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2022 MELISSA CONFERENCE
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CREATING A CIRCULAR FUTURE

MICROGRAVITY AFFECTS POLLEN TUBE DEVELOPMENT:

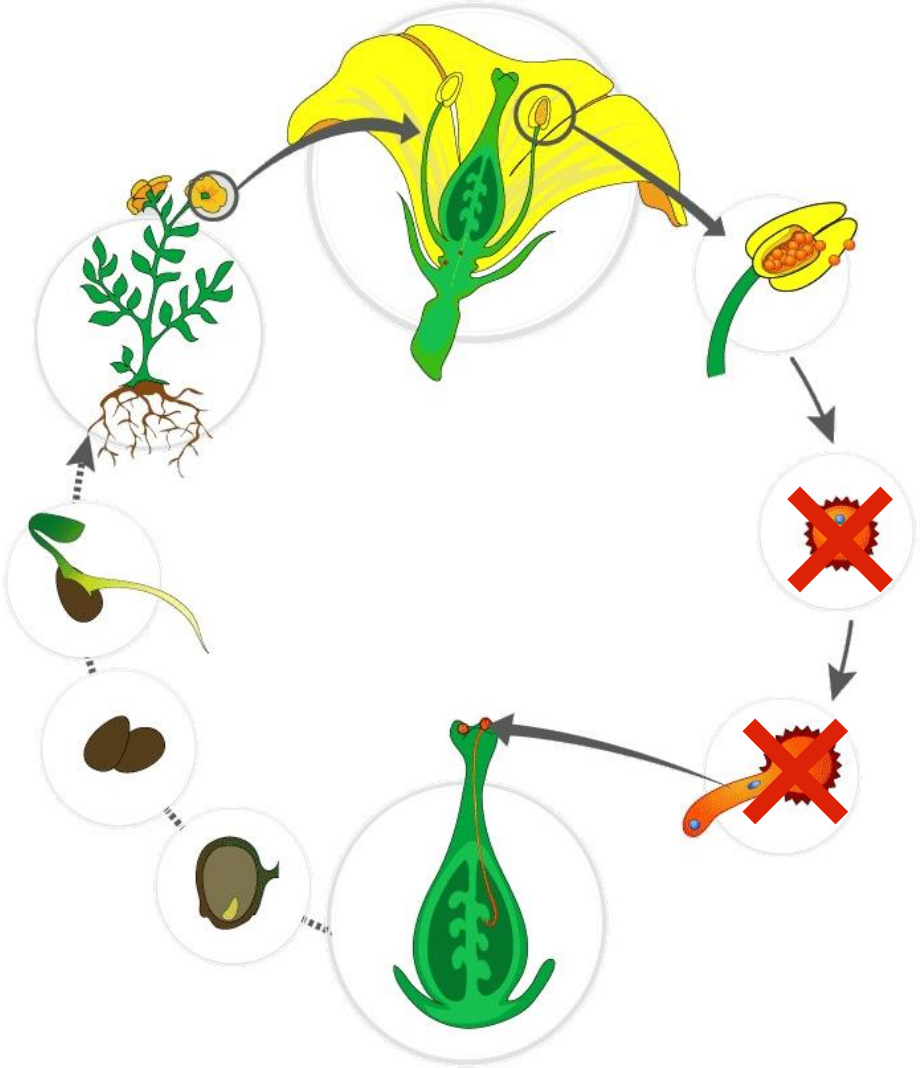
THE KEY ROLE OF POLLEN IN SEED-TO-SEED CYCLES OF SPACE CANDIDATE CROPS

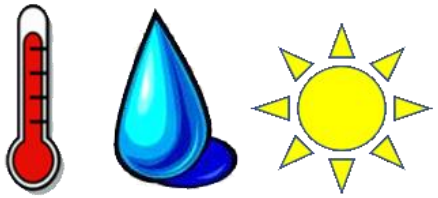
Maurizio Iovane, Luigi Gennaro Izzo, Giovanna Aronne

