The EuroBiotech Journal
RESEARCH ARTICLE
Plant Biotechnology

Studies and research regarding acclimatization and breeding of new vegetable plant, *Momordica charantia* at V.R.D.S. Buzău, România

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Abstract

Between 1996-2015, at V.R.D.S Buzau were conducted researches regarding the acclimatization, breeding and elaboration of crop technology for a new vegetable species, *Momordica charantia* (bitter cucumber). There were purchased and studied a large number of genotypes which were assessed for a long period; 4 of those have demonstrated increased adaptability, for which they were retained and multiplied in lineage. In time, by specific cucurbits improvement techniques were obtained 4 genetically stabilized accessions noted as G1, early accessions with large fruits,G2, medium fruit size, G3, medium fruit size and L4 with small crunchy fruits, semi tardy. Of these, L3 was homologated and patented under the name of Rodeo, and the other 3 will be proposed for homologation in the future. The studies demonstrated that this species has well adapted to our pedoclimatic conditions; it can be cultivated both in greenhouses and in open fields, in warmer areas, mentioning that for both crop variants it is recommended a drilling system. The new genotypes support various technological variants and can be ecologically cultivated with remarkable results.

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Published online: 27 January 2017

doi:10.24190/ISSN2564-615X/2017/01.13

Introduction

The vegetable species that we cultivate are coming from a specific geographical area, very few originating from or nearby our country. There are few cultivated species that can fit in endemic populations or endemic species. Along the history, there were introduced new crop species and populations. Neither their authors, nor the exact period of time when they were introduced are known. After the 90's, when circulation outside the borders country was easier, Breeding and Genetics Laboratory resumed the breeding and crop introduction of new suitable horticultural species as *Momordica charantia*, the species that is the subject of this paperwork.

Momordica fruit contains a complete range of chemicals: proteins and lecithin polypeptides; carotenoids; chlorogenic acid and resorcinol; fitosterolide type: beta-sitosterol and stigmasterol; glicosteroids: charantin and momordine; momordicine; B vitamins, including vitamin B3; minerals (calcium, magnesium and potassium) and trace elements (iron, zinc, silicon, nickel) (2, 3, 8).

This plant has been used since ancient times in herbal medicine, particularly as a natural alternative to blood sugar control (4, 5, 7).

Materials and Methods

In 1996 the researches started at V.R.D.S Buzau, following a thematic plan, structured on 4 working stages: documentation and purchasing of valuable genetic material from safe sources from origin areas, acclimated species, breeding of the genotypes which have demonstrated their capacity of adaptability, the crop tehnology elaborationfor the new aclimated species. The researches at this species have begun by purchasing valuable biological material from several regions of the world.

The main germplasm sources purchased by VRDS Buzau were from China, Nepal, Tibet, Mexico, France, stating that it could not procure all of the genotypes of this species inventoried around the world. Retained genotypes were studied for a long time into three crop systems: greenhouse, solarium and field (6).

The breeding methods were those specific to cucurbits, especially those for *Cucumis sativus*.

Results and Discussion

Research undertaken during 1996-2015 were finalized with positive results. From the large number of assessed genotypes, after the evaluation, 4 of these have proven a great adaptability, and were genetically stabilized after breeding. The obtained accessions are: G1, G2, G3 and G4, presenting distinct characteristics, especially in terms of fruit features.

Momordica charantia is an annual plant, herbaceous, with a slightly aspect of vine, that vegetates and fructifies well in our climatic conditions, especially in greenhouses.

The root is similar to that of the common cucumber, a little more branched with special requirements to aeration. The stem is creeping or climbing, fistulous, becoming vigorous and partly lignified as the plant matures. The stem has a length of over 3 m, if space permits, in a protected environment and in the field up to 1.8 - 2 m.

The leaves are smaller than the common cucumber, trilobated or pentalobated, slightly serrated and covered with fine glandular hairs. The leaf is smooth, when touched, it eliberates a strong pungent smell like the danewort (*Sambucus ebulus*). This plant's gasy secretion ensures it's natural phytosanitary protection.

The flowers are generally resembled with those of the common cucumber, but much more delicate, smaller, with thiner petals and slightly embossed (1).

Flowers (**Fig. 1**) are unisexual monoecious, 1-2 at the leaves base, have pale yellow gamopetale corolla and funnel shaped.

Generally, the plant has a dominant number of male flowers, over 70%. This flowers don't fructify, their primary role is to ensure the pollination of the female flowers that represent 30% of the total flowers per plant.

