

*Botany*

## **Growth and Development Peculiarities of Rare, Single and Highly Decorative Introduced Species of *Rhododendron* L. Genus in Climatic Conditions of the Batumi Botanical Garden**

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**Growth and development peculiarities of highly decorative, rare and single examples of *Rhododendron Delavayi* Franch., *Rhododendron japonicum* A. Gray., *Rhododendron brachycarpum* D. Don., *Rhododendron arborescens* (Pursh.) Torr., *Rhododendron macrosepalum* Maxim., of introduced species of *Rhododendron* L. Genus growing in the Batumi Botanical Garden are studied in humid subtropical climatic conditions. It is detected, that Vegetative development of the research objects takes 8-10 months. According to blooming periods, there are identified: species blooming in Spring and species blooming in Spring-Summer. Blooming duration is 31-45 days on average. Highly decorative rare species *Rhododendron Delavayi* is characterized with the longest blooming period; there are identified massively, average and poor blooming quality species. According to fruit bearing quality, there are identified: average and too poor fruit bearing species. In authors' opinion, poor fruit bearing quality is conditioned by the absence of some pollinating insects. Temperature falling down to 0°C in winter does no harm to the plants and has no negative effect on blooming too. Massively blooming, highly decorative, rare and single species available only in the collections of the Batumi Botanical Garden are very prosperous plants in terms of landscape architecture. © 2020 Bull. Georg. Natl. Acad. Sci.**

Highly decorative, rhododendron, introduced, unit, rare, vegetation, generation

The genus *Rhododendron* (*Rhododendron* L.) belongs to the family Ericaceae DC., extremely famous worldwide for its diversity conditioned by its ancient origins. It includes up to 1200 wild growing species and 8000 breeds. Over 20 introduced species and forms of rhododendron grow in humid subtropical climatic conditions of Ajara, in particular, the collection of the Batumi

Botanical Garden. The representatives of the genus *Rhododendron* L. – hardwood evergreen, semi-evergreen, deciduous species, breeds and forms are distinguished by their high decorative values, original flowers and habitus. They represent important cultures not only for landscape designing in open ground, but they are quite interesting in terms of room culture, interior decoration and also

in containers. The rhododendron species are also famous for high content of bioactive substances revealed in above ground organs of this or that species, having healing properties. Therefore, they are prosperous species worth of wide implementation in decorative gardening and also in terms of getting healing raw materials from them.

Generally, rhododendrons are characterized with spreading over wide areas and high plasticity. Abundance of the representatives of this genus in the Batumi Botanical Garden is conditioned by the above-mentioned fact, although bioecological peculiarities of some of them in local soil and climatic conditions haven't studied yet. Moreover, in the collections, there are only few units of some of the species with high decorative values and the attempts of their propagation with seeds and vegetative methods have been unsuccessful for decades. We tried to fix this flaw by studying biological rhythm of growth and development of introduced hardwood plants, having theoretical and practical importance as we count.

Evergreen and deciduous shrubs and trees with rare decorative values are selected as research species:

1. *Rhododendron delavayi* Franch., evergreen shrub or tree, 1-7 m tall. Its leaf is 7-15 cm long and 1-5 cm wide; upper surface is dark green in color and the lower surface – light green with 7-20 mm long stem. Extremely handsome scarlet-red 10-20 flowers are clustered and create upper-most shield-shaped catkins; fruit box is 8-10 mm long. Spread in Tibet, India, Thailand and Vietnam – in a mixture of broad-leaved or mixed forests, cliffy slopes, occurring 3200 m above the sea level. It has been introduced in the Batumi Botanical Garden since 1960.

2. *Rhododendron japonicum* A. Gray, deciduous shrub with too many branches, 1-2 m tall. Leaves are narrow, long lancet-shaped, 4-10 long and 2-4 cm wide with a stem 0.5-1.0 cm long. Orange-reddish 6-12 flowers with a dark orange spot on crown petals of 6-7 cm in diameter. The

flowers are clustered in catkins and they are mostly open before leaves appear. Fruit box is 10-12 mm long. Naturally spread in central and North Japan (Hokkaido). It has been introduced in the Batumi Botanical Garden since 1913.

