*Bulletin of Botanical Gardens, **13**: 179–186, 2004*

# PHENOLOGICAL STUDIES OF SELECTED SPECIES OF THE GENUS *RIBES* L. AT ADAM MICKIEWICZ UNIVERSITY BOTANICAL GARDEN IN POZNAŃ

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## SUMMARY

This article presents the results of phenological observations conducted from 1999 to 2000 on twenty taxa belonging to genus *Ribes* L. Their seasonal rhythmicity is discussed with reference to Poznań weather conditions, and its year-to-year constancy is evaluated. The plants were analyzed with respect to their tolerance to low temperatures and water shortages, and an assesment was made of their suitability for urban and industrial conditions.

In 16 species flowering and leaf burst were synchronized with phenological seasons. None of the studied shrubs suffered any low temperature related damage. Most of the species were sensitive to drought. Only in four species: *R. glaciale, R. odoratum, R. sanguineum* and *R. tenue* were drought symptoms entirely absent. When seasonal rhythmicity, sensitivity to low temperatures and drought were considered jointly, the analysis demonstrated a generally low suitability of genus *Ribes* for planting in urban or industrial locations. Only *R. odoratum, R. sanguineum* i *R. tenue* exhibited an elevated tolerance to climatic conditions and may be recommended for street and park planting. The highest ornamental qualities among the studied species were found in *R. alpinum, R. americanum, R. aureum, R. mandshuricum, R. odoratum, R. sanguineum* and *R. tenue*.

## INTRODUCTION

The principal method of characterization of plant development throughout the year in botanical gardens and arboreta involves phenological studies (Łukasiewicz 1984). Long-term studies of native and introduced plants allow determining the extent of their biological acclimation and form the ground for their selection (Harmata 1995). They is also one way to demonstrate the tolerance of plant species to urban and industrial pollution (Łukasiewicz 1978).

At the Poznań Botanical Garden, the developmental dynamics of plants has been studied for over 50 years. In this paper I report the results of observations conducted in the years 1999 and 2000 on selected taxa from the genus *Ribes*. Their seasonal rhythmicity is presented against the background of Poznań weather conditions. The influence of selected climatic factors, particularly temperature and precipitation, on the occurrence of phenological phases is shown. I further evaluate the year-to-year constancy of seasonal rhythmicity, as well as the tolerance to low temperatures and drought, and the suitability of the studied species to urban and industrial plantings. Finally, ornamental qualities of the plants are discussed.

## PLANT MATERIAL

Genus *Ribes* includes about 150 species of shrubs, both unarmed (currants) as well as covered with spines and prickles to various degrees (gooseberries). They occur in the temperate and cool zones of the Northern, as well as the Southern Hemisphere (from the Andes to Patagonia; Bugała 2000), as shown in Fig. 1. They grow at low elevations and in the mountains, mostly in the forest understorey or at forest edges, in shrubby vegetation, often close to water courses. They have been cultivated and valued for a long time for their fruits. They grow well in sunny as well as shady locations. Their soil requirements are modest but many species need moist substrate for good growth (Krüssmann 1986, Seneta i Dolatowski 2000; Sokolov 1954).

