

Chili Plants: Nutrition Content and Local Varieties as a Genetic Resources

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ABSTRACT

Chili (*Capsicum sp.*) is a vegetable commodity that is widely grown throughout the world after tomatoes are a member of the Solanaceae family, which have very many types, ranging from not spicy to very spicy. Chili originates from South America and Central America, Peru and Mexico and then brought by the Portuguese to Europe and Asia then spread throughout the world. Chili contains many compounds that are good for health, vitamin C, vitamin A, vitamin E, folic acid, flavonoid, phenol, capsaicin which can be used to treat malnutrition in society and non-infectious diseases such as heart disease, diabetes, cancer. The content of the nutrition depends on the genotype, environmental conditions, and the fruit ripening phase at harvest. In Indonesia, there are many local varieties or landraces of chili that have adapted well to the local environment. Local varieties are good genetic resources for developing new superior varieties of chili that have the quantity, quality, and resistance to environmental stress.

Keywords: Chilies, nutrition, local varieties

Introduction

Chili (*Capsicum sp.*) is a member of the Solanaceae family, is the second most important plant in the Solanaceae family (eggplant) after tomatoes, which are widely grown throughout the world, both as a vegetable and as a spice plant (Islam et al., 2020). Chili has been consumed by nearly a quarter of the world's population as a spice in American, Asian, European, and African dishes (Kantar et al., 2016).

The chili plant originated from the continents of Central America (Mexico) and South (Peru), and was consumed by the ancient Indians around 7000 BC. Archaeological evidence in the form of chunks and wild chili seeds found in a cave that was identified as *Capsicum annum*. Chili is an important plant for Indian tribes and is often used for religious and cultural events (Djarwaningsih, 2005). The domestication process took place marked by a change in the morphological form of plants and fruit that occurred 5000 years ago, then chilies were brought by Columbus to Europe and by Portuguese traders to India until finally entering Southeast Asia including Indonesia around the 16th century (Purseglove, 1979).

According to Undang et al. (2015), there are 100 species of chili that have been identified, but there are five chilies that are commonly cultivated (Kantar et al., 2016), namely *Capsicum annum*, *Capsicum frutescens*, *Capsicum chinense*, *Capsicum baccatum*, and *Capsicum pubescent*. The classification of chili species is based on morphological characters (especially flowers), the ability to cross between species, the seeds of a fertile cross.

In Indonesia, chili is an agricultural commodity that has high economic value because it is much needed for household needs and the food and drug industry. Many types of chili plants in

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Indonesia have been planted for years so that they become local varieties that have been adaptive to the local environment.

Nutritional content and efficacy of chili

Chili plants contain many important compounds that are nutritious for human health, namely macro and microelements, antioxidants, and vitamin C. Chili contains many carotenoids, various acids, sugars, polyphenols, flavonoids especially quercetin and luteolin. Capsaicinoid is an active compound in the genus *Capsicum* that can act as a digestive protective agent and also has an analgesic function. Carotenoids function to protect eye vision, treat stomach ulcers, and improve the body's immune system (Mamedov et al., 2017). Consuming chilies can reduce the risk of inflammation, cancer, and chronic non-infectious diseases including heart disease, diabetes, and obesity. Chili peppers are usually consumed in raw, cooked, and seasoning form. The history of the Mayans using chilies as a treatment and is thought that they contain anti-microbial compounds (Kantar et al., 2016)

The color of the fruit is also one of the most important indicators of the quality of chilies. 20 carotenoids form a red-yellow pigment in the color of ripe chilies. Capsanthin, capsorubin, and cryptoxanthin are only found in chilies that act as anti-free radicals. The red color is determined by capsanthin, capsanthin-5,6-epoxide, and capsorubin, the orange color is determined by zeaxanthin, β -carotene, β -cryptoxanthin, violaxanthin, and cucurbitaxantin A. Capsanthin in ripe fruit contains more than 60% total carotenoids. (Mamedov et al., 2017).

Apart from vitamin C, vitamin A, and vitamin E, chilies also contain folic acid. The content of vitamin C in chilies is twice that of tomatoes, apples, and oranges per gram of fruit weight. A folic acid is a group of B-complex vitamins that can reduce the risk of heart attack and cancer, the amount of nutrition content varies between chili varieties. The content of phytochemical compounds in chilies can be influenced by agronomic factors, harvest time, storage, cooking techniques, and cultivars (Kantar et al., 2016). Mamedov et al. (2017) states that the antioxidant content in chilies is influenced by genotype, environmental conditions (light, temperature, nutrients, atmospheric composition, and agrotechnology (for example fruit ripening at harvest, irrigation system). Understanding and increasing the nutrient content of chili plants is a strategy for preventing and treat malnutrition (Kantar et al., 2016).

