VARIABILITY OF CHEMICAL COMPOSITION IN TANACETUM VULGARE L. ESSENTIAL OILS OVER THE WORLD

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Abstract: *Intraspecific chemical diversity is a common phenomenon, especially found in shoots of essential oil accumulating plant species. Studies have proved that pedo-climatic factors have an influence on the chemical composition of the essential oil of different plant species. Tanacetum vulgare L occurs in various chemotypes that differ in the composition of mono- and sesquiterpenoids .The current article compiles data from literature with regard to the major compounds of the essential oils of Tanacetum vulgare L over three continents. Purpose: This study aims at emphasizing the main compounds of essential oils of Tanacetum vulgare L. over the world with a special regard on the influence of the geographical origin on the chemical composition.*

INTRODUCTION

Plants respond to varying environmental conditions by multiple morphological and chemical adaptations. Terpenoids are the largest group of organic compounds in the plant kingdom. Especially within aromatic plants, a high intraspecific variation in the composition of terpenoids can be found, allowing discrimination into different chemotypes, which are defined by their major terpenoid compound. High concentrations of terpenoids in above- and belowground tissues might be advantageous because several terpenoids have allelopathic properties and they are also known for their antagonistic activity against pathogens.(1) One of the plant species that appears to be a potential source of such compounds is tansy(*Tanacetum vulgare, Asteraceae*). Several studies have shown that essential oils or extracts of tansy contain bioactive compounds that are antifungal, antibactericidal or insect repellent. It also has an important anti-inflammatory, diuretical,antioxidant and antitumoral activity.(2,3,4) The pharmacological activity is influenced by the concentration of the different chemical compounds which are present in the essential oil of tansy. *T. vulgare* is native to Europe and Asia and has become established in North America, where it is invasive in some areas.(2)

PURPOSE

The purpose of this paper work is on the one hand, to summarize the major components of the essential oils of *T. vulgare* harvested from 11 countries spread over three continents and on the other hand, to assess the influence of the geographical origin on the chemical composition.

MATERIALS AND METHODS

The study was done by analyzing systematically the results from the literature regarding the major components, respectively the chemotypes of *T. vulgare L* essential oils harvested from 11 countries spread over four continents, North-America (Canada) and South-America (Brazil), Europe (Finland, Estonia, Poland, Slovakia, Lithuania, Germany, Romania, Turkey) and Asia (Iran).

RESULTS AND DISCUSSIONS

In the study presented by Guy J. Collin, several chemotypes were observed in the essential oil of 25 individual plants of tansy harvested in Quebec area (Canada). Half of the plants belong to a camphor-1,8- cineol- borneol (concentration >52%) mixed chemotype. The ß- thujone chemotype (>50%) was also present in six samples. Four specimens of a chrysanthenone type *(>50%) were also observed. Finally, one sample showed a high concentration of dihydrocarvone (>60%).(5)

In the essential oil of *T. vulgare* harvested from Juiz de Fora, Brazil, a total of 7 compounds were identified, being six monoterpenes (89,58%) and one sesquiterpene (6,81%). ß-thujone (84,15%) was identified as the major constituent.(6)

20 Finnish tansy essential oils were studied by Marjo Keskitalo, Eija Pehu and James E Simon. The most frequently found monoterpene was camphor with or without several satellite compounds such as camphene, 1,8-cineole, pinocamphone, chrysanthenyl acetate, bornyl acetate and isobornyl acetate. Other chemotypes rich in trans thujone, artemisia ketone or davadone-D were also identified. Genotypes containing camphor were most abundant in northern Finland, whereas genotypes containing thujone were most frequent in southern Finland.(7)

In the study of Ain Raal, Anne Orav and Tatjana Gretchushnikova, 83 compounds were identified in two tansy samples from different districts of Estonia. The most important quantitative components in tansy oil from Harju district were trans- chrysanthenone (41.4%), 1,8-cineole (9.6%), ß-pinene (5.0%) and 6-camphenone (4.6%). In the oil from Tartu district, ß-thujone (47.2%) and trans-chrysanthenyl acetate (30.7%) predominated. Thus analyses results in assigning the *T. vulgare* of Harju and Tartu district as trans-chrysanthenone and ß-thujone-trans-chrysanthenyl acetate chmotypes.(8)

