

# Pollination services in Pomoideae and Prunoideae orchards: does pollinator deficit compromise fruit production?



Carvalho, Rafael<sup>1,2\*</sup>; Castro, Sílvia<sup>1</sup>; Loureiro, João<sup>1</sup>; Queirós, Filipa<sup>3</sup>; Sánchez, Claudia<sup>3</sup>; De Sousa, Rui<sup>3</sup>; Martins, Maria do Carmo<sup>2</sup>

<sup>1</sup> Centre for Functional Ecology, Department of Life Sciences, University of Coimbra

<sup>2</sup> Centro Operativo e Tecnológico Hortofrutícola Nacional - Centro de Competências (COTHN - CC)

<sup>3</sup> Instituto Nacional de Investigação Agrária e Veterinária, I.P. (INIAV, IP)

\* contact: rafael\_apc@sapo.pt



## INTRODUCTION

**Pollination** is a key **ecosystem service** in both managed and natural terrestrial ecosystems. This process is essential to support **food provisioning**, directly affecting the yield and quality of over 75% of the crops worldwide. However, pollination services are currently being compromised due to an accelerated **decline of wild pollinator** populations and because of the honeybee colony collapse. **Pollinator's decline** constitutes a major threat to sustainable crop production, bearing severe economic impacts. Still, current **pollination deficits are largely unknown** and rarely quantified, although being crucial to develop and implement management solutions.

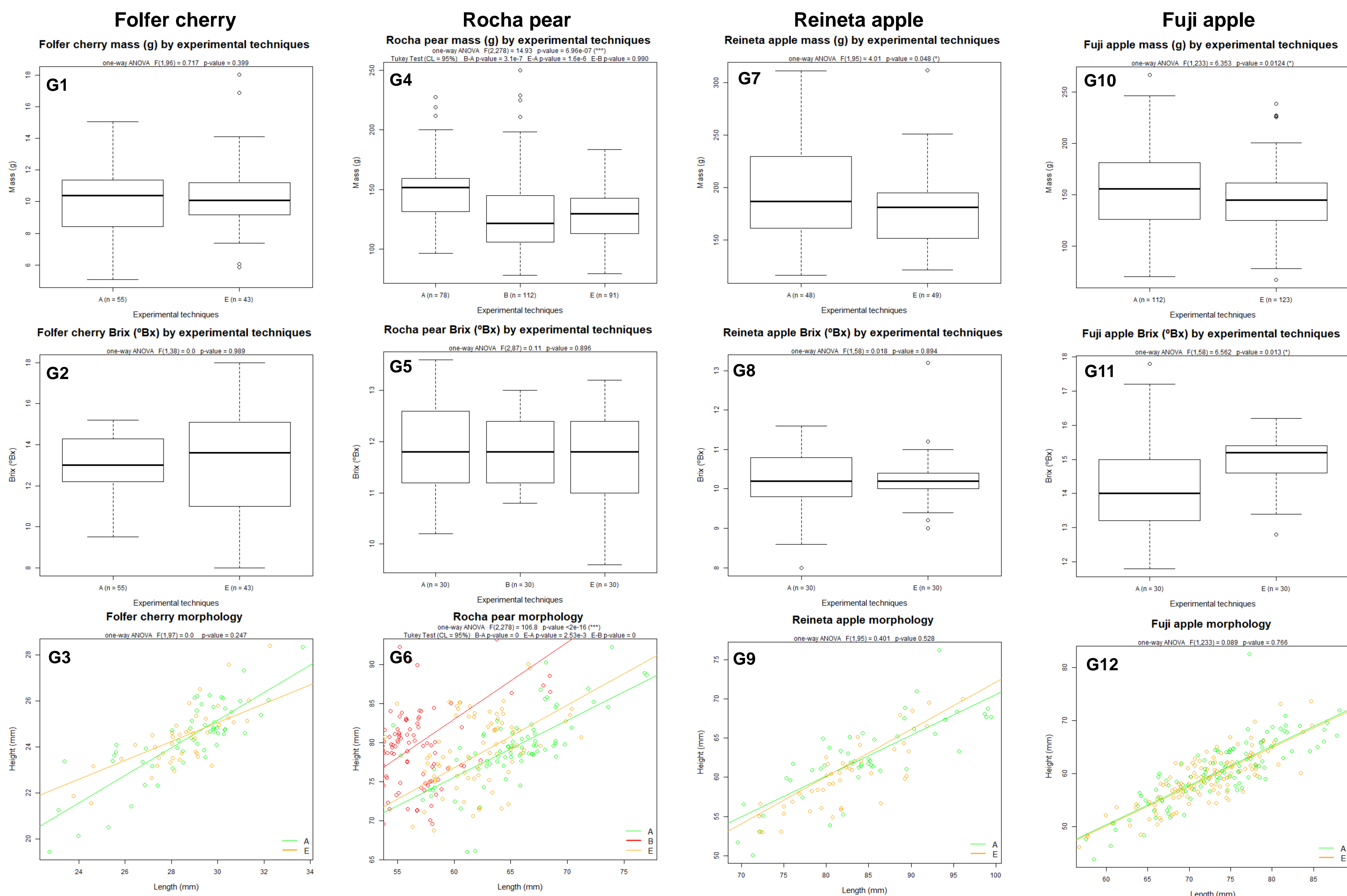
**Aim.** To quantify current pollination services in representative insect-pollinated fruit crops to understand how this service could be limiting crop production and develop ecological solutions to ameliorate it.

