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Professional paper

STUDY OF MORPHOLOGICAL AND PRODUCTIVE INDICATORS OF ST. JOHN'S WORT (BASAN FLOWERS) (*Hypericum perforatum L.*) IN ALBANIA

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Abstract

St. John's wort (basan flowers**)** (*Hypericum perforatum L.*) is one of the most widely used aromatic and medicinal plants in antiquity and in many parts of the world. It is widespread in the Mediterranean climate, where it is found in the wild. In some countries, it is being cultivated as a plant with many medicinal values.

The main medical value is the ability to regenerate cells. St. John's wort (basani flower) oil is used to lubricate wounds that have come from various burns. Depending on the degree of the burn, treatment with St. John's wort (basani flower) oil achieves a much better regeneration, and after a few years, the burn is not noticeable. It has been and continues to be used to prepare a solution for treating stomach ulcers, gastritis, and duodenal ulcers. The solution is prepared with olive oil and grape brandy. The flower petals can be taken, and about 100 g of petals are added to one and a half liters. The mixture is kept in the dark and shaken several times a day until a homogeneous mass is created. Once the solution is prepared, use one tablespoon of the grape solution at dinner and one tablespoon of the olive oil solution in the morning. Both solutions are used after meals.

The study was extended to: Berat, Rroskovec, Kuçovë, Poliçan, Dimal and Skrapar. St. John's wort (basani flower) is very sensitive to temperature, awakening at different times and in different places. In Skrapar, it germinates about two weeks later than in lower areas

Keywords: *St. John's wort, basani flower, oil, flower, leaves, herb, solution, medicinal.*

1. Introduction

St. John's wort (*Hypericum perforatum L*) is an aromatic and medicinal plant with a specific chemical composition and special uses. Its study in terms of morphological indicators and the chemical composition of the flower and its essence constitutes a scientific value in deepening knowledge and helps in its use. Due to the high demands of the medical market, several countries are cultivating this plant.

2. The scientific methodology

Object of the study: Determination of morphological and productive indicators of plant organs of St. John's wort (Hypericum perforatum L.) in six points of Albania. Points with different altitudes and different soil and climate characteristics were selected.
Purpose of the study: Determination of morphological and production indicators and their variation under the influence of climatic and soil conditions.
Plant sampling locations: Rroskovec, Fier, Poshnje, Dimal, Perondi, Dimal, Lapardha, Berat, Poliçan, at the entrance and Gjerbës, Çorovodë. Geographic coordinates and altitude above sea level will be provided for all six points.

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The morphological indicators taken in the study

a) Morphological indicators of the stem

1. Plant height (cm)
2. Number of branches at the base
3. Number of locations
4. Number of branches on the main inflorescence
5. Length of middle internodes (cm)

b. The leaf indicators

1. Leaf length (cm)
2. Leaf width (cm)

c. Indicators of the marketable part

1. Flower length (cm)
2. Length of the marketable part (cm)
3. Weight of the marketable part (g)

d. The indicators of leaf and flower

1. The color of the leaf
2. The shape of the leaf
3. The color of the flower

The data were measured on forty plants, 4 x 10, randomly selected from eighty uprooted plants. For the indicators, data processing was performed to determine their variance for each point, and comparisons were performed between the points. Correlation coefficients between measured morphological indicators were calculated. The average sample from Lapardha, Berat, was analyzed with a gas chromatograph in the laboratory of the Faculty of Pharmacy in North Macedonia.

3. Results and their interpretation

Plant samples were taken at six points according to the previously designed methodology. Eighty plant samples were selected and divided into 4 x 10 plants, which were subjected to biometric measurements for the indicators provided by the method.

3.1. Data on plant sampling points.

Tab.1.The coordinate data for the points where St. John's wort plant samples were taken.

