DOES PHOTOPERIOD AFFECT THE OLIVE FRUIT FLY SEASONAL CYCLE? A MODELLING APPROACH

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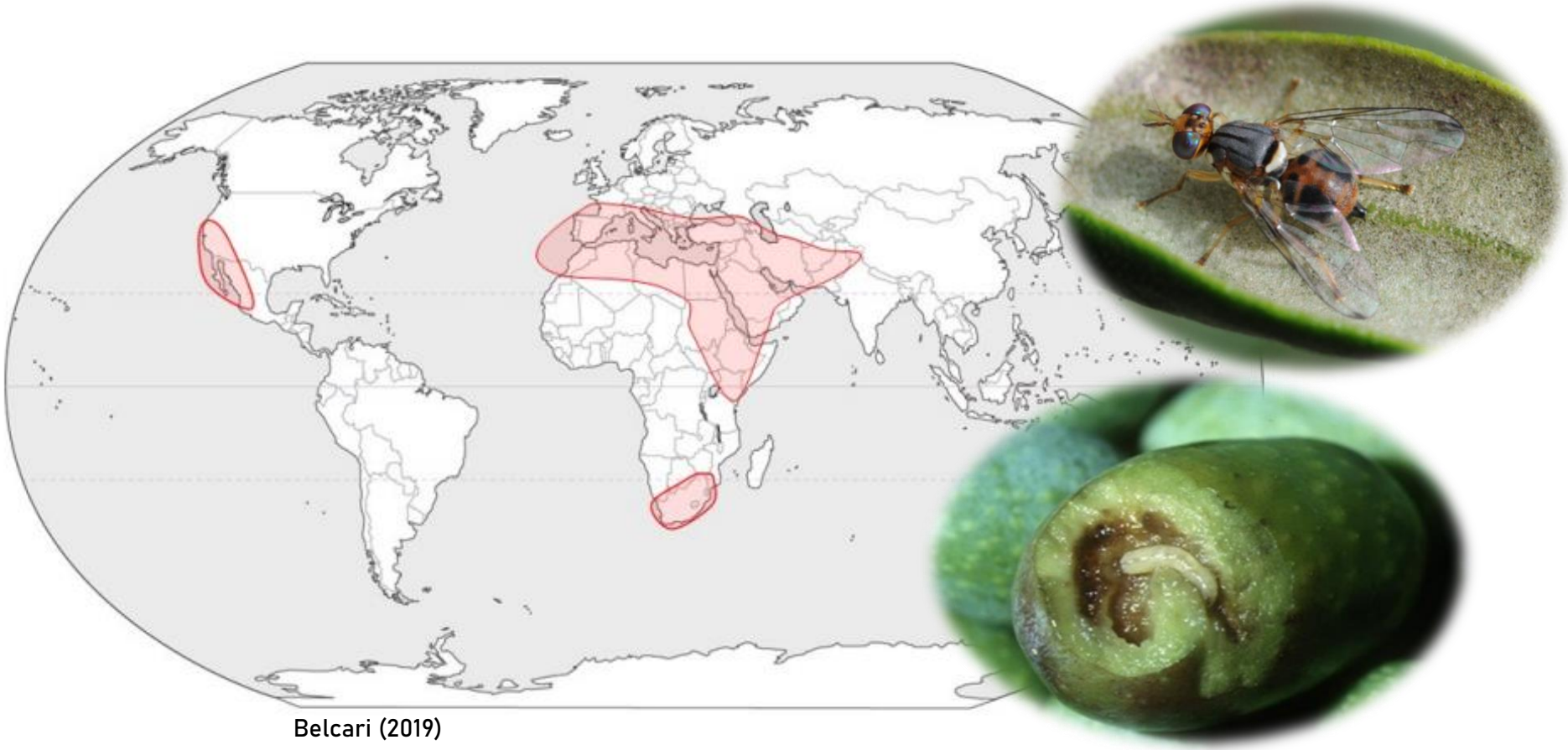
Europe is the biggest olive oil producer in the world with ~ 68% of the global production (~2051 thousand tonnes in 2020/21). The European olive oil production is mainly concentrated in Mediterranean countries such as Spain (68%), Italy (13%), Greece (13%) and Portugal (5%, 2020/21; https://ec.europa.eu/)

