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FIRST INVENTORY OF ANTS (HYMENOPTERA: FORMICIDAE) ON BALTRA ISLAND, GALAPAGOS

By: Henri W. Herrera¹ & Charlotte E. Causton

Charles Darwin Research Station, Galapagos, Ecuador.

¹<henri.herrera@fcdarwin.org.ec>

SUMMARY

Baltra island is vulnerable to ant invasions because it is one of the principal ports of entry to the Galapagos archipelago. In spite of this, little was known about its ant fauna. We present 13 new records of ants for Baltra collected during 2005 and 2006: *Tapinoma melanocephalum*, *Camponotus planus*, *Paratrechina longicornis*, *Paratrechina* sp., *Monomorium destructor*, *M. floricola*, *Pheidole* sp., *Solenopsis geminata*, *S. globularia pacifica*, *Tetramorium bicarinatum*, *T. lanuginosum* and *T. simillimum*. In addition to this, we report a new species for Galapagos: *Monomorium* sp. nr. *pharaonis*. *S. geminata* and *M. destructor* are considered threats to native fauna

RESUMEN

Primer inventario de las hormigas (Hymenoptera: Formicidae) en la Isla Baltra, Galápagos. La isla de Baltra es uno de los puntos vulnerables a la introducción de hormigas invasivas ya que es uno de los puertos principales del archipiélago de Galápagos. Pese a ello durante mucho tiempo la isla ha permanecido poco conocida en cuanto a su myrmecofauna. Presentamos 13 registros nuevos de hormigas para Baltra colectados durante 2005 y 2006; *Tapinoma melanocephalum*, *Camponotus planus*, *Paratrechina longicornis*, *Paratrechina* sp., *Monomorium destructor*, *M. floricola*, *Pheidole* sp., *Solenopsis geminata*, *S. globularia pacifica*, *Tetramorium bicarinatum*, *T. lanuginosum* and *T. simillimum*. Incluimos al resultado un nuevo registro de hormiga para Galápagos: *Monomorium* sp. c. *pharaonis*. Identificamos a *S. geminata* y *M. destructor* como las especies de mayor amenaza a la fauna nativa.

INTRODUCTION

Baltra is a small island (25.1 km²) that lies north of the island of Santa Cruz. The vegetation is similar to that of northern Santa Cruz and is dominated by native and endemic plants such as *Bursera malacophylla* B.L. Rob, *Chamaesyce punctulata* (Andersson) D.G. Burch, *Cordia lutea* Lam., *Crotalaria pumila* Ortega, *Opuntia echios* var. *echios*

Howell, *Panicum alatum* var. *minus* (Andersson) Zuloaga & Morrone, *Parkinsonia aculeata* L., and *Scalesia crockeri* Howell, and with important introduced elements such as *Cleome viscosa* L. (Wiggins & Porter 1971). Baltra has also been altered by human activities including the introduction of exotic animals. During the Second World War, Baltra was converted into a U.S. military base and in 1946 was placed under the jurisdiction of the armed forces of

Ecuador (Hamann 1979, 1981). Currently, Baltra airport is the main airport of entry for visitors and imported goods from mainland Ecuador and consequently it is considered as a major entry point for alien species including ants (Meier 1994).

Although ants are considered some of the most invasive organisms worldwide (McGlynn 1999), little attention has been paid to this group in the Galapagos and an inventory has not been carried out on Baltra. Prior to this study, only three species had been collected on Baltra: *Camponotus zonatus* Emery, an introduced ant (formerly *C. conspicuus zonatus*: W. Mackay pers. comm.); *Cylindromyrmex whymperi* (Cameron), a species of undetermined native/introduced status (previously identified for Galapagos as *C. striatus* Mayr: Andrade 1998) and *Dorymyrmex pyramicus albemarlensis* Wheeler, possibly endemic (F. Cuezso pers. comm.). The objective of this study was to carry out the first complete inventory of ants on Baltra in order to determine the composition of its ant fauna and identify species that may be potential threats for the archipelago.

MATERIALS AND METHODS

Two surveys were conducted. The first was carried out from 14 to 16 August 2005, when collecting locations included human settlements, the airport, rubbish dump, dock at Itabaca Canal, some less disturbed natural areas, and the site of repatriation to Baltra of the Land Iguana *Conolophus subcristatus* Gray (Fig. 1). Eleven sites were sampled in total. All locations were georeferenced using hand held Global Positioning System units (GPS). A second survey, 19–20 April 2006, was conducted at the Land Iguana colony because this was an area where *C. whymperi* and *D. pyramicus albemarlensis* had been recorded previously and these species were not recorded during the first collecting survey. At each location, one 4 x 1 cm tube containing either a honey or a tuna bait was placed alternately every 10 m along a transect approximately 200 m long (Fig. 1). On the first survey a total of 630 baits was placed along 30 transects and on the second survey 168 baits were placed along eight transects. Baits were placed from 6h00 to 8h00 and from 17h00 to 20h00. The

