Decomposability and un-coordination between flower and leaf litter

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Decomposition

The decomposition of litter organic matter is an important energy flow in ecosystems, affecting the carbon and nutrients cycle important for plant growth.

Swift et al. 1979; Aerts et al. 2006

Decomposition

The main factors affecting the decomposition are:

Climate

Litter quality

Detritivores

Aerts et al. 1997

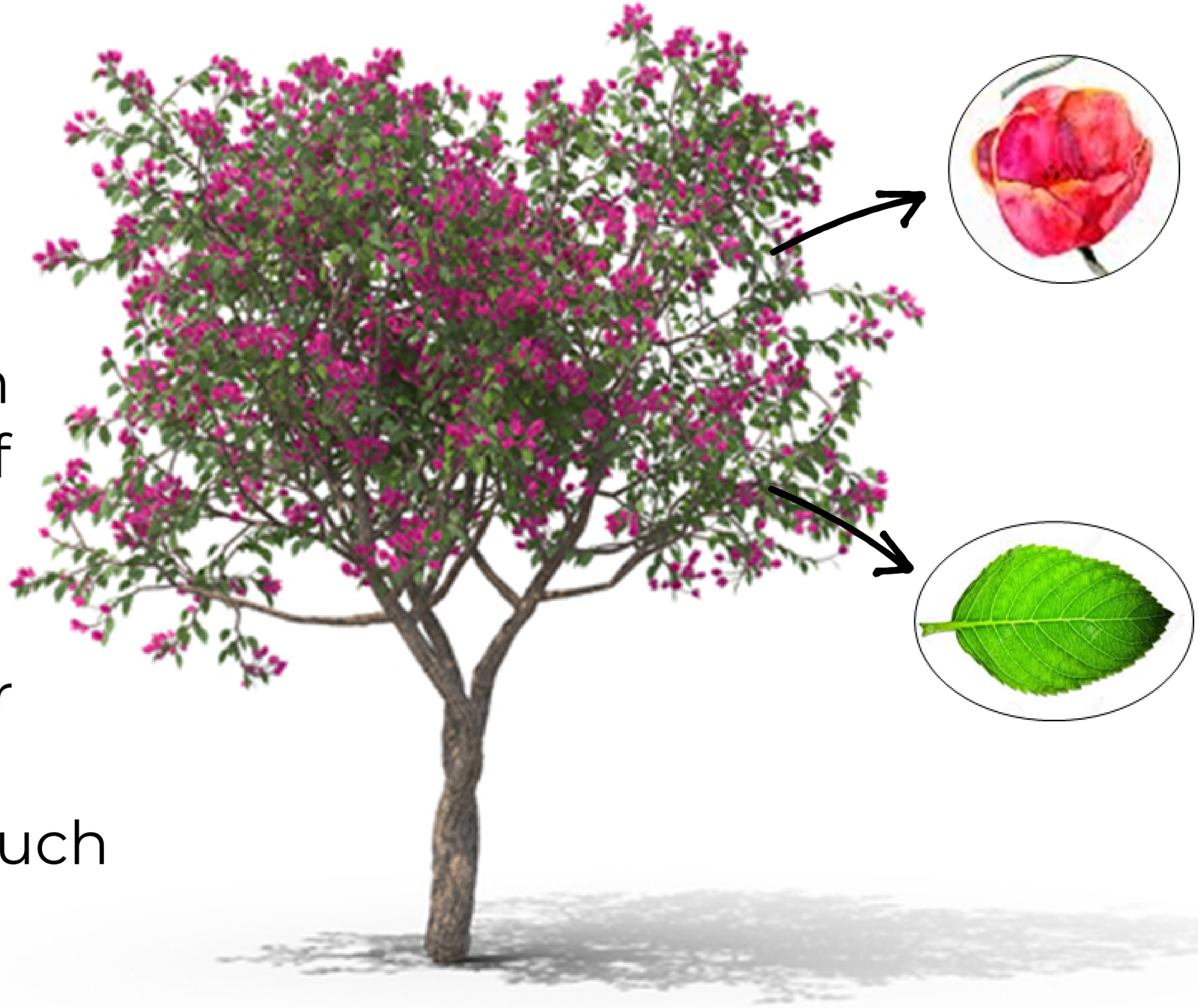
Organs and nutrient allocation are link the evolved strategies of plant species with their variations affecting the effects on ecosystems process.

