur.

A generalist predator, *Ceraeochrysa* sp. (Neuroptera: Chrysopidae), demonstrates a broad predatory behavior on all three invasive fluted scales. This species' ability to adapt to different prey species on various host plants highlights its ecological flexibility. The cryptic nature of its larvae, which use debris for camouflage, represents a fascinating adaptation that may enhance their survival in diverse environments.

Despite the poor understanding of the taxonomy of *Cardiastethus* (Hemiptera: Anthocoridae), minute pirate bugs of this genus have a wide distribution and potential as biological control agents for scale insects, including mealybugs and monophlebids. This underscores the need for further taxonomic work and ecological studies to better exploit their biological control capabilities.

The diversity of predators described above, ranging from coccinellids such as *N. cardinalis* and *N. punicus* to phorid flies, lacewings, and mirid bugs, illustrates the complex predator-prey interactions. Each predator contributes uniquely to pest control, reflecting the intricate balance required for the effective biological management of fluted scales. Understanding these predators' specific feeding behaviors and habitats can guide the development of targeted biological control strategies. For example, releasing or conserving these natural enemies can help manage pest populations more sustainably compared to chemical pesticides, which are often hard to deliver to scale insects living in treetops in urban green areas.

The difficulties in identifying some species and discovering new distribution records highlight the need for future research. Further taxonomic and ecological research is crucial for improving the understanding of these species' biology and maximizing their benefits in pest management. The present study underscores the importance of diverse predatory species in urban areas of Guayaquil, Ecuador, and the ongoing need for research to fully utilize their potential in controlling these invasive fluted scale species.

Conclusions

Five species of natural enemies in four insect taxonomic orders and four families, namely, *Novius punicus*, *Novius cardinalis* (Coleoptera: Coccinellidae), *Syneura cocciphila* (Diptera: Phoridae), *Ceraeochrysa* sp. (Neuroptera: Chrysopidae), and *Cardiastethus* sp. (Hemiptera: Anthocoridae) were found feeding on three species of invasive fluted scales: *Crypticerya genistae*, *C. multicastrices* and *Icerya purchasi* in urban areas of three Cantons (Guayaquil, Duale, and Samborondón) in Guayas, Ecuador. These predatory insects are crucial in controlling invasive fluted scales in the studied area. Parasitoid wasps were also found parasitizing specimens of *C. genistae* and *C. multicastrices* and are in the process of identification.

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Authors' Contributions

MAL: data curation, formal analysis, investigation, methodology, project administration, resources, supervision, visualization, writing - original draft, writing - review & editing; NMM: conceptualization, funding acquisition, investigation, methodology, project administration, resources, supervision, writing - original draft, writing - review & editing; DF: formal analysis, investigation, methodology, writing - original draft, writing - review & editing; GGF: formal analysis, investigation, methodology, writing - original draft, writing - review & editing; TK: conceptualization, data curation, investigation, methodology, supervision, validation, visualization, writing - original draft, writing - review & editing.

Ethical Implications

This article has no ethical implications for its development.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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