

Wild Native Chilli, Chile Piquin (*Capsicum annuum* L. var. *aviculare* Dierb.) in Northeastern Mexico: Research Progress

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Abstract

The paper gives a brief review on research progress on various aspects of Chile piquin (*Capsicum annuum* L. var. *aviculare* Dierb.), a native wild species of commercial importance in Northeast Mexico. It gives a background of the history of Chile piquin and its importance. Studies have been undertaken on morphology of the plant, its distribution in fields, root system, pollen viability. In addition, studies have been undertaken on pigment contents, water potential and biochemical composition of plant parts and fruits.

Keywords: Botany, chemistry, Chile piquin, economic importance, history, physiology

1. Introduction

The Chile piquin, a wild chili (*Capsicum annuum* L. var. *glabriusculum*) is a very important well known represents a natural resource of high commercial and medicinal values and represents typical culture of northeast Mexico. This plant species is a typical component of the shrubs of Northeast of Mexico and is perennial. It grows both in the semiarid and tropical region of Mexico. It is a source of income of the inhabitants of the region (Medina, 2007). The form of the management of wild chilli in northeast Mexico is mainly from its collection from its wild habitat in forests and mountains and occasionally its cultivation in lawns which are mostly transplanted from its wild habitat.

The consumption of chilli (*Capsicum annuum* L.) is a very important food habit in the history and culture of Mexicans. It is used in multiple forms since pre-hispanic period. It is consumed both in fresh or dry, in salad, cocktails etc. (Ciencia, 2012).

Chile piquin is collected by local farmers from its wild habitat during the months of September to December, and during this period, 60% of the income is obtained by the communities for the availability of the abundance quantity of chills during this period. The rest of 40% of the income is obtained from other agricultural activities. The collection of chilli is carried out mostly by women and children (Medina, 2007; 2010). The collection was found to decrease owing to the decrease in rainfall and high medicinal properties.

The medicinal properties are attributed to cure of skin

problems and bodies with scars, grains. For its cure is taken a bath with infusion of leaves after boiling. In few place the macerated leaves in alcohol is employed to treat evil eyes (Rodriguez et al., 2004; Medina et al., 2006).

The demand of this regional product in the market depends on the basis of the appearance, taste and the characteristics of the products to the consumers (Rodriguez et al., 2004). The price of the product is influenced by the demand of the market. The greater supply of the product by the producers tends to reduce the price (Medina, 2007). At the same time, the greater part of the production is available in the natural vegetation of northeast Mexico, depends mainly on the rainfall and the prevailing temperature (not more than 35 °C). It is reported that the greater volume of Chile piquin comes from the collection of wild plants showing less possibility of commercial exploitation of piquin, owing to the difficulty for germination of seeds (Robles and Gomez, 2008).

A concise review on research undertaken on various aspects of Chile piquin (*Capsicum annuum* L. var. *aviculare* Dierb.) by different authors and our research results done in the Forest Science Faculty, UANL, Mexico during last few years is mentioned below:

2. Morphology and Phenology

The Chile piquin plant has a bushy habit with a strong stem and horizontal branches presently alternate manner on main stem. The horizontal branch extends laterally on all sides of the main stem and produce secondary, tertiary, quaternary branches in dichotomous manner depending on the availability



of the space. Stem is round, strong, green with longitudinal streaks which may vary in different habitat.

Leaf deep green, thin, pliable, spear shaped. Mid rib thin with 5 to 6 lateral veins with reticulate venation. The upper surface of leaf is deeper green than the lower. Flowers small with 5 white petals, united; and five sepals, joined. Fruit small, round or elliptical depending on ecotype (Figure 1). Fruit contains many seeds. Seeds are flat with hard seed coat.

It is observed that seeds of wild chilli are dispersed in the month of December which is exposed to severe cold which might have induced to break dormancy. A technique has been developed for germination of Chile piquin. The seeds kept in refrigerator at 4 °C mixed with cow dung for seven days and then sown in black plastic bags filled with finely powdered soil mixed with organic matter gave reasonable germination. The seeds of Chile piquin possess hard seed coat, impermeable to water. The germination of seeds poses a great obstacle for its propagation and cultivation in the fields. Under natural conditions, the germination occurs after passing through digestive tracts of the birds or through other ecological factors which needs to be studied (Maiti et al., 2015).

