Genetics & Biodiversity Journal
Journal homepage: https://journals.univ tlemcen.dz/GABJ/index.php/GABJ
ISSN : 2588-185X

Original Research Paper

Morphometric characterization of three species of the genus *Urtica* in the North-western region of Algeria

SIDHOUM Latifa[1], MKEDDER Ikram[1.2] , BOUTOUB Ouissem[1], BENHAMADI Mohammed El Amine[1], HADDAM Hadi Youssouf [1], GAOUAR Semir Bechi Suheil*[1]

1: Applied genetic in agriculture, ecology and public health laboratory, University of Tlemcen, Algeria
2: Research unit on mediation of science Tlemcen, (RUMeS) Center for research on scientific and technical information research (CRIST), Algeria

Corresponding Author:** Gaouar Suheil, University University of Tlemcen, Algeria; **Email*: suheilgaouar@gmail.com

Article history: Received: November 25th 2023, Revised: February 20th , 2024; Accepted: February 24th 2024

Abstract

In this work we proceeded to a morphological characterization of three species of nettle (*Urtica dioica, Urtica pilulifera, Urtica urens*) in 8 regions of northwestern Algeria. Nettle (*Urtica*) is a well-known medicinal plant of the Urticaceae family and has an interesting economic interest. This characterization is based on 26 morphological markers (7 quantitative and 19 qualitative) for 116 nettle plants and 696 nettle leaves. The data were statistically exploited by SPSS software version 25. The results allowed us to morphologically describe the three species separately; although the inferential analyzes showed us the degree of the relations between the characters as well as the most discriminating characters on the statistical level which are: surface, shape, venation of the leaf and color of the stem. The three species studied showed morphological polymorphism depending on the region. The results brought in this work will be the subject of the valuation of nettle species in Algeria.

Key words: morphological characterization, *Urtica dioica, Urtica pilulifera, Urtica urens*, Western Algeria

Introduction

Algeria enjoys a very diverse climate, with a rich heritage of virtuous plants (Loukkas, 2006), there are more than 379 taxa belonging to 53 families and 233 genera, which represents about 8% of the total Algerian flora estimated at 4300 species (Dobinard and Chatelain, 2013)

Among these large species and medicinal plants in Algeria is the nettle (genus *Urtica*), of the family Urticaceae. Despite its pungent effect, all parts of this plant have a long history of use in both traditional and modern medicine; as a blood purifier, hypotensive, diuretic, anti-diarrheal, antihemorrhagic, antidiabetic, antirheumatic, as well as in the treatment of eczema, arthritis and urinary tract infections (Tahri et al. 2000, Vajić et al. 2018). A study on the species *Urtica dioica* has even demonstrated its curative action for prostate cancer (Vishal Bharmauria et al. 2009).

On the other hand, nettle cultivation is not widespread, partly because of its negative image. However, nettle is full of virtues used in many fields, (Billotte Blandine et al 2013, 2014).

Although there are several works on nettle species in the field of biochemistry: the composition of leaves, roots, stems, their effect on the body for the treatment of diseases and biological activities (antioxidant, anti-inflammatory, etc.). There are few studies in morphological and genetic characterization, especially the Algerian species. To this end, this work aims at the morphological characterization of three species of nettle in western Algeria, this characterization contributes to the valorization of the nettle and a better knowledge, in particular to change the vision of weed in Algeria.

Material and method

Study Area

The study carried out in this work was carried out in western Algeria at the level of three wilayas: Tlemcen, Oran and Ain-Temouchent. Sampling was carried out according to the availability of species *(Urtica dioica, Urtica pilulifera, Urtica urens);* A total of 8 sampling sites were included in this study. (Fig. 01)

- Khouriba which is part of the Daira of Nedroma in Wilaya of Tlemcen which is a coastal town (located 60 km north-west of the city of Tlemcen),
- Ghazaoeut in Wilaya of Tlemcen which is also a coastal town (located 72 km north-west of the city of Tlemcen). This city is best known for its high zinc pollution,
- Ain El Kbirra in Wilaya of Tlemcen is a mountainous and coastal region (located 50 km north-west of the city of Tlemcen),
- Bab el Assa (located in the north-west of city of Tlemcen, 30 km west of the city of Maghnia) is a commune in the wilaya of Tlemcen in Algeria, close to the Moroccan border,
- Maghnia: The territory of the commune of Maghnia is located in the north-west of city of Tlemcen. The town of Maghnia is located 39 km from Tlemcen, 30 km south of the port city of Ghazaouet and 20 km east of Oujda (Morocco).
- Sidi Saïd is part of the city of Tlemcen.

The nettle sampled in these areas is of the species *Urtica pelulifera* (Fig. 02).

Fig 1: Geographical map of the wilaya of Tlemcen with sampling area.

Fig 2: Sampled nettle *Urtica pelulifera* **(Original, Sidi Saïd, 2022)**

Sidi Ben Adda in the wilaya of Ain Temouchent (fig. 03) is located 4.1 km from the city of Ain Temouchent, a coastal town. The nettle sampled in this region is of *the Urtica dioica* type (Fig. 04).

Fig 03: Map of Ain Temouchent with sampling area

Fig 04: Sampled nettle *Urtica dioica* **(Original, Ain Temouchant, 2022)**

Ain Baida in the wilaya of Oran (Fig 05) located 4 km from the city of Es Senia, a coastal town.

The nettle sampled in this region is *Urtica urens* (fig 06).

Figure 5: Map of Oran with sampling area

Figure 6: Sampled nettle *Urtica urens (Original, Oran, 2022)*

Plant material

Sampling

The objectives of our study are the identification and morphometric characterization of nettle *(Urtica*) based on field prospecting; sampling was carried out during the year 2021-2022 in western Algeria (Table 01). During our survey, we randomly collected 116 plants and studied 696 leaves from these samples.

This characterization was based on 26 morphological markers (07 quantitative and 19 qualitative). The choice of traits was based on traits of agronomic interest.

Table 1: Number of samples at the level of each region.

Region	Number of plants harvested	Number of leaves harvested
Oran	10	60
Ain Temouchent	10	60
Ghazaoet	10	60
Khouriba	12	72
Ain El KebirRa	9	54
Sidi Saïd	31	186
Bab El Assa	17	102
Maghnia	17	102

Morphometric characterization

This description was based on 7 quantitative markers related to the plant and leaves (Table 2).

