Phenotypic Properties of Clones of Wild Cranberry (*Oxycoccus Palustris* Pers.) and Their Stability

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Clones of wild cranberry (*Oxycoccus palustris* Pers.) with different leaf, shoot and fruit properties were identified in natural habitats and described in 1995-1999. A total of 99 clones were propagated and cultivated in the field collection of Kaunas Botanical Garden of Vytautas Magnus University. Cranberry list of descriptors was supplemented and updated. It was established that the most of properties maintained their stability under the same growth conditions of clones. The early and late phenotypes were distinguished according to the phenological phases, and clones with large fruit and high yields selected.

Key words: clone, cranberry, phenotype, property, *Oxycoccus palustris*.

Introduction

Wild cranberry (*Oxycoccus palustris* Pers.) is one of the most valuable wild berry plants in Lithuania. This species distinguishes itself for high intraspecific diversity. Researchers described cranberry clones growing in the same bog, however, differing mostly in berry size, colour and shape (Rozanova 1934, Lekavičius, Butkus 1972, Cherkasov 1975) or shoot length and diameter predetermined by the ecological and phytocenological conditions (Stackevičienė, Labokas 2000). It was noted what contents of organic acids in the berries of early clones is lower in comparison with berries of late clones (Krasnov, Orlov 1991). Through cultivation of vegetatively propagated clones it was observed that the stability of their morphological properties is different (Gronskis, Liepniece 1989).

H. Vilbaste made a description of different forms of *Oxycoccus palustris* (Ruus, Vilbaste 1968). In Estonia the large-fruited and high-yielding clones selected from clone collection, became the first Estonian cranberry cultivars (Paal 1992).

The aim of this work was to study morphological diversity of wild cranberry, identify the major properties characterising cranberry and determine stability of these properties through cultivation under the same conditions as well as select clones with stable and valuable properties.

Materials and methods

The clones of wild cranberry with different morphological properties of leaves, stems and berries were found and described in the strict state reserves (Kamanos, Čepkeliai and Žuvintas) as well as in the raised bogs of Ignalina, Jurbarkas and Švenčionys districts during the field trips in 1995-1999. The collected cranberry stems and shoots were used for the vegetative propagation. The plants were planted in the field collection of Kaunas Botanical Garden of Vytautas Magnus University. The upper soil layer of the field collection was acid peat (pH 5.1) of 50 cm in depth, taken from the raised bog. At present time there are 99 clones of wild cranberry in the field collection. 49 of them were fruited during 2000-2003. Characterisation and evaluation of cranberry clones were based on our previously developed list of descriptors for cranberry (Budriūnienė 1997) as well as other sources (Plekhanova, Zamorskaja 1993). For the morphological characterisation stems, leaves and berry properties per clone were used: leaf size, shape, shape of leaf apex and base, leaf margin bending, colour of a fully opened flower, colour of filament, length of peduncle, bract attachment position, berry size, shape, colour, coloration pattern, wax layer brightness, calyx remnant shape, sepal size, fruit-stalk attachment position and berry apex shape, berry cross-section shape, flesh colour,

berry taste. Other researchers (Lekavičius, Butkus 1972, Cherkasov 1975, Novy, Vorsa 1995) for clone characterisation mostly use berry size, shape and colour. There are some attempts made to find out the relations between cranberry ploidy level and leaf dimensions (Ravanko 1990).

Susceptibility to diseases, overall view of plant coverage, berry yield per area covered and phenological rhythmicity were also investigated.

Results and discussions

It was observed that in the natural habitats some of cranberry morphological properties vary seldom and within a very narrow range. Therefore, it is difficult to identify the differences. These properties are plant height, stem colour, diameter and pilosity and leaf colour and pilosity. The other group of properties includes the ones, which are difficult to estimate during the field trip, because they are related to plant seasonal development phases. For instance, it is difficult to estimate flower properties of clones growing in different localities as well as the colour of fully ripe berries and intensity of a waxy layer. Differences in these properties become much more evident while cultivating plants in the same place, under the same conditions. That was the reason for the corrections to the list of descriptors, published earlier (Budriūnienė 1997), with new descriptors or their values.

