



COREMI COST action Training School « Molecular and Morphological Identification of Mites Associated with the Red Poultry Mite »

▣ Overall objectives

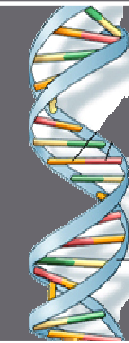
- Understanding the utility of morpho-molecular identification of mites
- Getting trained in mite morphological identification (theoretical and practical knowledge)
- Getting able to estimate what molecular analyses can bring to the study of mite species and communities

Framework of TS

WG3: Genetic structure in a changing world

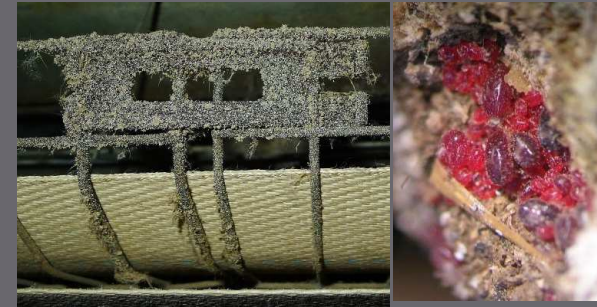
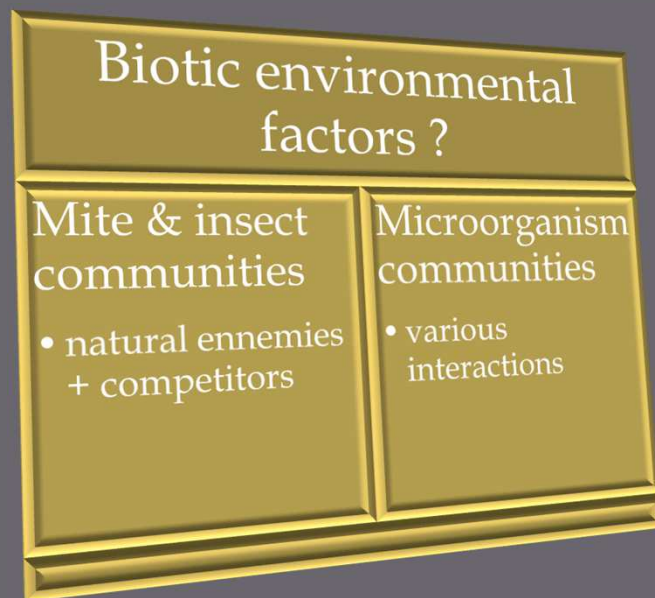
Leader: Lise Roy

- ▣ A methodological WG for an integrative approach
 - DNA markers
 - ☞ Molecular epidemiology of PRM (spread routes...), composition of associated communities (natural enemies, pathogenic microorganisms, ...)
 - ☞ Study of mechanisms underlying physiological features (immunological interactions with hen, resistances against acaricides...)
- ▣ Cross-disciplinary interests
 - direct links with all three other WGs



