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The Diet of the Rhinolophidae in the "Kabylia of the Babors" Region, Northern Algeria

by

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ABSTRACT

Many bats of the Rhinolophidae family are currently threatened all over the world. In Algeria they are represented by six species listed in the IUCN red list and whose hunting habits and diet are at best poorly known. This paper describes the diet composition of four of these species (*Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale* and *R. blasii*) in the Bejaia and Jijel districts, and in Kabylia of the Babors region, in northern Algeria. Between March 2007 and January 2008 guano was sampled every fortnight in the different sites used by the species and preys remains identified under microscope. Results show that these Algerian Rhinolophidae prey on three groups of Arthropodes (Insects, Chilopodes and Spiders) whose frequencies vary from one species to another.

Keywords: Diet, Rhinolophidae, guano, north Algeria, preys

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Introduction

Bats are of special concern almost everywhere throughout the world. However, feeding habits and diet of many of them remain at best poorly known, although many of them play an important ecological role particularly in terms of reproduction of plant species, reforestation or fight against pests (Bonnet-Garcia, 2003).

Bats are real natural insecticides: they contribute every night to the natural regulation of the populations of insects, in particular the harmful of the cultures and the mosquitoes.

They are among main animals that feed on insects at night and thus play a fundamental role in the food chain. Furthermore, bat manure (droppings) is an excellent fertilizing one.

According to the literature, in Algeria with six species [*Rhinolophus blasii* (Peters, 1866), *Rhinolophus clivosus* (Cretzchmar, 1828), *Rhinolophus euryale* (Blasius, 1853), *Rhinolophus ferrumequinum* (Schreiber, 1774), *Rhinolophus hipposideros* (Bechstein, 1800) and *Rhinolophus mehelyi* (Matschie, 1901)], the Rhinolophidae represent the second family in terms of species richness after the Vespertillionidae (Anciaux de Favaux, 1976; Gaisler, 1983; Gaisler and Kowalski, 1986; Kowalski, 1991). Four of them are among the 11 species listed on the UICN Red List (Hutson et al., 2001; Aulagnier et al., 2011).

Inasmuch as their diet remained almost unknown, we investigated the diet of the four species whose populations are decreasing (Greater horseshoe bat *R. ferrumequinum*, Lesser horseshoe bat *R. hipposideros*, Mediterranean horseshoe bat *R. euryale* and Blasius' horseshoe bat *Rhinolophus blasii*). This paper presents the results obtained in northern Algeria during a 1-year survey in the light of what is known elsewhere on these species.

Materials and methods

Study area and habitat mapping

Our study was conducted in the East of the Great Kabylia (Kabylia of Djurdjura), a natural region of north-eastern Algeria. It is a mountainous area characterized by series of coastal links with an average elevation of 1000 meters, culminating at Jebel Babor (2004 meters) and Jebel Tababor (1969 meters). The topography of the region is very rugged, with slopes often exceeding 25 %, mainly oriented North-East / South-West (Bellatreche, 1994).

The area selected corresponds to the Bejaia and Jijel districts, in the Kabylia of Babors region.

[Figure 1]

Ten sites were explored: the Boublatane cave in Jijel, the Taâssast, Boukhiama, Fort Lemercier, Château de la Comtesse and Aokas caves, and finally, the Elephants' cave in Bejaia.

Collection and analysis of the guano samples

Guano samples were collected in the different sites used by the four species and prey remains were identified under microscope. Field-trips were conducted between March 2007 and January 2008 (Table 1), once a fortnight or once a week depending on the weather.

During the sampling period, we localized colonies and collected all the manure among which 10

pellets only were analysed in the laboratory. All the manure once collected, we put a paper in order to sample the manure for the next sampling night.

The number of colonies sampled are varies from a sampling to another , they are composed by 15 to 80 animals .

Thus, throughout the study period, 102 samples were collected after 43 sampling nights; each sample contained 10 pellets of guano, so 1020 pellets were analysed in total.

Kervyn (1998) stated that a sample of 100 annual dung is sufficient to identify what the prey consumed, only to identify but not specify the composition of the diet and its annual changes of composition.

