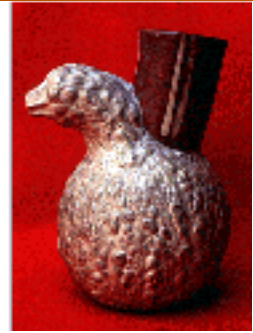




Ethnobotanical Leaflets



The Origin, Distribution and Classification of Cultivated Broccoli Varieties

By John McMurray

Of the many different vegetable crops now under cultivation in both the U.S. and abroad, one that has gained increasing importance is that of broccoli. Although it does not constitute a significant portion of most people's diets, it has nevertheless experienced a kind of "revival" in recent years and has become increasingly popular (Schery, 1972; Heywood, 1978). It may even be said that broccoli has emerged from relative obscurity and attained the status of a worthwhile garden vegetable,"(Talbert, 1953).

The botanical family to which broccoli belongs is the Brassicaceae, also known as the Mustard family. The Brassicaceae is a large family comprised of approximately 3,000 described species apportioned among 350-380 genera. The precise number of genera will vary depending on the authority(Heywood, 1978; Keil & Walters, 1988). The classification scheme for broccoli and indeed all of the other brassicas is clear and straightforward until one reaches the species level. At that point the addition of numerous subspecies, varieties, and cultivars results in a rather complex and confusing arrangement of-the taxa in question. For example, the scientific name for broccoli, *Brassica oleracea* (L.), is also shared by cabbage, Chinese cabbage, cauliflower, collards, brussels sprouts, kale, kohlrabi, and tronchuda kale, to name a few. Despite the fact that all of the aforementioned varieties are similar to one another and to broccoli, and are therefore referred to as *B. oleracea*, they are nevertheless separate entities. Most authorities today consider there are two major varieties of broccoli, *B. oleracea* (L.) var. *botrytis* or cauliflower broccoli and *B. oleracea* (Plenck) var. *italica* or sprouting broccoli (Harlan, 1975; Terrell, 1977; Heywood, 1978; Keil & Walters, 1988).

At this point, it may be useful to consider some of the diagnostic morphological features which serve to delimit the *B. oleracea* group. Since many of these feature are "...highly characteristic and constant,"(Heywood, 1978), especially the floral structure, a consideration of these characters is best done at the generic level. In characterizing the genus, one necessarily characterizes all subsequent taxa. Most representatives of the genus *Brassica* are annual herbs, although there are also a few perennial species. The leaves are generally alternate on the stem, estipulate (without stipules), and glabrous (without hairs). Leaf shape is highly variable and may range from simple to lobed to divided (Heywood,

1978; Gomez-Campo, 1980; Keil & Walter, 1988). The inflorescence are generally either racemose or corymbose and are comprised of perfect and regular flowers. Furthermore, each flower has four distinct sepals and petals, the latter of which are so arranged so as to form a cross, giving the family its alternate name, Cruciferae. The ovary is superior and is comprised of two carpels. The stamens are six in number and are somewhat unusual in that four of them possess long filaments and two have much shorter filaments (tetradynamous) (Heywood, 1978; Gomez-Campo, 1980; Keil & Walters, 1988). The fruit is either a silique or, if it is twice as long as broad or less, a silicle (Keil & Walters, 1988). The seeds which are produced are generally quite small, weighing between one and five milligrams, and may range in color from yellow to black. Furthermore, the seed coat is composed of four distinct layers: epidermal, subepidermal, palisade, and parenchymatous. Unlike many of the other genera of the Brassicaceae, seeds of the genus *Brassica* do not produce mucilage when the seed coat is moistened (Gomez-Campo, 1980). A last characteristic feature of the genus is the presence of very wide, deeply notched cotyledons in juvenile individuals (Gomez-Campo, 1980).

Representatives of the Brassicaceae exhibit a cosmopolitan distribution although certain regions of the world have a greater concentration of genera than others.

Members of this family are found in most parts of the world but are mainly concentrated in the north temperate region and more especially in the countries surrounding the Mediterranean basin and in southwestern and central Asia, where more genera occur than anywhere else in the world ... In the Mediterranean area 113 genera occur of which 21 (17%) are endemic, and 625 species of which 284 (45%) are endemic. The Irano-Turanian region has 147 genera of which 62 (42%) are endemic and 874 species of which 524 (60%) are endemic, while in the Saharan-Sindian region there are 65 genera, 19 (30%) being endemic and 180 species, 62 (34%) of which are endemic (Heywood, 1978).