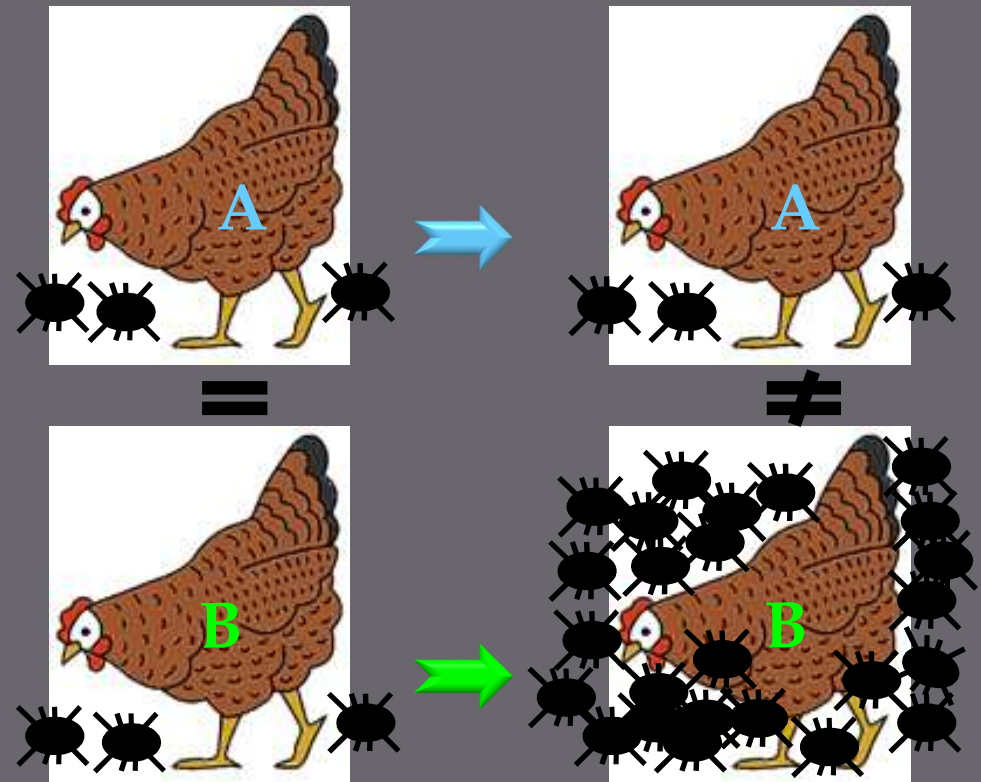
An ecosystem-level integrative approach

Why is PRM breaking up in some farms, whilst it keeps +/- stable in others?



Starting flock

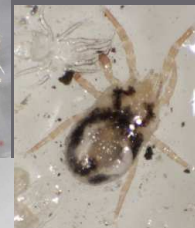
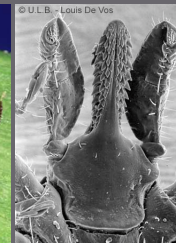
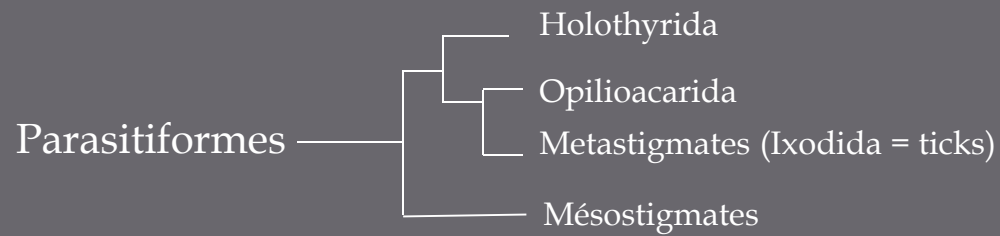
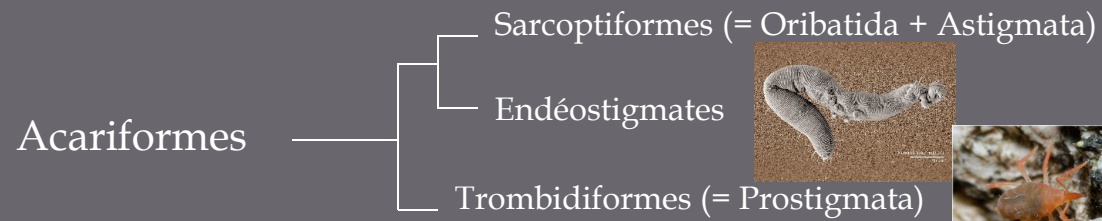
Mid-flock



L. Roy, first conference of COREMI in Foggia, Italy, May 28th, 2015

« *Acari* »