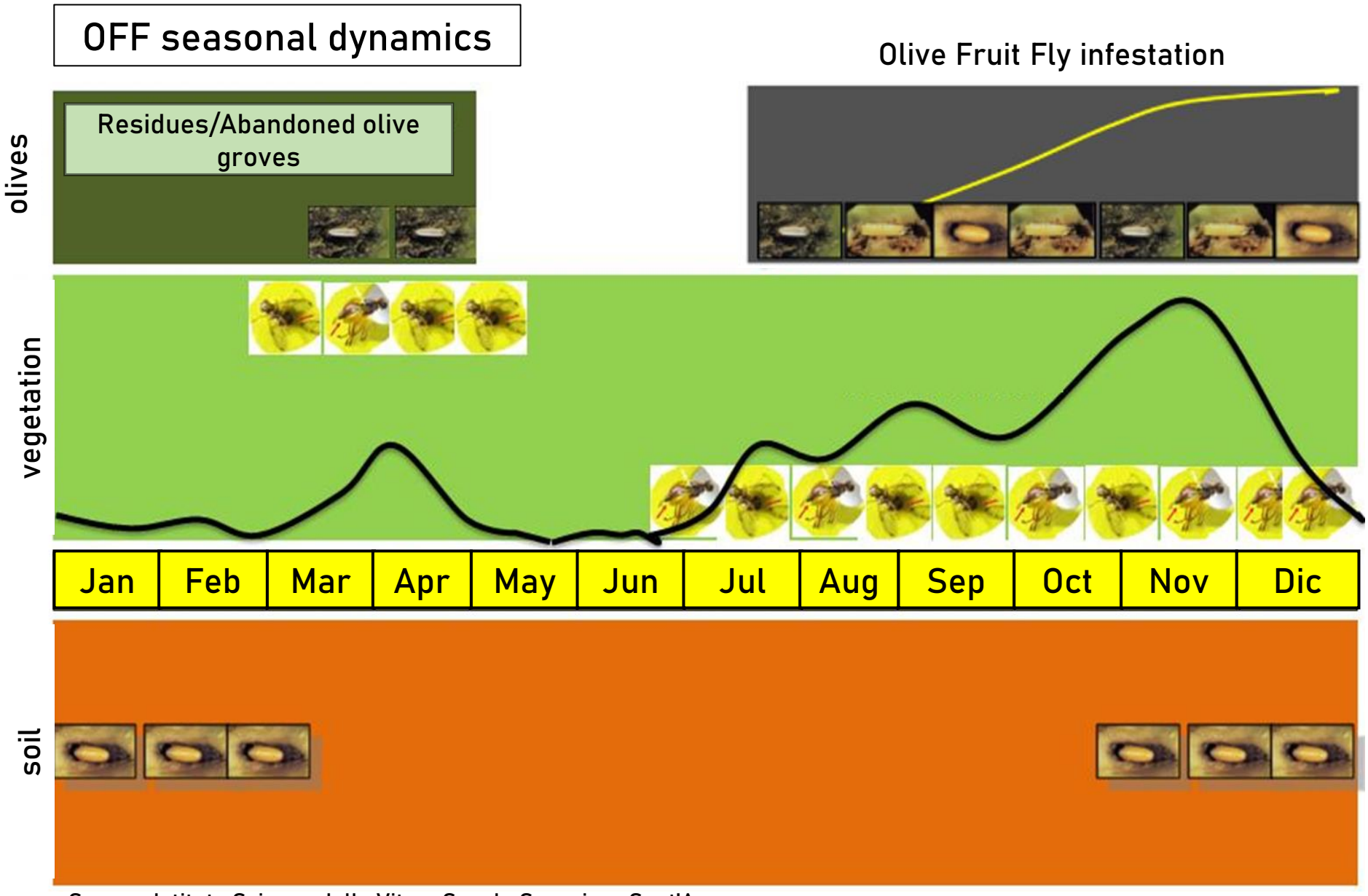
Olive Fruit Fly (OFF), *Bactrocera oleae* (Rossi), is the major pest affecting olive groves around the world. The pest produces several damages to olive crops by reducing the olive oil quality and production (Belcari, 2019; Malheiro et al., 2015)



Belcari (2019)

The impact of climate change may have a key role on altering the seasonal population dynamic of *B. oleae* and the olive tree phenology, by increasing the number of pest generations and the severity of the biotic stress

