Floral nectar production and nectar sugar composition of *Cotoneaster* species as determined by structural and environmental features*

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In addition to their decorative value, *Cotoneaster* species can provide an excellent bee pasture. Despite their small size, cotoneaster flowers can secrete large volumes of nectar with sugar concentrations sufficiently high to attract honey bees.

Plant taxa with larger and/or thicker nectary generally produce higher amounts of nectar than those with smaller/thinner nectariferous tissue (PETANIDOU et al. 2000, CHWIL and WERYSZKO-CHMIELEWSKA 2009). In *Cotoneaster* species positive correlation was found between nectar volume and nectary size, as well as stoma number per unit area (WERYSZKO-CHMIELEWSKA et al. 2004). The actual apicultural value of a species is determined by both genetic and environmental factors, such as climatic and soil relations. In order to determine which factors are decisive for nectar production in cotoneasters, we investigated the nectary structure, as well as the sugar value and composition of the nectar in 22 *Cotoneaster* species in the Botanical Garden in Vácrátót in three years (2007, 2010 and 2011).

For the histological investigation of the nectar glands, flowers were embedded in a hydroxyethyl methachrylate based resin, and medial longitudinal sections were stained with toluidine blue. The micrographs were analysed with Image Tool 3.0, measuring the area and thickness of the nectary. Nectar volume per flower was determined in the field with calibrated glass capillaries, following 24-hour isolation of the flowers by tulle nets, in order to exclude visiting insects. Sugar concentration was measured with a hand refractometer (ATAGO N-50E). Sugar value was calculated using the formula: nectar volume (µl) * nectar concentration (%)/100. Nectar sugar composition was determined with thin layer chromatography and densitometry.

The largest nectaries (280 000-360 000 μm^2) were found in *C. kitaibelii*, *C. halfhardii* and *C. simmonsii*, whereas the smallest glands (below 150 000 μm^2) were measured in *C. coliaceus*, *C. chailaricus* and *C. horizontalis* (Fig. 1.). In accordance with previous results, the species with large nectaries produced an average of 10-18 µl nectar per flower per day, whereas smaller nectaries were able to produce about 5 µl nectar. Besides the genetically coded structural features, nectar production was also influenced by environmental factors. Frost hardiness of the investigated cotoneasters ranges from -12°C to -28°C, therefore frost did not influence the development and nectar producing capacity of the plants at the study site in Vácrátót. Temperatures of 23-24°C proved to be optimal for nectar production in cotoneasters, while above 26°C nectar volumes decreased significantly. The nectar of all examined species was hexose-dominant, except for *C. dammeri*, whose nectar contained the disaccharide sucrose in addition to the hexoses glucose and fructose (Fig. 2.).

The apicultural value of a plant can be best characterised by the nectar sugar value, which includes both volume and concentration values of nectar. From the investigated species *C. kitaibelii* and *C. insulptus* produced nectar with sugar values above 3 mg/flower, thus being highly attractive for honey bees and valuable for apiculture. Species with sugar values below 1 mg/flower, such as *C. lanshangensis* and *C. lancasteri*, are less attractive for bees, and therefore can be recommended as ornamentals rather.

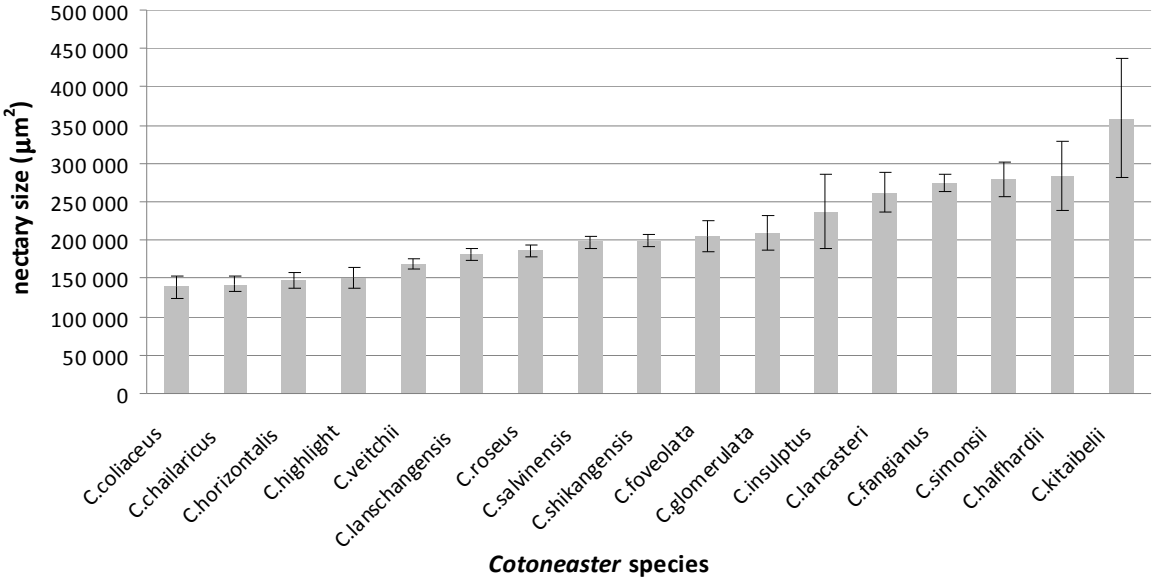

Figure 1. Nectary size of cotoneaster flowers in Vácrátót in 2010.
Data are represented as mean ± SD.

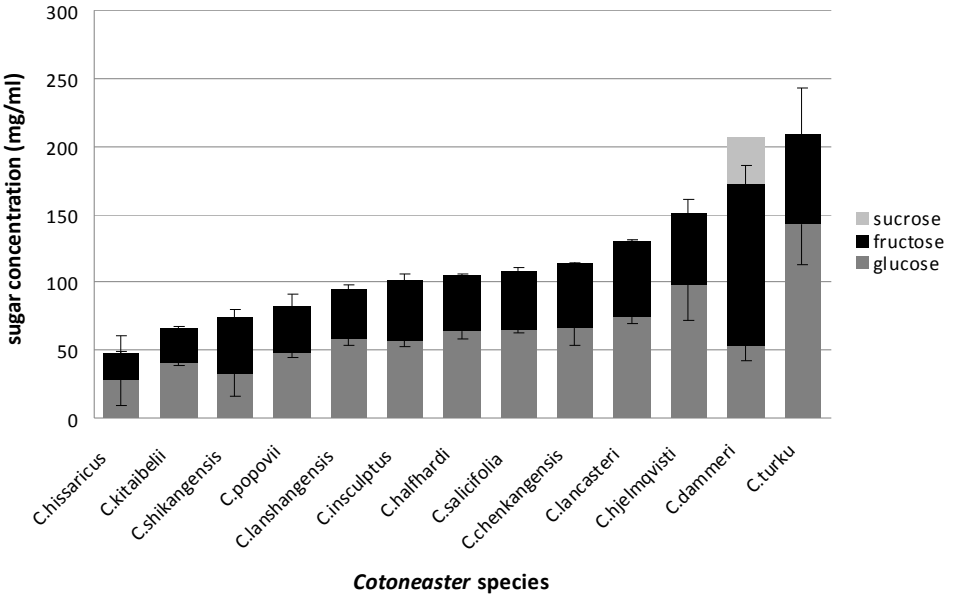

Figure 2. Nectar sugar composition of various *Cotoneaster* species in Vácrátót in 2011.
Data are represented as mean ± SD

References:

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