

## DIVERSITY OF MALACOFAUNA PRESENT ON THREE SPECIES OF CISTACEAE

(*CISTUS LADANIFERUS* L., *C. SALVIFOLIUS* L. AND *C. MONSPELIENSIS* L.)

IN THE REGION OF TLEMCCEN (NORTHWEST ALGERIA)

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### ABSTRACT

The region of Tlemcen is located in the north-west of Algeria, whose climatic impact is reflected in the degradation of the forest in matorral, an open formation made up of xerophytic plants such as the Cistes... We propose to realize an approach of the diversity of malacofauna found on 3 species of Cistaceae namely *Cistus salvifolius*, *C. ladaniferus*, and *C.monspeliensis*. The malacological richness is estimated at 11 species on the Sage-leaved Rockrose, 10 species on the Ladaniferous Cistus and 13 species on the Cistus of Montpellier. These are divided into 4 families: Milacidae, Sphincterochilidae, Helicidae, and Subulinidae. The 1st, 2nd and 4th families have one species each. These are *Milax gagates*, *Sphincterochila candidissima*, and *Rumina decollata*, respectively. The most diverse family of Helicidae has 2 subfamilies: Helicinae and Helicellinae. The 1st subfamily has 8 species on the Montpellier rockrose and the sage-leaf rockrose and 6 species on the ladaniferous rockrose. The 2nd subfamily includes 4 species on *Cistus monspeliensis* and only 2 species on the other two Cistaceae. The seasonal distribution according to the specific richness of gastropods is shown. We are looking for the malacological species specific to each of the three plant species and the species that are common to them and on the distribution according to the different strata.

**KEYWORDS:** Malacofauna, *Cistus Salvifolius*, *C.ladaniferus*, *C.monspeliensis*, Diversity & Region of Tlemcen (Northwest Algeria).

### INTRODUCTION

Molluscs Pest gastropods, snails are usually voracious with tender leaves. They use certain plants as a refuge but also as a source of food. Knowing that Cistaceae are pyrophyte species and are known for their medicinal properties, we try to study their relationship with fauna in general and gastropods in particular.

Very little faunistic work has been done in the Cistaceae stations except those of (HADJOUTI, 2010) on *Cistus salvifolius* and those of (LOURMIL, 2010) on the fauna of the Invertebrates of *Cistus ladaniferus* then (DAMERDJI, HADJOUTI, and LOURMIL, 2011a) on Orthopteroids and finally those concerning Orthoptera (DAMERDJI, HADJOUTI and LOURMIL, 2011b) which justifies the present work.

This study comes after various works carried out on the Doum, (DAMERDJI, 2002a) on the Diss (DAMERDJI, 2002b); (DAMERDJI and BOUHELLOU, 2002) on the Genet (DAMERDJI, 2008). In 2005, (DAMERDJI) shows the malacological diversity on 3 xerophilous plants. DAMERDJI, LADJMI and DOUMANDJI the same year, an inventory was

made of malacofauna associated with Rosemary. A study on malacological fauna on two aromatic plants (Rosemary-Thyme) was carried out by (DAMERDJI, 2009). The composition and structure of gastropods in thyme stations has been studied by (DAMERDJI, 2010). Recently, (DAMERDJI, 2011a) carried out a malacological inventory on 5 different plants than on 7 plants (DAMERDJI, 2011b). The results concern the malacological diversity of the 3 Cistaceae, the seasonal importance, the common species, and the distribution according to the strata.

## METHODOLOGY

### Overview of the Region of Tlemcen

The region of Tlemcen is located in northwestern Algeria. The climate tends to become arid, resulting in a degradation of the forest in open formation, where are found xerophilic plants such as the doum (*Chamaerops humilis*), the diss (*Ampelodesma mauritanicum*), the broom (*Calycotome spinosa*). Three other species of Cistaceae are considered: the sage-leaved rockrose (*Cistus salvifolius*), the ladaniferous rockrose (*Cistus ladaniferus*) in the Tlemcen Mountains and the Montpellier rockrose (*Cistus monspeliensis*) in the Nedroma zone. The poor distribution of rainfall on the one hand, and summer temperatures on the other characterize the Tlemcen region, located in the semi-arid temperate winter bioclimatic stage.

