

Seasonal variations of *Cinnamomum camphora* leaf aroma volatiles in greenhouse conditions of Belarus

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Abstract

Investigations of the qualitative and quantitative composition of dried up leaf aroma volatiles of *Cinnamomum camphora* introduced plants which are cultivated in greenhouse conditions of the Central Botanical Gardens of the National Academy of Sciences (CBG NAS) of Belarus have been carried out in summer (June) and in winter (December) by using of a Hewlett Packard gas chromatograph Model 5090. As it established the percentage proportion of the camphor, which is a basic component of *Cinnamomum camphora* leaf aroma volatiles, remains fixed within 93–94 % in summer and in winter. At the same time it has been revealed that qualitative compositions of attendant minor leaf aroma compounds represented by α -copaene, β -caryophyllene, β -pinene, 2-carene are dependent on the time of year.

Key words: *Cinnamomum camphora*, leaf aroma volatiles, terpenes, camphor

INTRODUCTION

Aroma volatiles are natural organic and essential substances of oil-producing tropical and subtropical plants. These compounds are secondary plant metabolites and are representatives of the large and varied class of hydrocarbons (terpenes). It should be expected that alterations of the qualitative and quantitative composition of these substances of introduced tropical and subtropical plants which is cultivated in conditions of the temperate zone may be revealed.

Cinnamomum camphora (L.) Nees a. Eberm. (*Lauraceae*), commonly known as the camphor tree, is a representative of the subtropical rain forest. That evergreen tree is native to Taiwan, Southern Japan, Southeast China and Indonesia where is cultivated for camphor and timber production. In the subtropical greenhouse of the CBG NAS of Belarus introduced *Cinnamomum camphora* taxons are cultivated at 13–15 °C in winter and 20–30 °C in summer as evergreen plot plants with uninterrupted leaf change. The main limiting factor in the temperate zone for light-requiring subtropical plants is the insufficient light intensity, and in these conditions plants of *Cinnamomum camphora* have the length leaf life during two years and never come into flower (Кабушева, Гетко, 2009).

Camphor tree contains volatile chemical compounds in all plant parts, and the wood and leaves are stem distilled for the essential oils. There are six different chemical variants called chemotypes which seem dependent upon the country of origin of the tree and differ in odor (Hirota, Hiroi, 1967; Laurence, 1995). Aroma volatiles of leaves which give a fragrance to plant have a large usable area in medicine and food industry. But some from its may be also significant plant systematic delineation in current botany investigations.

METHODS

Leaves of *Cinnamomum camphora* were dried up in air at 20 °C and crushed. Analysis of aroma volatiles was undertaken by putting 0,5 g of dried solid leaf matter into a Hewlett Packard gas chromatograph Model 5090 at 25 °C, gradually increasing it up to 100 °C.

RESULTS AND DISCUSSION

Dried and crushed leaf samples of *Cinnamomum camphora* plants have been submitted to aroma volatile analysis into a Hewlett Packard gas chromatograph Model 5090 in summer (June, 2009) and in winter (December, 2009). So compounds of leaves as the camphor, α -copaene,

β -caryophyllene, β -pinene, 2-carene have been identified with the high degree of confidence.

As it established the camphor is a basic leaf aroma volatile component of the leaf aroma volatiles of *Cinnamomum camphora* plants which is cultivated in the CBG NAS of Belarus. As it has been detected the percentage proportion of this compound in leaves is fixed within 93–94 % in summer and in winter. At the same time qualitative composition of attendant minor leaf aroma compounds is dependent on the time of year. So in summer (June) in leaves of *Cinnamomum camphora* plants small percentages of the α -copaene (1.14 %), 3-cyclohexen-1-ol (2.7 %), β -caryophyllene (1.6 %) are revealed. In winter qualitative composition of attendant minor compounds is different: β -pinene (1.8 %), 2-carene (4.9 %).

