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THE LASIOCHILIDAE AND ANTHOCORIDAE (HEMIPTERA: HETEROPTERA) OF THE GALÁPAGOS ISLANDS, ECUADOR: INTRODUCED OR NATIVE?

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Abstract.—Eight species of Lasiochilidae and Anthocoridae have been reported from the Galápagos Islands, Ecuador, 970 km west of mainland Ecuador. Six of the species are considered to be non-indigenous and one species, *Nidicola mazda* Herring, may be the only native species on the islands. An unidentified species of *Xylocoris* Dufour awaits identification before further consideration can be made. The history of each species is presented.

Key Words: Hemiptera: Heteroptera, Lasiochilide, Anthocoridae, Galápagos Islands, Ecuador, introduced species

Charles Darwin left England on the Beagle on December 27, 1831, at the age of 22, and returned on October 2, 1836, after an extended voyage around the world. The main purpose of this trip was to continue coastal surveys of South America. Darwin had ample opportunity to examine the fauna, flora, and geology wherever the ship stopped. One such stop was at the Galápagos Islands, some 970 km (600 mi) west of the coast of mainland Ecuador. The visit lasted from mid-September to mid-October, 1835. Darwin (1839) commented on the general paucity of the insect fauna and their drab appearance. He collected 25 species of beetles (his special interest) "...excluding a species of *Dermestes* (Dermestidae) and *Corynetes* (Cleridae) imported wherever a ship touches." This was a very early statement on the accidental introduction of non-indigenous insects. This paper concerns a group of true bugs of the Galápagos Islands.

Books that provide a useful background on the Galápagos Islands include: Darwin (1839), *The Voyage of the Beagle*; Weiner (1995), *The Beak of the Finch*; Thomson (1995), *HMS Beagle*; Quamen (1996), *The Song of the Dodo*; Larson (2001), *Evolution's Workshop*; Peck (2001), *Smaller Orders of Insects of the Galápagos Islands, Ecuador: Evolution, Ecology and Diversity*; Nicholes (2003), *Evolution's Captain*; papers by Peck et al. (1998), Introduced insect fauna of an oceanic archipelago; The Galápagos Islands, Ecuador; and Causton et al. (2006), Alien insects: threats and implications for the conservation of Galápagos Islands.

The former family Anthocoridae is now considered to be three families: Lasiochilidae, Lyctocoridae, and Anthocoridae (Schuh and Štys 1991). The families Lasiochilidae and Anthocoridae were first reported from the Galápagos Islands (as Anthocoridae) by Herring

(1966a). The species were Lasiochilidae: *Lasiochilus pallidulus*, Anthocoridae: Dufouriellini: *Alofa sodalis, Amphiarus constrictus, Cardiastethus limbatellus*; Oriini: *Orius tristicolor*; Scolopini: *Nidicola mazda*; and Xylocorini: *Xylocoris sordidus*. Linsley (1977) reported six of these species (except *Lasiochius pallidulus*) and Schaefer et al. (1980) added information on *L. pallidulus*. Froeschner (1981) cited references to five of these species but did not mention *Orius insidiosus* (Say) or *Xylocoris sordidus*. Froeschner (1985) covered all seven species previously published. Peck et al. (1998) reported 292 species of insects in 16 orders likely to have been introduced into the Galápagos Islands. Their list included two species of Anthocoridae: *Alofa sodalis* and *Amphiareus constrictus*, both from Santa Cruz Island. Peck (2001) treated all known species of Lasiochilidae and Anthocoridae (as Anthocoridae), added an unidentified species of *Xylocoris* Dufour, and added many new localities for all other species. The status of all species reported from the Galápagos Islands follows.

Lasiochilidae

Lasiochilus pallidulus Reuter (1871) was described from South Carolina. Herring (1966a) reported it from Academy Bay, Isla Santa Cruz, and stated that the species also was known from Guatemala and Brazil. Schaefer et al. (1980) added information on this species from "Puerto Ayora / Indefatigable I. Galápagos / Dec.–Mar., 1971–2 / J. Vagvolgyi / at lights." Froeschner (1981, 1985) repeated these records. Henry (1988) reported this species from Florida, South Carolina, and Texas, besides Mexico, Central America and the West Indies. Carpentero et al. (1997) cited the species from Nicaragua. Peck (2001) reported this species from Isla Isabela, Isla Marchena, Isla Pinta, Isla Santa Cruz, and Isla Santiago. Based upon the broad distribution records, I consider this species to be introduced into the Galápagos Islands.

