# HEALTHY
# FOREST BERRIES

The clean untouched growing environment for forest berries is vast, since 86 % of Finland is covered by forests with an average of only 18 people living per square kilometer. In summertime, long warm days together with the midnight sun help berries ripen and reach a high quality. Finnish forest berries are also available with organic certification, because Finland has the world's largest organic-certified forest berry areas.

Finnish forests offer a huge crop of forest berries every summer. The annual crop of forest berries is over 500 million kilos – over 100 kilos to every Finn. That's why we have "Everyman's rights". They also allow for tourists to pick berries or mushrooms and hike freely in nature without any need for permission from land owners.

About 60 % of households pick forest berries and over 20 million kilos are collected for sale. Lingonberries and bilberries are the most commonly found berries in Finnish forests. They are used in households as well as in domestic and foreign trade. Furthermore, a wide range of Finnish forest berry products are exported: dried berries, berry powders, berry seed oils, smoothies, berry mueslis, snacks, berry juices and drinks, jams, soups, liqueurs, berry wines, honey products, berry chocolates, other sweets, food supplements, cosmetics and other wellness products.

There is nowadays a great deal of worldwide interest in forest berries and their beneficial health effects. Medical and nutritional studies are being conducted in many countries concerning the chemical contents of forest berries and their health implications. It has been shown that Finnish forest berries can form a significant component of a healthy diet owing to their

- *high content of phenolic compounds*
- *health-promoting seed oils*
- *low energy content*
- *high fiber content*
- *a wide range of vitamins, particularly high content of vitamins C and E*
- *a wide range of minerals, but low sodium content*

Finnish forest berries contain high concentrations of water (approx. 80-90 %) and are, therefore, low-energy foodstuffs. Most of the energy content of forest berries derives from the presence of various sugars. However, they also contain proteins and fat, albeit in very low proportions (< 1 g/100 g) with an exception of sea buckthorn berry (5 g/100 g). The fat (oil) content of forest berries is of very high quality as it consists of essential health-promoting fatty acids (figure 1.). Most of the oil is held in the seeds. For this reason berry seeds should not be discarded during food preparation. Forest berries contain no cholesterol, gluten or lactose.

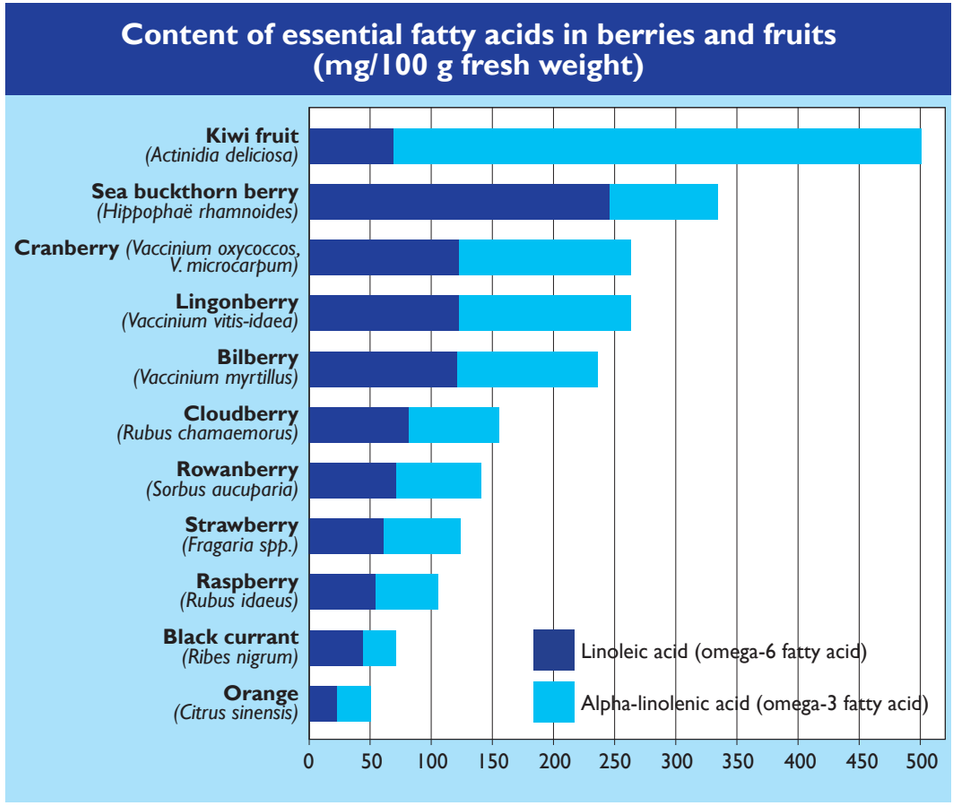



*Figure 1. Source: National Institute for Health and Welfare, Nutrition Unit, Fineli Food Composition Database 18 (10.1.2017). www.fineli.fi.*

Forest berries contain significant amount of both soluble and insoluble fiber (figure 2.). The concentrations of the various fiber types vary according to the berry in question. Particularly cloudberry, sea buckthorn berry and rowanberry are rich sources of dietary fiber.

