AGRISCIENCE AND TECHNOLOGY
Armenian National Agrarian University
ԱԳՐՈԳԻՏՈՒԹՅՈՒՆ ԵՎ ՏԵԽՆՈԼՈԳԻԱ АГРОНАУКА И ТЕХНОЛОГИЯ
International Scientific Journal
ISSN 2579-2822

UDC 581.1:581.4
doi: 10.52276/25792822-2025.2-132

Rubus Vulgaris Weihe & Nees and *Rubus Idaeus L.* in the Wild and in Agroecosystems of Lori Region

Zaruhy Vardanyan, Yugho Mirzoyan
Vanadzor State University
zaruhy.vartanyan@mail.ru, yughomirzoyan6@gmail.com

ARTICLE INFO

Keywords:
leaves,
phenophase,
phenological observations,
root pressure,
vegetation

Conflict of Interest
The authors declare no conflict of interest concerning the research, authorship, and/or publication of this article.

ABSTRACT

Rubus vulgaris Weihe & Nees and *Rubus idaeus L.* are valuable berry crops characteristic of both Armenia's natural ecosystems, including the Lori region, and agroecosystems. Their cultivation plays a significant role in preserving biodiversity in the natural habitat and in promoting sustainable agricultural development in agroecosystems (http://agroecoarm.com). Studying the growth of these plants in natural and agroecological conditions allows for the development of adapted agrotechnologies that ensure high productivity, stability, and efficiency (http://agroecoarm.com). The growth characteristics of *Rubus vulgaris* and *Rubus idaeus* were studied in both wild habitats and agroecosystems in the Lori region. Specifically, biometric indicators of leaves and root pressure were examined, and certain morphological traits of the two species were compared. Understanding the dynamics of root pressure can help regulate the plants water regime, enhancing leaf surface area, which in turn promotes increased photosynthetic activity and higher synthesis of organic compounds.The analysis of biometric data from vegetative organs confirmed that *Rubus vulgaris* develops leaves more slowly, with dense and thorny stems, whereas *Rubus idaeus* grows faster and demonstrates more efficient fruiting in agroecosystems. Phenological studies showed that *Rubus vulgaris* begins its vegetation phase relatively late, while *Rubus idaeus* flowers and fruits earlier. Comparative analysis of physiological processes revealed that raspberry has a more active adaptation to low-water conditions, demonstrated by higher root pressure.

Introduction

Rubus vulgaris Weihe & Nees and *Rubus idaeus L.* are valuable fruit-bearing cultivars characteristic both of natural ecosystems in Armenia, including the Lori region, and of agroecosystems. Cultivating these species is highly significant both for preserving biodiversity in the wild and for developing sustainable agriculture systems. Their fruits are rich in vitamins, antioxidants, and beneficial bioactive compounds, leading to high market demand (Gevrenova, at al., 2024). In Armenia, fruits of these plants are used both fresh and processed (juices, jams, dried fruits), which supports local economy and provides rural employment (Vardanyan, 2005).

By studying their growth conditions in the wild and in agroecosystems, tailored agro-technologies can be developed to ensure high yields and reliable, sustainable cultivation. Recently, especially since the start of the 21st century, these species have expanded into locations where they previously did not occur. This shift is attributed to climate change, deforestation, and alterations in land use. In Lori region increased distribution of these species has particularly been observed due to changes in forest structure and climate (Gabrielian and Zohary, 2004).

Climate change (CC) refers to long-term alterations in average temperature and precipitation at global or regional scales. It's a natural process. Over the past 50 years such changes have become most tangible. Each of the last three decades has been successively warmer than any preceding decade since 1850 (www.nihcm.org).

Currently, the global temperature is approximately 1 °C above the pre-industrial average and is increasing at about 0.2 °C per decade. Despite uncertainties in climate projections, it is estimated that by the end of the 21st century, the global mean temperature may rise by 1.4–5.8 °C above pre-industrial levels (World Bank Group, November 2024).