An impressive diversity

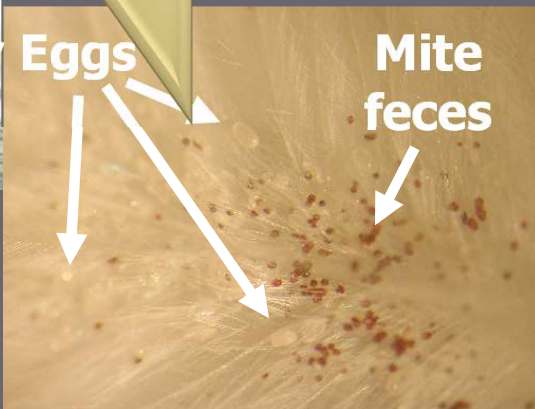


'Goodbye Acari' (Dabert et al. 2010)

Red mites: 2 different mite families, 2 different ecologies

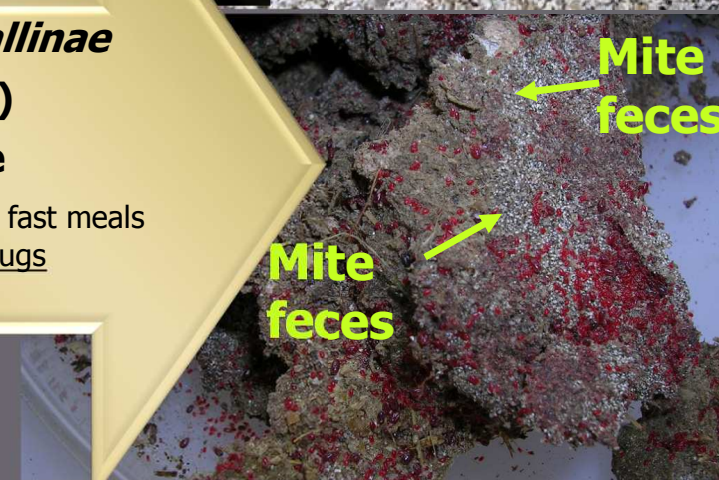
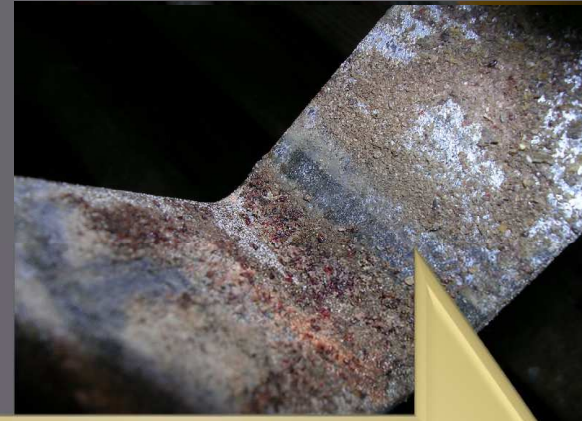
Ornithonyssus sylviarum (Macronyssidae) Northern Fowl Mite

