The Capsicum genus, chile, represents a diverse plant group, a genus of flowering plants in the nightshade family, Solanaceae, from the well known sweet green bell pepper to the fiery hot habanero. Its species are native to the Americas, where they have been cultivated for thousands of years by the people of the tropical Americas, and are now cultivated worldwide. Some of the members of Capsicum are used as spices, vegetables, and medicines. The fruit of Capsicum plants have a variety of names depending on place and type. They are commonly called chili pepper, red or green pepper, or sweet pepper in Britain, and typically just capsicum in Australia, New Zealand, and India. The large mild form is called bell pepper in the U.S. and Canada. They are called paprika in some other countries (although paprika can also refer to the powdered spice made from various capsicum fruit). The name "pepper" came into use because of their similar flavor to the condiment black pepper, *Piper nigrum*, although there is no botanical relationship with this plant, or with Sichuan pepper.
The original Mexican term, chilli (now chile in Mexico) came from the Nahuatl word *chilli* or *xilli*, referring to a Capsicum variety cultivated at least since 3000 BC, as evidenced by remains found in pottery from Puebla and Oaxaca. Chili peppers have been a part of the human diet in the Americas since at least 7500 BC. There is archaeological evidence at sites located in southwestern Ecuador that chili peppers were one of the first cultivated crops in the Central and South Americas that is self-pollinating. Domestication began perhaps 5000 years ago. Different groups within different regions are thought to have independently domesticated chilli plants. The process may have begun when peppers were given a privileged status as a tolerated weed. As humans began to use and select the plants for their fruits, they unconsciously or even consciously chose from plants that held fruits until ready to harvest so that they were more difficult for birds to steal. Other traits were selected. Most cultivated peppers have fruits that droop downward. This came about not only from a preference for larger fruit but also to protect from bird damage by hiding them amid the foliage.

As seeds began to be cultivated, other new characteristics began to develop. Wild chillies are susceptible to cross pollination with other plants, whereas cultivated peppers mainly pollinate themselves. This is favorable because self-fertilizing plants could be grown in a small area with other distinct types without the danger of cross breeding whereby its identity would be lost. By the time the Spanish arrived in America, native people had already developed dozens of varieties of chilli peppers - the precursors of our modern day chillies. Without the advantage of scientific insight, these early botanists named many sized, shaped, and colored forms giving us a plethora of plant names that are only recently starting to be understood.

Capsicum has been known since the beginning of civilization in the Western Hemisphere. It has been a part of the human diet since about 7500 BC (MacNeish 1964). It was the ancient ancestors of the native peoples who took the wild *chile piquin* and selected for the many various types known today. Heiser (1976) states that apparently between 5200 and 3400 BC, the Native Americans were growing chile plants. This places chiles among the oldest cultivated crops of the Americas. As opposed to most domesticated crops, the wild ancestral chiles are not looked upon as worthless or inferior by farming people who cultivate their domestic decedents. The wild *Capsicum annuum var. aviculare* is harvested and sold in the marketplace alongside the larger-fruited domesticated chiles. Capsicum was domesticated at least five times by prehistoric peoples in different parts of South and Middle America. The five domesticated species are *C. annuum* L., *C. baccatum* L., *C. chinense* Jacq., *C. frutescens* L., and *C. pubescens*.

Chile is historically associated with the voyage of Columbus (Heiser 1976) and Columbus is given credit for introducing chile to Europe, and subsequently to Africa and to Asia. On his
first voyage, he encountered a plant whose fruit mimicked the pungency of the black pepper, *Piper nigrum* L. Columbus, believing he had reached India, called it red pepper because the pods were red. The plant was not the black pepper, but a heretofore unknown plant, not related to the *Piper* genus, that was later classified as *Capsicum*. In 1493, Peter Martyr (Anghiera 1493) wrote that Columbus brought home "pepper more pungent than that from the Caucasus". Upon their introduction into Europe chilies were grown as botanical curiosities in the gardens of Spanish and Portuguese monasteries. But the monks experimented with the chilies' culinary potential and discovered that their pungency offered a substitute for black peppercorns, which at the time were so costly that they were used as legal currency in some countries.

It was Diego Álvarez Chanca, a physician on Columbus' second voyage to the West Indies in 1493, that brought the first chili peppers to Spain, and first wrote about their medicinal effects in 1494. From Mexico, at the time the Spanish colony that controlled commerce with Asia, chili peppers spread rapidly into the Philippines and then to India, China, Indonesia, Korea and Japan. The new spice, unlike most of the *solanums* from the Western Hemisphere, was incorporated into these cuisines instantaneously. Probably for the first time, pepper was no longer a luxury spice only the rich could afford. Since its discovery by Columbus, chile has been incorporated into most of the world's cuisines and has been commercially grown in the United States since at least 1600, when Spanish colonists planted seeds and grew chile using irrigation from the Rio Chama in northern New Mexico (DeWitt and Gerlach 1990).