Cebrian et al. 1999

Flower and leaf are metabolic activity

Responsible growth and reproduction of plants

They present higher concentrations of limiting resources such as N and P

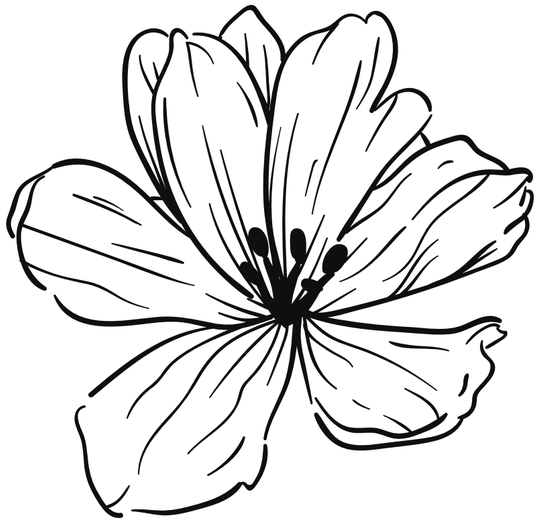


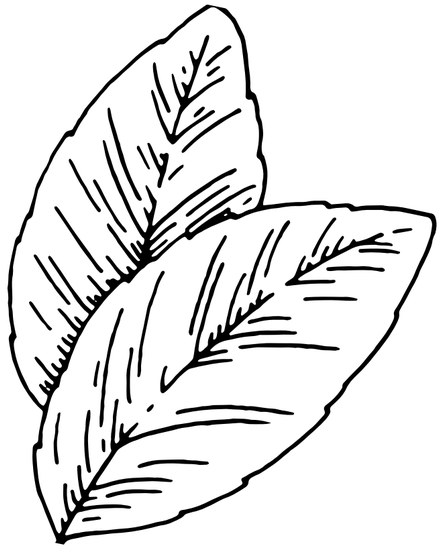
Whigham et al. 2013

Despite belong to the same metabolic category, they are functionally distinct organs.

Presenting disctint concentration in nutrients and structural compounds concentration, as lignin and carbon.

Thus, leaf traits can be bad predictors for flower litter





Whigham et al. 2013

Aim

We aim was to analyze the trait coordination in leaf and flower litter and their consequences on decomposition phylogenetically.

