

Main Presentation

Recent Progress in Strawberry Breeding in Iran

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Abstract

Kurdistan province accounts for a whopping more than half of Iran's entire strawberry production. During the last 30 years, about 30 strawberry cultivars have been gradually imported to the country mainly through Italy and Turkey. Some of these imported cultivars such as 'Queen Elisa' and 'Paros', have replaced the 'Kurdistan' cultivar in open fields. Cultivars such as 'Camarosa' and 'Gaviota' are also dominant in greenhouses of Jiroft and Alborz province. Current cultivars are very high yielding and firm fleshed but they are susceptible to several diseases and poor in flavor. In 2018, Kurdistan Agricultural Research Center started a strawberry breeding program for improving new cultivars. The emphasis was strongly on day neutral selections that are adapted for growing in alkaline soil, combined with superior berry qualities, profitable yields and resistant to common diseases in the region. In the experiments eight cultivars including Queen Elisa, Paros, Ventana, Diamante, Aromas, Camarosa, Selva and Kurdistan were intercrossed. As a result, 187 promising genotypes were selected from 3,000 hybrids and these were compared with parents. From these 187 genotypes, 14 types were selected, as promising cultivar candidates. These 14 selections have excellent fruit characteristics with good yield and have potential for naming in near future.

Keywords: Breeding, Imported cultivars, Selections, Strawberries.

1. Introduction

During the last decade strawberry production in Iran has increased gradually, reaching more than 118,000 tons. In 2021, the strawberry area in Iran is about 6609 hectares: 53% in the West (mainly in Kurdistan province), 37% in the North (mainly in Mazandaran and Golestan regions), and only 10 % in other regions (mainly in Jiroft and Alborz province). Kurdistan province accounts for a whopping more than half of the country's entire strawberry acreage (Ahmadi et al., 2021).

About 90 years ago, in 1934, the strawberries brought to Iran from Russia, for the first time. Also, during the chancellorship of 'Atabak Azam' in the Qajar era, one strawberry cultivar had been imported from France, which became known as 'Atabaki' strawberry. In the 1960s, a noble person named "Sheikh Osman Naqshbandi" imported some strawberry

plants from Europe and planted them in his famous garden located in Sarvabad, Kurdistan province (Karami & Gholami, 2012). This unknown cultivar was developed gradually in Marivan, Sanandaj, and Kamyaran regions and became known as the "Kurdistan" cultivar. For many years producers in Kurdistan have grown the cultivar 'Kurdistan' (unknown pedigree). During the last 30 years, about 30 strawberry cultivars have been gradually imported to the country mainly through Italy and Turkey. Their compatibility and yield components have been evaluated in different projects at the Grizeh Research Station, Kurdistan Agricultural Research Center, Sanandaj.

Currently, 25 strawberry cultivars, including San Andreas, Albion, Sabrina, Queen Elisa, Paros, Ventana, Diamante, Aromas, Camarosa, Gaviota, Pajaro, Selva, Mrak, Krasnyy bereg, Kurdistan, Dachnitsa, Chandler, Yalova, Aliso, Blakemoore, Fresno, Missionary, McDonance, Sequia, and Tennessee Beauty are kept in the strawberry collection of the Kurdistan agricultural research center. Some of these imported cultivars such as 'Queen Elisa' and 'Paros', have replaced the 'Kurdistan' cultivar in open fields. Cultivars such as 'Camarosa' and 'Gaviota' are also dominant in greenhouses of Jiroft and Alborz province.

The dominant strawberry cultivars in Iran are short-day cultivars and have a limited harvest range. The day neutral trait has the potential to expand the harvest season to three or more months each year (Pritts et al., 1989). The breeding efforts for the day-neutral character suggest that day-neutral varieties will have a far greater role to play in the future of strawberry production. Until the 1980's, fruit size and firmness were negatively correlated, while later studies have shown that these two traits are now independent in breeding populations (Faedi et al., 2016). Fruit quality combined with low susceptibility to pathogens are important traits of breeding programs. Disease resistance has become a major breeding goal for most programs in the last two decades, particularly in view of the impending ban (2005 in developed countries) of methyl bromide as a soil fumigant.

Current commercial cultivars imported from other countries are very high yielding, firm fleshed and big in size but they are susceptible to several diseases and poor in flavor. On the other hand, the well-known strawberry variety 'Kurdistan', which is used in this study as a female parent, is rich in flavor. However it has poor yielding and soft fleshed. Also some of imported cultivars have less adaptation to climatic conditions of Iran. Recently, the demand for suitable strawberry cultivars has increased in Iran. In such a situation, the improvement of new cultivars that always bear fruits with favorable quantitative and qualitative characteristics and more importantly compatible with the climatic conditions and resistant to common diseases in the region, can play an important role in the development of strawberry production. In 2018, Kurdistan Agricultural Research Center started a strawberry breeding program for improving new cultivars. The emphasis is strongly on day neutral selections that are adapted for growing in alkaline soil, combined with superior berry qualities, profitable yields and resistant to common diseases in the region. In this study we aimed to combine several positive characteristics of the best strawberry cultivars.

