

## **MOMORDICA CHARANTIA L. – NEW ACLIMATIZED PLANT IN ROMANIA. BOTANICAL CHARACTERS (REVIEW 1)**

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**Abstract:** It has been performed an ample documentation about *Momordica charantia* L., a plant for the future, for food, nutrition and health security, respectively a plant with extended benefits in domains as: botanics, horticulture, phytochemistry, medicine, therapy health security a. o. This is the first published review on *M. charantia* in Romania in the frame of the project PN-II-PT-PCCA-2013-4-0995-160/2014 “Multifunctional and innovative products for safe and bioenhanced functional food from newly cultivated plants in Romania” developed at ICECHIM (INCDCP) Bucharest [ȘESAN, 2017; ȘESAN & al. 2018]. The present review contains the following aspects: introduction, botanical description, synonyms, common names, taxonomy, nomenclature, origin, distribution, biological actions. This review will be continued in next contributions about the same promising plant.

**Key words:** *Momordica charantia*, taxonomy, nomenclature, origin, distribution, biological actions.

### **Introduction**

*Momordica charantia* L. is a medicinal and nutraceutical plant belonging to Cucurbitaceae family, widely grown in India, Asia, South America, Caribbes, South Africa, used as food and in the traditional medicine (GROVER & YADAV, 2004; BELOIN & al. 2005; BEHERA & al. 2010; KUMAR & al. 2010; KUMAR & BHOWMIK, 2010; GUPTA & al. 2011; MAHMOUD & al. 2012, 2017; AGARWAL, 2014; NAGARANI & al. 2014a, b; ANILAKUMAR & al. 2015; UPADHYAY & al. 2015; TCHEGHEBE & al. 2016; DE OLIVEIRA & al. 2018; RAHMAN & al. 2018 a.o.), mentioned in different databases.

### **Botanical description**

The most recent botanical description of *Momordica charantia* belongs to ASNA & al. (2020) in the most recent book of KOLE & al. (2020), published in Springer Verlag Nature Switzerland.

**Classification.** *Momordica charantia* belongs to the: Domain *Eukaryota*, Kingdom *Plantae*, Class *Dicotyledonae*, Order *Cucurbitales*, *Cucurbitaceae* Family, *Momordica* genus, *M. charantia* L. species.

**Synonyms** known for *M. charantia* are: *M. chinensis* Spreng., *M. elegans* Salisb., *M. indica* L., *M. operculata* L., *M. sinensis* Spreng., *Sicyos fauriei* H. Lév. ([https://uses.plantnet-project.otg/en/Momordica\\_charantia\\_\(PROSEA\)](https://uses.plantnet-project.otg/en/Momordica_charantia_(PROSEA))).

**Common Names:** Bitter melon, Balsam pear, Bitter cucumber, Bitter pear, Karalla, Balsam apple, Cerasee, Carillacundeamor, Papaila, Melao de saocetano, Bitter gourd,

Sorosi, Karela, Kurela, Kor-kuey, Pava-aki, Salsamino, Sorossies, Pare, Peria, Karla, Margose, Goo-fah, Mara chean [RAHMAN & al. 2018].

After Pl@ntNet ([http://publish.plantnet-project.org/project/riceweeds\\_en](http://publish.plantnet-project.org/project/riceweeds_en)) and *Invasive Species Compendium* (ISC) (<https://www.cabi.org/isc/>), *Momordica charantia* L., is “a tropical and subtropical species belonging to the family Cucurbitaceae, widely grown for its edible fruit, which is among the most bitter of all fruits” (ISC). *M. charantia* is “an annual to perennial climbing, scandent or prostrate broadleaf herb growing up to 5 meters high; there is a central taproot, from the apex of which the stems spread to climb over any available support”. **Stem** is herbaceous, tendrill-bearing vine, being either hairless of slightly hairy. Green stems are well branched, slender, usually slightly 5-angled or ridged, and carry unbranched tendrils in the leaf axis (PLATE I). **Leaves** are up to 2-3 cm (ISC) up to 5 cm long (Pl@ntNet), with spiral tendrils at opposite sides; petioles 4-5 cm long, pubescent. The leaves are carried singly along the stems, and each leaf is 4-10(12) cm long, rounded in outline, and deeply (3)5-(7)9-lobed; the foliage has an unpleasant smell when crushed. **Flower** (PLATE II). Monoecious pale to deep yellow flowers with bract part way on peduncle, solitary in the upper leaf axils on 2-10 cm long stalks with a small leaf-like bract towards the base. Male flowers larger than female flowers and have a slender basal swelling which is continuous with the base of sepal tube, which ends in five blunt sepals. There are five oval yellow petals 10-20 cm long, and five central stamens. Female flowers are similar to the male flowers but have a distinct warty swelling well below the base of the sepal tube and three stigmas. Male flowers appear first and usually exceed the number of female flowers by about 20:1. The flower opens at sunrise and remains open for one day. **Fruit** (PLATE II). The pendulous cylindrical fruits are egg-shaped and 2-10 cm long (up to 20 cm in cultivated varieties), and covered with longitudinal ridges and warts. At maturity, they turn orange to yellow, and the tips split into three and turn back to reveal the yellow pulp and the bright red arils that enclose the seeds which adhere to the inside of the fruit. Each of the flattened woody seeds is 5-9 mm long, and has finely pitted surfaces. The **seedlings** show epigeal germination, and resemble cucumber seedlings. The thick, brittle hypocotyls are 2-3 cm long and the first leaves shortly stalked, rounded, bluntly lobed and finely toothed.

