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INVESTIGATING VOLATILES AS INDICATORS OF SHELF-LIFE STABILITY IN APRICOTS UNDER DIFFERENT CULTURAL PRACTICES

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ABSTRACT: *Apricot (Prunus armeniaca L.), a member of the Rosaceae family, is cultivated worldwide and highly valued for its pleasant aroma, taste, and nutritional properties.*

The fruit is rich in volatile organic compounds (VOCs), which play a crucial role in determining its aroma and overall consumer acceptance.

Recent studies have identified esters, aldehydes, alcohols, and terpenes as the main contributors to apricot flavor.

The concentration and composition of these volatiles vary significantly among cultivars and are influenced by factors such as ripening stage, irrigation practices, and storage conditions.

A comprehensive understanding of the biochemical and environmental factors regulating volatile formation provides an essential foundation for improving postharvest management and extending the shelf life of apricots.

KEYWORDS: *apricot, volatile organic compounds, aroma, shelf life, postharvest quality, biochemical composition*

INTRODUCTION

Apricot (Prunus armeniaca L.) is one of the oldest cultivated fruit species, believed to have originated in China before spreading through Central Asia and later reaching Europe (Zhao et al., 2022a) Its long domestication history has resulted in wide genetic diversity, reflected in differences in pomological characteristics and adaptability to various climatic conditions.

Botanically, apricot is a hardy deciduous tree ranging from 2 to 10 m in height, producing stone fruits. The fruits

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typically ripen between late July and mid-August, depending on the cultivar. Morphologically, the fruit is a drupe resembling a plum, characterized by a thin, velvety outer skin enclosing yellow mesocarp; the inner layer hardens into a smooth, compressed stone that contains the kernel.(Erdogan-Orhan & Kartal, 2011)

In many Asian countries, apricots are widely consumed both fresh and dried, serving as an important source of natural sugars and energy in the human diet(Gómez-Martínez et al., 2021)

The fruits are also valued for their bioactive constituents, including phenolic compounds, carotenoids, and ascorbic acid, which contribute to their nutritional and antioxidant potential.

However, apricots are highly perishable and have a short postharvest life due to rapid softening, aroma loss, and susceptibility to microbial spoilage.(Melgarejo et al., 2014a) These features pose significant challenges for storage, transport, and export markets.

Therefore, identifying reliable biochemical indicators that reflect fruit quality and predict shelf-life stability is of great practical importance.

Apricot fruit quality is mainly associated with visual appearance, texture, taste, and color.

The fruit has a distinctively pleasant flavor and aroma, with skin color ranging from yellow to deep orange, often with a reddish blush.(Erdogan-Orhan & Kartal, 2011)

In recent years, advanced analytical methods such as headspace solid-phase microextraction combined with gas chromatography–mass spectrometry (SPME-GC-MS) have been applied to identify key aroma compounds and biomarkers responsible for sensory characteristics in different apricot cultivars (Farag et al., 2022) Furthermore, researchers have investigated the relationships between volatile composition, ripening stage, and antioxidant activity to determine reliable biochemical indicators of fruit quality(Karabulut et al., 2018)

METHODOLOGY OF LITERATURE SEARCH

This review was developed based on peer-reviewed scientific articles published between 2007 and 2025, retrieved from databases such as PubMed, ScienceDirect, Scopus, and NCBI.

The literature search was performed using combinations of keywords, including “apricot volatile compounds”, “shelf-life stability”, “postharvest quality”, and “cultural practices”.

Approximately 83 relevant publications were selected, focusing on studies that investigated the volatile composition of apricots, the biochemical basis of storage stability, and the effects of pre- and postharvest factors on fruit quality.

Priority was given to research providing experimental data or comparative analyses among different cultivars and storage conditions.

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Chemical Composition of Volatile Compounds

The volatile composition of apricots has been extensively investigated to better understand the biochemical processes occurring during postharvest ripening.

To explore these changes, (Aubert & Chanforan, 2007) analyzed 28 apricot cultivars using liquid–liquid microextraction (LLME), gas chromatography with flame ionization detection (GC-FID), and gas chromatography–mass spectrometry (GC-MS).

