Saint Barthelemy' s Myrmecophile Biodiversity

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SAINT BARTHELEMY

COM in 2007 / PTOM in 2011
→ Environmental responsibility
→ local environmental code

- ✓ Archipel of 21 Islands: the main island is 20 km2 large and 20 islets are 1 km 2 large.
- ✓ Arc of the islands of the Northern Caribbean. ; 175 km north of Guadeloupe
- ✓ Tropical climate, warm
- ✓ Volcanic & rocky land
- ✓ Secondary vegetation

Places of sampling :
Colombier, Grand fond, Tony, Flamands, Saint Jean, Grand Cul de sac, Gouverneur, Lurin, Grand Cul de sac , Gustavia.

SAINT BARTH ESSENTIEL Association

Development of historical, cultural & environmental interests of the island of Saint-Barthélemy

Identify the flora and terrestrial fauna.

- Inventory of existing inventories on the biodiversity of ground fauna and flora.
- Updating these inventories of Saint-Barthelemy species and study the new species rarity and risk of disappearance
- Propose measures for the protection of some endemic species of the island.
- Limit the proliferation of invasive species.

- **Ecological significance of ants - biodiversity index**
- **Environment functioning, ground restoration, decomposers, plant protection**
- **Sensitivity of communities of ants to environmental disturbances**
- **Bio-indicators of ecosystem change**
- **Shannon and Fisher indexes.**

Very few data on the Myrmecofauna of Saint Barthelemy

- **Sampling : Visual terricolous hunting (under stones, stem, low vegetation, Pit-Fall traps)**
- **Reference collections:**

✓ **National Museum of Nature History**

✓ **Collection CPDC Laboratorio de Myrmecologia UESC / CEPLAC Brésil.**

- **Study of diversity**
- **Laboratoire de Biologie *i EES Paris* . Université Paris Est Créteil.**

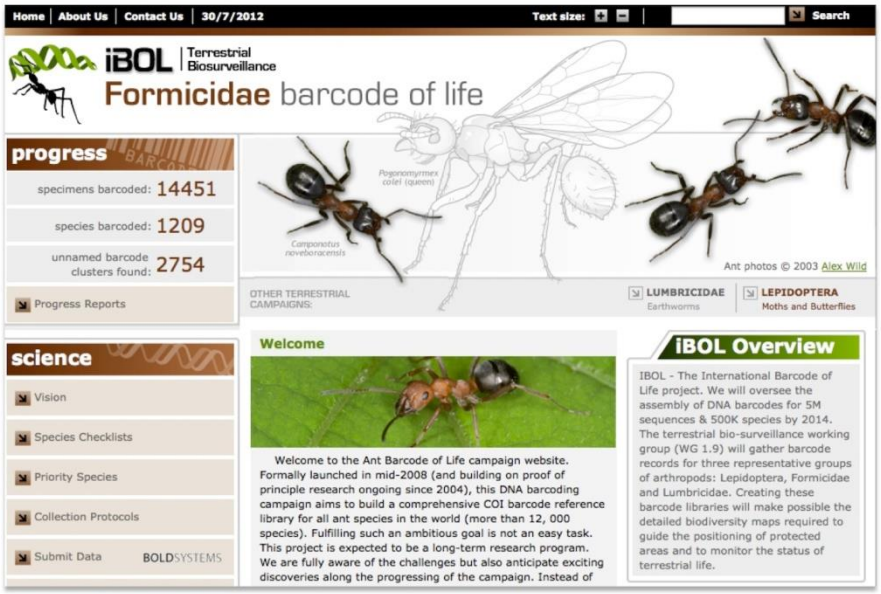
✓**Taxonomic determination: research of the characters of morphological diagnosis (identification keys).**

✓**Molecular analysis of the taxa.**

26 species … but are there more of them ? Work in progress…

Barcoding DNA : principe

The DNA barcode uses the genetic variability of short nucleotide regions standardized to help identification and the discovery of new species.



- Molecular identification of the species (Hébert et al. 2003).
- Based on a short standard nucleotide fragment sequencing
- ~ 650 bp of the mitochondrial gene cytochrome oxidase I (COI) for animals.
- Confrontation of the IOC to a sequence database formed from sequences of samples which taxonomy is known.