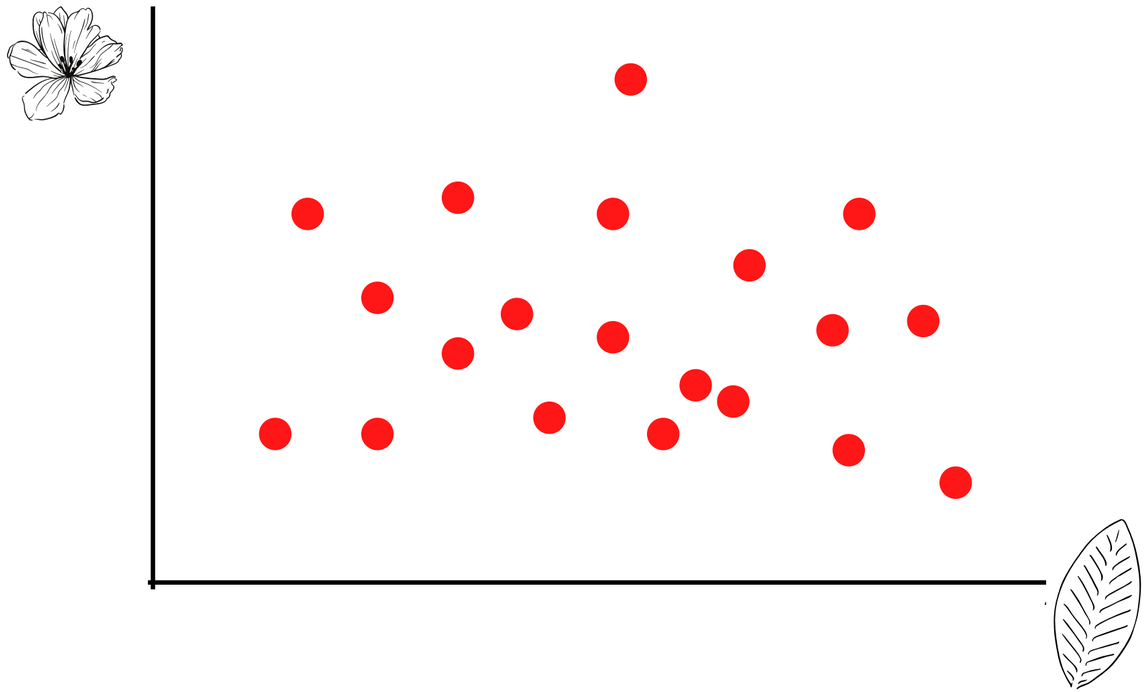

Photo: Mery Alencar

Hypothesis I

Flower litter, on average, will
presents a **higher decomposition rate compared to the leaf** litter

Hypothesis II

We will **not be traits coordination** between floral and foliar litter



Hypothesis III

The **phylogenetic history** will affect the decomposition rates through its influences on organ traits.

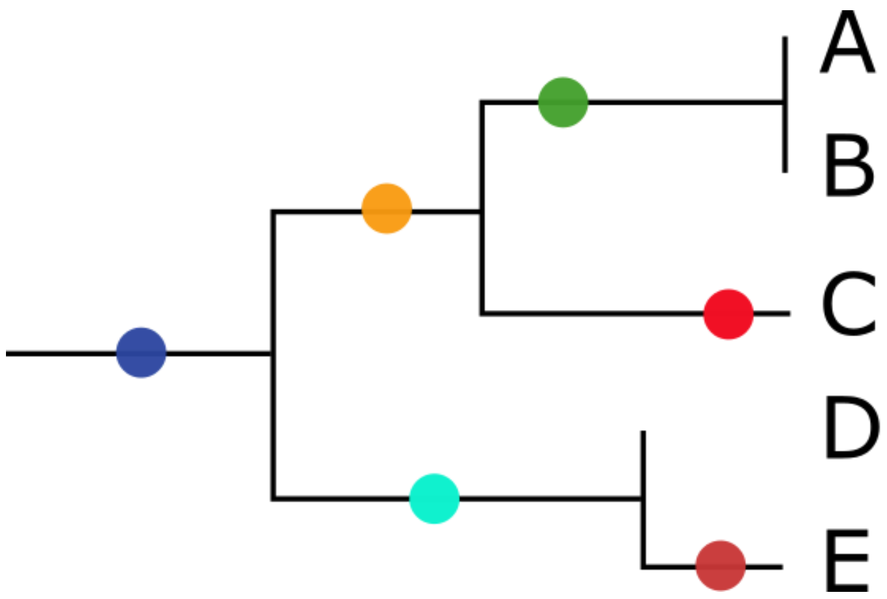


Image: Nextstrain

Methods

Image: Mery Alencar

29 species

Encompassing:

14 families

5 individuals per specie

Flower and leaf litter

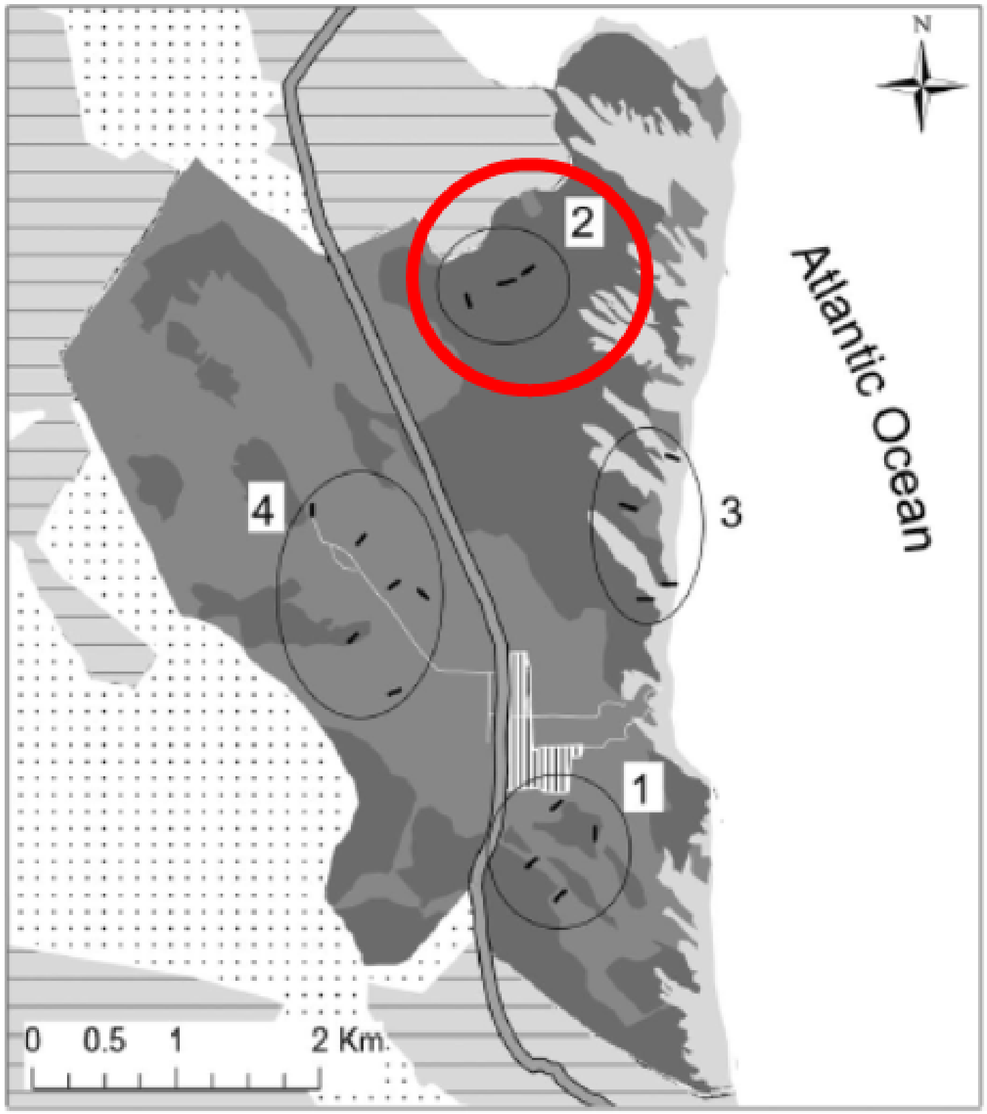
Image: Mery Alencar

Study site

Barreira do Inferno Lauch Center

Shrub-arboreal and forest Restinga (Atlantic forest)

Tropical climate with continuous periods of dry season



Silva et al. 2015

Experimental design

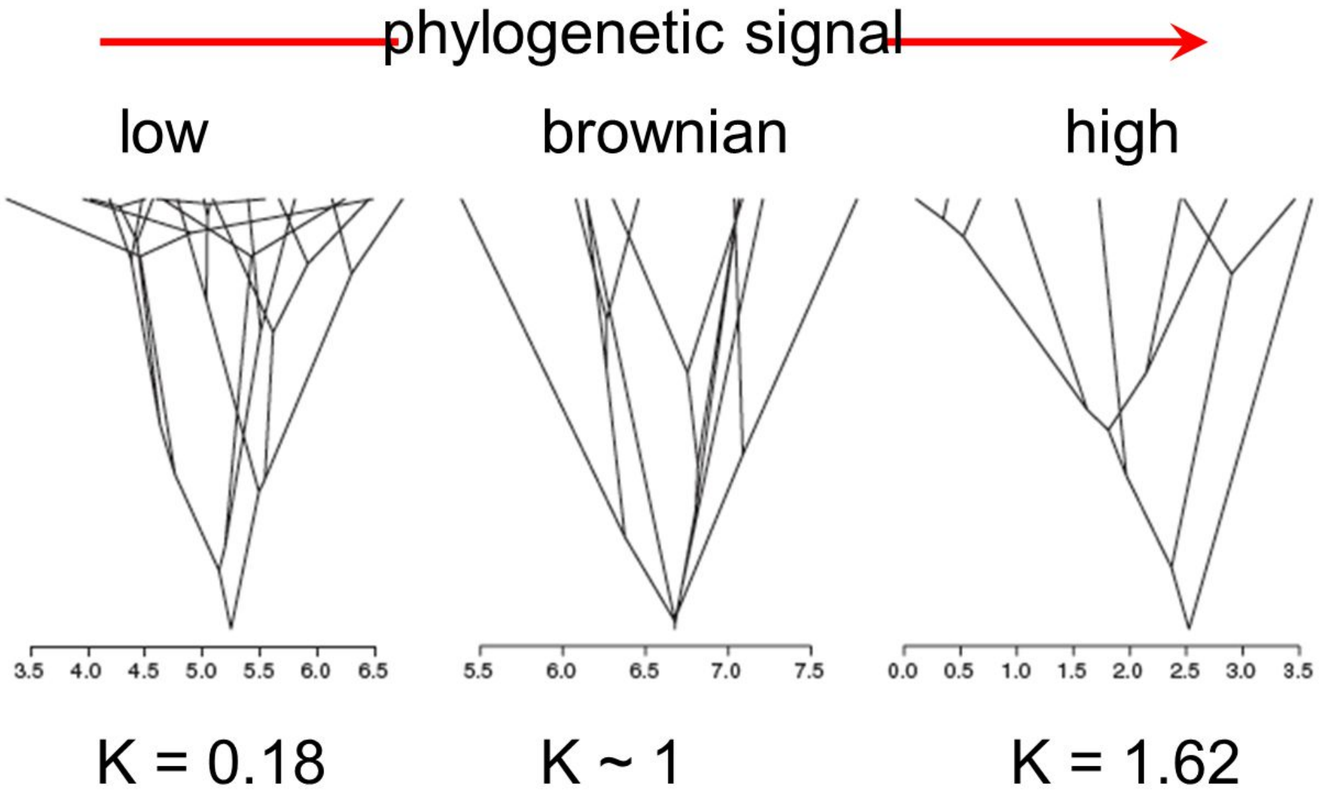
- Common garden approach
- Monocultures for litter type
- 5 replicates per treatment
- 290 microcosms
- Duration of the 6 months

