

Haba and Huitlacoche, Nutritious Foods of Little Consumption

Edmundo Arias Torres, Imilla I. Arias Olgún and Bolivar Arias Olgún

Department of Applied Technology, Mexican Institute of Appropriate Technologies, S. C. Mexico City 07270, México

Abstract: Haba and Huitlacoche are foods of little consumption worldwide. Both provide nutrients to the human body due to the fiber, antioxidants, vitamins and essential amino acids they contain. The broad bean can be grown alone or intercropped with corn and pumpkin. Huitlacoche is a fungus that affects corn, however in Mexico it has been used as food since the times of the Aztec culture.

Key words: Bean, Huitlacoche, nutritious food.

1. Introduction

1.1 Bean

Bean is native to the Mediterranean basin or Central Asia, and is already cultivated in many places in the world [1]. The main producing countries are: Australia, China, Egypt and Ethiopia, which account for four fifths of world production. Its cultivation is also widespread in several countries in Europe and Latin America, especially Bolivia, Chile, Ecuador, Peru and Venezuela. It is grown in cold and temperate areas. The optimal temperature is around 15 °C.

The broad bean grows well in almost all types of soil, but those with good drainage are best, although it also tolerates clay soils. Very light, wet or dry soils do not do well; pH is best between 6 and 7.5. It requires a lot of humidity, about 700 mm annual rain. It is not particularly photophilous and, being frost tolerant in its early development, it adapts to the conditions of mountain areas.

1.2 Huitlacoche

The huitlacoche or cuitlacoche (*Ustilago maydis*) is a Basidiomycota fungus of the Ustilaginaceae family that within its life cycle has two phases, one saprophytic and the other parasitic. In this last phase it affects the

corn, producing a disease called “smut” or “common corn blight”.

However, in Mexico it has been used as food since the times of the Aztec culture. The fungus is consumed when the galls appear and before maturation. It can be consumed both fresh and canned and its price is several times higher than that of uninfected corn.

The mushroom has little by little been gaining followers in Europe and the United States, especially in haute cuisine restaurants, where it reaches quite high values.

The fungus is also cultivated through artificial propagation.

2. Materials

2.1 Bean

In the producing regions it is predominantly planted in monoculture, although in some communities it is associated and intercropped with corn or pumpkin.

Españita, a town located in the Municipality of Tlaxcala, Mexico, has been the community where the largest number of farmers practicing the corn-bean association was recorded (30%); In this region, such farming system is practiced by 39.3% of farmers [2].

In this type of systems, maximizing the use of space,

light and nutrient resources is contemplated to improve the quality of crops [3]. Specifically with the binomial bean intercropped or associated with corn, it has been possible to reduce the incidence of diseases by creating an unfavorable environment for pathogens [4].

The Haba prefers uniform warm-temperate temperatures and maritime climates better than continental ones. In cold climates, sowing is done in spring. It is not very demanding on soil, although it prefers clay or siliceous soils and limestone clay soils rich in humus, deep and fresh. Wet, poorly drained soils harm it. It is relatively tolerant to salinity.

It is very sensitive to lack of water, especially from flowering to pod filling.

2.1.1 Taxonomy and Morphology

Family: Leguminosae, subfamily Papilionoidea.

Scientific name: *Vicia faba* L.

Plant: annual, straight carriage.

Root system: highly developed.

Stems: green in color, strong, angular and hollow, branched, up to 1.5 m high. Depending on the tillering of the plant, the number of stems varies.

Leaves: alternate, compound, paripinnate, with wide oval-rounded leaflets, green in color and devoid of tendrils.

Flowers: axillary, grouped in short clusters of 2 to 8 flowers, having a large black or violet spot on the wings, which are rarely devoid of spot.

Fruit: legume of variable length, which can reach more than 35 cm. The number of grains ranges between 2 and 9. The color of the seed is yellowish green, although there are other darker colors.

2.2 Huitlacoche

The habitat of the huitlacoche or thrasher is mainly associated with corn, although it can affect other grasses. It is a fungus that affects corn cultivation, mostly in optimal environmental conditions of high relative humidity and temperatures between 17 and 20 °C.

Huitlacoche has in its composition significant amounts of antioxidants, fiber, vitamins, as well as lysine and amino acids.

Table 1 Bean taxonomy.

Kingdom	Plantae
Divisi ón	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Fabaceae

Source: Thom é [5].

Table 2 Taxonomy of Huitlacoche.

Kingdom	Fungi
Division	Basidiomycota
Class	Ustilaginomycetes
Order	Ustilaginales
Family	Ustilaginaceae
Genus	<i>Ustilago</i>
Species	<i>U. maydis</i>

Source: Mart ínez et al. [6].

3. Results

3.1 Bean

3.1.1 Nutritional Value

Chemical composition for 100 g of fresh broad beans is as follows.

- Water 65-70 g;
- Carbohydrates 17-20 g;
- Proteins 7-9 g;
- Fats 0.4-0.7 g;
- Cellulose 2.75 g;
- Mineral salts and vitamins 2.50 g.

One hundred grams of fresh product provides seventy to one hundred calories.

Mineral salts are represented as follows for one hundred grams of fresh product:

- Calcium 105 mg;
- Potassium 1,390 mg;
- Phosphorus 600 mg;
- Magnesium 240 mg;
- Copper 3 mg;
- Iron 2 mg.

Vitamins are represented as follows in fresh product: ().

