



## Biodiversity Of Apoidea In Cultivated And Natural Environments In The Regions Of Algiers And Bouira (Algeria)

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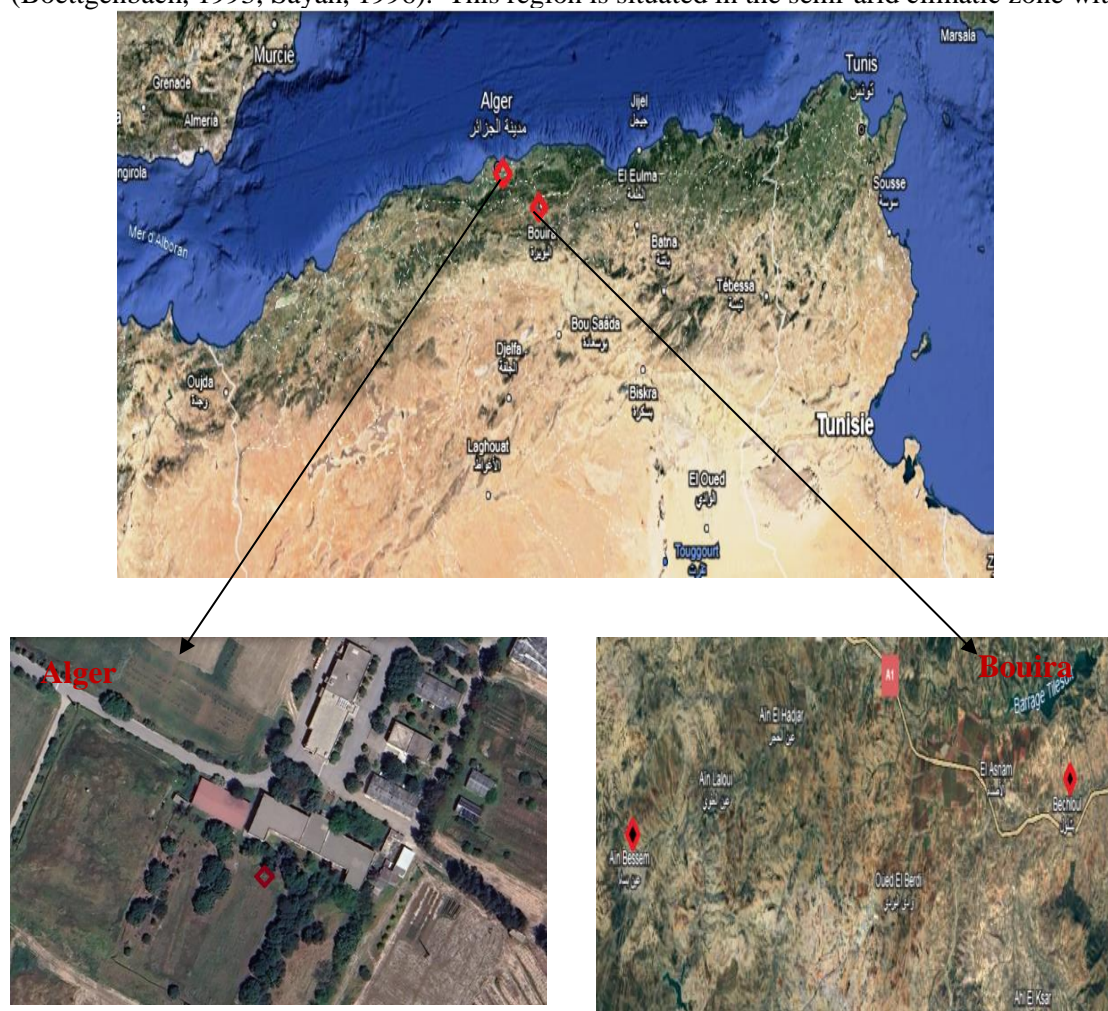
Article History	ABSTRACT
Received: 14/01/2023 Revised: 12/05/2023 Accepted: 29/07/2023	<p><i>This study is a contribution to the recognition of wild Apoid fauna in the Mahdi Boualem station in Algiers and the Bechloul and Ain Bessam stations in Bouira, in two environments, natural and cultivated at different altitudes. Sampling was carried out at different times during 2015, 2016 and 2017, using two methods, butterfly netting and hand capture. The 2399 Apoidea individuals captured belong to 4 families and 21 genera. The families are Andrenidae, Halictidae, Megachilidae and Apidae. The Apis genus is the most abundant at all stations, with over 90.67% of individuals. The genera Lasioglossum, Magachile, Melitturga and Anthidiini are the least represented, with just 1 individual. The relationship between Apoides plants and the plants visited for nectar collection is shown by the study of its floral choice.</i></p>
CC License CC-BY-NC-SA 4.0	<b>Keywords:</b> Biodiversity, Apoides, floral diversity, Bouira, Algiers.