### **Taxonomy and nomenclature**

After SCHAEFER & RENNER (2010), genus *Momordica* comprises 47 species distributed in the warm tropics, chiefly in Africa, and with ~12 species in S-E Asia and Australia. All have unisexual flowers; from African species, 24 are dioecious, 23 monoecious, while all Asian species are dioecious.

Phylogenetic relationships in the order Cucurbitales and a new classification of the gourd family (Cucurbitaceae) has been presented by SCHAEFER & RENNER (2011a,b), as follows: Tribe 8. **Momordiceae** H. Schaefer & S.S. Renner, **stat. nov.**, based on a diagnosis in Latin associated with Momordicinae M. Roem., Fam. Nat. Syn. Monogr. 2: 6. 1846 (‘Momordiceae’) – Typus: *Momordica* L. (Sp. Pl.: 1009. 1753). Thecae arcuate, duplicate or triplicate. Pollen large, 3-colporate, reticulate. Fruit small to large, fusiform or ovoid-ellipsoid or globose, usually spiny, tuberculate, winged or ridged, indehiscent or dehiscent by 3 valves or irregularly. Seeds few to several, yellow, brown or black, often with white, yellow or red arilli, medium-sized to large, subglobose to compressed; testa smooth or variously sculptured, margin often grooved.  $n=11$  or  $14$  [BEEVY & KURIACHAN, 1996].

**Genera and species:** 60 species in 1 genus. – *Momordica* [60 spp., in tropical rainforest, deciduous forest and bushland, savannah and semi-deserts of tropical and subtropical Africa, Arabia, (sub)tropical Asia, Malaysia and Northeastern Australia; two species (*M. charantia*, *M. balsamina*), naturalized in Americas and Pacific islands]”.

Maximum likelihood analyses performed by SCHAEFER & RENNER (2010) of 6257 aligned nucleotides of plastid, mitochondrial and nuclear DNA obtained for 122 accessions of *Momordica* and seven outgroups show that *Momordica* is monophyletic and consists of 11 well-supported clades. After the same authors, monoecy evolved from dioecy seven times independently, always in Africa and mostly in savanna species with low population densities. Leaky dioecy, with occasional fruit-producing males, occurs in two African species and might be the first step in an evolutionary transition towards monoecy.

Dated biogeographic analyses suggest that *Momordica* originated in tropical Africa and the Asian species are the result of one long-distance dispersal event about 19 million years ago. The pantropical vegetable *M. charantia* is of African, not Asian origin as had previously been suggested [SCHAEFER & RENNER, 2010].

The Asiatic species of *Momordica* falls under three sects. Dioecious species like *M. cochinchinensis*, *M. dioica*, *M. sahyadrica*, *M. denticulata*, *M. denudata*, *M. clarkeana* and *M. subangulata* grouped under the sect. *Cochinchinensis*, and monoecious species *M. charantia* and *M. balsamina* under the sect. *Momordica* and *M. cymbalaria* under the sect. *Raphanocarpus* [SCHAEFER & RENNER, 2010; BEHERA & al. 2011]. The monoecious species *M. charantia* and *M. balsamina* produce edible fruits, and have been widely distributed as crops becoming naturalized throughout the tropics.

Cytotaxonomical, – genetic and – molecular analysis on *Momordica* spp. have been performed by: TRIVEDI & ROY (1973), BEEVY & KURICHAN (1996), LOMBELLO & FERREIRA PINTO-MAGLIO (2007), BHARATHI & al. (2011), KAUSAR & al. (2014) a.o. Karyo-taxonomical, – genetic and – geographical studies of Cucurbitaceae are mentioned since '70 years [AYYANGAR, 1976]. The results of these studies are presented in the table 1. Recently, a high-density, high-resolution genetic map was constructed for *M. charantia* by RAO & al. (2018), using Genotyping-by-Sequencing (GBS) Technology.

**Table 1.** Status of chromosome number and sequences in *Momordica* spp. [BHARATHI & al. 2011; RICE & al. 2015, The Chromosome Counts Database (CCDB)].