- Vitamin A 200 I.U./100 g;
- Vitamin B1 0.30 mg/100 g;
- Vitamin B2 (riboflavin) 0.18 mg/100 g;
- Niacin (nicotinic acid) 1.80 mg/100 g;
- Vitamin C 25.00 mg/100 g.

3.2 Huitlacoche

In most countries of the world, the huitlacoche or thrasher is considered a pest and contaminated plants are eliminated to prevent the rapid spread of the disease.

However, in Mexico it has been used as food since the times of the Aztec culture, so not only is naturally infected corn used, but the fungus is also cultivated through artificial propagation.

The artificial propagation mechanisms are empirical infection, practiced directly by some producers, and inoculation of spores obtained by cultivation on potato dextrose agar.

It has been known for a long time that environmental conditions are very important for the production of huitlacoche [8] and most research coincides with maintaining the study site with an environment under control [9].

A good alternative to consistently obtain favorable environmental conditions to produce Huitlacoche is to grow corn under controlled conditions of relative humidity and temperature, which is possible in a greenhouse equipped to control these factors.

The form of consumption is in the form of a stew or part of other foods such as tortillas, tacos, quesadillas, soups, among others. The flavor of the mushroom is quite pleasant, with some similarity to that of Morcella mushrooms, but with a slight smoky and acidic touch. Its texture is also appreciated.

The growing interest in the fungus for food purposes has even allowed some States of the United States, such as Florida and Pennsylvania, to obtain authorization from the Department of Agriculture, USDA, to carry out the inoculation of the fungus, despite the rest of the States fight for its eradication.

Table 3 Nutritional value of broad beans per 100 g.

Water	77.1 g
Proteins	9 g
Fats	0.70 g
Carbohydrates	11.7 g
Fiber	0.30 g
Ashes	1.20 g
Calcium	15 mg
Phosphorus	217 mg
Iron	1.7 mg
Carotenes	0.15 mg
Vitamin B1	0.33 mg
Vitamin B2	0.18 mg
Vitamin C	12 mg

Source: USDA Fava Beans [7].

3.2.1 Nutritional Properties

Ustilago maydis has been classified as a nutraceutical food, that is, it has both nutritional and medicinal or pharmaceutical properties. Among these properties are high amounts of the following compounds: Soluble dietary fiber, antioxidants. Antioxidant foods help fight free radicals and therefore prevent premature aging.

3.2.2 Essential Vitamins and Amino Acids

In addition to presenting high levels of several vitamins, huitlacoche contains several essential amino acids, that is, they are necessary for the proper functioning of the human body. However, the body does not synthesize them, so they must be included in the diet.

Among these amino acids is lysine, which helps with the proper absorption of calcium, the formation of collagen, the release of growth hormone and mental development, in addition to strengthening the immune system.

Additionally, all of these components help control blood sugar and cholesterol levels in the long term and it has been suggested that they also help prevent some forms of cancer.

4. Conclusions

4.1 Bean

The Haba is a crop that can increase in Mexico since

only three States: Puebla, Michoacán and the State of Mexico are the main producers. It has the advantage that it can be grown intercropped with corn, which is the first and most consumed crop in the country. This would bring income for farmers and nutritional benefits for a greater range of the population.

4.2 Huitlacoche

It is a fungus that affects corn, but it has nutritional properties because it contains several essential vitamins and amino acids with the economic benefit that it costs more than corn.

References

- [1] Oplinger, E. S., Putnam, D. H., Doll, J. D., and Combs, S. M. 1989. *Alternative Field Crops Manual*. West Lafayette: Purdue University.
- [2] Damian, H. M. A., López, O. J. F., Ramírez, V. B., Parra, I. F., Paredes, S. J. A., Gil, M. A., and Cruz, L. A. 2008. "Men and Women in Corn Production: A Comparative Study in Tlaxcala."
- [3] Li, L., Zhang, F. S., Li, X. L., Christie, P., Sun, J. H., Yang, S. C., and Tang, C. 2003. "Interspecific Facilitation of Nutrient Uptake by Intercropped Maize and Faba Bean." *Nutrient Cycling in Agroecosystems* 65: 61-71.
- [4] Sahile, S., Fininsa, C. H., Sakhuja, P. K., and Ahmed, S. 2008. "Effect of Mixed Cropping and Fungicides on Chocolate Spot (*Botrytis fabae*) of Faba Bean (*Vicia faba*) in Ethiopia." *Crop Protection* 27 (2): 275-82.
- [5] Thomé, O. W. 1885. "Vicia faba in Flora von Deutschland, Österreich und der Schweiz." <http://www.biolib.de/thome3/index.html>.
- [6] Martínez, L., Villanueva, C., and Sahagún, J. 2000. "Susceptibility and Resistance of Corn to the Edible Huitlacoche Fungus (*Ustilago maydis* Cda.) Improving Its Virulence." *Revista Chapingo Serie Horticultura* 6 (2): 241-55.
- [7] USDA Fava Beans. 2022. *Pod and Raw in the USDA Nutrient Database*.
- [8] Tisdale, W. H., and Johnston, C. O. 1926. "A Study of Smut Resistance in Corn Seedlings Grown in the Greenhouse." *Journal of Agricultural Research* 32: 649-68.
- [9] Thakur, R. P., Leonard, K. J., and Pataky, J. K. 1989. "Smut Gall Development in Adult Plants Inoculated with *Ustilago maydis* Cda." *Plant Dis.* 73: 921-5.