Image: Mery Alencar

Functional traits

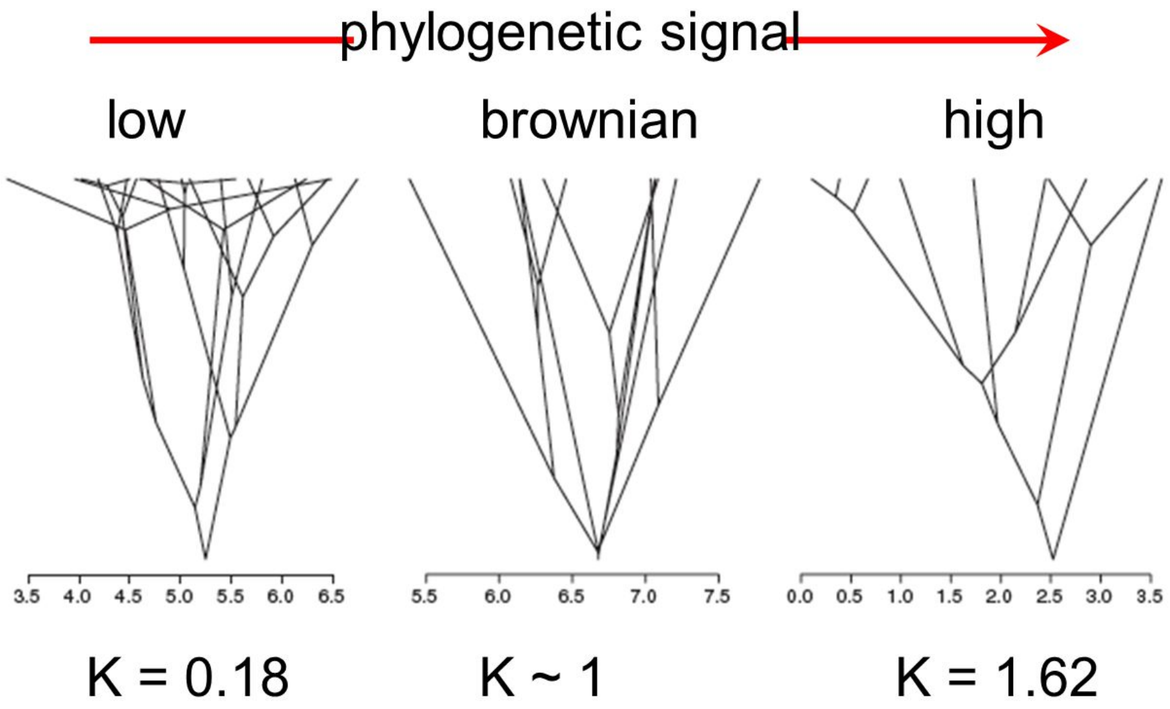
Chemical	Structural	Physical
Nitrogen	Carbon	Water holding capacity for 6 and 24 hours
Phosphorus	Lignin	Toughness
Calcium	Celulose	Leaching for 24 hours
Potassium	Soluble-carbon	Density
Magnesium		
Sodium		

We estimated phylogenetic signal in litter decomposition rates for each litter type using Blomberg's K.



