

IDENTIFICATION OF WEED SPECIES PRESENT IN LAVENDER CROPS (*LAVANDULA ANGUSTIFOLIA* L.) AND (*MENTHA PIPERITA* L.) FROM THE UASVM CLUJ-NAPOCA CAMPUS

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Abstract. The objectives of the paper are to identify the weed species in organic culture of *Mentha piperita* L. And *Lavandula angustifolia* L. founded in the UASVM Cluj-Napoca campus, both in terms of composition and the dominance of some species, but also the development of measures to reduce their negative effects, given that application of herbicides is excluded.

Key words: the inventory, ecological indicators, weeds, medicinal herbs

Introduction

In our country, mint was among the first cultivated aromatic and medicinal plants. The first experimental mint culture was made by Pater Bella in 1908 in Cluj, on an area of 88 m² (E. Păun, 1988, according to B. Pater, 1914). It is cultivated for leaves (*Menthae folium*) or aerial part (*Menthae herba*), fresh or dry, containing volatile oil, for use in the pharmaceutical, cosmetic, food, industries, etc.

The lavender has been cultivated for a long time, in our country, as an ornamental and aromatic plant, in the last years the plant's culture has expanded a lot, valuating in a good manner, the steep, calcareous, sunny slopes. The lavender volatile oil (*Aetheroleum lavandulae*) has a powerful flavor, used in perfumery and cosmetics, but also has medicinal uses.

The objectives of the paper are to identify the weed species in organic culture of *Mentha piperita* L. and *Lavandula angustifolia* L. founded in the UASVM Cluj-Napoca campus, both in terms of composition

and the dominance of some species, but also the development of measures to reduce their negative effects, given that application of herbicides is excluded.

Material and method

The *Mentha piperita* and *Lavandula angustifolia* cultures were founded in the Agro-botanical Garden located within the UASVM Cluj-Napoca campus, in 2016. Rooted cuttings were used for planting, and planting was done in spring for lavender culture and during September-October for peppermint culture.

In mint culture planting was done in gutters, at a distance of 100 cm between the rows and 25 cm between the plants by rows.

In lavender culture, the cutting plantation was made at distance of 100 cm between rows, and 50 cm by row, 20,000 cuttings/ha, being used.

Since 2017, the crops have grown appropriately and the land has been kept clean by removing the weeds, using 2 to 3 hoeings, on an area of approximately 2000 m². The soil in the Agro-botanical Garden has a loamy-clayey, eubasic texture with a low humus content (1.35%), low alkali pH (6.72), very well supplied with nitrogen (0.461%), very well supplied with potassium (312 ppm) and well supplied with phosphorus (68 ppm), according to data provided by OSPA Cluj.

Concerning the climatic conditions of 2018, April and May were hot and overly dry (deviation -40.22 mm in May), and June was excessively rainy (deviation +84.37 mm versus mean). July was warm and drought-free (-20.24 mm).

In 2018, prior to crops' harvesting (July), the species of weeds present in the crop were identified. Identification of the weeds was done using the numerical quantitative method, by determining the species and their number on 1 m² plots. Weed species were determined on 10 plots for each crop, repeated at equal distances on the plots' diagonal of the 2000 m² experimental area.

After the determination of the weed species, the numerical estimation, the percentage of representation, the floristic and geographical elements, as well as their main ecological indices were established.

Results and discussions

In the peppermint culture, a large number of weeds were found, scattered throughout the plot, without dominating the cultivated plants. Numerically, between 5 - 40 weeds by plot were recorded, the overall weed occurrence in the mint culture frames in the category of reduced to the average, from the point of view of weed frequency on the area. The compositional diversity of weeds is remarkable, but no dominant species have been observed in culture, to compete interspecifically with other weeds or peppermint culture. There were no weed species-problem.

From the agronomic point of view, out of the 28 species identified in the mint culture, 14 are annual or perennial weed species common to the arable land in the area, and the other are ruderal or meadow species developed due to the long time interval, when the field was uncultivated before the mint culture was installed.

The high percentage of biennial/perennial species may cause problems in the coming years by increasing frequency if they are not effectively controlled annually, so they are eradicated and not disturbing the culture.

From the compositional point of view, 28 species were identified, which belong to 15 botanical families, and Asteraceae family clearly predominates. As far as the ratio between the two classes is concerned, the *Magnoliatae* (dicotyledonous) species dominate, with monocotyledonous species being present at a rate of 19.2% (Table 1).