### INTRODUCTION

The first work on honey bees and wild bees dates back to 1953 by Frisch. Like honey bees, wild bees have also been extensively studied in recent decades. Several studies have been carried out in America (Michener, 1944; 1979; 2007; Chagnon, 2008), Europe (Jacob-Remacle, 1989 a and b; Rasmont et al., 1995; Patiny, 1999 and Pauly, 2014), Australia (Almeida et al., 2012) and Africa (Patiny et al., 2008). In Algeria, fragmented research has been undertaken following initial work by Saunders (1908), Alfken (1914) Schulthess (1924) and Benoist (1940). Like those carried out by Louadi and Doumandji (1998a, 1998b) and Louadi (1999), Benachour et al. (2007), Louadi et al. (2007, 2008), Benachour and Louadi (2011), Scheuchl, et al. (2011) and Chichoune et al. (2018) in eastern Algeria on Apoidea in general and their ecology includes those of. Come subsequently some research was carried out by Bendifallah et al. (2010, 2012) and Aouar-Sadli et al. (2012) and . In the eastern and central Sahara of Algeria, Cherair et al. (2013) and Djouama et al. (2017) about the Andrenidae and Bouti et al (2020) in northern Algeria. This study is intended to reinforce further studies on the biosystematics and diversity of wild Apoidea at three stations in two regions of northern Algeria. The Mahdi Boualem station in the Algiers region and the Ain Bessam and Bechelloul stations in the Bouira region.

## MATERIALS AND METHODS

Sampling was carried out in three localities in two regions of Algeria (Algiers and Bouira). In the Algiers region the survey is conducted in the Mehdi Boualem station (36° 39' 58.44" N, 3° 5' 29.84" E.). This station is located to the east of Algiers; in the eastern part of the Mitidja and the Algiers coastline. The Bouira region (36° 17' 48" Nord and 3° 40' 12" E) is located in the north-central part of the country. It covers an area of 4456.26 km<sup>2</sup>, representing 0.19% of the national territory. The great Djurdjura mountain range on the one hand and the Dirah mountains on the other frame the region, which opens out from west to east onto the Soummam valley. Two stations were chosen for apoid sampling, Bechelloul and Ain Bessam (Figure 1). The flora of the Algiers region is characterized by Mediterranean-type floristic heterogeneity. According to Mutin (1977), Abdelkrim (1995), Kheddami and Adane (1996), Akezouh (2000), arborescent plant strata with windbreaks such as Aleppo pine *Pinus halepensis* (Mill. , 1768) and cypress *Cupressus sempervirens* (L., 1753), while the other stratum is made up of shrubby plants such as bramble (*Rubus ulmifolius*), reed (*Arundo donax*), oleander (*Nerium oleander*), Chinese rose (*Hibiscus Rosa sinensis*) and a few herbaceous plants represented by Poaceae, this region is located in the sub-humid bioclimatic zone with mild winters. Vegetation in the Bouira region is steppe-like south of the Djebel Dirah. It is forested from north-east to north-west as far as Tikjda, dominated by Aleppo pine near Slim, cork oak and cedar towards Thigounatine (Boettgenbach, 1993; Sayah, 1996). This region is situated in the semi-arid climatic zone with mild winters.



**Fig1:** Geographic map of the location of the study regions (Google earth)

In order to inventory the Apoidea species in the two selected regions, as well as the fauna-flora relationship, the method used consisted of capturing wild bees in their own habitat during flight periods. The outings continued as regularly as possible, with one per week for each site. Bee sampling is carried out at selected stations in 2015, 2016 and 2017. Each visit lasts two hours. For a meaningful sampling of the entomofauna, it is necessary to use traps and harvesting techniques that allow the exploration of as many habitats as possible,

constituting the study environment (Southwood, 1966). This is the principle on which we based our sampling of Apoids. Hand-capture while foraging on flowers and butterfly netting are the techniques used for this study.

