
Brassica oleracea italica
x alboglabra



Scientific Name

Brassica oleracea italica x alboglabra

Synonyms

Brassica oleracea (Italica x Alboglabra Group)

Family

Brassicaceae

Common/English Names

Asparation, Asparations, Baby Broccoli, Bimi, Broccolette, Broccoletti, Broccolini, Sweet Baby Broccoli, Tenderstem, Tenderstem Broccoli

Vernacular Name

Brazil: broccolis

Origin/Distribution

The hybrid cultivar was developed by the Sakata Seed Company of Yokohama, Japan, in 1993 and named 'aspabroc'. In 1994, Sakata Seed Company in partnership with Sanbon Incorporated began growing 'aspabroc' commercially in Mexico under the name Asparation®. Asparation® first appeared in US markets in 1996. In 1998, Mann Packing Company in collaboration with Sakata Seed Company began marketing 'Aspabroc' throughout the United States under the name Broccolini.

Agroecology

Broccolini is a cool climate crop, sharing the same agroecological requirements as broccoli. It is intolerant of temperature extremes and is more sensitive to cold temperatures than broccoli and is more tolerant of slightly higher temperatures than broccoli.

Edible Plant Parts and Uses

The entire vegetable (leaves, tender young stems, unopened flowering shoots and flowers) is consumable. Broccolini is usually sold as the young tender unopened flowering shoot of 15–20 cm length; some supermarket chains allow a maximum of four opened flowers in the unopened flowering shoot product. Broccolini's flavour is sweet, with notes of both broccoli and asparagus. Broccolini can be sauteed, steamed, boiled, roasted, grilled and stir-fried. Broccolini makes a great appetizer, pasta or risotto ingredient and pizza topping. Broccolini's flavour goes well with butter, olive oil, light-bodied vinegars, lemon, lime, garlic, tomatoes, chillies, cured meats such as pancetta and prosciutto, barbecued

meat, flaky white fish, hard cheeses (parmesan and pecorino) or fresh cheeses (chevre and feta).

Botany

The plant has a structure similar to the sprouting type of broccoli. It is erect, annual or biennial, herbaceous and glabrous up to 80 cm high with an elongated slender, green stem, 15–30 cm long, branching at the top with relatively small, loosely arranged racemose heads. Leaves alternate, petiolate, simple, ovate to ovate-oblong, 40–50×30–40 cm, pinnatipartite or lobed with undulating, shallowly dentate margin, grey-green or blue green. The racemose flower heads are fully exposed from an early stage on slender rachis and peduncles unlike the heading or calabrese broccoli with larger compact head and thick peduncle and rachis. Flowers tetramerous; bisexual; four green sepals; four yellow, spatulate petals; six stamens, four long and two short; superior, two-loculed ovary. Fruit a slender silique with 10–30 subglobose seeds.

Nutritive/Medicinal Properties

Broccolini was reported to have the following nutrient composition: energy 35 kcal, protein 2.98 g carbohydrate 6.04 g, total dietary fibre 1 g, total sugars 2.04 g, calcium 60 mg, iron 0.68 mg, sodium 25 mg, vitamin C 78 mg and vitamin A 1,500 IU (Anonymous 2012).

The main hydroxycinnamic acids (sinapic, ferulic, *p*-coumaric and caffeic acids) were isolated from broccoli and broccolini by capillary zone electrophoresis (Lee et al. 2011).

Sixteen volatile constituents were identified from the ethanolic extract of broccolini leaves (Wang et al. 2012). The major components were 5-phenyl-undecane (11 %), n-hexadecanoic acid (9.34 %), octadecanoic acid (6.39 %), 1,1,3-trimethyl-3-phenyl-indan (4.0 %), 3-(2-phenylethyl)benzotrile (3.48 %) and phytol (3.37 %). Three purified fractions (BLF1, BLF2 and BLF3) were obtained from broccolini leaves by extraction of solvents (petroleum ether, ethyl acetate and

n-butanol), and polyamid resin chromatography and the flavonoids content of purified product increased from 10.2 to 41.6 % (Wang and Zhang 2012b). BLF1 was primarily consisted of quercetin (content up to 85.4), BLF2 was primarily composed of kaempferol (content up to 78.5 %), and BLF3 contains two major constituents kaempferol and apigenin (contents up to 82.6 %).

