الجمهورية الجزائرية الديمقراطية الشعبية
DEMOCRATIC AND POPULAR ALGERIAN REPUBLIC
وزارة التعليم العالي والبحث العلمي

MINISTRY FORHIGHER EDUCATION AND THE SCIENTIFIC RESEARCH

جامعة باجي مختار -عنابة
BADJI MOKHTAR UNIVERSITY – ANNABA

FACULTY OF SCIENCE

DEPARTEMENT OF THE MARINE SCIENCE

MARINE BIORESOURCES LABORATORY

DOCTORAL THESIS

Speciality : Marine Science

Option:Integrated Management of the Coastal Areas

Biodiversityand distribution of the carcinological fauna from continental waters of Northern Algeria

Presented by: GHAOUACI SOUAD

Supervisor : Mrs AMAROUAYACHE Mounya M. (Professor, Badji Mokhtar University- Annaba)

Jury of defense

President : Mr. DERBAL Farid (Professor, Badji Mokhtar University- Annaba)

Examiner : Mr. SCHARF Burkhard (Assistant-Professor, Technic University of Braunschweig, Germany)

Examiner : Mr. SAMRAOUI Boudjema (Professor, Badji Mokhtar University- Annaba)

2018

ACKNOWLEDGEMENTS

During the past four years I've had the amazing opportunity to spend half of my time in the Marines Bioresources laboratory and the other half in a field's sampling and training courses. During these two 'lives', I met a lot of people that directly and/or indirectly contributed to this thesis. Now, the time has come to thank them all.

I can't start without thanking my supervisor Mounia AMAROUAYACHE (Professor, Marine sciences department, Badji-Mokhtar University), and I do thank HER enough warmly; without her,this Thesis would not have been achieved. SHE especially encouraged me to be autonomous and persevering. I am honored and proud to have been the student of such a demanding and rigorous promoter. Despite her responsibilities, she was always available to be present with me during sampling and training courses. Thus, SHE improved the quality of the typewriter and completed this work. This is, in fact, thanks to her if I succeed in the field of research. I express to her my deep gratitude to have kindly accepted to lead this Doctoral work.

This investigation was realized in the framework of a CNEPRU project (year 2015-2019 Code: F01120140037) funded by the ministry of higher education and the scientific research (MESRS).

I'm grateful to Mr. Mohammed Hicham KARA (Professor and director of the Laboratory of Marines Bioresources, Badji-Mokhtar University), for having accepted me to work in his laboratory.

I want to thank strongly the jury members to have agreed to rate this work:

Mr. Farid DERBAL (Professor, Marine Sciences department, Badji-Mokhtar University), for having accepted to preside over the jury of defense despite his heavy responsibilities. Thank you Professor for having accompanied me for sampling; many thanks for your kindness, availability and especially helpfulness, scientifically as well as administrative. I address to you my thanks to honor me by accepting to preside this work.

Mr. Burkhard SCHARF (Assistant-Professor, Technic University of Braunschweig, Germany), despite his many occupations, accepted without hesitation to judge this work. His

large experience in the field of Ostracoda and Limnology (more than 40 years) would be profitable. He finds here my deep gratitude.

Mr. Boudjema SAMRAOUI (Professor, Badji Mokhtar University),I address to him all my recognition for having agreed to examine this work.

I thank deeply Mr Okan KÜLKÖYLÜOĞLU and Mehmet YAVUZATMACA (Department of Biology, Faculty of Arts and Science, Abant İzzet Baysal University), for their warm welcome to their team and in Turkey in general, their infallible help, they enabled me to learn technic for the determination of Ostracoda.

I am very grateful to Mr Alexey A. KOTOV (A. N. Severtsov Institute of Ecology and Evolution, Moscow. Kazan Federal University, Kazan, Russia) who accepted me in hislaboratory in Russia (Aquatic Ecology and invasions) with his team Mr Artem Y. SINEV (Department of Invertebrate Zoology, Biological Faculty, M.V. Lomonosov Moscow State University, Moscow, Russia) and Mr Nikolai M. KOROVCHINSKY(A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia). He actively contributed to my training for Cladocera identification.

I'm very grateful to Prof. N. N. SMIRNOV (Laboratory of Aquatic Ecology and invasions, A. N. Severtsov Institute of Ecology and Evolution, Moscow, Russia) for his welcome in Moscow. He was proud to talk about his colleague the professor GAUTHIER (thesis on Algerian fauna in 1928) and he dedicated me his book with great emotion.

My deep gratitude goes to Mm. Maria HOLYNSKA (Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Poland), for the training on the determination of Cyclopoida (copepods) in Warsaw (Poland).She kindly recommended me to join the ICOC (California, 2017).

I would like to thank to Dr. Robin James SMITH (Lake Biwa Museum, Japan), Dr.Burkhard SCHARFfor their comments and suggestion on our manuscript and Dr Gerd-Oldman BRANDORFF and Dr KAYSER for their comments and suggestion on my thesis.

I'm very grateful to Pr. Nikolai SHADRIN who recommended me to join the Advanced International Training Course on Salt Lakes and Salts in China (Tianjin, May

2017). I also thank all the Chinese team for their welcome in Tianjin and especially for the awarded prize.

I would like to express my deep gratitude to the teaching staff of the Department of Marine Sciences, who provided me with quality education both in graduation and post-graduation. My thanks go especially to Mr Farid DERBAL (Head of department), who has always supported me and helped me in the sampling and materials.

I would like to express my thanks to general direction of forest of Djelfa province for their help during sampling, especial M. Mostafa.

I also want to thank our group of master- and licence-and doctorate students for all the hard work they put in, especially Djamel MERAKHA, Ayman MENAIL, Lylia BOUMENDJEL, Ghouzala GOUASMIA, Tarek, Adila, Zwawiya, Rabeb, Halima, HaceneFoued,Rabie, Hocine, Amel, and Sara, you all were of a great help!

I thank deeply all members of BIOMAR (Marines Bioressources Laboratory), always ready to help!.

And because we keep always the best to the end! SPECIAL THANKS ***To my dear parents who have allowed me to be what I am today,*** *my Sisters and Brothers****.*** *I would have done nothing of all this without your support.*

Many thanks also to all those I forgot to mention!

LISTE OF THE FIGURES

LISTE OF TABLES

TABLE OFCONTENTS

Abstract

Biodiversity and distribution of the carcinological fauna from Algerian continental waters made the subject of extensive work in the beginning of the 20th century. Since then, few investigations have been carried out. The aim of the present study is to update knowledge on the systematic and distribution of the crustaceans (Entomostracan) from the continental waters of Algeria, based on both original data and careful review of literature. Because of the vastness of the country, we focused on its Northern part, including the three climatic zones humid, semi-arid, and arid. In total, 200 samples, from 156 water bodies from 20 provinces were collected during the wet period between 2013 and 2017. The main are temporary pools, but some ditches, basins, lakes, reservoirs, Sebkhas and Chotts have been considered as well. Additionally, some physico-chemical parameters were measured of which salinity was the main one. This study allowed to present updated checklists of the main carcinological groups of such types of waterbodies; non-marine living ostracods, Cladocera and Copepoda (Cyclopoida) from the continental waters of Algeria and large branchiopods of Northeastern Numidia. Such lists might be usefull for further studies of biodiversity. A total of 81 species were identified in this study, of which 25 species are new to Algeria. Now the lists of non-marine ostracods, cladocerans and cyclopoids increased to 49, 81, 47 species respectively. Among the new records, we point out that some species are rare or of a limited world distribution, such as *Eucyclops leschermoutouae* (Cyclopoida) which is the second word record, *Ilyocypris* cf. *japonica* (Ostracoda) and others. The extensive sampling in the richest region in temporary pools (Northeastern Numidia in the sense of Quézel & Santa 1962, 1963) showed so far that the distribution of the Anostraca *Tanymastix stagnalis* is limited to two sites in Algeria (El-Frine and Reghaia). Efforts are urgently needed to afford a statute to this species as endangered and to protect its habitats.

Considering the limited sampling effort, presence of highly diverse water bodies and difficulties of access to water sources, the carcinological biodiversity of Algerian continental waters is believed to be underestimated. Further studies are required to complete the present work.

Key words: Carcinological fauna**,** checklist, distribution, continental waterbodies, Algeria

Résumé

Les études de la biodiversité et la distribution de la faune carcinologique des eaux continentales de l'Algérie ont été réalisées avec des relevés extensifs au début du XXe siècle. Depuis, peu de travaux ont été entrepris. Le but de la présente étude est d'actualiser les connaissances sur la systématique et la distribution des crustacés (Entomostracés) dans les eaux continentales du Nord de l'Algérie, sur la base de données originales et d'un examen approfondi de la littérature. En raison de l'immensité du pays, nous nous sommes concentrés sur sa partie nord, comprenant les trois zones climatiques humides, semi-arides et arides. Au total, 200 échantillons provenant de 156 plans d'eau dans 20 wilayas ont été collectés pendant la période humide entre 2013 et 2017. La majorité est représentée par des mares temporaires, mais certains fossés, bassins, lacs, réservoirs, Sebkhas et Chotts ont été également pris en compte. De plus, six paramètres physico-chimiques ont été mesurés (salinité, conductivité, TDS, température, pH, oxygène dissous). Cette étude a permis de dresser des listes taxonomiques actualisées des principaux groupes carcinologiques de différents hydrosystèmes : ostracodes vivants non marins, cladocères et copépodes (Cyclopoida) des eaux continentales de l'Algérie et des grands branchiopodes du Nord-Est de la Numidie. De telles listes pourraient être utiles pour de futures études sur la biodiversité. Au total, 81 espèces ont été identifiées, dont 25 sont nouvelles pour l'Algérie. Actuellement, les listes d'ostracodes, de cladocères et de cyclopoïdes ont augmenté à 49, 81, 47 espèces respectivement. Parmi les nouveaux signalements, nous préciserons que certaines espèces sont rares ou d'une distribution mondiale limitée, comme *Eucyclops leschermoutouae* (cyclopoide), *Ilyocypris* cf. *japonica* (ostracode) et d'autres espèces. En augmentant l'effort d'échantillonnage dans la région la plus riche en mares temporaires (Numidie du Nord-Est dans le sens de Quézel et Santa 1962, 1963), nous avons montré que la répartition de l'anostracé *Tanymastix stagnalis* est limitée à deux sites en Algérie, El-Frine et Reghaia. Des mesures urgentes sont à prendre pour donner à cette espèce un statut de protection avec protection de ses habitats.

Compte tenu de l'effort d'échantillonnage limité, de la présence de plans d'eau très nombreux et diversifiés en Algérie et des difficultés de l'accès de beaucoup d'entre eux, la biodiversité carcinologique des eaux continentales algériennes reste sous-estimée. D'autres études sont nécessaires afin de compléter les listes actuelles.

Mots-clés: Faune carcinologique, listes, distribution, plans d'eau continentaux, Algérie.

الملخص

قد جعل التنوع البيولوجي وتوزيع الحيوانات المسرطنة من المياه القارية الجزائرية موضوع عمل مكثف في بداية القرن العشرين. ومنذ ذلك الحين، لم تجر سوى تحقيقات قليلة. الهدف من هذه الدراسة هو تحديث المعرفة عن المنهجية وتوزيع القشريات (إنتوموستراسان) في المياه القارية في الجزائر، استنادا إلى كل من البيانات الأصلية ومراجعة متأنية للاعمال السابقة. وبسبب اتساع البلاد، ركزنا على الجزء الشمالي منها، بما في ذلك المناطق المناخية الثلاث الرطبة وشبه الجافة والجافة. وفي المجموع، تم جمع 200 عينة من 156 من المسطحات المائية من 20 ولاية في الجزائر خلال الفترة الرطبة بين عامي 2013 و 2017. والأغلبية هي برك مؤقتة، ولكن بعض الخنادق والأحواض والبحيرات والخزانات وسيبخا ت وشطوط قد اعتبرت كذلك. بالإضافة إلى ذلك، تم قياس بعض المعا مات الفيزيائية والكيميائية و كانت الملوحة المعامل الرئيسي . سمحت هذه الدراسة بتقديم قوائم محدثة من المجموعات السرطانية الرئيسية من مثل هذه الأنواع من الاحواض المائية؛Copepoda (Cyclopoida), Cladocera, Ostracoda , من المياه القارية في الجزائر وBranchiopoda من شمال شرق نوميديا. وقد تكون هذه القوائم مفيدة لإجراء المزيد من الدراسات للتنوع البيولوجي. وقد تم تحديد ما مجموعه 81 نوعا في هذه الدراسة، منها 25 نوعا جديدا على الجزائر. أما الآن، فقد ارتفعت قوائم Cyclopoida, Cladocera, Ostracoda إلى 49 و 81 و 47 نوعا على التوالي. من بين السجلات الجديدة، نشير إلى أن بعض الأنواع نادرة أو محدودة التوزيع العالمي، مثل (Cyclopoida) *Eucyclops leschermoutouae* وهو ثاني تسجيل عالمي **,***Ilyocypris* cf. *japonica* (Ostracoda) وغيرها. وأظهرت العينات الموسعة في أغنى منطقة في برك مؤقتة (شمال شرق نوميديا Quézel et Santa 1962، 1963) حتى الآن أن توزيع *Tanymastix stagnalis* Anostraca يقتصر على موقعين في الجزائر (الفرين والراغية). وهناك حاجة ملحة إلى بذل جهود من أجل توفير نظام أساسي لهذا النوع من الأنواع المهددة بالانقراض وحماية موائله.

وبالنظر إلى محدودية جهود أخذ العينات، ووجود أجسام مائية شديدة التنوع، وصعوبات الوصول إلى مصادر المياه، يعتقد أن التنوع البيولوجي الحيوانات السرطينية في المياه القارية الجزائرية لا يستهان به. ويلزم إجراء مزيد من الدراسات لاستكمال العمل الحالي.

الكلمات الدالة: الحيوانات السرطينية، قائمة التحقق، التوزيع، الاحواض المائية القارية، الجزائر

1. INTRODUCTION

Biodiversity is one of the main criteria used when elaborating wetland protection policies (Ramsar Convention Bureau 1992), especially if we know that non-marine aquatic biodiversity is declining rapidly, faster than terrestrial or marine diversity (Dudgeon *et al*. 2006) due to anthropological and climatic changes. These aquatic habitats, comprising permanent and temporary as well, are diverse ecosystems that play important roles in the landscape such as flood control, groundwater recharge, toxicant removal and recycling of nutrients. They are also the main breeding and feeding grounds for many birds and other wildlife. These habitats are home to a unique fauna and flora and contribute significantly to regional diversity (Williams 2006), among them, the carcinological fauna is considered as an important compartment of aquatic ecosystems for its role in the trophic chain. Crustaceans are considered as the dominant fauna in freshwater ecosystems which represent 10 % of the 126,000 freshwater animal species, made up of 23 % copepods, 16 % ostracods and 9 % branchiopods (Balian *et al*. 2008).

Mussel-shrimps, or Ostracoda are small bivalved Crustacea, their calcified carapaces have an average length of 1 mm and completely envelop the reduced body (Martens *et al.* 2008). Ostracods are widely distributed in all types of aquatic habitats including fresh, brackish and saline waters (Bronshtein, 1947; Delorme, 1991; Meisch 2000; Külköylüoğlu 2000, 2005a, b). Being mostly benthic, they play important role as part of the food web in both natural and unnatural habitats. The extreme efficiency of their habitat colonization is due to their different reproductive modes such as parthenogenetic, bisexual and/or both (Martens 1998, Butlin *et al*. 1998; Ozawa 2013). Moreover, Ostracoda is one of the more diverse taxonomic groups having with about 2100 non-marine ostracods which are listed in the checklist of Martens & Savatenalinton (2011) and half of them occur in the family Cyprididae.

Among zooplanktonic groups, cladocerans are small crustaceans of about 0.2 to 3mm (except some large species), with double carapace. As grazers, they play an important role in controlling food webs. About 620 species of Cladocera (Crustacea: Branchiopoda) were reported by Forró *et al.* (2008) for the world fauna. Among them, 250 species from 60 genera are present in the Palearctic region (Forró *et al.* 2008). Cladocerans live in various biotopes in the continental water bodies at different environmental condition: in small and large pools (freshwater, brackish and saline), in open water of large lakes, in the bottom sediments and among vegetation, and even in small accumulations of water in epiphytic plants (phytotelmata) and other exotic localities (Dumont & Negrea 2002; Forró *et al.* 2008). Cladocerans are remarkable by their parthenogenetic reproduction, either obligate or which is periodically interrupted by periods of sexual reproduction (Dumont & Negrea 2002; Smirnov 2013). The sexual reproduction is associated with the formation of resistant dormant eggs colled ephippia, which allow the organisms to withstand the unfavorable conditions (Dumont & Negrea 2002).

Copepods, including three major groups calanoids, cyclopoids and harpacticoids are small segmented crustaceans which occur in almost all freshwater habitats comprising large ancient lakes, pools of glacial melt water subterranean waters, hot springs, hyper saline lakes, and phytotelmata. Some are terrestrial and many live as parasites. They comprise a major component of most planktonic, benthic and groundwater communities. Approximately 2814 copepod species inhabit freshwater (Huys & Boxshall 1991). Boxshall & Defaye (2008) recorded 1138 species copepods cyclopoids in the world. The Palearctic region is the richest with 1,204 species and the major contributors are the family Cyclopidae (28%) with 800 species (Dussart & Defaye 2006). This family lives with variety of life styles from small-particle feeders, to predators or even parasites (Boxshall & Strong 2006).

Large branchiopods are considered as the flagship group of the ecosystems and for the temporary pool invertebrates in general (Colburn 2004; Brendonck *et al.* 2008). They belong to the orders Anostraca (fairy shrimps), Notostraca (tadpole shrimps), Laevicaudata (smooth clam shrimps) and Diplostraca (sub order Spinicaudata, spiny clam shrimps). Except some taxa (eg: *Artemia* L. 1819), they are obligatory residents of temporary water bodies throughout the world (Brendonck *et al*. 2008; Rogers 2009), and are primarily restricted to rain-fed temporary aquatic habitats, such as ephemeral rock pools, natural depressional wetlands, roadside ditches, farm dams and pools in riverbeds that dry completely in the warm months (Brendonck *et al*. 2008; Rogers 2009).They are adapted to these ecosystems and survive drought phases as dormant eggs, which can remain in the sediments of a dry wetland for many years (Wiggins *et al.* 1980; Rogers 2015). Most large branchiopods are filter feeders, which indiscriminately filter particles from water (Brendonck *et al*. 2008). However, the notostracans and a few anostracans are omnivorous and predatory as adults (Rogers 2009).

In general, all those crustaceans occupy important position in the trophic link between primary producers and higher trophic levels. Their richness is influenced by several local factors including latitude, climate, productivity, water plant cover, and by biological interactions such as predation and competition (Jeppesen *et al*. 2000; Oertli *et al*. 2002; Declerck *et al*. 2005). Physico-chemical factors play an important role, in the assemblage of communities, and water salinity is probably the most determinant (Hammer 1986).

Freshwater crustaceans can colonise new habits thanks to resting eggs (cysts and ephippia) and other diapausing forms such as quiescence (juvenile and adult stages) to insure the perrenniality of species. Potential dispersal vectors include wind and rain (Green *et al.* 2002; Havel & Shurin 2004), surface waters between connected water bodies (Frisch *et al*. 2005), even by men via agricultural activities (Rossi *et al.* 2003) and endozoochory (Frisch *et al.* 2007).

Algeria is the largest country in Africa with about 2.4 x 10^6 km^2 surface area, and one of the Afro-Mediterranean countries comprising essentially Palaearctic ecozone (around 90 %) and Afrotropical (Dumont 1979). The variability of its climatic and geological conditions accentuates its wealth in wetlands with various types of water bodies such as, rivers, ponds, reservoirs, wadies and Chotts or Sebkhas. These two latters are the Arabic names of huge and shallow water bodies which are generally saline. In Algeria water resources are dependent on the influence of climate, which is arid for about 80% of the territory. One can distinguish three to four climatic zones, according to authors (Gauthier 1928; Gagneur & Kara 2001). From north to south: the humid climate (700-1000 mm/year), includes the marginal area from the center to the eastern region, it is rich in small freshwater pools especially in El-Tarf province; the sub-humid (500-700 mm/year) which comprises Orania region in the west and sub-littoral region where some saline temporary lakes occur (eg. Sebkha Oran). The semi-arid region (300-500 mm/year) is situated at high altitude (> 1000 m a.s.l.), this zone is characterized by saline lakes (Chotts and Sebkhas) forming a belt between the two Atlas Tellian and Saharan throughout east to west. These saline water-bodies are ephemeral with unstable abiotic conditions. Finally, arid to hyper-arid climate (100 to less than 70 mm/year), characterize the Sahara Desert, which is the greatest and also the hottest in the world. It contains a variety of water bodies such as permanent saline lakes especially in Oued Righ region (Gouasmia *et al*. 2016) as well as Chotts and Sebkhas, freshwater Gueltats (ponds), rocky pools, Oases and others. The extreme southern part of the country (Tamanrasset and Tassili n'Ajjer) belongs to the Afrotropical ecozone.

Carcinological fauna of the Algerian freshwater-bodies made the subject of several works since the 19th century. The first published works were those of Lucas (1849) on Ostracoda, followed by Simon (1885, 1886) who mentioned the presence of some branchiopods and ostracods. Then, Guerne & Richard (1888, 1894) provided information on

some cladocerans and copepods from Bouguezoul. Blanchard & Richard published several works on crustaceans of saline and freshwater (Blanchard & Richard 1890, 1891; Blanchard 1891; Richard 1896). Moniez (1891) recorded nine ostracod species from Algerian inland waters including saline lakes; in 1893, he described a curious form by its habitat *Cypris balnearia* in the warm waters of Hammam Dbegh (Guelma province, with 43 to 51° C). Brady (1902) gave a list of 4 ostracods of Algeria including 2 new species from the oasis of Biskra. In 1908 Daday cited in his memoir monograph of the Branchiopoda Anostraca six species, two of which were new. Gurney (1909), formed a large collection of freshwater crustaceansin zoological trip, he studied aquatic fauna from Algiers and oases of Biskra (Sahara) and identified 21 species. Roy (1924, 1927a, b, 1929) added four new copepod species. Kiefer (1926, 1930, 1952, and 1958) studied various samples of copepods coming from sites in the north and the south (central Sahara). Roy & Gauthier (1927), Gauthier (1928a, b, c, 1929, 1930, 1931, 1933a-b, 1934, 1937, 1938) and Gauthier & Brehm (1928) are the main contributors to our knowledge to the Algerian aquatic microfauna and the thesis of Gauthier (1928) addressed to the fauna of Chotts and Sebkhas of Algeria and Tunisia constitutes the first most extensive work. Beadle (1943) focused on aquatic fauna of saline water bodies of northern Algerian Sahara (mainly Oued Righ, Biskra, and El Golea) and the semi arid region (Orania and High Plateaus of Constantine). Then, Rose & Vaissière (1952) produced the first checklist of Copepoda from fresh and marine waters of North Africa. H.J. Dumont, in his Dissertation (Dumont1979), mainly addressed the Sahara region. His doctorate thesis was the second most extensive work including crustaceans and other aquatic groups; however, only a part of his data, especially on Tunisian microcrustaceans, was subsequently published (Dumont *et al.* 1979). Some ostracod's collections from the Saharan region previously sampled by Professor H. Dumont were examined and published by De Deckker (1981). Akli (1991) added three new copepods from various ponds in North and

South Algeria. More extensive studies have been performed in coastal wetlands in northeastern Algeria in the last decade by Samraoui *et al.* (1998) and Samraoui (2002), who presented lists of cladocerans, copepods, and ostracods from Numidia (provinces Annaba, Skikda, and El-Tarf). In addition, Mouelhi *et al.* (2000) compiled a list of cladocerans and copepods of Maghreb (Algeria, Morocco and Tunisia) and Hamaidi *et al* (2010) that of copepods. More recently, De Los Rios Escalante & Amarouayache (2016) listed species from some saline lakes of the Algerian semi-arid and arid regions.

The carcinological fauna of the Algerian continental waters still poorly studied, considering the vastness of the country with its various climates, landscapes, and existing of many types of inland waters. In another hand, biodiversity should have changed due to anthropological and climatic change since the previous works on Algerian fauna.The aim of the present study is to update knowledge on continental waters' crustaceans based on both published and original data. Checklists include the most currently acceptable scientific names and synonyms, and bears information about individual species which provides knowledge on species diversity and distribution as well as some characteristics of habitats; it provides historical background about the species and taxonomic levels, and also makes a comparison with the faunal inventories from other countries. Such results will allow to provide a better understanding of the functioning of populations, communities and ecosystems, for a better theoretical and practical framework for the integrated management of wetlands and their biodiversity.

2. MATERIALS AND METHODS

2.1. Sampling sites

The greatest part of sampling sites in this study is situated in northeastern of Algeria, (El Tarf, Annaba and Skikda provinces), including El-Kala and the Guerbes-Senhadja wetlands complex, where various areas are designated as Ramsar sites.This region is characterized by the highest precipitation level (up to 1200 mm) and a wet period which extends from November to May, with cool temperatures (Fig.1). The second part was carried out in the eco-complex of the High Plateaux wetlands of Algeria. Some sites (Chotts and Sebkhas) located in the Orania region in the west and northern Sahara have been also sampled.

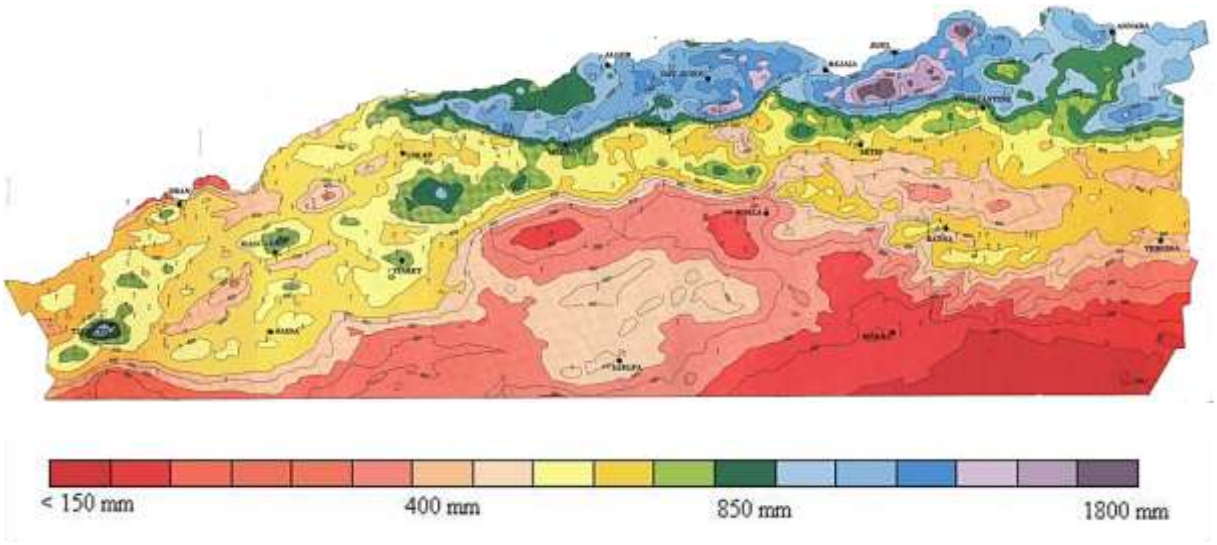

Figure 1. Map of rainfall for northern Algeria (source: ANRH).

In total, 200 samples of cacinological fauna, from 156 water bodies were collected in 20 provinces : Annaba, El-Tarf, Skikda, Guelma, Souk-Ahras, Constantine, Algiers, Tébessa, Tizi-Ouzou, Medea, Sétif, Batna, Oum El-Bouaghi, Khenchela, Oran, Rélizane, Sidi Bel Abbes, Mascara, Djelfa and El Oued (Table 1, Fig. 2), during the wet period between 2013 and 2017 in humid, semi-arid and arid regions. Sampling sites are located from 1 m to 1149 m

a.s.l. and include a variety of aquatic environments such as temporary pools, marshes, ditches, basins, lakes, reservoirs, Sebkhas and Chotts the latter two names refer to the Arabic names of huge, temporary and shallow saline lakes (Demnati *et al.* 2017).

Figure 2. Map of Algeria shows 20 provinces sampled during this study. 1: Annaba (34 samples), 2: El-Tarf (42 samples), 3: Skikda (19 samples), 4: Guelma (5 samples), 5: Constantine (2 samples), 6: Tébessa (10 samples), 7: Sétif (2 samples), 8: Tizi Ouzou (2 samples), 9: Medea (1 sample), 10: Batna (6 samples), 11: Oum El Bouaghi (8 samples), 12: Khenchela (2 samples), 13: Algiers (1 sample), 14: Souk-Ahras (9 samples), 15: Oran (5 samples), 16: Rélizane (1 sample), 17: Sidi Bel Abbes (3 samples), 18: Mascara (1 sample), 19: Djelfa (2 samples), 20: El Oued (1 sample).

2.2. Sampling methods

2.2.1. Ecological parameters

Some physico-chemical parameters (salinity, temperature, TDS, conductivity, pH, dissolved oxygen, and saturation percentage of oxygen) were measured during sampling using a multiparameter Hanna (HI 9829) (see appendix1). The geographical coordinates and altitude were recorded with a GPS.

2.2.2. Ostracoda

In total, 166 samples of living non-marine ostracods were collected from 117 waterbodies. Since the most are benthic ostracods were collected using a hand-net with 125 µm mesh size from the sediment and through vegetation, the samples were filtered again on asieve of 5 mm mesh size in order to remove large particules and the coarse sediment, then were narcotized for about 30 minutes in low concentrated ethanol, and preserved afterwards in 70% ethanol (Fig. 3).

2.2.3. Branchiopoda and Cyclopoida

Cladocerans and Cyclopoida (copepods) samples were collected from 112 and 28 water bodies respectively, using a hand-net (125 µm mesh size) in different points of water bodies and through vegetation, the smallest environments were sampled by collecting water with a bucket and concentrating the samples on a sieve with 125 µm-mesh (Fig.4). Large branchiopods (anostracans, notostracans, and spinicaudata) were collected from 47 water bodies, using a sieve of 400 µm mesh size. Samples were duplicated depending of the density and the size of the water bodies, and fixed in 70 % ethanol and/or 4 % formaldehyde.

Figure 3. Photo of sampling ostracods with hand net.

Figure 4. Photo of sampling with sieve.

2.3. Sars' method

The most intensive sampling has been performed in Numidia (northeastern Algeria) on several occasions due to a high number of water-bodies. When Sebkhas/Chotts appeared to be dried up during our visit (Fig. 5), specimens of crustaceans were reared from mud collected from the upper layer of soil, from different parts of depressions according to Sars' method recently described by Van Damme & Dumont (2010). A fraction of sample was incubated by adding 3 L of distilled water to 300 g of sediment placed in a 5 L plastic aquarium. As Sebkhas generally fill in winter and spring, rearing was started in cold temperatures (10-20°C) in natural photoperiod. Predators as large branchiopods were removed and no food was added (Fig. 6).

Figure 5. Photo of a dried Sebkha.

Figure 6. Photo of plastic aquarium containing incubated mud (Sars' method).

2.4. Sorting and identification

Back in the laboratory, specimens of ostracodswere sorted using a pipetteand were dissected in a drop of Hydro-Matrix solutionunder a stereo-microscope (Olympus ACH 1X), with two fine dissecting needles, the valves of the ostracod are opened and the soft body extracted to isolate the various appendages like the antenna, walking leg, cleaning leg, uropod, maxiliped, maxillula, the mandibles, the furca, and the male copulatory organs, all necessary for taxonomic identification (Fig. 7), then mounted in permanent slides. The carapaces and valves were retained in micropaleontological slides.

Cladocera were sorted under a stereo-microscope (Olympus ACH 1X), and dissected with entomological needles in glycerine solution, it isnecessary to dissect the animal in order to discern the state of characters such as the postabdominal claw, details of the antennules and the rostrum, or details of the spinulation of the dorsal margin of the ephippium or on the margins of the carapace, head shield and thoracic limbs (Fig. 7). The specimens were mounted in permanent slides.

The copepods (Cyclopoida) were dissected under a stereo-microscope (Olympus ACH 1X), with fine needles on semi permanent slides using glycerine solution to separate the different part of the body like Pediger 5 and genital double somite, caudal rami, antennule, Labrum, mandible, maxillulary palp, maxilla, and maxilliped (Fig. 7).

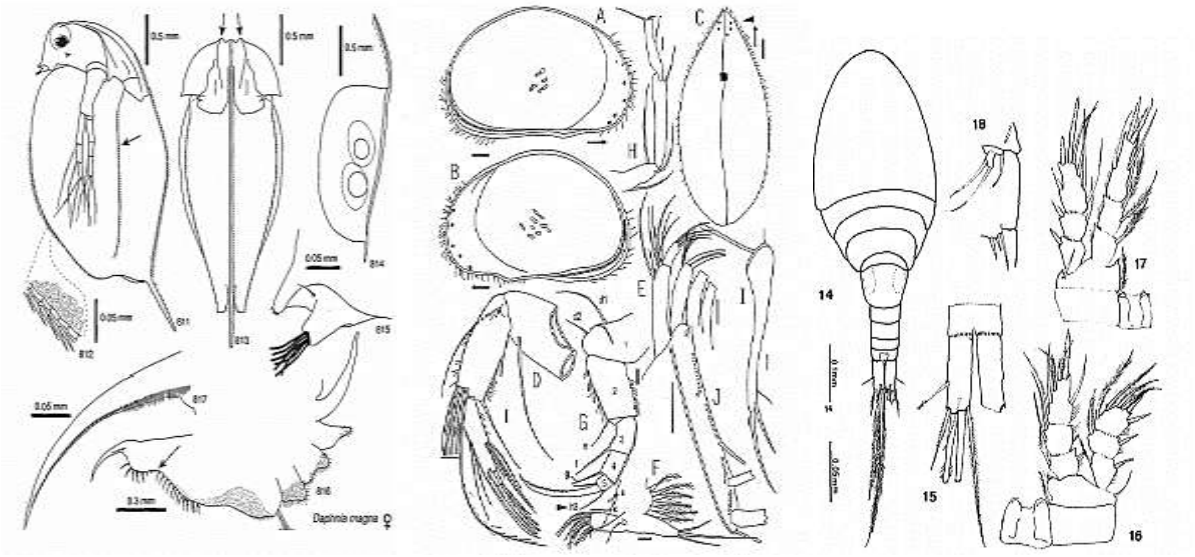

Figure7. Anatomy of different parts of crustaceans after dissection (Benzie 2005, Meisch 2000, Einsle 1993).

Species were identified under a light microscope (Olympus BX-51) using standard taxonomic keys and recent taxonomic revisions: Meisch (2000) for ostracods; Smirnov (1971, 1976, 1992, 1996), Amoros (1984), Alonso (1996), Benzie (2005), Sinev (2001a, b, 2009a, b, 2015), Korovchinsky (1992) and Kotov & Štifter (2006) for Cladocera, Einsle (1993) for Cyclopoids, Alonso (1996), Thiéry & Nourisson (1996) for large branchiopods.

Damaged individuals were identified to genus level if possible and juveniles were identified only up to generic level and were not accounted for the taxonomy.

2.5. Scanning electron microscopy (SEM)

SEM photos of some species were taken for cyclopoids, *Eucyclops leschermoutouae* Alekseev & Defaye, 2004 as a new record and *Cyclops abyssorum mauritaniae* Lindberg, 1950 to separate this species from both C. *abyssorum divergens* (Lindberg, 1936) and C. *abyssorum abyssorum* Sars G.O, 1863. Specimens were dehydrated in graded acetone followed by hexamethyl-disilazane (HMDS) drying. Surface structures were investigated using Hitachi S 3400 N (Museum and Institute of Zoology PAS, Warsaw) scanning electron microscope.

2.6. Checklists and distribution

The checklists of the Carcinological fauna of Algeria were based on original data in the present study and previous records: Lucas (1849), Blanchard & Richard (1890, 1891), Blanchard (1891), Richard (1896), Moniez (1891), Gurney (1909), Roy (1924, 1927a, b, 1929), Roy & Gauthier (1927), Kiefer (1926, 1930, 1952, and 1958) Gauthier (1928a, b, c, 1929, 1930, 1931, 1933a-b, 1934, 1937, 1938), Gauthier & Brehm (1928), Beadle (1943), Rose & Vaissière (1952), Dumont (1979), Dumont *et al.* (1979), Samraoui *et al*. (1998), Samraoui (2002). Karanovic & Pesce (2000), Hamaidi *et al*. (2010), De Los Rios Escalante & Amarouayache (2016).

The checklists of species were listed following the most currently acceptable taxonomy: Martens & Savatenalinton (2011), Kotov *et al.* (2013a).

Table 1. Site number (Site no), site name (Type), province, coordinates, altitude (m), surface area (ha, km^2, m^2) and salinity (psu) from 156 sampling sites from 20 provinces in Algeria.