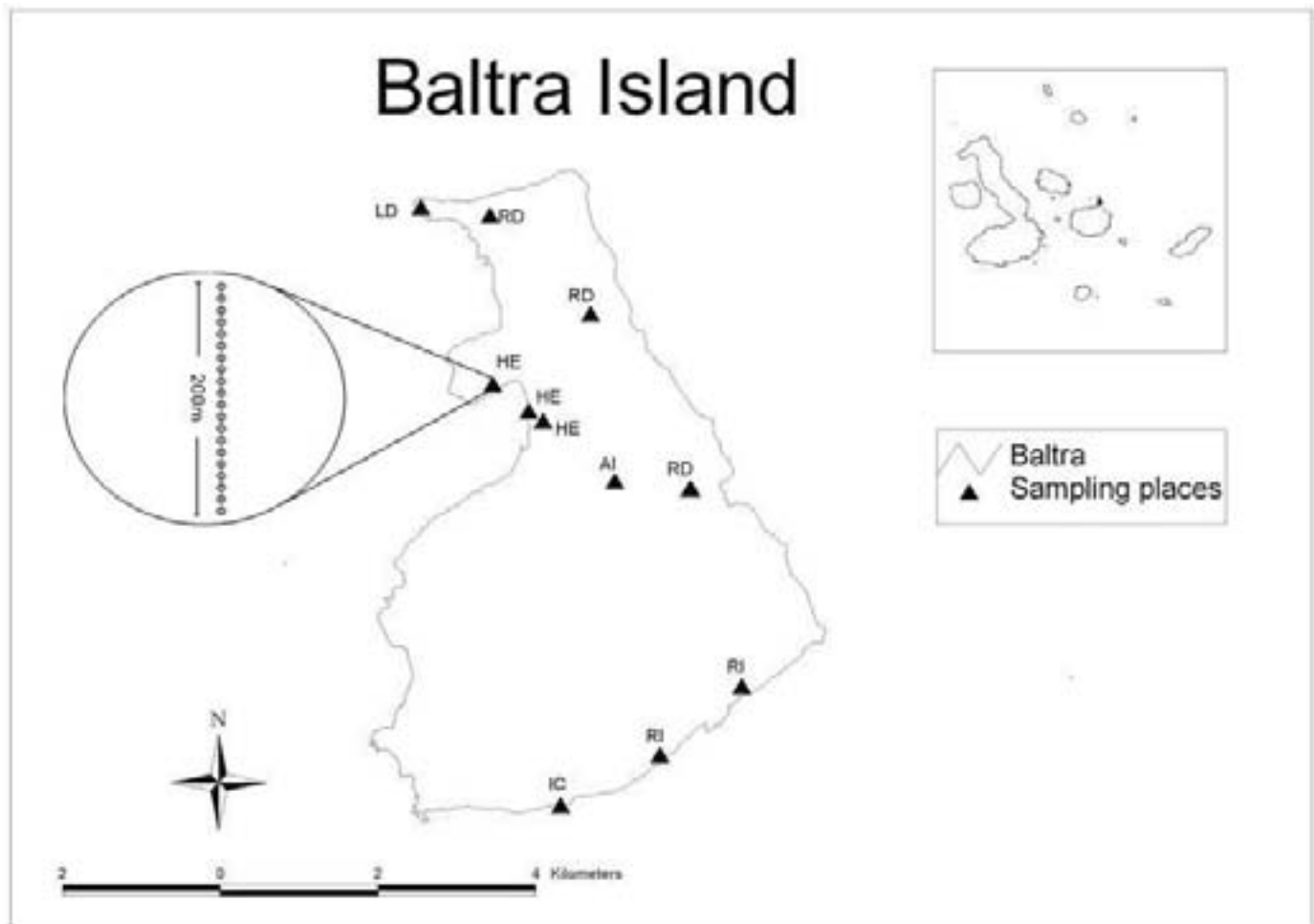


Figure 1. Sampling locations: AI = airport; HE = human settlements; IC = dock at Itabaca Canal; LD = less disturbed areas; RD = rubbish dumps; RI = site of repatriation of Land Iguanas. Enlarged circle shows the layout of baits on the transects, although the orientation of each transect differed.

rubbish dump and the housing of the Ecuadorian Airforce were also surveyed, at 12h00–14h00. Additional specimens were collected by Galapagos National Park guards using peanut butter baits in October and November 2006.