[Table 1]

For their analysis, guano samples were soaked at least one hour in 70 % alcohol before being dissected, using forceps, under a binocular magnification (400×); determination was made through the identification key by Shiel et al., (1997).

Several methods to express results are used by the authors but their definitions are not always consistent throughout publications. We referred to the diet composition in accordance with Vaughan (1997); the results are expressed as frequency percentage of occurrence, i.e. the number of taxa equals the number of contained samples divided by the total number of occurrences, multiplied by 100.

Results

[Table 2]

[Figure 2]

1 – Diet composition of *Rhinolophus ferrumequinum*

The results expressed in Table 2 show that in our study area *Rhinolophus ferrumequinum* consumes preys belonging to three groups of arthropods: Insecta (95.81 %), Chilopoda (4.01 %) and Araneida (0.18 %).

The insect preys most consumed by *Rhinolophus ferrumequinum* are Diptera (39.96 %) and Lepidoptera (21.53 %). Diptera include mainly Culicidae (10.40 %), Chironomidae / Ceratopogonidae (10.94 %) and Tipulidae (4.28 %).

2 - Diet composition of *Rhinolophus hipposideros*

In our study area, *Rhinolophus hipposideros* consumes preys belonging to only two groups of arthropods: Insecta (93.49 %) and Chilopoda (6.51 %) (Table 3).

The insect preys most consumed by *R. hipposideros* are Dipterans (41.40 %). This percentage comprises mainly Culicidae (15.59 %), Chironomidae / Ceratopogonidae (9.68 %) and Tipulidae (6.45 %). The order Lepidoptera (moths) also accounts for a good proportion (21.38 %) in the

diet of *R. hipposideros* as well as Hemipterans (11.63 %). (Table 2)

3 - Diet composition of *Rhinolophus euryale*

In our study area, *Rhinolophus euryale* consumes preys belonging to only two groups of arthropods: Insecta (92.86 %) and Chilopoda (7.14 %).

The insect preys most consumed were Dipterans (40.00 %). This percentage comprises mainly Culicidae (14.29 %), Chironomidae / Ceratopogonidae (7.14 %) and Tipulidae (5.71 %). The order Lepidoptera, (moths) also represents a good proportion (21.42 %) in the diet of *Rh. euryale* (Table 2).

4 - Diet composition of *Rhinolophus blasii*

In the Algerian study area, *Rhinolophus blasii* preys on two groups of arthropods: Insecta (96.87 %) and Chilopoda (7.14 %).

The insect preys most consumed were Dipterans (37.5 %). This percentage comprises mainly Chironomidae / Ceratopogonidae (9.38 %), Culicidae, Anisopodidae and Sphaeroceridae (6.25 %). The order Trichoptera represents a good proportion in the diet of *R. blasii* (15.63 %) and the Lepidoptera accounts for 12.50 % (Table 2).

Discussion

The diet composition of the Rhinolophidae varies according to the seasons and biogeographical areas which determine the availability in types of prey. It translates to a relative plasticity which consists in diversifying preys when the food is rare and in specializing more on two or three groups of insects recognized as "key" when the resource is plentiful. The rhinolophidae preys belong mainly to the insect class. Arachnids are also captured.

The *Rhinolophus ferrumequinum* diet

The Greater houseshoe bat *Rhinolophus ferrumequinum* is more specialized and consumes mainly night-Lepidoptera moths (in summer) and beetles of which the most appreciated are *Geotrupes*, *Melolontha* and *Aphodius*. These same "key" items are found on various sites of a common biogeographical area (Ransome, 1996). Dipterans (especially Tipulidae and Muscidae) appear among the most frequent secondary preys and can represent – locally and during certain seasons – 10 to 20 % of identified groups in the manure (Duvergé, 1996; Ransome, 1968, 1996). When the availability in insects is favourable, preys consumed by the Greater houseshoe bat are larger than those of the Lesser horseshoe bat *Rhinolophus hipposideros*. Besides capacities of absorption and digestion, higher in bigger-sized species, it is the frequency of the emitted sounds of the bats that would determine the prey type and size. Gould (in McAney and Fairley, 1989) showed that bats tend not to catch insects that are smaller than the wavelength of the emitted ultrasound. Greater horseshoe bat perches frequently to break down the large preys.