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity
1	Les Salines (temporary marsh)	Annaba	36°50'34.00"N 07°47'46.00"E	1	1 ha	0.84-2.98
2	Boukhadra (temporary marsh)	Annaba	36°51'50.76"N 07°43'3.09"E	2	3 ha	0.45
3	El-Rym (temporary marsh)	Annaba	36°52'44.38"N 07°43'42.70"E	2	1 ha	3-6
4	Laalalig (permanent pond)	Annaba	36°51'13.55"N 07°45'21.63"E	2	2 ha	4.55
5	Sidi Salem (temporary pond)	Annaba	36°50'30.72"N 07°49'37.52"E	2	500 m^2	0.35
6	Kherraza (temporary pond)	Annaba	36°50'3.70"N 07°39'35.01"E	16	400 m^2	0.34
7	El Bouni1(ditch)	Annaba	36°51'51.47"N 07°43'36.36"E	21	6 m^2	0.27
8	Bouzaaroura (temporary pool)	Annaba	36°50'35.22"N 07°44'59.61"E	10	500 m^2	0.26
9	Les Salines1 (temporary pool)	Annaba	36°50'4.87"N 07°47'59.32"E	2	300 m^2	0.84
10	Les Salines (ditch)	Annaba	36°49'53.01"N 07°38'2.78"E	21	<1 m^2	0.15
11	Les Salines 2 (temporary pool)	Annaba	36°50'34.00"N 07°47'46.01"E	1	1 m^2	0.13
12	Oued El Nil (temporary pool)	Annaba	36°49'53.01"N 07°38'2.78"E	21	20m^2	0.15
13	Boukhadra (El-Rym) (tem.pool)	Annaba	36°52'18.33"N 07°43'28.77"E	2	10m^2	1.04
14	Boukhadra (temporary pool)	Annaba	36°52'19.64"N 07°43'32.19"E	4	25m^2	0.45
15	Hdjar-Diss (ditch)	Annaba	36°47'36.14"N 07°36'28.03"E	33	10m^2	0.59
16	Kalitoussa (basin)	Annaba	36°48'58.20"N 07°26'7.13"E	45	100m^2	0.18
17	Berrahal (temporary pool)	Annaba	36°52'18.33"N 07°43'28.77"E	2	100 m^2	1.04
18	Oued Ziad (temporary pool)	Annaba	36°49'57.48"N 07°35'4.09"E	17	25 m^2	0.20
19	Aib Ammar (temporary pool)	Annaba	36°49'43.32"N 07°35'1.20"E	16	< 1ha	0.14
20	Boukhmira 1(temporarypool)	Annaba	36°51'3.43"N 07°48'8.54"E	1	20m^2	0.43
21	Boukhmira 2(temporary pool)	Annaba	36°51'3.41"N 07°48'11.13"E	1	10m^2	0.31
22	Chabia (temporary pool)	Annaba	36°51'7.70"N 07°41'50.10"E	6	1 ha	0.35
23	Les Ruines (rocky basin)	Annaba	36°52'59.50"N 07°45'7.11"E	12	100 m^2	0.57
24	El-Chorfa (ditch)	Annaba	36°42'59.24"N 07°33'27.75"E	15	50m^2	0.43
25	El-Karma 1(basin)	Annaba	36°45'26.97"N 07°40'55.66"E	15	6m^2	0.54
26	El-Karma 2 (ditch)	Annaba	36°45'27.80"N 07°40'57.02"E	16	6m^2	0.32
27	El-Karma 3 (temporary pool)	Annaba	36°45'34.93"N 07°40'41.43"E	20	100m^2	0.48
28	El-Eulma (temporary pool)	Annaba	36°41'37.37"N 07°35'9.85"E	90	100m^2	0.83

29	Chbaita Mokhtar (temp. pool)	Annaba	36°46'7.04"N 07°44'17.16"E	10	500m^2	0.21
30	Bouzizi (temporary pool)	Annaba (Séraidi)	36°90'13.44"N 07°64'15.03"E	950	20 m^2	0.17
31	El Manjra (temporary pool)	Annaba (Séraidi)	36°91'95.15"N 07°61'17.92"E	578	6 m^2	0.08
32	El Chara (permanent pool)	Annaba (Séraidi)	36°56'10.10"N 07°40'41.34"E	630	3ha	0.80
33	El Makroun, Tacha (ditch)	Annaba	36°52'04.52"N 07°25'03.43"E	9	50m^2	0.12
34	El Makroun (Temp. pool)	Annaba	36°52'00.47"N 07°24'54.86"E	9	200 m^2	0.08
35	El Frine (peanut field)	El-Tarf	36°50'17.35"N 08°25'19.45"E	30	1ha	0.15
36	Mridima (temporary pool)	El-Tarf	36°52'42.21"N 08°24'10.19"E	41	1.5 ha	0.12
37	El-Guentra (temporary pool)	El-Tarf	36°46'49.37"N 08°18'49.56"E	25	1ha	0.12
38	Sidi Mbarek (temporary pool)	El-Tarf	36°49'51.55"N 07°55'58.63"E	5	537m^2	0.32
39	El-Feid (marsh)	El-Tarf	36°44'59.79"N 08°4'5.99"E	2	10 ha	0.25
40	El-Battah (temporary pool)	El-Tarf	36°50'33.29"N 07°56'57.19"E	2	1 ha	0.49
41	El Oued (temporary pool)	El-Tarf	36°46'53.87"N 08°18'50.29"E	30	1 ha	0.07
42	Dey Lagraa (temporary pool)	El-Tarf	36°50'21.56"N 08°25'39.41"E	32	6.085 m^2	0.25
43	Souk Rguibet (temporary pool)	El-Tarf	36°53'41.91"N 08°17'29.27"E	6	1.676 m^2	0.09
44	El Qriaat (temporary pool)	El-Tarf	36°48'23.20"N 07°59'26.60"E	12	3.856 m^2	0.22
45	Ain Khiar (temporary pool)	El-Tarf	36°48'25.36"N 08°19'33.07"E	42	7.841 m^2	0.09
46	Sebaa (temporary pool)	El-Tarf	36°50'51.86"N 08°4'28.50"E	27	3.240 m^2	0.30
47	El Malha (temporary pool)	El-Tarf	36°52'3.03"N 08°20'22.83"E	5	4.5621ha	0.21
48	El Henaya (temporary pool)	El-Tarf	36°53'47.90"N 08°8'31.39"E	16	5.246 m ^{2}	0.21
49	Faid El Gharnoug (temp. pool)	El-Tarf	36°50'36.00"N 08°10'42.92"E	23	1.1284ha	0.08
50	Houaychia (ditch)	El-Tarf	36°49'5.28"N 08°37'7.83"E	265	< 1ha	0.16
51	Boutheldja 1(ditch)	El-Tarf	36°46'36.88"N 08°13'17.04"E	16	< 1ha	0.09
52	Boutheldja 2 (temporary pool)	El-Tarf	36°46'34.31"N 08°13'17.73"E	17	< 1ha	0.07
53	Ain Assel (temporary pool)	El-Tarf	36°46'36.88"N 08°13'17.04"E	16	600 m^2	0.09
54	El Frine 2 (peanut field)	El-Tarf	36°50'21.96"N 08°25'21.36"E	25	< 1ha	0.32
55	El Frine (sandy pool)	El-Tarf	36°50'21.96"N 08°25'21.36"E	25	1 ha	0.32
56	Lac Bleu (small lake)	El-Tarf	36°50'48.47"N 08°4'29.37"E	31	3 ha	0.17
57	Lac Noir (lake)	El-Tarf	36°51'17.82"N 08°12'23.77"E	34	3.5 ha	0.23
58	Ben M'hidi (ditch)	El-Tarf	36°50'1.23"N 08°6'43.94"E	16	10 m²	0.07

59	La Mekhada (temporary pool)	El-Tarf	36°49'20.49"N 08°36'14.50"E	240	2 ha	0.17
60	Draouche (peanut field)	El-Tarf	36°50'48.47"N 08°4'29.37"E	31	< 1ha	0.17
61	Berrihane (temporary pool)	El-Tarf	36°50'1.23"N 08°6'43.94"E	16	< 1ha	0.07
62	El Asfour (temporary pool)	El-Tarf	36°39'10.22"N 07°56'37.29"E	70	< 1ha	0.10
63	El Kous (temporary pool)	El-Tarf	36°48'35.23"N 07°51'57.79"E	6	1ha	0.06
64	Jnene Echouk (temporary pool)	El-Tarf	36°40’53.35”N 07°43’59.22”E	20	< 1ha	0.16
65	Oum Tboul (Dghidgha) (t. pool)	El-Tarf	36°53'24.29"N 08°36'40.74"E	116	< 1ha	0.09
66	Essouarekh (temporary pool)	El-Tarf	36°53'0.26"N 08°34'15.31"E	14	< 1ha	0.19
67	La Messida (temporary pool)	El-Tarf	36°53'2.71"N 08°31'54.88"E	1	< 1ha	0.07
68	El –Aioun (ditch)	El-Tarf	36°49'20.49"N 08°36'14.50"E	240	< 1ha	0.17
69	Oum Tboul (temporary pool)	El-Tarf	36°52'57.60"N 08°34'28.40"E	34	< 1ha	0.09
70	Ain Ben Beida1(ditch)	El-Tarf	36°37'59.06"N 07°42'0.95"E	85	1 m²	0.24
71	Ain Ben Beida2 (temp. pool)	El-Tarf	36°36'32.29"N 07°41'54.16"E	112	< 1ha	0.43
72	El-Chatt (ditch)	El-Tarf	36°49'38.26"N 07°51'18.07"E	2	< 1ha	0.25
73	El Frine (peanut field)	El-Tarf	36°49'46.44"N 08°25'16.01"E	27	< 1ha	0.08
74	Tonga (temporary pool)	El-Tarf	36°36'32.29"N 07°41'54.16"E	112	50 m²	0.43
75	Near to Tonga Lake (a pond)	El-Tarf	36°52'1.74"N 08°22'28.44"E	27	500 m²	0.16
76	Near to Oubeira Lake (a pond)	El-Tarf	36°52'1.74"N 08°22'28.44"E	27	< 1ha	0.16
77	Garaa Bechna (marsh)	Skikda	36°53'23.54"N 07°17'50.64"E	10	< 1ha	0.23
78	Aïn Nechma (temporary pool)	Skikda	36°50'18.64"N 07°16'59.46"E	18	< 1ha	0.38
79	Lemsaousa (temporary pool)	Skikda	36°56'35.98"N 07°15'8.76"E	20	< 1ha	0.14
80	Garaa Beni- Mohamed (marsh)	Skikda	36°56'19.82"N 07°15'46.14"E	3	1ha	0.61
81	Garaa Sidi Makhlouf (marsh)	Skikda	36°53'46.21"N 07°18'07.76"E	16	50 ha	0.11
82	Deyar El Jedri (ditch)	Skikda	36°57'59.38"N 07°19'8.04"E	13	1 m²	0.22
83	Mgez Stah (temporary pool)	Skikda	36°57'20.26"N 07°17'50.38"E	2	< 1ha	0.15
84	Aux Linaires (temporary pool)	Skikda	36°48'17.82"N 07°16'46.71"E	21	1 ha	0.51
85	Aux Oliviers (temporary pool)	Skikda	36° 50'52.96"N 07°18'25.02"E	5	1 ha	0.32
86	El Hamma (temporary pool)	Skikda	36°48'17.82"N 07°16'46.71"E	21	< 1ha	0.51
87	Hdjar –Soud (temporary pool)	Skikda	36°46'55.84"N 07°17'17.16"E	29	< 1ha	0.18
88	Garaa Rmaila (marsh)	Skikda	37° 0'52.96"N 07°15'25.02"E	5	< 1ha	0.32
89	Ras El Maboun (ditch)	Skikda	37° 0'37.44"N 07°15'48.68"E	16	10 m²	0.11

90	Ain Magroun (temporary pool)	Skikda	36°50'20.99"N 07°17'01.17"E	19	1 ha	0.07
91	El Khlelfa (temporary pool)	Skikda	36°53'38.82"N 07°18'22.12"E	15	500 m²	0.12
92	Ben Azouz (temporary pool)	Skikda	36°51'12.80"N 07°17'34.85"E	13	500 m²	0.09
93	Akarom (temporary pool)	Skikda (Collo)	37° 3'33.47"N 06°30'44.39"E	932	< 1ha	0.15
94	Telza (temporary pool)	Skikda (Collo)	37° 1'46.10"N 06°30'22.46"E	823	< 1ha	0.18
95	El-Mraige (temporary pool)	Skikda (Collo)	36°57'26.99"N 06°32'39.60"E	758	< 1ha	0.22
96	Bouchegouf 1 (temporary pool)	Guelma	36°31'14.80"N 07°43'19.66"E	82	3 m^2	0.26
97	Bouchegouf 2 (temporary pool)	Guelma	36°30'49.45"N 07°42'56.03"E	84	3 m^2	0.19
98	Tamlouka (temporary pool)	Guelma	36° 8'45.00"N 07° 8'45.00"E	745	< 1ha	1.22
99	Hammam Dbegh (thermal pool)	Guelma	36°27'50.00"N 07°16'1.00"E	335	0.1 m^2	1.27
100	Bir Osmane (temporary pool)	Guelma	36°27'50.00"N 07°16'1.00"E	335	10 m^2	1.27
101	Guerrah 1 (temporary pool)	Constantine	36° 6'44.00"N 06°36'4.00"E	757	200 m^2	0.45
102	Guerrah 2 (ditch)	Constantine	36° 8'48.00"N 06°37'23.00"E	755	0.4 m^2	0.17
103	Les grands vents (temp.pool)	Algiers	36° 8'48.00"N 06°37'23.00"E	755	300 m²	0.17
104	Safsaf (temporary pool)	Tébessa	34°57'9.03"N 08°13'42.10"E	866	20 m²	0.54
105	El-Doukken (temporary pool)	Tébessa	35°23'20.46"N 08° 4'49.75"E	922	10 m²	0.65
106	El-Malabiod (temporary pool)	Tébessa	35°10'20.72"N 08° 9'35.94"E	1000	< 1ha	1.23
107	Ain-Kemellal (temporary pool)	Tébessa	35°55'27.43"N 05°32'53.46"E	903	1 ha	4-7
108	El Sendoug (temporary pool)	Tébessa	36°42'23.64"N 04°7'45.02"E	74	10 m^2	0.19
109	El Btine (reservoir)	Tébessa	35°13'25.54"N 07°37'33.84"E	1144	2.5 ha	0.27
110	Dbidiba (temporary pool)	Tébessa	35°52'49.92"N 07°50'46.45"E	713	1.2 ha	0.22
111	Ain Sadik (temporary pool)	Tébessa	35°52'17.04"N 07°53'39.98"E	643	600 m^2	0.08
112	Oum Arroudj (pond)	Tébessa	35°57'52.40"N 08°02'52.93"E	539	500 m^2	2.32
113	El Frahna (temporary pool	Tébessa	35°22'07.36"N 07°35'45.15"E	1149	1 ha	0.15
114	Bourgas 1 (temporary pool)	Souk -Ahras	35°12'12.67"N 03°29'57.93"E	750	4 ha	3-4
115	Bourgas 2 (temporary pool)	Souk- Ahras	34°54'48.83"N 02°50'31.46"E	837	5 ha	3-4
116	Khemissa (temporary pool)	Souk- Ahras	33°39'48.63"N 06°3'8.84"E	6	1 ha	1.50
117	Ain Sanour (temporary pool)	Souk- Ahras	36°17'53.67"N 07°54'0.47"E	200	1ha	0.13
118	Ma Lahmar (temporary pool)	Souk- Ahras	36°25'42.94"N 08°13'40.86"E	200	300 m²	0.43
119	El Tahouna (temporary pool)	Souk- Ahras	36°19'52.67"N 07°54'0.41"E	221	1ha	0.56
120	Lahnancha (temporary pool)	Souk- Ahras	36°12’48.01"N 07°41’30.39"E	789	350 m²	0.62

121	Ain Zana (basin)	Souk- Ahras	36°23'50.95"N 08°12'49.48"E	920	140 m²	0.33
122	Lamouadjen (temporary pool)	Souk- Ahras	36°22'42.88"N 08°08'40.02"E	900	5ha	0.17
123	Oued Aissi (temporary pool)	Tizi Ouzou	36°42'23.64"N 04°7'45.02"E	74	10 m²	0.19
124	Illoula Ou Malou (temp.marsh)	Tizi Ouzou	36°35'9.21"N 04°27'3.38"E	592	21 m²	0.19
125	Bouguezoul (Chott)	Medea	35°43'60.00"N 02°46'60.00"E	700	90 km²	3.00
126	Hamiet (Chott)	Sétif	35°55'27.43"N 05°32'53.46"E	903	25 km²	4-7
127	Bazer (Sebkha)	Sétif	36° 3'8.85"N 05°40'38.81"E	907	158 km²	11.55
128	Tizourite (temporary pool)	Batna	35°48'57.55"N 06°20'48.91"E	798	1ha	2.12
129	Draa-Boultif (temporary pool)	Batna	35°50'6.60"N 06°22'25.56"E	797	1ha	2.23
130	Djendli (Sebkha)	Batna	35°41'60.00"N 06°31'55.40"E	831	70 km²	0.53
131	Es-Shari (Chott)	Batna	35°49'50.00"N 06°23'24.00"E	794	2.500ha	0.12
132	Djerma (temporary pool)	Batna	35°49'58.10"N 06°43'52.90"E	828	10 m^2	0.15
133	Ain Yagout (temporary pool)	Batna	35°56'1.00"N 06°56'13.00"E	993	5ha	0.38
134	Tinsilt (Chott)	Oum El Bouaghi	35°53'15.89"N 06°28'37.16"E	786	2.500 ha	14.51
135	Timerganine (Chott)	Oum El Bouaghi	35°39'24.10"N 06°57'46.80"E	837	57 km²	0.56
136	El-Tarf (Chott)	Oum El Bouaghi	35°38'42.00"N 07°01'28.10"E	830	25ha	8.00
137	El-Maghssel (Chott)	Oum El Bouaghi	35°49'58.10"N 06°43'52.90"E	828	1ha	0.15
138	Ourkis (Reservoir)	Oum El Bouaghi	35°56'1.00"N 06°56'13.00"E	998	5ha	0.38
139	Guellif (Chott)	Oum El Bouaghi	35°45'22.50"N 06°54'44.20"E	829	5500ha	10.00
140	Melah (Chott)	Oum El Bouaghi	35°36'44.60"N 07° 5'13.60"E	840	85ha	0.12
141	Ez-Zemoul (Sebkha)	Oum El Bouaghi	35°53'13.70"N 06°30'20.00"E	785	6400 ha	4.20
142	M'Toussa (Chott)	Khenchela	35°37'49.00"N 07°13'54.93"E	837	10 ha	0.64
143	Ouled M'barek (Sebkha)	Khenchela	35°20'45.67"N 07°15'42.85"E	1066	34 ha	7.50
144	Zahres El-Chergui (Chott)	Djelfa	35°12'12.67"N 03°29'57.93"E	750	50.98ha	3-4
145	Zahres El-Guarbi (Chott)	Djelfa	34°54'48.83"N 02°50'31.46"E	837	52.2ha	3-4
146	Tindla (Chott)	El Oued	33°39'48.63"N 06° 3'8.84"E	6	10 km²	1.50
147	Ettouama (Sebkha)	Oran	35°34'43.00"N 00°30'1.00"W	92	15ha	5.59
148	Telamine (Sebkha)	Oran	35°43'4.22"N 00°23'25.03"W	78	2400 ha	3.20
149	Sidi Chami (Sebkha)	Oran	35°39'36.03"N 00°31'52.76"W	87	20 ha	6.75
150	Daya Bagrat (Sebkha)	Oran	35°33'3.72"N 00°33'42.30"W	98	80 ha	0.81

151	La Macta (marsh)	Oran	35°42'60.00"N 00°43'60.00"W	5	190 ha	2.40
152	Sidi Bouziane (salt marsh)	Rélizane	35°50'37.08"N 00°39'22.40"E	33	1740 ha	8.04
153	Sidi Mhammed Ben Ali (lake)	Sidi-Bel-Abbes	35°14'31.08"N 00°38'51.60"W	460	7.3 ha	0.5
154	Oued El Besbes (ditch)	Sidi-Bel-Abbes	35°15'51.23"N 00°49'37.12"W	520	10 m²	1.29
155	Sarno (Dam)	Sidi-Bel-Abbes	35°17'29.96"N 00°35'43.99"W	420	26 ha	0.9
156	Bouhnifia (pond)	Mascara	35°17'24.32"N 00° 4'35.45"W	285	1 ha	0.2

3. RESULTS

3.1. Checklists and distribution of crustaceans of Algeria

3.1.1. Non-marineostracods

3.1.1.1. Checklist

Twenty eight podocopid ostracod species in four families were identified in this study: Candonidae Kaufmann 1900 (4%), llyocyprididae Kaufmann 1900 (14%), Cyprididae Baird, 1845 (78%), Limnocytheridae Klie 1938a (4%) (Fig. 8) with 13 new record taxa. The highest number of species was reported from Les Salines with 9 species per sample. The most frequently encountered species were *Eucypris virens* recorded in almost all the sites (95%), followed by *Heterocypris incongruens* from 20 sites. We also identified males of *Eucypris virens* from the sites with relatively high salinity ranges. The following taxa *Eucypris kerkyrensis*, *Ilyocypris decipiens*, *I.* cf. *japonica*, *Limnocythere inopinata*, *Potamocypris smaragdina* and *Prionocypris zenkeri* have been found only once (Fig. 9).

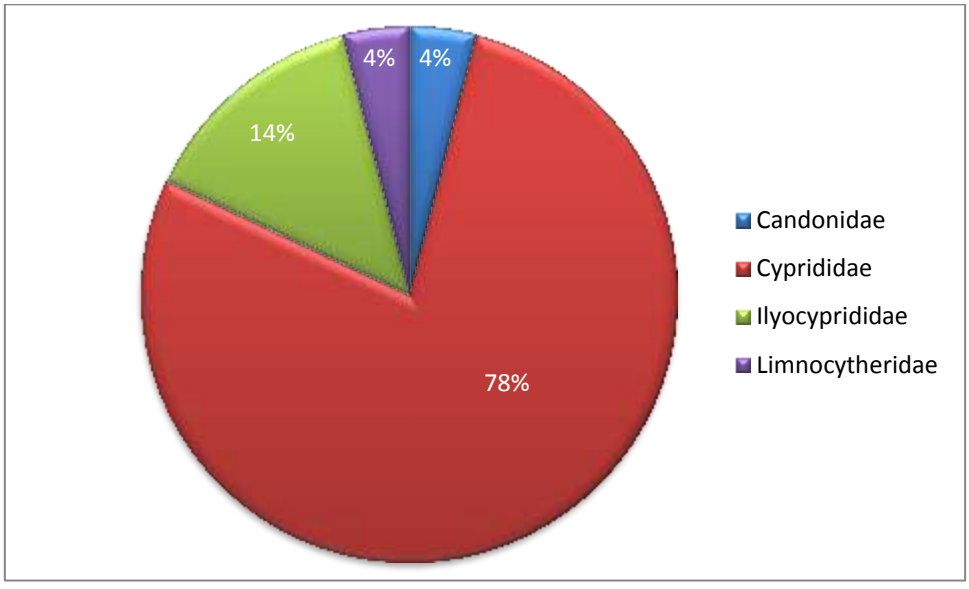

Figure 8. Distribution percentage of non-marine ostracod families in this study.

Table 2. List of non marine ostracods found in this study, (*) new record.

Family	Genus	Species	Author, year
Candonidae	*Candona*	*neglecta*	Sars, 1887
Cyprididae	*Cypris*	*bispinosa*	Lucas, 1849
	**Cypris*	*pubera*	O. F. Muller, 1776
	**Eucypris*	*kerkyrensis*	Stephanides, 1937
	**Eucypris*	*lilljeborgi*	(G.W. Müller, 1900)
	Eucypris	*virens*	(Jurine, 1820)
	Tonnacypris	*lutaria*	(Koch, 1838)
	Trajancypris	*clavata*	(Baird, 1838)
	Herpetocypris	*chevreuxi*	(Sars, 1896)
	Heterocypris	*barbara*	(Gauthier & Brehm, 1928)
	Heterocypris	*incongruens*	(Ramdohr, 1808)
	**Heterocypris*	*rotundata*	(Bronshtein, 1928)
	Heterocypris	*salina*	(Brady, 1868)
	**Isocypris*	*beauchampi*	(Paris, 1920)
	**Scottia*	*sp.*	Brady & Norman, 1889
	Cypridopsis	*vidua*	(O. F. Muller, 1776)
	Plesiocypridopsis	*newtoni*	(Brady & Robertson, 1870)
	Sarscypridopsis	*aculeata*	(Costa, 1847)
	Potamocypris	*arcuata*	(Sars, 1903)
	**Potamocypris*	*smaragdina*	(Varva, 1891)
	**Potamocypris*	*variegata*	Kaufmann, 1900
	**Potamocypris*	*villosa*	(Jurine, 1820)
	**Prionocypris*	*zenkeri*	(ChyZer &Toth, 1858)
Ilyocyprididae	**Ilyocypris*	cf. *japonica*	Okubo & Terauchi 1992
	**Ilyocypris*	*decipiens*	Masi, 1905
	Ilyocypris	*getica*	Masi, 1906
	Ilyocypris	*gibba*	(Ramdohr, 1808)
Limnocytheridae	**Limnocythere*	*inopinata*	(Baird, 1843)
4 Family	**15 Genera**	**28 Species**	

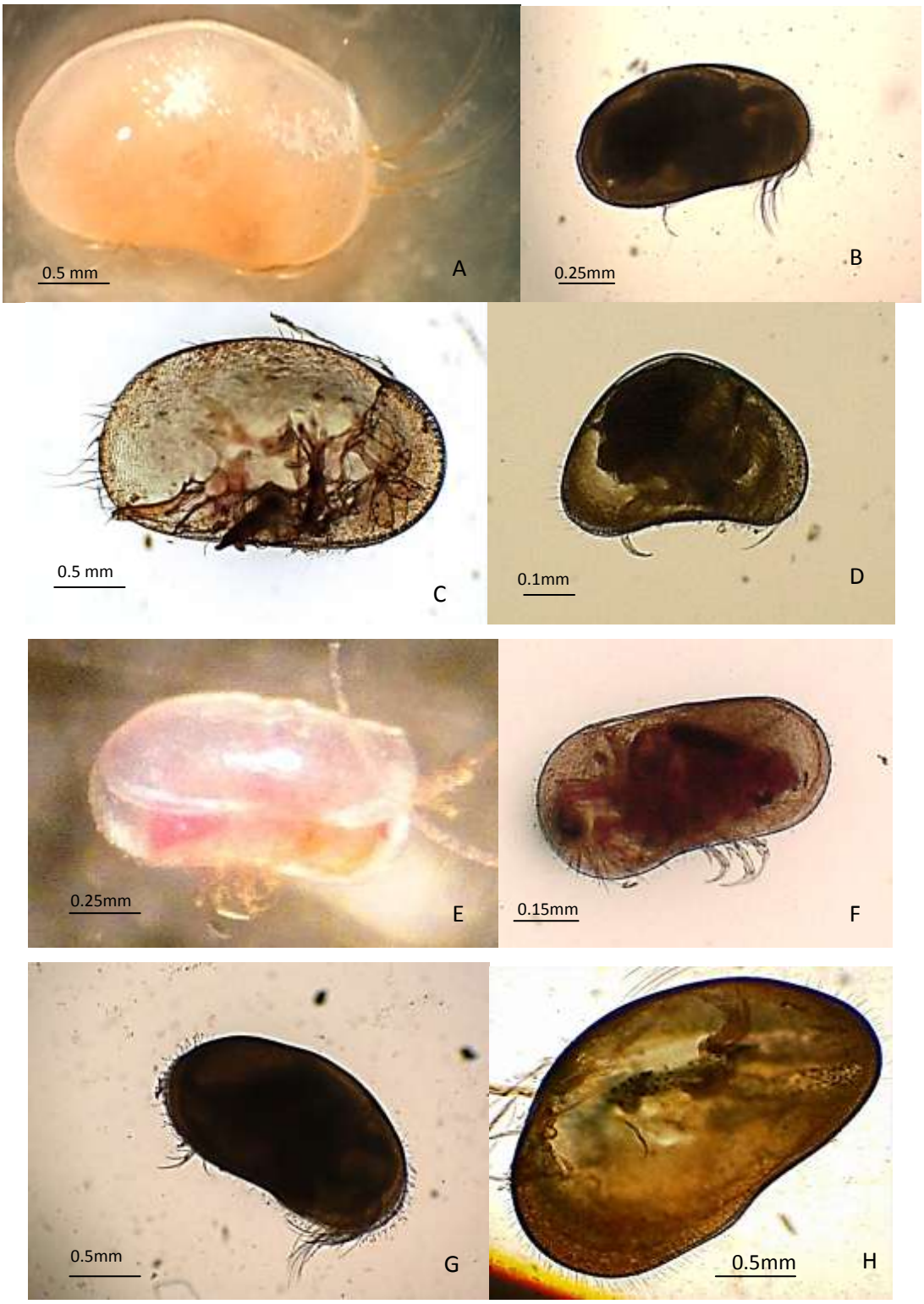

Figure 9. Some new and common ostracods species: A. *Cypris pubera*, B. *Heterocypris rotundata*, C. *Isocypris beauchampi*, D. *Potamocypris villosa*, E. *Ilyocypris decipiens***,** F. *Limnocythere inopinata,* G. *Eucypris lilljeborgi*, H. *Eucypris virens.*

3.1.1.2. Distribution of non-marine ostracods in Algeria

Class Ostracoda Latreille, 1806

Subclass Podocopa G.W. Müller, 1894

Order Podocopida G.O. Sars, 1866

Suborder Cypridocopina Baird, 1845

Superfamily Cypridoidea Baird, 1845

Family Candonidae Kaufmann, 1900

Subfamily Candoninae Kaufmann, 1900

Candona angulata G.W. Müller, 1900, recorded by Gauthier (1928a) in Kreider Dam (Chott Ech-Chergui), Sebkha Ain Ouarka (east of Ain-Safra, Naama province), Bahr (Lake) Temacine from Sahara (Ouargla province). Palaearctic species (Martens & Savatenalinton 2011).

Candona neglecta Sars, 1887, recorded by Gauthier (1928a) inpond from Forest of Réghaia (Algiers), ancien Halloula Lake (Algiers), agoulmine of Azerou, pond near Wadi Boudjema, Frétis Lake near Fetzara marsh (Annaba province), marsh beteen Oubeira and Tonga Lake, Forest marshy near Tonga Lake, pond on the road of Bouliff (El-Kala), pond of agoulmine Lakhès (Teniet-El-Haad, Tissemsilt province), marsh of Baniou depression of Chott El-Hodna, pond la Mardja (Chélif), marsh near of Guerrah El-Tarf (Ain Beida), pond Djurdjura great Kabylie, and this study. Palaearctic species (Martens & Savatenalinton 2011).

Candonopsis* cf. *kingsleyi (Brady & Robertson, 1870), recorded by Samraoui *et al.* (1998) in Garaa Chichaoua (a marshy) Guerbes-Senhadja, Skikda province. Nearctic, Neotropical and Palaearctic regions (Martens & Savatenalinton 2011).

Subfamily Cyclocypridinae Kaufmann, 1900

Cypria ophtalmica (Jurine, 1820), recorded by Gauthier (1928a) in pond on the road of Bouliff (El-Kala), pond la Mardja (Chélif province); Samraoui *et al*. (1998) in Garaa Chichaoua (a marshy) Guerbes-Senhadja, Skikda province, Neotropical and Palaearctic regions (Martens & Savatenalinton 2011).

Physocypria bullata (Vávra, 1897), recorded by Samraoui *et al.* (1998) inTonga Lake and Lac Bleu (El Tarf provine). Afrotropical species (Martens & Savatenalinton 2011).

Cyclocypris ovum (Jurine, 1820), recorded by Gauthier (1928a) in pond Akhal Ben-Aknoun Dely-Brahim (Algiers), agoulmine Temjout (Bejaia province), Forest marshy near Tonga Lake, pond near Letourneux (El-Kala), Neotropical and Palaearctic regions (Martens & Savatenalinton 2011).

Family Ilyocyprididae Kaufmann, 1900

Ilyocypris bradyi Sars, 1890, recorded by Gauthier (1928) in marsh of Chaib (Chott Ech-chergui, Garaa El-Kheli between Djelfa and Laghouat, marsh Bou-Merzoug (Ain M'lila), marsh near Guerrah El-Tarf (Ain Beida), small Oued near Sétif, Oued Isser (Tlemcen province), almost cosmopolitan species (Martens & Savatenalinton 2011).

****Ilyocypris* cf. *japonica*** Okubo & Terauchi 1992 new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

****Ilyocypris decipiens*** Masi, 1905 new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

Ilyocypris getica Masi, 1906, recorded by Gauthier (1928a) in pond Akhal Ben-Aknoun Dely -Brahim (Algiers), pond in drainage canal of Halloula Lake, pond near Wadi Boudjema (Annaba province), marsh of Mekhada, marsh near Oued El-Aroug (Mellah Logoon), pond near Médea, Daya El-Itima (Mécheria, Naama province), Daya Oum Si-Chérif (Mécheria),

Dam Guelt-Es-Stel, R'dir near Laghouat, pond of Oued Sfid (Saida), ditch between Sidi-Bel-Abes and Saida, ditch between Ain Témouchent and Valmy (Oran province), ditch near Chélif, pond near Blida province, pond between Ain El-Beida and Khenchela, and this study. Palaearctic species (Martens & Savatenalinton 2011).

Ilyocypris gibba (Ramdohr, 1808), recorded by Gauthier (1928a) in Fetzara marsh, pond near Wadi Boudjema (Annaba province), and this study. Nearctic, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Ilyocypris biplicata (KOCH, 1838), recorded by Gauthier (1928a) in drainage Canal of ancien Halloula Lake, pond near Halloula Lake, pond near Medea, marsh between Jijel and El-Millia, ditch near Fetzara marsh, pond on the road of Bouliff (El-Kala), marsh Chaib (Chott Ech-Chergui), Trough Ain El-Ibel (Djelfa province), brackish marsh Djelfa, water hole near Laghouat, ditch near Tlemcen, Wadi Béja (Souk-Ahras), Oued Bou-Sellam between Sétif and Bordj Bou-Arréridj. Australian, Oriental and Palaearctic regions (Martens & Savatenalinton 2011).

Family Notodromadidae Kaufmann, 1900

Subfamily Notodromadinae Kaufmann, 1900

Notodromas persica Gurney, 1921, recorded by Gauthier (1928a) inWadi between Azazga andYakouren great Kabylie, Wadi near Yakouren, Wadi Talmatz Tighalt great Kabylie. Palaearcticspecies (Martens & Savatenalinton 2011).

Family Cyprididae Baird, 1845

Subfamily Cypridinae Baird, 1845

Cypris bispinosa Lucas, 1849, recorded by Gauthier (1928a) in pond Akhal Ben-Aknoun Dely-Brahim (Algiers), marsh Rassauta (Algiers), ditch near Algiers, ancien Halloula Lake (Algiers), pond near Boumerdes province, agoulmine between Yakouren and El-Kseur

(Bejaia province), marsh near Bejaia, pond near Wadi Boudjema (Annaba province), pond on the road of Bouliff (El-Kala), Lac Noir, pond agoulmine Lakhès (Teniet-El-Haad, Tissemsilt), pond la Mardja (Chélif), Saharan springs (Kreider, El-Bayadh province), Samraoui *et al*.(1998) in temporary pond Bordj du Cantonnier (Guerbes-Senhadja, Skikda province) and this study. Palaearctic species (Martens & Savatenalinton 2011).

Cypris pubera O. F. Muller, 1776, new record in this study, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Subfamily Eucypridinae Bronshtein, 1947

Eucypris mareotica (Fischer, 1855), recorded by Gauthier (1928) in Dam of Es-Stel (Biskra province), Daya Oum El-Reblaz (Gharabas Lake), Sebkha of Oran, Daya Morselli (Sénia Lake), salt R'dir (creek) near Ain Ez-Zarga, brackish marsh (Djelfa province), pond near Mostaganem province. Palaearctic species (Martens & Savatenalinton 2011).

Eucypris kerkyrensis Stephanides, 1937, new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

Eucypris lilljeborgi (G.W. Müller, 1900), new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

Eucypris ungulata (Moniez, 1891), recorded by Moniez (1891) in Sebkha of Oran, Gauthier (1928) in Sebkha Oum El-Ledjem (Mécheria, Naama province). Palaearctic species (Martens & Savatenalinton 2011).

Eucypris virens (Jurine, 1820), recorded by Moniez (1891) in Sénia Lake, Gharabas Lake, Chegga (Biskra province), Gauthier (1928) in ponds from Forest of Réghaia (Algiers), pond Akhal Ben-Aknoun Dely-Brahim (Algiers), marsh Rassauta (Algiers), ditch near Algiers, pond near Wadi Smar (Algiers), ancien Halloula Lake (Algiers), pond near Halloula Lake,

marsh near Bejaia province, pond near Wadi Boudjema (Annaba province), ditch near marsh of Fetzara, Lac des Oiseaux, pond between Oubeira and Tonga Lakes, Forest marshy near ancien Tonga Lake, pond on the road of Bouliff (El-Kala), pond of Wadi El-Aroug (Mellah Lagoon), pond agoulmine Lakhès (Teniet-El-Haad, Tissemsilt), pond of Santon (west Oran province), ditch near Tlemcen, R'dir (creek) near Mécheria, Daya El-Itima (Mécheria, Naama province), Daya Oum Si-chérif (Mécheria), Kreider dam (Chott Ech-Chergui), R'dir in El-Bayadh province, Garaa El-Kheli, R'dir near Djelfa province, pond of Wadi Sfid (Saida), ditch betwenn Sidi-Bel-Abes and Saida provinces, ditch near Tlemcen province, ditch between Ain Témouchent and Valmy (Oran province), ditch near Chélif province, pond in Medea province, Sebkha of Oran side of Bou-Tlélis, Wadi Béja (Souk-Ahras), Wadi Saida, Wadi near Ain Sidi Hafir, Saharan springs (Kreider, El-Bayadh province) and this study. Cosmopolitan species (Martens & Savatenalinton 2011).

Prionocypris zenkeri (ChyZer &Toth, 1858), new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

Tonnacypris lutaria (Koch, 1838), recorded by Gauthier (1928a) in pond agoulmine Lakhès (Teniet-El-Haad, Tissemsilt), pond of Ain Sidi Hafir, ditch near Tlemcen, R'dir near Mécheria, DayaEl-Itima (Mécheria), R'dir near El-Bayadh province, Dam Guelt-Es-Stel, R'dir near Laghouat, pond of Wadi Sfid (Saida), ditch between Sidi-Bel-Abes and Saida, ditch near Tlemcen, ditch between Ain Témouchent and Valmy (Oran), pond Djurdjura great Kabylie and this study. Palaearctic species (Martens & Savatenalinton 2011).

Trajancypris clavata (Baird, 1838), recorded by Gauthier (1928a) in pond near Algiers, pond from Medea province, pond of Santon (west Oran province), pond near from Blida province, Wadi Béja (Souk-Ahras) and this study. Palaearctic species (Martens & Savatenalinton 2011).

Subfamily Cypricercinae McKenzie, 1971

Bradleycypris obliqua *(*Brady, 1868), recorded by Gauthier (1928a) in pond from forest of Réghaia Algiers, ditch near Algiers, pond from forest of Farghen-Mittidja (Algiers province), agoulmine Boualsous, agoulmine Ikeur, marsh between Jijel and El- Millia, Frétis Lake near Fetzara marsh, pond near Wadi El-Aneb from Annaba province, pond near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, pond on the road of Bouliff (El-Kala, El Tarf province). Nearctic, Oriental, Palaearctic species (Martens & Savatenalinton 2011).

Subfamily Herpetocypridinae Kaufmann, 1900

Herpetocypris chevreuxi (Sars, 1896), recorded by Gauthier (1928a) in pond near Halloula Lake (Algiers), pond in Boumerdes province, agoulmine Boualsous from Bejaia province, Oubeira Lake, marsh near Oubeira Lake, pond on the road of Bouliff (El-Kala), marsh near Wadi El-Aroug (Mellah Lagoon), pond la Mardja (Chélif provine), Wadi between Azazga and Yakouren great Kabylie, pond near Wadi Boudjema and this study. Nearctic, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Herpetocypris reptans (Baird, 1835), recorded by Gauthier (1928a) in drainage Canal of ancien Halloula Lake (Algiers), marsh between Jijel and El-Millia, pond in Medea province, pond agoulmine Lakhès (Teniet-El-Haad, Tissemsilt), marsh of Chaib (Chott Ech-Chergui), marsh of Baniou (Chott El-Hodna), pond la Mardja (Chélif), marsh Bou-Merzoug (Ain-M'lila), marsh near of Guerrah El-Tarf (Ain Beida), La Chaaba Bergoug great Kabylie, Wadi Béja (Souk-Ahras), Wadi Djoumine, Wadi near Sedrata, Wadi Cherf between Sedrata and Ain Baida, Wadi Berda near Khroub (Constantine province), small Wadi near Sétif, Wadi Bou-Sellam between Sétif and Bordj Bou-Arréridj provinces, Saharan springs (Kreider), hot spring Ain Melah (Mécheria, Naama province).Palaearctic species (Martens & Savatenalinton 2011).

Subfamily Cyprinotinae Bronshtein, 1947

Heterocypris balnearia (Moniez, 1893), described for the first time by Moniez (1893) in Hammam Dbegh (previosely Hammam Meskoutine) Guelma province, and by Mason (1939) in the same locality at 40-50° C. Palaearctic species (Martens & Savatenalinton 2011).

Heterocypris Barbara (Gauthier & Brehm, 1928), recorded by Gauthier (1928a) in R'dir near Laghouat province, pond of Wadi Sfid (Saida), ditch between Ain Témouchent and Valmy (Oran), pond near Khenchela province, pond near Mécheria (Naama province), R'dir (Creek) near Baniou (M'Sila province), R'dir (brackish Creek) near Ain Ez-Zarga, brackish marsh from Djelfa province, Gauthier & Brehm (1928) in R'dir near Laghouat and this study. Palaearctic species (Martens & Savatenalinton 2011).

Heterocypris congenera (Vávra, 1897), recorded by Gauthier (1928a) in Oubeira Lake from El-Tarf province. Afrotropical species (Martens & Savatenalinton 2011).

Heterocypris exigua (Gauthier & Brehm, 1928), recorded by Gauthier (1928a) in pond near Wadi Boudjema, pond near Wadi El-Aneb (Annaba province), pond near Lac des Oiseaux, Oubeira Lake, marsh near Oubeira Lake, pond on the road of Bouliff (El-Kala), Gauthier & Brehm (1928) in pond on the road of Bouliff (El-kala). Afrotropical species (Martens & Savatenalinton 2011).

