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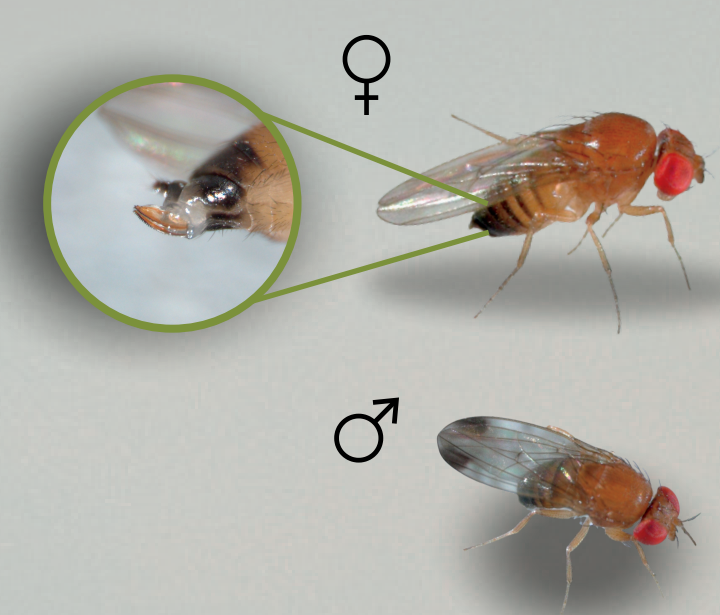
Winter is ending : how does the invasive pest *Drosophila suzukii* develop and survive in winter fruits?

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BACKGROUND

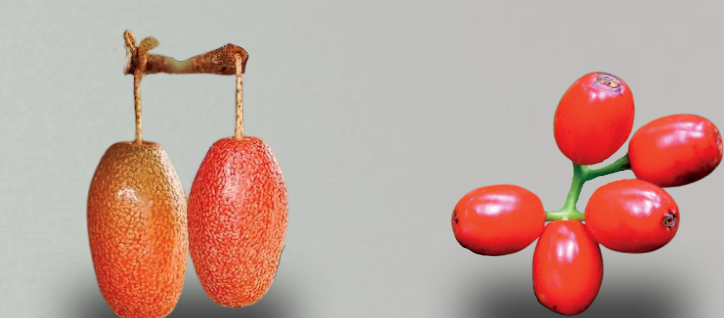


The exotic invasive fly *Drosophila suzukii* is an extremely polyphagous pest causing serious fruit crop damage worldwide (Poyet *et al.*, 2015; Ørsted *et al.*, 2021). Fly population densities are variable throughout the year, being the lowest in winter. During the coldest months *D. suzukii* adults undergo a reversible state of reproductive dormancy (Mitsui *et al.*, 2010; Panel *et al.*, 2018) mainly refuging in wooded areas. When temperatures increase, they leave their dormancy to search for food and egg-laying sites. Winter fruits are thus the key resource available allowing the build-up of spring populations. As survival, larval development time and adult size vary considerably with *D. suzukii* development substrate and temperature (Tochen *et al.*, 2014 ; Clymans *et al.*, 2019) we raised the following question :

What is the contribution of winter fruits to the survival and development of *D. suzukii* under different temperature conditions?

METHODS

4 nutritional media



Eleagnus x ebbingei *Aucuba japonica*

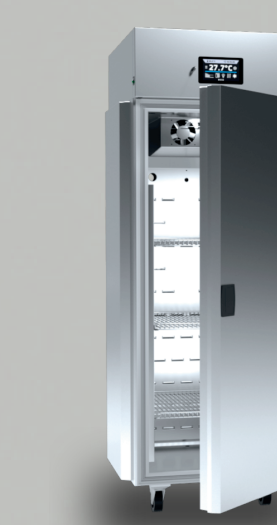


Viscum album Control (carrot/corn medium)

Controlled *D. suzukii* infestation

N = 5 (at L1 stage)

Randomly allocated



Controlled constant 20°C



Controlled fluctuant 8/15°C



Uncontrolled fluctuant outside temperature

FITNESS PARAMETERS OF EMERGING *D. SUZUKII*

- Emergence rate
- Development time
- Sex ratio
- Survival at 15 days (water and food)
- Survival without food (water only)
- Wing and tibia size
- Ovarian load at 3 days
- Energetic budget (lipid, protein, carbohydrate, glycogen)
- Number of melanized abdominal segments (winter/summer morphs)

MEASUREMENTS ON FRUITS

- Fruit weight (before infestation)
- Metabolic reserves (lipid, carbohydrate, protein)