### Study of Different Host Plants

The three plants studied are part of the Spermaphytes Branch, the Angiosperm Sub-Branch, the Eudicots Class, the Eurosidea Subclass, the Malvales Order and the Cistaceae Family.

#### *Cistus ladaniferus* L. (Cistus gum)

*Cista ladanière* or *Ciste à gomme* is a woody pyrophyte shrub with young shoots and glutinous leaves. It can reach 1 to 2 m in height. This shrub appreciates the warmth, sun, and light, well-drained soils. It is quite hardy and tolerates a minimum temperature of  $-5^{\circ}\text{C}$ . *Cistus ladaniferus* has strongly aromatic leaves (ladanum), sessile, very elongated. In the pharmacopoeia, she was known to be stimulating and expectorant. It is also used in the parapharmaceutical industry.

The classification is as follows:

Genus-species *Cistus ladaniferus* subsp *africanus*

Common name *Cistus ladanière*, *Lédon*, *Ciste gum*

#### *Cistus Salvifolius* L. (Rockrose) White Rockrose

Sage-leaved Rockrose is a very branched shrub, compact, erect, sometimes prostrate. This plant can reach 20 to 60 cm high, sometimes 100 cm. The root has no absorbent hairs in general. The leaves are simple, persistent, opposite and with a short petiole of up to several cm. They look like sage leaves, slimy as well as a young twig.

Genus-species *Cistus salvifolius* L.

Common name Sage-leaved Rockrose, *Ciste mondré*

It is a moderately odorous plant. *Cistus salvifolius* is a thermophilic shrub that prefers sunny places and siliceous soils. It is a species that prefers sunny resorts with limestone soils or soils that are low in nutrients. This plant is considered an important food source for cattle and is grown as an ornamental plant. *Cistus salvifolius* is used as a traditional remedy. It

is visited by bees, especially for pollen.

***Cistus Monspeliensis* L. (Cistus of Montpellier)**

This cistus is known as a shrub with very vigorous vegetation, forming a beautiful pyramid very compact, which can reach a height of 0.5 to 1.2m and a width of 1.5m. The leaf is lanceolate, linear, without petiole, sticky due to the presence of resin, dark green on the top and clear on the reverse. They last only one day but they are numerous and are renewed for nearly 6 weeks. The white flowers are very fragrant and pollinating attract insects and mainly butterflies. The fruits of *C. monspeliensis* are oval capsules dehiscent with 5 valves. It supports very well the seaside and the dry and poor grounds, prefers the sunny places and does not like the very strong winds. The Montpellier rockrose is very common and grows in forests, scrub, and non-calcareous terrain. The rockrose is also used for its medicinal properties.

Genus-species. *Cistus monspeliensis*

French name. Ciste de Montpellier or flower of a day

**Description of the Stations**

The description of the *Cistus ladaniferus*, *C. salvifolius*, and *C.monspeliensis* stations are given in the following tables respectively.

**Table 1: Edaphic and Botanical Data of the 3 Prospected *Cistus Ladaniferus* Stations**

Prospected Stations	Altitude	Slope	Humidity	Recovery Rate
Station 1 (Koudiat Hafir)	1321 m	12%	60%	45-50%
Station 2 (Sour El-Hammem)	1078 m	8-10%	60%	50-60%
Station 3 (Zarifelt)	1060 m	8-10%	70%	60-70%

**Table 2: Edaphic and Botanical Data of the 3 Prospected *Cistus Salvifolius* Stations**

Prospected Stations	Altitude	Slope	Humidity	Recovery Rate
Station 1 (Zarifelt 1)	1078 m	8-10%	60%	50-65%
Station 2 (Zarifelt 2)	1060 m	8-10%	60%	60-70%
Station 3 Hafir (Oued Fernane)	1285 m	>12%	70%	30-50%

**Table 3: Edaphic and Botanical Data of the 3 Prospected *Cistus Monspeliensis* Stations**

Prospected Stations	Altitude	Slope	Exposure	Recovery Rate
Station 1 (Zaouia de Sidi Amer)	525m	30-35%	South-West	60-70%
Station 2 (Mkhalfa 1)	514m	30-35%	East	50%
Station 3 (Mkhalfa 2)	587m	35-40%	East	70-75%

**Sampling Equipment and Methods**

**In the field**

To perform this work, we prospected 3 stations for each of the three Cistaceae species with a fairly high recovery rate. The experimental protocol carried out is the same for the three Cistaceae species. The techniques used are the quadrats of 100 m<sup>2</sup>, pots traps and the collection by hand. Sampling is carried out for 5 months (March to July) with 2 samples per month.

