



CONTRIBUTION TO THE STUDY OF DIVERSITY AND ABUNDANCE OF ODONATES IN SOME WET BIOTOPES IN TIARET REGION, ALGERIA

Hayet Senouci* and Farid Bounaceur

Laboratory of Agro-biotechnology and Nutrition in Semi-arid Areas, Faculty of Natural and Life Sciences, Departement of Biology, Compuskarman University, Ibn Khaldoun of Tiaret, Algeria.

Abstract

Dragonflies and damselflies are beautiful colored insects, representing the order of Odonata, they are amphibiotic, predatory insects and considered as an important link in the functioning and dynamics of aquatic ecosystems. This research was realised by systematic monitoring during three successive months from April to Jun 2014 in the hydrographic system of Tiaret-Algeria. Sampling was carried from 09 stations in order to explore the species richness and diversity of Tiaret's Odonata, which never has been explored before. A first list of 11 species has been established: 08 species of damselflies (sub order Zygoptera) belonging to 04 Families: Lestidae, Platnimitydae, Calopterigidae and Coanagronidae and 03 species of dragonflies (sub order Anisoptera) belonging to 03 families: Ashenidae, Libellulidae and Gomphidae.

Key words : Odonata, sampling, wetland, inventory, diversity.

Introduction

The order of odonates is one of ancient groups of insects around the age of dinosaurs (Precigout, *et al.*, 2009), these beautiful colored insects known as dragonflies and damselflies are predators and can reduce other populations. Considered as an important link in the food chain, odonates are amphibiotic (Riservato *et al.*, 2009), they spend a big part of their life as aquatic nymphs, the adults only are aerial (Ndiaye, 2010), their life is closely linked to aquatic ecosystems, that is why odonates are an excellent bioindicator for knowledge of environmental fluctuations (CotrelandRoullier, 2007; Khan, 2016). The present study was conducted to explore the abundance, species richness and diversity of odonata in Tiaret region. Since, the 19 century, many scientists were interested to study Odonata in Algeria (Khelifa *et al.*, 2011; Kimmins, 1934; Menaï, 1933; Samraoui and Corbet, 2000; Samraoui and Menaï, 1999; Sélys-Longchamps, 1848, 1865, 1866, 1871, 1902; etc).

Materials and Methods

Sampling of Odonates was carried out from April to June 2014. The adults' Odonata were chosen by a direct observation and capture of insects in sectors located on borders of aquatic zones, working with the method of (Oertli *et al.*, 2000) using by (Gordeau, 1999) and (Oertli, 1994) only by sunny times (FRAPNA, 2009), which allows to observe nearly 90% of species (Rohming, 2000). The Odonata observation needs few materials: Odonata trapping by using entomologic nets (minimum of 3) diameter from 30 to 50 cm with a nylon pocket. Petri boxes for the conservation of specimen, digital camera to photograph the fields and the Odonata behaviour and GPS for localisation of the sampling sits. To carry out the present study 09 sites with varied habitat types were selected (table 1). Beyond the Odonata sampling, informations about experimental fields are necessary: altitudes and dimensions of exploited beds, flow velocity of water and presence or absence of vegetation.

Population structural quality analysis

Diversity of the different dragonflies and damselflies is studied according to the following index.

*Author for correspondence : E-mail : ha-senouci@outlook.fr

Table 1 : List of surveyed stations.

Stations Name	Stations Code	Latitude	longitude	Altitude(m)	Flow velocity
Sebaïne I	P1	N 35° 27' 9,6"	E 01° 36' 25,9"	897,5	stagnant to very slow
Sebaïne II	P2	N 35° 26' 41,2"	E 01° 36' 10,1"	897,5	medium to fast
Dahmouni I	P3	N 35° 25' 37,7"	E 01° 34' 1,5"	909	fast
Tousnina	P4	N 35° 03' 49,3"	E 01° 16' 43,6"	1090	medium
Sidi Ouadah	P5	N 35° 17' 23,1"	E 01° 16' 13,3"	792,9	fast
Sidi Hosni I	P6	N 35° 28' 56,9"	E 01° 28' 37,1"	725	stagnant
Sidi Hosni II	P7	N 35° 28' 0,3"	E 01° 31' 11,9"	727,2	fast
M sfa	P8	N 35° 21' 49,2"	E 01° 03' 04"	590,7	medium
BRAI	P9	N 35° 25' 14,5"	E 01° 17' 07,4"	850	stagnant

- a. **Shannon-Weaver diversity index (H')** : Measures the diversity of the stand. Its formula is :
 $H' = - \sum((ni/N) \times \log 2 (ni / N))$ (ECOGEA, 2008).
- b. **Pielou Evenness index (E)** : Measures the balance of the stand. It is the ratio of H' on Hmax. $E = H' / Hmax$ (ECOGEA, 2008).
- c. **Jacquard similarity index (I)** : Measures the degree of similarity between the stands. Its formula is : $I = Nc / (N_1 + N_2 - Nc)$; with Nc: number of common taxa stations 1 and 2 and N₁ and N₂: number of taxa present respectively to stations 1 and 2. It varies from 0 to 1 (ECOGEA, 2008).

