

# Composition of the Essential Oil from the Leaves of Palma Real (*Tanacetum vulgare* L) from Perú

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**Abstract:** The present work presents the chemical composition of the essential oil of *Tanacetum Vulgare* L from Perú. The chemical composition was compared with the chemical composition of the essential oils of *Tanacetum Vulgare* L reported in others papers. Fresh leaves of *Tanacetum Vulgare* L were hydrodistilled in a Clevenger type apparatus. GC analyses were carried out using two gas-chromatographs, a Hewlett-Packard 6890 gas-chromatograph equipped with a flame ionization detector and a GC-MS Hewlett-Packard 5890 gas-chromatograph series II coupled with a Hewlett-Packard 5989 B mass-spectrometer. Identities of compounds were established by use of on-line Willey275/ NBS75k/ NIST mass spectral data bases and literature MS data.

**Keywords:** *Tanacetum Vulgare* L, terpenoids, essential oils, , gas-cromatography, mass spectrometry

## 1. Introduction

*Tanacetum Vulgare* L (Asteraceae family) is a native from Europe and grows to about 1 meter (3 feet) high and has a smooth stem, dark green ferny leaves, and small, round brilliant yellow flowers borne in clusters. This essential oil (tansy oil) is steam distilled from the flowering herb of *Tanacetum Vulgare* L. The plant is a very common wild growing perennial, probably originating in Central Europe and brought to the United States by the European immigrants. Tansy Oil is a yellowish to orange olive liquid with a warm, almost sharp and spicy, dry and herbaceous odor. The taste is very sharp, pungent and bitter. This oil is toxic due to the high content of thujone. It should not be used in flavors or any food preparations. Tansy oil is high in thujone, a poison that can cause convulsions, vomiting and uterine bleeding. Death is normally the result of respiratory arrest and organ degeneration. Fresh leaves of *Tanacetum Vulgare* L yields between 0.12% and 0.18% volatile oil which is extremely variable in its chemical composition, depending upon the specific source plants utilized. Indeed, scientists indicate that a number of chemical races of tansy exist which perpetuate their own distinctive composition of the oil, just as other plants breed true for flower color or a similar more noticeable characteristic. It is generally agreed that the physiological actions attributed to the plant mainly come from the thujone content of the essential oil. But some tansy oils are entirely free of  $\beta$ -thujone and others contain much than 95% of that compound. This composition is determined by the genetic makeup of the plant and is not appreciably influenced by environmental factors. Thus the effect of any tansy oil preparation will be dependent on the chemical race represented, since this determines the  $\beta$ -thujone content of the essential oil. Without subjecting a specific

plant sample to an analysis for thujone, it is impossible to estimate the proper dosage for a tansy preparation. The compositions of the tansy oil were revised in [1]. Twenty-three chemotypes were determined according to the first dominant constituent. The main component of the essential oils in eight country (Argentina, Belgium, Canada, Germany, Holland, Hungary, Finland and Italy) was  $\beta$ -thujone (thujone chemotype) while camphor chemotype were collected in seven country (Belgium, Germany, Holland, Hungary, Kazakhstan and USA). Others chemotypes are: 1,8-cineol and artemisia ketone (Holland, Finland and Hungary), *trans*-crysanthenyl acetate (Belgium, Finland, Holland, Hungary and Italy), bornyl acetate (Finland, Hungary and USA). The sixteen chemotypes are differentiated by the main components such as: sabinene, thujyl alcohol, unbellulone, thujyl acetate,  $\alpha$ -pinene, chrysanthenone, chrysanthenone, oxide, isopinocampone, borneol,  $\gamma$ -terpinene, piperitone, *trans*-dihydrocarvone, lyratol, lyratyl acetate, davanone and germacrene D. In Lithuania was identified fifth myrtenol chemotype. In literature are not available the chemical composition of the essential oil of *Tanacetum Vulgare* L from Perú.

## 2. Experimental

**Plant material-** Aerial parts of *Tanacetum vulgare* L were collected in March 2004 from Aparaya, provincia de Aymaraes-Apurimac at an altitude of 2900 m.

**Essential oil isolation-** Fresh leaves were hydrodistilled in a Clevenger type apparatus for 68 min and the percentage of the essential oil was found to be 0.9 % (v/w).

### GC-FID Analyses

GC analyses were carried out with a Hewlett-Packard 6890 gas-chromatograph equipped with a flame ionization detector. The sample was analyzed on two fused silica capillary columns with bonded phases of different polarity. The semi-polar system comprised a HP-5 fused silica capillary column (30m x 0.25 mm i.d., film thickness 0.25  $\mu$ m). The temperature program was: 50°C (2 min) // ramp 2°C/min // 180°C // ramp 20°C/min // 250°C (2 min). The polar system included a HP-Wax fused silica capillary column (60m x 0.25 mm i.d., film thickness 0.25  $\mu$ m). The temperature program was: 50 °C (2 min) // ramp 2°C/min // 250°C (2 min). The identity of the components was assigned by comparison of their RIs, relative to C9-C23 n-alkanes, with those of authentic standards available in our own laboratory or with GC data previously published [1-3].

### GC-MS Analyses

GC-MS analyses also were performed on a Hewlett-Packard 5890 series II gas-chromatograph coupled with a

Hewlett-Packard 5989 B mass-spectrometer. The gas-chromatograph is equipped with a HP-5MS fused silica capillary column (30m x 0.25 mm i.d., film thickness 0.25  $\mu$ m). The temperature program was: 50 °C (2 min) // ramp 2°C/min // 180°C // ramp 20 °C/min // 250°C (2 min). Helium was used as carrier gas and the flow rate was 1 mL/min. Identities of compounds were established by use of on-line Wiley275/ NBS75k/ NIST mass spectral data bases and literature MS data [4, 5].

