ALOE, TODAY

R. Longo

ALOE, INTRODUCTION

The Aloe genus, known and used in phytotherapy for thousands of years, continues to be of therapeutic interest from new points of view as well: in addition to its recognised laxative and disinfectant qualities, its immunostimulant, anti-ulcerogenous and anti-tumoural characteristics make it worthy of closer study. Despite some terminological difficulties of a botanical and chemical nature, which hinder the identification of the drug and its derivatives, all the species of the genus seem to contain, with the natural variants, active ingredients of a similar chemical structure, which are divided into the two chemical groups of anthranoids and polysaccharides. Botanical, chemical and phytotherapeutic research continues and, as far as possible, will be described here below for the purpose of facilitating its comprehension and topicality.

BOTANICAL AND PHARMACEUTICAL TERMINOLOGY

1.1. The term ALOE

The term "Aloe" can lend itself to misunderstanding because it indicates both a plant genus including numerous species and the "juice" which is extracted and dried. The national and international Pharmacopoeias which have monographs on two species of the *Aloe* genus (aloe vera and Cape aloe, see point 1.2) do not define, contrary to consolidated use, the plant drug but its product extracted (juice) from the leaves, concentrated and dried. European Pharmacopoeia 4 states the following "Aloe barbadensis . Definition: Barbados aloe consists of the concentrated and dried juice of the leaves of *Aloe barbadensis* Miller. Aloe capensis. Definition: Cape aloe consists of the concentrated and dried juice of the leaves of various species of *Aloe*, mainly *Aloe ferox* Miller and its hybrids". As the term "drug" can mean both the dried plant parts and the products obtained from them in the natural state (essences, gums, fats), the aforementioned dried juices are also considered and commonly called "drugs". European Pharmacopoeia 4 goes further and also considers an "Aloes Extractum Siccum Normatum" which is obtained from each of the two aforementioned juices, or from their mixture, as follows: "Standardised aloes dry extract is prepared from Barbados aloes or Cape aloes, or a mixture of the two, by treatment with boiling water". It is adjusted, if necessary, to contain not less than 19.0 % and not more than 21.0 % of hydroxyanthracene derivatives".

1.2 Taxonomic difficulties

Always attributed to the family of the *Liliaceae*, due to the characteristics of its flowers, the *Aloe* genus is today ascribed, together with three other genera (*Gasteria*, *Haworthia* and *Poellnitzia*) with which it is often confused, to the specific family of *Aloaceae*, due to the presence of organs (e.g. flowers and succulent stems) extraneous to lilies (1). The same happened with the genus *Agave* [easily confused, on first sight, with aloe, to the extent that is was erroneously defined "American aloe" (see below under point 1.4)] which, attributed first to *Amaryllidaceae*, now belongs to the family of the *Agavaceae*. The taxonomy of the some 600 species making up the genus (2) presents difficulties due to the formal resemblance and the tendency to hybridize; it follows that literature often describes the same species with different botanical names, creating confusion in the attribution of the chemical and therapeutic characteristics. The only two species described in the European Pharmacopoeia are Cape aloe (Cape of Good Hope in South Africa), with its hybrids and Barbados aloe (islands in the West Indies off Central America) which, botanically, are named as follows. Cape aloe is classified as *Aloe ferox* Mill. with the synonym: *Aloe supralaevis* Haw. and hybrid (with *arborescens) Aloe x principis* (Haw.) Stearn; the hybrid is also defined *Aloe africana* Salm-Dyck non Mill. so that it is not confused with *Aloe africana* Mill., which is a separate species. For USP 25, the officinal hybrids of *Aloe ferox* are those with *Aloe africana Miller* and with *Aloe spicata* Baker. The 1982 European Pharmacopoeia, DAB 8 and Swiss Pharmacopoeia (Helvetica VII) define Cape aloe: *Aloe capensis*, with a pharmaceutical terminology that is easily comprehensible but not botanical. Barbados aloe is now correctly called *Aloe vera* (L.) Burm. f. because the specific epithet *barbadensis* Mill., used until the present, is considered synonymous (1). Other synonyms are: *Aloe vulgaris* Lam., *Aloe maculata* Forssk., *Aloe mitriformis* Mill. var. *vera*, *Aloe chinensis* Staud and *Aloe perfoliata* var. *vera* L. Another typical species, but not belonging to pharmacopoeia, is *Aloe arborescens* Mill. (aloe candelabra) also from the South African area of the Cape, to which immunostimulant and anti-tumoural properties are attributed. As mentioned above, this species too is hybridized with Cape aloe. The non-botanical terminologies are complex, proper to the various languages, because normally they refer to the places of origin (today of little significance) which are hardly ever related to the place of current cultivation. The different species of aloe are now cultivated all over the world, including in the European Mediterranean regions (Italy, France and Spain) (*arborescens, vera, succotrina)* and Australia *(vera)*. Pignatti (4) reports that the only species that naturalizes on Ischia, in Calabria and Sicily is *Aloe vera* stating that "other species are cultivated for ornament in gardens or as greenhouse plants, but do not tend to naturalize". In recent years, however, the cultivation of various species of aloe (*vera, ferox, arborescens)* has spread throughout Italy both in the field and in greenhouses.

