



Diversity of the Malacofauna on Two Species of Cistaceae (*Cistus Salvifolius* L. and *C. Monspeliensis* L.) in the Tlemcen Region (Northwestern Algeria)

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Abstract

The region of Tlemcen is located in the northwest of Algeria, whose climatic impact is reflected in the degradation of the forest in the scrub, open formation made up of xerophytic plants such as *Cistus* ... We propose to carry out an approach of the diversity of the malacofauna found on 2 species of Cistaceae namely *Cistus salvifolius* and *C.monspeliensis*. The malacological richness is estimated at 11 species on the *Cistus* with sage leaves and 13 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. Concerning the family of Helicidae, the most diversified includes 2 subfamilies: those of Helicinae and Helicellinae. The 1st subfamily has 8 species on the *cistus* of Montpellier and 7 species on the *cistus* with sage leaves. The 2nd subfamily includes 4 species on *Cistus monspeliensis* and only 2 species on the other Cistaceae. The seasonal distribution according to the specific richness of the Gastropods is shown. We are looking for the malacological species specific to each of the two Cistaceae species and the species which are common to them. Finally, the vertical distribution of gastropods is given.

Keywords: Malacofauna- *Cistus salvifolius*- *C. monspeliensis* - Diversity- Tlemcen region (North-West Algeria).

Introduction

Predatory gastropod molluscs, snails are generally 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 gastropods in particular.

Very little wildlife work has been done in Cistaceae stations except those of (Hadjouti, 2010) relating to *Cistus salvifolius* and those of (Lourmil, 2010) relating to the fauna of the Invertebrates of *Cistus ladaniferus* then (Damerdji. *et al.*, 2011a) on Orthopteroids and finally those concerning orthoptera (Damerdji. *et al.*, 2011b) which justifies the present work.

This study comes following various works carried out on the doum, (Damerdji, 2002a) on the diss (Damerdji, 2002b); (Damerdji and Bouhellou, 2002) on Broom (Damerdji, 2008). In 2005, (Damerdji) shows the malacological diversity on 3 xerophilic plants. Damerdji, Ladjmi and Doumandji the same year, an inventory was made of the 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 have been studied by (Damerdji, 2010). Recently, (Damerdji, 2011a) carried out a malacological inventory on 5 different plants then on 7 plants (Damerdji, 2011b). The results relate to the mala-

ecological diversity of the 2 Cistaceae, the seasonal importance, the common species and the distribution according to the different strata.

Methodology

Presentation of the Tlemcen Region

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

Study of the Two Host Plants

The two plants studied are part of the Spermatophyte branch, the Angiosperm sub-branch, the Eudicots class, the Eurosidae sub-class, the Malvales order and the Cistaceae family.

Cistus Salvifolius L. (Rocky Cistus) White Rockrose

Sage-leaved Cistus is a much branched, compact, erect, sometimes prostrate shrub. 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 have a short petiole up to several cm. The leaves are slimy as are the young twigs.

Genus species *Cistus salvifolius* L.

Common name Sage-leaved cistus, hilted cistus

It is a medium fragrant plant. *Cistus salvifolius* is a thermophilic shrub that prefers sunny locations. It is a species that prefers sunny stations with calcareous soils or soils poor in nutrients. This plant is considered an important food source for cattle and is cultivated as an ornamental plant. *Cistus salvifolius* is used as a traditional remedy. It is visited by bees, especially for pollen.

Cistus Monspeliensis L. (Ciste De Montpellier) (Rockrose of Montpellier)

This rockrose is known as a shrub with very vigorous vegetation, forming a beautiful very compact pyramid, 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 light on the reverse. They only last one day but they are numerous and are renewed for almost 6 weeks. The white flowers are very fragrant and polliniferous attract insects and mainly butterflies. The fruits of *C. monspeliensis* are dehiscent oval capsules with 5 valves. It supports very well the seaside and the dry and poor grounds, prefers the very sunny places and does not like the very strong winds. Montpellier rockrose is very common and develops in forests, undergrowth and in few calcareous grounds. This rock rose is also used for its medicinal properties.

Genus species. *Cistus monspeliensis* L.

French name. Montpellier cistus or flower for a day

Description of Stations

The description of the stations for *C. salvifolius* and *C.monspeliensis* is given respectively in the following tables

Table 1: Edaphic and botanical data of the 3 prospected stations of *Cistus salvifolius*

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

Table 2: Edaphic and botanical data of the 3 prospected stations of *Cistus monspeliensis*

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

Sampling Equipment and Methods In The Field

To carry out this work, we prospected 3 stations for each of the two Cistaceae species with a fairly high recovery rate. The experimental protocol carried out is the same for the two Cistaceae species. The techniques used are 100 m² quadrats, trap pots and hand picking. Sampling is carried out for 5 months with 2 samples per month.