Anthocoridae

Dufouriellini

Alofa sodalis (White) was described from the Hawaiian Islands in 1878 (as *Cardiastethus sodalis*). Herring (1966a) reported it as *Buchananiella sodalis* from the Galápagos Islands (Academy Bay, Isla Santa Cruz) based on a single male and cited its occurrence in Africa, many islands in the Pacific, North, Central and South America, and the West Indies. It is thought to be a native species in the Hawaiian Islands. It is a non-indigenous species in the Galápagos Islands and was so reported by Peck et al. (1998), and Causton et al. (2006). Peck (2001) recorded Isla Islabela and Isla Santa Cruz.

Amphiareus constrictus (Stål) was described from Brazil in 1860 (as *Xylocoris constrictus*). Herring (1965) clarified the taxonomy of *Amphiareus constrictus* and later (Herring 1966a) reported it from Academy Bay, Isla Santa Cruz, and indicated that the species occurred in Africa, the Orient, many of the islands in the Pacific Ocean, North, Central and South America, and the West Indies. As with *A. sodalis*, it is regarded as an introduction into the Galápagos Islands and was so reported by Peck et al. (1998, 2001), and Causton et al. (2006). Peck (2001) listed Isla Isabela and Isla Santa Cruz.

Cardiastethus limbatellus (Stål) was described from Brazil in 1860. Herring (1966a) first reported it from the Galápagos Islands (Academy Bay, Isla Santa Cruz, ex. *Scalesia affinis* Hook.f. (as *Scaleia affinis*)) and several other sites on the island, as well as from Guatemala and Brazil. These records were repeated by Linsley (1977) and Froeschner (1981, 1985). Peck (2001) recorded Isla Baltra,

Isla Floreana, Isla Isabela, and Isla Santa Cruz. Peck (2001) and Peck et al. (1998) and Causton et al. (2006) did not consider this species in their charts of introductions. I consider this a non-indigenous species based upon the original site of description, in addition to the activities on Isla Baltra that was converted into an airport many years ago.

Oriini

Orius tristicolor (White) was described from California in 1880 (as *Triphleps tristicolor*). Herring (1966a) reported it from the Galápagos Islands (Isla Santa Cruz) and stated it was common in western United States, south through Mexico to South America, and the West Indies. He included this species in his revision of *Orius* (1966b). Linsley (1977) repeated Herring's (1966a) record, as did Froeschner (1985), but not in his Heteroptera of Ecuador (Froeschner 1981). Froeschner (1999) reported it from Panama based on the record of Champion (1900). Henry (1988) provided detailed province and state localities for *O. tristicolor*. Peck (2001) reported this species from Isla Española, Isla Fernandina, Isla Isabela, Isla Marchena, Isla Pinta, Isla Pinzón, Isla Santa Cruz and Isla Santago. Based upon its widespread occurrence, I consider this species non-indigenous in the Galápagos Islands.

Xylocorini

Xylocoris sordidus (Reuter) was described from Texas and Brazil in 1871 (as *Piezostethus sordidus*). Herring (1966a) first reported it from the Galápagos Islands (Isla Baltra and Isla Santa Cruz). He stated that it occurred in the southern United States, south through Mexico to Central America and South America, and the West Indies. Froeschner (1985) repeated previously published records. Henry (1988) provided detailed distribution of it in the United States. Peck (2001) reported this species from Isla Baltra, Isla Isabela, Isla Pinta, Isla San Cristóbal, Isla Santa Cruz, and Isla Santa Fé. *Xylocoris sordidus* is found at many locations in the United States (Henry 1988) and is widely distributed in Mexico, Central and South America (Lattin 2007). It is often associated with stored foodstuff (Arbogast et al. 1983, 1985) and thus, is easily introduced. Peck et al. (1998); Peck (2001), and Causton et al. (2006) have provided detailed information on the import of commercial goods, the very activities that would allow *X. sordidus* to have been introduced into the Galápagos Islands. It is here considered to be introduced in these islands.

