



Latest records of introduced invertebrates in Galapagos and measures to control them

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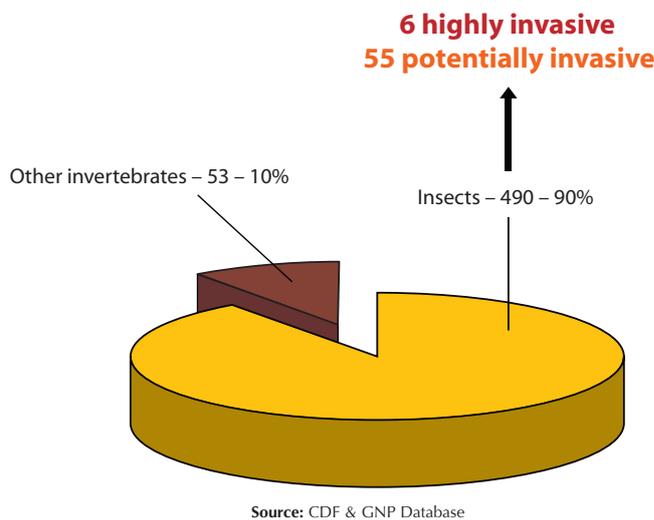
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Records up to late 2006 show **490** species of insects and **53** species of other invertebrates (e.g., spiders, snails, and slugs) introduced into Galapagos. Out of these species, six are known to be invasive species with significant impacts on Galapagos ecosystems: fire ants (*Wasmannia auropunctata* and *Solenopsis geminata*), wasps (*Brachygastra lecheguana* and *Polistes versicolor*), cottony cushion scale, (*Icerya purchasi*), and a bird ectoparasite (*Philornis downsi*). A risk analysis has highlighted another 55 species of insects considered to have the potential to cause serious impacts in Galapagos.

During 2005 and 2006, at least **26** species of introduced invertebrates were recorded for the first time in Galapagos: 2 beetles (Coleoptera), 7 flies (Diptera), 3 scale insects (Homoptera), 8 ants and 1 wasp (Hymenoptera), 1 moth (Lepidoptera), 2 booklice (Psocoptera), and 2 thrips (Thysanoptera). These species

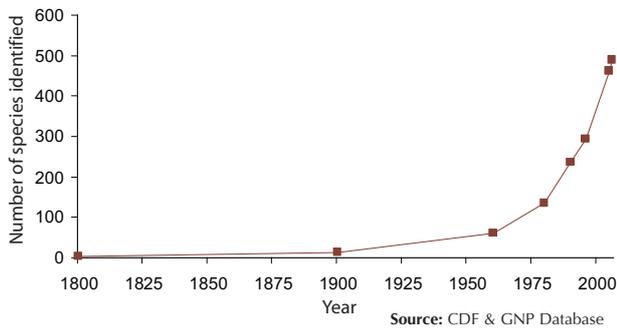
were probably introduced in lumber, fruits and vegetables, and decomposing organic matter. Figure 2 clearly shows the increase in the number of species recorded in the last few years. However, some of the species reported during 2005 and 2006 arrived in Galapagos at an earlier date; 69% of the new species recorded were collected in Galapagos from 1960 to 2004, but were first identified in 2005 and 2006. This was mainly due to difficulties in identifying species or because many specimens were kept unclassified for years in the Terrestrial Invertebrates Reference Collection of the Charles Darwin Foundation (CDF). It is also possible that some other species reached Galapagos before 2005 but were not recorded because they were in places where no intensive invertebrate collections had been carried out until recently, e.g., in urban areas. As a consequence, the interval between the collection date and the first record makes it difficult to compare invertebrate introductions over the years.

Figure 1. Introduced invertebrate species recorded in Galapagos up to 2006



To date, **490** species of introduced insects and **53** species of other introduced invertebrates have been registered in Galapagos.

Figure 2. The cumulative number of introduced invertebrate species recorded in Galapagos



Notes

Many were introduced from a few years to decades prior to their identification.

