



**UNIVERSITAS MUHAMMADIYAH SURAKARTA
FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN
PROGRAM STUDI PENDIDIKAN BIOLOGI**

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The ecology of *Zaprionus* genus in Brazil and adaptation process during the bioinvasions.

Prof. PhD. Luis Gustavo da Conceição Galego
Education and Natural and Exact Sciences Institute (ICENE)
Federal University of Triângulo Mineiro (UFTM)





About me:

Majored in:

- Life Sciences



Pos Graduated in:

- Genetics (Master e PhD)
- Biosciences (Pos-Doctoral)



I've been studying *Zaprionus indianus* since 2000, soon after of their first record in Brazil (1999)

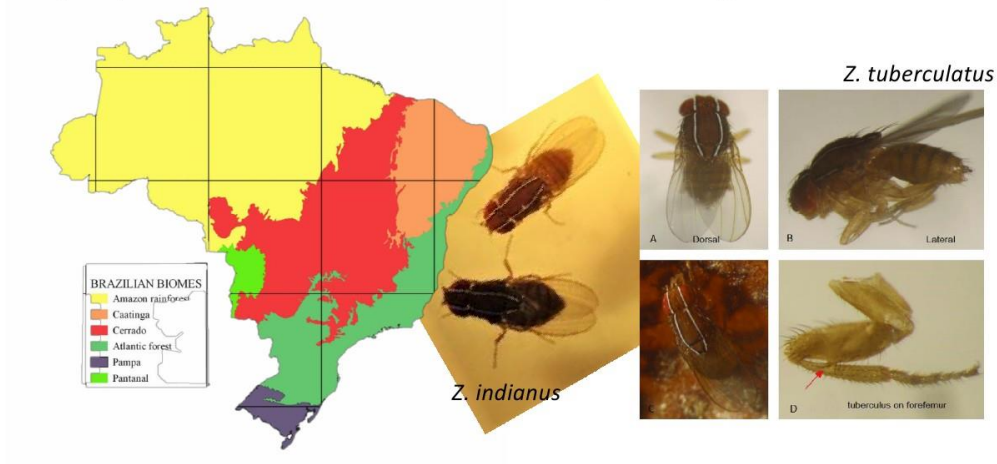


From 2023, we have started studies with *Z. tuberculatus*.



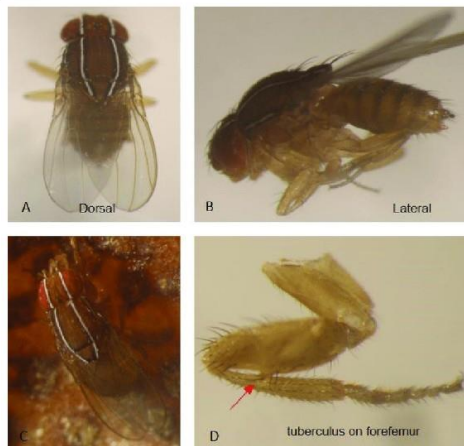
Structure of the talk:

- 1) Introduction
- 2) Bioinvasion throughout Brazil: ecological and adaptation processes
- 3) *Zaprionus tuberculatus* in Neotropical region



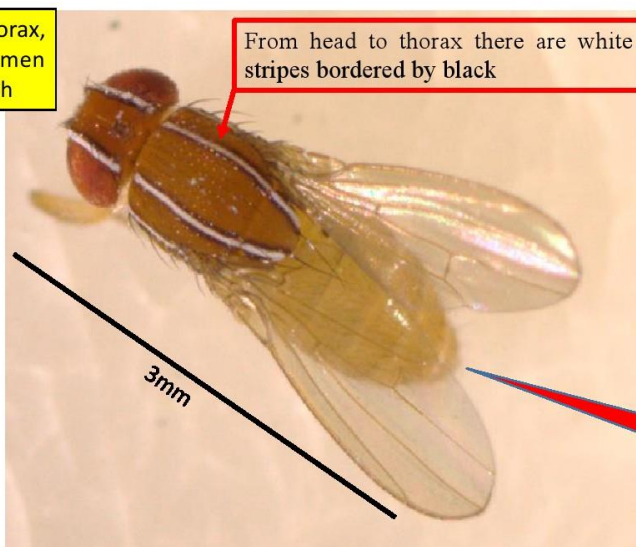
Structure of the talk:

•1) Introduction



Introduction – Morphology and Taxonomy

Head, thorax, and abdomen is yellowish



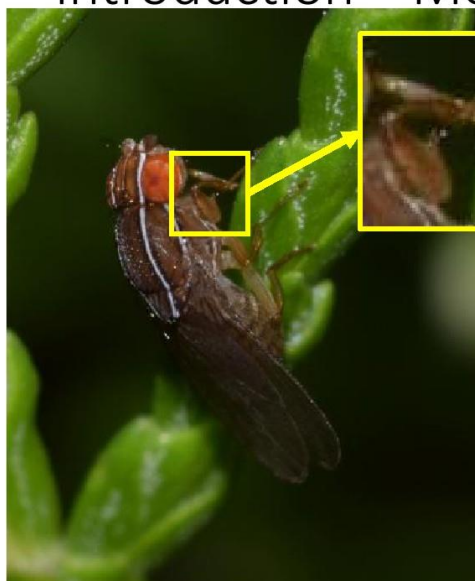
From head to thorax there are white stripes bordered by black

- Animalia
- Arthropoda
- Insecta
- Diptera
- Schizophora
- Drosophilidae
- Zaprionus*
- Zaprionus indianus*

Did you know this fly species before today?