In Korea, the diet variation of the *Rhinolophus ferrumequinum* was investigated through analysis of faeces collected before and after parturition. The results showed a high use of Coleoptera, which accounted for 30-77 % in the diet. Diptera (total 27.38%) and Lepidoptera (total 13.31 %) were also consumed for the most part. Prey types recovered also included small numbers of Hymenoptera and Neuroptera. The diet of *R. ferrumequinum* varies before and after parturition. In lactating period, Coleoptera were mainly consumed (77 %), but the use of Diptera significantly increased in post-lactating period (51 %) (Hyun Kuk, et al., 2007).

According to the present Algerian study, the diet of *Rhinolophus ferrumequinum* is mainly composed of insects such as the Lepidoptera, the corn borer which affects cultures and provokes losses, the Chironomidae / Ceratopogonidae, as well as members of the Culicidae family – like mosquitoes which parasite man and animals and are vectors in disease transmission. Hemiptera also contains species belonging to these two categories of nuisance.

The results we obtained bring to light that the *Rhinolophus ferrumequinum*, besides the flying preys, captures at least a considerable fraction of surface preys. This is indicated by the fact that insects which fly relatively rarely (e.g., Cercopedae, Aphidoidea and Dermaptera) and non-flying arthropods (e.g., Chilopoda and Arachnida) appeared in its diet. 31 taxa distributed into 3 classes: Insecta (95.80 %), Chilopoda (4.01 %) and Arachnidae (0.18 %) were determined. The figure 2 clearly highlights the ascendancy of the order Lepidoptera with more than 21 %. Studies in Bass-Brittany led by the “Groupe Mammalogique Breton”, show that this species consumes particularly some lepidoptera, tipules and dung beetles (Boireau and Dubos, 2005). In the order

Lepidoptera, it is very difficult to determine fragments to the family, on the other hand, in the order Diptera, we were able to determine 11 families which together constitute the highest frequency percentage (about 40 %) in the diet.

Among these 11 families, Chironomidae / Ceratopogonidae and Culicidae families of subordinate Nematocera are the most represented with more than 10 % each. The percentage of 9 other families varies between 0.55 % and 4.56 %; noticeably, Tipulidae has the maximal value followed by the family Anisopodidae with 3.65 %. The Corixidae family of the order Hemiptera (12.77 %) occupies the third position with 7.66 %, a little more than half of the percentage of the order.

The presence of a small proportion of spiders (0.18 %) raises a number of questions, e.g., are the spiders captured on the vegetation, on the ground, or during their aerial movements? The determination of the rests of the family turns out problematic and it is thus difficult to answer to the questions. According to Beck *et al.* (1997), McAney and Fairley (1989), McAney et al. (1991) and Pir (1994) *Rhinolophus ferrumequinum* captures occasionally spiders in very small proportion.

The *Rhinolophus hipposideros* diet

In Ireland, the Lesser horseshoe bat *Rhinolophus hipposideros* diet was investigated over one season by analysing faeces and discarded insect fragments. Remains of 23 insect families from seven orders (Lepidoptera, Neuroptera, Trichoptera, Hymenoptera, Coleoptera, Diptera and

Hemiptera) and of spiders (Araneae: Arachnida) were identified. Nematoceran Diptera was the chief prey but Lepidoptera, Trichoptera and Neuroptera were also important. Both local and seasonal variations were demonstrated for certain food categories. The predicted seasonal availability of the different insect taxa is broadly reflected in the results: the question of possible prey selection is discussed. The bat fed successfully on three families of Lepidoptera known to possess hearing organs sensitive to bat ultrasounds. The possible mechanisms by which *R. hipposideros* might catch such prey are reviewed in Mcaney and Fairley (1989) and Mcaney *et al.* (1991).