- Eggs laid and molt performed on host
- as headlice



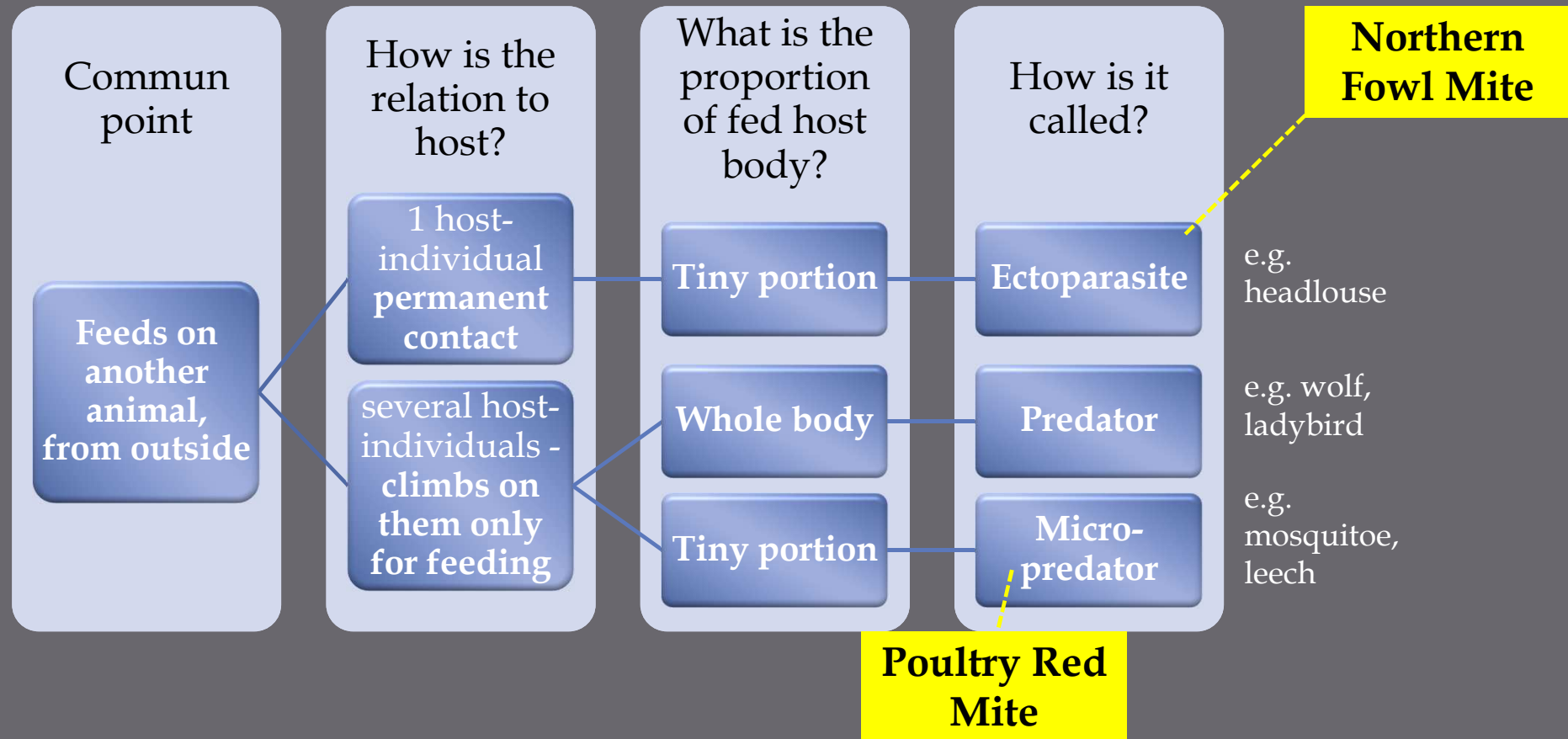
Dermanyssus gallinae (Dermanyssidae) Poultry Red Mite

- climbs on host only for fast meals
- as mosquitoes or bedbugs



Poultry Red Mite lays eggs and molts in the environment
(nest in wild avifauna, litter, dried droppings, cracks
crevices in farms)

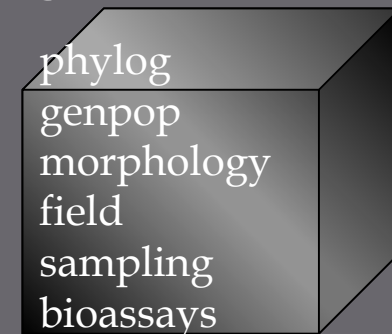
The Poultry Red Mite (*Dermanyssus gallinae*) = a micropredator



⇒ A pest mite typically dwelling in the same microhabitats as predatory mites ...