Pequin has a compact habit growing typically 0.3–0.6 m tall, with bright green, ovate leaves and small fruits that rarely exceed 2 cm in length. Like other chillies, the fruits are green in the beginning, while ripening they turn to brilliant red at maturity. Pequin peppers are very hot, often 13–40 times hotter than the chilli, jalapenos on the Scoville scale (100,000–140,000 units). Flavor is described as citrusy, smoky (if dried with wood smoke), and nutty. Ripe fruits are used in the preparation of hot sauce, soups, and vinegars. The fruits look like star. The fruits are green and at maturity are orange yellowish or reds. It is originated in tropical regions and grows on hot climate starting from sea level up to 30 m.

3. Commercialization of Chile Piquin

The largest volume of piquin chili which is marketed in Mexico comes from collections of wild plants; there is little evidence of commercial plantations. A study was made to learn the of production and profitability requirements, and to investigate possible target markets. The research included a review of the literature, and a review of written and electronic literature from public, private and academic institutions. There is a benefit cost higher than 1 in three production scenarios (low, medium and high-tech) so the crop is economically feasible as a new productive option in Mexico. It is feasible to establish large-scale production of piquin chili in Mexican territory and it can be an important income source for the poor families from the semi-desert regions. There is a niche market in the United States based on the high average growth rates of trade flow in this market. India is Mexico principal competitor in the United States of America, while in the domestic market it is China (Robles and Gomez, 2008).

With respect to the commercialization of this product, it is sold commonly in fresh forms. Besides, some alternatives may be to store in dry forms in packets, preparing sauce, in brine, or in the form of powders, which pretends to give

higher prices, and thereby, preserve the resource in natural forms (Medina, 2010).

The high price of this wild chilli compared to the price paid for commercial chilli, is attributed to its size, taste, hotness, the quality of the smell and the use of the products (Medina et al., 2006).

The growth of this species depends on the ecological condition prevalent in their natural habitat. The price of this wild chilli in the market in the northeast Mexico depends mainly on the climatic condition prevailing in the growing regions and its location and demand by the local populations and export markets (Horacio et al., 2014). It needs an efficient development of its technology for its sustainability.

For its great importance, a series of investigations have been conducted to search the development of technology to promote this natural resource for an alternative for its sustainable production in the northeast Mexico.

There is a possibility for value addition e for the inhabitants of northeast Mexico for the type of chilli needed for the consumer preference in the international market, besides its consumption in the fresh forms. There is a necessity to enhance the time of storage and possibilities of commercialization in the export markets. This chilli may be prepared in the form of sauce, conserved vinegar, powder and other products for its export markets.

In the context of the above facts Chile piquin represents a valuable natural resource of great relevance and socioeconomic conditions for the rural inhabitants for the collection of this chilli and sale in the streets and markets. About 63% of them collect these chillis for its sale in the streets, high ways, local markets in fresh forms.

The pictures show different stages of growth of Chile piquin in polythin bags and field.

Few studies have been undertaken on chemistry of Chile piquin.

4. Chemistry, Pharmacology and Toxicology

The injection of capsaicin accelerates the aperture of eyes of rats and increase in reddening of eyes which induce the presence of lesions in the skin of the body and head of the animal.

5. Root System

A Chile piquin plant was grown in a big 5 kg polythene bag up to fruiting stage and then the roots were washed carefully to expose root system, Chile piquin possess profuse fasciculated root system. Starting from the base of the stem few thick roots grow downwards grow downwards in an inclined manner which in turn produce profuse secondary, tertiary finer roots occupying a greater part of soil extending to deeper depth.

6. Pollen Viability

Pollen viability of Chile piquin was determined by staining squashed anther in 3% potassium iodide for 10 minutes. The



percentage of pollen viability ranged from 68 to 90%.

7. Analysis of Pigment

A comparative analysis of pigments (Chl a, Chl b, carotenoids, Chl(a+b), Chl(a/b), Chl(b/a)) reveal that the pigment contents varied in different dates of collection in both Chile piquin.

8. Chemical Composition

Using standard protocol the chemical composition of leaves, flowers, fruits and seeds of Chile piquin for Cu (copper),

Fe (iron) and Zn (Zinc), and macronutrients (Mg, K, P) was determined and shown in Table 1 and 2.