Newly recorded species posing the greatest risk for Galapagos

Of the new introduced species recorded in Galapagos, 16 have the potential to cause a major impact on the economy and biodiversity of Galapagos (3 are very high risk species and 13 are high risk species). Of these, the three species of scale insects (Hemiptera), *Coccus longulus* (collected on an ornamental plant in Santa Cruz), *Nipaecoccus nipae* (collected on a guava plant in Isabela), and *Inglisia vitrea* (found on a chirimoya plant in San Cristóbal), deserve special attention because they are well known as pests in other parts of the world, and they eat a wide variety of plants, which could jeopardize both cultivated and endemic vegetation. The 8 species of ants (Hymenoptera: Formicidae), the thrips, *Neohydatothrips portoricensis* (Thysanoptera: Thripidae), and the wasp *Sceliphron caementarium* (Hymenoptera: Vespidae) are predators of other insects. The moth, *Phyllocnistis citrella* (Lepidoptera: Gracillaridae), specializes on citrus, affecting tree growth by mining the leaves.

Out of the introduced insects recorded, 55 have the potential to cause a serious impact on the economy and biodiversity of Galapagos.

The Annex includes new reports of introduced invertebrate species in Galapagos for the 2005-2006 period and identifies their threat level.

Control and eradication of invasive invertebrates to date

The most invasive or potentially invasive species of introduced invertebrates, their distribution, and the management actions implemented are shown in Table 1.

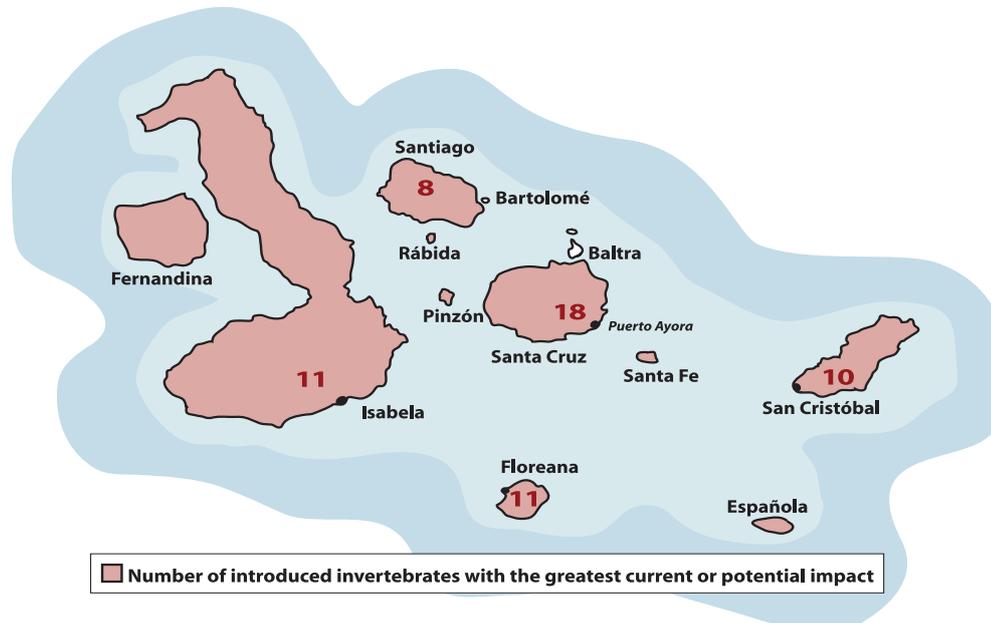
Since most of the species recorded in 2005 and 2006 arrived previously, no action has yet been taken for any of them. However, studies are recommended to determine if Galapagos ecosystems are being affected. Early in 2006, CDF and staff of the Quarantine Inspection System for Galapagos (SICGAL) responded quickly when a large number of thrips (*Gynaikothrips uzeli*) were discovered attacking ornamental plants of the *Ficus* genus. However, when it was later confirmed that this species of thrips specializes on *Ficus* (an introduced, potentially invasive plant), it was concluded that Galapagos plants would not be affected. The mud dauber wasp, *Sceliphron caementarium*, is currently being monitored to see if it has become established.

