

# Malacological diversity of five Lamiaceae in the region of Tlemcen (Northwest Algeria)

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**Abstract.** This article investigates the malacological diversity of five Lamiaceae in the region of Tlemcen (Northwest Algeria). Its arid climate leads to open formation degradation of vegetation. The doum palm is widely distributed in this region as well other aromatic species such as: rosemary, thyme, lavender crocus and horehound. The four aromatic species mentioned above belong to the Labiatae family based on their morphological and botanical characteristics and are certainly an importance source for this malacological fauna. This study proposes an approach to find the diversity of malacofauna identified in these Lamiaceae. For this, an inventory was made in different stations. Malacological wealth of thyme is estimated at 19; rosemary, 18; lavender, 14; *Salvia*, 9, and lastly, horehound, 7. They belong to four families namely Milacidae, Sphincterochilidae, Helicidae and Subulinidae. The Milacidae have horehound and lavender. In this case, Sphincterochilidae, *Sphincterochila candidissima* do not have lavender, *Salvia* and horehound. Subulinidae family has one species: *Rumina decollata*. Helicidae specifically has the richest two subfamilies: Helicinae and Helicellinae. The first subfamily consists of 11 species of thyme, 10 species of rosemary and 5 of lavender, 4 of horehound and 2 of *Salvia*. The second subfamily comprises 7 lavender, 6 species respectively of thyme and rosemary, 5 *salvia* and one horehound. This study also tries to investigate the molluscan species specific to each of these plants that are common. Finally, the vertical distribution of gastropods is given.

**Key words:** Malacological fauna, Lamiaceae, wealth, vertical distribution, region of Tlemcen (Northwest Algeria).

## INTRODUCTION

In the region of Tlemcen, several studies have been conducted on terrestrial molluscs. Damerdji *et al.* (2005) conducted an inventory of malacofauna associated with rosemary. A study on wildlife associated with *Thymus ciliatus*' malacology (Labiatae) was carried out by Damerdji (2010). A comparative study of the fauna present in these two herbs (thyme and rosemary) is made by Damerdji (2009a). Recently, DAMERDJI (2012a) conducted a study on wildlife malacological and medicinal plants namely rosemary, thyme, horehound, cistus and sage leaves in the region of Tlemcen.

The composition and structure of the malacology fauna in *Lavandula dentata* were studied in the coast of

Ghazaouet (Damerdji, In Press). Also, the taxonomic diversity of malacofauna in the station of *Salvia officinalis* at the garden Park of Tlemcen was studied (Damerdji, In Press).

In the same direction, the two malacofauna of Cistaceae, *Cistus salvifolius* and *C. ladaniferus* were studied by Damerdji (2011). Also, this comparative study is the result of the work done on the diversity of the malacology of 3 xerophytic plants namely *Chamaerops humilis*, *Ampelodesma mauritanicum* and *Calycotome spinosa* (Damerdji, 2005). The working methodology is given. The results relate to the diversity of the malacological species in 5 Lamiaceae species (specific and common)

and their distribution by strata.

### Overview of the region of Tlemcen

Tlemcen region is located in North-western Algeria. The climate tends to be dry which causes forest degradation in open formation, which is found xerophytic plants such as doum (*Chamaerops humilis*), the diss (*Ampelodesma mauritanicum*) and broom (*Calycotome spinosa*). Other aromatic species considered are: rosemary (*Rosmarinus officinalis*) thyme (*Thymus ciliatus*), horehound (*Marrubium vulgare*), lavender (*Lavandula dentata*) and *Salvia officinalis*. Considered stations are chosen according to the recovery rate (over 30%) of plant species belonging to the family Lamiaceae in the region of Tlemcen. The uneven distribution of rainfall, on one hand; summer temperatures, on the other hand, characterize the Tlemcen region located in the semi-arid bioclimatic winter in temperate region.

### Study of different host plants

The five plants studied belong to the Phylum Spermaphytes, sub-Phylum Angiosperms, and class of Eudicotes. Thyme, rosemary, horehound, lavender and *Salvia* are part of the sub-class of Enasteridés I. The five species belong to the order Lamiales and family Lamiaceae.

The Labiatae, bringing together more than 3000 species in 200 genera thereabout, are not only distinguished by the structure of their irregular flowers with two lips but also by the essential oils they contain. The Labiatae are shrubs, sub-shrubs or herbaceous plants with usually fragrant stem quadrangular. The leaves are usually opposite without stipules.