S.No.	Species	Chromosome number & References
1.	<i>Momordica balsamina</i> L.	$n = 11$ [JHA & TRIVEDI, 1989]; $2n = 22$ [ROY & al. 1966]
2.	<i>M. charantia</i> L.	$n = 11$ [SHIBATA, 1962]; $2n = 22$ [ROY & al. 1966]
3.	<i>M. cochinchinensis</i> (Lour.) Spreng.	$2n = 28$ [JHA & al. 1989]
4.	<i>M. cymbalaria</i> Fenzl ex Naudin	$n = 8$ [MEHETRE & THOMBRE, 1980]; $n = 11$ [BEEVY & KURIACHAN, 1996]; $2n = 16, 22$ [BHARATHI & al. 2011]; $2n = 18$ [CCDB]
5.	<i>M. denudata</i> (Thwaites) C. B. Clarke	$n = 14$ [BEEVY & KURIACHAN, 1996] $n = 14$ [BEEVY & KURIACHAN, 1996]
6.	<i>M. dioica</i> Roxb. ex Willd.	$2n = 28$ [ROY & al. 1966]; $2n = 42$ [TRIVEDI, 1978]; $2n = 56$ [ROY & al. 1966]
7.	<i>M. sahyadrica</i> Kattuk. & V. T. Antony	$2n = 28$
8.	<i>M. subangulata</i> Blume	$2n = 56$
9.	<i>M. tuberosa</i> Dennst. ex Miq. (syn. of <i>M. dioica</i> Roxb. ex Willd.)	$n = 11$ [AYYANGAR & SAMPATH-KUMAR, 1978]; $2n = 22$ [AYYANGAR, 1976]

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Referring to *Momordica* genus, RENNER and PANDEY (2013) presented also the status of sequences after SCHAEFER & RENNER, 2010, as follows (Table 2).

**Table 2.** Status of sequences in *Momordica* spp. [SCHAEFER & RENNER, 2010].

S.No.	Species	Sequences
1.	<i>Momordica balsamina</i> L.	HM367595, GQ163349
2.	<i>M. charantia</i> L.	DQ501269, HE585488 [SCHAEFER & RENNER, 2010; LIAO & al. 2012]
3.	<i>M. cochinchinensis</i> (Lour.) Spreng.	GQ163379, GQ163256
4.	<i>M. cymbalaria</i> Fenzl ex Naudin	An ITS sequence from an Indian specimen, Karuppusamy 28631 from Andhra PRADESH (ALI & al. 2009, GQ183046) is available and it is identical to sequences from Africa [SCHAEFER & RENNER, 2010]
5.	<i>M. denudata</i> (Thwaites) C.B. Clarke	SCHAEFER & RENNER (2010) generated sequences from THWAITES 28 (K), collected from Sri Lanka, GQ163385, GQ163262
6.	<i>M. dioica</i> Roxb. ex Willd.	GQ163389, GQ163387
7.	<i>M. sahyadrica</i> Kattuk. & V. T. Antony	No published sequences available [RENNEN & PANDEY, 2013]
8.	<i>M. subangulata</i> Blume	GQ163451, GQ163332

**Origin and distribution of *Momordica charantia***

**Origin.** *M. charantia* is native to the Old World tropics. It is possibly domesticated in India and southern China. It is now found naturalized in almost all tropical and subtropical regions, being now pantropical. It is an important market vegetable in southern and eastern Asian and wild and cultivated populations can be found in India, Sri Lanka, Vietnam, Thailand and Malaysia, S. China and tropical Africa [PROTA, 2014]. It is believed that *M. charantia* was introduced into America from West Africa with the slave trade. In the West Indies, *M. charantia* was first recorded in Puerto Rico in 1885 (US National Herbarium). By the end of XIX<sup>th</sup> century, local cultivars originally from Asia were recorded on small scale cultivations in tropical America and the South United States (PROTA, 2014. PROTA4U web database. GRUBBEN G. J. H. & DENTON A. O. (Eds.), Wageningen, Netherlands: Plant Resources of Tropical Africa; <http://www.prota4u.org/search.asp>).

**Distribution.** *M. charantia* is widely distributed throughout tropical and subtropical regions on all continents. It appears to be native to the African and Australian continents, but its actual origin has been obscured by its spread as a food crop. Currently it can be found cultivated and naturalized in North, Central and South America, the West Indies and on several islands in the Pacific Ocean (after ISC). The original place of domestication of *M. charantia* is unknown or unclear. The putative areas for domestication of *M. charantia* proposed by various workers include southern China, eastern India or eastern Asia [WALTERS & DECKER-WALTERS, 1988]. In the synthetic distribution table and map (<https-www.cabi.org-isc-distribution-map>) from *Invasive Species Compendium (ISC)*, at 10. January 2020 (including the updated data presented in 2014 by J. ROJAS-SANDOVAL and P. ACEVEDO-RODRÍGUEZ, from Botany-Smithsonian NMNH Department, Washington DC, USA), there are presented the situation in Africa, Asia, North America, South America and Oceania.

