

Review Article





# A review about *Pastinaca sativa* L. ssp. sylvestris [Mill.] secondary metabolite diversity and inducibility

#### **Abstract**

Pastinaca sativa L. ssp. sylvestris [Mill.] is a biennial, vegetable plant, whose root is tuberous and pivoting and the stem is tall and branched. The leaves are feather-sectate and the flowers are yellow, umbrella-shaped, compound. The fruits are dicariopse with winged edges. The plant is used in food and as a natural remedy in folk medicine. P. sativa is considered a very nutritious plant, important also due to its medicinal effects. The sweet taste and pleasant aroma made this vegetable indispensable in the traditional cuisine: either eaten in raw salads, or steamed, or it gives consistency and flavor to soups and broths. The roots and leaves are used for phytotherapeutic purposes.

Keywords: Pastinaca sativa, phytotherapeutic, vitamins, chemicals compounds

Volume 9 Issue I - 2022

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Received: January 08, 2022 | Published: January 28, 2022

# **Botanical and biological peculiarities**

The story of the P. sativa begins in Eurasia in ancient times when this vegetable was widely used in the kitchen, but especially in the treatment of diseases. Often confused with white carrot or parsley, this root is a very hardy annual or biennial plant that, as we know, gives a specific taste to food. Due to its sweet taste, P. sativa was used by Europeans as a sweetener before sugar was discovered. It can be baked, boiled, fried, cooked as a puree, as a soup or steamed. It is a wonderful ingredient for salads if used to shave or cut into thin slices.1 The sweet taste makes the *P. sativa* can be eaten raw, in root salads with carrots, celery and parsley. It can often replace P. sativa root in recipes so that food can become slightly sweeter and tastier without the use of sugar. In Scotland, P. sativa are a staple vegetable in the daily menu and are eaten in various ways. In the popular tradition, P. sativa was considered, along with celery, a root aphrodisiac. And not for nothing: this vegetable contains healthy nutrients essential for human health, minerals, fiber and vitamins. The root contains large amounts of potassium, manganese, magnesium, phosphorus, zinc, iron and, in addition, an impressive range of vitamins: B1, B2, C, E, and K, as well as fiber and some proteins. P. sativa contains the following compounds: byakangelicin [C<sub>17</sub>H<sub>18</sub>O<sub>7</sub>], byakangelicol  $[C_{17}H_{16}O_6]$ , heraclenin  $[C_{16}H_{14}O_5]$ , heraclenol  $[C_{16}H_{16}O_6]$ , isobergapten  $[C_{12}H_8O_4]$ , isobyakangelicin  $[C_{17}H_{18}O_7]$ , psoralen  $[C_{11}H_6O_3]$ , and furanocoumarins i.e.: bergapten [C<sub>12</sub>H<sub>8</sub>O<sub>4</sub>], imperatorin [C<sub>16</sub>H<sub>14</sub>O<sub>4</sub>], isopimpinellin  $[C_{13}H_{10}O_5]$ , methoxsalen  $[C_{12}H_8O_4]$ , phellopterin  $[C_{17}H_{16}O_5]$ , pimpinellin  $[C_{13}H_{10}O_5]$  etc. The plant has a spicy odor due to the presence of butyric ester in the composition of heptyl, hexyl and octyl-butyl esters. P. sativa roots also contain carotene, starch, pectin, vitamins and sugars. The nutritional value of the root of the pod percent of grams of fresh produce: 9.2 g carbohydrates, 1.4 g protein, 0.5 g fat. The caloric content of vegetables is 47 kcal / 100g.<sup>2</sup>

# The health of the P. sativa

The high level of potassium in *P. sativa* recommends it for a good heart function: vasodilating effect, reduces blood pressure and heart stress. Because it also contains folic acid, it reduces the level of the homocysteine cellular toxin in the blood, which reduces the risk of heart and circulatory system diseases.<sup>3</sup> According to the USDA, *P. sativa* contain high levels of minerals such as calcium, potassium, manganese, magnesium, phosphorus, zinc and iron. It is rich in folate (vitamin B9 or folic acid), which is associated with reducing malignant neural tube defects in infants. This vegetable also helps to optimize metabolic processes related to energy production and nervous system

activity, helping new mothers cope with postpartum depression. It is rich in soluble fiber which helps lower cholesterol levels and also reduces the chances of having diabetes. Dietary fiber also contributes to improved digestion, preventing constipation and gastrointestinal disorders. The root contains a high level of potassium, which acts as a vasodilator and reduces blood pressure and stress on the heart. High levels of folate in this vegetable reduce blood homocysteine levels, which are generally associated with an increased risk of heart disease. Fiber helps lower cholesterol.