Eradication or control efforts focus on high-impact species, such as the little fire ant, *Wasmannia auropunctata*, and the tropical fire ant, *Solenopsis geminata*.

Current emphasis is on eradicating or controlling high-impact species such as the little fire ant, *Wasmannia auropunctata*, and the tropical fire ant, *Solenopsis geminata*. These ants give a painful sting and affect juvenile reptiles and birds, as well as impact human activities. They are also predators of other invertebrates. Currently, the distribution of these two ants is being researched and priority areas for control actions identified. Sites with threatened plant species and islands with new infestations are top priority. The Galapagos National Park, with technical assistance provided by CDF, is now pursuing eradication programs for the little fire ant on Marchena (an area of 21 ha), San Pedro on Isabela (an area of 28 ha), and Mao islet (1.2 ha). They are also carrying out eradication programs for tropical fire ants on Bainbridge Rocks (10 ha), Las Marielas (1.2 ha), and Champion (2 colonies). Fire ants are also being controlled on Black Turtle Beach on Isabela, the last refuge of the critically endangered Mangrove Finch.

Another invasive species being controlled is the cottony cushion scale, *Icerya purchasi*. Since 2002, its primary natural enemy, the Australian ladybug (*Rodolia cardinalis*), has been released on 11 islands of the archipelago. This is the first time that biological control has been applied in Galapagos and the program is being evaluated with the help of the community. The results so far indicate that the ladybug has been established on most islands and has also spread naturally to Baltra.

Figure 3. Distribution of introduced invertebrate species with the greatest current or potential impact in 2006



Source: CDF & GNP Database

Table 1. Introduced invertebrate species with the greatest current or potential impact and their distribution on the larger islands of Galapagos.

Common Name	Scientific Name	Santa Cruz	San Cristóbal	Isabela	Floreana	Santiago	Fernandina	Santa Fe	Marchena	Other Islands ¹
Little fire ant ²	<i>Wasmannia auropunctata</i>	P	P	P/E? ² (28ha)	P	P		E (3ha)	E? (21ha)	P
Tropical fire ant ³	<i>Solenopsis geminata</i>	P	P	P/C (3ha)	P	P	P	P		P
Cottony cushion scale	<i>Icerya purchasi</i>	BC	BC	BC	BC	BC	BC	BC	BC	BC
Paper wasp	<i>Polistes versicolor</i>	P	P	P	P	P				P
Black paper wasp	<i>Brachygastra lecheguana</i>	P	P							
Ectoparasitic fly	<i>Philornis downsi</i>	P	P	P	P					
Lesser snow scale	<i>Pinnaspis strachani</i>	P	P	P	P	P			P	P
Tiger beetle	<i>Cicindela trifasciata</i>	P								
Mealybug	<i>Paracoccus solani</i>	P		P		P				P
Southern house mosquito	<i>Culex quinquefasciatus</i>	P	P	P	P					
Singapore ant	<i>Monomorium destructor</i>				P					P
Bicolored trailing ant	<i>Monomorium floricola</i>	P			P					P
Woolly white fly	<i>Aleurothrixus floccosus</i>	P		P		P				
Lantana lace bug	<i>Leptobyrsa decora</i>	P	P		P					
Southern green stink bug	<i>Nezara viridula</i>	P	P	P	P					P
Cow pea aphid	<i>Aphis craccivora</i>	P		P		P	P			
Coconut mealybug	<i>Nipaecoccus nipae</i>	P		P					P	
Green peach aphid	<i>Myzus persicae</i>	P					P			
Yellow Fever mosquito	<i>Aedes aegypti</i>	P								

Source: CDF & GNP Database

Key to abbreviations: P = Present, C = Control under way, BC = Biological control, E = Eradicated, E? = Eradication to be confirmed.

