

## Malacofauna diversity in Kabylia region (Algeria)

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### ABSTRACT

The terrestrial malacofauna of Kabylia is largely unknown until today. For this reason we are led to establish a qualitative and quantitative inventory of snails at 4 stations at different altitudes (along transect from the sea to the mountains). This work focuses on the identification of the different species and their presence and abundance at several stations in the region. Sampling is performed on a surface of 100 m<sup>2</sup>, during a period from June 2012 to May 2013. The sampling method used is hunting for sweet, wet weather in sight. Land snails are also recovered on boards previously raised, which have served their shelter. This survey allowed us to make a list of 26 species belonging to 10 families representing biodiversity gastropods. The study of species richness showed the importance of gastropods workforce, month by month in the four stations, indeed 17125 individuals were sampled there. The Shannon-Weaver index was higher in the four stations, proving the diversity and balance of terrestrial gastropod species of these stations.

**KEYWORDS:** Malacofauna, Gastropoda, Species richness, Kabylia.

### INTRODUCTION

Continental molluscs are often ignored in media studies. This fact is generally related to a misunderstanding of this zoological group [5]. In Algeria, the malacofauna remains largely unexplored. Despite their rich biodiversity, their evolutionary, biological, ecological and economic interests, terrestrial gastropods are biologically poorly studied, especially as the distribution of their species where most of the data comes from old studies [11]. Michaud and Terver (1833 and 1839) have studied independently malacofauna in Algeria. These investigations can be considered as founders of Algerian continental malacology that Bourguignat, Letourneux and Pallary have enriched a few decades later [1]. After the work of Letourneux in 1870, no further malacological studies have been conducted in Kabylia. Tizi-Ouzou department is considered virgin, in malacological studies. To remedy this, a qualitative and quantitative study of the various species of land snails was conducted in order to characterize the diversity and updating of the systematic group in the region of Kabylia Djurdjura along a sea mountain transect.

## MATERIALS AND METHODS

To conduct the study of the ecological diversity of terrestrial gastropods in Kabylia region (36°20' N, 36°0' E et 4°35' W), four experimental stations were chosen for inventory along an altitudinal gradient. The studied stations follow a transect North to South, Tizirt (31m), Makouda (260m), Tizi-Ouzou town (146m) and Redjaouna (600 m) (Table 1).

**Table 1:** Presentation of the four stations of study.

	Name	Altitude	Distance from the capital of the wilaya (Km)	Slope (%)	Exposure
Station 1	Tizirt	31	40	12	N
Station 2	Makouda	260	15	15	N-O
Station 3	Tizi-Ouzou	146	0,5	5	N-N
Station 4	Redjaouna	600	6	45	N-E

### Sampling method:

Hunting view is widely used in malacology. It consists to observe directly the individuals present in their habitation tree trunks, under windfalls, under stones and upon the old walls. Traps are used in order to reap the most individuals; this method consists to put a plank of wood in damp places frequented by snails. Three or four days later, this board is recovered. Sampling took place on a surface of 100m<sup>2</sup>, in each station.

### Treatment data:

On the ground, 12 samples are taken at each station during the period extending from June 2012 to May 2013. The samples are brought back to the laboratory, where individuals are identified and classified. The results are processed by different ecological indices of composition (occurrence frequency, relative abundance and density) and structure (Shannon-Weaver diversity indices and equitability).

### Results:

#### Species recorded within studied stations:

The prospected stations count 26 snail species distributed in 10 families (Table 2).