### *Rosmarinus officinalis* L. (Rosemary)

Rosemary is a shrub that can be recognized from afar by its smell. This plant can reach 2 m high. The root is deep and swivel. The stem is crooked, angular and fragile. The leathery leaves are sessile with opposite rigid glossy folded edges and greenish above; it is more or less hispid, and whitish below. Its blue flowers blossoming throughout the year attract many insects. The fruit is an oval berry, dry and smooth. Rosemary is found even in the wild. It can be grown. It is a plant with stimulant properties and qualities; can be used for antiseptics, insecticides and perfumes.

### *Thymus ciliatus* Desf. (Thyme)

*Thymus ciliatus* is an aromatic plant that is growing wild

in the guise of a highly branched subshrub at the base; it is very leafy, up to 40 cm. The root system rotates and spreads. The stem is highly branched. Thyme has many small floral leaves, little dilated; it lacks stipules opposite and has short petiolate. The flower is very large, with a red or purplish corolla bilabiate. The fruit is a smooth tetrakene. It is characterized of limestone matorrals. Thyme has a strong smell, pleasant aromatic, bitter taste and warm. Thyme is widely used in herbal medicine. It is widely used in cooking for its pleasant aroma. It is also used by the perfume and pharmaceutical industries.

### *Lavandula dentata* L. (lavender)

Lavender is a chamaephyte in the form of dense clumps. This is an annual herb of a height of 40 to 80 cm, opposite evergreen leaves, which may be whole or toothed. Bracts are located at the base of each cyme. The foliage is finely cut vegetation allowing more air.

Abundant flowering violet blue light is observed in spring season. Corolla monopetalous is reversed, tube longer than calyx limb and divided into five unequal lobes, rounded, imperfectly divided into two lips. *Lavandula dentata* is found in rock gardens, pastures and matorrals, on calcareous and siliceous soils superficiels. Lavender is used in herbal medicine as well as in aromatherapy where it is considered a medicinal plant for the action of its oil used in perfumery.

### *Marrubium vulgare* L. (Horehound)

Herbaceous perennial thyme scents when crushed, is covered with white down, has erect stems, often with many short shoots and is sterile. It has height of 40 to 60 cm. In general, it is a fragrant plant with quadrangular stem; opposite leaves have no stipules; flowers, pentamers, usually hermaphrodite; its axillary cymes together in more or less often contracted simulating whorls, or condensed at the top of the stems and simulating ears; its lower lip forms a plane for landing insects used for pollination. Horehound prefers sunny places, grows on dry sandy fields and roadsides. This plant grows naturally in scrubland, djebels and wasteland. The horehound is known for its therapeutic properties.

### *Salvia officinalis* L.

This is perennial with ligneous stalk on the base, forming a bush sometimes overtaking 80 cm. Its leaves are rather big, thick, and green - whitish opposite. Flowers are blue - made purple in cowardly terminal ears; its verticilles are spaced out by 3 - 6. *Salvia officinalis* requires a sunny exposure, and tolerates very well the limestone. The sage grows spontaneously in the wild in different nest geographically. It

**Table 1.** Species found on the Malacological 5 species of Lamiaceae

Emb.	Class	Order	sub-Order	Families	sub-Families	Genres – species	Thyme (19 sp.)	Rosemary (18 sp.)	Lavender (14 sp.)	Salvia (9 sp.)	Horehound (7species)	
				Milacidae		<i>Milax nigricans</i> <i>Milax gagates</i>	- -	- -	- +	+ -	+ -	
	Gasteropoda	Pulmonata	Stylommatophora	Sphincterochilidae		<i>Sphincterochila candidissima</i>	+	+	-	-	-	
MOLLUSCA						<i>Macularia hieroglyphicula</i>	+	+	+	-	+	
						<i>Macularia jourdaniana</i>	+	+	-	-	+	
						<i>Helix aspersa</i>	+	+	+	-	-	
						<i>Archelix punctata</i>	+	+	-	+	-	
						<i>Archelix lactea</i>	+	-	-	-	-	
						<i>Archelix zapharina</i>	+	-	-	-	-	
						<i>Archelix jullei</i>	+	+	-	-	+	
						<i>Archelix wagneri</i>	+	+	-	-	-	
						<i>Archelix polita punctatiana</i>	+	+	+	-	-	
						<i>Eobania vermiculata</i>	+	+	+	-	-	
						<i>Euparypha pisana</i>	+	+	+	+	+	
						<i>Helix (Alabastrina) soluta</i>	-	+	-	-	-	
							<i>Helicella (Cernuella) virgata</i>	+	+	+	+	-
							<i>Helicella acompsia</i>	+	-	+	+	-
							<i>Helicella pyramidata</i>	+	+	+	+	-
							<i>Helicella reboudiana</i>	-	-	+	-	+
							<i>Helicella (Xeromagna) terveri</i>	+	+	+	+	+
							<i>Helicella (Xerovaga) globuloidea</i>	+	+	-	-	-
							<i>Helicella lauta</i>	+	+	-	+	-
							<i>Helicella breveti</i>	-	-	+	-	-
							<i>Cochlicella acuta</i>	-	+	+	-	-
				Subulinidae		<i>Rumina decollata</i>	+	+	+	+	+	