The tape was used to measure the width of the plant and the diameter of the stem. The software

Image J was used to calculate the surface area, leaf length and petiole (fig 7).

Table 2 : Quantitative traits studied.

Characters	Abbreviations
Shaft Length	*LONGT*
Rod diameters	*DIAMT*
Shaft Length	LONGT
Number of nodes	NBRR
Sheet Length	LONGF
Sheet Width	LARGF
Petiole length	LONGP
Sheet Surface	ESPCF

Fig 7: Demonstrative image of morphometric measurements

Qualitative characteristics

This characterization was based on 19 qualitative markers related to the plant and leaves, (Table 03)

Table 3 : Qualitative traits studied

Characters	
Classification leaves (CLSSF)	1-Simple
	2- Compound
Dentition Leaf (DNTF)	1- Incised
	2- Toothed
Nervation Leaf (NRVTF)	1- Penne Opposite
	2- Alternating pinnate
	3- Webbed
Leaf Color (CLF)	1- vert clair
	2- Dark green
	3- Green
Sheet Layout (DISPTF)	1- Opposite
	2- Whorled
Leaf Shape (FORMF)	1- Roped
	2- Lanceolate oval
	3- Elliptical
	4- Orbicular
	5- Oval
The Base of the Leaf (FBASF)	1- Heart
	2- Obtuse
	3- Rounded
	4- Acute
	5- cunéiforme
	6- Oblique
	7- Hunted
The apex of the leaf (FAPXF)	1- Caudate
	2- Obtuse
	3- Attenuated
	4- Acute
Presence of the pill (PRSP)	0- Absent
	1- Present
Presence of fruit (PRSF)	0- Absent
	1-Present
Leaf petiole color (CLPTLF)	1- Green & Move
	2- Light green
	3- Green
	4- Dark green
Stem Classification (CLASST)	1- Simple
	2- Branches
Shaft Type (TYPET)	1- Herbaceous
	2- High
Stem Nature (NTRT)	1- Full

	2- Hollow
Branching type (TYPERMF)	1-monopode simple
	2- Branched monopod
Stem Color (CLT)	1- Green & Move
	2- Light green
	3- Green
	4- Dark green
Shaft Shape (FORMT)	1- Cylindrical
	2- Ribbed
Shaft Surface (SURFT)	1- Warts
	2- Glandulars
	3- Smooth
Root Type (TYPER)	1- Swivel
	2- Booklet

Statistical analysis

The data were collected on an Excel spreadsheet and coded according to each modality of the characters studied. In order to describe the three species studied, we began with descriptive analysis; SPSS Software (version 25) was used.

The Chi-square test with (contingency test) was used to get an idea of the relationship between two traits, Pearson's correlation used to show whether the correlation between two quantitative traits is real or stochastic, PCA (Principal Component Analysis) was used to highlight existing correlations between the quantitative variables being studied, The ANOVA (Analysis of Variance of Quantitative Traits) allowed us to determine the groups and see where the similarities and differences between them reside, The MCA (Multiple Correspondence Analysis) was used to analyze the qualitative variables and get an idea of the qualitative characteristics common between the three species studied, The CAH (Ascending Hierarchical Classification) was used to obtain the optimal number of groups.

Results and Discussions

Morphological descriptive analyses

In order to properly describe the sampled population, we began our study with a descriptive analysis for each species separately.

Urtica dioica:

Table 4 shows the extreme values of the species *Urtica dioica.* The latter had a stem length that varies between (20 cm - 125 cm), with an average of 65.46 ± 27.02 cm. Node count values range from 5.00 to 14.00 with an average = 9.46 ± 2.62. Surface measurements range from 2.29 cm² to 242.34 cm², with an average equal to 32.80 ± 33.77 cm.

Table 4: Results of quantitative descriptive statistics for the species *Urtica Dioica*.

	N	Minimum	Maximum	Average	Ecart type
Shaft Length	258	20,0	125,0	65,465	27,0247
Shaft diameter	258	,40	2,00	,9151	,39998
Node number	258	5,00	14,00	9,4651	2,62299
Sheet Length	258	2,12	70,70	7,5647	6,08512
Sheet width	258	1,32	29,04	5,9989	3,40966
petiole length	257	,49	14,15	4,5185	3,12083
Sheet Space	258	2,29	242,34	32,8036	33,76968

The qualitative characteristics of the *Urtica Dioica* plants observed are given in the table (Table 4) which presents the percentage of each variable. In this table we can see that 55.8% of the sampled leaves are "compound" and 44.2% are "simple", 57.4% of the leaves are toothed, and 42.6% have incised dentition. The vein of the leaves is 76.7% pinnate, alternate, and the rest (23.3%) is pinnately opposite. As for the color of the leaves, dark green prevails at 62.8% and the rest are either light green (32.6%) or green (4.7%). The arrangement of the leaves is more characterized by the "whorled" character, 45.3% of the sampled leaves are "cordate" in shape, 41.9% of the leaves are "oval" in shape, the rest of the sample are "elliptical" (5.0%) and "lanceolate oval" (7.8%). The basic shape of the leaves was 42.6% heart-shaped, 27.9% obtuse, 22.5% rounded. The leaf apex was acute at 53.5%, Obtuse at 37.2%. The petiole colour was 95% light green and 95.3% had fruit. For stem morphology, 100% of the plants studied were herbaceous with 83.7% solid and 16.3% were hollow.

Table 4: Results of qualitative descriptive statistics Urtica dioica.