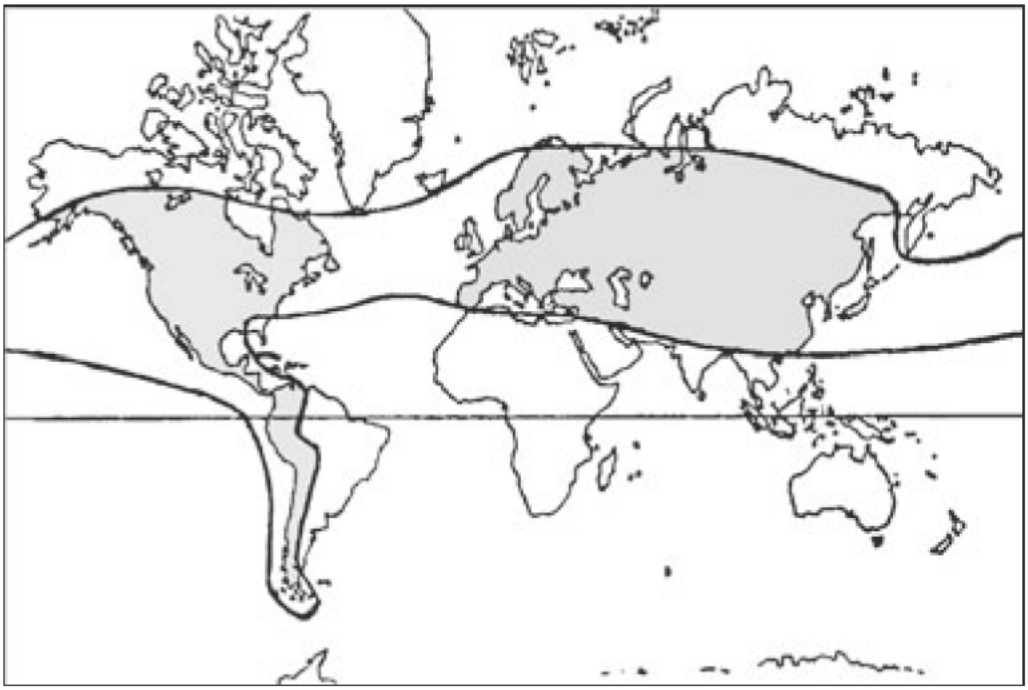


**Fig. 1.** Geographical distribution of the genus *Ribes* L. (Krüssmann 1986).

## STUDY LOCATION

Adam Mickiewicz University Botanical Garden is located in the western part of Poznań in Jeżyce municipality. The Garden's area is c. 22 hectars, most of which is brown soil underlaid by sandy clays. Ground water level is at 1 to 3 m depth in various parts of the Garden, depending on precipitation and temperatures (Łukasiewicz 1980). The climate of Poznań is intermediate between oceanic and continental. The mean monthly precipitation and temperatures based on Poznań-Ławica weather station data are shown in Gaussen and Walter *klimadiagramm* (Fig. 2).

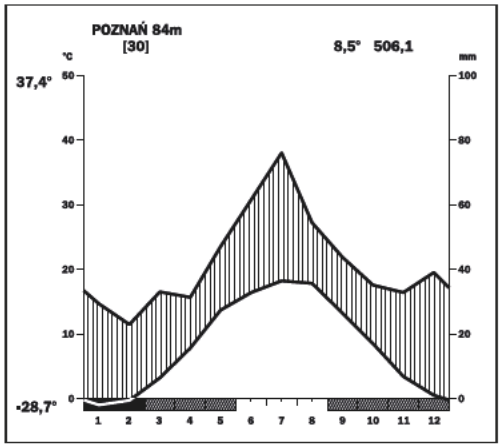



**Fig. 2.** The Gaussen-Walter *klimadiagramm* for Poznań-Ławica weather station.

## MATERIALS AND METHODS

The study included 20 species of diverse origins. Four species were European: *Ribes alpinum* L., *R. petraeum* Wulf (with some stations also in Nort West Africa), *R. silvestre* (Lam.) Martens & Koch., and *R. warszewiczii* Jancz. Two species: *R. nigrum* L. and *R. uva-crispa* L. were Eurasian with the latter occurring also in the Atlas Mountains of North Africa. Further eight species: *R. aciculare* Sm., *R. alpestre* Wall., *R. emodense* Rehd., *R. glaciale* Wall., *R. janczevskij* Pojark., *R. latifolium* Jancz., *R. mandshuricum* Kom. and *R. tenue* Jancz. were from Asia and the remain-

ing six: *R. americanum* Mill., *R. aureum* Pursh, *R. niveum* Lindl., *R. odoratum* H. L. Wendl., *R. oxyacanthoides* L. and *R. sanguineum* Pursh. from America. In the available literature range maps were found for only 13 out of the 20 studied species (Browicz 1976–1981; Hegi 1995; Sokolov 1954). Maps were combined with Gaussen-Walter *klimadiagramms* for the range areas of particular species (Fig. 3). Phenological observations were conducted using the Szennikov's method modified by Łukasiewicz (1984). Results were presented graphically as phenological spectra. They were plotted jointly with phenological seasons and Gaussen-Walter *klimadiagramms* for the two study years (Fig. 4). The plant species were analyzed with respect to their tolerance to summer drought and low winter temperatures using tolerance scales. The following scale of frost damage for non-evergreen species was adopted after Łukasiewicz (1994): 0 – no damage; 1 – darkened shoot vascular bundles but buds develop; 2 – damaged flower buds; 3 – damaged leaf buds; 4 – damaged apices of annual shoots; 5 – annual shoots damaged or only their bases alive; 6 – also two-year old and older shoots damaged; 7 – whole aboveground shoots (or portions above snow level) damaged but new shoots grow from shoot bases or roots; 8 – plants entirely dead, lack of regrowth; 9 – frost burn on trunks and boughs; 10 – trunks cracking.

