Spatio-Ecological Factors Affecting Pyrethrin Content in Natural Populations of Dalmatian Pyrethrum

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1. Introduction

Dalmatian pyrethrum (*Tanacetum cinerariifolium* /Trevir./Sch. Bip.)

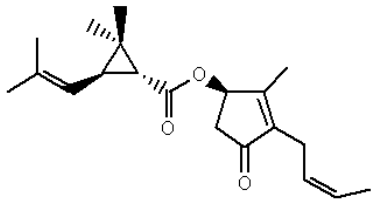
- plant species from Asteraceae family
- naturally distributed along the eastern Adriatic coastline
- extremely degraded habitats with shallow rocky soils (dry grasslands and garrigue)
- endemic and strictly protected plant species in Croatia

1. Introduction

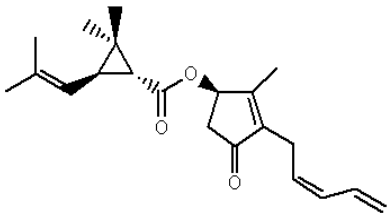
Pyrethrin(s)

- natural insecticide
- pyrethrin I and II are the most active
- affecting the nervous system of insects causing *knock-down* effect and death

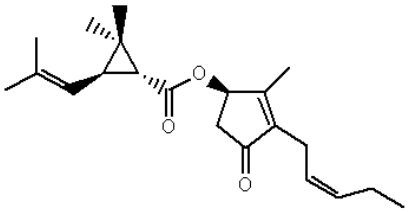
PYRETHRINS I



Cinerin I

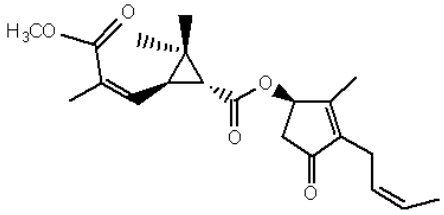


Pyrethrin I

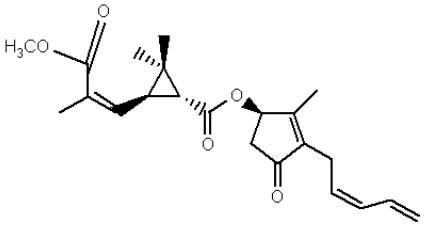


Jasmolin I

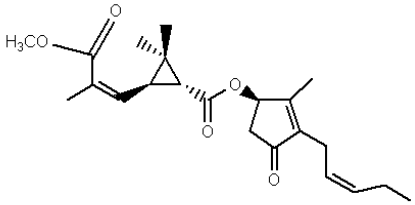
PYRETHRINS II



Cinerin II



Pyrethrin II



Jasmolin II

1. Introduction

History of cultivation

- long history of cultivation and use of Dalmatian pyrethrum and its products in households and agricultural systems in Dalmatia (since 1850)
- rapid decrease in production from 1930
- today leading producers are Tanzania, Rwanda, Papua New Guinea and Kenya (2017)

1. Introduction

Objectives

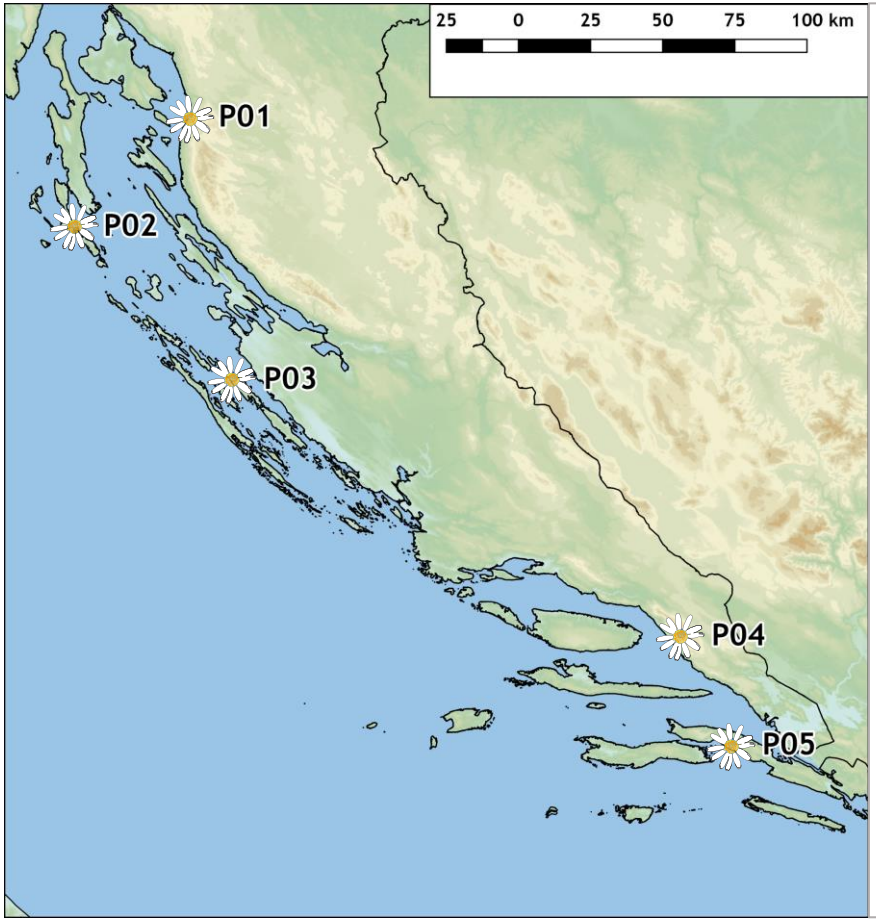
(1) Application of recently optimized matrix-solid phase extraction method (MSPD) on samples of natural Dalmatian pyrethrum populations

(2) Evaluation of biochemical diversity of natural Dalmatian pyrethrum populations

(3) Examination of possible connection between spatio-ecological variables and biochemical diversity

