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# Accumulation of terpene compounds in valerian (*Valeriana officinalis* L.)



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## Introduction



cultivated plants  
(landrace 'Lubelski')



wild-growing plants

## Introduction



Harvest of roots  
(Autumn, 1.5 year old plants)

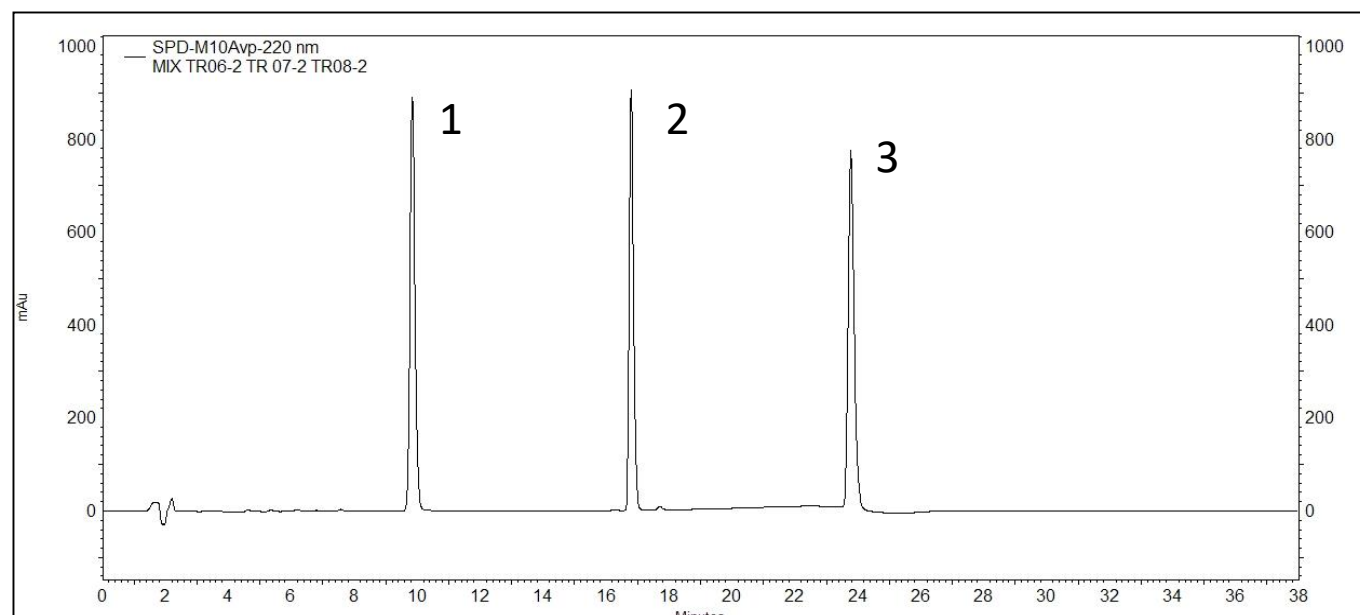


## Introduction

European Pharmacopoeia (monograph 04/2017: 0453)

**Raw material:** underground organs  
(rhizome with roots)

- sesquiterpenic acids (not less than 0.17%)
- essential oil (not less than 4mL/kg DW)