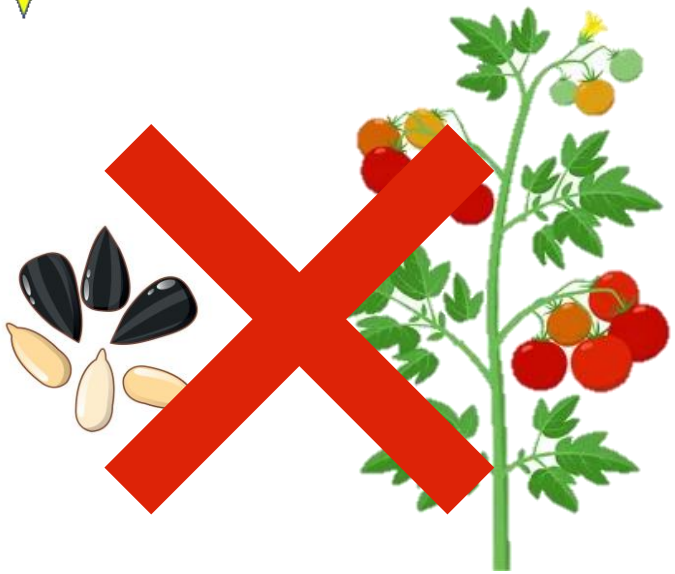
DIPARTIMENTO DI AGRARIA

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

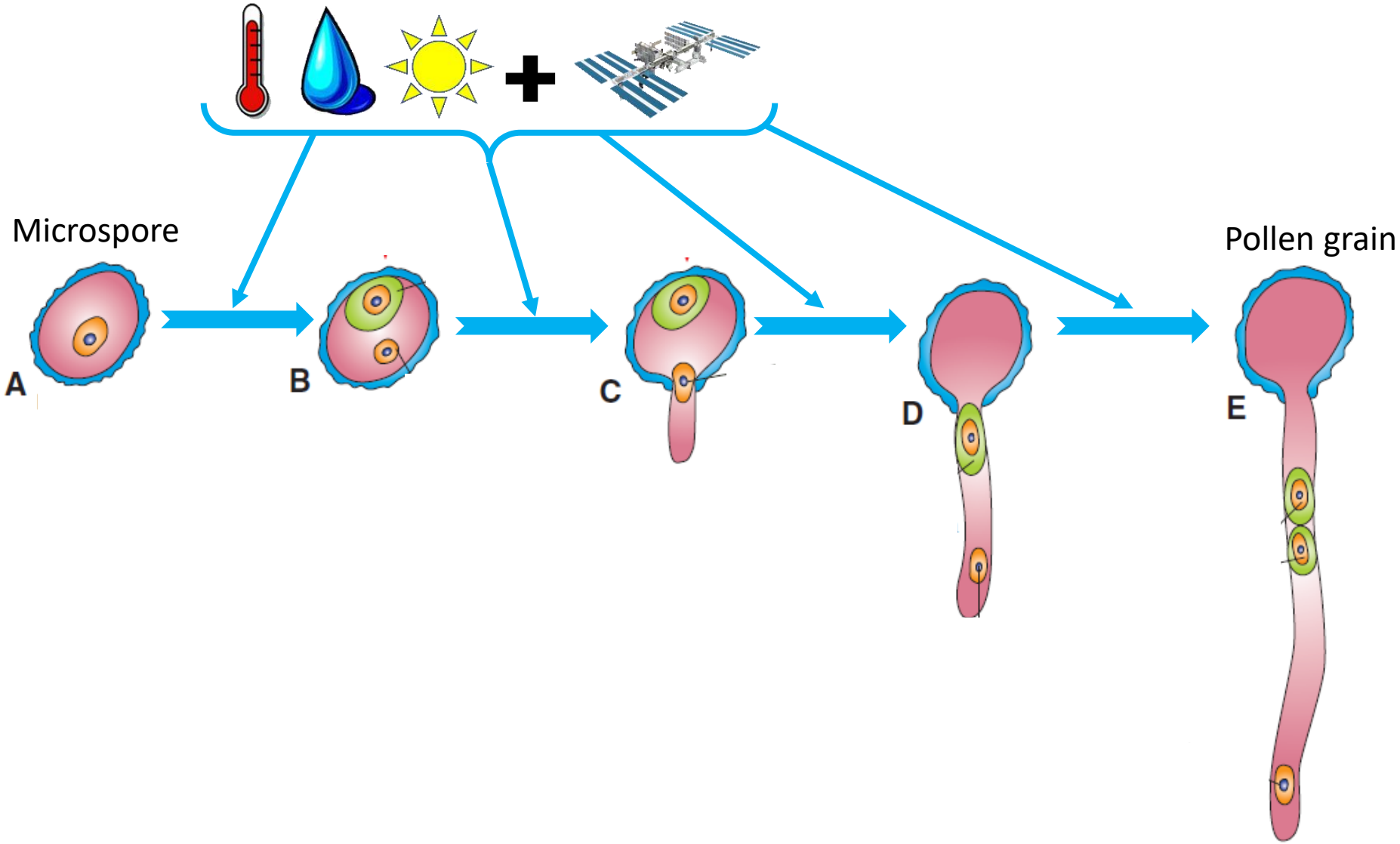
Reproductive cycle in Plants







POLLEN DEVELOPMENT AND ENVIRONMENTAL CONSTRAINTS



MICROGRAVITY IN LIFE CYCLE OF SPACE CROPS

plant biology

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REVIEW ARTICLE

Microgravity effects on different stages of higher plant life cycle and completion of the *seed-to-seed* cycle

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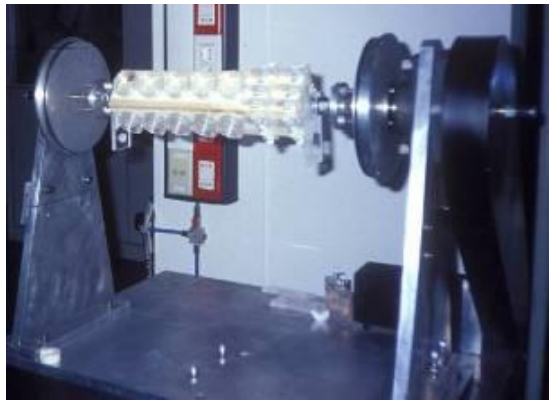
Choice of the Space Crops