Gupta, 1970

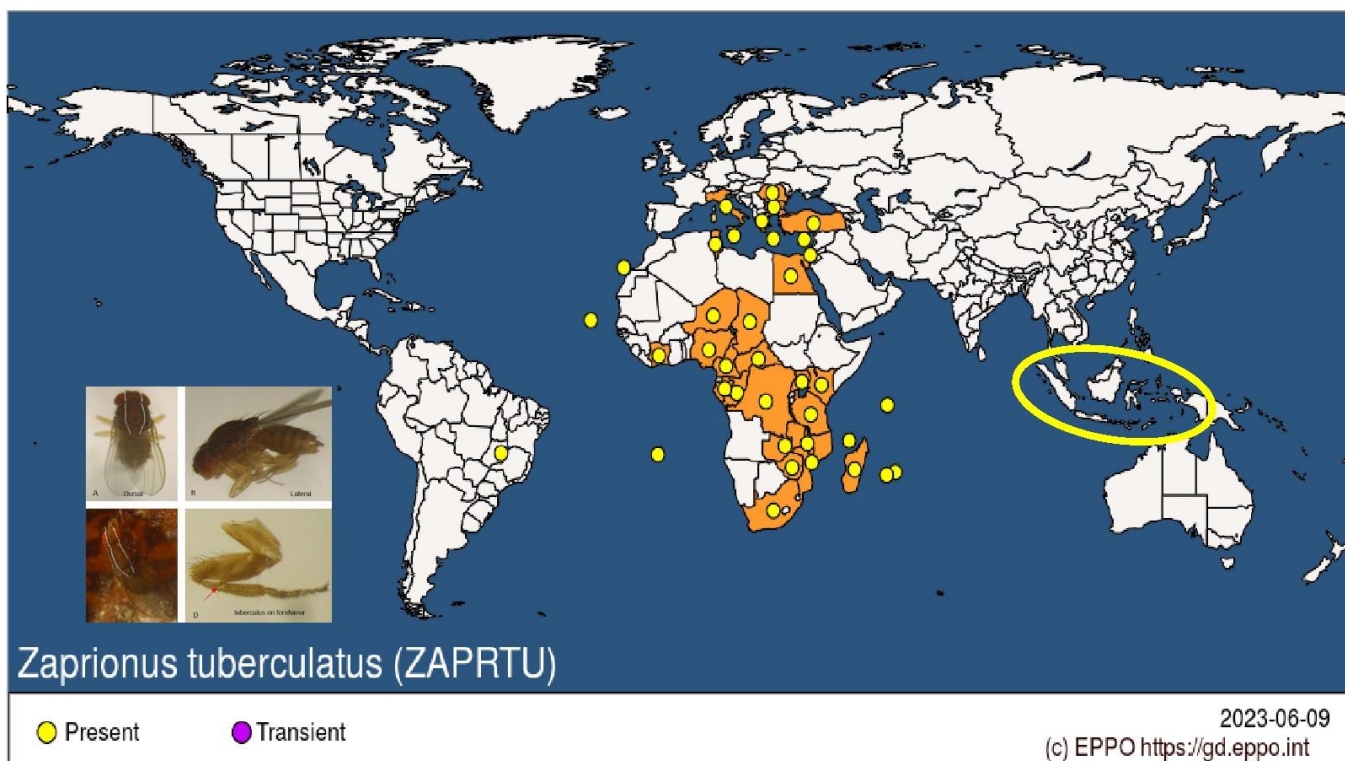
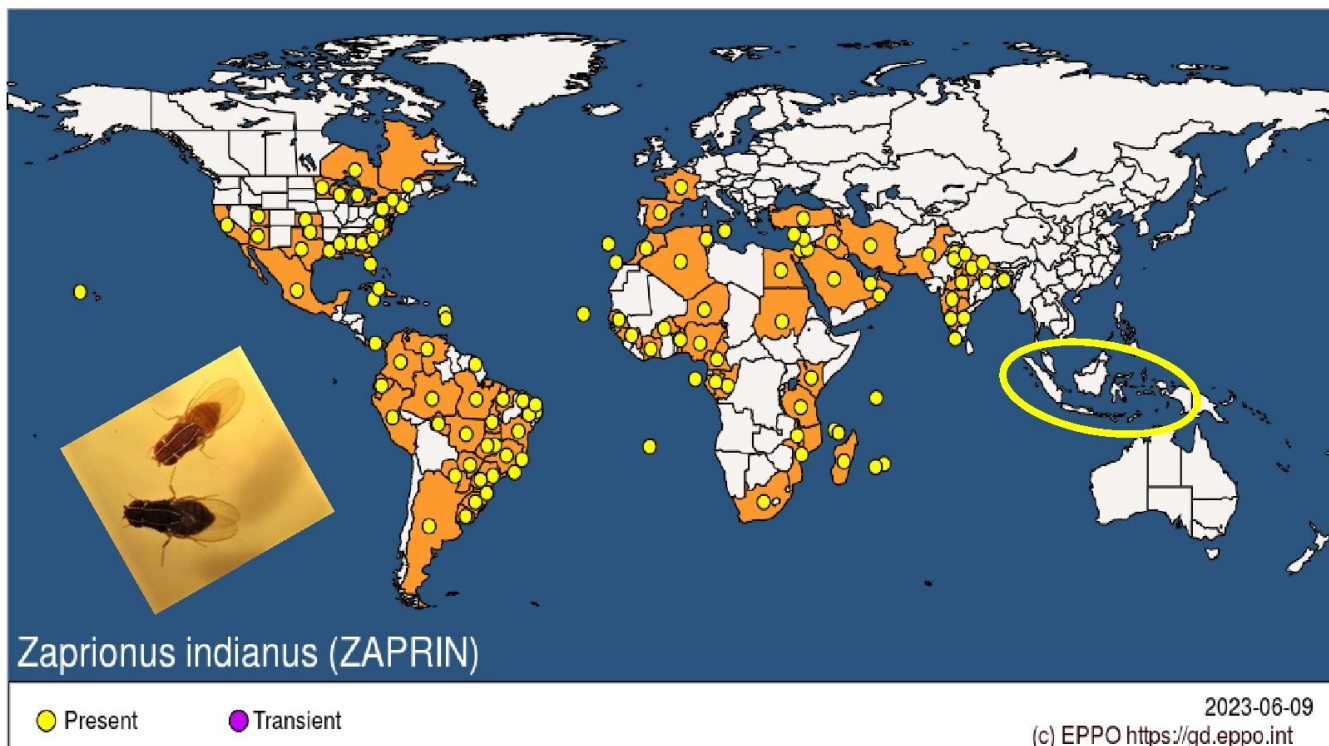
Introduction – Morphology and Taxonomy



Profemur with a prominent tubercule on the medioventral margin

- Animalia
- Arthropoda
- Insecta
- Diptera
- Schizophora
- Drosophilidae
- Zaprionus*
- Zaprionus tuberculatus*


Gupta, 1970



Structure of the talk:

•2) Bioinvasion throughout Brazil: ecological and adaptation process



 *Genetics and Molecular Biology*, 35, 2, 395-406 (2012)
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Review Article

Taxonomic and evolutionary analysis of *Zaprionus indianus* and its colonization of Palearctic and Neotropical regions

Leliane Silva Commar¹, Luís Gustavo da Conceição Galego², Carlos Roberto Ceron³ and Claudia Marcia Aparecida Carareto¹



Vilela (1999) and Commar *et al.* (2012)