Local varieties as a source of genetic diversity in developing new superior varieties of chili pepper

In Indonesia, the use of superior chili varieties by farmers is still quite low, even though many varieties have been released by the Ministry of Agriculture because most of these varieties were introduced from abroad so that their adaptability is relatively low, especially their resistance to disease (Syukur et al., 2013). From 1994 to 2017, 303 varieties of chili were released (Agriculture Ministry of Indonesia, 2017). For years, the use of local chili varieties has been cultivated by farmers, because in addition to being cheaper, each region has local varieties that have adapted well to the local environment.

Local varieties or landraces are defined as dynamic populations of cultivated plants in an area, their identities can be distinguished, are often genetically diverse and have been able to adapt to a certain area, have been selected by farmers based on the farmer's knowledge. Local varieties are reserve gene pools that enrich the diversity and maintain functional ecosystem stability (Azeez et al., 2018).

However, local varieties of chili have shortcomings, according to farmers, local varieties produce lower yields than hybrid varieties and late maturity. Local varieties generally have genes for resistance to environmental stress because they have long adapted to the local environment. Local varieties are good genetic resources for developing new superior varieties of chili to provide qual-

ity seeds that are resistant to climate change. Sangam et al. (2016) stated that landraces are heterozygous domesticated species that have adapted to local areas that provide genetic resources to face new challenges in agriculture in terms of environmental stress. Landraces are associated with specific geographic areas, in contrast to cultivars that are the result of breeding, trial in many areas, and planted in various places, so landraces are related to specific locations and are often given the name of the area.

Table 1. Research on local varieties or landraces of chili in Indonesia

Local varieties and origin	Research topic	Authors
Ten accessions of <i>C. frutescens</i> from East Java and Kalimantan	Morphological and agronomic characterization	Makhziah & Sukartiningrum (2019)
Three accessions of local <i>C. annum</i> Karo	Characterization and Performance	Marpaung et al. (2019)
Forty-eight accessions of local Timorese <i>C. frutescens</i>	Characterization	Lelang et al. (2019)
Local chili Pana 'Lipak from Mamasa	Characterization	Sirappa et al. (2019)
Fifteen accessions of <i>C. frutescens</i> from Kediri and Jember	Performance analysis	Chesaria et al. (2018)
<i>C. frutescens</i> di 18 daerah di Kediri, Jombang, Nganjuk	<i>C. frutescens</i> in 18 regions in Kediri, Jombang, Nganjuk	Dewansyah & Soetopo (2018)
Two local varieties of <i>C. frutescens</i> Karang Anyar and Boyolali	Production potential	Citra et al. (2018)
Bulk population of local varieties <i>C. frutescens</i>	The genetic diversity of local varieties	Saptadi et al. (2017)
Fifteen accessions of <i>C. annum</i> chilies	Resistance to anthracnose	Syukur et al. (2013)

Research on local varieties or landraces of chili as a breeding material has been widely carried out in Indonesia, as shown in Table 1. Makhziah and Sukartiningrum (2019) explored and characterized the local varieties of Chili from Kediri, Blitar, Tulungagung, Mojokerto, Ponorogo, Lamongan, Kalimantan, and they found similarities in cayenne pepper in adjacent areas such as Kediri, Blitar, and Tulungagung, presumably the origin of the local chili originates from the same ancestor. Lelang et al. (2019) explored local cayenne pepper on the island of Timor, that grows wild in the forest understands with small fruit size but very spicy taste. Marpaung et al. (2019)

also conducted a characterization of three local red chilies (*C. annum*) in Karo Regency, North Sumatra, and observed differences in morphological and biochemical characters, the content of capsaicin and vitamin. Sirappa et al. (2019) characterized the local chili Panak 'Lippak-Lippak on the island of Mamasa, West Sulawesi, a group of paprika that grows mostly in highlands above 1000 m sea level. Chesaria et al. (2018) examined the performance of fifteen cayenne pepper accessions in Kediri and Jember. Dewansyah and Soetopo (2018) explored and characterized local cayenne pepper in Kediri Regency in 18 different locations. Saptadi et al. (2017) observed the diversity of local varieties collected from Batu City, East Java. Syukur et al. (2013) examined that local chilies have the potential for resistance to anthracnose disease.

Conclusion

Chili contains nutrients that are important for health and can be a food ingredient to prevent malnutrition for society. Nutritional content is influenced by genotype, agrotechnology treatment, and the environment. Chili originates from Central America and South America and then spread throughout the world by the Portuguese. In Indonesia, many types of chilies grow long and have adapted to the local environment so that they become local varieties/landraces. Landraces could be as potential genetic resources to develop new high-yielding varieties of chilies and also, resistant to environmental stress and rich in healthy nutrients.

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