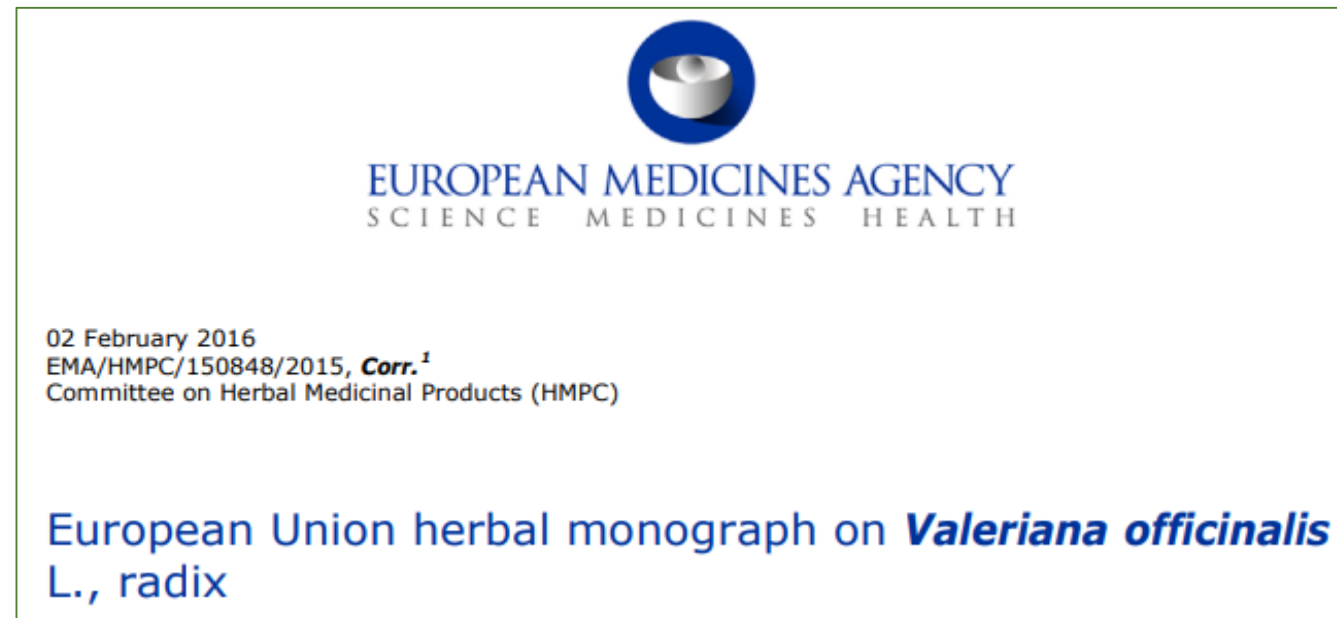
HPLC-DAD (EP IX)

1. Hydroxyvalerenic acid
2. Acetoxyvalerenic acid
3. Valerenic acid

Essential oil (EP IX)




## Introduction



**Well-established use:** dry extracts (DER 3-7.4:1);  
extraction solvent: ethanol 40-70% (V/V)

**Additional use:** herbal preparations (e.g. powdered raw material,  
juice, dry extract, liquid extract, tincture)

# Introduction

  
EUROPEAN MEDICINES AGENCY  
SCIENCE MEDICINES HEALTH

02 February 2016  
EMA/HMPC/150848/2015, *Corr.*<sup>1</sup>  
Committee on Herbal Medicinal Products (HMPC)

European Union herbal monograph on *Valeriana officinalis*  
L., radix



## 4.1. Therapeutic indications

Well-established use	Traditional use
Herbal medicinal product for the relief of mild nervous tension and sleep disorders.	Traditional herbal medicinal product for relief of mild symptoms of mental stress and to aid sleep.  The product is a traditional herbal medicinal product for use in the specified indication exclusively based upon long-standing use.