**Table 2:** List of terrestrial gastropod species recorded at the four stations

Families	Species	S1 Tizirt	S2 Makouda	S3 Tizi-Ouzou	S4 Redjaouna
Helicidae	<i>Cornu aspersa maxima</i>	0	330	258	4
	<i>Cornu aspersa aspersa</i>	19	315	413	646
	<i>Cantareus apertus</i>	26	204	391	113
	<i>Theba pisana</i>	357	167	595	449
	<i>Otala punctata</i>	0	839	0	0
	<i>Eobania vermiculata</i>	0	32	0	0
	<i>Eobania sp.</i>	0	0	622	0
Hygromiidae	<i>Xerosecta cespitum</i>	359	323	392	0
	<i>Xerosecta calida</i>	218	79	181	98
	<i>Xerosecta sp.</i>	93	16	10	0
	<i>Cermeuella virgata</i>	333	66	697	92
	<i>Cermeuella sp1.</i>	18	46	307	0
	<i>Cermeuella sp2.</i>	59	79	699	0
	<i>Trochoidea pyramidata</i>	319	36	104	0
	<i>Ganula roseotincta</i>	31	63	0	0
Cochlicellidae	<i>Trochylus flavus</i>	14	0	29	0
	<i>Cochlicella barbara</i>	0	0	34	0
Subulinidae	<i>Cochlicella acuta</i>	0	0	21	0
	<i>Rumina paivae</i>	34	540	138	1408
Oxychilidae	<i>Rumina decollata</i>	32	247	0	1530
	<i>Oxychylus sp.</i>	45	0	0	131
Enidae	<i>Mastus pupa</i>	61	9	0	0
Spiraxidae	<i>Poiretia algira</i>	0	0	5	0
Pomatiidae	<i>Tudorella sulcata</i>	696	15	0	0
Ferussaciidae	<i>Ferussacia folliculum</i>	16	0	10	0
Sphincterochilidae	<i>Sphincterochyla sp.</i>	0	369	775	0
10	26	2730	3775	5681	4939

At Tizirt station, 18 species were inventoried, of which 09 species belonging to Hygromiidae, 3 species to Helicidae and 2 species to Subulinidae; while Oxychilidae, Enidae, Pomatiidae and Ferussaciidae families were represented only by one species each.

Makouda station located at 260m of altitude, counted 19 species identified and divided into 6 families, of which 8 species belong to Hygromiidae. While only 6 species of Helicidae and two species of Subulinidae were sampled. However, Enidae, Pomatiidae and Sphincterochilidae were represented by a single species *Mastus pupa*, *Tudorella sulcata* and *Sphincterochyla sp.* respectively.

At the Tizi-Ouzou station, 19 species are identified and divided into 7 families, of which 8 species belonging to Hygromiidae and 5 species to Helicidae. The Subulinidae family was represented by a single species *Rumina decollata* and only *Ferussacia folliculinum* for Ferussaciidae family. A new family, Cochlicellidae was represented in this station by two species namely *Cochlicella barbara* and *Cochlicella acuta*. Otherwise, two new species *Eobania sp.* and *Poiretia algira* which were absent in the higher altitude stations were recorded at the site of Tizi-Ouzou.

Three families Helicidae, Subulinidae and Oxychilidae remain at the Redjaouna station, they include four species of Helicidae. However, Subulinidae and Hygromiidae families counted only two species each and Oxychilidae were poorly represented by a single species namely *Oxychilus sp.*

#### Families identified within studied stations:

The species present in the four stations are distributed in 10 families whose proportions vary from one station to another (Fig.1).