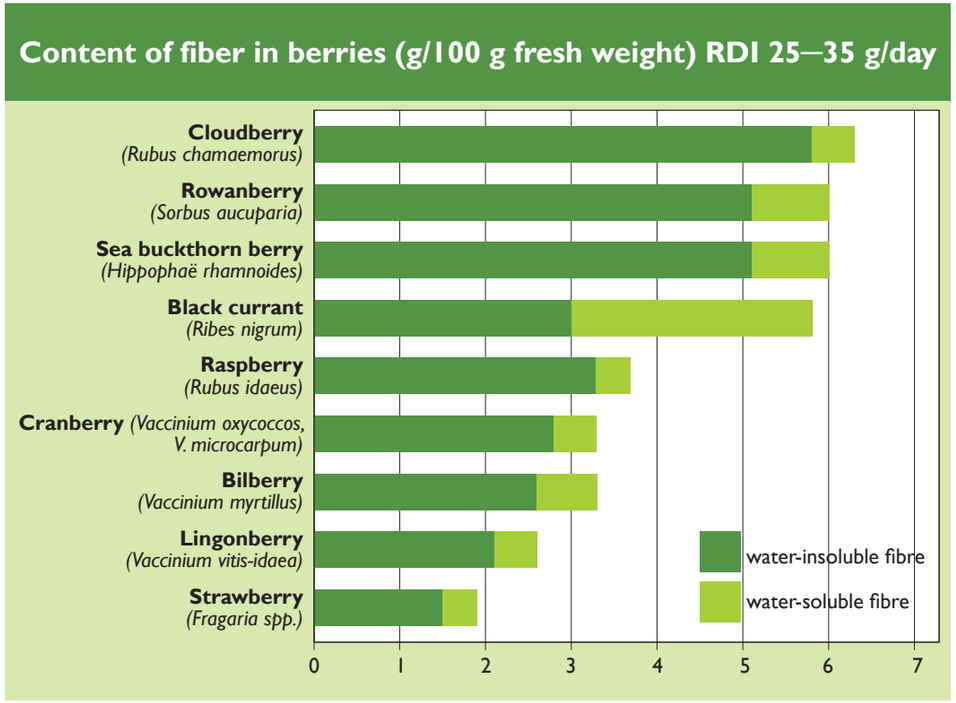
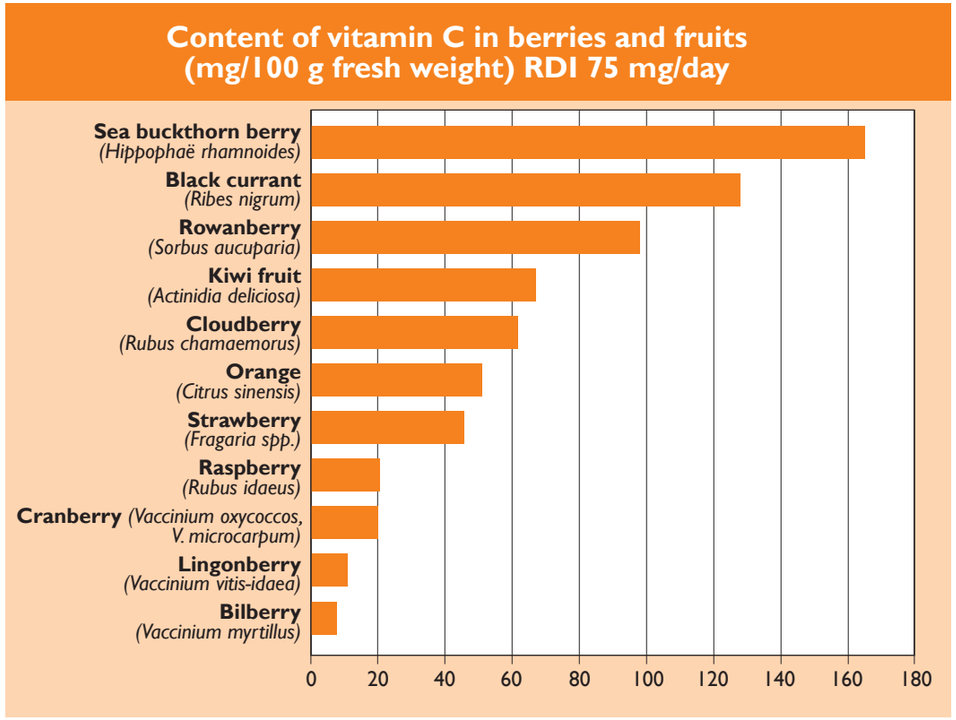



*Figure 2. Source: National Institute for Health and Welfare, Nutrition Unit, Fineli Food Composition Database 18 (10.1.2017). www.fineli.fi and RDI (Recommended Daily Intake) Finnish Nutrition Recommendations 2014 by the National Nutrition Council www.ravitsemusneuvottelukunta.fi/portal/en/nutrition+recommendations/*

Forest berries are an equally rich source of vitamin C when compared with other fruits. Sea buckthorn berry, cloudberry, rowanberry and raspberry are rich sources of vitamin C (figure 3 a.). Bilberry, cloudberry, lingonberry and sea buckthornberry can act as sources of vitamin E (figure 3 b.). Furthermore, cloudberry and raspberry can act as a source of folic acid and sea buckthornberry as a source of thiamin (vitamin B1).