An alternate account for the spread of chili peppers is that the Portuguese got the pepper from Spain, and cultivated it in India. The chili pepper, in effect, figures heavily in the cuisine of the Goan region of India, which was the site of a Portuguese colony (e.g., vindaloo, an Indian interpretation of a Portuguese dish). Chili peppers journeyed from India, through Central Asia and Turkey, to Hungary, where it became the national spice in the form of paprika.

Capsicum terminology is confusing. Pepper, chili, chile, chilli, aji, paprika, and Capsicum are used interchangeably for plants in the genus Capsicum. Capsicum investigators use chile, pepper, or aji, as vernacular terms. Capsicum is reserved for taxonomic discussion. The word "chile" is a variation of "chil" derived from the Nahuatl (Aztec) dialect which referred to plants now known as Capsicum, whereas "aji" is a variation of "axi" from the extinct Arawak dialect of the Caribbean.

This brings up the point of the correct way to spell "chile" (Domenici 1983). The "e" ending in chile is the authentic Hispanic spelling of the word, whereas English linguists have changed the e to an i. Chile pepper has come to mean pungent chile cultivars. However,
chile means pepper (Capsicum) whether the fruits are pungent or not. Generally, chili is used to identify the state dish of Texas, which is a combination of pungent chile cultivars and meat (Domenici 1983). Bell pepper generally refers to non-pungent blocky chile types. Additional confusion is present within species designation, because C. annuum was sometimes called C. frutescens in the scientific literature (Heiser and Smith 1953).

Pod-types and Cultivars - Several hundred chile pod-types are grown worldwide. Chile pod-types are a subspecific category that allows for distinguishing among the specific horticultural varieties. Types such as ancho, bell, jalapeño, pasilla, New Mexican, yellow wax, are distinct pod-types that have specific traits for processing and fresh use, flavor and pungency.

The most economically important species in the world is C. annuum (Greenleaf 1986; Bosland et al. 1988). Many pod-types are central ingredients in ethnic dishes such as ancho and New Mexican for chile rellenos, pasilla for mole sauce, and serrano for pico de gallo. Like wine-tasting, one can discern between the subtle flavors of chiles after a few years of experience; ancho is sweetish, mulatto is chocolaty, mirasol is fruity, and chilpotle is smoky.

Grinding the pods produces one flavor, toasting before grinding produces another, and soaking the chiles in water produces yet another.

By the time the Spanish arrived in Mexico, Aztec plant breeders had already developed dozens of pod-types. According to historian Bernardino de Sahagún, who lived in Mexico in 1529, "hot green chiles, smoked chiles, water chiles, tree chiles, beetle chiles, and sharp-pointed red chiles" existed (DeWitt and Gerlach 1990). Undoubtedly, these chiles were the precursors to the large number of pod-types found in Mexico today. Even though many pod-types exist, improvement continues today because of specific needs in the industry. Improvement in quality and yields are occurring, along with refinement of the pod-types to fit special niches of the industry.

Fresh market types such as bell peppers, cuban, and squash, are usually non-pungent, and eaten raw, stir-fried, or prepared in some fashion to season a culinary dish. Bell apparently refers to the fruit's blocky shape, with four lobes preferred in the United States.

Bell types were first mentioned in 1699 by the English pirate, Wafer, who found them growing in Panama (Wafer 1699). The conventional green bell pepper has given way to innovative colored pods that can ripen to shades of red, orange, yellow, and brown. A survey in the 1992 issue of Fresh Trends stated that 95% of the people who tried a colored bell liked them and 5 out of 6 preferred them over the green bell. More people are trying colored bell peppers than any other produce category. There has been an increase of 75% in the consumption of colored bells in the United States. In 1992, colored bells were tried by as many consumers as leaf lettuce, fresh asparagus, peas, squash, and red potatoes.
Consumers bought more colored bells than yellow beans, artichokes, or romaine lettuce. The innovative fruit colors have brought increased consumption and sales.

Chile processing pod-types can be grouped into two main categories. The first consists of a fresh product that is frozen, canned, or pickled. Some of the pod-types included in this group are the pimento, jalapeño, serrano, pepperoncini, yellow wax, and the New Mexican. The second category consists of those used as a dehydrated product. Dehydrated pod-types are New Mexican, cayenne, ancho, pasilla, mirasol, piquin, and de arbol (Bosland 1992).

