

# Survey of Species of the Genus *Orius* in the Tunisian Sahel Region

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## ABSTRACT

**Elimem, M., Limem-Sellemi, E., Ben Othmen, S., Hafsi, A., Ben Fekih, I., Harbi, A., and Chermiti, B. 2017. Survey of the genus *Orius* species in the Tunisian Sahel region. Tunisian Journal of Plant Protection 12: 173-187.**

Species of the genus *Orius* belong to the Anthocoridae family. They are polyphagous predators of small sized insects and they are of great importance in biological control. During an inventory of *Orius* species on *Chrysanthemum coronarium* flowers undertaken in 2010 and 2011 in different locations in the Tunisian Sahel region, three species were encountered namely *O. laevigatus*, *O. albidipennis* and *O. majusculus*. These species are predators of mites and small insects such as thrips, aphids, and white. The first species was the most abundant one in all localities (a total of 4358), followed by *O. albidipennis* and *O. majusculus* with 51 individuals. Temporal evolution of *Orius* species showed that activity of the predaceous bugs depends essentially on the flowering period of *C. coronarium*. *Orius* species occurred during spring period with various densities, depending on species, and increased considerably in June. *O. laevigatus* was detected in February and remained active until June. Regarding *O. albidipennis* and *O. majusculus*, their activity has begun in April-May but with different densities. Monitoring revealed the abundance of females as compared to males within *Orius* species which indicated that females occupy a significant importance within population.

*Keywords:* *Chrysanthemum coronarium*, inventory, *Orius* species, temporal evolution

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Phytophagous and zoophagous Heteroptera are an important section of entomofauna in crops and orchards (Fauvel 1999). Zoophagous Heteroptera are of great interest as predators and their diversity is highly beneficial for the regulation of pests. Their global predation

level increases from spring to summer and the abundance of a species in one season may compensate for its scarcity during another season (Fauvel 1999). Among predaceous Heteroptera, the Anthocoridae family contains 400-600 species that are distributed worldwide (Péricart 1996). Most species of Anthocoridae are predaceous as nymphs and adults (Péricart 1972). They are good predators of little insects especially aphids, psyllids, white flies, and mites (Fauvel 1999). The predaceous activity of a number of Anthocorids and Mirids was noted early in the development of IPM and indicated that these insects might represent an interesting alternative to the use instead of chemicals (Fauvel 1999).

The family Anthocoridae is divided into two subfamilies: Anthocorinae and Lyctocorinae (Péricart 1972). In the first subfamily, two tribes are of importance in agro-ecosystems because of their role in predation: the tribe Anthocorini and the tribe Oriini with the genus *Orius*. Predators of the genus *Orius* are polyphagous and are part of various agro-ecosystems worldwide (Veres et al. 2012). In the Palearctic region, *Orius* species are estimated at twenty and live as predators occasionally phytophagous on trees and herbaceous plants (Péricart 1972).

According to Loomans and van Lenteren (1995) and Parker et al. (1995), predatory bugs belonging to the Anthocoridae family are known as effective agents in biological control against many thrips species such as *Frankliniella occidentalis*. Most of these species belongs to the genus *Orius* such as *O. laevigatus*, *O. albidipennis*, *O. tricolor*, *O. insidiosus*, and *O. majusculus*. These species are naturally present on different host plants and weeds

growing in protected cultures when pesticide treatments are minimized (Bosco and Tavella 2008; Sanchez and Lacasa 2002; 2006; Tommasini 2004). Ben Moussa (2004) indicated that *Chrysanthemum coronarium* is the host plant on which different species of the genus *Orius* were encountered in Tunisian vineyards.

In Tunisia, studies on the *Orius* genus are scarce and few works has been performed. We cite the studies of Boulahia Kheder et al. (2005) on *Anthocoris nemoralis*, predator of pear psyllid, and Elimem and Chermiti (2012) on predators of thrips in pepper greenhouses and in vineyards (Ben Moussa 2004).

The aim of this work is to study different *Orius* species population evolution and their sex-ratio evaluation on *C. coronarium* flowers in different localities in the Tunisian Sahel region.