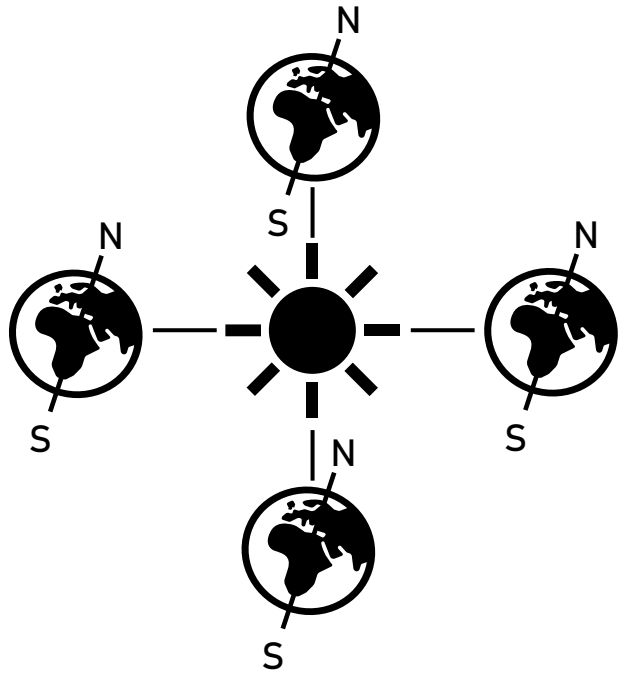
OFF seasonal dynamics

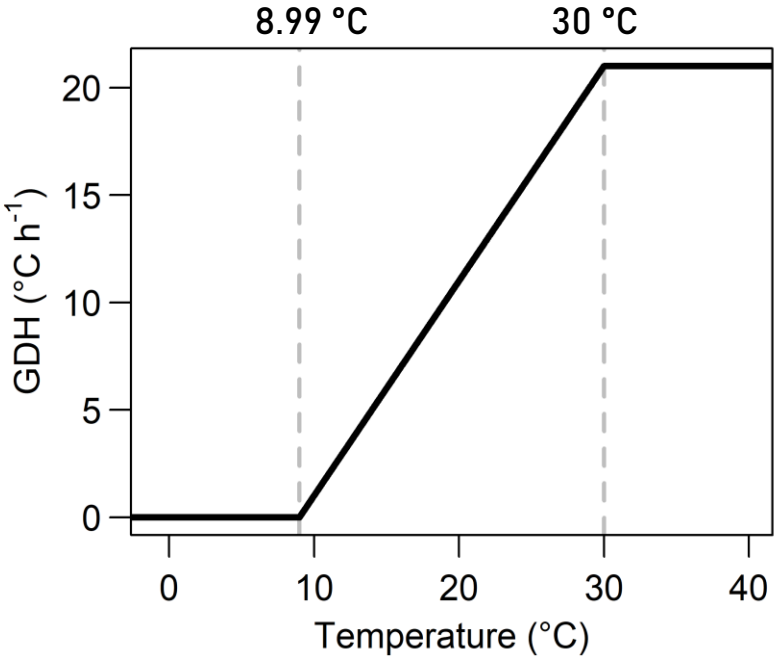


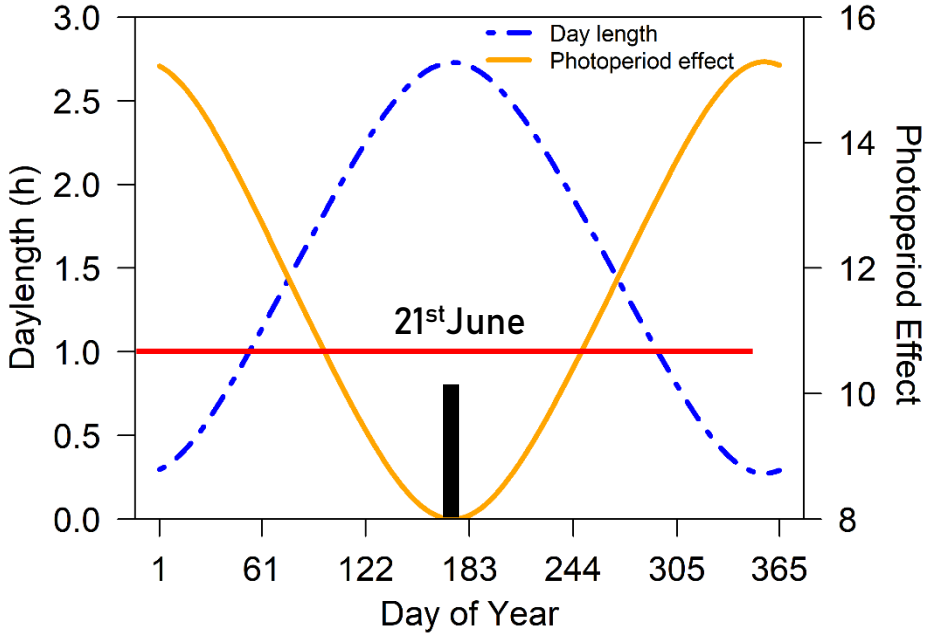
Source: Istituto Scienze della Vita – Scuola Superiore Sant'Anna

The OFF model was based on the thermal accumulation approach proposed by Belcari et al. (1989)

The model was then implemented with the photoperiod effect for improving the seasonal estimation of *B. oleae*







OFF captures data were extracted from Agroambiente (http://www.agroambiente.info/) and ASSAM Marche (www.meteo.marche.it) databases