Results and Discussion

The study aims at gaining a better knowledge of the odonatofauna of Tiaret region, located in semi-arid areas excluded from any previous studies of odonatofauna.

Classification

A total of 11 species of Odonata spread over seven families (Calopterygidae, Lestidae, Platycnemididae, Coenagrionidae, Gomphidae, Aeshnidae, Libellulidae).

Zygoptera

Calopterygidae

Calopteryx haemorrhoidalis (Vander Linden, 1825).

Distribution : West Mediterranean species (Jourde, 2005).

Stations where species are present : P2, P4, P5, P8.

Coenagrionidae

Coenagrioninae

Coenagrion mercurial (Charpentier, 1840).

Distribution : holoméditerranéan species (Jourde, 2005) present average in southern Europe and North Africa (Faton, 2003).

Stations where species are present: P1, P2, P7.

Coenagrion caerulescens (Fonscolombe, 1838).

Distribution : Species typical West Mediterranean (Jaquemin and boudot, 1999), characterise high altitudes: Middle Atlas about (1900 m) and High Atlas, up to 2300 m (Elhaisoufi *et al.*, 2008). Rare in France, Italy and Spain (Faton, 2003).

Stations where species are present: P2, P3, P4, P8, P9.

Erythrom malindenii (Selys, 1840).

Distribution : holoméditerranéan species. It avoids the coastal parts with briny water (Jourde, 2005).

Stations where species are present: P1, P3, P4, P6, P8, P9.

Ischnura graellsii (Rambur, 1842)

Distribution : species strict West Mediterranean, limited to the Iberian Peninsula and North Africa (Jaquemin and Boudot, 1999), abundant in the Tell regions in Algeria (Samraoui and Menai, 1999).

Stations where species are present: P1, P3, P4, P7.

Ischnura pomilio (Charpentier, 1825).

Distribution : The distribution of this little odonata is sub-Mediterranean. The distribution of I.pumilio in the region is fragmented and as such we must be vigilant about its status (Cotrel and Roullier, 2007).

Stations where species are present: P6.

Lestidae

Sympecmatinae

Sympecma fusca (Vander Linden, 1820).

Distribution : West Palaearctic species (Jourde, 2005).

Stations where species are present: P1, P4.

Platycnemididae

Platycnemiss udbilatata (Selys, 1849).

Distribution : Endemic species in Maghreb (Jaquemin, 1994).

Stations where species are present: P2, P4, P5, P8, P9.

Anisoptera

Aeshnidae

Aeshninae

Anax imperator (Leach, 1815)

Distribution : African-European Species (Jourde, 2005) with a very wide distribution covering Europe (except its northern regions), the near and the Middle East to Pakistan and the whole of Africa, including the Indian Ocean Islands (Jaquemin and Boudot, 1999).

Stations, where species are present: P3.

Gomphidae

Gomphus lucasii (Selys, 1850).

Distribution : Maghrebienendemic (Khelifa *et al.*, 2011)

Stations, where species are present: P4, P9.

Libellulidae

Sympetrinae

Sympetrum fonscolombii (Selys, 1840).

Distribution : Extends to the warm regions of Africa and Asia, sedentary and often common in the mediteraneanzone (Dijkstra, 2007).

Stations, where species are present: P7 and P9.

Species state and endemism

Two of the eleven species observed are Maghrebien endemic (*Gomphus lucasii* and *Platycnemis subdilata*) and one is Mediterranean endemic (*Coenagrion caerulescens*), *Gomphus lucasii* is classified as a "Vulnerable" specie (VU) on global Red List of IUCN (Riservato *et al.*, 2009) due to its very limited range and moderately abundant distribution (Samraoui and Menaï, 1999). The *Coenagrion mercurial* demanding on water quality (Faton, 2003), occupies the status of "Near Threatened" (NT) all other species observed during our study holds the status of "Least Concern" (LC) on the global IUCN Red List (Riservato *et al.*, 2009). (fig. 1).