Forest berries contain a wide range of minerals, such as potassium, zinc and magnesium. As with vitamins, the mineral concentrations of forest berries compare favourably with those of fruits. Moreover, sodium concentration is very low, thus making berries of significant health value to those suffering from raised blood pressure.



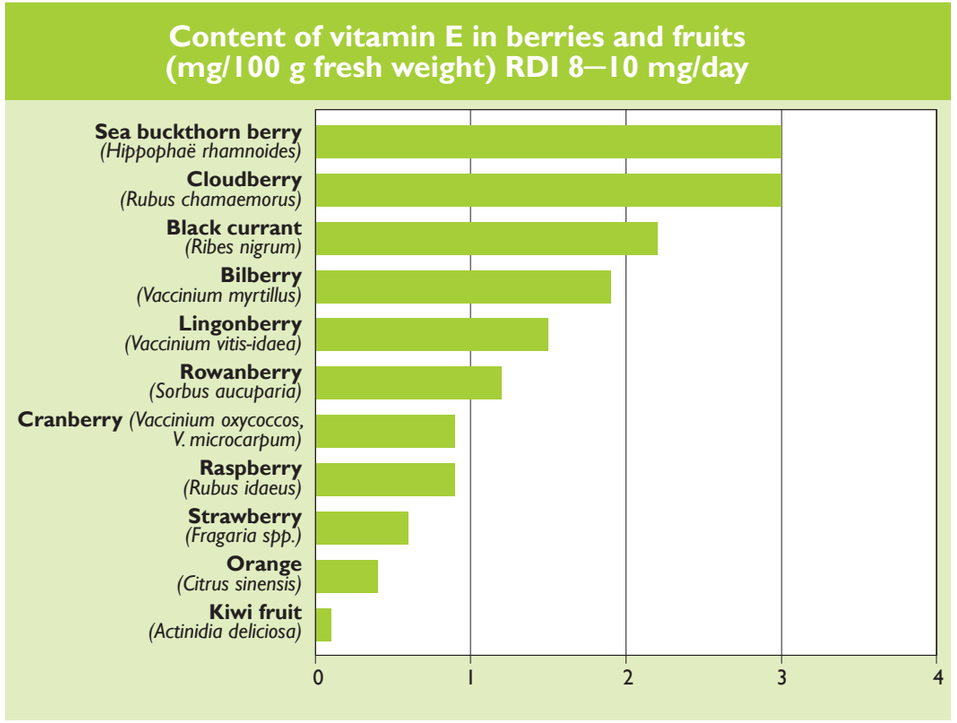




*Figure 3 a and 3 b. Source: National Institute for Health and Welfare, Nutrition Unit, Fineli Food Composition Database 18 (10.1.2017). www.fineli.fi and RDI (Recommended Daily Intake) Finnish Nutrition Recommendations 2014 by the National Nutrition Council www.ravitsemusneuvottelukunta.fi/portal/en/nutrition+recommendations/*

Besides vitamins and minerals, dietary polyphenols are natural compounds occurring in berries, fruits and vegetables (figure 4.). Chemically, polyphenols are a large heterogeneous group of compounds which are generally classified into flavonoids and nonflavonoids. Polyphenols are not actually classified as a nutrient. However, they are the subject of intensive research and have been found to have beneficial effects on human health as well. The phenolic compounds are concentrated in the skin of the berry. It is therefore important to use the whole berry in food or foodstuff preparation and not to waste the skin or seeds.

**Phenolic compounds which berries consist are:**

**flavonoids**

- **anthocyanins**
  - cyanidin, delphinidin, peonidin, petunidin, malvidin
  - berry sources: bilberry, crowberry, bog bilberry
- **flavonols**
  - quercetin, isorhamnetin, kaempferol and myricetin
  - berry sources: bog bilberry, sea buckthorn
- **catechins (flavan-3-ols)**
  - berry sources: lingonberry, (bilberry, crowberry)

**nonflavonoids**

- **tannins**
  - proanthocyanidins
  - berry sources: lingonberry, cranberry, crowberry
  - ellagitannins
  - berry sources: cloudberry, raspberry, arctic bramble
- **phenolic acids**
  - hydroxycinnamic acids, hydroxybenzoic acids
  - berry sources: rowanberry, (bilberry, crowberry)
- **stilbens**
  - resveratrol
  - berry sources: lingonberry
- **lignans**
  - berry sources: lingonberry