The main compounds found in essential oil of *T. vulgare* harvested in Poland were monoterpenes, ß-thujone (61.0%), camphor (13.0%) and trans-chrysanthenyl acetate (6.5%).(9)

In the samples from Slovakia, the main compounds identified were: α-pinene, camphene, sabinene, ß-pinene, 1,8-cineole, artemisia ketone, ß-thujone,camphor, borneol, chrysantenyl-acetate, D-carvone. They constituted 82.1% of total essential oil.(10)

In the study of Asta Judzentiene and Danute Mockute, 57 compounds in the essential oils of *T. vulgare* harvested in Lithuania, made up 80.7-99.6%. The volatile oils were divided into four groups with 1,8-cineole (23.6%-46.3%, 11 oils), ß-

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thujone (35.7-78.4%, 6 samples), camphor (19.8-61.8%), 17 oils) and myrtenol (13.1-24.9%) as major components.(2,10,11)

In essential oil of *T. vulgare* harvested from Germany, the terpenoid composition was divided in 3 chemotypes, namely trans-carvyl acetate (8±2.6%), ß-thujone (9±3.1%) and camphor (9±2.7%).(1)

In Romania, the main constituents of *T. vulgare* essential oils was represented by camphor and ß-thujone.(2)

Kilic Ömer reported borneol, germacrene D, spathulenol, α-pinene, 1,8-cineol, ß-pinene and camphor as main constituents of essential oil composition of *T. vulgare* from Turkey.(12)

The samples of tansy harvested from Iran presented high amount of trans- thujone (44%), camphor(31.04%) and trans-chrysanthenyl acetate (31.1%).(13)

Table no. 1. The distribution of the main constituents of the essential oils of T. vulgare from 11 habitats

Chemical Constituent of the essential oil *of T. vulgare*	1	2	3	4	5	6	7	8	9	10	11
camphor	x				x	x	x	x	x	x	x
1,8-cineole	x		x	x		x	x				
borneol	x									x	
ß-thujone	x	x	x	x	x	x	x	x	x		x
trans-chrysanthenylacetate	x		x	x	x						x
myrtenol						x	x				
davadone D			x								
artemisia ketone			x								
bornylacetate			x								
spathulenol										x	
α-ß-pinene				x		x				x	
pinocamphone			x								
camphene						x					
isobornylacetate			x								
trans-crysanthenone				x				x			
dihydrocarvone	x										
trans-carvyl-acetate											
sabinene						x					

*__1__-Canada, __2__- Brazil, __3__- Finland, __4__-Estonia, __5__- Poland, __6__-Slovakia, __7__- Lithuania, __8__-Germany, __9__- Romania, __10__- Turkey, __11__- Iran *x- major compound of the essential oil of *T. vulgare*

According to the results of the studies summarized in table no 1, the essential oils of T. vulgare from Europe (*Finland, Estonia, Poland, Slovakia, Lithuania, Germany, Romania, Turkey)* in comparison to those from America (Brazil and Canada) and Asia (Iran) present a variety of monoterpenes as major compounds, such as: camphor, 1,8-cineole, ß-thujone, trans-thujone, trans-chrysanthenilacetate, myrtenol, α-and ß-pinene, trans-chrysanthenone. Dihidrocarvone was found as major compound only in the samples from Canada. In Asia, the main constituents of the essential oils were trans-thujone, camphor and trans-chrysanthenilacetate, found also in the samples from Europe and America.

However, the main and common chemical constituents identified in the samples over 3 continents are the monoterpenes, ß-thujone, respectively trans-thujone, camphor and trans-chrysanthenilacetate.

CONCLUSIONS

The centralization of the results from the literature identified ß-thujone, respectively trans-thujone, camphor and trans-chrysanthenilacetate as common main components of the essential oils of T. vulgare from 11 different habitats over the world. According to the results the class of monoterpenes is representative for *T. vulgare* essential oils chemical composition. However, the highest concentration of monoterpenes was found in the essential oils of the European T. vulgare. Therefore, a possible factor what maid have influenced the chemical composition is the geographical origin of the samples.

This study and its results maid represent a base for other research on chemical composition, but also on therapeutic activities of *T. vulgare.*

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