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MORPHOLOGICAL STRUCTURE OF CITRUS PLANTS IN THE CLIMATE OF UZBEKISTAN

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Abstract
Under the climatic conditions of Uzbekistan, specifically in the Kibray district of the Tashkent region, new local lemon (Citrus limon L.) varieties were developed under controlled greenhouse (limonarium) and laboratory conditions. The research was conducted based on the breeding methodologies proposed by Z. Fakhruddinov, which were further refined and adapted to local environmental factors. As a result of the study, improved breeding approaches were established, enabling the development of new citrus genotypes characterized by high yield potential, enhanced resistance to abiotic and biotic stress factors, and superior adaptability to regional climatic conditions. Hybridization with local cultivars, grafting techniques, and artificial cross-pollination were employed to select promising

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forms. These approaches facilitated the creation of competitive, high-yielding lemon varieties distinguished by desirable organoleptic properties, high vitamin content, and increased resistance to diseases.

Keywords Citrus, plant, varieties, climate, greenhouse laboratory, disease, productivity, cultivated varieties, tolerant.

INTRODUCTION

In the Republic of Uzbekistan, particular attention is devoted to the cultivation of nutritionally valuable and medicinal fruit crops, including lemon (Citrus limon L.), orange (Citrus sinensis L.), mandarin (Citrus reticulata Blanco), and grapefruit (Citrus paradisi Macfad.). In this context, numerous studies have been conducted on the cultivation of export-oriented, high-yielding citrus crops under both open-field conditions and unheated greenhouse systems, yielding significant scientific and practical outcomes.

Within the framework of the New Uzbekistan Development Strategy 2022–2026, particular emphasis is placed on agricultural development. Specifically, Goal 30 highlights the need to expand the production of export-oriented agricultural products and horticulture, including increasing the area of intensive orchards by threefold and greenhouse facilities by twofold, as well as enhancing export potential by an additional USD 1 billion.

In this regard, it is of critical importance to conduct comprehensive scientific and applied research aimed at expanding the assortment of citrus varieties, investigating their agrobiological characteristics, improving breeding methodologies, developing intensive cultivation technologies, and determining the biochemical composition of fruits under protected cultivation conditions.

MAIN PART

In Uzbekistan, citrus plants are typically cultivated under greenhouse conditions as small trees, reaching heights of 2.50–2.75 m, and in some cases up to 2.80 m. It has been established that tree height is a biological characteristic determined by the

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variety, while the shape and growth habit of the trees reflect varietal traits. The crown architecture of citrus trees varies depending on the cultivar and may be spreading, semi-upright, upright, or strongly upright. However, many varieties are characterized by relatively flat branching patterns. The trunk is woody, smooth, and exhibits bright green to bluish-light green coloration. Branches are green, densely arranged, and actively involved in the formation of fruit-bearing structures.

Long branches originate from older parts of the tree and are distinguished by elongated internodes, smooth surfaces, and a light greenish color. Under favorable light conditions, the formation of branches and flower buds begins from the second year of growth. One-year-old fruiting branches are predominantly green and may bear single, paired, or triple buds or inflorescences. Fruiting shoots are typically short, with very short internodes and 6–7 buds concentrated at the apex, forming flower-like structures.

Leaves of citrus plants vary depending on the variety but are generally elongated, arrow-shaped, and dark green in color. In many cultivars, leaves are densely arranged, showing variation in size while maintaining overall uniformity. Citrus leaves differ from those of other plants in their coloration and structure, often being lanceolate with serrated margins and varying thickness. It has been established that citrus plants possess two main types of buds: vegetative and generative. Vegetative buds give rise to shoots and leaves, whereas generative buds develop into flowers and fruits.

The growth cycle of citrus plants includes flowering, fruit set, fruit development, and the initial stages of bud formation for the subsequent growing season. Vegetative shoots are generally thinner and smaller than generative shoots. Vegetative buds are typically located at the tips of shoots, while fruiting structures are found in the middle or near the ends of branches, often on the outer sides. Fruiting buds are smaller and more delicate compared to non-fruiting buds, with leaf band formation measuring approximately 2–3 cm. Non-productive shoots, often referred to as “water sprouts,” grow vigorously and may divert nutrients from

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the plant. Some sterile shoots, with or without thorns, also develop and compete for assimilates.