is seen in clearings, forests, bushes, pastures, steppes, plains and high plateaus. The sage is known for its medicinal properties (antioxidizing - stimulating and astringent).

## METHODOLOGY

### Field study

The methods used are 100 m<sup>2</sup> quadrats, traps, direct pots and debits. Outputs on field ranged between 2012 and 2015. On the field, the samples are taken two times a month. The samples are taken to the laboratory where the living organisms are separated from empty shells. These are placed in plastic bags; the small species are maintained in plastic tubes or glass.

### Laboratory study

The live samples are placed in jars filled with water for 48 hours that is, until complete death. They are then removed and placed in alcohol at 70° for their final conservation. First, organisms for dissection are removed to isolate the genitals required in the determination of gastropods. The shape, size, color and ornamentation of the shell are morphological differences that can help in

the determination. The morphological description is based on the study of Mollusca Gastropoda Pulmonata biosystematics land in the region of Tlemcen. The determination was made from conchylological characters (Damerdji, 1990).

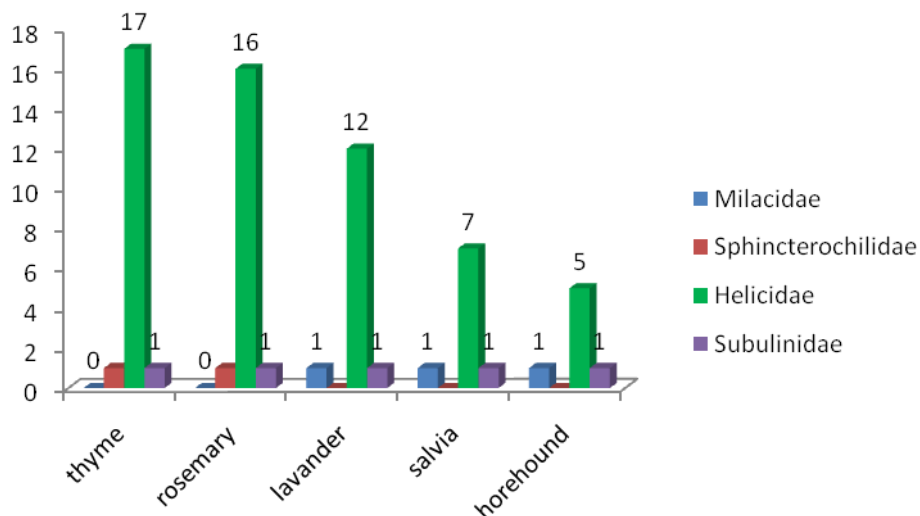
## RESULTS

The results are based on the inventory of gastropods collected on 5 plants specific species common to the various Lamiaceae.

### *Harvested molluscan species diversity on different plants*

Based on our classification according to Germain (1969a, b) a systematic list of species of gastropods found has been established. The results are given in Table 1.

A total of 25 species of gastropods are inventoried on five Lamiaceae. Helicidae family, the richest specifically includes 21 species. Ascending, thyme is the most populous in gastropods with 19 species followed by rosemary with 18 species. Malacological wealth is estimated at 14 to lavender and 9 of the *Salvia* and only 7 on horehound (Table 1).