Micro-tom

Fruits



Clinostat

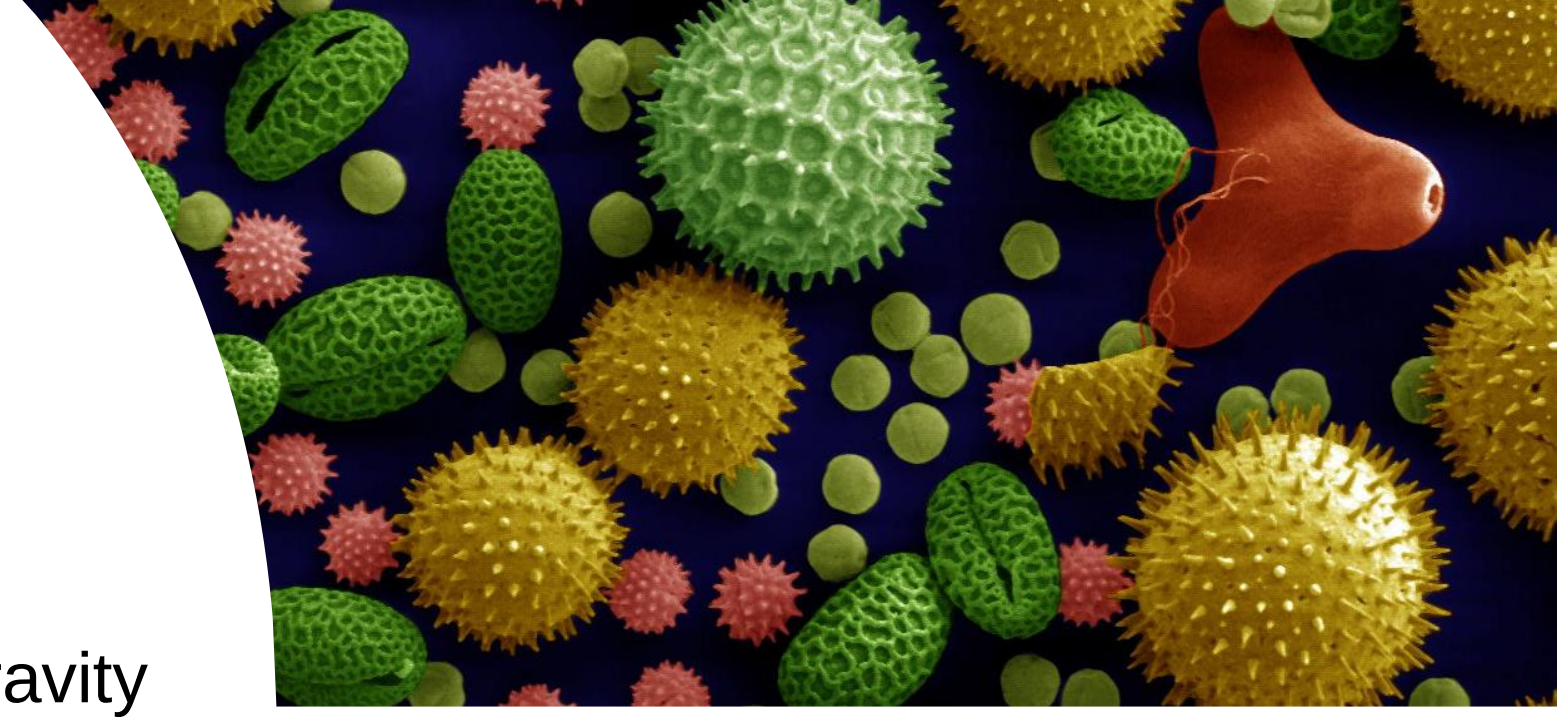
Brassica rapa

Leaves

Microgravity

- Seed and fruits formed in altered gravity conditions
- Seed and embryos development compromised

Investigation on pollen functionality under microgravity is required to ensure seed and fruit production over repeated seed-to-seed cycles

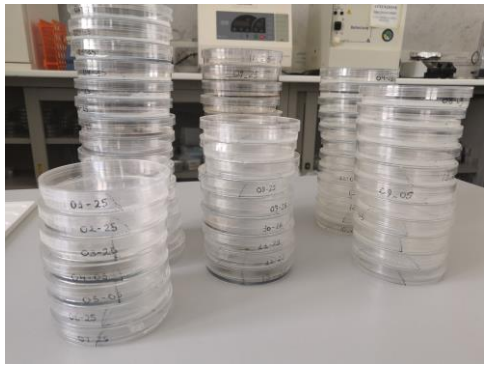


Research questions

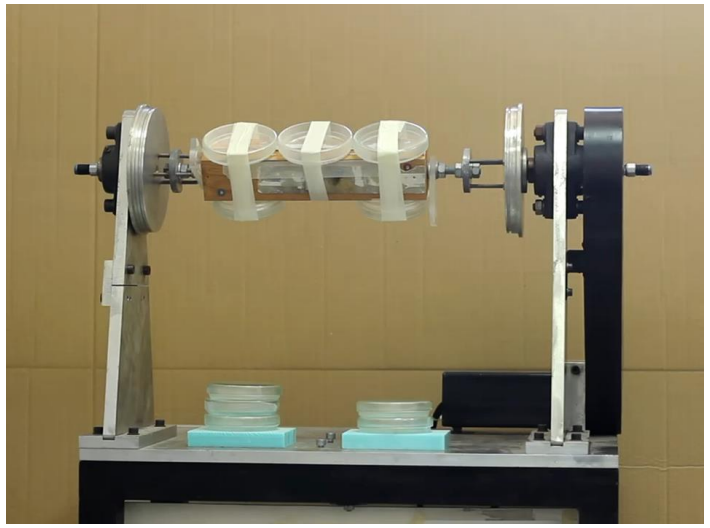
1. Effect of simulated microgravity on pollen tube development
2. Interference of altered gravity on pollen tube path
   (pollen gravitropism)