Considering these factors, studying the growth of dewberry and raspberry in the Lori region holds not only theoretical but also practical importance - supporting biodiversity conservation, sustainable agricultural development, and activation of local economic potential. Cultivation of these species can also advance organic farming by reducing chemical fertilizers and pesticides. Rubus vulgaris Weihe & Nees and *Rubus idaeus L.* possess naturally high resistance, which makes them tolerant to pests and diseases. Due to this the need for pesticide application during the cultivation of *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.* is reduced. In addition, these plants have a well-developed root system that enables them to absorb nutrients from the deeper layers of the soil, by decreasing the necessity for chemical fertilizers. These plants can be integrated into permaculture and agroforestry systems, helping maintain soil fertility and ensure sustainable production (https://link.springer.com).

Materials and methods

The Lori region possesses favorable climatic conditions for the growth of studied species; however, climate change may pose serious challenges.

The aim of this study is to investigate the growth characteristics of *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.* in the wild and agroecosystems of the Lori region (www.fao.org). To assess the growth features of the studied plants, we performed biometric measurements of the leaves and determined the root pressure, which will make it possible to evaluate the absorption of water by plants, while the biometric measurements of the leaves will allow us to asses their growth. These species belong to the Rosaceae family, genus *Rubus L.* The genus includes over 600 perennial species, widespread in Europe, Asia, North and South America, and parts of Africa, growing in both wild and cultivated environments (Vardanyan, 2005; Tutin, et al., 1968). Recent literature notes approximately 700 Rubus species, including blackberry, raspberry, and related hybrids, mostly shrubs or subshrubs (Graham, et al., 2018; Meng, et al., 2022).

Table 1.*

Characteristic	*Rubus vulgaris Weihe & Nees / Rubus fruticosus agg.*	*Rubus idaeus L.*
Life form	Perennial thorny shrub	Shrub with biennial stems
Stems	Thorny, often flexible and semi-arched	Upright, usually without thorns or with few thorns
Leaves	Five-part or three-part, serrated	Three-part, sometimes five-part, serrated
Flowers	White or light pink, 5 petals	White or light pink, 5 petals
Fruits	Black or dark purple, aggregate drupelets	Red or pink, aggregate berries
Plant height	1.0-1.5 m	1.0 - 2 m
Environmental requirements	Undemanding grows in both sunny and shaded areas	Prefers sunny locations, moist soil
Distribution	Europe, Asia, Caucasus	Northern and Central Europe, Asia
Uses	Fresh fruits, jam, syrup, medicines	Fresh, jam, juice, dried fruit, medicinal infusions
Medicinal properties	Anti-inflammatory, diuretic, antioxidant	Tonic, anti-inflammatory, digestive regulator

*Composed by the authors.

In Armenia, 12 natural Rubus species exist, of which the most widespread are *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.*. Other species e.g., Anatolian (*R. Anatolicus*), Armenian (*R. Armenicus*), Whitish (*R. Candicans*), Kartvelian (*R. Cartalinicus*) are limited to moist habitats in the NE and Zangezur forest zones (Vardanyan, 2005). The most prevalent and economically valuable species in Armenia are *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.*.

Numerous studies focus on their medicinal and nutritional significance, bioactive compounds in tissues, and fruit uses (Verma, et al., 2014; Zia-Ul-Haq, et al., 2014; Bhatt, et al., 2023; Tao, et al., 2023). Gevrenova and others highlight that leaves of Rubus species are less used than their fruits, but possess anti-inflammatory, antioxidant, wound-healing, and antidiabetic properties (Gevrenova, et al., 2024). Detection of bioactive compounds in plant tissues suggests potential for use as natural medicinal raw materials. Some authors regard Rubus fruits as "superfoods" due to secondary metabolites like hydrolyzable tannins, anthocyanins, polyphenols, flavanols, organic acids, etc. (Foster, et al., 2019; Wang, et al., 2012).

Table 1 compares certain morphological traits of cultivated *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.* (Torosyan, 1983; Vardanyan, 2005).

