

## SPICES

**Éva Németh**

*BKA University, Department of Medicinal and Aromatic Plants, Budapest, Hungary*

**Keywords:** culinary herbs, aromatic plants, condiment, flavoring plants, essential oils, food additives.

### Contents

1. Introduction
2. Spices of the temperate zone
  - 2.1. Basil, *Ocimum basilicum* L. (*Lamiaceae*). (See Figure 1).
  - 2.2. Caraway *Carum carvi* L. (*Apiaceae*)
  - 2.3. Dill, *Anethum graveolens* L. (*Apiaceae*)
  - 2.4. Mustard, *Sinapis alba* and *Brassica* species (*Brassicaceae*)
  - 2.5. Oregano, *Origanum vulgare* L. (*Lamiaceae*)
  - 2.6. Sweet marjoram, *Majorana hortensis* Mönch. (*Lamiaceae*)
3. Spices of the tropics
  - 3.1. Cinnamon, *Cinnamomum zeylanicum* Nees, syn. *C. verum* J.S.Presl. (*Lauraceae*)
  - 3.2. Clove, *Syzygium aromaticum* L syn. *Eugenia caryophyllata* Thunb. (*Myrtaceae*)
  - 3.3. Ginger, *Zingiber officinale* Roscoe (*Zingiberaceae*)
  - 3.4. Pepper, *Piper nigrum* L. (*Piperaceae*)
- Glossary
- Bibliography
- Biographical Sketch

### Summary

In ancient times no sharp distinction was made between flavoring plants, spices, medicinal plants and sacrificial species. In the past, spices were very valuable articles of exchange, for many countries they assured a source of wealth and richness.

Today, spices are lower in price, but they are essential of foods to any type of nation. In addition to synthetic aromatic compounds, spices from natural resources have increasing importance again.

The majority of spices not only add flavor and aroma to our foods, but contribute to their preservation and nutritive value. Although the flavoring role of spices in our food cannot be separated from their other (curing, antimicrobial, antioxidant, etc.) actions, in this article we try to introduce some of the most important plants selected according to their importance as condiments.

In addition several significant crops are used as spices, but these are considered among the vegetables (e.g. garlic, chives, parsley). A common feature of the huge majority of spices is, that they contain essential oil, which is mainly responsive for the aromatic value.

Most of the spice plants originate from the Mediterranean region and from tropical Asia. Roots, leaves, flowers and seeds may be utilized, dependent on species.

In this chapter ten selected spice species are described in detail, giving a short history, a botanical description, introduction to their ecological requirements, active materials of the utilized plant organs, areas and methods of consumption, as well as other types of utilization, and the main aspects of cultivation.

## 1. Introduction

The first fragmentary records about utilization of spices date back to ancient Egypt. In China, as early as in 2700 B.C. the bases of herbal medicine were described. Some spice plants of Indian origin—cardamon, turmeric—were cultivated in Babylon already in the eighth century B.C. A bit later, the Bible provides information about the trade, utilization and appreciation of spice plants.

The ancient Greeks frequently consumed culinary herbs both imported from Asia (e.g. pepper, cinnamon, ginger) and produced in neighboring countries (e.g. anise, caraway, poppy).

In the first century AD, the Roman Empire developed an active spice trade with and direct routes towards different countries, first of all to India. Intensive utilization of spices was continued also by the Arabs and Muslims.

In Europe, oriental spices were rather scarce even to the time of the First Crusade. The first commodities were pepper, ginger and cloves. Later, exploiting the growing interest in spices, Jewish traveling merchants found ways, even between Christians and Muslims, to assure the supply of spices. The Crusades opened the way for trade with the east, including trade in valuable spices.

In ancient times no sharp distinction was made between flavoring plants, spices, medicinal plants and sacrificial species. In the past, spices were very valuable articles of exchange and trade, like jewels, pearls, and precious metals.

In the Middle Ages, oriental spices were highly valued: a German document lists a pound of nutmeg as being worth seven fat oxen in 1393. At this time, cultivation of herbs and spices in Europe started, but it was carried out mainly in monastery gardens.

It should not be forgotten, that in this period many of the condiments and foods widely used today were unknown or unavailable (tea, coffee, cocoa, sugar, lemon, potato, etc.). With the help of spices, food could be made more appetizing.