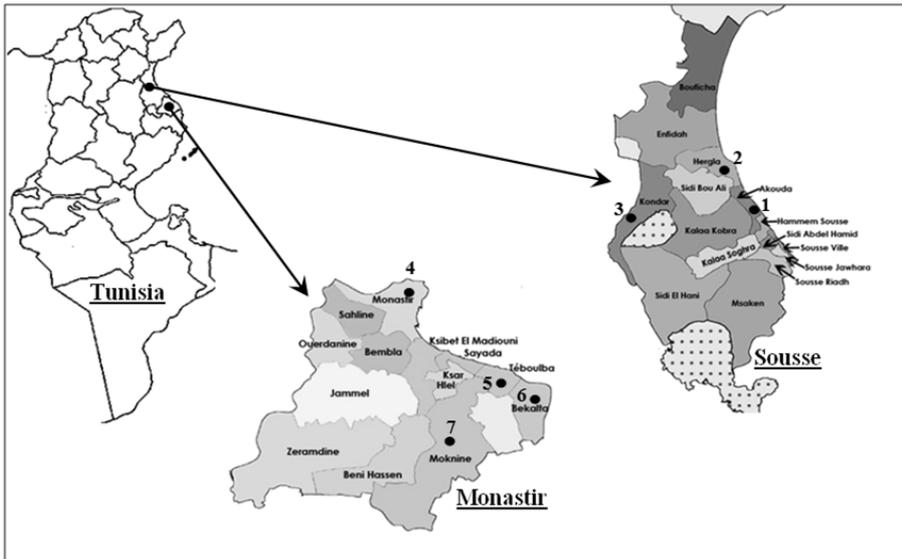
## MATERIALS AND METHODS

### Experimental sites.

This study was carried out in seven natural localities belonging to the Sahel region of Tunisia (Central Eastern Coast) (Fig. 1). In these sites, *C. coronarium* is abundant. The bioclimatic area is inferior/superior semi-arid. Geoclimatic characteristics of the different localities are listed in Table 1.

### Sampling.

*Orius* species are frequent on the flowers of *C. coronarium* flowers (Ben Moussa, 2004). The period of flowering of *C. coronarium* in Tunisia is from February to June (Carem, 1990). During this study, 100 flowers from each site were sampled monthly from February to June during 2010 and 2011.



**Fig. 1.** Localization of the different experimental sites in the governorates of Sousse and Monastir. 1: Chott-Mariem; 2: Hergla; 3: Kondar; 4: Monastir; 5: Teboulba; 6: Bekalta; 7: Moknine.

**Table 1.** Geo-climatic characteristics of the different experimental sites

Site code	Experimental site	Geographic localization	Area (m <sup>2</sup> )
1	Chott-Mariem	35°54'39.69''N 10°33'24.42''E	7 176
2	Hergla	36°01'00.95''N 10°28'07.22''E	897
3	Kondar	35°55'03.11''N 10°17'10.59''E	11 088
4	Monastir	35°45'04.03''N 10°49'22.80''E	1 722
5	Teboulba	35°38'18.34''N 10°57'17.20''E	728
6	Bekalta	35°37'52.20''N 10°58'55.31''E	1 768
7	Moknine	35°37'48.66''N 10°56'06.68''E	2 457

### Identification of the specimens.

Identification of specimens were based on the key of Péricart (1972) and on the analysis of adults male genitaliae and adults female copulatory tubes. Only

adults concerned this study because no identification can be made based on larvae according to Péricart (1972).

## RESULTS

### Identification of the specimens.

Three *Orius* species collected on *C. coronarium* flowers were identified namely *Orius laevigatus* (Fieber 1860), *O. albidipennis* (Reuter 1884) and *O. majusculus* (Reuter 1897).

*O. laevigatus* was present in all experimental sites, but *O. albidipennis* was not detected in Chott-Mériem (Governorate of Sousse) and Monastir (Governorate of Monastir). However, *O. majusculus* was found only in Kondar (Governorate of Sousse) and Moknine (Governorate of Monastir) (Table 2).

**Table 2.** Distribution of species of the genus *Orius* on *Chrysanthemum coronarium* flowers in the different localities of the Tunisian Sahel region

Site code	Governorate	Experimental site	<i>Orius</i> species		
			<i>O. laevigatus</i>	<i>O. albidipennis</i>	<i>O. majusculus</i>
1	Sousse	Chott-Mariem	+	-	-
2	Sousse	Hergla	+	+	-
3	Sousse	Kondar	+	+	+
4	Monastir	Monastir	+	-	-
5	Monastir	Teboulba	+	+	-
6	Monastir	Bekalta	+	+	-
7	Monastir	Moknine	+	+	+

Legend: (+) present, (-) absent.

### Temporal evolution of the *Orius* species.

Monitoring of *Orius* species on *C. coronarium* flowers during 2010 and 2011 showed differences within species, especially regarding periods of activity and the densities of adults' population (Table 3). In fact, *O. laevigatus* was the most abundant bug on *C. coronarium* flowers in all studied localities with a total number of 4358 followed by *O. albidipennis* with 1092 individuals and then *O. majusculus* with only 51 individuals. *Orius* species found on *C. coronarium* appear generally during February and March, especially for *O. laevigatus*. However, *O. albidipennis* and *O. majusculus* occurred late. Indeed, *O. laevigatus* generally appeared during February of each year in all the exploited biotopes. Its average densities varied between 0.02 and 0.28 individual per flower in the biotopes of Hergla (February 2010) and Kondar (February 2011), respectively. *O. laevigatus* reached

high densities in all the localities during May and June when average number of individuals recorded varied between a minimum of 0.62 (June 2011 in Hergla) and a maximum of 3.24 individuals per flower (June 2011 in Kondar) (Fig. 2).