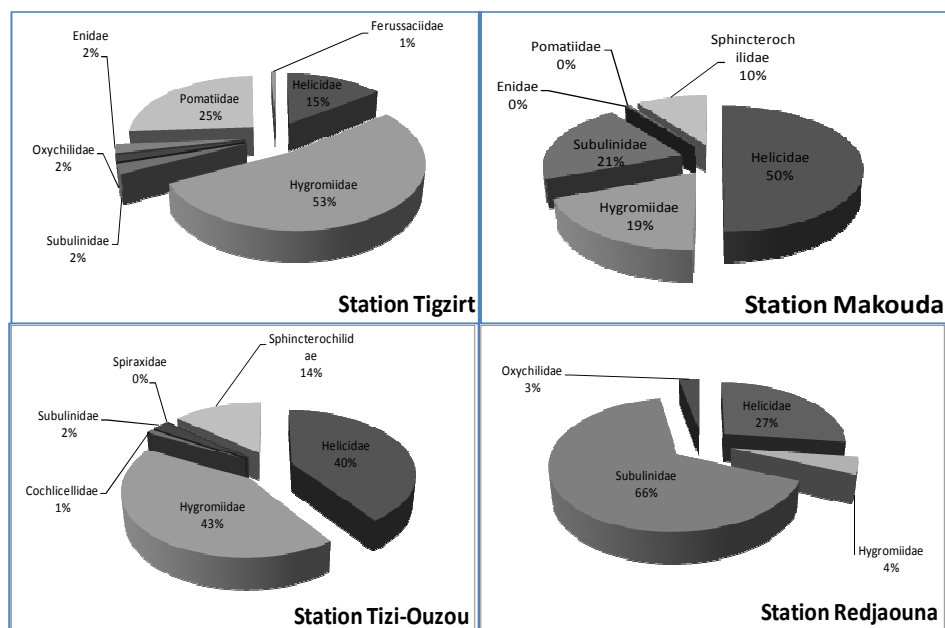


Fig. 1: Distribution of families of snails at the four stations.

The families of terrestrial gastropods have different proportions depending on the station. The Helicidae, Hygromiidae and Subulinidae coexist at the 4 stations. At the Makouda station, 53% is allocated to the Hygromiidae family, followed by the Pomatiidae with a rate of 25% which is represented by *Tudorella sulcata*. While the Helicidae represented by *Cornu aspersa aspersa*, *Cantareus apertus* and *Theba pisana*, as well as the of Subulinidae represented by *Rumina decollata* and *Rumina paivae* are only weakly sampled with 15% and 2% respectively. Oxychilidae, Enidae and Ferrussaciidae families are low representation.

The second studied station revealed significant proportions of Helicidae Subulinidae and Hygromiidae and the existence of the Sphincterochilidae family with a rate of 10%; while Enidae and Pomatiidae are represented by *Mastus pupa* and *Tudorella sulcata* respectively and considered as the least prevalent families.

The Hygromiidae with 43% and 40% Helicidae are the most abundant families at Tizi-Ouzou station followed by Sphincterochilidae with 14%. While the Cochlicellidae represented by *Cochlicella barbara* and *Cochlicella acuta*, as well as Spiraxidae represented by *Poiretia algira* are observed only at this station with a low rate, similar to that of Subulinidae.

Redjaouna station count only four families, of which Subulinidae prospect with a high rate estimated at 66% followed by Helicidae with a rate of 27% and Hygromiidae and Oxychilidae with 4% and 3% respectively.

Occurrence frequency, relative abundance and density variations of malacological species identified: Tizirt station:

Occurrence Frequencies, relative abundance and density of all terrestrial gastropod species inventoried at the Tizirt station are shown in Table 3.

**Table 3:** Occurrence frequency, relative abundance and density of snails identified at Tizirt station.

Malacological species	Frequency (%)		Abundance (%)		Density
<i>Cornu aspersa aspersa</i>	75	Constant	0,69		1,58
<i>Cantareus apertus</i>	75	Constant	0,95		2,16
<i>Theba pisana</i>	100	Omnipresent	13,07	Abundant	29,75
<i>Xerosecta calida</i>	100	Omnipresent	13,15	Abundant	29,91
<i>Xerosecta cespitum</i>	75	Constant	7,98	Abundant	18,16
<i>Xerosecta sp.</i>	66,66	Constant	3,4	Abundant	7,75
<i>Cerņuella virgata</i>	100	Omnipresent	12,19	Abundant	27,75
<i>Cerņuella sp1.</i>	50	Regular	0,65		1,5
<i>Cerņuella sp2.</i>	50	Regular	2,16	Abundant	4,91
<i>Trochoidea pyramidata</i>	100	Omnipresent	11,68	Abundant	26,58
<i>Ganula roseotincta</i>	10	Accidental	1,13		2,58
<i>Trochylus flavus</i>	66,66	Constant	0,51		1,16
<i>Rumina paivae</i>	66,66	Constant	1,24		2,83
<i>Rumina decollata</i>	50	Regular	1,17		2,66
<i>Oxychylus sp.</i>	91,66	Omnipresent	1,64		3,75
<i>Mastus pupa</i>	83,33	Omnipresent	2,23	Abundant	5,05
<i>Tudorella sulcata</i>	100	Omnipresent	25,49	Abundant	58
<i>Ferussacia folliculum</i>	58,33	Regular	0,58		1,33