In Europe at least 12 orders and 34 families of the insect class were identified in the manure of the Lesser horseshoe bat *Rhinolophus hipposideros* (Roué and Barataud, 1999).

Our own data for *Rhinolophus hipposideros* represent a total of 9 orders belonging to the insect class. Dipterans are the most represented with more than 41 % shared between 9 families. The Culicidae family detains the biggest portion (14.42 %) of the total, then come Chironomidae / Ceratopogonidae, followed by Tipulidae. The order Lepidoptera which constitutes easy-to-capture preys occupies the second position in comparison with the other orders; it is the best represented taxa with 21.38 %. The order Hemiptera (Corixidae, Cercopedae, Delphacidae and Aphidoidea) is well represented with 11.64 %.

Besides the insect class, the Chilopoda class was determined and it represents not less than 6.50 %. As for the Arachnida class, no fragment was identified. All the other taxa consumed appear in very low percentage, playing a limited role in the diet of the lesser horseshoe bat.

THE *Rhinolophe euryale* diet

The Mediterranean horseshoe bat *Rhinolophe euryale* has a very precise slow flight. Its great manoeuvrability allows it to hunt insects in crowded environment. It uses various techniques of hunting. It captures its preys either near the ligneous vegetation, or by flying into the vegetation, or by sit-and-wait on a perch. Its diet is a specialized one, it varies however according to the seasons and regions. It consumes nocturnal Lepidoptoptera in great quantities, as well as Dipteran (Tipulidae) and Beetles (Scarabeidae) (Anonyme, 2008).

To Gioti and al (2008) foraging areas of *R. euryale* typically has been associated with woodland, our results suggest that the existence of edge habitat, created by semicluttered structures such as hedgerows and woodland edges, was a significant factor in the choice of foraging areas by these bats

The diet of *Rhinolophe euryale* was not thoroughly studied. The bibliographical data mention the ascendancy of Lepidoptera and Dipterans (especially Tipulidae) (Koselj and Krystufek, 1999; Goiti and al., 2004). The work of Grabovac and al. (1999) (In Goiti and al, 2004) allowed us to identify mainly fragments of Beetles in the manure of a colony (summer camp) of *Rhinolophe euryale*. According to Goiti and al. (2004), the results would have be to taken with precaution because of the possible formation of multispecies swarms (Lecoq, 2006).

In May 2001, guano was collected under a summer colony of *Rhinolophus euryale* of the Basque country (in south-western Europe). Simultaneously, traps Malaise were put in the various housing

environments to measure the availability in insects there, balanced by the use of housing environments by bats. The frequencies of the prey groups identified in faeces and available were statistically compared. The most consumed insects were, by far, the small Lepidoptera (5-11 millimetres long), followed by Tipulidae and Scarabeidae (Rhizotrogus sp.). A selection of Lepidoptera and Scarabeidae was put forward, while the other available preys seem to be under-represented in the diet. These results confirm the importance of the small Lepidoptera for the Mediterranean horseshoe bat *Rhinolophus euryale* in period of pre-birth, the other preys which can constitute an important seasonal resource. (Goiti U and al. 2004).

Only 21 taxa of both insect and chilopoda classes were determined in the diet of *Rhinolophus euryale*. It consumes a little less than 40 %, dipterans are the best represented, they are divided as such: 14.29 % of Culicidae, 7.14 % of Chironomidae / Ceratopogonidae, 5.71 % of Tipulidae; the rest is shared between Syrphidae, Anisopodidae, Dolichopodae, Calliphoridae, Sphaeroceridae and Scathophagidae.

Lepidoptera represent more than 21 % of the total of the frequencies of the consumed taxa. As for the order Hemiptera, it is well represented, enough with more than 14 %, more than a third of which returns to the family Corixidae. Let us find the important frequency of Chilopoda and Dermaptera which reflect the faculty of this species in the capture of preys that are rarely or not flying on surfaces.