Regarding *O. albidipennis*, it was completely absent in the biotopes of Chott-Mariem and Monastir, whereas its presence in the other localities differed much from that of *O. laevigatus*. The first individuals of this species were recorded during April in the majority of the cases with average densities ranging between 0.02 (April 2010 in Teboulba) and 0.31 individuals per flower (April 2011 in Moknine). In the locality of Hergla during 2010, *O. albidipennis* appeared in May with an average number of individuals of 0.1 individuals per flower. On the other hand, in the biotope of Kondar, *O. albidipennis* was present on *C. coronarium* for the same periods as *O. laevigatus* since February till June but with lower densities. Compared to the

other localities, the biotope of Kondar presented the highest densities of *O. albidipennis* with a maximum of about 1.47 individuals per flower during June 2011 (Fig. 2).

Regarding *O. majusculus*, its period of activity was relatively late, varying according to localities where it was recorded but always with low densities. Indeed, this species was captured in the locality of Kondar during April with 0.02 and 0.01 individual per flower respectively during 2010 and 2011. Concerning the experimental site of Moknine, *O. majusculus* appeared only during May in 2010 and 2011 with 0.02 and 0.07 individual per flower. The follow-up of the spatio-temporal evolution of this species revealed no significant variations; its populations remained low with a tendency to decrease during June (Fig. 2).

#### ***Orius* species' sex-ratio evaluation.**

*Orius* species' sex-ratio was calculated according to the formula mentioned by Ramade (2003): Sex-ratio = Number of males / Number of females.

Evaluation of both sexes of the various collected individuals of the three *Orius* species, showed a difference between the developments of both sexes. In fact, a predominance of the female sex was observed. Indeed, the follow-up of the populations of the two sexes of *O. laevigatus* (Fig. 3) revealed that during the first months of sampling period (February and March), the populations of males and the females percentages were approximately the same, in spite of a predominance of females. On the other hand, this difference increased considerably while approaching the hot season in favor of females except for the

locality of Kondar where the number of females exceeded slightly that of males during May and June 2011.

The sex-ratio of *O. laevigatus* varied between a minimum of 0.52 and a maximum of 0.75 respectively in the localities of Hergla and Kondar with a cumulated average of the area of the Tunisian Sahel of 0.67. This proved the predominance of the females compared to the males knowing that the rates of cumulated percentages of females and males were 59.72 and 40.27%, respectively (Table 4).

Concerning *O. albidipennis* (Fig. 4), the number of the females was also higher than that of the males. Unlike *O. laevigatus*, this species showed an earlier female appearance compared to the males in the quasi-majority of the localities, except that of Kondar where the population of *O. albidipennis* was the highest. The females appear during April whereas the males are recorded during May. The sex-ratio of *O. albidipennis* during all the period of the observations in the area of the Tunisian Sahel was 0.62 testifying a female dominance as indicated by rates of females and males which were 61.63 and 38.36%, respectively (Table 4).

Regarding *O. majusculus* (Fig. 5), it appeared only in the form of females and no males were observed in both biotopes where it was recorded since the beginning of the visits until the end of the flowering of *C. coronarium*. Consequently, the evolution of number of the female individuals identically followed the total of the population, which was reflected on the sex-ratio and the rate of femininity which were respectively 0 and 100% (Table 4).

