

# Malacological Diversity on Some Lamiaceae in the Region of Tlemcen (Northwest Algeria)

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**Abstract:** The region of Tlemcen is located in the northwestern part of Algeria. Its arid climate leads to the degradation of vegetation in open formation, where can be found the doum, the diss and broom. Other aromatic species such as rosemary, thyme, lavender and horehound are considered as well. The four previous aromatic species belong to the family Labiatae for their morphological and botanical characters. The authors propose to design an approach to identify the diversity of malacofauna found on these different Lamiaceae. These are certainly a nutritional source for this malacological fauna. So, a survey was performed in various stations. The malacological richness is estimated to be 19 for thyme, 18 for rosemary, 16 for lavender, and finally 7 for horehound. It includes four families, namely Milacidae, Sphincterochilidae, Helicidae and Subulinidae. Milacidae are present only in horehound and lavender stations. On the other hand, the Sphincterochilidae, namely *Sphincterochila candidissima*, is absent on horehound. *Rumina decollata* is the only species in the family Subulinidae. As for the family Helicidae, it is the richest and includes two specific subfamilies: Helicinae and Helicellinae. The first subfamily consists of 11 species of thyme, 10 species of rosemary and lavender. The second subfamily includes 6 species of thyme and rosemary and 3 of lavender, respectively. In addition, the author tries to look for the malacological species specific to each of these plants and those who are common to them as well. Finally, the vertical distribution of gastropods is given.

**Key words:** Malacological fauna, Lamiaceae, specific richness, vertical distribution, region of Tlemcen (northwest Algeria).

## 1. Introduction

Several studies were performed on terrestrial malacofauna in the region of Tlemcen. Damerdji [1] conducted an inventory of the malacofauna related to rosemary. A malacological study of the fauna related to *Thymus ciliatus* (Labiatae) was performed by Damerdji [2], and a comparative study of the fauna present on these two aromatic herbs (thyme and rosemary) was also conducted by Damerdji [3]. Recently, Damerdji [4] conducted a study on the Malacological fauna of medicinal plants such as rosemary, thyme, horehound and Sage-leaved *Cistus* in the region of Tlemcen.

The composition and structure of the malacological fauna were studied in stations of *Marrubium vulgare*

[5] and *Lavandula multifida* [6], respectively.

Similarly, the malacofauna on two Cistaceae, i.e. *Cistus salvifolius* and *C. ladaniferus*, was studied [7].

In addition, this comparative study came as a result of various works carried out on the malacological diversity on three xerophytic plants such as the doum, diss and broom [8]. The working methodology is given. The results relate to the malacological diversity on four Lamiaceae, on specific and common species and on the distribution by strata as well.

### 1.1 Overview of the Region of Tlemcen

The region of Tlemcen is located in northwestern Algeria. The climate tends to be arid resulting in forest degradation in open formation, where are found xerophytic plants such as the doum (*Chamaerops humilis*), diss (*Ampelodesma mauritanicum*), and broom (*Calycotome spinosa*). Besides, other aromatic species like the rosemary (*Rosmarinus officinalis*),

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thyme (*Thymus ciliatus*), horehound (*Marrubium vulgare*) and lavender (*Lavandula multifida*) are considered. The stations are selected according to the recovery rate (over 30%) of plant species belonging to the family Lamiaceae in the region of Tlemcen. The poor distribution of rainfall on the one hand, the summer temperatures on the other hand characterize the region of Tlemcen, located in the semi-arid bioclimatic area with a temperate winter.

### 1.2 Study of Various Host Plants

The four plants under study belong to the branch of Phylum spermaphytes and sub-branch of Phylum Angiospermae, in the class of Eudicotes. Thyme, rosemary, horehound and lavender are part of the sub-class of Enasterides I. The four species belong to the order Lamiales and the family Lamiaceae.

Labiatae, with more than 3000 species gathered in about 200 classes, are not remarkable only for the structure of their irregular flowers with two lips, but also by the essential oils they contain. Labiatae are shrubs, sub-shrubs or herbaceous plants, usually fragrant, with quadrangular stems. The leaves are usually opposite without stipules.