THE *Rhinolophus blasii* diet

Among 8 orders of insects found in the manure of *Rhinolophus blasii* the clear predominance of dipterans, Chironomidae families of which / Ceratopogonidae are the most represented with their 15.63 %, Trichoptera is well represented and comes just after dipterans. The orders Lepidoptera and Hemiptera represent 12.5 % each, the third most important percentage. Remains corresponding to the class Chilopoda were determined to a 3.13 % frequency. Let us find the low diversification of the consumed preys and the low variation of the various determined taxa frequencies, which can probably be due to the low number of the analyzed samples.

Conclusion

The original data of the Rhinolophidae diet in Algeria show us that three classes of arthropods are included in the diet of the Rhinolophidae: Insecta, Chilopoda and Arachnida, the predominance being attributed to insects. The most abundant taxa insects are parasites and harmful.

We can say that in many ways, bats play a very important role in the ecological balance, especially as regards the fight against harmful interference. The diet analysis of these bats gives us very important information on the limitations of the number of insects and their diversity.

The four species of Rhinolophidae studied from the Kabylia of Babors region in northern Algeria, consume approximately the same preys, however with some differences: Insecta *Rhinolophus ferrumequinum* do not consume hymenoptera, *Rhinolophus hipposideros* do not consume neuropteran and Siphanoptera, *Rhinolophus euryale* do not consume Psocoptera, Neuroptera and siphanoptera; Rhinolophus blasius do not consume Psocoptera, Dermaptera and Siphonoptera.

The Chilopoda are consumed by all the species and the Araneidae and Siphonoptera are only present in the *Rhinolophus ferrumequinum* diet.

These results for Algeria show that for the four species of bats, the prevalence is for insects; the chilopoda are also consumed by the four rhinolophidae and the araneidae and Siphoptera are consumed only by one species.

In North Africa, further research into population trends, establishment and management of protected areas, education, and implementation of national-scale legislation are needed (Aulagnier *et al.* 2008).

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Figure legends

Figure 1 - Location of sampled deposits

Figure 2 – Diet comparison of the four rhinolophidae in Algeria

Table 1 - Release calendar and number of samples collected

Table 2 - Frequencies of *Number of different anatomical parts identified (prey parts)* (in %) found in the guano of *Rhinolophidae of Kabylia*