Character	Variable	Percentages %
Sheet Classification	**Simple**	44.2
	Compound	55.8
Leaf dentition	**Incised**	42.6
	Toothed	57.4
Leaf venation	**Opposite Pennate**	23.3
	Penné alterne	76.7
Leaf color	**Light Green**	32.6
	Green	4.7
	Dark Green	62.8
Sheet layout	**Opposite**	22.9
	Whorl	77.1
Leaf shape	**Cordate**	45.3
	Lanceolate oval	7.8
	Elliptic	5.0
	Oval	41.9
Basic Shape Sheet	**Cordate**	42.6
	Obtuse	27.9
	Rounded	22.5
	Sharp	1.2
	Cuneiform	0.8
	Oblique	3.5
	Tracked down	1.6
Apex Leaf	**Caudé**	4.3
	Obtuse	37.2
	Attenuated	5.0
	Sharp	53.5
Present proliferation	**Absent**	100
Presence of fruit	**Absent**	4.7
	Present	95.3
Petiole color	**Vert-move**	5
	Light green	95.0
Classification tige	**Simple**	37.2
	Branches	62.8
Rod Type	**Herbaceous**	100
Stem Nature	**Pregnant**	83.7
	Creuse	16.3
Type ramification	**Monopode simple**	11.6
	Branched Monopod	88.4
Stem Color	**Vert-move**	35.3
	Light green	9.3
	Green	46.1
	Dark Green	2.3
	Move	7
Shaft shape	**Cylindrical**	69.8
	Ribbed	30.2
Shaft surface	**Warty**	27.9
	Glandular	39.5

	Smooth	32.6
Root Type	**Swivel**	41.9
	Fascicle	58.1

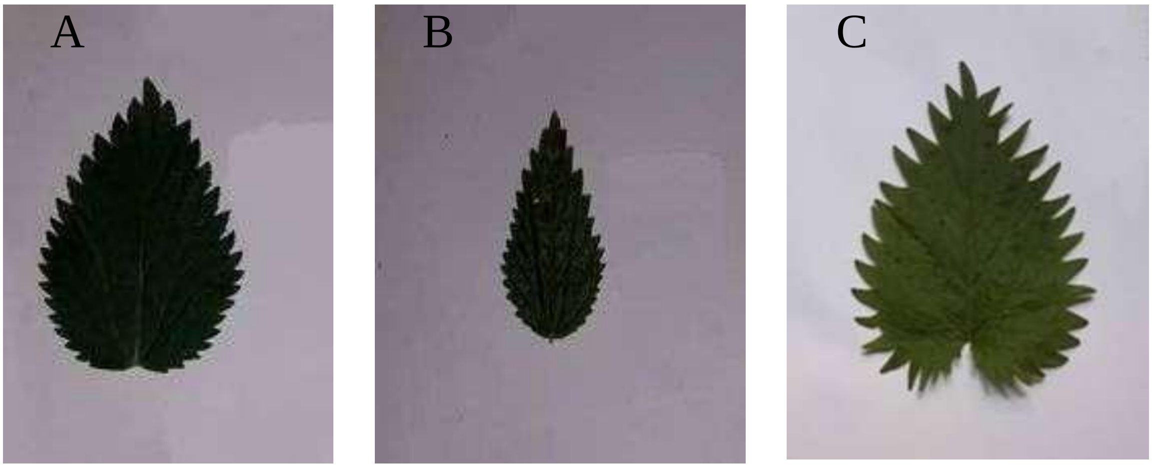

Figure 8: *Urtica dioica* leaves: A) oval shape, B) lanceolate oval shape, B) corded shape **(original 2022)**

The type of branching depicted was most often (88.4%) monopod branching, the color was 46.1% green, 35.3% green-move, 9.3% light green and 7% move. The shape of the upper is 69.8% cylindrical and 30.2% ribbed. The leaf surface was 27.9% warty, 39.5% glandular and 32.6% smooth. The root type is divided between 41.9% tappoint and 58.1% fascicle. Figure 8 is an image of the leaf of *Urtica dioica*.

Urtica pilulifra:

The results of the descriptive statistics of the quantitative traits are given in Table 5. The extreme values of the stem length are 57 cm (minimum) and 124 cm (maximum), with an average of 94.17 ± 17.41 cm. The values of the number of nodes vary between 6.00 and 20.00 with an average = 12.40 ± 4.26. The surface measurements range from 5.72 cm² to 243.75 cm², corresponding to an average equal to 42.44 ± 35.16 cm.

Table 5: Results of quantitative descriptive statistics *Urtica pilulifra*

	N	**Minimum**	**Maximum**	**Average**	**Ecart type**
Shaft Length	180	57,0	124,0	94,167	17,4152
Shaft diameter	180	,50	1,90	,8833	,33568
Node number	180	6,00	20,00	12,4000	4,25920
Sheet Length	180	4,20	19,40	8,6800	2,98739
Sheet width	180	2,20	22,50	7,2317	3,68053
petiole length	180	,90	16,10	5,4050	3,00724
Sheet Space	180	5,72	243,75	42,4363	35,15861

The percentages of the qualitative characteristics of the plants *Urtica pilulifra* observed are given in Table 6. As far as the classification of sheets is concerned; The extreme values are 95.5% for the "simple" leaves and 4.4% for the "compound" leaves, the leaf dentition is 100% incised, the highest percentage for phenotype of the leaf venation are 98.3% for alternately pinnate, and the rest of the venations are 1.7% pinnate opposite. As for the color of the leaves, dark green dominates with 78.3% and the rest is 18.3% light green and 3.3% green. The arrangement of the leaves is divided between 60.6% opposite shape and 39.4% whorl, 32.8% of the sampled leaves are "cordate" in shape, 42.8% of leaves are "Lanceolate oval" in shape, the rest of the sample is represented by 23.3% "oval" and (1.1%) "elliptical" shape. The basic shape of the leaves was 30.6% heart-shaped, 22.2% obtuse and 27.2% stalked. The leaf apex was 51.7% acute, 32.8% attenuated, and 15.8% caudate. The color of the petiole is divided into 50% green-move, 50% light green and 100% nettle. The morphology of the stem is 100% herbaceous and its nature 100% hollow. The branching type is 90% monopod branching, the color was 46.7% green-move, 43.3% light green, 6.7% dark green, 3.3% green. The stem is 99.4% cylindrical, 26.7% warty, 70% glandular and 3.3% smooth. The root type is 100% tap. Figure 9 is an image of the leaf of *Urtica pilulifra*.

DOI: *10.46325/gabj.v8i1.387*

Table 6: Results of qualitative descriptive statistics for *Urtica pilulifra*.