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

Rosemary is a shrub which is recognized from afar by its smell. This plant can be 2 m high with a deep swiveling root. The stem is crooked, angular and fragile. The leathery leaves are sessile, opposite, stiff and shiny, with folded edges, with a greenish upper face and whitish lower face, more or less hispid. The blue flowers, blooming throughout the year, attract many insects. The fruit is an oval berry, dry and smooth. Rosemary can be found even in the wild. It can be grown, which has insecticidal, stimulating and antiseptic qualities and properties, and can be used to make perfumes as well.

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

*Thymus ciliatus* is an aromatic plant, found in the wild, in the form of a sub-shrub highly branched at the base, very leafy, and can be as high as 40 cm. It has a

winding and spreading root system and the stem is highly branched. Thyme has plenty of small floral leaves, little dilated and opposite, short-stalked and without stipules. The flower is very large, red or purple, with a lipped corolla. The fruit is a smooth tetrakene. It is characteristic of limestone matorrals. Thyme has a nice strong aromatic odor, with a bitter and warm flavor. It is also widely used in herbal medicine and cooking for its pleasant aroma. It is also employed in perfume and pharmaceutical industries.

#### 1.2.3 *Lavandula multifida* L. (Lavender Multifidus)

Lavender is a chamaephyte in the form of dense clumps. It is an annual herb, about 40-80 cm tall, with opposite evergreen leaves that can be entire or toothed. Bracts are located at the base of each cyme. The fruit is tetrakene. The foliage is finely cut, enabling airier vegetation. An abundant blue light purple flowering is observed in the spring season. The monopetalous corolla is upside down, longer than the calyx tube; with a limb divided into five unequal rounded lobes, imperfectly divided into two lips. *Lavandula multifida* is found in rock gardens, pastures and matorrals, on calcareous and siliceous substrates and superficial soils. 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.

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

It is a herbaceous plant, hardy, thyme-scented when crushed, covered with white down, with erect stems, often presenting numerous short and sterile shoots. Its height range goes from 40 cm to 60 cm.

In general, it is a fragrant plant with a quadrangular stem, with opposite leaves and no stipules. The pentamerous flowers, usually hermaphrodite, gathered in auxiliary cymes, more or less contracted, often resemble whorls, or can be condensed at the top of stems and look like ears. The lower lip forms a landing plane for insects; and therefore allowing insect pollination. Horehound prefers sunny places, growing on dry, sandy fields and on roadsides. This plant grows naturally in

scrublands, djebels (mountains) and wastelands. It has always been known for its therapeutic properties since antiquity.

## 2. Methods

### 2.1 In the Field

The methods used are the 100 m<sup>2</sup> quadrats, pot traps and direct samplings. The field trips were programmed between 2010 and 2012.

In the field, the samplings are done twice a month. The samples are taken to the laboratory where living individuals are separated from empty shells. They are placed in plastic bags; the small species are kept in plastic or glass tubes.

### 2.2 In the Laboratory

Living samples are placed in water-filled jars for 48 hours, i.e. until complete death. Then, they are removed and placed in 70° alcohol for final storage. Beforehand, interesting individuals are removed for dissection, to

isolate the genitals needed to determine the gastropods. The shape, size, color and ornamentation of the shell are morphological differences that may help in the identification operation. The morphological description comes from the biosystematic study of terrestrial pulmonate gastropod molluscs in the region of Tlemcen [9]. Indeed, the identification was made by the authors from the conchological characters.

## 3. Results

The results are based on the inventory of Gastropods collected from the four plants, on specific species and on species common to various plants.

### 3.1 Diversity of Malacological Species Collected from Different Plants

Based on the classification of Ref. [10] and Ref. [11], a systematic list of species of Gastropods encountered was established. The results obtained are given in Table 1.