2. Materials and Methods

Seed sampling and field trial

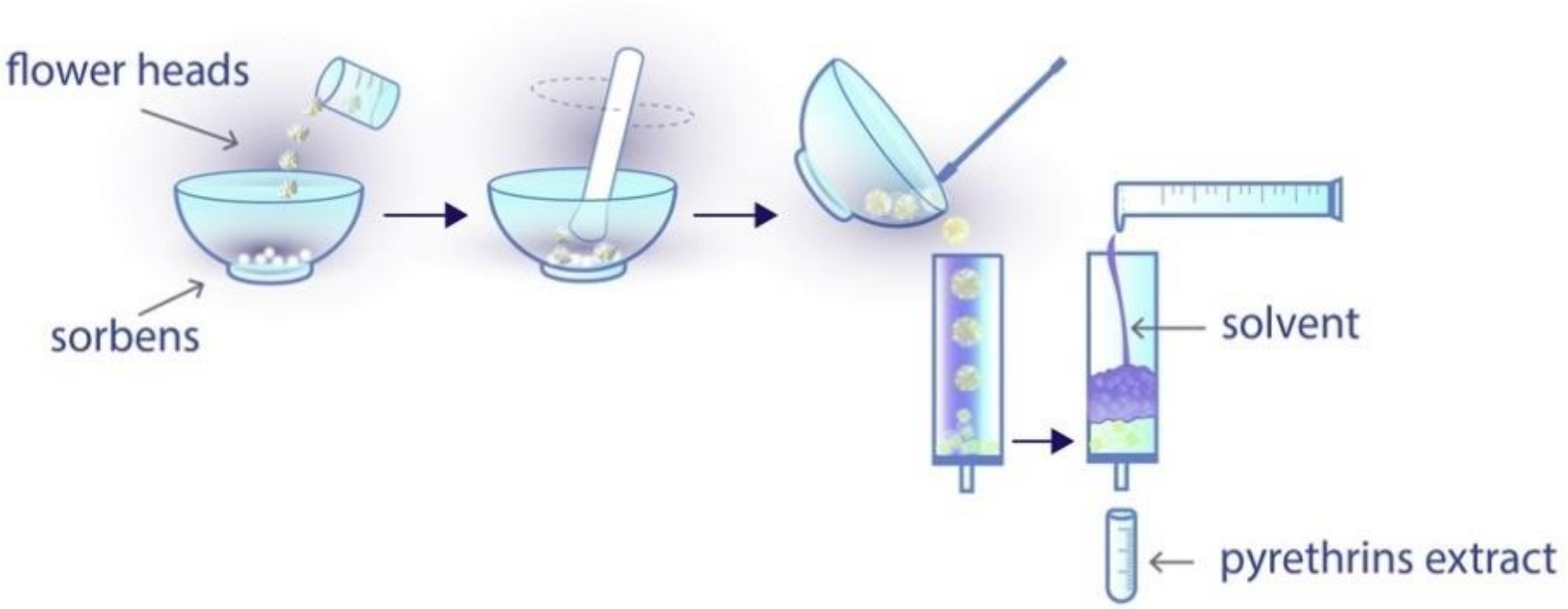


- 5 populations sampled:
  - P01 – Senj
  - P02 – Mali Lošinj
  - P03 – Ugljan
  - P04 – Mt Biokovo
  - P05 – Pelješac
- field trial of 20 plants per population (100 samples in total)
- voucher specimens stored in ZAGR herbarium collection

2. Materials and Methods

Biochemical analysis

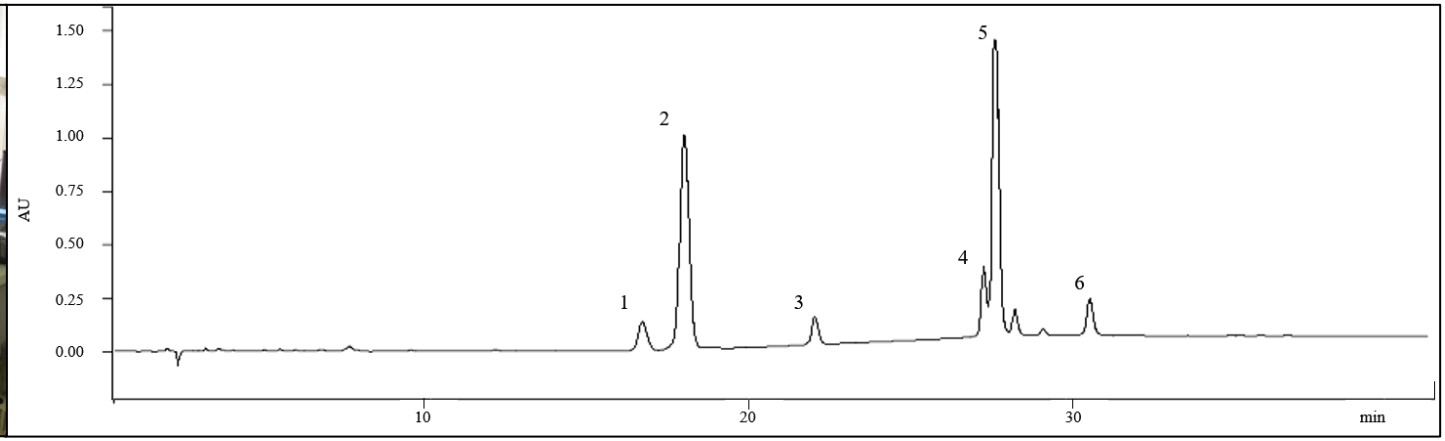
(1) Extraction of pyrethrins from flower samples using MSPD