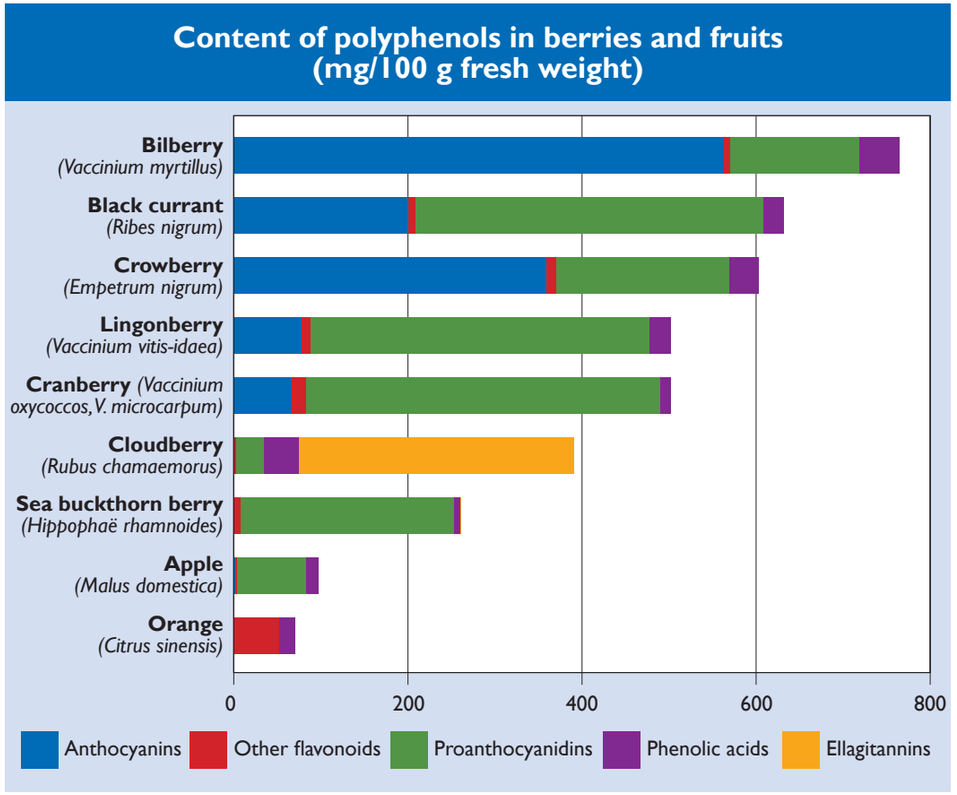



*Figure 4. Source: Koponen et al. 2007. Hellström et al. 2009.*

The flavonol (quercetin, isorhamnetin, kaempferol and myricetin) content in forest berries has been studied extensively. It may be concluded that all forest berries contain flavonols, even though their concentrations vary significantly among different berry species (figure 5.). Flavonol content is high in cranberry, bog bilberry and sea buckthorn berry, higher than in apples and tea leaves.

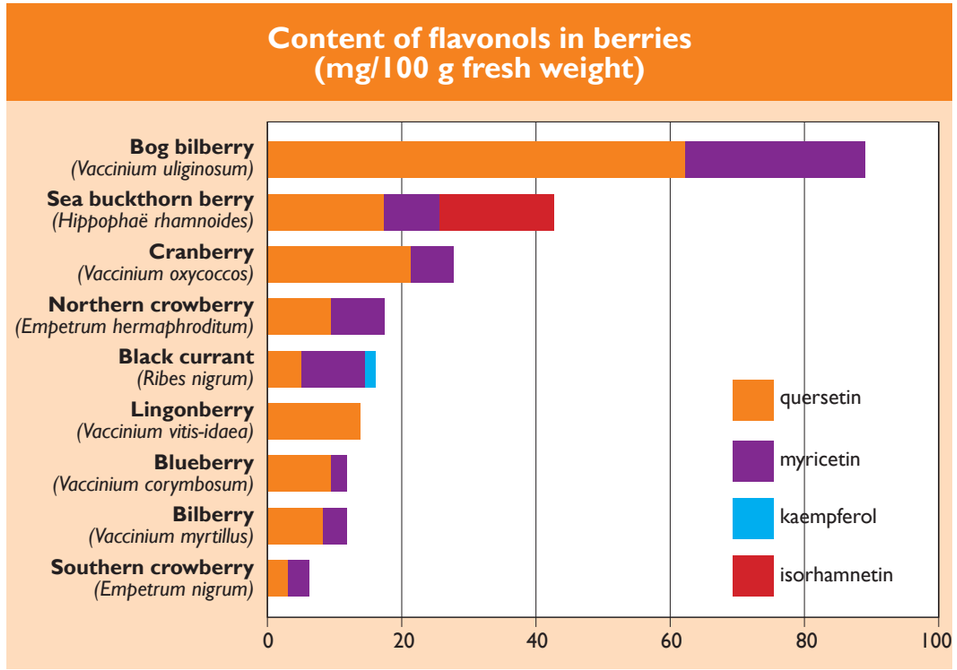



*Figure 5. Source: Riihinen 2005.*



# LINGONBERRY *(Vaccinium vitis-idaea)*

The Finnish lingonberry grows on dry forest soils, typically in pine forests and on lichen heaths where the undergrowth is sparse. The dark red berries can be found growing in clusters on small shrubs close to the ground. The thick, wax-coated leaves are dark green in colour. Lingonberries are ready for picking between late August and the end of September. The average annual crop in Finnish nature is an estimated 257 million kilos.

