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European grapevine moth and *Vitis vinifera* L. phenology in the Douro region: (a)synchrony and climate scenarios

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The European grapevine moth, *Lobesia botrana* (*Lepidoptera: Tortricidae*) is considered to be the main pest in the vineyards of the Douro Demarcated Region due to the economic losses it can cause. The phenology of both the grapevine and the pest has changed in the last decades due to the increase in temperature. Therefore, we assess the potential impact of climate change on the (a)synchrony of both species. The results show that the phenological stages (budburst, flowering and veraison) undergo an advancement throughout the region (at an ~1 km resolution) under a climate change scenario (Representative Concentration Pathways, RCP8.5) for the period 2051–2080, with respect to the historic period (1989–2015). For cv. *Touriga Nacional* and *Touriga Franca*, the budburst advances up to 14 days, whereas for flowering and veraison the advancements are up to 10 days (mainly at low elevations along the Douro River). For the phenology of *Lobesia botrana*, earliness was also verified in the three flights (consequently there may be more generations per year), covering the entire region. Furthermore, the third flight advances further compared to the others. For both varieties, the interaction between the third flight (beginning and peak) and the veraison date is the most relevant modification under the future climate change scenario (RCP8.5, 2051–2080). The aforementioned outcomes from the phenology models help to better understand the possible shifts of both trophic levels in the region under future climate, giving insights into their future interactions. To summarize, this study provides new knowledge at a regional scale and with a medium-long term projection (2051–2080). The projection mainly takes into account the RCP8.5 climate scenario.

Keywords: *Lobesia botrana*; grapevine; varieties; synchrony; climate scenario; Douro Demarcated Region; phenology models; simulations; spatial-temporal map.