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[Mini Review] Viburnum: an overview in relation to risks of allergy

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Abstract

The genus *Viburnum* L. (Adoxaceae, formally classified as Caprifoliaceae), contains approximately 163 species of high ecological value, distributed in the temperate and subtropical regions of the Northern Hemisphere and extending to the mountains of South America and Asia. Some species have been considered for contact sensitivity and the pollen allergenicity. The literature shows that some species can give contact hypersensitivity and *V. opulus* can determine pollen allergy. The practical implications of this research are destined to the public health practitioners and policymakers, the green designers, and the public administrations: in fact, the specific knowledgements of the use of *Viburnum* species in gardening can help to deduce some important considerations about the right destinations of the plants. In particular, in the case of school gardens, children's green areas or sport areas, some species, as *V. opulus*, *V. plicatum*, *V. tinus*, *V. rhytidophyllum*, which cause dermatitis in the case of contact, should be avoided.

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Abbreviations

- VPA is Value of Potential Allergenic
- OPALS is Ogreen Plant Allergy Scale (Ogren 2000)

- VO is *Viburnum opulus*

Introduction

The genus *Viburnum*, of the botanical family of Adoxaceae, formally classified as Caprifoliaceae (Winkworth, 2005), includes species from different parts of the world, widely used in forestry and gardening, as an ornamental plant of high ecological value. It contains approximately 163 species (Landis MJ, 2021), distributed in the temperate and subtropical regions of the Northern Hemisphere and extending to the mountains of South America and Asia (Hoch W, 1995). The species can be evergreen or semievergreen, deciduous shrubs or small trees. The scientific interest of these plants is due to the chemical components and diverse biological activities as saponin, butanolide, terpenes and others (carotenoids, polyphenols, and flavonoids) (Cheng-Yu C, 2024; Sharifi-Rad 2021). These biochemical components are what give *Viburnum* plants their primary biological activities. While the plant's well-documented antibacterial, anti-inflammatory, and antioxidant properties are well-known, recent studies have also linked the chemical components of *Viburnum* to disease prevention and treatment. Chronic conditions include Alzheimer's disease, diabetes, cancer and any condition that a clot may cause (Sharifi-Rad J, 2021)

Although frequently used as an ornament, the *Viburnum* species show biological properties with health-promoting effects. Fruits, flowers, and barks of certain species are used for pharmaceutical purposes or as cooking ingredients, hence containing biochemical compounds with health-promoting activity such are carotenoids, polyphenols, and flavonoids (Sharifi-Rad, 2021). In the *Viburnum* genus the leaves are arranged in opposite pairs on the twigs; they are oval; the flowers are small, with five whitish petals, arranged in large round terminal cymes; the flowers have both female and male parts (hermaphrodite), actinomorphic and united in showy compound tops, flowering is in general in late spring; the fruit is a drupe or a berry.

Materials and Methods

The botanical research was conducted from a personal original database of most common trees, herbs and shrubs in the Mediterranean area with different allergenic value of the pollen, and also considering the bee pollination of the plants. The research was partially published in a recent book by the authors (Marinangeli F, Brini S, Pace G L 2023. Terrazzi fioriti: come allestire aiuole del respiro. Rubbettino editore; luglio 2023. ISBN 978-88-498-7615-4) and an international paper on this topic is also in press. This study of a single genus (*Viburnum*) between all the plants considered in this book, aims to be a first focus on the botanical, pharmaceutical, traditional, and allergenic value of the plants most used in gardening in Europe.

The research considers the following values useful in floriculture and forestry of some most important species of *Viburnum*: origin of the species, distribution area, presence and types of flowers and fruits, main uses of the plant, interactions with the human health such as contraindications in the traditional medicine, dermatopic sensitization by contact, and scientific evidence of presence of allergens in pollen (Dambra, 2000) fundamental for a complete genus

review (Zengion AH, 2011). The classification of the plants in the Ogren Plant Allergy Scale (OPALS), an allergy rating system for plants that measures the potential of a plant to cause allergic reactions in humans (Ogren, 2000) was also considered, as well as the International Union of Immunological Societies (IUIS) database. The databases investigated to study and find if the species have been reported in Italian territory, are the Actaplanctarum database and the Dryades-The Flora of Italy database (linked on: <https://www.actaplanctarum.org/index.php>; http://dryades.units.it/floritaly/index.php?procedure=simple_new&tipo=all)

In fact, it is essential, in ornamental use in parks, gardens, schools, and sports facilities, to consider the impact on public health of the plant choice; where the choice of one species rather than another can determine the difference, the parameters of the plant&human health relationship must be taken into first consideration. Bibliographic searches relating to the genus *Viburnum* were carried out in the main scientific databases as Scopus, PubMed, Science Direct, with the following keywords: “*Viburnum*+allergen”; “*Viburnum*” in general; “*Viburnum* sp. + dermatitis”., species were investigated at the Database pollenlibrary.com. Furthermore, the most recent databases published on the most common trees and shrubs in the Mediterranean areas were consulted (Cariñanos, 2021). The phytochemical compounds of the species of the genus *Viburnum* were investigated in the most recent literature in the already cited databases.