## The aim

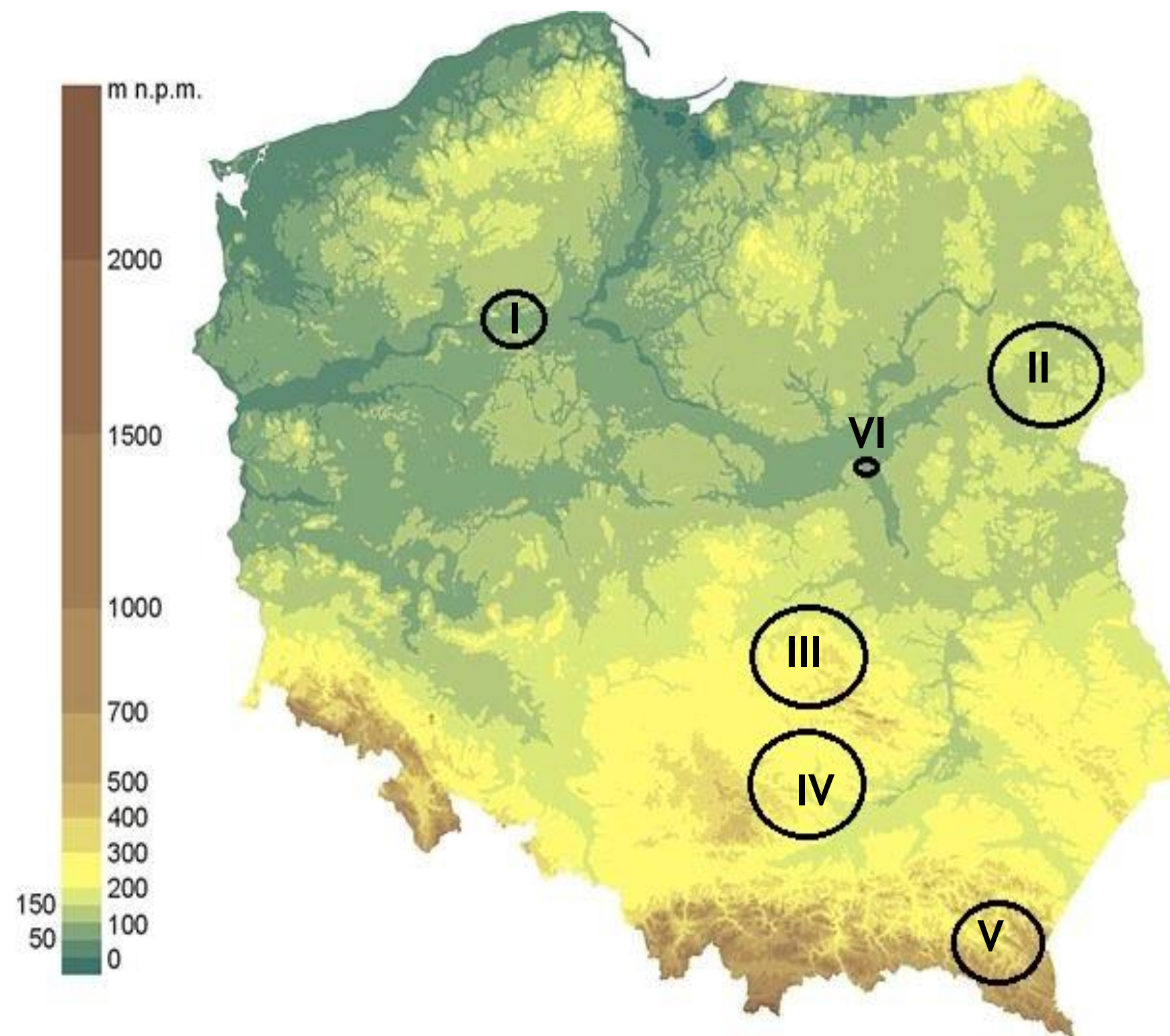
**to assess the factors influencing the accumulation of terpene compounds in valerian (*Valeriana officinalis* L.)**



**Funding:** This work was financed by Polish Ministry of Agriculture and Rural Development  
Project title: Genetic and developmental aspects of yielding and quality of valerian raw materials (Task no. 32)



## Accumulation of terpene compounds among wild-growing populations



Geographical region (origin)	
I	Noteć River Valley
II	Mazovian Lowland
III	Kielce Upland
IV	Nida Basin
V	Bieszczady Mountains
VI	'Lubelski' landrace