Table 1. The list of the species identified in peppermint culture

	Scientific denomination	Family	%	Bio-shapes/ Geographical elements	Ecological indices		
					U	T	R
1	<i>Amaranthus retroflexus</i>	<i>Amarantaceae</i>	6.4	Th, Adv.	3	3	0
2	<i>Daucus carota</i>	<i>Apiaceae</i>	12.9	TH.H, Eua (Med)	2	4	0
3	<i>Torilis arvensis</i>	<i>Apiaceae</i>	2.5	Th, Euc-Med	2.5	3	4
4	<i>Cirsium arvense</i>	<i>Asteraceae</i>	8.0	G, Eua	2.5	3	0
5	<i>Senecio vulgaris</i>	<i>Asteraceae</i>	2.1	Th, Eua	3	3	0
6	<i>Lactuca serriola</i>	<i>Asteraceae</i>	1.7	TH,Eua	1.5	4	4
7	<i>Sonchus oleraceus</i>	<i>Asteraceae</i>	4.6	Th,Cosm	3	0	0
8	<i>Cichorium</i>	<i>Asteraceae</i>	10.	H, Eua	3	0	3

	<i>intybus</i>		1				
9	<i>Picris hieracioides</i>	<i>Asteraceae</i>	0.8	TH. H, Eua	1.5	3	4
10	<i>Arctium tomentosum</i>	<i>Asteraceae</i>	0.4	TH, Eua	3	0	5
11	<i>Symphytum officinale</i>	<i>Boraginaceae</i>	3.4	H, Eua	4	3	0
12	<i>Lycopsis arvensis</i>	<i>Boraginaceae</i>	0.4	Th-TH, Eur	3	3	3
13	<i>Silene alba</i>	<i>Caryophyllaceae</i>	1.2	Th-TH, Eua	3.5	3	2
14	<i>Silene vulgaris</i>	<i>Caryophyllaceae</i>	0.4	H. (Ch.) Eua	3	3	4
15	<i>Chenopodium album</i>	<i>Chenopodiaceae</i>	3.0	Th, Cosm	3	3	0
16	<i>Chenopodium hybridum</i>	<i>Chenopodiaceae</i>	2.1	Th Eua (Med)	3	3	0
17	<i>Convolvulus arvensis</i>	<i>Convolvulaceae</i>	5.1	G, Cosm	2.5	3.5	3.5
18	<i>Vicia sepium</i>	<i>Fabaceae</i>	0.4	H, Eua	3	3	3
19	<i>Lathyrus pratensis</i>	<i>Fabaceae</i>	3.3	H, Eua	3	0	4
20	<i>Mentha longifolia</i>	<i>Lamiaceae</i>	1.7	H, Eua	4.5	3	4
21	<i>Setaria pumila</i>	<i>Poaceae</i>	12.1	Th.Cosm	2.5	4	0
22	<i>Setaria viridis</i>	<i>Poaceae</i>	2.1	Th.Cosm	2	3.5	0
23	<i>Echinochloa crus-galli</i>	<i>Poaceae</i>	5.6	Th.Cosm	4	0	3
24	<i>Fallopia convolvulus</i>	<i>Polygonaceae</i>	1.7	Th, Circ	2.5	3	3
25	<i>Anagalis arvensis</i>	<i>Primulaceae</i>	0.8	Th. Circ	2	3	4
26	<i>Rubus caesius</i>	<i>Rosaceae</i>	2.1	H-N, Eur	4.5	3	4
27	<i>Gallium mollugo</i>	<i>Rubiaceae</i>	0.8	H, Eua	3	2.5	3
28	<i>Linaria vulgaris</i>	<i>Schrophullariaceae</i>	4.3	H, Eua	2	3	3

From the analysis of the bioforms, it was found that 46.42% of the weed species identified in the mint culture are annual theorofites, and 14.28% are biennial theophyll species. 28.57% of the hemicritophyte species and two geophysical species have been identified (*Cirsium arvense* și *Convolvulus arvensis*).

We mention that, in the previous years, on the current field, the systematic sector of the Agro-botanical Garden (2 years) was installed, and

the weeds were vigorously combated. The annual and biannual weeds, with a much higher release and resistance capacity as seed reserves in the soil, have been installed and expanded rapidly after the establishment of the mint culture. Perennial species (hemicriptophytes and geophytes) are harder to install under the conditions described above, but they are present in a worrying percentage, especially because the mint extends through the stolons, and their combating becomes difficult (Fig.1).