The following isothiocyanates were isolated and identified from broccolini seeds: 3-BITC (3-benzyl-isothiocyanate) (10.8 %), 4-methylpentyl-isothiocyanate (0.5 %), 1-isothiocyanatobutane (26.8 %), PEITC (phenethylisothiocyanate) (22.6 %) and sulforaphane (19.2 %) (Zhang et al. 2011). The glucosinolates contents of broccolini, broccoli and Chinese broccoli seeds were determined to be 39.96, 37.77 and 37.25 $\mu\text{mol/g}$, respectively (Yang and Zhang 2012). Six, eight and four major glucosinolates were identified in broccolini, broccoli and Chinese broccoli seeds, respectively. The common glucosinolates in the three vegetables included 4-methylsphenylbutyl, 3-butenyl and 4-methylthiobutyl glucosinolates. However, three glucosinolates were different for broccolini and broccoli, one glucosinolate was different for broccolini and Chinese broccoli, and six glucosinolates were different for broccoli and Chinese broccoli.

Anticancer Activity

Studies showed that broccolini leaf flavonoids exhibited a dose-dependent antiproliferative effects in-vitro on four human cancer cell lines (SW480, HepG2, Hela and A549) and induce apoptosis in SW480 cell line (Wang and Zhang 2012a). Studies showed that the crude broccolini Leaf crude extract and the purified flavonoid extracts (BLF1, BLF2 and BLF3) all exhibited an inhibitory effect on the growth of human colon cancer SW480 cell line; the IC_{50} values were estimated to be 88.14, 65.06, 72.62 and 79.42 $\mu\text{g/ml}$, respectively (Wang and Zhang 2012b). The antiproliferative activities on SW480 cells were increased by 10–26 % after purification. Broccolini seed extract exhibited antiproliferative effects on

human lung A549 and ovarian OVCAR-3 cancer cells in a dose-dependent manner by using MTT assay, giving IC_{50} values of 81.49 and 78.6 $\mu\text{g/ml}$, respectively (Yang and Zhang 2011). Further, at high dosage (90–120 $\mu\text{g/ml}$), the morphology structure of OVCAR-3 cells became irregular and exhibited characteristics of apoptosis such as cell membrane shrinkage, condensation and fragmentation of nuclear chromatin, as well as formation of apoptotic bodies. Isothiocyanates from broccolini seeds induced apoptosis in human colon cancer SW480 cells in a dose-dependent manner in the MTT assay, and the IC_{50} was calculated to be 77.72 $\mu\text{g/ml}$, superior to the chemotherapeutic drug 5-fluorouracil (Yang et al. 2011).

Other Uses

See notes under broccoli.

Comments

There is a purple broccolini sold under the registered name peacock broccolini. This purple broccolini has small beautifully purple racemose loose flower heads, purple stem and side shoots and large flamboyant purple-tinged edible leaves.

Selected References

- Anonymous (2012) Nutrient composition of broccolini. <http://caloriecount.about.com/calories-safeway-broccolini-i274242>
- Lee ISL, Boyce MC, Breadmore MC (2011) A rapid quantitative determination of phenolic acids in *Brassica oleracea* by capillary zone electrophoresis. *Food Chem* 127(2):797–801
- Wang B, Zhang X (2012a) Inhibitory effects of broccolini leaf flavonoids on human cancer cells. *Scanning* 34(1):1–5
- Wang B, Zhang X (2012b) Separation, purification and bioactivity of broccolini leaves flavonoids. *Solvent Extr Res Dev Jpn* 19:161–170
- Wang X, Zhang B, Wang B, Zhang X (2012) Volatile components of ethanolic extract from broccolini leaves. *Nat Prod Res* 26(7):680–683

- Wikipedia (2012) Broccolini. <http://en.wikipedia.org/wiki/Broccolini>
- Yang Y, Zhang X (2011) In vitro antitumor activity of broccolini seeds extracts. *Scanning* 33(6):402–404
- Yang Y, Zhang X (2012) Extraction, identification and comparison of glucosinolates profiles in the seeds of broccolini, broccoli and Chinese broccoli. *Solvent Extr Res Dev Jpn* 19:153–160
- Yang Y, Yan H, Li Y, Yang ST, Zhang X (2011) Isothiocyanates from broccolini seeds induce apoptosis in human colon cancer cells: proteomic and bioinformatic analyses. *Pharmazie* 66(5): 382–390
- Zhang B, Wang X, Yang Y, Zhang X (2011) Extraction and identification of isothiocyanates from broccolini seeds. *Nat Prod Commun* 6(1):65–66