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Article

The genus *Ochthebius* in the Lebanese rivers, with additional notes on its ecology (Insecta, Coleoptera, Hydraenidae)

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ABSTRACT

The aim of the present study was to fill in the gaps in previous knowledge of the faunistics and distribution of the running water species of *Ochthebius* species in Lebanon, by sampling throughout the entire country. 14 catchments of the largest river systems, not previously taken into account, were studied between 1984 and 2015, including a great diversity of running waters, from springs and streamlets to lower river reaches. This faunal program was extended up to 200 stations during 35 years. At 39 sites within the range of 0 to 2100 m elevation a. s. l., 3245 samples representing 161 imagines of *Ochthebius*. Seven species have been determined.

Keywords: distribution, Lebanon, whole territory, 14 catchments, running water, stagnant water, new data.

Le genre *Ochthebius* dans les rivières libanaises, avec quelques notes supplémentaires sur son écologie (Insecta, Coleoptera, Hydraenidae)

RÉSUMÉ

La présente étude à long terme a pour but de compléter les connaissances antérieures sur la faunistique et la répartition des Coléoptères du genre *Ochthebius* des eaux courantes du Liban par des prospections étendues à la totalité de son territoire. 14 bassins versants supplémentaires des plus grandes rivières, qui n'avaient pas encore été prospectés, ont ainsi été étudiés entre 1984 et 2015, concernant une grande variété d'eaux courantes, depuis les sources et ruisselets jusqu'aux secteurs inférieurs des rivières. En 35 ans, le programme faunistique global s'est étendu jusqu'à 200 stations. À 39 d'entre elles, situées entre 0 et 2 100 m d'altitude, 3 245 échantillons de faune dont 161 imagos d'*Ochthebius* ont été récoltés. Sept espèces ont été déterminées.

Mots-clés : répartition, Liban, totalité du territoire, 14 bassins versants, eaux courantes, eaux stagnantes, citations nouvelles.

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Sampling site 14: Ouâdi Ras En Nahr stream (*El Bared river, 1800 m*).

1. Introduction

Lebanon has an area of 10,452 km^2. It has two mountain ranges parallel to the coast: Mount Lebanon in the West and Anti-Lebanon in the East, culminating at 3,088 and 2,814 m respectively, and separated by the inner Bekaa plain.

The Mediterranean climate is locally strongly modified by the altitude with frequent snowfall and an often-negative temperature in the mountains. The main characteristic is the relative amount of precipitation (average 600 mm per year): except in the northeast of the country, there are many permanent rivers. 12 coastal rivers with a length of less than 60 km originate on the western flank of Mount Lebanon and flow towards the sea, with small catchments, often encased and forested. Three more important rivers (Nahr el-Assi Orontes, Nahr Litani and Nahr Hasbani), flow in the depression of the Bekaa. The low-water period is from July to October and the high-water period from February to May.

Although water is less scarce in Lebanon than in neighboring countries, consumption and the diversification of needs are clearly on the rise. As a result, the quality of surface water deteriorates (Dia 1983, 1993, 1994, 2004, Bou-Zeid & El Fadel 2002), especially in the middle and lower reaches, while the available quantity decreases.

In 1992, we published (Dia & Jäch) a study on the *Ochthebius* of southern Lebanon where we listed 5 species on the coastal rivers of Damour and Aouali, one of which was new to science.

2. Sampling stations

The location of the prospected sites (from North to South) is given below and in Fig. 1. For each river are indicated: the corresponding withdrawal years, the area of the watershed, and the length of the main course. The altitude of each station is mentioned in parentheses.

The following information is given for each station (Tab. 1): E: elevation, D: distance from the source, W: stream width, t: annual water temperature and coordinates. Signification of some arabic words: nahr = permanent stream, ras = head spring, nabaa = spring, ain = small spring, jisr = bridge.

