CactusNet Newsletter

Special Issue 15. May 2021

CACTI AND SUCCULENTS ECOPHYSIOLOGY

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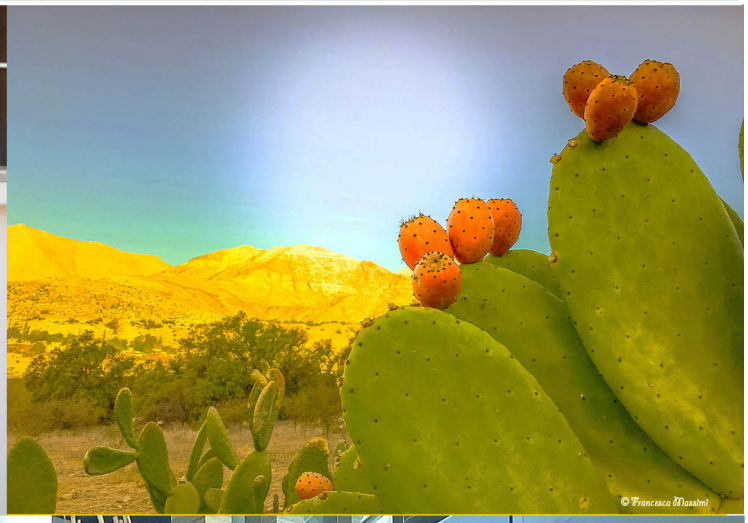
Giorgia Liguori



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PERFORMANCE OF CACTUS PEAR UNDER WEST ASIA CONDITIONS

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Introduction

Arid and semi-arid regions cover approximately 30% of the world's continental surface and support more than 20% of the world's population (Wu, 2001). These areas are less suitable for crop production due to inherent soil constraints like low water retention, sandy texture, shallow depth, occurrence of rocks and stones. Under these conditions, certain species such as spineless cactus pear (*Opuntia ficus-indica* L. Mill.) can grow well and help to enhance the livelihood of the poor farmers. Cactus pear is one of the most important species of the cactaceae family which records approximately 1600 species distributed worldwide (Griffith, 2004; Bárcenas et al., 2011). In fact, cactus pear plays an important economic role and provides good quality foods (fruits, juices, marmalades), cosmetics, and medicinal products and plays an important economic role as a forage and fodder provider (Todaro et al., 2020; Louhaichi et al., 2018; FAO and ICARDA, 2017; Inglese et al., 2002). Moreover, cactus pear has proven potential to alleviate soil erosion and increase carbon sequestration (Hassan et al., 2018). Under semiarid conditions, carbon sequestration was estimated at 0.3 t/ha and 1.9 t/ha respectively for young plantation and for old plantation (Daly-Hassen et al., 2019).

From its native distribution area and in the late 15th century, the species *O. ficus-indica* have spread into different parts of the world, particularly in the Mediterranean Basin, Northern and Southern Africa, the Middle East, Australia and Northern India (Osuna-Martinez et al., 2014). Now, this species is cultivated in over 20 countries for its fruits and as feed for livestock (Inglese et al., 2002). The reasons behind the diffusion of *O. ficus indica* species around the world are many, they are related to the simple cultivation practices required to grow the plant; the easy vegetative propagation practices that favour speedy planting material exchange among different areas, the ability to grow in unfavourable environmental conditions, multifunctionality and industrialization of different parts of the *O. ficus indica* in addition to the potential of this plant to combat desertification and waste and Rangeland improvement (Nefzaoui et al., 2014; FAO and ICARDA, 2017).

Despite the importance of cactus pear, there has been very little research reported on that quantified areas and production of cactus pear crop in most of the countries (FAO and ICARDA, 2017). In West Asia, cactus pear is cultivated for fruit production which have a good market value. Also, it is planted at the edges of farms and gardens as a biological fence. For instance, in Jordan the planted cultivar is the local spiny and spineless Khadri cactus area is estimated at 300 ha mainly in the Jordan Valley, Madaba area and Irbid area (FAO and ICARDA, 2017; Katbeh Bader and Abu-Alloush, 2019). More recently, farmers are becoming

increasingly interested in growing cactus to produce fruits as a mean to generate income (Liguori and Inglese, 2015; FAO and ICARDA, 2017).

The lack of diversity of cactus pear cultivars in West Asian countries is one of the limiting factors that affect the adoption rate and out scaling of this technology. Thus, introduction of new cactus cultivars will provide opportunities to increase the cultivation of cactus pear under local conditions and to help small holders to diversify their products and increase their income.