A total of thirty-three volatile compounds were identified, including six esters, five C_6 compounds, four alcohols, three carbonyl compounds, six terpenic compounds, and nine lactones.

The levels of volatile compounds were found to increase markedly during postharvest ripening, showing much greater variation than other physicochemical parameters.

Sugars are another key group of constituents influencing apricot flavor and sweetness.

The predominant sugars are glucose and fructose, while sucrose and maltose (disaccharides) and raffinose (a trisaccharide) are present at lower concentrations (Mesarović et al., 2018) In addition, apricot fruit contains considerable amounts of organic acids, mainly malic, citric, and quinic acids(Melgarejo et al., 2014b), which balance sweetness and contribute to overall flavor perception.

Regarding aroma composition, more than 80 volatile compounds have been identified in apricot fruits, predominantly terpenes, esters, lactones, aldehydes, and alcohols(Melgarejo et al., 2014b)

These compounds collectively shape the characteristic fruity and floral aroma that defines apricot sensory quality.

Overall, the complexity of apricot flavor results from the dynamic interplay between sugars, organic acids, and volatile constituents synthesized during fruit ripening and storage.

Factors Affecting the Volatile Composition of Apricots

The types and concentrations of volatile compounds in apricots are strongly influenced by cultivation practices and environmental conditions, such as temperature, sunlight, irrigation regime, and soil composition.

Ripening stage is another critical determinant of volatile composition.

As apricot fruits ripen, ester concentrations—responsible for sweet and fruity notes—tend to increase, while aldehydes and alcohols associated with green or grassy aromas decrease (Aubert & Chanforan, 2007) found that linalool, β-ionone, and other terpenes were more abundant in specific Italian cultivars, highlighting the influence of genetic regulation on aroma compound formation. Similarly, (Zhao et al., 2022b)identified key volatile biomarkers such as hexyl acetate and ethyl butanoate

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that significantly differ among cultivars grown in various Chinese regions, reflecting both genetic and geographic effects.

Different apricot cultivars exhibit unique aromatic fingerprints due to variations in their enzymatic activity and biosynthetic pathways. For example,(Fratianni et al., 2022)

Significant variations have been observed not only between different cultivars, but also among fruits grown within the same region under distinct cultural and climatic conditions (Zhang et al., 2016)

Agronomic practices such as irrigation regimes, fertilization, root-stock choice and sunlight exposure significantly modulate volatile biosynthesis. A case in point: in 'Mirlo Rojo' apricot trees, regulated deficit irrigation at 60 % or 33 % ETc altered the concentration of esters (from 7.17 mg kg^{-1} in full irrigation to 3.35 mg kg^{-1} in some deficit treatments) and increased content of terpenoids under certain RDI (regulated deficit irrigation) treatments.(Andreu-Coll et al., 2024)

These results suggest that moderate water stress may enhance the synthesis of specific aroma-related metabolites, improving the overall flavor intensity of apricots.

CONCLUSION

This review highlights the complexity and diversity of volatile organic compounds (VOCs) in apricots (Prunus armeniaca L.) and their dependence on genetic, agronomic, environmental, and postharvest factors. The synthesis and accumulation of VOCs are strongly influenced by cultivar genetics, irrigation regime, climatic conditions, and storage environment, which collectively determine fruit aroma and consumer quality.

Recent research has shown that controlled agricultural practices such as regulated deficit irrigation and optimized harvest timing can significantly modify the biosynthesis of key volatiles including esters, terpenes, and lactones, thereby improve the flavor intensity and extend shelf life. Moreover, correlations between primary metabolites (sugars and organic acids) and VOCs emphasize the biochemical interconnections shaping apricot sensory attributes.

Further investigation is needed on local cultivars, such as Isfarak, Khurmoi, and Shalak, to characterize their specific volatile profiles under different climatic and cultural conditions. Such studies will not only support the preservation of valuable regional genetic resources but also contribute to developing postharvest technologies for improving apricot quality and marketability.

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