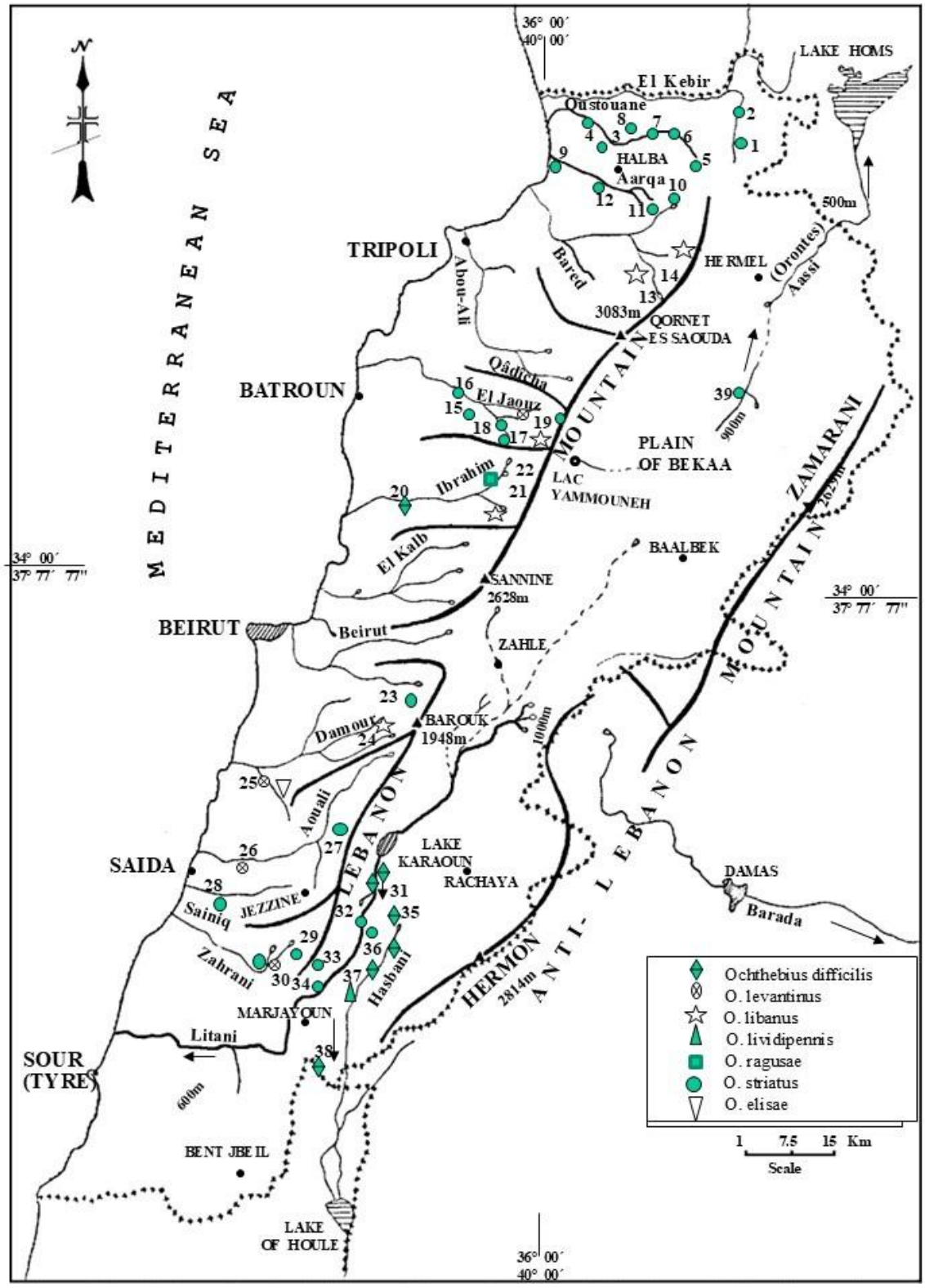


Figure 1. Map of Lebanon showing the hydrographic network. All collecting locations are indicated by numbers.

Figure 1. Carte du Liban montrant les réseaux hydrographiques. Tous les lieux de collecte sont indiqués par des chiffres.

Sampling site 21: Afqa spring and brook (*Ibrahim river, 1200 m*).

I. El Kebir (Nahr) river, 2008, 2009 (area 1000 km^2, length 60 km):

-S1 Magl Bal spring (1 330 m).

-S2 Chadra brooklet (village) (373 m).

II. Oustouane (Ostuene) river, 1998, 1999 (area 160 km^2, length 22 km): Main course:

-S3 Oustouane at El Mazraat bridge (near the village of El Mazraat Baldé) (240 m).