Heterocypris incongruens (Ramdohr, 1808), recorded by Moniez (1891) in Biskra, Chegga, Sidi-Rached, Gauthier (1928a) in pond from Medea province, pond near Blida province, marsh El-Chaib (Chott Ech-Chergui), Kreider Dam (Chott Ech-Chergui), Trough of Ain El-Ibel, flooded Steppe in Djelfa province, Ain Oussera Dam, water hole near Djelfa, marsh of Baniou (Chott El-Hodna, M'Sila province), pond of Wadi Sfid (Saida), ditch between Ain Témouchent and Valmy (Oran), ditch near Chélif province, marsh near Guerrah El-Tarf (Ain Beida), Sebkha Ain Ouarka (East Ain Safra), brackish marsh (Djelfa), Wadi Béja (Souk-Ahras), Wadi Berbour between Saida and Sidi-Bel-Abbès provinces, Wadi Mzi near Laghouat

province, hot spring Melah (Mécheria, Naama province) and this study, cosmopolitan species (Martens & Savatenalinton 2011).

Heterocypris rotundata (Bronshtein, 1928) new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

Heterocypris salina (Brady, 1868), recorded by Gauthier (1928a) in pond from Boumerdes province, marsh of Chaib (Chott Ech-Chergui), Kreider Dam (Chott Ech-Chergui), Ain Oussera Dam, pond Ain Ez-Zerga (Bordj Bou-Arreridj province), pond Bou-Merzoug (Ain M'lila), Sebkha Ain Ouarka (East Ain Safra), Bahr (Lake) Temacine, Saharan springs (Kreider) and this study. Nearctic, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Subfamily Isocypridinae Rome, 1965

Isocypris beauchampi (Paris, 1920) new record in this study. Nearctic, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Subfamily Scottiinae Bronshtein, 1947

***Scottia* sp. Brady & Norman, 1889,** new record in this study.

Subfamily Cypridopsinae Kaufmann, 1900

Cypridopsis elongata (Kaufmann, 1900), recorded by Gauthier (1928a) in pond near Algiers province, marsh between Oubeira and Tonga Lakes, pond between Blida and Miliana, ditch near Tlemcen province, Palaearctic species (Martens & Savatenalinton 2011).

Cypridopsis hartwigi (G.W. Müller, 1900), recorded by Gauthier (1928a) in pond from forest of Réghaia (Algiers), pond Akhal Ben-Aknoun Dely-Brahim (Algiers), marsh la Rassauta (Algiers), ancien Halloula lake (Algiers), pond near Boumerdes province, agoulmine (pond) between Yakouren and El-Kseur (Bejaia province), pond near Wadi El-Aneb (Annaba province), marsh of Mekhada, pond near Lac des Oiseaux, pond on the road of Bouliff (El-

Kala), Kreider Dam (Chott Ech-Chergui). Palaearctic species (Martens & Savatenalinton 2011).

Cypridopsis vidua (O. F. Muller, 1776), recorded by Gauthier (1928a) in ponds from forest of Réghaia (Algiers), pond Akhal Ben-Aknoun Dely-Brahim (Algiers), five Wadis from Algiers province: Hamiz, Harrach, Mazafran, Réghaïa, Boudouaou, pond near Boumerdes province, agoulmine (pond) Temjout from Bejaia province, marsh between Bejaia and Jijel provinces, Lac des Oiseaux, pond near Lac des Oiseaux, drainage Canal of ancien Tonga Lake, pond of Santon (west Oran province), Wadi between Azazga and Yakouren great Kabylie, Creek Bergoug, Wadi Nil Jijel province, Wadi Djoumine, Wadi Béchar, Samraoui *et al*. (1998) in Oubeira Lake and this study. Cosmopolitan species (Martens & Savatenalinton 2011).

Plesiocypridopsis newtoni (Brady & Robertson, 1870), recorded by Gauthier (1928a) in ditch between Ain Témouchent and Valmy (Oran), pond between Ain El-Beida and Khenchela, marsh near Guerrah El-Tarf (Ain Beida), brackish marsh from Djelfa province, Samraoui *et al.* (1998) in Lac Ochrea (shallow pond) from El-Tarf province, and this study. Afrotropical and Palaearctic species (Martens & Savatenalinton 2011).

Martenscypridopsis materia Karanovic & Pesce, 2000, recorded by Karanovic & Pesce (2000) in well from Tindouf province. Afrotropical species (Martens & Savatenalinton 2011).

Sarscypridopsis aculeata (Costa, 1847), recorded by Gauthier (1928a) in pond from Boumerdes province, brackish marsh from Djelfa province, and this study, almost cosmopolitan species (Martens & Savatenalinton 2011).

Potamocypris arcuata (Sars, 1903), recorded by Gauthier (1928a) in pond from Medea province, pond from Blida province, pond agoulmine Lakhès (Teniet-El-Haad, Tissemsilt province), marsh Chaib (Chott Ech-Chergui), Guelt-Es-Stel Dam from Djelfa province, R'dir near Laghouat, ditch between Sidi-Bel-Abes and Saida provinces, ditch between Ain

Témouchent and Valmy (Oran), ditch near Chélif province, pond from Blida province, pond between Ain El-Beida and Khenchela, and this study. Palaearctic species (Martens & Savatenalinton 2011).

Potamocypris smaragdina (Varva, 1891), new record in this study. Nearctic, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Potamocypris variegata Kaufmann, 1900, new record in this study. Palaearctic species (Martens & Savatenalinton 2011).

Potamocypris villosa (Jurine, 1820), new record in this study. Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Superfamily Cytheroidae Baird, 1850

Family Limnocytheridae Klie, 1938

Subfamily Limnocytherinae Klie, 1938

Limnocythere inopinata (Baird, 1843), new record in this study. Nearctic, Afrotropical and Palaearctic species (Martens & Savatenalinton 2011).

Leucocythere algeriensis Martens 1989 recorded by Danielopol *et al.* (1989) and identified by Koan Martens from samples collected by Dumont (1979) in Wadi Tesselata, Tassili-n-Ajjer, drying pool in temporary river system. Accompanying fauna: bisexual population of *Ilyocypris getica* and *Heterocypris* sp.

Family Cytherideidae Sars, 1925

Cyprideis torosa (Jones, 1850), recorded by Gauthier (1928a) in Wadi Réghaïa, Fetzara marsh (Annaba province), Sebkha Ain-Ouarka (East of Ain-Safra), Bahr (Lake) Temacine. Afrotropical, Australasian, Neotropical and Palaearctic species (Martens & Savatenalinton 2011).

Family Loxoconchidae Sars, 1925

Loxoconcha elliptica Brady, 1868, this marine species recorded by Gauthier (1928a) in Mafrag estuary from El-Tarf province.

Table 3. Distribution of ostracod species found in 117 sampling sites from 18 provinces in this study.

Site no	Site name (Type)	Province	Sp. code
1	Les Salines (temporary marsh)	Annaba	Cp (1); Ev (280; 51j; 33v); Id (4); Ij (20); Ib (2; 2j); Pn (140); Pa (17); Sa (104); TI (3)
2	Boukhadra (temporary marsh)	Annaba	Cb (31); Ev (223; 21j); Ig (8; 4j)
3	El-Rym (temporary marsh)	Annaba	Cn (1M); Ev (153; 60j); Hi (1)
4	Laalalig (permanent pond)	Annaba	Cv (3); Ev (75: 2j; 2v); Hi (30; 20j); Ig (15;20)
5	Sidi Salem (temporary pond)	Annaba	Cn (1; 1j); Cv (8); Ev (112; 20j; 4v); Hi (1) Ig (1); Pn (20); Sa (2)
6	Kherraza (temporary pond)	Annaba	Ev (70)
7	El Bouni (ditch)	Annaba	Cn (19); Ev (334; 37j)
8	Bouzaaroura (temporary pool)	Annaba	Cn (4)
9	Les Salines 1(temporary pool)	Annaba	Ev (25: 39j)
10	Oued El Nil (temporary pool)	Annaba	Cn (2)
11	Boukhadra (El-Rym) (temporary pool)	Annaba	Cn (3); Ev (89; 5j)
12	Boukhadra (temporary pool)	Annaba	Ev (48)
13	Hdjar-Diss (ditch)	Annaba	Ev (6; 2v); Hi (4; 1v)
14	Kalitoussa (basin)	Annaba	Cv (1); Ev (24)
15	Boukhmira 1(temporarypool)	Annaba	Hi (1); Sa (195; 97j)
16	Boukhmira 2(temporary pool)	Annaba	Ev (3; 10j); Sa (111)
17	Les Ruines (rocky basin)	Annaba	Cb (2; 1j)
18	El Chara (permanent pool)	Annaba	Cv (1); Hc (10; 14j)
19	El Manjra (temporary pool)	Annaba	Hi (1); Ig (1)
20	El-Chorfa (ditch)	Annaba	Cb (6); Ev (28; 6j)
21	El-Karma 1(basin)	Annaba	Ev (1M; 4; 1j)
22	El-Karma 2 (ditch)	Annaba	Ev (2; 11j); Hr (7)
23	El-Karma 3 (temporary pool)	Annaba	Ev (16; 8j)
24	El-Eulma (temporary pool)	Annaba	Ev (23; 1j)

25	Chbaita Mokhtar (temporary pool)	Annaba	Ev (18; 6j)
26	El Frine (peanut field)	El-Tarf	Cv (1) ; Cb (2 ; 1j) ; Cp (18) ; Ev (11M ; 279 ; 3j) ; Pz (4)
27	Mridima (temporary pool)	El-Tarf	Cb (115 ; 3j) ; Ev (10j)
28	El-Guentra (temporary pool)	El-Tarf	Cb (20; 19j)
29	Sidi Mbarek (temporary pool)	El-Tarf	Cb (12; 3v)
30	El-Feid (marsh)	El-Tarf	Ev (22)
31	El-Battah (temporary pool)	El-Tarf	Ev (1; 3j)
32	El Oued (temporary pool)	El-Tarf	Cv (3); Ev (4j); Ig (3; 5v); Ib (1); Ps (3)
33	Dey Lagraa (temporary pool)	El-Tarf	Cn (1); Cv (3); Cb (1); Ev (91)
34	Souk Rguibet (temporary pool)	El-Tarf	Ev (9; 2j); Pn (3)
35	El Qriaat (temporary pool)	El-Tarf	Cb (1); Ev (7)
36	Ain Khiar (temporary pool)	El-Tarf	Cv (1)
37	Sebaa (temporary pool)	El-Tarf	Ev (2M; 6)
38	El Malha (temporary pool)	El-Tarf	Hc (1; 4j)
39	El Henaya (temporary pool)	El-Tarf	Ev (1M); Hc (4; 15j)
40	Faid El Gharnoug (temp. pool)	El-Tarf	Ev (1)
41	Houaychia (ditch)	El-Tarf	Ev (35)
42	Boutheldja 1(ditch)	El-Tarf	Ev (28; 9j)
43	Boutheldja 2 (temporary pool)	El-Tarf	Ev (62; 2j)
44	El Frine 2 (peanut field)	El-Tarf	Ev (223)
45	Draouche (peanut field)	El-Tarf	Ev (2j)
46	Berrihane (temporary pool)	El-Tarf	Cb (2); Ev (24); Ib (1)
47	El Asfour (temporary pool)	El-Tarf	Ev (48; 1v); Ib (1)
48	Jnene Echouk (temporary pool)	El-Tarf	Ev (64; 16j)
49	Oum Tboul (Dghidgha) (temporary pool)	El-Tarf	Cb (33; 13j); Ev (243; 44j)
50	Essouarekh (temporary pool)	El-Tarf	Cb (3); Ev (33); Sa (1)
51	La Messida (temporary pool)	El-Tarf	Ev (46; 6j); Ig (1)
52	El –Aioun (ditch)	El-Tarf	Ev (129; 6j)
53	Oum Tboul (temporary pool)	El-Tarf	Ev (37); Ib (1)
54	Ain Ben Beida1(ditch)	El-Tarf	Ev (16; 1j)
55	Ain Ben Beida2 (temporary pool)	El-Tarf	Ev (17; 3j); TI (2); Ige (9)
56	El-Chatt (ditch)	El-Tarf	Ev (3)
57	El Frine (peanut field)	El-Tarf	Ev (24)
58	Oubeira lake (a pond)	El-Tarf	Ev (1)
59	Garaa Bechna (marsh)	Skikda	Cb (83; 5j); Ev (17j)
60	Aïn Nechma (temporary pool)	Skikda	Cb (2; 2j); Ev (3M; 107; 3j; 2v)
61	Lemsaousa (temporary pool)	Skikda	Ev (40; 15j)
62	Garaa Beni- Mohamed	Skikda	Cn (1j); Cb (1j); Ev (111; 15j)

	(marsh)		
63	Deyar El Jedri (ditch)	Skikda	Cn (1); Ev (190)
64	Mgez Stah (temporary pool)	Skikda	Ev (28; 25j)
65	El Hamma (temporary pool)	Skikda	Ev (2; 5v)
66	Hdjar –Soud (temporary pool)	Skikda	Ev (35; 4j)
67	Garaa Rmaila (marsh)	Skikda	Ev (3)
68	Ras El Maboun (ditch)	Skikda	Ev (3; 46j; 2v); Ig (3; 3v)
69	Akarom (temporary pool)	Skikda (Collo)	Hr (27); Ig (1)
70	Telza (temporary pool)	Skikda (Collo)	Hi (33)
71	El-Mraige (temporary pool)	Skikda (Collo)	Hi (7)
72	Bouchegouf 1 (temporary pool)	Guelma	Ev (52)
73	Bouchegouf 2 (temporary pool)	Guelma	Cn (3) ; Ev (4 ; 8j)
74	Tamlouka (temporary pool)	Guelma	Ev (2)
75	Hammam Dbegh (thermal pool)	Guelma	Hb (23; 9j)
76	Guerrah (temporary pool)	Constantine	Ev (17) ; Hb (8)
77	Guerrah (ditch)	Constantine	Ev (26 ; 7j)
78	Bourgas1 (temporary pool)	Souk-Ahras	Cv (1)
79	Khemissa (pond)	Souk-Ahras	Hs (1 ; 1j)
80	Safsaf (temporary pool)	Tébessa	Pa (10); Tc (5; 5v; 4j)
81	El-Doukken (temporary pool)	Tébessa	Ev (4); Ige (16)
82	El-Malabiod (temporary pool)	Tébessa	Ige (7 ; 2v)
83	Ain-Kemellal (temporary pool)	Tébessa	Hi (3M; 6; 3j; 7v)
84	El-Sondoug (temporary pool)	Tébessa	Tc (1; 2v)
85	El-Btine (reservoir)	Tébessa	Tc (1)
86	Dbidiba (temporary pool)	Tébessa	Cv (1; 1j); Pva (18; 12j; 3v)
87	Ain-Sadik (temporary pool)	Tébessa	Hs (24; 37j)
88	Oum-Arroudj (pond)	Tébessa	Ev (1); Ig (1M; 1)
89	Hamiet (Chott)	Sétif	Ev (14) ; Hi (1) ; *Ssp*.(2)
90	Bazer (Sebkha)	Sétif	Hb (1; 3j)
91	Oued Aissi (temporary pool)	Tizi Ouzou	Hi (39; 5j)
92	Illoula Ou Malou (temporary marsh)	Tizi Ouzou	Cv (5); Ev (1, 5j)
93	Bouguezoul (Chott)	Medea	Ev (2; 3j); Ig (93)
94	Tizourite (temporary pool)	Batna	Ev (12; 11j)
95	Draa-Boultif (temporary pool)	Batna	Ev (17; 2j); Li (3); Pv (5)

96	Djendli (Sebkha)	Batna	EI (1); Ev (15M; 236; 87j); Sa (1)
97	Es-Shari (Chott)	Batna	Hi (6); Pv (4)
98	Tinsilt (Chott)	Oum El Bouaghi	Ev (45M ; 434 ; 39j) ; Ek (3) ; EI (2)
99	Timerganine (Chott)	Oum El Bouaghi	Ev (2 ; 2j) ; Ig (1M) ; Tc (2)
100	El-Tarf (Chott)	Oum El Bouaghi	Ev (154 ; 27j)
101	El-Maghssel (Chott)	Oum El Bouaghi	Ev (10 ; 3j) ; Hb (2)
102	Ourkis (Reservoir)	Oum El Bouaghi	Cv (1); Ev (1; 1j); Hs (31); Pva (2)
103	Guellif (Chott)	Oum El Bouaghi	EI (1; 1j); Hr (15; 1j)
104	Melah (Chott)	Oum El Bouaghi	Cv (12); Hi (3)
105	Ez-Zemoul (Sebkha)	Oum El Bouaghi	Hi (42; 5j)
106	M'Toussa (Chott)	Khenchela	Hi (4)
107	Ouled M'barek (Sebkha)	Khenchela	Ev (14; 6j; 2v)
108	Zahres El-Chergui (Chott)	Djelfa	Ev (2); Hb (1M; 13)
109	Zahres El-Guarbi (Chott)	Djelfa	Hr (58)
110	Tindla (Chott)	El Oued	Hi (2)
111	Ettouama (Sebkha)	Oran	Ev (14); Hb (5M; 9); Hi (8M; 8); *Ssp*.(1)
112	Telamine (Sebkha)	Oran	Ev (8M; 10; 8j); Hi (11; 5j)
113	Sidi Chami (Sebkha)	Oran	Ev (3; 5j); Hb (11; 2j); Hi (46; 3j); Hr (16); Pn (40; 2j)
114	Daya Bagrat (Sebkha)	Oran	EI (5); Hb (1)
115	La Macta (marsh)	Oran	Hi (3)
116	Sidi Bouziane (Salt marsh)	Relizane	Ev (2)
117	Oued El Besbes (ditch)	Sidi Bel Abbes	Hi (5)

Abbreviations: *Candona neglecta* (Cn); *Cypridopsis vidua* (Cv); *Cypris bispinosa* (Cb); *Cypris pubera* (Cp); *Eucypris kerkyrensis* (Ek); *Eucypris lilljeborgi* (El); *Eucypris virens* (Ev); *Herpetocypris chevreuxi* (Hc); *Heterocypris barbara* (Hb); *Heterocypris incongruens* (Hi); *Heterocypris rotundata* (Hr); *Heterocypris salina* (Hs); *Ilyocypris decipiens* (Id); *Ilyocypris getica* (Ige); *Ilyocypris gibba* (Ig); *Ilyocypris* cf.*japonica* (Ij); *Isocypris beauchampi* (Ib); *Limnocythere inopinata* (Li); *Plesiocypridopsis newtoni* (Pn); *Potamocypris arcuata* (Pa); *Potamocypris smaragdina* (Ps); *Potamocypris variegata* (Pva); *Potamocypris villosa* (Pv); *Prionocypris zenkeri* (Pz); *Sarscypridopsis aculeata* (Sa); *Scottia* sp. (Ssp.); *Tonnacypris lutaria* (Tl); *Trajancypris clavata* (Tc); Valve (v); Juvenile (j); Male (M). Number represents parthenogenetic individuals or females.

3.1.2. Cladocera of Algeria

3.1.2.1. Checklist of Cladocera

In total, 38 taxa belonging to 18 genera and seven families: Sididae (3%), Daphnidae (42%), Bosminidae (3%), Chydoridae (36%), Ilyocryptidae (3%), Moinidae (5%) and Macrothricidae (8%) (Fig.10) have been identified in this study. Among them 11 species (*Ceriodaphnia quadrangula* (O.F. Müller, 1785), *D. curvirostris* Eylmann, 1887, *D. galeata* Sars, 1864, *D. mediterranea* Alonso, 1985, *Daphnia obtusa* Kurz, 1874, *Macrothrix dadayi* Behning, 1941, *Scapholeberis rammneri* Dumont et Pensaert, 1983, *Acroperus angustatus* Sars, 1863, *Alona nuragica* Margaritora, 1971, *Ovalona orellanai* (Alonso, 1996), *Coronatella anemae* Van Damme et Dumont, 2008) are new to Algeria. The maximum number of taxa per site was eight (El Frine, El-Tarf province) (Fig.11) and seven per sample (Kalitoussa pool, Annaba province) (Fig.12) Among the revealed taxa, *Simocephalus vetulus* (O.F. Müller, 1776) was the most frequently encountered species recorded in 27 sampling sites, followed by *Daphnia magna* Straus, 1820 found in 17 sampling sites. On the other hand, the following 10 rare species have been found only in a single locality each: *Acroperus angustatus* Sars, 1863, *Alona affinis* (Leydig, 1860), *A. nuragica* Margaritora, 1971, *Bosmina longirostris* (O.F. Müller, 1776), *Coronatella rectangula* (Sars, 1862), *Ilyocryptus* sp., *Macrothrix spinosa* King, 1853, *Ovalona orellanai* (Alonso, 1996), *Oxyurella tenuicaudis* (Sars, 1862), *Scapholeberis rammneri* Dumont & Pensaert, 1983 (Fig. 13).

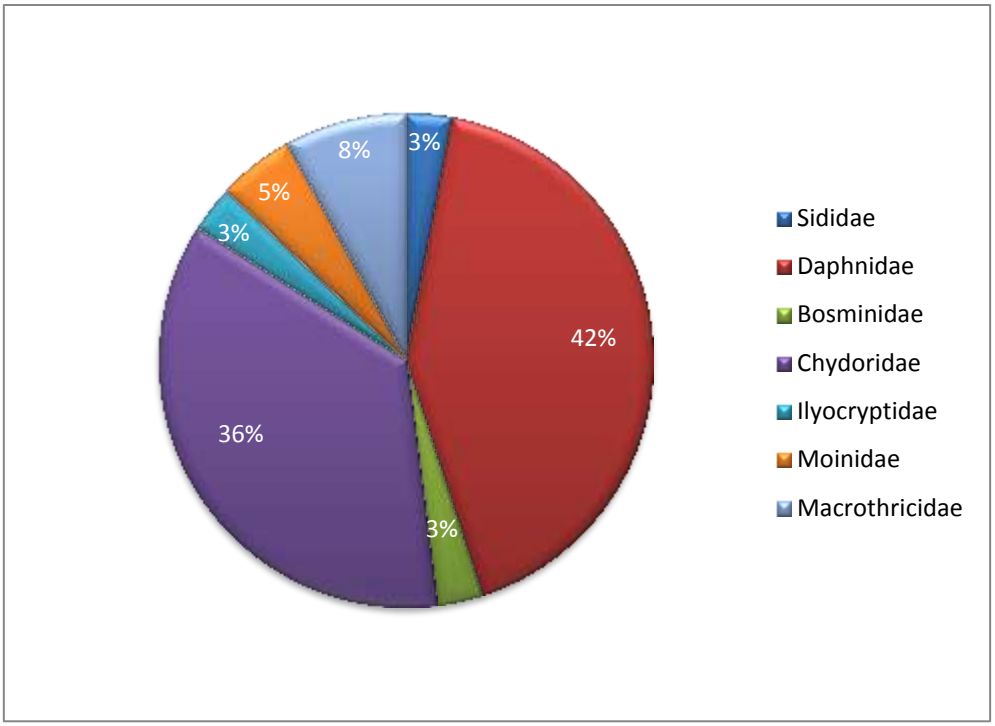

Figure 10. Distribution percentage of Cladocera families in this study.

Figure11. Photo of El Frine pond.

Figure 12. Photo of El Kalitoussa basin.

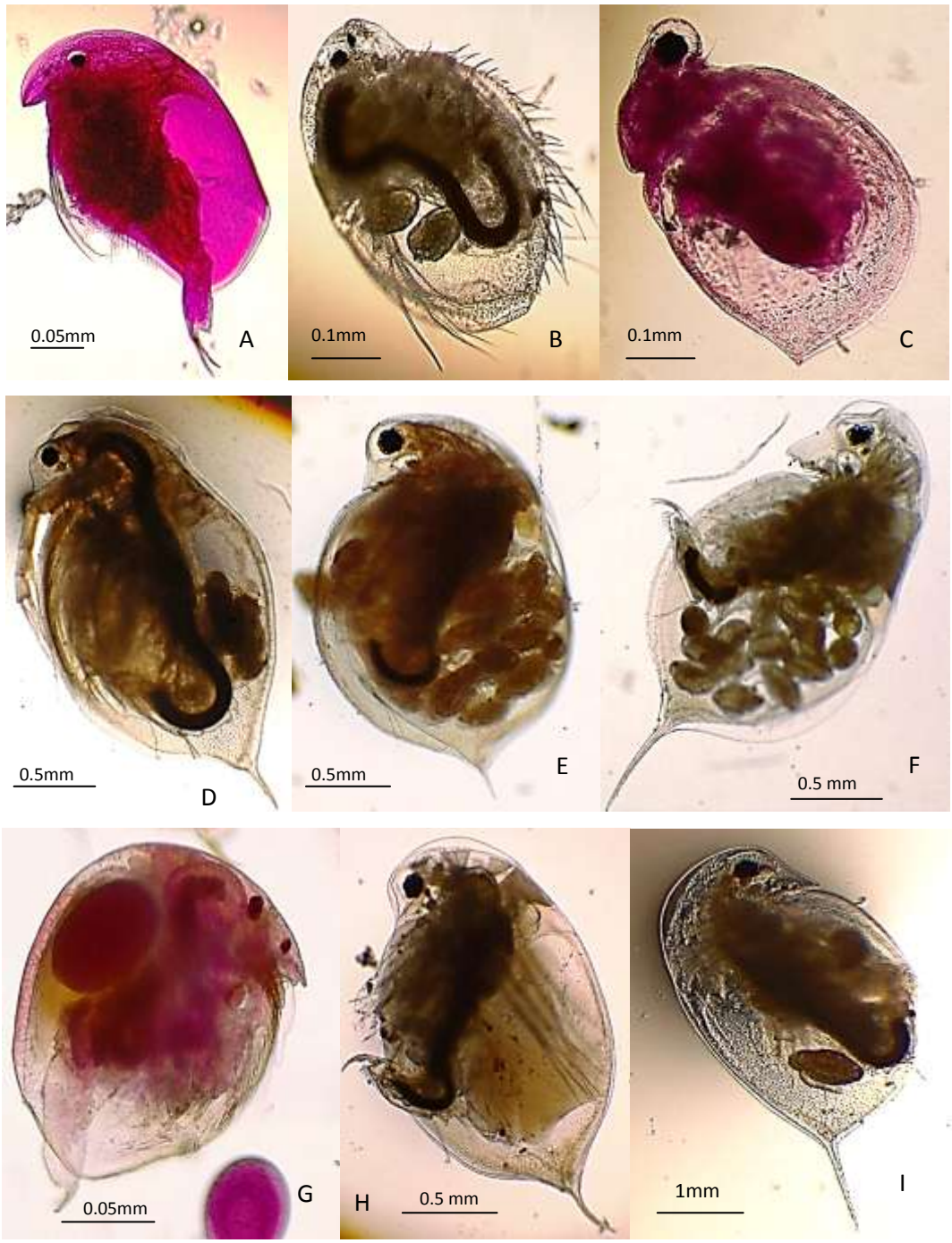

Figure 13. Some new and common Cladocera species: A. *Acroperus angustatus*, B. *Macrothrix dadayi*, C. *Ceriodaphnia* cf. *quadrangula*, D. *Daphnia mediterranea*, E. *D. obtusa*, F. *D.galeata*, G. *Coronatella anemae*, H. *Daphnia curvirostris*, I. *D. magna*.

Table 4. List of Cladocerafound in this study, (*) new record.

Family	Genus	Species	Author, year
Sididae Baird, 1850	*Diaphanosoma*	*brachyurum*	(Liévin, 1848)
Daphniidae Straus, 1820	*Ceriodaphnia*	*laticaudata*	P. E. Müller, 1867
	**Ceriodaphnia*	*quadrangula*	(O. F. Müller, 1785)
	Ceriodaphnia	*reticulata*	(Jurine, 1820)
	Daphnia (*Ctenodaphnia*)	*atkinsoni*	Baird, 1859
	Daphnia (C*tenodaphnia*)	*chevreuxi*	Richard, 1896
	**Daphnia (Daphnia)*	*curvirostris*	Eylmann, 1887
	**Daphnia (Daphnia)*	*galeata*	Sars, 1864
	Daphnia (*Ctenodaphnia*)	*magna*	Straus, 1820
	**Daphnia (Ctenodaphnia)*	*mediterranea*	Alonso, 1985
	Daphnia (Ctenodaphnia)	*similis*	Claus, 1876
	**Daphnia (Daphnia)*	*obtusa*	Kurz, 1874
	Daphnia (Daphnia)	*pulex*	Leydig, 1860
	Megafenestra	*aurita*	(Fischer, 1849)
	**Scapholeberis*	*rammneri*	Dumont & Pensaert, 1983
	Simocephalus	*exspinosus*	(De Geer, 1778)
	Simocephalus	*vetulus*	(O. F. Müller, 1776)
Moinidae Goulden, 1968	*Moina*	*brachiata*	(Jurine, 1820)
	Moina	*salina*	Daday, 1888
Ilyocryptidae Smirnov, 1976	*Ilyocryptus*	*sp*	(Liévin, 1848)
Macrothricidae Norman et Brady, 1867	**Macrothrix*	*dadayi*	Behning, 1941
	Macrothrix	*hirsuticornis*	Norman and Brady, 1867
	Macrothrix	*spinosa*	King, 1853
Bosminidae Baird, 1845	*Bosmina* (*Bosmina)*	*longirostris*	(O. F. Müller, 1776)
Family Chydoridae Dybowski et Grochowski, 1894			
Subfamily Aloninae Dybowski et Grochowski, 1894 emend Frey, 1967			
	**Acroperus*	*angustatus*	Sars, 1863
	Alona	*affinis*	(Leydig, 1860)
	Alona	*elegans*	Kurz, 1875
	**Coronatella*	*anemae*	Van Damme & Dumont, 2008
	Coronatella	*rectangula*	(Sars, 1862)
	Oxyurella	*tenuicaudis*	(Sars, 1862)
	**Ovalona*	*nuragica*	(Margaritora, 1971)

	**Ovalana*	*orellanai*	(Alonso, 1996)
	Tretocephala	*ambigua*	(Lilljeborg, 1901)
Subfamily Chydorinae Dybowski et Grochowski, 1894			
	Alonella	*excisa*	(Fischer, 1854)
	Chydorus	*sphaericus*	(O. F. Müller, 1776)
	Dunhevedia	*crassa*	King, 1853
	Pleuroxus	*aduncus*	(Jurine, 1820)
	Pleuroxus	*letourneuxi*	(Richard, 1888)
7 Family	**20 Genera**	**38 Species**	

3.1.2. 2. Distribution of Cladocera in Algeria

Order Ctenopoda Sars, 1865

Family Sididae Baird, 1850

Diaphanosoma brachyurum (Liévin, 1848), recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891) in Sidi Yahia (Biskra province), Gauthier (1928a) in Oubeira Lake,The forest of Réghaia (7 ponds), marsh of Fetzara (Annaba province), marsh of mekhada, marsh between Oubeira and Tonga Lakes, Gauthier (1931) in Sahara (Hoggar), Beadle (1943) in a small Ain Zerga Lake in Northern Touggourt, Samraoui *et al.* (1998) in Lac Bleu; Samraoui (2002) in Garaa Dakhla, and in this study. This species is regarded Palearctic (Korovchinsky 1992), but similar forms have been reported from the Nearctic and Neotropical regions, forming a complex of cryptic species (Korovchinsky 2004; Kotov *et al.* 2013b). It is quite probable that in previous studies in Algeria other species could be present under this name, but further works are needed to study the genus diversity in Algeria adequately.

Diaphanosoma mongolianum Uéno, 1938, recorded by Korovchinsky (2004) in Keddara Dam, Boughzoul Dam, and guelta Efenni (rockpool in Sahara). This species is distributed in Afrotropical and Palaearctic regions (Kotov *et al.* 2013a).

Order Anomopoda Sars, 1865

Family Daphniidae Straus, 1820

Ceriodaphnia affinis Lilljeborg, 1901, recorded by Gauthier (1929, 1931) from a pool in Amguid (Sahara) and Hoggar respectively, and Gauthier (1934) from northern Algeria. Smirnov *et al.* (1995) did not recognize this species as valid, according to Kotov *et al.* (2013a) this is a junior synonym of *M. dubia*, but further studies are needed to resolve the taxonomic problems in *dubia*-group.

Ceriodaphnia cornuta Sars, 1885, recorded by Samraoui *et al.* (1998) in Oubeira Lake and Bordj du Cantonnier.This taxon is widely distributed in tropics and subtropics of all continents (Smirnov *et al*. 1995), but it definitively represents a group of species which are continental endemics (Sharma & Kotov 2013).

Ceriodaphnia dubia Richard,1894, recorded by Gurney (1909) in two ponds from Biskra and by Gauthier (1928a) in Wadi Boudjema (Annaba province), pond in Wadi Smar, ditch in Tlemcen province, Wadi Isser (Tlemcen province), ditch near Oran province, La macta, swamp flow channel (Oran province), agoulmine l'Akhès (4 ponds), pond from Medea province, El Ak'hal pond from Algiers, pond near Algiers, The forest of Réghaia (7 ponds, Algiers), pond in Boumerdes province, pond near Medea province, pond between Ain Beida and Khenchela province, pond near Wadi El Aneb from Annaba province, marsh of Mekhada, Lac des Oiseaux, pond south of El-kala, Bog near El-kala, Dumont (1987) in Sahara (Hoggar). Valid species regarded as cosmopolitan one (Smirnov *et al.* 1995; Chatterjee *et al.* 2013).

Ceriodaphnia laticaudata P. E. Müller, 1867, recorded by Gauthier (1928a) in a single localitythe forest of Réghaia (Algiers province), and in this study. Widely distributed in the Holarctic, Oriental zone, Africa and Australia (Smirnov *et al.* 1995; Chatterjee *et al.* 2013) and needs a revision.

Ceriodaphnia megops Sars, 1862, recorded by Dumont *et al.* (1979) in swamps bordering Lac des Oiseaux and northern edge of Oubeira Lake. Palaearctic and Nearctic regions (Kotov *et al.* 2013a).

Ceriodaphnia quadrangula (O.F. Müller, 1785), newly recorded species in Algeria. Cosmopolitan taxon (Kotov *et al*. 2013a) probably represented by a group of close species.

Ceriodaphnia reticulata (Jurine, 1820), recorded by Gurney (1909) in pond of Jardin d'Essai Algiers, Gauthier (1928a) in La chaaba Bergoug, Wadi Nil (Tlemcen province), ditch near Algiers, Oued M'zab, groundwater from Ghardaia province, santon pond (Oran province), Le Merdja (marsh) Chelif province, agoulmine l'Akhès (4 ponds) Teniet El-Had from Tismssilt province, old Halloula Lake (Algiers), pond from Medea province, agoulmine between Yakouren and El-Kseur, agoulmine Boualsous, agoulmine Temjout, agoulmine Ikeur, marsh near Bejaia province, small Wadi near Sétif province, marsh of Fetzara, Wadi Boudjema (Annaba province), pond near Tonga Lake, Gauthier (1929) in pond near Algiers, Samraoui *et al.* (1998) in marsh Bou Redim, Garaa Sidi Lakhdar, Samraoui (2002) in pond Lac Bleu, pond near Lac Bleu, and ponds from El Kala region (Isoetes, Berrihane, Berrihane (south), Mafragh, Oued El Aneb, Garaa Estah, Garaa Dakhla, Ghora, Ruppia), and present study. Widely distributed everywhere except Australia (Smirnov *et al*. 1995; Chatterjee *et al.* 2013).

Ceriodaphnia rigaudi Richard, 1894, recorded by Gauthier (1928a) in Oubeira Lake and marsh near Lac des Oiseaux, Gauthier (1931) in Hoggar. The latter author considered this taxon as valid; while Kotov*et al.* (2013a) mentioned it as species inquirenda (its differences from *C. cornuta* are unclear. Rzóska (1956) concluded that *C. rigaudi* to be regarded as a synonym of *C. cornuta*, but see the *cornuta* section above.

Ceriodaphnia rotunda (Straus, 1820), recorded by Gauthier (1928a) in a single site marsh la Rassauta (Algiers), Samraoui (2002) in pond Berrihane south. Almost cosmopolitan species (Kotov *et al.* 2013a).

Daphnia* (*Ctenodaphnia*) *atkinsoni Baird, 1859, recorded by Gauthier (1928a) in a ditch between Sidi Bel Abbes and Saida provinces, in R'dir near Méchria, R'dir near Tlemcen, Daya Oum Si-Cherif (Tlemcen province), R'dir near El-Bayadh province, marsh of El Kheli from El-Bayadh, pond of Oued Sfid (Saida province), ditch between from Saida, ditch in Tlemcen province, ditch between Ain Temouchent and Oran province, R'dir near Djelfa, Guelt-es-stel Dam Djelfa province, R'dir near Laghouat, Gauthier (1934) in pond near Algiers, Beadle (1943) in Sebkha of Oran and two adjacent pools, it is also recorded in the course of present study. Palaearctic taxon (Kotov *et al.* 2013a) apparently represented by a series of cryptic species (Petrusek *et al*. 2009).

Daphnia (Ctenodaphnia) barbata Weltner, 1898, recorded by Dumont (1979) in Righia from El Kala region. Afrotropical species (Benzie 2005; Kotov *et al.* 2013a).

Daphnia* (*Ctenodaphnia*) *carinata King, 1853, recorded by Gauthier (1928a, b) in Sebkha from Mécheria (Naama province), pond from Medea, ditch near Algiers, R'dir near Djelfa province, R'dir near Laghouat, steppe flooded south zahrez Ggharbi (Djelfa province), Drinking trough of Sidi-Maklouf (Djelfa), R'dir between Laghouat and Djelfa, and Gauthier (1929, 1931) in Sahara (Hoggar). It is distributed in Australasia, Southern Asia and Africa and is apparently represented by a large number of different species (Adamowicz *et al*. 2009), and presence of a member of this group in Africa is confirmed by genetic methods (Mergeay *et al*. 2005).

Daphnia* (C*tenodaphnia*) *chevreuxi Richard, 1896, initially described by Richard (1896a) based on Algerian samples from Annaba (marsh of Mekhada, pond near Fetzara Lake, Kheraza marsh), Gauthier (1928a) in Wadi Boudjema (Annaba province) and the forest of Réghaia (Algiers), Samraoui *et al.*(1998) in Sidi Makhlouf and Sidi Freitis Lakes, Samraoui (2002) in ponds Berrihane (south), El Hrib, Messida, El Frine, Khobzi, and in this study.

Palaearctic species (Kotov *et al.* 2013a). The biology of the Algerian populations of the species has been studied by Touati & Samraoui (2002).

Daphnia (Ctenodaphnia) deserti Gauthier, 1937, first described by Brehm (1958) from Hoggar and Tassili from Sahara. Its distribution is restricted to Sahara region (Hudec 1993). It is a valid taxon (Hudec 1993; Benzie 2005).

Daphnia (Daphnia) ambigua Scourfield, 1947, recorded by Amar *et al*. (2012) in Hammam Boughrara Dam (Tlemcen province). This record is doubtful because no description has been given for this new record. Nearctic, Neotropical and Palaearctic species (Kotov *et al.* 2013a), buts its record in Palaearctic is a result of anthropogenic introduction (Benzie 2005).

Daphnia (Daphnia) curvirostris Eylmann, 1887, newly recorded species in this study. Palaearctic species, it presents also in the north-western corner of North America (Kotov *et al.* 2013a; Popova & Kotov 2013).

Daphnia (Daphnia) galeata Sars, 1864, newly recorded species; considered to be Palaearctic species (Benzie 2005), but it has also been recorded in the Nearctic (Ishida & Taylor 2007).

Daphnia (Daphnia) hyalina Leydig, 1860, recorded only by Bidi-Akli *et al*. (2014) in Zeralda Dam, and no description was given for this new record. Palaearctic species (Kotov *et al.* 2013) which is not considered valid by Petrusek *et al.* (2008), but this opinion could not be regarded as final one (Kotov 2015).

Daphnia* (*Daphnia*) *longispina (O.F. Müller, 1776), recorded by Gauthier (1928a) in agoulmine between Yakouren and El-Kseur (Bejaia province), FrétisLake, Lac des Oiseaux. Almost cosmopolitan species group (Benzie 2005) with a confused taxonomy (Petrusek *et al*. 2008; Kotov 2015).