3. *Rhododendron brachycarpum* D. Don straight-standing, evergreen tree, 2-4 m tall. Leaves are lancet-shaped, 8-20 cm long and 3-5 cm wide, upper surface of the leaf is light green, glossy, lower surface – grayish with gray fuzzes. Its stem is 1-3 cm long. White-pinkish 10-20 flowers are clustered in round catkins 10-12 cm in diameter. Fruit box is 8-10 mm long. Spread in Korea, Japan (Honshu, Hokkaido). It has been introduced in the Batumi Botanical Garden since 1960.

4. *Rhododendron arborescens* (Pursh) Torr.-deciduous, straight-standing shrub, 2-3 m tall. Leaves are narrow, upside-down egg-shaped, oblong and lancet-shaped, 4-8 cm long and 1.5-3 cm wide, upper surface of the leaf is bright green, lower surface – pale green with a stem is 5-7 cm long. White-pinkish 3-6 flowers are clustered in catkins, too aromatic. Fruit box is 11-12 mm long. Naturally grow in North America. It has been introduced in the Batumi Botanical Garden since 1974.

5. *Rhododendron macrosepalum* Maxim.; deciduous, rarely evergreen shrub, 1-3 m tall. Leaves are narrow, lancet-shaped or egg-shaped-elliptical, 2-5 cm long, upper surface of the leaf is too fuzzy, turning reddish in Autumn and is extremely efficient in this period. Pinkish-purple up to 2-10 flowers are clustered in aromatic catkins. Fruit box is 9-10 mm long. They are spread in Japan (Honshu and South part of Kyushu). It has been introduced in the Batumi Botanical Garden since 1913.

**Materials and Methods.** The peculiarities of growth and vegetation, flower and fruit development of the genus rhododendron (*Rhododendron* L.) were studied in accordance with phenological observations Beideman; Serebryakov method was applied; a Guidebook of plant pheno-

logical phases by Yelagin and Lobanov; biometric indices have been determined according to Tsitsvidze's "Dendrology"; Kolesnikov's "Decorative Dendrology" and "Decorative Dendrology" [1-7].

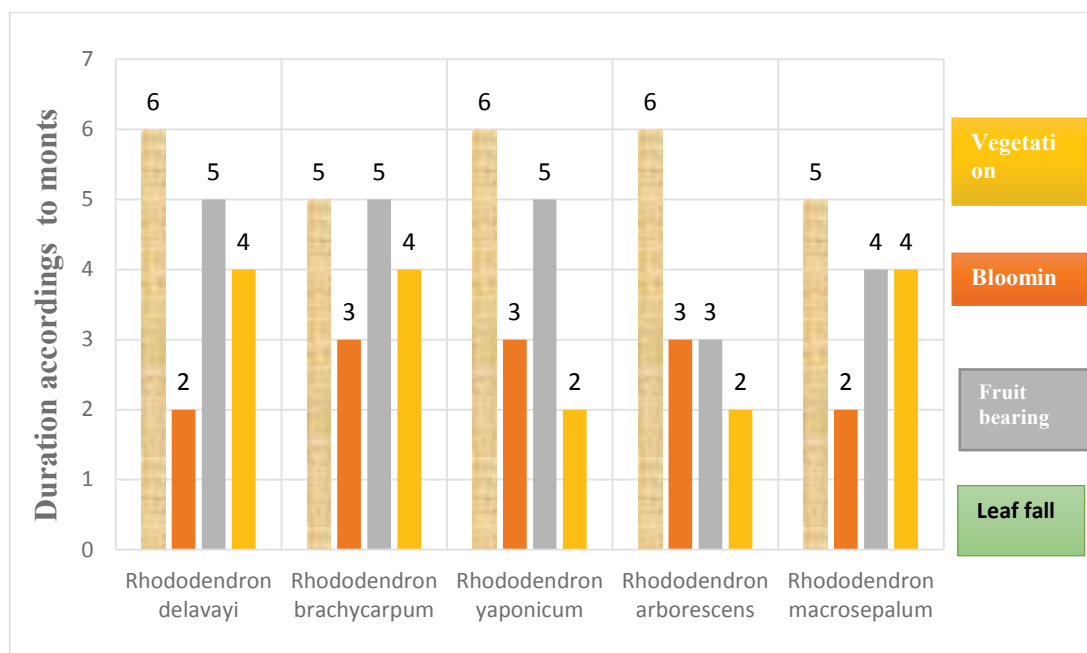
Phenological observations were carried out in 2016-2018. Its outcomes are represented in this paper.