-S4 Oustouane at the El Koucha bridge (near the village of El Koucha) (88 m).

Tributaries:

-S5 Esh Sheikh Jnaîd spring (982 m) near the village Aakkâr El Aatiqa.

–S6 Kharrar spring and brooklet (950 m).

-S7 Taba (Aîn) spring (727 m).

-S8 stream from Hadbiyé to the Taya bridge (700 m).

III. Aarqa river, 2000 (area 153 km^2, length 20 km): Main course:

-S9 Aarqa at the Aarqa bridge (Tripoli-Halba Road) (75 m).

Tributaries:

-S10 Amount of the El Houaïch bridge (near the village of El Houaïch) (480 m).

-S11 Upstream from El Aiyoûna bridge (Nahr Châne) (300 m).

-S12 Ed Delbé spring near the Bqerzla waterfall (village) (260 m).

IV. El Bared river, 1997, 1998 (area 277 km^2, length 24 km):

Tributaries:

-S13 Brissa spring (2100 m).

-S14 Ouâdi Ras En Nahr stream (1800 m).

V. El Jaouz river, 1999, 2015 (area 198 km^2, length 38 km): Main course:

-S15 El Jaouz (610m), near the village Beit Chlala.

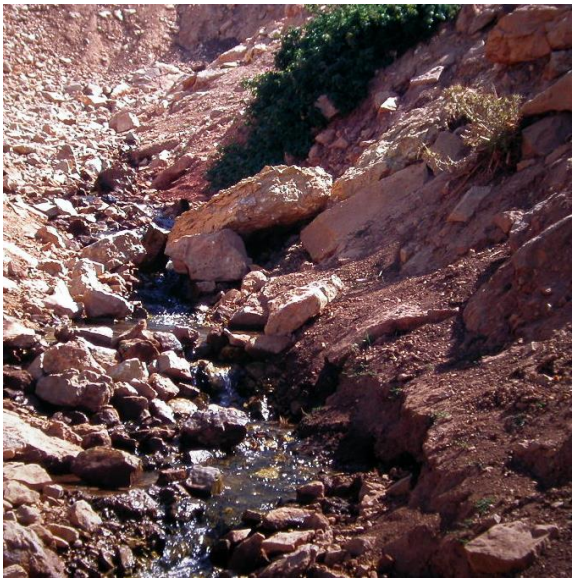
-S16 El Jaouz after receiving Ed Dalli spring (near the Kfar Hilda drinking water treatment plant) (605 m).

Tributaries:

-S 17 Tannôurîne stream upstream from the Tannôurîne El Faouqa bridge (village): Ouâdi Merzîyé (1 350 m).

-S18 Tannôurîne stream (Ouâdi Tannôurîne, near the Tannôurîne water bottling plant and the Knîssit Mâr Yacoûb church) (1000 m).

-S19 stream of Aîn Er Râha (near the village of Tannôurîne Et Tahta) (950 m).



Sampling site 13: Brissa spring (*El Bared river, 2100 m*).

VI. Ibrahim river, 1994, 2002, 2014 (area 330 km^2, length 30 km): Main course:

-S20 Ibrahim Facing the Yahchouch hydroelectric plant (150 m).

Tributaries:

-S21Afqa spring (1200 m).

-S22 Rouais à Yânoûh (village) (1 015 m).

VII. Beirut river, 2003, 2007, 2008, 2009, 2015 (area 231 km^2, length 29 km):

Tributary:

-S 23 Baalchmay stream at the Ras El Meten bridge (445m).

VIII. Damour river, 1981 (area 288 km^2, length 33 km): Main course:

-S24 Damour downstream Nahr es Safa near village Ain Zhalta (950 m).

Tributary:

-S 25 Nahr el Hammam (45m).

IX. Aouali (Awali) river, 1981 (area 302 km^2, length 48 km): Main course:

- S26 above Aouali hydroelectric plant (230 m).

Tributary:

-S27 Bâter ech Choûf spring (820 m).

X. Sainiq river, 2008 (area 108 km^2, length 20 km):

-S28 Ouadi El Leimoun near village Berti (200 m).

XI. Zahrani river, 2004, 2008 (area 109 km^2, length 25 km): Main course:

-S29 El Tassé spring (700 m).

