



# A Pepper Primer

Introducing the *Capsicums*



# A Brief History



- Peppers are members of the genus *Capsicum*. The first wild *Capsicums* originated in eastern Bolivia and southern Brazil. Birds spread seed from these peppers across the Americas.
- Indigenous Americans first domesticated peppers about 7,000 years ago. Other wild pepper species were then independently domesticated at least 4 more times in other locations.
- Members of Christopher Columbus' crew collected pepper plants and seeds to bring back to Europe. Wrongly believing the plants to be related to black pepper (*Piper nigrum*), Columbus gave them their common name "pepper."
- Peppers quickly grew in popularity and were spread across the world through colonial trade networks.
- 2,000-3,000 pepper varieties are grown world-wide today.

# Pepper Classification

- Along with tomatoes, potatoes, and eggplant, peppers are members of the night shade family, *solanaceae*.
- The pepper genus, *Capsicum*, is named from the Greek word “kapto” meaning “to bite.”
- There are about 23 different species of peppers, but only five species contain domesticated varieties. These five species, *annuum*, *chinense*, *frutescens*, *pubescens*, and *baccatum*, will be discussed in the following slides.



# *Capsicum annuum*

- Early Aztec plant breeders are credited with domesticating the *annuum* species in what is now Mexico. The peppers were used for religious, culinary, and medicinal purposes.
- By European conquistador Hernán Cortés' arrival in 1519, the Aztecs had developed dozens of unique *annuum* cultivars including poblanos, jalapeños, serranos, and non-pungent varieties.
- The *annuums* are now the most economically important and widely cultivated species around the world.



# *Capsicum chinense*



- *Capsicum chinense* originated in the lowland jungles of the western Amazon basin in Brazil.
- Dutch physician Nikolaus von Jacquin named the species while collecting plant samples for Emperor Francis I in 1776.
- The spiciest peppers found to date, such as the 'Scotch Bonnet,' 'Red Savina Habanero' and 'Bhut Jolokia' varieties are all members of the *chinense* species.
- *Chinense* cultivars are distinguished by their wrinkly leaves.

# *Capsicum frutescens*

- *Capsicum frutescens* originated in the western Amazon River basin of Colombia and Peru and was domesticated in Panama.
- *Frutescens* means shrubby or bushy, which describes the vigorous prostrate growth of the species.
- Tabasco is the most commonly grown *frutescens* type outside of the tropics.



# *Capsicum pubescens*



- *Capsicum pubescens* cultivars are easily identified by their fuzzy leaves and stems, deep purple flowers, and dark colored seeds.
- The species likely originated in the highlands of Bolivia, where it was also domesticated.
- *Pubescens* varieties, like the spicy 'Rocoto,' are adapted to cooler temperatures and require long growing seasons that makes them difficult to grow in the U.S.

# *Capsicum baccatum*

- *Capsicum baccatum* is the most commonly grown species in South America.
- The species, whose name means “berry-like” was domesticated about 2,500 years ago in Peru.
- Pre-Incan civilizations began selecting for traits in the species that laid the foundation for the modern *ají* peppers that are grown in the lowland tropics around the Andean mountain range today.





# What Makes Peppers Hot?

- A pepper's spiciness is determined by the presence of seven alkaline compounds called *capsaicinoids*.
- *Capsaicinoids* are likely produced to protect the pepper plants from consumption by mammals.
- The concentration of *capsaicinoids* in a pepper is the result of genetics and environmental factors.
- Environmental stress, such as extreme heat and water scarcity, increases the pungency of peppers.
- Contrary to popular belief, pepper seeds do not contain *capsaicinoids*. The compounds are actually found in the placenta of the fruit, which runs along the base of the seeds like a vein.

# Scoville Scale



- Historically, pepper pungency has been measured using the Scoville Heat Unit scale. The scale relies upon five trained testers to sample dilutions of different peppers until the pungency can no longer be discerned. That final dilution is the Scoville Heat Rating for the pepper.
- More advanced forms of chromatography are now used to accurately measure the concentration of capsaicinoids present, but the Scoville system is still the most popular reference for measuring a pepper's spiciness.

# Bhut Jolokia: The Hottest Pepper in the World

- In 2005, researchers at New Mexico State University tested the capsaicinoid levels of the Bhut Jolokia pepper found in Bangladesh and northeastern India. The tests revealed that the pepper had enough capsaicinoid to equal 1,001,304 Scoville Heat Units, making it the hottest pepper in the world.