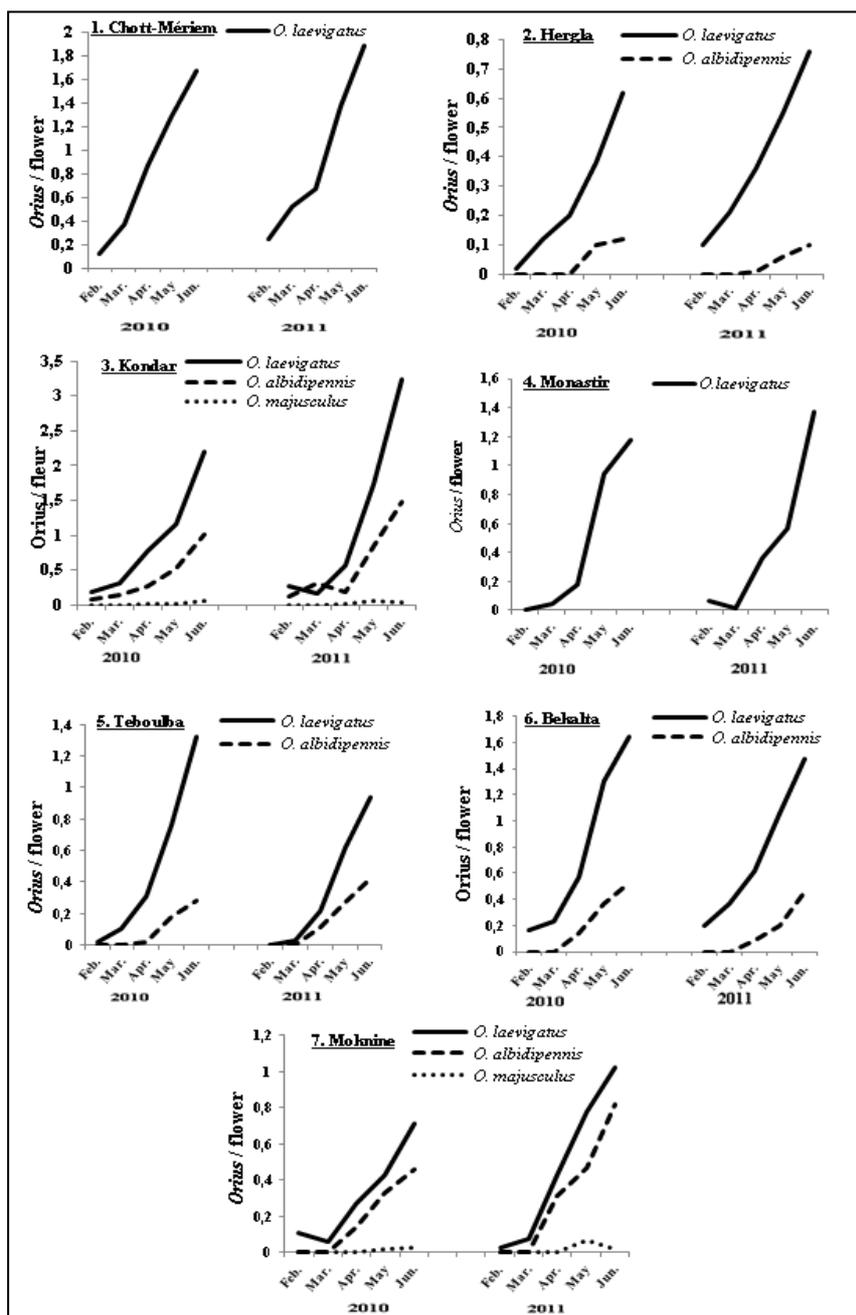


Fig. 2. Spatio-temporal evolution of *Orius* species in the Tunisian Sahel. 1: Chott-Mariem; 2: Hergla; 3: Kondar; 4: Monastir; 5: Teboulba; 6: Bekalta; 7: Moknine.

**Table 3.** Presence and abundance of *Orius* species on *Chrysanthemum coronarium* flowers in the different localities of the Tunisian Sahel region during 2010 and 2011

<i>Orius</i> species	Year	Month	Location							Total
			1	2	3	4	5	6	7	
			Chott-Mariem	Hergla	Kondar	Monastir	Teboulba	Bekalta	Moknine	
<i>O. laevigatus</i>	2010	February								
		March								
		April								
		May								
		June								
	2011	February								
		March								
		April								
		May								
		June								4358
<i>O. albidipennis</i>	2010	February	-			-				
		March	-			-				
		April	-			-				
		May	-			-				
		June	-			-				
	2011	February	-			-				
		March	-			-				
		April	-			-				
		May	-			-				
		June	-			-				1092
<i>O. majusculus</i>	2010	February	-	-		-	-	-		
		March	-	-		-	-	-		
		April	-	-		-	-	-		
		May	-	-		-	-	-		
		June	-	-		-	-	-		
	2011	February	-	-		-	-	-		
		March	-	-		-	-	-		
		April	-	-		-	-	-		
		May	-	-		-	-	-		
		June	-	-		-	-	-		51
<p>Legend:  : 0 <i>Orius</i>,  : 0-5 <i>Orius</i>,  : 5-10 <i>Orius</i>,  : 10-30 <i>Orius</i>,  : 30-50 <i>Orius</i>,  : 50-100 <i>Orius</i>,  : &gt; 100, (-) : no <i>Orius</i>.</p>										