The research results confirmed the statement that clones distinguishing themselves in natural habitats are not ecotypes, morphological differences of which are caused only by the different growth conditions. In comparison to the natural bogs, plants grown in the field collection distinguished themselves for larger and thicker leaves, bigger berries, which is predetermined by better growth conditions in the field collection. Similar leaf and stem morphological changes after introduction into cultivation were observed by the other researchers (Cherkasov *et al*. 1981, Vakhrameyeva 1982). However, the other morphological properties – leaf shape, berry shape, colour and coloration pattern, etc. – remained unchanged. The relative difference between berry size of separate clones remains as well. Clones, which distinguished themselves for large berries among others in the wild, did so in the field collection. And those with small berries in the wild, remained with small or medium size berries in the field collection. Correlation coefficient r were calculated to indicate the relation between size of berries in the wild and in the collection. This coefficient was high and equal 0.79 (Figure 1). An average berry weight (1.20-1.32 g) in some clones approaches to that of the large-fruited cranberry cultivars.

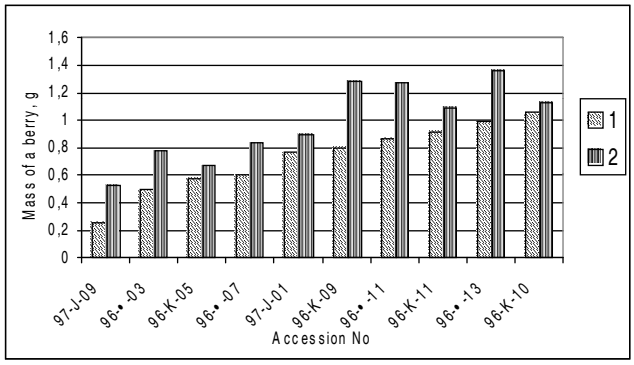

Figure 1. Mass of a berry: 1 - in natural habitat, 2 - in field collection in 2001.

A comparison was made between the morphological properties of plants in the wild and these in the field collection, it should be noted that the most stable remained both leaf and berry shapes. Differences in leaf size estimation could be caused by the occasional measurement of leaves on different shoot types – runners in the bog and uprights in the field collection. The former ones were mostly collected for the propagation, while in the field collection uprights were collected, because their properties could be compared more exactly.

Differences in the estimation of berry size, colour and coloration pattern mostly are related to the different degree of berry ripening during field trips. However, an overall comparison of all morphological properties allows concluding that most of the clones maintain their leaf and berry properties unchanged under the same growth conditions.

The differences between clones were revealed during the investigations, which had been not observed while collecting the material, e.g., differences in phenological rhythmicity. Early and late phenotypes were distinguished according to the duration of phenological phases (Figure 2 and Figure 3). The difference between the beginning of phenological phases in spring (between the beginning of shoot growth and budding) reached 3-9 days. Further the difference increased and amounted to 10-18 days at the beginning of flowering and mass flowering. The difference of the beginning of mass berry ripening time was 7-13 days in different clones. A lot of clones were at the intermediate position according to phenological rhythmicity.

Some of the clones in the field collection distinguished themselves not only for the large berries, but also for high yield. Those are promising for the breeding purposes.

A wide range of resistance to diseases was revealed cultivating many clones on a small area – from almost undamaged plants to actually dead ones.

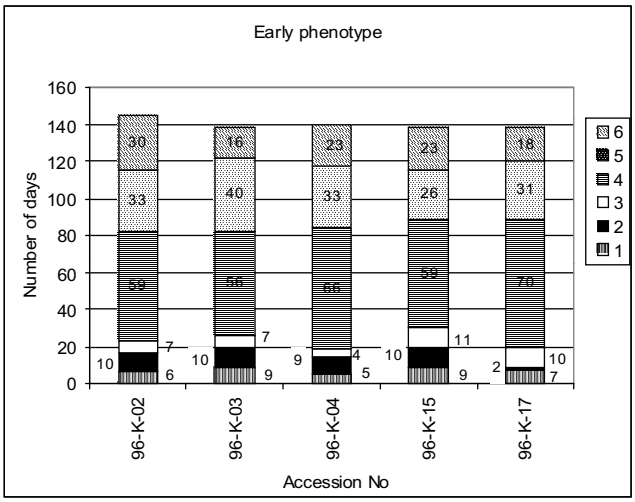

Figure 2. Phenology of the early cranberry phenotypes. Number of days: 1 - since the beginning of shoot growth until the beginning of budding,
2 - since the beginning of budding until the beginning of flowering,
3 - since the beginning of flowering until the beginning of mass flowering,
4 - since the beginning of mass flowering until the beginning of berry ripening,
5 - since the beginning of berry ripening until the beginning of mass berry ripening,
6 - since the beginning of mass berry ripening until the beginning of autumn colour