*Theba pisana*, *Xerosecta calida*, *Cerņuella virgata*, *Trochoidea pyramidata*, *Oxychylus sp.*, *Mastus pupa* and *Tudorella sulcata* are seven species omnipresent in the Tizirt station. *Cornu aspersa aspersa*, *Cantareus apertus* and *Xerosecta cespitum* are constant species with a 75% occurrence rate for each. *Xerosecta sp.*, *Trochylus flavus* and *Rumina paivae* are also constant species but having a frequency of 66.66% each. However, other species are regular as *Cerņuella sp1*, *Cerņuella sp2.*, *Rumina decollata* and *Ferussacia folliculum* with frequencies between 25 and 50%. *Ganula roseotincta* is the only accidental species recorded with a 10% frequency of occurrence.

The abundance and species density varies from one station to another. In the first station *Tudorella sulcata* is the most abundant species with 25.49% and a density of 58 per 100 m<sup>2</sup>.

Makouda station:

Occurrence frequencies, relative abundance and density of all terrestrial gastropod species identified at Makouda station are shown in Table 4.

**Table 4:** Occurrence frequency, relative abundance and density of snails identified at Makouda station

Malacological species	Frequency (%)		Abundance (%)		Density
<i>Cornu aspersa maxima</i>	91,66	Omnipresent	8,74	Abundant	27,5
<i>Cornu aspersa aspersa</i>	100	Omnipresent	8,34	Abundant	26,25
<i>Cantareus apertus</i>	83,33	Omnipresent	5,4	Abundant	17
<i>Theba pisana</i>	75	Constant	4,42	Abundant	13,91
<i>Otala punctata</i>	100	Omnipresent	22,22	Abundant	69,91
<i>Eobania vermiculata</i>	83,33	Omnipresent	0,85		2,66
<i>Xerosecta calida</i>	100	Omnipresent	8,55	Abundant	26,91
<i>Xerosecta cespitum</i>	75	Constant	2,1	Abundant	6,58
<i>Xerosecta sp.</i>	25	Accessory	0,42		1,33
<i>Cerņuella virgata</i>	91,66	Omnipresent	1,75		5,5
<i>Cerņuella sp1.</i>	58,33	Regular	1,22		3,83
<i>Cerņuella sp2.</i>	91,66	Omnipresent	2,09	Abundant	6,58
<i>Trochoidea pyramidata</i>	41,66	Regular	0,95		3
<i>Ganula roseotincta</i>	100	Omnipresent	2,38	Abundant	5,25
<i>Rumina paivae</i>	100	Omnipresent	14,3	Abundant	45
<i>Rumina decollata</i>	91,66	Omnipresent	6,54	Abundant	20,58
<i>Mastus pupa</i>	25	Accessory	0,24		0,75
<i>Tudorella sulcata</i>	33,33	Accessory	0,4		1,25
<i>Sphincterochyla sp.</i>	100	Omnipresent	9,77	Abundant	30,75

For Makouda station, 12 species are omnipresent, *Cornu aspersa maxima*, *Cornu aspersa aspersa*, *Cantareus apertus*, *Otala punctata*, *Eobania vermiculata*, *Xerosecta calida*, *Cerņuella virgata*, *Cerņuella sp2.*, *Ganula roseotincta*, *Rumina decollata*, *Rumina paivae* and *Sphincterochyla sp.* Two (2) species only are constant *Theba pisana* and *Xerosecta cespitum* with occurrence frequency of 75%. *Cerņuella sp1.* and

*Trochoidea pyramidata* are regular species, while *Xerosecta sp.*, *Mastus pupa* and *Tudorella sulcata* are accessories species.