Lingonberry is prized for its unique and sharp taste. Before freezers and refrigerators lingonberries were mashed in their own juice and preserved in cellars of Finnish homes. Lingonberries contain the natural preservative, benzoic acid. Lingonberries have many applications in the kitchen and are commonly made into jams, jellies, juices, pasties, pies and porridges. They may also be used to flavour bread, cookies, milk products etc.



Lingonberry typically contains a low amount of energy but significant amounts of vitamin E (figure 3 b.), quercetin (figures 5. and 6.) and proanthocyanidins (figure 7.) as well as catechins. Lingonberries also contain significant amounts of the widely studied phenolic compound resveratrol, which is also present most noticeably in grapes and red wine (figure 8.). Lignans, which are phenolic phytoestrogens and general compounds in linen and rye, also exist among the compounds found in lingonberry.

Companies can use certain nutritional claims when they market lingonberries in the EU. The following claims are allowed:

- *High fiber content (5,3 g/100 kcal)*
- *Low fat content (<0,1 g/100g)*
- *No saturated fats (< 0,1 g/100 g)*
- *No salt (0,002 g/100 g)*
- *Natural source of vitamin E/Source of vitamin E (1,9 mg/100g)*

According to recent publications, lingonberries are studied in maintaining healthy blood vessels and preventing type 2 diabetes.

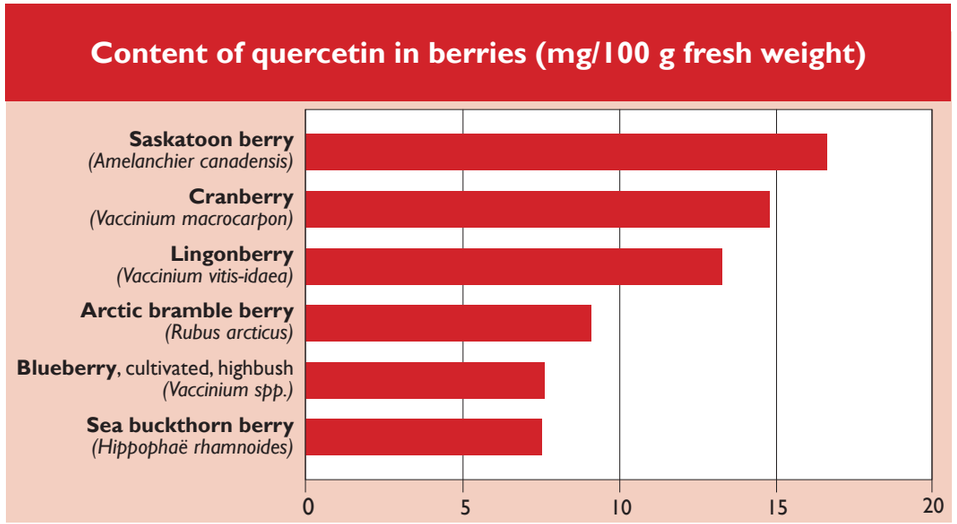



*Figure 6. Source: U.S. Department of Agriculture, Agricultural Research Service. 2013. USDA National Nutrient Database for Standard Reference, Release 26. Nutrient Data Laboratory Home Page, www.ars.usda.gov/ba/bhnrc/ndl*