## 3. Results and discussion

The chemical composition of the essential oil of *Tanacetum Vulgare* L from Perú, together with the chemical composition reported in others papers [1-3] from different countries is presented in Table 1. The comparison of the essential oil composition of *Tanacetum vulgare* L is only orientative owing to the different conditions of harvest and extraction.

TABLE 1. The chemical composition of the essential oil of *Tanacetum Vulgare* L [1-3]

Country/Compound [%]	Canada	India	Finnland	Poland	Hungary	Japan	USA	Argentina	Belgia	Perú	Lituania
1	2	3	4	5	6	7	8	9	10	11	12
Tricyclene			0.20				0.20			0.01	tr.
$\alpha$ -Thujene	0.20						0.80			0.10	tr.
$\alpha$ -Pinene	0.50		0.1-1.00	0.70		4.80				0.19	5.5
Camphene	0.60		3.4-14	1.00	20.30-30.60		1.60			0.03	1.50
$\beta$ -Pinene	0.10		0.20-0.60		23.80	5.60				0.10	2.20
Sabinene	1.50		0.1-36.5			1.00		0.97			1.70
$\alpha$ -Phelandrene	0.10										
$\Delta$ -3-carene	Tr.						0.20				
$\alpha$ -Terpinene	0.20		0.10-2.1				0.30				0.50
Limonene	0.20		0.60-1.3				3.50				
<b>Eucaliptol (1,8-cineol)</b>	<b>0.70</b>	<b>11.80</b>	<b>1.90-3.6</b>	<b>2.50</b>	<b>14.60-42.20</b>	<b>9.10</b>	<b>1.80</b>	<b>0.83</b>	<b>0.50</b>	<b>0.90</b>	
$\gamma$ -Terpinene	0.30		0.1-4.30		33.30		0.40	0.25		0.12	0.90
<b>Artemisia ketone</b>	<b>23.50</b>				<b>15.7-82.</b>						
<i>p</i> -Cymene	0.80		0.1-0.90			1.00	1.70	0.32		0.80	
Terpinolene	tr.		0.1-0.80								0.10
$\alpha$ -Thujone	1.00		0.2-0.50				1.20	0.76	1.40	0.60	
<b><math>\beta</math>-Thujone</b>	<b>49.50</b>	<b>28.10</b>	<b>0.1-81.2</b>	<b>72.50</b>	<b>29.3-94.</b>		<b>4.80</b>	<b>91.65</b>	<b>97.90</b>	<b>87.83</b>	
<b>Camphor</b>	<b>6.10</b>	<b>10.00</b>	<b>0.30-64.</b>	<b>8.50</b>	<b>42.20</b>		<b>1.70</b>			<b>0.60</b>	<b>16.20</b>
Pinocarvone			0.40					0.15			
Neo-mnhol	0.10										
Menthol	0.20										
<b>Bornyl acetate</b>			<b>3.50</b>	<b>0.50</b>	<b>41.20</b>		<b>73.50</b>			<b>0.20</b>	
Terpinen-4-ol	0.70		0.6-6.60					0.39		0.10	2.40
<b>Myrtenol</b>											<b>24.90</b>
$\beta$ -Caryophyllene	0.30		0.5-0.70			0.50	4.50			0.32	
<b>Thujyl alcohol</b>	<b>0.40</b>	<b>8.70</b>	<b>0.40</b>		<b>63.90-84.00</b>						
<b>Borneol</b>	<b>1.00</b>		<b>1.80</b>	<b>0.50</b>	<b>23.6-54.0</b>		<b>0.20</b>			<b>0.41</b>	<b>1.80</b>
Carvone	6.60		1.30							0.15	
<b>Umbellulone</b>					<b>22.5-81.</b>						
<b>Piperitone</b>					<b>23.1-64.</b>						
$\alpha$ -Copaene	0.10										0.30
$\beta$ -Burbonene	0.10										
$\beta$ -Copaene	0.10										
1	2	3	4	5	6	7	8	9	10	11	12
Germacrene D	1.50					8.60		0.55		0.20	tr.
$\delta$ -cadinene	tr.										
Vulgarone A						7.60					
Vulgarone B						11.90					2.00

The essential oil of *Tanacetum vulgare* L have been the subject of several studies and the results show high differences regarding to the concentration of the most important component,  $\beta$ -thujone.

The essential oil of *Tanacetum vulgare* L from Perú is characterized by a high amount of  $\beta$ -thujone (87.83%) and this plant belongs to the thujone chemotype. By comparison with the literature data it can be observe that the concentration of  $\beta$ -thujone in tansy oil from Peru is very high, this making others components allmost unsemnificative. Regarding to the others components of the essential oil of *Tanacetum vulgare* L, in different countries, the differences appear due to the place of grow and in the same time these can be due too to the others reasons.

The high concentration in  $\beta$ -thujone, makes the tansy oil from Peru very valuable.

#### 4. Conclusions

Our study presents the composition of the essential oil of the *Tanacetum vulgare* L from Perú. The essential oil is characterized by a high amount of  $\beta$ -thujone (87.83%) and this plant belongs to the thujone chemotype, others components allmost there are not semnificative. The chemical composition of the essential oil of the *Tanacetum vulgare* L from Perú was compare with the chemical

composition of the essential oils of *Tanacetum Vulgare* L reported in others papers.

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