**Table 1 Malacological species found on the four species of Lamiaceae.**

Phyl.	Cl.	Order	S/O	Families	Sub/Fam.	Genus-species	Thyme (19 species)	Rosemary (18 species)	Lavander (16 species)	Horehound (7 species)
Mollusca	Gasteropoda	Pulmonata	Stylommatophora	Milacidae		<i>Milax nigricans</i>	-	-	+	+
				Sphincterochilidae		<i>Sphincterochila candidissima</i>	+	+	+	-
						<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 juilleti</i>	+	+	+	+
						<i>Archelix wagneri</i>	+	+	-	-
						<i>Archelix polita punctatiana</i>	+	+	+	-
						<i>Eobania vermiculata</i>	+	+	+	-
						<i>Euparypha pisana</i>	+	+	+	+
						<i>Helix (Alabastrina) soluta</i>	-	+	+	-
						<i>Helix (Alabastrina) alabastrites</i>	-	-	+	-
						<i>Helicella virgata</i>	+	+	+	-
						<i>Helicella acompisia</i>	+	-	-	-
						<i>Helicella pyramidata</i>	+	+	-	-
						<i>Helicella terveri</i>	+	+	+	+
						<i>Helicella globuloïdea</i>	+	+	-	-
		<i>Helicella lauta</i>	+	+	+	-				
		<i>Cochlicella acuta</i>	-	+	-	-				
		Subulinidae		<i>Rumina decollata</i>	+	+	+	+		

As a whole in Table 1, 23 species of Gastropod are inventoried on the 4 Lamiaceae. The family Helicidae is the richest and includes 20 species. In ascending order, thyme is the most populous with gastropods with 19 species, followed by rosemary with 18 species. The malacological wealth is estimated to 16 on *Lavandula multifida* and only 7 on horehound.

3.2 Distribution of Different Malacological Families Collected on All Four Labiatae

The results on the distribution of different malacological families are given in Fig. 1.

The family Milacidae is present on *Lavandula multifida* and horehound. It is represented by the species *Milax nigricans*. The family Sphincterochilidae is represented on three Lamiaceae, namely rosemary, thyme and lavender. The family Helicidae is the most important specifically. It has 17 species on thyme, 16 on rosemary, 13 on lavender and only 5 on horehound. The family Subulinidae is represented by a single species, i.e. *Rumina decollata*, on all four plants.

3.3 Distribution of Subfamilies Helicinae Collected from the Four Labiatae

Given the importance of the family Helicidae, the author splits it up into two subfamilies: Helicinae and Helicellinae. The results are shown in Fig. 2.

The subfamily Helicinae includes 11 species on thyme, 10 on rosemary and lavender and only 4 on horehound. The subfamily Helicellinae has 6 species on the two plants (thyme, rosemary), 3 on lavender and only 1 on horehound.

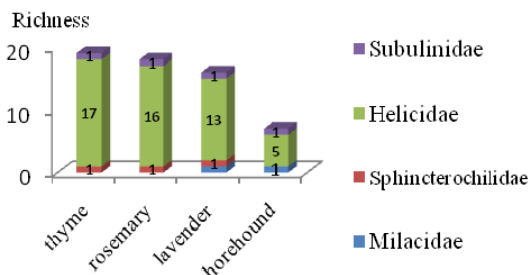


Fig. 1 Importance of different malacological families on all four Labiatae.

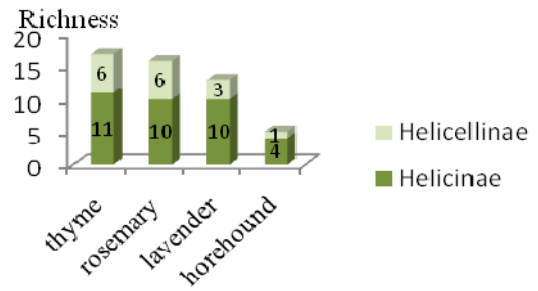


Fig. 2 Importance of subfamilies Helicinae present on the four Labiatae species.

3.4 Specific Species to Each Lamiaceae

There are three specific malacological species which are *Helix (Alabastrina) alabastrites* (Helicinae) for lavender, *Helicella (Trochoidea) acompisia* (Helicellinae) for thyme and *Cochlicella acuta* (Helicellinae) for rosemary.

3.5 Malacological Species Common to Various Lamiaceae

3.5.1 Common Species to Four Lamiaceae

*Macularia jourdaniana*, *Archelix juilleti*, *Euparypha pisana* (Helicinae), *Helicella terveri* (Helicellinae, Helicidae) and *Rumina decollata* (Subulinidae) are the 5 species common to these four Lamiaceae.

3.5.2 Common Species to Three Lamiaceae

*Sphincterochila candidissima* (Sphincterochilidae), *Archelix punctata*, *A. polita punctatiana*, *Eobania vermiculata* (Helicinae, Helicidae), *Helicella (Cernuella) virgata* and *H. lauta* (Helicellinae, Helicidae) are the six common species to thyme, rosemary and lavender.