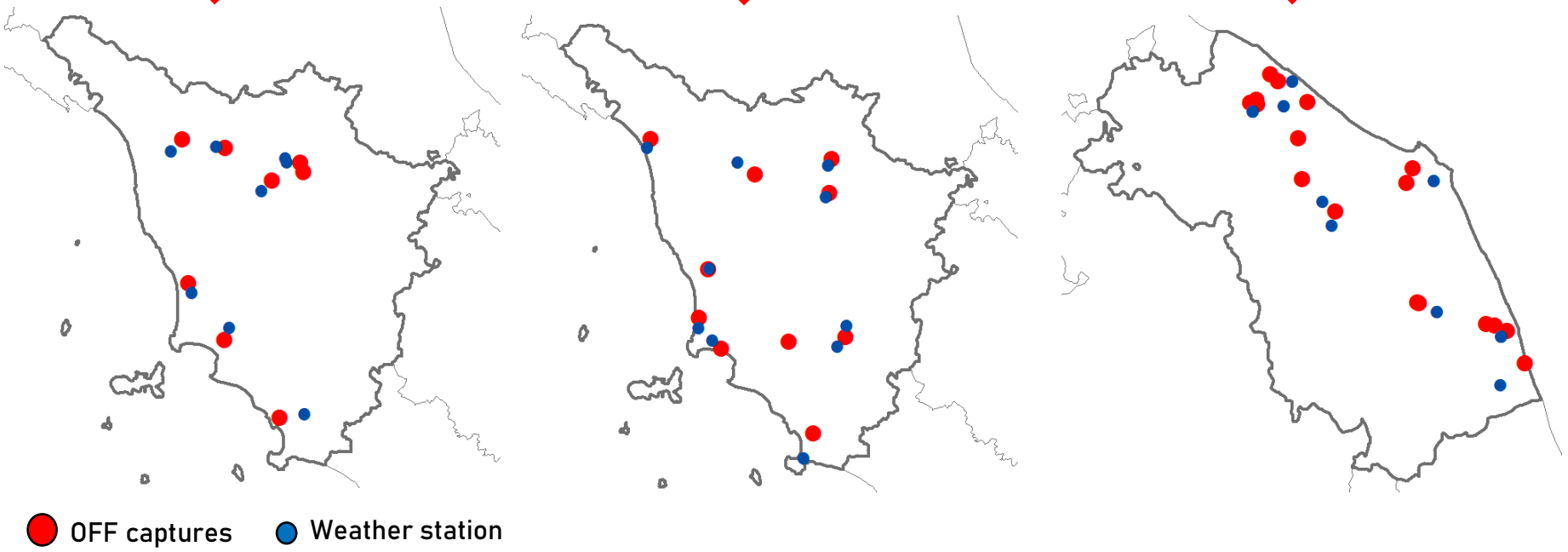
Calibration/Validation

22 observed data
2008-2017

29 observed data
2008-2017

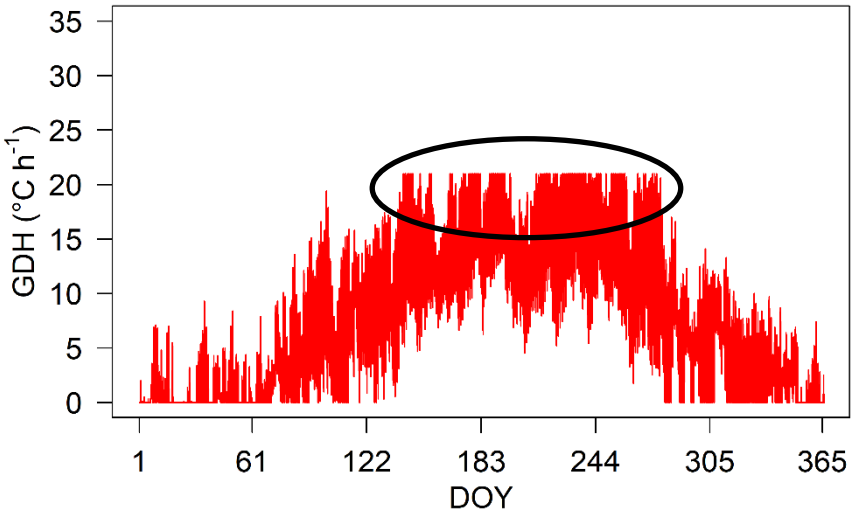
Application

44 observed data
2012-2020

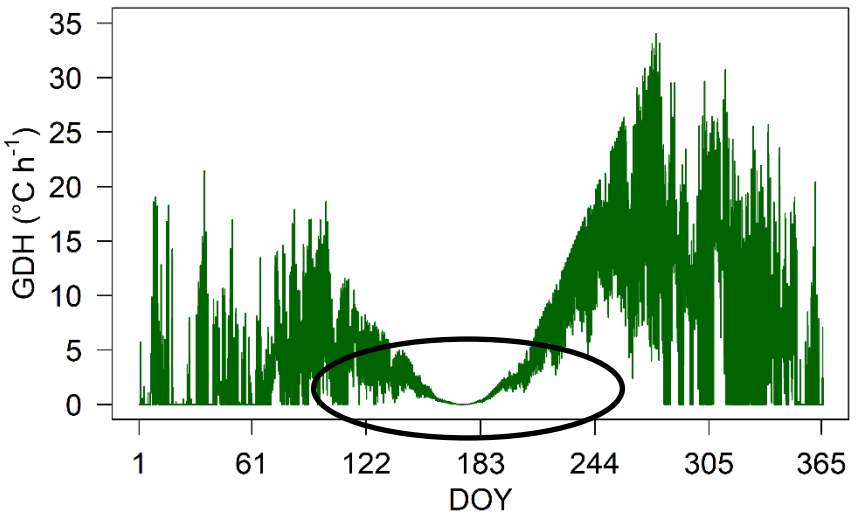


Location x Year x OFF generation

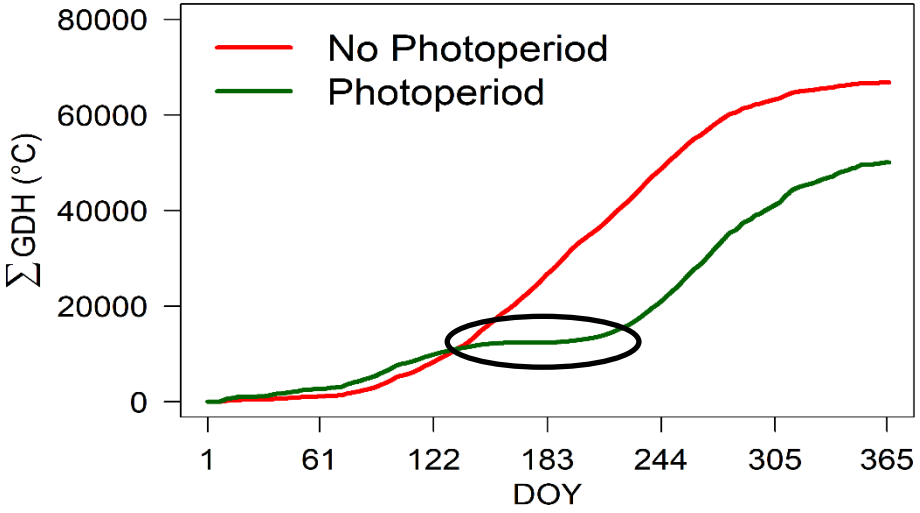