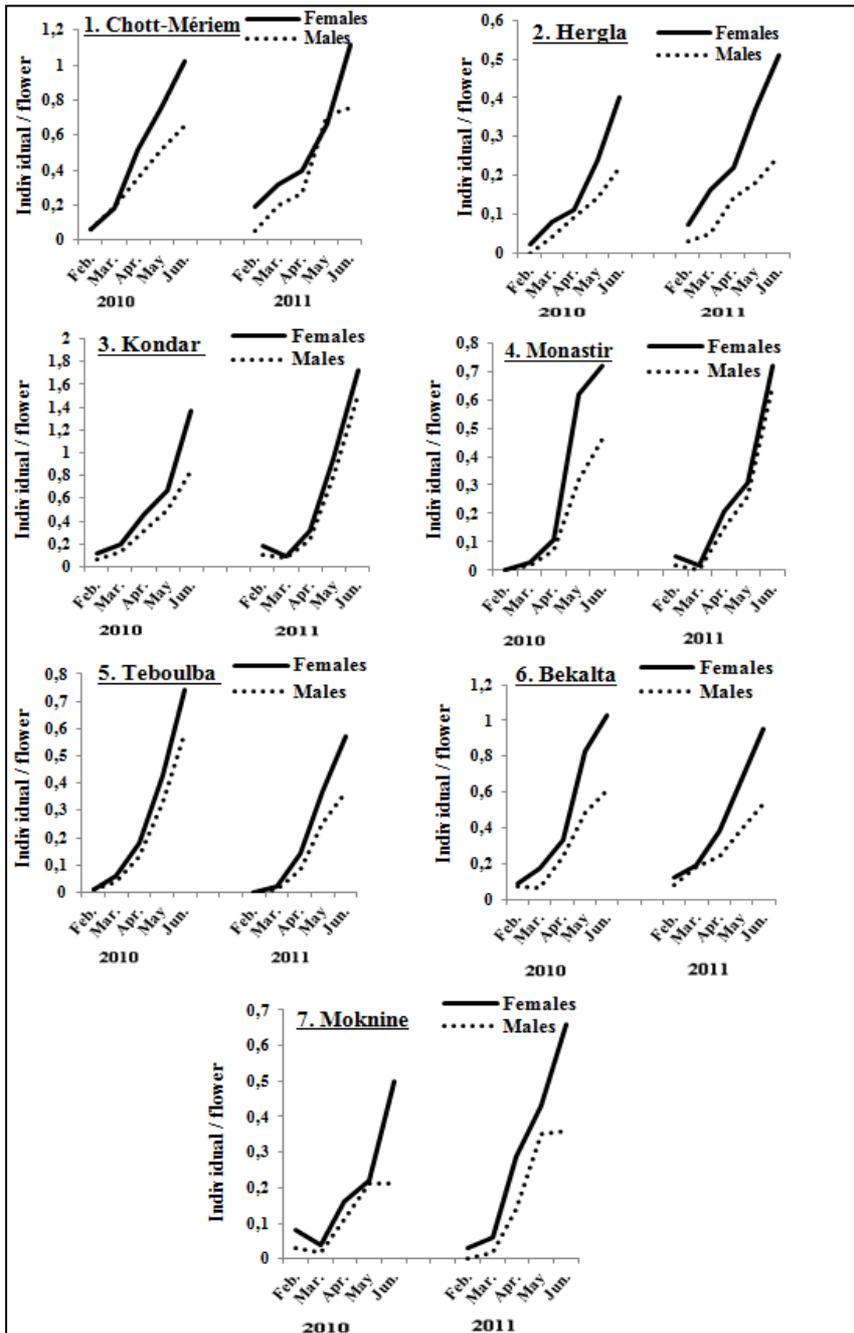


Fig. 3. Spatio-temporal evolution of *Orius laevigatus* males and females in the Tunisian Sahel. 1: Chott-Mariem; 2: Hergla; 3: Kondar; 4: Monastir; 5: Teboulba; 6: Bekalta; 7: Moknine.