At each collecting site, tree trunks, leaf litter and soil were checked manually for ants. Specimens were taken to the Charles Darwin Research Station (CDRS) where they were processed and identified. Specimens from Baltra housed in the CDRS museum were also identified. All specimens were deposited in the Invertebrates Reference Collection at CDRS (IC CDRS). Specimens of *Monomorium* sp. nr. *pharaonis* were also deposited at The Natural History Museum, London (BMNH). Digital pictures of all species may be found at <<http://www.antweb.org/galapagos.jsp>>.

RESULTS AND DISCUSSION

As a result of these surveys an additional 13 species were registered on Baltra bringing the total known from that island to 16: 10 introduced, one endemic, one possibly endemic and four species of unknown status. Nine of the species belong to the subfamily Myrmicinae, followed by Formicinae (4), Dolichoderinae (2) and Cerapachyinae (1). Eight species are “tramp ants”, species that have been dispersed worldwide through trade (Table 1).

We did not find two of the three ant species reported previously from Baltra: *C. whymperei* and *D. pyramicus albemarlensis*. *C. whymperei* (two workers and a female) was

collected during the Harrison Williams expedition at the southern end of the island (Wheeler 1924) and also by C. Marquez in 1991 on *Maytenus octogona* (L’Hér.) DC. next to Caleta de las Tintoreras (C. Marquez pers. comm.). It is reported from Baltra, Fernandina, Isabela and Santa Cruz (Wheeler 1924, Silberglied 1972, Clark et al. 1982). *D. pyramicus albemarlensis*, was collected by L. Roque-Albelo in 1991 (exact location not recorded) and at the airport by S. Abedrabbo in 1992. This species is reported from Eden, Española, Fernandina, Genovesa, Isabela, Marchena, Pinta, Santa Cruz, Santa Fe (IC CDRS database). It is possible that aggressive ants such as *Solenopsis geminata* (Fabricius) and *Monomorium destructor* (Jerdon) have influenced the distribution of these two species of ant.

Camponotus planus Smith was the only endemic species to be collected during the surveys. It is nocturnal and is typically found on the coast of this island. On Baltra we observed it to displace the introduced carpenter ant, *C. zonatus*, at baits. In areas occupied by *S. geminata* or *M. destructor*, *C. planus* was displaced at baits.

On Baltra, *C. zonatus*, *M. destructor*, *Monomorium* sp. nr. *pharaonis*, *Paratrechina longicornis* (Latreille), and an unidentified *Paratrechina* species are widely distributed and apparently have established colonies throughout most of the island. *Solenopsis globularia pacifica* Wheeler, an unidentified *Pheidole* species and the tramp species *Monomorium floricola* (Jerdon), *S. geminata*, *Tapinoma melanocephalum* (Fabricius), *Tetramorium simillimum* (Smith), *Tetramorium bicarinatum* (Nylander), and *Tetramorium lanuginosum* Mayr

Table 1. Ant records for Baltra. (x) = species collected previously but not reported in this study; x = species present; new species for Baltra in bold; * new record for Galapagos.

SUBFAMILY <i>Species</i>	Sites ¹								Tramp/ Invasive?	First record in Baltra	Status ²
	AI	HE	IC	LD	RD	RI	LU				
CERAPACHYINAE											
<i>Cylindromyrmex whymperei</i>								(x)	-	1924	?
DOLICHODERINAE											
<i>Dorymyrmex pyramicus albemarlensis</i>	(x)							(x)	-	1992	E?
<i>Tapinoma melanocephalum</i>	x	x	x						T	2005	I
FORMICINAE											
<i>Camponotus planus</i>				x	x			x	-	2005	E
<i>Camponotus zonatus</i>	x	x	x	x	x	x			-	1992	I
<i>Paratrechina longicornis</i>	x	x	x	x	x	x			T	2005	I
<i>Paratrechina</i> sp.		x	x	x		x			-	2005	?
MYRMICINAE											
<i>Monomorium destructor</i>	x	x		x	x	x			T	2005	I
<i>Monomorium floricola</i>				x					T	2005	I
* <i>Monomorium</i> sp. nr. <i>pharaonis</i>	x	x	x		x	x			-	2005	I
<i>Pheidole</i> sp.						x			-	2005	?
<i>Solenopsis geminata</i>		x			x	x			T/I	2005	I
<i>Solenopsis globularia pacifica</i>		x	x						-	2005	?
<i>Tetramorium bicarinatum</i>	x								T	2005	I
<i>Tetramorium lanuginosum</i>		x	x	x					T	2005	I
<i>Tetramorium simillimum</i>		x							T	2005	I

¹Site codes as in Fig. 1; LU = Location undetermined.

²E = Endemic; E? = Possibly endemic; I = Introduced; ? = Undetermined.

are not widely distributed on Baltra, and are found principally in the human settlements.