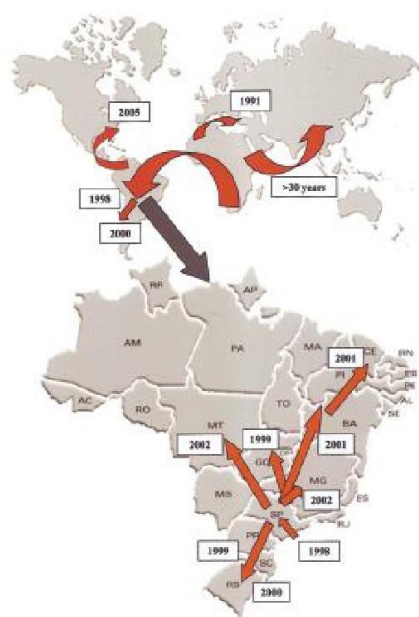
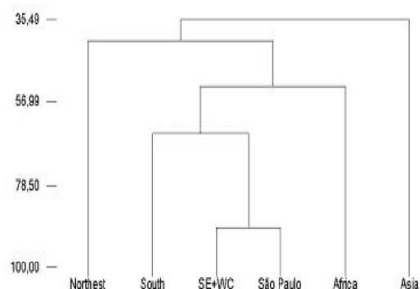


Figure 1 - Migration routes for *Z. indianus* involved in its dispersal throughout the world, based on studies cited in the text. The process that occurred in Brazil is highlighted.




Analysis of the drosophilid *Zaprionus indianus* introduction in Brazil: contribution of esterase loci polymorphisms.

Galego, Luís Gustavo C., and Claudia Márcia A. Carareto. UNESP – São Paulo State University, Rua Cristóvão Colombo, São José do Rio Preto - São Paulo – Brasil; e-mail: carareto@ibilce.unesp.br.



-After the arrival, *Z. indianus* has spread over the State of São Paulo by highway transportation and from there to the whole country, mainly as a result of fruit commerce.

-After its introduction, *Z. indianus* rapidly spread over the southeastern, southern, and mid-western regions, only reaching the northern and north-eastern regions later on.

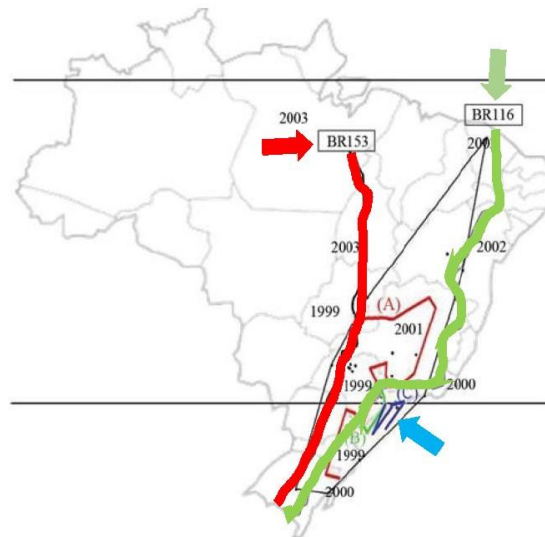
 *Genetics and Molecular Biology*, 33, 4, 767-773 (2010)
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Research Article

Scenario of the spread of the invasive species *Zaprionus indianus* Gupta, 1970 (Diptera, Drosophilidae) in Brazil

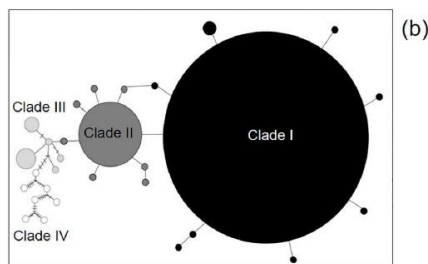
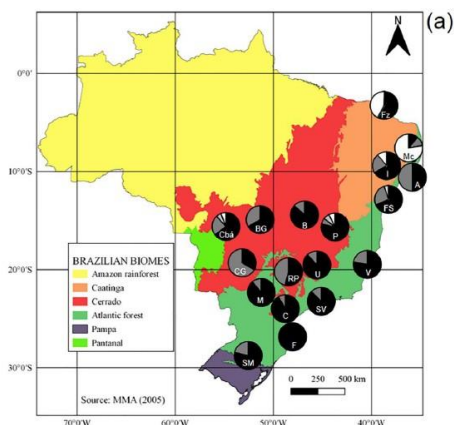
Luís Gustavo da Conceição Galego and Claudia Marcia Aparecida Carareto

Z. indianus, after first arriving in São Paulo state, spread throughout the country, probably together with the transportation of commercial fruits by way of the two main Brazilian freeways, **BR 153**, to the south and the surrounding countryside, and the **BR 116** along the coast and throughout the north-east.



Networking haplotype (Est6-like)

-There are 4 clades to *Z. indianus* Est-6 like DNA sequences;
 -The clades 1 and 2 are widely distributed;
 -Clades 3 and 4 are more restricted, and they were detected only in populations from **Pantanal** and **Caatinga** (two Biomes from Brazil)



Galego and Carareto, in preparation

Population size



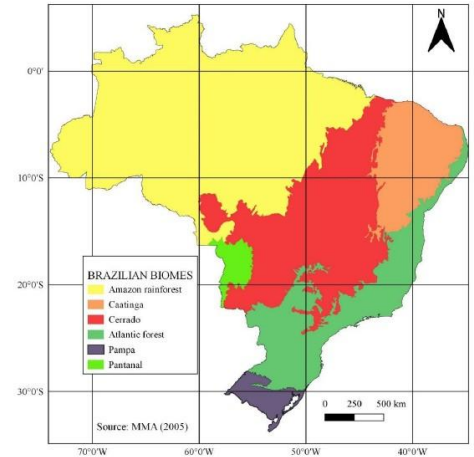
Z. indianus showed the highest frequencies compared to other drosophilids during the seasons with the highest mean temperatures, but the frequency consistently dropped during autumn and winter to increase again in the spring.