An example of morpho-molecular investigation on genus *Dermanyssus*

- ▣ Previous works highlighted important shortcomings in *Dermanyssus* species diagnostics due to highly variable morphological characters
 - ⇒ A feature common to many parasitic mites
 - ⇒ Use of molecular tools to contribute clarifying the issue: my PhD
- ▣ My PhD work as a case in point to illustrate general methods
 - 1) Main striking results – with info on methods :
 - 2) Then, basic knowledge with punctual references to my work



An example of morpho-molecular investigation Inventory of *Dermanyssus* mites and species delineation

phylog
morphology
field sampling

▣ Wild vs domestic birds:

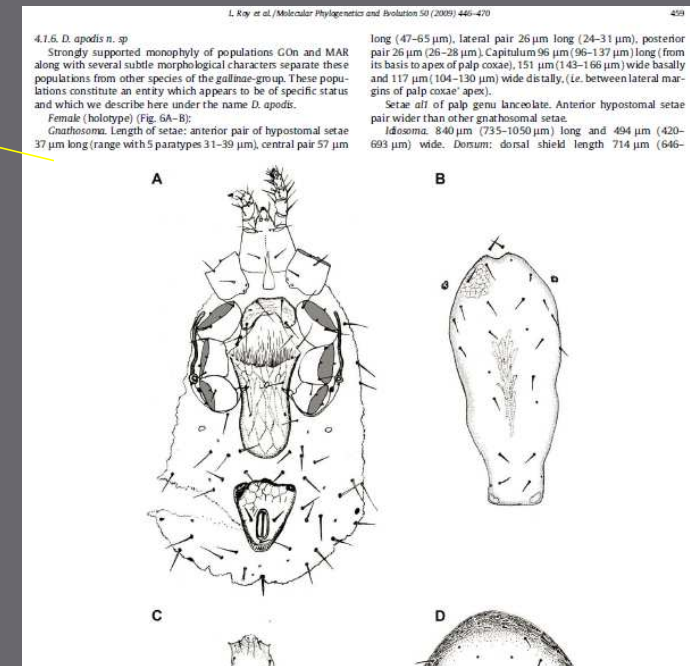
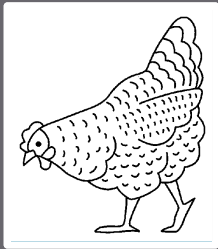
- ▣ Different species of *Dermanyssus* found in wild birds
 - ▣ 5 species recorded in wild birds in France (9 different bird orders sampled):

- ▣ *D. gallinae*, *D. carpathicus*, *D. apodis*,
D. hirundinis, *D. longipes*

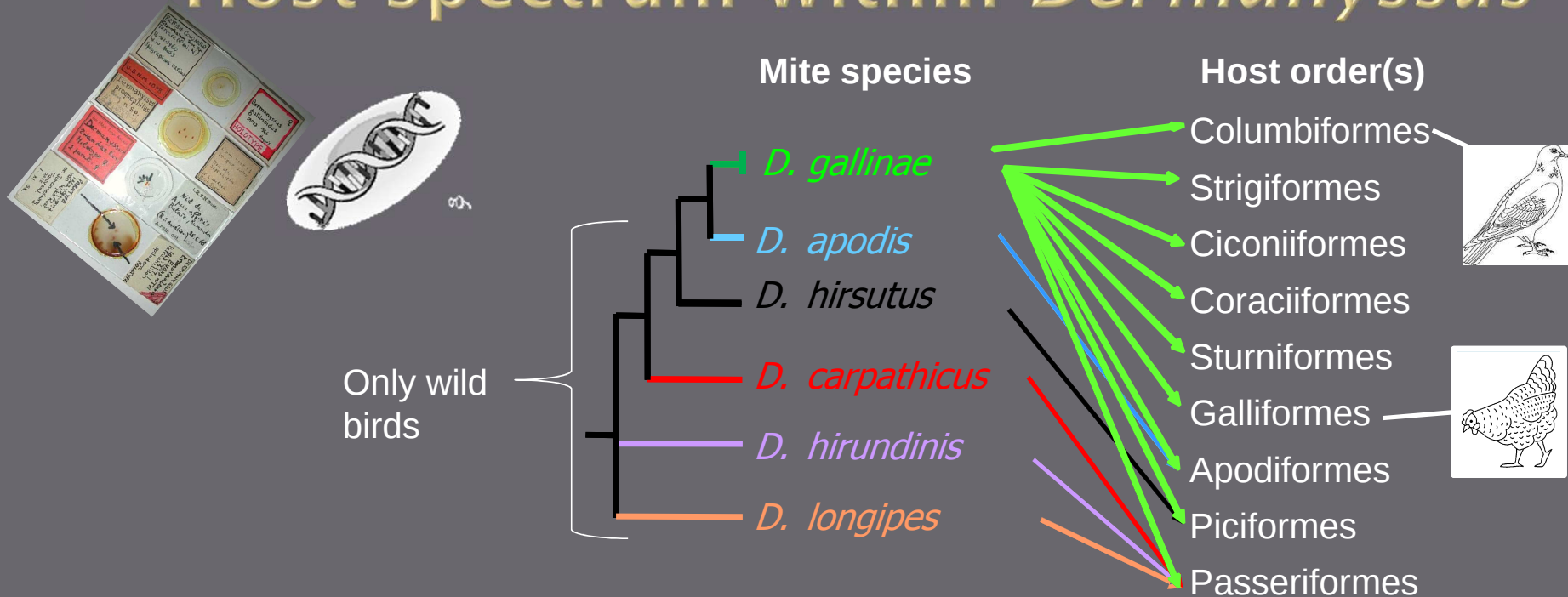
- ▣ A single species in poultry farms:

- ▣ *D. gallinae*

D. gallinae = the only generalist species
and the only species found in farm contexts



An example of morpho-molecular investigation Host spectrum within *Dermanyssus*



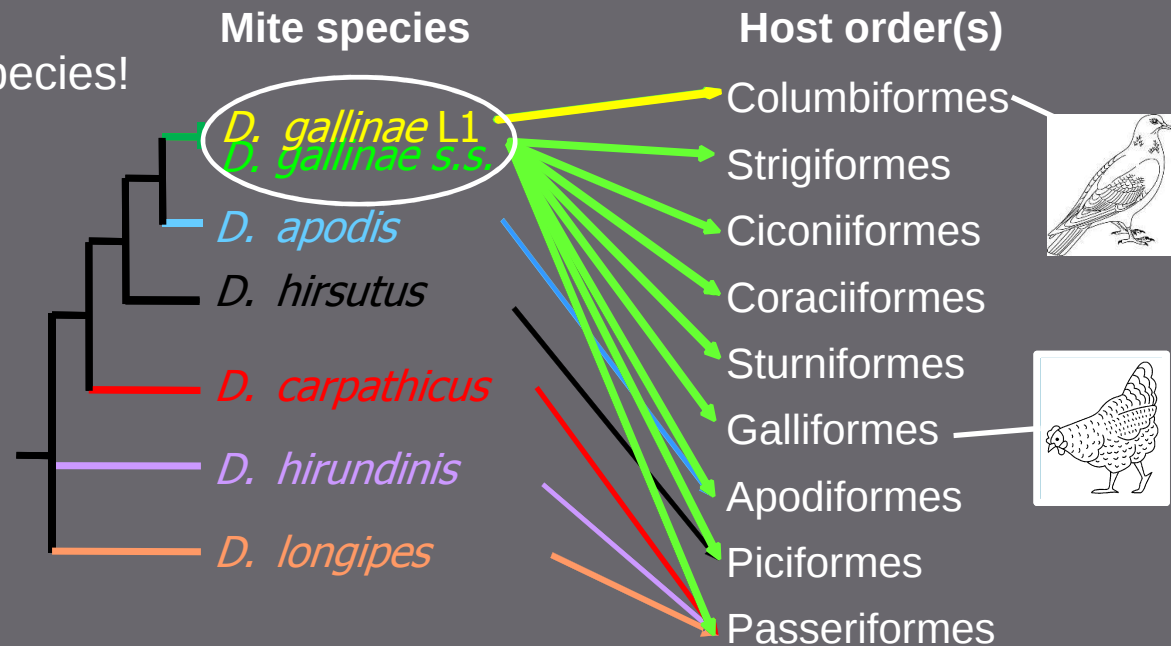
Whilst most of *Dermanyssus* species were recurrently recorded from a large diversity of birds, only *D. gallinae* was confirmed with a large host spectrum

Other species: either specific to a bird genus or to 1-2 bird families

phylog
morphology
field sampling
bioassays

An example of morpho-molecular investigation Host spectrum within *Dermanyssus*

Dg is not a single species!



