

First Person: Hacking Musk Strawberry Flavor

Decoding an exotic botanical close to home

Ján Pet'ka, Akras Flavours

It is quite intriguing to hear from time to time about expeditions that take scientists into tropical forests to study unknown species of plants or animals as illustrated by the 1992 film *Medicine Man* in which Sean Connery examines the medical properties of the rain forest flora.

It is no surprise that similar attempts have appeared recently in the flavor industry. Givaudan, for example, is known for organizing its TasteTrek in which scientists use a sort of dynamic headspace apparatus to capture volatiles of exotic fruits. Similarly, IFF's Living Flower and Living Fruit programs have employed solid phase microextraction to capture the smell of uncut vegetation. Top companies furthermore organize treks for their flavorists and perfumers to get to know raw materials in the authentic environment. The driving force for such efforts is an assumption that in the exotic condition it is easier to find surprising flavors or scents. Nevertheless, it is still possible to find interesting smells closer to home.

Origins of a Flavor Mystery

I was brought up in a small village in central Slovakia. In the boring era of the Slovak Socialist Republic that ended in 1990, it was quite difficult to find exotic fruits in the groceries. Bananas or mandarins were mostly accessible only if you were a good friend with the shop assistant. On rare occasions, however, large supplies of sweet green oranges and canned mangoes would arrive from Cuba. When I tasted the mangoes for the first time, I was quite surprised and told myself, "This taste I know."

Since my childhood I liked the small crimson-red wild strawberries, which smelled and tasted much different compared to the more familiar woodland strawberries. These were musk strawberries, which grew on a bleak hill above the village. While tasting canned mango, I realized that musk strawberries shared some notes with it.

About Musk Strawberries

Of all the strawberry types, only musk strawberry (*Fragaria moschata*) is a hexaploid ($2n = 6x = 42$). The musk strawberry is most likely a result of the natural cross between the diploid species *Fragaria vesca* (woodland strawberry) and *Fragaria viridis* (green strawberry), which sometimes co-occur.¹

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Musk strawberry is native to highland areas from Great Britain through to Siberia. Its name points to the rather strong spicy smell of this specie (in German, the musk strawberry is sometimes called *zimterdbeere*, or cinnamon strawberry). Until the boom of the garden strawberry in the 19th century, it was the musk strawberry, together with woodland strawberry, that was most widely cultivated.²

The musk strawberry is believed to be the first strawberry with a given cultivar name, *Gallobelgis des Chapirons*.² It was also the preferred strawberry variety of Jane Austen and Franklin Delano Roosevelt, who encouraged strawberry breeders to experiment with musk varieties.³

Resolving the Mystery

Years after my experience with the canned Cuban mangoes, I started to work for an Austrian flavor house and learned that nobody in the company knew the profile of the musk strawberry. One summer morning I took our senior flavorist, Baskaran Parameswaran, in a car along with a solid-phase extraction unit, some sorbents and solvents and drove about 330 km east to visit my home village.



Senior flavorist Baskaran Parameswaran in the Slovakian highlands on the hunt for musk strawberries.



Musk strawberry's name points to the rather strong spicy smell of this specie; in German, the musk strawberry is sometimes called zimterdbeere, or cinnamon strawberry.

Once we reached the highlands above the village (700-plus m above sea level) our olfactory journey started. The area was filled with a pleasant—and for Baskaran, a Tamil, even holy—herbal smell of dried wild thyme. We soon found large crops of ripe musk strawberries, which imparted a very intense mangolike, tropical smell. The freshly picked fruits had pronounced sweet-caramel and tropical orthonasal notes. The flavor in mouth was balanced, sour-sweet, a little astringent with green, caramel, seedy and clovelike retronasal notes.

In my mother's house, Baskaran and I extracted the freshly picked fruits, and later back in Austria we performed various analyses (GC/MS, dynamic headspace of the whole fruits, GC-O)^a. A wide array of volatiles was identified in the extracts. However, the GC-O revealed for me the main secret of musk strawberries.

While smelling the GC effluent at the Technical University Graz, I recognized two volatiles, namely mesifurane (**F-1**; methyl ether of Furaneol^b) and 3-mercaptohexyl acetate (**F-2**), as the most prominent keys of musk strawberries.

The secret code of my favorite fruit has been hacked!

^a Poster: J Pet'ka, E Leitner and B Parameswaran, *Musk strawberries—formerly famous fruit reassessed*; presented in September 2011 on a XIIIth Weurman Flavour Research Symposium in Zaragoza, Spain. Its extended version is accepted for a special issue of the *Flavour and Fragrance Journal*.

^b Furaneol is a trademark of Firmenich

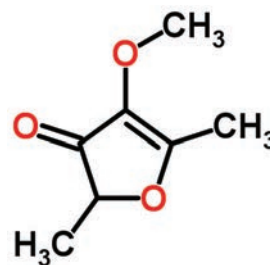
Address correspondence to Ján Pet'ka; jan.petka@akras.at

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2. GM Darrow, *The strawberry: history, breeding and physiology*, 447, Holt, Rinehart and Winston, New York (1966)
3. D Kapp, Berried treasure. *Smithsonian*, 37, 82–86 (2006)

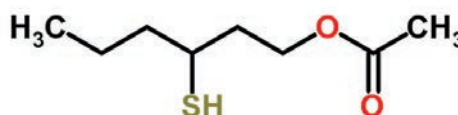
4-Methoxy-2,5-dimethyl-3(2H)-furanone
(mesifuran)

F-1



3-Merceptohexyl acetate

F-2



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