The samples are taken back to the laboratory where we separate live individuals from empty shells. These are put in plastic bags; small species are kept in plastic tubes or glass.

### In the laboratory

The live samples are put in jars filled with water for 48 hours that is to say until their complete death. They are then removed to be placed in 70 ° alcohol for final preservation. Beforehand, we remove the individuals interesting for the dissection and of course to isolate the genitals which represent a criterion of primary determination for the Gastropods. The shape, size, color, and ornamentation of the shell are morphological differences that can help us in the determination. In addition, the anatomical characters including the genital tract are also determining criteria for the identification of species. The morphological description is taken from the biosystematic study of the mollusks gastropods terrestrial lambs of the Tlemcen region (DAMERDJI, 1990). Indeed, the identification was made by us from the conchological characters.

### Results

The results relate to the inventory of gastropods harvested on the 3 Cistaceae and the species common to all three plants.

### Diversity of Malacological Species Harvested on the Three Cistaceae

Based on the classification of (GERMAIN, 1969a and 1969b) a systematic list of recovered gastropod species has been established. The results obtained are given in the following table.

In total, 16 species of gastropods are inventoried on the 3 Cistaceae. In ascending order, the Montpellier rockrose is slightly more populated in gastropods with 13 species, followed by the rockrose with 11 species and the caterpillar with 10 species. The family of Helicidae, the richest specifically, comprises 13 species, that of Milacidae, Sphincterochilidae and Subulinidae are represented by one species each (Table 4).

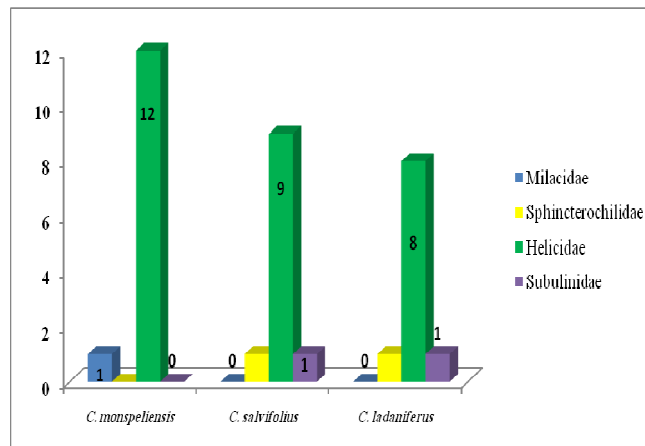
**Table 4: Malacological Species Found on Three Cistaceae Species**

Embranchement	Class	Sub-Class	Order	Families	Sub-Families	Malacological Species	Rubber tree (10 species)	Sage leaf rockrose de sauge (11 species)	Ciste of Montpellier (13 species)
MOLLUSCA	GASTROPODA	Pulmonata	Stylommatophora	Milacidae		<i>Milax gagates</i>	-	-	+
				Sphincterochilidae		<i>Sphincterochila candidissima</i>	+	+	-
				Helicidae	Helicinae	<i>Helix (Cryptomphalus) aspersa</i>	-	+	+
						<i>Macularia hieroglyphicula</i>	-	-	+
						<i>Macularia jourdaniana</i>	+	+	+
						<i>Archelix punctata</i>	+	+	+
						<i>Archelix lactea</i>	+	+	-
						<i>Archelix zapharina</i>	-	-	+
						<i>Archelix polita punctatiana</i>	+	+	+
						<i>Eobania vermiculata</i>	+	+	+
						<i>Euparypha pisana</i>	+	+	+
						Helicellinae	<i>Helicella (Cernuella) virgata</i>	+	+
				<i>Helicella pyramidata</i>	-		-	+	
				<i>Helicella (Xeromagna) terveri</i>	+		+	+	
				<i>Helicella breveti</i>	-		-	+	
					Subulinidae		<i>Rumina decollata</i>	+	+

+: Presence

**Distribution of the Different Malacological Families Harvested on the 3 Plants**

The results concerning the distribution of the different malacological families are given in the following figure.