NO Photoperiod



Photoperiod

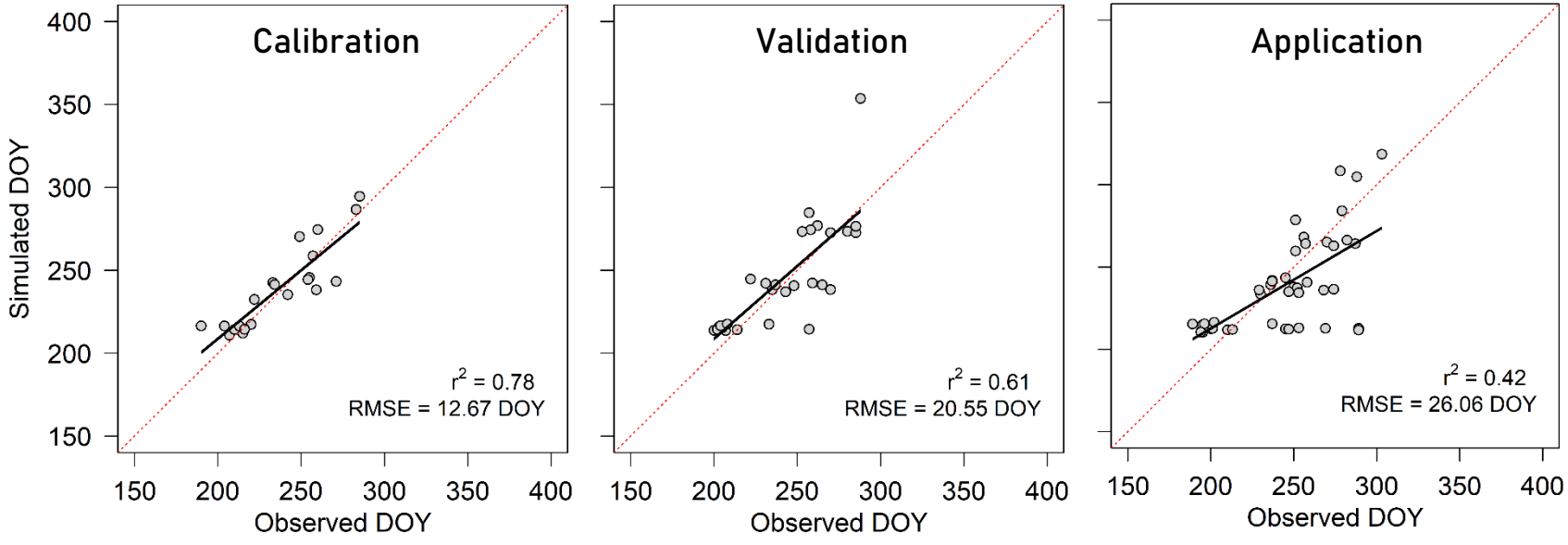


Example starting from DOY 1

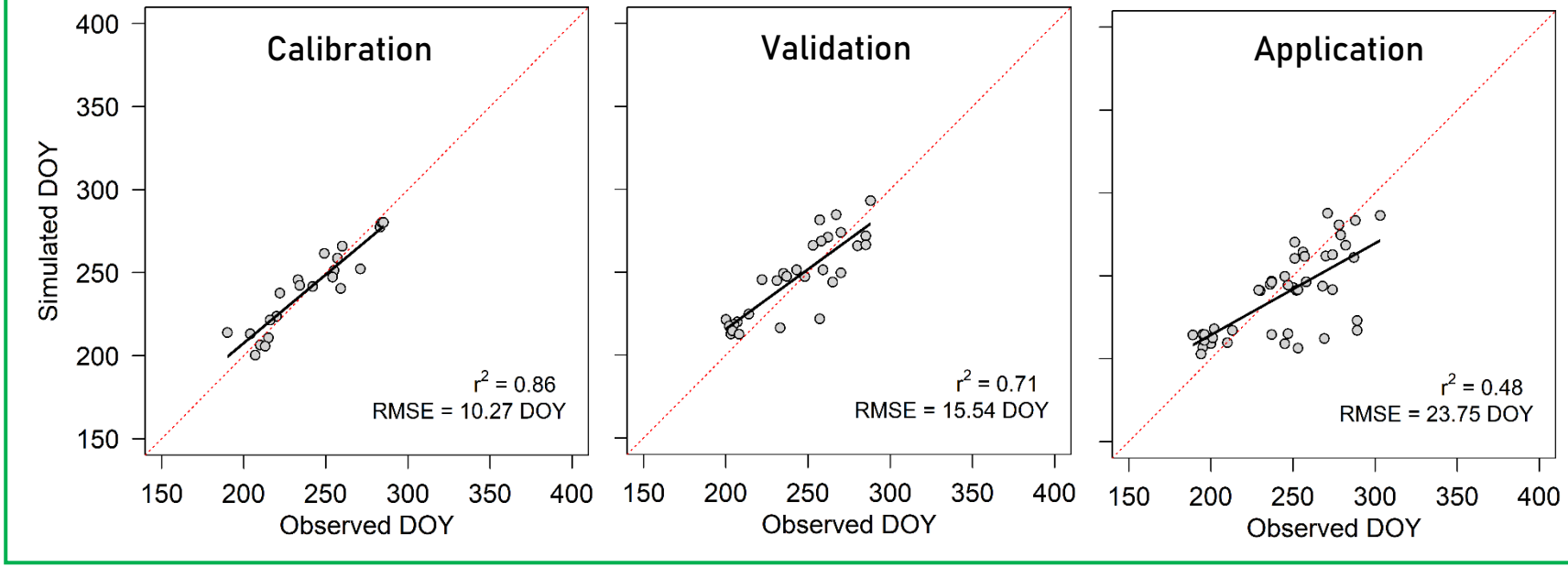


The model implemented with the photoperiod effect has a GDH rate equal to 0 around the summer solstice while it shows a faster GDH rate at the end of the season