A relatively recent pod-type is the New Mexican, also called long green or 'Anaheim' type. Actually, the pod-type is New Mexican, and 'NuMex Big Jim' and 'Anaheim' are cultivars within this type. The New Mexican pod-type was developed in 1894 when Fabian Garcia at New Mexico State University began improving the local chiles grown by the Hispanic gardeners around Las Cruces, New Mexico. This type, characterized by long green pods that turn red, is the chile of choice for Mexican-style cooked sauces in the United States. Green and red chile represent two developmental states of the same fruit. 'Anaheim' seed originated in New Mexico and was brought to Anaheim, California, where it was widely cultivated. Thus, until Dr. Garcia released the New Mexican pod-type, it did not exist. If pods are left on the plant to be harvested at the red stage, they are usually dried and ground into chile powder (paprika if non-pungent). A green, New Mexican chile pod contains three times the vitamin C of a 'Valencia' orange and provides the minimum daily requirement. As green pods turn red, pro-vitamin A content increases until they contain twice the pro-vitamin A of a carrot (Lantz 1943). A one half tablespoon of red chile powder furnishes the minimum daily requirement of vitamin A.

A peculiar chile category is paprika. It is not a pod-type in the United States, but it is a product. In Europe, there are chile pod-types that are paprikas. This is because in the Hungarian language "paprika" means Capsicum (Somos 1984). Paprika is defined in the United States as a sweet, dried, red powder. This mild powder can be made from any type of C. annuum that is non-pungent and has brilliant red color. Paprika may be pungent in Hungary, but paprika is always non-pungent in international trade.

A small group of chiles can be classified as ornamental. Although edible, ornamentals are grown primarily for their unusual pod shapes or for their dense foliage and colorful fruits. A tradition in New Mexico is to harvest mature red chiles and string them into colorful strings (ristras). The ristra is hung near the entrance of the house as a symbol of hospitality. Ornamental chiles have become an innovative way for small farmers to produce a high-value alternative crop.

**Capsicum species** - Capsicum consists of approximately 20–27 species, five of which are domesticated: *C. annuum, C. baccatum, C. chinense, C. frutescens*, and *C. pubescens*. Though there are only a few commonly used species, there are many cultivars and methods
of preparing chili peppers that have different names for culinary use. Green and red bell peppers, for example, are the same cultivar of *C. annuum*, immature peppers being green. In the same species are the jalapeño, the poblano (which when dried is referred to as ancho), New Mexico (which is also known as chile colorado), Anaheim, serrano, and other cultivars. Peppers are commonly broken down into three groupings: bell peppers, sweet peppers, and hot peppers. Most popular pepper varieties are seen as falling into one of these categories or as a cross between them.

The *C. chinense* species, like all Capsicum species, originated in the New World. However, the French taxonomist who named this species in 1776 got his seed from China (Smith and Heiser 1957). Habanero, or Scotch Bonnet, is the best known chile of this species. One accession of Habanero has the distinction of being one of the world's hottest chile (in excess of 200,000 scoville heat units). Fruit shape can vary from long and slender to short and obtuse. Fruit can be extremely pungent and aromatic, with persistent pungency when eaten. *C. chinense* is popular in all tropical regions.

The *C. frutescens* species is represented by two cultivars, tabasco and malagueta. Tabasco is the most common cultivar of *C. frutescens*. The red fruit is the ingredient in Tabasco sauce. The malagueta is a popular cultivar in Brazil. It is not related to *Aframomum melegueta*, the melegueta or Guinea pepper, from Africa which is related to ginger.

In South America, *C. baccatum* is the most commonly grown species, where it is called aji, not chile. Three botanical varieties of *C. baccatum* are recognized: *C. baccatum var. baccatum*, *C. baccatum var. pendulum*, and *C. baccatum var. microcarpum*. *C. baccatum* flowers have yellow, brown, or dark green spots on the corolla. As many different pod-types of chiles (in relation to shape, color, and size) exist within *C. baccatum* as in *C. annuum*. Fruits vary in pungency from non-pungent to very hot. They embody unique aromatics and flavors that can be overpowering to some people. *C. baccatum* is the chile of choice when making ceviche (marinated fish).

Another of the five species, *C. pubescens*, is a relatively unknown chile. It is found from Mexico to Peru, growing in the Andean South America and the Central American highlands. Common names include rocoto or locoto in South America. Instead of white flowers, it has purple flowers with large nectaries. The presence of conspicuous leaf pubescence and black seeds readily distinguish this chile from any of the other species. This chile is adapted to cooler temperatures, 4.4° to 21.1°C (40° to 70°F), but does not tolerate frost.

The other approximately 20 Capsicum species lack extensive study on their biology. It is interesting to note that all wild chiles have small fruits which are eaten with ease by birds, the natural dispersal agent for Capsicum. Many of the known wild species have restricted
distribution. These species may contain genes for adaptation to unusual environmental conditions as well as disease resistance.