Santos et al., 2005

Demography on Brazilian Biomes

Variation in the abundance of *Z. indianus* among Brazilian biomes:

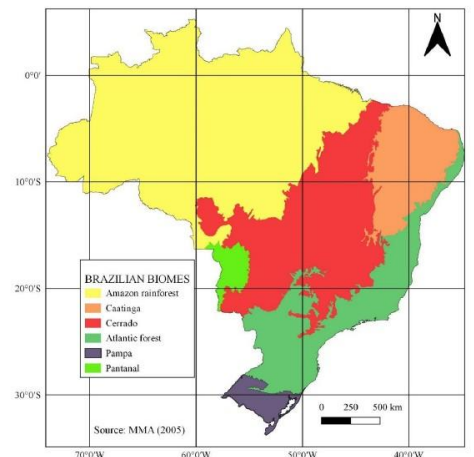
- The abundance of *Z. indianus* in the **cerrado** and **riverine forests** is greater in the **cerrado** during rainy periods;
- Z. indianus* is the most abundant species in the urbanized environment;
- In mangrove forests was higher than in the **Atlantic rain forest** but lower than in the **cerrado** or in urban environments;



Tidon *et al.* (2003); Ferreira and Tidon (2005); Tidon *et al.*, (2003); Commar *et al.*, 2012.

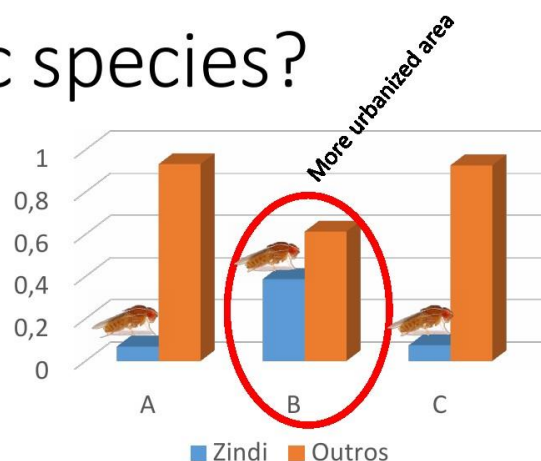
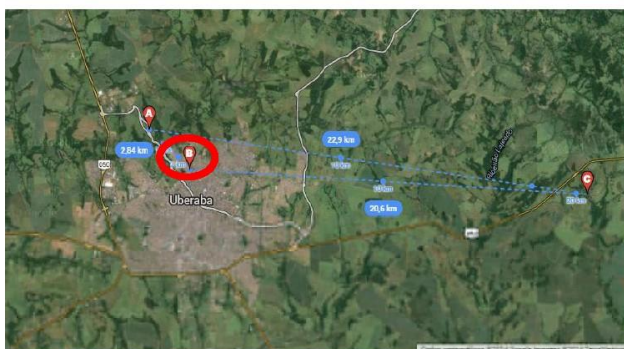
Demography on Brazilian Biomes

Cerrado > Caatinga > Pampa > Pantanal > Atlantic rain forest



Tidon *et al.* (2003); Ferreira and Tidon (2005); Tidon *et al.*, (2003); Commar *et al.*, 2012.

Is it a synurbic species?

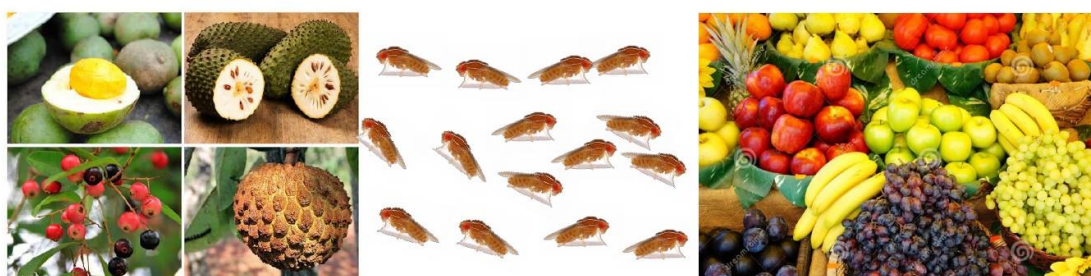


Several studies indicate that together with other introduced Drosophilidae, *Z. indianus* could be useful as an indicator of disturbed areas.

Ferreira and Tidon (2005); Rodrigues and Galego, in preparation.

Niche occupation

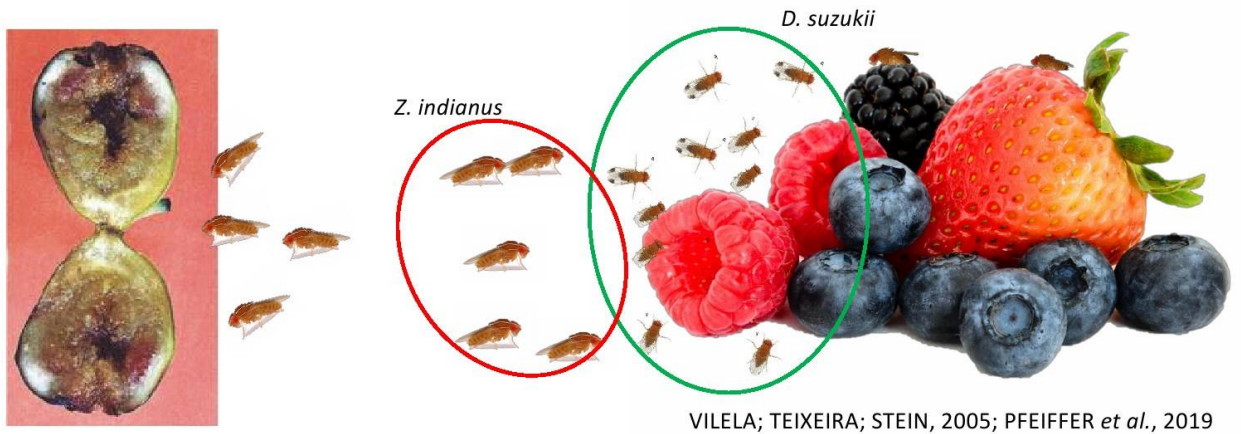
- It is a polyphagous species and it was detected in more than 80 different species of plants