Collected specimens are identified by mounting the wings. This method makes it possible to observe the veins of the species' wings to facilitate recognition. The wings of the insect are delicately cut at the base, then mounted in a drop of Faure's liquid between slide and coverslip, on which the species name, place and date of capture are written. The mounts are then observed under a binocular loupe or stereo-microscope with a magnification of at least 50 times and with various determination keys, principally the key to genera of the super-family Apoidea by Scheuchl (2000) and the key to genera of Western European Apoids by TERZO and RASMON (1996). The study also highlighted the relationship between plants and bees through the study of their floral preference when collecting nectar. Plants foraged by Apoidea are collected and stored in Kraft paper bags. The plants are identified in the herbarium of the Ecole Nationale Supérieure d'Agronomie d'El Harrach (ENSA).

## RESULTS AND DISCUSSION

**Table 01** - Relative abundance of Apoidea families caught in the Algiers and Bouira regions

Families	Gender	Algiers region		Bouira region			
		Mahdi Boualem		Ain Bessam		Bechlloul	
		Ni	AR %	Ni	AR%	Ni	AR%
Apidae	Eucera	23	2,62	24	3,15	49	6,46
	Nomada	2	0,23	6	0,79	43	5,67
	Apis	764	86,92	690	90,67	329	43,35
	Melecta	-	-	2	0,26	12	1,58
	Anthophora	-	-	-	-	7	0,92
	Anthophoridae indet	-	-	-	-	7	0,92
	Tetralonia	-	-	-	-	4	0,53
	Xylocopa	-	-	-	-	15	1,98
	Ceratina	-	-	-	-	13	1,71
	Bombus	-	-	-	-	22	2,9
Andrenidae	Andrena	43	4,89	14	1,84	82	10,8
	Melitturga	1	0,11	5	0,66	-	-
	Panurgus	13	1,48	2	0,26	3	0,4
Megachilidae	Megachile	1	0,11	-	-	16	2,11
	Osmia	15	1,71	2	0,26	47	6,19
	Stelis	-	-	3	0,39	20	2,64
	Chalicodoma	-	-	-	-	12	1,58
	Anthidium	-	-	-	-	9	1,19
	Anthidiini	1	0,11	-	-	-	-
Halictidae	Lasioglossum	1	0,11	-	-	10	1,32
	Halictus	15	1,71	13	1,71	59	7,77
Total	<b>21Gender</b>	879	100	761	100	759	100

A total of 2,399 individuals were captured at the 3 stations. These specimens were divided into 4 families and 21 bee genera.

At the Mahdi Boualem station in Algiers, the Apis genus is the most represented, with AR% = 86.97%. The other genera Nomada, Eucera, Melitturga, Panurgus, Anthidiini, Halictus Lasioglossum, Osmia, Megachile and Andrena are poorly represented, with rates ranging from 4.89 to 0.11 %. In the Bechlloul station, on the other hand, the most represented genus is Apis with AR% = 43.34%, followed by Andrena with AR% = 10.80%. The remaining genera Nomada, Eucera, Melecta, Anthophora, Anthophoridae indet, Tetralonia, Xylocopa, Ceratina, Bombus, Stelis, Chalicodoma, Panurgus, Anthidium, Halictus, Lasioglossum, Osmia and Megachile are poorly represented, with rates ranging from 6.45% to 0.40%. In the Ain Bessam station, the Apis genus is the most represented, with an AR value of 90.67%, while the other genera Nomada, Eucera, Melitturga, Panurgus, Anthidiini, Halictus, Lasioglossum, Osmia, Megachile, Stelis and Andrena are poorly represented, with rates ranging from 3.15% to 0.26%.