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

In The Laboratory

Live samples are put in jars filled with water for 48 hours, ie until their complete death. They are then removed to be placed in 70 ° alcohol for final storage. Beforehand, we remove the interesting individuals for the dissection and of course to isolate the genitals which represent a crucial criterion of determi-

nation for Gastropods. The shape, size, coloring and ornamentation of the shell are morphological differences which can help us in the determination. Furthermore, the anatomical characters, in particular the genitalia, are also determining criteria for the identification of species. The morphological description is taken from the biosystematic study of terrestrial pulmonary gastropod molluscs in the Tlemcen region (Damerdji, 1990). Indeed, the identification was made by us from the conchology characters.

Results

The results relate to the inventory of Gastropods harvested from the 2 Cistaceae and to the species common to the two plants.

Diversity of Malacological Species Harvested From the Two Cistaceae

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

Table 3: Malacological species found on two species of Cistaceae

Emb.	Class	sub-Class	Order	Family	sub-Family	Malacological species	<i>Cistus salvifolius</i> (11 species)	<i>Cistus monspeliensis</i> (13species)
M O L L	G A S T	P u l m	S t y l o m	Milacidae		<i>Milax gagates</i>	-	-
				Sphincterochilidae		<i>Sphincterochila candidissima</i>	+	-
				Helicidae		<i>Helix(Cryptomphalus)</i>	+	+
						<i>Macularia</i>	-	+
						<i>Macularia jourdaniana</i>	+	+
						<i>Archelix punctata</i>	+	+
						<i>Archelix lactea</i>	+	-
	<i>Archelix zapharina</i>	-	+					
	<i>Archelix polita</i>	+	+					

U S C A	R O P O D A	o n a t p h o r a	m a t p h o r a		Helicellinae	<i>Eobania vermiculata</i>	+	+
						<i>Euparypha pisana</i>	+	+
						<i>Helicella (Cernuella)</i>	+	+
						<i>Helicella pyramidata</i>	-	+
						<i>Helicella (Xeromagna)</i>	+	+
						<i>Helicella breveti</i>	-	+
				Subulinidae		<i>Rumina decollata</i>	+	-

In total, 16 species of Gastropods are inventoried on the 2 Cistaceae. In ascending order, the cistus of Montpellier is slightly more populated with gastropods with 13 species, followed by the hilted cistus with 11 species. The family of Helicidae, the richest specifically comprises 13 species, that of Milacidae, Sphinc-

terochilidae and Subulinidae are represented by one species each (Table 3).

Distribution of Different Malacological Families Harvested From the 2 Plants

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

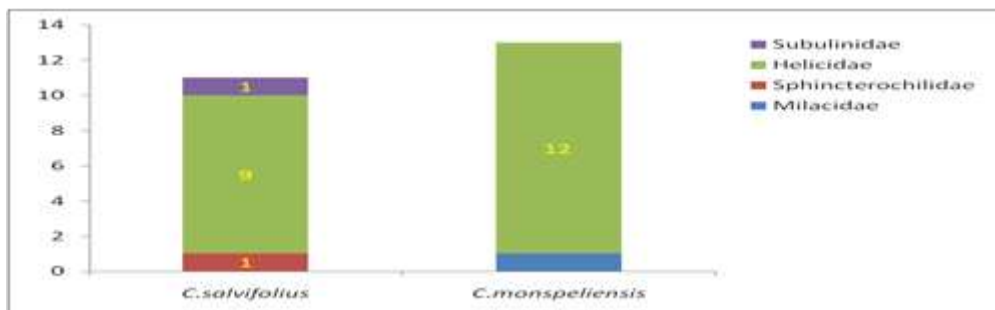


Fig. 1 - Importance of the different families present on the 2 Cistaceae

The Helicidae family is the most important specifically for the 2 Cistaceae. It has 12 species on *C. monspeliensis*.

The Milacidae family is represented by *Milax gagates* on *Cistus monspeliensis*. The family of Sphincterochilidae and that of Subulinidae are represented respectively by a single species on *C. salvifolius*.

Only one species of Helicidae differentiates them, it is *Helix aspersa* found only in stations at *Cistus salvifolius*.

Distribution of Helicidae Subfamilies Harvested From the 2 Cistaceae

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

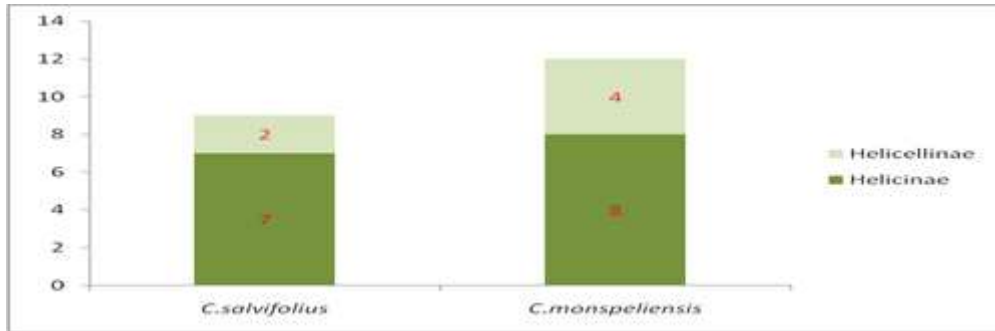


Fig. 2 - Importance of the Helicidae subfamilies present on the 2 plants

The Helicinae subfamily includes 8 species on the cistus of Montpellier; 7 species on sage-leaved cistus and that of Helicellinae count 4 species on *C. monspeliensis* and 2 species on the second species of Cistaceae. These are *Helicella virgata* and *H. terveri*.