LACHAISE; TSACAS, 1983; GOTTSCHALK, 2008

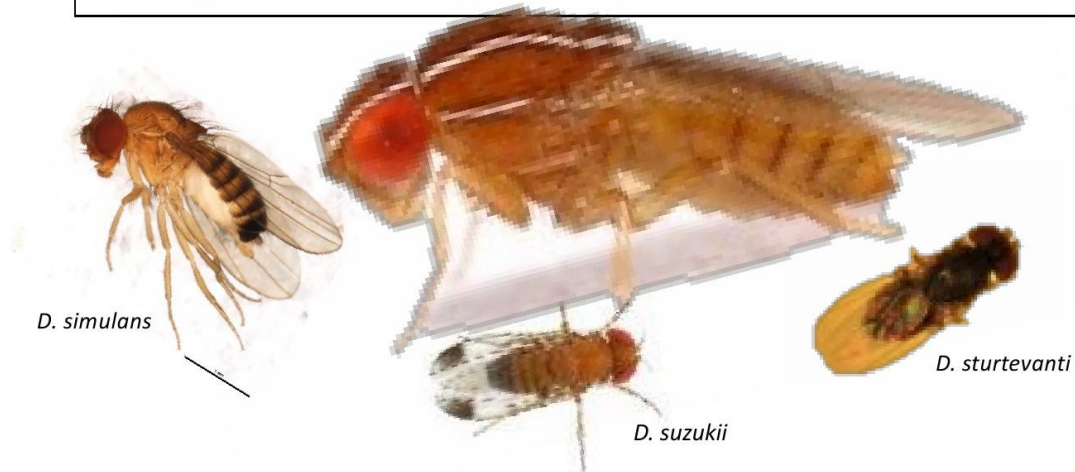
Niche occupation

Z. indianus is considered a potential secondary pest in soft fruits and it damaged fig culture in Brazil during their introduction.



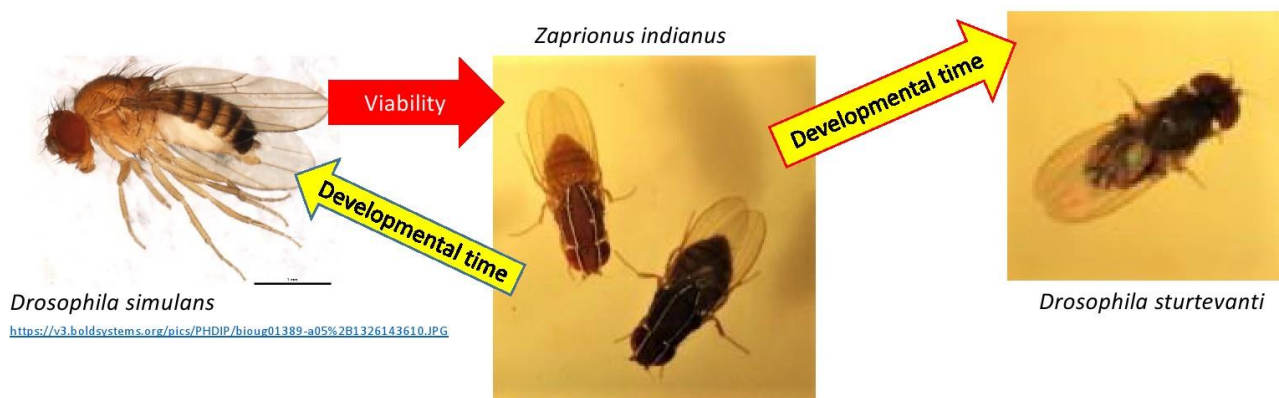
Niche occupation

• *Z. indianus* showed competitive advantage against other species of *Drosophila* with which shares niches.



INTRASPECIFIC AND INTERSPECIFIC PRE-ADULT COMPETITION ON THE NEOTROPICAL REGION COLONIZER ZAPRIONUS INDIANUS (DIPTERA: DROSOPHILIDAE) UNDER LABORATORY CONDITIONS ⁽¹⁾

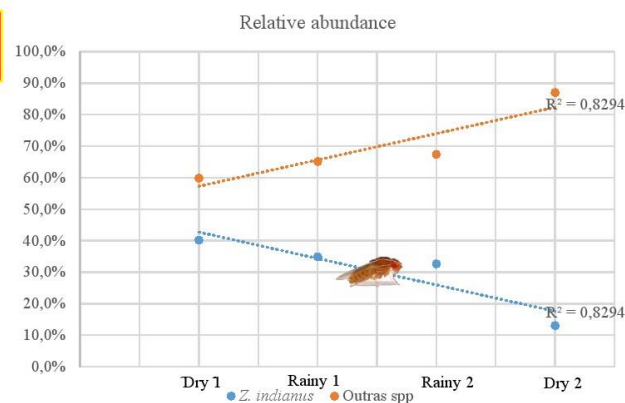
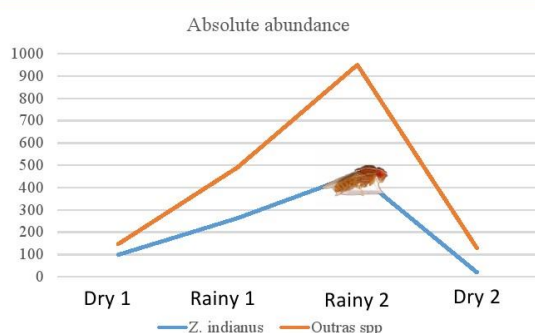
LUÍS GUSTAVO DA CONCEIÇÃO GALEGO ⁽²⁾; CLAUDIA MARCIA APARECIDA CARARETO ⁽²⁾



Niche occupation

Seasonal variation in **demography**, morphometry, and genetics in Cerrado population due to pressures caused by rain distribution and competition during the year.

Greater intraspecific competition in dry seasons and interspecific in rainy ones.



POSSARI; GALEGO, in preparation.

Niche occupation

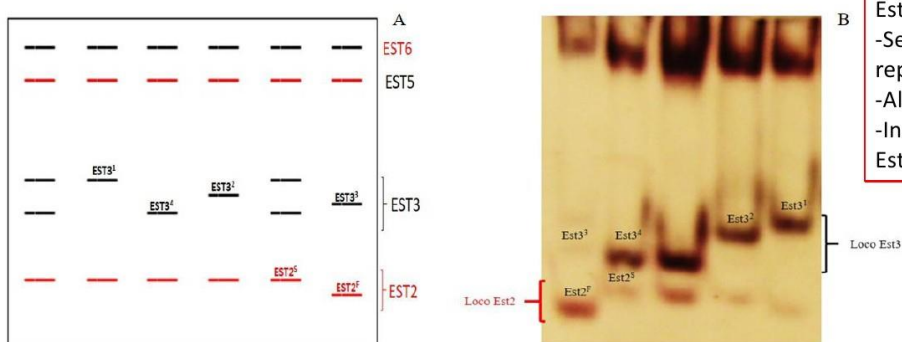
Seasonal variation in demography, **morphometry**, and genetics in Cerrado population due to pressures caused by rain distribution and competition during the year.



POSSARI; GALEGO, in preparation

Niche occupation

Seasonal variation in demography, morphometry, and **genetics** in Cerrado population due to pressures caused by rain distribution and competition during the year.