2. Materials and methods

This Project was carried out at the Kurdistan agricultural research center, Sanandaj, started in 2018 in order to obtaining new strawberry cultivars through cross-breeding. Sanandaj is located in the north-western Iran. In the experiments eight cultivars including Queen Elisa, Paros, Ventana, Diamante, Aromas, Camarosa, Selva and Kurdistan, chosen on the basis of their performance under local conditions, or as potential donors of valuable characteristics were intercrossed based on the method of Hancock et al. (2008). Some achenes were obtained from the crosses and these achenes were refrigerated, at +4 °C for three months.

After the achenes were germinated and the young seedling had reached the 3 to 4 leave stage they were transferred to small plastic pots in the greenhouse. As a result, approximately 3000 hybrid cross-bred strawberry seedlings were obtained. The basic characteristics used in the selection of new promising cross-bred types, included number of inflorescences, number of flowers, number of fruits, average fruit weight, yield, skin colour, flesh colour, flesh firmness, total soluble solids (TSS), day neutral trait and the growth performance of the plants. The hybrid seedlings were transplanted to the field in the early April 2019. They were planted in a matted row system at a distance of 50 cm and allowed to form small plots with a width of 25 cm. When they flowered and set fruits, preliminary selection was done during 2020-2021 and the promising ones were selected and propagated by runners. In 2022, about 187 promising selections selected and were planted with parents in replicated plots for further evaluation.

3. Results and Discussion

Our observations, revealed the date of germination of achenes to vary according to the cross lines. Erenoglu and Seniz (2002) reported the similar results. The number of crossbred plants differed according to the cross lines. The largest number of selections were obtained from Camarosa x Ventana and Selva x Ventana crosses. Although fewer selection were obtained from Paros x Ventana crosses, they showed better fruit and plant characteristics in particular, selections: PV-31-2, PV-31-6, PV-32-5, PV-32-14, PA-33-4, QA-45-12 and KD-4-3 appeared most promising. The highest yield was obtained from selection PV-31-2 (2036 g/plant), however it was a short day selection, suggesting the necessity for new back-crosses. From these crosses PV-32-5, PV-32-14, PA-33-4, PV-31-6 and QA-44-17 were selected as promising candidates from the stand-point of day neutral and high yield.

Most of the Kurdistan crosses had shown the same characteristics like Kurdistan cultivar such as compact plant habit and small fruit. However, one of the selections KD-4-3, had larger fruit weight (11.13 g) and higher TSS (13 °BX) than Kurdistan cultivar and thus considered promising for the future breeding program. As a result of the study, 187 promising genotypes were selected from 3,000 hybrids and these were compared with Queen Elisa, Paros, Ventana, Diamante, Aromas, Camarosa, Selva and Kurdistan. From these 187 genotypes, 14 types were selected, as promising cultivar candidates. These 14 selections (PV-31-2, PV-31-6, PV-32-5, PV-32-14, PA-33-4, QA-45-12, QA-44-17, KD-4-

3, PA-34-25, QA-45-19, PA-34-11, PV-31-1, PV-31-9, and PV-31-13) have excellent fruit characteristics with good yield and have potential for naming in near future (Table 1). Some of the cultivar candidates were dey neutral including PV-31-6, PV-32-5, PV-32-14, PA-33-4, QA-44-17, QA-45-19 and PV-31-13.

All the cultivar candidates have much better fruit characteristics than that of parents. Fruit flesh firmness of the cultivar candidates ranged from soft to firm with many of the cultivar candidates producing very firm fruits.

Table 1. Yield, fruit weight and other characteristics of 14 promising selections compared to some commonly grown strawberry cultivars in Iran.

Promising selections	Yield g/plant	Fruit weight g	TSS °BX	rating of plant vigor	number of runners	Dey neutral
PV-31-2	2036	11.8	9.7	4.0	20	No
PV-32-5	2025	11.1	9.7	5.0	17	Yes
PV-32-14	1814	9.6	9.7	4.5	23	Yes
PA-33-4	1431	8.9	12.0	4.0	13	Yes
QA-45-12	1250	9.7	12.3	2.0	7	No
PV-31-6	1498	7.3	8.0	4.5	24	Yes
QA-44-17	1318	10.7	9.0	3.0	17	Yes
KD-4-3	968	11.1	13.0	2.5	15	No
PA-34-25	1440	7.4	8.3	4.0	16	No
QA-45-19	898	9.3	15.5	3.5	10	Yes
PA-34-11	1200	7.9	11.3	3.0	12	No
PV-31-1	1278	10.5	8.7	3.5	18	No
PV-31-9	1175	10.2	9.0	5.0	20	No
PV-31-13	1155	9.2	10.3	4.5	17	Yes

CONCLUSIONS

This study has shown that the success in cross-breeding is strongly related to the parent characteristics. In this study, Paros was found to be the best parent. Particularly, good selections were obtained from Paros x Ventana crosses. The results obtained in the last two years showed that promising selections could possibly take the place of Queen Elisa and Paros in the west of Iran. These promising selections may be released as new cultivars if they will continue their good performances in the future.

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