The study focused on wild and agroecosystem (greenhouse) samples of common dewberry and raspberry around Hobardzi village, Stepanavan region, Lori. The goal was to investigate leaf sizes and root pressure in these environments.

Results and discussions

The change in biometric indicators of the vegetative organs (leaves) of *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.* plants has been studied. The individuals regenerated from root offshoots of the mother plant have been examined. The variation in leaf size has been studied both in experimental plants growing in the wild and in agroecosystems.

Sample 1 *Rubus vulgaris Weihe & Nees* in the wild

Sample 2 *Rubus vulgaris Weihe & Nees* in the agroecosystem (greenhouse)

Sample 3 *Rubus idaeus L.* in the wild

Sample 4 *Rubus idaeus L.* in the agroecosystem (greenhouse)

Plants growing in the greenhouse have been chosen as agroecosystem samples.

Measurements have been made at stages with 1–3 leaves, 4–8 leaves, and ≥9 leaves. The results of the measurements are presented in table 2.

According to the literature, the average length of *Rubus idaeus L.* leaves is 5–10 cm (Hanelt, 2001), while the average length of *Rubus vulgaris Weihe & Nees* leaves is 4 -12 cm (Clapham, at all., 1962). Biometric measurements reveal that the climatic conditions and soil composition in the Lori region—particularly in the Hobardzi community of Stepanavan - favour the good growth of the studied crops (Manasyan, et al., 2003).

Biometric measurements show that under greenhouse conditions, the *Rubus vulgaris Weihe & Nees* crop grows 2.79 times faster at the 1–3 leaf stage, 3.43 times faster at the 4–8 leaf stage, and 2.18 times faster at the ≥ 9 leaf stage compared to growth in the wild.

The *Rubus idaeus L.* crop under greenhouse conditions grows 2.15 times faster at the 1–3 leaf stage, 1.75 times faster at the 4–8 leaf stage, and 1.18 times faster at the ≥ 9 leaf stage compared to in the wild.

Table 2. Comparison of biometric indicators of leaves of *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.* plants*

		Rubus vulgaris Weihe & Nees		***Rubus idaeus L.***	
		Sample 1	**Sample 2**	**Sample 3**	**Sample 4**
Leaf length (cm) (including petiole)	Stage of 1–3 leaves, March 30	1.9	5.3	2.7	5.8
	Stage of 4–8 leaves	3.5	12	8	14
	≥ 9 leaves	11	24	17	20

*Composed by the authors.

The table clearly shows that *Rubus idaeus L.* grows faster than *Rubus vulgaris Weihe & Nees* during the same periods: In the wild 1.42 times faster at the 1–3 leaf stage, 2.29 times faster at the 4–8 leaf stage, and 1.55 times faster at the ≥9 leaf stage. In the greenhouse: 1.09 times faster at the 1–3 leaf stage, and 1.17 times faster at the 4–8 leaf stage.

However, at the ≥9 leaf stage, the vegetation rate of greenhouse-grown *Rubus vulgaris* begins to accelerate and becomes 1.2 times faster than that of Rubus idaeus.

Determination of Root Pressure Indicators in Common Blackberry (*Rubus vulgaris Weihe & Nees*) and Common Raspberry (*Rubus idaeus L.*) Plants has been carried out.

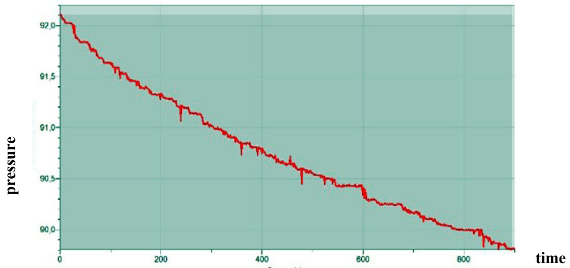
It is known that the normal functioning of terrestrial plants is possible only when a certain amount of water is present in plant tissues. In particular, the rate of leaf growth and their size are directly related to the water content in plant tissues. Water absorption by terrestrial plants from the external environment is an osmotic phenomenon and occurs in accordance with the law of osmosis. The water absorbed by the roots is transported to the aboveground parts of the plant through root pressure (Tangamyan, 2006; Ordog, 2011).

