

The preservation and study of the biodiversity of subtropical crops are carried out in the genetic collection of the FRC SSC of RAS

Alexey Ryndin¹, Raisa Kulyan¹, and Natalia Slepchenko^{1*}

¹Federal Research Centre the Subtropical Scientific Centre of the Russian Academy of Sciences, 2/28, Yana Fabritsiusa str., Sochi, 354002, Russia

Abstract. The issue of preserving, replenishing, and rational utilization of biological diversity is acute worldwide. Special attention is devoted to the preservation of plant biodiversity at the Federal Research Center "Subtropical Scientific Centre of the Russian Academy of Sciences (FRC SSC of RAS)" in Sochi. A comprehensive germplasm of subtropical crops has been collected and maintained, comprising 753 cultivars. Research is conducted on the Black Sea coast of the Krasnodar Region, Russian Federation. The climatic conditions of the region correspond to the zone of humid subtropics, allowing the cultivation of many thermophilic plants. The results of the conducted research and the inventory of germplasm in 2023 have led to their categorization into 7 main collections: nut crops, citrus crops, subtropical fruit crops, seed crops, stone fruit crops, subtropical industrial crops, and berry crops. From each collection, a promising assortment has been identified for commercial orchards (54 cultivars), amateur gardeners (126), landscaping (71), as well as for scientific research (breeding, physiological, biochemical, genetic, entomological, phytopathological, etc.) (222). Wild and semi-wild relatives of cultivated plants, possessing valuable traits, are of great value and are regularly utilized in breeding studies, contributing to the maintenance of the collection.

1 Introduction

Plant biodiversity plays a crucial role in the development of horticulture and agriculture as a whole. Plant resources are utilized in various aspects of human life, serving as key elements not only in agricultural production for ensuring food security but also in other fields, including biology, genetics, medicine, and contributing significantly to the creation of a comfortable environment [1-3].

Ecologists note a significant reduction in biodiversity in recent years. In this regard, considerable attention is given to the maintenance and preservation of living organism collections. Introductory and breeding research plays a crucial role in this process [4-10].

* Corresponding author: otd-flora@mail.ru

2 Materials and methods

At the Federal Research Centre, the Subtropical Scientific Centre of the Russian Academy of Sciences (FRC SSC of RAS), a unique gene pool of subtropical crops is preserved and maintained in living form, including 753 cultivars (Figure 1). Research is conducted on the Black Sea coast of the Krasnodar Krai, where climatic conditions correspond to the zone of humid subtropics, allowing the cultivation of many heat-loving plants.

The collection is regularly supplemented with new cultivars, including both introductions and varieties and hybrid material from their own breeding. Studies are carried out using classical methodologies. The collections serve as a basis for research in various directions, including the preservation of unique genotypes, identification of donors and sources of economically valuable traits, and addressing issues of adaptability and resistance to biotic and abiotic factors.

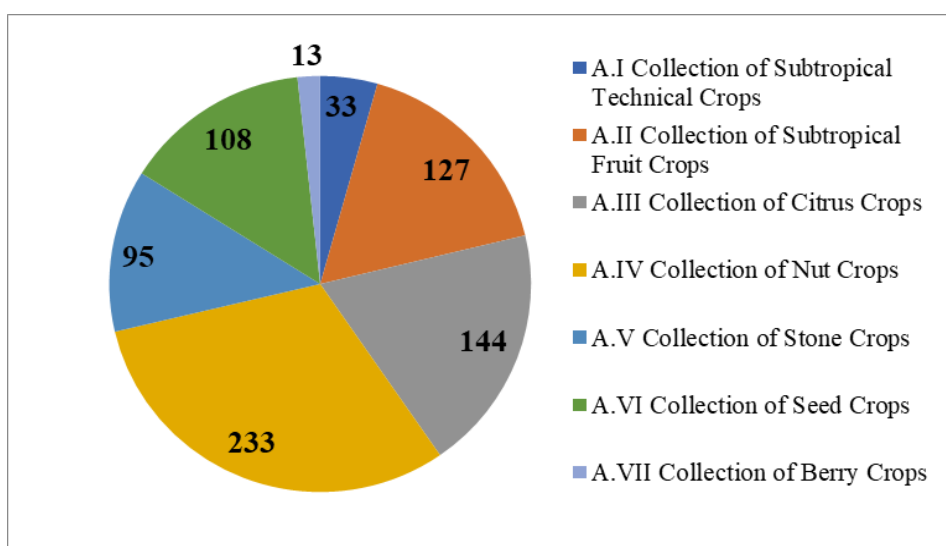


Fig. 1. Biological Resource Collections of the Federal Research Centre, Subtropical Scientific Centre of the Russian Academy of Sciences (FRC SSC of RAS).