**Table 02** - Presentation of Shannon-Weaver index values and equitability at the two stations.

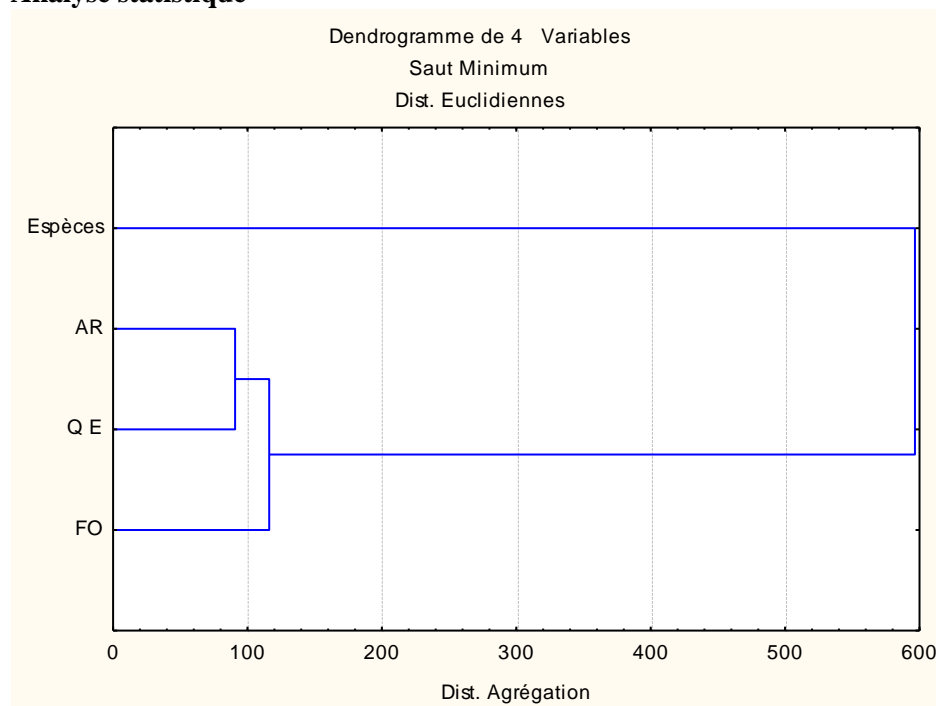
	Algiers region		Bouira region	
	Mahdi Boualem	Ain Bessam	Bechloul	
Shannon-Weaver index(H')	0,88	0,7	3,1	
Maximum diversity (H' max)	3,46	3,32	4,25	
Equitability (E)	0,25	0,21	0,72	

Calculation of the bird population structure indices in this study gave high diversity values ranging from 0.7 bits at Ain Bessam to 3.1 bits at Bechloul. This means that the stands studied are highly diverse. As for equitability, the values noted at Algiers and Ain Bessam tend towards 0, meaning that the species numbers are not in equilibrium and that the population studied is dominated by a single species. On the other hand, the value noted at Bechloul (0.72) tends towards 1, revealing a balance in numbers between the bee species found at this site.