*Macularia hieroglyphicula* (Helicinae, Helicidae) is common to thyme, rosemary and horehound.

3.5.3 Common Species to Two Lamiaceae

*Milax nigricans* (Milacidae) seems to be common to lavender multifidus and horehound.

There are four species common to thyme and rosemary. They are *Helix aspersa*, *Archelix wagneri* (Helicinae), *Helicella (Trochoidea) pyramidata* and *Helicella (Xerovaga) globuloidea* (Helicellinae).

The two species common to thyme and lavender

**Table 2** Distribution of malacological species according to the strata of the four Lamiaceae.

Various strata (number of species)	Root	Area of soil	Stem	Leaves
Number of species on rosemary (18 species)	1	17	5	5
Number of species on thyme (19 species)	0	19	1	0
Number of species on lavender multifidus (16 species)	1	14	8	0
Number of species on horehound (7 species)	0	5	2	0

multifidus are *Archelix lactea* and *A. zapharina* (Helicidae).

Finally, the species *Helix (Alabastrina) soluta* seems to be common to rosemary and lavender multifidus.

### 3.6 Vertical Distribution of Gastropods

The vertical distribution of different Lamiaceae is given in Table 2.

## 4. Discussion

In the study done on the malacological fauna of medicinal plants, Ref. [4] identified 11 species among which 9 are Helicidae, found on sage leaves. On *Marrubium vulgare*, Refs. [4, 5] showed the presence of 7 malacological species. The diversity of malacofauna on two kinds of Cistaceae indicates the presence of 10 malacological species on *Cistus ladaniferus* out of which 8 are Helicidae. Phenology of *Cistus salvifolius* seems to favor the presence of *Helix aspersa* [7]. Furthermore, in the region of Tlemcen, especially in the plain of Maghnia, Ref. [6] gave the composition of 16 species in stations of *Lavandula multifida*. The family Sphincterochilidae is found on 5 plants [12]. The family Subulinidae is represented by a single species in seven studied plants [12, 13]. In 2005, it is showed the malacological diversity on 3 xerophytic plants [8]. The biotope of *Chamaerops humilis* L. is the typical biotope of *Leucochroa candidissima*. This low scrubland, often developed on limestone, arid and ruthlessly exposed to overgrazing, still characterizes many of the arid regions of the west of the Mediterranean area [14]. *Sphincterochila candidissima* is particularly fond of limestone [9]. But, *Euparypha pisana* is found all over

the Camargue where its shells gather under *Salicornia fruticosa* and host many invertebrates [15]. According to Bigot [16], an important fauna representing most of invertebrate orders and about all known insect orders in the Camargue, took refuge in the empty shells. Gastropods make their own epiphragms in order to survive severe conditions [17]. A spectacular eco-ethological phenomenon was found; hundreds of individuals belonging to a specific species of molluscs, *Euparypha pisana*, formed some kind of “high meetings” by gathering on various plants. These are real “clusters” assembling between 0.3 m and 1.5 m, from 15 to 1500 individuals [18]. Thorny species (Thistles, Opuntia) often carry clusters. Thorns would favor setting individuals on the plant. On the Diss, 2 species of Helicidae (*Euparypha pisana* and *Eobania vermiculata*) are considered as phytophagous [19]. According to Khelil [20], individuals of *Leucochroa candidissima* feed on alfa foliage. Aromatic plants are certainly a source of nutrition for the malacological fauna [4]. Insects, mainly Orthoptera, use Lamiaceae as a food source and enable them to pollinate as well [21].

## 5. Conclusion

The malacological study conducted in different stations allows the authors to say that thyme is the richest specifically with 19 species and horehound with seven species only. The family Helicidae remains the largest and most diverse on various Lamiaceae. Five species are found to be common to these four plants, among which four are Helicidae and *Rumina decollata* (Subulinidae) species. *Milax nigricans* (Milacidae) are found on *Lavandula multifida* and *Marrubium vulgare*. Six species are common to thyme,

rosemary and lavender.

A rapprochement between the botanical characters adapted to lipped species and the malacological diversity is to be considered.

Snails have a relatively greater biological activity on some Lamiaceae, i.e. thyme and rosemary.

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