The drought tolerance scale was based on Łukasiewicz (1989) as follows: 1 – leaf wilting 2 – partial leaf desiccation, 3 – complete desiccation of leaf blades, 4 – premature leaf shedding, 5 – formation of an additional crop of shoots and leaves in a given season, 6 – lack of flower buds, 7 – sparse flowering, 8 – abundant flowering, 9 – drying or falling of floral buds and flowers, 10 – fruits not setting, 11 – fruits not forming or forming poorly, 12 – fruiting sparse, 13 – fruiting abundant, 14 – premature fruit dropping, 15 – death of shoot apices or individual fine twigs, 16 – desiccation of some of the main shoots, 17 – complete desiccation of aboveground shoot system, 18 – production of replacement shoots from basal or underground parts of the plant in the following year, 19 – complete desiccation of the plant a) only of young or newly planted individuals, b) of older individuals, 20 – after-effect of drought on plant growth in the subsequent years. Ornamental qualities of the *Ribes* shrubs were evaluated on the basis of their overall habit, durability and attractiveness of the foliage, autumn leaf coloration, characteristics of flowers and fruits (Łukasiewicz 1995).

## RESULTS

Observations conducted in the years 1999 and 2000 produced the following results:

1. When plant developmental phases were analyzed with respect to corresponding phenological seasons, two groups of species emerged: a) Species whose development is synchronized with phenological phases, i.e. with flowering and spring leaf flush occurring each year in the same phenological season. In *R. aciculare, R. alpinum, R. glaciale, R. mandshuricum, R. oxyacanthoides, R. sanguineum, R. tenue* and *R. uva-crispa* the beginning of leaf expansion and flowering occurred in antespring. On the other hand, *R. alpestre, R. americanum, R. aureum, R. emodense, R. latifolium, R. nigrum, R. niveum, R. odoratum* initiated leaf flush in antespring and began to flower in early spring. b) Species not showing full synchrony with seasons. In *R. silvestre* and *R. warszewiczii* only the vegetative phase was tied to the same phenological season, with leaf burst occurring in antespring in both years. In *R. petraeum* only the generative phase occurred in the same phenological season (starting in early spring) in both years.

2. None of the studied shrubs showed any symptoms of low temperature damage. This was possibly due to mild winters in both years.

3. The assessment of drought tolerance showed that most species were sensitive to moisture deficiency (Table 1). Only in four taxa (*R. glaciale, R. odoratum, R. sanguineum and R. tenue*) there was no apparent drought damage.

4. Detailed analysis of developmental rhythmicity between 1957 and 2000 based on earlier studies and my own data revealed that genus *Ribes* is dominated by species which annually undergo a complete developmental cycle. Nevertheless, in some species the vegetative phase of autumnal color change was poorly expressed or did not occur altogether. In some years also the generative development appeared