Barcoding DNA : methodology

- Extracting DNA of an individual for each nest for morpho-species
- → kit DNeasy® Blood & Tissue (Qiagen, France)

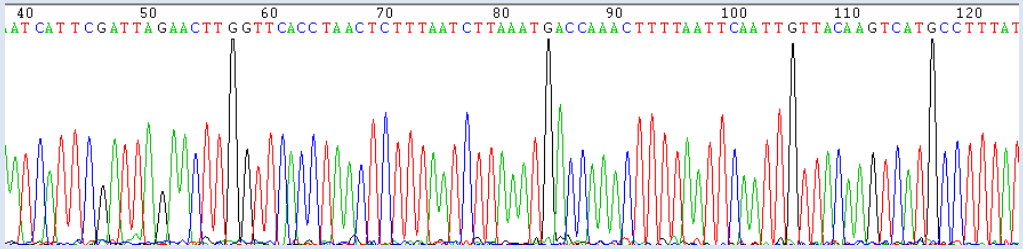
- Amplification by PCR (Polymerase Chain Reaction) of the COI fragment

→ standard primers och-1490/HCO-2198 (Hébert et al, 2003)

→ If failure, PCR primers alternative LepF1/LepR1 (Hébert et al, 2004)

- Sanger Sequencing

→ Genewiz



- Comparison of the sequences obtained with the data bank

→ BOLD SYSTEMS Identification Engine

ANTS DIVERSITY
Exemples
Neotropical: Amerique of South, Central, West Indies, Galapagos Islands

- ✓ Cretaceous period, 100 million years

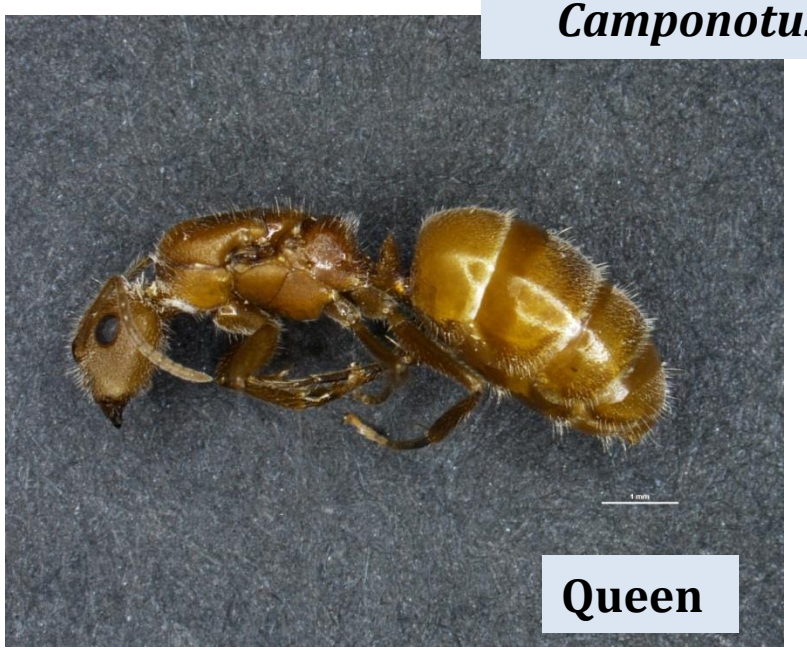
Eusocial insects: colonies of a few dozen to thousands of individuals (sometimes super colonies (hundreds of thousands of individuals)).

- ✓ Social organization: 3 caste: Queens, workers and males
- ✓ Under-castes: monomorphic, polymorphic
- ✓ Polygynous, monogynous.

Nests: terricolous, arboreal, lignicole

FORMICINAE

Camponotus sexgutattus antiguana



Queen

Queen's head

workers

workers

Camponotus sexgutattus sexgutattus

Paratrechina longicornis (Latreille,1802)
Crazy ant

PONERINAE

Odontomachus hoematodes L.