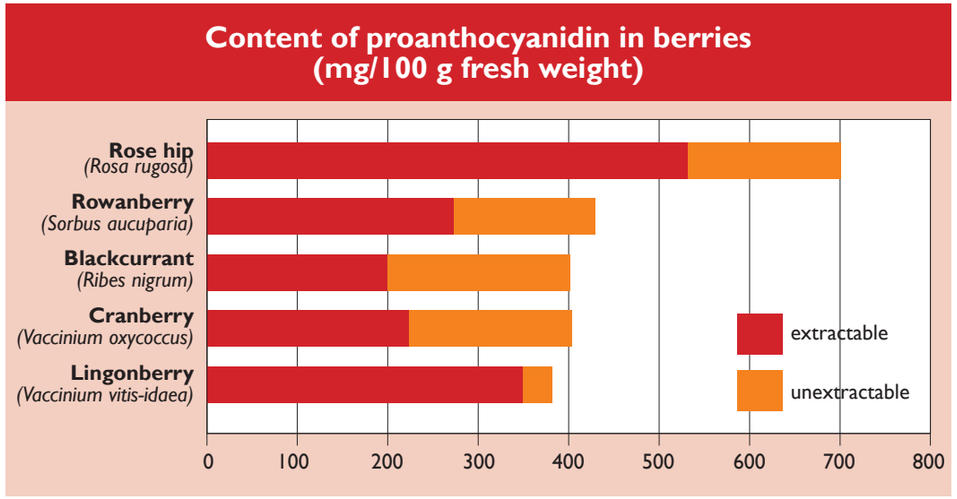



*Figure 7. Source: Hellström et al. 2009.*

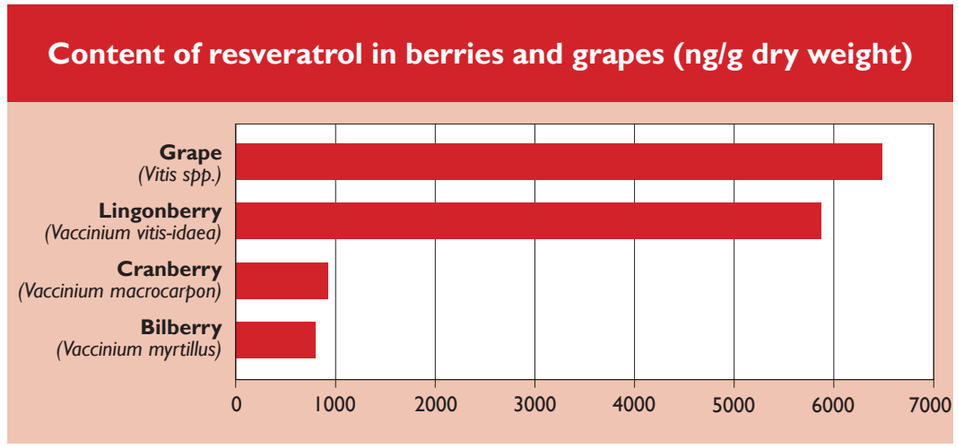



*Figure 8. Source: Rimando et al. 2004.*



# BILBERRY *(Vaccinium myrtillus)*

The Finnish forest bilberry (*Vaccinium myrtillus*) differs from the cultivated blueberry (*Vaccinium corymbosum, V. angustifolium*). The bilberry is smaller and has a unique, sweet and juicy taste thanks to the climatic conditions and wild environment of the far north. The bilberry is also blue inside – indeed, it is rich in colour. Forest bilberries require a lot of water and are therefore typically to be found growing in spruce forests. The leaves of the bilberry shrub are light green in colour while the berries are dark blue. Bilberries are suitable for picking between late July and the beginning of September. The average annual crop of bilberries in the Finnish nature is about 184 million kilos.

The Finnish forest bilberries have a sweet flavour even though they do not contain very much sugar. They are used in soups, puddings, pastries and even porridges. Freshly baked bilberry pie is, without doubt, one of the best-loved delicacies. Bilberry juice may be served with meals and warm bilberry soup is an excellent form of refreshment when out hiking or skiing on a freezing winter's day.



The Finnish forest bilberry typically contains significant amounts of fiber (figure 2.), anthocyanins and phenolic acids such as hydroxycinnamic acids and hydroxybenzoic acids (figure 4.). Anthocyanins give the Finnish forest bilberry peel and pulp their dark blue pigmentation. The Finnish forest bilberries have three times more anthocyanins than the amounts found in cultivated blueberries (figure 9.).

Companies can use certain nutritional claims when they market fresh or frozen bilberries in the EU. The following claims are allowed:

- *High fiber content (5,0 g/100 kcal)*
- *Low fat (1,1 g/100g)*
- *No saturated fats (< 0,1 g/100 g)*
- *No salt (0,002 g/100 g)*
- *Natural source of vitamin E/source of vitamin E (1,9 mg/100g)*

According to recent publications, the Finnish forest bilberries (or their isolated fractions) are studied in relation to the prevention of heart diseases, cancers, type 2 diabetes and eye disorders.

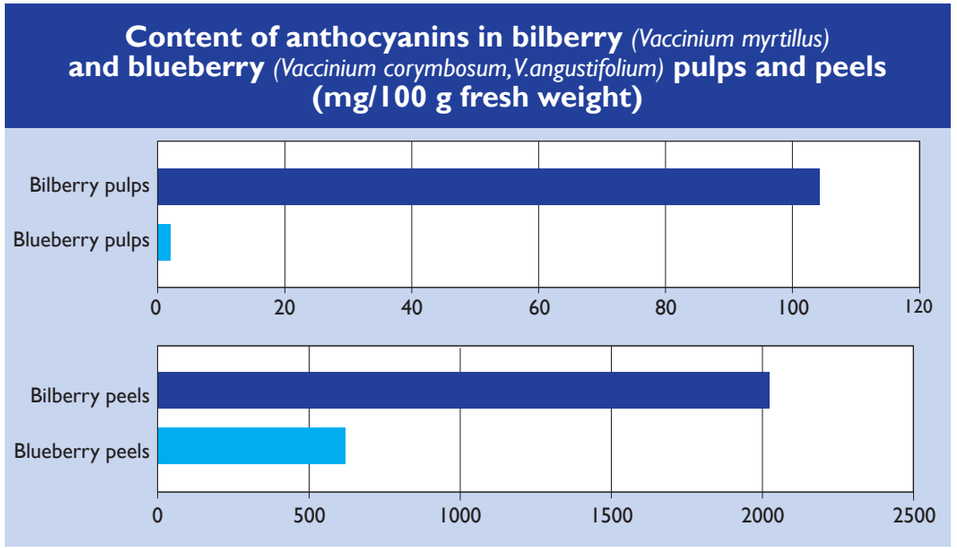



*Figure 9. Source: Riihinen et al. 2008.*

# CLOUDBERRY *(Rubus chamaemorus)*

The Finnish cloudberry grows on remote swamps and forest mires. It is generally confined to the northern parts of Finland. The leaves of the cloudberry are dark green. As the berry ripens its colour changes from an apricot orange to a bright yellow. The berries are ripe for picking for only a relatively short period of time at the end of July and beginning of August. The average annual crop of cloudberries in Finnish nature is about 25 million kilos.