Methodological Approach

Micro-tom



Petri containing pollen



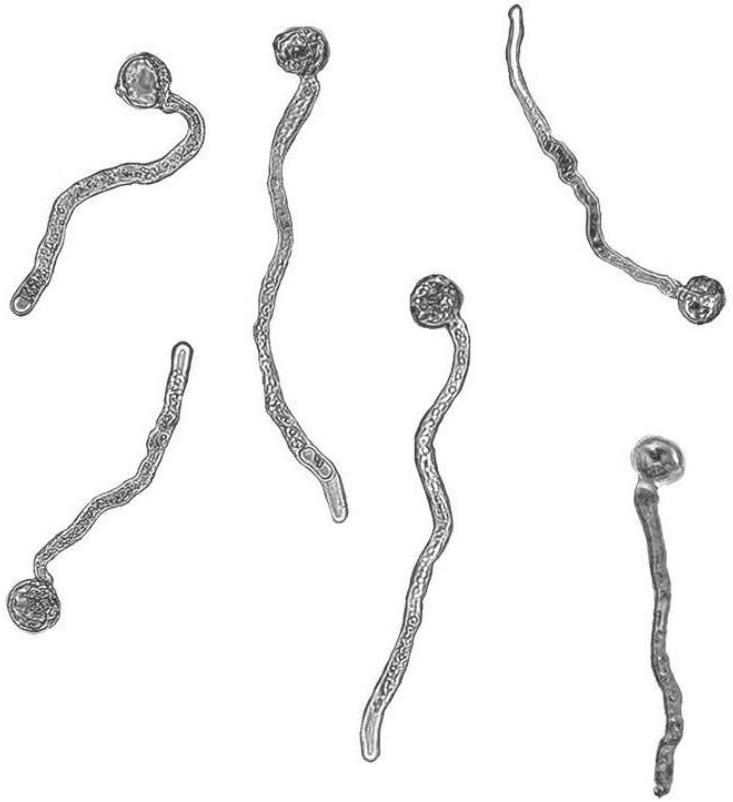
Simulated microgravity

Brassica rapa

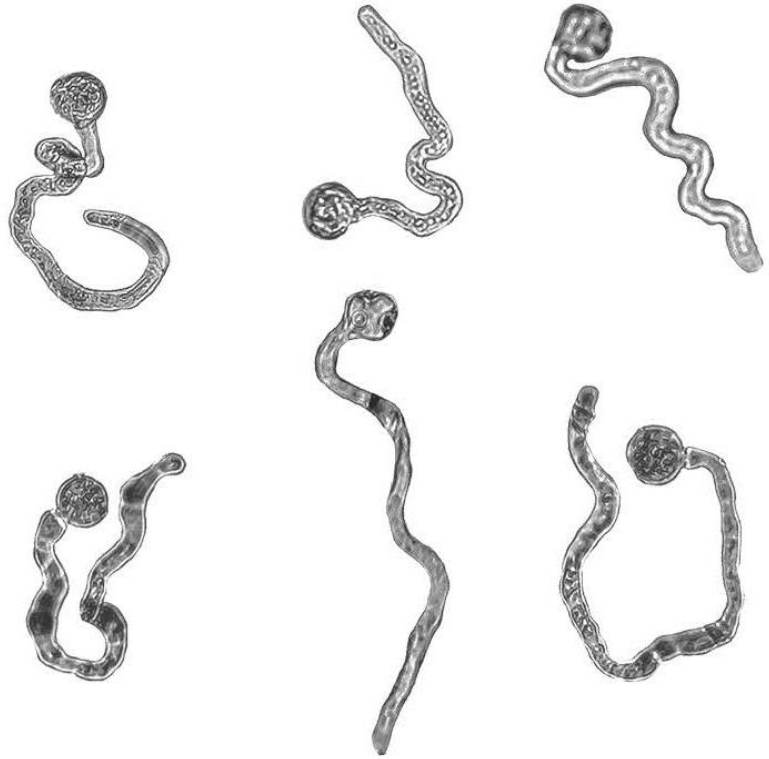
Ground

Overview on pollen tubes

Ground



Clinostat