Daphnia* (*Ctenodaphnia*) *magna Straus, 1820, recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891) in Gharabas Lake from Oran, and Biskra oasis, Gurney (1909) in four ponds from Biskra province, Gauthier (1928a) in a ditch between Sidi Bel-Abbes and

Saida provinces, groundwater in Wadi Mzab, santon pond, La macta, swamp flow channel from Oran province, old Halloula Lake (Algiers), Guelt-es-stel Dam Djelfa, Baniou marsh from M'Sila province, Fetzara marsh, marsh of Mekhada, Gauthier (1931) in Hoggar, Beadle (1943) in Daya Oum Er-Relaz near Arzew, well in Touggourt, El Golea small Lake, Hassi Iniguel well on Ouargla road, Samraoui (2002) in Boukhadra pool and Garaa Stah (Annaba and El Tarf provinces), De Los Rios-Escalante & Amarouayache (2016) in Sbikha (Tazougguert) and in present study. Distributed in Holarctic and Africa (Benzie 2005; Kotov *et al*. 2013a), some aspects of biology of Algerian populations were studied by Chakri *et al*. (2010). North African populations are conspecific with European ones (De Gelas & De Meester 2005).

Daphnia (Ctenodaphnia) mediterranea Alonso, 1985, species newly recorded for Algeria, considered to be Palaearctic one (Kotov *et al.* 2013a). It has a Mediterranean distribution (Alonso 1985; Benzie 2005).

Daphnia (Ctenodaphnia) similis Claus, 1876, recorded by Dumont (1979) in Saharan Hoggar (Tamanrasset); also it was found during the present study. It is a widespread species group known from north and south America, Eurasia and Africa (Benzie 2005) and considered cosmopolitan (Kotov *et al.* 2013a). The real distribution of members of the *similis*-group is unknown (Chatterjee *et al*. 2013; Popova *et al*. 2016). Algerian populations must be checked genetically and/or based on the male morphology, as another species from this group, *D. sinensis* Gu, Xu, Li, Dumont, Han, 2013, is detected in at least in Ethiopia by genetic methods (Popova *et al.* 2016).

Daphnia (Daphnia) obtusa Kurz, 1874, newly recorded species in Algeria, almost cosmopolitan and recently introduced even to Australia (Benzie 2005). This is a group of close species needs in a revision worldwide (Adamowicz *et al.* 2009).

Daphnia (Daphnia) pulex Leydig, 1860, recorded by Gauthier (1928a) in pond of Wadi Smar, Le Merdja (marsh), old Halloula Lake, agoulmine Boualsous, marsh near Ziama from Jijel province, marsh between Oubeira and Tonga Lakes, pond near Tonga Lake, Gauthier (1929, 1931) in l'Abankor Imegha (Sahara, Hoggar), Beadle (1943) in El Golea Hassi El Abid well, Dumont *et al.* (1979) in swamps and pools in Garrigue between Lac des Oiseaux and Oubeira Lake, Samraoui *et al.* (1998) in Necha Righia, Garaa El Khobzi, Samraoui (2002) in pond Isoetes, Garaa Estah, and Dakhla pond, and in present study. According to recent genetic studies (Crease *et al.* 2012), it is a complex of species, and at least one of them has almost cosmopolitan range (except Australia and Antarctica).

Megafenestra aurita (Fischer, 1849), recorded as *Scapholeberis* by Gauthier (1928a) in La macta, swamp flow channel from Oran province, Le Merdja (marsh) Chelif, Wadi Boudjema (Annaba province), marsh Mekhada, Dumont *et al.* (1979) in edge of Oubeira Lake and in present study. Afrotropical and Palaearctic regions (Kotov *et al.* 2013a).

Scapholeberis kingi Sars, 1888 recorded by Dumont (1979) and Dumont *et al.* (1979) in northern edge of Oubeira Lake, Samraoui *et al.* (1998) in marsh of Bou Redim, Garaa Sidi Lakhdar and Samraoui (2002) in pond of Lac Bleu. Widely distributes species (Kotov *et al.* 2012; 2013a).

Scapholeberis mucronata (O.F. Müller, 1776), recorded by Gauthier (1928a) in Wadi Réghaia, drainage canal of Halloula Lake, Wadi Isser from Tlemcen province, marsh between Oubeira and Tonga Lakes, marsh of Wadi El-Aroug (Mellah Lagoon), ditch in Blida province, Le Merdja (marsh). Mostly in Palaearctic and Nearctic regions, also known in Neotropics (Kotov *et al.* 2013a).

Scapholeberis rammneri Dumont & Pensaert, 1983, newly recorded species, known from Nearctic and Palaearctic regions (Dumont & Pensaert 1983; Kotov *et al.* 2013a).

Simocephalus exspinosus (De Geer, 1778), recorded by Gauthier (1928a) in Oubeira Lake, ditch near Algiers, pond in Wadi Smar, Kreider Dam (Saida province), santon pond, La macta, swamp flow channel, Le Merdja (marsh), la Rassauta marsh Algiers, Baniou marsh M'Sila, agoulmine (pond) between Yakouren and El-Kseur (Bejaia province), Ain ez-zerga from Biskra province, Guerrah marsh, Fetzara marsh, marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, pond south of El-kala, Marsh forest near Tonga Lake, pond near Tonga, Beadle (1943) in Ain Zerga (Tolga Biskra province), Samraoui *et al*. (1998) in Oubeira Lake, marsh of Bou Redim, the Mekhada swamp, Necha Righia, Garaa El Khobzi and Lake Sidi Makhlouf, Samraoui (2002) in some ponds from El Kala region, and in this study. Almost cosmopolitan taxon (Orlova-Bienkowskaja 2001).

Simocephalus vetulus (O. F. Müller, 1776), recorded by Gurney (1909) in ponds of Jardin d'Essai Algiers, Gauthier (1928a) in Wadi Boudjema, Oubeira Lake, Lac Noir, ditch near Algiers, Kreider Dam (Saida provine), pond of Wadi Sfid (Saida), Le Merdja (marsh), agoulmine l'Akhès (Tissemsilt province), ditch from Medea province, old Halloula Lake, drainage canal of old Halloula Lake, El Ak'hal pond, la Rassauta marsh from Algiers, pond near Blida province, agoulmine Azerou Boudjema, agoulmine between Yakouren and El-Kseur, agoulmine Aberkane, agoulmine Boualsous, agoulmine Temjout (Bejaia province), marsh near Jijel province, marsh between Jijel and El-Milia,Wadi Bou-Sellam near Sétif province, Frétis Lake, pond near Wadi El-Aneb (Annaba province), marsh of Mekhada, Lac des Oiseaux, marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, pond near Tonga Lake, marsh of Wadi El-Aroug (Mellah Lagoon), pond Bordj Ali-bey near Lac noir, agoulmine Ikeur, The forest of Réghaia (Algiers), Dumont (1979) in Righia and Oubeira Lake from El-Kala, Dumont *et al.* (1979) in swamps bordering Lac des Oiseaux, swamps and pools between Lac des Oiseaux and Oubeira Lake, Samraoui *et al.* (1998) in Tonga and Oubeira Lakes, Lac Bleu, marsh of Bou Redim, Mekhada swamp, Ochrea Lake, Brabtia

Reserve, Boumalek's wells, Sidi Makhlouf Lake, Garaa Sidi Lakhdar, Sidi Freitis Lake, Necha Demnat El Ataoua, Bordj du Cantonnier from El-kala and Skikda province, Samraoui (2002) in Lac Bleu, and Lac Bleu (pool), and in a number of ponds from El-Kala region and in this study. This taxon is widely distributed in the Palaearctic region (Kotov *et al.* 2013a), probably represented by a group of close species (Huang *et al*. 2014).

Family Moinidae Goulden, 1968

Moina belli Gurney, 1904, recorded by Dumont (1979) in Tassili n'Ajjer (Sahara). This species was described from Republic of South Africa (Gurney 1904) and then found in other regions, even in Central Asia (Smirnov 1976). This is a valid taxon, but its distribution range in the Old World needs to be specially studied.

Moina brachiata (Jurine, 1820), recorded by Gauthier (1928a) in ditch between Ain Temouchent and Oran province, Sebkha near marsh la macta, Brackich marsh near la macta, ditch from Chelif province, ditch near Djelfa province, marsh of Mekhada (El-Kala), also found during the present study. It is a Palearctic taxon which has also been reported from Africa (Kotov *et al*. 2013a). This taxon definitively includes some species with the unknown distribution ranges (Nédli *et al.* 2014; Bekker *et al*. 2016).

Moina dubiaGuerne & Richard, 1892, recorded by Gauthier (1929) in a pool in Amguid (Tamanrasset) and Gauthier (1931) in Hoggar (Sahara). This is an Afrotropical and Palaearctic species (Kotov & Ferrari 2010; Kotov *et al*. 2013a) from the *M. micrura* species group.

Moina lateralis Brehm, 1958 described by Brehm (1958) from Tassili n'Ajjer (Sahara). This is probably a junior synonym of *M. belli* (Smirnov 1976).

Moina macrocopa (Straus, 1820), recorded by Blanchard (1891) in Sebkha Oran and Sénia Lake and Dumont (1979) in Tamanrasset from Sahara. Distribution restricted to eastern Hemisphere (Europe, Africa, and southern Asia) (Smirnov 1976). Most Palaearctic

populations belong to *M. macrocopa macrocopa*, what is confirmed by genetic methods (Bekker *et al*. 2016), but African populations are not studied yet.

Moina micrura Kurz, 1874, recorded by Dumont (1979) in Sahara (Hoggar, Tassili, Biskra), Samraoui *et al.* (1998) in GaraaTacha (Annaba province), Samraoui (2002) in pond Berrihane (south). A cosmopolitan species group needed a detailed revision (Petrusek *et al*. 2004; Kotov *et al*. 2013a; Bekker *et al*. 2016).

Moina rectorostris (Strauss, 1820), recorded by Bidi-Akli *et al*. (2014) in Zeralda Dam, and no description has been given for this new record.This is a dubious record, see the discussion of "*M. rectirostris*-problem" by Goulden (1968).

Moina salina Daday, 1888, recorded by Gauthier (1928a) in Guelt-Es-Stel Dam (Djelfa province), Daya Oum el-Reblaz (Gharabas Lake), Sebkha of Oran, Sebkha of Ain Ouarka (Naama province), brackich pool (Djelfa province) and Daya Morselli (Sénia Lake), Sebkha of Oran, Brackich marsh near la macta, Beadle (1943) in pool near Sebkha of Oran, Amarouayache *et al.* (2012) in Sebkha Ez-Zemoul, De Los Rios-Escalante & Amarouayache (2016) in Garaa Ank Djemel, Garaa El-Tarf, Garaa Guellif, Sebkha Djendli, Daya Bagrat, Chott Telamine, also it was recorded in this study. The name *M. mongolica* Daday, 1901 is still widely used, however, it is a presumable junior synonym of the former (Negrea 1984). The *salina*-group is represented in the Palaearctic by at least two species (Bekker *et al*. 2016), therefore African populations need to be revised morphologically and analyzed genetically.

Family Ilyocryptidae Smirnov, 1976 sensu Smirnov, 1992

Ilyocryptus sordidus (Liévin, 1848), recorded by Gauthier (1928a) in El-Chaib marsh south of chott Ech-chergui.This species is distributed in Northern Palaearctic, but close forms are widely distributed worldwide and need to be revised (Kotov & Štifter 2006).

Ilyocryptus sp recorded inthis study in one site (Mridima, El Tarf province). Specimens were juvenile andcouldn’t be identified to the species level.

Family Macrothricidae Norman et Brady, 1867

Bunops serricaudata (Daday, 1888), recorded by Samraoui *et al.* (1998) in Lac Bleu. Palaearctic species (Kotov *et al*. 2013a).

Lathonura rectirostris (O. F. Müller, 1785), recorded by Samraoui *et al.* (1998) in Bou Redim marsh. Holarctic species (Kotov *et al.* 2013a), occurring also in South Africa (Hart & Dumont 2005).

Macrothrix dadayi Behning, 1941, newly recorded species in Algeria. Palaearctic region (Kotov 2008).

Macrothrix hirsuticornis Norman and Brady, 1867, recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891) in oasis of Biskra, Gurney (1909) in six ponds from Biskra, Gauthier (1928a) in Oubeira Lake, Wadi Berda near Khroub (Constantine province), ditch near Saida, Daya Oum Si-Cherif Mécheria (Naama province), R'dir near El-Bayadh, Daya moumene, R'dir near Bechar province, Garaa El Khelifrom El-Bayadh province, pond Wadi Sfid (Saida), Ditch near Tlemcen province, Wadi Isser (Tlemcen province), La macta, brackich marsh near la macta marsh, ditch in Blida province, ditch near Algiers, R'dir near Djelfa province, la Rassauta marsh (Algiers), small Oued near Sétif, marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, forest of Réghaia (Algiers, 7 ponds), Gauthier (1931) and Gauthier (1934) in Sahara (Hoggar), Beadle (1943) in El Golea artificial Lake, Dumont *et al*. (1979) in swamps bordering Lac des Oiseaux, swamps and pools between Lac des Oiseaux and Oubeira Lake, northern edge of Oubeira Lake and in this study. Only Palearctic populations could be regarded as *M. hirsuticornis* (Smirnov 1992), non-Palaearctic records belong to other taxa (Kotov 2007).

Macrothrix laticornis **(**Jurine, 1820), recorded by Gauthier (1928a) in Oubeira Lake (El Kala). It is known from most territory of temperate Eurasia, with populations occurring even in Central Nepal (Silva-Briano *et al.* 1999).

Macrothrix rosea (Jurine, 1820), recorded by Gauthier (1928a) in Wadi Boudjema (Annaba province), drain canal of Tonga Lake,The forest of Réghaia (Algiers, 7 ponds), Samraoui *et al.* (1998) in Tonga Lake, Oubeira Lake, Bou-Redim marsh, Mafragh. Holarctic taxon needed to be revised (Kotov *et al*. 2012).

Macrothrix spinosa King, 1853, recorded by Samraoui *et al.* (1998) in Oubeira Lake, Lac des Oiseaux, Ochrea Lake, Brabtia Reserve, Oubeira wells and in this study. Pantropical taxon (Smirnov 1992) needed to be revised.

Family Bosminidae Baird, 1845 sensu Sars, 1865

Bosmina (Eubosmina) coregoni Baird, 1857, recorded by Amar *et al.* (2012) in Hammam Boughrara Dam (Tlemcen province). This record is doubtful, no description was given. Palaearctic species (Kotov *et al.* 2013a).

Bosmina* (*Bosmina) longirostris (O. F. Müller, 1776), recorded by Samraoui *et al.* (1998) in Lac Bleu and in this study. Cosmopolitan species (Kotov *et al.* 2013a).

Family Eurycercidae Kurz, 1875 emend. Dumont et Silva-Briano, 1998

Eurycercus (Eurycercus) lamellatus (O. F. Müller, 1776), recorded by Gauthier (1928a) in marsh of Wadi El-Aroug (Mellah Lagoon), Samraoui (2002) in Tonga Lake and Wadi Bouaroug (El-Kala). Widely distributed Palaearctic species (Frey 1971; Bekker *et al*. 2012), records in other regions are mainly anthropogenic invasions.

Family Chydoridae Dybowski et Grochowski, 1894

Subfamily Aloninae Dybowski et Grochowski, 1894 emend Frey, 1967

Acroperus angustatus Sars, 1863, newly recorded species in Algeria, definitely known only from the Palaearctic zone (Sinev 2009b).

Acroperus harpae (Baird, 1834), recorded by Dumont *et al.* (1979) in northern edge of Oubeira Lake, Samraoui *et al.* (1998) in Lac Bleu, Sidi Makhlouf Lake, Wadi El Aneb

(Annaba province), Samraoui (2002) in Lac Bleu. It is definitely known only from the Palaearctic zone (Sinev 2009b).

Alona affinis (Leydig, 1860), was recorded by Gauthier (1928a) in Lac Noir, old Halloula Lake, la Rassauta marsh from Algiers province, Wadi betweeen Azazga and Ykouren, pond in Medea province, Frétis Lake, marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, Dumont (1979) in northern edge of Oubeira Lake, Samraoui *et al.* (1998) in Lac Bleu, Sidi Makhlouf Lake, Sidi Freitis Lake and in this study. The species is distributed in Eurasia and Africa (Sinev 2009a), but tropical populations need to be specially revised (Kotov *et al.* 2013b).

Alona elegans Kurz, 1875, recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891) in Oasis of Biskra, Gurney (1909) in a pond from Biskra, Dumont (1979) in Righia (El-Kala), Dumont (1987) in Tassili (Sahara), Samraoui *et al.* (1998) in Necha Righia and in this study. Palaearctic species (Kotov *et al.* 2012).

Alona guttata Sars, 1862, recorded by Samraoui *et al.* (1998) in Tonga Lake, Oubeira Lake, Lac Bleu, Lac Noir, Necha Oum El Agareb, Ochrea Lake, Sidi Freitis Lake, Necha Demnat El Ataoua from El-Kala region. Cosmopolitan species complex (Smirnov 1971) with highly complicated taxonomy, real species distribution range is unknown. A detailed taxonomical revision of the *A. guttata*-group worldwide is necessary, as it is among the most common Aloninae (Van Damme *et al.* 2010; Kotov *et al.* 2013b).

Alona striolata Sars, 1916, recorded by Brehm (1958) in Tassili n'Ajjer (Sahara).Species inquirenda (Kotov *et al.* 2013a). It could be a inadequately described South African endemic (Van Damme *et al.* 2010, 2013), but its presence in Algeria, in any case, is dubious.

Camptocercus rectirostris (Schödler, 1862), recorded by Gauthier (1928a) in Oubeira Lake and Gauthier (1931, 1938) in Sahara Hoggar. Common Palearctic species (Smirnov 1998).

Camptocercus uncinatus Smirnov, 1971, recorded by Dumont*et al.* (1979) in swamps bordering Lac des Oiseaux, pools between Lac des Oiseaux and Oubeira Lake, Samraoui *et al.*(1998) in Tonga Lake, Oubeira Lake, Lac Bleu, Garaa Sidi Lakhdar, Samraoui (2002) in Lac Bleu. Distributed in East (Kotov *et al.* 2012), central and south Asia, south Europe, north-east and east Africa; in Mediterranean region, it was recorded from Turkey, Israel, Egypt and Italy (Sinev 2014).

Coronatella anemae Van Damme & Dumont, 2008, newly recorded species in Algeria. Recorded from North-East Africa, Arabian Peninsula, and Central Asia (Van Damme & Dumont 2008).

Coronatella bukobensis (Weltner, 1898), recorded by Gauthier (1928a) in Oubeira Lake, Wadi Béchar, Kreider Dam from Saida province, ditch near Tlemcen, santon pond, La macta, swamp, ditch near Oran province, pond from Medea province, Drinking trough of Ain El-Ebel (Djelfa province), pond near Algiers, Guerrah marsh (Constantine province), Fetzara marsh (Annaba). Species inquirenda (Kotov *et al.* 2013a).

Coronatella rectangula (Sars, 1862), recorded by Gauthier (1928a) in Oubeira Lake, Lac Noir, La macta (Oran province), swamp flow channel, Le Merdja (marsh), drainage canal of old Halloula Lake, The forest of Réghaia (Algiers, 7 ponds), agoulmine between Yakouren and El-Kseur (Bejaia province), pond between Ain Beida and Khenchela province, Frétis Lake,Wadi Boudjema, Gauthier (1931) in Sahara Hoggar, Beadle (1943) in channel following into Ouargla Chott, El Golea, Sebkha El Melah, Dumont (1979) in Hoggar and Dumont *et al.* (1979) in swamps bordering Lac des Oiseaux, northern edge of Oubeira Lake, Samraoui *et al.* (1998) in Tonga Lake, Lac Bleu, Lac Noir, Necha Oum El Agareb, Garaa Estah, Garaa El Khobzi, Ochrea Lake, Brabtia Reserve, Mafragh, Oubeira wells, Garaa Sidi Lakhdar, Sidi Freitis Lake, Garaa Chichaoua, Bordj du Cantonnier, Samraoui (2002) in Lac Bleu, in ponds:

Carriere, Sangliers, Gauthier pond, Garaa Estah and in this study. Palaearctic species (Sinev 2001a; Van Damme & Dumont 2008).

Graptoleberis testudinaria (Fischer, 1851), recorded by Gauthier (1928a) in one site the forest of Réghaia (Algiers, 7 ponds), Dumont *et al.* (1979) in swamps bordering Lac des Oiseaux, Swamps and pools between Lac des Oiseaux and Oubeira Lake, northern Edge of Oubeira Lake, Samraoui *et al.*(1998) in Tonga Lake, Bou Redim marsh, Lac Noir, Necha Oum El Agareb. Species presumed to be cosmopolitan (Smirnov 1971), probably represents a species complex.

Karualona karua (King, 1853), recorded by Gauthier (1929, 1931, 1933b) in Hoggar (Sahara), and by Brehm (1958) as *Alonella karua* from Tassili. *Karualona karua*is not present in Mediterranean region, being substituted here by *K. iberica* (Alonso & Pretus 1989). Therefore previous records need to be specially re-checked.

Leydigia acanthocercoides (Fischer, 1854), recorded by Gauthier (1928a) in El-Chaib marsh South of chott Ech-chergui, pond between Ain Beida and Khenchela province, Wadi Boudjema (Annaba province), Samraoui *et al.* (1998) in pond Ruppia. Palaearctic species (Kotov 2009).

Leydigia leydigi (Schödler, 1863), recorded by Gauthier (1928a) as *Alona leydigi* in one site pond near Tonga Lake, Dumont *et al.* (1979) in swamps and pools between Lac des Oiseaux and Oubeira Lake. Palaearctic species (Kotov 2009).

Oxyurella tenuicaudis (Sars, 1862), recorded by Blanchard (1891) and Blanchard & Richard (1890.1891) in Sidi Yahia, Biskra province, Gauthier (1928a) in two sites agoulmine between Yakouren and El-Kseur, agoulmine Boualsous (Bejaia province), and Gauthier (1931) in Hoggar, Beadle (1943) in El Golea small shallow pond, Dumont (1979) in Tassili n'Ajjer and Tamanrasset (Mertoutek and Ain Deheine), Samraoui *et al.* (1998) in Tonga Lake, Bordj du Cantonnier and in this study. Palaearctic species (Kotov *et al.* 2013a).

Ovalona azorica (Frenzel & Alonso, 1988), recorded by Samraoui (2002) in pond Fedjoudj as *Alona azorica*. According to the recent revision (Sinev *et al.* 2012), *Ovalona azorica* is confined to Azores and humid regions of West Iberia, in dry regions of west Mediterranean it is substituted by sibling-species, *O. anastasia* Sinev, Alonso, Miracle & Sahuquillo, 2012.

Ovalona cambouei **(**Guerne & Richard, 1893), recorded by Samraoui *et al.* (1998) in Sidi Freitis Lake. Mediterranean region, Africa, Madagascar, Iraq, Central and Southern Asia (Sinev 2001b, 2015).

Ovalona nuragica (Margaritora, 1971), newly recorded species for Algeria. West Mediterranean (Sinev 2015).

Ovalana orellanai (Alonso, 1996), newly recorded species for Algeria. So far, this species was known from Spain only (Alonso 1996).

Ovalona **cf.** ***pulchella*** King, 1853, recorded by Gauthier (1928a) as *Alona pulchella* in sites agoulmine l'Akhès (Tissemsilt province, 4 ponds), pond in Medea, pond near Wadi El Aneb (Annaba province), Gauthier (1929) in Guelta Tiguelguemine (Tamanrasset) and Gauthier (1931) in Hoggar, O. *pulchella* is restricted to Australia (Sinev 2001b, 2015). The records need to be re-checked, most probably, they belong to its sibling species, *O. cambouei*, instead.

Tretocephala ambigua (Lilljeborg, 1901), recorded by Gauthier (1928a) in El Ak'hal pond, la Rassauta marsh, The forest of Réghaia (Algiers, 7 ponds), pond near Wadi El Aneb (Annaba province), ponds near Tonga Lake, also in this study. Palaearctic species (Kotov *et al.* 2013a).

Subfamily Chydorinae Dybowski et Grochowski, 1894

Alonella excisa (Fischer, 1854), recorded by Gauthier (1928a) in Lac Noir, Le Merdja (marsh), agoulmine between Yakouren and El-Kseur, agoulmine Aberkane, agoulmine Ikeur, agoulmine Boualsous, Frétis Lake, Wadi Boudjema, marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, 2 ponds near Tonga Lake, the forest of Réghaia (Algiers, 7 ponds), Dumont *et al.* (1979) in northern edge of Oubeira Lake, Samraoui *et al.* (1998) in

Tonga Lake, Lac Bleu, Bou Redim marsh, Necha Righia, Brabtia Reserve, Sidi Makhlouf Lake, Garaa Sidi Lakhdar, Sidi Freitis Lake, and in this study. Cosmopolitan species complex (Smirnov 1996) there are some signs of existence of more than one species in the tropics (Kotov *et al*. 2013b).

Chydorus sphaericus (O. F. Müller, 1776), recorded by Gurney (1909) in pond of Jardin d'Essai Algiers, Gauthier (1928a) in Oubeira Lake, Wadi Réghaia, Wadi from Bejaia province, Wadi Berda near Khroub (Constantine province), ditch near Algiers, pond Wadi of Smar, Kreider Dam (Saida province), ditch in Saida, Wadi Safsaf Tlemcen, Le Merdja (marsh), agoulmine l'Akhès (Tissemsilt, 4 ponds), ditch near Medea, drainage canal of old Halloula Lake, drinking trough of Ain El-Ebel from Djelfa province, El Ak'hal pond (Algiers), la Rassauta marsh, pond near Blida, agoulmine Azerou Boudjema (Bejaia province),Wadi and agoulmine (pond) betweeen Azazga and Ykouren, agoulmine Ikeur, agoulmine Boualsous, agoulmine Temjout from Bejaia province, marsh near Jijel, Wadi Bou-Sellam, Frétis Lake, pond near Wadi El Aneb (Annaba province), Wadi Boudjema, Lac des Oiseaux, marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, ponds near Tonga Lake, marsh of Wadi El-Aroug (Mellah Lagoon), the forest of Réghaia (Algiers, 7 ponds), Dumont (1979) in Righia and Lac des Oiseaux, Dumont *et al*. (1979) in swamps bordering Lac des Oiseaux, swamps and pools between Lac des Oiseaux and Oubeira Lake, northern edge of Oubeira Lake, Samraoui *et al.* (1998) in Tonga Lake, Oubeira Lake, Lac Bleu, Lac Noir, Necha Righia, Garaa El Khobzi, Sidi Makhlouf Lake, Garaa Sidi Lakhdar, Sidi Freitis Lake, Bordj du Cantonnier, Lac Bleu, and some ponds in El Kala region, also in this study. Recent genetic investigations of *C. sphaericus* complex (Belyaeva & Taylor 2009; Kotov *et al*. 2016) have revealed a number of sibling species within the Palearctic region, which can be recognized either by morphology of males and ephippial females, or genetically. So the taxonomic status of Algerian populations needs to be clarified.

Dunhevedia crassa King, 1853, recorded by Gauthier (1928a) in drainage canal of old Halloula Lake, pond near Wadi El Aneb (Annaba province), marsh near Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, pond near Medea, pond between Ain Beida and Khenchela province, the forest of Réghaia (Algiers, 7 ponds), Gauthier (1931) and Gauthier (1934) in Hoggar, Samraoui *et al.* (1998) in Tonga Lake, Bou Redim marsh, Mekhada swamp, Bordj du Cantonnier, Samraoui (2002) in pond near Lac Bleu, ponds of (Berrihane, Mafragh, Frenes, Gauthier, Ruppia), and in this study. Taxon is distributed "worldwide, at warm latitudes" (Smirnov 1996) and needs to be revised (Van Damme *et al.* 2013b).

Ephemeroporus barroisi (Richard, 1894), recorded as *Chydorus barroisi* by Gauthier (1928a, c) in one site the forest of Réghaia (Algiers province), Dumont (1979) in Tassili n'Ajjer (Sahara), Samraoui *et al.* (1998) in Lac Bleu. A complex of *Ephemeroporus* species was revealed in Mediterranean region (Frey 1982; Alonso 1987), the taxonomic status of Algerian and other Mediterranean (Kotov & Ferrari 2010) populations needs to be clarified.

Ephemeroporus phintonicus (Margaritora, 1969), recorded by Frey (1982) referring to Gauthier's (1928a) description from Réghaia (Algiers province). Mediterranean region (Frey 1982).

Picripleuroxus laevis (Sars, 1862), recorded by Gauthier (1928a) in one site pond from Algiers province, Dumont *et al.* (1979) in northern edge of Oubeira Lake, Samraoui *et al.*(1998) in pond Bordj du Cantonnier. Palaearctic species, similar forms occur in Australia (Smirnov 1996) and Africa (Chiambeng & Dumont 2004).

Pleuroxus aduncus (Jurine, 1820), recorded by Gurney (1909) in pond of Jardin d'Essai (experiments garden) Algiers, Gauthier (1928a) in El-Chaib marsh, Wadi Safsaf from Tlemcen province, drainage canal of old Halloula Lake, la Chaaba Bergoug (a brook), Gauthier (1929) in El Golea (Sahara) and Gauthier (1931) in Hoggar, Dumont (1987) in Geltas Atakor (Hoggar), Samraoui *et al.* (1998) in Tonga Lake, Oubeira Lake, Brabtia

Reserve, Oubeira wells, Sidi Makhlouf Lake, Garaa Sidi Lakhdar, Sidi Freitis Lake, Garaa Chichaoua, Necha Demnat El Ataoua from Skikda province, Samraoui (2002) in Garaa Dakhla and in this study. Cosmopolitan species complex (Kotov *et al.* 2013a). Populations studied here belong just to *P.aduncus*s.str.instead of some other taxa revealed in Africa (Smirnov *et al.* 2006; Smirnov 2007, 2008).

Pleuroxus letourneuxi (Richard, 1888), recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891) in oasis of Biskra, Gurney (1909) in three ponds from Biskra, Gauthier (1928a) in El-Chaib marsh, pond of Wadi Sfid, Wadi Isser from Tlemcen province, ditch near Oran, La macta marsh, Brackich marsh la macta, Baniou marshfrom M'sila province, small spring Ain-Tinn (Arris, Batna), pondnear Khenchela province, Guerrah marsh (Constantine province), and Gauthier (1934) in Hoggar (Sahara), Dumont (1979) in Hoggar (Sahara) and in this study. This taxon was described from Tunisia; see comments in Kotov & Ferrari (2010).West Mediterranean species (Smirnov 1996).

Table 5. Distribution of Cladocera species found in this study from 112 sampling sites in 18 provinces in Algeria.

S.no	Site name (Type)	Province	Species
1	Les Salines (temporary marsh)	Annaba	*Ceriodaphnia quadrangula, Daphnia magna, Moina brachiata, Simocephalus exspinosus*
2	Boukhadra (temporary marsh)	Annaba	*Ceriodaphnia reticulata, Simocephalus exspinosus*
3	El-Rym (temporary marsh)	Annaba	*Daphnia magna, Megafenestra aurita, Simocephalus exspinosus*
4	Laalalig (permanent pond)	Annaba	*Ceriodaphnia laticaudata, Daphnia curvirostris, Megafenestra aurita, Moina brachiata*
5	Sidi Salem (temporary pond)	Annaba	*Daphnia chevreuxi, Ceriodaphnia quadrangula, Simocephalus vetulus, Macrothrix laticornis, Alonella excisa*
6	Kherraza (temporary pond)	Annaba	*Daphnia chevreuxi*
7	El Bouni (ditch)	Annaba	*Daphnia obtusa, Daphnia pulex*
8	Bouzaaroura (temporary pool)	Annaba	*Daphnia curvirostris, Simocephalus exspinosus*
9	Les Salines 1 (temporary pool)	Annaba	*Daphnia magna, Moina brachiata, Pleuroxus letourneuxi, Simocephalus exspinosus*
10	Les Salines (ditch)	Annaba	*Daphnia magna*
11	Berrahal(temporary pool)	Annaba	*Simocephalus vetulus*
12	Boukhadra (temporary pool)	Annaba	*Ceriodaphnia reticulata, Chydorus sphaericus, Daphnia curvirostris, Daphnia magna,*

			Simocephalus vetulus
13	Hdjar-Diss (ditch)	Annaba	*Daphnia curvirostris*
14	Kalitoussa (basin)	Annaba	*Ceriodaphnia quadrangula, Ceriodaphnia reticulata,Chydorus sphaericus, Coronatella anemae,Daphnia magna, Moina brachiata, Simocephalus vetulus*
15	Oued Ziad (temporary pool)	Annaba	*Daphnia obtusa*
16	Boukhmira 1(temporary pool)	Annaba	*Daphnia magna*
17	Chabia (temporary pool)	Annaba	*Ceriodaphnia reticulata, Simocephalus vetulus*
18	Bouzizi (temporary pool)	Annaba (Séraidi)	*Daphnia magna*
19	El Manjra (temporary pool)	Annaba (Séraidi)	*Daphnia magna, Alona elegans, Macrothrix hirsuticornis, Daphnia* sp.
20	Boukhmira 2(temporary pool)	Annaba	*Daphnia magna, Moina brachiata, Pleuroxus letourneuxi*
21	Les Ruines (rocky basin)	Annaba	*Ceriodaphnia reticulata, Daphnia curvirostris, Simocephalus vetulus*
22	El-Chorfa (ditch)	Annaba	*Simocephalus vetulus*
23	El-Karma 1(basin)	Annaba	*Ceriodaphnia laticaudata, Daphnia magna, Macrothrix dadayi*
24	El-Karma 3 (temporary pool)	Annaba	*Ceriodaphnia quadrangula, Macrothrix dadayi, Pleuroxus letourneuxi*
25	El-Eulma (temporary pool)	Annaba	*Daphnia obtusa, Ceriodaphnia laticaudata, Ceriodaphnia quadrangula, Daphnia magna, Simocephalus vetulus*
26	Chbaita Mokhtar (temporary pool)	Annaba	*Daphnia pulex, Daphnia obtusa*
27	El Frine (peanut field)	El-Tarf	*Alona orellanai*
28	Mridima (temporary pool)	El-Tarf	*Ilyocryptus sp*
29	El-Guentra (temporary pool)	El-Tarf	*Ceriodaphnia quadrangula, Chydorus sphaericus, Scapholebris rammneri, Simocephalus vetulus*
30	Sidi Mbarek (temporary pool)	El-Tarf	*Ceriodaphnia reticulata, Chydorus sphaericus, Simocephalus vetulus*
31	El-Feid (marsh)	El-Tarf	*Simocephalus vetulus*
32	El-Battah (temporary pool)	El-Tarf	*Ceriodaphnia quadrangula, Ceriodaphnia reticulata,* *Daphnia magna, Moina brachiata, Simocephalus exspinosus, Simocephalus vetulus*
33	El Oued (temporary pool)	El-Tarf	*Simocephalus exspinosus*
34	Dey Lagraa (temporary pool)	El-Tarf	*Ovalona nuragica, Chydorus sphaericus, Dunhevedia crassa*
35	Souk Rguibet (temporary pool)	El-Tarf	*Ceriodaphnia laticaudata, Ceriodaphnia reticulata, Daphnia obtusa*
36	El Qriaat (temporary pool)	El-Tarf	*Simocephalus vetulus*

37	Ain Khiar (temporary pool)	El-Tarf	*Acroperus angustatus, Bosmina longirostris, Chydorus sphaericus*
38	Sebaa (temporary pool)	El-Tarf	*Ceriodaphnia quadrangula, Chydorus sphaericus, Simocephalus exspinosus, Diaphanosoma brachyurum*
39	El Malha (temporary pool)	El-Tarf	*Simocephalus exspinosus*
40	El Henaya (temporary pool)	El-Tarf	*Ceriodaphnia reticulata, Simocephalus vetulus*
41	Faid El Gharnoug (temporary pool)	El-Tarf	*Ceriodaphnia reticulata*
42	Ain Assel (temporary pool)	El-Tarf	*Daphnia obtusa, Diaphanosoma brachuyrum*
43	Boutheldja 2 (temporary pool)	El-Tarf	*Daphnia obtusa*
44	El Frine (sandy pool)	El-Tarf	*Ceriodaphnia quadrangula, Daphnia magna, Simocephalus vetulus*
45	Lac Bleu (small lake)	El-Tarf	*Alona affinis, Acroperus* sp. *Simocephalus* sp.
46	Ben M'hidi (ditch)	El-Tarf	*Ceriodaphnia laticaudata, Daphnia chevreuxi, Daphnia magna, Simocephalus exspinosus*
47	El Asfour (temporary pool)	El-Tarf	*Alona elegans, Ceriodaphnia quadrangula, Daphnia chevreuxi, Megafenestra aurita, Simocephalus vetulus*
48	Jnene Echouk (temporary pool)	El-Tarf	*Macrothrix dadayi, Moina brachiata*
49	Oum Tboul (Dghidgha) (t. pool)	El-Tarf	*Simocephalus vetulus*
50	Essouarekh (temporary pool)	El-Tarf	*Daphnia obtusa, Ceriodaphnia reticulata, Simocephalus exspinosus, Simocephalus vetulus*
51	La Messida (temporary pool)	El-Tarf	*Daphnia obtusa, Macrothrix hirsuticornis*
52	La Mekhada (temporary pool)	El-Tarf	*Pleuroxus aduncus, Simocephalus vetulus*
53	Oum Tboul (temporary pool)	El-Tarf	*Ceriodaphnia reticulata, Daphnia chevreuxi, Simocephalus vetulus, Daphnia* sp.
54	Ain Ben Beida1(ditch)	El-Tarf	*Ceriodaphnia laticaudata*
55	Tonga (temporary pool)	El-Tarf	*Alonella excisa, Chydorus sphaericus*
56	El-Chatt (ditch)	El-Tarf	*Chydorus sphaericus, Daphnia chevreuxi, Daphnia curvirostris, Moina brachiata*
57	El Frine2 (peanut field)	El-Tarf	*Ceriodaphnia reticulata, Simocephalus vetulus*
58	Near to Tonga Lake (a pond)	El-Tarf	*Ceriodaphnia reticulata, Simocephalus vetulus*
59	Garaa Bechna (marsh)	Skikda	*Daphnia magna*
60	Aïn Nechma (temporary pool)	Skikda	*Simocephalus exspinosus*
61	Lemsaousa (temporary pool)	Skikda	*Ceriodaphnia laticaudata, Chydorus sphaericus, Ovalona nuragica, Simocephalus exspinosus, Simocephalus vetulus*
62	Garaa Beni- Mohamed (marsh)	Skikda	*Simocephalus exspinosus*
63	Deyar El Jedri (ditch)	Skikda	*Daphnia obtusa*
64	Mgez Stah (temporary pool)	Skikda	*Ceriodaphnia laticaudata, Chydorus sphaericus, Moina brachiata, Simocephalus vetulus*

65	Aux Linaires (temporary pool)	Skikda	*Alonella excisa, Chydorus sphaericus, Coronatella rectangula, Oxyurella tenuicaudis, Simocephalus vetulus, Tretocephala ambigua*
66	Hdjar –Soud (temporary pool)	Skikda	*Alonella excisa*
67	Aux Oliviers (temporary pool)	Skikda	*Daphnia curvirostris, Simocephalus exspinosus*
68	Garaa Sidi Makhlouf (marsh)	Skikda	*Chydorus sphaericus, Pleuroxis letourneuxi, Simocephalus vetulus*
69	El-Mraige (temporary pool)	Skikda (Collo)	*Ceriodaphnia quadrangula, Daphnia chevreuxi, Daphnia obtusa*
70	Tamlouka (temporary pool)	Guelma	*Alona elegans*
71	Bir Osmane (temporary pool)	Guelma	*Ceriodaphnia quadrangula, Daphnia atkinsoni, Macrothrix hirsuticornis, Simocephalus vetulus*
72	Guerrah 1 (temporary pool)	Constantine	*Macrothrix dadayi, Moina brachiata*
73	Bourgas 1 (temporary pool)	Souk -Ahras	*Simocephalus vetulus, Chydorus sphaericus*
74	Bourgas 2 (temporary pool)	Souk -Ahras	*Simocephalus vetulus, Ceriodaphnia laticaudata, Tretocephala ambigua*
75	Khemissa (temporary pool)	Souk -Ahras	*Daphnia magna, Chydorus sphaericus*
76	Les grands vents (temporary pool)	Algiers	*Ceriodaphnia laticaudata, Chydorus sphaericus, Pleuroxus letourneuxi*
77	Bazer (Sebkha)	Sétif	*Daphnia mediterranea*
78	Safsaf (temporary pool)	Tébessa	*Daphnia atkinsoni, Daphnia similis*
79	El-Doukken (temporary pool)	Tébessa	*Daphnia atkinsoni*
80	El-Malabiod (temporary pool)	Tébessa	*Daphnia atkinsoni, Macrothrix hirsuticornis*
81	Ain-Kemellal (temporary pool)	Tébessa	*Daphnia magna, Alona elegans*
82	El Sendoug (temporary pool)	Tébessa	*Daphnia magna, Simocephalus vetulus, Ceriodaphnia reticulata, Chydorus sphaericus, Alona elegans*
83	El Btine (reservoir)	Tébessa	*Daphnia magna*
84	Dbidiba (temporary pool)	Tébessa	*Simocephalus vetulus*
85	Ain Sadik (temporary pool)	Tébessa	*Simocephalus vetulus, Chydorus sphaericus, Alona elegans*
86	Oum Arroudj (pond)	Tébessa	*Daphnia similis*
87	El Frahna (temporary pool	Tébessa	*Daphnia magna*
88	Illoula Ou Malou (temporary marsh)	Tizi Ouzou	*Ceriodaphnia reticulata, Macrothrix spinosa*
89	Bouguezoul (reservoir)	Medea	*Ceriodaphnia quadrangula, Daphnia curvirostris, Simocephalus vetulus*
90	Tinsilt (Chott)	Oum El Bouaghi	*Daphnia mediterranea*
91	Timerganine (Chott)	Oum El Bouaghi	*Daphnia* sp.
92	El-Tarf (Chott)	Oum El Bouaghi	*Moina salina, Simocephalus vetulus*

93	Guellif (Chott)	Oum El Bouaghi	*Moina salina*
94	Ez-Zemoul (Sebkha)	Oum El Bouaghi	*Moina salina*
95	El-Maghssel (Chott)	Oum El Bouaghi	*Daphnia sp, Simocephalus* sp.
96	Ourkis (Reservoir)	Oum El Bouaghi	*Daphnia magna, Daphnia* sp.
97	Djerma (temporary pool)	Batna	*Simocephalus exspinosus*
98	Ain Yagout (temporary pool)	Batna	*Simocephalus vetulus*
99	Tizourite (temporary pool)	Batna	*Daphnia magna, Moina brachiata*
100	Draa-Boultif (temporary pool)	Batna	*Alona elegans, ceriodaphnia quadrangula, Coronatella anemae, Daphnia magna, Pleuroxus letourneuxi, Simocephalus exspinosus*
101	Djendli (Sebkha)	Batna	*Moina salina, Daphnia mediterranea*
102	Ouled M'barek (Sebkha)	Khenchela	*Daphnia mediterranea*
103	M'Toussa (Chott)	Khenchela	*Chydorus sphaericus, Daphnia* sp.
104	Ettouama (Sebkha)	Oran	*Daphnia mediterranea*
105	Telamine (Sebkha)	Oran	*Moina salina, Daphnia mediterranea*
106	Sidi Chahmi (Sebkha)	Oran	*Chydorus sphaericus, Daphnia magna, Daphnia mediterranea, Moina salina*
107	Daya Bagrat (Sebkha)	Oran	*Moina salina, Daphnia mediterranea*
108	Sidi Bouziane (salt marsh)	Rélizane	*Moina brachiata, Daphnia mediterranea*
109	Sidi Mhammed Ben Ali (lake)	Sidi-Bel-Abbes	*Daphnia galeata*
110	Oued El Besbes (ditch)	Sidi-Bel-Abbes	*Daphnia galeata, Daphnia similis,Moina brachiata*
111	Sarno (Dam)	Sidi-Bel-Abbes	*Daphnia galeata*
112	Bouhnifia (pond)	Mascara	*Daphnia galeata*

3.1.3. Copepods (cyclopoids) of Algeria

3.1.3.1. Checklist of Cyclopoida

A total of 11 cyclopoid species, belonging to 9 genera of one family Cyclopidae have been identified in this study; of which, *Eucyclops leschermoutouae* Alekseev & Defaye, 2004 (Fig. 14, 15) is new to Algeria and North Africa, and a second world record. This species was found in the sub-humid and semi-arid regions in Bourgas and Ain-Kemellal temporary pools

Souk-Ahras, Tébessa provinces respectively (Fig.16, 17). The total number of cyclopoids rises now to 47 species.