Cloudberries are at their best when served freshly picked, for example, on pancakes or waffles with some ice cream. Cloudberries have a subtle and irresistible flavour, and are commonly used in bakeries to decorate cakes and desserts. The food industry uses cloudberries in yoghurts and jams while one of the specialities of distilleries is the sweet and aromatic cloudberry liqueur.



The cloudberry is especially rich in nutrients. It contains very high concentrations of fiber (figure 2.) as well as vitamins C and E (figure 3 a. and 3 b.). Cloudberries do not contain high flavonoid levels.

However, another phenolic compounds, called ellagitannins, are present in abundance (figure 10.). Researchers have found, that these compounds are typical for all the berries with aggregates of drupes, like raspberry and arctic bramble.

Companies can use certain nutritional claims when they market fresh or frozen cloudberries in the EU. The following claims are allowed:

- *High fiber content (6,3 g/100 g)*
- *Low fat (1,1 g/100g)*
- *No saturated fats (< 0,1 g/100 g)*
- *No salt (0,002 g/100 g)*
- *High content of vitamin C/good source of vitamin C (61,5 mg/100 G)*
- *Natural source of vitamin E/source of vitamin E (3,0 mg/100g)*

According to recent publications, cloudberries (or their isolated fractions) are studied in relation to their antimicrobial and anticarcinogenic properties.

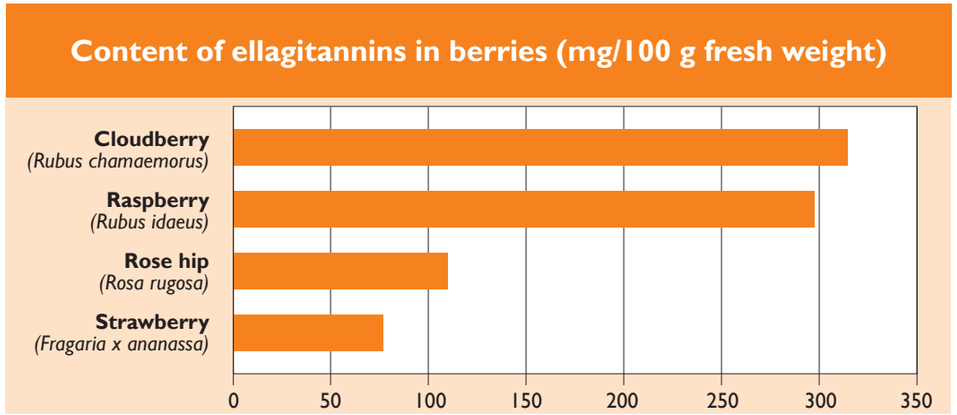



*Figure 10. Koponen et al. 2007.*

# CROWBERRY

*(Empetrum nigrum, E. hermaphroditum)*

The crowberry grows throughout Finland. With its green shoots and black berries, this dwarf shrub grows on the dry heaths of hills, on raised bogs and even on the barren peatlands and fields of Lapland. The crowberry season begins in August and lasts until the first snows. Crowberry jelly or juice blends well with other berries like bilberries. In addition to juices and jellies, crowberries are used in soups, pies, and other berry preparations. The average annual crop of crowberries in the Finnish nature is about 120 million kilos.



Crowberries contain high levels of flavonoids, such as flavonols (figure 5.) and antocyanins (figure 11.). Many studies confirm, that crowberries are rich in anthocyanins such as forest bilberries. In addition to the health-promoting effects of these compounds, they lend the berry its deep blue colour. These pigments are used as natural colouring by the foodstuff industry.

Each of the Finnish forest berries has an unique combination of different nutrients, phenolics and other compounds. Thus, the best nutritional benefit is gained by using a wide range of berry products, which contain whole berries instead of their isolated fractions or single compounds.