Character	Variable	Percentages %
Sheet Classification	**Simple**	95.5
	Compose	4.4
Leaf dentition	**Incised**	100
Leaf venation	**Penné Opposes**	1.7
	Penné alterne	98.3
Leaf color	**Light Green**	18.3
	Green	3.3
	Dark Green	78.3
Sheet layout	**Oppose**	60.6
	Whorl	39.4
Leaf shape	**Cordate**	32.8
	Lanceolate oval	42.8
	Elliptic	1.1
	Oval	23.3
Leaf Base Shape	**cordate**	30.6
	Obtuse	22.2
	Rounded	11.1
	Oblique	8.9
	Tracked down	27.2
Apex Leaf	**Caudate**	15.8
	Attenuated	32 ,8
	Sharp	51.7
Presents Pill	**Present**	100
Present Fruit	**Absent**	93.3
	Present	6.7
Petiole colour	**Vert-move**	50
	Light green	50
Classification tige	**Simple**	46.5
	Branches	53.3
Rod Type	**Herbaceous**	100
Stem Nature	**Creuse**	100
Type ramification	**Monopode simple**	10
	Branched Monopod	90
Stem Color	**Vert-move**	46.7
	Light green	43.3
	Green	3.3
	Dark Green	6.7

Shaft shape	**Cylindrical**	99.4
	Ribbed	0.6
Shaft surface	**Warty**	26.7
	Glandular	70
	Smooth	3.3
Root Type	**swivel**	100

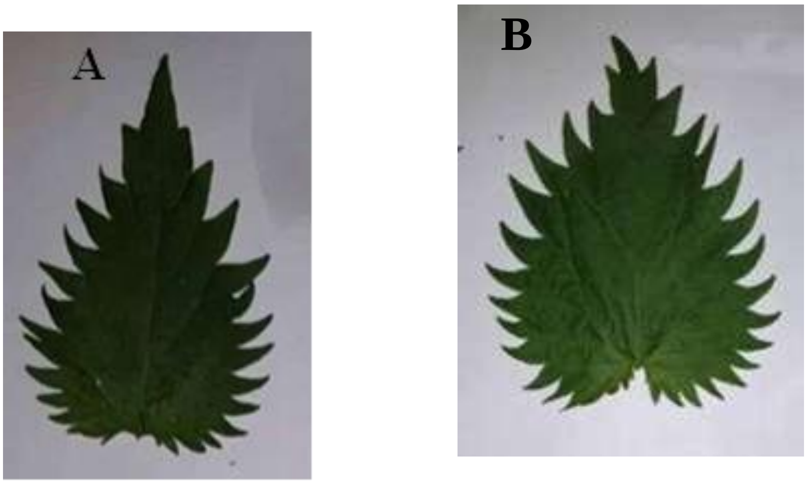

Figure 9: *Urtica Pelulifra* leaves: A) lanceolate oval shape, B) corded shape (original, 2022)

Urtica urens:

Table 7 shows the results of the descriptive statistics of the quantitative traits studied for the species *Urtica urens.* The extreme values of the stem length are 26 cm (minimum) and 87 cm (maximum), with an average of 58.86 ± 12.38 cm. The values of the number of nodes vary between 9.00 and 23.00 with an average = 14.19 ± 3.13. Surface measurements range from 1.09 cm² to 12.65 cm², corresponding to an average of 5.01 ± 2.50 cm.

Table 7: Results of quantitative descriptive statistics for *Urtica urens.*

	N	Minimum	Maximum	Average	Ecart type
Shaft Length	258	26,0	87,0	58,860	12,3765
Shaft diameter	258	,30	1,40	,5093	,19545
Node number	258	9,00	23,00	14,1860	3,13327
Sheet Length	258	1,90	6,10	3,8337	,91208
Sheet width	257	1,10	4,20	2,4829	,68689
petiole length	258	,80	4,50	2,0236	,63468
Sheet Space	258	1,09	12,65	5,0137	2,50538

The qualitative characteristics of the urticaria plants observed are listed in Table 8, which presents the percentage of each variable. As for the classification of the leaves, they are 100% "simple", the leaf dentition is 100% toothed, the venation of the leaves is 100% "webbed". As for the color of the leaves, it is mainly light green that is the majority at 46.1%, the rest 31.1% are dark green and 22.9% green, the arrangement of the leaves is divided between 41.9% opposite and 58.1% whorled, 58.9% of the sampled leaves are 58.9% "cordate" in shape, 10.5% of the leaves are "Lanceolate oval" in shape, the rest of the sample 8.9% are "oval" and 6.2% "elliptical". The basic shape of the leaves was 58.9% obtuse, 10.5% rounded. The leaf apex was 82.2% acute and 11.2% attenuated. The petiole color is 100% light green. All plants had fruit (100%). The morphology of the stem is 100% herbaceous and its nature is 81.4% hollow. The branching type is 93% monopod branching. The stem color was 9.3 % Vert-move, 83.7 % Light green, 7% Green, its shape was 100% ribbed and its surface was 48.8% warty, 48.8% smooth and 2% glandular. The root type is 100% tap. Figure 10 is an image of the leaf of *Urtica urens.*

This description allowed us to highlight a high degree of polymorphism between the species studied. It has been noticed that the greatest measurement value of the stem and surface of the leaf measure is found in the species *Urtica dioica*, they are longer than wide, its leaves are dark green in color, cord-shaped, oval and heart-shaped at the base, toothed or incised (with large oval-triangular teeth) and their stem herbaceous, full and branched cylindrical in shape and green or green-move in color. The species *Urtica pilulifra* is characterized by a medium size compared to *Urtica dioica*, it has large leaves of dark green color, oval-shaped, corded, oval-shaped

DOI: 10.46325/gabj.v8i1.387

lanceolate and heart-shaped, obtuse, rounded at the base, incised-toothed, herbaceous stem, hollow green-move color, these two plants were uprooted on the edge of farmland and on the sides of a roadside valley. The species *Urtica urens* showed the smallest dimensions for the stems and the leaf surface, this plant is characterized by a small form with erect stems, often branching in the base, its leaves quite small, oval, rounded or obtuse at the base, toothed and has palm veins.

Table 8: Results of quantitative descriptive statistics *Urtica urens*.