Results and Discussion

Some of the considered species can cause pollen allergies or dermatitis to the people that come into contact with them through breathing or gardening. Irritant contact dermatitis (ICD) from plants is a very common phenomenon as potentially irritant plants and plant products are commonly found in the everyday environment, including the home, garden, workplace, and recreational setting (Modi GM, 2009). Plant dermatitis is an inflammation of the skin caused by topical contact with a plant or plant constituent, so in gardening is necessary to use long gloves to handle these plants. The species of *Viburnum* genus can give adverse reactions upon contact, because the stems contain trichomes that cover the leaves and branches. In particular, *Viburnum opulus* and *V. prunifolium* have been investigated and cited in the literature: the bark of both species is used medicinally and may be decocted, tinctured, or encapsulated as a crude herb. *Viburnum opulus* contains hydroquinones, coumarins, and tannins, whereas *Viburnum prunifolium*'s primary constituents include coumarins, biflavones, and phenolic acids (Zengion AH, 2011).

The Genus *Viburnum* was investigated also in the point of view of the honey bees, and the studies by spectroscopy show the high antioxidant activity in the pollen of *Viburnum*, resulted in the highest polyphenols and flavonoids content (Barbieri D., 2020).

Some of the most cultivated species of *Viburnum* have been investigated:

V. carlesii -Koreanspice *viburnum*, Carles' *viburnum* – It is an alien species (Celesti-Grapow, 2009) reported in Italy, casually, only in the Lombardia Region, wild relative and cultivated; it has a very small size and soft deciduous leaves; it flourishes in spring with white flowers appearing in mid to late spring. No allergy has been reported for this species. Usage in gardening: ornamental, ethnobotanical (Ciancaleoni S, 2021). it attracts birds and butterflies; it has very fragrant

flowers.

V. dilatatum - Linden Arrow-Wood or linden *viburnum* – It is native to eastern Asia and can be found as an introduced plant in the mid-Atlantic regions in the U.S from New York to Virginia. The stems are pubescent. The leaves have shallowly toothed margins, usually are pubescent and they drop in late autumn. The fruit is a red glabrous fleshy round drupe that, on the plant from September to early December. No allergy has been reported for this species. Usage of plant: it attracts butterflies.

V. lantana – Wayfaring-Tree – It is native to Central, Southern and Western Europe (S-Europ-Pontic), Northwest Africa, and Southwestern Asia. The fruit is an oblong drupe 8 mm (0.31 in) long, green at first, turning red, then finally black at full maturity, and contains a single seed. It is spontaneous in the deciduous woods (with *Quercus pubescens* especially) from 0 to 1000 m asl (meters above sea level). No allergy has been reported for Wayfaring-Tree species. Usage of plant: used as a colored dye; it attracts butterflies. In the phytotherapeutic use, the *V. lantana* bud extract is an effective natural remedy for the treatment of allergic asthma.

V. lentago – Nanny-Berry, sheepberry, or Sweet *Viburnum* - This species is native to North America north of Mexico. Flowering is in late spring. The fruit is a small round blue-black drupe. No allergy has been reported for Nanny-Berry species. Usage of plant: it attracts butterflies.

V. opulus (sin. *V. trilobum*)– Highbush-Cranberry, European cranberrybush or guelder-rose, wild guelder rose, cherry-wood, rose elder, crampbark tree and snowball brush, and gilaburu in Turkey, it is Eurasiat-temperata, and widespread in Europe, North and Central Asia and North Africa (Polka D, 2019). This species, a valuable decorative, medicinal and foot plant, includes one or more native variety (or subspecies) to North America and one or more introduced variety (or subspecies). The leaf buds are green, with valvate bud scales. It has glabrous and shiny stems. The hermaphrodite flowers are white, produced in corymbs. The fruit is a globose bright red drupe containing a single seed. The seeds are dispersed by birds. Highbush-Cranberry (*Viburnum opulus*) is a mild allergen. The specie contains (in fruits, flowers and bark) phenoles (more active against free radicals if extracted from the barks), fiber, pectines, sugars (in particular in flowers and barks), organic acids and carotenoids, vitamin C, ash, protein and fat. In particular, it contains hydroquinones, coumarins, and tannins (Zengion AH, 2011) and iridoids, essential oils, dietary fiber (Poljka D., 2019). In traditional cuisine, in Russia, Ukraine and Siberian nations the *V. opulus* astringent-taste fruits are used as component of marmelades, jams, cordials and liqueurs, and “Kallinikov” pies or herbal teas, or in fruit juices (Turkey) (Polka D, 2019). Pharmacological usage of the plant: used to treat ailments such as cough, colds, tuberculosis, rheumatic aches, ulcers, stomach, high blood pressure and heart diseases, neurosis and diabetes (Polka D., 2019) and kidney problems, among others (Kajszczak D, 2020) and for Vitamin C (Rop O, 2010); the bark is used in the traditional medicine (decocted, tintured or encapsuled as crude herb) to treat dysmenorrhea (Zengion AH, 2011); fruits are edible in small quantities, with a very acidic taste. Usage in gardening: it attracts butterflies.