-S30 Zahrani at Ouadi El-Akhader near Bridge (445 m).

XII. Litani river, 1984, 1985, 1986, 2000 (area 2170 km^2, length 170 km): Main course:

-S31 Litani at Aîn Zarka spring (580 m).

-S 32 Litani in Qelia (Dellâfi bridge) (520 m).

Tributaries:

-S33 Maidani spring near Jarmaq village (420 m).

-S34 stream at the Ouadi Zraikoun Bridge (300 m).

XIII. Hasbani river, 2003, 2004, 2013, 2014 (area 526 km^2, length 21 km): Main course:

-S35 Hasbani spring (545 m).

-S36 Hasbani at the Fardis bridge (495 m).

-S37 Hasbani at El Meri (391 m).

-S38 Hasbani downstream Wazzani spring/ Ouazzani (270 m).

XIV. Orontes (Aassi) river, 1985, 1986, 1996, 2000, 2001, 2002, 2004, 2014 (area 1870 km^2, length 46 km):

Tributary:

-S39 Jabboulé stream (840m) near village Jabboulé.

3. Sampling methods

Between 1984 and 2015, the *Ochthebius* imagines were taken with the Surber net (mesh void = 250 µm; surface = 225 cm^2) and together with the troublet net (diameter of 30 cm), the latter always handled for a period of one hour. Many adults were captured on sight, using forceps. A list of the material with numbers of imagines found at stations is given (Tab. 2).

Table 1. Elevation range, distance from Source, stream width, annuel wate temperature and coordinates of the Stations thirty-nine in the fourteen rivers (El Kebir, Ostouene, Aarqa, El Bared, El Jaouz, Ibrahim, Beirut, Damour, Aouali, Sainiq, Zahrani, Litani, Hasbani, Orontes).

Tableau 1. Gamme d'altitude, distance de la source, largeur du cours d'eau, température de l'eau et coordonnées des 39 stations dans les quatorze rivières.

Basin of Rivers	**Elevation (m)**	**Distance from the source (km)**	**Stream width (m)**	**Tº mini -Tº maxi (ºC) annual water Temperature**	**Coordinates**
I. El Kebir (area 1000 km2, length 60 km)					
Tributaries					
St1 Magl Bal, little spring - brook in Ouadi Audine	1330		1-2	11-12	34°30'34″N; 36°16'43″E
St2 Chadra, stream at bridge Jisr Chadra near village Chadra	373	10	3-6	15,5-19,5	34°37'11″N; 36°19,13″E
II. Ostouene (Oustouane) (area 160 km^2, length 22 km)					
Main course					
St3 Ostuene at bridge Jisr Mazraat nr. vil. Mazraat el Balde	240	13	2-4	15-22	34°33'40″N; 36°8'35″E
St4 Ostuene at bridge Jisr El **Koucha**	88	20	3-4	16-24	34°33'30″N; 36°6'8″E
Tributaries					
St5 Esh Sheikh Jnaîd, a spring- brook near village Aakar el Aatiqa	982		10	10,3-11,5	34°30'15″N; 36°14'3″E
St6 Kharrar, a spring- brook near village Aakar el Aatiqa	950		1-2	12,2-13	34°30'15″N: 36°14'3″E
St7 Taba, a spring- brook near village Aakar el Aatiqa	727		1-2	13-14,5	34°31'24″N; 36°14'11″E
St8 Taya, stream at bridge Jisr Taya nr. village Aakar el Aatiqa	700	2	0,5-3	10,2-19,5	34°31'24"N; 36°14'11″E
III. Aarqa (area 153 km^2, length 20 km)					
Main course					
St9 Aarqa at bridge Aarqa near village Aarqa	75	14	4-6	14,7-21,5	34°32'51″N; 35°59'42″E
Tributaries					
St10 El Houaich, a stream near village El Houaich	480	5	1-2	12,7-17,2	34°29'53″N; 36°7'7″E
St11 El Aiyoûna (Nahr Châne) a stream at bridge El Aiyoûna	300		1-2	15,3-18	34°32'51″N; 35°59'42″E
St12 El Delbé, a spring- brook near village Bqerzla	260		0,5	15,7-19	34°30'29″N; 36°84'3″E