### ***Momordica charantia* L. in Romania**

*M. charantia* was known in 1990's years, when some seeds have been provided from Nepal by prof. dr. biologist Ovidiu BOJOR, mentioned by dr. STOIAN(OV) in *Sănătatea plantelor*, 2002, **48**(5): 9. Since 1990 up to the present, *M. charantia* plants was continually cultivated under opened-greenhouses at Romanian S. C. HOFIGAL EXPORT IMPORT S.A., which is manufacturing natural (bio)products from many pharma- and nutraceutical plants, among them *M. charantia*. In parallel with their specific cultivation of *M. charantia*, they are performed researchs in national projects like PN-II-PT-PCCA-2013-4-0995-160/2014 "Multifunctional and innovative products for safe and bioenhanced functional food from newly cultivated plants in Romania" developed at ICECHIM (INCDCP) Bucharest [ȘESAN, 2017; ȘESAN & al. 2018]. After the official published data from the Research-Development Station of Vegetables Buzău, under the egide of Academy of Agricultural Sciences and Forestry (AASF), the beginning of the bitter gourd crop started in the year 1992, when it have been brought some seeds from Tibet and Nepal, and has been started a crop which produced along the time 5 cultivars, among them Rodeo cv. (patent omologated by dr. engr. C. Vânătoru). Production was in greenhouse 60 t/ha and in the field 25 t/ha. At present *M. charantia* is evaluated as the most profitable crop in Romania. It was published a CD dedicated to the crop technology of bitter gourd under the condition of South Romania, at Buzău R-D Station for Vegetables (details in CĂPĂȚÎNĂ G. *Cultura castravetelui antidiabet*, CD, RENTROP & STRATON). Another project "High valorization of *Momordica charantia* L. (bitter gourd) for obtaining food functional ingredients with hypoglycemic effect" was developed by ONISEI (2016-2017) in the frame of Bioresources Research Institute of AASF. After 2000, it is important to mention some PhD thesis performed at the University of Agronomical Sciences and Veterinary Medicine Bucharest, having as research purpose the species *M. charantia* in order to establish its biomorphological features [STOIAN(OV), 2001], biotechnologies for obtaining some bioproducts based on medicinal plants (*M. charantia*) and fruits or approaches on leaf and stem anatomy of *M. charantia* [SĂVULESCU & HOZA, 2010]. After 2006, there were initiated approaches on *M. charantia* in the Western part of Romania, mainly at the University "Aurel Vlaicu" Arad [CRIȘAN & HĂLMĂJAN, 2007] and at University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca [KESERÛ & al. 2018].

### **Main biological activities of *Momordica charantia***

*Momordica charantia* L. has multiple benefic actions medicinal and nutraceutical, among them: (i) anti-inflammatory; (ii) anticancer/antimutagenic/antitumoral; (iii) anxiolytic, antistress, immuno-modulatory effects; (iv) antioxidant; (v) antimicrobial, antibacterial, antifungal, antiviral / anti-HIV; (vi) antiparasitic, antimalaria; (vii) beneficial for skin, antipsoriasis, anti-wound healing; (viii) anti-cardiovascular diseases, hypotensive, blood detoxifying; (ix) hepatoprotective; (x) protective for eyes diseases, cataracta a.o.; (xi) analgesic, antipyretic / febrifug; (xii) effects on reproductive activity, abortifacient and, especially, (xiii) antidiabetic, anti-obesity, hypoglycemic effects; (xiv) fungicide effect against phytopathogens; (xv) insecticide/ larvicidal/ pupaecidal effect against plant pests and others. A scheme of biological actions of *Momordica charantia* are presented in Figure 2.

Conclusions

*M. charantia* crop has started in Romania in years '90, when some seeds of the plant have brought from Nepal, Tibet, have been sown and acclimatized for their benefits, especially in horticulture, medicine, therapy health security a.o.

It has been accomplished a synthetic documentary study consisting in: botanical characteristics, plant description, taxonomy, nomenclature, plant origin and distribution, main benefic actions of *M. charantia* a.o.

Specific aspects of the *M. charantia* plant/crop (Plate I-II) are provided from opened-greenhouses of S.C. HOFIGAL EXPORT IMPORT S.A., which developed research activities in the national project PN-II-PT-PCCA-2013-4-0995-160/2014 “Multifunctional and innovative products for safe and bioenhanced functional food from newly cultivated plants in Romania” (2013-2017). *M. charantia* plants were deposited as Vauchers BUC Nr. 408946-408950 at the Botanical Garden of the Bucharest University-Romania.