**Results and discussion.** We carried out the observation on the following phenol-phases: 1) plant awakening – vegetation; 2) shoot development, leaf formation, the end of growth; 3) the beginning and the end of blooming; 4) fruit formation, ripening, the end of fruit bearing; 5) leaf color change; 6) the beginning and the end of leaf fall. Phenointervals were detected.

*Rhododendron delavayi* – vegetative buds (buttons) start to open in the first decade of March. Apical growth of shoots occurs from the second decade of March and lasts including the first decade

appear in the end of March and beginning of April, in May it is wrapped in massive young leaves. The Color of old leaves start to change in April. Leaf fall begins in the end of April or beginning of May and lasts till the end of August. Flower buds begin to open in the end of the first decade of March and in the end of March it is in massive blossom till the third decade of April. Blooming quality is mostly massive, blooming duration is 40-45 days on average. Fruit ripening starts from the second half of June and ends in the second decade of December. Seed scattering begins in December-January and continues in February too (Fig.).

*Rhododendron brachycarpum* – Vegetative buds tend to open in the end of March and the beginning of April. Apical growth of shoots begins from the second decade of April and lasts till the end of July, sometimes till the end of August too with two-week break in June. Average annual growth of the shoot is 15-23 cm. Leaves appear from the first half of April. In May it is fully



**Fig.** Vegetative and Generative development spectrum of research species of *Rhododendron*.

of August with a short break in June. Average annual growth of the shoot is 10-15 cm. Young, fresh leaves

wrapped in young leaves. The Color of old leaves start to change in the end of May or beginning of

June and lasts till the third decade of August. Flower buds begin to open in the second decade of April. Blooming starts from the end of April reaching massive blooming in the first decade of May and ends in the beginning of June. Blooming duration is 35-40 days on average. Blooming quality is poor. Its fruit formation and ripening is rare. In 2016, it started to develop small amount of fruit in some parts, fruit bearing was too poor. Fruit developing begins in the third decade of June, growing and ripening periods occur from the first decade of June and end in the end of October. Seed scattering starts in the beginning of November and end in the end of November (Fig.).

*Rhododendron japonicum* – the opening of vegetative buds mostly starts from the second decade of March. Apical growth of shoots begins from the second-third decade of March and lasts till the end of July, or the first decade of August. Leaves appear from the end of February and in the end of June, the plant is fully in leaves. Leaf colors start to change from the first decade of September and end in the first decade of October. Annual growth of the shoot is 11-13 cm. Generative buds tend to open in the end of the second decade of March. Flowering starts in the end of March and lasts till the end of April or beginning of May. Its massive blooming occurs in the middle of April. Blooming duration is 32-34 days on average. It has massive and attractive blooming. Fruit ripening begins from June and ends in September-October. Seed scattering period continues till October-November. Fruit bearing quality is weaker compared to blooming quality (Fig.).