Consumers are better protected against stroke, atherosclerosis and other coronary heart disease. *P. sativa* has beneficial action in cholecystitis, constipation, anorexia, stomach pain, bladder atony, spastic enterocolitis, minor insomnia, nephritis, dysuria, renal colic, endocrine disorders (menstrual syndrome), rheumatism, avitaminosis, obesity, vascular disease, infections, loss of appetite, dysmenorrhea, fever, atherosclerosis, detoxification, anemia and diabetes.<sup>7</sup>

## Fiber for the digestive system

Like any root and *P. sativa*, it has a high soluble fiber content that helps lower cholesterol and prevents the development of diabetes. Fiber also helps digestion, reduces constipation and prevents gastrointestinal disorders.<sup>8</sup>

Low in protein *P. sativa* are valuable in their mineral and vitamin content. Thus, it can be an ideal snack or a formidable dietary supplement when it comes to balancing the diet of those who are obese or overweight. Thus, like carrots or parsley, *P. sativa* are an alternative to snacks or worthless food, generically called "junk food".

*P. sativa* provides a viable option to regulate digestive processes by optimizing them and helps eliminate waste and assimilate nutrients from healthy food. If you eat fresh *P. sativa*, it eliminates the symptoms of hunger between meals, so you will always stop nibbling on something.<sup>10</sup>

#### Antioxidants against chronic diseases

The vitamins, organic compounds and antioxidants contained in *P. sativa* make it a protector against viruses and bacteria as well as an important cleanser of toxins from cellular metabolism. Antioxidants such as vitamins A and C, which it generously contains, eliminate and neutralize free radicals, which are responsible for the body's illness (chronic diseases) and premature aging. The substances in this vegetable stimulate the production of white blood cells that attack microbes in the body and eliminate them.<sup>11</sup>





*P. sativa* contains folic acid which plays an important role in heart health and also in reducing birth defects. Moreover, some research has shown that a diet rich in folic acid reduces depression. So, *P. sativa* is also recommended in such cases.<sup>12</sup>

The importance of daily consumption of raw vegetables is an important fact because a balanced diet containing the nutrients and vitamins necessary for the proper functioning of the body makes the quality of life better, disease-free and healthy iron.<sup>13</sup>

# Allergic skin reactions caused by P. sativa leaves

Phytophotodermatosis is a phototoxic condition that occurs in summer, through contact with plants containing photoreactive substances (parsley leaves, celery, *P. sativa*, dill, carrots), followed by sun exposure. <sup>14</sup> It is also called meadow dermatitis. At 12-24 hours after contact, the skin becomes swollen, red and itchy, sometimes blisters, blisters, even necrosis can appear. After healing these lesions leave hyper- or depigmented spots. <sup>15</sup>

The leaves, stems, flowers of *P. sativa* contain toxic sap (furanocoumarins) that can cause phycophotodermitis, which can lead to severe burns, rashes or blisters. <sup>16</sup> Some people may experience dermatitis, bloating, gas, stomach cramps, and food allergies, as well as oral allergy syndrome such as burning, itching, and swelling of the lips and tongue, redness of the eyes, and difficulty breathing when first consuming *P. sativa*. <sup>17</sup> Therefore, it is recommended that you consult your doctor before consuming this vegetable. Due to the large number of useful substances that make up the vegetable, a number of pharmaceuticals are manufactured for various purposes. <sup>18</sup>

For example, Pastinacin and Beroxan  $[C_{24}H_{16}O_8]$ , having antispasmodic and photosensitizing effects. Beroxan activates the processes of regeneration of skin pigmentation, as well as hair growth during alopecia. <sup>19,20</sup> In the event of exposure to ultraviolet light, the medicine will stimulate the formation of melanin and restore the skin's sensitivity to sunlight.

### **Conclusions and remarks**

P. sativa is a type of root vegetable with a high content of nutrients and antioxidants that can improve immunity, increase digestive health and help with weight loss. Above all, this vegetable is easy to prepare and has a sweet taste that works well in a variety of recipes. The healing properties of P. sativa are also recognized by allopathic medicine. P. sativa and beroxane are prepared from P. sativa roots. The first preparation has a spasmolytic action and is used to treat angina pectoris, heart neurosis, gastrointestinal disorders and bile ducts. Beroxan, in combination with other preparations, is recommended in cases of skin diseases such as vitiligo.

## **Acknowledgments**

None.

### **Conflicts of interest**

The authors state that there is no conflict of interest.