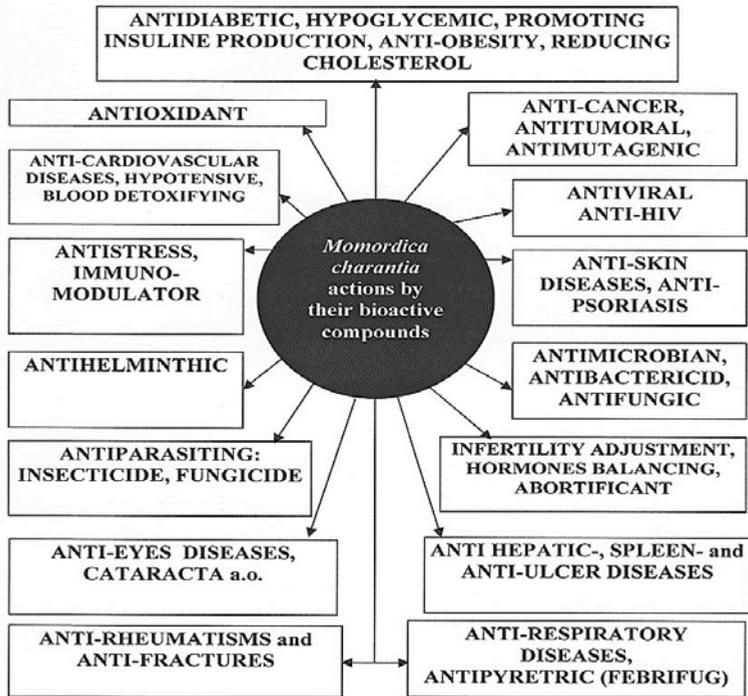
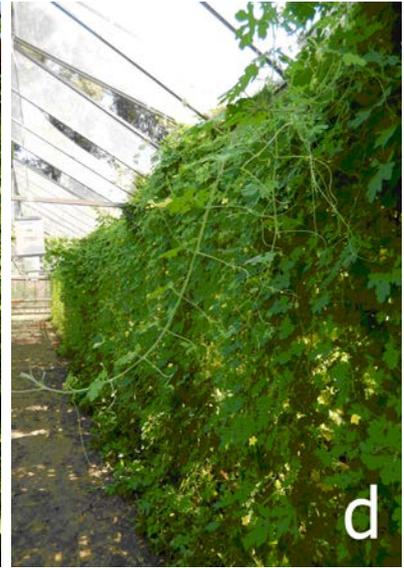


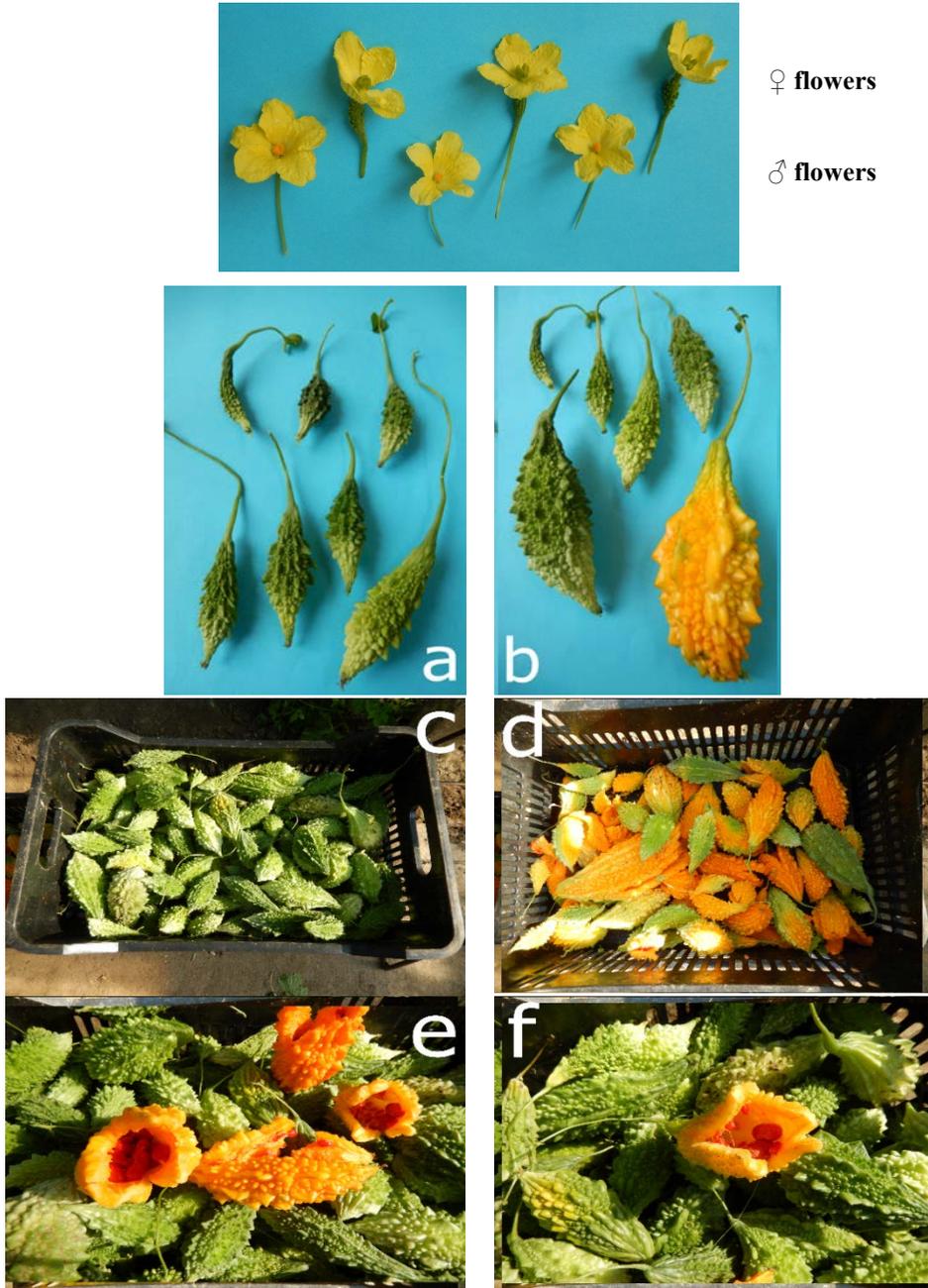
Figure 2. Main medicinal importance of *Momordica charantia*.