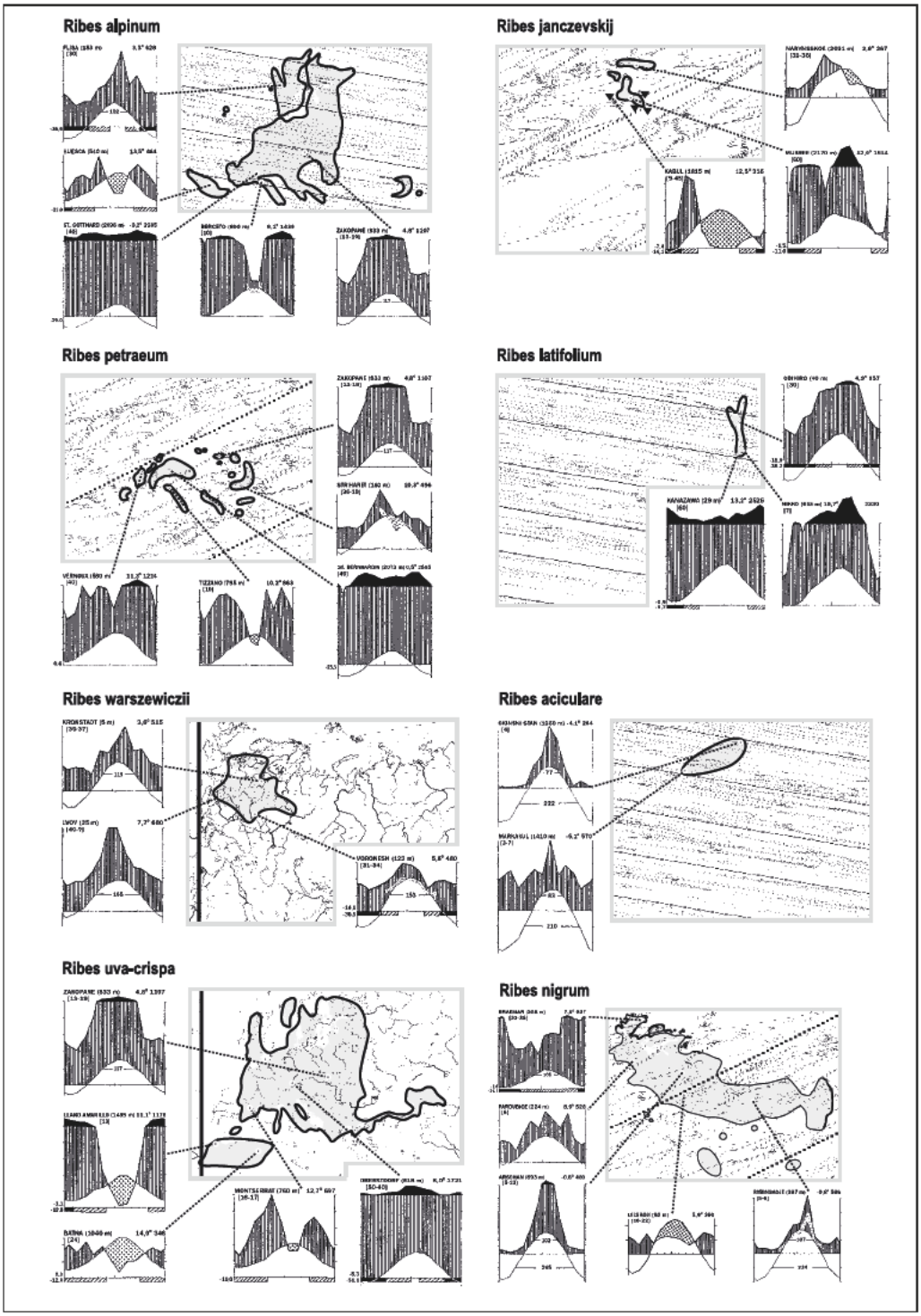
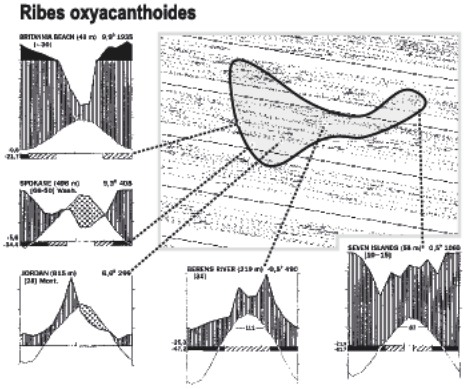
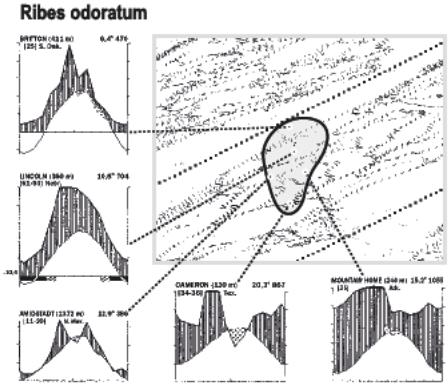
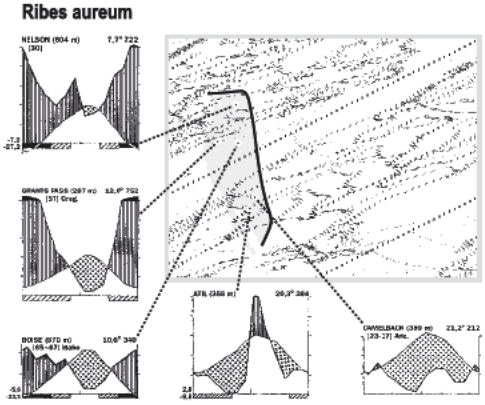
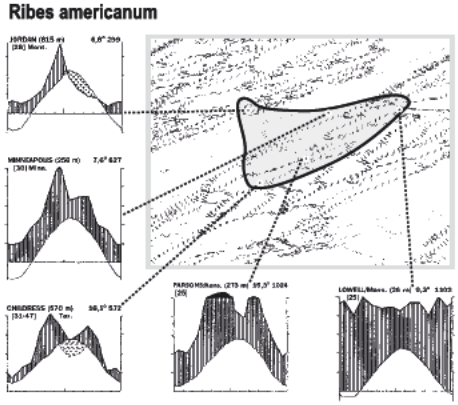