Basin of Rivers	**Elevation (m)**	**Distance from the source (km)**	**Stream width (m)**	**Tº mini -Tº maxi (ºC) annual water Temperature**	**Coordinates**
IV. El Bared (area 277 km^2, length 24 km)					
Tributaries					
St13 Brissa, a spring- brook near village Kfar Dmine	2100		2-3	5,2 -12	34°26'34″N; 36°18'44″E
St14 Ouadi Ras En Nahr, a stream in Ouadi Jhannam	1800	4	2-3	10-15,6	34°21'49″N; 36°1' 49″E
V. El Jaouz (area 198 km^2, length 38 km)					
Main course					
St15 El Jaouz at village Beit Chlala	610	10	3	8,5-20,5	34°13'0″N; 35°50'55″E
St16 El Jaouz near spring-brook Ed-Dalli	605	10,5	4-5	9-15,5	34°1'34″N; 35°50'47″E
Tributaries					
St17 Tannourine el Faouqa, a stream at bridge near village Tannôurîne el Faouqa	1350	2	2-3	8,9-13,2	34°10'54″N; 35°54'6″E
St18 Ouadi Tannourine, a stream near village Tannôurîne el Faouqa	1000	5	2-4	8,5-14,5	34°12'35″N; 35°52'39″E
St19 Ain Er Raha, a stream near village Tannôurîne Et Tahta	950	10	2-3	8,4-15,8	34°12'35″N; 35°52'39″E
VI. Ibrahim (area 330 km^2, length 30 km)					
Main course					
St20 Ibrahim at **Yahchouch** Power Plant	152	21	6-10	9-20	34°04'06″N; 35°44'23″E
Tributaries					
St21 Afqa, spring- brook near village Afqa	1200		3-5	8,5-10	34°04'12″N; 35°53'12″E
St22 Rouais, stream near village Yanouh	1015	3	6-10	9-17	34°06'13″N; 35°53'42″E
VII. Beirut (area 231 km^2, length 29 km)					
Tributary					
St23 Baalchmay, a stream at bridge **Ras El Meten**	445	4	1	8-20,5	33°50'57" N; 35°39'44" E
VIII. Damour (area 288 km^2, length 33 km)					
Main course					
St24 Damour, downstream Nahr es Safa near village Ain Zhalta	950	2	2-4	9-17	33°44'47" N; 35°41'57" E
Tributary					
St25 Nahr el Hammam	45	15	4-6	13.5-22	33°43'42" N; 25°29'12" E

Basin of Rivers	**Elevation (m)**	**Distance from the source (km)**	**Stream width (m)**	**Tº mini -Tº maxi (ºC) annual water Temperature**	**Coordinates**
IX. Aouali (area 302 km², length 48 km)					
Main course					
St26 Aouali **at Aouali power plant**	230	30	6-10	9.5-26	33°34'27″N; 35°30'9″E
Tributary					
St27 Nabaa **Bâter ech Choûf** a spring-brook near village Niha	820		2-3	13-14.5	33°36'3″N; 35°37'4″E
X. Sainiq (area 108 km², length 20 km)					
Main course					
St28 Ouadi (Valley) el Leimoun, near village Berti	205	8	2-3	15,6-21,6	33°31'20″N; 35°28'16″E
XI. Zahrani (area 109 km², length 25 km)					
Main course					
St29 Nabaa **El Tassé,** a spring-brook near village Jarjouaa	700		4-5	14-16	33°27'10″N; 35°31'40″E
St30 Zahrani **at Ouadi El Akhdar**	445	3,5	4-5	14-22,5	33°27'45″N; 35°31'31″E
XII. Litani (area 2170 km², length 170 km)					
Main course					
St31 Litani at spring Zarqa near Markabe Power Plant	560	1,5	4-6	15-18	33°32'N; 35°41'E
St32 Litani at bridge **Jisr Qelia (Dellafi)** near village Qellia	520	5	8-15	14-22	33°26'0″N; 35°38'42″E
Tributaries					
St33 Maidani, a spring- brook near village Jarmaq	420		0,5-1	16,5-17,5	33°23'08″N; 35°32'16″E
St34 Zraikoun stream at bridge Zraikoun	300	4	1-2	15,6-21,5	33°23'N; 35°32'E
XIII. Hasbani (area 526 km², length 21 km)					
Main course					
St35 Nabaa **Hasbani,** a spring- brook near village Hasbaya	545		8-12	14-18	33°24'30″N; 35°40'21″E
St36 Hasbani **at Fardis near** village Fardis	495	5	8-10	16-19,5	33°22'17″N; 35°39'49″E
St37 Hasbani **at EL Meri near** village El Meri	390	14	8-20	16,5-24	33°19'17″N; 35°38'56″E
St38 Hasbani **at El Wazzani near** village El Wazzani	270	20	8-20	19-20	33°16'35″N; 35°37'15″E
XIV. Orontes (Aassi) (area 1870 km², length 46 km)					
Tributary					
St39 Jabboulé, stream at bridge near village Jabboulé	840	8	1-3	12-18	34°13'36″N; 36°21'7″E