PRELIMINARY RESULTS

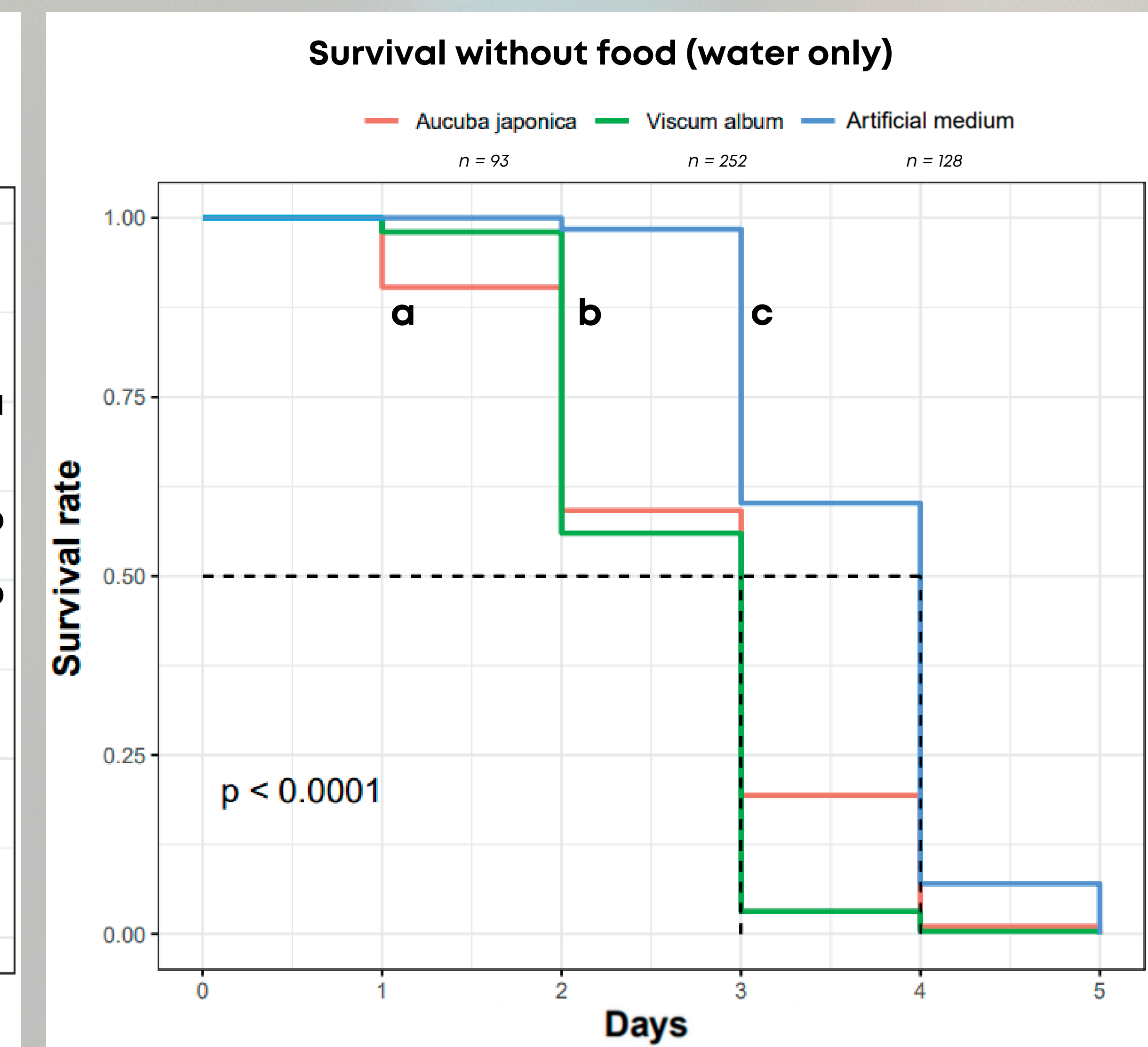
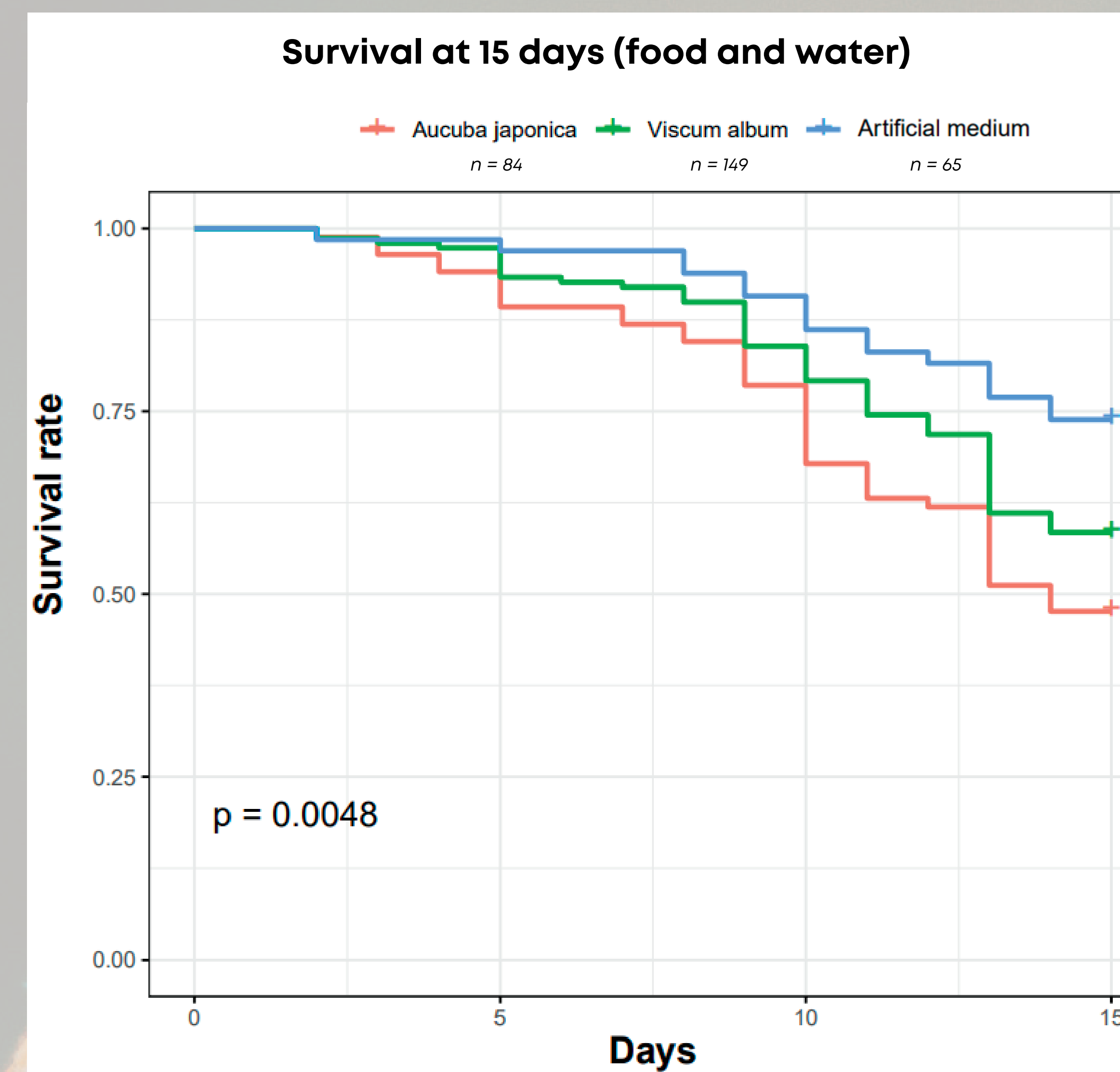
Performances of *D. suzukii* individuals emerging from *Aucuba japonica*, *Viscum album* and artificial medium at 20°C