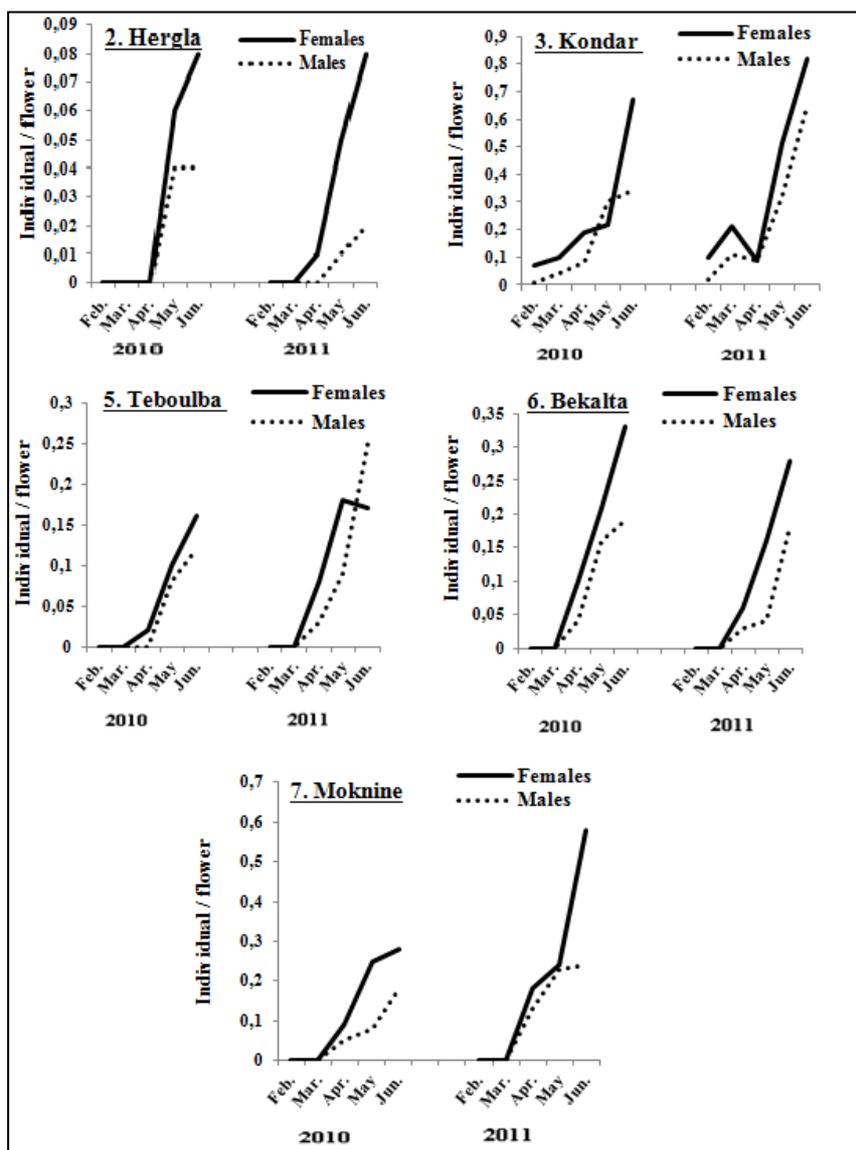


Fig. 4. Spatio-temporal evolution of *Orius albidipennis* males and females in the Tunisian Sahel. 2: Hergla; 3: Kondar; 5: Teboulba; 6: Bekalta; 7: Moknine.

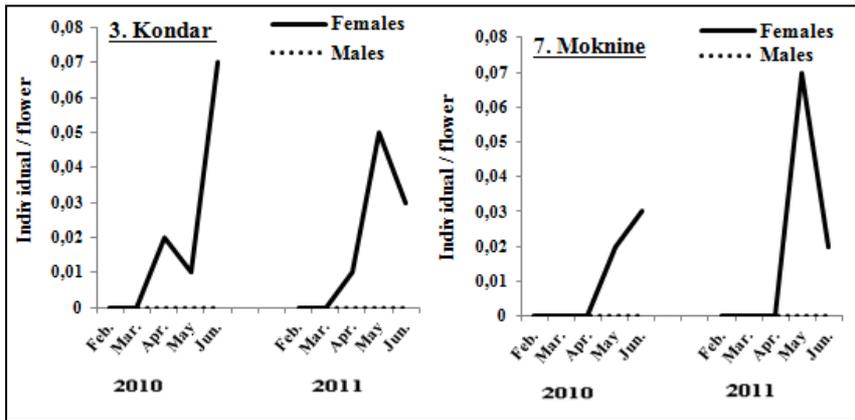


Fig. 5. Spatio-temporal evolution of *Orius* species in the Tunisian Sahel. 3: Kondar; 7: Moknine.

Table 4. Males and females population structure and sex-ratio of different *Orius* species recorded in the Tunisian Sahel region

<i>Orius</i> species	Governorate	Region	Females	Males	Total	Sex-ratio	Female rate (%)	Male rate (%)
<i>O. laevigatus</i>	Monastir	Monastir	279	195	474	0.69	58.86	41.13
		Teboulba	252	180	432	0.71	58.33	41.66
		Bekalta	476	288	764	0.60	62.30	37.69
		Moknine	247	145	392	0.58	63.01	36.98
	Sousse	Chott-Mariem	523	376	899	0.71	58.17	41.82
		Hergla	218	114	332	0.52	65.66	34.33
		Kondar	608	457	1065	0.75	57.08	42.91
Total			2603	1755	4358	0.67	59.72	40.27
<i>O. albidipennis</i>	Monastir	Monastir	-	-	-	-	-	-
		Teboulba	71	57	128	0.80	55.46	44.53
		Bekalta	114	64	178	0.56	64.04	35.95
		Moknine	162	91	253	0.56	64.03	35.96
	Sousse	Chott-Mariem	-	-	-	-	-	-
		Hergla	28	11	39	0.39	71.79	28.20
		Kondar	298	196	494	0.65	60.32	39.67
Total			673	419	1092	0.62	61.63	38.36
<i>O. majusculus</i>	Monastir	Monastir	-	-	-	-	-	-
		Teboulba	-	-	-	-	-	-
		Bekalta	-	-	-	-	-	-
		Moknine	34	0	34	0	100	0
	Sousse	Chott-Mariem	-	-	-	-	-	-
		Hergla	-	-	-	-	-	-
		Kondar	17	0	17	0	100	0
Total			51	0	51	0	100	0

