

Galápagos threatened by tropical fire ant invasion

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Introduction

The Galápagos Islands constitute one of the **most pristine** archipelagos on Earth, with high levels of **endemism** (over 500 endemic plant spp, 1500 invertebrate spp and 109 vertebrate spp). The main threat to Galápagos wildlife is the introduction of invasive species.

The **tropical fire ant** *Solenopsis geminata* (TFA) is one of the most widespread and damaging invasive species on Earth. It is present on all the continents and it has an impact on **native fauna**, **cultivations** and **human activities**.

In this study we provide a combined approach of the invasion of the TFA in Galápagos that includes distribution data, ecological aspects and genetic life-history traits of this species.



Distribution of TFA in Galápagos

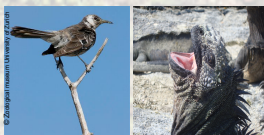
Compilation of databases, bibliography and personal sampling

On **seven islands** and **11 islets**

First record in **1891**, but the TFA has been recorded more often since the 1960's (development of tourism)

The TFA is uncommon in pristine areas and shows a **preference for disturbed sites** (Fisher's tests, $p < 0,001$)

It has been observed near the **nesting sites** of 26 **endemic** or **endangered** species



The Floreana mockingbird *Mimus trifasciatus* and the marine iguana *Amblyrhynchus cristatus*, two endemic species potentially threatened by the TFA

Structure of populations and routes of invasion

84 nests on 6 islands were analyzed with 12 microsatellite markers (8 samples per nest) + samples from Ecuador mainland and 8 other South and Central American countries

Genetic diversity:

Low allelic richness: (mean \pm SD= 3.011 \pm 1.335) in comparison with native areas in Costa Rica (9.131 \pm 3.911)

Deficiency of Heterozygosity: 0.030 < H < 0.169

Reproduction and dispersal strategies :

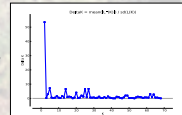
High inbreeding coefficient (0.363 < F_{IS} < 0.788)

High relatedness between workers of a same nest (0.589 \pm 0.221 < r_{W-W} < 0.815 \pm 0.035)

Low polygyny: 1.014 < N_e < 1.817

→ facultatively polygynous

Estimation of the number of genetically distinct groups (K)



Structure of populations

Galápagos populations are separated into **two groups**

Source populations

The Galápagos TFA populations probably come from **Venezuela**, **Costa Rica** (+ Brazil), and all probably transited through the main Ecuadorian harbor/airport in **Guayaquil**

Evaluations of impact on ant communities and endemic tortoises

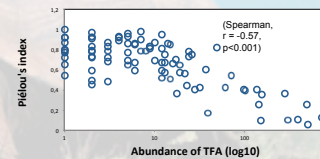
Impact on ant communities

155 pitfall traps on Santa Cruz Island in all environment types



Pitfall trap

The TFA is the **dominant species**, and is **negatively** correlated with Piérou's **evenness** index and with the proportion of **native and endemic** ant species



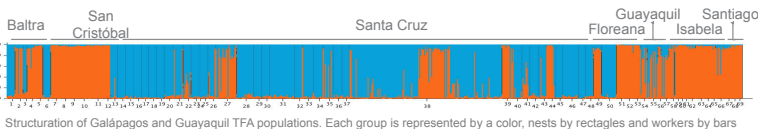
Impact on endemic tortoises

56 burrows of *Geochelone nigra porteri* were excavated in La Torta, Santa Cruz. Presence of ants was assessed with baits 1m away from each tortoise burrow.

The tortoise mortality is 54%. The TFA is present at 85% of the baits, (mean \pm SD= 124,5 \pm 111,3 individuals per bait)

Ant-free burrows have a **lower mortality** (Mann-Whitney, $p=0.047$).

Correlation between the **mortality** and number of days of **incubation** (Spearman, $r=0.33$, $p=0.024$), but not with the number of ants.



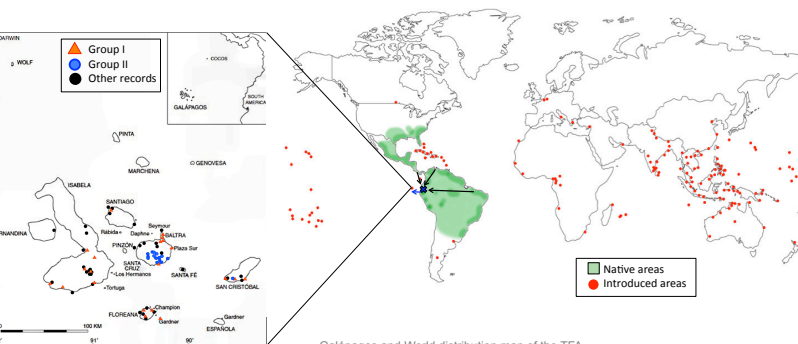
Structuration of Galápagos and Guayaquil TFA populations. Each group is represented by a color, nests by rectangles and workers by bars



Young *Geochelone* tortoise found inside a burrow and covered in TFA

Acknowledgements

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Galápagos and World distribution map of the TFA

Conclusions

- 1) TFA on 7 islands and 11 islets.
- 2) More common in disturbed areas but potentially threatening 26 endemic or endangered species.
- 3) Dominant ant species, disrupts native ant community structure.
- 4) Impact on endemic tortoises (although the incubation time is determinant)
- 5) Low genetic diversity and high inbreeding as often observed in invasive species
- 6) TFA populations in 2 groups → introduction in two phases ?
- 7) Source populations from Costa Rica, Venezuela and Brazil, transiting through the city of Guayaquil