Characters	Variable	Percentages %
Sheet Classification	**Simple**	100
Leaf dentition	**Incised**	100
Leaf venation	**Webbed**	100
Leaf color	**Light Green**	46.1
	Green	22.9
	Dark Green	31.1
Sheet layout	**Oppose**	41.9
	Whorl	58.1
Leaf shape	**Cordate**	58.9
	Lanceolate oval	10.5
	Elliptic	6.2
	Oval	8.9
Leaf Base Shape	**Obtuse**	58.9
	Rounded	10.5
	Cuneiform	6.2
	Oblique	8.9
	Tracked down	15.5
Apex Leaf	**Caudate**	2.3
	Obtuse	4.3
	Attenuated	11.2
	Sharp	82.2
Presence abounds	**Absent**	100
Present Fruit	**Present**	100
Petiole color	**Light green**	100
Classification tige	**Simple**	60.1
	Branches	39.9
Rod Type	**Herbaceous**	100
Stem Nature	**Pregnant**	18.6
	Creuse	81.4
Type ramification	**Monopode simple**	7
	Monoclee ramifier	93
Stem Color	**Vert-move**	9.3
	Light green	83.7
	Green	7.
Shaft shape	**Ribbed**	100
Shaft surface	**Warty**	48.8
	Glandular	2
	Smooth	48.8
Root Type	**Swivel**	100

DOI: *10.46325/gabj.v8i1.387*

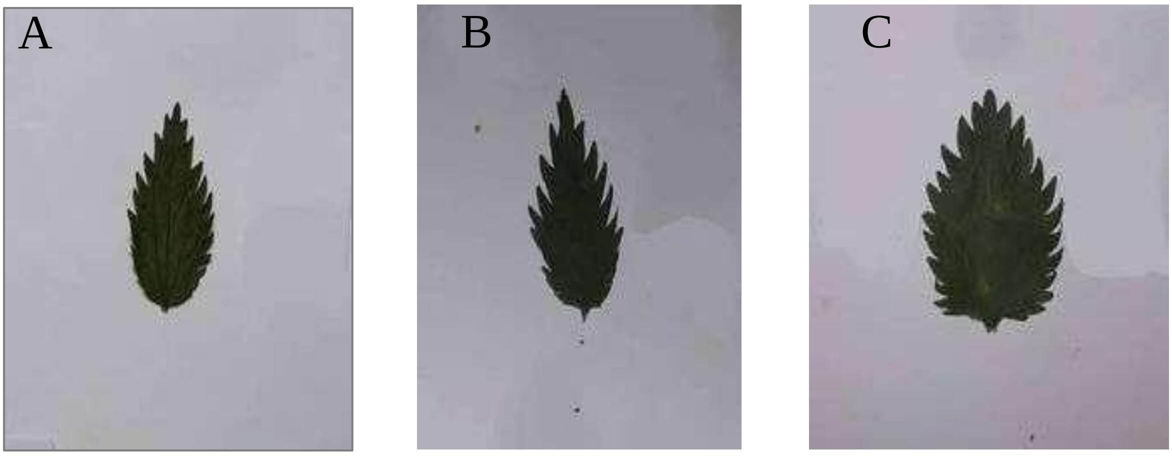

Figure 10: *Urtica urens leaves*: A) elliptical shape, B) lanceolate oval shape, C) oval shape **(original, 2022)**

This morphological polymorphism (quantitative and qualitative) is quite possibly influenced by the genetic characteristics of each species. However, these traits change with the age of the plant and its environment.

Almost the same result for *Urtica Dioica* is obtained by (Draghi, 2005, Raume, 2006, Bertrand, 2008, Moutsie, 2008, Langlade, 2010, Uplon, 2013, Mor, 2014). For *Urtica urens* and *Urtica pilulefra*, we cite (Bertrand, 2010, Tissier, 2011, Delvaille, 2013).

Associating Variables

In order to determine the discriminating power of the traits studied, an attempt was made to verify the association of the two-to-two variables for each species separately (Table 9).

Table 9: Chi-square test values and trait contingency coefficient according to the species studied.

	Coefficient of contingency	Alfa Chi-Two Theoretical	
Sheet Classification	,535	,000	***
Leaf dentition	,561	,000	***
Leaf venation	,722	,000	***
Leaf color	,389	,000	***
Sheet layout	,290	,000	***
Leaf shape	,555	,000	***
Leaf Base Shape	,517	,000	***
Apex Leaf	,508	,000	***
Present abounds	,707	,000	***
Present Flower	,674	,000	***
Petiole color	,507	,000	***
Classification tige	,194	,000	***
Rod Type	,		
Stem Nature	,595	,000	***
Type ramification	,0.69	,189	NS
Stem Color	,602	,000	***
Shaft shape	,638	,000	***
Shaft surface	,507	,000	***
Root Type	,564	,000	***

*NS: Not significant, / ***: high significant*

Table 9 shows the chi-square values and the contingency coefficient between the traits studied in the three species studied.

We notice that all variables have a significance rate (theoretical Alfa Chi-square = 0.000) that is less than 0.05, so we accept the hypothesis of the dependence of the variables on the species. Depending on the species, with a value (0.000), on the other hand, for the type of branching trait, we noticed a theoretical Chi-square Alfa value = 0.189 greater than 0.05, therefore not significant.

The values of the contingency coefficient allowed us to estimate the degree of relationships between variables and species. These values show us that there is a strong relationship for the traits of leaf venation, presence of pills, presence of flowers, stem color and stem shape. For the rest of the characters, there is a medium intensity (0.2 to 0.5), but in the characters of the stem classification and the arrangement of the leaves, there is a small dependence between the variables.

Multiple Match Analysis

The multiple correspondence analysis was performed on 116 plants (3 species) in different regions of western Algeria and allowed us to assess the variance explained on the two axes 1 and 2 represent respectively 30% and 21% of the inertia (total is 51%). The multiple correspondence analysis for the most relevant variables is expressed in Figure 11, the variables are expressed positively; It can be seen that the surface, shape, stem color and shape, venation of the leaf is well expressed and correlated with the species. A strong positive correlation is presented between the variables root type and leaf shape as well as between leaf classification and leaf venation as well as between leaf apex and leaf dentition.

These results show us the most statistically discriminating variables between the three species studied.

