

RESEARCH ARTICLE

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Flower and fruit development stages of bilberry plant (*Vaccinium myrtillus* L.) in Tropoja region

AGIM PEPKOLAJ^{1*}, NDOC FASLIA²^{1,2}Department of Plant Sciences and Technologies, Agricultural University of Tirana, Koder- Kamez, 1029, Tirana, Albania

North part of Albania is considered as a great asset of biodiversity not yet fully explored. Such richness is due to climatic factors, geographical position and pedological/ hydrological factors. As parts of its biodiversity are medicinal plants such as bilberry, (*Vaccinium myrtillus* L.) considered also as wild food plant.

The study focused on the determining the bilberry flower and fruit development stages in the six explored sites in Tropoja region. With the study, we could define the following stages of flower and fruit development such as early pink bud, early blooming, full bloom, early green fruit and late green fruit.

These observations on flower and fruit development stages are very important to evaluate the progress of the accumulation of anthocyanin in fruit, and how much the flowering and fructification period influence the level of anthocyanin as well as knowing the phenology of flower and fruit development. Also it will contribute to the better understanding of flowering period and fruit ripening in the explored sites

Keywords: medicinal and aromatic plants, biodiversity, bilberry, flowering stages

1. Introduction

North part of Albania is not yet fully explored in order to evaluate the biodiversity and especially wild food plants. This is due to difficulties to explore the region, terrain difficulties and budget needed to do such exploration. Tropoja region is one of the neglected regions for evaluation of wild plant diversity and especially for bilberry wild plant as a great profitable resource for farmers with the limited of other economic resources.

Bilberry plant is one of the most important wild berry plant called European blueberry (Rolf N et al 2010). Bilberry is a perennial plant and it could be found in different type of habitats and soils. It naturally grown in the forest (Ibraliu A et al 2014) but also it could be found also in the pasture areas above the forest limit, in different region of Albania. Conifer forest ecosystem and high altitude pastures are the main habitats for bilberry destitution.

Antioxidant activity is one of the most important properties of bilberry fruits due to its anthocyanin content of the fruits. Compare to cultivated

blueberry (*Vaccinium corymbosum*), Cowberry (*Vaccinium vitis-idea*) bilberry fruits contains the highest antioxidant concentration per 100 g of berry fruits (Halvorsen et al 2001).

The anthocyanin content is affected by geographical factors (Kalt et al 2001). Bilberry outputs are used as food and for health benefits due to its chemical compounds of the leaves and fruits (Bubueanu G et al 2015, Upton R 2001). It is proven that bilberry fruits may reduce the risk of type 2 diabetes in middle age men and it have anti-inflammatory effects (Jaakko M et al 2014, Aedin C 2015).

The purpose of the study is to evaluate the bilberry flowering and fruit development stages in order to know the stages of development and to take appropriate actions for bilberry conservation and take the full advantage of wild bilberry by the farmers in the near future not damaging the wild bilberry populations by using inappropriate collection practices. Phenology of bilberry plant is an important trait, which is not yet studied.

The study was carried out in the natural populations of bilberry plant in Tropoja region, Margegaj commune. In Tropoja region the elevation gradient for the studied areas ranges from 1673 m up to 2211 m for six studied sites:

1. Above Qerem (Two sites),
2. Maja e boronices (Two sites),
3. Doberdol (One site)
4. Sylbice (One site) as presented in the Fig no 1.

Figure 1. Bilberry studied sites



Source: Google earth

For the purpose study, we selected 6 sites in order to distinguish the flower and fruit development stages based on the elevation gradient and exposure to the sun as two main factors which indicate the flowering time. Flowering time it response to climate (Abraham J et al 2009) and the elevation gradient it affects the flowering time over the different altitudes. During the field visit, we selected the sites in order to get the results that will be representative for the area

The selected sites were done based on the Brown-Blanquet approach (WesthoffV et al 2014) and the selected site were intermediate to moderately high coverage of bilberry plants. There is positive correlation when the bilberry coverage is high also the berries produced per unit area is considered to be high (Miina et al 2009). On each site, we spot 10 m² of bilberry plant where we evaluated the flower and fruit development stages. The study took place in the period June to August 2015 in order to distinguish the flower and fruit development stages of bilberry plant.

2. Results and Discussion

The flowering phonology is related to evaluation gradient and the length of flowering (BlionisG et al 2001) also it has been proven the correlation between the changes in temperature related to the altitude. Increasing of the temperature will indicate faster snowmelt which may have negative effect on biological diversity in the high elevation (KivinenS et

al 2012). The flowering is coming earlier in springs due to the temperature increased and snowmelt.

The flowers are bell shaped and symmetric in single flower unit. Bilberry plant is self-pollinator where the pollen is transferred within the same flower (Albert et al 2008).