Notes

- 1 'Other Islands' includes: Rábida, Genovesa, Española, Daphne, Pinta, Seymour Norte, Pinzón, Baltra
- 2 Found in many places on Isabela and being eradicated in the San Pedro area.
- 3 Found in many places on Isabela and being controlled on Black Turtle Beach.

Top-priority actions.

- Strengthen SICGAL, both in control and inspection activities as well as detection, monitoring, and rapid response.
- Determine the distribution and impact of species identified as potentially very invasive in Galapagos.
- Prioritize areas that require control of fire ants and develop control methods for inhabited areas.

Annex. New records of introduced invertebrate species in 2005-2006

ORDER	SPECIES	ISLAND	TYPE OF ARRIVAL	THREAT	ACTION TAKEN	ESTABLISHED
Choleoptera (beetles)	<i>Trigonodera lineata</i>	Santa Cruz	A- in wood	Low	NA	Yes
Choleoptera (beetles)	<i>Ancholaemus acuminatus</i>	Santa Cruz	A- in wood	Low	NA	Yes
Diptera (flies)	<i>Bradysia ocellaris</i>	Floreana	A- in organic material	Low	NA	Yes
Diptera (flies)	<i>Bradysia radicum</i>	Floreana	A- in organic material	Low	NA	Yes
Diptera (flies)	<i>Calycomyza lantanae</i>	Santa Cruz Floreana	A-in plants	High	NA	Yes
Diptera (flies)	<i>Eugnoriste planiforceps</i>	Santa Cruz Floreana	A- in organic material	Low	NA	Yes
Diptera (flies)	<i>Lonchaea n. sp.</i>	San Cristóbal	A-in plants	High	NA	Yes
Diptera (flies)	<i>Megaselia seticauda</i>	San Cristóbal	A- in organic material	Low	NA	Yes
Diptera (flies)	<i>Zaprionus? sp.</i>	Santa Cruz	A- in fruits or vegetables	Low	NA	Yes
Hemiptera (scale insects)	<i>Coccus longulus</i>	Santa Cruz	A-in fruits	Very High	NA	Yes
Hemiptera (scale insects)	<i>Inglisia vitrea</i>	San Cristóbal	A-in fruits or plants	High	NA	Yes
Hemiptera (scale insects)	<i>Nipaecoccus nipae</i>	Isabela agricultural zone	A-in fruits	Very High	NA	Yes
Hymenoptera (ants/wasps)	<i>Adelomyrmex myops</i>	Isabela	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Brachymyrmex heeri</i>	Santa Cruz	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Crematogaster sp</i>	Baltra	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Cyphomyrmex rimosus</i>	Santa Cruz	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Hypoponera punctatissima</i>	Santa Cruz	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Pyramica membranifera</i>	Isabela (Alcedo)	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Rogeria curvipubens</i>	Santa Cruz	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Sceliphron caementarium</i>	Santa Cruz	A	High	NA	Yes
Hymenoptera (ants/wasps)	<i>Solenopsis (near) tenuis</i>	Floreana, Isabela, Santa Cruz	A	Very High	NA	Yes
Lepidoptera (moths)	<i>Phyllocnistis citrella</i>	Santa Cruz San Cristóbal	A-in citrus	High	NA	Yes
Psocoptera (booklice)	<i>Pseudocaecilius citricola</i>	Isabela (agricultural zone)	A	Low	NA	Unknown
Psocoptera (booklice)	<i>Soa flaviterminata</i>	San Cristóbal (agricultural zone)	A	Low	NA	Unknown
Thysanoptera (thrips)	<i>Gynaikothrips uzeli</i>	Santa Cruz San Cristóbal	A-in plants	None	CO	Yes
Thysanoptera (thrips)	<i>Neohydatothrips portoricensis</i>	Isabela (agricultural zone)	A- in plants or vegetables	High	NA	Yes

Source: CDF & GNP Database

Key to Abbreviations:

Type of Arrival: Accidental (A), Intentional (I)

Action Taken: Control Method Developed (CO), No Action (NA)

Established: Yes, No