They also had a very important role in preservation of foodstuff. At that time, only salting and cool storage in winter could assure short term preservation of meat. Spices, because of their antimicrobial properties, were suitable both as preservatives and as materials to disguise unpleasant flavors and odors.

With the development of shipping and the era of great discoveries, the trade to the Orient increased.

In the following decades, western Empires (e.g. Spain, Portugal, the Netherlands, etc.), controlling large areas of land, especially in the Far East, enjoyed a big boom through the trade in spices.

Large battles were even fought for them. The Spice Islands, off the eastern coast of Africa, and surroundings assured supplies of pepper, nutmeg, cloves, and similar products, which had been gradually introduced into cultivation.

In the twentieth century, the important spice producing countries became independent, and trading is still proceeding on a large scale.

Production of spices from the Mediterranean and temperate regions also increased. Today they are mainly produced under field conditions, using modern technologies.

Although the flavoring role of spices in our food cannot be separated from their other (curing, antimicrobial, antioxidant, etc.) actions, in this article we have tried to introduce some of the most important plants selected according to their importance as condiments.

However, there are no scientific basis to make precise distinction between spices and herbs. For instance basil, marjoram and thyme are utilized for spicing and well as for curing.

In this chapter we are focusing on species which are mainly used for making spices and their therapeutic application is a secondary one. Beside the spices described in detail, some other frequently used ones are listed in Table 1.

The main component of all of them is essential oil. Plants which, although having value as condiments, are mainly used and produced as vegetables (garlic, chives, parsley, etc.) are discussed elsewhere.

| Latin name                             | English name | Plant family  | Utilised organ | Plant life form                         | Main source area                      |
|--|--------------|---------------|----------------|---|---------------------------------------|
| <i>Anethum graveolens</i> L.           | dill         | Apiaceae      | fruit          | herbaceous annual                       |                                       |
| <i>Artemisia dracunculus</i> L.        | tarragon     | Asteraceae    | shoot          | herbaceous perennial                    | temperate countries                   |
| <i>Brassica juncea</i> (Cosson) Czern. | mustard      | Brassicaceae  | fruit          | herbaceous annual                       | temperate climate countries           |
| Capsicum species                       | capsicum     | Solanaceae    | fruit          | herb. or semiwoody, annual or perennial | tropical and temperate countries      |
| <i>Carum carvi</i> L.                  | caraway      | Apiaceae      | fruit          | herbaceous annual or biennial           | mediterranean and temperate countries |
| <i>Cinnamomum cassia</i> Blume         | cassia       | Lauraceae     | bark           | evergreen tree                          | China                                 |
| <i>Coriandrum sativum</i> L.           | coriander    | Apiaceae      | fruit          | herbaceous annual                       | mediterranean and temperate countries |
| <i>Crocus sativus</i> L.               | saffron      | Iridaceae     | stigma         | bulbous perennial                       | mediterranea                          |
| <i>Cuminum cyminum</i> L.              | cumin        | Apiaceae      | fruit          | herbaceous annual                       | mediterranean                         |
| <i>Curcuma longa</i> L.                | turmeric     | Zingiberaceae | rhizome        | herbaceous perennial                    | tropical Asia                         |
| <i>Cinnamomum zeylanicum</i> Nees      | cinnamon     | Lauraceae     | bark           | evergreen tree                          | Ceylon                                |
| <i>Elettaria cardamomum</i> Maton.     | cardamom     | Zingiberaceae | seed           | evergreen bush                          | tropical Asia                         |
| <i>Foeniculum vulgare</i> Mill.        | fennel       | Apiaceae      | fruit          | herbaceous perennial                    | mediterranean and temperate countries |
| <i>Hyssopus officinalis</i> L.         | hyssop       | Lamiaceae     | leaf           | herbaceous perennial                    | mediterranean and temperate countries |
| <i>Illicium verum</i> Hook             | star anise   | Magnoliaceae  | fruit          | evergreen tree                          | tropical Asia                         |
| <i>Laurus nobilis</i> L.               | laurel       | Lauraceae     | leaf           | evergreen tree or shrub                 | mediterranean                         |
| <i>Majorana hortensis</i> Mönch.       | marjoram     | Lamiaceae     | shoot          | herbaceous annual or perennial          | mediterranean and temperate countries |
| <i>Myristica fragrans</i> Houtt        | nutmeg       | Myristicaceae | fruit          | evergreen tree                          | Indonesia, Sri Lanka, Jamaica         |
| <i>Ocimum basilicum</i> L.             | basil        | Lamiaceae     | shoot          | herbaceous annual or perennial          | from subtropic to temperate countries |
| <i>Origanum vulgare</i> L.             | oregano      | Lamiaceae     | shoot          | herbaceous perennial                    | mediterranean and temperate countries |
| <i>Pimenta officinalis</i> Lindl.      | allspice     | Myrtaceae     | fruit          | evergreen tree                          | Jamaica                               |
| <i>Pimpinella anisum</i> L.            | anise        | Apiaceae      | fruit          | herbaceous annual                       | mediterranean                         |
| <i>Piper nigrum</i> L.                 | pepper       | Piperaceae    | fruit          | perennial climbing shrub                | tropical Asia and America             |
| <i>Rosmarinus officinalis</i> L.       | rosemary     | Lamiaceae     | leaf           | semiwoody bush                          | mediterranean                         |
| <i>Saturja hortensis</i> L.            | savory       | Lamiaceae     | shoot          | herbaceous annual                       | mediterranean and temperate countries |
| <i>Salvia officinalis</i> L.           | sage         | Lamiaceae     | leaf           | semiwoody shrub                         | mediterranean and temperate countries |
| <i>Syzygium aromaticum</i> L.          | clove        | Myrtaceae     | bud            | evergreen tree                          | Indonesia, Sri Lanka, Madagascar      |
| <i>Thymus vulgaris</i> L.              | thyme        | Lamiaceae     | leaf           | herbaceous perennial                    | mediterranean and temperate countries |
| <i>Vanilla planifolia</i> Andr.        | vanilla      | Orchidaceae   | Pods           | evergreen climbing herbaceous           | Madagascar, Réunion, Mexico           |
| <i>Zingiber officinale</i> Roscoe      | ginger       | Zingiberaceae | rhizome        | herbaceous perennial                    | India, China, Nigeria, Australia      |

