

Polyphenolic compounds, antibacterial and antioxidant properties of flower and leaf extracts of *Tanacetum vulgare*

Renāte Šukele^{1,2}, Ingus Skadiņš^{1,3}, Inga Sīle^{1,4}, Rudīte Koka¹, Dace Bandere^{1,3}

¹ Riga Stradins university, Latvia; ingus.skadins@rsu.lv, rudite.koka@rsu.lv, dace.bandere@rsu.lv

² Red Cross Medical college of Riga Stradins university, Latvia; renate.sukele@rcmc.lv

³ Baltic Biomaterials Centre of Excellence, Riga Technical University, Latvia

⁴ Latvian Institute of Organic Synthesis, Riga, Latvia; inga.sile@farm.osi.lv

Aim & Background

Tanacetum vulgare or Tansy is aromatic medicinal plant. Its aerial parts are rich in essential oil, polyphenolic compounds and phenolic acids.^{1,2} Aim of this study was to assess antibacterial and antioxidant properties of ethanol and acetone extracts of *T. vulgare* flower (FE) and leaf (LE).

Methods

Aqueous ethanol and aqueous acetone (30%, 50%, 70%) extracts from flowers and leaves of *T. vulgare* growing in Riga district, Latvia were analyzed.

Extracts were macerated in solvent (ratio 1:10) for 80 min, then filtered and solvent removed via rotary vacuum evaporation, finally extracts were freeze dried by lyophilisation (−80°C).

Antibacterial tests performed were agar disc diffusion test, minimum inhibitory concentration (MIC) and minimal bactericidal concentration (MBC).

- Six bovine mastitis clinical isolates (*Escherichia coli* [ID. V-2019-4], *E. coli* [ID. V-2019-252], *Streptococcus agalactiae* [ID. V-2019-171], *Strep. uberis* [ID. V-2019-243], *Serratia liquefaciens* [ID. V-2019-251], and *Staphylococcus aureus* [ID. V-2019-256]) were obtained from the Latvia University of Life Sciences and Technology, Research Laboratory of Biotechnology.
- The two reference strains, *S. aureus* (ATCC 25923) and *E. coli* (ATCC 25922), were provided by Riga Stradins University, Biology and Microbiology Faculty.

Antiradical activity was measured using the DPPH assay, total phenolic content (TPC) was tested using the Folin-Ciocalteu method and total flavonoid content (TFC) was determined using the AlCl₃ colorimetric method.

Data were tabulated using Microsoft® Excel® 2019 MSO (16.0.10382.20010) 32-bit. and analyzed using The IBM® SPSS® Statistics Software (Version 27.0; IBM Corp©, Armonk, NY, USA). Simple descriptive statistics (one-way analysis of variance and the Mann–Whitney–Watt test) were used to investigate the significance of differences between samples. Spearman's correlation analysis was also used. In all cases, significance was set at $p < 0.05$.

Conclusions

Our study showed that *T. vulgare* aqueous acetone and aqueous ethanol extracts of both flower and leaves have potential antibacterial and antioxidant properties.

REFERENCES

1. Ivănescu, B., Tuchiluş, C., Corciovă, A., Lungu, C., Mihai, C. T., Gheldiu, A. M., & Vlase, L. Antioxidant, antimicrobial and cytotoxic activity of *Tanacetum vulgare*, *Tanacetum corymbosum* and *Tanacetum macrophyllum* extracts. *Farmacia*, 2018, 66(2), 282-288.
2. Muresan, M., Benedec, D., Vlase, L., Oprean, R., Toiu, A., & Oniga, I. Screening of polyphenolic compounds, antioxidant and antimicrobial properties of *Tanacetum vulgare* from Transylvania. *Studia Universitatis Babeş-Bolyai. Chemia*, 2015, 60(1), 127-138.

Acknowledgements:

This project has received funding from „ĀRSTNIECĪBAS AUGU EKSTRAKTU SATUROŠA PRETPARAZITĀRĀ FITOLĪDZEKĻA IZSTRĀDE” 18-00-A01620-000028

PROJEKTU ATBALSTA ZEMKOPIBAS
MINISTRIJA UN LAUKU ATBALSTA DIENESTS



Results

All inhibition zones were measured in mm, and zones lower than 7mm were considered ineffective. FE of tansy extracted by 30% ethanol and 30% acetone extracts had no antibacterial properties. The 70% FE had the broadest spectrum, covering all tested bacteria, except *Strep. uberis* and *Serratia liquefaciens*.

The 70% ethanol and 70% acetone of LE had effects against all bacteria, except *E. coli* strains. Since there was no statistically significant difference ($p > 0.05$) between both extracts, for further testing ethanol extract was chosen as it is safer. Both extracts inhibited *S. aureus* strains better than other types of bacteria, which corresponds with other studies on *T. vulgare*.

1. Table. Antibacterial activity of *T. vulgare* 70% ethanol extracts

Bacteria type tested	Tansy flower		Tansy leaf	
	MIC, mg/ml	MBC, mg/ml	MIC, mg/ml	MBC, mg/ml
<i>E.coli</i> ATCC	53.9	53.9	-	-
<i>E. Coli</i> V252	53.9	107.8	-	-
<i>E.Coli</i> V4	53.9	107.8	-	-
<i>S.aureus</i> ATCC	3.4	6.8	7.8	15.7
<i>S.aureus</i> V256	3.4	3.4	15.73	125.9
<i>Strep. agalactiae</i> V171	53.9	53.9	31.48	62.95
<i>Strep.uberis</i> V243	-	-	62.95	125.9
<i>Serratia liquefaciens</i> V251	-	-	125.9	125.9

Tansy Leaf acetone extract contained more polyphenols and flavonoids, and had the best antioxidant activity.

There is relation between polyphenol and flavonoid content and antioxidant activity, more polyphenols extract contained stronger was the antioxidant activity.

2. Table. Antioxidant activity of *T. vulgare* 50% ethanol and 50% acetone extracts and total polyphenol and flavonoid content.

Plant Sample	TPC (mg GAE/g lyophilized extract wt), ±SD	TFC (mg QE/g lyophilized extract wt), ±SD	IC ₅₀ value of DPPH radical scavenging activity (µg/ml), ±SD
Ascorbic acid	-	-	43.92 ± 1.15
Tansy flower ethanol	154.11 ± 7.95	25.12 ± 2.53	193.64 ± 1.10
Tansy flower acetone	155.38 ± 3.17	29.69 ± 0.02	181.97 ± 1.07
Tansy leaf ethanol	158.48 ± 15.57	46.15 ± 0.29	185.35 ± 1.12
Tansy leaf acetone	225.99 ± 3.69	52.75 ± 2.37	146.55 ± 1.05

TPC: total phenolic content; TFC: total flavonoid content; GAE: gallic acid equivalents; QE: quercetin equivalents; wt: weight; DPPH: DPPH free radical