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*Momordica charantia* characters in the crop at S.C. HOFIGAL EXPORT IMPORT S.A. (Vauchers BUC 408946-408950) under the opened greenhouse: **a.** crop after planting at 08.06.2016 and **b.** later at 05.07.2016; **c.** experimental plot at the finishing of experiment (06.09.2016); **d.** liane plants developed on the trellis; **e, f.** crop of bitter melon in flower with coiling stems, tendrils, and palmate-divided leaves (photos: A. F. Popescu: **a.** 08.06.2016; **b.** 05.07.2016 and T. E. Şesan: **c.** 06.09.2016; **d.** 25.07.2016; **e.** and **f.** 06.09.2016).



Female flowers (up) and masculine flowers (down) in the first line of the plate; Fruits of *Momordica charantia* at different ages (a-d) and seeds (e-f) (photos: T. E. Şesan, 06.10.2016).

## References

- AGARWAL M. 2014. *Momordica charantia* L.: a potent medicinal plant. LAP LAMBERT Academic Publishing, OmniScriptum GmbH & Co. KG, Germany; ISBN 978-3-659-56191-7, 75 pp.
- ALIM A., PANDEY A. K. & LEE J. 2009. Taxonomic relationships among the genera of subfamily Cucurbitaceae (family Cucurbitaceae) from India inferred from ITS sequences of nuclear ribosomal DNA. *Phytomorphology*. **59**(3-4): 127-140.
- ANILAKUMAR K., KUMAR G. & ILAIYARAJA N. 2015. Nutritional, pharmacological and medicinal properties of *Momordica charantia*. *International Journal of Nutrition and Food Science*. **4**(1): 75-83. <https://doi.org/10.11648/j.ijnfs.20150401.21>
- ASNA A. C., JOSEPH J. & JOSEPH JOHN K. 2020. Chap. 3. *Botanical description of bitter gourd*, pp. 7-31. In: KOLE C., MATSUMURA H. & BEHERA T. K. 2020. *Compendium of plant genomes*, 135 pp.; ISBN 978-3-030-15061-7.
- AYYANGAR K. R. 1976. Karyotaxonomy, karyogenetics and karyogeography of Cucurbitaceae. In: NAIR P. K. K. 1976. *Aspects of Plant Sciences. Today and Tomorrow's & Publishers*, N. Delhi: 85-116.
- AYYANGAR K. R. & SAMPATHKUMAR R. 1978. On the chiasma specificity in the genus *Momordica*. *Proceedings of the Indian Science Congress Association*. **65**: 107.
- BEEVY S. S. & KURIACHAN P. 1996. Chromosome numbers of south Indian Cucurbitaceae and a note on the cytological evolution in the family. *Journal of Cytology and Genetics*. **31**(1): 65-71.
- BEHERA T. K., BEHERA L. K., BHARATHI L. K., JOHN K. J., SIMON P. W. & STAUB J. E. 2010. Bitter Gourd: Botany, Horticulture, Breeding. *Horticultural Reviews* (ed. JANICK J.). **37**: 101-141.
- BEHERA T. K., JOSEPH J. K., BHARATHI L. K. & KARRUPAIYAN R. 2011. *Momordica*, Netherlands, Springer: 217-246. In: KOLE C. (Ed.) *Wild Crop Relatives: Genomic and Breeding Resources*, 297 pp.