APPENDIX

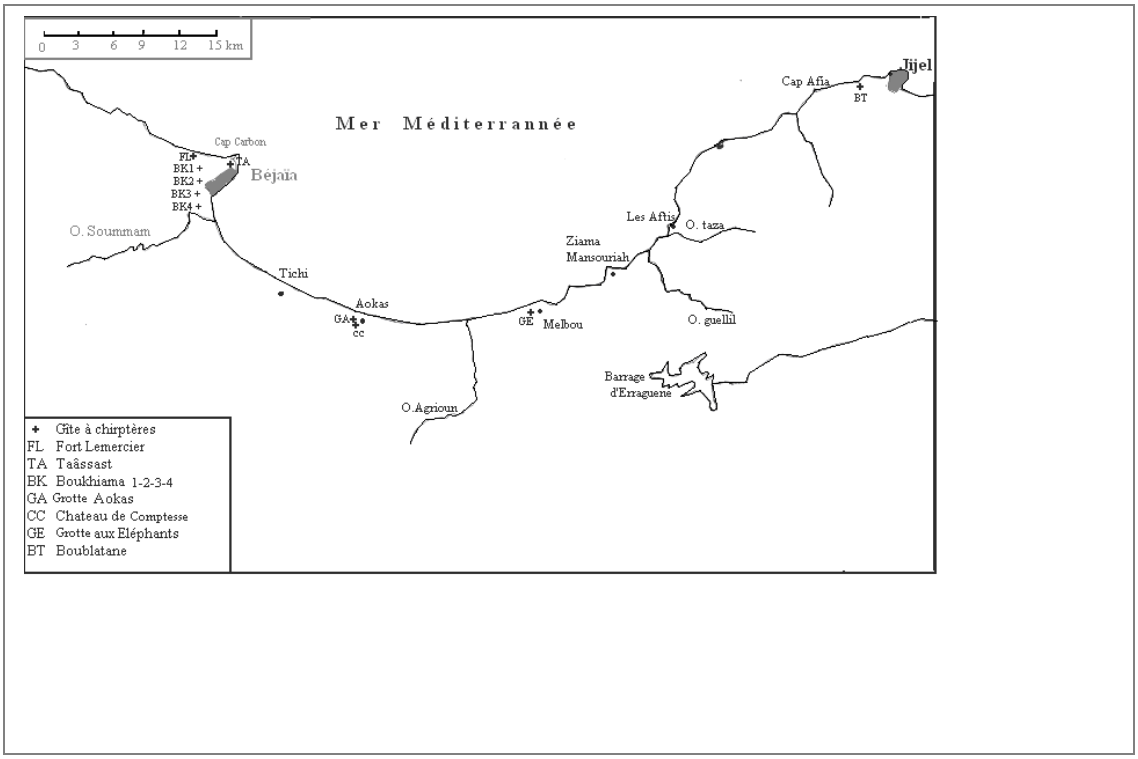

Figure 1 - Location of sampled deposits

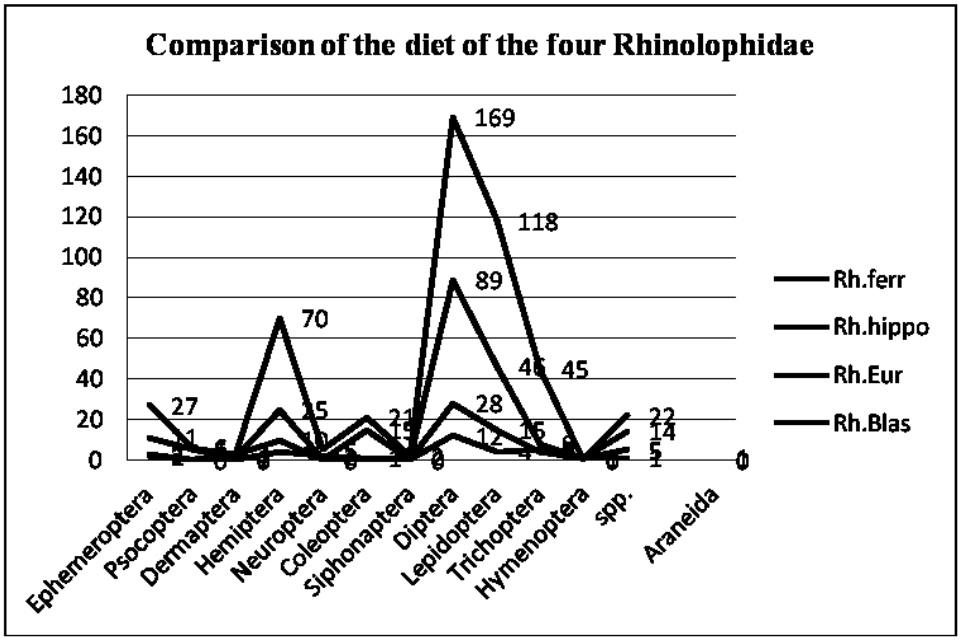

Figure 2 – Diet comparison of the four rhinolophidae in Algeria

Table 1 - Release calendar and number of samples collected

Months	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan	**Total**
Number of sampling night	03	03	07	04	04	03	05	04	05	01	04	**43**

Table 2 - Frequencies of *Number of different anatomical parts identified (prey parts)* (in %) found in the guano of *Rhinolophidae of Kabylia*