2. Materials and Methods

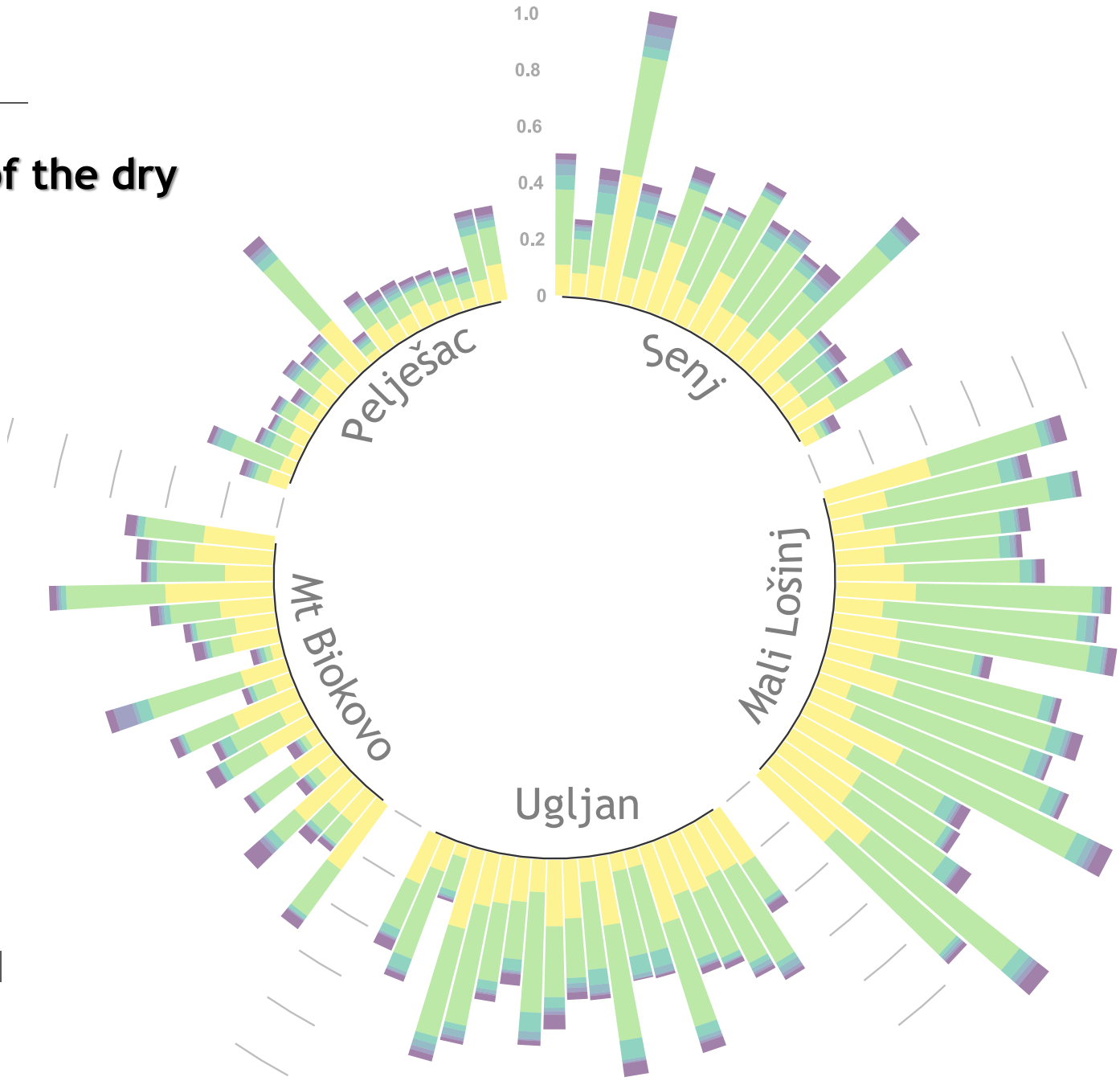
Biochemical analysis

(2) Determination and quantification of 6 extracted pyrethrin components (HPLC-DAD)