Blomberg et al. 2003

Values around 0 indicate that a trait has no phylogenetic, autocorrelation to 1 the trait has phylogenetic autocorrelation. K values higher than 1 indicates that close relatives are more similar than expected

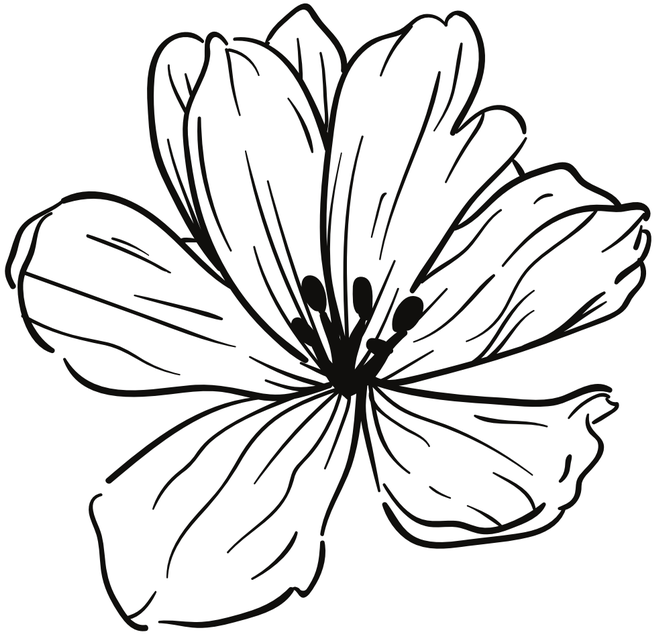


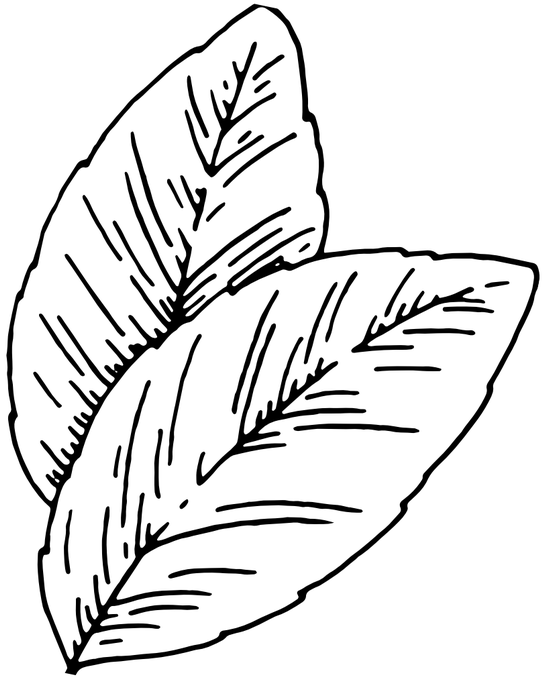
Blomberg et al. 2003

Results and Discussion

Remaining mass

11,81%





40%

t=-6.0143; p<0,0001

Higher decomposition rates in flower litter

Nutrients concentration

Water holding capacity

Lower reabsorption

Makkonen et al. 2012

Traits important for decomposition

Flower and leaf belong to the same physiological category, but they are **functionally distinct organs.**

Leaves **present structural compounds** such as lignin, cellulose, and complex compounds responsible for mechanical protection structuring.

