Review Article

MAUKA – A PROMISE FOR FIGHTING WITH THE UNBALANCED NUTRITION OF HIGH ANDEAN REGIONS

KLÁSKOVÁ T., FERNANDÉZ C.E.

Institute of Tropics and Subtropics, Czech University of Life Sciences, Prague, Czech Republic

Abstract

Cultivation of root and tuber crops has a very long tradition and history in the Andean region. However thanks to global warming, change of life style, deforestration, walk out of young people from villages, international seed business concerns as well as the tendency to uniformity, the genetic erosion is becoming increasing problem. An intensively endangered genus is a group of neglected root and tuber crops of the Andean region, which includes traditionally cultivated and processed crops adjusted to very specific climatic conditions of the Andean region. One of those plants is Mirabilis expansa.
In spite of rich nutritional value and other splendid properties, there is very limited use of mauka. In this moment there are two introductions of mauka to Europe – to the Czech Republic and Belgium. The aim is to find out if it is possible to cultivate mauka in the Central European climatic conditions. If so, mauka would be cultivated as a new kind of vegetable and would increase diversity of available vegetables on the European market. In addition mauka could be interesting even as a fodder because of its high conversion of feed nutrients. Currently there is very limited source of information concerning mauka, therefore there is need to continue in the research.

Key words: *Mirabilis expansa*, neglected crop, unbalanced diet, Andean region

INTRODUCTION

Andean region is one of the richest genetic resources in the world with a great collection of root and tuber crops. Unfortunately, in the general awarness mostly only wild and native potatoes appear. However, this group of root and tuber crops includes also other crops which are special because of their unique qualities and properties, nevertheless they are neglected and some of them endangered by extinction. One of those plants is also *Mirabilis expansa Ruíz & Pavón* belonging to Nyctaginaceae family.

Origin and distribution

Mirabilis expansa in Quechua language commonly known under the names of mauka, chago, miso, tazo is a plant with its origin in the Andes of the South America. It is widely distributed in the area of La Paz (Bolivia), to the North of Quito (Ecuador) and in Cajamarca (Peru), however, it was also found in Venezuela and Chile (Flores, 2003).

As the most suitable cultivation conditions are consider higher elevation between 2500 and 3500 m above sea level, with annual average temperature of 13°C (maximum 25°C, minimum 5°C) with apropriate amount of annual precipitation (680 mm) and intensive sunshine. The soil should be deep, humid, fertile and rich in organic matter (Flores, 2003).

Plant description

Mauka is a relatively low and compact herbaceus plant with a maximum height of 1 m. The above ground part of the plant is formed by basal shoots overgrown densely with many leaves. The plant can reach thanks to its wide branching shoots up to 180 cm in the diameter. The stems are cylindrical and are divided by nodes. Colour of the stem can oscilate from light green to green with reddish marks on it. The leaves have cordate or ovulate shape. They are up to 8 cm long and 3 cm wide with reddish or pale greenish nervures covered with tiny hair. The inflorescences are 3 to 6 cm long and are covered with hairs. Mauka flowers by many

Picture 1: Mirabilis expansa – white variety ("mauka blanca")

tiny white or purple flowers. The plant produces tens os of small dark brown seeds with a very good viability (Seminario, 2004).

Tab. 1: Chemical composition and nutritinal value of mauka's root in dry matter (100 g)

Component	Amount
Energy (Kcal/100 g)	427
Moisture (%)	61.94
Fibre (%)	4.83
Protein (%)	7.41
Ash Matter (%)	4.49
Starch (%)	67.71
Carbohydrates (%)	80.46
Calcium (%)	0.61
Phosphorus (%)	0.09
Magnesium (%)	0.09
Sodium (%)	0.03
Potassium (%)	1.27
Copper (ppm)	6
Iron (ppm)	50
Manganese (ppm)	7
Zinc (ppm)	62

Mauka is cultivated for leaves and underground organs – thickened roots which can reach the lenght of 50 cm with the width of 6 cm. The plant can create up to 10 big roots which often evoke the shape of man forearm (Seminario, 2004).