The most abundant species at this station is *Otala punctata* with a rate of 22.22% and a relative density of 69.91 per 100 m<sup>2</sup>.

#### Tizi-Ouzou station:

Inventory data of terrestrial gastropods of Tizi-Ouzou station are exploited by calculating occurrence frequency, relative abundance and species density (Table 5).

**Table 5:** Occurrence frequency, relative abundance and density of snails identified at Tizi-Ouzou station

Malacological species	Frequency (%)		Abundance (%)		Density
<i>Cochlicella barbara</i>	50	Regular	0,59		2,83
<i>Cochlicella acuta</i>	58,33	Regular	0,36		1,75
<i>Cornu aspersa maxima</i>	91,66	Omnipresent	4,54	Abundant	21,5
<i>Cornu aspersa aspersa</i>	91,66	Omnipresent	7,26	Abundant	34,41
<i>Cantareus apertus</i>	91,66	Omnipresent	6,88	Abundant	32,58
<i>Theba pisana</i>	66,66	Constant	10,47	Abundant	49,58
<i>Eobania sp.</i>	91,66	Omnipresent	10,94	Abundant	51,83
<i>Xerosecta calida</i>	100	Omnipresent	6,9	Abundant	32,66
<i>Xerosecta cespitum</i>	83,33	Omnipresent	3,18	Abundant	15,08
<i>Xerosecta sp.</i>	8,33	Accidentelle	0,17		0,83
<i>Cerņuella virgata</i>	100	Omnipresent	12,26	Abundant	58,08
<i>Cerņuella sp1.</i>	100	Omnipresent	5,4	Abundant	25,58
<i>Cerņuella sp2.</i>	100	Omnipresent	12,3	Abundant	58,25
<i>Trochoidea pyramidata</i>	75	Constant	1,83	Abundant	8,66
<i>Trochylus flavus</i>	83,33	Omnipresent	0,51		2,41
<i>Rumina paivae</i>	100	Omnipresent	2,42	Abundant	11,5
<i>Poiretia algira</i>	25	Accessory	0,08		0,41
<i>Ferussacia folliculum</i>	33,33	Accessory	0,17		0,83
<i>Sphincterochyla sp.</i>	100	Omnipresent	13,64	Abundant	64,58

Tizi-Ouzou station count 12 species omnipresent, 2 constant species *Theba pisana* and *Trochoidea pyramidata*, 2 regular species *Cochlicella barbara* and *Cochlicella acuta* and two accessories species *Poiretia algira* and *Ferussacia folliculum*. A single accidental species *Xerosecta sp.* is recorded with occurrence frequency of 8.33%.

*Sphincterochyla sp.* is the most abundant species with a rate of 13.64% and density of 64.58 per 100 m<sup>2</sup>.

#### Redjaoua station:

Occurrence frequencies, relative abundance and density of all terrestrial gastropod species inventoried at Redjaoua station are shown in Table 6.

**Table 6:** Occurrence frequency, relative abundance and density of snails identified at Redjaoua station.

Malacological species	Frequency (%)		Abundance (%)		Density
<i>Cornu aspersa maxima</i>	100	Omnipresent	9,55	Abundant	39,33
<i>Cornu aspersa aspersa</i>	100	Omnipresent	13,07	Abundant	53,83
<i>Cantareus apertus</i>	33,33	Accessory	2,28	Abundant	9,4
<i>Theba pisana</i>	91,66	Omnipresent	9,09	Abundant	37,41
<i>Xerosecta cespitum</i>	91,66	Omnipresent	1,98		8,16
<i>Cerņuella virgata</i>	5	Accidental	1,86		7,66
<i>Rumina paivae</i>	100	Omnipresent	28,5	Abundant	117,33
<i>Rumina decollata</i>	100	Omnipresent	30,97	Abundant	127,5
<i>Oxychylus sp.</i>	83,33	Omnipresent	2,65	Abundant	10,91