During the last decade, the International Center for Agricultural Research in the Dry Areas (ICARDA) with the collaboration with the National Agricultural Research Center (NARC) and support of the CactusNet facilitated the transfer of selected material from different locations such as Italy, Brazil, Mexico and Tunisia and for both fruit and fodder production to establish a cactus pear germplasm in Jordan (Figure 1). Following their introduction, the new cultivars were evaluated in order to assess their adaptation and performance to specific local habitats. This work has resulted in the characterization and identification of most promising traits of the available cactus cultivars which will be promoted at farm level.

Figure 1- Cactus pear germplasm collection at Muchaqqer research station, south Amman, Jordan.

Methodology

Thirty cultivars introduced from Italy, Tunisia, Brazil and Mexico in addition to the local cultivar were selected and planted in 5 replications to compare their performance under the Jordan environmental conditions (Table 1). These cultivars were planted at Mushaqqar research station, (31°46'37.50"N, 35°47'51.06"E; 797 m a.s.l), located in the Madaba Governorate, 25 km south of Amman. The climate is semi-arid, characterized by a highly variable and fluctuating rainfall with a mean annual value of 360 mm. Plant Morphological Traits (plant vigour, number of cladodes per plant, plant height (cm), plant diameter east-west (cm), plant diameter north-south (cm)); cladode morphological traits (Cladode: length (cm), width (cm), shape index (length/width), thickness (mm) and surface area (cm^2)) and were recorded using the "Descriptor for Cactus Pear" published by the FAO-ICARDA Cactusnet (Chessa and Nieddu, 1997). Fruits color, fruits crunchiness, fruits sweetness, seed softness and preference were evaluated by farmers.

Table 1. Cactus pear cultivars planted in Muchaqqer station and the country of origin.

Accession name	Country of Origin	Accession name	Country of Origin
Trunzara Red San Cono	Italy	46_Mornag B_74076	Tunisia
Red Roccapalumba	Italy	20_Sbeitla_74071	Tunisia
Yellow Santa Margherita Belice	Italy	34_Caref 58_69219	Tunisia
Yellow San Cono	Italy	31_Burbank Azrou_69223	Tunisia
Yellow Roccapalumba	Italy	15_Sicile Le folin_73063	Tunisia
Red Santa Margherita Belice	Italy	30_Mdjez El Bab_73952	Tunisia
Red San Cono	Italy	29_Matmata_69242	Tunisia
Trunzara yellow San Cono	Italy	26_Djebel Bargou_68247	Tunisia
10_ FOZA10	Mexico	32_Matmata_69242	Tunisia
2_17_21	Mexico	37_Thala_69241	Tunisia
2_11_85	Mexico	6_Ain Boudriess_96245	Tunisia
2_25_15	Mexico	22_El Borouj_75018	Tunisia
2_21_68	Mexico	13_Bab Toza_74115	Tunisia
F1_COPENA F1	Mexico	Muchaqqer	Jordan
IPA – 90 - 115	Brazil		
COPENA V1	Brazil		
Jalpa – F23	Brazil		

Results

The dendrogram resulted from the Hierarchical Ascending Classification of the cactus pear cultivars based on morphological traits allowed as identifying four major clusters (Figure 2). Group (I) with better performance included 14 cactus pear cultivars majority from Tunisia: 10_ FOZA10, 6_Ain Boudriess_96245, 26_Djebel Bargou_68247, 2_21_68, 46_Mornag B_74076, 20_Sbeitla_74071, 30_Mdjez El Bab_73952, 2_17_21, V1_ COPENA V1, 34_Care F 58 C, 37_Thala_69241, 31_Burbank Azrou_69223 29_Matmata_69242, 15_Sicile Le folin_73063. The second cluster included 6 cactus pear cultivars (one from Brazil, three from Italy and two from Tunisia) namely: IPA_90_156, Red Roccapalumba, Turunza Yellow San Cono, Yellow Roccapalumba, 32_Matmata_69242, 13_Bab Toza_74115. Third group consisted of five cultivars: 2_23_15, Jalpa – F23, Trunzara Red San Cono, 22_El Borouj_75018 and Muchaqqer. Last last cluster continues six Italian and Mexican cultivars: F1_COPENA F1, 2_11_85, Yellow Santa Margherita Belice Red Santa Margherita Belice, Red San Cono, Yellow San Cono.