# Quest for the Perfect Pepper

- Modern plant breeders are carrying on the tradition established by the Aztecs of selecting for desirable traits to create new and improved pepper varieties.
- Breeders use advanced techniques to create DNA maps of different varieties to identify specific genes that produce traits like disease tolerance and pungency.
- The Van Deynze lab at UC Davis is currently working on introducing resistance to the devastating soil-borne disease caused by the fungus *Phytophthora* into commercial pepper varieties, thanks in part to a USDA research grant.

# The Student Farm Pepper Diversity Garden

- Over 40 varieties of peppers representing four of the five domesticated species are being grown at the Student Farm.
- Many of these varieties are not commercially available, but are used as breeding stock to help confer desirable traits like leaf size and shape, fruit color, and disease resistance.
- More information on several of the varieties is on the following slides.



# Yolo Wonder

- 'Yolo Wonder' is a bell pepper that was bred and released by the Campbell's Soup Company in 1952.
- Named after Yolo County, California, the peppers are sweet and the plants have bushy foliage that helps prevent sunburn.



# Ancho 101



- Ancho type peppers (known as Poblanos when in their green stage) were developed by the Aztecs.
- The term “Poblano” refers to the Puebla Valley south of Mexico City where these peppers were first grown.
- These wide-shouldered medium-spicy peppers are most often dried after they have matured to a deep mahogany color.

# NuMex Joe E. Parker

- Developed by breeders at New Mexico State University, 'NuMex Joe E Parker' was released in 1990 and has become one of the most widely grown commercial green chile peppers in the United States today.
- The uniform, thick-walled fruit is a favorite of the pepper canning industry and is also often used to make *chile relLENos*.





# NuMex R Naky



- Another variety bred at New Mexico State, 'R Naky' was released in 1985 to be used in making paprika powder.
- The cultivar, developed by Dr. Roy Nakayama, sets fruit under high temperatures and low humidity levels.

# Carolina Cayenne

- Cayenne peppers most likely originated in what is today French Guiana and were named after the Cayenne River that runs through the country.
- The variety 'Carolina Cayenne' produces spicy pods that are most often dried to make cayenne powder.
- 'Carolina Cayenne' is also resistance to root-knot nematodes; a trait that makes the cultivar popular with plant breeders.



# Early Jalapeño



- Jalapeños originated in Mexico and are named for the city of Jalapa where they were processed, not grown.
- Most Jalapeños are still grown in Mexico, but some commercial production does exist in southern Texas.
- As its name implies, 'Early Jalapeño' matures about two weeks earlier than most other Jalapeño varieties and has been used extensively in breeding faster-maturing pepper varieties.

# CM 334

- 'CM334' is a semi-domesticated pepper originating in Mexico.
- Purple hued stems, tiny leaves, bountiful flowers, and pungent fruit characterize the cultivar.
- 'CM334' is resistant to the fungus *Phytophthora* and is currently being further analyzed by the Van Deynze lab on campus.



# Pusa Jwala



- 'Pusa Jwala' peppers originate in India.
- The plants produce many thin, wrinkled, spicy peppers that are used both fresh and dried on the subcontinent.
- The pepper is widely adapted to various climates and is also well-suited for container gardening.

# Interested in Plant Breeding at UC Davis?



- Undergraduate students can choose a plant breeding emphasis as a Plant Science, Plant Biology, or Biotechnology major. Click [here](#) for more information and class offerings .
- Prospective graduate students can apply to the Genetics Graduate Group and specialize in Plant Breeding and Biodiversity. Click [here](#) for more information.
- For more information on what is involved in studying plant breeding, click [here](#).

Produced by [Ethan Grundberg](#) with funds from the USDA

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1. [http://www.ethno-botanik.org/Capsicum/Capsicum\\_baccatum/Fotos/Fotos.html](http://www.ethno-botanik.org/Capsicum/Capsicum_baccatum/Fotos/Fotos.html)
2. [http://www.eatmorechiles.com/Scoville\\_Heat.html](http://www.eatmorechiles.com/Scoville_Heat.html)
3. <http://www.tomisimo.org/blog/2007/espanol/and-people-thought-food-was-spicy-in-mexico/>
4. [http://www.chilepepperinstitute.org/cart/product/holy\\_jolokia\\_salsa/](http://www.chilepepperinstitute.org/cart/product/holy_jolokia_salsa/)
5. [http://www.chilepepperinstitute.org/cart/product/bhut\\_jolokia/](http://www.chilepepperinstitute.org/cart/product/bhut_jolokia/)



This project is funded by the USDA National Institute of Food and Agriculture