Botanical Name: *Capsicum annum* var. minimum, Solanaceae

Similar species: *C. frutescens, C. pubescens C. chinense, C. baccatum, C. longum, C. cordiforme, C. grossum, C. chlorocladum, C. fastigiatum, C. cerasiforme.*

Common names: Cayenne, Chili, Chile, Chillies, Chili Pepper, Red Pepper, Red Chili, Tabasco Pepper, African Pepper, Bird Pepper

Plant description: Cayenne is a dark-green annual or short-lived perennial plant, obtaining a height between one half and two meters. The stems are furrowed, branching, and angular. The simple leaves are on medium to long petioles and are usually wrinkled, entire, ovate to oval. The pendulous flowers are white to violet, solitary, arising from the axillary nodes. Stamens 5; ovaries ovate; style filiform; stigma blunt. The fruits are long, cylindrical, and mostly ovoid, and when ripe are either scarlet or yellow, with a smooth shiny surface. The many seeds are yellow, smooth and round, with a spiny protuberance on the edge.

Habitat, ecology and distribution: *Capsicum annuum* and the many similar species in this genus are native to Central and South America. Since the advent of the Europeans in the Americas during the 16th century however, *Capsicum* has been introduced to and become naturalized in many different tropical and subtropical environs all over the world. To some extent the botanical classification of Cayenne has been obscured by its relatively rapid introduction into other societies, and the plethora of cultivars that have resulted.

Part used: fruit

History: Archeological evidence uncovered from the Tehucan Valley site in Mexico indicates that *Capsicum* species were cultivated as early as 4000 BCE, during the Coxcatlan era (Heiser 1969, 18). Cayenne is first mentioned by the Europeans in the diaries of Chanca, a physician that accompanied Columbus on his second voyage to the West Indies in 1494 CE. Soon after Portuguese colonists introduced Cayenne into India, where it became widely cultivated and used as a food and medicine. From India the use

of Cayenne spread into Europe, Asia and Africa, and like other solanaceous foods such as tomato and potato, has become an important staple the world over. The species *C. annuum* includes not only Cayenne or Chili peppers, but non-pungent varietals such as the 'Bell' pepper.

The widespread usage of Cayenne in clinical herbal medicine is in large part due to the pioneering work of Samuel Thomson, through the sale of his patented system of healing to millions North Americans during the mid-19th century. According to Thomson, Cayenne "…is no doubt the most powerful stimulant ever known; its power is entirely congenial to nature, being powerful only when raising and maintaining the heat, on which life depends. It is extremely pungent, and when taken sets the mouth as it were on fire; this lasts, however, but a few minutes, and I consider it essentially a benefit, for its effects on the glands causes the saliva to flow freely, and leaves the mouth clean and moist" (Thomson 593, 1841).

Today Cayenne is grown commercially all over the word, with considerable intermixing between similar species and the various varieties and cultivars. For this reason, the commercial classification of Cayenne is not based on botanical criteria but on Scoville 'heat units' (HU), or by determining the capsaicinoid profile by high-pressure liquid chromatography (HPLC). The Scoville unit system is an organoleptic method that originated with Wilbur Scoville in 1912, that involves adding sugar to a Cayenne solution until one can no longer taste the pepper. The more sugar added, the greater degree of pungency, and the higher the measurement in Scoville units. Generally, Cayenne pepper is any *Capsicum* species that is above 30,000 HU, which is tolerable for most people. Anything less than 5,000 HU is considered 'mild,' and anything over 20,000 is considered 'hot.' Moderate pungency is between 5,000 and 20,000 HU. Some peppers, such as the 'Habanero' pepper, are upwards of 200,000 to 300,000 HU, whereas 'Bell' peppers are so mild they are not even listed in Scoville units. Today the Scoville method has largely been supplanted by HPLC, but in many cases the potency of a given product is still translated in Scoville heat units for the consumer market.

Constituents: The pungent constituents found in Cayenne are the capsaicinoids, present only in the fruit of the plant and not the stems, roots, or leaves. The capsaicinoid content in the whole, powdered fruit of a given specimen can vary to a great degree, anywhere from 0.11% upwards to 1.5% (Evans 1989, 385; Newall 1990, 60). The majority of the capsaicinoids are found in the dissepiment (1.79%), the internal walls that separate the seed chambers in the fruit, and to a lesser degree in the pericarp (0.1%) and the seeds (0.07%) (Evans 1989, 385). The major capsaicinoid found in Cayenne is capsaicin, representing 48.6% of the total capsaicinoid content. Capsaicin is a phenolic compound, the vanillyl amide of isodecenoic acid (Evans 1989, 385). Other capsaicinoids more recently described include dihydrocapsaicin (36%), nordihydrocapsaicin (7.4%), homodihydrocapsaicin (2%), and homocapsaicin (2%). Cayenne also contains appreciable amounts of ascorbic acid (0.1-0.5%), red carotenoids (capsanthin, capsorubin, carotene, lutein), thiamine, protein and a fixed oil (Evans 1989, 385; Newall 1990, 60)

Medical research:

•*Nervous:* Capsaicin has been used for a number of years as a neurochemical tool for studying sensory neurotransmission. In particular, capsaicin has been shown to promote the release of substance P from sensory neurons, a neuropeptide involved in the sensation of pain. The local application of capsaicin cream (1%) has been noted for its ability to deplete local stores of substance P when applied repeatedly over a period of days (Yoshimura et al 2000). Taken internally, capsaicin has been shown to evoke catecholamine secretion from the adrenal medulla of pentobarbital-anesthetized rats (Watanabe et al 1987), accounting for its stimulant properties that many people equate with caffeine-containing beverages.