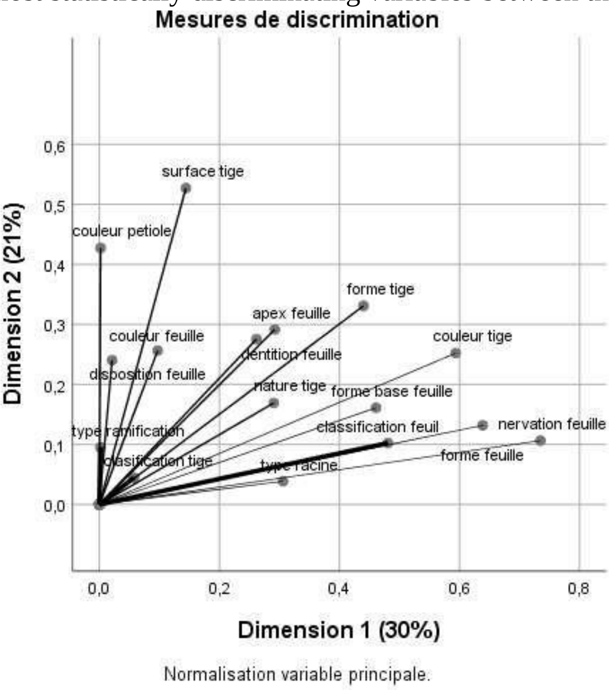

Fig 11: Graphical representation of variables by multiple correspondence analysis.

Analysis of Variance (ANOVA)

Analysis of variance by species

The quantitative analysis of variance of traits studied by species is presented in Table 10, the results were highly significant for all traits (Sig <0.05). So, we accept the alternative hypothesis and we reject the null hypothesis, and so there is a difference between these groups of means. These results show that the traits studied are discriminating for species. In view of the traits studied, it is quite possible that these traits are influenced by a group of genes, especially those that control the length of the stem and the surface area of the leaf that differentiate between species.

Table 10: Analysis of variance (ANOVA) of traits by species.

	Significance Rate
Shaft Length	0,000
Shaft diameter	0,000
Node number	0,000
Sheet Length	0,000
Sheet width	0,000
petiole length	0,000
Sheet Surface	0,000
: meaningful	

Pearson's correlation

Correlation coefficients were calculated, which allowed us to give a synthetic measure of the strength of the relationship between two traits as well as the direction of this relationship. We used the Pearson correlation coefficient, since our population follows the normal distribution and the traits are quantitative.

Sidhoum et al 2024, Genet. Biodiv. J, 2024; 8 (1): 42 -58
DOI: *10.46325/gabj.v8i1.387*

Table 11: Pearson correlation result.

		length stem	diameter stem	number knot	length leaf	width leaf	length petiole	space leaf
Shaft Length	Correlation by Pearson	1						
	GIS. (bilateral)							
Shaft diameter	Correlation by Pearson	,365**	1					
	GIS. (bilateral)	0,000						
Node number	Correlation by Pearson	,340**	-0,061	1				
	GIS. (bilateral)	0,000	0,110					
Sheet Length	Correlation by Pearson	,209**	,514**	-,227**	1			
	Say. (bilateral)	0,000	0,000	0,000				
Sheet width	Correlation by Pearson	,245**	,655**	-,304**	,672**	1		
	Say. (bilateral)	0,000	0,000	0,000	0,000			
petiole length	Correlation by Pearson	,302**	,588**	-,208**	,639**	,884**	1	
	Say. (bilateral)	0,000	0,000	0,000	0,000	0,000		
Sheet Space	Correlation by Pearson	,251**	,610**	-,191**	,617**	,844**	,845**	1
	Say. (bilateral)	0,000	0,000	0,000	0,000	0,000	0,000	

There is a highly significant correlation for petiole length and leaf length (.884) is also between leaf area and leaf width (.884) and between leaf area and petiole length (.845). On the other hand, there is a weak correlation between leaf area and stem length (.251) and a very weak negative correlation between the number of nodes and stem diameter (-0.061).

Principal Component Analysis (PCA)

Principal component analysis allowed us to graphically assess the explained variance for the quantitative variables. The graphical interpretation of the PCR results is carried out mainly according to the design 1 and 2 representatives (56.37%) and (19.67%) respectively with a total inertia of 76.04%, which is statistically representative.

The variables are well presented, (Figure 12) the PCA results are in agreement with that of the Pearson correlation. It is noticeable that the width and surface area of the leaves are positively correlated, as well as the length of the leaf and the length of the petiole. These traits are probably traits controlled by a number of genes in common.

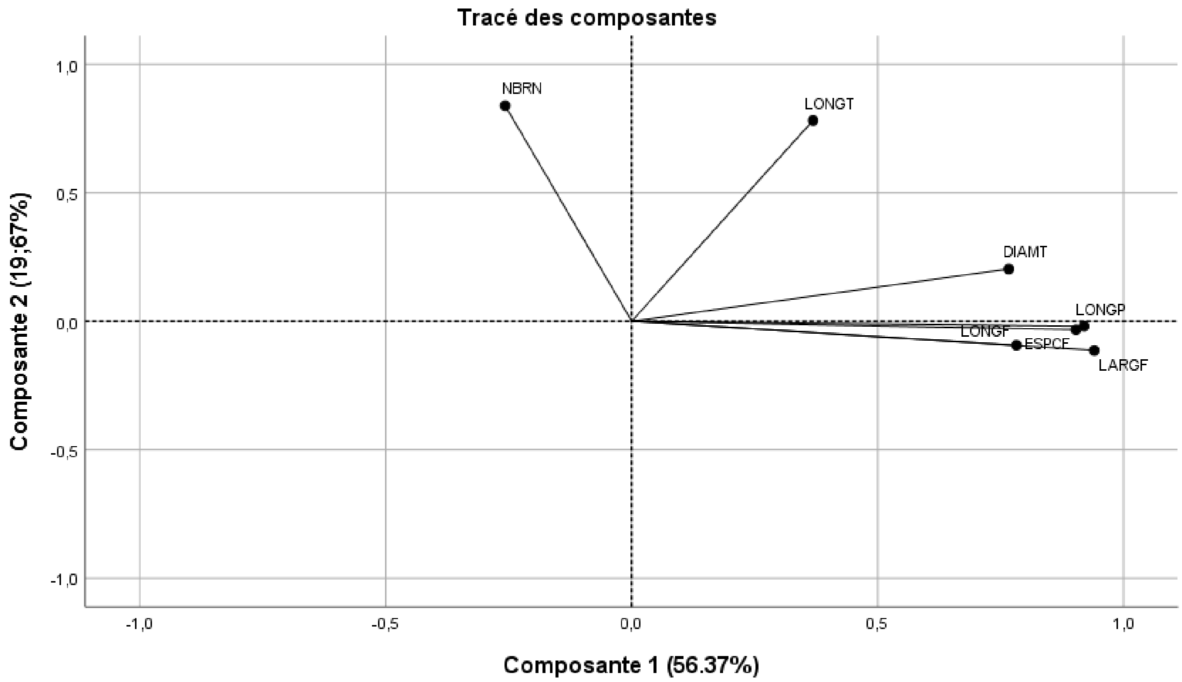

Fig 12: Graphical representation of variables by main component analysis.