Nr	Sampling site		Coordinates	Altitude above sea level (m)	Date of sampling
	The municipality	Site			
1	Berat	Lapardha	E19º 56’ 05.37” N40º44’49.57”	42	25 may 2024
2	Rroskovec	Në hyrje	E19º 42' 14.70” N49º 44’16.76”	25	25 may 2024
3	Kuçovë	Perondi	E19º34’23.41” N40º43’48.47”	39	25 may 2024
4	Poliçan	Në hyrje	E20º 05’55.69” N40º 36’ 42.53”	330	05 June 2024
5	Dimal	Poshnje	E29º 50’38.04” N40º 46’ 42.65”	28	25 may 2024
6	Skrapar	Gjerbës	E20º 15’07.37” N40º 37’53.12”	775	13 june 2024

The sampling points have different altitudes, climate, and soil indicators, therefore, the development of the plants is different, and the harvest was done on different dates, respecting the full flowering of the flowers.

3.2. Data of biometric indicators by points

According to the previously designed methodology, biometric measurements were made for the indicators presented in Table No. 2.

Tab.No.23.2.1. Data on morphological indicators of St. John's wort (*Hypericum perforatum)*

No.	Site		Indicators				
	The municipality	Administrative unit	Number of main branches	Plant height (cm)	Number of locations	Number of branches in the main inflorescence	Length of middle internodes (cm)
1	Berat	Lapardha	7.25	98.77	14.85	12.76	4.85
2	Rroskovec	At the entrance towards Berat	8.76	90.25	14.35	13.44	4.67
3	Kuçovë	Perondi	7.65	104.35	20.78	16.82	4.75
4	Poliçan	At the entrance towards Çorovoda	8.56	99.95	14.67	11.75	4.95
5	Dimal	Poshnje	7.35	98.95	15.65	12.85	4.87
6	Skrapar	Gjerbës	6.65	76.67	10.46	9.54	3.13

The morphological indicators of St. John's wort plants are higher in the plain areas and lower in the cool areas. This is because the vegetative part develops in the most suitable and longest period of plant development, and there is an intensive growth of the plant.

3.2.2. Data on the marketable part of St. John's wort (Hypericum perforatum L). Tab. No.

N	Site		Length of main inflorescence cm	Length of the marketable part	Weight of the marketable part g
	The municipality	Administrative unit			
1	Berat	Lapardha	22.69	20.87	40.65
2	Rroskovec	At the entrance towards Berat	23.56	20.79	40.36
3	Kuçovë	Perondi	23.58	21.74	40.35
4	Poliçan	At the entrance towards Çorovoda	22.41	21.34	39.46
5	Dimal	Poshnje	28.12	26.41	42.46
6	Skrapar	Gjerbës	24.32	28.48	44.87

The sizes of the flower are approximate, with a significant increase in the size of the plants in cooler areas where the need for moisture is not felt during the period of flower growth. A limiting factor for the plain area is the sudden increase in temperature during May in these areas.

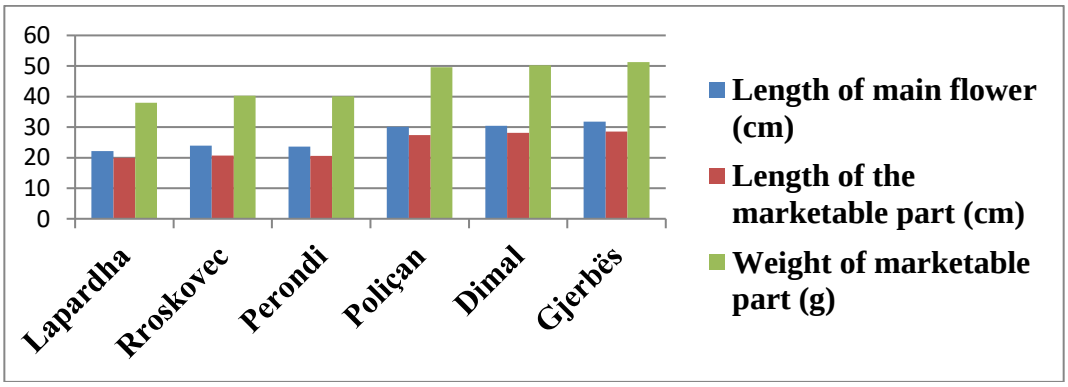

Chart No.1: Graphical representation of the three flower indicators

Flowering indicators are higher in Poliçan, Dimal, and Gjerba, which is more related to the coolness needed for flowering, and the plant does not undergo uncontrolled vegetative development. The balance of vegetative mass with generative organs is best maintained in balanced climatic and soil conditions of soil fertility with natural freshness. The ratio of vegetative mass (leaves and stems) to the flowering part is more in favor of the flowering or medicinal part.