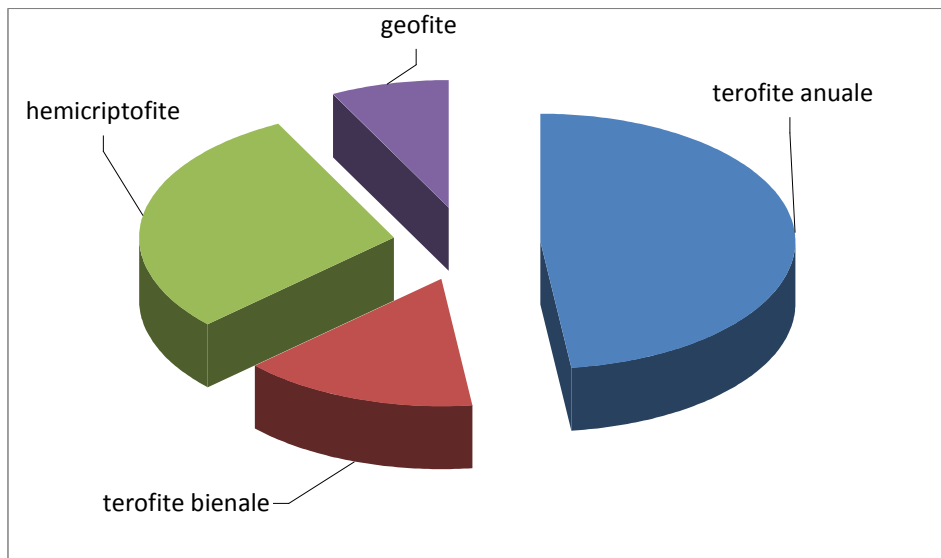


Fig. 1. The bioforms of species identified in peppermint culture

Analyzing the phytogeographical spectrum, it was found that the Eurasian element is predominantly represented by 53.57%. Only one European - Central species has been identified (*Torilis arvensis*), two European species (*Lycopsis arvensis* și *Rubus caesius*) and one adventive species (*Amaranthus retroflexus*). The presence of two circumpolar species is found (*Anagalis arvensis* and *Fallopia convolvulus*). The cosmopolitan species represents 21.42% of the total number of weeds present in the crop (Fig. 2).

We observe the prevalence of broad-leaved weed species on the continent of Europe and Asia and a small number of weeds with a narrower spreading area. This may be due to the usual static conditions for the temperate Eurasian climate. There is only one adventive species remarkable, surprising enough for a freshly installed weed community.

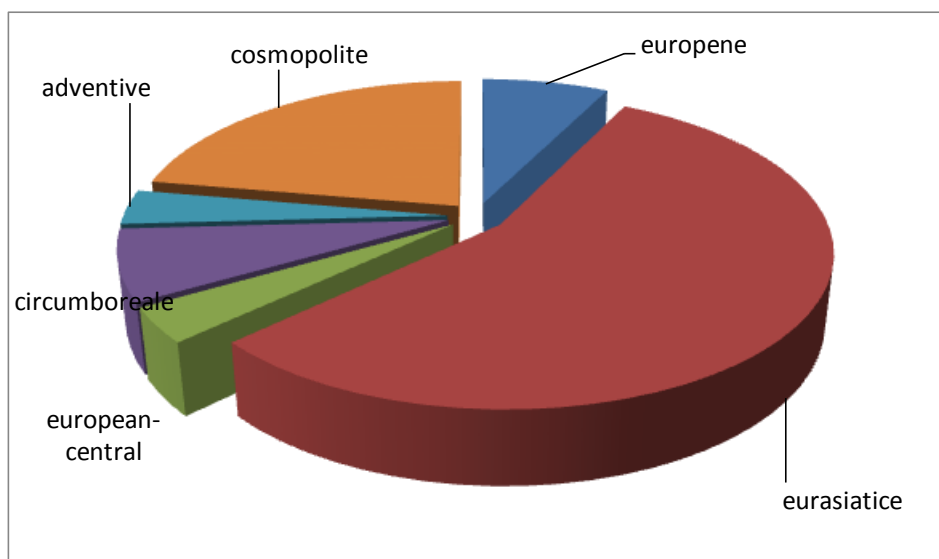


Fig. 2. The phyto-geographical spectrum of weed species

From the analyse of the temperature indices (Fig. 3), the clear dominance of the mesothermal species (67.85%). A single microthermal species (*Gallium mollugo*) species. The euriterms species are represented by 17.85% and moderately thermophilic 10.71% (*Daucus carota*, *Lactuca serriola*, *Setaria pumila*).