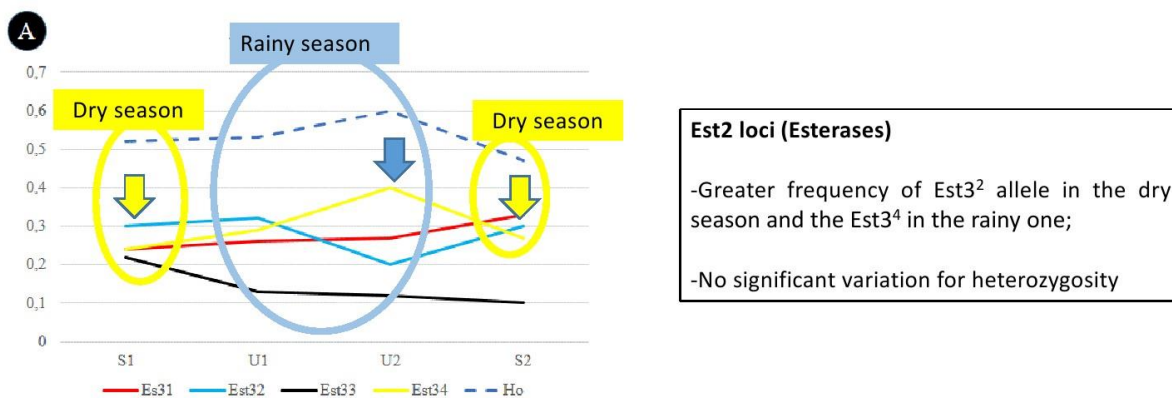


Esterases (enzymes):
 -Several biological functions (feed, reproduction, development)
 -Allele polymorphisms
 -In *Z. indianus* => Two loci:
 Est3 (4 alleles) and Est2 (2 alleles)

Galego, Ceron and Carareto, 2006

Niche occupation

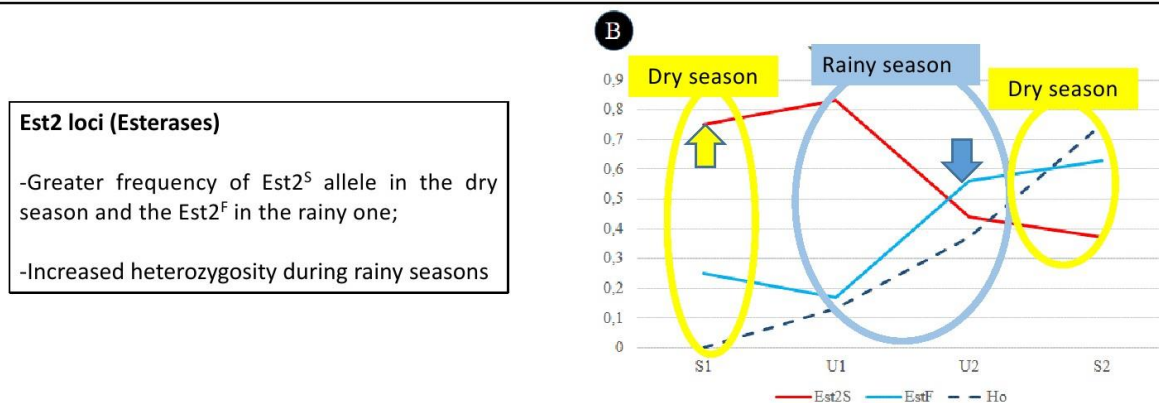
Seasonal variation in demography, morphometry, and **genetics** in Cerrado population due to pressures caused by rain distribution and competition during the year.



POSSARI; GALEGO, in preparation.

Niche occupation

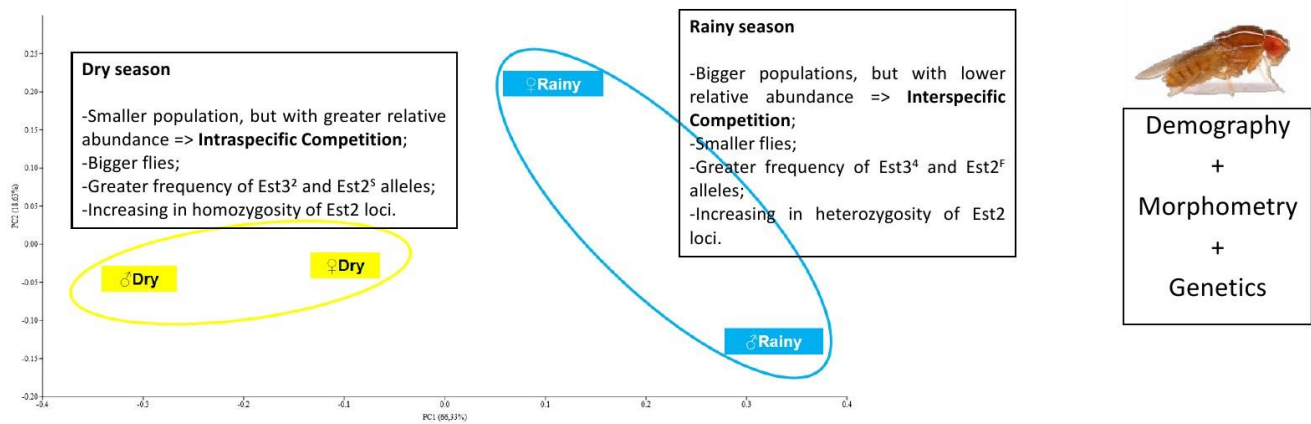
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POSSARI; GALEGO, in preparation

Niche occupation

Seasonal variation in **demography, morphometry, and genetics** in Cerrado population due to pressures caused by rain distribution and competition during the year.