- BELOIN N., GBEASSOR M., AKPAGANA K., HUDSON J., DE SOUSSA K., KOUMAGLO K. & ARNASON T. 2005. Ethnomedicinal uses of *Momordica charantia* (Cucurbitaceae) in Togo and relation to its phytochemistry and biological activity. *Journal of Ethnopharmacology*. **96**(1-2): 49-55.
- BHARATHI L. M., MUNSHI A. D., VINOD, CHANDRASHEKARAN S., BEHERA T. K., DAS A. B., JOSEPH J. & VISHALNATH. 2011. Cytotaxonomical analysis of *Momordica* L. (Cucurbitaceae). *Journal of Genetics*. **90**: 21-30.
- CĂPĂȚÎNĂ G. *Cultura castravetelui antidiabet*. CD, RENTROP & STRATON, ISBN: 978-606-47-0219-7.
- CRÎȘAN S. & HĂLMĂGEAN L. 2007. Technological solutions with impact on the yield of *Momordica charantia* L. fruits (Cucurbitaceae) in Arad agro-ecological area. *Bulletin USAMV-CN*. **64**: 6 pp.
- DE OLIVEIRA M. S., DA COSTA W. A., BEZERRA W. F., ARAÚJO M. E., FERREIRA G. C. & DE CARVALHO JUNIOR R. N. 2018. Phytochemical profile and biological activities of *Momordica charantia* L. (Cucurbitaceae): A Review, *African Journal of Biotechnology*. **17**(26): 829-846.
- GROVER J. K. & YADAV S. P. 2004. Pharmacological actions and potential uses of *Momordica charantia*: A review. *Journal of Ethnopharmacology*. **93**(1): 123-132.
- GUPTA M., SHARMA S., GAUTA M. A. K. & BHADOURIA R. 2011. *Momordica charantia* Linn. (Karela): Nature's silent healer. *International Journal of Pharmaceutical Sciences Review and Research*. **11**(1): 32-37, article-007.
- JHA U. C. & TRIVEDI S. K. 1989. Meiotic analysis in three species of *Momordica* (Cucurbitaceae). *Proceedings of the Indian Science Congress Association*. **76**: 185.
- JHA U. C., DUTT B. & ROY R. P. 1989. Mitotic studies in *Momordica cochinchinensis* (Lour.), a new report. *Cell and Chromosome Research*. **12**: 55-56.
- KAUSAR N., YOUSUF Z., YUONAS A., AHMED H. S., RASHEED M., ARIF A. & REHMAN H. A. 2014. Karyological analysis of bitter gourd (*Momordica charantia* L., Cucurbitaceae) from Southeast Asian countries. *Plant Genetic Resources: Characterization and Utilization* (2014) not known(not known); 1-3.
- KESERÜ A., BUTA E., BORSAI O., NEGRUȘIER C. & MĂNUȚIU D. 2016. The influence of cultivation method on crop production of bitter gourd (*Momordica charantia* L.). *Bulletin UASVM Horticulture*. **73**(2): 2 pp.
- KOLE C., MATSUMURA H. & BEHERA T. K. (Eds.). 2020. *Compendium of plant genomes*. Springer Nature Switzerland AG 2020, 13 chapters, 135 pp.; ISBN 978-3-030-15061-7.
- KUMAR D. S., SHARATHNATH K. V., YOGESWARAN P., HARANI A., SUDHAKAR K., SUDHA P. & BANJI D. 2010. A medicinal potency of *Momordica charantia*. *International Journal of Pharmaceutical Sciences Review and Research*. **1**(2): 95-100, article 018.