Mean (+/- SEM) emergence rate, development time and sex ratio of *D. suzukii* developing in different substrates

	<i>Aucuba japonica</i>	<i>Viscum album</i>	Control	Chi ² *	p-value
EMERGENCE RATE	0.38 (± 0.02) a	0.82 (± 0.03) b	0.94(± 0.02) b	153.41	< 0.001
DEVELOPMENT TIME	20.99 (± 0.19) a	16.74 (± 0.06) b	13.48 (± 0.05) c	850.21	< 0.001
FEMALE SEX RATIO	0.49 (± 0.003) a	0.44 (± 0.027) b	0.52 (± 0.0) a	316.78	< 0.001
n	292	556	281		
n	292	556	281		
n	288	429	281		

* Kruskal-Wallis Test
n = number of measured individuals ; Emergence rate = number of emerged imagos/number of introduced larvae in fruit ; sex ratio = females/(females+males) ; Different letters indicate significant differences at the 5% threshold (Dunn post-hoc tests)

- The emergence rate was significantly greater for flies emerging from *V. album* and artificial medium than for those developing in *A. japonica*. Moreover, larvae developed slower in *A. japonica* than in *V. album*.
- The variability observed in fruit weight didn't influence larval development time nor emergence rate (ANCOVA : F_{3,844} = 239.9; p = 0.1984).
- Significant differences were observed in adult fly survival (with and without food) depending on the larval development medium. Survival was always the highest in flies developing in artificial medium. At 15 days, there was no significant difference in the probability of survival between flies developing in *A. japonica* or in *V. album*. Nevertheless, individuals developing in *A. japonica* had a higher significant probability of survival without food than those developing in *V. album*.



DISCUSSION / CONCLUSION

Preliminary results show that, at 20°C, *V. album* represents a better fruit substrate for *D. suzukii* than *A. japonica* (higher emergence rate, lower development time). However, on *V. album*, sex ratio was male-biased (due to sex differential mortality of larvae) and flies died more quickly when only hydrated.

The next experiments will explore the variation of *D. suzukii* populations parameters in fluctuating and uncontrolled temperature regimes. They will also take into account another winter fruit, *Eleagnus x Ebbingei* which reaches its full maturity stage at the end of March/ beginning of April. In addition, fly morphological (i.e. wing and tibia size, melanized abdominal segments, ovarian load) and biochemical (i.e. energetic budget) measurements will be made for all development substrates and temperature regimes. The objective is to relate the fitness parameters of flies to the quantity and quality of fruits (weight and metabolic reserves of fruits). In order to explore these interactions and find possible correlations, GLMs will be performed.

This study should help to better understand how *D. suzukii* manages to overcome the harsh winter conditions (low temperature, lack of resources) in order to rapidly build-up large spring populations

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