Classification of varieties according to qualitative variables

The hierarchical classification of the three species in the different regions is cited in the Dendrogram (Figure 13) and the barycenter projection of the classes is shown in Figure 14, this classification divides our sample into five groups

- The first group, "majority group", contains four subgroups that include *Urtica dioica* from the Ghazaoeut, Oran, Ain-tmouchent regions, and the species of *Urtica urens* from the Ain-Elkbira region. This group is located in a mountainous area and close to the coast, which probably influenced the characters.
- The second subgroup includes *Urtica dioica* plants from the Khoriba region.
- The third group includes individuals of the species *Urtica urens* from the Maghnia region.
- The fourth group is made up of *Urtica urens* from the Beab ElAssa region.
- The fifth group includes *Urtica pilulifra* from the Sidi Said region.

Indeed, the effect of the water source (especially in the regions of Sidi Saïd and Khoriba) is an important factor that can directly influence the development of the plant, as well as the adaptation of individuals. These results must be verified by the molecular tool.

Diversity Index

The results cited in Table 12 express the Shannon and Wever diversity index, as well as the Peilou index of each species according to the quantitative traits studied. The plant length trait (LONGT) expresses low diversity for all species.

Sidhoum et al 2024, Genet. Biodiv. J, 2024; 8 (1): 42 -58
DOI: 10.46325/gabj.v8i1.387

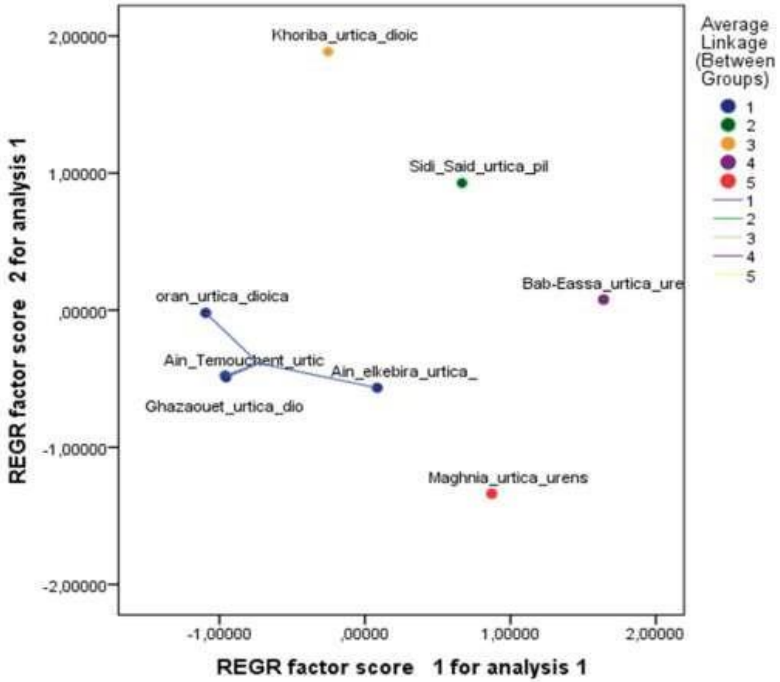

Fig 13: Representation of varieties according to qualitative parameters.

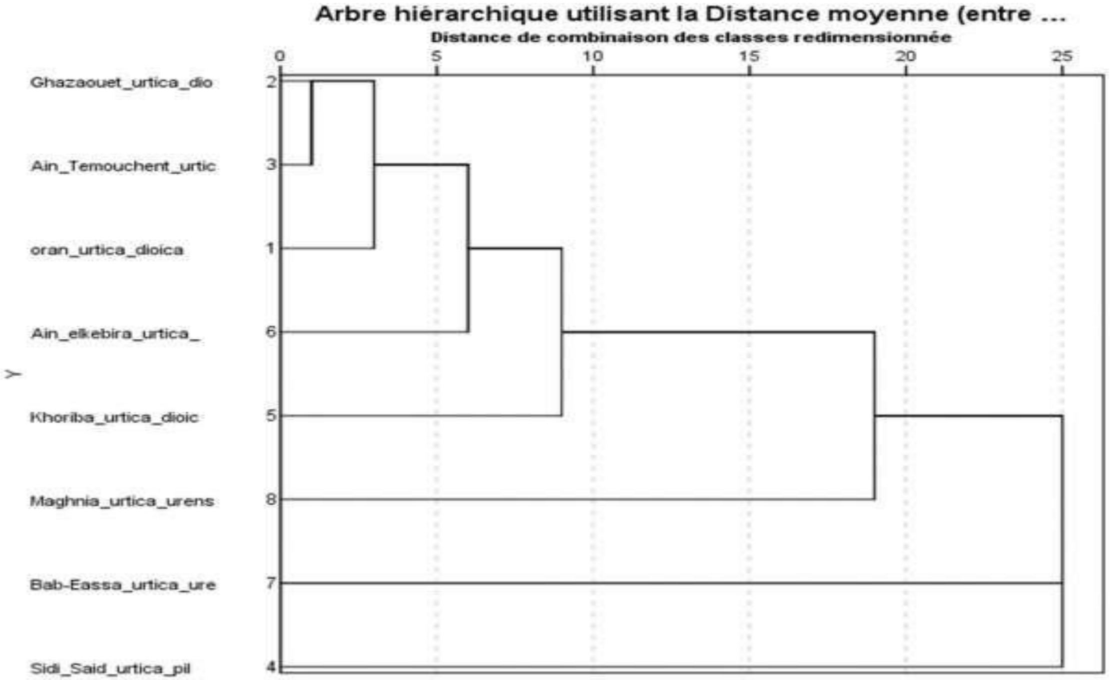

Fig 14: Individual hierarchical ascending classification (HAC).

Table 12: Shannon-Wever and Pielou's diversity result.