Distribution and biologic index

The examination of (fig. 2); shows a high value of relative abundance in P8 with 24,95%, a mean value in the stations P2, P4, P5 respective 15,04%, 15,80% and 15,04%, weak value in the stations P1, P3, P6, P7, P9 with total of 5,71%, 8,76%, 5,52%, 5,52%, 4,95%, 4,19%.

There are several factors that control the distribution of Odonata; the combination of the favorable factors

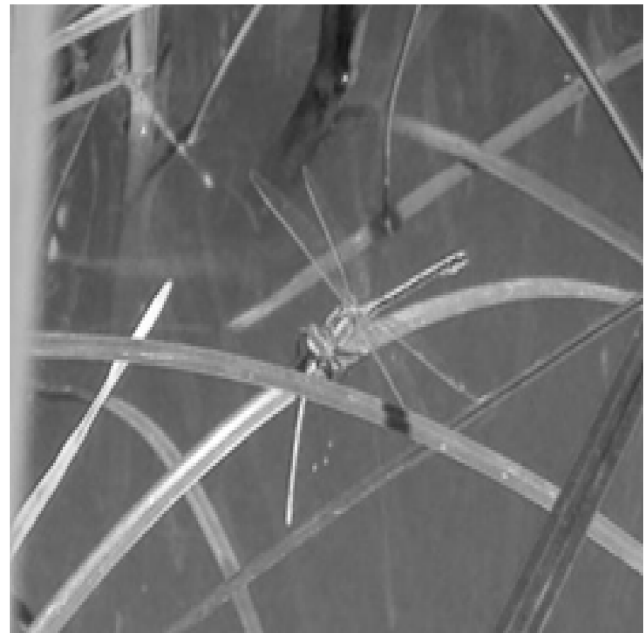


Fig. 1 : *Gomphus lucasii* feeding on *Platycnemis subdilata*.

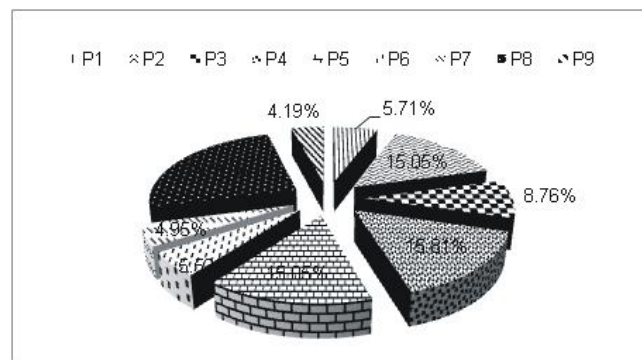


Fig. 2 : Relative abundance of each station.

allows their good development on a site (Corbet, 1999). Stations of larger surfaces and dense riverine and aquatic vegetation contain the highest value of odonatological diversity (Oertli *et al.*, 2002; Bouchelouche, 2015), it is the case of station P4 the richest one with 6 species and P9 with 5 species. The other stations hosted from 2 to 4 species (fig. 3). Station P4 is located in a high altitude (1090 m) water source zone, this location excludes this station from being contaminated by pollution, characterized by dense vegetation and an average flow velocity (table 1) whereas station P8 is an artificial reserve of water, surrounded by low vegetation in the form of brush, occupies a large surface. P1 and P2 are located in the same area and have a similar type of habitat, P3 and P5 are characterized by a fast flow velocity, P5 and P8 are located in the sector of the Oued Mina, each of the 5 stations is inhabited by 4 species. P6 and P7 contain the lowest number of species 2 and 3 species, respectively, both are located in the same zone and have temporary