The most frequently encountered species was *Cyclops abyssorum mauritaniae* Lindberg, 1950 (Fig. 18), the highest species richness was found in Numidia (Annaba province) in Sidi Salem and Bouzizi ponds with a total of 4 species.

Figure 14. *Eucyclops leschemoutouae* male, A. Antennulary segments (1-8), B.Caudal rami, C. Male habitus, D. Antennal coxobasis.

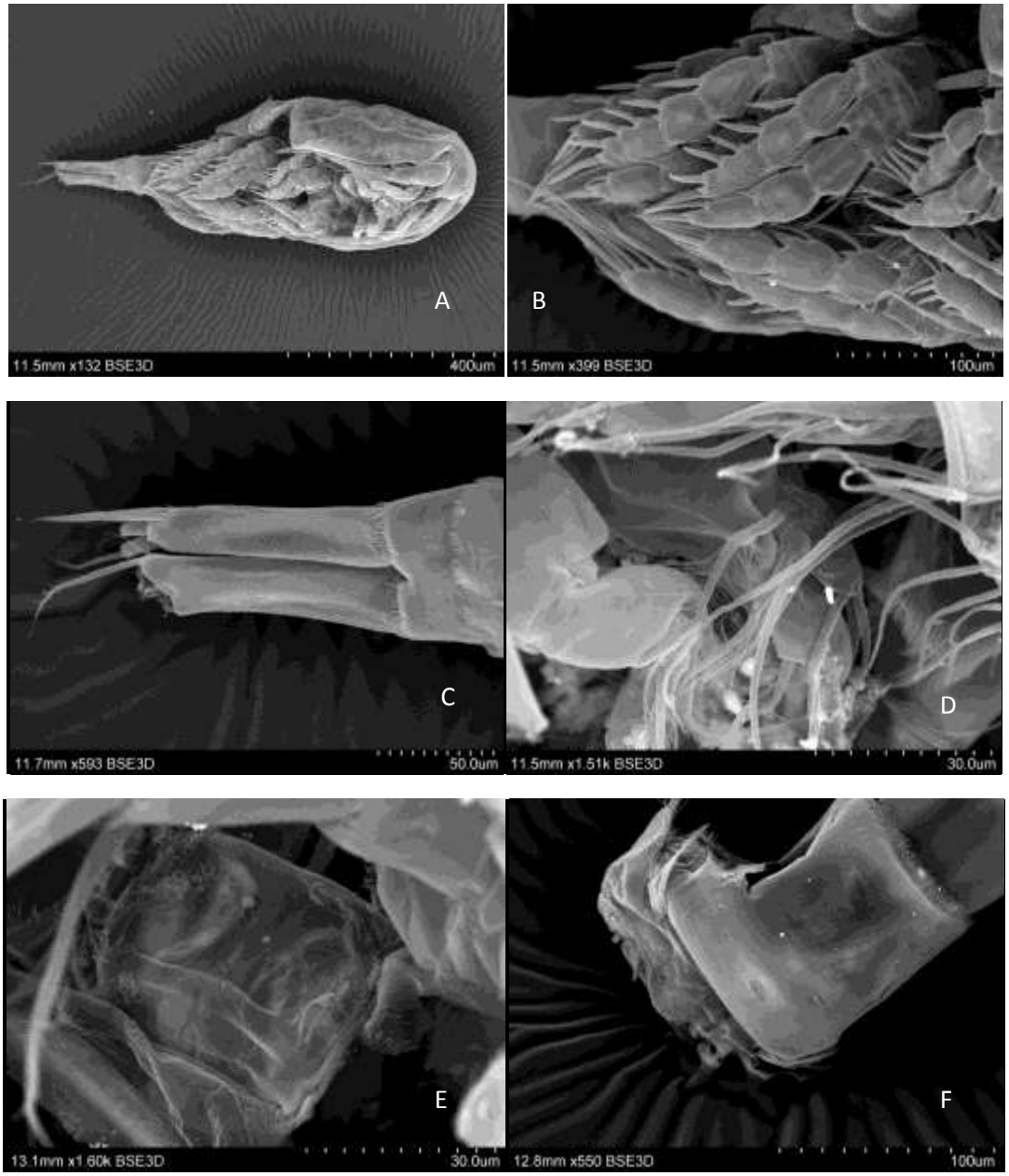

Figure 15. *Eucyclops leschemoutouae* female, A. Female habitus, B. Leg1-leg4, C. Caudal rami, D. Maxillule, E. Leg 4 intercoxal sclerite, F. Urosome.

Figure 16. Photo ofBourgas pond.

Figure 17. Photo of Ain kemellel pond.

Table 6. List of Cyclopoida identified in this study, (*) new record.

Family	genus	species	Author, year
Cyclopidae	*Acanthocyclops*	*trajani*	Mirabdullayev & Defaye, 2004
	Cyclops	*abyssorum mauritaniae*	Lindberg, 1950
	Diacyclops	*bicuspidatus odessanus*	Schmankevitch, 1875
	**Eucyclops*	*leschermoutouae*	Alekseev & Defaye 2004
	Eucyclops	*serrulatus*	Fischer, 1851
	Macrocyclops	*albidus*	Jurine, 1820
	Megacyclops	cf. *gigas*	Claus, 1857
	Megacyclops	*viridis*	Jurine, 1820
	Metacyclops	*minutus*	Claus, 1863
	Microcyclops	*rubellus*	Claus, 1857
	Tropocyclops	cf.*prasinus*	Fischer, 1860
One family	**9 Genera**	**11 Species**	

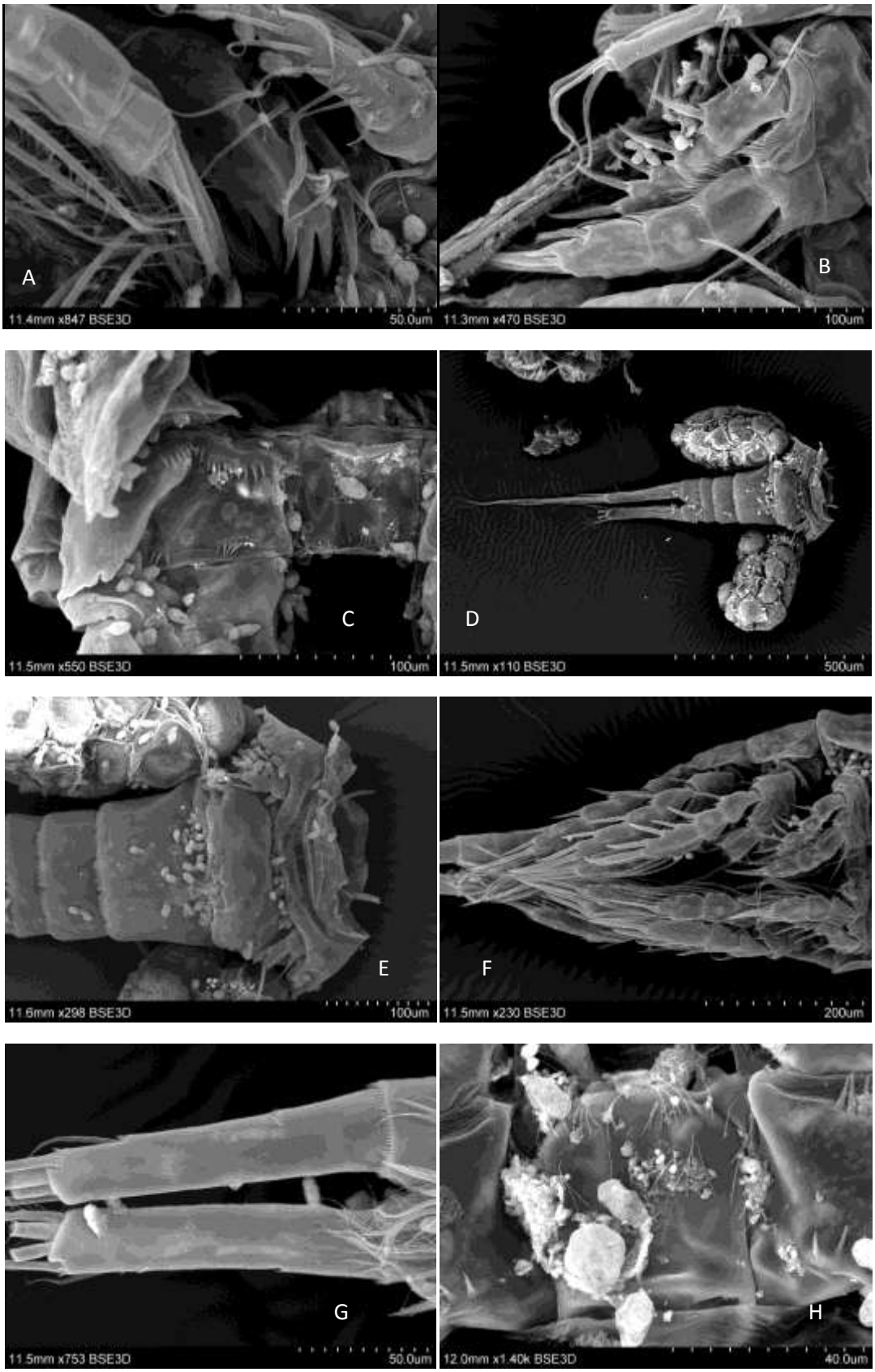

Figure 18. *Cyclops abyssorum mauritaniae* female, A. Maxillule, B.Leg 1, C.Leg 4, D. Urosome, E.urosome Leg 5, F. Male leg 1- leg 4, G. Leg 1, H. Leg 4.

3.1.3.2. Distribution of cyclopoids in Algeria

Class Copepoda Milne Edwards, 1830

Order Cyclopoida Burmeister, 1834

Family Cyclopidae Rafinesque, 1815

Subfamily Cyclopinae Kiefer, 1927

Acanthocyclops trajani (Mirabdullayev & Defaye, 2002), recorded by Cherbi *et al.*(2008) in Boukourdane Dam (Tipaza), Hamaidi *et al.*(2010) in five Dams Lakes (Boukourdane, Lekhal, Taksebt, Ghrib, Keddara) and Wadi Chiffa, and this study.

Acanthocyclops robustus (Sars G.O., 1863), recorded by Gauthier (1928a) in Fetzara marsh from Annaba province.

Acanthocyclops vernalis (Fischer, 1853), recorded by Roy & Gauthier (1927) in Wadi Boudjema from Annaba province, pond near El Kala,Gauthier (1928a) in Wadi Boudjema, Dumont *et al.*(1979) in Swamps bordering Lac des Oiseaux, swamps and pools between Lac des Oiseaux and Oubeira Lake, northern edge of Oubeira Lake (El-Tarf province).

Cryptocyclops linjanticus (Kiefer, 1928), recorded by Kiefer (1949), Hamaidi *et al.*(2010) in Lekhal Dam from Bouira province and Taksebt Dam Lake, Tizi-Ouzou province.

Cyclops abyssorum mauritaniae Lindberg, 1950, recorded by Akli (1991) in northern Algeria, Boudiffa (1993) in Sidi M'hamed Ben Ali Lake, and Sarno Dam (Sidi Bel Abbes province), Hamaidi *et al*. (2010) in Lekhal Dam Bouira province, Keddara Lake (Algiers), and this study.

Cyclops abyssorum divergens (Lindberg, 1936), recorded by Dumont (1979) from Tassili n'Ajjer (Sahara).

Cyclops strenuus strenuus Fischer, 1851, recorded previouslyas *Cyclops furcifer* by Blanchard (1891) in Oasis of Chegga from Biskra, Blanchard & Richard (1890, 1891) from Oasis of Chegga (Biskra province), Roy & Gauthier (1927) everywere in the rainy and steppe zone, Gauthier (1928, 1931) in Wadi Boudjema from Annaba province, some sites in Algiers (pond oued Smar, ancient Halloula Lake, pond in forest of Farghen-Mittidja), pond near Boumerdes, Lac des Oiseaux, marsh between Oubeira and Tonga Lakes, pond near Tonga Lake (El-Kala), pond in Souk-Ahras province, pond in Medea province, pond agoulmine Lakhès (Theniet El Had, Tissemsilt), R'dir in El-Bayadh province, pond Wadi Sfid (Saida), Cherbi (1984) in Lakes of Hamiz, Ghrib, and Boughzoul (north of Algeria), Akli (1991) in northern Algeria, Boudiffa (1993) in Lake Sidi M'hamed Ben Ali, and Sarno Dam (Sidi Bel Abbes province), Samraoui (2002) El Feid pond (El-Kala), Ghora pond, Boukhadra pond, Khobzi a pool, Hamaidi *et al.*(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira province, Taksebt Dam Tizi-Ouzou, Keddara Lake from Algiers.

Diacyclops bicuspidatus odessanus (Schmankevitch, 1875), recorded by Blanchard & Richard (1890, 1891) in Chegga (Biskra province), Roy & Gauthier (1927) in la Macta, Gauthier (1928a) in many ponds in the forest of Réghaia, pond Akhal Ben Aknoun (Algiers), Fetzara marsh, pond in Souk-Ahras province, pond in Tipaza, pond from Medea province, agoulmine Lakhès (Tissemsilt province), pond of Santon (west Oran), ditch near Sidi Hafir (Tlemcen province), Wadi El-Korina (Mécheria, Naama province), marsh in Djelfa province, pond near Mostaganem province, Wadi Djurdjura, Akli (1991) in northern Algeria, Samraoui (2002) in Fedjoudj, Gerard ponds, El Feid a series of four adjacent temporary pools, Garaa Estah a dune slack, El Frine pool, Hamaidi *et al.* (2010) in Lekhal Dam Bouira province, Taksebt Dam Tizi-Ouzou, Keddara Lake Algiers, Wadi Chiffa from Medea province.

Diacyclops bisetosus (Rehberg, 1880), recorded by Gurney (1909) in Kasbah pond near oasis of Biskra, Akli (1991) in northern Algeria, Samraoui (2002) in Isoetes pond, Tamaris a

permanent pool, Hamaidi *et al.*(2010) in Lekhal Dam Bouira, Taksebt Dam Tizi-Ouzou, and this study.

Diacyclops crassicaudis crassicaudis (G. O. Sars, 1863) recorded by Roy & Gauthier (1927) in flooded meadow Djelfa province.

Graeteriella unisetigera (Graeter, 1908) recorded by Hamaidi *et al*. (2010) in Oued Chiffa, Medea province.

Megacyclops donnaldsoni algericus Kiefer, 1930 recorded by Kiefer (1930).

Megacyclops gigas (Claus, 1857) recorded by Roy & Gauthier (1927) in agoulmine Temjout Kabylie, Fetzara marsh Annaba province, marsh between Oubeira and Tanga Lakes, pond Akhel Algiers, Akli (1991) in northern Algeria, Samraoui (2002) in Tamaris a permanent pool, Sangliers a brackish pool, Mafragh a brackish pool, Frenes pond, Gauthier ponds 2 temporary pools, Hamaidi *et al*. (2010) in Lake Keddara Algiers, and this study.

Megacyclops viridis viridis (Jurine, 1820) recorded by Gurney (1909) in palm pools from Biskra province, Roy & Gauthier (1927) in Kreider Dam (west Oranai), small permanent stream near Guerrah (Constantine), Gauthier (1928a) in some ponds in Algiers (7 ponds in the Forest of Réghaia, pond Akhal Ben Aknoun-Dely Ibrahim, marsh la Rassauta, pond of Wadi Smar, ancient Halloula Lake, drain canal of Halloula Lake, some ponds in Kabylie region (agoulmine between Yakouren and El-Kseur, agoulmine Aberkane, agoulmine Boualsous, agoulmine Ikeur, agoulmine Temjout, agoulmine Azerou, marsh between Bejaia and Jijel), marsh between Jijel and El Millia, Frétis Lake near Fetzara marsh, pond near Fetzara marsh, Fetzara marsh, ditch near Fetzara, Garaa la Mekhada, Lac des Oiseaux, pond near Lac des Oiseaux, Oubeira Lake, marsh near Oubeira, marsh between Oubeira and Tonga Lakes, Swamp forest near Tonga Lake, marsh of Wadi El Aroug (near Mellah Lagoon), pool between Annaba and El-Kala, Lac Noir, pond agoulmine Lakhès (Theniet El Had,

Tissemsilt), pond of Santon (west Oran), Kreider Dam (Chott Chergui), pond near Chélif province, drain canal (marsh la Macta),Wadi Nil from Jijel province, Wadi Boudjema, drain Canal of Tonga Lake, Wadi Rhummel, Saharan springs, Roy (1929) from the Sahara, Beadle (1943) in Chott Ouargla and channel in the same Chott, Kiefer (1952), Akli (1991) in northern Algeria, Samraoui *et al.*(1998) in Tonga Lake, Oubeira Lake, Lac des Oiseaux, Bou Redim marsh, la Mekhada swamp, Necha Oum El Agareb, Mafragh, Boumalek's wells, Sidi Makhlouf Lake, Sidi Freitis Lake, Garaa Chichaoua, Bordj du Cantonnier temporary pond, Samraoui (2002) in Saulaie temporary dune slack, pond Berrihane,Tamaris a permanent pool, El Feid a series of four adjacent temporary pools, Frenes pond, Gauthier a series of 4 adjacent temporary pools, Garaa Estah, Garaa Dakhla, pond Ghora, Hamaidi *et al.* (2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Taksebt Dam Tizi-Ouzou, Keddara Lake Algiers, Wadi Chiffa from Medea province, and this study.

Mesocyclops aequatorialis similis Van de Velde, 1984, recorded by Van de Velde (1984).

Mesocyclops dussarti Van de Velde, 1984, recorded by Van de Velde (1984).

Mesocyclops major G. O. Sars, 1927, recorded by Van de Velde (1984).

Mesocyclops ogunnus Onabamiro, 1957, recorded by Samraoui *et al.*(1998) in Oubeira Lake, Lac Bleu, Garaa El Khobzi, Ochrea Lake, Oubeira wells, artificial water holes from El-Tarf province.

Mesocyclops salinus Kiefer, 1981, recorded by Samraoui *et al.*(1998) in Tonga Lake from El-Tarf province.

Metacyclops minutus (Claus, 1863), recorded by Blanchard & Richard (1890), Roy & Gauthier (1927) in pond from Algiers, Gauthier (1928a, 1933a) in pond from Medea province, R'dir and pond in El-Bayadh province, R'dir near Laghouat province, pond near Mécheria (Naama province), ditch near Laghouat, pond of Wadi Sfid (Saida province), ditch

in Tlemcen province, ditch near Ain Temouchent, Wadi Boudouaou (Algiers), Beadle (1943) in Sebkha of Oran and pool near Sebkha of Oran, Kiefer (1952), Akli (1991) in northern Algeria, Samraoui (2002) in Boukhadra pond, Hamaidi *et al.*(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Keddara Lake Algiers, and this study.

Metacyclops planus (Gurney, 1909), recorded by Gurney (1909) in palm pools from Biskra province, Roy & Gauthier (1927) in R'dir near Constantine province, Gauthier (1928a) in Daya Oum si-Chérif (Mécheria), R'dir near El-Bayadh, R'dir and ditch near Laghouat province, pond between Ain-Beida and Khenchela province, Gauthier (1932) in hot fontain from north Batna province, Akli (1991) in northern Algeria, Samraoui (2002) in Saulaie temporary dune slack, Gauthier pool a series of 4 adjacent temporary pools, Ghora pond, Hamaidi *et al.*(2010) in Lekhal Dam from Bouira province.

Microcyclops* (*Microcyclops*) *rubellus (Lilljeborg, 1901), recorded by Lindberg (1953) from Tassili N'Hajjer (Sahara), Samraoui *et al.*(1998) in Tonga Lake, Bou-Redim marsh, Necha Oum El Agareb, Oubeira wells, artificial water holes, Samraoui (2002) in Garaa Dakhla a dune slack, Hamaidi *et al.*(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Taksebt Dam Tizi-Ouzou province, and this study.

Microcyclops* (*Microcyclops*) *varicans varicans (G.O. Sars, 1863), recorded by Hamaidi *etal.*(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Taksebt Dam Tizi-Ouzou, Wadi Chiffa, Medea province.

Thermocyclops crassus (Fischer, 1853), recorded by Hamaidi *et al*. (2010) in Lekhal Dam Bouira province.

Thermocyclops dybowskii (Landé, 1890), recorded by Roy & Gauthier (1927) in Wadi Nahr Ouassel Algiers, pond near Medea, agoulmine Boualsous (Kabylie), Samraoui *et al.*(1998) in Tonga Lake, Mekhada swamp, Hamaidi *et al*. (2010) in Lekhal Dam Bouira province.

Thermocyclops oblongatus G. O. Sars, 1927, recorded by Dumont (1979) from Tassili n'Ajjer (Sahara), Hamaidi *et al*. (2010) in Taksebt Dam Tizi-Ouzou province.

Thermocyclops macracanthus (Kiefer, 1929), recorded by Dumont (1979) from Tassili n'Ajjer (Sahara).

Subfamily Eucyclopinae Kiefer, 1927

Afrocyclops gibsoni (Brady, 1904), recorded by Roy (1929) from Hoggar (Sahara).

Ectocyclops phaleratus (Koch, 1838), recorded by Hamaidi *et al.*(2010) in Keddara Lake from Algiers province.

Eucyclops* (*Eucyclops*) *agiloides (G. O. Sars, 1909), recorded by Roy & Gauthier (1927) in Oubeira Lake, Gauthier (1928a) in Oubeira Lake, Hamaidi *et al*.(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Taksebt Dam Tizi-Ouzou, Ghrib Lake from Ain Dafla province,Wadi Chiffa in Medea province.

Eucyclops* (*Eucyclops*) *euacanthus (G. O. Sars, 1909), recorded by Akli (1991) from northern Algeria.

Eucyclops leschermoutouae Alekseev & Defaye, 2004, new record in this study.

Eucyclops* (*Eucyclops*) *lilljeborgi (G. O. Sars, 1914), recorded by Roy & Gauthier (1927) from Oubeira Lake (El-Tarf province).

Eucyclops* (*Eucyclops*) *macruroides macruroides (Lilljeborg, 1901) recorded by Roy & Gauthier (1927) in small Lake near El-Kala region, Wadi Cherf, Kreider Dam west Orania, Gauthier (1928a) ponds from Algiers province.

Eucyclops* (*Eucyclops*) *macrurus (G.O. Sars, 1914), recorded by Blanchard & Richard (1891) in Chegga from Biskra province, Roy & Gauthier (1927) from many ponds in El-Kala region, Gauthier (1928a) in Oued Béchar from Sahara.

Eucyclops* (*Eucyclops*) *serrulatus hadjebensis (Kiefer, 1926), recorded by Kiefer (1926), Roy & Gauthier (1927) in swimming roman pool (Heliopolis, Guelma province).

Eucyclops* (*Eucyclops*) *serrulatus serrulatus (Fischer, 1851) recorded by Gurney (1909) in ponds from Biskra province, Roy (1929) from the Sahara (Tassili n'Ajjer), Gauthier (1928a, 1932) in pond from forest of Farghen-Mittidja (Algiers), agoulmine between Yakouren and El-Kseur (Bejaia province), agoulmine Boualsous, Frétis Lake, Oubeira Lake, swamp near Oubeira Lake, pond near Tonga Lake, bog near El-Kala region, pond in Medea province, pond of Santon (west Oran), marsh Chaib in the edge of Chott Chergui, bog and Dam from Djelfa province, Swamp Baniou near Chott El Hodna, pond near Medea, pond Ain Tellout (Chélif province), Bou-Merzoug marsh (Ain M'lila), Swamp near Guerrah (Constantine province), Wadi Réghaïa, Wadi between Azazga and Yakouren, Wadi Nil from Jijel province, Wadi El Maboun (Skikda), Wadi Boudjema Annaba province, many ponds and Wadi from Souk-Ahras province, small Wadi near Sétif province, Wadi Bou-Sellam from Sétif province, Wadi Saida, Wadi Berbour between Saida et Sidi Bel-Abbès, Wadi Safsaf (Tlemcen province) spring near Wadi Arris (Biskra),Wadi Mzi near Laghouat province, Saharan Springs (Kreider), Spring Melah Mécheria (hot spring), Akli (1991) from northern Algeria, Samraoui *et al*. (1998) in Tonga Lake, Lac des Oiseaux, Bou Redim marsh, Necha Righia, Necha Oum El Agareb, Ochrea Lake, Brabtia Reserve, Oubeira wells artificial water holes, Boumalek's wells, Sidi Makhlouf Lake, Garaa Sidi Lakhdar, Bordj du Cantonnier temporary pond, Samraoui (2002) in Lac Bleu, Lac Bleu pond, Saulaie temporary dune slack, pond Isoetes, Tamaris a permanent pool, pond Frenes, Garaa Estah, Garaa Dakhla, Cherbi *et al.*(2008) in Djorf Torba Dam (Béchar province), Hamaidi *et al*. (2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Taksebt Dam Tizi-Ouzou, and this study.

Eucyclops* (*Eucyclops*) *speratus (Lilljeborg, 1901), recorded by Roy & Gauthier (1927) in all types of permanent and stagnant water, Gauthier (1928a) in pond from Algiers province.

Eucyclops turcomanus Lindberg, 1959, recorded by Dumont (1979) in Oubeira Lake from El Tarf province.

Macrocyclops albidus *(*Jurine, 1820), recorded by Gurney (1909) in pond from the Jardin d'Essai Algiers, Roy & Gauthier (1927) in Wadi Safsaf from Tlemcen province, Wadi Saïda, Wadi Réghaïa, pond Akhal Algiers, Wadi Mzi Laghouat province, Chaaba Bergoug in Bouira province, Wadi El Maboun from Skikda province, agoulmine Temjout (Kabylie), Gauthier (1928a) in pond from forest of Farghen-Mittidja (Algiers), pond near Wadi Réghaïa, Wadi Nil Jijel, small Wadi near Saida province,Wadi Safsaf (Tlemcen province), Roy (1928), Akli (1991) from northern Algeria, Samraoui *et al*. (1998) in Tonga Lake, Oubeira Lake, Lac Bleu, Necha Oum El Agareb, Ochrea Lake, Sidi Makhlouf Lake, Garaa Sidi Lakhdar, Sidi Freitis Lake, Necha Demnat El Ataoua, Garaa Tacha, Garaa Boumaiza, Samraoui (2002) in Garaa Butomes a temporary marsh, Hamaidi *et al*. (2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Keddara Lake from Algiers, and this study.

Macrocyclops fuscus (Jurine, 1820), recorded by Roy & Gauthier (1927) in Wadi Hamiz and Wadi Réghaia Algiers, Gauthier (1928a) in Wadi Hamiz (Algiers), Samraoui *et al.*(1998) in Brabtia Reserve, Samraoui (2002) in Saulaie temporary dune slack, Hamaidi *et al.*(2010) in Taksebt Dam Tizi-Ouzou province, Lekhal Dam in Bouira province.

Paracyclops affinis (G.O. Sars, 1863), recorded by Gauthier (1928a) in Wadi near Algiers. Hamaidi *et al.*(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira province.

Paracyclops chiltoni (Thomson, 1882), recorded by Akli (1991) from northern Algeria, Samraoui (2002) in Lac Bleu, Lac Bleu pond, Saulaie temporary dune slack, Frenes pool, Gauthier pool, Garaa Dakhla a dune slack, Hamaidi *et al.*(2010) in Boukourdane Dam Tipaza provine, Lekhal Dam from Bouira province, Taksebt Dam Tizi-Ouzou, Keddara Lake Algeirs, Wadi Chiffa from Medea province.

Paracyclops fimbriatus (Fischer, 1853), recorded by Roy & Gauthier (1927) in Wadi Saida, Wadi Bou-Sellam Sétif province, Wadi Isser from Tlemcen province, Gauthier (1928a) in Wadi Bou-Sellam Sétif, Wadi Saida,Wadi Isser (Tlemcen province), Beadle (1943) in well from Touggouert, well in El Golea and well in Hassi Iniguel (Ouargla province), Akli (1991) from northern Algeria.

Paracyclops poppei (Rehberg, 1880), recorded by Samraoui (2002) in Frenes pond, Hamaidi *et al.* (2010) in Wadi Chiffa from Medea province.

Tropocyclops prasinus prasinus (Fischer, 1860), recorded by Blanchard(1891) in Sidi Yahia (Biskra province), Roy & Gauthier (1927) in Wadi Kerma Algiers, Wadi Béchar, Wadi El Melah from Djelfa province, pond from Jijel province, agoulmine Temjout, agoulmine Boualsous (Kabylie), pond near Batna province, Gauthier (1928a, 1931) in Wadi Béchar, Wadi Melah (Djelfa province),Wadi Nil from Jijel province, Wadi between Azazga and Yakouren, Sebkha of Ain Ouarka (east Ain Safra), pond near Algiers, pond near El-Bayadh province, Dumont *et al.*(1979) in swamps bordering Lac des Oiseaux, swamps and pools between Lac des Oiseaux and Oubeira Lake, Cherbi (1984) in some Lakes from north Algeria (Hamiz, Ghrib, and Boughzoul), Akli (1991) from North Algeria, Boudiffa (1993) in Sidi M'hamed Ben Ali Lake and Sarno Dam (Sidi Bel-Abbes province), Samraoui *et al*.(1998) in Bou Redim marsh, Brabtia Reserve, Bordj du Cantonnier temporary pond, Samraoui (2002) in Lac Bleu pond, Berrihane school pond, pond Frenes, Garaa Estah a dune slack, Ghora pond, Cherbi *et al.* (2008) in Foum El Ghorza Dam (Biskra province), Hamaidi *et al.*(2010) in Boukourdane Dam Tipaza, Lekhal Dam Bouira, Wadi Chiffa from Medea province, and this study.

Subfamily Halicyclopinae Kiefer, 1927

Halicyclops magniceps (Lilljeborg, 1853), recorded by Blanchard & Richard (1891) in ponds from Biskra province, Roy & Gauthier (1927) in Oubeira Lake (El-Tarf province).

Table 7. Distribution of Cyclopoidaspecies found in 28 sites from 11 provinces in this study.

Site	Site name (Type)	Province	Species
1	Sidi Salem (temporary pond)	Annaba	*Microcyclops rubellus, Diacyclops bicuspidatus odessanus, Cyclops abyssorum mauritaniae*
2	Bouzaaroura (temporary pool)	Annaba	*Megacyclops gigas, Macrocyclops albidus*
3	Bouzizi (temporary pool)	Annaba (Séraidi)	*Acanthocyclops trajani, Megacyclops viridis, Cyclops abyssorum mauritaniae, Eucyclopsserrulatus*
4	El Frine 1 (peanut field)	El-Tarf	*Megacyclops* cf. *gigas*
5	El-Feid (marsh)	El-Tarf	*Megacyclops* cf. *gigas*
6	Sebaa (temporary pool)	El-Tarf	*Cyclops abyssorum mauritaniae*
7	El Frine (sandy pool)	El-Tarf	*Megacyclops* cf. *gigas, Cyclops abyssorum mauritaniae*
8	Lac Bleu (small lake)	El-Tarf	*Megacyclops viridis*
9	El Frine 2 (peanut field)	El-Tarf	*Megacyclops* cf. *gigas*
10	Near to Tonga Lake (a pond)	El-Tarf	*Megacyclops viridis*
11	Lac Noir (lake)	El-Tarf	*Acanthocyclops trajani*
12	El-Mraige (temporary pool)	Skikda (Collo)	*Megacyclops viridis*
13	Bir Osmane (temporary pool)	Guelma	*Megacyclops viridis*
14	Ain-Kemellal (temporary pool)	Tébessa	*Eucyclops leschermoutouae*
15	El Sendoug (temporary pool)	Tébessa	*Cyclops abyssorum mauritaniae*
16	Dbidiba (temporary pool)	Tébessa	*Megacyclops viridis*
17	Ain Sadik (temporary pool)	Tébessa	*Megacyclops viridis*
18	Oum Arroudj (pond)	Tébessa	*Metacyclops minutus*
19	El Frahna (temporary pool	Tébessa	*Cyclops abyssorum mauritaniae*
20	Illoula Ou Malou (temporary marsh)	Tizi Ouzou	*Cyclops abyssorum mauritaniae*
21	Bouguezoul (reservoir)	Medea	*Megacyclops viridis*
22	Draa-Boultif (temporary pool)	Batna	*Megacyclops viridis*
23	Djendli (Sebkha)	Batna	*Megacyclops* cf. *gigas*

24	Tinsilt (Chott)	Oum El Bouaghi	*Megacyclops viridis*
25	Bourgas 1 (temporary pool)	Souk -Ahras	*Eucyclops leschermoutouae*
26	Sidi Mhammed Ben Ali (lake)	Sidi-Bel-Abbes	*Acanthocyclops trajani*
27	Oued El Besbes (ditch)	Sidi-Bel-Abbes	*Tropocyclops* cf.*prasinus*
28	Sarno (Dam)	Sidi-Bel-Abbes	*Acanthocyclops trajani*

3.1.4. Large branchiopods (Anostraca, Notostraca and Spinicaudata) from Numidia

3.1.4.1. Checklist of large branchiopods (Anostraca, Notostraca and Spinicaudata) from Numidia

Four species of large branchiopods have been identified in this study from Numidia, two Anostraca, *Chirocephalus salinus* Daday 1913 and *Tanymastix stagnalis* (Linnaeus, 1758) in one site El Frine pond in the border of the Southestern part of Oubeira Lake (Fig. 19); one Notostraca, *Lepidurus apus lubbocki* (Brauer, 1873); and one Spinicaudata, *Cyzicus tetracerus* (Krynicki, 1830) (Fig. 20). The most frequently encountered species was *Chirocephalus salinus* Daday 1913 folowed by *Lepidurus apus lubbocki* (Brauer, 1873).

Figure 19. Photo of El Frine pond in the border of Oubeira Lake.

Table 8. List of large branchiopods (Anostraca, Notostraca and Spinicaudata) found in Numidia during this study.