Tab. No. 4-3.2.3. Data of the leaf indicators.

No	Ordinal plant number		Leaf color	Leaf shape	Flower color
	The municipality	Administrative unit			
1	Berat	Lapardha	Green	Elliptical	Dark yellow
2	Rroskovec	At the entrance towards Berat	Green	Eliptical	Dark yellow
3	Kuçovë	Perondi	Green	Eliptical	Dark yellow
4	Poliçan	At the entrance towards Çorovoda	Green	Eliptical	Yellow
5	Dimal	Poshnje	Green	Eliptical	Dark yellow
6	Skrapar	Gjerbës	Dark green	Eliptical	Light yellow

The leaf color is the same in the five points of the plain area and is darker in Gjerbës of Skrapar. This may be a result of the organic matter that is in higher quantities in the soil as well as the higher sunlight. The shape of the leaf is the same at all sampling points and is specifically elliptical. The flower color is dark yellow at the five experimental sites, while in Gjerba of Skrapar it is light in color, which is a result of the lack of sunlight duration since the plants bloom later, that is, when the day is shorter.

Tab.No. 5-3.6. The sizes of the balsam leaf in the six points studied

No.	Site		Leaf length cm	Leaf width cm
	The municipality	Administrative unit		
1	Berat	Lapardha	1.33	0.49
2	Rroskovec	At the entrance towards Berat	1.33	0.41
3	Kuçovë	Perondi	1.33	0.48
4	Poliçan	At the entrance towards Çorovoda	1.38	0.46
5	Dimal	Poshnje	1.35	0.47
6	Skrapar	Gjerbës	1.21	0.34

The leaves vary in size, length, and width. In the plain areas, the length and width of the leaf are greater, and in Gjerba and Skrapar, they have smaller dimensions. This is related to two factors: first, the early start of vegetation, which coincides with better climatic conditions, temperatures that are not high, and soil and air humidity that are higher and more favorable for plant development. Secondly, it is related to the soil conditions, which are better nutritional conditions than in Gjerbës, where plants suffer from a lack of soil and air moisture.

Tab.No.6-3.4. Correlation coefficients between indicators of the marketable part.

No.	The trait	Length of main inflorescence	Length of the marketable part	Weight of the marketable part
1	Length of main inflorescence cm	1		
2	Length of the marketable part	0.29	1	
3	Length of the marketable part	0.29	1	

The strongest correlation is between the length of the inflorescence and the weight of the marketable part of the inflorescence, and the weakest correlation is between the two lengths of the inflorescence