While flowers are **ephemeral organs** with large concentrations of soluble compounds and carbohydrates, then higher water holding capacity

ADD RFE

Lower reabsorption

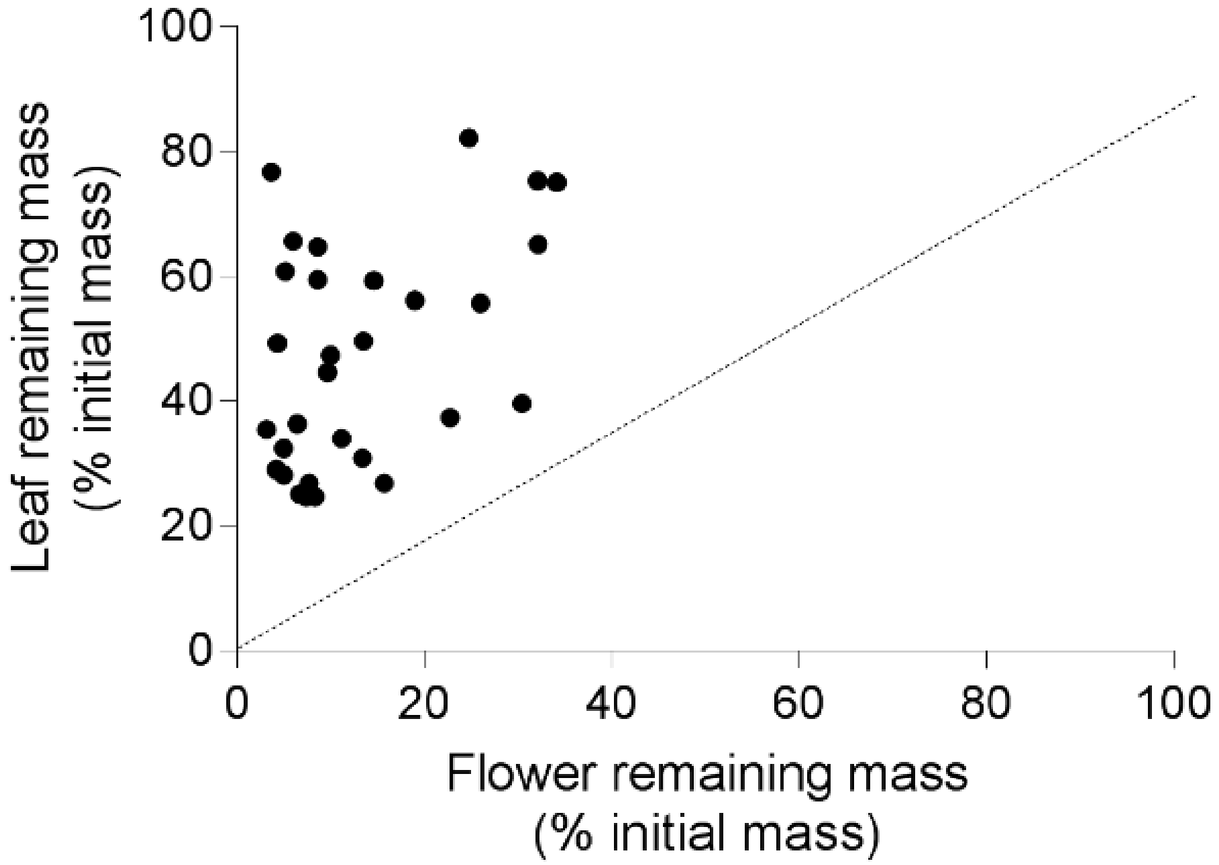
During the senescence, the differences between these organs tend to increase, because the reabsorption of nutrients occurs strongly in the leaves, while the flowers seem to fall into the soil without any changes in chemical composition.

Some studies show the decomposers preference by flower litter.

Quiao et al. 2016
Schmitt and Perfecto, 2020
Whigham et al. 2013

Coordination among litter type

We did not find a significant correlation among the remaining mass of the litter types.