Some greater length about certain compounds which we revealed in leaves of *Cinnamomum camphora* belonging to the plant collection fund of the CBG NAS of Belarus:

- Camphor is a terpenoid with the chemical formula $C_{10}H_{16}O$. It is a white crystalline substance, obtained from the wood of *Cinnamomum camphora* and so occurs in some other related trees in the laurel family.
- α -Copaene is a tricyclic sesquiterpene ($C_{15}H_{24}$) and one from oily liquid hydrocarbons that is founded in a number of essential oil-producing plants in small amounts. The name is derived from tropical tree *Copaifera landsdorffii*, from which the compounds was for the first time isolated.
- β -Caryophyllene is a natural bicyclic sesquiterpene ($C_{15}H_{24}$) which is a consistent of many essential oils, especially clove oil and essential oils isolated from different parts of *Cinnamomum zeylanicum* Blume (Kaul et al., 2003) and *Cinnamomum tamala* (Ham.) Nees a. Eberm. (Ahmed, Choudhary et al., 2000).
- β -Pinene is a bicyclic monoterpene ($C_{10}H_{16}$) which occurs naturally in *Rosmarinus officinalis*, *Anethum graveolans*, *Ocimum basilicum* and in another plants.
- 2-Carene is a bicyclic monoterpene ($C_{10}H_{18}$) which occurs as a constituent of terpine.
- 3-Cyclohexen-1-ol is a monocyclic terpene ($C_{10}H_{18}O$).

Thereby, as it seems the camphor is the dominant component of leaf aroma volatiles of introduced *Cinnamomum camphora* clones belonging to the collection of the CBG of NAS of Belarus. And if to follow the approval (Hirota, Hiroi, 1967; Laurence, 1995) these clones are representatives of India and Sri Lanka high camphor variety so far as the percentage proportion of camphor in the composition of aroma volatile of its leaves is within 93–94 %.

CONCLUSIONS

1. Investigations of the qualitative and quantitative composition of dried up leaf aroma volatiles of *Cinnamomum camphora* introduced plants which are cultivated in greenhouse conditions of the Central Botanical Gardens of the National Academy of Sciences of Belarus have been carried out in summer (June) and in winter (December) by using of a Hewlett Packard gas chromatograph Model 5090. So compounds as the camphor, α -copaene, β -caryophyllene, β -pinene, 2-carene have been identified with the high degree of confidence in its leaves.

2. Percentage proportion of camphor as basic component in the aroma volatiles volume of *Cinnamomum camphora* leaves remains fixed within 93–94 % in summer and in winter. At the same time it has been revealed that qualitative compositions of attendant minor leaf aroma compounds represented by α -copaene, β -caryophyllene, β -pinene, 2-carene are dependent on the time of year in conditions of the temperate zone.

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CINNAMOMUM CAMPHORA LAPUOSE ESANČIŲ LAKIŲJŲ AROMATINIŲ MEDŽIAGŲ SEZONINĖ KAITA BALTARUSIJOS ŠILTNAMIŲ SĄLYGOMIS

Santrauka

Buvo tiriama kokybinė ir kiekybinė introdukuoto augalo *Cinnamomum camphora* džiovintuose lapuose esančių lakiųjų aromatinių medžiagų sudėtis. Šie augalai buvo auginami šiltnamio sąlygomis Baltarusijos nacionalinės mokslų akademijos Botanikos sodo šiltnamiuose. Birželio mėnesį visai vasarai augalai buvo išnešami į lauką, o žiemą, gruodžio mėnesį, tiriami chromatografu *Model 5090*. Buvo nustatyta kamparo, kuris yra pagrindinė *Cinnamomum camphora* lapų aromatinių medžiagų sudedamoji dalis, dalis procentais. Ji išlieka pastovi – 93–94 % tiek vasarą, tiek žiemą. Dar buvo nustatyta, kad kitų lakiųjų aromatinių medžiagų – α -kopaeno, β -karyofileno, β -pineno, 2-kareno – kiekis priklauso nuo metų laiko.

Raktiniai žodžiai: *Cinnamomum camphora*, lapuose esančios lakiosios aromatinės medžiagos, terpenai, kamparas.