Table 1. Frequently used spice plants and their characteristics

## 2. Spices of the temperate zone

### 2.1. Basil, *Ocimum basilicum* L. (*Lamiaceae*). (See Figure 1).



Figure 1. Basil, *Ocimum basilicum* L. (Photo: Bernáth, J.)

The genus *Ocimum*, which consists of 50 to 60 species, are herbaceous perennials or bushes in tropical and subtropical areas. *O. basilicum*, basil (sweet or common basil) as the most popular one, is today distributed throughout much of the world. Its original growing area is supposed to be in North-west India, under subtropical climatic conditions. It has been cultivated for thousand of years in the southern part of Asia, in Central America and Africa. In Europe it has been known for about 200 years and is produced in Mediterranean and central European countries. Because of its sensitivity to frosts, in these regions it can be grown only as an annual plant, like green and red pepper, or tomato.

Basil requires warmth and much sunshine, and also considerable precipitation and a good supply of nutrients, especially potassium. The height is variable, 20 to 80 cm, depending on variety and growing conditions. The stems are quadrangular, and the leaves variable in size, color and shape. Varieties, selected for ornamental purposes, often have big, strongly curled and/or serrated, dark reddish leaves with very few flowers. Normally, flowers appear in the middle of the foliage, in whorls at the axils of the leaves; the petals are white or pink. Seeds ripen unevenly, and the nutlets are black or dark brown, and small.

The basil plant is sacred in its home, India, where it can be found in every Hindu house. It is believed to serve as a "Passport to Paradise". Records tell us, that in the Middle Ages, many superstitions were connected with this species; among others it was believed to bring scorpions into one's brain when smelling it.