•*Gastrointestinal:* Researchers have determined that the gastric and duodenal mucosa contain capsaicin-sensitive (CS) areas that are involved in a local defense mechanism against ulcer formation. The stimulation of these CS sensory nerves with low concentrations of capsaicin have been shown to protect the rat gastric mucosa against injury produced by different ulcer-promoting agents (Abdel-Salam 1997). In contrast, very high levels of capsaicin appear to have the opposite effect (Abdel-Salam 1997; Maggi et al 1987; Dugani and Glavin 1986). The gastroprotective effect of capsaicin is thought to involve an enhancement of mucosal microcirculation, effected through the release of mediator peptides from the sensory nerve terminals, and is independent of sympathetic stimulation or the induction of locally acting prostanoids (Abdel-Salam 1997). Capsaicin has also been shown to have a protective role for CS sensory nerves in the colon (Abdel-Salam 1997). Generally, capsaicin appears to inhibit gastric acid secretion when introduced into the stomach of rats or cats (Abdel-Salam 1997). Capsaicin has also been shown to inhibit the growth of *Helicobacter pylori,* a bacterium associated with ulcer formation (Jones et al 1997).

•*Cardiovascular:* Capsaicin has been shown to significantly lower serum triglyceride levels in male rats fed a diet containing 30% lard, as compared to controls, when supplemented at 0.014% of the diet (Kawada et al 1986). Juvenile guinea pigs fed a cholesterol-enriched vitamin C deficient diet, and concurrently treated with dihydrocapsaicin (8 mg per animal per day) were shown to exhibit significantly lower serum triglyceride concentrations when compared with controls, comparable to controls fed a regular diet (Negulesco et al 1989). Similarly, when capsaicin and dihydrocapsaicin were used to treat turkeys fed a cholesterol-rich diet, both were shown to significantly lower VLDL-cholesterol levels and increase HDL-cholesterol as compared to controls. Dihydrocapsaicin in particular had a greater efficacy in producing beneficial anti-hyperlipidemic effects in the cholesterol-fed animals (Negulesco et al 1987).

•*Respiratory:* Cayenne has been shown to exhibit a protective effect on the respiratory system. Local or systemic pretreatment with capsaicin can reduce vascular permeability and edema caused by histamine, bradykinin and cigarette smoke (Chow and Biggs 1986; Lundberg and Saria 1983; Lundberg et al 1983). Capsaicin appears to activate antioxidant systems and stabilize lung membrane lipids, protecting against edema and lipid peroxidation induced by respiratory irritants (Tilgner 1999, 49).

•*Cancer:* Capsaicin has been studied for its effects on cancer, often with conflicting results. While early experimental evidence suggested the moderate tumorigenicity of capsaicin, more recent research suggests that capsaicin has substantial antigenotoxic and

anticarcinogenic effects, and is an important dietary phytochemical with potential chemopreventive activity (Surh et al 1998). Researchers report that capsaicin appears to interact with xenobiotic metabolizing enzymes, particularly microsomal cytochrome P450-dependent monooxygenases, which are involved in the activation and detoxification of various chemical carcinogens and mutagens (Surh and Lee 1995). Capsaicin has been shown to be a potent *in vitro* inhibitor of human and murine epidermal metabolism of benzo(a)pyrene (BP) and the enzyme-mediated binding of BP metabolites to DNA (Modly et al 1986).

Toxicity: The capsaicinoids in Cayenne pepper are strongly irritant to mucosal surfaces, and with acute inhalant exposure may promote a kind of self-limiting allergic alveolitis (Newall et al 1996, 61). Kawada et al reports that the capsaicinoids are absorbed by a nonactive process in the jejunum where they are partially metabolised and then quickly transported to the hepatic portal vein (1984). It is thought that this rapid metabolism of the capsaicinoids significantly reduces their acute toxicity (Kawada and Iwai 1985). Newall et al reports that the LD_{50} for capsaicin is 190 mg /kg (1996, 61), which relative to the whole herb, makes a fatal dose of Cayenne almost impossible to achieve.