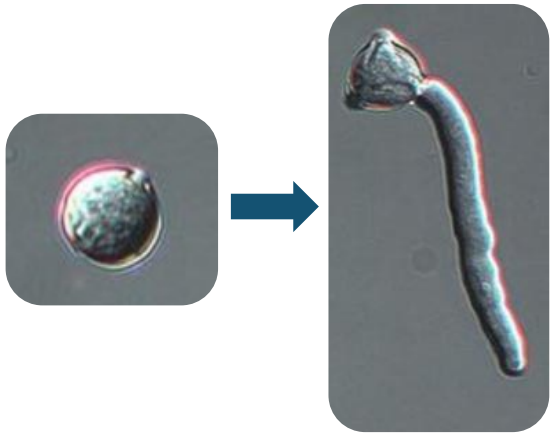


1g

Simulated microgravity

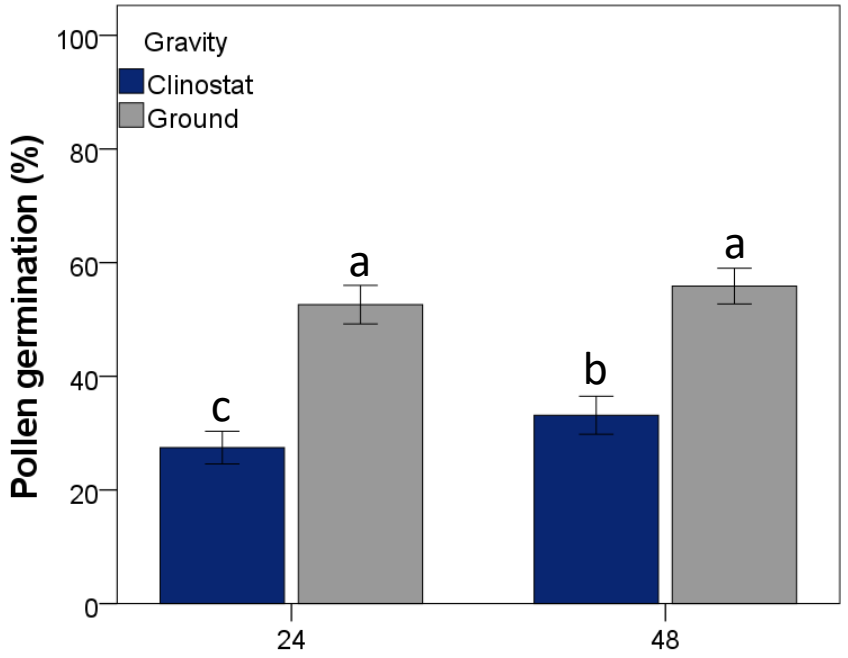
Results: Ground vs Clinostat

Pollen Germination

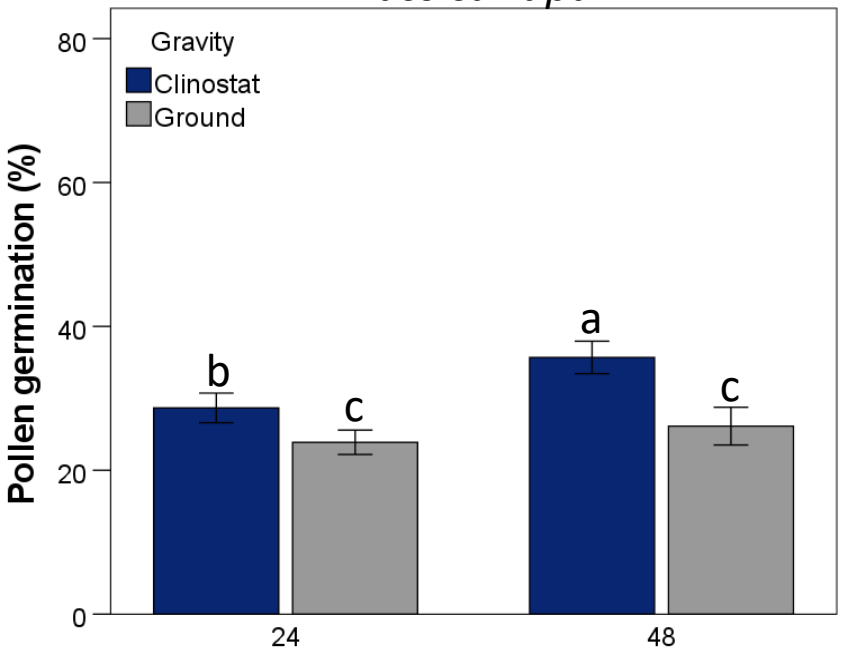


Germinated pollen

Micro-tom

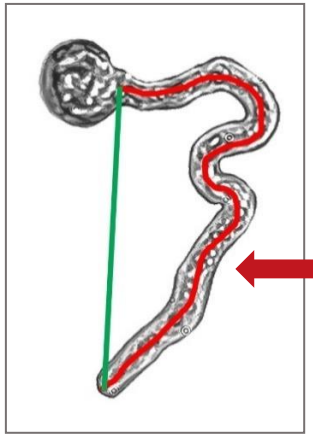