**Fig. 3.** Geographical distribution of species from genus *Ribes* L. and the *klimadiagramms* from their ranges (Browicz 1976–1981; Hegi 1995; Sokolov 1954; Walter 1967).



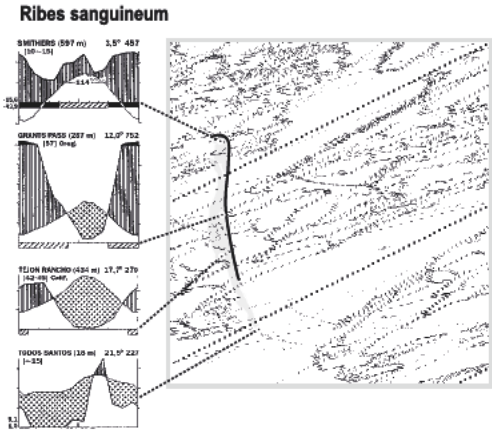
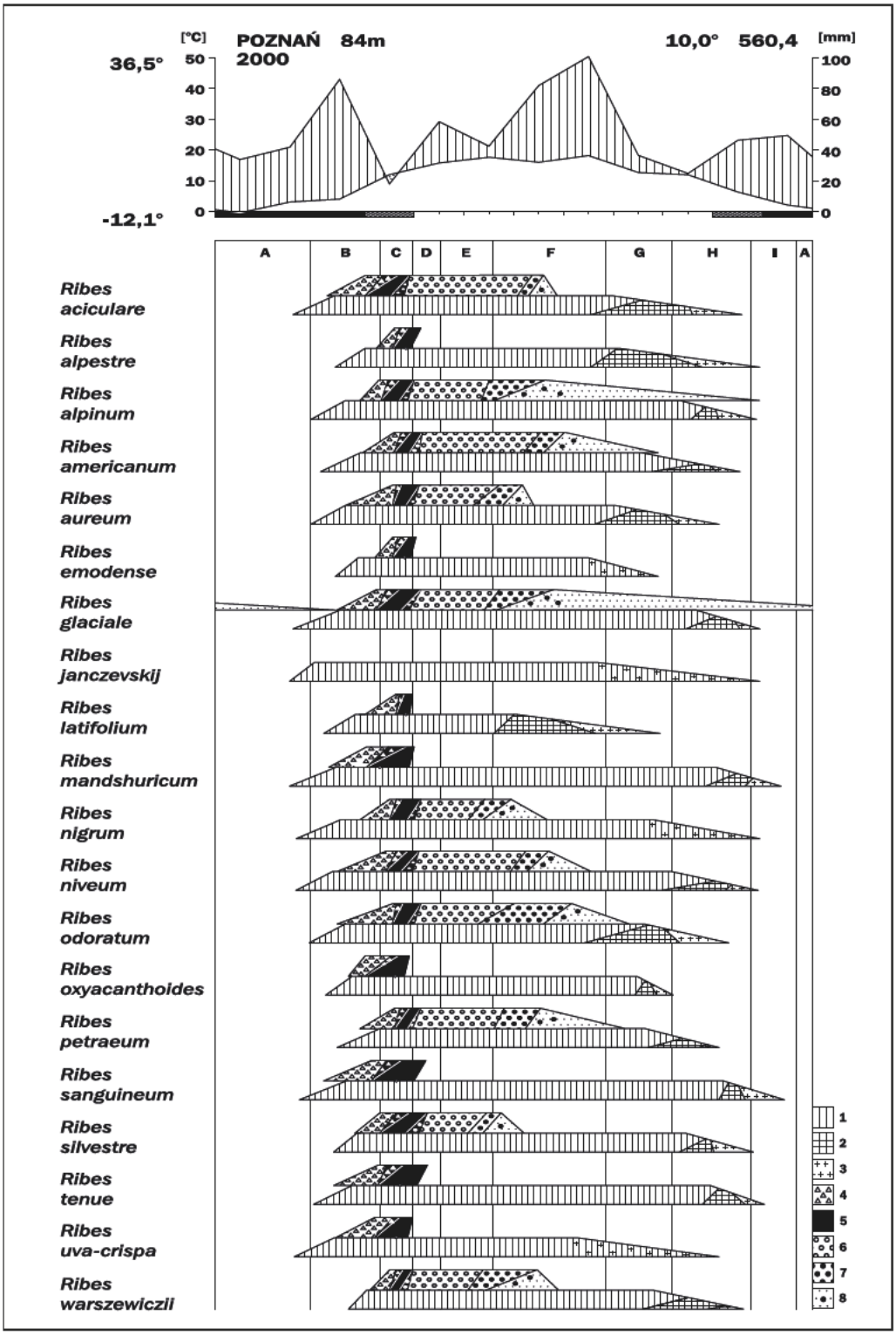