By knowing the dynamics of root pressure indicators in the studied plants, it is possible to improve leaf surface growth by regulating the plant's water regime. This, in turn, will contribute to an increase in the plant's photosynthetic activity and an increase in the amount of synthesized organic substances (Tangamyan, 2006).

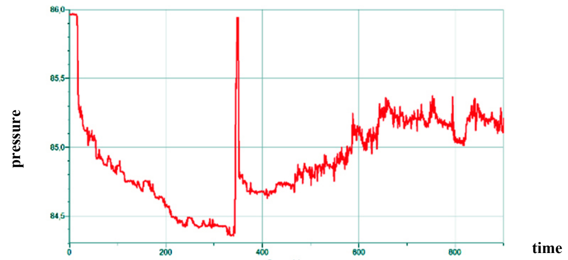
The root pressure of the cultivated plants *Rubus vulgaris Weihe & Nees* and *Rubus idaeus L.* was determined using the LabQuest 2 device (Picture). LabQuest 2 is an automated wireless interface used for collecting sensor data with built-in graphical and analytical applications. Its large, high-resolution touchscreen makes the collection, analysis, and sharing of experimental data easy and intuitive (www.vernier.com).

Graphs 1–4 show the root pressure dynamics: Graph 1 shows the changes in the root pressure index in the wild-growing common raspberry (*Rubus idaeus L.*) plant.

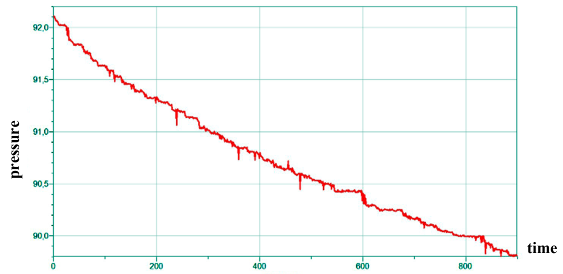
Picture. Equipments for determining root pressure using the LabQuest 2 device.



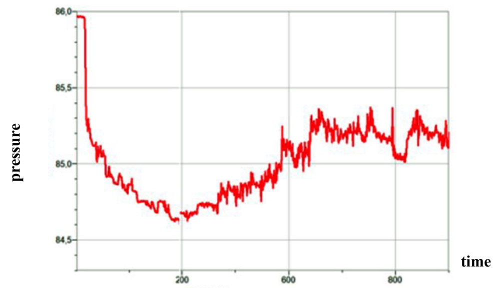
Graph 1. Root pressure of *Rubus idaeus L.* growing in the wild (*composed by the authors*).



Graph 2. Root pressure of Common Raspberry (*Rubus idaeus L.*) growing in a greenhouse (*composed by the authors*).



Graph 3. Change in root pressure of *Rubus vulgaris Weihe & Nees* growing in the wild over time (*composed by the authors*).



Graph 4. Change in root pressure of *Rubus vulgaris Weihe & Nees* growing in the wild over time (*composed by the authors*).

As can be seen from Graph 1, at the beginning of the experiment the root pressure is about 92.1 kPa.

This can be considered as the initial hydrostatic or baseline root pressure level of the system.

Over time, the pressure steadily decreases, reaching about 89.9 kPa. This trend indicates a decrease in root pressure, which may be due to a reduction in transpiration or a weakening of root activity (Tangamyan, 2006).

The study reveals that in the wild raspberry plant, root pressure decreases slowly but steadily by about 2.2 kPa over ~15 minutes.

Graph 2 shows the change in root pressure in the common raspberry (*Rubus idaeus L.*) plant grown in a greenhouse.

At the beginning of the study, the pressure is about 86.0 kPa. It decreases rapidly and steadily, reaching about 84.4 kPa in about 5 minutes, which is due to the intensive use of water by the plant (e.g., transpiration), and the temporary suppression of the active function of the roots (Pascale, 2020).