Rivers/Cours d'eau Coleoptera Hydraenidae	El Kebir	Oustouane	Aarqa	El Bared	Abou Aali	El Jaouz	Ibrahim	Beirut	Damour	Aouali	Sainiq	Zahrani	Litani	Orontes	Hasbani	Total
Ochthebius difficilis							3			+			3		19	25
O. elisae									+							
O. levantinus						1			4	1, +		2			x	8
O. libanus				6		1	4		9	+						20
O. lividipennis															1	1
O. ragusae					x		1									1
O. striatus	8	9	23			31		1	+	3, +	10	6	14	1	x	106
Total number																161

Table 2. Distribution and abundance of the 7 species of Coleoptera Ochthebius *identified in the 14 catchment-basins of Lebanon (x correspond to the species recorded by other searchers, the + already reported by DIA & JÄCH 1992).*

Tableau 2. Distribution et abondance des 7 espèces de Coléoptères Ochthebius *identifiées dans les 14 réseaux hydrographiques du Liban (les x correspondent aux espèces signalées par d'autres chercheurs, les + déjà signalées par DIA & JÄCH 1992).*

In all, 161 imagines of *Ochthebius* were collected at 39 stations, to be compared to the 129 stations for the Trichoptera (DIA 2015) and 158 concerned by the Coleoptera component (excluding the Elmidae and Hydraenidae families) of our same program overview (DIA 2014).

4. Results: distribution and ecological comments on *Ochthebius* species

The global inventory of affected *Ochthebius* currently includes 7 species.

The numbers below correspond to the serial numbers of the stations (Fig. 1 and Tab.1). A list of the material with numbers of imagines (S: n/m^2) found at the stations is given (Tab.3).

HYDRAENIDAE: *Ochthebius*

1. *Ochthebius* (*Asiobates*) *striatus* Castelnau: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 23, 27, 28, 29, 30, 31, 32, 33, 34, 39.

2. *Ochthebius* (*s.str.*) *difficilis* Mulsant : 20, 31, 32, 35, 36, 37, 38.

3. *Ochthebius* (*s. str.*) *elisae* Sahlberg : 25.

4. *Ochthebius* (*s. str.*) *libanus* Jäch & Dia : 13, 14, 17, 21, 24.

5. *Ochthebius* (*s. str.*) *levantinus* Jäch : 19, 25, 26, 30.

6. *Ochthebius lividipennis* Peyron: 37.

7. *Ochthebius ragusae* Kuwert: 22.

Imagines of *Ochthebius* were confined to the benthos (medium rubble, small boulders, water moss, filaments of green algae encrusting the substrate).

Ochthebius* (*Asiobates*) *striatus Castelnau was the dominant species (106 imagines). It occured from 36 to 1330 m and accounted for 70.7% of the total number of *Ochthebius* imagines collected and 69 % of stations surveyed (27 st. on 39 st.). *Ochthebius striatus* is eurytope (main river, tributaries) and eurythermous (8°-29°C).

Ochthebius* (s.str.) *difficilis Mulsant is a species limited to low and medium altitude waters (150 to 1000 m). It cohabits with *O. lividipennis* in the same station of the Hasbani River at El Meri. *Ochthebius difficilis* is eurytope (main river, tributaries) and eurythermous (5°-24°C).