**Figure 1.** Importance of the different malacological families of the four Labiatae.

#### **Distribution of different families' malacology harvested from 5 Labiatae.**

The results on the distribution of different families are given malacologically in Figure 1. The family Milacidae is present in lavender, *Salvia* and horehound. It is represented by the species *Milax nigricans* and *M. gagates*. The family of Sphincterochilidae is shown in two Lamiaceae namely: thyme and rosemary. This family is the most important, Helicidae specifically. It has 17 species of thyme; rosemary, 16; 12 species of lavender; 7 *Salvia* and only 5 of horehound. Subulinidae family is represented by a single species of five plants with regard to *Rumina decollata*.

#### **Distribution of subfamilies, Helicidae harvested from five Labiatae**

Given the importance of the family Helicidae, we separate it into two subfamilies: Helicinae and Helicellinae. The results are shown in Figure 2.

Sub-Helicinae family has 11 species of thyme, 10 of rosemary, 5 of lavender and 4 of the horehound and only 2 of *Salvia*. Helicellinae accounts for six species on the first 2 plants (thyme and rosemary), 7 species of lavender and 5 of *Salvia* and only 1 of horehound.

#### **Specificity to each species of Lamiaceae**

Five species are specific malacologically: *Milax gagates* (Milacidae) for *Lavandula dentata*, *Archelix lactea* and *A. zapharina* Helicinae for thyme, *Helix*"; *Alabastrina soluta* (Helicinae) for rosemary, (*Helicella*) *breveti* and *H. reboudiana* (Helicellinae) for *Lavandula dentata*.

#### **Cash malacology common to the various Lamiaceae**

##### **- Common species to five Lamiaceae**

*Euparypha pisana* (Helicinae), *Helicella terveri* (Helicellinae, Helicidae) and *Rumina decollata* (Subulinidae) are common to these five species Lamiaceae.

##### **- Common species to four Lamiaceae**

*Macularia hieroglyphicula* (Helicinae); *Helicella virgata*, *H. pyramidata* (Helicellinae) are common to four plants. *Macularia hieroglyphicula* (Helicinae, Helicidae) is common in thyme rosemary lavender and horehound. *Helicella virgata* and *H. pyramidata* are common in thyme, rosemary, lavender and *Salvia*.

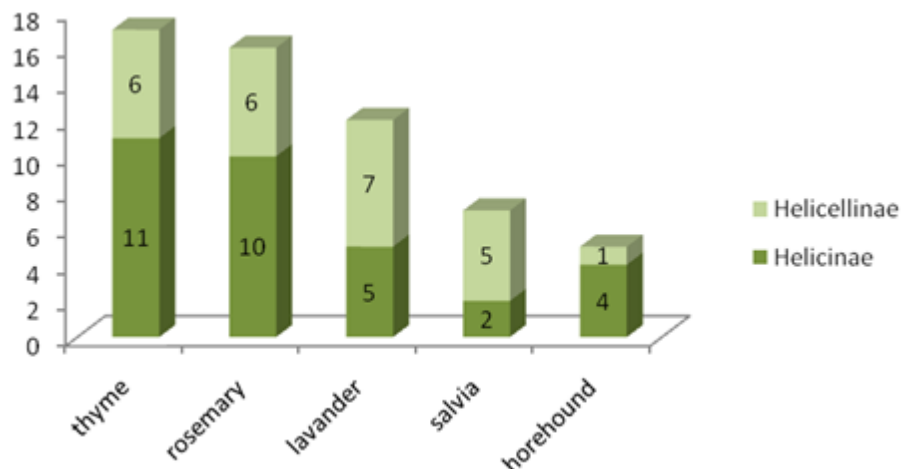
##### **- Common species to three Lamiaceae**

*Macularia jourdaniana*, *Helix aspersa*, *Archelix punctata*, *A. julieti*, *A. polita punctatiana*, *Eobania vermiculata* (Helicinae, Helicidae); *Helicella acompisia* and *H. lauta* (Helicellinae, Helicidae), 8 species are common in three plants.

For example, *Archelix punctata* and *Helicella lauta* are found in thyme, rosemary and *Salvia*. *Helix aspersa*, *A. polita punctatiana* and *Eobania vermiculata* are in thyme, rosemary and lavender. *Helicella acompisia* is thyme, lavender and *Salvia officinalis*. *Macularia jourdaniana* and *Archelix julieti* are respectively common in thyme, rosemary and horehound.