## DISCUSSION

According to Elimem and Chermiti (2009), *Orius* species appear on greenhouses during spring with various densities and increase considerably in June, confirming observations of this study. Guérineau (2003) and Loomans and van Lenteren (1995) mentioned that the majority of *Orius* species have an adequate development at higher temperatures and relatively low hygrometry and that they remain active even in hot and dry periods. In the same way, these beneficial insects seem to be sensitive to the low temperatures. Indeed, their development is limited by temperatures lower than 15°C (Loomans and van Lenteren 1995). According to Elimem and Chermiti (2009) and Elimem et al. (2011), the average temperatures of some explored biotopes of the Sahel such as the localities of Sahline and Moknine (Governorate of Monastir) become higher during May and June and are accompanied by the lowest relative percentages of humidity of the year. These elements explain the appearance and the increase in populations of *Orius* species during this time in the year. Tommasini et al. (2004) mention that the development and the performances of these bugs change according to time and depend on the environmental conditions.

Concerning the *O. laevigatus*, Lacasa et al. (1996) and Lacasa and Llorens (1996) reported that this species is present in the South of Spain, such as in the area of Murcia, with very high densities in a continuous way during the hot winters and in the presence of food, and that it is abundant and frequent even during the cold months of the year. In the same context, Lacasa et al. (1996) reported that in cold season, the larvae can be found since the second half of December until February. Sanchez (1998) indicated that *O. laevigatus* may develop

in more or less low temperatures. In fact, Tommasini (2004) mentioned that *O. laevigatus* is adapted to the Mediterranean climate. On the other hand, Elimem and Chermiti (2012) mentioned that this species was also found in the locality of Bekalta pepper crop greenhouses since February until June, which is similar to the results obtained on *C. coronarium* in the locality of Bekalta and the other prospected biotopes.

Regarding *O. albidipennis*, Lacasa et al. (1996) mentioned that this species is present especially by approaching hot season confirming the data of this study where individuals appear in spring to considerably increase thereafter during June. In the same context, Lacasa and Llorens (1996) indicate that *O. albidipennis* hibernates in the form of adult. The duration of its diapause is prolonged as compared to *O. laevigatus* and its annual activity starts since the end of March and spreads out until the beginning of November. Indeed, this confirms the evolution of this bug in the area of the Sahel where it starts from April, in a delay of one month compared with *O. laevigatus*. On another side, Chyzik et al. (1995) indicated in their work that during November, the fertility of the females decreases to the half and becomes zero during December. In addition, Sanchez (1998) signaled that *O. albidipennis* has a better adaptation to the high temperatures than *O. laevigatus*, reason for which its development improves with the approach of hot season.

Concerning *O. majusculus*, Fisher et al. (1992) reported that its activity starts in spring and that its development begins during summer by carrying out two to three generations. According to the same authors, the adults stop probably development, during the beginning of autumn, because of the reduction of the

duration of illumination, which causes an ovary diapause. Moreover, Péricart (1972) reported that this species hibernates especially in the form of females which resume their activity in March-April and deposit their eggs in May confirming thus our results where *O. majusculus* appears between April and May. This is confirmed by Bosco and Tavella (2008) and Tommasini (2004) who indicated that *O. majusculus* is more abundant in North Italy which is colder than the South. Alauzet et al. (1992) and Alauzet et al. (1994) mentioned that *O. majusculus* is less adapted to the high temperatures than *O. laevigatus*. In addition, this insect seems to be very sensitive to this climatic factor which can affect its period of development and its activity of laying eggs more than the availability of food which can affect them only slightly (Alauzet et al. 1992).

Sex-ratio evaluation of the various collected individuals of the three *Orius* species showed a difference between both sexes proliferation. A predominance of females was observed. *O. laevigatus* monitoring reveals that during the first months of sampling (February and March), the males and females percentages are approximately the same, in spite of a predominance of females. On the other hand, this difference increased considerably while approaching hot season in favor of females except for the locality of Kondar where the number of females exceeded slightly that of males during May and June 2011.

Sex-ratio of *O. laevigatus* varies between a minimum of 0.52 and a maximum of 0.75 respectively in the localities of Hergla and Kondar with a cumulated average of the Tunisian Sahel region of about 0.67. This proves the predominance of females compared to males knowing that the rates of

cumulated percentages of females and males were respectively 59.72 and 40.27%. Tommasini (2004) mentioned that the percentage of females largely exceeded that of males in Italy. In addition, Lacasa and Llorens (1996) indicate that during the winter season, females are more abundant than males.

