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Original Article

## Production process and characterization of the traditional Greek fruit distillate “Koumaro” by aromatic and mineral composition

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### Abstract

Koumaria is the common name of the bushy shrub *Arbutus unedo* L., also known as the strawberry tree. Its fruits are round, fleshy and red colored at full maturity. They are mainly used for the production of an aromatic traditional distillate, named Koumaro. To gain a better understanding of this product, we gathered information regarding its traditional production process and we analyzed volatile substances by gas chromatography (GC) according to the official method of the Office International de la Vigne et du Vin (OIV), mineral compounds by atomic absorption spectrometry (AAS), sugar content of the fruit and pH level using standard methods.

The fruit of Koumaria has a high mean sugar content of 24.6 °Brix, while its distillate has an alcoholic tittle with a mean value of 39.4% vol, but with great variations. Methanol content, generally, is lower than the limit of 1000 g/hL. Absolute alcohol (AA) and the higher alcohol values satisfy the qualitative demands of 140 g/hL AA. Isovaleric acid was found in high concentrations compared to other fruit distillates. Substances which can cause health hazards (e.g., estragol) or organoleptic faults (e.g., acetaldehyde, ethyl acetate, ethyl lactate, diethyl succinate) were lower than their respective limits or thresholds. Furthermore, the very low concentrations of Cu, Pb along with Ca and Fe indicate the good maintenance of the alembics and do not pose a threat to consumer safety.

Since great variations in composition were observed, a better standardization process is required to achieve better control of the levels of the above compounds as well as the ethanol concentration, which was found to vary in many distillates. Areas where better quality control should be applied are the quality of the

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fruit, the fermentation and storage process, the distillation and the good condition of the equipment.

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## 1. Introduction

Koumaro distillate is the spirit beverage that comes from the distillation of fermented fruits of the Koumaria tree. Koumaro is also the Greek common name of the strawberry tree fruit to which this distillate owes its name.

Koumaria tree is the Greek term for strawberry tree (*Arbutus unedo* L.) also known as Cain-apple tree, which belongs to the family of Ericaceae. It is widespread in Europe, in countries like Italy, Great Britain, Ireland and Greece, as well as in the Paramediterranean area (Minor Asia), Atlantic and regions of North America (Gilman and Watson, 1993; Alarcão-Silva et al., 2001). Koumaria came to Greece probably from the Caucasus (Ayaz et al., 2000) and it is found mostly in Pieria, at the feet of mount Olympus, and to a lesser extent in other areas of Greece (Vardavakis, 1993). It is an evergreen bushy shrub of 1.5–3 m which occasionally becomes a tree of 10–12 m. Koumaria grows on steep mountain slopes (Fig. 1) unfavorable for cultivation of other plants such as grape vines or other trees (Gilman and Watson, 1993). Due to the pareniautophory phenomenon, the strawberry tree blooms and gives fruits every second year.

Koumaro is an unusual spherical fruit of 1–1.7 cm diameter, with a rough, peddled outer surface, which ripens from yellow to dark red (Fig. 2) and stays on the tree throughout winter (Gilman and Watson, 1993). The maturation phase extends to almost two periods. The first harvest starts in the middle of October and ends in the beginning of December, while the second one takes place a few days after New Year's Eve. It is juicy, edible, and pulpy to the touch when fully matured and the fruit contains sugars, non-volatile and phenolic acids and terpenoid compounds contributing to its taste quality (Ayaz et al., 2000; Alarcão-Silva et al., 2001; Yayli et al., 2001). Koumaro fruit is considered to be an organic product because it is widely grown without any agrochemical substances. Although it looks appealing, its bland taste does not make it popular for consumption as fresh fruit (Gilman and Watson, 1993; Ayaz et al., 2000). Instead, it is processed into value-added products such as jam, wine, distillates and liqueurs (Ayaz et al., 2000; Alarcão-Silva et al., 2001).

The distillation of koumaro has been documented since the early Byzantine times, although there are indications that it began even earlier. This spirit is a popular and traditional alcoholic beverage along with other distilled spirits from various Greek and foreign regions. *Tsipouro* and *tsikoudia* from Greece (Soufleros and Bertrand, 1987, 1991), *grappa* from Italy, *marc grape* from France, *sambucca* from Spain, *cachaças* from Brazil (Nascimento et al., 1999), *bagaceiras* (Silva et al., 1996; Silva and Malcata, 1998, 1999) and *aguardiente* from Portugal (Rogerson and Freitas, 2001), *slivovicha* from ex-Yugoslavia, *melon fruit distillates* (Hernández-Gómez et al., 2003), *williams* or *poiré* and *calvados* from France are but a few of the most popular distillates of different countries.

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