##### **- Species common to two Lamiaceae**

*Milax nigricans* (Milacidae) seems common in *Salvia officinalis* and horehound. Common species with thyme and



**Figure 2.** Importance of subfamilies Helicidae present on five species of Labiatae.

**Table 2.** Distribution of species' malacology according to the strata of five Lamiaceae.

Different strata	Number of species	Root	Area of Soil	Stem	Leaves
Number of species of rosemary (18 species)		1	17	5	5
Number of species of thyme (19 species)		0	19	1	0
Number of species of lavender <i>dentata</i> (14 species)		1	14	08	0
Number of species of <i>Salvia</i> (9 species)		0	9	1	0
Number of species on the horehound (7 species)		0	5	2	0

rosemary are 3 in number: *Sphincterochila candidissima* (Sphincterochilidae) *Archelix wagneri* (Helicinae) *Helicella (Xerovaga) globuloïdea* (Helicellinae). Finally, the species *Cochlicella acuta* (Helicellinae, Helicidae) seems common in rosemary and lavender.

#### **Vertical distribution of gastropods on five Lamiaceae**

The vertical distribution of different Lamiaceae is given in Table 2. The majority of malacological species are found on the surface of soil in different stations of Lamiaceae.

#### **DISCUSSION**

In the study on the mollusk fauna of medicinal plants, Damerdji (2012a) identified 11 species, among which are 9 species of Helicidae, found on *Cistus* sage leaves.

On *Marrubium vulgare*, Damerdji (2012a) indicates the presence of seven malacological species.

The diversity of malacofauna Cistaceae indicates the presence of 10 malacological species of *Cistus ladaniferus* including 08 species of Helicidae. Phenology

of *Cistus salvifolius* seems to favor the presence of *Helix aspersa* (Damerdji, 2012b).

Damerdji, (In press) also gave the composition of 12 species of *Lavandula dentata* of which 10 species are common in 5 plants: *Chamaerops humilis*, *Ampelodesma mauritanicum*, *Calycotome spinosa*, *Rosmarinus officinalis* and *Thymus ciliatus* (Damerdji, 2009b).

Seven malacological species are common in seven studied plants (Damerdji, 2011). The family Sphincterochilidae is represented in five plants and seven plants (Damerdji, 2009, 2011).

The Subulinidae family is represented by a single species in five plants (Damerdji, 2009) and seven plants studied (Damerdji, 2011).

Damerdji (2005) shows the malacological diversity of 3 xerophytic plants: *Ampelodesma mauritanicum*, *Chamaerops humilis* and *Calycotome spinosa*.

The biotope of *Chamaerops humilis* L. is the typical biotope of *Leucochroa candidissima*. The low scrubland, most often developed on limestone, arid and ruthlessly exposed to overgrazing, still characterizes many of the arid regions of the western Mediterranean (Sacchi, 1958). *Sphincterochila candidissima* is found in this region, being particularly fond of limestone (Damerdji, 1990).

The *Euparypha pisana* is also common throughout the Camargue, its shells are gathered under *Salicornia fruticosa* and home to many invertebrates (Aguesse and Bigot, 1962).

According to Bigot (1957) an important fauna representing the bulk orders of invertebrates and almost all orders of insects known in the Camargue, took refuge in empty shells. Gastropods make their own epiphragmes in order to survive extreme conditions (Damerdjji and Djedid, 2008).

Ecoethological, spectacular phenomenon was found among hundreds of organisms belonging to a specific species of molluscs, *Euparypha pisana*, they gather on various plants forming clusters assembling between 15 to 1500 organisms and 0.30 m and 1.5 m meeting height (Bigot, 1967). Thorny species (Thistles, *Opuntia*) often form clusters. Thorns favor setting individuals on the plant. Base on the findings, two species of Helicidae (*Euparypha pisana* and *Eobania vermiculata*) are considered phytophagous (Damerdjji, 2002). According to Khelil (1989), individuals are consumers of *Leucochroa candidissima* and foliage of *Stipa tenacissima*. Herbs are certainly a source of nutrition for wildlife malacologically (Damerdjji, 2012). Insects including Orthoptera are used as food source and for the pollination of Lamiaceae (Damerdjji, 2012c).

## CONCLUSION

Base on the result of this study, the following conclusion can be drawn: thyme is the richness specifically with 19 species while horehound is the least with 7 species. The family, Helicidae is the largest and most diversified. Three species were found to be common in these five plants including two species of Helicidae and *Rumina decollata* (Subulinidae)- *Milax nigricans* (Milacidae), *Salvia officinalis* and *Marrubium vulgare*. There were also three common species between the thyme rosemary and lavender.

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