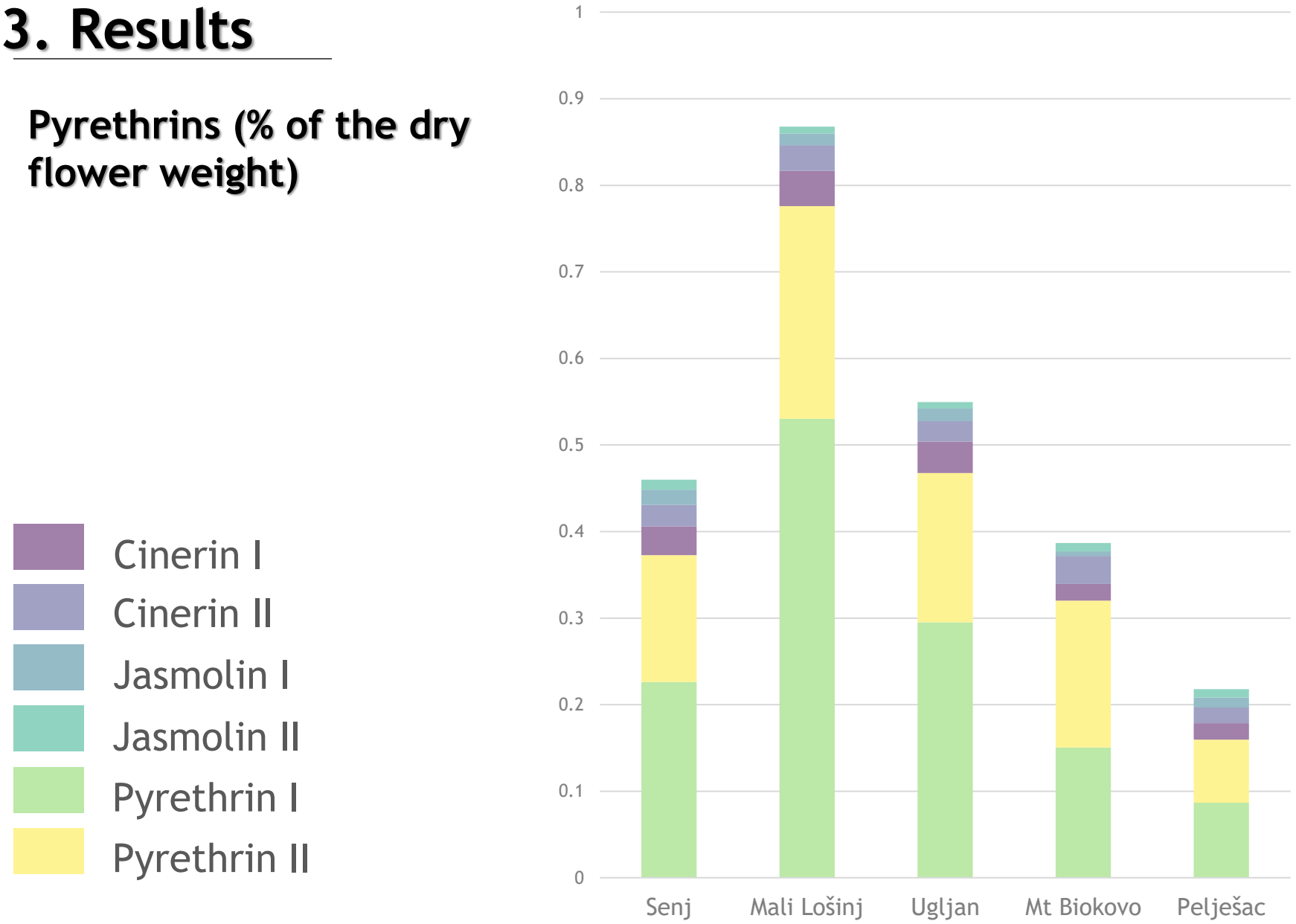
3. Results

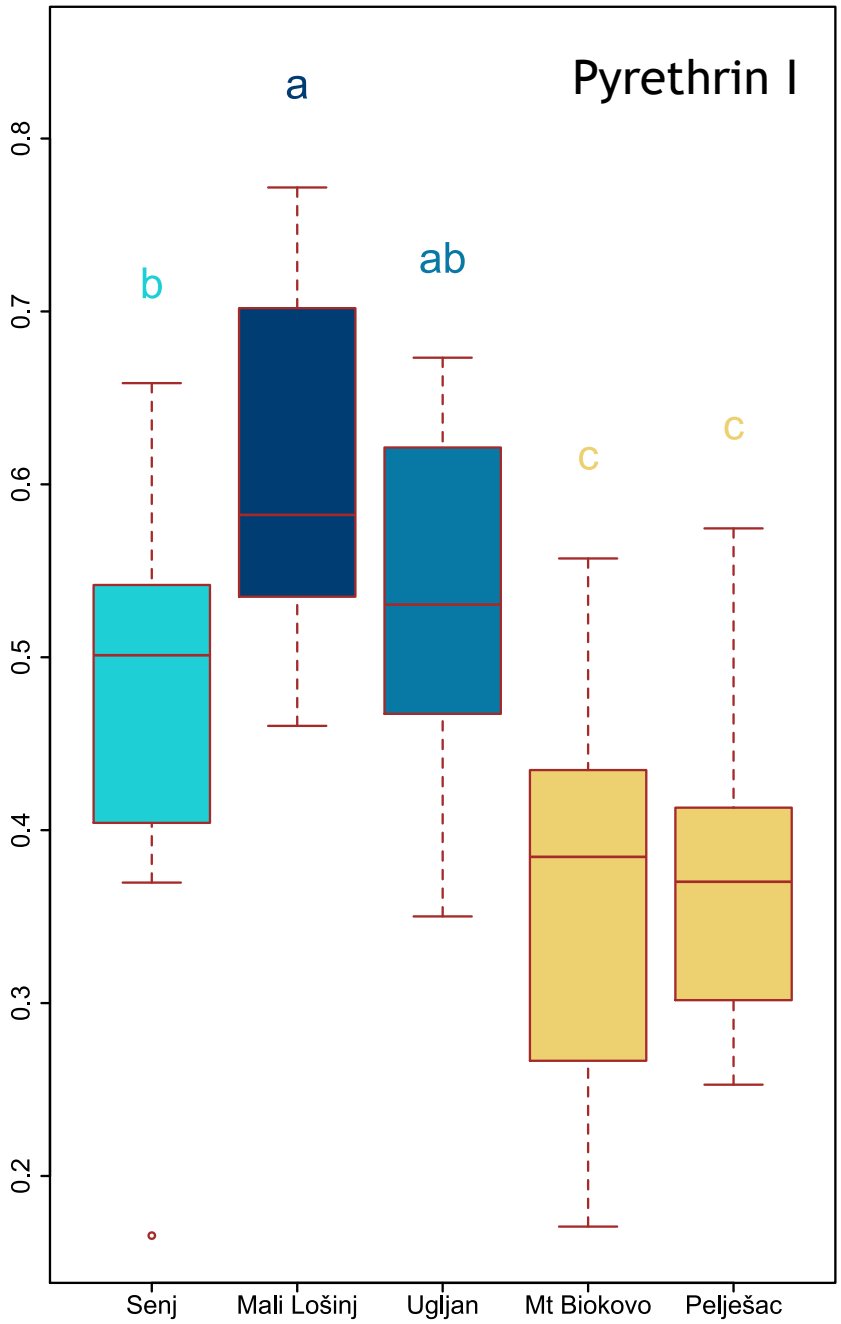
Pyrethrins (% of the dry flower weight)