At Redjaoua station, only 7 omnipresent species are counted, they are *Cornu aspersa maxima*, *Cornu aspersa aspersa*, *Theba pisana*, *Xerosecta cespitum*, *Rumina decollata*, *Rumina paivae* and *Oxychylus sp.* and only an accessory species *Cantareus apertus* and one accidental species *Cerņuella virgata* are met in this station with occurrence rate of about 30.97%; *Rumina decollata* is the most abundant species with a density of 127.5 per 100 m<sup>2</sup>.

#### Shannon-Weaver index variations:

The Shannon index H 'assesses the rich biodiversity of the stations studied. It quantifies the heterogeneity of biodiversity which shows a monthly and seasonal variation (Table 7 and Table 8).

**Table 7:** Monthly variations of Shannon-Weaver Index of studied stations

Shannon Weaver Index												
Months	J	F	M	A	M	J	J	A	S	O	N	D
Station1	2,77	2,69	3,12	3,20	3,02	2,92	2,26	2,28	3,17	2,98	3,19	3,29
Station2	2,86	3,08	3,38	3,53	3,57	1,89	2,54	2,48	3,25	3,28	3,36	3,55
Station3	2,86	3,50	3,55	3,31	3,38	3,32	3,48	2,80	3,40	2,97	3,35	3,55
Station4	2,49	2,32	2,63	2,56	2,19	2,29	1,99	0,99	1,87	2,55	2,49	1,97

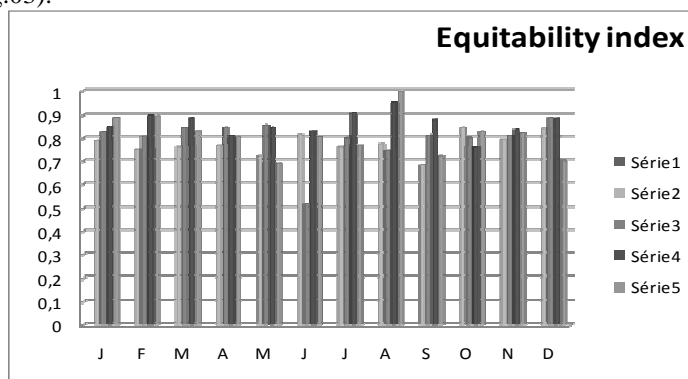
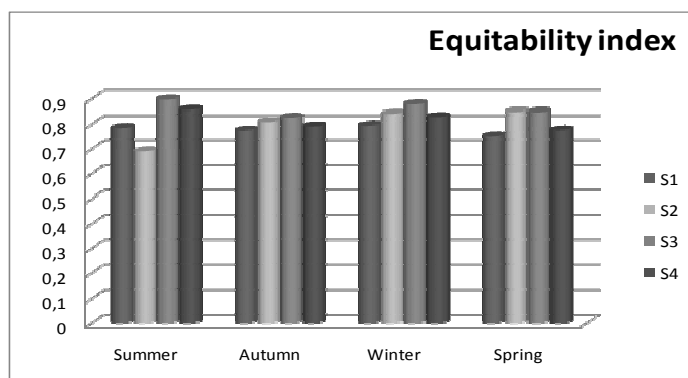
**Table 8:** Seasonal variations of Shannon-Weaver Index of studied stations

Shannon Weaver Index				
	Summer	Autumn	Winter	Spring
Station 1	2,49	3,12	2,92	3,11
Station 2	2,30	3,29	3,16	3,49
Station 3	3,20	3,24	3,30	3,42
Station 4	1,76	2,30	2,26	2,46

Shannon-Weaver index is important during every month of the year for all stations. Its greatest values are recorded at stations 2, 3 and 4 during March, April and May with a maximum value of 3.57 in the second station; while the most important index for the first station is registered in December with a value of 3, 29. The Shannon index  $H'$  allows to evaluate the wealth of biodiversity, the lowest values were noted during the summer period (June, July and August) for all stations, with values ranging between 0.99 and 2.80. We hold that the index of Shannon-Weaver is variable both between seasons and stations. The highest values at all stations are registered in spring and autumn. The least important values are registered in summer and winter.