V. plicatum – Japanese snowball bush. The Latin specific epithet *plicatum* means “pleated”, referring to the texture of the leaves on the surface. It is native to mainland China, Korea, Japan, and Taiwan. Some of the more popular cultivars are

selected for having all of their flowers large and sterile with few or no fertile flowers. No allergy has been reported for this species. The fruit is an ovoid blue- black drupe 8-10 mm long. Usage in gardening: the particular look of the leaves is very admired.

V. rhytidophyllum -Leatherleaf *Viburnum*. Native to Asia. The plant is an evergreen shrub or small tree with a suckering habit. The leaf stems are fuzzy brown. In spring, fragrant creamy-white flowers bloom in clusters. Blue berries form in June and become glossy black through September. There aren't allergens in pollen, but the hypersensitivity is evident (Dambra P, 2000). In the Actaplanctarum database it is checked like a cryptogenic plant, an alien species with a not known origin and cause of presence.

V. rufidulum - Rusty Blackhaw - This species is native to North America and to North Mexico. The drupes are purple or dark blue, glaucous, globose or ellipsoid and they mature in mid to late summer. The edible fruit has been said to taste like raisins and attracts birds. No allergy has been reported for Rusty Blackhaw species. Usage of plant: it attracts butterflies.

V. tinus – Laurustinus, laurustine or laurestine; native to the Mediterranean area of Europe (Steno-Medit) and North Africa. It is most commonly found in the western Mediterranean due to a shorter drought season and is one of the dominant species of Mediterranean sclerophyllous shrubland. It has also been introduced to Australia, Pakistan, California, Oregon and Tajikistan. It is evergreen, with glabrous stems, the fruit is a dark blue-black drupe. Usage of the plant: *V. tinus* has been used for its traditional medicinal properties for the tannins. The leaves when infused have antipyretic proprieties, but tannins can cause upset stomach.

Conclusions

Some of the most used species in floriculture and forestry, of the genus *Viburnum*, were considered for their allergenic potential. The literature shows that some species can cause contact hypersensitivity due to the trichomes on the stem, additionally, *V. opulus* also can cause some pollen allergies. The practical implications of this research are destined to the public health practitioners and policymakers, the green designers and the public administrations: the specific knowledge of the use of *Viburnum* species in gardening can give some important considerations about the right destinations of the plants. In particular, in the case of school gardens, children's green areas or sport areas, some species as *V. carlesii*, *V. opulus*, *V. plicatum*, *V. tinus*, *V. rhytidophyllum*, which cause dermatitis in the case of contact, should be avoid. Throughout the genus, this study found that *V. opulus* can cause pollinosis.

Tables

Table 1. *Viburnum*, some species most used in floriculture and forestry and their allergenic potential

Scientific name	Common name	Flowers	Flowering period	Allergenicity - OPALS	Allergenicity Carinanos 2021	Allergenicity PollenLibrary	Sensitivity	Reported in Italy
<i>Viburnum carlesii</i>	Koreanspice <i>viburnum</i> , Carles' <i>viburnum</i>	all fertile	Spring	Not shown	-	No allergy	Hypersensitivity by contact	Yes
<i>Viburnum dilatatum</i>	Linden Arrow-Wood	all fertile	Spring to Summer.	low	-	No allergy	-	-
<i>Viburnum lantana</i>	Wayfaring-Tree	all fertile	Spring to Summer.	low	-	No allergy	-	Yes
<i>Viburnum lentago</i>	Nanny-Berry	all fertile	Spring to Summer.	low	-	No allergy	-	-
<i>Viburnum opulus</i> (=V <i>trilobum</i>)	Highbush-Cranberry	few fertile (external) or no fertile	Spring to Summer.	low	-	Mild allergen	Hypersensitivity by contact	Yes
<i>Viburnum plicatum</i>	Japanese snowball bush	few fertile (external) or no fertile		low	-	No allergy	Hypersensitivity by contact	-
<i>Viburnum rhytidophyllum</i>	Leatherleaf viburnum	all fertile	Spring to Summer.	low	-	No allergy	Hypersensitivity by contact	Yes
<i>Viburnum rufidulum</i>	Rusty Blackhaw	all fertile	Winter to Summer.	low	-	No allergy	-	-
<i>Viburnum tinus</i>	Laurustinus, laurestine	all fertile	Spring to Summer.	low	Low VPA=1	No allergy	Hypersensitivity by contact	Yes

Statements and Declarations

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Conflict of interest

There are not any economic interest and any conflict of interest.

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Links

- Allergens in the plants of *Viburnum*:
 - <https://www.pollenlibrary.com/Genus/Viburnum/>
 - <http://allergen.org/>
- Geobotany of *V. rhytidophyllum*:
 - https://www.actaplantarum.org/flora/flora_info.php?id=508643