Many varieties of the same species can be used in many different ways; for example, *C. annuum* includes the "bell pepper" variety, which is sold in both its immature green state and its red, yellow or orange ripe state. This same species has other varieties as well, such as the Anaheim chiles often used for stuffing, the dried ancho chile used to make chili powder, the mild-to-hot jalapeño, and the smoked, ripe jalapeño, known as a chipotle.

The substances that give chili peppers their intensity when ingested or applied topically are capsaicin and several related chemicals, collectively called capsaicinoids. Capsaicin is the primary ingredient in the pepper spray used as an irritant weapon. When consumed, capsaicinoids bind with pain receptors in the mouth and throat that are responsible for sensing heat. Once activated by the capsaicinoids, these receptors send a message to the brain that the person has consumed something hot. The brain responds to the burning sensation by raising the heart rate, increasing perspiration and release of endorphins.

Most of the capsaicin in a pungent (hot) pepper is concentrated in blisters on the epidermis of the interior ribs (septa) that divide the chambers of the fruit to which the seeds are attached. A study on capsaicin production in fruits of *C. chinense* showed that capsaicinoids are produced only in the epidermal cells of the interlocular septa of pungent fruits, that blister formation only occurs as a result of capsaicinoid accumulation, and that pungency and blister formation are controlled by a single locus, Pun1, for which there exist at least two recessive alleles that result in non-pungency of *C. chinense* fruits.

The "heat" of chili peppers was historically measured in Scoville heat units (SHU), which is a measure of how much a chili extract must be diluted in sugar syrup before its heat becomes undetectable to a panel of tasters. Bell peppers rank at 0 SHU, New Mexico green chilis at about 1,500 SHU, jalapeños at 2,500–5,000 SHU, and habaneros at 300,000 SHU. The modern commonplace method for quantitative analysis of SHU rating uses high-performance liquid chromatography to directly measure the capsaicinoid content of a chili pepper variety. Pure capsaicin is a hydrophobic, colorless, odorless, and crystalline-to-waxy solid at room temperature, and measures 16,000,000 SHU.

According to Guinness World Records, as of March 1st, 2011, the world's hottest chili pepper is the Trinidad Scorpion Butch T pepper with a Scoville rating of 1,463,700 SHU.

Chili pepper pods, which are berries, are used fresh or dried. Chiles are often dried to preserve them for long periods of time. Preserving may also be done by pickling fresh chilies. Dried chilies are often ground to powders, although some Mexican dishes including variations on *chiles rellenos* may use whole reconstituted chilies, and others may reconstitute dried chilies before grinding to a paste. Chilies may be dried using smoke, such as the chipotle, which is the smoked, dried form of the jalapeño.
Many fresh chilies such as poblano have a tough outer skin which does not break down on cooking. For recipes where chiles are used whole or in large slices, roasting, or other means of blistering or charring the skin are usually performed so as not to entirely cook the flesh beneath. When cooled, the skins will usually slip off easily.

Chili pepper plant leaves, mildly bitter but nowhere near as hot as the fruits that come from the same plant, are cooked as greens in Filipino cuisine, where they are called dahon ng sili (literally "chili leaves"). They are used in the chicken soup, tinola. In Korean cuisine, the leaves may be used in kimchi. In Japanese cuisine, the leaves are cooked as greens, and also cooked in tsukudani style for preservation. Fresh or dried chilies are often used to make hot sauce, a bottled condiment to add spice to other dishes. Hot sauces are found in many cuisines including harissa from the Middle East, chili oil from China (known as rāyu in Japan), habanero sauces in Central America and sriracha from Thailand.

Capsicum fruits and peppers can be eaten raw or cooked. Those used in cooking are generally varieties of the C. annuum and C. frutescens species, though a few others are used as well. They are suitable for stuffing with fillings such as cheese, meat or rice. They are also frequently used both chopped and raw in salads, or cooked in stir-fries or other mixed dishes. They can be sliced into strips and fried, roasted whole or in pieces, or chopped and incorporated into salsas or other sauces, of which they are often a main ingredient.

They can be preserved in the form of a jam, or by drying, pickling or freezing. Dried peppers may be reconstituted whole, or processed into flakes or powders. Pickled or marinated peppers are frequently added to sandwiches or salads. Frozen peppers are used in stews, soups, and salsas. Extracts can be made and incorporated into hot sauces.

Red chilis contain high amounts of vitamin C and carotene (provitamin A). Yellow and especially green chilis (which are essentially unripe fruit) contain a considerably lower amount of both substances. In addition, peppers are a good source of most B vitamins, and vitamin B6 in particular. They are very high in potassium, magnesium, and iron. Their high vitamin C content can also substantially increase the uptake of non-heme iron from other ingredients in a meal, such as beans and grains.