#### Equitability index Variations:

Equitability index was used to evaluate the malacological populated state stand on its monthly and seasonal variations (Fig.02 and Fig.03).

**Fig. 2:** Monthly variations of equitability index of the studied stations**Fig. 3:** Seasonal variations of equitability index of the studied stations.

Figures 02 and 03 show that equitability index is important for most of the year for the 4 stations and does not present any significant monthly and seasonal variations. Values vary mostly within a narrow range of 0.67 and 0.99; it marks a sharp increase where it approaches a value of 1 (0.93 and 0.99) in August for the stations 3 and 4, respectively. However, equitability index is low in June at station 2 recording a value of 0.53.

### Discussion and Conclusion:

After prospecting four stations along an altitudinal gradient, 17125 snails harvested for total species richness of 26 species belonging to 10 families. A total of 2730 individuals are collected at the station Tizirt for species richness of 18 species, eight dominate the stand: *Theba pisana*, *Xerosecta cespitum*, *Cerņuella virgata*, *Trochoidea pyramidata*, *Mastus pupa*, *Tudorella sulcata* and *Oxychylus sp.* Makouda station account 3775 snails including 19 species identified, of which 12 are dominant: *Cornu aspersa maxima*, *Cornu aspersa aspersa*, *Cantareus apertus*, *Otala punctata*, *Eobania vermiculata*, *Xerosecta cespitum*, *Cerņuella virgata*, *Cerņuella sp2.*, *Ganula roseotincta*, *Rumina decollata*, *Rumina paivae* and *Sphincterochyla sp.* A number of 5681 individuals were sampled at the Tizi-Ouzou station for total species richness of 19 species, of which 12 dominate the stand: *Cornu aspersa maxima*, *Cornu aspersa aspersa*, *Cantareus apertus*, *Eobania sp.*, *Xerosecta cespitum*, *Xerosecta calida*, *Cerņuella virgata*, *Cerņuella sp1.*, *Cerņuella sp2.*, *Trochylus flavus*, *Rumina decollata* and *Sphincterochyla sp.* Redjaoua station enregistred 4939 individuals divided into 9 species of which 7 are dominant, *Cornu aspersa maxima*, *Cornu aspersa aspersa*, *Theba pisana*, *Xerosecta calida*, *Rumina decollata* and *Oxychylus sp.* According to [13], the complexity of the habitat structure plays an important role. The ecological preferences of the species are often very different and the existence of many microhabitats which contributes to significantly increase the rich fauna. Thus this malacological study allowed us to retain a richness enough important in number of individuals and number of species at the four sites explored. The Helicidae, Hygromiidae and Subulinidae families exist in the 4 stations. Despite their high sensitivity to climate change, gastropods could conquer all terrestrial environment by various forms of morphological (Color and size of the shell) or physiological (epiphragm) or behavioral (microhabitats and adapted activity rhythms) adaptation. According to [14] study realized in 1976, the Helicidae are strongly represented in the northeast of the Maghreb. This corroborate with the results obtained in the different studied stations, having set values abundance *Cornu aspersa maxima* (*Helix aspersa maxima*) *Cornu aspersa aspersa* (*Helix aspersa aspersa*) and *Cantareus apertus* (*Helix aperta*). [16] argue that *Helix aspersa aspersa* is a Mediterranean snail native to North Africa, results comforted by the high frequency of this species after sampling field. Hygromiidae family is represented by 9 species, of which 7 inventoried at three stations, whereas the species *Xerosecta cespitum* and *Cerņuella virgata* are harvested at the four stations. By [9], *Xerosecta cespitum* is a strictly Mediterranean species. [12] attest that *Cerņuella virgata* is an endemic snail of the Mediterranean. The Subulinidae observed during such exploration are essentially *Rumina decollata* and *Rumina paivae*, which according to [18] are two species of land snails from predatory Helicidae, however they are typically Mediterranean. At the Redjaoua station and with 30.97% of frequency of occurrence, *Rumina decollata* is the most abundant species recording a density of 127.5 per 100 m<sup>2</sup>. [4] reports that this omnivorous species has been used as a biological control agent against *Helix aspersa*, this may explain the proliferation of this family at this station. Cochlicellidae family is represented by only two species *Cochlicella barbara* and *Cochlicella acuta* and Spiraxidae represented by the only *Poiretia algira*. These three species are encountered at Tizi-Ouzou station at 146m of altitude. The Oxychilidae family inventoried at two stations Tizi-Ouzou and Redjaoua is only represented by a single species *Oxychylus sp.