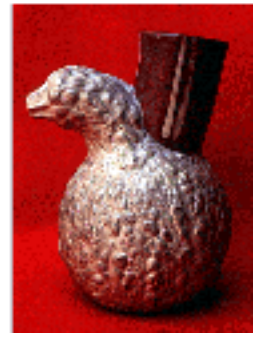




Ethnobotanical Leaflets



Garlic

By Tina Sydlowski

Garlic has been used for thousands of years as a food additive and as medicine in China (Han 1993). The name is of Anglo-Saxon origin, derived from *gar* (a spear) and *lac* (a plant), referring to the shape of its leaves. It belongs to the Liliaceae family and genus *Allium*, which has more than 600 available species. Included in this family are onions, shallots, leeks, Japanese bunching onions, Chinese and common chives. Mostly all *Allium* crops originate from the main center of *Allium* diversity that stretches from the Mediterranean basin to central Asia (Meer *et al.* 1997. 1997). Garlic has a long history of use throughout Europe as well, being used as a food additive and for various medicinal purposes, and has often been mentioned in folklore.

There is a Mohammedan legend that states: "When Satan stepped out from the Garden of Eden after the fall of man, Garlic sprang up from the spot where he placed his left foot, and Onion from that where his right foot touched". In some parts of Europe, there is a superstition that if a man running a race chews on a morsel of the bulb, it will prevent his competitors from passing him (Grieve 1995).

However, garlic is very important in many cultures for their cuisine. What would Chinese or Italian food be without garlic? And its long history of medicinal uses are now being backed up by numerous studies proving its antibacterial and healing powers.

Center of Origin of Garlic

Garlic is believed to have originated in western China from around the Tien Shan Mountains to Kazakhstan and Kirgizstan. Vvedensky proposed that garlic evolved from the wild species *Allium longicuspis* (Etoh and Pank 1996, Al-Zahim *et al.* 1997). The spread of garlic probably was first to the Old World and then to the New World (Bozzini 1991).

Chromosome Number

Common garlic, found in supermarkets, has a somatic number of $2N=16$ with a karyotypic formula of 6

metacentric chromosomes, 4 submetacentric chromosomes, and 6 acrocentric chromosomes. Garlic plants found in the Campania region of Italy were shown to be tetraploid with $4N=32$ (Bozzini 1991).

Nutritive Value

While garlic is primarily used as an herb to enhance many food dishes in various cultures, many compounds can be found in its bulbs. It contains vitamins A and C, potassium, phosphorous, selenium, and a number of amino acids (Mayo 1999). Most important are the over 75 sulfur containing compounds including alliin (S-allyl-Lcysteine sulfoxide). If the bulbs are ground or crushed, alliin is transformed into allicin (diallyldisulfide S-oxide), which the typical garlic odor is attributed. A broad spectrum of antibacterial properties is associated with allicin (Dubick 1986).

Medicinal Uses

In the 1970's many epidemiological and experimental studies provided evidence that garlic influences risk factors associated with heart disease. Feeding garlic to patients with coronary heart disease decreased serum cholesterol, triglycerides, LDL and VLDL and increased HDL levels (Dubick 1986). A 1993 study showed garlic can lower serum cholesterol by as much as 9 percent (Mayo 1999) by stimulating the release of bile by the gallbladder and by decreasing the production of cholesterol in the liver. Garlic may also aid in the lowering of blood pressure by slowing the production of the body's pressure raising hormones (Holladay 1995). Another benefit of garlic is its ability to relax vascular smooth muscle, which prevents the acute hypoxic increase in pulmonary pressure (Fallon *et al.* 1998).

Garlic is also able to stimulate the immune system's macrophages, white blood cells that destroy foreign organisms. It also increases the activity of T-helper cells, and can be used to treat upper respiratory viral infections because of its ability to clear mucous from lungs (Holladay 1995), and help asthma patients (Grieve 1995). During WWI garlic was used as an antiseptic for wounds (Grieve 1995) and to treat typhus and dysentery. Researchers have found that garlic blocks the action of certain enzymes that help infectious microbes survive in host tissue (Mayo 1999).

Potent antioxidants are found in garlic that protects cell membranes and DNA from damage. A study done on 22 vegetables and tea found garlic to be in the top quintile of ORAC_{cro}, or oxygen radical absorption capacity. Garlic also had the highest antioxidant activity against peroxy radicals based on fresh weight (Cao *et al.* 1996). It also stimulates the production of the liver's detoxifying enzymes that neutralize carcinogens (Holladay 1995). Nitrosamines are carcinogens absorbed from food and water and can be blocked in a test tube by garlic. This is evidence that higher intake of garlic may reduce some cancer type risks (Mayo 1999). Dietary intake of garlic is inversely related to the incidence of gastric cancer as shown in a study in Shandong Province, China. Chemical studies have shown diallyl sulfide to be the major active compound of garlic (Han 1993).

Morphology of Garlic

There are two distinctive botanical varieties of garlic recognized, *Allium ophioscorodon* (L.) and *A. sativum* (L.). Variety *ophioscorodon* is characterized by an initially coiled, tall woody scape with relatively few brownish-purple cloves per bulb.

The *sativum* variety, or common garlic, produces a weak flower stalk, if it bolts, and has a bulb with many pure white or pink-blushed bulblets (Pooler and Simon 1993). The bulb, or part which is eaten, is composed of numerous bulblets or cloves, They are enclosed in a whitish skin and grouped between membranous papery scales. The leaves are like grass, long, narrow, and flat. If flowers are produced, they are at the end of a stalk rising directly from the bulb. The flowers, which are white, are grouped together in a globular head, or umbel, and are enclosed in a kind of leaf or spathe (Grieve 1995). Small bulbils may be produced to replace the flowers. The development of these aerial bulbils may be a result of domestication (Bozzini 1991).

Cultivation of Garlic

Garlic is normally cultivated vegetatively (Bozzini 1991). Garlic produces best in a rich, moist, sandy soil, but can also be grown in a loam or clay soil. A little lime should be added to the soil. The bulb should be divided into individual cloves, and these are planted separately about 6 inches apart and 2 inches deep. A sunny spot is best and weeding recommended while occasionally gathering the soil up around the roots (Grieve 1995).

A look at the effects different fertilizers can have on garlic showed that phosphorous can decrease plant height, average bulb weight, and marketable yield. Farmyard manure can also decrease the average bulb weight and marketable yield but increase the plant height (Seno *et al.* 1995).

The date that garlic is planted can have a significant effect on the yield. In one study, bulbs planted in the autumn increased total yield by 3.13 tons/ha and marketable yield by 2.93 tons/ha as compared, with bulbs planted in the spring. Trimming can also affect yield. Trimming an upright shoot can increase total yield by 10.07 tons/ha and 0.42 tons/ha for marketable yield (Orlowski *et al.* 1994). Therefore, if planting for higher yield, planting in the autumn and trimming the shoots can be very advantageous for greater bulblet production.

Conclusion

Garlic has a long history running through many civilizations, and will continue to be an important part of cooking and medicine. With more and more studies being done on the positive aspects found in garlic that help to prevent, cancer with its powerful antioxidants, and its antibacterial properties, garlic will remain indispensable.

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