The present species reflects the temperate hill area with moderate temperature.

The ecological structure is dominated by mesophytes (50%), along with xeromezophytes (28.57%) and mezohydrophytes (14.28%). Two xerophyte species have been identified (*Lactuca serriola* și *Picris hieracioides*).

The dominance of mesophilic and xeromezophilic species, as well as the presence of a high percentage of mezo-hygrophilic species, reflects the fact that water supply was sufficient (watering was done during periods of drought).

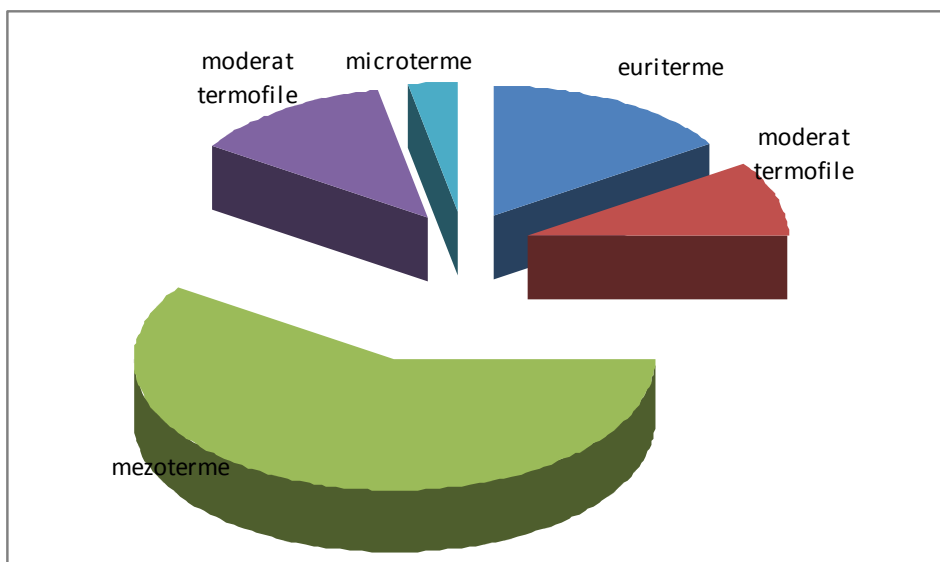


Fig. 3. The temperature indices

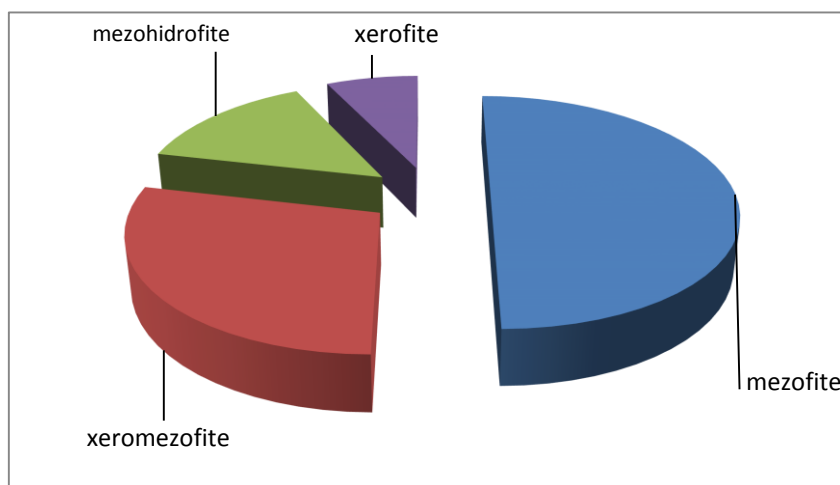


Fig. 4. The humidity indices

Concerning soil reaction, the highest percents were recorded in procentele cele mai mari s-au înregistrat la amphithelial species (35.71%), acido-neutrophils (28.57%) and weak acid-neutrophils (28.57%). An

acidophilic species was recorded (*Silene alba*) and a neutro-basal species (*Arctium tomentosum*).