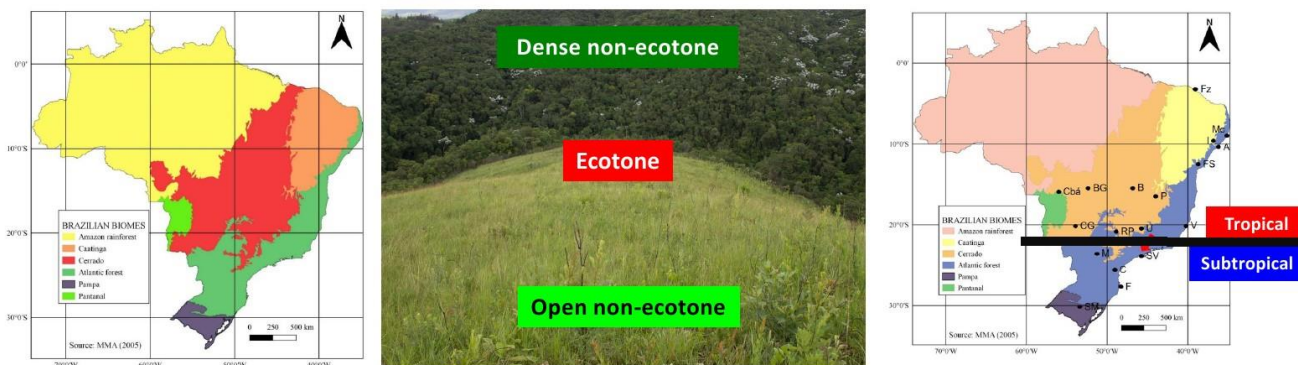


POSSARI; GALEGO, in preparation

Niche occupation



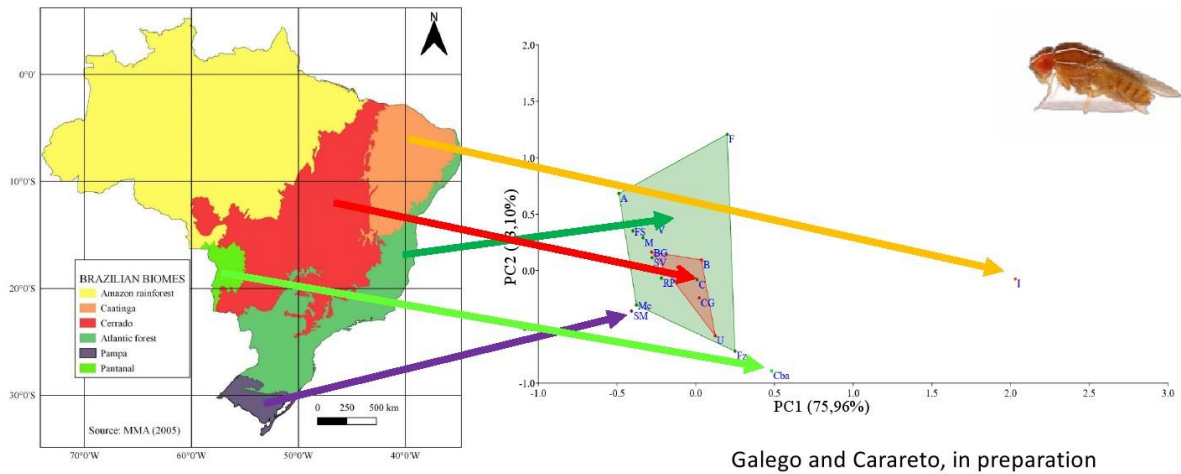
- Genetic structuring in population from biomes (Cerrado and Atlantic forest) and ecotones, or from different climatic zones (Tropical or subtropical)



Galego and Carareto, in preparation

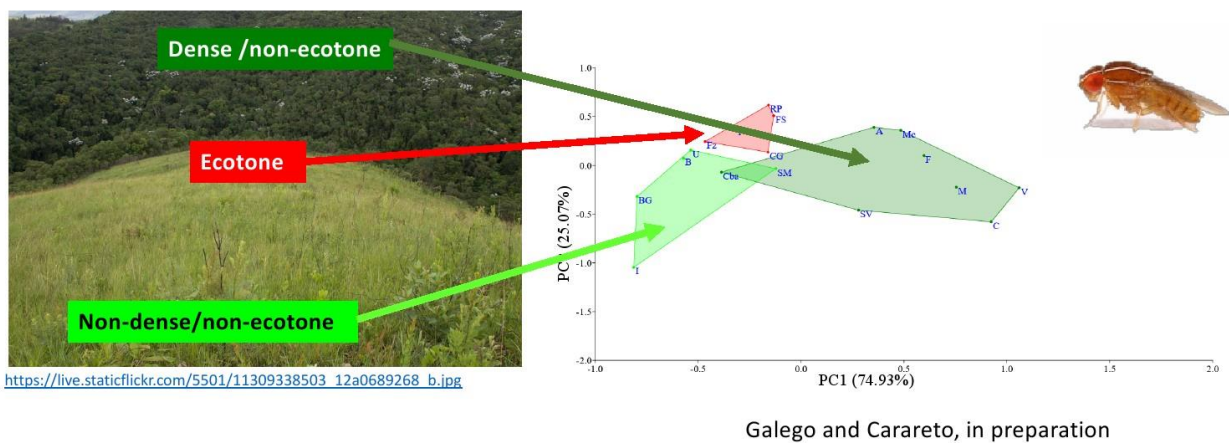
Niche occupation - Biomes

- Genetic structuring in population from biomes (Cerrado and Atlantic forest) and ecotones, or from different climatic zones (Tropical or subtropical)



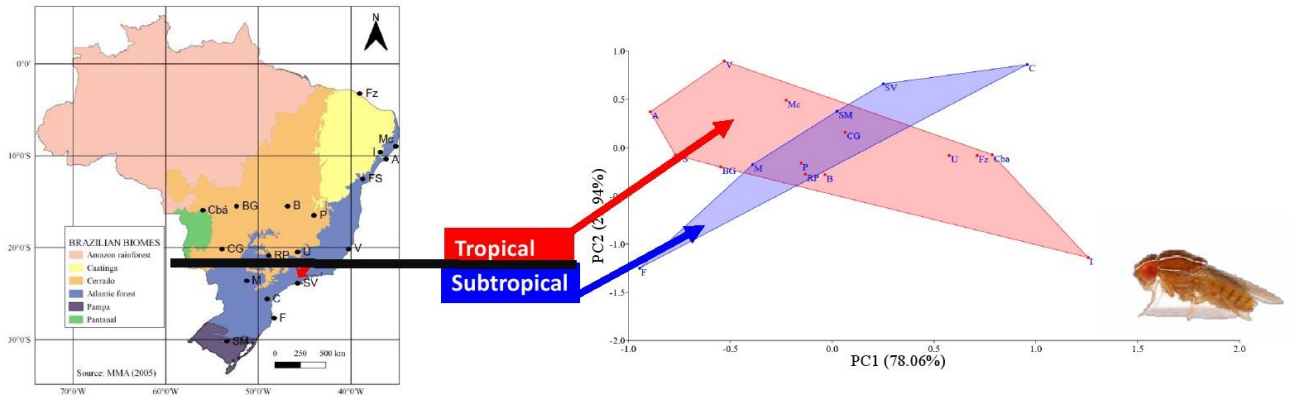
Niche occupation – Ecotones/Non Ecotones (Vegetation)