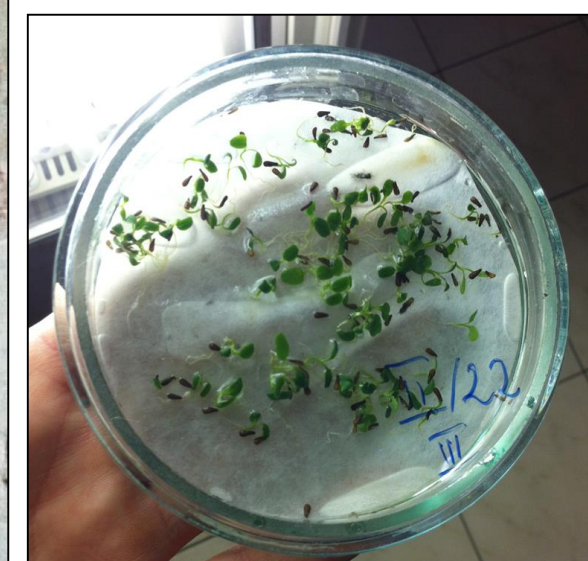
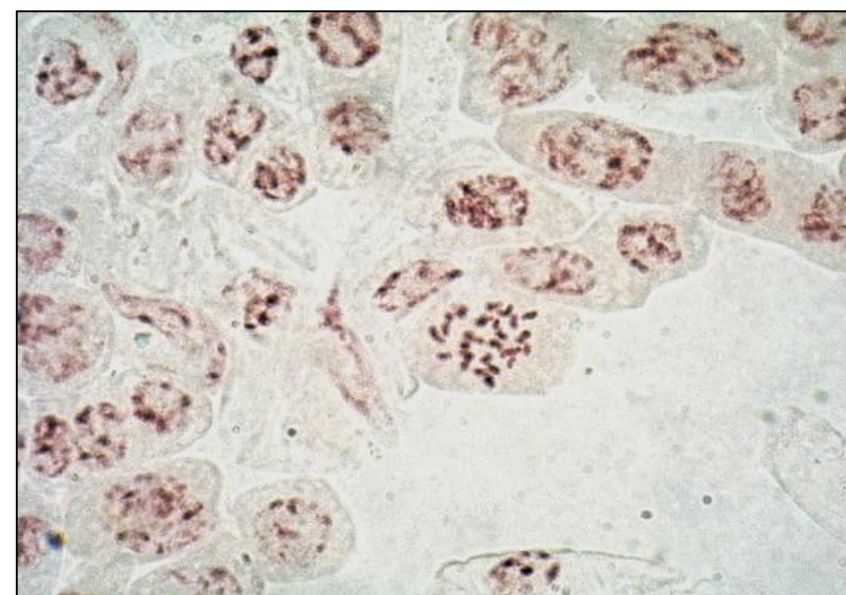