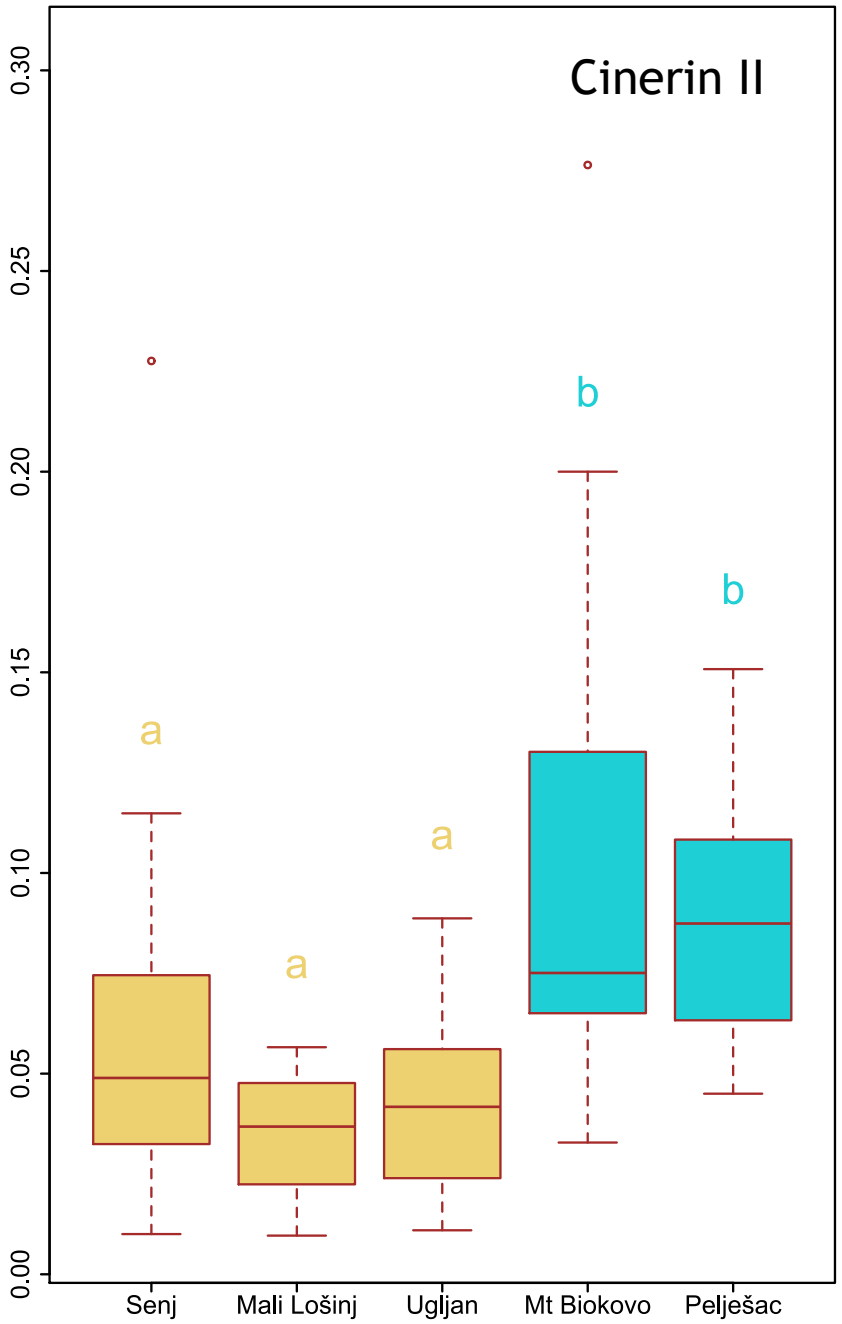


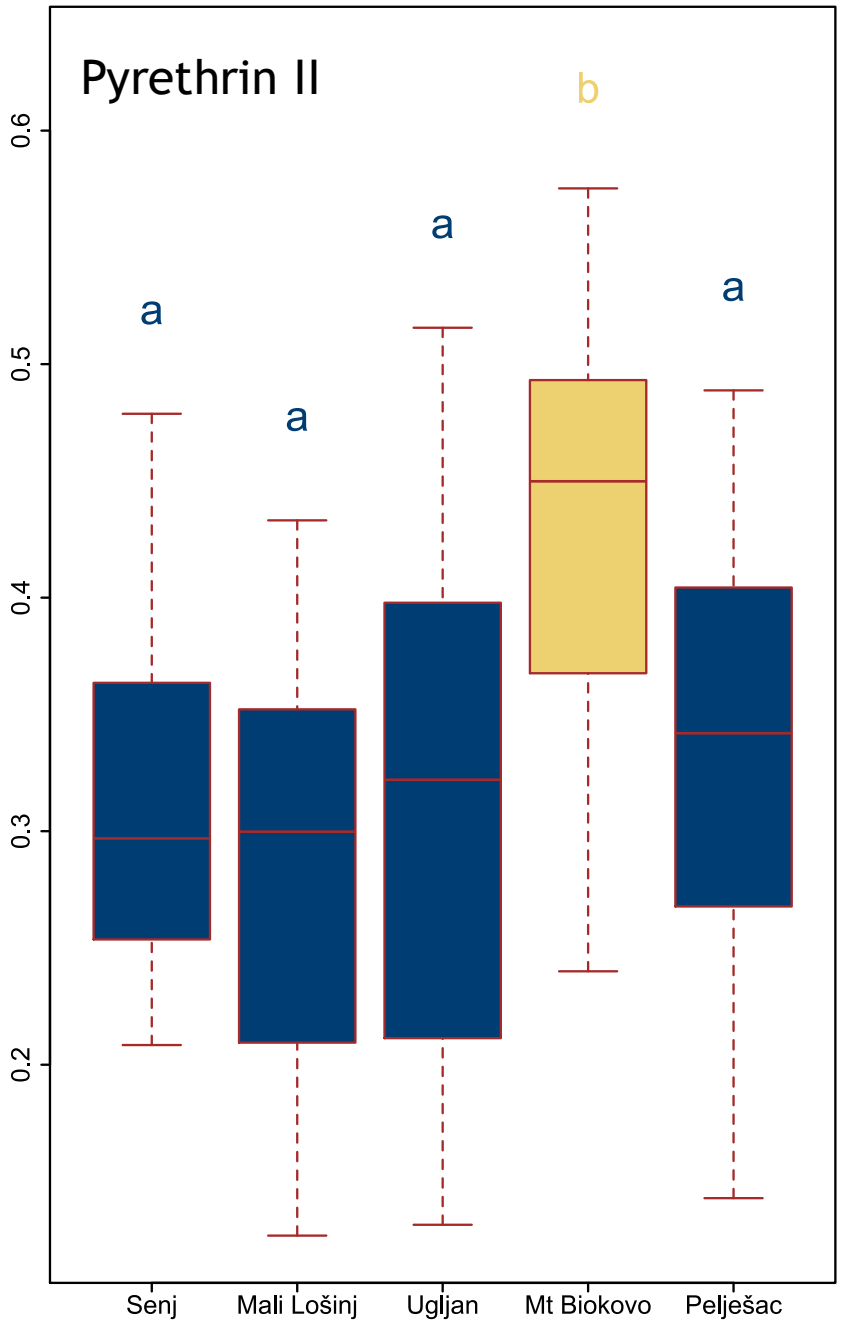
3. Results

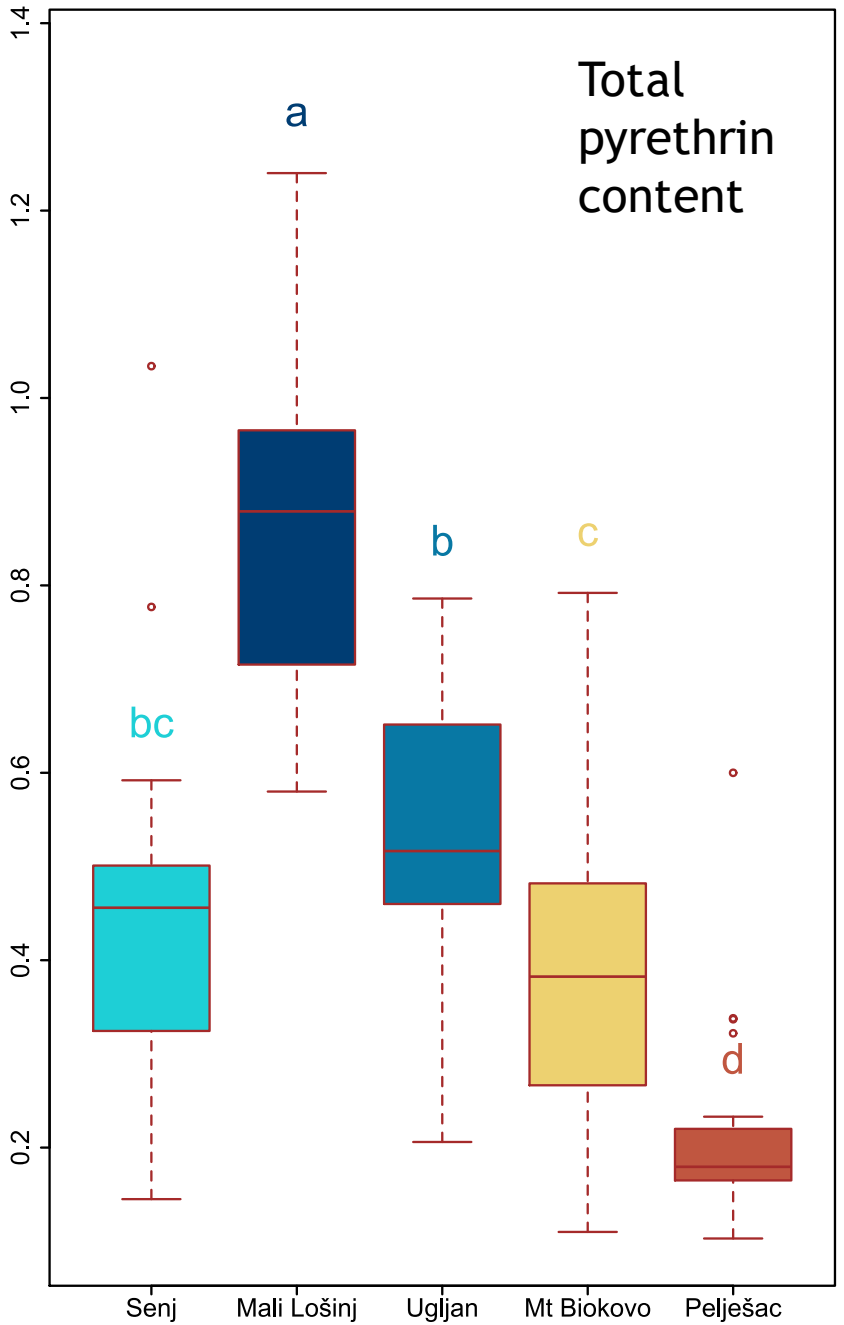
Pyrethrins (% of the dry flower weight)




Pyrethrin I
a
b
ab
c
c
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Senj
Mali Lošinj
Ugljan
Mt Biokovo
Pelješac