Class	Order	*Number of different anatomical parts identified (prey parts)*				*Percentage*			
		R.ferru	*R.hipp*	*R.eur*	*R.bla*	*R.ferru*	*R.hipp*	*R.eur*	*R.bla*
Insecta	*Ephemeroptera*	*27*	*11*	*03*	*02*	*4.93*	*5.12*	*4.29*	*6.25*
	Dermaptera	*06*	*05*	*03*	*-*	*1.09*	*2.33*	*4.29*	*-*
	Psocoptera	*03*	*01*	*-*	*-*	*0.55*	*0.47*	*-*	*-*
	Hemiptera	*70*	*25*	*10*	*04*	*12.77*	*11.63*	*14.29*	*12.50*
	Neuroptera	*05*	*-*	*-*	*02*	*0.91*	*-*	*-*	*6.25*
	Coleoptera	*21*	*15*	*01*	*01*	*3.83*	*6.97*	*1.43*	*3.13*
	Siphonoptera	*02*	*-*	*-*	*-*	*0.36*	*-*	*-*	*-*
	Diptera	*169*	*89*	*28*	*12*	*39.96*	*41.40*	*40.00*	*37.50*
	Lepidoptera	*118*	*46*	*15*	*04*	*21.53*	*21.38*	*21.42*	*12.50*
	Trichoptera	*45*	*8*	*04*	*05*	*8.21*	*3.72*	*5.72*	*15.63*
	Hymenoptera	*-*	*-*	*01*	*01*	*-*	*0.47*	*1.43*	*3.13*
Chilopoda	*spp.*	*22*	*14*	*05*	*01*	*4.01*	*6.51*	*7.14*	*3.13*
Arachnida	*Araneida*	*01*	*-*	*-*	*-*	*0.18*	*-*	*-*	*-*

APPENDIXES

Appendix 1 - Frequencies (in%) of prey parts found in the guano of *Rhinolophus Ferrumequinum* in Kabylia

Class	Order	Suborder	Superfamily or family	Number *(of prey parts)*	Frequency (%)
	Ephemeroptera			**27**	**4,93**
	Dermaptera.			**06**	**1,09**
	Psocoptera			**03**	**0,55**
		Heteroptera	*F. Corixidae.*	42	7,66
			F. CercopidaeF.	13	2,37
		Homoptera.	*delphacidaeSup. F.*	05	0,91
			Aphidoidea	10	1,82
			Total	**70**	**12,77**
			F. Hemerobiidae	01	0,18
			F. Chrysopidae	04	0,73
			Total	**05**	**0,91**
		Adephaga	*F. Carabidae*	11	2,01
			Sup. F. Scarabaeoidea	07	1,28
		Polyphaga.	*F. Scarabaeidae*	01	0,18
			F. Scolytidae.	02	0,36
			Total	**21**	**3,83**
	Siphonaptera:			**02**	**0,36**
			F. Tipulidae.	24	4,28
			F. Anisopodidae.	20	3,65
			F. Psychodidae.	08	1,46
			F. Culicidae.	57	10,40
			F. Chironomidae /Ceratopogonidae	60	10,94
			Total	**169**	**30,83**
			F. Syrphidae.	03	0,55
			F. Sphaeroceridae.	16	2,92
			F. Calliphoridae	11	2,01
			F. Scathophagidae	15	2,74
			Total	**45**	**8,21**
		Brachycera	*F. Rhagionidae.*	05	0,91
			Total	**219**	**39,96**
	Lepidoptera.			**118**	**21,53**
				07	1,28
			F. Limnephilidae.	15	2,74
			F. Hydropsychidae	23	4,2
			Total	**45**	**8,21**
	Hymenoptera.	*Apocrita*	*F. Ichneumonidae*	**03**	**0,55**
			Total	**525**	**95,80**
Chilopoda				**22**	**4,01**
Arachnida	*Araneida*			**01**	**0,18**

Appendix 2 - Frequencies (in%) of prey parts found in the guano of *Rhinolophus Hipposideros* in Kabylia