Seasonal Importance of Gastropods on the Two Cistaceae

The results of the seasonal distribution of Gastropods on the 2 Cistaceae are given in the following figure.

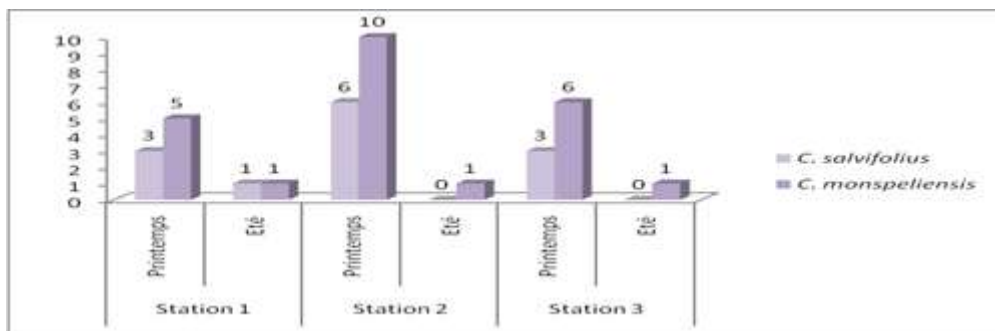


Fig. 3 - Seasonal importance of Gastropods on the 2 plants

We note that station 2 (*Cistus salvifolius*) in the spring seems the richest in malacological species. In this season, stations 1 and 3 comprise half of the species compared at the second station. In summer, the malacological richness is very low, not exceeding 1, especially in the 2 nd and 3 rd stations with *C. salvifolius*.

Species Specific to Each of the Two Plants

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

candidissima, *Archelix lactea* and *Rumina decollata*.

Malacological Species Common to the Two Cistaceae

Helix (*Cryptomphalus*) *aspersa*, *Macularia jordaniana*, *Archelix punctata*, *A. polita punctatiana*, *Eobania vermiculata*, *Euparypha pisana* (Helicinae) and *Helicella virgata* and *Helicella terveri* (Helicellinae) are the 8 species common to the 2 Cistaceae.

Vertical Distribution of Malacological Species on the Two Cistaceae

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

Table 4: Distribution of harvested malacological species according to the strata of the two cistaceae

Different strata	Root	Soil surface	Stem	leaves
Number of species				
On <i>Cistus salvifolius</i>	0	7	4	1
On <i>Cistus monspeliensis</i>	1	11	5	0

The soil surface appears to be the most populated with snails, followed by the stem.

Discussion

The biotope of *Chamaerops humilis* L. is the typical biotope of *Leucochoera candidissima*. This low garrigue, most often developed on limestone, arid pitilessly exposed to overgrazing, still characterizes a good part of the arid regions of the Western Mediterranean (Sacchi, 1971). *Sphincterochila candidissima* is particularly fond of limestone rocks (Damerdji, 1990). On the other hand, *Euparypha pisana* is common throughout the Camargue where its tests are collected under the *Salicornia fruticosa* and harbor many invertebrates (Aguesse and Bigot, 1962). According to (Bigot, 1957) a large fauna representing the major part of the orders of invertebrates and almost all the orders of known insects in the Camargue, took refuge in the empty shells. Gastropods manufacture their epiphragms to be able to survive under extreme conditions (Damerdji, 2008). A spectacular ecoethological phenomenon has been observed: hundreds of individuals belonging to a specific species of molluscs, *Euparypha pisana*, form by grouping on various plants "meetings in height", real "clusters" gathering between 0.30m and 1, 5m, from 15 to 1500 subjects (Bigot, 1967). Thorny species (Thistles, Opuntia) very often carry clusters. The thorns would promote the fixation of individuals on the plant. The phenology of the plant as regards *Cistus salvifolius* seems to favor the presence of this malacological species which is *Helix aspersa*. On the Diss, 2 species of Helicidae (*Euparypha pisana* and *Eobania vermiculata*) are considered as phytophagous (Damerdji, 2002a).

According to (Khelil, 1989) individuals of *Leucochoera candidissima* are consumers of alfa foliage. The Milacidae family is present on Diss and Broom. That of the Sphincterochilidae is represented on the 5 plants (Damerdji, 2011a). The Helicidae family has 10 species on *Ampelodesma mauritanicum* and 18 species on *Calycotome spinosa*. The Subulinidae family is represented by a single species in 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 for the Rocky *Cistus*, being: *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).

Conclusion

The malacological study carried out in different stations allows us to say: The cistus of Montpellier comprises 13 species, 11 species on the cistus with sage leaves. The Helicidae family remains the largest and most diverse of the two Cistaceae. We find 07 species of Helicidae common to these 2 plants.

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