## METHODOLOGY

The study was developed within the **PolimMax project** (PDR2020-101-031727) in insect-pollinated fruit crops of Centro and Centro-Oeste Region of Portugal. Orchards of three varieties of Pomoideae, var. Reineta and Fuji for apples (*Malus domestica* Borkh), and var. Rocha for pears (*Pyrus communis* Linnaeus), and one variety of Prunoideae, the cherry (*Prunus avium* L.) var. Folfer were selected.

During flowering of 2018 we performed controlled pollinations involving open pollination (A), pollinator exclusion (B) and supplemented pollination (E), to quantify fruit production under different treatments. Direct pollinator observations in the selected orchards were also carried out to quantify pollinator diversity and abundance.

## RESULTS



- Similar mass, Brix and morphology (G1-3) between treatments.
- High abundance and activity of honey bees (hives installed in the orchard).
- Low diversity of wild pollinators.
- Open pollination produced heavier fruits (G4), although supplemented ones were larger and narrower (G6).
- Low abundance, activity and diversity of pollinators.
- High levels of parthenocarp.
- Similar mass, Brix and morphology (G7-9) between treatments.
- Still, open pollinated fruits were highly variable in mass and Brix.
- Some abundance and diversity of pollinators (wild and domestic).
- Similar mass and morphology (G10, G12) between treatments.
- Still, open pollinated fruits were highly variable and had lower Brix (G11).
- Honey bees were abundant, but the diversity of wild pollinators was low.

## DISCUSSION & CONCLUSIONS

Ours results show a reasonably high fruit set irrespective of the pollination treatment in some varieties. Indeed, in these orchards there was no evidence of insufficient pollination during the studied year. Still, a high variability in pollination deficits and pollinator abundances was found within and among orchards.

However, the pollination service was very dependent on the honey bees and consequently on their performance: in the cherry orchard the pollination service was done almost exclusively by honey bees through hives installed in the orchard; in Rocha pear tree, the low nectar attractiveness may be responsible for the low activity of pollinators, and the occurrence of parthenocarp may have masked the poor performance of the pollinators; in apple orchards, the high variability of the open pollinated fruits suggest a variable quality of the pollination service.

In conclusion, although the pollination services were sufficient, the most common pollinator (honey bees) might not be the most efficient for each studied variety. These results provide quantitative measurements of pollinator dependence and pollination services and, together with other questions related with agricultural productivity and pollination, they will be further studied in the PolimMax project over the next years.

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