The main active ingredient of basil is the essential oil, which accumulates in glandular trichomes of the leaves, bracts and flowers. The content of essential oil in dried plant material may reach 2%, but usually it is much less, say 0.2 to 0.8%. As with the morphological variability of the species, it is also rather variable concerning the chemical constituents. Several chemical varieties are known, according to the composition of the oil. The chemotype in India and the Far East has methyl-chavicol (estragole) as the main component in the oil, up to 80 to 90%. The best known chemotypes in Europe consist of about 50% methyl-chavicol and 40 to 45% linalool. The African chemotype possess an essential oil, which, beside methyl-chavicol, is rich in camphor (30 to 45%). Today, even further varieties have been developed. Other biologically active chemical compounds of basil are tannins and fatty oil in the fruits.

Basil plays a significant role in our diet as a spice. It is widely added to pizzas, soups, salads, and egg dishes. The essential oil or extracts of it are used in fish conserves, refreshments and liqueurs. Its scent is said to resemble that of clove, so basil may also be used for sweets.

Basil is also utilized in therapy, as a medicinal plant. For centuries, it was applied against cold and lack of appetite. Modern phytotherapy utilizes its antispasmodic, carminative, mild sedative and galactagogue effect in different infusions and herbal preparations.

For cultivation of basil, warm, sunny places with fertile, sandy loam soils of good water management are appropriate. Usually, it is propagated by seedlings, which are raised in

nursery beds for 6 to 7 weeks. These have to be planted into open fields after the frosts. Basil develops quickly, and some weeks after transplantation the first flowers appear. At the time of full bloom, the plants are cut by hand or machines, collected and dried at low temperatures. Basil is marketed mainly in dried, chopped form, chopping is regularly made by special equipments. Under favorable conditions and in southern areas the plants can be harvested again, although the yield of the re-grown material is always less than the first cut.

Recently, basil plants have become popular also as pot-herbs. They are produced for use fresh in the kitchen, at the same time of being of decorative value.

## 2.2. Caraway *Carum carvi* L. (*Apiaceae*)

Caraway was a popular spice, even in early times. The plant was mentioned in the Bible and Dioscorides proposed its consumption for achieving roborant action. Caraway fruits were known to the Arabian physicians and probably came into use in Europe in the thirteenth century. It became a cultivated crop distributed from Sicily to northern Scandinavia. Today, the plant is cultivated on a large scale, and its products, fruit and essential oil are utilized and commercialized all over the world.

Two forms of caraway are known: *C. carvi* f. *annua* is an annual, while *C. carvi* f. *biennis* is a biennial which requires vernalization for flowering induction. Caraway, especially the biennial form is native in central and northern Europe, as well as on the meadows of hilly and mountainous regions of Asia. The annual form probably came from the Mediterranean region. It was recorded in the temperate zone only in the 1860s. Both forms are cultivated on a large scale. Although the biennial form has been in cultivation for several decades, an intensive spread of the annual form can be observed, where ecological circumstances allow. The most important countries cultivating caraway are the Netherlands, Poland, Hungary, Spain, Egypt, Israel, Russia, and USA.

Both the annual and biennial forms can be grown on deep, limy, humid, medium-type soils, which are rich in nutrients. Biennial caraway needs moderate temperature and higher levels of precipitation than the annual one, which needs irrigation only under extremely arid conditions.

Caraway is a herbaceous species, has branched stem which reaches a height of up to 60 to 100 cm, the populations of the annual form usually being taller. The pinnatisect leaves are lobed from base to apex. Fertile shoots are formed in the first year by the annual, but only in the second year by the biennial form. Each inflorescence consists of an umbel with up to 15 unequal, white ray florets. The fruit is an elongated, ovoid ribbed cremocarp. Fruits of the annual form are larger; their color is light brown.

The characteristic spicy taste of caraway originates from essential oils, which accumulate in all parts of the plant, especially in the schizogenous oil ducts of fruits. The essential oil content of the biennial caraway fruit is 3 to 7%, and that of the annual caraway is much lower, around 2 to 3%. The main constituent of the essential oil is d-carvone (50 to 70%), its level being usually higher in biennial forms. Significant

amounts of d-limonene (25 to 30%), dihydrocarvone, carveol and dihydrocarveol are also present in the oil.