* The Enidae family represented by the species *Mastus pupa* and pomatiidae represented by *Tudorella sulcata*. Those species are encountered only at two stations (Tizirt and Makouda). Many studies have shown the close relationship between the distribution and diversity of terrestrial molluscs and large-scale factors such as climate, geology and habitat type. Some of these factors determine the distribution and abundance of many regions malacofauna [19, 20]. [11] argues that preferences or ecological requirements of the terrestrial gastropods are very different from one species to another. [7] add that the terrestrial pulmonate gastropods occupy a variety of habitats. Depending on the species, there is often considerable variation according to the variety of altitudes, seasons, climate and ecological tolerance. The Sphincterochilidae family represented by a single species *Sphincterochyla sp.* is not met at Makouda and Tizi-Ouzou stations, where it is abundant with an estimate of 13.64% and a density of 64.58 to 100 m<sup>2</sup>. This confirms the results of [6] announcing that in the dry and hot stations there is a concentration of individuals with a white shell. At Tizirt station, *Tudorella sulcata* is the most abundant species with 25.49% and a density of 58 per 100 m<sup>2</sup>, indeed [10] certify that this species is present in the Western Mediterranean coastline. Furthermore at the Makouda station, the most abundant species is *Otala punctata* with a rate of 22.22% and a relative density of 69.91 per 100 m<sup>2</sup>. [8] report that this species is often found in agricultural areas in the coastal plains. In North Africa, *Otala punctata* occurs from west to north-western Algeria. The highest values of Shannon-Weaver index are recorded in spring and autumn in the four stations. This malacofauna wealth recorded during these seasons coincides with the breeding period of Helicidae and Hygromiidae. The least important values of the Shannon-Weaver index are registered for all stations in summer. This low wealth during the months of June, July and August can be explained by estivation of snails for the purpose of protect themselves from desiccation due to high temperatures and intense sunshine during that season. The index values are low in winter, this is probably due to the behavior of snails towards the cold, this is probably due to the behavior towards the cold snails, which grow in the take shelter and go into hibernation. [3] stating that an active life is possible for Mediterranean molluscs in a fairly narrow range of environmental variables which in natural conditions typically correspond to those of Autumn,

of part of the Spring and winter and Summer few nights. The abundance of several species in the different stations did not induce disequilibrium on terrestrial gastropods stands, since the index of equirepartition tends to 1 at the four stations of study. Indeed, according to [2] it tends toward 1 when all species have the same abundance. [15] affirm that equirepartition can appreciate the imbalances that the index of diversity could not detect. More its value tends to move closer to 1, it reflects a more balanced stand. Sampling of snails made throughout the year, revealed a constant presence of malacofauna due to the geographical locations of the stations grouping factors conducive to the proliferation of terrestrial molluscs, such as, humidity, ambient temperature and the diverse vegetation.

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