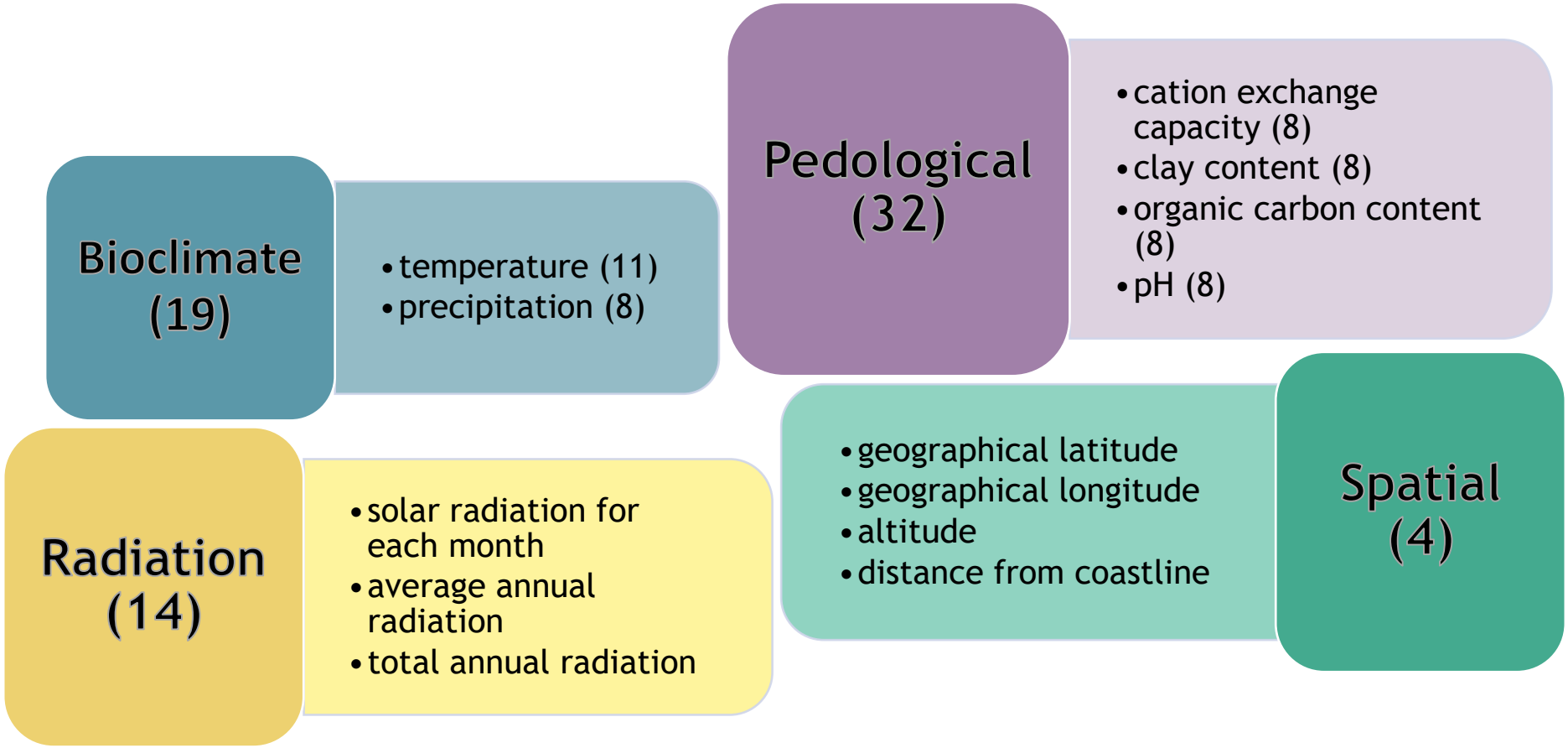

Cinerin II
a
a
a
b
b
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Senj
Mali Lošinj
Ugljan
Mt Biokovo
Pelješac


Pyrethrin II
0.2
0.3
0.4
0.5
0.6
a
a
a
b
a
Senj
Mali Lošinj
Ugljan
Mt Biokovo
Pelješac


Total pyrethrin content
0.2
0.4
0.6
0.8
1.0
1.2
1.4
bc
a
b
c
d
Senj
Mali Lošinj
Ugljan
Mt Biokovo
Pelješac

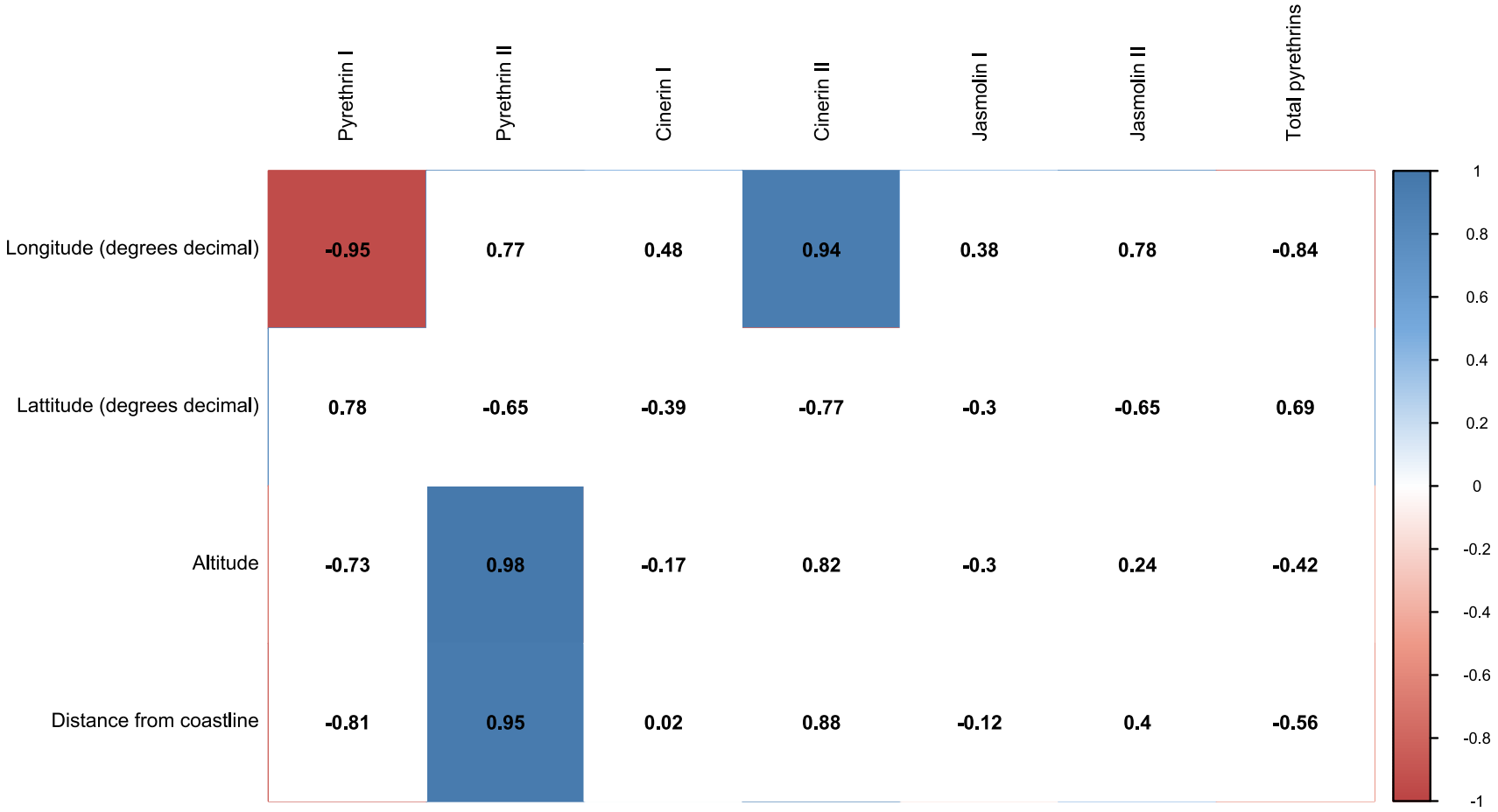
3. Results

Correlation of pyrethrins and spatio-ecological variables (69)