Table 3. Distribution and abundance of Coleoptera Ochthebius at 39 sampling stations across 14 hydrographic networks in Lebanon (*S=sum of Surber samples, converted into 1m²; P. à v.=qualitative samples* (*duration one hour*) (*xx correspond to the species already reported by DIA & JÄCH in 1992; the x* recorded by other searchers*)

Tableau 3. Distribution et abondance des Coléoptères Ochthebius à 39 stations appartenant à 14 réseaux hydrographiques du Liban (*S: somme des effectifs au filet Surber ramenée à 1m² ; P. à v. =prélèvements qualitatifs "à vue" d'une durée d'une heure*) (*les xx correspondent aux espèces déjà signalées par DIA & JÄCH en 1992 ; les x* celles mentionnées par d'autres chercheurs*).

		Rivers and n° stations																					
		El Kebir		**Oustouane**						**Aarqa**				**El Bared**		**Abou Aali**	**El Jaouz**					**Ibrahim**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Species *Total*	**Sampling method**																							
Ochthebius difficilis	**S**																							
	(S: n/m²)																							
25	**P.à v.**																					3		
O. elisae																								
O. levantinus	**S**																							
	(S: n/m²)																							
8	**P.à v.**																				1			
O. libanus	**S**																		1					
	(S: n/m²)																		3					
20	**P.à v.**													4	2								4	
O. lividipennis	**S**																							
	(S: n/m²)																							
1	**P.à v.**																							
O. ragusae	**S**																							
	(S: n/m²)															x*								
1	**P.à v.**																							1
O. striatus	**S**	2															2	3	1	16				
	(S: n/m²)	4		3	6	2	1		3		18	1					5	8	3	30				
106	**P.à v.**		6				3	6		11		8	4				3			3	3			
Total number **161**																								
Species richness		**1**		**1**						**1**				**1**		**1***	**3**					**3**		

		Rivers and n° stations																
		Beirut	Damour		Aouali		Sainiq	Zahrani		Litani				Hasbani				Orontes
		23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Species *Total*	**Sampling method**																	
Ochthebius difficilis 25	**S**				xx					1	2			2		1	1	
	(S: n/m²)									3	5			5		3	3	
	P.à v.														1	4	10	
O. elisae				xx										x*				
O. levantinus 8	**S**													x*				
	(S: n/m²)																	
	P.à v.			4	1				2									
O. libanus 20	**S**				xx													
	(S: n/m²)																	
	P.à v.		9															
O. lividipennis 1	**S**															1		
	(S: n/m²)															3		
	P.à v.																	
O. ragusae 1	**S**																	
	(S: n/m²)																	
	P.à v.																	
O. striatus 106	**S**						5	1						x*				
	(S: n/m²)						8	2										
	P.à v.	1	xx			3	5	2	3	1	2	1	10					1
Total number **161**																		
Species richness		**1**	**4**		**4**		**1**	**2**		**3**				**2+3***				**1**

Sampling site 17: Tannôurîne stream upstream from the Tannôurîne El Faouqa bridge (*village*) (*El Jaouz river, 1350 m*).

Ochthebius (s.str.) *elisae* Sahlberg is a very rare species. A specimen was found in a tributary of the Nahr el Hammam, Damour River (DIA & JACH, 1992).

Ochthebius (s.str.) *libanus* Jäch & Dia is a cold-adapted species restricted to headwaters (water temperature 5-22 °C). It was found living in association with *Ochthebius striatus* at several stations. Located on the western slope of Mount Lebanon (i.e. coastal rivers), it is the most alticolous species in Lebanon (elevation 950-2100 m). It inhabits crenal and rhithral zones.

Ochthebius (s.str.) *levantinus* Jäch (elevation 40-950 m) was found in association with *Ochthebius striatus* at two stations: the El Jaouz River (Ain Er Räha) and the Zahrani River (Ouadi el Akhdar). *Ochthebius levantinus* is eurytopic (main river and tributaries) and eurythermous (water temperature 8-26 °C).

Ochthebius lividipennis Peyron is a very rare species. It was found at a single isolated station on the Hasbani River at El Meri (elevation 390 m, water temperature 16.5-24 °C).

Ochthebius ragusae Kuwert is a very rare species. It was found at a single isolated station on the Ibrahim River at Roueis à Yânoûh (elevation 1015 m, water temperature 9-17 °C).

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