**Content of anthocyanins in bilberries, crowberries and blueberries (mg/100 g fresh weight)**

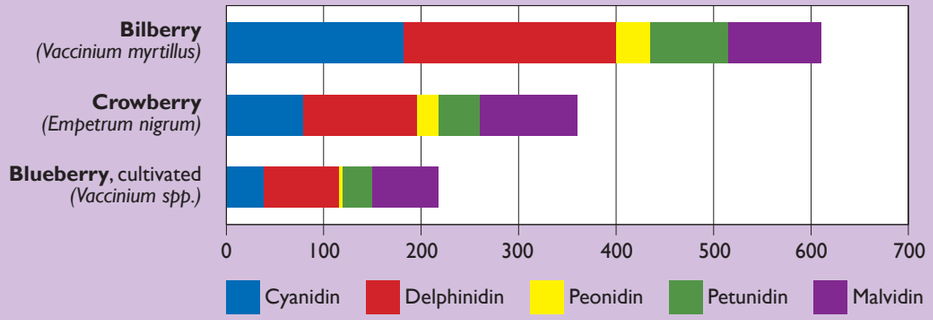



*Figure 11. Source: Koponen et al. 2007.*

# SEA BUCKTHORN BERRY

*(Hippophaë rhamnoides)*

The sea buckthorn is a thorny shrub 0.5–3 metres tall. Its leaves are greenish-grey above and silvery-grey to rusty-brown underneath. The plant is dioecious and wind-pollinated; the male and female flowers grow on separate individual plants. Its flowers are small, approximately 3 mm in diameter and yellowish-green. The berry is an elongated, yellow or yellowish-orange juicy drupe 8–10 mm long.



Wild sea buckthorn grows in the coastal regions of the Gulf of Bothnia and the Åland Islands. The sea buckthorn grows best on pebbly, sandy or shingly beaches. Actinobacteria present in the root system of the shrub bind with nitrogen in the atmosphere, which enables the sea buckthorn to grow even in fairly low-nutrient soil. It does, however, require plenty of sunlight to grow.

Wild sea buckthorn berries can be picked beginning in October, when they have reached their peak ripeness and are easily detached from the base. The shrubs are thorny and dense, which can make picking difficult. The berries can be picked by hand or by tapping the branches with a stick, releasing the berries, which can then be gathered from the ground below. Collecting wild sea buckthorn berries by breaking or crushing the branches of the shrub is prohibited.

The sea buckthorn has the highest nutrient content of all the wild berries. It is rich in vitamins C and E, fibre and essential fatty acids. The amount of vitamin C contained in 50 grams of sea buckthorn berries is equivalent to a medium-sized orange. Approximately 4–7 % of the berry's weight is made up of oil in the pulp and seed consisting primarily of mono- and polyunsaturated fatty acids.

Companies can use certain nutritional claims when they market fresh or frozen sea buckthorn berries in the EU. The following claims are allowed:

- *High fiber content (6,0 g/100 g)*
- *Low content of saturated fats (0,8 g/100 g)*
- *No salt (0,0035 g/100 g)*
- *High content of vitamin C/good source of vitamin C (165 mg/100 G)*
- *Source of vitamin E/good source of vitamin E (3,0 mg/100g)*
- *Source of thiamine/source of B1 vitamin (0,18 mg/100g)*

Sea buckthorn is used in the food industry to make sauces, jams, berry powders and juices. Sea buckthorn oil is used in the preparation of dietary supplements and cosmetics. The berries can be enjoyed on their own or in porridge or yoghurt, for instance. They can be preserved by drying or freezing or in the form of juice or jam.

# EXAMPLES OF DIFFERENT BERRY PRODUCTS WHICH FINNISH COMPANIES ARE MAKING

- Dried berries
- Berry soups and sauces
- Berry smoothies and juices
- Berry mixes, dried
- Berry jams and jellies
- Berry mueslis
- Berry gels and sport products
- Berry wines and liqueurs
- Natural cosmetics products
- Chaga-berry products
- Berry seed oils and capsules
- IQF berry products
- Berry powders and ground berries
- Berry juice concentrates
- Berry and linseed powders
- Berry snacks, chips and granules
- Berry purées
- Berry sweets and chocolate berries
- Birch sap-berry products
- Wild herb-berry products

More information

- www.arctic-flavours.fi > companies
- www.arctic-bilberry.fi > companies
- www.arcticlingonberry.fi > companies

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## Tips for enjoying of healthy berries!

- *Eat one hundred grams of berries a day!*
- *Berries are a light food to munch on. Replace salty snacks with nutritious, low-calorie berries.*
- *You can make quick, tasty snacks by combining berries with plain yoghurt, soy yoghurt, cottage cheese, curd cheese, and various kinds of nuts, seeds or bran.*
- *To make delicious and healthy milkshakes and beverages, combine berries with berry juice, plain yoghurt, buttermilk, milk, water, soy or oat milk, and different sorts of seeds or nuts.*
- *Berry powder can be easily added to yoghurts, cereals, porridge or tea.*
- *One tablespoon of berry powder is equivalent to about 1.5 dl of fresh berries.*
- *Berry powder is easy to take with you to work or on trips.*
- *Keep the berry powder in an airtight container so that you can take it along even in warm or humid weather.*
- *Dried berries are easy to carry along as a snack, and can be used instead of raisins in baking.*
- *Combine berry juice with mineral water for a bubbling celebration drink.*
- *Partly frozen berries with chocolate, caramel or vanilla sauce can be served as a quick dessert even on special occasions.*
- *You can make a refreshing summer treat by puréeing fresh or frozen berries with ice cream.*
- *Welcome to Finland: Everyman's rights allow You to find and pick the forest berry and mushroom treasures and hike freely in the nature. Although, the berry picking season is short, there is always a wide range of commercial Finnish forest berry products available!*



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