**Table 1.** Sensitive species to drought.

| Species | Year 1999 | Year 2000 |
|---|---|---|
| *R. aciculare* | 2, 4 (10%) | – |
| *R. alpestre* | 2, 4 (10%) | – |
| *R. alpinu* | 2, 4 (15%) | – |
| *R. americanum* | – | 9 (10%) |
| *R. aureum* | 2, 4 (20%) | 9 (10%) |
| *R. emodense* | 2, 3, 4 (30%) | 1 (40%); 9 (10%) |
| *R. janczevskij* | 2, 3, 4 (20%) | – |
| *R. latifolium* | 2, 4 (10%) | – |
| *R. mandshuricum* | 2, 4 (10%) | – |
| *R. nigrum* | 2, 3, 4 (30%) | 9 (10%) |
| *R. niveum* | 2, 4 (20%) | 9 (10%) |
| *R. oxyacanthoides* | 2, 3, 4 (15%) | – |
| *R. petraeum* | 2, 4 (10%) | 9 (10%) |
| *R. silvestre* | 2, 4 (5%) | – |
| *R. uva-crispa* | 2, 4 (20%) | 9 (10%) |
| *R. warszewiczii* | 2, 4 (5%) | – |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Ribes alpestre
Ribes alpinum
Ribes americanum
Ribes aureum
Ribes emodense
Ribes glaciale
Ribes janczevskij
Ribes latifolium
Ribes mandshuricum
Ribes nigrum
Ribes niveum
Ribes odoratum
Ribes oxyacanthoides
Ribes petraeum
Ribes sanguineum
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Ribes tenue
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to be disturbed, e.g. *R. janczevskii* failed to flower, *R. americanum, R. latifolium, R. sanguineum* did not set fruits, and *R. tenue* dropped immature fruits. Such irregularities might have been caused by conditions under cultivation differing somewhat from those in the natural ranges. Some of the species range into subtropical climatic zone. Majority of the taxa occur, however, in habitat conditions resambling those found in Poland. Moreover, disturbances of developmental phenology were found also in the four native *Ribes* species. These could likely be attributed to spring and summer drought episodes (many *Ribes* species require abundant soil moisture for good growth), as well as to pests and fungal diseases.

5. Taken together, data on the seasonal rhythmicity of the studied species, their sensitivity to low temperatures and drought indicate their low overall suitability for urban and industrial plantings. Only *R. odoratum, R. sanguineum* and *R. tenue* showed an elevated tolerance to climatic stresses and may be recommended for street and park planting.

6. Based on joint analysis of attractiveness of leafing, flowering and fruiting phases allowed selecting *R. alpinum, R. americanum, R. aureum, R. mandshuricum, R. odoratum, R. sanguineum* and *R. tenue* as species with the highest ornamental qualities.

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