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Mini Review

Underutilized Andean Crop Kañawa (*Chenopodium Pallidicaule Aellen*)

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Abstract

Small farmers worldwide are the custodians of agro-biodiversity belonging to both the plant and animal kingdoms. Grains and vegetables are the essentials needed to sustain our food systems. Goosefoots, i.e., *Chenopodium* species like kañawa (*Ch. pallidicaule*) and Quinoa (*Ch. quinoa*), are prominent examples of domestication by small farmers during ancient times that still exist. *Chenopodium* grains possess high nutritional profiles and are further characterized by being resilient climate crops. Kañawa tolerates salinity, drought and frost and its diversity allows farmers to cultivate the crop even above 4000m a.s.l. It is a staple food source as an ingredient in a balanced and low glycaemic index diet.

Introduction

Kañawa, also known as cañahua or cañihua (*Ch. pallidicaule Aellen*), is a close relative of quinoa (*Ch. quinoa Willd.*) originating in the Peruvian and Bolivian Andean Highlands or Puna. Bolivia and Peru conserve a large collection of cañahua accessions with 801 and 341 entries, respectively [1-3]. While the quinoa is cultivated widespread both commercially and experimentally, the kañawa is cultivated on a small-scale by farmers in both countries [4]. The grain is an achene fruit like that of the quinoa and small-sized and with a very low saponin content and a high nutritional value that surpasses that of the quinoa. Kañawa is a semi- domesticated crop, which is apparent by its grain-shattering trait (15-35%) that occurs between flowering and fruit maturity [5]. This mini-review presents the underutilized crop's potentialities as a nutraceutical Andean grain, resilient crop, and multi-use grain for urban and rural stakeholders.

Diversity and morpho-type plants related to use by small-scale farmers

Small-scale farmers conserve and use a great plant diversity of the kañawa involving both vegetative growth-forms and grain colors. Due to its flower size-considerably smaller than the quinoa flower-classical breeding by crossing is difficult and many cultivars derive from a selection. Andean farmers use their own landraces or native varieties, and three main growth habit forms of the kañawa are known (Figure 1); the '*Saihua* (*Chuqhu*)' with a prominent main stem and erect growth type (Figure 1a); the '*Lasta* (*Thasa*)' denoted with multiple-branched growth habit (Figure 1a) [6]. These two growth habit forms of kañawa are cultivated in Bolivia and Peru. Nevertheless, yet is possible to find the wild kañawa type, called '*mamakañawa*' or '*Illamanku*' (Figure 1b), in the spaces of the plots or plots where potato is cultivated or plots in fallowing [5,6].

Figure 1: Morphological variation in semi-domesticated and wild type kañawa, where,
a. denotes '*Lasta*' type (plans in yellow colour) and '*Saihua*' type (plants in red colour), and
b. 'Illamanku', Wild type.

Benefits as food, feed, industrial and nutritional

Compared to quinoa, the kañawa grain has a higher nutritional content, mainly in amino acids, phenolic compounds, unsaturated fatty acids, mineral composition and its enzymes that enable the use of the grains as an alternative source to combat malnourishment [7,8]. Farmers toast the grain in clay-pots, and then they are ground to a flour with flat stones. The flour has an aroma very similar to vanilla, and this flour is known as '*kañiwaco*' in Peru and '*pito de kañawa*' in Bolivia. Kañawa grains contain vanillic acid; thus, this sweet flavour is attractive for making soft drinks while at the same time being a nutritive beverage. As seen in Table 1, the high amount of vitamin B and iron in the kañawa grains makes it recommendable to include and use the kañawa in complementary School Food programs to combat anaemia in pupils [9-11].

Table 1: Nutritional and chemical composition of kañahua and other grains.

	Chemical Composition (g/ 100 g) a					Mineral Content (mg /100 g) b			Vitamin Content (mg /100g grain) b		
Specie/Crop	Protein	Total Crude Fat	Total Crude Fibre	Ash	CARB	Ca	P	Fe	B1	B2	B3
Kañahua	16.7	6.8	5.4	3.7	56.4	126	461	18.8	0.78	0.55	1.34
Quinoa	14.5	5.2	14.2	2.7	64.2	56.5	468.9	14.0	0.4	0.2	n.d.
Amaranth	15.5	7.6	4.7	3.4	68.8	236	453	7.5	0.3	0.01	0.4
Wheat whole raw	12.0	2.2	12.2	1.6	59.1	36	224	4.6	0.52	0.09	7.8
Rice white raw	7.0	0.6	3.6	0.8	75.9	14	168	1.9	0.12	0.03	3.3

Bold characters highlight the nutritional and chemical content of grains of kañawa. CARB; Carbohydrates; a) [15-18] ; b) [17, 19-20]

Besides, the shell (pericarp) of the grains following post-harvest processing and cleaning can be offered to minor livestock as guinea pigs, locally known as cuyes, and chicken which will improve the meat quality and, also, serve to valorize the kañawa [4,12]. Starch quality studies have suggested using the kañawa seeds manufacturing biodegradable biofilms [13,14]. The diversity of kañawa could be developed into a sustainable pool of materials for sustainable, eco-friendly products [15-20].

Conclusion

Soil salinity is expanding, and it affects many parts of the world's agro-ecological regions. The kañawa cultivated by small-scale farmers in the high-altiplano regions showed tolerance to frost and drought, and it is a main source of proteins. Ethno-varieties need to be studied for their uses, e.g., the grains have a very low saponin content and make them easy to process by toasting and flour production.

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