Mirabilis expansa is multiplicated by seeds, hypocotyls and stem cuttings (Pebe, 1989).

Varieties

Although this plant is quite widely distributed (in its wild form) there is lack of information available about the varieties. In general, two main varieties are distinguished – mauka blanca (the white mauka) and mauka roja (the red mauka) (Seminario, 2004).

The habitus of both plants is without any big differences, however, the varieties differ in colour. While mauka blanca has the aerial part in green colour, mauka roja has reddish to purplish spots over the leaves and stems. The different colour is also evident in roots. The mauka blanca has roots of whitish to creamy colour, while for the mauka roja are typical yellowish to light orange shades (Tapia, 1990).

It is believed that other variety, mauka silvestre has much more astrigent taste than the roots of domesticable kinds. Nevertheless even betweeen the cultivated demesticable kinds are big differencies concerning the pungency. It is believed that the Ecuatorian varieties are much sweeter than those from other localities (Seminario, 2000).

Nutritional properties

Mauka is a plant with rich nutritional properties. If compared with the other Andean root and tuber crops, it has the highest amount of calcium and phosphorus. This fact is especially important for poor highland peasants whose diet is very unbalanced with a significant lack of protein, phosphorus and calcium. On the contrary, mauka contains a tiny amount of sodium therefore it is a very suitable food for people on a low sodium diet (Montenegro, 1988).

The chemical composition of mauka can be seen in the Table 1.

Uses and the way of preparation

Mauka provides edible leaves as well as thickened roots. The leaves can be prepared in the same way as spinach or added into salads. The thickened roots harbour certain astringent constituents, which could injure mouth and tonguage, therefore it is necessary to cook the roots before consumption. Roots are prepared in both salty and sweet way. The freshly dig roots are boiled in salt or sweet water, and when ready peeled and served. The mauka root can also be used as a soup ingredient. The water from boiling sweet mauka dish is drunk as a substituent to fruit juice (Seminario, 2004).

The chemical analysis shows that mauka's leaves are very rich in protein (up to 17%), thanks to this fact there is an idea to use mauka leaves as a fodder for animals (sheeps, cavies, pigs). The preliminary evaluation demonstrates a great conversion, higher than that of other agricultural by-products (Montenegro, 1988).

Erosion prevention is another manner how to put on mauka. Due to its strong well developed root system it has a meaning meaningfull power to reinforce soil.

Cultivation

Mauka is loosing its importance and place in the Andean diet step by step. This process is continuing so far that nowdays is mauka believed to face intensive genetic erosion (Rea, 1968).

There are still less peasants cultivating mauka on their fields. There are probably more reasons for it. The main can be seen in the astringent taste, disappearing knowledge and awareness and an aversion to traditional crops which are often linked with the status of poverty.

Even those, who cultivate mauka on their fields, have no more then four plants. Mauka is usually consumed as the last option, if there is nothing better.

DISCUSSION AND CONCLUSIONS

Mirabilis expansa is a neglected, however very interesting plant with a high future potential. Unfortunately, in this moment there are not enough data concerning it and therefore a deep study and ethnobotanical search are needed. The options are to cultivate it for fodder and as a soil erosion fighter. Mauka could assert in low sodium as well as in the high montanous diet, where it could cover the absence of protein, calcium and phosphorus. There is also an effort to find out if mauka is a short or a long day crop and if there is a possibility to cultivate it in Europe.

In this moment there are simultaneously two introductions in process, to Belgium and to the Czech Republic. The results obtained from that experiments should clear up this question.

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Corresponding author:

Ing. Táňa Klásková
Institute of Tropics and Subtropics
Czech University of Life Sciences Prague
Kamycka 129, 165 21 Prague 6
Czech Republic
e-mail: tanya.klaskova@seznam.cz