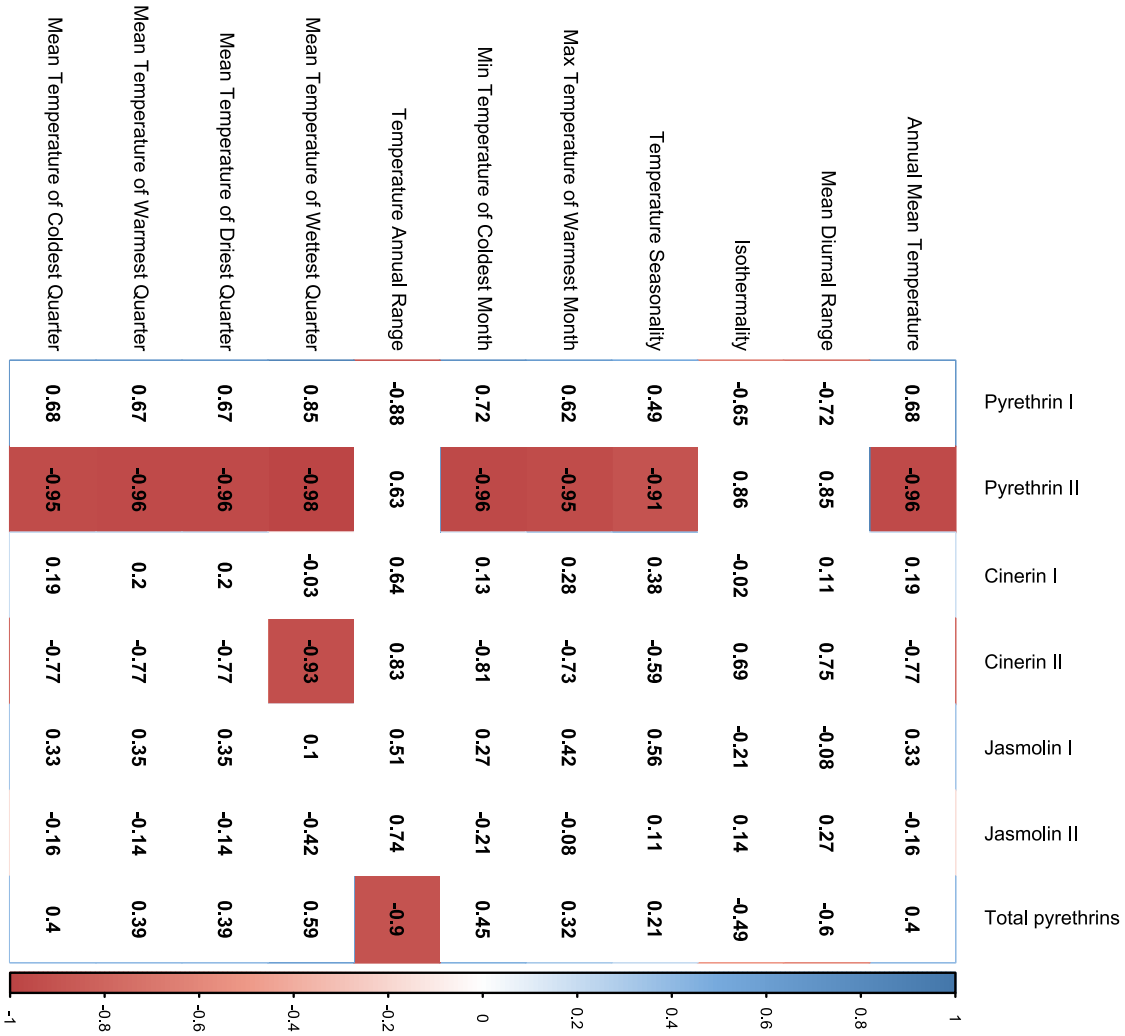
3. Results

Correlation of pyrethrins and spatial variables



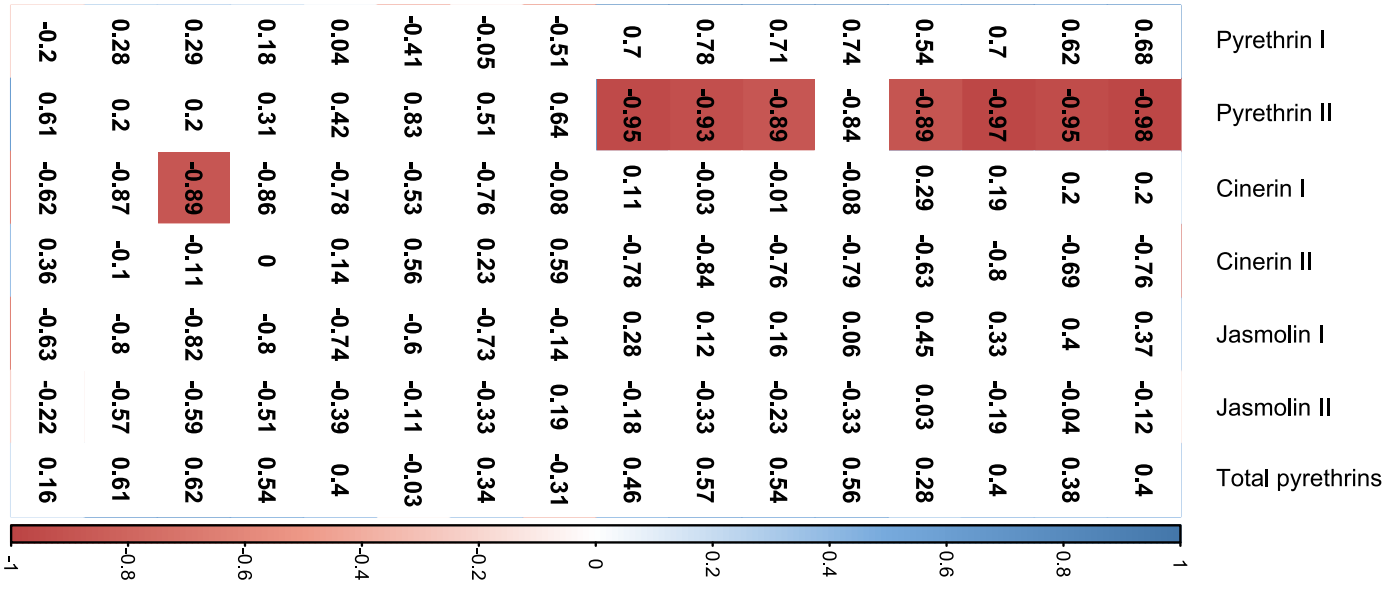
3. Results

Correlation of pyrethrins and bioclimate variables



3. Results

Correlation of pyrethrins and pedological variables



4. Prospects and future research

(1) Expanding the number of populations

(2) Multivariate analyses

(3) Connection to data obtained by molecular markers

(4) Background for future breeding and agricultural exploitation od Dalmatian pyrethrum in Croatia

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Thank you for your attention