- Genetic structuring in population from biomes (Cerrado and Atlantic forest) and ecotones, or from different climatic zones (Tropical or subtropical)



Niche occupation – Climatic Zone

- Genetic structuring in population from biomes (Cerrado and Atlantic forest) and ecotones, or from different climatic zones (Tropical or subtropical)

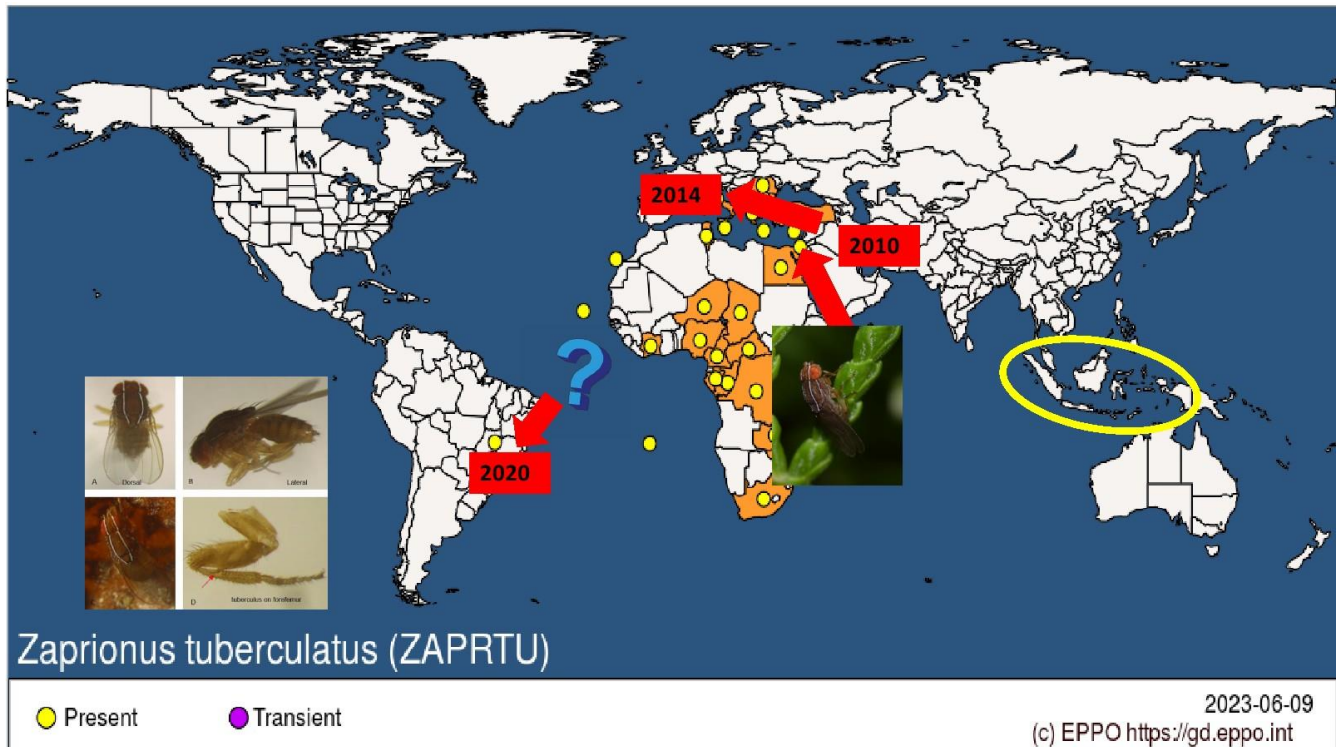


Galego and Carareto, in preparation

Structure of the talk:

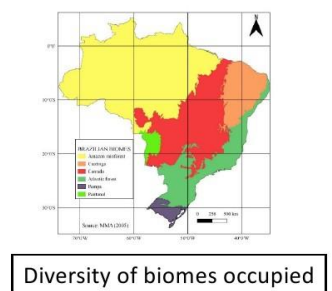
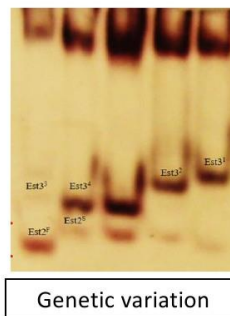
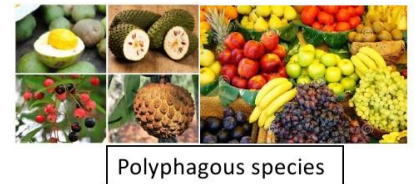
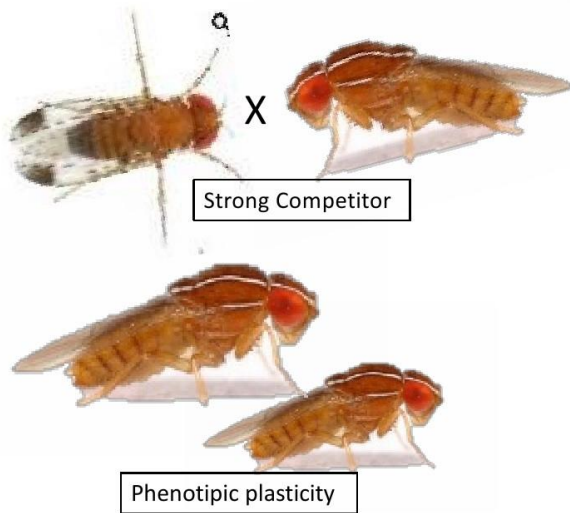
- 3) *Zaprionus tuberculatus* in Neotropical region





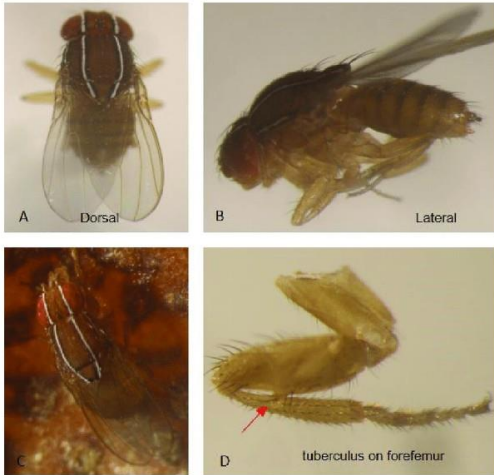
Summing Up

- *What makes Zaprionus indianus a successful colonizing species?*



Summing Up

- *What about Zaprionus tuberculatus?*



• **Terima kasih!**

• E-mail:

Luis.galego@uftm.edu.br

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