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Pheno-anomalies of sub-alpine Vaccinium heaths in response to climatic variations

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A phenological survey on Vaccinium heaths was repeated thirty years after the first observations, in the Northern Apennines (Italy). In line with the sampling method adopted in the earliest phases of the study, the phenological monitoring was undertaken in the same sites, located above the tree line between 1600 and 1800 m asl.
The phenology of each plant species was recorded in order to single out the flowering patterns of the plant communities and their variations. In the years with average weather conditions, flowerings begin at the end of May, after the melting of the last spring snow, and finish in September, showing a bimodal pattern. The first blooming peak occurs in mid June and the second in mid July, in coincidence with the annual maximum temperatures. The first peak is due to the dwarf shrubs and to other species typical of the Vaccinium heaths, while the second is due to herbs with a wider ecology.
Among the years on study, we found that 1984 and 2012 diverged from the aforementioned pattern, in that flowerings showed strong pheno-anomalies and a lower phenological diversity. In 1984, a marked delay of the blooming start (1 month) and of the first peak (3 weeks) were observed, while the second peak and the flowering end were normal: the delay was due to a very cold and snowy spring in 1984. On the contrary, 2012 was characterized by the disappearance of the second flowering peak and by a dramatic advance of the blooming end: it is worth mentioning that summer 2012 was exceptionally dry, with temperatures above the average. In summary, while the very cold spring 1984 led simply to an initial shift and then to a compaction of the blooming rhythms, the xero-thermal stress of the summer 2012 caused a deep variation of the symphenological pattern and a fail of sexual reproduction in several late flowering species. Given that xero-thermal stress occurred often in the last decades, some sensible species, flowering in mid summer, could have undergone a reduction in seed production and could have therefore be disadvantaged in turn-over. This hypothesis is consistent with the results on vegetation changes: in fact, the comparison of the actual vegetation with the historical observations in the same sites, shows a reduction of herb (Hemicryptophytes) diversity and cover in time. It is noteworthy that many of the declining species flower in the driest and hottest weeks of the year.
In a climate-warming scenario, the low extension of these sub-alpine islands of the Apennines leads to a high extinction risk of the most sensible species. So, the monitoring of this vulnerable vegetation type seems necessary in order to detect the current trends and should be continued in the future.
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