Family	Genus	Species	Author, year
Chirocephalidae Daday	*Chirocephalus*	*salinus*	Daday 1913
Branchipodidae Daday	*Tanymastix*	*stagnalis*	(Linnaeus, 1758)
Triopsidae Keilhack	*Lepidurus*	*apus lubbocki*	(Brauer, 1873)
Cyzicidae Barnard	*Cyzicus*	*tetracerus*	(Krynicki, 1830)
4 Family	**4 Genera**	**4 Species**	

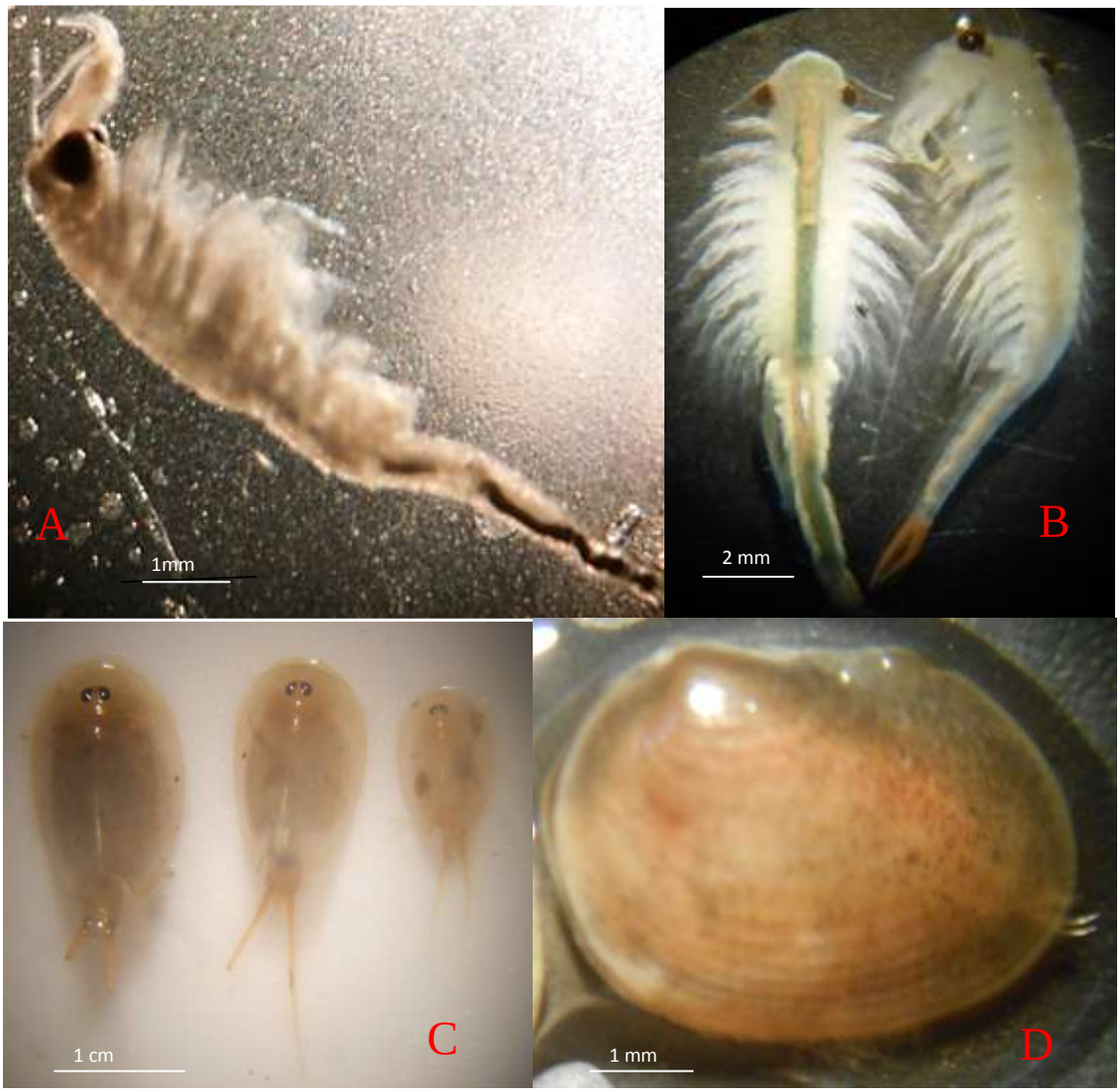

Figure 20. Photo of Large branchiopods: A. *Tanymastix stagnalis*, B. *Chirocephalus salinus*, C. *Lepiderus apus lubbocki*, D. *Cyzicus tetracerus.*

3.1.4.2. Distribution of large branchiopods (Anostraca, Notostraca and Spinicaudata) in Numidia

Chirocephalus diaphanus Prévost, 1803, recorded by Gauthier (1928a, 1934a) between Souk-Ahras and Ghardimaou (Tunisia), Algiers, Derrag, Theniet El Had, Tlemcen and Saïda provinces; Samraoui & Dumont (2002) in ponds of (Joinonville, Boukhadra, Salines, Gérard, El Feid, Frênes, Messida, Gauthier, Berrihane, Berrihane south, El Hrib, Tamaris), shallow depression close to Lac Bleu, Garaa Medjez Ezzitoun, Canal Sidi Makhlouf , Garaa Bechna, pond aux Oliviers, pond aux Linaires; Samraoui *et al.* (2006) in pond Oued Nachef (Sebdou, western Hauts Plateaux).

Chirocephalus salinus Daday 1913, recorded by Samraoui *et al.* (2006) in Les Salines, pond Laalalig (Annaba province), and this study.

Tanymastix stagnalis (Linnaeus, 1758), recorded by Gauthier (1928a) and Samraoui & Dumont (2002) in El Frine pond, and this study.

Lepidurus apuslubbocki (Brauer, 1873), recorded by Gauthier (1928a) in ditch close to Fetzara marsh, marsh between Oubeira and Tonga Lakes, Samraoui & Dumont (2002) in ponds of (Boukhadra, Gérard, Frênes, Messida, El Frine, Gauthier, Berrihane, Berrihane south, El Hrib, Tamaris) from El Tarf province, Garaa Medjez Ezzitoun, and this study.

Cyzicus tetracerus (Krynicki, 1830), recorded by Samraoui & Dumont (2002) in Joinonville pond, and this study.

Table 9. Distribution of large branchiopods (Anostraca, Notostraca and Spinicaudata) from 47 waterbodies in Numidia.

Site name(type)	Province	***Chirocephalus salinus***	***Tanymastix stagnalis***	***Lepidurus apus***	***Cyzicus tetracerus***
Les Salines (ditch)	Annaba	+	-	+	+
Les Salines 2(temporary marsh)	Annaba	+	-	-	-
Laalalig (ditch)	Annaba	+	-	-	-
Boukhadra (temporary marsh)	Annaba	-	-	-	+
El-Rym (temporary marsh)	Annaba	+	-	-	-
Sidi Salem (temporary pond)	Annaba	+	-	+	+
Les Salines1 (temporary pool)	Annaba	+	-	-	-
Oued El Nil (temporary pool)	Annaba	+	-	-	-
Boukhadra (El-Rym)(temp. pool)	Annaba	-	-	+	-
Berrehal (temporary pool)	Annaba	-	-	+	-
Kalitoussa-Berrehal (bassin)	Annaba	-	-	-	+
Aib Ammar (temporary pool)	Annaba	+	-	+	-
El-Chorfa (ditch)	Annaba	-	-	-	+
El-Karma 1(basin)	Annaba	+	-	-	-
El-Eulma (temporary pool)	Annaba	+	-	-	-
Chbaita Mokhtar (temporary pool)	Annaba	+	-	+	-
El Makroun (Tacha) (ditch)	Annaba	+	-	-	-
El Makroun (temporary pool)	Annaba	-	-	+	-
El Frine (peanut field)	El-Tarf	+	+	+	-
El Frine (sandy pool)	El-Tarf	-	-	-	+
El Frine (temporary pool)	El-Tarf	+	-	+	-
Souk Rguibet (temporary pool)	El-Tarf	+	-	+	-
Souk Rguibet (ditch)	El-Tarf	-	-	+	-
Sebaa (temporary pool)	El-Tarf	-	-	+	-
Boutheldja 1(ditch)	El-Tarf	+	-	+	-
Boutheldja 2 (temporary pool)	El-Tarf	+	-	-	-
El Frine 2 (peanut field)	El-Tarf	-	-	+	-
El Frine (ditch)	El-Tarf	+	-	+	-
Draouche (peanut field)	El-Tarf	+	-	-	-
Berrihane (temporary pool)	El-Tarf	+	-	+	-
El Asfour (temporary pool)	El-Tarf	+	-	+	-
Ben M'hidi (ditch)	El-Tarf	+	-	-	-
El Kous	El-Tarf	+	-	-	-
Jnene Echouk (temporary pool)	El-Tarf	+	-	-	-
El-Chatt (ditch)	El-Tarf	+	-	-	-
El Hamma (temporary pool)	Skikda	-	-	+	-
Hdjar –Soud (temporary pool)	Skikda	-	-	+	-
Ain Magroun (temporary marsh)	Skikda	+	-	+	-
El Khlelfa (temporary pool)	Skikda	-	-	+	-
Ben Azouz (temporary pool)	Skikda	+	-	-	-
Ain Sanour (temp. pool)	Souk Ahras	+	-	-	-
Ma Lahmar (temp. pool)	Souk Ahras	+	-	-	-
El Tahouna (temp. pool)	Souk Ahras	+	-	-	-
Lahnancha (temp. pool)	Souk Ahras	+	-	-	-
Ain Zana (basin)	Souk Ahras	+	-	-	-
Lamouadjen (temp. pool)	Souk Ahras	+	-	-	-
Bir Osmane (pool)	Guelma	+	-	-	-

4. DISCUSSION

4.1. Ostracoda

During the present study 28 ostracod species were newly identified. Among them, three species (*Cypris pubera*, *Limnocythere inopinata*, *Potamocypris variegata*) are new to Algeria while 10 taxa (*Eucypris kerkyrensis*, *E. lilljeborgi*, *Heterocypris rotundata*, *Ilyocypris decipiens*, *I.* cf. *japonica*, *Isocypris beauchampi*, *Potamocypris smaragdina*, *P.villosa*, *Prionocypris zenkeri,* and *Scottia* sp) are new to North Africa (Ramdani *et al*. 2001b; Yacoubi-Khebiza *et al*. 2001; Hussein *et al.* 2004; Zaibi *et al*. 2013). Thus, the record of non-marine ostracods from Algeria increased to 49 species belonging to 7 families (Fig. 21). This number exceeded that of Tunisia with 41 species (Zaibi *et al.* 2013), Portugal with 32 species (Martins *et al*. 2010) and Morocco with 15 species (Ramdani 1982; Ramdani *et al.* 2001b; Yacoubi-Khebiza *et al*. 2001). However, this number remains low for the country (Algeria), which is the largest one in the Mediterranean region. For example, the number of species was 152 in Italy (Pieri *et al*. 2015), 143 in Turkey (Külköylüoğlu *et al.* 2015), 113 in France (Meisch *et al*. 1990) and 86 species in Spain (Meisch 2000). In fact, the species richness of a country appears to be more related to the presence of specialists and to the sampling effort rather than the region or wealth in water bodies, e.g., about 100 species were recorded in a small island such as Sicily in Italy (Rossetti *et al.* 2004, 2006). In their previous works, Gauthier (1928a-c) and Gauthier & Brehm (1928) found 31 species of living ostracods in 113 water bodies in Algeria, which were often sampled punctually. In our study, only lentic waters were considered. The half of the species were found in Numidia, in the sense of biogeographic subdivisions of Quézel & Santa (1962, 1963), where efforts were highlighted by visiting pools several times. This region is considered as a biodiversity hotspot in the Mediterranean (Véla & Benhouhou 2007; Belouahem-Abed *et al.* 2011) and harbours 80 % of the total richness of the country (Samraoui & de Bélair 1998). The climate there was

classified as humid by Gauthier (1928), with the greatest number of pools in the country (de Bélair 2005) and a hydroperiod that generally lasts 8 months from November to June. The most influential factor affecting biota is the desiccation of the habitat during the dry season; species richness normally increases as the length of the flooded period in ponds increases (Zacharias *et al*. 2007). The highest species richness was found in Numidia (Annaba district, previously Bône) in Les Salines (marsh) with a total of 9 species of which the majority is cosmopolitan (e.g., *Eucypris virens*, *Isocypris beauchampi*, *Sarscypridopsis aculeata*). However, since this area has been used as stabilization ponds (constructed wetlands) in the past, the species richness could be biased because of the high amounts of organic matter and habitat degradation, described in the concept of "Pseudorichness" (Külköylüoğlu 2013). Furthermore, cosmopolitan species can often be associated with disturbed and degraded habitat (Külköylüoğlu 2004).

In the semi-arid region (35-36°N), water bodies become scarce and saline, with important distances between each Sebkha or Chott, making the sampling in these areas quite difficult, in addition to their inaccessibility, as mentioned by Gauthier (1928a). They were often dried during our visit, even in winter. This is the reason for which ostracods were raised from mud. These huge and shallow saline lakes are generally situated at high altitude (>1000 m a.s.l.) where great differences in temperatures occur between day and night and between seasons. Salinity can vary from 3 psu to several tens, and sometimes until complete saturation (Amarouayache *et al*. 2009) depending on the soil-type and ionic composition of water. Thus, they are considered as unstable environments and so, harbour specific ostracod fauna, which is well adapted to these conditions, such as euryoecious or halophilic species. Sixteen species have been found in the semi-arid region, of which *Eucypris virens*, *Heterocypris barbara*, *H. incongruens*, *Limnocythere inopinata*, *Potamocypris villosa* are halotolerant species, *Heterocypris salina*, *Ilyocypris gibba*, *Sarscypridopsis aculeate* and *Trajancypris clavata* are

considered as halophilic (Meisch 2000, Karanovic 2012). These species can also be fit to the "cosmoecious species concept" referring to the species with high tolerance levels within large geographical distribution (Külköylüoğlu 2007). Species of saline waters in the semi-arid region represent about 40% of the total species number. A maximum of five species was found in a single saline lake (e.g., see Sebkha Sidi Chami). When compared to earlier works, this number is relatively high. Indeed, previous studies exhibited showed that species richness decreases with salinity (Beadle 1943; de Deckker 1981; Hammer 1986; Williams 1998).

In the Sahara, water bodies are few compared to the semi-arid region, they are very scattered and often saline and dry during several years. The perennial of ostracods in temporary habitats is ensured by the production of resting eggs, especially for Cypridoidea, which can be also dispersed by winds and even by men via agricultural activities (Rossi *et al.* 2003), or by animals (endozoochory) (Frisch *et al.* 2007). For example, Green *et al.* (2013) found live adults of *Candona simpsoni* in birds (killdeer) teal faeces. In previous works, de Deckker (1981) reported that *Eucypris mareotica* Fisher (1855) was the most widespread inhabitant of saline waters of the Sahara. In the present study, only three samples were from Sahara, where the cosmopolitan and halotolerant species *E. virens* and *H. incongruens* were often found. The genus *Heterocypris* is also represented in the Sahara by *H. barbara* and *H. rotundata* which are halophilic species (de Deckker 1981).

The most abundant and common species was *Eucypris virens* found in the majority of sites (95%). These results are not surprising when especially this species is known as cosmopolitan with high tolerance levels to different ecological variables (Külköylüğlu *et al.* 2007). This freshwater ostracod species complex occurs mainly in winter and spring in ephemeral ponds (Meisch 2000), with extreme salinities between 0.6 and 5 ‰ (de Deckker 1981). Parthenogenetic lineages are found throughout Europe, North Africa, North America and Palearctic Asia (Meisch 2000; Semenova 2005). However, populations with males are

known only from the circum-Mediterranean area and central Asia (Meisch 2000), where males and sexual females may co-exist with clonal lineages (Schön *et al.* 2000). The presence of males in 7 sites (El Karma, El Frine, Sebaa, El Henaya, Ain Nechma, Chott Tinsilt, and Sebkha Djendli) is to be noticed. The second most abundant species in this study was *Heterocypris incongruens*, a well-known cosmopolitan species which can be found in almost all kinds of fresh and brackish waters (Meisch 2000), and especially strongly eutrophic ponds.

Half of the species (50%) reported in about a century years ago were found again in our study. Nineteen species recorded previously (Gauthier 1928; Samraoui *et al.*1998; Karanovic & Pesce 2000) are missing in our samples. It is probable that anthropogenic and climatic changes along with habitat lost and seasonal differences can play important role for those missing species. Also, it should be mentioned that some species reported by Gauthier (1928) were found in some sites and types of water bodies such as rivers, springs and wells, which have not been sampled in this study.

Among rare species ***Eucypris lilljeborgi*** is poorly known worldwide (Meisch 2000) and no biological data are available. It is a stenochronal spring form and has been reported from temporary ponds and ditches situated in meadowland (Klie 1938). In this study, it was found in Sebkha Djendli, Chott Tinsilt and Garaa Guellif which are all saline and temporary, and situated in the semi-arid region with cold winter and hot and dry summer at high altitude (1000 m a.s.l.).

Prionocypris zenkeri was only found in El Frine with few female individuals. This species clearly avoid both deep and stagnant waters (Meisch 2000) and prefers slow flowing streams with rich aquatic vegetation. Most recently, studies (e.g., Akdemir *et al.* 2016) showed that *P. zenkeri* can also inhabit troughs, springs and small water bodies.

Heterocypris rotundata found in El-Karma 2, Akarom and the saline lakes of Guellif, Zahres El-Guarbi and Sidi Chami, lives in the littoral zone of lakes and small pools. This

halophilic ostracod is able to resist a gradual increase in salinity (Meisch 2000). Ecological and biological data are scarce about this species.

Ilyocypris decipiens was found in Les Salines located nearby the sea. This species can live in fish ponds, the littoral zone of lakes, slowly flowing brooks and rivers, temporary pools (Akdemir *et al*. 2016) and fountains and also tolerate moderately high salinity as about 2.2‰ (Meisch 2000).

Isocypris beauchampi were found in Numidia in Les Salines, El Oued (pond), Berrihane, El Asfour and Oum Tboul ponds. It prefers slowly flowing streams and canals (fish) ponds, the littoral zone of lakes and rice fields and also it is common in both the benthic and interstitial habitats (Külköylüoğlu 2003).

Potamocypris villosa was found in Draa Boultif, a marsh (with 2.23 psu salinity) on wheat field and Chott Es-Shari both situated in a semi-arid region at 1000 m a.s.l. Roca & Baltanás (1993) and Mezquita *et al*.(1999) suggested *P. villosa* as a cold stenothermal species of high altitudes (>600 m a.s.l.). Similarly, Külköylüoğlu &Yılmaz (2006) reported that *P. villosa* had the highest salinity in a helocrene spring in Turkey located at about 1400 m a.s.l., implying a wide range of tolerance. Li *et al.* (2010) reported that the shells of this species were highly abundant in a spring with slightly acidic conditions (pH = 6.6) and salinity (0.57 ‰) at about 3200 m a.s.l.

Potamocypris smaragdina was found only in El Oued pond which was previously a Wadi, being currently derived. It is reported from the littoral zone of the lakes and slow streams and seems to be absent from temporary waters although having desiccation resistant eggs (Meisch 2000).

Ilyocypris* cf. *japonica was only found in Les Salines. Little is known about the occurrence of *I. japonica* since its first description (under the name of *Ilyocypris haterumensis* n. sp.) from Hateruma Jima island of Japan by Okubo & Terauchi (1992) (R. Smith pers.

comm.). Although our individual shows similarities to the type species described by Okubo & Terauchi (1992), the specimen is left open to nomeclature because of lack of individuals.

Eucypris kerkyrensis was found in Chott Tinsilt. Also, this species is known from shallow and slightly brackish and temporary pools (NaCI 2-4 ‰) (Meisch 2000)**.**

***Scottia* sp.**was found only in Hamiet and Ettouama Sebkhas which are large saline lakes situated in the semi-arid region. Although we were not able to identify the samples yet to the species level, it is worth to talk about its value as being a possibly new form inferring to increase the species richness of the areas.

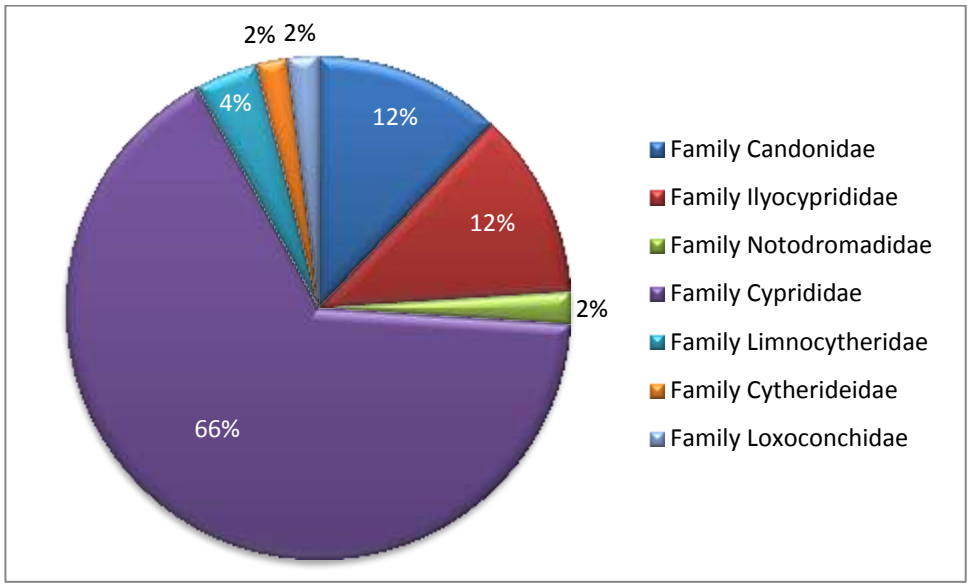

Figure 21. Distribution percentage of non-marine ostracod families in Algeria.

4.2. Cladocera

Present study was resulted in identification of 38 taxa, 11 of which are new to the country and eight are new to Maghreb (Morocco-Algeria-Tunisia) in general (see Mouelhi *et al*. 2000; Turki &Turki 2010; Aoujdad *et al*. 2014). Thus, the overall recorded Algerian cladoceran species richness has increased up to 81 taxa belonging to 27 genera and 8 families (Fig. 22).

This number exceeds that for Tunisia, where Turki & Turki (2010) reported 49 species belonging to 19 genera, and that of Morocco with 53 known species belonging to 21 genera (Aoujdad *et al*. 2014). The genus *Daphnia* is the most specious genus in Maghreb, being represented by 13 species.

In previous surveys, Gauthier (1928a, c) reported 40 species of Cladocera from 113 water bodies located in the Northern part of Algeria, including some Saharan regions. In contrast, Dumont (1979) was focused on the southern Sahara (Tassili N'Ajjer and Hoggar) while Samraoui *et al*. (1998) and Samraoui (2002) studied the northeastern region (Numidia). Thus, 40 species recorded previously were not found again during our study when only the lentic waters of the Northern part of the country were considered.

As for ostracods, the climatic and anthropogenic changes, caused the disappearance of many water bodies, could be responsible for these differences. Most species were found in the humid region in northeast of Algeria (Annaba, previously Bône and El-Tarf provinces). This region is characterized by the greatest number of water bodies in the country (de Bélair 2005). We detected the highest species richness in Kalitoussa bassin (Annaba) but unfortunately this site has been destroyed just our visit, it contains seven species, and most revealed taxa are currently considered widespread (Alonso 1991; Kotov *et al.* 2013a). Some common taxa, as *Daphnia magna,* were always represented by few specimens in each sample. This could partly explain its absence in the recent lists by Samraoui *et al.* (1998) and Samraoui (2002) where this species was present only in two sites.

In the semi-arid region, the halophylic *Moina salina*is a common inhabitant of saline lakes, being found at 255 psu in Sebkha Ez-Zemoul (Amarouayache *et al.* 2012). *Daphnia mediterranea*, reported for the first time from Sebkhas of the region, was found at moderate salinity up to (22 psu). This species was previously confused with *Daphnia dolichocephala* Sars, 1895 (Alonso 1985). *D. mediterranea* occurs in the saline lakes of the Mediterranean

region, mainly in Spain and North Africa, experiencing a wide salinity range between 10 and 60 ‰ (Alonso 1990). Other reported species are weakly represented in the saline environments, although their occurrence in brackish waters is more or less common especially in eurybiotic and widely distributed taxa (e.g. *Chydorus sphaericus* and *Daphnia atkinsoni*). Poorness of the saline lake fauna is well known: a negative correlation between salinity and species richness is well documented (see De Deckker & Geddes 1980; Hammer 1986; Williams *et al.* 1990).

The absence of some species in Algeria that were occurring in Morocco and/or Tunisia is probably an artifact of insufficient sampling efforts. For example *Daphnia lumholtzi* Sars, 1886, a common African species, have been recorded from Morocco (Brehm 1954) and not found in Algeria. *Ceriodaphnia setosa* Matile, 1890, *Alonella nana* (Baird, 1843), *Alona esteparica* Alonso, 1985, *A. costata* Sars, 1862 and *Leydigia ciliata* (Gauthier, 1939), which are absent in the Algerian species list, were recorded from Morocco also (Ramdani 1982), although any descriptions have not been provided and at least some of aforementioned identifications need to be confirmed. Such taxa as *Daphnia dolichocephala* (Sars, 1895) or *Alona quadrangularis* (O. F. Müller, 1776) were recorded from Tunisia (Gauthier & Brehm 1928; Turki & Turki 2010), but have not been found in Algeria as well, probably also due to the insufficient sampling efforts, because some types of water bodies were missed in our study.

Mouelhi *et al.* (2000) reported the western-eastern climatic gradient in the Maghreb and concluded that a greater diversity of habitats is characteristic of Morocco, which is influenced by the Atlantic Ocean, as compared with Algeria with its arid climate dominance. But this observation could explaine only in part the higher diversity of the freshwater fauna in Morocco: such phenomenon might be also explained by insufficient sampling efforts, taking into consideration lack of such common north African taxa as *Ilyocryptus sordidus*, *Daphnia*

similis and *Moina belli* in the species lists of the aforementioned authors which dealt with North Africa. *Daphnia* cf. *similis* Claus, 1876 reported for the first time by Dumont (1979) from Algeria about 40 years ago has never been mentioned again until the present study. In some cases it was probably confused with *Daphnia carinata* (see Gauthier 1929). The genus *Ilyocryptus*, being recorded for the first time by Gauthier (1928a) in the Saharan El-Chaib marsh (Saida province), has been recorded next time only in the present survey. Algeria (including Sahara desert) is rich in water bodies which have not been sampled yet.

The number of 81 species seems to be low for such a large country being compared to other Mediterranean regions. Thus, 103 species were recorded from Turkey (Ustaoglu 2015), 102 from Italy (Margaritora 2005), 92 from France (Amoros 1984), and 88 from the Iberian Peninsula (Alonso 1996), 57 and 43 species were recorded from such relatively small area as Sicily (Marrone *et al.* 2005, Marrone 2006) and the Balearic Islands (Pretus 1990) respectively. In fact, the knowledge of species richness of a country seems to be more dependent on number of surveys rather than on its size.

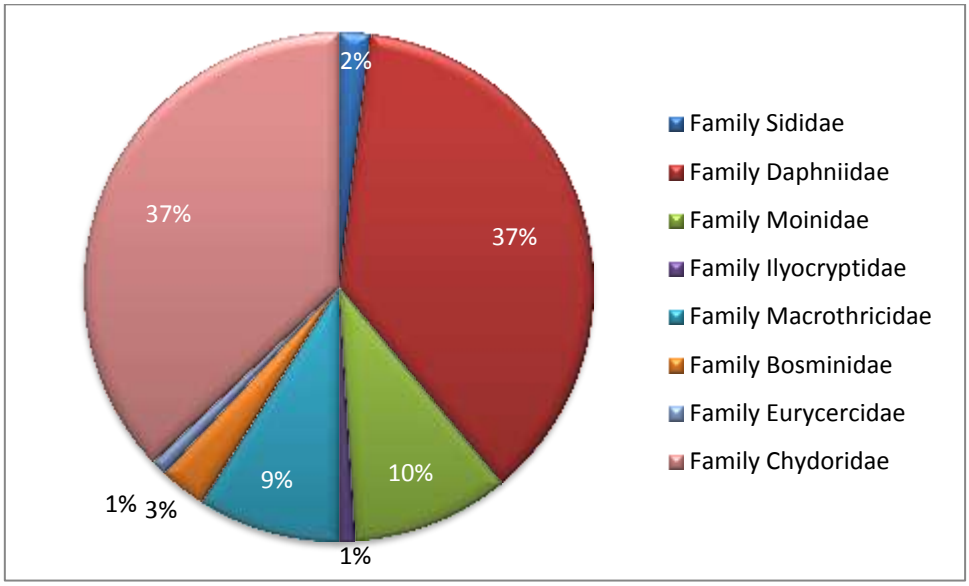

Figure 22. Distribution percentage of Cladocera families in Algeria.

4.3. Cyclopoida

During the present study only a part of specimens of cyclopoids were identified from 28 sites among the 97 samling sites, because of the lack of time in this Thesis. Thus, only eleven species were identified. Among them, *Eucyclops leschermoutouae* Alekseev & Defaye, 2004, is new to Algeria (Hamaidi *et al.* 2010) and a second world record (Alekseev & Defaye 2004). All the cyclopoid species encountred in this study belong to the family of Cyclopidae which is cosmopolitan and of Palaearctic distribution (Dussart & Defaye 2006). Thus, the record of Cyclopoids from Algeria increases now to 47 species belonging to 18 genera. This number exceeded that of both Tunisia and Morocco with 30 species (Mouelhi *et al.* 2000; Turki & Turki 2010).

However, this does not prevent that some species recorded in Tunisia and Morocco are absent in Algeria. In North Africa, *Halicyclops troglodytes* Kiefer, 1954 (Ramdani, 1988); *Eucyclops speratus ifniensis* Dumont & Decraemer, 1977 (Dumont & Decraemer 1977); *Paracyclops fimbriatus chiltoni* (Thomson, 1882) (Kiefer 1928); *Ectocyclops phaleratus* (Koch, 1838) (Ramdani 1988); *Thermocyclops oithonoides* (Sars, 1863) (Kiefer, 1953); *Apocyclops dengizicus* (Lepechkine, 1900) (Kiefer, 1949) have been reported only in Morocco. Two other species *Thermocyclops tchadensis* Dussart & Gras, 1966 (Turki & El Abed 1999); *Apocyclops royi* (Lindberg, 1940) (Turki & El Abed 1999) have been listed only in Tunisia; and one species *Halicyclops neglectus* Kiefer, 1935 (Ramdani 1988) is common to Tunisia and Morocco but absent from lists of Algeria. In their previous work, Gauthier (1928a) found 17 species of Cyclopoids in 113 water bodies in Algeria. Kiefer (1926, 1930, 1952, 1958) studied various samples coming from sites in the north and the south (central Sahara), adding *Eucyclops hadjebensis* Kiefer, 1926, *Cryptocyclops linjanticus* (Kiefer, 1928), *Megacyclops donnaldsonni algericus* Kiefer, 1930 to the previous lists. Dumont (1979), in his Thesis reported 8 cyclopoid species from Sahara. Samraoui *et al.* (1998) and Samraoui (2002) gave a

checklist of 22 copepod species for Numidia, including as new records *Eucyclops turcomanus* Lindberg, 1959, *Mesocyclops ogunnus* Onabamiro, 1957, and *Mesocyclops salinus* Kiefer, 1981. Hamaidi *et al*. (2010) added five new species: *Graeteriella unisetigera* (Graeter, 1908), *Microcyclops* (*Microcyclops*) *varicans varicans* (G.O. Sars, 1863), *Thermocyclops crassus* (Fischer, 1853), *Thermocyclops oblongatus* G.O. Sars, 1927, *Ectocyclops phaleratus* (Koch, 1838); however their checklist is incomplete, they missed three species: *Cyclops abyssorum divergens* (Lindberg, 1936), *Thermocyclops macracanthus* (Kiefer, 1929), and *Eucyclops turcomanus* Lindberg, 1959 reported by Dumont (1979) in his unpublished Thesis.

The highest species richness was found in Numidia (Annaba province) in Sidi Salem and Bouzizi ponds with a total of 4 species in the same sample andof which the majority are cosmopolitan (Boxshall & Strong 2006). Five species have been found in the semi-arid region, of which *Eucyclops leschermoutouae* described for the first time by Alexseev and Defaye (2004) in Well from Majorca Balearic Islands. In this study, this new species has been found in shallow temporary pools with less than 1m depth and salinity range from 4 to 7 psu.The Algerian type needs to be redescribed and genetic study is required (Ghaouaci *et al*. 2017).

4.4. Large branchiopods (Anostraca, Notostraca, Spinicaudata) from Numidia

During this study, four species of large branchiopods have been identified from 47 water bodies in 5 provinces of northeastern Algeria. Among them, *Tanymastix stagnalis* (Linnaeus, 1758), was found only in El-Frine pond (El-Tarf province). Its distribution in Algeria is limited to two sites Reghaia (Algiers) and El Frine according to Gauthier (1928) and Samraoui *et al*. (2006). In Numidia, *T.stagnalis* co-occured with other large branchiopods, like *Chirocephalus salinus* and *Lepidurus apus lubbocki*, and the decapod *Atyaephyra desmaresti* (Millet, 1831) (Fig.19). In our knowledge, this co-occurrence has never been recorded by other authors. Adding to low fecundity (personal observation), short developing

period and low food availability, the occurrence of *T.stagnalis* is threatened by agriculture, pollution and/or inundation of Oubeira Lake which is rich in fish predators like eels, grey mullets and others (Fig. 20). This species deserves the statute of endangered species and sites protection measures (Ghaouaci & Amarouayache 2017). Elsewhere, the French commission of the UICN (International Union for Conservation of Nature) classified this species as nearly threatened and suggested specific conservation measures (UICN France &MNHN 2016).The most encountered species of large branchiopods was the anostracan *Chirocephalus salinus.* This species was long confused with *C. diaphanus* but recent investigations in the framework of a doctoral Thesis allowed to confirm that the species sampled in this study is *C. salinus* (Boumendjel *et al*. 2017). *C. salinus* was often found to co-occur with the Notostraca *L.apus lubbocki* in about 27% of sampled sites. The Spinicaudata *C. tetracerus* (Krynicki, 1830) is relatively rare also, itwas encountered only in 6 sampled sites, which corresponds to 12 % of total sampling sites. It co-occured with *C. salinus* and *L. apus lubbocki* only in 2 sites (Les Salines and Sidi Salem). This co-occurrence is attributed to different partitioning resource and abiotic factors, such as temperature and salinity, thatare known to structure the distribution of large branchiopods. Several authors (Moscatello *et al*. 2002; Thiéry & Puente 2002; Rogers 2014a, b, c, 2015) demonstrated that these vagaries of distribution are directly related to species-specific geochemical tolerance ranges, and a strong correlation between pool substrate geochemistry and species or species assemblages.

C. *salinus*, collected in 72% of the waterbodies (Table 9), is a widespread and common species in Numidia (Samraoui *et al.* 2006), and has previously been recorded by these authors in the same region. However, its distribution is known in the humid to subhumid region where rainfall is more than 600 mm per year (Gauthier 1928). According to Reniers *et al*. (2013), the taxonomy of the *Chirocephalus* species of the diaphanus-group is currently under revision, and it is possible that the taxa occurring in Maghreb belong in fact to several different species.

Figure 23. Photo of Decapoda *Atyaephyra desmaresti*.

Figure 24. Photo of Fish in the edge of Oubeira Lake.

5. CONCLUSION

The present study was resulted in identification of 28 ostracods 38 cladocerans, 11 cyclopoids and 4 large branchiopod species. Among them 25 taxa are new to Algeria or North Africa in general. Thus, the overall recorded Algerian non-marine ostracods, cladoceran, and cyclopoid species biodiversity has increased up to 49, 81, and 47 respectively.

However, those numbers remain low for the largest country (Algeria) in the Mediterranean region and Africa compared with other Mediterranean countries. In fact, the species richness of a country appears to be more related to the presence of specialists and to the sampling effort rather than the region or wealth in water bodies. In their previous and extensive works of Thesis, Gauthier (1928) found 31 species of living ostracods, 40 species of Cladocera, and 17 cyclopoids species in 113 water bodies located in the Northern part of Algeria, including some Saharan regions.In contrast, Dumont (1979) focused on the southern Sahara (TassiliN'Ajjer and Hoggar). Thus, 19 ostracods, 40 cladocerans, and 36 cyclopoid species recorded previously were not found again during our study when only the lentic waters of the northern part of the country were considered. Except the sampling efforts, the climatic and anthropogenic changes, which caused the disappearance of many water bodies, could be responsible for these differences.The half of the species were found in Numidia northeast of Algeria (Annaba, previously Bône, El-Tarf and Skikda provinces), which is characterized by the greatest number of water bodies in the country, and where efforts were highlighted by visiting pools several times. Samraoui *et al*. (1998) and Samraoui (2002) focused on this region, which is considered as a biodiversity hotspot in the Mediterranean andharbours 80 % of the total richness of the country, with the greatest number of pools. However, it is known that the most influential factor affecting biota is the desiccation of the habitat during the dry season; species richness normally increases as the length of the flooded period in ponds increases. In Algeria, the most water bodies are filled few months of the year, and the

majorities are temporary. Several species from this study deserve systematic revision and a statute of protection.

In the semi-arid region, Sebkhas or Chotts, harbour a specific carcinological fauna, which is well adapted to these conditions, such as euryoecious or halophilic species.

There is no doubt that these numbers will increase in future as vast area of Algeria have yet to be adequately sampled and, due to the size of the country. Aconsiderable effort is needed to bring our knowledge in line with that of Mediterranean countries. More samples are needed from the steppic region, which unfortunately was experiencing a severe drought during our survey, and the Sahara before a true picture of the distribution of the Algerian carcinological fauna can emerge.

REFERENCES

AGENCE NATIONALE DES RESSOURCES HYDRIQUES (A.N.R.H.) (1993) Carte pluviométrique de l'Algérie du Nord au 1/500 000 (2 feuilles, notice explicative de 49 p). Ministère de l'Equipement, Alger.

AKLI, S. (1991) Systématique et répartition géographique des copépodes (Crustacés) dulcicoles dans le Nord de l'Algérie: 1–158. (Thesis, University of Algiers).

AGENCE NATIONALE DES RESSOURCES HYDRIQUES (A.N.R.H.) (1993) Carte pluviométrique de l'Algérie du Nord au 1/500 000 (2 feuilles, notice explicative de 49 p). Ministère de l'Equipement, Alger.

ALEKSEEEV, V. R. & DEFAYE, D. (2004) *Eucyclops leschermoutouae* sp. n. (Copepoda, Cyclopidae) from Majorca, Balearic Islands. *Zoosystematica Rossica*, 12, 163–169.

ALONSO, M. & PRETUS, J. L. (1989) *Alona iberica*, new species: first evidence of non cosmopolitanism within the *A. karua* complex (Cladocera: Chydoridae). *Journal of Crustacean Biology,* 9, 453–476.

ALONSO, M. (1987) Morphological differentiation of two new *Ephemeroporus* species (Cladocera, Chydoridae) belonging to the *barrosi* complex: *E. margalefi* and *E. epiaphantoii*, in Spain. *Hydrobiologia*, 145, 131–146.

ALONSO, M. (1990) Anostraca, Cladocera and Copepoda of Spanish saline lakes. *Hydrobiologia*, 197, 221–231.

ALONSO, M. (1991) Review of Iberian Cladocera with remarks on ecology and biogeography. *Hydrobiologia*, 225, 37–43.

ALONSO, M. (1996) Fauna Iberica. Crustacea Branchiopoda. Consejo Superior de Investigaciones Cientificas, Madrid, 486 pp.

ALONSO, M. (2010) Branchiopoda and Copepoda (Crustacea) in Mongolian saline lakes *Mongolian Journal of Biological Sciences Vol. 8(1):* 9–16.

AMAR, Y., DJAHED, B., LEBID, S., ANANI, M., MOUEDDENE, K. & MATHIEU, C. (2012) Impact of industrial pollution on the zooplankton population diversity of the Hammam Boughrara Dam.*Journal of Environmental Science and Engineering*. A. 1: 527–532.

AMAROUAYACHE, M., DERBAL, F., KARA, M.H. (2009) Biological data on *Artemia salina* (Branchiopoda, Anostraca) From Chott Marouane (Northeast Algeria). *Crustaceana* 82 (8), 997–1005.

AMAROUAYACHE, M., DERBAL, F. & KARA, M.H. (2012) Note on the carcinological fauna associated with *Artemiasalina* (Branchiopoda: Anostraca) from Sebkha Ez-Zemoul (northeast Algeria). *Crustaceana*, 85: 129–137.

AMOROS, C. (1984) Introduction pratique à la systématique des organismes des eaux continentales françaises. Crustacés Cladocères. *Bulletin de la Société linnéenne d*e *Lyon* 5: 72–145.

ANONYMOUS (1998) Atlas des zones humides algériennes. Direction Générale des Forêts (Eds), MADR Algérie, 46 pp.

ANONYMOUS (2001) Atlas des zones humides algériennes d'importance internationale. Direction Générale des Forêts (Eds.), MADR, Algérie, 56 pp.

ANONYMOUS (2004) Atlas (IV) des zones humides algériennes d'importance internationale. Direction Générale des Forêts (Eds.), MADR, Algérie, 107pp.

AOUJDAD, R., MAQBOUL, A., DRIOUICH, A., RHIAT, M., LABIOUI, H. & FADLI, M. (2014) Biodiversity and seasonal dynamics of the cladoceran community in the wetlands of the Gharb and Loukkos plains in Morocco. *Journal of Biodiversity and Environmental Sciences*, 4 (2) 104–110.