NO Photoperiod



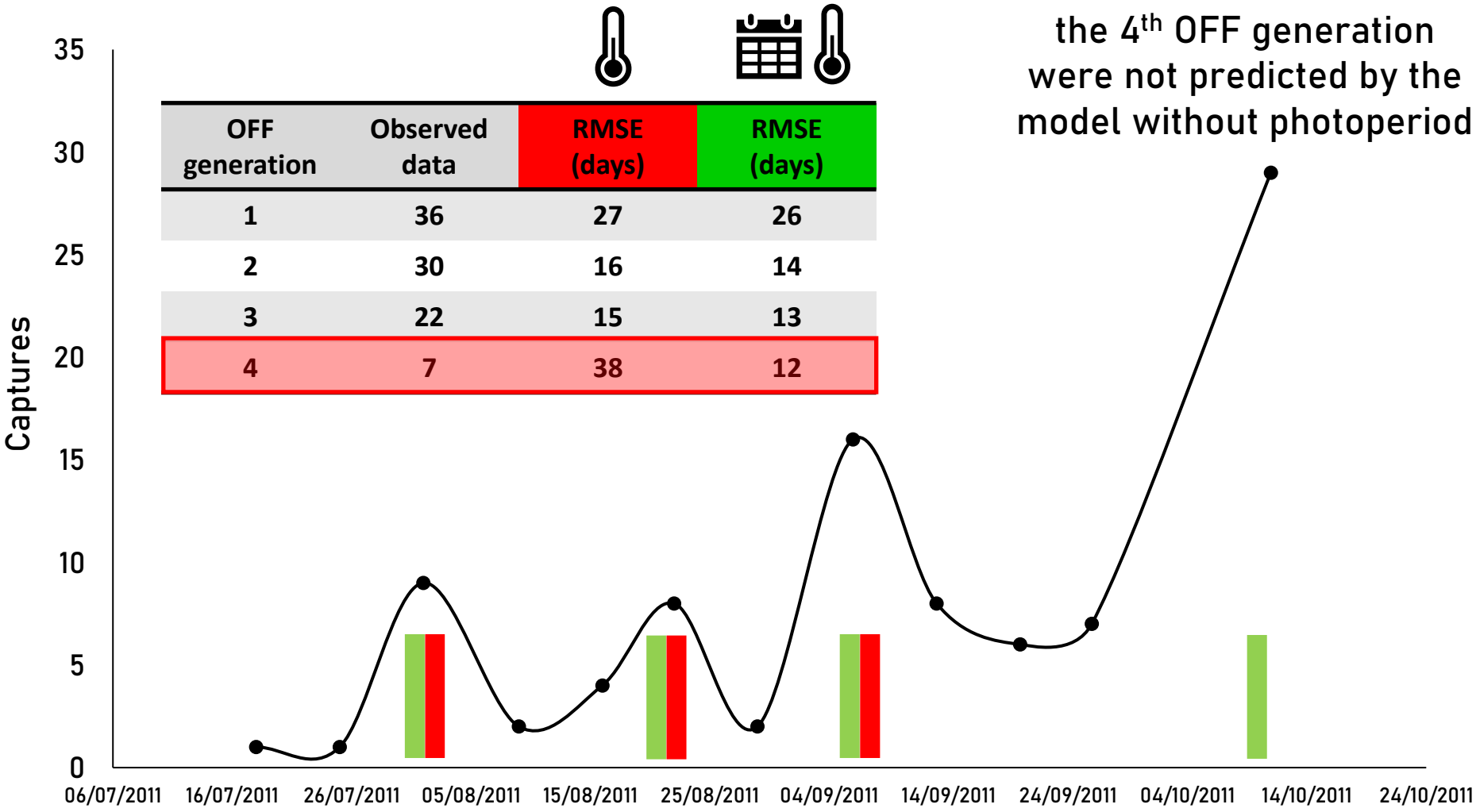
Photoperiod



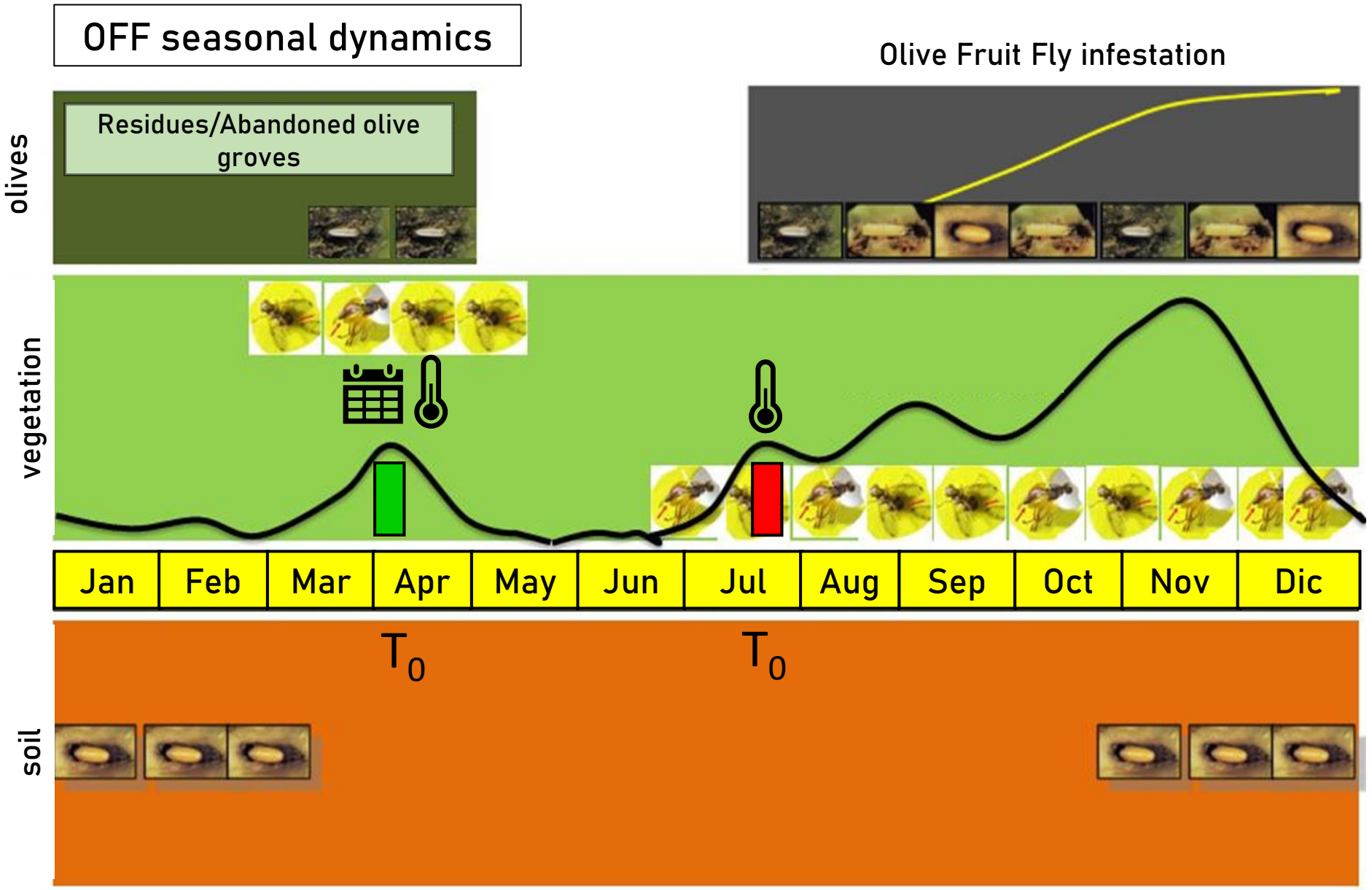
The model with photoperiod is able to predict all the last OFF generations

OFF generation	Observed data	RMSE (days)	RMSE (days)
1	36	27	26
2	30	16	14
3	22	15	13
4	7	38	12

Three out of seven data of the 4th OFF generation were not predicted by the model without photoperiod