The installed species clearly show a soil with a neutral pH, weak acid, even though the chemical analysis shows alkalinity tendencies (Fig. 5).

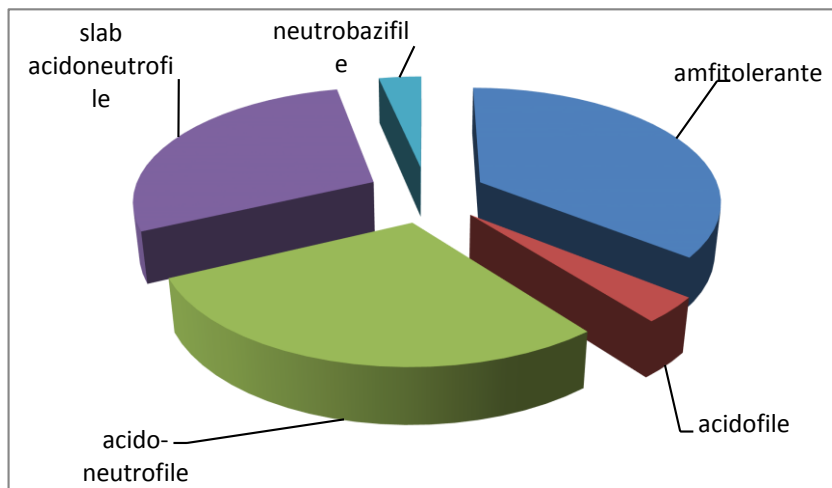


Fig. 5. The indices concerning the soil reaction

In *Lavandula angustifolia* species, due to the vigorous growth of the plants, we can observe isolated species of weeds, numerically being recorded 3 - 20 plants/m².

From the point of view of the mean frequency of weeds by surface unit, it can be stated that in the lavender culture the weeding degree is low, but with a very wide diversity of the identified species.

Under compositional aspect, a number 34 species is recorded, predominating the species belonging to the family *Asteraceae*, *Fabaceae* and *Poaceae*. The weeds belonging to the class *Liliatae* represents 19.6%, predominating the species of the class *Magnoliatae* (Table 2).

Table 2. The list of the species identified in lavender culture

	Scientific denomination	Family	%	Bio-shapes/ Geographical elements	Ecological indices		
					U	T	R
1	<i>Amaranthus retroflexus</i>	<i>Amarantaceae</i>	4.8	Th, Adv	3	3	0
2	<i>Daucus carota</i>	<i>Apiaceae</i>	3.2	TH.H, Eua	2	4	0
3	<i>Sonchus arvensis</i>	<i>Asteraceae</i>	7.4	G, Eua	3	0	0
4	<i>Sonchus oleraceus</i>	<i>Asteraceae</i>	4.0	Th,Cosm	3	0	0
5	<i>Cirsium arvense</i>	<i>Asteraceae</i>	2.0	G, Eua	2.5	3	0