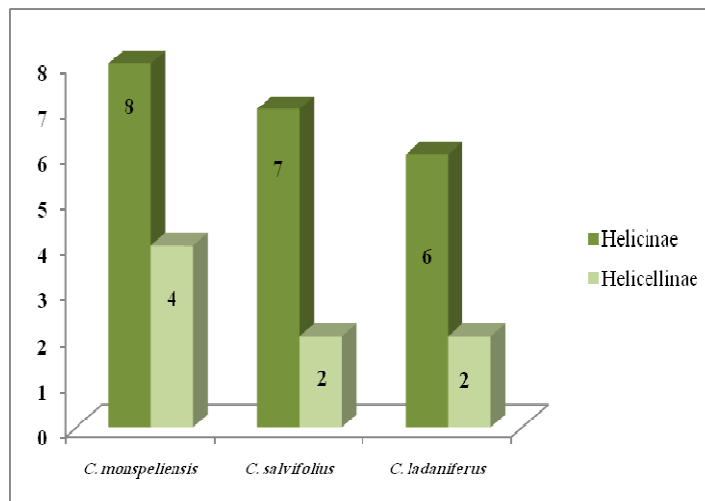


**Figure 1: Importance of the Different Families Present on the 3 Cistaceae**

The family Helicidae is the most important specifically for the 3 Cistaceae. It has 12 species on *C. monspeliensis*. Only one species of Helicidae differentiates them, it is *Helix aspersa* found only in the stations with *Cistus salvifolius*. Concerning the species *Rumina decollata* (Subulinidae) it is present on both Cistaceae. We do not find it in the resorts at *Cistus monspeliensis*.

**Distribution of Subfamilies of Helicidae Harvested from the 3 Cistaceae**

Given the importance of the Helicidae family, we try to separate it into 2 sub-families: Helicinae and Helicellinae. The results are given in Figure 2.

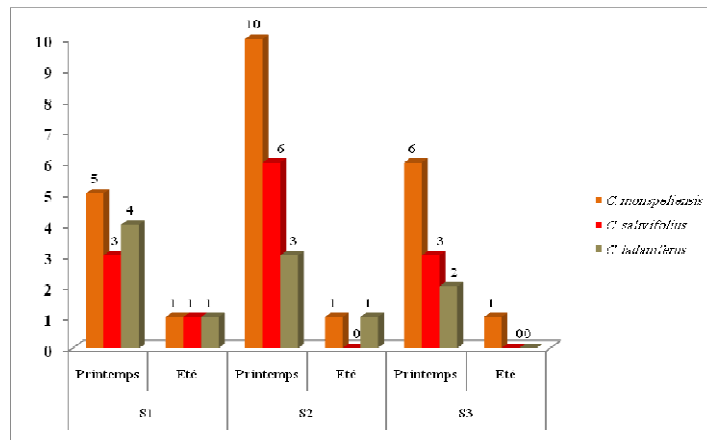


**Figure 2: Importance of the Helicidae Subfamilies Present on the 3 Plants**

The subfamily Helicinae contains 8 species on the Montpellier rockrose; 7 species on sage-leaf rockrose and 6 species on gum-rockrose, that of Helicellinae has 4 species on *C. monspeliensis* and 2 species on the other two Cistaceae. These are *Helicella virgata* and *H. terveri*.

**Seasonal Importance of Gastropods on the Three Cistaceae**

The results of the seasonal distribution of gastropods on the 3 Cistaceae are given in the following figure.



**Figure 3: Seasonal Importance of Gastropods on the 3 Plants**

We note that the station 2 (*Cistus salvifolius*) in spring seems the richest in malacological species. In this season, stations 1 and 3 comprise half of the species compared to the second station. In summer, the malacological wealth is very low or even zero, especially in the 3rd station.

**Species-Specific to Each Plant**

*Milax gagates* (Milacidae), *Macularia hieroglyphicula* and *Archelix zapharina* (Helicinae) *Helicella pyramidata* and *H. breveti* (Helicellinae) are found only in *Cistus monspeliensis* stations.