*Rhododendron arborescens* – Vegetative buds start to open in the end of March. Leaves appear in the end of March. Shoot growth begins in the beginning of April and lasts till the end of August with two-week break in June. Annual growth of the shoot is 9-17 cm. Leaf colors start to change in the beginning of September and lasts till the end of October. Leaf fall starts in the end of September and continues till the end of October. Flower buds

start to open from the third decade of May. Massive blooming occurs in the middle of June. Blooming period ends in the beginning of July. Blooming duration is 30 days on average. Its blooming quality is average. Fruit bearing occurs not always. During the years of our observation, fruit developing, ripening and scattering occurred only in 2016. Fruit ripening starts from July and ends in the first decade of October. Seed scattering begins from the end of October till the middle of November (Fig.).

*Rhododendron macrosepalum* – Vegetative buds start to open from the third decade of March. Leaves appear from the third decade of March. In the last decade of June, it is massively in fully grown leaves, characterized with sticky and fussy leaves. Shoot growth starts in the end of March and ends in the first decade of July. With two-week break in May. Annual growth of the shoot is 9-14 cm. Leaf colors start to change from the third decade of August and lasts till the end of September – the beginning of October. Leaf fall starts in the beginning of October and ends in the end of October. Flower buds open in the third decade of April. Blooming starts in the first decade of April and lasts till the first decade of June. Sticky glands are typical for flowers. Blooming duration is 31 days on average. Blooming quality is average. Fruit ripening begins in the beginning of July and ends in the second decade of October. Seed scattering starts in the end of October and ends in November. Fruit bearing quality is average (Fig.).

In last 5 years, in Ajara Black Sea littoral and in particular, Batumi Botanical Garden, there was a bit colder winter for these zones in 2016 and ongoing 2020, when absolute minimum temperature fell down to  $-1.9^{\circ}\text{C}$  in the second decade of January, 2016 and  $-4.7^{\circ}\text{C}$  in the second decade of February, 2020, in some areas of the garden territory there was even  $-6^{\circ}\text{C}$ , but having no negative effect on vegetation and blooming of rhododendrons.

## Conclusion

After studying growth and development phases of highly decorative, rare and single examples of introduced species of *Rhododendron* genus *Rhododendron* L.; *Rhododendron delavayi* Franch., *Rhododendron japonicum* A. Gray., *Rhododendron brachycarpum* D. Don., *Rhododendron arborescens* (Pursh). Torr., *Rhododendron macrosepalum* Maxim., growing in humid subtropical climatic conditions of the Batumi Botanical Garden, we can conclude, that: 1) Vegetative development of research objects takes 8-10 months; 2) Growing process mainly begins from March and finishes in August after one or two-week break in June-July; 3) *Rhododendron macrosepalum* is characterized with the shortest period of sprout growing; 4) According to blooming periods, there are identified: a) species blooming in Spring: *Rhododendron delavayi*; *Rhododendron japonicum*; b) species blooming in Spring-Summer: *Rhododendron brachycarpum*, *Rhod. macrosepalum*, *Rhododendron arborescens*; 5) Blooming duration is 31-45 days on average. Highly decorative rare species *Rhododendron delavayi* is characterized with the longest blooming period; 6) *Rhododendron delavayi*, *Rhododendron japonicum* are distinguished by massive blooming; *Rhod. macrosepalum*, *Rhododendron arborescens* have average blooming quality

and *Rhododendron brachycarpum* is characterized with poor blooming; 7) Fruit ripening of research objects occurs mostly in September-October-November, seed scattering starts in November-December; *Rhododendron delavayi* is an exception as its fruit ends to ripen up in December and seed scattering continues in January-February-March; 8) Among research species, *Rhododendron delavayi*, *Rhod. Macrosepalum* have average quality of fruit bearing and *Rhododendron japonicum*. *Rhododendron arborescens*; *Rhododendron brachycarpum* are characterized as too poor; 9) Leaf fall of the following evergreen research species: *Rhododendron delavayi*, *Rhododendron brachycarpum* occurs in Summer and mostly ends in the end of August, while deciduous species – *Rhododendron japonicum*, *Rhododendron arborescens*, *Rhod. Macrosepalum* start to change color in the end of Summer and leaves fall mainly in September-October, even November; 10) It is noteworthy, that temperature falling down to 0°C does no harm to the plants and has no negative effect on blooming too; 11) We think poor fruit bearing quality of research species is conditioned by the absence of pollinating insects.