Trap-jaws

- ✓ Orig: South America
- ✓ Colonies of 200 individuals
- ✓ Monoginous
- ✓ Wide habitat diversity
- ✓ Unpleasant bite
- ✓ Biotop : Dead wood, litter

Hypoponera opaciceps Mayr

MYRMICINAE
Species polymorphous
Ex: *Solenopsis geminata* Smith,1858

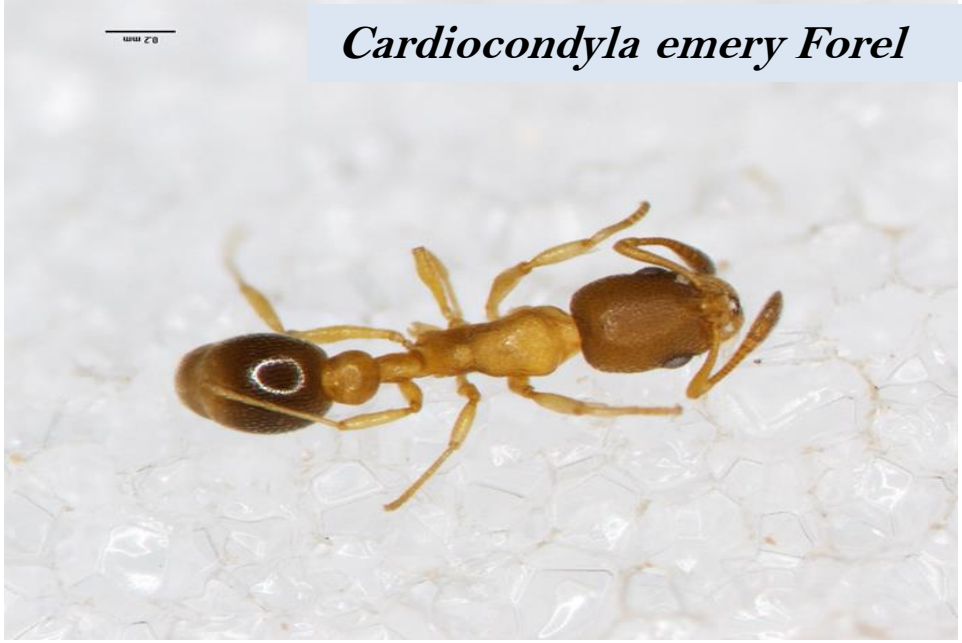
- Polymorphism
- Vagrant species in homes
- Large varieties of nests: soil bare or covered pebbles, dead wood, Hollow stems ,
- Omnivorous

MYRMICINAE

Monomorium carbonarium Smith 1858

Tetramorium simillimum Smith 1858

Cardiocondyla emery Forel



Solenopsis globularia (Smith)

DOLICHODERINAE
Azteca delpini antillana Forel ,1899

No dard

DORYLINAE
Ectatomma ruidum Roger,1966

Atrophied dard

DOLICHODERINAE
***Tapinoma melanocephalum Fabricius* 1793**
Fantom ant

Origin : Africa, Eastern regions

- ✓**Invasive Ant**, pest in the USA : Florida, Texas
- ✓don't sting but invasions of homes: kitchens (attracted by food)
- ✓spread diseases
- ✓Impossible eradication

DOLICHODERINAE
Technomyrmex difficilis Mayr 1872

First observation in St Barts in July 2011. Probably established through trade, the flow of tourists coming from the United States, or circulating between the various islands of the French Antilles.

Danger to some cultures because it likes honeydew and nectar from plants.

Molecular analysis has shown that the colony of Saint-Barthélemy belongs to this species, which was sequenced for the CO1 gene and referenced under the BIN (Barcode Index Number Registry) BOLD:AAB6241

Celini et al 2014 - Bulletin Entomologique de France 119(3)293-298

Some species of interest in MYRMICINAE with impacts in economy, health & agronomy

- ***Pheidole megacephala*** ***Fabricius*** **1793 :** ***Large head ant***
- ***Solenopsis invicta*** ***Buren :*** ***Large fire ant***
- ***Wasmannia auropunctata*** **(Roger 1863) :** ***Little fire ant***
- ***Cyphomyrmex minutus*** **Forel 1890 &** ***Acromyrmex octospinosus*** **Mayr ,186 → Fungus growing ants**

Pheidole megacephala (Fabricius,1793)

Brown Ant of the houses

- ✓ Polymorphic, polygynous: 1-16 Queens/1000 workers
- ✓ Unicolonialism, very aggressive but not aggressive with neighboring nests.
- ✓ Oportunistic, omnivorous
- ✓ Feed on honeydew from aphids and mealybugs
- ✓ Activity 24/24h
- ✓ Rapid mobilization, quick blast
- ✓ *Invasive species*

Threats: invertebrates, local vegetation, dwellings

Ex: Presence in 2012 in Hawaii: nb endemic species and endangered lizard Emoia.