**Common Malacological Species**

- To the three Cistaceae

*Macularia jourdaniana*, *Archelix punctata*, *A. polita punctatiana*, *Eobania vermiculata*, *Euparypha pisana* (Helicinae); *H. virgata*, *H. terveri* (Helicellinae, Helicidae) are the 7 species common to the 3 Cistaceae.

- To two Cistaceae

*Sphincterochila candidissima* (Sphincterochilidae), *Helix (Cryptomphalus) aspersa*, *Archelix lactea* (Helicidae) and *Rumina decollata* (Subulinidae) are the 4 species common to 2 Cistaceae.

**Vertical Distribution of Malacological Species on the Three Cistaceae**

The distribution of malacological species according to the strata is given in the following table.

**Table 5: Distribution of Malacological Species Harvested According to the Strata of the Three Cistaceae**

Different Strata	Root	Surface of soil	Stem	Leaves
Number of species on the Cistus gum	0	7	4	2
on the sage leaf rockrose	0	7	4	1
on the Montpellier rockrose	1	11	5	0

The surface of the ground seems the most populated in species of snails followed by the stem.

## DISCUSSIONS

The biotope of *Chamaerops humilis* L. is the typical biotope of *Leucochroa candidissima*. This low scrubland, developed mostly on limestone, arid ruthlessly exposed to overgrazing, still characterizes much of the arid regions of the western Mediterranean (SACCHI, 1971). *Sphincterochila candidissima* is particularly fond of calcareous rocks (DAMERDJI, 1990). On the other hand, *Euparypha pisana* is common throughout the Camargue where its tests accumulate under *Salicornia fruticosa* and harbor many invertebrates (AGUESSE and BIGOT, 1962). According to (BIGOT, 1957) a large fauna representing most of the orders of invertebrates and almost all orders of insects known in the Camargue, took refuge in empty shells. Gastropods make their epiphragms to survive extreme conditions (DAMERDJI, 2008). A spectacular eco-ethological phenomenon has been observed: Hundreds of individuals belonging to a specific species of mollusk, *Euparypha pisana*, form by grouping themselves on various plants "meetings in height", true "clusters" assembling between 0,30m and 1, 5m, from 15 to 1500 subjects (BIGOT, 1967). The thorny species (Chardon, *Opuntia*) are very often carriers of bunches. The spines would favor the attachment of individuals on the plant. The phenology of the plant with regard to *Cistus salvifolius* seems to favor the presence of this malacological species which is *Helix aspersa*. On Diss, 2 species of Helicidae (*Euparypha pisana* and *Eobania vermiculata*) are considered phytophagous (DAMERDJI, 2002a). According to (KHELIL, 1989) individuals of *Leucochroa candidissima* are consumers of alfalfa foliage. The family Milacidae is present on Diss and Genet. That of Sphincterochilidae is represented on the 5 plants (DAMERDJI, 2011a). The family Helicidae has 10 species on *Ampelodesma mauritanicum* and 18 species on *Calycotome spinosa*. The family Subulinidae is represented by a single species among the 7 plants studied (DAMERDJI, 2011b). Four malacological species including *Archelix punctata*, *Alabastrina soluta* (Helicinae), *Helicella terveri* and *Cochlicella acuta* (Helicellinae) are common to 3 plants (DAMERDJI, 2011b). *Archelix zapharina* and *Alabastrina alabastrites* (Helicinae) are represented on 2 plants (DAMERDJI, 2011b). In 2012, DAMERDJI showed that 10 species are common to *C. salvifolius* and *C. ladaniferus*, and only one species is specific to the *Cistus mondroso*, with respect to *Helix aspersa*. The malacological inventory shows the absence of three species in *C. monspeliensis* stations: *Sphincterochila candidissima* (Sphincterochilidae), *Archelix lactea* (Helicidae) and *Rumina decollata* (Subulinidae) (DAMERDJI and MEBAREK, 2014).

## CONCLUSIONS

The malacological study conducted in different stations allows us to say: The Montpellier rockrose comprises 13 species, 11 species on the sage leaf rockrose; the ladanifer hosts 10 species of snails. The Helicidae family remains the largest and most diverse on the three Cistaceae. We find 07 species common to these 3 plants, all species of Helicidae.

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