Brassica rapa



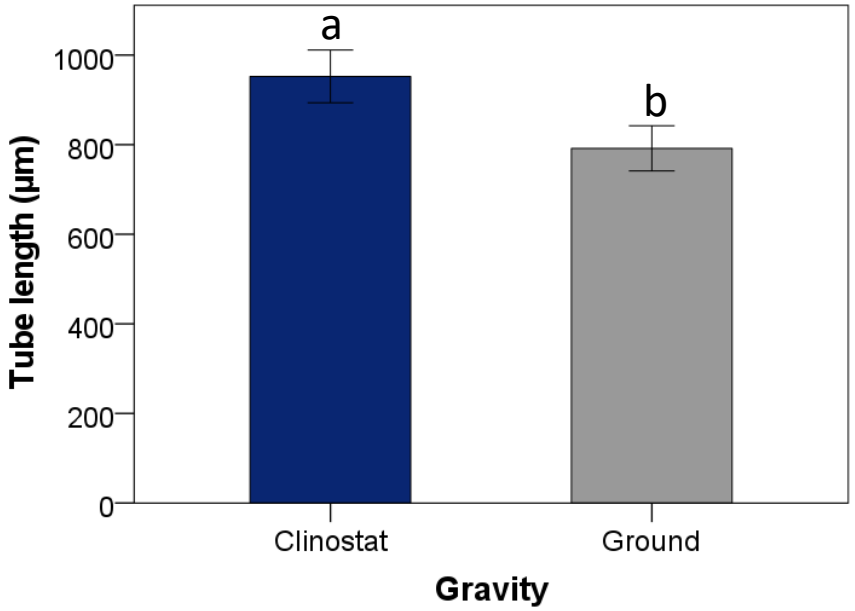
RESULTS: GROUND VS CLINOSTAT

POLLEN TUBE LENGTH

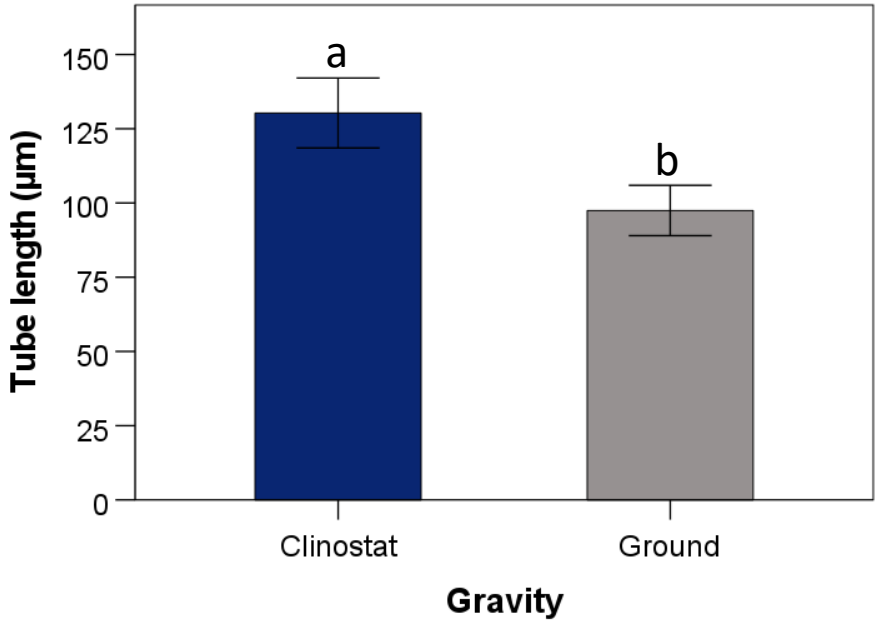


Tube length

Micro-tom

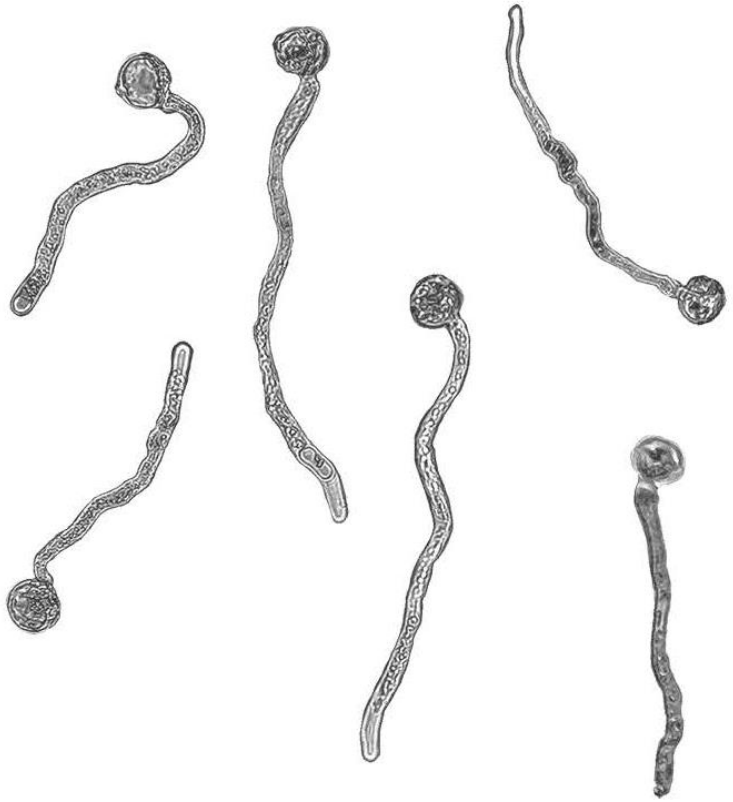


Brassica rapa