R= 0.2843; p=0.1279

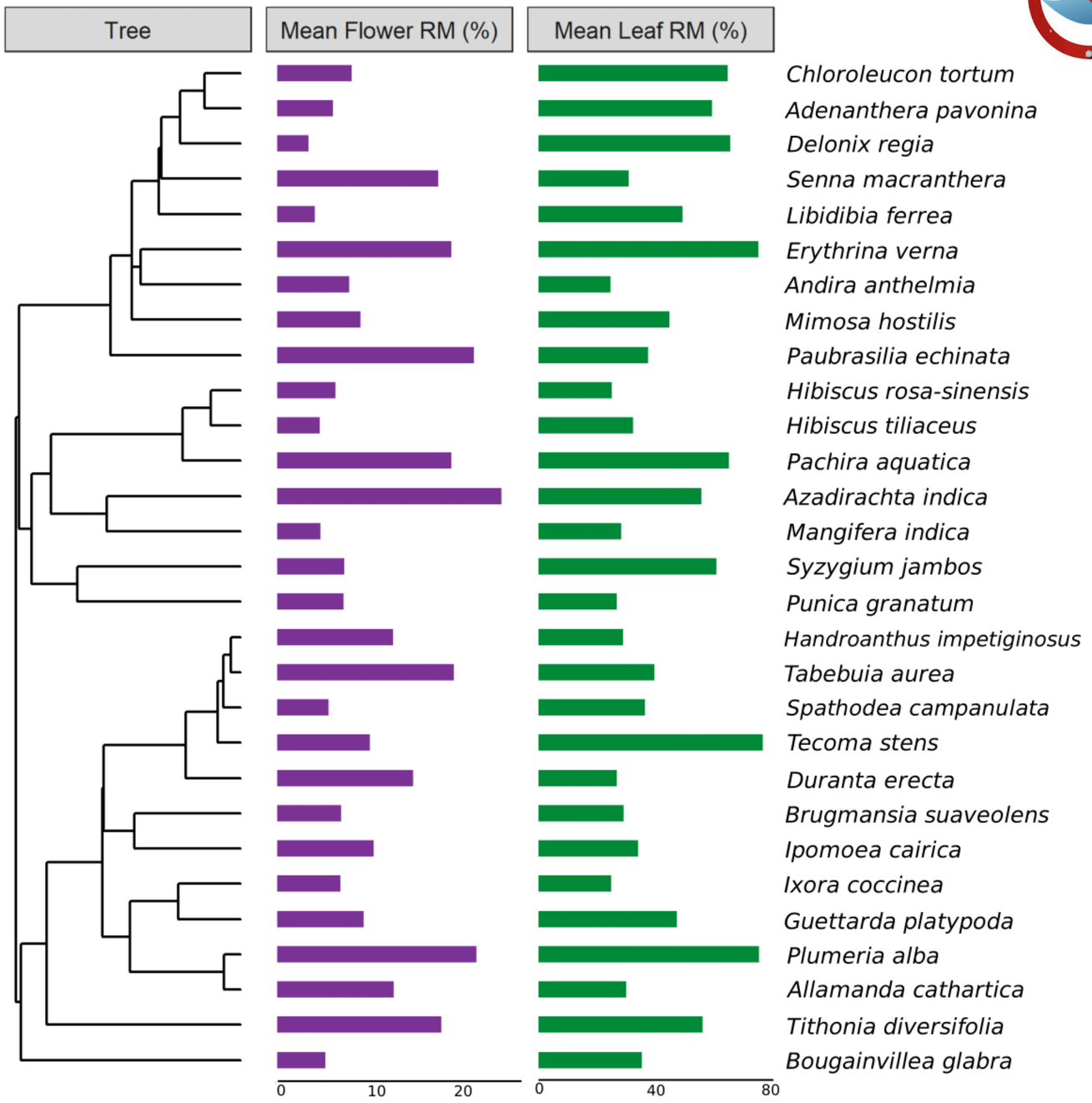
Uncoordination among flower and leaf litter

The differences in nutrients reabsorption among litter types explains the absence of coordination.

No phylogenetic signal

The phylogenetic patterns in decomposition rates were similar among the litter types, **showed low values of phylogenetic signal**

leaves (K = ~ 0.26, p-value = 0.68)
flowers (K = 0.29, p-value = 0.53)



The absence of phylogenetic signal

A previously work that evaluated phylogenectic signal in leaf litter globally, find a relation among decomposition rate and species evolution[1].

Although they evaluated this effects on aquatic enviroment, thus the parttern could be different in terrestrial systems.

Also the context is important ecological processes, as decomposition, to use the common garden approch, we affected the decomposition rates of the species.

[1]LeRoy et al. 2019
Pavoine et al. 2010

Conclusion

Despite the lack of phylogenetic signal, we show that leaf litter is not a good predictor for the plant as a whole, so to better understand decomposition we need to take into account other compartments of variation, such as within-individual.

Also, we need to expand the works with phylogenetic signal, and their to understand the possible predictions on ecological process.

Acknowledgments

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