Accumulation of terpene compounds among wild-growing populations

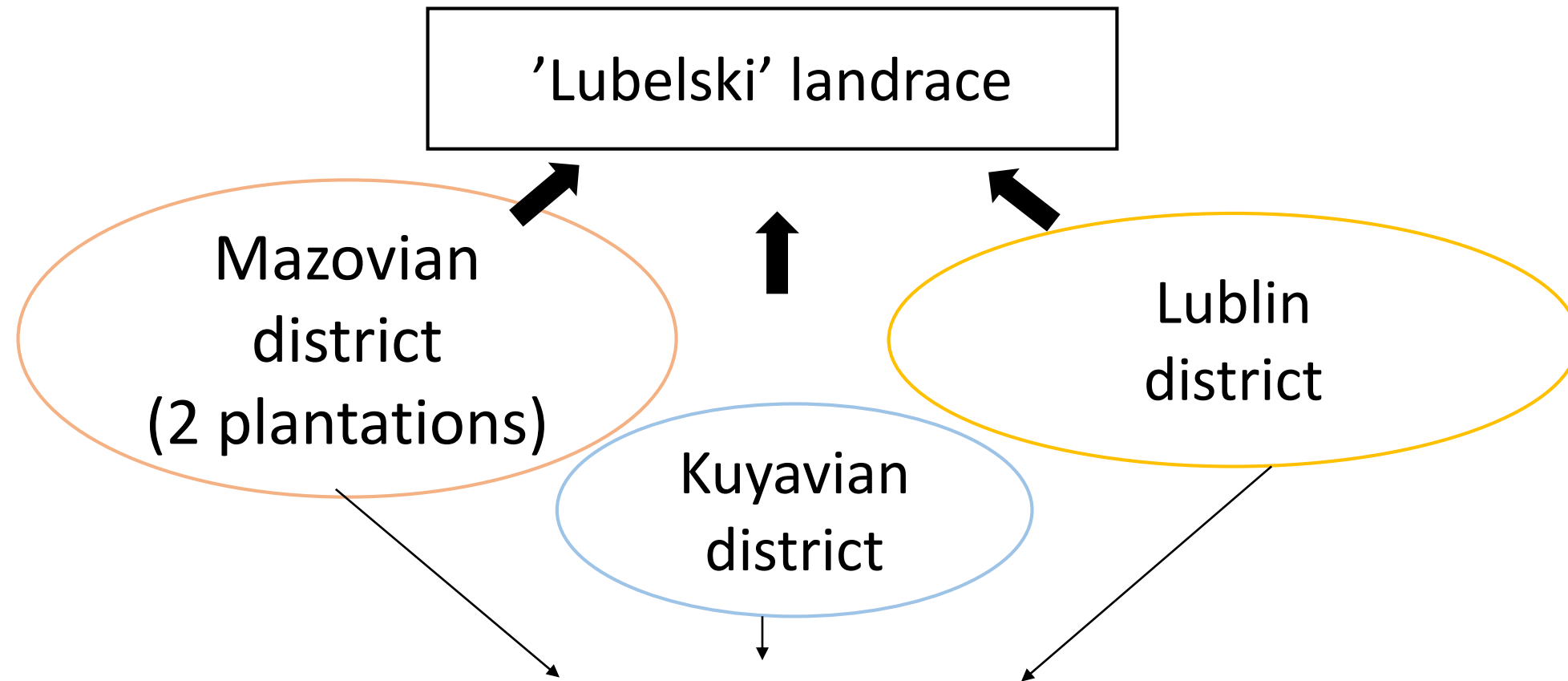


## Accumulation of terpene compounds among wild-growing populations

Origin	Fresh mass of roots (g x plant)	Sesquiterpenic acids (%)	Essential oil (mL/kg DW)	Ploidy level
I	107.4	0.007	9.0	2n=2x=14
II	190.8	0.010	9.4	2n=2x=14
III	112.0	0.012	6.0	2n=2x=14
IV	186.6	0.004	5.4	2n=2x=14
V	161.1	0.006	6.7	2n=2x=14
'Lubelski' landrace	<b>375.0</b>	<b>0.175</b>	<b>4.3</b>	<b>2n=4x=28</b>



# Accumulation of terpene compounds among forms of landrace 'Lubelski'



**Accumulation of terpene compounds among forms of landrace 'Lubelski'**

Origin	Dry mass of roots (g x plant)	Sesquiterpenic acids (%)	Essential oil (mL/kg DW)	Ploidy level
L1*	76.4	0.28	4.5	2n=4x=28
L2	81.7	0.40	4.7	2n=4x=28
L3	90.7	0.30	3.9	2n=4x=28
L4	48.7	0.31	4.4	2n=4x=28
<b>mean L1-L4</b>	<b>74.4</b>	<b>0.32</b>	<b>4.4</b>	<b>2n=4x=28</b>
<b>mean W-G pop</b>	<b>22.6</b>	<b>0.01</b>	<b>7.6</b>	<b>2n=2x=14</b>