On the graph, a sharp increase in root pressure is visible (around 350–400 seconds), a sudden peak—the pressure immediately rises to almost 86.0 kPa. Such a sharp spike is due to mechanical interference (change in sensor position, interference with water supply pipes, or reflex response). If no mechanical interference had occurred, the pressure would have decreased even further, indicating that under greenhouse conditions the plant's root pressure is higher, has a higher hydro-regulatory capacity (restores pressure more quickly), is practically less subject to acute water loss or stress, as can occur in the wild, and has a controlled adaptability to the environment, which is facilitated by the stable temperature, humidity, and lighting in the greenhouse.

Graph 3 shows the change in root pressure in the Rubus vulgaris Weihe & Nees plant growing in the wild. Graph 3 presents the change in root pressure of the Rubus vulgaris Weihe & Nees plant growing in the wild over time. It is clear from the graph that the plant's root pressure shows a steady decreasing trend throughout the experiment, which lasts about 900 seconds.

At the initial stage of the experiment, the root pressure is about 92.1 kPa, and at the end of the experiment about 89.9 kPa. That is, the root pressure decreases by about 2.2 kPa. The root pressure of plants growing in the wild usually depends on the soil moisture content, the plant's transpiration activity, as well as atmospheric conditions. According to the presented data, the root pressure of the blackberry decreases on average by about 0.0024 kPa per second, which indicates quite an active loss of water, probably due to strong transpiration and a gradual decrease in soil moisture.

Graph 4 shows the change in root pressure of the *Rubus vulgaris Weihe & Nees* plant growing in a greenhouse over time.

From Graph 4 it can be seen that at the beginning of the experiment there is a sharp decrease in root pressure from about 86.0 kPa to about 84.6 kPa.Then the pressure drop slows down and reaches its minimum value about 84.45 kPa, after which the pressure begins to increase and return to values close to the initial level in the range of about 85.4–85.6 kPa.

The data from Graph 4 indicate that the root pressure of the Rubus vulgaris Weihe & Nees plant is sensitive to changes in the external environment and responds to them quite quickly. The initial sharp change suggests a sudden change in soil moisture or nutrient flow. The subsequent stabilization and growth phases prove the activity of the plant's adaptive mechanisms. The fluctuations show that the plant has not reached full equilibrium, i.e., physiological adaptation, and that some intracellular or intercellular processes continue to develop.

Conclusion

The results of the studies make it possible to conclude:

- Both species are widespread in both natural landscapes and cultivated systems and exhibit high ecological plasticity.
- *R. vulgaris* n *idaeus* prefers sunny, open areas.
- Biometric analysis confirms that *R. vulgaris* has slower leaf development and thornier, denser stems, whereas *R. idaeus* grows faster and yields more efficiently in agroecosystems.
- Phenological observations indicate that *R. vulgaris* begins vegetating later, while *R. idaeus* flowers and fruits earlier.
- Physiological comparisons show that *R. idaeus* possesses more active drought adaptation, reflected in higher root pressure.

Considering that the studied plants have a well-developed root system, it is recommended to expand the thickets of these plants in order to strengthen the soil layers and improve the soil structure.