As far as the two broccoli varieties are concerned, the cauliflower broccoli (var. *botrytis*) is more widely grown in Europe than in the U.S. It is a hardier variety than sprouting broccoli and is grown to be harvested in the winter and spring. In the U.S., sprouting broccoli (var. *italica*) is more common and is planted as a summer annual (Schery, 1972). The centers of U.S. production of broccoli lie principally in California and also along the South Atlantic Coast (Talbert, 1953; Schery, 1972).

The primary use of broccoli, both modern and ancient, is, quite obviously, as a source of food. The part of the broccoli plant consumed is the fleshy-stemmed flowering head. It is cut before the buds open. When the terminal head is removed, lateral shoots develop, smaller but equally tasty (Schery, 1972).

However, if one broadens one's scope to include the uses of other members of the Brassicaceae, then the true economic significance of the family becomes readily apparent. As was stated earlier, the genus *Brassica* includes a number of notable vegetable crops other than broccoli. The Brassicaceae also includes many important forage crops such as *B. campestris*, *B. napus*, and *B. oleracea*. Furthermore, this family is the source of a number of oilseed (colza, oilseed rape) and fodder crops in addition to ornamentals such as *Cheiranthus* (wallflower), *Lobularia maritima* (sweet alysson), and *Hesperis* (rocket) (Heywood, 1978; Keil & Walters, 1988).

The origin of our modern day broccoli may well be an ancient one. Cultivation of a bygone ancestral cabbage may have occurred as early as 8,000 years ago along the Northern European coast. It was from this area that this wild ancestral cabbage was later introduced into the Mediterranean, Eastern Europe and even into the Near East and Orient (Schery, 1972; Heywood, 1978; Snogerup, 1980). Theophrastus (370-285 B.C.) indicates "... that at his time several different coles were already used in Greece," (Snogerup, 1980). The Romans Plinius (23-79 A.D.) and Cato (234-149 B.C.) also mention the cultivation of a number of different forms of coles, primarily cabbages and kales (Snogerup, 1980). Indeed it is more than likely that "The first selection of sprouting broccoli was probably made in Greece and Italy in the pre-Christian era," (Heywood, 1978). The present day distribution of many of the brassicas also corresponds nicely to the hypothesis that broccoli and the other coles originated from a wild, Western European *B. oleracea* (Snogerup, 1980). The preponderance of Brassica genera, species, and varieties is in keeping with N.I. Vavilov's assertion that the center of origin for a crop corresponds to an area of diversity of its wild relatives.

The high degree of similarity among the coles, including broccoli, is due in large part to the high degree of genomic similarity between varieties of *B. oleracea*. Hybridization is a frequent occurrence even between "... taxonomically distant parents," (Snogerup, 1980). Although the fertility of the resulting F1 hybrids is often variable, it is generally high enough to assure the production of hybrid progeny through the F2 and subsequent generations (Snogerup, 1980). The frequency of hybridization and outcrossing is greatly enhanced by a high degree of self-incompatibility among the *brassic*as. In light of these considerations, it is not surprising to find so many different varieties among the *brassic*as and the *B. oleracea* group in particular. In fact, the close proximity of various cultivars of *B. oleracea* with their wild relatives will more than likely result in further hybridization (Snogerup, 1980).

Like virtually every other crop plant species and/or variety, broccoli is also susceptible to a number of different pathogens. Many of the most damaging pathogens attack broccoli after it has been harvested and are hence referred to as "post-harvest pathogens" (Geeson, 1983). These pathogens are most often imperfect fungi (Form Subdivision Deuteromycetes) or the anamorph stage of sexually reproducing fungi. Examples include *Alternaria brassicae*, *Botrytis cinerea*, *Sclerotinia sclerotiorum*, and various species of *Cladosporium* and *Mucor* (Geeson, 1983). An infection by any one of these pathogens generally results in a softening of the tissue or the spotting of the leaves. Some control over the severity of an infection can be achieved by slightly modifying the atmosphere in which the broccoli is stored (Geeson, 1983).

Despite its seemingly small economic importance, broccoli is an integral component of a very economically important genus and family, and not even the disdain for broccoli by George Bush can change that.

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