BALIAN, E. V., SEGERS, H., LEVEQUE, C. & MARTENS, K. (2008) The Freshwater Animal Diversity Assessment: an overview of the results. *Hydrobiologia*, 595:627–637

BEADLE, l. C. (1943) An ecological survey of some Inland Saline Waters of Algeria. *Zoological Journal of the Linnean Society*, 218–242.

BEKKER, E.I., KARABANOV, D.P., GALIMOV, Y.R. & KOTOV, A.A. (2016) DNA barcoding reveals high cryptic diversity in the North Eurasian *Moina* species (Crustacea: Cladocera). *PLoS ONE* 11(8): e0161737.

BEKKER, E.I., KOTOV, A.A. & TAYLOR, D.J. (2012) A revision of the subgenus *Eurycercus* (Eurycercus) Baird, 1843 emend. nov. (Cladocera: Eurycercidae) in the Holarctic with the description of a new species from Alaska. *Zootaxa*, 3206, 1–40.

BELOUAHEM-ABED, D., BELOUAHEM, F., BENSLAMA, M., DE BELAIR, G. & MULLER, D.S. (2011) Les aulnaies de Numidie (N.E. Algérien) : biodiversité floristique, vulnérabilité et conservation. *Comptes Rendus Biologies*, 334, 61–73.

BELYAEVA, M. & TAYLOR, D.J. (2009) Cryptic species within the *Chydorus sphaericus* species complex (Crustacea: Cladocera) revealed by molecular markers and sexual stage morphology. *Molecular Phylogenetics and Evolution*, 50, 534–546.

BENZIE, J.A.H. (2005) The genus *Daphnia* (including *Daphniopsis*) (Anomopoda: Daphniidae). *Guides to the identification of the microinvertebrates of the continental waters of the world21*. Kenobi Productions, Ghent & Backhuys Publishers, Leiden, 376 pp.

BIDI-AKLI, S., ARAB, A. & SAMRAOUI, B. (2014) Variation spatio-temporelle du zooplancton dans le barrage de la réserve de chasse de Zéralda (Algérie). *Revue de l'Écologie* (*Terre Vie*), 69, 214–224.

BLANCHARD, R. & RICHARD, J. (1890) Sur les crustacés des Sebkhas et des chotts d'Algérie. Bulletin de la Société Zoologique de France, 15, 136–138.

BLANCHARD, R. & RICHARD, J. (1891) Faune des lacs salés d'Algérie. cladocerès et copépodes. Mémoires de la Société Zoologique de France, 4, 512–535.

BLANCHARD, R. (1891) Résultats d'une excursion zoologique en Algérie. *Mémoires de la Société zoologique de France* 4, 208–245.

BOUDIFA, H. (1993) Etude comparative du zooplancton de la zone littorale de deux sites de la région de Sidi Bel Abbés: Lac Sidi M'Hamed, Benali et le barrage Sarno: 1-184. (Thesis, University of Algiers).

BOUMENDJEL, L., GHAOUACI, S., GOUASMIA, G., AMAROUAYACHE, M. & RABET, N. (2017) Distribution and biological data of *Chirocephalus salinus* (Crustacea, Anostraca) in Northeastern Algeria.The International Colloque Franco-Japanese of Oceanography (COAST),Coast Bordeaux-France, November 7 -10, 2017.

BOXSHALL, G. A. & HALSEY, S. H. (2004) An Introduction to Copepod Diversity. The Ray Society, London, 966 pp.

BOXSHALL, G. A. & STRONG, E. E. (2006) An extraordinary shift in life habit in a genus of cyclopid copepods from Lake Tanganyika. *Zoological Journal of the Linnean Society* 146: 275–285.

BOXSHALL, G. A., DEFAYE, D. (2008) Global diversity of copepods (Crustacea: Copepoda) in freshwater. *Hydrobiologia*, 595,195–207.

BREHM, V. (1913) Cladoceren-Ergebnisse de zweiten deutschen Zentral Africa-Expedition 1910-1911. l, Zoologie, Teil l, Leipzig: 35–40.

BREHM, V. (1954) Sur quelques crustacés inférieurs du Maroc. *Bulltin du societé scientifique du Maroc*, 34, 211–215.

BREHM, V. (1958) Die Cladoceren fauna des Tassili Gebietes. pp. 73-84. In F Bernard (Ed.), Mém. Miss. & Tassili n'Ajjer *Institue du Recherche Saharienne* Univ. Alger 3.

BRENDONCK, L., ROGERS, D.C., OLESEN, J., WEEKS, S.R.H. (2008) Global diversity of large branchiopods (Crustacea: Branchiopoda) in fresh water. *Hydrobiologia* 595: 167–176.

BRONSHTEIN, Z.S. (1947) Ostracoda Presnykh Vod. Fauna SSSR, Rakoobraznye, Tom 2, Vyp. 1. (Zoologicheskii Institut, Akademiya Nauk SSSR, Moscow). English translation 1988: Fresh-water Ostracoda. Fauna of the USSR. Crustaceans. 2 (1), Amerind Publishing Co. Pvt. Ltd., New Delhi, xv + 470 pp.

BUTLIN, R., SCHON, I. & MARTENS, K. (1998) Asexual reproduction in non-marine ostracods. *Heredity*, 81, 473–480.

CHATTERJEE, T., KOTOV, A.A., VAN DAMME, K., CHANDRASEKHAR, S.V.A. & PADHYE, S. (2013) An annotated checklist of the Cladocera (Crustacea: Branchiopoda) from India. *Zootaxa*, 3667 (1), 1–89.

CHERBI, M. (1984) Contribution à l'étude des peuplements zooplanctoniques de trois lacs: Hamiz, Ghrib et Boughzoul 1-154. (Thesis, University of Algiers).

CHERBI, M., LEK-ANG, S., LEK, S & ARAB, A. (2008) Distribution du zooplancton dans les lacs à climat méditerranéen. *Comptes Rendus Biologies*, 331: 692-702.

CHIAMBENG, G.Y. & DUMONT, H.J. (2004) The genus *Pleuroxus* Baird, 1843 (Crustacea: Anomopoda: Chydoridae) in Cameroon, Central-West Africa. *Annales de Limnologie*, 40, 211–229.

CREASE, T.J., OMILIAN, A.R., COSTANZO, K.S. & TAYLOR, D.J. (2012) Transcontinental phylogeography of the *Daphnia pulex* species complex. *PLoS One*, 7, e46620.

COLBURN, E.A. (2004) Vernal Pools: Natural History and Conservation. McNaughton & Gunn, Inc., Saline, MI. 426p.

DADAY, E.V. (1910) Untersuchungen über die Süsswasser-Mikrofauna Deutsch-Ost-Afrikas. *Zoologica* 59 (1/5): 1–316.

DANIELOPOL, D.L., MARTENS, K., CASALE, L.M., (1989) Revision of the genus *Leucocythere* Kaufmann, 1892 (Crustacea, Ostracoda, Limnocytheridae), with the description of a new species and two new tribes.*Bulletin de l'Institut Royal des sciences naturelles de Belgique, Biologie*, 59, 63–94.

DE BELAIR, G. (2005) Dynamique de la végétation de mares temporaires en Afrique du Nord (Numidie orientale, NE Algérie). *Ecologia Mediterranea*, tome 31, fascicule 1, 1–18.

DECLERCK, S. VANDEKERKHOVE J. JOHANSSON, L., MUYLAERT, K. CONDE-PORCUNA, J. M. VAN DER GUCHT, K. PEREZ-MARTINEZ, C. LAURIDSEN, T. SCHWENK, K. ZWART, G. ROMMENS, W. LOPEZ-RAMOS, J. JEPPESEN, E. VYVERMAN, W. BRENDONCK, L.& DE MEESTER L. (2005) Multi-group biodiversity in shallow lakes along gradients of phosphorus and water plant cover. *Ecology*, 86(7), 1905–1915.

DE DECKKER, P. & GEDDES, M.C. (1980) Seasonal fauna of ephemeral lakes near the Coorong Lagoon, South Australia. *Australian Journal of Marine and Freshwater Research*, 31, 677–699.

DE DECKKER, P. (1981) Ostracods of athalassic saline lakes, a review. *Hydrobiologia*, 81, 131–144.

DE LOS RIOS-ESCALANTE, P. & AMAROUAYACHE, M. (2016) Crustacean zooplankton assemblages in Algerian saline lakes: a comparison with their Altipalno Chilean counterparts. *Crustaceana*, 89(1), 1485–1500.

DELORME, L.D. (1991) Ostracoda. *In :* 'Ecology and Classification of North American Invertebrates'. (Eds JH Thorp and A. P. Covich.). *New York: Academic Press*, 691–722.

DEMNATI, F., SAMRAOUI, B., ALLACHE, F., SANDOZ, A. & ERNOUL, L. (2017) A literature review of Algerian salt lakes: values, threats and implications.*Environmental Earth Sciences* [Internet]; 76. doi: 10.1007/s12665-017-6443-x

DUDGEON, D., ARTHINGTON, A.H., GESSNER, M.O., KAWABATA, Z., KNOWLER, D.J., LEVEQUE, C., NAIMAN, R.J., PRIEUR-RICHARD, A., SOTO, D., STIASSNY, M.L.J. & SULLIVAN, C.A. (2006) Freshwater biodiversity: Importance, threats, status and conservation challenges. *Biological Reviews*, 81, 163–182.

DUMONT, H. J. (1966) *Scapholeberis aurita* (S. Fischer, 1849) Hellich, 1877 (Crustacea: Cladocera) en *Thermocyclops dybowskii* (Landé, 1890) Kiefer, 1927 (Crustacea: Copepoda) in België. Biol. Jaarb. Dodonaea, 34: 85-93.

DUMONT, H. J., PENSAERT, J., & VAN DE VELDE, I. (1981) The crustacean zooplankton of Mali (West Africa). *Hydrobiologia*, 80, 161–187.

DUMONT, H.J. & NEGREA, S.V. (2002) Introduction to the Class Branchiopoda. In: Dumont, H.J. (Eds.), *Guides to the identification of the microinvertebrates of the contnental waters of the world* 19. Backhuys Publishers: Leiden, pp. 1–397.

DUMONT, H.J. & PENSAERT, J. (1983) A revision of the *Scapholeberis* (Crustacea: Cladocera). *Hydrobiologia*, 100, 3–45.

DUMONT, H.J. (1979) Limnologie van Sahara en Sahel. DSci.Thesis, University of Ghent, 557 pp.

DUMONT, H.J. (1980) Zooplankton and science of biogeography: the example of Africa. In: W.C.Kerfoot (ed), Evolution and Ecology of Zooplankton Communities. University *Press of New England, Hanover*, N.H., 685–696.

DUMONT, H.J. (1981) Cladocera and free-living Copepoda from the Fouta Djalon and adjacent mountain ares in West Africa. *Hydrobiologia*, 85 (2), 97–116.

DUMONT, H.J. (1987) Region 2. Sahara, pp. 79-154. In: M. Burgis & J. J. Symoens (eds.): African wetlands and shallow waterbodies. Directory. ORSTOM, Paris, 649 pp.

DUMONT, H.J., LAUREYS, P. & PENSAERT, J. (1979) Anostraca, Conchostraca, Cladocera and Copepoda from Tunisia. *Hydrobiologia*, 66, 259–274.

DUSSART, B. & DEFAYE, D. (1985) Répertoire mondial des copépodes cyclopoïdes: 1–236. (CNRS,Paris).

DUSSART, B. & DEFAYE, D. (2006) World Directory of Crustacea Copepoda of Inland Waters.II - Cyclopiformes.Backhuys Publishers, Leiden.354 pp.

DUSSART, B. (1967) Les copépodes des eaux continentales d'Europe occidentale. I. Calanoïdes et Harpacticoïdes: 1–500. (Ed. N. Boubée et Cie, Paris).

DUSSART, B. (1969) Les copépodes des eaux continentales d'Europe occidentale. II: Cyclopoïdes et biologie:1–292. (Ed. N. Boubée et Cie, Paris).

EAST, L.T., HAVENS, K.E., RODUSKY, A.J. & BRADY, M.A. (1999) *Daphnia lumholtzi* and *Daphnia ambigua*: population comparisons of an exotic and a native cladoceran in Lake Okeechobee, Florida. *Journal of Plankton Research*, 21, 1537–1551.

FORRO, L., KOROVCHINSKY, N.M., KOTOV, A.A. & PETRUSEK, A. (2008) Global diversity of cladocerans (Cladocera; Crustacea) in freshwater. *Hydrobiologia*, 1, 177–184.

FREY, D.G. (1971) Worldwide distribution and ecology of *Eurycercus* and *Saycia* (Cladocera). *Limnology and Oceanography* 16 (2), 254–308.

FREY, D.G. (1982) Relocation of *Chydorus barroisi* and related species (Cladocera, Chydoridae) to a new genus and description of two new species. *Hydrobiologia* 86: 231–269.

FREY, D.G. (1991) The species of *Pleuroxus* and of three related genera (Anomopoda, Chydoridae) in Southern Australia and New Zealand. *Records of the Australian Museum*, 43, 291–372.

FREY, D.G. (1993a) Species of *Pleuroxus* (Anomopoda, Chydoridae) from the subantarctic islands and southern most South America: a partial unraveling of the Pleuroxus aduncus problem. *Hydrobiologia*, 262,145–188.

FREY, D.G. (1993b) The penetration of cladocerans into saline waters. *Hydrobiologia*, 267, 233–248.

FRISCH, D., LIBMAN, B.S. D'SURNEY, S.J. & THRELKELD, S.T. (2005) Diversity of floodplain copepods (Crustacea) modified by flooding: species richness, diapause strategies and population genetics. *Archiv fur Hydrobiologie*, 162, 1–17.

FRISCH, D., GREEN, A.J. & FIGUEROLA, J. (2007) High dispersal capacity of a broad spectrum of aquatic invertebrates via water birds. *Aquatic Sciences,* 69, 568–574.

GAGNEUR, J. & KARA, M.H. (2001) Limnology in Algeria. *In*: Wetzel, R. G. & Gopal, B. (Eds). Limnology in Developing Countries 3. *International Association of limnology,* (SIL), 1–34.

GAUTHIER, H. (1928a) Recherche sur la faune des eaux continentales de l'Algérie et de la Tunisie. Minerva, Alger, 419 pp.

GAUTHIER, H. (1928b) Ostracodes et Cladocères de l'Afrique du Nord (Première note*). Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 19, 10–19.

GAUTHIER, H. (1928c) Ostracodes et Cladocères de l'Afrique du Nord (2^{e} note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 19, 69–79.

GAUTHIER, H. (1929) Ostracodes et cladocères du Sahara Central. *Bulletin de la Société d'Histoire naturelle de l'Afrique du Nord* 20 (2), 143–162.

GAUTHIER, H. (1930) Mission saharienne Augieras-Draper. Gladocères, Ostracodes, Phyllopodes, Anostracés et Gonchostracés. *Bulletin du Muséum national d'histoire naturelle.* Paris, 2, 92–116.

GAUTHIER, H. (1931) Faune aquatique du Sahara central. Récoltes de M.L. Seurat au Hoggar en 1928. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 22(8): 350– 400.

GAUTHIER, H. (1932) Remarques sur la faune aquatique de la «Fontaine-Chaude» au nord de Batna, en Algérie. Bull. Soc. Hist. nat. Afrique Nord, 23: 105-108.

GAUTHIER, H. (1933a) Faune aquatique du Sahara central. Récoltes de Th. Monod dans l'Emmidir et l'Ahnet. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord* , 24, 127 – 132.

GAUTHIER, H. (1933b) Nouvelles recherches sur la faune des eaux continentales de l'Algérie et de la Tunisie (introduction). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 24, 63–68.

GAUTHIER, H. (1934) Nouvelles recherches sur la faune des eaux continentales de l'Algérie et de la Tunisie (4è note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 25, 121 – 126.

GAUTHIER, H. (1937) Ostracodes et Cladocères de l'Afrique du Nord (4e note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 28, 147–156.

GAUTHIER, H. (1938) La vie désertique dans les déserts subtropicaux. pp.107-120. In La vie dans la region désertique nord-tropicale de l'Ancien Monde. Mémoire de la Societé Biogéographique. Paris 6.

GAUTHIER, H. & BREHM, V. (1928) Ostracodes et Cladocères de l'Algerie et de la Tunisie (3e note*). Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 19, 114–121.

GHAOUACI, S. & AMAROUAYACHE, M. (2017) Ecological data on the endangered crustacean *Tanymastix stagnalis* (Linnaeus, 1758) in El-Frine pool (Northeastern Algeria).The International Symposium Franco-Japanese of Oceanography (COAST), Coast Bordeaux-France, November 7 -10, 2017.

GHAOUACI, S., AMAROUAYACHE, M., GOUASMIA, G., & HOLYNSKA, M. (2017) An annotated checklist of Cyclopidae (Crustacea: Copepoda) of Algeria. The 13thInternational Conference on Copepoda (ICOC), Los Angeles, California, USA. July 16- 21, 2017,

GOUASMIA, G., AMAROUAYACHE, M., FRIHI, H., & KARA, M.H. (2016) Caractérisation physico-chimique de trois lacs salés permanents de la Valée d'Oued Righ (Sahara Septentrional, Algérie nord-est). *Revue d'Ecologie (Terre et Vie),* 71 (4), 1–12.

GREEN, A.J., FIGUEROLA, J. & SANCHEZ, M.I. (2002) Implications of waterbird ecology for the dispersal of aquatic organisms. *Acta Oecologica*, 23, 177–189.

GREEN, A.J., FRISCH, D., MICHOT, T.C., ALLAIN, L.K. & WYLIE, C. (2013) Endozoochory of seeds and invertebrates by migratory waterbirds in Oklahoma, USA, *Limnetica*, 32 (1), 39– 46.

GURNEY, R. (1904) On a small collection of a freshwater Entomostraca from South Africa. *Proceedings of the General Meetings from Scientific Business of the Zoological Society of London*, 2, 298–301.

GURNEY, R. (1909) On the fresh-water Crustacea of Algeria and Tunisia. J. R. Microscop. Soc., June 1909, 273–305.

HAMAIDI, F., DEFAYE, D., SEMROUD, R. (2010) Copepoda of Algerian fresh waters: checklist, new records, and comments on their biodiversity.*Crustaceana* 83 (1), 101–126

HAMMER, U.T. (1986) *Saline lakes ecosystems of the World*. Monographic biologicae, 59. Junk Publishers. 616 pp.

HARDING, J.P. (1942) Cladocera and Copepoda collected from East African Lakes by Miss C. K. Ricardo and Miss R. J. Owen. *Annals and Magazine of Natural History*, 11th ser., 9 (51), 174–191.

HARDING, J.P. (1961) Some South African Cladocera collected by Dr A.D Harrison. *Annals of the South African Museum*, 46(3), 35–46.

HART, R.C. & DUMONT, H.J.F. (2005) An Holarctic taxon in the Ethiopian region - a first record of *Lathonura* (Crustacea: Cladocera: Macrothricidae) of the Okavango swamps of subtropical Africa. *South African Journal of Sciences*, 101, 565–567.

HAVEL, J.E. & SHURIN, J.B. (2004) Mechanisms, effects, and scales of dispersal in freshwater zooplankton. *Limnology and Oceanography*, 49, 1229 – 1238.

HEBERT, P.D.N., SCHWARTZ, S.S., WARD, R.D. & FINSTON, T.L. (1993) Macrogeographic patterns of breeding system diversity in the *Daphnia pulex* group. I. Breeding systems of Canadian populations. *Heredity*, 70, 148 – 161

HUANG, X., SHI, X., KOTOV, A.A. & GU, F. (2014) Confirmation through genetic analysis of the existence of many local phyloclades of the genus *Simocephalus* (Crustacea, Cladocera) in China. *PLoSONE*, 9 (11), e112808.

HUDEC, I. (1993) Redescription of *Daphnia deserti* (Gauthier, 1937) (Crustacea: Daphniiformes: Daphniidae). *Hydrobiologia*, 264, 153–158.

HUSSEIN, M.A., OBUID-ALLAH, A.H., MAHMOUD, A.A. & MOHAMMED FARGARY, H. (2004) Ecology of eight species of freshwater Ostracods (Crustacea) from Qena Gouernorate. Upper Egypt. *Egyptian Journal of Aaquatic Biology Fisheries*, 8 (4), 107–122.

HUYS, R. & BOXSHALL, G. A. (1991) Copepod Evolution. The Ray Society, London, 468 pp.

JEPPESEN, E., JENSEN, J. P., SØNDERGAARD, M., LAURIDSEN, T. & LANDKILDEHUS, F. (2000) Trophic structure, species richness and biodiversity in Danish lakes: changes along a phosphorus gradient. *Freshwater Biology*, 45, 201–218.

KARANOVIC, I & PESCE, G.L. (2000) *Martenscypridopsis* a new ostracod genus (Crustacea: Ostracoda) from African inland waters. *Annals of Limnology,* 36 (3), 149–155.

KARANOVIC, I. (2012) *Recent Freshwater Ostracods of the World: Crustacea, Ostracoda, Podocopida*. Springer, Heidelberg, Dordrecht, London, New York.608 pp.

KIEFER, F. (1926) Diagnosen neuer süsswasser Copepoden aus Afrika. Zool. Anz., 66 (9/12), 262–269.

KIEFER, F. (1930) Beiträge zur Copepodenkunde (XIV) 40.Eine *Cyclops*-form aus Algerien. Zool. Anz, 87, 122–123.

KIEFER, F. (1952) Beiträge zur Kenntnis der Copepodenfauna Algeriens. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 43 (7), 87–112.

KIEFER, F. (1981) Beitrag zur Kenntnis von Morphologie, Taxonomie und geographischer Verbreitung von *Mesocyclops leuckarti* auctorum. Archiv für Hydrobiologie, (suppl.) 62 (1), 148–190.

KIEFER, F. (1949) The Armstrong College Zoological Expedition to Siwa Oasis (Libyan desert) 1935. Freilebende Ruderfuszkrebse (Crustacea Copepoda). Proceedings of the Egyptian Academy of Sciences, 4, 62–112.

KLIE, W. (1938) Krebstiere oder Crustacea III. Ostracoda, Muschelkrebse. *In*: Dahl, F. (Ed.) *Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise*. Gustav Fischer Verlag, Jena, 230 pp.

KORINEK, V. (1984) Cladocera Hydrobiological Survey of Lake Bangweulu and Luapulu River Basin. J. Symoens. *Cercle Hydrobiologique de Bruxelles* 13 (2), 1–117.

KORINEK, V. (1999) A guide to limnetic species of Cladocera of African inland waters (Crustacea, Branchiopoda). Occasional Publications SIL, Geneva, (1), 1–57.

KOROVCHINSKY, N.M. (1992) Sididae and Holopediidae. Guides to the identification of the microinvertebrates of the continental waters of the world 3. SPB Academic Publishing: The Hague, 82 pp.

KOROVCHINSKY, N.M. (2004) Cladocera order Ctenopoda of the world: morphology, systematics, ecology and zoogeography. KMK Publishers: Moscow, 410 pp.

KOTOV, A.A. & ELIAS-GUTIERREZ, M. (2009) A phylogenetic analysis of *Ilyocryptus* Sars, 1862 (Cladocera: Ilyocryptidae). *International Review of Hydrobiology*, 94, 208–225.

KOTOV, A.A. & FERRARI, F.D. (2010) The taxonomic research of Jules Richard on Cladocera (Crustacea: Branchiopoda) and his collection at the National Museum of Natural History, U.S.A. *Zootaxa*, 2551, 37–64.

KOTOV, A.A. & ŠTIFTER, P. (2006) *Cladocera: family Ilyocryptidae (Branchiopoda: Cladocera: Anomopoda). Guides to the identification of the microinvertebrates of the Continental Waters of the world,* 22. Kenobi Productions, Ghent & Backhuys Publishers, Leiden, 172 pp.

KOTOV, A.A. (2007) Revision of the *hirsuticornis*-like species of *Macrothrix* Baird, 1843 (Cladocera: Anomopoda: Macrothricidae) from Subantarctic and temperate regions of the southern hemisphere. *Journal of Natural History,* 41, 2569–2620.

KOTOV, A.A. (2008) Importance of male and ephippial female characters for differentiating three Palaearctic species of *Macrothrix* Baird, 1843 (Cladocera: Anomopoda), with a

redescription of *Macrothrix dadayi* Behning, 1941. *Annales de Limnologie*, 44(1), 45–61.

KOTOV, A.A. (2009) A revision of *Leydigia* Kurz, 1875 (Anomopoda, Cladocera, Branchiopoda), and subgeneric differentiation within the genus. *Zootaxa*, 2082, 1–68.

KOTOV, A.A., FORRO, L., KOROVCHINSKY, N.M. & PETRUSEK, A. (2013) World checklist of freshwater Cladocera species. Available from: Freshwater animal diversity assessment project. Belgium Biodiversity Platform. http://fada.biodiversity.be/group/show/17

KOTOV, A.A., ISHIDA, S. & TAYLOR, D.J. (2009) Revision of the genus *Bosmina* Baird, 1845 (Cladocera: Bosminidae), based on evidence from male morphological characters and molecular phylogenies. Zoological Journal of the Linnean Society, 156, 1–51.

KOTOV, A.A., JEONG, H.J. & LEE, W. (2012) Cladocera (Crustacea: Branchiopoda) of the south–east of the Korean Peninsula, with twenty new records for Korea. *Zootaxa*, 3368, 50–90.

KOTOV, A.A., KARABANOV, D.P., BEKKER, E.I., NERETINA, T.V. & TAYLOR, D.J. (2016) Phylogeography of the *Chydorus sphaericus* Group (Cladocera: Chydoridae) in the Northern Palearctic. PloS ONE, 11 (12): e0168711.doi:10.1371/journal. pone.0168711

KOTOV, A.A., SINEV, A.Y. & BERRIOS, V.L. (2010) The Cladocera (Crustacea: Branchiopoda) of six high altitude water bodies in the North Chilean Andes, with discussion of Andean endemism. *Zootaxa*, 2430, 1–66.

KOTOV, A.A., SINEV, A.Y., KOROVCHINSKY, N.M., SMIRNOV, N.N., BEKKER, E.I. & SHEVELEVA, N.G. (2011) Cladocera (Crustacea, Branchiopoda) from the Zeya River

basin (Amur Region, Russia) 1. New taxa for the fauna of Russia. *Zoologicheskiy Zhurnal*, 90, 131–142.

KOTOV, A.A., VAN DAMME, K., BEKKER, E.I., SIBOUALIPHA, S., SILVA-BRIANO, M., ADABACHE ORTIZ, A., GALVANDELA ROSA, R. & SANOAMUANG, L. (2013b) Cladocera (Crustacea: Branchiopoda) of Vientiane province and municipality, Laos. *Journal of Limnology*, 72 (s2), 81–108.

KÜLKÖYLÜOĞLU, O. (2013) Diversity, distribution and ecology of nonmarine Ostracoda (Crustacea) in Turkey: Application of pseudorichness and cosmoecious species concepts. *Recent Research in Development & Ecology*, 4, 1–18.

KÜLKÖYLÜOĞLU, O. & YILMAZ, F. (2006) Ecological requirements of Ostracoda (Crustacea) in three types of springs in Turkey. *Limnologica* 36, 172–180.

KÜLKÖYLÜOĞLU, O. (2000) The importance of cosmopolitan and indicator species of Ostracoda (Crustacea) in Turkey based on some water variables. Water Product Conference-Sinop Turkey 2000 (abstract in English), 421– 437.

KÜLKÖYLÜOĞLU, O. (2003) First report of the genus *Isocypris* (Ostracoda) from Turkey: taxonomy, ecology, and general distribution. *Crustaceana* 75 (9), 1083–1093.

KÜLKÖYLÜOĞLU, O. (2004) On the usage of Ostracoda (Crustacea) as bioindicator species in the different aquatic habitats in the Bolu region, Turkey. *Ecology Indicators,* 4, 139 –147.

KÜLKÖYLÜOĞLU, O. (2005a) Factors effecting Ostracoda (Crustacea) occurrence in Yumrukaya Reedbeds (Bolu, Turkey). *Wetlands*, 25, 224– 227.

KÜLKÖYLÜOĞLU, O. (2005b) Ecological requirements of freshwater Ostracoda (Crustacea) in two limnocrene springs (Bolu, Turkey). *International Journal of Limnology*, 41, 237–246.

KÜLKÖYLÜOĞLU, O. (2007) Ostracod Pseudorichness: Is it real? In:European Ostracodologists Meeting (EOM VI)/19th International Senckenberg Conference, Frankfurt, Germany, 5–7 September 2007, Abstract Volume, pp.6.

KÜLKÖYLÜOĞLU, O., AKDEMIR, D., YAVUZATMACA, M & YILMAZ, O (2015) A checklist of recent non-marine Ostracoda (Crustacea) of Turkey with three new records. *Review of Hydrobiology*, 8/2, 77– 90.

KÜLKÖYLÜOĞLU, O., DUGEL, M. & KILIC, M. (2007) Ecological requirements of Ostracoda (Crustacea) in a heavily polluted shallow lake, Lake Yeniçağa (Bolu, Turkey) *Hydrobiologia*, 585, 119– 133.

KÜLKÖYLÜOĞLU, O., DUGEL, M., BALCI, M., DEVECI, A., AVUKA, D. & KILIC, M. (2010) Limnoecological relationships between water level fluctuationsand Ostracoda (Crustacea) species composition in Lake Sünnet (Bolu, Turkey). *Turkish Journal of Zoology*, 34, 429– 442.

LI, X., LIU, W., ZHANG, L & SUN, Z. (2010) Distribution of recent ostracod species in the Lake Qinghai area in Northwestern China and its ecological significance. *Ecological indicators*, 10, 880–890.

LIEVIN, F. (1848) *Die Branchiopoda der Danziger Geden, ein Beitrag zur Fauna der Provinz Preussen*. Naturforschen den Gesellschaft in Danzig, 4 (2), 1–52.

LINDERG, K. (1953) Cyclopoïdes (Crus., Cop.) du Tassili des Ajjer (Sahara central). Missions scientifiques au Tassili des Ajjer (1949). Travaux de l'institue de recherche du Sahara, (1), 55–64.

LINDERG, K. (1957) Le groupe *Cyclops rubens* (syn. *C. strenuus*). Révision du genre *Cyclops* s. str. (O. F.Müller, 1770): 1–335.

LUCAS, P.H. (1849) Histoire naturelle des animaux articulés. Exploration scientifique de l'Algérie, pendant les années1840, 1841 et 1842. Paris, Imprimerie Nationale, 1846–1849, 3 vol., 1 atlas.

MARGARITORA, F.G. (2005) Crustacea Branchiopoda Cladocera. In: Ruffo S. and Stoch F. (eds.), Checklist e distribuzione della fauna italiana. Memorie del Museo Civico di Storia Naturale di Verona, 2.serie, *Sezione Scienze della Vita*, 16, 87–89.

MARRONE, F. (2006) The microcrusracean fauna of Sicily and the central Mediterranean Sea area: current knowledge and gaps to be filled. *Polish Journal of Ecology*, 54(4): 681–685.

MARRONE, F., BARONE, R. & NASELLI-FLORES, L. (2005) Cladocera (Branchiopoda: Anomopoda, Ctenopoda and Onychopoda) from Sicilian inland waters: an updated inventory. *Crustaceana*, 78(9), 1025–1039.

MARTENS, K. (1998) Sex and parthenogenesis.Evolutionary ecology of reproductive modes in non-marine ostracods. *Backhuys, Leiden*, 1–335 pp.

MARTENS, K., HALSE, S. & SCHON, I. (2013) On the *Bennelongia barangaroo* lineage (Crustacea, Ostracoda) in Western Australia, with the description of seven new species. *European Journal of Taxonomy*, 66, 1–59.

MARTENS, K. & SAVATENALITON, S. (2011) A subjective checklist of the Recent, free-living, non-marine Ostracoda (Crustacea). *Zootaxa*, 3855, 1–79.

MARTENS, K., SCHON, I., MEISCH, C. & HORNE, D.J. (2008) Global biodiversity of non-marine Ostracoda (Crustacea). *Hydrobiologia*, 595, 185–193.

MARTINS, F., NAMIOTKO, M.J., CABRAL, T., FATELA, M.C. & BOAVIDA, M.J. (2010) Contribution to the knowledge of the freshwater Ostracoda fauna in continental Portugal, with an updated checklist of Recent and Quaternary species, *Journal of Limnology*, 69 (1), 160–173.

MEISCH, C. (2000) *Freshwater Ostracoda of Western and Central Europe*.*In*: Schwoerbel, J. & Zwick P. (Eds), Süßwasserfauna von Mitteleuropa 8/3. Spektrum Akademischer Verlag, Heidelberg, Berlin, 522 pp.

MEISCH, C., WOUTERS, K. & MARTENS, K. (1990) Liste annotée des ostracodes actuels non-marins trouvés en France. *Travaux Scientifiques du Parc National de la Vanoise*, 15, 1–48pp.

METHUEN, P.A. (1910) On a collection of freshwater Crustacea from the Transvaal. Proceedings of the zoological Society of London, 148–167.

MEZQUITA, F., GRIFFITHS, H.I., SANZ, S., SORIA, J.M. & PINO, A. (1999) Ecology and distribution of ostracods associated with flowing waters in the eastern Iberian Peninsula. *Journal of Crustacean Biology,* 19 (2), 344–354.

MONIEZ, R. (1891) faune des Lacs sales d'Algérie. Mémoires de la société zoologique de France, 246–257.

MOUELHI, S., BALVAY, G. & KRAIEM M.M. (2000) Branchiopodes (Cténopodes et Anomopodes) et Copépodes des eaux continentales d'Afrique du Nord: inventare et biodiversité. *Zoosystema*, 22 (4), 731–748.

NEGREA, Ş. (1984) Redescription de *Moina salina* Daday, 1888 (Cladocera, Moinidae) d'Aprės des exemplaires trouvės en terra typica. *Crustaceana*, 47, 83–97.

NOBLE, R.C. & SCHAEFTER, H.W. (1967 a) Keys to the freshwater Cladocera of Southern Africa. I. The families, and the genera and species of the family Sididae. *Limnological Society of Southern Africa Newsletter*, 8, 35–40.

NOBLE, R.C. & SCHAEFTER, H.W. (1967b) Keys to the freshwater Cladocera of Southern Africa. II. Genera of the family Daphniidae and species of the genera Scapholeberis and Daphnia. *Limnological Society of Southern Africa*, *Newsletter*, 9, 62–79.

OKUBO, I. & TERAUCHI, M. (1992) Freshwater Ostracoda from the Southwestern Islands of Japan. Proceedings of the Japanese Society for Systematic Zoology, 46, 101–108.

ORLOVA-BIENKOWSKAJA, M.Y. (2001) Daphniidae: Genus *Simocephalus*. In: Dumont, H.J. (Eds.), Guides to the identification of the Microinvertebrates of the continental waters of the world 17. Backhuys: Leiden, pp. 1–130.

OERTLI, B., AUDERSET, J.D., CASTELLA, E., JUGE, R., CAMBIN, D., LACHAVANNE, J.B. (2002) Does size matter? The relationship between pond area and biodiversity. *Biological Conservation*, 104, 59–70.

OZAWA, H. (2013) The history of sexual dimorphism in Ostracoda (Arthropoda, Crustacea) since the Palaeozoic. *Hydrobiologia*, 243, 213– 220.

PETRUSEK, A., ÈERNY, M. & AUDENAERT, E. (2004) Large intercontinental differentiation of *Moina micrura* (Crustacea: Anomopoda): one less cosmopolitan cladoceran. *Hydrobiologia*, 526, 73–81.

PETRUSEK, A., HOBAEK, A., NILSSEN, J.P., SKAGE, M., ČERNY, M., BREDE, N. & SCHWENK, K. (2008) A taxonomic reappraisal of the European *Daphnia longispina* complex (Crustacea, Cladocera, Anomopoda). *Zoologica Scripta*, 37, 507–519.

PETRUSEK, A.R., TOLLRIAN, K., SCHWENK, A. H. & LAFORSCH, C. (2009) A ‘‘crown of thorns’’ is an inducible defense that protects *Daphnia* against an ancient predator. Proceedings of the *National Academy of Sciences* USA, 106, 2248–2252.

PIERI, V., MARTENS, K., MEISCH, C., ROSSETTI, G. (2015) An annotated checklist of the Recent non-marine ostracods (Ostracoda: Crustacea) from Italy. *Zootaxa,* 17, 271–305.

POPOVA, E.Y. & KOTOV, A.A. (2013) Latitudal patterns in the diversity of two subgenera of the genus *Daphnia* O.F. Müller (Crustacea: Cladocera: Daphniidae). *Zootaxa*, 3736 (2), 159–174.

POPOVA, E.V., PETRUSEK, A., KORINEK, V., MERGEAY, J., BEKKER, E.I., KARABANOV, D.P., GALIMOV, Y.R., NERETINA, T.V., TAYLOR, D.J. &KOTOV, A.A. (2016) Revision of the Old World *Daphnia* (Ctenodaphnia) similis group (Cladocera: Daphniidae). *Zootaxa*, 4161(1), 1–40.

PRETUS, J.L.T. (1990) Acommented Cheklist-list of the Balearic Branchiopda (Crustacea). *Limentica*, 6, 157–164.

QUEZEL, P. & SANTA, S. (1962-1963) Nouvelle Flore de l'Algérie et des régions désertiques méridionales. CNRS. Paris. 170 pp.

RAMDANI, M. (1982) Les entomostracés de la merja Sidi Bou Ghaba. *Bulletin de l'Institut Scientifique, Rabat*, 6, 105–117.

RAMDANI, M., FLOWER, R.J., ELKHIATI, N., KRAIEM, M.M., FAHTI, A.A., BIRKS, H.H. & PATRICK, S.T. (2001) North African wetland lakes: characterization of nine sites included in the CASSARINA Project. *Aquatic Ecology*, 35, 281–302.

RAMSAR CONVENTION BUREAU (1992) Proceedings of the 4th Meeting of the Conference of Contracting Parties. Montreux, Switzerland. Published by Ramsar Convention Bureau, Gland, Switzerland.

RICHARD, J. (1896) Révision des Cladocères. Deuxième Partie. Anomopoda. Famille III. Daphnidae. *Annales des Sciences Naturelles, Zoologie, 8th Serie*, 2, 187–363.

ROCA, J., BALTANAS, A. (1993) Ecology and distribution of Ostracoda in Pyrenean springs. *Journal of Crustacean Biology*, 13 (1), 165–174.

ROGERS, D.C. (2002a) A genus level revision of the Thamnocephalidae (Crustacea: Branchiopoda: Anostraca). *Zootaxa*, 1–25.

ROGERS, D.C. (2002b) A morphological re-evaluation of the anostracan families Linderiellidae and Polyartemiidae, with a redescription of the linderiellid *Dexteria floridana* (Dexter 1956) (Crustacea: Branchiopoda). *Hydrobiologia*, 486: 56–61.

ROGERS, D.C. (2009) Branchiopoda (Anostraca, Notostraca, Laevicaudata, Spinicaudata,Cyclestherida). In: Likens GF (Ed.) Encyclopedia of Inland Waters. *Elsevier*, Boston, 242–249.

ROGERS, D.C., RABET, N., WEEKS, S.C. (2012) A revision of the extant genera of theclam shrimp family Limnadiidae. Journal of Crustacean Biology 32: 827–842.

ROGERS, D.C. (2013) Anostraca Catalogus (Crustacea: Branchiopoda). Raffles Bulletin of Zoology 61: 525–546.

ROGERS, D.C. (2014a) Anostracan (Crustacea: Branchiopoda) Biogeography I. North American Bioregions. *Zootaxa* 3838: 251–275.

ROGERS, D.C. (2014b) Anostracan (Crustacea: Branchiopoda) Zoogeography II. Relating distribution to geochemical substrate properties in the USA. *Zootaxa* 3856(1): 1–49.

ROGERS, D.C. (2014c) Anostracan (Crustacea: Branchiopoda) Biogeography III. Australian Bioregions. *Zootaxa* 3881: 453–487.

ROGERS, D.C. (2015a) Hatching response to temperature along a latitudinal gradient by the fairy shrimp *Branchinecta lindahli* (Crustacea: Branchiopoda: Anostraca) in culture conditions. *Journal of Limnology* 74: 85–94.