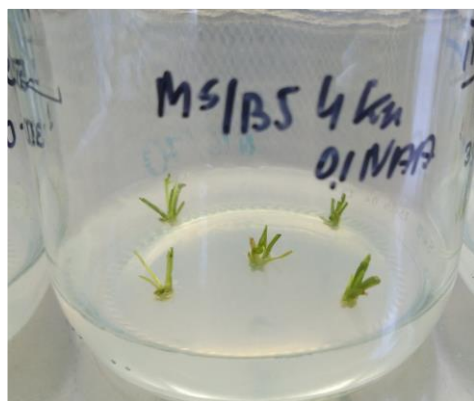
\* L - 'Lubelski' landrace forms originating from 4 plantations



**Accumulation of terpene compounds among clones of landrace 'Lubelski'**

Clones/ 'Lubelski' landrace	Fresh mass of roots (g x plant) *	Sesquiterpenic acids (%)	Essential oil (mL/kg DW)	Ploidy level
I 42/2	266.0	0.56	6.8	2n=4x=28
III 16/1	109,7	0.55	5.8	2n=4x=28
III 16/5	127,8	0.43	5.0	2n=4x=28
<b>'Lubelski'</b>	<b>120.2</b>	<b>0.24</b>	<b>4.4</b>	<b>2n=4x=28</b>

\*filed experiment established: June 2023; term of harvest: October 2023



## Influence of plant age on accumulation of terpene compounds

Terms of seed sowing (plant age)	Number of flowering shoots per plant*	Dry mass of roots (g x plant)**	Sesquiterpenic acids (%)	Essential oil (mL/kg DW)
March 2022 (19 months)	15.3	90.7	0.32	4.4
May 2022 (17 months)	13.6	93.0	0.36	5.1
July 2022 (15 months)	1.3	122.3	0.40	6.0

\* Flowering shoots appeared in 2023, cut off during summer

\*\* Term of harvest - October 2023



## Influence of harvest term on accumulation of terpene compounds

Terms of harvest (plant age)	Dry mass of roots (g x plant)*	Sesquiterpenic acids (%)	Essential oil (mL/kg DW)
September 2022 (6 months)	57.6	0.38	4.1
November 2022 (8 months)	93.3	0.52	4.0
January 2023 (11 months)	71.5	0.40	4.6

\*term of seed sowing: march 2022; filed experiment established: May/June 2022; term of harvest: 2022/2023



**Accumulation of terpene compounds in underground organs (raw material)**



Rhizome



Thick root



Thin root





## Accumulation of terpene compounds in underground organs (raw material)

Raw materials	Dry mass (g x plant)*	Sesquiterpenic acids (%)	Essential oil (mL/kg DW)
rhizome	26.0	0.51	3.6
thick roots	38.3	0.57	4.4
thin roots	29.0	0.49	3.9

\*term of seed sowing: march 2022; filed experiment established: May/ June 2022; term of harvest: November 2022

Raw materials	dominants identified in EOs (GC/MS)				
	bornyl acetate	valerenal	valeric acid	isospathulenol	humulene
rhizome	24.6	12.4	4.7	4.0	3.4
thick roots	23.7	15.2	5.4	4.8	3.1
thin roots	16.8	17.8	5.7	5.0	3.0



## Conclusions

The mass of underground organs and the content of terpene compounds in valerian raw materials is related both with genotype and agricultural practices carried out during cultivation:

- landrace Lubelski, reproduced by the farmers themselves, is highly diversified;
- the landrace is an interesting source of individuals of high content of terpene substances;
- the content of terpenes in valerian raw materials depends on the age of plants (developmental stage), term of harvest and plant organs used as raw materials.

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# Accumulation of terpene compounds in valerian (*Valeriana officinalis* L.)



Thank You



SZKOŁA GŁÓWNA  
GOSPODARSTWA  
WIEJSKIEGO