The plant iscross pollinatedby insects that are very much attracted by the fragrance of flowers.

The fruit is melon type, elyptical shaped, slightly curved in the middle with both ends slightly sharp. The color of immature fruit is green until physiological maturity, and whitish to the tip. At physiological maturity, the fruit is yellow - orange. The fruit changes color from green to yellow - orange in a short time of 3-4 days.

The investigations undertaken have shown that when the fruit reaches physiological maturity behave differently from one genotype to another: G1, which has the longest and fleshy fruits, with a minor split, when the fruits of G2, instead of splitting they turn their colour to yellow-orange and get soften at the end and dry out, G3 splits in 3 parts opening themselves from top to bottom. After the fruit is completely open, it has

Figure 1. Flowers (Male and female).

Figure 2. Unriped and riped fruit.

the shape of a lily, spreading the seeds around the plant. The G4 fruit splits on one side but rarely spreads seeds on the ground. Before changing its colour in yellow, the unriped fruit is very bitter, and after it has changed to yellow-orange it looses it's bitterness becoming slightly flavorless and even a little bit sweet. Regarding the fructification, refering to the climatic conditions of our country, this plant can be classified as a tardy plant, especially when it is cultivated in open field, where fructifies in autumn, after august 15. Fruit ripening is different from one fruit to another, a trait that is also another element of distinctivity. Regarding the earliness, on the first place are G1 and G2, followed by the G3; G4 is the latest whose fruits are maturing in 15 days after G3.The main propagation mean at this species is by seeds, and when they are evacuated naturally from the fruit are covered with an aryl, a red-burgundy gelatinous tissue. (**Fig. 2**)

The main features of the seeds: the average weight of a single seed, after it is 0, 25 g. The average number of germinable seeds is of 20 – 25 pcs., but they can reach even 40 pcs.; total weight of the seeds/fruit is 5,5 g; MTG (mass of a 1000 grains) = 250 g. Well conditionedseeds that are kept in optimal conditions retain their germination up to 5 – 6 years, and in some cases even more (**Table 1**).

This plant has been used since ancient times in herbal medicine, particularly as a natural alternative to blood sugar control. One of the active principles responsible for this action is charantina. Numerous studies have demonstrated that hypoglycemic effect is more pronounced in the case of bitter cucumber fruit, much richer in these substances than other parts of the

Table 1. The main features of the 4 obtained genotypes

G	Fruit weight (g)	Fruit length (cm)	Ridges no./fruit	Pulp thickness (cm)	Seed no.	Aryl-seed weight(g)
1	447	40	8	1,2	27	30,3
2	245	25	10	1,1	22	19,1
3 (Rodeo)	210	22	8	1,0	34-36	30,1
4	45-53	7,5	8	0,8-0,9	7-8	5

plant. These substances that lower blood sugar include a mixture of steroidal saponins insulin-like: charantin and alkaloids. Seedling production is in protected spaces (greenhouses, tunnels, seedbeds) with or without heating technology but it must provide the optimal temperature of 18-22 ° C to ensure germination. The optimal seedlings must have 55-60 days.

The crop establishment depends on numerous factors like: machine used, irrigation system and chosen variety. The planting distance between plants / nrow is 40-50 cm at smaller vigor lines, L1 and L2 and 70-80 cm at lines with greater vigor, Rodeo and L4 and between rows can vary from 2 to 3 m. In the field, planting distances between plants in the rows varies between 40-50 cm and 1.2-1.4 m between rows. The maintenance operations of culture are similar with the common cucumbers.

Harvesting takes place in stages and depends on the variety. Earliest accessions G1 and G2 can be harvested starting on 1 July in protected areas and starting from July 15, accessions slightly tardy, Rodeo and L4. In the field, harvesting is shifted by about 15-30 days, depending on variety.Fighting against diseases and pests is a insignificant technological component for this plant because until now, in the climatic conditions of our country was not identified any disease and pest to bring any significant damage or to attack plant production. It is also the strong point of this species: rusticity and particularly valuable genetic heritage employing this plant among ecological plants, which do not apply chemical treatments to combat diseases and pests.

Conclusions

Researches finalized with the acclimatization and breeding of the species and now can be cultivated throughout our country, in protected areas and fields, in a drilling system. L3 was homologated and patented under the name of Rodeo, and introduced in crop by disseminating seeds and seedlings across the country.

Specific crop technology was developed for both protected areas and for field. Romanian vegetable patrimony was enriched with varieties that belong to a species with multiple uses: food, medicinal and ornamental.

Conflict of interest statement

The authors declare no conflict of interest.

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