The chemical composition of different organs of Chile piquin shows variation in the contents of Cu, Fe and Zn among different organs.

It is observed that Cu content was higher leaves followed flowers, fruits and seeds. With respect to Fe it was remarkably greater in fruits followed by seeds, leaves and flower. Zn content was much higher in flowers and fruits followed by leaves and seeds.

Table 1: Micronutrients in Chile piquin (*Capsicum annum* L. var. *aviculare* Dierb). (SD= Standard deviation)

Component	Cu mg/gps	SD Cu	Fe mg/gps	SDs Fe	Zn mg/gps	SDs Zn
Leaves	0.015	0.0018	0.4078	0.0395	0.01971	0.0024
Flowers	0.010	0.00229	0.2140	0.0208	0.0273	0.0009
Fruits	0.010	0.00221	0.7730	0.1983	0.0267	0.0047
Seeds	0.010	0.00247	0.5102	0.2231	0.0198	0.0016

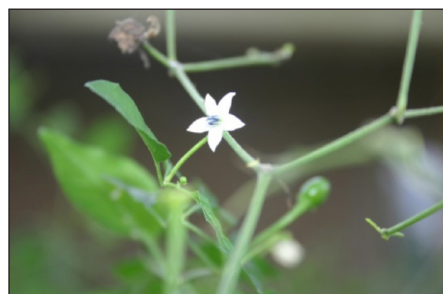
Table 2: Macronutrients in Chile piquin (*Capsicum annum* L. var. *aviculare* Dierb).

Component	Mg mg/g	DS Mg	K mg/g (emission)	DS K	P mg/ gps	DS	Cu mg/ gdwt	Fe mg/ gdwt	Zn mg/gdwt
Leaves	4.5546	0.4289	80.364	2.7168	1.3898	0.1293	0.01515	0.40785	0.0198
Flowers	1.1713	0.1356	104.274	22.891	2.1606	0.4435	0.0107	0.2140	0.02798
Fruits	0.7109	0.3091	203.353	12.2171	3.2917	0.1689	0.01058	0.7730	0.0266
Seeds	0.4770	0.3067	135.288	10.6147	2.3987	0.4186	0.01037	0.51023	0.01985

8.1. Effect of moisture on the growth and development of Chile piquin

In the following are presented the results of 4 treatments of water application (moisture) irrigated at intervals of 2, 4, 6

and 8 days from treatment 1 to 4 respectively. In treatment 1 was applied 150 ml of water every 2 days intervals, the other 3 treatments with 250 ml of water. Initially the seeds were sown on 12 March, 2014 in black polythene bag and were allowed



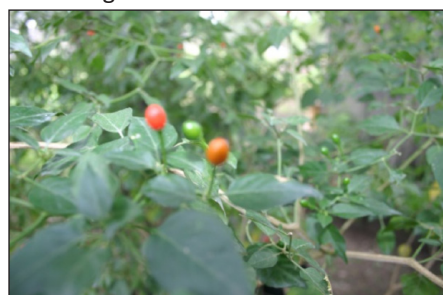
Flowering



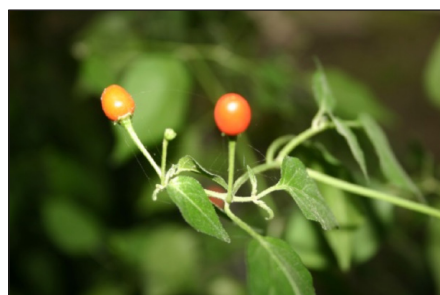
Fruit Set



Plants



Fruit development



Fruit Ripening



Seedling

Figure 1: Chile piquin at different phenological stages in its habitat and green house culture

to grow for 3 months. Ultimately we took observations every 15 days intervals for growth parameters and finally root roots.

9. Conclusion

Though Chile piquin has high commercial and medicinal values very little progress has been directed on research in various aspects of this plant. Concerted research emphasis should be directed need to be given to develop technology for propagation, and cultural practices water use efficiency etc. To make it highly profitable to the farmer and national economy.

10. Further Research

There is a necessity for value addition to this wild chilli, either in fresh, preserved or powder forms for international markets in USA, Germany, Japan and other European countries.. Concerted research activities need to be directed on detailed physiology, biochemistry and agronomy of this wild chilli of high commercial value.

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