Evidence for complete reproductive isolation between pigeon « *Dg* » mites (L1) and other « *Dg* » mites (cryptic species)

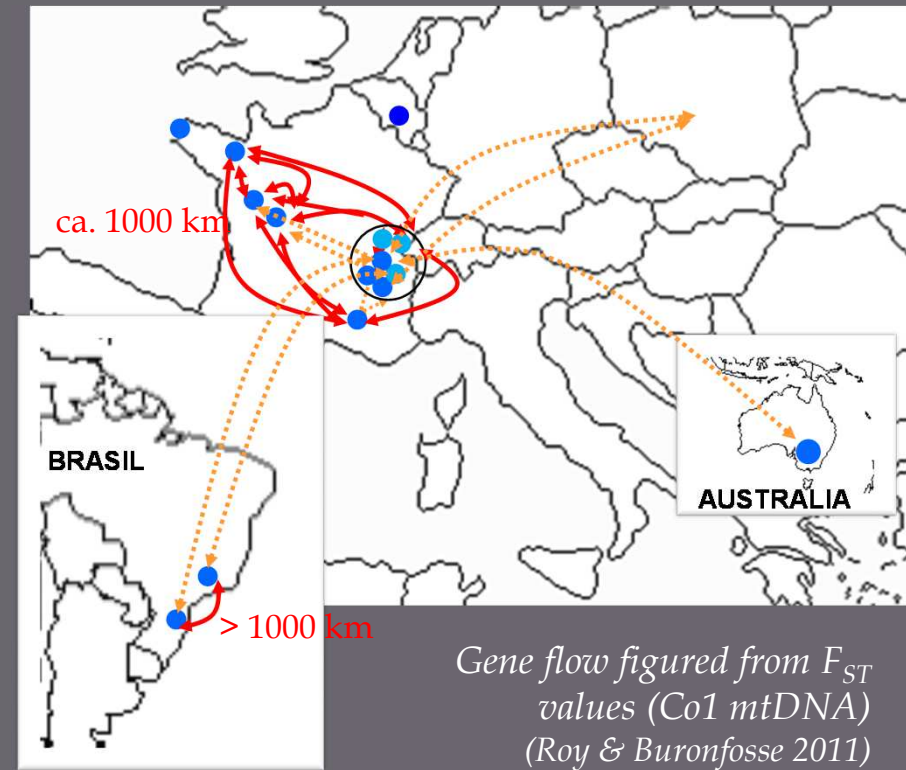
One is commonly found in poultry farms, one in pigeon nests/farms

phylog
genpop
field sampling

An example of morpho-molecular investigation

Spread routes consistent with trade routes

- ▣ High gene flow within European countries and Brazil
 - Same populations 1000 km apart within countries
 - Patterns consistent with known trade routes
- ▣ Populations from several different European countries (and Japan) related to each another
 - excluding Norway (consistent with drastic isolation from an economic perspective)



genpop
field sampling

An example of morpho-molecular investigation

Spread routes: ways and vectors



International
scale

PRM disseminates
from farm to farm

- = crucial role
of long
distance traffic

Farm scale

Main
vectors

- = cages, other inert
objects

Building scale

Transient
vectors

- = hens over short distances
(a few meters)

An example of morpho-molecular investigation

Spread routes: ways and vectors

In France, mite transfer between farms at least during spent hen removal

At international scale, gene flow identified, but specific modes of mite transfer to be further explored



No transfer between wild bird and domestic fowl



Persistence of PRM after empty period

An example of morpho-molecular investigation

Genetic structure of *D. gallinae* s. l.

- ▣ *D. gallinae* s. str. most likely results from recurrent hybridisation events between incipient species