# **Funding**

None.

## References

 Bell L, Lignou S, Wagstaff C. High Glucosinolate Content in Rocket Leaves (*Diplotaxis tenuifolia* and *Eruca sativa*) after Multiple Harvests Is Associated with Increased Bitterness, Pungency, and Reduced Consumer Liking. *Foods*. 2020;9(12):1799.

- Kviesis J, Klimenkovs I, Arbidans L, et al. Evaluation of furanocoumarins from seeds of the wild parsnip (*Pastinaca sativa* L. s.l.) J Chromatogr B Analyt Technol Biomed Life Sci. 2019;1105:54–66.
- Kenari HM, Kordafshari G, Moghimi M, et al. Review of Pharmacological Properties and Chemical Constituents of Pastinaca sativa. J Pharmacopuncture. 2021;24(1):14–23.
- Galati G, Gandin A, Jolivet Y, et al. Untargeted Metabolomics Approach Reveals Diverse Responses of *Pastinaca Sativa* to Ozone and Wounding Stresses. *Metabolites*. 2019;9(7):153.
- Munakata R, Olry A, Karamat F, et al. Molecular evolution of parsnip (Pastinaca sativa) membrane–bound prenyltransferases for linear and/or angular furanocoumarin biosynthesis. New Phytol. 2016;211(1):332–344.
- Gürbüz P. Flavonoid Glycosides from Heracleum Pastinaca Fenzl. Turk J Pharm Sci. 2019;16(2):191–195.
- Hakimi F, Tansaz M, Mokaberinejad R. The Parsnip (*Pastinaca sativa* L), A Proposed Remedy as to a Fertile Agent in the Viewpoint of Iranian Traditional Medicine. *Curr Drug Discov Technol*. 2020;17(5):711–715.
- Okrathok S, Thumanu K, Pukkung C, et al. Extraction of dietary fibers from cassava pulp and cassava distiller's dried grains and assessment of their components using Fourier Transform Infrared Spectroscopy to determine on their further use as a functional feed in animal diets. *Anim Biosci*. 2022;10.5713/ab.21.0430.
- Turesson H, Andersson M, Marttila S, et al. Starch biosynthetic genes and enzymes are expressed and active in the absence of starch accumulation in sugar beet tap–root. *BMC Plant Biol*. 2014;14:104.
- Zangerl AR, Berenbaum MR. Genetic variation in primary metabolites of Pastinaca sativa; can herbivores act as selective agents?. *J Chem Ecol*. 2004;30(10):1985–2002.
- Berenbaum MR, Zangerl AR. Parsnip webworms and host plants at home and abroad: trophic complexity in a geographic mosaic. *Ecology*. 2006;87(12):3070–3081.
- Krieger C, Roselli S, Kellner–Thielmann S, et al. The CYP71AZ P450 Subfamily: A Driving Factor for the Diversification of Coumarin Biosynthesis in Apiaceous Plants. Front Plant Sci. 2018;9:820.
- Skalicka–Wozniak K, Budzynska B, Biala G, et al. Scopolamine– Induced Memory Impairment Is Alleviated by Xanthotoxin:Role of Acetylcholinesterase and Oxidative Stress Processes ACS Chem Neurosci. 2018;9(5):1184–1194.
- Stahl E. Variation of myristicin content in cultivated parsnip roots (Pastinaca sativa ssp. sativa var. hortensis). J Agric Food Chem. 1981;29(4):890–892.
- Grabarska A, Skalicka–Woźniak K, Kiełbus M, et al. Imperatorin as a Promising Chemotherapeutic Agent Against Human Larynx Cancer and Rhabdomyosarcoma Cells. *Molecules*. 2020;25(9):2046.
- Lafon A, Boulard C. Perioral phytophotodermatitis induced by parsnip mash. Contact Dermatitis. 2020;83(4):318–319.
- Corell M, Sheehy E, Evans P, et al. Absolute configuration of falcarinol (9Z-heptadeca-1,9-diene-4,6-diyn-3-ol) from Pastinaca sativa. *Nat Prod Commun.* 2013;8(8):1123-1126.
- Ellis CR, Elston DM. Psoralen–Induced Phytophotodermatitis. *Dermatitis*. 2021;32(3):140–143.
- Walling AL, Walling HW. Phytophotodermatitis induced by wild parsnip. *Dermatol Online J.* 2018;24:13030/qt0rc4v2qz.
- Stegelmeier BL, Colegate SM, Knoppel EL, et al. Wild parsnip (Pastinaca sativa)—induced photosensitization. Toxicon. 2019;167:60–66.