3.7. Chemical analyses of St. John's wort (*Hypericum perforatum L*)

Chemical analyses of St. John's wort (*Hypericum perforatum L*). Table No.7

No	Chemical components	No	Chemical components
1	Cumene	64	Trans-(E)Caryophylene
2	ά- Pinene	65	β – Copaene
3	Camphene	66	Aroadendrene
4	Propylbenzene	67	ά- Humachalene
5	Nonane	68	ά- Hummulene
6	Sabinene	69	β – -(Z)-Farnesene
7	β –Pinene	70	Sesquisabinene
8	β – Myrcene	71	4.5-di-epi-Aristolochene
9	n- Decane	72	Dodecanol
10	ά- Phellandrene	73	y-Muurolene
11	ά- Terpinene	74	Germacrene D
12	ά- Cymene	75	β – Selinene
13	Limonene	76	ά- Selinene
14	1.8 Cineole	77	ά- Muurolene
15	β – Z- Ocymene	78	ά- Farnesene
16	β –E- Ocymene	79	β – Bidolene
17	y- Terpinene	80	y- Cadinene
18	2-Methyl decane	81	7-epi- ά- Selinene
19	Cis- Linalol oxide	82	Ğ- Cadinene
20	Translinalol oxide	83	Trans-cadina-1.4-diene
21	ά- Terpinole	84	ά- Cadinene
22	ά- Undecane	85	ά- Calacorene
23	Nonanal	86	E- Nerolidol
24	Cis- Thujone	87	Dodecanoiv acid
25	Endo-fencol	88	Apathylenol
26	ά- Campholenal	89	Caryophylene oxid
27	Trans-Pinocarveol	90	Viridiflorol
28	Cis- Verbenol	91	Londiborneol
29	Trans- verbenol	92	Ledol
30	Camphor	93	Humulene epoxide II
31	Trans-pinocamphone	94	1,10-di-epi-Cubenol
32	Pinocarvone	95	1-epi- Cubenol
33	Borneol	96	Cis-Cadin-4-en-7-ol
34	P-Mentha-1,5dien-8-ol	97	Murrolol-+epi ά- Cadinol
35	Terpinene-4-ol	98	(Torreyol) VulgaroneB
36	p-Cynene-8-ol	99	Vilgarone B
37	ά- Terpineol	100	ά-Cadinol
38	Myrtenol	101	Neo- Intermedeol
39	Methyl chavicol	102	n-Tetradecanol
40	Myrtenal	103	ά- Cadalene
41	Verbenone	104	Amorpha-4,9dien-2-0l
42	Trans-Carveol	105	Methyl tetradecanoate
43	Trans-Crysanthemyl accetate	106	Cyclocolorenone
44	Carvacrol methyl ether	107	Benzyl benzonate
45	Carvone	108	ά- PENTADECANONE
46	Carvotane acetone	119	Epi- Ciclocolorenone
47	Gearniol	110	2-pentadecanone
48	Cis- geraniol	111	6,10,15-Trimethyl 2-pentadecanone
49	2- Methyl dodecane	112	ά- Hexadecanol
50	E- Anethole	113	Cyclohexadecane

51	Boranyl acetate	114	Nonadecane
52	Thymol	115	Methyl hexadecanoate
53	Tridecane	116	Hexadecanoic acid
54	Carvacrol	117	Eicosane
55	ά- Longipinene	118	Manool
56	ά- Cubebene	119	Methyl linoleate
57	ά- Ylangene	120	Heneicosane
58	ά- Copaene	121	Mthyl octadecanoate
59	Italicene	122	(Z)-9-Octa-decenoic acid
60	β – Elemene	123	Docosane
61	Italicene	124	Tricosane
62	2-epi- β –Funebrene	125	Tetracosane
63	β – Cedrene	126	Pentacosane

St. John's wort (*Hypericum perforatum L*.) contains in its plant organs, mainly in its flowers, 126 (one hundred and twenty-six) chemical compounds with curative and regenerative values for the cells of the human body. They also increase the healing values for ulcer regeneration and in cases of superficial burns. The diversity of its chemical composition has led to the St. John's wort (*Hypericum perforatum L*.) plant finding widespread use in folk medicine but also in the preparation of many medications that significantly improve people's health.

There are six grouped classes of chemical compounds:

1. Monoterpene hydrocarbons (MH).
2. Oxygen containing monoterpene (OM)
3. Sesquiterpene hydrocarbons (SH).
4. Oxygen -containing sesquiterpene (OS).
5. Diterpene (D);
6. Non-terpene components (NT).

4. Conclusions and recommendations

From the study of six points for St. John's wort (*Hypericum perforatum L*.) and from the processing of the data, we are able to draw several conclusions and provide advice for the future. Among them, we can mention:

A. Conclusions

From the general analysis of morphological indicators, we can draw some conclusions, the most important of which are:

1. The plant of St. John's wort (*Hypericum perforatum L.)* has differences for each study point and all indicators.
2. The highest variation is represented by plant height, flower length, and the length of the marketable part of the flower
3. There is a large variation in the weight of the marketable part of the flower.
4. Among the studied indicators, there is a strong and medium correlation.
5. There is proven variation between points for all indicators.
6. Germination and the passage of development phases show differences between the studied points, with the latest being in Gjerbës, Skrapar.
7. St. John's wort (*Hypericum perforatum L.)* contains 126 chemical compounds, divided into six important classes, that give the plant its healing properties.

B. Recommendations

From the study conducted and from the experience of the literature, we recommend that:
1. The harvest should be done at the time of the complete formation of the flowers.
2. Drying should be done first in the sun (for 4-5 hours) and then in the shade so that the color, which is related to the chemical composition of the flower, does not fade.

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