Scolopini

Nidicola mazda Herring (1966a) was described from Academy Bay, Isla Santa Cruz, based upon a single female. The illustration of the type shows that the individual is submacropterous. Linsley (1977) and Froeschner (1981, 1985) included this record in their publications. Peck (2001) reported this species from Isla Fernandina, Isla Isabela, Isla Marchena, Isla Rábida, Isla Santa Cruz, and Isla Wolf. Earlier, Drake and Herring (1964) published a revision of *Nidicola* Harris and Drake that included five species with illustrations. The forewing of *N. mazda* by Herring shows a reduced membrane, similar to that of submacropterous *N. engys* Drake and Herring. Peet (1979) reported the same condition for *N. jaegeri* Peet from southern California. Ford (1979) listed seven species in the genus *Nidicola*. Peet (1973, 1979) provided detailed biological information on *N. marginata* Harris and Drake and *N. jaegeri*. Specimens were taken from woodrat nests, bat guano, and grain bins where they fed on small insects. He also stated that species of *Nidicola* had been intercepted from shipments of flowers and other plant materials at inspection centers in Arizona and Texas (Peet 1979). Species

of the genus *Nidicola* are found from Arizona and California south through Mexico to Guatemala and Nicaragua (Ford 1979; Carpintero et al. 1997). No records exist as yet for any species of *Nidicola* in mainland Ecuador (Froeschner 1981) or Panama (Froeschner 1999). Peck (2001) considered this species to be the only endemic Anthocoridae on the Galápagos Islands. He reported it as occurring in the "littoral to transition zones." No mention was made of the condition of the wings of the additional specimens collected. Considering the amount of traffic to the islands, especially Isla Santa Cruz (Peck et al. 1998), there is a possibility this species is introduced. Despite this, comparison with all other known species of *Nidicola* supports the validity of it being a distinct species.

In summary, seven species of Lasiochilidae and Anthocoridae were reported from the Galápagos Islands, Ecuador, by Herring (1966a). These are Lasiochilidae: *Lasiochilus pallidulus* and Anthocoridae: *Alofa sodalis, Amphiareus constrictus, Cardiastethus limbatellus, Orius tristicolor, Xylocoris sordidus*, and *Nidicola mazda*. I consider the first six non-indigenous to the islands, whereas the last, *Nidicola mazda*, is perhaps the only endemic species. All other species of *Nidicola* occur from Arizona and California, south through Mexico to Guatemala and Nicaragua. Most of the described species have been intercepted at the United States border in Arizona and Texas in shipments of plant material, especially flowers, from Mexico. It is possible that *N. mazda* was introduced into the Galápagos Islands the same way. Peck (2001) treated all previously known species of Lasiochilide and Anthocoridae (as Anthocoridae), added many new island records, and included an unidentified species of *Xylocoris*.

Peck et al. (1998) reported 292 species of introduced insects from the Galápagos Islands and their possible modes of introduction, including two species of Anthocoridae (*Alofa sodalis* and *Amphiareus constrictus*). Table 4 was of particular interest, listing the various islands and the number of species introduced on each island. They reported 165 species introduced onto Santa Cruz - by far the greatest number cited. All of the true bugs reviewed by Herring were reported from Santa Cruz Island, only *Xylocoris sordidus* was also recovered from another island - Baltra. Baltra Island was converted into an air base during World War II and was a major site for introduction of all types of materials. Peck (2001) published a study of the smaller insect orders besides providing an extensive overview of the origin, arrival and evolution of the insect fauna of the islands. Many additional localities of the included insects were given, including the true bugs. Henry and Wilson (2004) reported eleven species of Hemiptera: Heteroptera not previously recorded from the Galapágos Islands. Causton et al. (2006) reported 463 species, up from 292 cited in Peck et al. (1998). Peck and his associates have provided an excellent study of the Galápagos insects. Their treatment of the extraordinary number of introduced species is particularly relevant to the present paper.

Dedication

This paper is dedicated to my friend and colleague, the late Jon L. Herring. Jon was the first to publish on the Anthocoridae of the Galápagos Islands in 1966, including the description of a new species (*Nidicola mazda*). He also published the only major work on the Anthocoridae of Micronesia in 1967.

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