Effects of graphene-related materials on the extracellular environment of the stigmatic surface of seed plants

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GRAPHENE FLAGSHIP

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1-Background

- Graphene related materials (**GRMs**) are becoming **more and more common** in our daily life
- **Agrochemical applications of GRMs** are under development
- Use and incorrect disposal of **GRMs containing products may lead to their release into the environment**
- Aero-dispersed **GRMs may land on** plants structures like **flowers**
- ***In-vitro*** experiments show that **GRMs can impair pH of pollen germination medium**, resulting in a decrease of pollen germination and elongation of pollen tube[1].

2-Knowledge gap

- Nothing is known about **GRMs effects on stigmatic surfaces**
- Can **stigmatic surfaces buffer GRMs acidity?**

3-Rationale

pH measurements were taken in aliquots of 0.01 M $NaNO_3$ solutions, pH = 6.5, in which **stigmas** had been soaked (solution volume/stigmatic surface = 36 µL / mm^2), when appropriate, before (**T0**) the progressive addition of one of the following materials: graphene oxide (**GO**); **washed GO;** few-layer graphene (**FLG**); pristine, reduced-GO (**Pr-rGO**); **PA6-Nylon**; a composite material made of the former two (**PA6-rGO**); **0.1 M HNO_3**

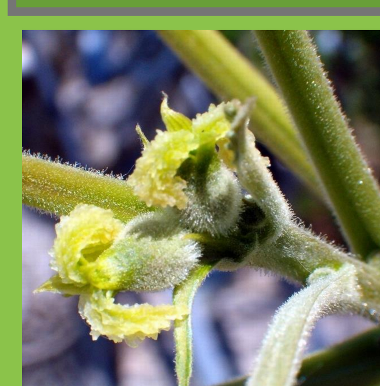
Zucchini

Cucurbita pepo

Kiwifruit

Actinidia deliciosa

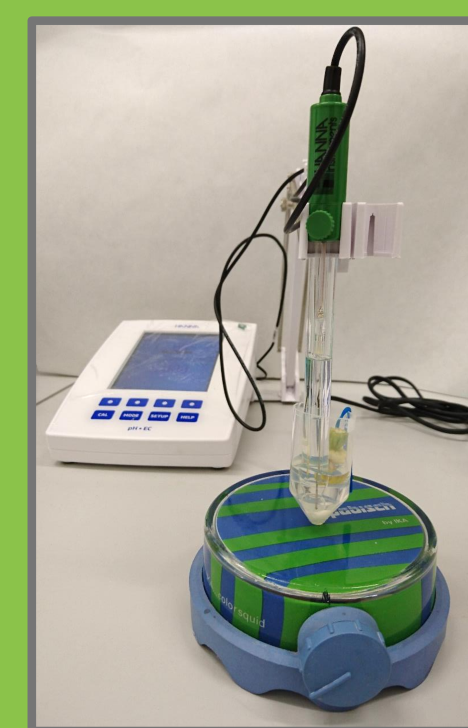
Walnut



Juglans regia

Corn

Zea mays



4-Results

- **GRMs have different acidic properties** according to their surface chemistry (Fig. 1)
- ***C. pepo*** stigmatic surface **buffers** the pH decrease induced by **GRMs** (Fig. 2)
- ***C. pepo*, *J. regia*** and ***A. deliciosa* can buffer GO** acidity whereas ***Z. mays* cannot** (Fig. 3)
- ***C. pepo*** and ***J. regia*** show a **better buffering capability than *A. deliciosa*** and ***Z. mays*** towards HNO_3 (Fig. 4)