6	<i>Lactuca serriola</i>	<i>Asteraceae</i>	0.4	TH,Eua	1.5	4	4
7	<i>Cichorium intybus</i>	<i>Asteraceae</i>	0.4	H, Eua	3	0	3
8	<i>Erigeron annuus</i>	<i>Asteraceae</i>	2.4	Th- TH-H, Adv	4	0	4
9	<i>Inula britannica</i>	<i>Asteraceae</i>	1.2	TH, Eua (Med)	3	3	0
10	<i>Helianthus tuberosus</i>	<i>Asteraceae</i>	4.0	G, Am. N	4.5	4	4
11	<i>Artemisia vulgaris</i>	<i>Asteraceae</i>	3.2	H, Circ	2.5	3	4
12	<i>Symphytum officinale</i>	<i>Boraginaceae</i>	1.2	H, Eua	4	3	0
13	<i>Capsella bursa-past</i>	<i>Brassicaceae</i>	1.2	Th-TH, Cosm (Med)	3	0	0
14	<i>Chenopodium album</i>	<i>Chenopodiaceae</i>	1.2	Th, Cosm	3	3	0
15	<i>Calistegia sepium</i>	<i>Convolvulaceae</i>	4.0	G (H), Eua	5	3	4
16	<i>Convolvulus arvensis</i>	<i>Convolvulaceae</i>	4.0	G, Cosm	2.5	3.5	3.5
17	<i>Euphorbia helioscopia</i>	<i>Euphorbiaceae</i>	2.4	Th, Eua- Cosm	3	3	0
18	<i>Vicia villosa</i>	<i>Fabaceae</i>	2.4	Th (TH),Eur	2.5	3.5	2.5
19	<i>Vicia sativa</i>	<i>Fabaceae</i>	0.8	Th, Med	0	3	0
20	<i>Trifolium pretense</i>	<i>Fabaceae</i>	4.0	H-TH,Eua	3	0	0
21	<i>Coronilla varia</i>	<i>Fabaceae</i>	0.4	H, Euc (Med)	2	3	4
22	<i>Vicia pannonica</i>	<i>Fabaceae</i>	5.2	Th, Pont-Med	2.5	3.5	4
23	<i>Melilotus officinalis</i>	<i>Fabaceae</i>	0.4	Th (TH),Eua	2.5	3.5	0
24	<i>Geranium pratense</i>	<i>Geraniaceae</i>	0.4	H, Eua(Cont)	3.5	3	5
25	<i>Hypericum perforat</i>	<i>Hypericaceae</i>	2.0	H, Eua	3	3	0
26	<i>Mentha longifolia</i>	<i>Lamiaceae</i>	4.8	H, Eua	4.5	3	4
27	<i>Setaria pumila</i>	<i>Poaceae</i>	4.0	Th.Cosm.	2.5	4	0
28	<i>Setaria viridis</i>	<i>Poaceae</i>	0.4	Th.Cosm	2	3.5	0
29	<i>Echinochloa crus-g.</i>	<i>Poaceae</i>	14.0	Th.Cosm	4	0	3
30	<i>Agropyron repens</i>	<i>Poaceae</i>	1.2	G, Circ	0	0	0
31	<i>Anagallis arvensis</i>	<i>Primulaceae</i>	4.0	Th. Circ	2	3	4
32	<i>Rubus caesius</i>	<i>Rosaceae</i>	4.0	H-N, Eur	4.5	3	4
33	<i>Potentilla reptans</i>	<i>Rosaceae</i>	3.0	H, Eua	3.5	4	4
34	<i>Linaria vulgaris</i>	<i>Schrophulariaceae</i>	2.0	H, Eua	2	3	3

In lavender culture, biofilms were found to predominate annual (44.1%) and hemicryptophyte (20.93%) terophoretic species. There are few biennial terophyte species (8.82%), represented by *Daucus carota*, *Lactuca serriola*, *Inula britannica*. Geophysical weed species are present at 11.62%

La lavender culture, from the bioform analysis it was found that annual terophyte species are predominant (44.1%), and also the hemicryptophyte species (20.93%). A small number of biennial terophyte species were identified (8.82%), represented by *Daucus carota*, *Lactuca serriola*, *Inula britannica*. The geophyte weed species are present in percent of 11.62%.

A large number of annual weeds are found in this crop, but biennial and perennial species are larger. Some of these may become problematic for lavender if they increase their frequency: *Helianthus tuberosus*, *Cirsium arvense*, *Agropyron repens*, *Sonchus sp.*, *Amaranthus retroflexus*, *Echinochloa crus-galli*, *Setaria sp.* – due to their competitiveness in relation to crop plants or others, due to the difficulties created by the crop by planting, their suffocation and the degradation of flowering shoots: *Rubus caesius*, *Calistegia sepium*, *Convolvulus arvensis*, *Vicia sp.* (Fig. 6).