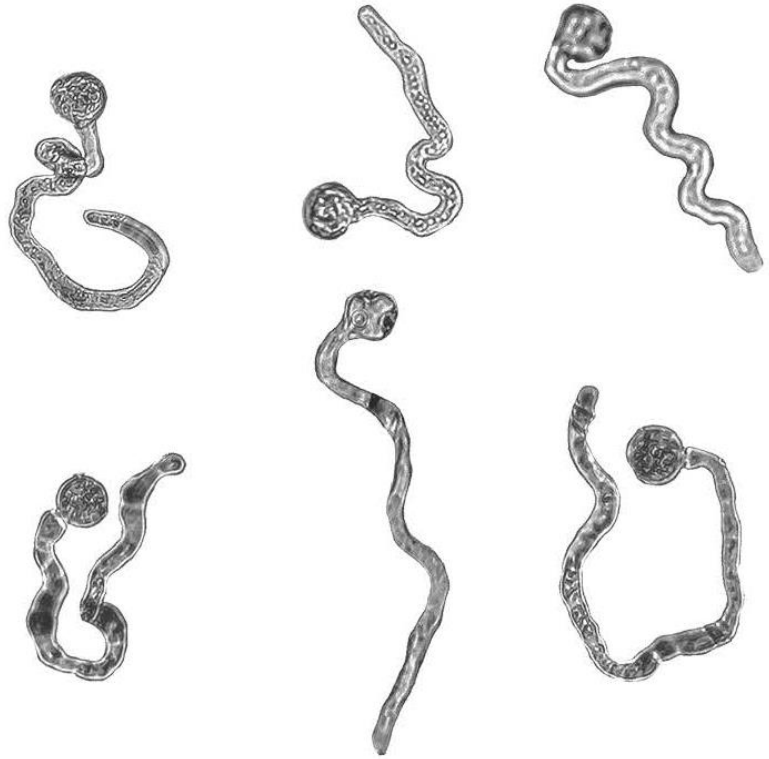


Overview on pollen tubes

Ground



Clinostat



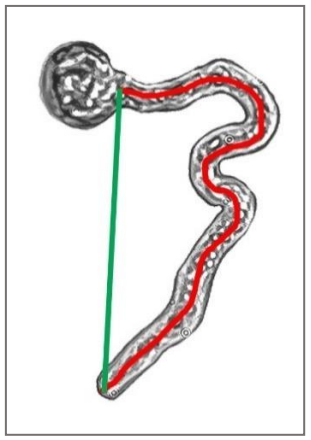
1g

Simulated microgravity

RESULTS: GROUND VS CLINOSTAT

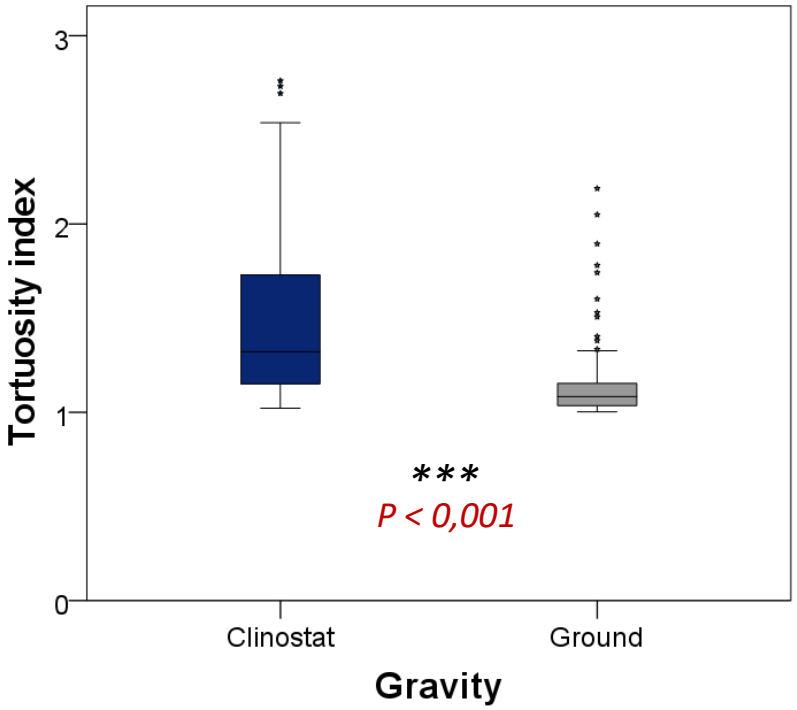
POLLEN TUBE TORTUOSITY

Tortuosity index (T)