Massively blooming, highly decorative, rare and single species available only in the collections of the Batumi Botanical Garden are very prosperous plants in terms of landscape architecture.

## ბოტანიკა

# *Rhododendron* L. გვარის იშვიათი, ერთეული, მალაღდეკორატიული ინტროდუცირებული სახეობების ზრდა-განვითარების თავისებურებები ბათუმის ბოტანიკური ბაღის პირობებში

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\*\*ბათუმის შოთა რუსთაველის სახელმწიფო უნივერსიტეტი, ფიტოპათოლოგიისა და ბიომრავალფეროვნების ინსტიტუტი, ბათუმი, საქართველო

§აკადემიის წევრი, საქართველოს მეცნიერებათა ეროვნული აკადემია, აკადემიკოსი, ბათუმის შოთა რუსთაველის სახელმწიფო უნივერსიტეტი, ბათუმი, საქართველო

შესწავლილია ბათუმის ბოტანიკურ ბაღში მოზარდი როდოდენდრონის *Rhododendron* L. გვარის ინტროდუცირებული სახეობების: *Rhododendron delavayi* Franch., *Rhododendron japonicum* A. Gray., *Rhododendron brachycarpum* D. Don., *Rhododendron arborescens* (Pursh), Torr., *Rhododendron macrosepalum* Maxim., მალაღდეკორატიული, იშვიათი და ერთეული ეგზემპლარების ტენიანი სუბტროპიკული კლიმატის პირობებში ზრდისა და განვითარების თავისებურებანი. დადგინდა იქნა, რომ საკვლევი სახეობების ვეგეტატიური განვითარება 8-10 თვეს მოიცავს; ყვავილობის ვადების მიხედვით გამოიყოფა: ა) გაზაფხულზე მოყვავილე სახეობები: *Rhododendron delavayi*; *Rhododendron japonicum*; ბ) გაზაფხულ-ზაფხულში მოყვავილე სახეობები: *Rhododendron brachycarpum*, *Rhod. macrosepalum*, *Rhododendron arborescens*; ყვავილობის ხანგრძლივობა საშუალოდ 31-45 დღეს შეადგენს. ყველაზე ხანგრძლივი ყვავილობა ახასიათებს მალაღდეკორატიულობით გამორჩეულ იშვიათ სახეობას: *Rhododendron delavayi*. გამოყოფილ იქნა მასიურად მოყვავილე: *Rhododendron delavayi*, *Rhododendron japonicum*, საშუალოდ მოყვავილე: *Rhod. macrosepalum*, *Rhododendron arborescens* და სუსტად – *Rhododendron brachycarpum* სახეობები. ნაყოფმსხმოიარობის ხარისხის მიხედვით გამოყოფილ იქნა: საშუალო ხარისხის *Rhododendron delavayi*, *Rhod. Macrosepalum*; ძლიერ სუსტი ხარისხის: *Rhododendron japonicum*, *Rhododendron arborescens*; *Rhododendron brachycarpum*, სახეობები. ავტორთა აზრით, ნაყოფმსხმოიარობის სუსტი ხარისხი განპირობებული უნდა იყოს რომელიმე დამამტვერიანებელი მწერის არარსებობით. ზამთარში ტემპერატურის 0°C-ს ქვემოთ ჩამოსვლა მცენარეებს ზიანს არ აყენებს და არც ყვავილობის პროცესს აფერხებს. მასიურად მოყვავილე, მალაღდეკორატიული, მხოლოდ ბათუმის ბოტანიკური ბაღის კოლექციაში არსებული იშვიათი და ერთეული სახეობები, წარმოადგენენ მეტად პერსპექტიულ მცენარეებს ლანდშაფტური არქიტექტურისთვის.

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