OFF seasonal dynamics



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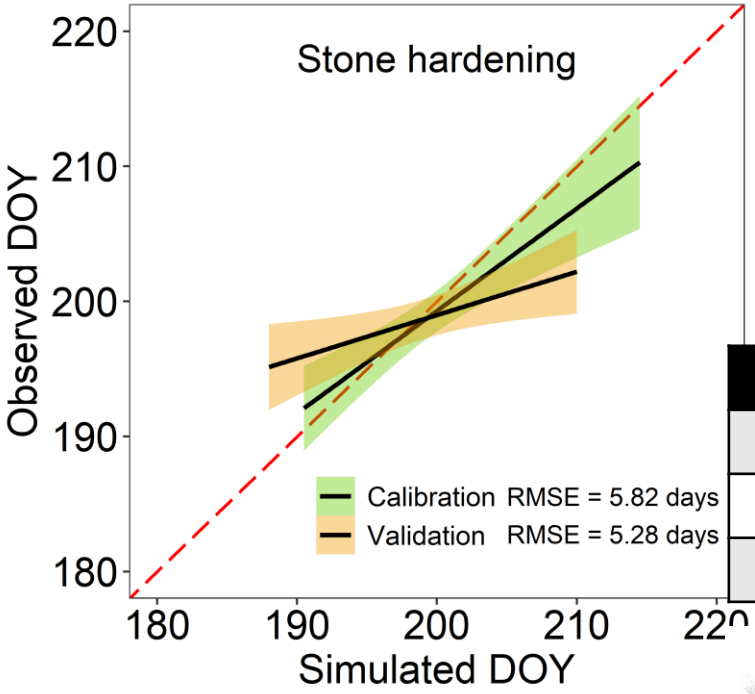
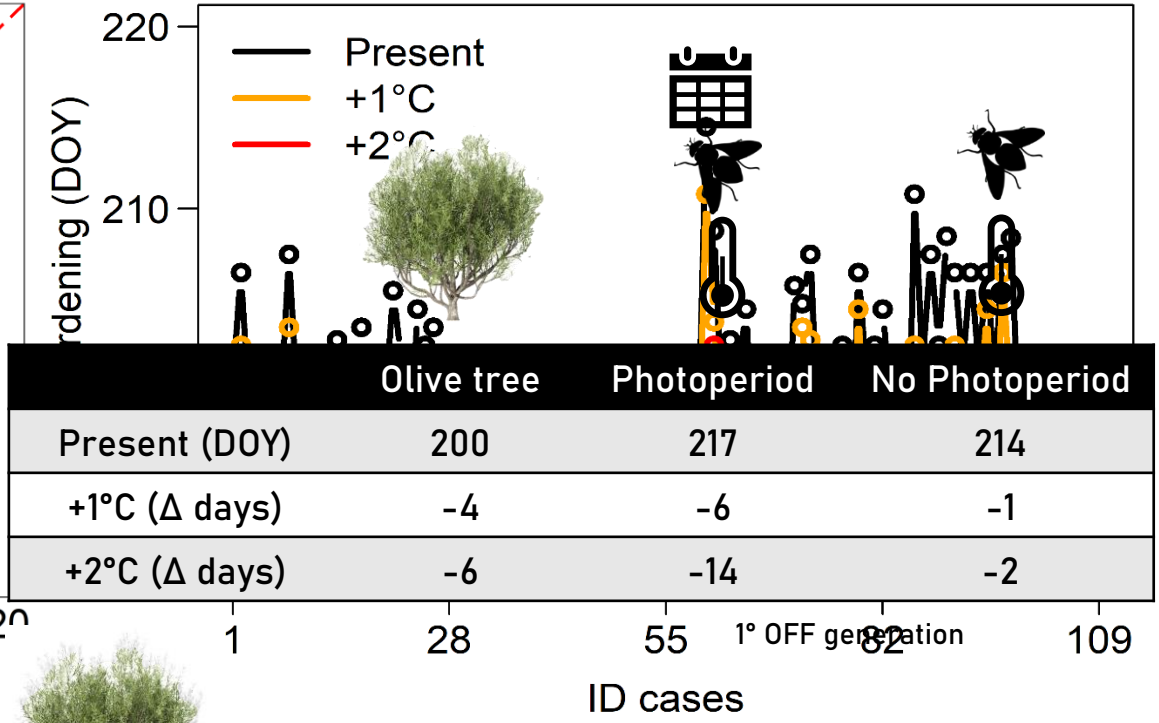
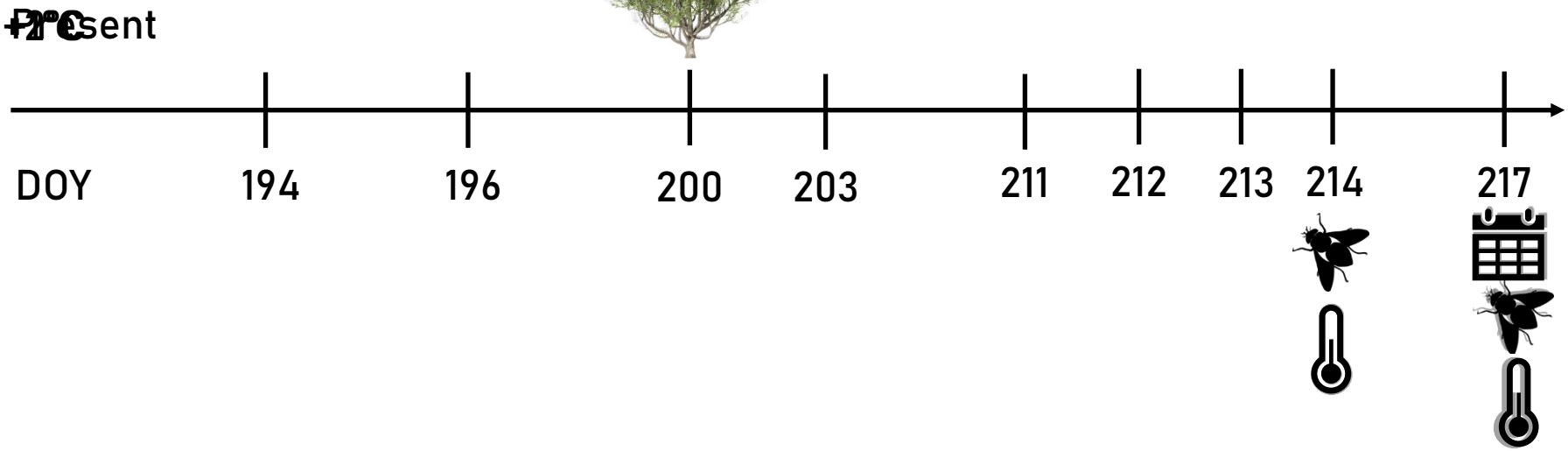


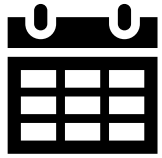


	Olive tree	Photoperiod	No Photoperiod
Present (DOY)	200	217	214
+1°C (Δ days)	-4	-6	-1
+2°C (Δ days)	-6	-14	-2



Overall, the model integrated with the photoperiod effect showed higher performances compared to the thermal-based model

The photoperiod effect allowed to account the pest sensitivity to the different day length. As the end of the season approaches, the model integrated with the photoperiod is able to predict all the last OFF generation



The OFF summer infestation is strictly correlated to the olive tree phenology (stone hardening). Both shifts, in plant phenology and pest dynamics, should be considered for assessing OFF impacts

This study represents a first step to finalize a decision support tool for improving the estimation of OFF seasonal dynamics and the pest management as well


Thank you for your attention

References

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Malheiro, R., Casal, S., Baptista, P., Pereira, J. A. (2015). A review of Bactrocera oleae (Rossi) impact in olive products: From the tree to the table. *Trends in Food Science & Technology*, *44*(2), 226-242.

Acknowledgements

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