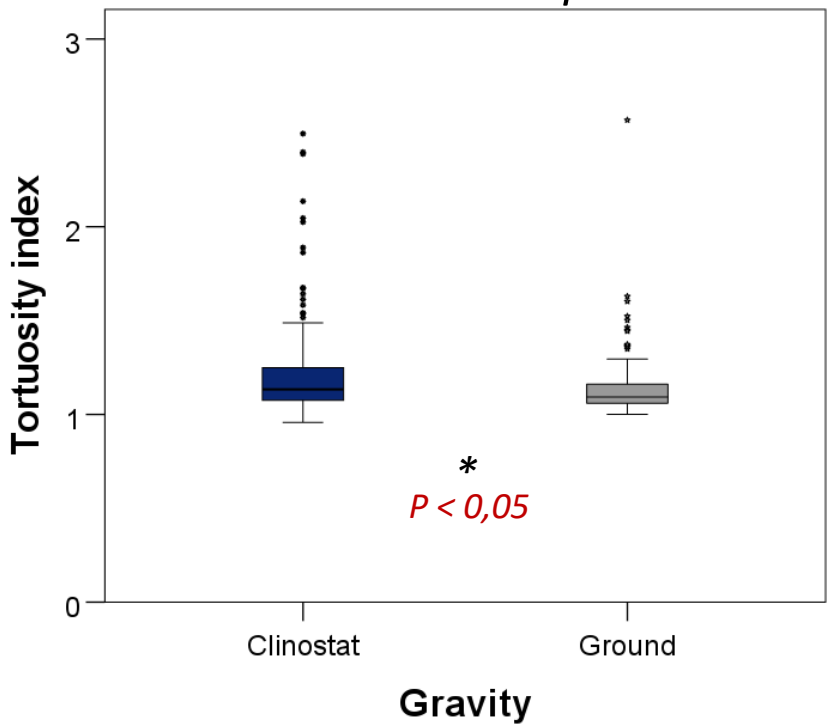


$$\frac{Length}{Strip}$$

Micro-tom



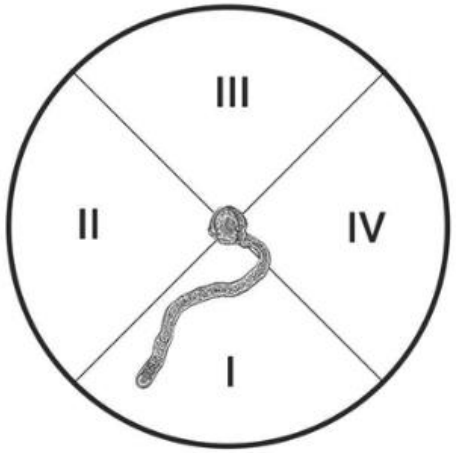
Brassica rapa



RESULTS: GROUND VS CLINOSTAT

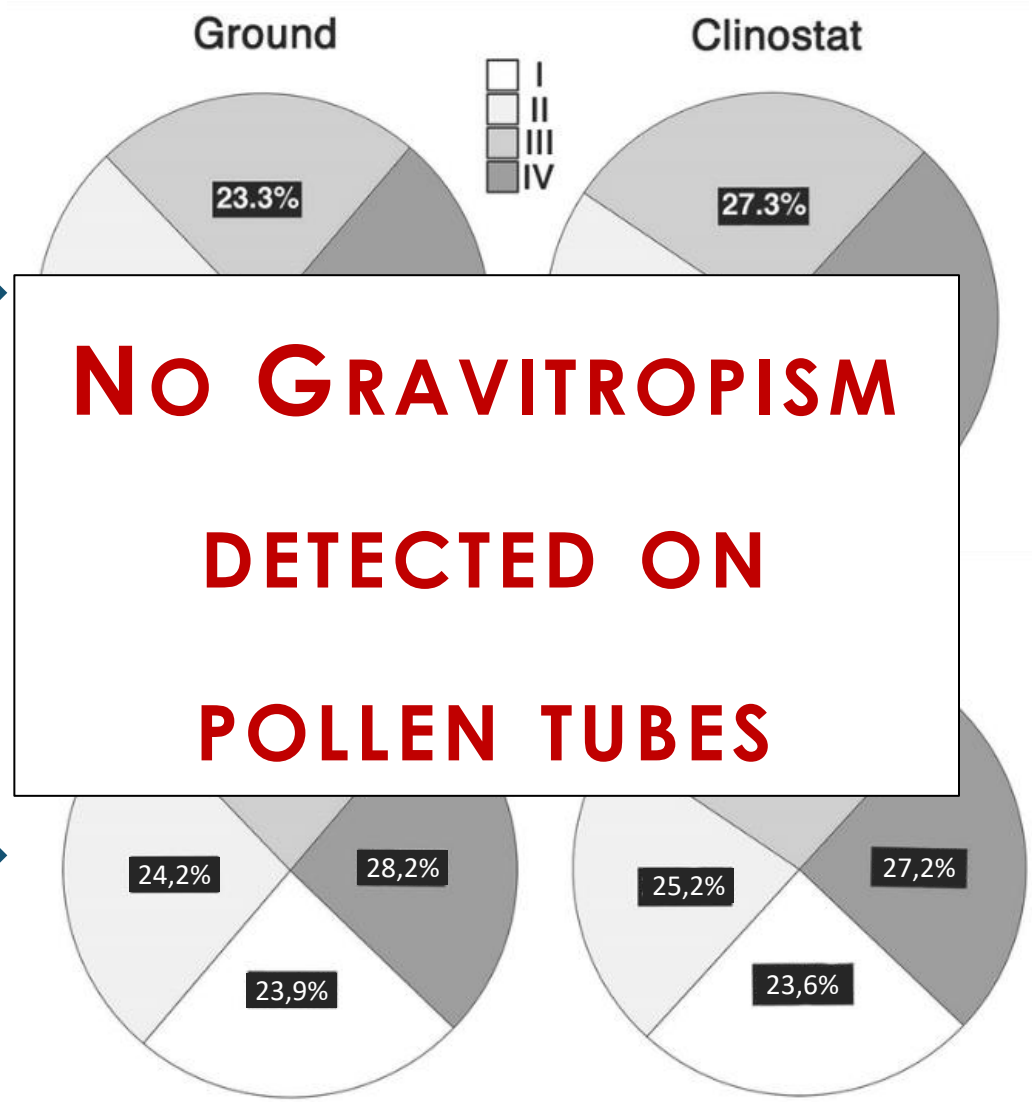
POLLEN TUBE GRAVITROPISM

Gravitropism on pollen tubes



Micro-tom

Brassica rapa



NO GRAVITROPISM DETECTED ON POLLEN TUBES

CONCLUDING REMARKS

- Simulated microgravity significantly affects pollen tube development depending on the space crop tested
- Clinostat treatment reduced pollen capability to germinate potentially reducing fertilization success and seed/fruits production
- Despite simulated microgravity interfered with pollen tube path (tortuosity), pollen tube direction in both species showed no gravitropic response

New experiment on the ISS to assess reproductive features and ensure feasibilty of seed-to-seed-to-seed...

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THANK YOU.

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