Citrus plants belong to the same botanical family, and their cultivation is based on shared morphological and physiological characteristics. Lemon varieties such as F-1 Tashkent and F-2 Yubileyny differ in seed content, with some varieties containing numerous seeds while others are seedless. Citrus fruits also vary in peel thickness, which may increase or decrease depending on the variety and stage of ripening. It has been observed that certain varieties, including F-1 Tashkent and Turan lemons, can be consumed together with the peel. Additionally, citrus fruits may be consumed at different stages of ripeness, including before complete development of the fleshy part and endocarp.

The number of seeds in citrus fruits varies significantly, ranging from 6–12 to as many as 95 seeds per fruit, depending on the variety. For example, the F-2 Yubileyny variety contains a high number of seeds, whereas the F-1 Tashkent variety has relatively few. The root system of citrus plants is well developed. Seed-propagated plants typically form a strong taproot, while plants grown from green cuttings develop a fibrous root system. In the first year, seedlings form a deep taproot, followed by the development of lateral roots, which results in a robust root system in the second year.

These characteristics enable the establishment of citrus plantations even in soils with low fertility under greenhouse conditions. Proper irrigation is essential, and soil moisture should be maintained at 65–70% to ensure optimal plant growth. Leaves play a crucial role in plant development; they are typically oval in shape, measuring 10–15 cm in length and 7–10 cm in width. Young leaves are light green, while mature leaves are dark green. Leaf renewal occurs approximately every 2–3 years, and leaves serve as important sites for the accumulation of assimilates. Optimal physiological functioning of citrus plants is observed when soil moisture is maintained at 65–70% and air temperature at 12–13°C.

Citrus flowers are white, strongly fragrant, and may occur singly, in pairs, or in clusters. The fruit belongs to the hesperidium type, characterized by a multicellular structure. Fruits may be oval, round, or pear-shaped. The peel consists of two

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layers: the outer flavedo (rich in essential oils) and the inner albedo (white spongy tissue). In lemon varieties with thick albedo, the peel is often used for the production of candied products. Peel thickness varies from 2–3 mm to 7–8 mm and may be smooth or rough. Fruit color ranges from yellow and orange to green and reddish-yellow.

The internal structure of citrus fruits consists of 8–14 segments containing juice sacs filled with nutrient-rich juice, including vitamins, organic acids, and trace elements beneficial for human health. Seeds are typically located between juice sacs, and their number varies widely depending on the variety, ranging from 4–6 to 95–100 seeds, while seedless varieties also exist and are generally more valuable in the market. Citrus fruits within the same family exhibit considerable diversity in color, morphology, and biochemical composition.

CONCLUSIONS

1. Under greenhouse and laboratory conditions, and based on the breeding methods applied by Z. Fakhruddinov, new local varieties of citrus plants were developed, adapted to climatic conditions, and improved methodologies were established. As a result, new varieties characterized by high yield potential and resistance to stress factors were created. Through intraspecific and interspecific hybridization, grafting, and artificial crossing with cultivated varieties, it became possible to select promising forms and develop new competitive varieties that are disease-resistant and rich in vitamins.
2. The main seed types and commonly cultivated citrus species, along with their botanical and biological characteristics, beneficial properties during growth, and potential for varietal development, were systematically investigated.
3. Citrus plant varieties were selected using the re-selection method, which revealed traits such as high productivity, disease resistance, and early maturity. The selection process was based on detailed study and analysis of seed production processes and associated beneficial properties.
4. New citrus plant varieties were obtained through crossbreeding with cultivated forms and repeated selection of hybrid progeny. Their distinguishing

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characteristics, including yield, early maturity, disease resistance, and beneficial properties, were comparatively evaluated against control varieties.

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