Both the fruit, either whole, chopped or ground, and the oil of the caraway are used by the food industry and households, for spicing various bakery products. It is also applied to meat, salads, cheese, pickles and drinks. The essential oil is used for making cosmetics and pharmaceutical products of plant origin. Caraway also possesses significant therapeutic effects. It is used as a medicinal remedy in tea-mixtures and tinctures applied as a digestive aid, against stomach disorders, and flatulence. Its essential oil has considerable antiseptic effect. More recently the essential oil is being used as a natural inhibitor of sprouting during storage of potato.

When cultivating in the temperate zone, the fruit should be sown into the ground in March. In Mediterranean areas the cultivation is done in the winter, by sowing in November. Spacing is 20 to 50 cm, depending on the form of caraway. Annual caraway flowers after about 3 months, while the biennial type only develops a leaf-rossette in the year of sowing. In this case, a cover crop (annual caraway, dill, pea, etc.) is usually applied. The harvest of the annual form can be started when fully ripening, while in the case of biennial form - to prevent shattering loss - much earlier, in the waxy ripe. A single phase harvest can be done using combine harvesters, or it can be done in two phases using cutting machines in the first phase, followed by combine harvester taking the half-dried material from the stubble.

For establishment of effective cultivation, breeding is oriented towards developing varieties which unite the advantages of the two forms: annual habit, erect stem, high essential oil and carvone content, and non-shattering feature.

-  
-  
-

TO ACCESS ALL THE 21 PAGES OF THIS CHAPTER,  
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

### Bibliography

Dachler, M. and Pelzmann, H. (1999). *Arznei- und Gewürzpflanzen, Anbau, Ernte, Aufbereitung*. 350 pp. Klosterneuburg, Austria, Österreichischer Agrarverlag, [The book is in German language, summarising the most important and up-to date information about cultivation and processing of more than 50 herbs which can be used either as medicinal plant or spice plant]

Kokkini, S. (1996). *Taxonomy, diversity and distribution of Origanum species*, in: Padulosi, S. (ed.) *Oregano - Proceedings of the IPGRI International Workshop on Oregano, 8-12 May, Bari, Italy, 175 pp.*[The proceedings contain about 20 contributions to different approaches of *Origanum* as plant and as spice or medicinal plant]

Németh, É. ed. (1998). *Caraway, - The genus Carum*. in the Series *Medicinal and Aromatic Plants, Industrial Profiles*, pp. 200. Amsterdam, The Netherlands, Harwood Academic Publishers. [A very up-



to- date and comprehensive monographs, also other volumes of the series assure a wide range of information on further species, e.g. Allium, basil, cinnamon, cardamom, curcuma, Salvia]

Parry, J. W. (1969). *Spices, Vol. 1-2*. 232 + 236 pp. London, England, London Food Trade Press, Ltd. [Story, description, chemical constituents, histology is overviewed in case of each species]

Rosengarten, F. (1969). *The book of spices*. 490 pp. Wynnewood, Pennsylvania, Livingston Publishing Company. [This book is a comprehensive guide to the story, utilization and production aspect of more than 40 spices all over the world, written in an interesting style]

### **Biographical Sketch**

**Éva Németh** is Professor at the Department of Medicinal and Aromatic Plants at the BKA University, Budapest, Hungary. Her main topics in education and her research activities are focused on breeding, genetics, chemotaxonomy, production and physiology of medicinal and aromatic plants. In the last decade she has been the leader of eight scientific projects and partner in a further twelve on the development of biological bases of medicinal plant production, investigations on the influencing factors of drug quality, and modernization of agrotechnology. She is one of the leaders of the PhD School in Horticultural Sciences and scientific supervisor of several students.

She has over 200 scientific publications, among them 10 books. She is known as a breeder of 12 registered plant varieties and lecturer at different international and national conferences. For several years she worked as technical editor of scientific journals on medicinal plants such as *Herba Hungarica*, and *ICMAP Newsletter*.

Dr. Németh has been engaged in Hungarian and international scientific activities as secretary of the Hungarian Society for Horticultural Sciences, secretary of the Medicinal and Aromatic Plants Section in FIP, vice president of Medicinal Plant Committee of the Hungarian Scientific Academy, member of the board of the medicinal Plant Section of Hungarian Pharmaceutical Society and a member of the IUCN Medicinal Plant Specialists Group.