Concerning *O. albidipennis*, females' number was also higher than that of males. On another side, contrary to *O. laevigatus*, this species showed an earlier female appearance compared to males. Indeed, in the quasi-majority of the localities, except that one of Kondar where the population of *O. albidipennis* was the highest. Females appear during April whereas males are recorded during May. *O. albidipennis* sex-ratio during all the study period in the Tunisian Sahel region was 0.62 testifying a female dominance which is confirmed by rates of females and males estimated at 61.63 and 38.36%, respectively.

The abundance of females compared to males of the various *Orius* species was also cited by Tommasini (2004) which indicated that for *Orius* species, females are more important than males within the bug's population.

As for *O. majusculus*, this species appeared only in the form of females and no males were observed in the two biotopes since the beginning of the visits until the end of *C. coronarium* flowering period. Consequently, the evolution of females' number identically follows that of the total population, which was reflected on the sex-ratio and the rate of femininity that were respectively 0 and 100%. Indeed, Lacasa and Llorens (1996) report that *O. majusculus* populations during cold season are composed by females and that its activity starts in spring and reach its maximum during the summer.

## RESUME

Elimem M., Limem-Sellemi E., Ben Othmen S., Hafsi A., Ben Fekih I., Harbi A. et Chermi B. 2017. Enquête sur les espèces du genre *Orius* dans la région du Sahel tunisien. *Tunisian Journal of Plant Protection* 12: 173-187.

Les espèces du genre *Orius* appartiennent à la famille des Anthocoridae. Elles sont des prédateurs de plusieurs espèces d'insectes de petite taille et ont une grande importance dans la lutte biologique. Au cours d'une enquête sur les différentes espèces du genre *Orius* dans différentes localités de la région du Sahel tunisien sur les fleurs de *Chrysanthemum coronarium* en 2010 et 2011, trois espèces ont été rencontrées à savoir *O. laevigatus*, *O. albidipennis* et *O. majusculus*. La première espèce était la plus abondante dans toutes les localités (avec un total de 4358 individus), suivie par *O. albidipennis* et *O. majusculus* avec 51 individus. L'évolution temporelle des différentes espèces a montré que leur activité dépend essentiellement de la période de floraison de *C. coronarium*. En effet, les trois espèces du genre *Orius* ont été observées au printemps avec des densités différentes qui augmentent considérablement en Juin. *O. laevigatus* apparaît pendant le mois de Février, alors que pour *O. albidipennis* et *O. majusculus*, l'activité commence en Avril-Mai avec des densités différentes. En outre, la suivi de l'abondance des femelles par rapport aux mâles des différentes espèces d'*Orius* a montré que les femelles occupent une importance significative au sein de la population par rapport aux mâles.

*Mots clés:* *Chrysanthemum coronarium*, espèces d'*Orius*, évolution temporelle, inventaire

## ملخص

الإمام، محمد وآسيا الإمام-سلامي وسكينة بن عثمان وعبير الحفصي وابتسام بن فقيه وأحلام الحربي وبرايم الشرميطي. 2017. مسح لجنس *Orius* في المنطقة الساحلية التونسية

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تنتمي حشرات البق إلى عائلة Anthocoridae. تُعدُّ هذه الحشرات المقترسة من أهم الحشرات المستعملة في مكافحة البيولوجية وبالرغم من صغر حجمها إلا أنَّها قادرة على التهام العديد من الحشرات الضارة. من خلال عمليّة جرد لمختلف حشرات البق المتواجدة على زهرة الأقحوان الإكليلاني في الساحل التونسي خلال سنة 2010-2011، تبين وجود ثلاثة أنواع مختلفة من حشرات البق وهي كالاتي *O. laevigatus* و *O. albidipennis* و *O. majusculus*. يُعدُّ النوع الأول الأكثر وفرة في أغلب المناطق التونسية ما يقارب على 4358 فردا يليه *O. albidipennis* ثم *O. majusculus* بمجموع 51 فردا. أظهرت دراسة التطور الزمني لهذه الحشرات أنّ فعالية حشرات البق ترتبط أساسا بفترة إزهار الأقحوان الإكليلاني قبل شهر جوان وذلك حسب النوع. يبدي *O. laevigatus* بالظهور خلال شهر فيفري وبظل ناشطا حتّى شهر جوان، بينما يظهر كلا النوعان *O. albidipennis* و *O. majusculus* في الفترة المتروحة بين شهري أفريل وماي. علاوة على ذلك، فإنّ هذه الدراسة قد أظهرت وفرة الإناث في هذه المجتمعات الحشرية مقارنة بالذكور.

كلمات مفتاحية: أقحوان إكليلاني، أنواع *Orius*، تطور زمني، جرد

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