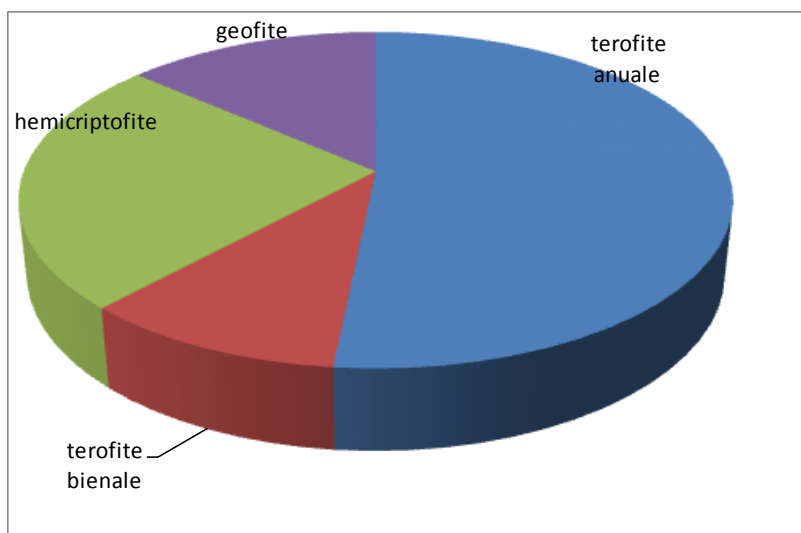


Fig. 6. The bioforms of species identified in lavender culture

The phytogeographical spectrum is as follows: the Eurasian element 50.00%, the European one 5.8% (*Vicia villosa*, *Rubus caesius*), 17.64 % of species are cosmopolitan and 8.8% circumboreal (*Agropyron repens*,

Anagallis arvensis, *Artemisia vulgaris*). A species of North American origin (*Helianthus tuberosus*), a Central European species (*Coronilla varia*), a Pontic-Mediterranean species (*Vicia pannonica*) 8% and one Mediterranean (*Vicia sativa*) have been identified. Two Adventive Species (*Amaranthus retroflexus* and *Erigeron annuus*).

A larger number of cosmopolitan species is observed, the *Helianthus tuberosus* species of North American origin was maintained on the field, the most likely as consequence of cultivation in the systematic sector of the Agro-botanical Garden (Fig.7).

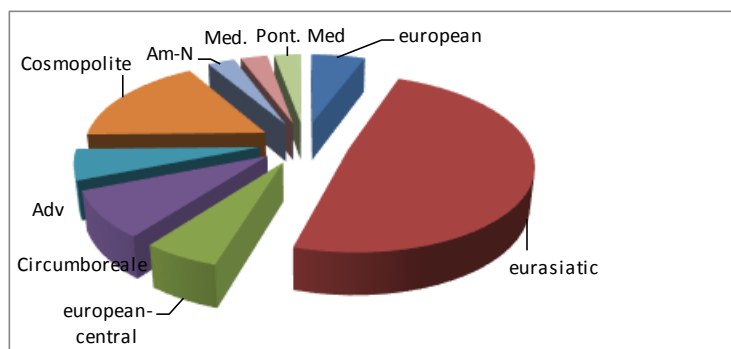


Fig. 7. The phyto-geographical spectrum

In the lavender culture, the mezoterm species predominate (61.76%), followed by the euritherms (23.52%) and the thermophiles (14.70%). No microterms and hechistotherms are recorded. The dominance of mesotherm species reflects the climatic conditions in the Cluj area (Fig.8).

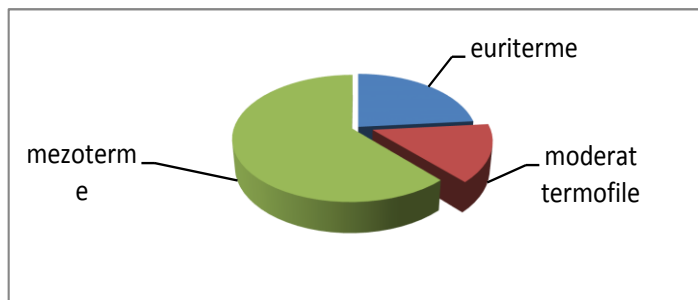


Fig. 8. The temperature indices

In culture predominate mesophilic (38.23%) and xeromezopites species (32.35%), but mezigrophite species also occur (17.64%). A xerophyte species (*Lactuca serriola*), a hydrophite species (*Calistegia*

sepium) and two amphithelial species (*Vicia sativa* and *Agropyron repens*), were identified (Fig. 9).

The lavender culture is located on a dry land, the number of xeromezopite species is quite high. Water stagnation on small surfaces due to rain and irrigation has favored the development of meshigrophytes (17.64%).