Table 1. Geographical coordinates and flower/fruit development stages

Sites	Latitude	Longitude	Elevation	Early flowering	Full bloom	Early green fruit	Fruit ripening	Number of days: Early flowering – Fruit ripening
1	423028	195974	1673 m	10-20 June	20-30 June	1-10 July	15-20 August	61 -71
2	422994	195969	1783 m	10-20 June	20-30 June	1-10 July	15-20 August	
3	422789	200148	1816 m	15-30 June	1-10 July	15-25 July	15-25 August	
4	422796	200128	1911 m	15-30 June	1-10 July	15-25 July	15-30 August	
6	422870	201058	1854 m	10-25 June	15-30 June	1-10 July	1-10 August	
5	423179	200530	2211 m	15-30 June	1-10 July	15-25 July	15-30 August	

Based on the date we get from the field survey we could distinguish six stages of flower and fruit development such as:

1. early pink bub,
2. early blooming,
3. full bloom,
4. petal fall,
5. early green fruit,
6. late green fruit

The number of days from early flowering to the fruit ripening is approximately 61-71 days. The days from early flowering to the fruit ripening are effected by

several factors such as site exposure to the sun, elevation gradient, plant association, late or early snow melt etc.

In the graph no 1 are presented the bilberry flower and fruit development stages based on the elevation gradient.

Graph 1. Flower/fruit development stages

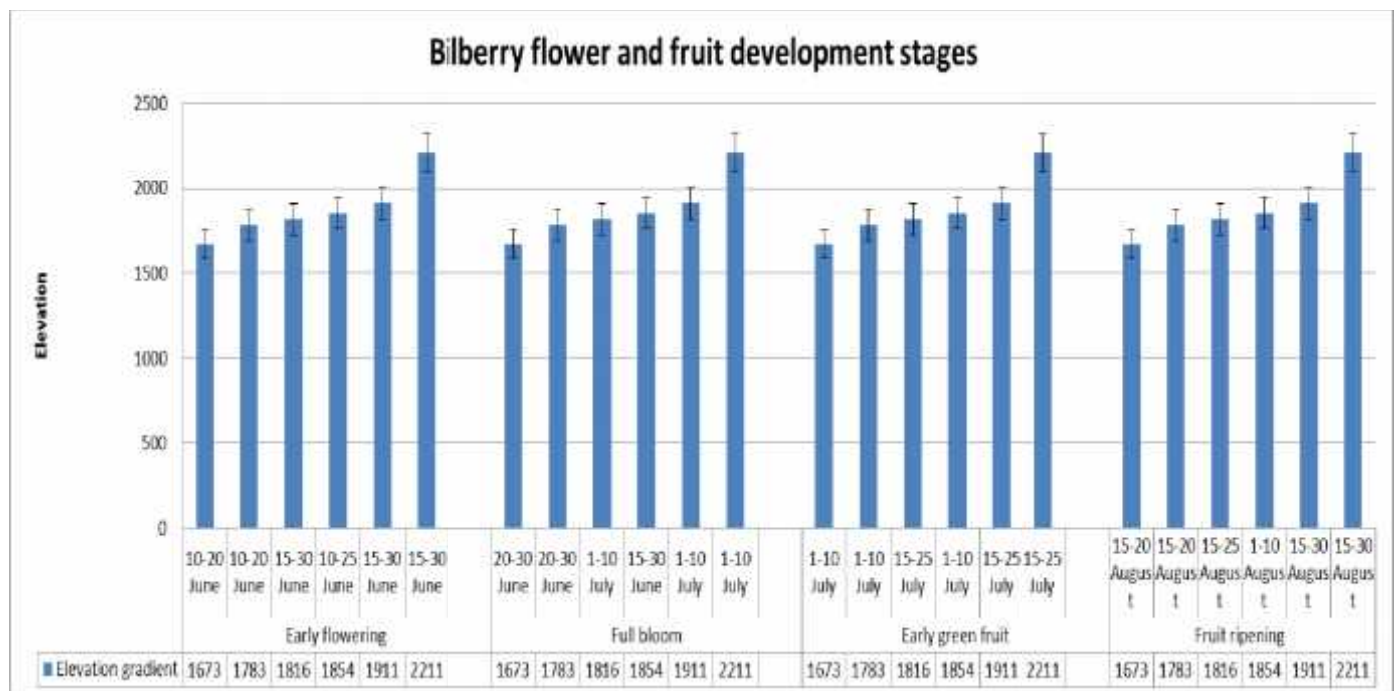


Figure 2: Flower and fruit development stages (based on blueberry growth stages)



3. Conclusions

- Among the studied sites, the differences in the site were minor related to the development stages.
- We found out that the contributors for flower pollinators of bilberry plant were bumblebees (*Bombus* spp.) and honey bees (*Apis mellifera*). The interest of bilberry plant flowers and pollinators is mutual interaction benefit while the pollinators increase their nectar uptake and for flower pollination as well (Rodriguez-Saona C et al 2011).
- Shifting of the winter may cause also flower development to be shifted and in the same time, the fruit ripening is also shifted.

4. References

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