Herbal action: sialagogue stomachic, carminative, stimulant, antispasmodic, analgesic, rubifacient, alterative, astringent, hemostatic, antiseptic, emetic

Indications: flatulent dyspepsia, colic, constipation, gastric ulcer, hemorrhoids, sore throat, subacute or chronic laryngitis, colds and flu, fever, bronchial congestion, cough, asthma, tuberculosis, peripheral circulatory insufficiency, chilblains, neuralgia, pain, headaches, arthritis, rheumatism, cardiovascular disease, stroke prevention, wounds, hemorrhage, menorrhagia, gangrene and mortification, abscess, ulcers, carbuncles

Contraindications and cautions: high fever, gastric irritation or inflammation, acute sensitivity of the throat and lungs, conditions where the skin is hot with a sensation of burning and heat, a large and strong pulse, topical application on mucosal surfaces, pregnancy (use with caution); in very large doses Cayenne will act as an emetic or purgative

Medicinal uses: Cayenne is widely considered by herbalists to be the most potent and safest stimulant known. It has wide application wherever there are symptoms of coldness. Mixed with water Cayenne powder is used in any catarrhal affliction as in colds, cough, asthma and urinary catarrh. In cases of sore throat, hoarseness or laryngitis Cayenne powder in water makes an effective gargle, although where the pain is acute, Cayenne should not be used. In intermittent or low-grade fever, especially in cases where the tongue and oral cavity are dry, Cayenne is indicated. Similarly, in cases of dyspepsia, flatulence and constipation Cayenne promotes the digestive secretions and stimulates peristalsis. In the treatment of mucus or bloody diarrhea Cayenne is used to relieve bowel spasm and stop bleeding. Many practitioners suggest that Cayenne is effective in gastric and duodenal ulcer, although this use is best indicated for low-grade, unresolving conditions, rather than in acute cases. In hemorrhoids, particularly where

there is more a sensation of heaviness and congestion rather than burning and irritation, Cayenne comes highly recommended.

Cayenne has a strong effect upon the circulation, initially acting upon the heart and the large arteries, followed by a stimulant activity upon the arterioles and then the capillaries. Cayenne won't increase the frequency of the pulse per se, but enhances the power of the pulse wave, indicated in a weak pulse where circulation is enfeebled. It is of utility in cardiovascular disease, in stroke or high blood pressure, but is ill-suited in the sthenic who complains of heat, and whose pulse is strong and large.

Cayenne is indicated in any state of paralysis, particularly in the aged where vitality is weak and the patient complains of chills. Combined with antispasmodics such as *Lobelia* and *Scutellaria* Cayenne is used as an antispasmodic in the treatment of epilepsy. Taken internally, Cayenne is also indicated in tired, painful muscles, joint stiffness, and coldness in the extremities.

Cayenne is an effective hemostatic and astringent, applied topically as a powder on wounds to arrest bleeding, working rapidly to form a clot and seal off the wound. The physiomedical and eclectic physicians also considered Cayenne a useful remedy in menorrhagia, and in particular, hemorrhage after parturition.

Used topically Cayenne oil, salve or liniment is an important remedy in any kind of pain, inflammation or spasm, not just of the muscles and limbs, but over the abdomen and chest in the treatment of dysentery, pneumonia, pleurisy, peritonitis, and to treat afflictions of the liver, uterus, ovaries, spleen or kidneys. Cayenne exerts its beneficial effects by restoring proper circulation in these areas. Used on unbroken skin Cayenne will promote a local, transient reddening and sensation of heat, but will not typically cause any blistering or serious irritation. In cluster headaches and migraines a Cayenne salve or liniment can be applied topically several times daily to reduce pain and deplete the stores of substance P. Similarly, a topical Cayenne preparation is effective to relieve the pain of diabetic neuropathy, trigeminal neuralgia or post-herpetic neuralgia.

Applied locally Cayenne is of great service in the treatment of indolent ulcers, abscesses, and sores. Cayenne may be used both internally and externally, along with antimicrobial agents such as *Echinacea*, in the treatment of carbuncles— large, staphylococcal infections that form deep, interconnecting subcutaneous pockets. Cayenne is also an important among remedy to stop the process of mortification and gangrene, arresting decomposition and decay through its antiseptic properties, as well repelling the products of putrefaction so that they will not be absorbed. In such cases W.H. Cook states that the only mistake a practitioner can make in giving Cayenne "is in not giving enough."

Throughout the physiomedical literature of the 19th century Cayenne is considered a specific in delirium tremens, an acute and sometimes fatal psychotic reaction caused by the abrupt cessation of alcohol intake in chronic alcoholics. For this purpose Cayenne

can be given in frequent doses, mixed with warm broth, to allay the cravings for alcohol, combat nausea, and to stimulate the appetite.

Powdered Cayenne has long been a favourite winter remedy to prevent cold feet and frostbite, sprinkled inside the socks. In the treatment of chilblains Cayenne tincture can be directly applied to the sores with piece of cotton until a strong tingling feeling is produced. This should be should be applied on a daily basis until the sores are gone. In the treatment of toothache a few drops of Cayenne tincture may be applied directly onto the tooth with a cotton swab.

In homeopathic medicine Cayenne is especially indicated in states of laxity and weakness, with diminished vitality. There is a fear of cold and wind, with a tendency towards aching or jerking muscles. The patient is overweight and somewhat lazy, sentimental, and dislikes being inconvenienced by alterations in routine.

Pharmacy and dosage:

•*Fresh Plant Tincture:* 1:2, 95% alcohol, 3-10 gtt.
•*Dry Plant Tincture:* 1:3, 65% alcohol, 3 gtt – 3.5 mL
•*Powder:* 50 – 400 mg

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