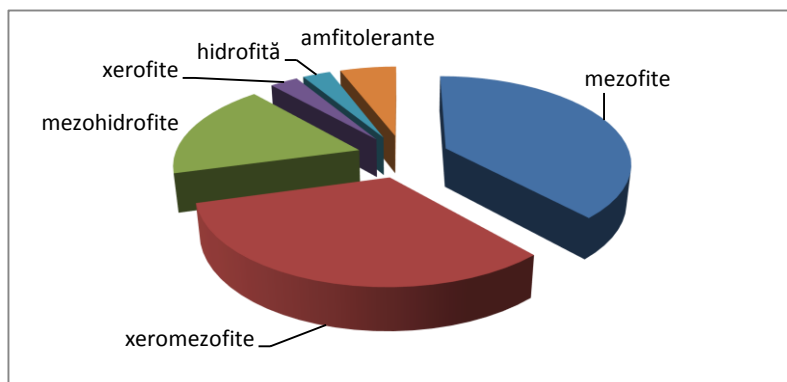


Fig. 9. The humidity indices

Concerning to the soil reaction, 52.94% of the species are amphitolerant, and 32.35% weak acido-neutrophils. 8.8% of the species are acido-neutrophils (*Linaria vulgaris*, *Cichorium intybus*, *Echinochloa crus-galli*), a very acidophilous species (*Vicia villosa*) and a neutrophilic species (*Geranium pratense*). The high percentage of amphitolerant species (over 50%) reduces a more rigorous analysis and characterization of weed species installed under this ecological index (Fig. 10).

Conclusions

The following conclusions can be drawn from the determination of the weed species present in the two crops:

- 28 moth species were identified in mint culture, and 34 species were identified in lavender culture. We can observe the prevalence of broad-leaved species on the continent of Europe and Asia, and fewer species with a more restricted area, largely due to normal stationary conditions

for the temperate Eurasian climate. The species present reflect the

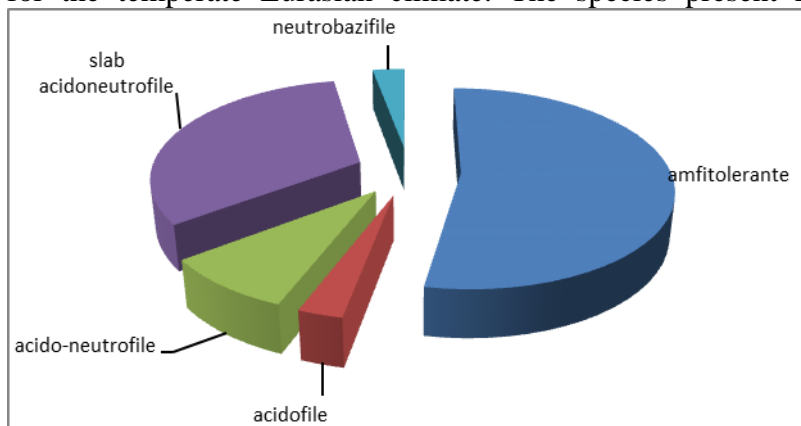


Fig. 10. The indices concerning the soil reaction

- temperate hill area with moderate temperature values, as well as the fact that the water supply of the land was adequate.
- Yearly and biannual weed species, with a much higher dissemination capacity and resistance as seed reserves in the soil, have been installed and expanded rapidly after mint and lavender crops have been established;
- The degree of weed occurrence in the year 2018 in the mint culture is low to medium and in lavender culture- low;

The potential for weed occurrence in both crops for the following years is high due to the large share of perennial and biennial species, but also of annual species with high generative multiplication potential: *Amaranthus retroflexus*, *Echinochloa crus-galli*, *Setaria sp.*, *Erigeron annuus*;

- There are also known weed species with invasive potential: *Helianthus tuberosus*, *Artemisia vulgaris*, *Inula britannica*, *Erigeron annuus*, but also species that we consider potentially invasive on the basis of field observations: *Lactuca serriola*, *Sonchus oleraceus* or *Rubus caesius*;
- Because perennial/biennial weeds, or annual blooming species with high proliferation capacity are predominant, action must be constantly undertaken, for rigorous control. Perennial or biennial weeds must be depleted so that they no longer regenerate and the annual ones must be removed from the crop prior to harvesting and shaking the seeds.

Considering the importance of maintaining clean weed crops, especially during the harvesting period (June-July), the following recommendations are made:

- On the plants' rows: repeated use of traditional weed control methods: weeding, cutting, hoeing;
- Between plants' rows:
 - mechanical hoeing (or manual) repeated or a 15 cm organic well molded mulch consisting of chopped straw or other chopped vegetable residue, or
 - a biodegradable black foil fixed in soil, sideways of the plants' rows, taking into account that both mint and lavender are already installed cultured.

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