Minor 2-2.8mm

Major 3.5-4.5mm

Solenopsis invicta Buren

Grande fourmi de feu Red imported fire ant RFA

- Name: suffering inflicted by his sting. The most dangerous ants around the world
- Origin: South America USA, beginning XXesc from Alabama then States in the South of the United States.
- Distribution: Reg: Australian, Nearctic, Neotropical, Oceania.

- Pest, aggressive predator
- Mandibles: use as a clamp (stings and bites)
- Great power of adaptation ,
- Empty biological areas they colonize, pushing even higher vertebrates.

✓Ground nests, mounds.

✓Attracted by the electric fields, in air conditioning units, wiring of the lights.

✓Impact on human health,Venom with allergens (kill 80 people per year in the USA); impacts quality of life, biodiversity;

MYRMICINAE
Species polymorphous
Ex: Solenopsis invicta Buren

Minor

Polygynous
or monogynous
1000 eggs/day

Major

Minor's head

Major's head

Wasmannia auropunctata (Roger 1863)
Little fire ant

✓Native from Central and South America. In all the tropical belt.

auro = gold, **punctata** = puncted

✓Workers monomorphic 1.2 mm.
✓ No ant hills but nests (soils, between bark and trunks)

✓Omnivorous, carnivorous, honeydew of Hemiptera

✓Reproduction by cuttings and clonal (anthropisation of territories?)
✓Very invasive clonal genotypes
✓Reproduction intranidale, no nuptial flight.

✓ Ecologically disturbed houses, dark, wet places.
✓Nuisance in crops (cocoa Brazil, Guyana), livestock, pets: Florida keratitis (blindness)

➢ Exterminate almost all species of ants, insects,

MYRMICINAE
Cyphomyrmex minutus Mayr ,1862

✓Nearctic region and Neotropicale in many islands in the Caribbean: Gua, Mart, Marie galante;

✓Terricolous species.
✓ Forage in small groups or isolated
✓ little populous ants hills; in the interstices of rocks consolidated.

- ✓ Analysis molecular species of st Barth, belongs to a taxon sequenced for the first time for the COI gene.
- ✓ Registration at Gen Bank: JX625155 accession number. Reference for specimens collected in other locations.
- ✓ Verification of the identity of the species of the Guadeloupe ?
- ✓ Geographical variations (discrete or distinct friendly forms in some localities.