3 Results

As a result of the conducted research and inventory of the genetic resources in 2023, the biological resources of the Federal Research Centre, Subtropical Scientific Centre of the Russian Academy of Sciences (FRC SSC of RAS) are organized into 7 main collections. The collection of nut crops is more widely represented, constituting 31 %, while the collection of citrus crops is the most unique and diverse, accounting for 19 % in terms of both species and variety composition. The collection of subtropical fruit crops comprises 17 %, seed crops make up 14 %, stone fruit crops constitute 13 %, subtropical technical crops contribute 4 %, and berry crops represent 2 %.

In recent years, there has been an increasing interest in searching for wild relatives of cultivated plants as carriers of unique traits and properties. FRC SSC of RAS preserves valuable genetic samples of wild and semi-wild relatives in the biological resource collections of many subtropical crops (Table. 1).

Table 1. Wild and Semi-Wild Relatives in the Biological Resource Collections of FRC SSC of RAS.

Biological Resource Collection	Samples
Subtropical Technical Crops	<i>Laurus nobilis</i> L.
Subtropical Fruit Crops	<i>Diospyros lotus</i> L., <i>Diospyros virginiana</i> L., <i>Ficus carica</i> L.
Citrus Crops Collection	<i>Citrus trifoliata</i> L. (syn. <i>Poncirus trifoliata</i> (L.) Raf.), <i>Citrus × insitorum</i> Mabb., <i>Citrus junos</i> Siebold ex Tanaka, <i>Citrus cavaleriei</i> H.Lév. ex Cavalerie (syn. <i>Citrus ichangensis</i> Swingle), <i>Citrus × georgiana</i> Mabb.
Nut Crops Collection	<i>Corylus avellana</i> (L.) H.Karst., <i>Castanea sativa</i> Mill., <i>Juglans nigra</i> L. (syn. <i>Wallia nigra</i> (L.) Alef.), <i>Carya illinoensis</i> (Wangenh.) K.Koch.

The majority of wild and semi-wild relatives are maintained in the citrus crop collection and are used as pollinators to create new citrus forms resistant to low temperatures, as well as to obtain rootstock material (Figures 2-5).



Fig. 2. *Citrus ichangensis*.



Fig. 3. *Citrus × insitorum*.



Fig. 4. *Diospyros lotus*.



Fig. 5. *Citrus junos*.

Selected specimens from the subtropical crop biological resource collection serve various purposes (Table 2).

Table 2. Utilization of Some Representatives in the Biological Resource Collections of FRC SSC of RAS.

Crops	Production	Scientific Research	Breeding	Ornamental Horticulture	Amateur Gardening
Mandarin	16	47	22	24	20
Lemon	10	50	5	15	35
Grapefruit	3	6	2	2	6
Orange	4	8	1	2	8
Feijoa	4	13	4	13	13
Persimmon	6	27	8	5	25
Azimina	4	4	1	4	4
Unabi	7	21	3	6	15
Total:	54	176	46	71	126

For production, 54 cultivars have been selected, with the highest number observed in the mandarin (16) and lemon (10) groups within the citrus collection. In the subtropical fruit collection, unabi (7) and persimmon (6) are predominant.

Scientific research is conducted on all cultivars in the collections. The most numerous groups include the lemon group (50), mandarin group (47), persimmon (27), and unabi (21). Analysis of trait inheritance, pollen quality, earliness, dwarfing, winter hardiness, and other characteristics has identified promising genetic material for breeding. In hybridization, 46 cultivars are utilized, with 22 from the mandarin group, 8 from persimmon, and 5 from lemon. The smallest number is selected from the orange group and azimina due to sterility along the male line in these groups.

Many cultivars of subtropical crops exhibit decorative qualities and are frequently used in landscaping, contributing to the preservation of genetic diversity and promoting subtropical crops. A total of 71 cultivars are recommended, including 24 mandarins, 15 lemons, 13 feijoa, and 6 unabi.

In amateur gardening, a diverse set of cultivars with various traits and qualities are utilized. A total of 126 cultivars from different crops are recommended, with the highest number in the lemon group (35), persimmon (25), mandarin group (20), and unabi (15).

4 Conclusion

Thus, the biological diversity of subtropical crops in the genetic collection of the Federal Research Centre the Subtropical Scientific Centre of the Russian Academy of Sciences (FRC SSC of RAS), comprising 753 cultivars, contributes to the preservation and maintenance of unique genetic resources. It facilitates the identification of donors and sources of economically valuable traits, as well as the creation of new resilient hybrid forms and varieties. Analysis of the collection has allowed the identification of a promising assortment from each collection for commercial plantations, scientific research (breeding, physiological, biochemical, genetic, entomological, phytopathological, etc.), landscaping, and amateur gardening.

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