Class	Order	Suborder	Superfamily or family	Number *(of prey parts)*	Frequency (%)
	Ephemeroptera			**11**	**5,12**
	Dermaptera.			**05**	**2,33**
	Psocoptera			**01**	**0,47**
		Heteroptera	*F. Corixidae.*	17	7,91
			F. Cercopedae	05	2,33
		Homoptera.	*F. Delphacidae*	02	0,93
			Sup. F. Aphidoidea	01	0,47
			Total	**25**	**11,63**
		Adephaga	*F. Carabidae*	05	2,33
		Polyphaga.	*Sup. F. Scarabaeoidea*	05	2,33
			F. Scarabaeidae	05	2,33
			Total	**15**	**6,97**
			F. Tipulidae.	12	5,58
			F. Anisopodidae.	06	2,79
			F. Psychodidae.	02	0,93
			F. Culicidae.	31	14,42
			F. Chironomidae /Ceratopogonidae	25	11,63
			Total	**76**	**35,35**
			F. Syrphidae.	01	0,47
			F. Sphaeroceridae.	07	3,26
			F. Calliphoridae	01	0,47
			F. Scathophagidae	04	1,86
			Total	**13**	**6,05**
			Total	**89**	**41,40**
	Lepidoptera.			46	21,38
			F. Limnephilidae.	05	2,33
			F. Hydropsychidae	03	1,40
			Total	**08**	**3,72**
	Hymenoptera.	*Apocrita*	*F. Ichneumonida.*	**01**	**0,47**
		Total		**201**	**93,49**
Chilopoda				**14**	**6,51**

Appendix 3 - Frequencies (in%) of prey parts found in the guano of *Rhinolophus Euryale* in Kabylia

Class	Order	Suborder	Superfamily or family	Number *(of prey parts)*	Frequency (%)
	Ephemeroptera			**03**	**4,29**
	Dermaptera.			**03**	**4,29**
		Heteroptera	*F. Corixidae.*	07	10
		Homoptera.	*F. Cercopedae*	02	2,82
			Sup. F. Aphidoidea	01	1,43
			Total	**10**	**14,29**
	Coleoptera	*Adephaga*	*F. Carabidae*	**01**	**1,43**
			F. Tipulidae.	04	5,71
			F. Anisopodidae.	01	1,43
			F. Culicidae.	10	14,29
			F. Chironomidae		
			/Ceratopogonidae	05	7,14
			Total	**20**	**28,57**
			F. Syrphidae.	03	4,29
			F. Sphaeroceridae.	02	2,82
			F. Calliphoridae	01	1,43
			F. Scathophagidae	01	1,43
			Total	**07**	**10**
		Brachycera	*F. dolichopodidae*	01	1,43
			Total	**28**	**40,00**
	Lepidoptera.			15	21,42
	Trichoptera.		*F. Limnephilidae.*	01	1,43
			F. Hydropsychidae	03	4,29
	Hymenoptera.	*Apocrita*	*Sup. F. Chalcidoidea*	**01**	**1,43**
		Total		**65**	**92,86**
Chilopoda				**05**	**7,14**

Appendix 4 - Frequencies (in%) of prey parts found in the guano of *Rhinolophus Blasii* in Kabylia

Class	Order	Suborder	Superfamily or family	Number *(of prey parts)*	Frequency (%)
	Ephemeroptera			02	6,25
		Heteroptera	*F. Corixidae*	02	6,25
		Homoptera.	*F. Cercopedae*	02	6,25
			Total	**04**	**12,50**
			F. Hemerobiidae	01	3,13
			F. Chrysopidae	01	3,13
			Total	**02**	**6,25**
	Coleoptera	*Adephaga*	*F. Carabidae*	**01**	**3,13**
			F. Tipulidae.	01	3,13
			F. Anisopodidae.	02	6,25
			F. Psychodidae.	01	3,13
			F. Culicidae.	02	6,25
			F. Chironomidae /Ceratopogonidae	03	9,38
			Total	**09**	**28,13**
			F. Syrphidae.	01	3,13
			F. Sphaeroceridae.	02	6,25
			Total	**03**	**9,38**
			Total	**12**	**37,5**
	Lepidoptera.			**04**	**12,50**
				01	3,13
			F. Limnephilidae.	02	6,25
			F. Hydropsychidae	02	6,25
			Total	**05**	**15,63**
	Hymenoptera.	*Apocrita*	*F. Ichneumonida.*	**01**	**3,13**
			Total	**31**	**96,88**
Chilopoda				**01**	**3,13**