Celini et al 2013-Bulletin entomologique de France 118 (3) 393-398 2013

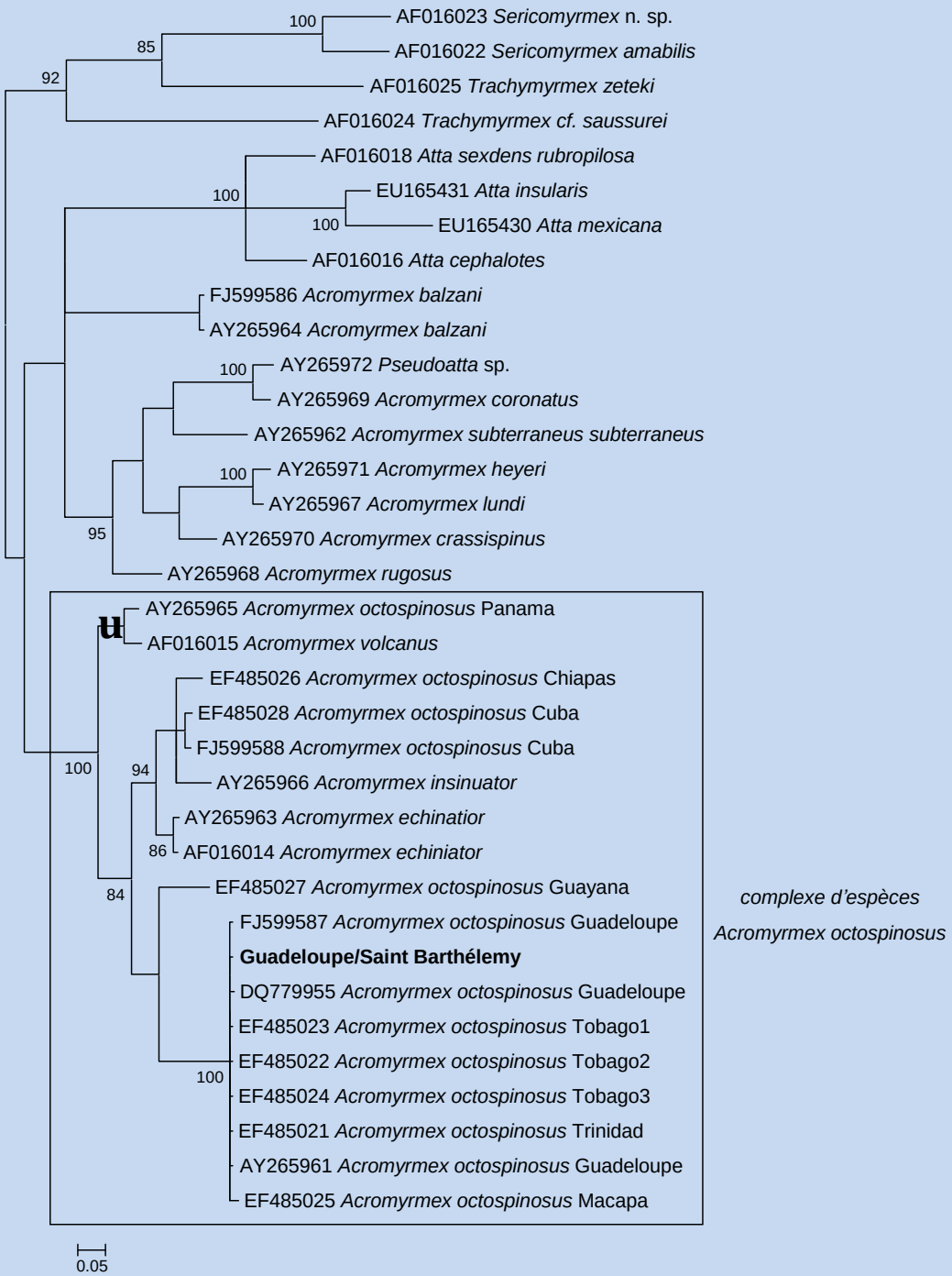
MYRMICINAE
Acromyrmex octospinosus Mayr
Fungus growing ant

- ✓ Invasive species
- ✓ Reported in 2011 in St Barthelemy

Bacteria, Actinomycete

Leucoagrinus gongylophorus

Phylogenetic reconstruction Sequences of Saint - Barth have been inserted in a phylogenetic reconstruction including *Acromyrmex* sequences available in the molecular data banks, as well as the sequences obtained for 34 nests of Guadeloupa.



Conclusions :

- **St. Barts ants origins close from Guadeloupe, Trinidad, Tobago and Brazil.**
- **High complexity of the taxonomic status of the species *A. octospinosus*.**
- **Reinforces the idea of a polyphyly of species, already suggested by SUMNER et al. (2004).**

Conclusions:
Taxonomy and DNA Barcoding

Morpho-espèce	Identification morphologique	Barcode le plus proche	% identité
SSB1	*Camponotus sexgutattus*	*Camponotus sp. CIP01*	88,4%
SSB3	*Wasmannia auropunctata*	*Wasmannia auropunctata*	96,55%
SSB4	*Azteca delpini antillana*	*Azteca EC04*	98,42%
SSB6	*Solenopsis geminata*	*Solenopsis geminata*	97%
SSB7	*Solenopsis invicta*	*Solenopsis invicta*	100%
SSB8	*Solenopsis globularia*	*Solenopsis globularia*	95,65%
SSB9	*Paratrechina longicornis*	*Paratrechina longicornis*	100%
SSB10	*Odontomachus haematodus*	*Odontomachus ruginodis*	99,66%
SSB11	*Odontomachus ruginodis*	*Odontomachus ruginodis*	99,48%
SSB12	*Ectatomma ruidum*	*Ectatomma ruidum*	99,84%
SSB13	*Monomorium carbonarium*	*Monomorium*	99,68%
SSB14	*Monomorium floricola*	*Monomorium floricola*	100%
SSB17	*Cardiocondyla emeryi*	*Cardiocondyla emeryi*	100%
SSB20	*Tetramorium simillimum*	*Tetramorium simillimum*	100%

- ***Confirmation of morphological identification in 6 cases (99, 84-100% match) + 3 cases (cryptic species?)***
- ***Identification to question in 1 case***
- ***missing data on species in 3 cases***