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- KUMAR K. P. S. & BHOWMIK D. 2010. Traditional medicinal uses and therapeutic benefits of *Momordica charantia* Linn. *International Journal of Pharmaceutical Sciences Review and Research*. **4**(3): 23-28.
- LIAO P. C., TSAI C. C., CHOU C. H. & CHIANG Y. C. 2012. Introgression between cultivars and wild populations of *M. charantia* L. (Cucurbitaceae) in Taiwan. *International Journal of Molecular Sciences*. **13**(55): 6469-6491.
- LOMBELLO R. A. & PINTO-MAGLIO C. A. F. 2007. Cytomolecular studies in *Momordica charantia* L. (Cucurbitaceae), a potential medicinal plant. *Cytologia*. **72**(4): 415-418.
- MAHMOOD A., RAJA G. K. R., MAHMOOD T., MUHAMMAD G. & KHANUM A. 2012. Isolation and characterization of antimicrobial activity conferring component(s) from seeds of bitter gourd (*Momordica charantia*). *Journal of Medicinal Plants Research*. **6**(4): 566-573.
- MAHMOUD M. F., EL EL ASHRY F. E. Z., EL MARAGHY N. N. & FAHMY A. 2017. Studies on the antidiabetic activities of *Momordica charantia* fruit juice in streptozotocin-induced diabetic rats. *Pharmaceutical Biology*. **55**(1): 758-765.
- MEHETRE S. S. & THOMBRE M. V. 1980. Meiotic studies in *Momordica cymbalaria* Fenzl. *Current Science*. **49**: 289.
- NAGARANI G., ABIRAMI A. & SIDDHURAJU P. 2014a. Food prospects and nutraceutical attributes of *Momordica* species: A potential tropical bioresources: A review. *Food Science and Human Wellness*. **3**(3-4): 117-126.
- NAGARANI G., ABIRAMI A. & SIDDHURAJU P. 2014b. A comparative study on antioxidant potentials, inhibitory activities against key enzymes related to metabolic syndrome, and anti-inflammatory activity of leaf extract from different *Momordica* species. *Food Science and Human Wellness*. **3**(1): 36-46.
- ONISEI T. 2016-2017. Project NUCLEU “Superior valorification of *Momordica charantia* L. (bitter gourd) for obtaining some food functional ingredients with hypoglycemic effect”, AASF, RIB.
- RICE A. & al. 2015. The Chromosome Counts Database [CCDB] – a community resource of plant chromosome numbers. *New Phytologist*. **206**: 19-26. www.newphytologist.com.
- RAHMAN A., SIKTA S. A., SARAH S. H., SHETU H. J. & DASH P. R. 2018. A comprehensive review on *Momordica charantia* Linn (Karela). *International Journal of Botany Studies*. **3**(1): 85-102.
- RENNER S. S. & PANDEY A. K. 2013. The *Cucurbitaceae* of India : Accepted names, synonyms, geographic distribution, and information on images and DNA sequences. *PhytoKeys*. **20**: 53-118.
- ROY R. P., THAKUR V. & TRIVEDI R. N. 1966. Cytogenetical studies in *Momordica*. *Journal of Cytology & Genetics*. **1**: 30-40.
- SĂVULESCU E. & HOZA G. 2010. Research results regarding the anatomy of *Momordica charantia* L. species. *Lucrări științifice USAMVB. Seria B*: 694-700.
- SCHAEFER H. & RENNER S. S. 2010. A three-genome phylogeny of *Momordica* (Cucurbitaceae) suggests seven returns from dioecy to monoecy and recent long-distance dispersal to Asia. *Molecular Phylogenetics and Evolution*. **54**(2): 553-560. <https://doi.org/10.1016/j.ympev.2009.08.006>
- SCHAEFER H. & RENNER S. S. 2011a. *Cucurbitaceae*. In: KUBITZKI K. (ed.), *Families and Genera of Flowering Plants*, Springer Verlag, Berlin, Germany. ISBN 978-3-642-14396-0. **10**: 112-174.
- SCHAEFER H. & RENNER S. S. 2011b. Phylogenetic relationships in the order Cucurbitales and a new classification of the gourd family (Cucurbitaceae). *Taxon*. **60**(1): 122-138.
- SHIBATA K. 1962. Estudios citologicos de plantas silvestres y cultivadas. *Journal of Agricultural Science* (Tokyo). **8**: 49-62.
- STOIAN(OV) R. 2001. *Studiul biomorfologic al speciei Momordica charantia L. ca sursă vegetală de principii active cu acțiune antidiabetică*. PhD Thesis, USAMV București.
- STOIAN(OV) R. 2002. Castravețele miraculos. *Sănătatea plantelor / Plant's Health*. **48**(5): 9.
- ȘESAN T. E. 2017. PROIECTUL PN-II-PT-PCCA-2013-4-0995-160/2014 (MAIA). [PN-II-PT-PCCA-2013-4-0995-160/2014 (MAIA) *Project. Multifunctional and innovative products for safe and bioenhanced functional food from newly cultivated plants in Romania*]. *Revista HOFIGAL®, Natură și Sănătate*. **54** (decembrie 2016-februarie 2017): 34-35.
- ȘESAN T. E., OANCEA A., TOMA A., SAVIN S., TATIA R., CRĂCIUNESCU O., MOLDOVAN L., OANCEA F., RĂUȚ I., GHIUREA M., VASILESCU G., NEGRU G., BIRA-POPESCU A. F. & POMOHACI C. M. 2018. Action of multifunctional bioproducts on *Momordica charantia* L. Morpho-physiological and phytochemical characteristics. *IX Symposium AGROSYM, Sarajevo/Jahorina* (Bosnia & Herzegovina 3-7.10.2018), Book of Abstracts, Poster 385: p. 650.
- TCHEGHEBE O. T., TIMOLÉON M., SEUKEP A. J. & TATONG F. N. 2016. Ethnobotanical uses, phytochemical and pharmacological profiles, and cultural value of *Momordica charantia* Linn.: An overview. *Global Journal of Medicinal Plant Research*. **4**(4): 23-39.

- 
- TRIVEDI R. N. 1978. Cytological studies in triploid *Momordica dioica*. *Proceedings of Indian Sciences Congress Association*. **65**: 116.
- TRIVEDI R. N. & ROY R. P. 1973. Cytogenetics of *Momordica charantia* and its polyploids. *Cytologia*. **38**: 317-325.
- UPADHYAY A., AGRAHARI P. & SINGH D. K. 2015. A review on salient pharmacological features of *Momordica charantia*. *International Journal of Pharmacology*. **11**(5): 405-413.
- WALTERS T. W. & DECKERS-WALTERS D. S. 1988. Balsampear (*Momordica charantia*, Cucurbitaceae). *Economic Botany*. **42**: 286-288.

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