Fig. 1

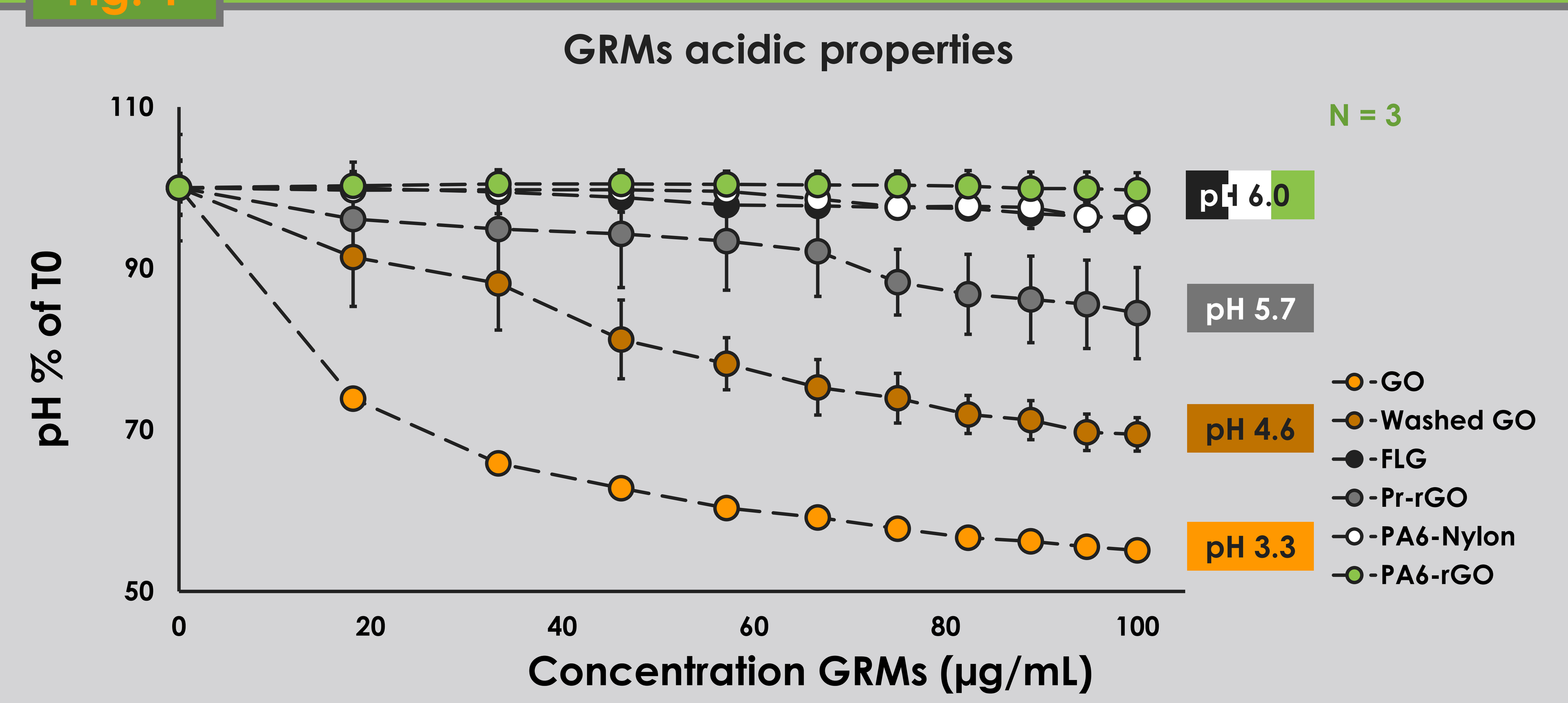


Fig. 2

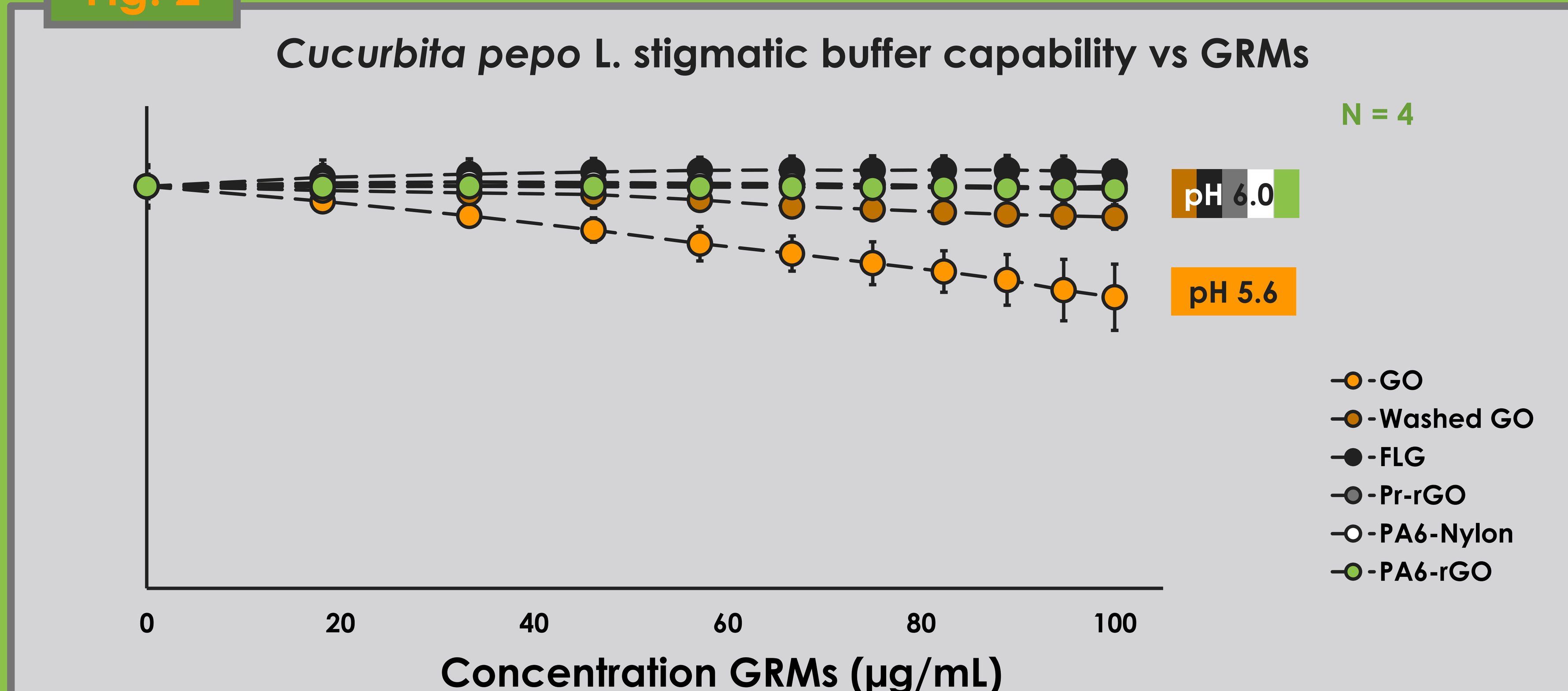


Fig. 3

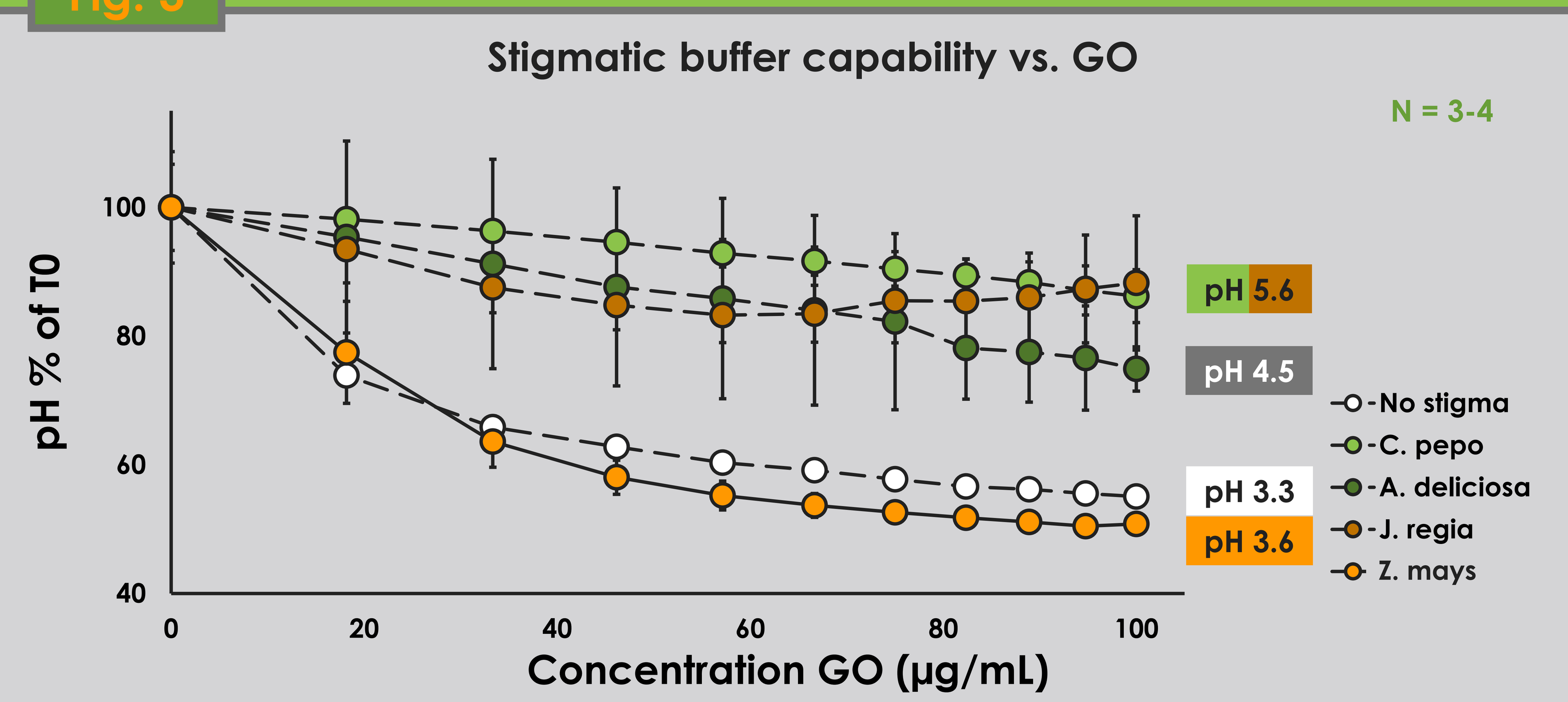
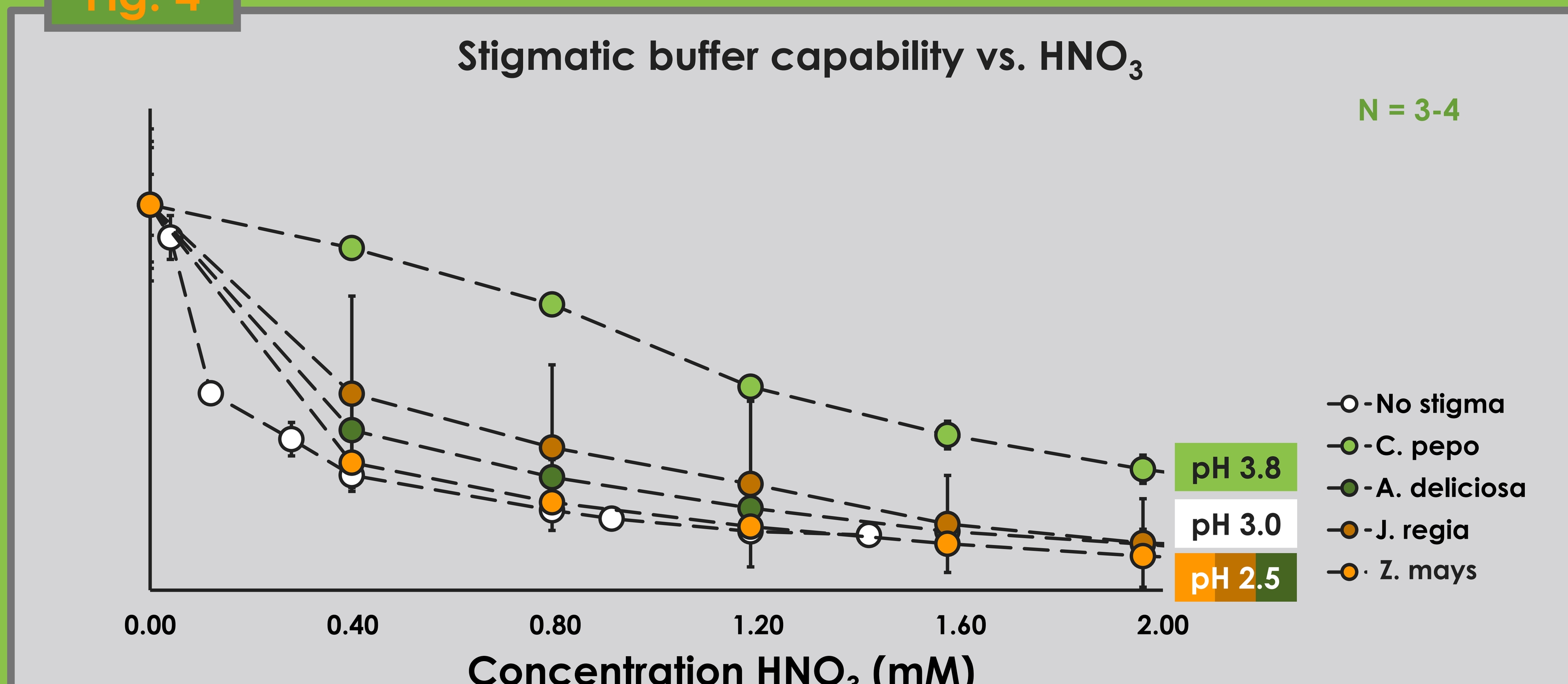


Fig. 4



5-Preliminary Conclusions

The different buffering capabilities among species towards acidic substances suggest **different sensitivities to** possible depositions of airborne **GRMs**. These differences **may be due to diverse stigmatic compositions. Applications exploiting GRMs for agricultural purposes** should take these results in consideration, as **acidification of the stigmatic surface** may lead to a **failure of crops sexual reproduction** and, eventually, **reduction of fruits and seeds production**.

6-References

1. Candotto Carniel, F.; Gorelli, D.; Cai, G.; Nepi, M.; Prato, M. Graphene oxide impairs the pollen performance of *Nicotiana tabacum* and *Corylus avellana* suggesting potential negative effects on the sexual reproduction of seed plants. Environ. Sci. Nano 2018, 00, 1–10.