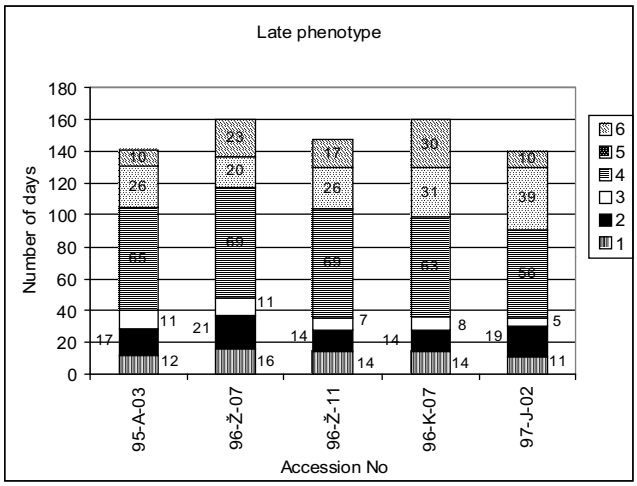

Figure 3. Phenology of the late cranberry phenotypes. Number of days: 1 – since the beginning of shoot growth until the beginning of budding,
2 – since the beginning of budding until the beginning of flowering,
3 - since the beginning of flowering until the beginning of mass flowering,
4 – since the beginning of mass flowering until the beginning of berry ripening,
5 – since the beginning of berry ripening until the beginning of mass berry ripening,
6 – since the beginning of mass berry ripening until the beginning of autumn colour

The analysis of chemical composition of the berries of different clones was conducted and it was confirmed that the amounts of some chemical substances are very different. The amount of saccharose changed from 0,06 to 0,49 %, the amount of vitamin C changed from 10,9 to 19,9 mg%, and that of anthocyanins changed from 12,82 to 109,77 mg/100g.

It was observed that the rot less damages clones with the darkest coloration of berries, than those with light pink berries. That could depend on the contents of anthocyanins, which is up to 10 times higher in the dark red berries than in the light pink ones.

Conclusions

1. Among cranberry descriptors the most important are leaf, flower and berry properties.

2. Cultivating the clones of wild cranberry in the field collection revealed their most stable properties – the shapes of leaf and berry.

3.The clones of wild cranberry differentiate much according to the time and duration of phenological phases. The early and late phenotypes have been selected.

4. The clones with large berries and high yields have been selected in the field collection of wild cranberry clones.

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ФЕНОТИПНЫЕ СВОЙСТВА КЛОНОВ КЛЮКВЫ БОЛОТНОЙ *(OXYCOCCUS PALUSTRIS* PERS.). И ИХ СТАБИЛЬНОСТЬ.

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Резюме

В течение экспедиций, проведенных с 1995 по 1999 годы в Государственных заповедниках и верховых болотах Литвы, были обнаружены, описаны и собраны натуральные клоны клюквы болотной, различающиеся морфологическими характеристиками листьев, стеблей и ягод. В процессе выращивания собранных образцов в коллекциях Каунасского ботанического сада, университета *Витаутас Магнус* дополнен список признаков, характеризующих морфологические признаки клюквы.

Установлено, что при выращивании клюквы в коллекции Ботанического сада в одинаковых условиях окружающей среды, основные показатели, характеризующие отобранные клоны (форма ягод, их цвет, форма листьев и др.) остались стабильными. Отмечена четкая разница между величиной ягод различных клонов (образцов) клюквы.

На основе фенoритмических данных выделены ранние и поздние фенотипы клюквы. Начало фенофаз у выделенных фенотипов различалось на 13 – 18 дней.

Отобраны клоны клюквы, выделяющиеся крупными ягодами и большой урожайностью, которые перспективны для дальнейшего исследования и селекционной работы.

Ключевые слова: клон, клюква, фенотип, признак, *Oxycoccus palustris*