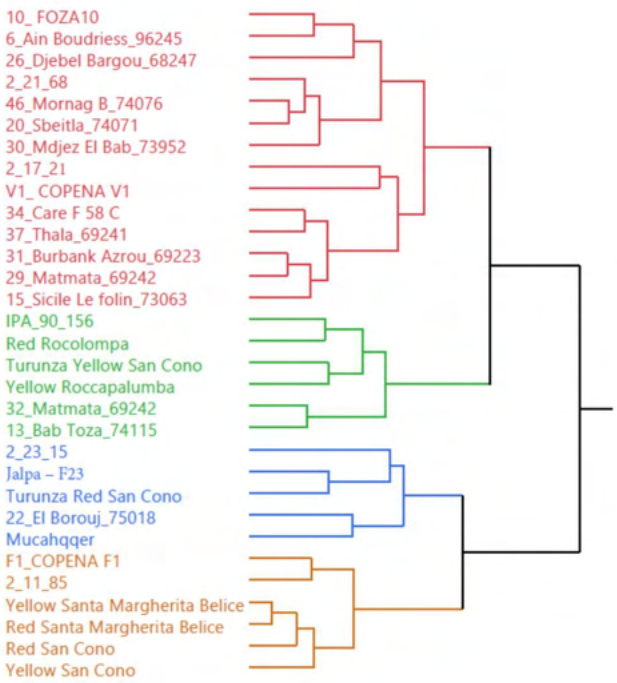

Figure 2 - Dendrogram constructed by Euclidean distance using Ward's method, to study the relationships among the 31-cactus pear cultivars based on their morphological characteristics.

Farmers were very excited to explore the huge divert of cactus pear, the common fruit type in Jordan is the yellow one therefore they were very excited to test the other types. In general, farmers were in favour of the white fruits type had the highest preference of the farmers, it was more attractive, crunchier and continued the softest seeds among the three types, both red and white type fruits were sweeter that the yellow type (Figure 3).

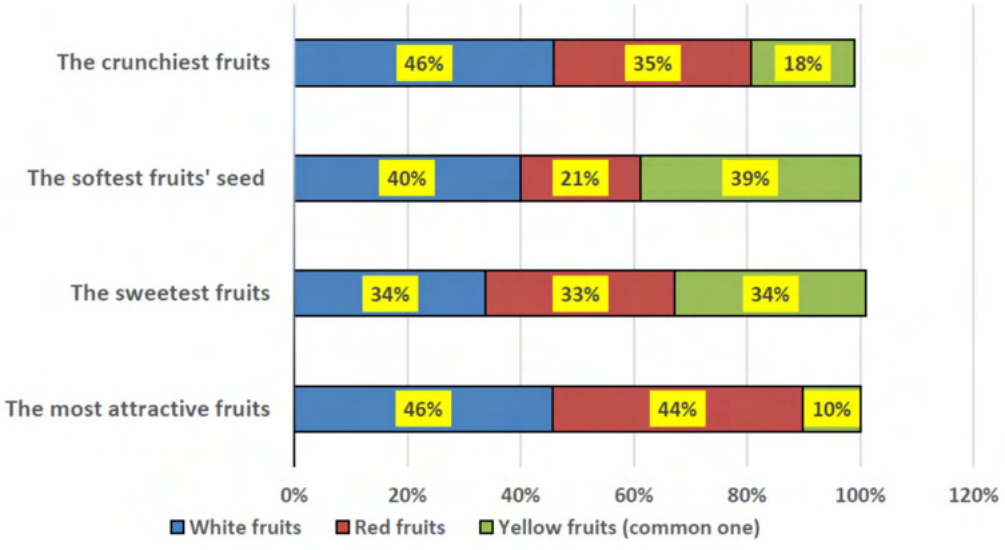

Figure 3 - Cactus pear fruits preference.

Among the white fruiting type, IPA – 90 – 115 was ranked first, while Red Roccapalumba and 2_17_21 recorded the highest score among the red type cultivars. Yellow San Cono and Yellow Roccapalumba were the best among the yellow fruiting type including the local cultivar. Farmers think that new types are better than the common ones and they showed big interest in growing the new accessions in order to produce the new fruits. Farmers expressed the high economic value of the new cactus pear accessions as they are willing to pay higher prices to get the new cactus fruits.

Concluding remarks

- The introduction, evaluation, and dissemination of new cactus cultivars for fruit production is very important to boost consumer preference and increase commercialisation of these cactus fruits
- Awareness-raising programmes are necessary to inform decision makers, government officials and farmers about the importance of cactus using local TV and social media
- Cactus pear offer an opportunity to help poor farmers in west Asia diversify their products and increase their income
- The diversity of cactus pear cultivars can be a mean to create the interest of many farmers to start growing cactus pear
- Cactus pear cultivars at Mushaqqar research station in Jordan have been playing an important role for the high adoption rate. The demand for cactus pear plant materials (cladodes) is higher than what is available at the local nurseries.

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