References

1. Bhatt, S. C., Naik, B., Kumar, V., Gupta, A. K., Kumar, S., Preet, M. S., ... & Rustagi, S. (2023). Untapped potential of non-conventional rubus species: bioactivity, nutrition, and livelihood opportunities. Plant Methods, 19(1), 114.
2. Buttner, R. (2001). Mansfeld's encyclopedia of agricultural and horticultural crops:(except ornamentals) (Vol. 1, pp. 1660-1661). P. Hanelt (Ed.). Berlin: Springer.
3. Clapham, A. R., Tutin, T. G., Warburg, E. F., & Roles, S. J. (1952). Flora of the British isles.
4. Foster, T. M., Bassil, N. V., Dossett, M., Leigh Worthington, M., & Graham, J. (2019). Genetic and genomic resources for Rubus breeding: a roadmap for the future. Horticulture research, 6.
5. Gabrielian, E., & Zohary, D. (2004). Wild relatives of food crops native to Armenia and Nakhichevan.
6. Gevrenova, R., Zheleva-Dimitrova, D., & Balabanova, V. (2024). The genus Rubus L.: An insight into phytochemicals and pharmacological studies of leaves from the most promising species. Pharmacia, 71, 1-12.
7. Graham, J., & Brennan, R. (2018). Introduction to the Rubus genus. In Raspberry: breeding, challenges and advances (pp. 1-16). Cham: Springer International Publishing.
8. http://agroecoarm.com/wp-content/uploads/2016/07/ՀԱՏԱՊՏՈՒՂՆԵՐ-Berries.pdf.
9. https://link.springer.com/article/10.1186/s13007-023-01094-y?utm_source.
10. https://nihcm.org/publications/climate-changes-health. Climate Changes Health. Webinar Series. NIHCM foundation (Accessed 20.03.2025).
11. https://www.fao.org/digital-villages-initiative/europe/digital-villages/lori/en. Digital Villages Initiative in Europe and Central Asia (Accessed 20.03.2025).
12. https://www.vernier.com/product/labquest-2/. Vernier Software & Technology, LabQuest 2, accessed March 31, 2025 (Accessed 31.03.2025).
13. Manasyan, M. G., Grigoryan, A. T., Yeghyan, G. B., Lori Region: Nature, Population, Economy, Yerevan, 2003, p. 208 (in Armenian).
14. Meng, Q., Manghwar, H., & Hu, W. (2022). Study on supergenus Rubus L.: Edible, medicinal, and phylogenetic characterization. Plants, 11(9), 1211.
15. Ordog, V. (2011). Plant Physiology. 115 p.
16. Pascale, A., Proietti, S., Pantelides, I. S., & Stringlis, I. A. (2020). Modulation of the root microbiome by plant molecules: the basis for targeted disease suppression and plant growth promotion. Frontiers in plant science, 10, 1741. https://doi.org/10.3389/fpls.2019.01741.
17. Tangamyan, T. V., Plant Physiology, Yerevan, 2006, p. 288 (in Armenian).
18. Tao, Y., Bao, J., Zhu, F., Pan, M., Liu, Q., & Wang, P. (2023). Ethnopharmacology of Rubus idaeus Linnaeus: A critical review on ethnobotany, processing methods, phytochemicals, pharmacology and quality control. Journal of ethnopharmacology, 302, 115870.
19. Torosyan, A. (1983). Medicinal Plants of Armenia, Yerevan, - p. 297 (in Armenian).
20. Tutin, T. G. (Ed.) (1968). Flora Europaea, Vol. 2, Rosaceae to Umbelliferae, Cambridge Univ. Press.
21. Vardanyan, Zh. H., (2005). Dendrology, Yerevan, - p. 372 (in Armenian).
22. Verma, R., Gangrade, T., Punasiya, R., & Ghulaxe, C. (2014). Rubus fruticosus (blackberry) use as a herbal medicine. Pharmacognosy reviews, 8(16), 101.
23. Wang, L., Lei, T., Han, G., Yue, J., Zhang, X., Yang, Q., ... & Wang, Y. (2021). The chromosome-scale reference genome of Rubus chingii Hu provides insight into the biosynthetic pathway of hydrolyzable tannins. The Plant Journal, 107(5), 1466-1477.
24. World Bank Group, Country Climate and Development Report, November 2024. https://www.worldbank.org/en/publication/country-climate-development-reports (Accessed on 10.03.2025).
25. Zia-Ul-Haq, M., Riaz, M., De Feo, V., Jaafar, H. Z., & Moga, M. (2014). Rubus fruticosus L.: constituents, biological activities and health related uses. Molecules, 19(8), 10998-11029.

Received on 09.04.2025
Revised on 03.06.2025
Accepted on 30.06.2025