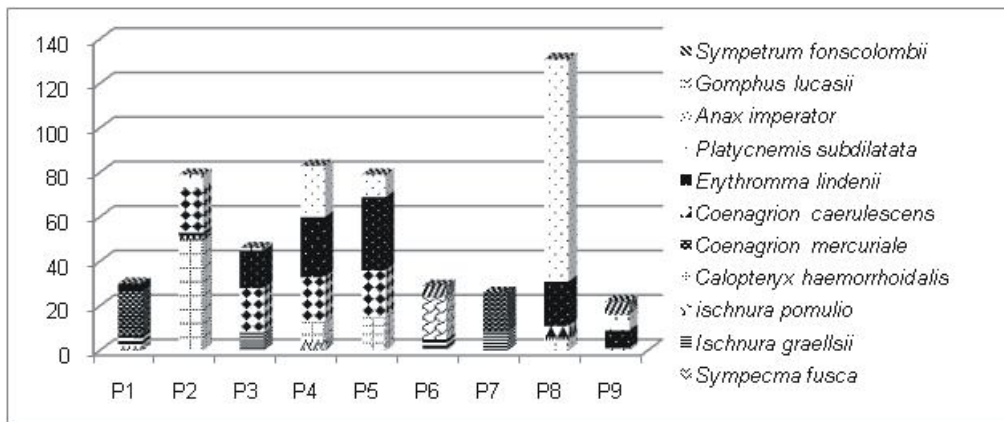


Fig. 3 : Distribution of Odonata species inventoried by station.

Table 2 : Values of: Shannon Weaver diversity index (H'), index of maximum (H'_{max}) Diversity and Fairness Index (E) of Odonata captured in Tiaret (Algeria).

Stations	Code	H'	H'_{max}	E
Seb1	P1	1,18	2	0,59
Seb2	P2	1,38	2	0,69
DahI	P3	1,61	2	0,805
Tou	P5	2,17	2,58	0,841
Siou	P6	1,86	2	0,93
SiHI	P7	1,27	1,58	0,803
SiHII	P8	0,82	1	0,82
Msfa	P10	1,09	2	0,545
BRA	P11	1,95	2,32	0,840

2004).

Fig. 4 shows Shannon Weaver diversity index (H'), Shannon Weaver maximal diversity (H'_{max}) and Pielou Evenness index (E) of Odonata captured in study area.

The value of Shannon Weaver diversity index (H') vary between 0,82 and 2,17 which implies that only some sits are diversified. P4 and P9 are characterized by diversified and balanced stands, the least diverse population is found in P7. Following the results of (table 2) cited other stations are characterized by stands rather moderately balanced.

The value of Pielou Evenness index (E) vary between 0,54 and 0,93, the highest value is that of P5(0,93), stations

Table 3 : Similarity matrix of studied stations.

Stations	P1	P2	P3	P5	P6	P7	P8	P10	P11
P1	1	0,14	0,33	0,25	0,14	0,16	0,5	0,14	0,12
P2		1	0,14	0,42	0,6	0	0,2	0,42	0,28
P3			1	0,25	0,33	0,16	0,2	0,33	0,28
P4				1	0,66	0	0	0,66	0,57
P5					1	0	0	1	0,5
P6						1	0,25	0	0,14
P7							1	0	0
P8								1	0,5
P9									1

stagnant waters, their areas are very large with the dense herbaceous vegetation. According to the descriptions of the stations, aquatic vegetation is a limiting factor for the distribution of odonates, the highest diversity values coincides with the sites of dense vegetation (Bouchelouche, 2015; Oertli *et al.*, 2002). The aquatic vegetation constitutes a better refuge and a place of laying for the Odonata, specially the sub order of zygoptera, which represents a strong dependence with this vegetation (Bouchelouche, 2015; Hafiane *et al.*, 2016; Samyaws,

P3, P4, P6, P7 and P9 present near values (0,805), (0, 841), (0,803), (0,82), (0,84) all these values are close to 1 which implies that the number of different species tend to be balanced with each other. The lowest values of Pielou Evenness index (E) are those of P1(0,59), P2 (0,62) and P8 (0,545).

Table 3, similarity matrix presents the degree of similarity by comparing biodiversity level across sites. Station P4 and P8 are similar. They present the same

value of species richness and a value of similarity index equal to 1, station P4 inhabited by more than 50% of species presents a high value of index of similarity ($I = 0,66$) with stations P5 and P8 all located along Oued Mina, and a value of similarity index equal to 0,57 with station P9.

Stations presenting a called middle index of similarity between each other ($I = 0,5$) are : P9 and P5, P9 and P8, P7 and P2. P6 and P7 characterised by a low specific richness (2 species by station) present a zero index ($I = 0$) with many other stations.

Conclusion

Odonates are an important indicator of water quality and occupy diverse habitats, forming an important biocontrol agent for aquatic ecosystems. The establishment of monitoring and study of Odonatofauna diversity is a first step in a long way leading to effective conservation of biodiversity and ecosystem health. Currently the Algerian odonatofauna contains 63 species, indeed our exhaustive inventory allowed us the establishment of a preliminary list of 11 species. The present study confirms that Tiaret region is a favorable habitat for odonates population. Since, there were no informations on dragonflies and damselflies about our studied area, this paper can be considered as a reference for futures odonatofaunistic studies.

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