	LONGT		DIAMT		NBRN		LONGF		LARGF		LONGP		ESPCF		average	
	SDI	PI	SDI	PI	SDI	PI	SDI	PI	SDI	PI	SDI	PI	SDI	PI	SDI	PI
S. Dioica	0.37	0.27	0.25	18	0.33	0.24	0.24	0.17	0.25	0.18	0.34	0.24	0.23	0.16	0,29	0.21
U.Pilulifra	0.18	0.13	0.23	0.17	0.37	0.27	0.29	0.21	0.03	0.02	0.27	0.19	0.17	0.12	0,22	0.16
U.Urens	0.37	0.26	0.25	0.18	0.09	0.06	0.32	0.23	0.33	0.24	0.35	0.25	0.32	0.23	0,29	0.21

LONGT: length of the plant, DIAMT: diameter of the stem, NBRN: number of nodes, LONGF: length of the leaf, LARGF: leaf width, LONGP: petiole length, ESPCF: leaf area

Although the lowest diversity was noted for the species *Urtica pilulifra.* For the number of nodes (NBRN), there was an SDI (0.09) with an IPD (0.06) that was the lowest among species. For the leaf area trait (ESPCF), the lowest diversity was observed in the species *Urtica pelulifra*. For all the characters, the same value was observed in the two species *Urtica dioica* and *Urtica urens* with an average of (0.21) and 0.16 for the species *Urtica pilulifra*. There is therefore a low phenotypic diversity within species for the 3 species

Conclusion

The nettle is a plant endowed with many qualities from which several uses are derived that deserve to be highlighted and popularized among the general public. In this work, we proceeded to the morphological characterization of three species of nettle at the level of three Wilayas: Tlemcen, Oran and Ain Temouchent, in total 8 regions (Khouriba, Ain el Kbira, Ghazaout, Sidi said, Beb el Assa, Maghnia, Ain Baida, Sidi Ben Adda). A total of 116 nettle plants *(Urtica dioica, Urtica pilulifera, Urtica urens)* were characterized based on 26 morphological markers (19 qualitative and 7 quantitative).

This characterization allowed us to describe the three species separately, the modalities of the qualitative traits are expressed as percentages, and for the quantitative traits we estimated the arithmetic means, the standard standard deviation, and the minimum and maximum values for each species. The results showed variability within the same species. This is most likely due to the genetics of the species but also to the effect of adaptation to climatic and geographical conditions

The statistical analysis of the data was carried out by the SPSS version 25 software.

The results of the Variation of Variables by Species (ANOVA) test were statistically significant.

The results of the Multiple Correspondence Analysis (MCA) allowed us to distinguish the discriminating factors that make the difference in the species studied: surface, shape, stem color and shape, leaf venation and characteristics are the most discriminating for the three species, which brings us back to basing more on leaf-related characters to describe the species.

The results of the principal component analysis (PCA) showed that leaf width and area are positively correlated, as well as leaf length and petiole length. These traits are likely traits that are controlled by a number of genes in common.

The hierarchical classification results (HAC) allowed us to distinguish 5 groups; the grouping of species according to regions highlighted the effect of the environment which influences the development of plants, in particular for the species *Urtica dioica.*

The aim of this work is to characterize the genus *Urtica* morphologically in order to know the species existing in Algeria, this morphological description must be verified by other markers, in particular biochemical and molecular markers, in order to better value the local heritage. Although this work is part of the purpose of the valorization of natural resources.

From a perspective, we plan to expand the study area with an increase in sampling, but also to carry out a biochemical study on the different species and on its essential oil. And finally, molecular characterization is needed

Reference Bibliographic

Bertrand B. 2010. The Secrets of the Nettle. From Terran. Vol. 1. The Plant Companion.

Bertrand, B. 2008. The Secrets of Nettle. Le Compagnon végétal ,10th edition, Terran, 223p.

Billotte Blandine and All 2013 - 2014. Multi Valorization Book of Nettle Page 6 and 7. AFSSAPS (French Agency for the Safety of Health Products) Herbal Medicines. Les cahiers 3 de l'agence, 1998.

Delvaille, A. 2013. *All the Virtues of a Miracle Product: Nettle*. Artemis. Lozenge.

Draghi, F. 2005. Nettle (Urtica dioica L.): A Literature Review. Ph.D. Thesis in Pharmacy, Université Henri Poincaré Nancy, 89p.

Dobinard. A and Chatelain C., 2013. index synonymique de la flore d'Afrique du Nord Conservatoire et jardin botanique Genéve.5 vol

Langlade, V. 2010. L'Ortique Dioïque, *Urtica Dioïca L*.: Etude bibliographique en 2010, Thèse de doctorat en pharmacie, Université de Nante.

Loukkas, 2006. Atlas des parcs nationaux algériens PN Theniet-El-Had Tissemsilt

MOUTSIA. The nettle, a friend who wishes you well. 2008. The Encyclopidia of Utopia. Editions d'Utovie

RAUME, T. 2010. Nettele Urtica Dioicauticaeceae- Nettele Family. Nature Manitoba

Tahri A, S Yamani, A Legssyer, M Aziz, H Mekhfi, M Bnouham, A Ziyyat, 2000. Acute diuretic, natriuretic and hypotensive effects of a continuous perfusion of aqueous extract of *Urtica dioica* in the rat Journal of Ethnopharmacology 73 (2000) 95–100. PII: S0378-8741(00)00270-1

TISSIER, Y. 2011**.** The virtues of nettle. Tredaniel. The Courier of the Book. France

UPTON, R. 2013. Stinging Nettles Leaf (Urtica Dioica L.): Extraordinary Vegetable Medicine. Journal of Herbal Medicine, 3(1), 9-38.

Vajic Una-Jovana, Jelica Grujic-Milanovic, Zoran Miloradovic, Djurdjica Jovovic, Milan Ivanov, Danijela Karanovic, Katarina Savikin, Branko Bugarski, Nevena Mihailovic-Stanojevic, 2018.*Urtica dioica L*. leaf extract modulates blood pressure and oxidative stress in spontaneously hypertensive rats, Phytomedicine, Vol 46, P :39-45 ISSN 0944-7113,https://doi.org/10.1016/j.phymed.2018.04.037.

Vishal Bharmauria, Navjyoti Narang, Vivek Verma, Shalini Sharma. 2009. Genetic variation and polymorphism in the Himalayan nettle plant *Urtica dioica* based on RAPD marker Journal of Medicinal Plants Research P 166-170