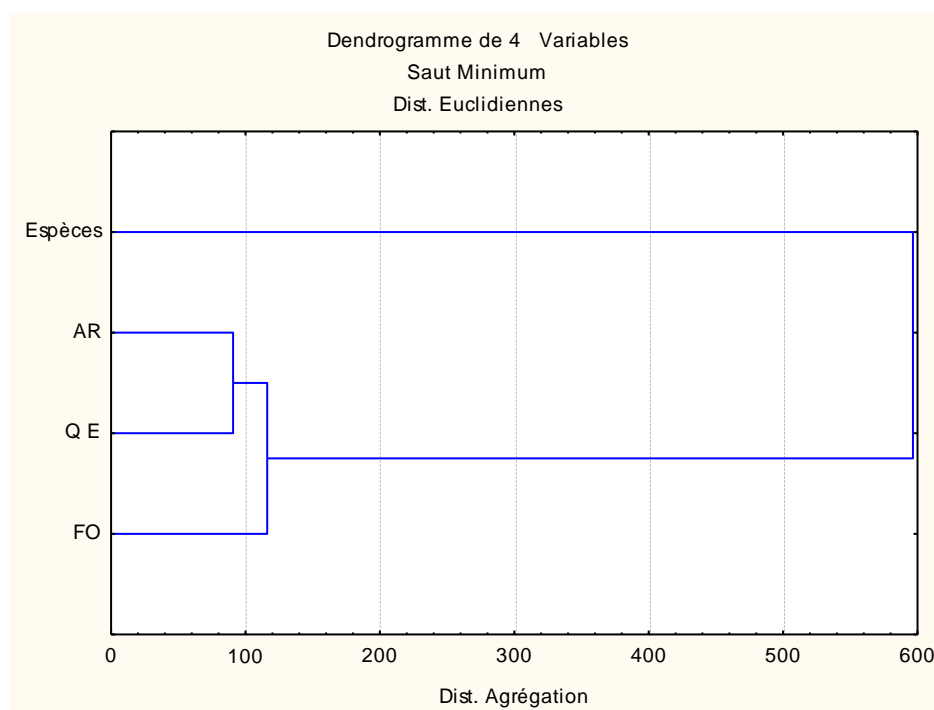
### Flora visited by all Apoidea caught

The first flights of wild bees were observed on flowering plants. The flight periods of bee species are estimated on the basis of successive captures of local flora. The floristic surveys provide an overview of the botanical families that are most important for wild bees in the region. The species captured visit the most dominant spontaneous plants in the two study regions. The sampling enabled us to record species belonging to different families, such as: Brassicaceae (*Sinapis arvensis*), Papaveraceae (*Papaver Rhoeas*), Malvaceae (*Malva sylvestris*), Boraginaceae (*Borago officinalis*, *Echium vulgare*), Rutaceae (*Citrus limon*), Oxalidaceae (*Oxalis pes-caprae*), Primulaceae (*Anagallis foemina*), Asteraceae (*Galactites tomentosa*, *Sonchus asper*, *silybum marianum*, *Xanthium strumarium*), Urticaceae (*Urtica dioica*), Fabaceae (*Melilotus indicus*), Convolvulaceae (*Convolvulus arvensis*), Geraniaceae (*Erodium malacoides*).

### Analyse statistique



**Fig. 2** - Dendrogram of ecological indices (Algiers region)



**Fig.3-** Dendrogram of ecological indices (Bouira region)

The two dendrograms established (Fig. 2 and 3) are highly comparable and explain the frequency of the same diversity in these two biotopes, which have the same ecological conditions despite their floristic, agricultural and natural differences.

Relative abundance (RA) is strongly linked to equitability, as both ecological variables depend on frequency of occurrence (FO). With very close aggregate values. The values of the three variables are conditioned by the diversity of Apoidea species in the environment composed of fruit trees (Mahdi Boualem station) and its floristic diversity and agricultural environment (Bechloul and Ain Bessam). Various Apoidea species are vulnerable to environmental disturbance. We are currently witnessing a decline in the number of these useful species in their natural environment. It is likely that several species in the bioclimatic zone surveyed are in a fragile state or threatened with extinction. With known climate change, this group of insects may be subject to species migration. Environmental protection of this natural environment should be taken into consideration to enable Apoidea in general to fulfil their role.

## Discussion

The families indicated in the present work are the same as those revealed by the work of Louadi and Doumandji (1998 a and b), in the Constantine region. However, we noted the absence of two families, Colletidae and Mellitidae, which appear to be relatively rare in Algeria. The former was reported by AOUAR (2009), while the latter was recorded in 1914 by Alfken in the Algiers and Médéa regions. Bendifallah et al. (2010) reported 4 Apoidea families in the Bouira region: Andrenidae, Halictidae, Megachilidae and Apidae, out of a total of 365 specimens. It could be that the bees recorded form a tiny part of the Apoidea fauna in the Bouira region. Bendifallah et al (2012) noted the presence of 173 taxa in northern Algeria and part of the Sahara in 2012. The same authors counted 4 Apoidea families in the El Harrach region, namely Andrenidae, Halictidae, Megachilidae and Apidae. The Apoidea families represented in the present study are the same as those reported by Louadi and Doumandji (1998 a and b) near Constantine. However, the Mellitidae family is absent from Mitidja. According to Bendifallah et al (2010), the El Harrach station is more diverse than the Boumerdes, Bouira and Blida stations. According to the same authors, out of a total of 3,281 specimens, a specific richness of 64 Apoidea species was noted. According to Bouti 2013, the apidofauna of the eastern Mitidja comprises 5 families. These are the Andrenidae, Halictidae, Megachilidae, Colletidae and Apidae. These families are largely represented by common species. There are also some rare species. A total of 48 Apoidea taxa were counted, including 2 subspecies of honey bees. 14 genera belong to 5 families. Louadi et al (2008) identified 382 wild bee species belonging to 55 genera.



The Shannon Weaver diversity index values obtained at the three study stations confirm those reported by Bendifallah et al. (2010). These authors give an  $H'$  value of 5.27 bits for the Apoidea population at the El Harrach station and an equitability of 0.82. The high level of  $H'$  can be explained firstly by the great botanical diversity in the region, and also by the mildness of the bioclimatic stage with its warm winters.

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