Most of the species found on Baltra are distributed widely in the archipelago with the exception of *M. destructor* and *T. lanuginosum*. These two species have previously been reported from Puerto Velasco Ibarra on Floreana Island (Pezzatti *et al.* 1998, Aesch & Cherix 2005). Recently, *M. destructor* has also been registered on Isabela and Santiago islands (H.W.H. unpubl. data).

The introduced species *T. melanocephalum*, *P. longicornis*, *M. floricola* and *T. lanuginosum* are considered lesser threats to Galapagos fauna (Causton *et al.* 2006). *T. bicarinatum* was suggested as the possible causal factor of the displacement of *Camponotus macilentus* Wheeler during the El Niño event of 1982 on Española Island (Lubin 1985), but has not been observed to be invasive (in the sense of causing ecological damage). Little is known about the impact of *C. zonatus* in Galapagos or other parts of the world and studies are needed to determine its potential to become invasive in the archipelago.

The fire ant *S. geminata* is considered invasive in Galapagos and there is concern that *M. destructor*, first recorded in Galapagos in 1997, is also becoming invasive (Causton *et al.* 2006). *M. destructor* and *S. geminata* have been shown to be highly dominant and competitive at baits on Floreana Island (Aesch & Cherix 2005). On Baltra, both species displaced the introduced *C. zonatus*, undetermined beetles and cockroaches from honey baits. Displacement at baits of other ant species by *S. geminata* and *M. destructor* was not observed on Baltra. However, in the area of repatriation of iguanas, both species quickly monopolized the baits and the baits were not approached by other invertebrates. *S. geminata* has been identified as a threat to other invertebrates as well as to young and weak Land Iguanas (Williams & Whelan 1991, Roque-Albelo & Causton 1999). High numbers of *M. destructor* were found at most collecting sites on Baltra, in both natural and

inhabited areas, whereas on Floreana it is restricted to the port area (Pezzatti *et al.* 1998, Aesch & Cherix 2005). The impact of *M. destructor* in Galapagos has not been studied, although it is widely regarded as a threat to biodiversity in the Pacific. It also chews on telephone cabling and electrical wires, and could therefore affect the operation of the airport on Baltra. The control of *M. destructor* and *S. geminata* on Baltra and in other parts of the archipelago is currently a priority for the Galapagos National Park Service.

On Baltra, *P. longicornis*, *Monomorium* sp. nr. *pharaonis* and *M. destructor* were observed tending the invasive scale insect *Icerya purchasi* Maskell and aphids on *Catharanthus roseus* (L.) G. Don, *Sida ciliaris* L. and an *Acacia* sp. These ants may aid in the transportation, and hence dispersal, of homopterans as well as help build up their population numbers.

One new record for Galapagos is from the subfamily Myrmicinae: *Monomorium* sp. nr. *pharaonis* (Fig. 2). It was attracted to tuna bait at the dock at Itabaca Canal (0°28'59.52" S, 90°16'39.84" W), in the littoral zone at 5–15 m altitude, 16 Oct 2005; 20 workers were collected (H. Herrera & R. Azuero, HWH 154, at IC CDRS and BMNH). This taxon has so far been recorded only in California and India (P.S Ward & B. Heterick pers. comm.), but a review of specimens at IC CDRS revealed that it has also been previously collected on Santa Cruz and San Cristobal in the Galapagos islands. It possibly originates from India or southeast Asia and its precise identification awaits a full revision of the Oriental *Monomorium* species (B. Bolton pers. comm.). The date of its establishment in Galapagos and its impact on Galapagos ecosystems are unknown.

CONCLUSIONS AND RECOMMENDATIONS

Many of the ant species found on Baltra are tramp ants introduced by humans. These are still mainly restricted to human settlements and the Itabaca Canal dock, which



Figure 2. *Monomorium* sp. nr. *pharaonis* worker, face and lateral views.

is used for movement of passengers and goods to and from Santa Cruz Island. *Monomorium* sp. nr. *pharahonis*, *T. lanuginosum* and *M. destructor*, the last two previously found only on Floreana, may be more widely distributed in the archipelago than current records indicate.

S. geminata and *M. destructor* are considered serious threats to Baltra island's biodiversity and we recommend that the area occupied by these species be defined and a management plan developed as soon as possible. Because Baltra is a principal port of entry for invasive ants we suggest intensifying current monitoring protocols so that surveys are conducted monthly. This will help ensure the early detection of newly introduced species that are a serious threat to Galapagos, such as the Argentine Ant *Linepithema humile* (Mayr), the Red Imported Fire Ant *Solenopsis invicta* (Buren) and the Big-headed Ant *Pheidole megacephala* (Fabricius).

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