1.3 Aloe hepatica and aloe lucida

The terms "Aloe hepatica" and "Aloe lucida" are not botanical but commercial names used to indicate aloe vera (as "hepatica") and Cape aloe (as "lucida"). From the pharmaceutical point of view, they refer to the aspect of the concentrated and dried juice (see below) rather than to the aloe of origin. There is also an aloe vera with a black reflecting appearance and an aloe "hepatica" from eastern Africa (8). Aloe hepatica (liver-coloured) is formed by slow concentration, at moderate heat (even only from the sun), so that aloine (the active ingredient of the juice) separates, crystallizing, to form brown masses. When dispersed in glycerine, these appear under the microscope as opaque fragments which, with the addition of a few drops of water, release brown-yellow crystals that are clearly visible to the polarizer. When pulverized, aloe hepatica takes on red-brown reflections. Aloe lucida (reflecting) is obtained by rapid concentration of the juice, at a high heat. It appears in shiny and sharp pieces, with concave fracture and gives a greenish coloured powder.

1.4 Aloe and Agave

Aloe

The distinction between the various species of aloe, especially in the state of dried juice, may be made using chemical and chromatographic methods which will be discussed separately.

The botanical field identification, based on the morphology of three species *(Aloe vera, Aloe ferox, Aloe arborescens)* mentioned under point 1.2 above, is thus described by the various authors (see illustrations alongside). *Aloe barbadensis* Miller, aloe vera, Barbados aloe (4): "bush, 8-15 dm. Strong woody stem, rarely ramified, with a thick tuft of leaves similar to the blade of a sword (ensiform: 6-10 x 45-65 cm) , succulent, rigid, dentate on the edge and an erect scape, generally ramified. Numerous yellow flowers, with tube-shaped tepals (2-2.5 cm); protruding stamens and style; ovoid capsule". Characteristic of aloe vera are the grey floral scapes, about one metre high and normally ramified, with yellow racemes of hanging flowers which stand out above the bush of base leaves which they dominate.

Aloe ferox Miller, Cape aloe (5): perennial arborescent bush, which originates a single stem of 2-3 metres, covered with residue of dried leaves and crowned by a rosette of oval-lanceolate succulent leaves of a blue-green colour, 40-60 cm long and with thorns, both along the edges and on the lower pagina. Inflorescences consisting of a raceme with several scapes, up to 60 cm. in length, come out from the floral rosettes, with ramifications covered almost completely by flowers of 2-3 cm, mainly orange but also yellowish, and closely packed together. Characteristic of the Cape aloe are the strong thorny leaves on the edges and on the lower leaf pagina to which, perhaps, it owes the epithet of "fierce" *(ferox)*. *Aloe arborescens* Miller (6): a sapling, contorted and ramified (*arborescens*), which can reach a height of 3 metres, with green-brown leaves, tapered and thorny along the edges, grouped together in rosettes with from each from 1 to 4 floral scapes emerge with conical panicles of red flowers.

Agave

Plants similar in appearance to aloe which are commonly confused with this genus are frequent in Italy, especially along the promenades and roads bordering the sea in western and southern coastal town and around lakes (but they are also cultivated in gardens for ornamental purposes). These are agaves, including the common *Agave americana* L. (Agavacee) which can be easily distinguished due to its broad fibrous (and not succulent) leaves with an apical thorn, arranged in radical rosettes (and not around a stem) and due to the absence of flowers (see below). Pignatti (7) gives the following description: "Bushy plant of 3-8 metres. Swollen woody rhizome; erect scape up to 1 decimetre thick, with hardened scales. Awl-shaped linear evergreen leaves, rigid and sword-shaped, (8-18 dm long, up to 3 dm wide at the base),with thorns of 1 cm on the edge and a long apical thorn. Wide panicle, 2-5 metres long; branches that are more or less horizontal; yellow-greenish perigonium (5 cm), tubulous in the lower third; obovoid capsule (4 cm).

Originally from tropical America (probably Mexico where, however, it is not known in the wild state) it was introduced into Italy in the 16th century (Pisa 1583, Florence 1586) and in the whole of the Mediterranean, where it tends to grow in the wild state without, however, entering into the natural vegetation. In Italy the best conditions for growth are found in Sicily, where it is propagated vegetally: the plant grows for 10-15 years, blooms a single time and then dies". Curiously, it is absent from the Adriatic coast.

LITERATURE AND NOTES

(1) Zander, "Handwörterbuch der Pflanzennamen, Dictionary of plant names, Dictionnaire des noms des plantes" Ulmer Verlag, Stuttgart, 16th edition, 2000, p. 98

(2) Kawai K. et al., "Tissue culture of *Aloe arborescens* Miller var. *natalensis* Berger", Phytother. Res. **7** (1993) S5-S10

(3) For historic and hermeneutic-religious reasons rather than scientific ones, the Biblical meaning of the Hebrew term *ahalim* has also been studied: translated by *aloe* in the various editions in Greek and Latin, obtaining a dual interpretation. It appears that the *ahalim* used as a perfume (Psalm 45, 9; Proverbs, 7, 17; Song of Songs 4, 17; Numbers, 24, 6) does not correspond to our aloe but to the so-called "lignum aloes", a perfumed Indian thymelaeaceae (botanically: *Aloëxylon agallochum* Lour., *Aquilaria agallocha* Roxb., *Cynometra agallocha* Spreng) in Italian called calambucco or calambà and in English agallochum (Bedevian A.K., "Illustrated Polyglottic Dictionary of Plant Names", Argus & Papazian Press, Cairo, 1936; Grieve M., "A Modern Herbal", Penguin Books 1976, p. 29
Chopra R.N., "Indigenous Drugs of India", Dhur & Sons Private Ltd, Calcutta 1958); when it was mixed with the blends for the preparation of corpses (St. John, 19, 39) it is attributed by some to the wood of *Santalum album* L. or white sandalwood (Santalacee) originally from the Malaysian archipelago but cultivated in tropical Asia (Segalla G., "Nuovissima versione della Bibbia: "Giovanni" , Edizioni Paoline 1998, p. 454. A Monograph: "Lignum Santali albi" is included in the Suppl. to DAB 6 (Erg.-B. 6), Deutscher Apotheker Verlag, 1953 p. 306. According to this monograph, the wood must contain not less than 0.25% of essence, with a perfume similar to oil of roses.
Various interpretations are given by other authors (Cristiano L., De Martino G., "Profumi e balsami della Bibbia – Seconda Parte", Erboristeria Domani, Aprile 2002, p. 72).

(4) Pignatti S., "Flora d'Italia", Edagricole 1982, vol. III, p. 349

(5) Description partially obtained from the WHO Monograph "Aloe", vol. I, p. 34

(6) Onderstall J., "South African Wild Flower Guide 4: Transvaal, Lowveld and Escarpment" Botanical Society of South Africa, 1984, p. 42

(7) Pignatti S., "Flora d'Italia", Edagricole 1982, vol. III, p. 402

(8) Karsten, Weber, Stahl, "Lehrbuch der Pharmakognosie", Gustav Fischer Verlag, Stuttgart, 1962, p. 561.