ROGERS, D.C. (2015b) A conceptual model for anostracan biogeography.*Journal of Crustacean Biology* 35: 686–699.

ROSSETTI, G., BARTOLI, M. & MARTENS, K. (2004) Limnological charateristics and recent ostracods (Crustacea, Ostracoda) of freshwater wetlands in the Parco Oglio Sud (Northern Italy). *Annales de Limnologie*, 40 (4), 329–341.

ROSSETTI, G., MARTENS, K., MEISCH, C., TAVERNELLI, S. & PIERI, V. (2006) Small is beautiful: diversity and distributional patterns of ostracods (Crustacea, Ostracoda) in marginal freshwater habitats of the province of Parma (Northern Italy). *Journal of Limnology*, 65 (2), 121–131.

ROSSI, V., BENASSI, G., VENERI, M., BELLAVERE, C., MENOZZI, P., MORONI, A. & MCKENZIE, K.G. (2003) Ostracoda of the Italian ricefields thirty years on: new synthesis and hypothesis. Journal of Limnology, 62 (1), 1–8.

ROY, J. (1929) Mission saharienne Augieras-Draper 1927-1928. Copépodes et Ostracodes. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord,* 2 (1), 392–393.

ROY, J. & GAUTHIER, H. (1927) Sur les Copépodes d'Algérie et de Tunisie (eaux douces et saumâtres). *Bulletin de la Société zoologique du France*, 52, 558–575.

RZOSKA, J. (1956) On the variability and status of the Cladocera *Ceriodaphnia cornuta* and *C. rigaudi*. *Annales and magazine of natural history*, 12(9), 505–510.

SAMRAOUI, B., DE BELAIR, G. (1998) Les zones humides de la Numidie orientale. Bilan et perspectives. *Synthèse*, 4, 1–90.

SAMRAOUI, B. (2002) Branchiopoda (Ctenopoda and Anomopoda) and Copepoda from eastern Numidia (Algeria). *Hydrobiologia*, 470, 173–179.

SAMRAOUI, B., DUMONT, H.J. (2002) The large branchiopods (Anostraca, Notostraca and Spinicaudata) of Numidia (Algeria). *Hydrobiologia* 486, 119–123.

SAMRAOUI, B., CHAKRI,K., SAMRAOUI, F. (2006) Large branchiopods (Branchiopoda: Anostraca, Notostraca and Spinicaudata)from the salt lakes of Algeria. *Journal of Limnoogy*, 65(2), 83–88.

SAMRAOUI, B., SEGERS, H., MAAS, S., BARIBWEGURE, D. & DUMONT, H.J. (1998) Rotifera, Cladocera, Copepoda, and Ostracoda from coastal wetlands in northeast Algeria. *Hydrobiologia,* 386, 183–193.

SARS, G.O. (1895) On some South-African Entomostraca raised from dried mud. Vidensklabs-selskabets skrifter. I. Klasse Mathematik-naturvidenskab, 1895(8), 1–56.

SARS, G.O. (1916) The fresh-water Entomostraca of Cape Province. Part I.Cladocera.*Annals of the SouthAfrican Museum* XV (IV), 303–351.

SCHON, I., GANDOLFI, A. & DI MASSO, E. (2000) Persistence of asexuality through mixed reproduction in *Eucypris virens* (Crustacea, Ostracoda). *Heredity*, 84, 161–169.

SEAMAN, M.T., KOK, D.J. & WATSON, M. (1999) *Cladocera Guides to the freshwater invertebrates of South Africa*. Crustacea I. WRC Report, TT121/ (00), 81–110.

SEMENOVA, L.M. (2005) Fauna and distribution of the Ostracoda (Crustacea, Ostracoda) of inland waterbodies of Russia and contiguous states. *Inland Water Biology*, 3, 17–26.

SEURAT, L.G. (1830-1930) Exploration zoologique de L'Algérie. Collection du centenaire de L'Algérie, Etudes scientifiques, 708pp.

SHARMA, P. & KOTOV, A.A. (2013) Molecular approach to identify sibling species of the *Ceriodaphnia cornuta* complex (Cladocera: Daphniidae) from Australia with notes on the continental endemism of this group. *Zootaxa*, 3702 (1), 79–89.

SILVA-BRIANO, M., DIEU, N.Q. & DUMONT, H.J. (1999) Redescription of *Macrothrix laticornis* (Jurine, 1820), and description of two new species of the *M. laticornis*–group. *Hydrobiologia*, 403, 39–61.

SINEV, A.Y. (2001a) Distribution and polymorphism of *Alona rectangula* Sars, 1862 (Branchiopoda: Anomopoda: Chydoridae) in Russia and surrounding countries. *Arthropoda Selecta*, 10 (2), 83–86.

SINEV, A.Y. (2001b) Separation of *Alona cambouei* Guerne & Richard, 1893 from *Alona pulchella* King, 1853 (Branchiopoda: Anomopoda: Chydoridae). *Arthropoda Selecta*, 10 (1), 5–18.

SINEV, A.Y. (2009a) Cladocerans of the *Alona affinis* (Leydig, 1860) group from South Africa. *Zootaxa*, 1990, 41–54.

SINEV, A.Y. (2009b) Discrimination between two sibling species of *Acroperus* (Baird, 1843) from the Palearctic (Cladocera: Anomopoda: Chydoridae). *Zootaxa*, 2176, 1–21.

SINEV, A.Y. (2014) A comparative morphological analyses of four species of *Camptocercus* Baird, 1843 (Cladocera: Anomopoda: Chydoridae). *Zootaxa*, 3895 (2), 183–207.

SINEV, A.Y. (2015) Revision of the *pulchella*-group of Alona s. lato leads to its translocation to *Ovalona*Van Damme et Dumont, 2008 (Branchiopoda: Anomopoda: Chydoridae). *Zootaxa*, 4044 (4), 451–492.

SINEV, A.Y., Alonso, M., Miracle, M.R. & Sahuquillo, M. (2012) The West Mediterranean *Alona azorica* Frenzel & Alonso, 1988 (Cladocera: Anomopoda: Chydoridae) is composed of two species. *Zootaxa*, 3276, 51–68.

SMIRNOV, N.N. (1971) Chydoridae of the world fauna. *Fauna SSSR.Rakoobraznie*, 1 (2), 1–531. [in Russian]

SMIRNOV, N.N. (1976) Macrothricidae and Moinidae of the World fauna.*Fauna SSSR, novaya seriya.Rakoobraznye*, 1(3), 1– 237. [in Russian]

SMIRNOV, N.N. (1992) *The Macrothricidae of the world. In: Dumont, H.J. (Eds.), Guides to the identification of the microivertebrates of the continental waters of the world*. SPB Academic Publishing: The Hague, pp. 1–143.

SMIRNOV, N.N. (1996) *Cladocera: the Chydorinae and Sayciinae (Chydoridae) of the world. In: Dumont, H.J. (Eds.), Guides to the identification of the microivertebrates of the Continental Waters of the world* 11. SPB Academic Publishing, Amsterdam, pp. 1–197.

SMIRNOV, N.N. (1998) A revision of the genus *Camptocercus* (Anomopoda, Chydoridae, Aloninae). *Hydrobiologia*, 386, 63–83.

SMIRNOV, N.N. (2007) *Pleuroxus*-like chydorids (Crustacea: Anomopoda) from South Africa, with the description of *Dumontiellus africanus* gen. n., sp. n. *Hydrobiologia*, 575, 433–439.

SMIRNOV, N.N. (2008) Check-list of the South-African Cladocera (Crustacea: Branchiopoda). *Zootaxa*, 1788, 47–56.

SMIRNOV, N.N. (2013) Physiology of the Cladocera. Academic Press, *Zoology*, 352 pp.

SMIRNOV, N.N., GLAGOLEV, S.M., KOROVCHINSKY, N.M., KOTOV, A.A., ORLOVA-BIENKOWSKAJA, M.Ya. & RIVIER, I.K. (1995) *Cladocera. In: Alekseev, V.R. (Ed.), Guides to the identification of the freshwater invertebrates of Russia and surrounding territories. Crustacea.*St Petersburg, Zoological Institute of Russian Academy of Sciences, 2, 34–74.

SMIRNOV, N.N., KOTOV, A.A. & CORONEL, J.S. (2006) Partial revision of the *aduncus*-like species of *Pleuroxus* Baird, 1843 (Chydoridae, Cladocera) from the southern hemisphere with comments on subgeneric differentiation within thegenus, *Journal of Natural History,* 40, 1617–1639.

THIERY, A., PUENTE, L. (2002) Crustacean assemblage and environmental characteristics of a manmade solar salt work in southern France, with emphasis on anostracan (Branchiopoda) population dynamics. *Hydrobiologia* 48: 191–200.

TOUATI, L., SAMRAOUI, B. (2002) The ecology of *Daphnia chevreuxi* Richard in Northeast Algeria (Crustacea: Anomopoda). *Sciences & Technologie*, Numéro Spécial-D (1), 75–81.

TURKI, S. & TURKI, B. (2010) Copepoda and Branchiopoda from Tunisian temporary Waters. *International Journal of Biodiversity and Conservation*, 2(4), 86–97.

USTAOGLU, M.B. (2015) An updated zooplankton biodiversity of Turkish inland waters, *Limnofish* 1(3), 151–159.

VAN DAMME, K & DUMONT, H.J. (2010) Cladocera of the Lençois Maranhenses (NE-Brazil): faunal composition and a reappriasal of Sars' Method. Brazilian Journal of Biology, 70 (3), 755–779.

VAN DAMME, K. & DUMONT, H.J. (2008) Further division of *Alona* Baird, 1843: separation and position of Coronatella Dybowski & Grochowski and *Ovalona* gen.n. (Crustacea: Cladocera). *Zootaxa*, 1960, 1–44.

VAN DAMME, K., KOTOV, A.A. & DUMONT, H.J. (2010) A checklist of names in *Alona* Baird 1843 (Crustacea: Cladocera: Chydoridae) and their current status: an analysis of the taxonomy of a lump genus. *Zootaxa*, 2330, 1–63.

VELA, E., BENHOUHOU, S. (2007) Evaluation d'un nouveau point chaud de biodiversité végétale dans le Bassin méditerranéen (Afrique du Nord). Comptes Rendus Biologies, 330, 589–605.

WELTNER, W. (1899) Zur Cladocerenfauna Africas. Zoologischer Anzeiger 22 (577), 8–9.

WIGGINS, G.B., MACKAY, R.J., SMITH, I.M. (1980) Evolutionary and ecological strategies of animals in annual temporary pools.*Archiv fur Hydrobiologie Supplement* 58(1/2): 97–206.

WILLIAMS, W.D. (1998) The Management of Inland Saline Waters. Guide lines of Lake Management. Vol. 6.ILEC/UNEP.

WILLIAMS, W.D., BOULTON, A.J. & TAAFFE, R.G. (1990) Salinity as a determinant of salt lake fauna: a question of scale. *Hydrobiologia*, 197, 221–231.

WILLIAMS, W.D. (2006) The biology of temporary waters. Oxford University Press, Oxford, 347 pp.

YACOUBI-KHEBIZA, M., MESSOULI, M., COINEAU, N. & EL ABIARI, A.F. (2001) Contribution to the knowledge of the Groundwater communities from Northern Morocco.13th International Congress of Speleology 4th Speleological Congress of Latin América and Caribbean 26th Brazilian Congress of Speleology, 407–410.

YEE, S.H., WILLIG, M.R., MOORHEAD, D.L. (2005) Tadpole shrimp structure macro invertebrate communities in playa lake microcosms. *Hydrobiologia* 541: 139–148.

ZACHARIAS, I., DIMITRIOU, E., DEKKER, A. & DORSMAN, E. (2007) Overview of temporary ponds in the Mediterranean region: Threats, management and conservation issues. *Journal of Environmental Biology*, 28 (1), 1–9.

ZAIBI, C., SCHARF, B., VIEHBERG, F.A., KEYSER, D. & KAMOUN, F. (2013) Preliminary report on the living non-marine Ostracoda (Crustacea) from Tunisia with the description of a new *Psychrodromus* species. *Zootaxa*, 3626 (4), 499–516.

International Communications

- The 8th European Ostracodologists Meeting (8EOM), Tartu" Estonia, on July 22- 30, 2015

Entitled: Annotated checklist of the non-marine living ostracods of Algeria (Poster).

- the 13th International Conference on Copepoda (ICOC), July 16- 21, 2017, Los Angeles, California, USA.

Entitled: An annotated checklist of Cyclopidae (Copepoda; Crustacea) of Algeria (Poster).

- The International Colloque Franco-Japanese of Oceanography (COAST), November 7 -10, 2017 Bordeaux, Domaine du Haut Carré, France.

Entitled: Ecological data on the endangered crustacean *Tanymastix stagnalis* (Linnaeus, 1758) in El-Frine pool (Northeastern Algeria) (Poster).

EOM8

Tartu * Estonia * 2015

IRGO

International Research Group on Ostracoda

Statement of participation

The organizing committee of the 8th European Ostracodologists' Meeting that was held in Tartu, Estonia, on July 22th – 30th, 2015, states that

Ghaouaci Souad, Amarouayache Mounia and Gouasmia Ghouzala
from Marine Bioresources Laboratory, University Badji Mokhtar, Annaba, Algeria

participated to the 8th EOM with a poster presentation entitled

Annotated checklist of the non-marine living Ostracods of Algeria

Prof. Tõnu Meidla
Head of the Organizing Committee, EOM8

23.05.2016, Tartu, Estonia

13th International CONFERENCE on COPEPODA
July 16 - 21, 2017
Cabrillo Marine Aquarium
Los Angeles, California
USA

Cabrillo Marine Aquarium

October 4, 2017

Souad Ghaouaci
Annaba University
Algeria

Dear Souad,

The organizers of the 13th International Conference on Copepoda (ICOC) acknowledge that your poster entitled “An annotated checklist of Cyclopidae (Copepoda; Crustacea) of Algeria” was accepted for the 13th ICOC, but was ultimately presented by your coauthor, Professor Maria Hołyńska, on Thursday, July 20, 2017, since you could not obtain a US travel visa to attend the conference.

Regards,

Dr. Julianne Kalman Passarelli, Ph.D.
13th ICOC Local Secretary
Cabrillo Marine Aquarium

3720 STEPHEN M. WHITE DRIVE • SAN PEDRO, CALIFORNIA 90731
PHONE 310-548-7562 • FAX 310-548-2649 • www.cabrillomarineaquarium.org
A FACILITY OF THE CITY OF LOS ANGELES DEPARTMENT OF RECREATION AND PARKS
ACCREDITED BY ASSOCIATION OF ZOOS & AQUARIUMS

COAST Bordeaux 2017

From November 7th to 10th, 2017

Bordeaux, November 9, 2017

CERTIFICATE OF PRESENTATION

This document certifies that:

Souad GHAOUACI

is the author of the poster *« Ecological data on the endangered crustacean Tanymastix stagnalis (Linnaeus, 1758) in El-Frine pool (Northeastern Algeria) »*

presented by his colleagues present on the COAST Bordeaux 2017 Conference, from November 7th to 10th, 2017 held in Bordeaux, France, at Domaine du Haut Carré.

Patrick Prouzet
Co-Organizer COAST Bordeaux 2017
Vice-President SFJO

cnrs

Société franco-japonaise d'Océanographie

Zootaxa 4290 (1): 140–154
http://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.4290.1.8
http://zoobank.org/urn:lsid:zoobank.org:pub:DFAEDA0F-3649-4F44-8F0B-DC38171F45DC

An annotated checklist of the non-marine ostracods (Crustacea) of Algeria with some ecological notes

SOUAD GHAOUACI[1], MEHMET YAVUZATMACA[2],
OKAN KÜLKÖYLÜOĞLU[2,3] & MOUNIA AMAROUAYACHE[1]

[1]*Marine Bioresources Laboratory, Annaba University Badji Mokhtar, BP12 El-Hadjar, Annaba 23002, Algeria*
[2]*Abant İzzet Baysal University, Department of Biology, Faculty of Arts and Science, Gölköy 14280 Bolu, Turkey*
[3]*Corresponding author. E-mail: kulkoyluoglu_o@ibu.edu.tr*

Abstract

A total of 47 non-marine ostracods are listed from Algeria including both, the species reported in literature and those collected from 117 water bodies in humid, semi-arid and arid regions of Algeria between 2012 and 2016. Twenty seven taxa were identified with three species (*Cypris pubera, Limnocythere inopinata*, *Potamocypris variegata*) new to Algeria and nine taxa (*Eucypris kerkyrensis*, *E. lilljeborgi*, *Heterocypris rotundata*, *Ilyocypris decipiens*, *I.* cf. *japonica*, *Isocypris beauchampi*, *Potamocypris smaragdina*, *P. villosa*, *Prionocypris zenkeri*) as new reports for North Africa. Considering the presence of highly diverse water bodies, seasonal differences and difficulties of access to water sources, the number of species listed in here is believed to be underestimated. Further studies are required to complete this list.

Key words: Ostracoda, checklist, freshwater, Sebkhas, Algeria

Introduction

Ostracods are widely distributed in all types of aquatic habitats including fresh, brackish and saline waters (Bronshtein 1947; Delorme 1991; Meisch 2000; Külköylüoğlu 2000, 2005a, b). The extreme efficiency of their habitat colonization may depend on several factors such as different reproductive modes as parthenogenetic, amphigonic, or both (Martens 1998; Butlin *et al*. 1998; Ozawa 2013) or relatively high ecological tolerances to different environmental conditions. There are about 2090 species in c. 209 genera, and about half of them occur in the family Cyprididae (Martens *et al*. 2008; Martens & Savatenalinton 2011).

Algeria is one of the largest countries in Africa with about 2.4 x 10^6 km^2 surface area. One can distinguish three climatic zones from north to south as humid climate (700–1000 mm), semi-arid climate (300–500 mm) and arid to hyper-arid climate (100 to less than 70 mm). While the humid region is rich in small freshwater pools, saline lakes are concentrated in the semi-arid region at high altitude (> 1000 m a.s.l.) between the two Atlas Tellian and Saharan throughout east to west (Anonymous 1998, 2001, 2004). These saline water-bodies, locally called Chotts or Sebkhas, are huge, shallow and ephemeral with unstable abiotic conditions. Arid and hyperarid climates characterize the Sahara desert which covers 85% of the country, and the surface water resources are very scarce in there (Gagneur & Kara 2001).

History of ostracod studies in Algeria begins with the studies of Lucas (1849) followed by Moniez (1891) who recorded nine species from Algerian inland waters including saline lakes. Gauthier (1928a, b, and c) and Gauthier & Brehm (1928) are the most important studies on ostracods in all types of water bodies where the most part of the country was concerned. In 1981, De Deckker examined some ostracods collections from the Saharan region that were previously sampled by Professor H. Dumont (De Deckker 1981). Since then, no work has been done on ostracods, until that of Samraoui *et al*. (1998), who gave species lists of rotifers, cladocerans, copepods and six ostracods from Numidia in the northeast of the country. More recently, Karanovic & Pesce (2000) described the new species *Martenscypridopsis materia* from Algerian inland waters in Tindouf, southwest of the Sahara. As

 Accepted by R. Matzke-Karasz: 7 Apr. 2017; published: 6 Jul. 2017

seen, works on ostracods of Algeria are few and ancient. Thereby, the present study is the first extensive research on ostracods in Algeria.

Considering the vastness of the country and the lack of data from unsampled regions, ostracod biodiversity of the region requires further studies (Ghaouaci *et al*. 2015). Therefore, the aim of this study is to provide a most recent list of documented non-marine ostracod taxa from Algeria.

Material and methods

In total, 166 samples were collected from 117 water bodies during the wet period between 2012 and 2016 in humid, semi-arid and arid regions of 18 provinces of Algeria (Provinces of Annaba, El-Tarf, Skikda, Guelma, Constantine, Tébessa, Tizi Ouzou, Medea, Sétif, Batna, Oum El Bouaghi, Rélizane Khenchela, Sidi Bel Abbes, Oran, Souk-Ahras, Djelfa and El Oued) (Appendix 1, Fig.1). Sampling sites are located from 1 m to more than 1000 m a.s.l. and include a variety of aquatic environments such as temporary pools, marshes, side roads, lakes, reservoirs, and large temporary saline lakes (Sebkhas and Chotts). Ostracod samples were collected using a hand-net (125 µm mesh size), and then fixed in 70 % ethanol.

FIGURE 1. Map of Algeria shows 18 provinces sampled during this study. 1; Annaba (25 samples), 2; El-Tarf (33 samples), 3; Skikda (13 samples), 4; Guelma (4 samples), 5; Constantine (2 samples), 6; Tébessa (9 samples), 7; Sétif (2 samples), 8; Tizi Ouzou (2 samples), 9; Medea (1 sample), 10; Batna (4 samples), 11; Oum El Bouaghi (8 samples), 12; Khenchela (2 sample), 13; Djelfa (2 samples), 14; El Oued (1 sample), 15; Oran (5 samples), 16; Rélizane (1 sample), 17; Sidi Bel Abbes (1 sample), and 18; Souk-Ahras (2 samples).

The sampling has been performed in Numidia (Northeast) on several occasions due to presence of rich aquatic bodies but less frequently in the other regions by two of us (SG, MA). When Sebkhas/Chotts were dried during our visit, ostracods were reared from mud collected from the upper layer of soil, from different parts of depressions, according to Sars' method recently redescribed by Van Damme & Dumont (2010). A fraction of each of those samples was incubated by adding 3 L of distilled water to 300 g of sediment placed in a 5 L plastic aquarium. As Sebkhas generally fill in winter and spring, rearing was started in cold temperatures (10–20°C) in natural photoperiod. Predators as large branchiopods were removed and no food was added.

Ostracods were dissected in lactophenol solution (McGinnis 1980) prepared in biology department under a stereomicroscope (Olympus ACH 1X) and mounted as permanent slides. Species were identified under a light microscope (Olympus BX-51) by using the taxonomic key of Meisch (2000). Damaged individuals were identified to genus level if possible and juveniles were not accounted for the taxonomy. Additionally, all salinity values (ppt) were measured with a multiparameter (Hanna, HI 9829) (Appendix 1).

Results

Twenty-seven podocopid ostracod species in four families (Candonidae, llyocyprididae, Cyprididae, Limnocytheridae) were identified in this study. In total, the species number of living non-marine ostracods in Algeria increased to now 47. The highest number of species per site was reported from Les Salines with nine species per sample. The most frequently encountered species were *Eucypris virens* recorded in almost all the sites (95%), followed by *Heterocypris incongruens* from 21 sites. We also identified males of *E. virens* from the sites with relatively high salinity ranges. The taxa *E. kerkyrensis, I. decipiens*, *I.* cf. *japonica*, *L. inopinata*, *P. smaragdina* and *P. zenkeri* have been found only once.

A checklist of non-marine ostracod species in Algeria is presented below. [([a]) New report in the present study, ([b]) Gauthier (1928), ([c]) Gauthier & Brehm (1928), ([d]) Mason (1939), ([e]) Samraoui *et al*. (1998), and ([f]) Karanovic & Pesce (2000).]

Bradleycypris obliqua (Brady, 1868)[b]
Candona angulata G.W. Müller, 1900[b]
Candona neglecta Sars, 1887[a,b]
Candonopsis cf. *kingsleyi* (Brady & Robertson, 1870)[e]
Cyclocypris ovum (Jurine, 1820)[b]
Cypria ophtalmica (Jurine, 1820)[b,e]
Cyprideis torosa (Jones, 1850)[b]
Cypridopsis elongata (Kaufmann, 1900)[b]
Cypridopsis hartwigi (G.W. Müller, 1900)[b]
Cypridopsis vidua (O. F. Müller, 1776)[a,b,e]
Cypris bispinosa Lucas, 1849[a,b,e]
Cypris pubera O. F. Müller, 1776[a]
Eucypris mareotica (Fischer, 1855)[b]
Eucypris kerkyrensis Stephanides, 1937[a]
Eucypris lilljeborgi (G.W. Müller, 1900)[a]
Eucypris ungulata (Moniez, 1891)[b]
Eucypris virens (Jurine, 1820)[a,b]
Herpetocypris chevreuxi (Sars, 1896)[a,b]
Herpetocypris reptans (Baird, 1835)[b]
Heterocypris balnearia (Moniez, 1893)[d]
Heterocypris barbara (Gauthier & Brehm, 1928)[a,b,c]
Heterocypris congenera (Vávra, 1897)[b]
Heterocypris exigua (Gauthier & Brehm, 1928)[b,c]

Heterocypris incongruens (Ramdohr, 1808)[a,b]
Heterocypris rotundata (Bronshtein, 1928)[a]
Heterocypris salina (Brady, 1868)[a,b]
Ilyocypris bradyi Sars, 1890[b]
Ilyocypris biplicata (Koch, 1838)[b]
Ilyocypris cf. *japonica* Okubo & Terauchi, 1992[a]
Ilyocypris decipiens Masi, 1905[a]
Ilyocypris getica Masi, 1906[a,b]
Ilyocypris gibba (Ramdohr, 1808)[a,b]
Isocypris beauchampi (Paris, 1920)[a]
Limnocythere inopinata (Baird, 1843)[a]
Loxoconcha elliptica Brady, 1868[b]
Martenscypridopsis materia Karanovic & Pesce, 2000[f]
Notodromas persica Gurney, 1921[b]
Physocypria bullata (Vávra, 1897)[e]
Plesiocypridopsis newtoni (Brady & Robertson, 1870)[b]
Potamocypris arcuata (Sars, 1903)[a,b]
Potamocypris smaragdina (Vávra, 1891)[a]
Potamocypris variegata Kaufmann, 1900[a]
Potamocypris villosa (Jurine, 1820)[a]
Prionocypris zenkeri (Chyzer & Toth, 1858)[a]
Sarscypridopsis aculeata (Costa, 1847)[a,b]
Tonnacypris lutaria (Koch, 1838)[a,b]
Trajancypris clavata (Baird, 1838)[a,b]

Discussion

During the present study 27 ostracod species were newly identified. Among them, three species (*Cypris pubera, Limnocythere inopinata*, *Potamocypris variegata*) are new to Algeria while nine taxa (*Eucypris kerkyrensis*, *E. lilljeborgi*, *Heterocypris rotundata*, *Ilyocypris decipiens*, *I.* cf. *japonica*, *Isocypris beauchampi*, *Potamocypris smaragdina*, *P. villosa*, *Prionocypris zenkeri*) are new to North Africa (Ramdani *et al*. 2001; Yacoubi-Khebiza *et al*. 2001; Hussein *et al.* 2004; Zaibi *et al*. 2013). Thus, the record of non-marine ostracods from Algeria increased to 47 species. This number exceeds that of Tunisia with 41 species (Zaibi *et al.* 2013), Portugal with 32 species (Martins *et al*. 2010) and Morocco with 15 species (Ramdani 1982; Ramdani *et al.* 2001; Yacoubi-Khebiza *et al*. 2001). However, the number still appears low for Algeria, which is the largest country in the Mediterranean region. For example, the number of species was reported to be 152 in Italy (Pieri *et al*. 2015), 143 in Turkey (Külköylüoğlu *et al.* 2015), 113 in France (Meisch *et al*. 1990) and 109 in Spain (Anonymous 2016). In fact, the reported species richness of a country appears to be more related to the presence of specialists and to the sampling effort rather than the region or wealth in water bodies, as possibly exemplified by the amount of around 100 ostracod species recorded from a small island like Sicily in Italy (Rossetti *et al.* 2004, 2006). In their previous works, Gauthier (1928a–c) and Gauthier & Brehm (1928) found 31 species of living ostracods in 113 water bodies in Algeria, which were often sampled punctually. In our study, only lentic waters were considered. Half of the species were found in Numidia, in the sense of biogeographic subdivisions of Quézel & Santa (1962, 1963), where efforts were biased by visiting pools several times. This region is considered as a biodiversity hotspot in the Mediterranean (Véla & Benhouhou 2007; Belouahem-Abed *et al.* 2011) and harbours 80 % of the total richness of the country (Samraoui & de Bélair 1998). Its climate was classified as humid by Gauthier (1928), with the greatest number of pools in the country (De Bélair 2005) and a hydroperiod that generally lasts 8 months from November to June. The most influential factor affecting biota is the desiccation of the habitat during the dry season; species richness normally increases as the length of the flooded period in ponds increases (Zacharias *et al*. 2007). In the present

study, the highest species richness was found in Numidia (Annaba district, previously Bône) in Les Salines with a total of nine species of which the majority is cosmopolitan (e.g., *E. virens*, *I. beauchampi*, *S. aculeata*). However, since this area has been used as stabilization ponds (constructed wetlands) in the past, the species richness could be biased because of the high amounts of organic matter and habitat degradation, described in the concept of "Pseudorichness" (Külköylüoğlu 2013). Furthermore, cosmopolitan species can often be associated with disturbed and degraded habitats (Külköylüoğlu 2004).

In the semi-arid region (35–36°N), water bodies become scarce and saline, with important distances between each Sebkha or Chott, making the sampling in these areas quite difficult, in addition to their inaccessibility, as mentioned by Gauthier (1928a–c). They were often dried during our visit, even in winter, so that ostracods were raised from mud. These huge and shallow saline lakes are generally situated at high altitude (>1000 m a.s.l.) where great differences in temperatures occur between day and night and between seasons. Salinity can vary from 3 ppt to several tens, and can sometimes rise to complete saturation (Amarouayache *et al*. 2009) depending on the soil-type and ionic composition of water. Thus, they are considered as unstable environments and harbour a specific ostracod fauna, which is well adapted to these conditions, such as euryoecious or halophilic species. Sixteen species have been found in the semi-arid region, of which *E. virens*, *Heterocypris barbara, H. incongruens, L. inopinata*, *P. villosa* are halotolerant species*, H. salina, I. gibba, S. aculeata* and *T. clavata* are considered as halophilic (Meisch 2000, Karanovic 2012). These species can also be fit to the "cosmoecious species concept" referring to the species with high tolerance levels within large geographical distribution (Külköylüoğlu 2007). Species of saline waters in the semi-arid region represent about 40% of the total species number. A maximum of five species was found in a single saline lake (e.g., see Sebkha Sidi Chami). When compared to earlier works, this number is relatively high. Indeed, previous studies exhibited that species richness decreases with salinity (Beadle 1943; De Deckker 1981; Hammer 1986; Williams 1998).

In the Sahara (33°–35° latitude), water bodies are few compared to the semi-arid region, they are very scattered and often saline and dry during several years. The pereniallity of ostracods in temporary habitats is ensured by the production of resting eggs, especially for Cypridoidea, which can be also dispersed by winds and animals (Frisch *et al.* 2007) and even by men via agricultural activities (Rossi *et al.* 2003). For example, Green *et al.* (2013) found live adults of *Candona simpsoni* in birds (killdeer) teal faeces. De Deckker (1981) reported that *Eucypris mareotica* (Fischer 1855) was the most widespread inhabitant of saline waters of the Sahara. In the present study, there were only three samples from Sahara where the two species (*E. virens* and *H. incongruens*) were the most common cosmopolitan species. The genus *Heterocypris* is also represented in the Sahara by *H. barbara* and *H. rotundata* which are halophilic species (De Deckker 1981).

The most abundant and common species was *E. virens* found in the majority of sites (95%). This result is not surprising because this species is known as cosmopolitan with high tolerance levels to different ecological variables, as called "cosmoecious species" (Külköylüoğlu 2007; Külköylüğlu *et al*. 2007). This freshwater ostracod species complex occurs mainly in winter and spring in ephemeral ponds (Meisch 2000), with extreme salinities between 0.6 and 5 ppt (De Deckker 1981). Parthenogenetic lineages are found throughout Europe, North Africa, North America and Palearctic Asia (Meisch 2000; Semenova 2005). However, populations with males are known only from the circum-Mediterranean area and central Asia (Meisch 2000), where males and sexual females may co-exist with clonal lineages (Schön *et al.* 2000). The presence of males in seven sites (El Karma, El Frine, Sebaa, El Henaya, Ain Nechma, Chott Tinsilt, and Sebkha Djendli) is to be noticed. The second most abundant species in this study was *H. incongruens*, a well-known cosmopolitan species which can be found in almost all kinds of fresh and brackish waters (Meisch 2000), and especially strongly eutrophic ponds. The species *E. kerkyrensis, I. decipiens*, *I.* cf. *japonica*, *L.inopinata, P. smaragdina*, *P. variegata* and *P. zenkeri* were found only once.

New records and taxonomic remarks

Half of the species (50%) reported about a hundred years ago were found again in our study. Nineteen species recorded previously (Gauthier 1928; Samraoui *et al.* 1998; Karanovic & Pesce 2000) are missing in our samples. It is probable that anthropogenic and climatic changes along with habitat loss and seasonal differences can play a role in this development. Also, it should be mentioned that some species reported by Gauthier (1928) were found in types of water bodies, which have not been sampled in the present study, such as rivers, springs and wells,

Eucypris lilljeborgi is considered as rare and its biological characteristics are poorly known (Meisch 2000). It is a stenochronal spring form and has been reported from temporary ponds and ditches situated in meadowland (Klie 1938). In this study, it was found in Sebkha Djendli, Chott Tinsilt and Garaa Guellif, which are all saline and temporary, and situated in the semi-arid region with cold winter and hot and dry summer at high altitude (1000 m a.s.l.).

Prionocypris zenkeri was only found in El Frine with few female individuals. This species clearly avoids both, deep and stagnant waters (Meisch 2000) and prefers slow flowing streams with rich aquatic vegetation. Most recently, studies (e.g., Akdemir *et al*. 2016) showed that *P. zenkeri* can also inhabit troughs, springs and small water bodies.

Heterocypris rotundata found in El-Karma 2, Akarom and the saline lakes of Guellif, Zahres El-Guarbi and Sidi Chami lives in the littoral zone of lakes and small pools. This halophilic ostracod is able to resist a gradual increase in salinity (Meisch 2000). Ecological and biological data are scarce about this species.

Ilyocypris decipiens was found in Les Salines located nearby the sea. This species can live in fish ponds, the littoral zone of lakes, slowly flowing brooks and rivers, temporary pools (Akdemir *et al*. 2016) and fountains and also tolerate moderately high salinity as about 2.2‰ (Meisch 2000).

Isocypris beauchampi were found in Numidia in Les Salines, El Oued (pond), Berrihane, El Asfour and Oum Tboul. It prefers slowly flowing streams and canals, (fish-) ponds, the littoral zone of lakes and rice fields, as well as in benthic and interstitial habitats (Külköylüoğlu 2003).

Potamocypris villosa was found in Draa Boultif, a marsh (with 2.23‰ salinity) on wheat field and Chott Es-Shari both situated in a semi-arid region at 1000 m a.s.l. Roca & Baltanás (1993) and Mezquita *et al*. (1999) suggested *P. villosa* as a cold stenothermal species of high altitudes (>600 m a.s.l.). Similarly, Külköylüoğlu & Yılmaz (2006) reported that the highest salinity from which *P. villosa* was sampled was that of a helocrene spring in Turkey located at about 1400 m a.s.l., implying a wide range of tolerance. Li *et al.* (2010) reported that the shells of this species were highly abundant in a spring with slightly acidic conditions (pH = 6.6) and salinity (0.57 ‰) at about 3200 m a.s.l.-

Potamocypris smaragdina was found only in El Oued pond, which was previously a Wadi, being currently derived. It is reported from the littoral zone of the lakes and slow streams and seems to be absent from temporary waters although having desiccation resistant eggs (Meisch 2000).

Ilyocypris cf. *japonica* was only found in Les Salines. Little is known about the occurrence of *I. japonica* since its first description (under the name of *I. haterumensis*) from Hateruma Jima island of Japan by Okubo & Terauchi (1992) (R. Smith pers. comm.). Although our individual shows similarities to the type species described by Okubo & Terauchi (1992), the specimen is left in open nomenclature because of lack of individuals.

Eucypris kerkyrensis was found in Chott Tinsilt. This species is known from shallow and slightly brackish and temporary pools (NaCI 2-4 ‰) (Meisch 2000).

Additionally, a few more valves and carapaces were found during the study but they are not included into the list, because identification was not possible. However, such findings suggest a possible higher species richness in the region than shown in the species list here presented.

Conclusion

We here present the most current list of living ostracods from Algeria. The number of species remains to be low because different biological factors (e.g., seasonality) may play an important role in species occurrence, but also because more than half of the country has not been covered by ostracod sampling campaigns so far. Further surveys are required to obtain a less biased data base.

Acknowledgement

We would like to thank to Dr. Robin James Smith (Lake Biwa Museum, Japan) for his comments on *I. japonica*, and Dr. Burkhard Scharf (Germany) for his comments on an earlier version of this manuscript. We would like to thank to Dr. Renate Matzke-Karasz for her help and time on our manuscript. The authors thank the Algerian Ministry for Higher Education MESRS within the framework of the CNEPRU project.

References

Akdemir, D., Külköylüoğlu, O., Yavuzatmaca, M. & Sarı, N. (2016) Freshwater ostracods (Crustacea) of Gaziantep (Turkey) and their habitat preferences according to movement ability. *Fundamental and Applied Limnology*, 187/4, 307–314. https://doi.org/10.1127/fal/2016/0665

Amarouayache, M., Derbal, F. & Kara, M.H. (2009) Biological data on *Artemia salina* (Branchiopoda, Anostraca) From Chott Marouane (Northeast Algeria). *Crustaceana*, 82 (8), 997–1005. https://doi.org/10.1163/156854009X452768

Anonymous (1998) *Atlas des zones humides algériennes*. Direction Générale des Forêts (Eds.), MADR Algérie, 46 pp.

Anonymous (2001) *Atlas des zones humides algériennes d'importance internationale*. Direction Générale des Forêts (Eds.), MADR, Algérie, 56 pp.

Anonymous (2004) *Atlas (IV) des zones humides algériennes d'importance internationale*. Direction Générale des Forêts (Eds.), MADR, Algérie, 107 pp.

Anonymous (2016) Available from: http://insectoid.info/checklist/podocopida/spain/ (Accessed 7 Jun. 2017)

Beadle, L.C. (1943) An ecological survey of some Inland Saline Waters of Algeria. *Zoological Journal of the Linnean Society*, 1943, 218–242. https://doi.org/10.1111/j.1096-3642.1943.tb01698.x

Belouahem-Abed, D., Belouahem, F., Benslama, M., De Bélair, G. & Muller, S. (2011) Les aulnaies de Numidie (N.E. algérien): biodiversité floristique, vulnérabilité et conservation. *Comptes Rendus Biologies*, 334, 61–73. https://doi.org/10.1016/j.crvi.2010.10.005

Bronshtein, Z.S. (1947) *Ostracoda Presnykh Vod. Fauna SSSR, Rakoobraznye, Tom 2, Vyp. 1. (Zoologicheskii Institut, Akademiya Nauk SSSR, Moscow). English translation 1988: Fresh-water Ostracoda. Fauna of the USSR. Crustaceans. 2 (1)*. Amerind Publishing Co. Pvt. Ltd., New Delhi, xv + 470 pp.

Butlin, R., Schön, I. & Martens, K. (1998) Asexual reproduction in non-marine ostracods. *Heredity*, 81, 473–480. https://doi.org/10.1046/j.1365-2540.1998.00454.x

De Bélair, G. (2005) Dynamique de la végétation de mares temporaires en Afrique du Nord (Numidie orientale, NE Algérie). *Ecologia Mediterranea*, 31, 1–18.

De Deckker, P. (1981) Ostracods of athalassic saline lakes, a review. *Hydrobiologia*, 81, 131–144. https://doi.org/10.1007/BF00048710

Delorme, L.D. (1991) Ostracoda. *In:* Thorpe, J.H. & Covich, A.P. (Eds.), *Ecology and Classification of North American Invertebrates.* Academic Press, New York, pp. 691–722.

Frisch, D., Green, A.J. & Figuerola, J. (2007) High dispersal capacity of a broad spectrum of aquatic invertebrates via waterbirds. *Aquatic Sciences*, 69, 568–574. https://doi.org/10.1007/s00027-007-0915-0

Gagneur, J. & Kara, M.H. (2001) Limnology in Algeria. *In*: Wetzel, R.G. & Gopal, B. (Eds.), *Limnology in Developing Countries. 3*. International Association of Limnology and SIL, New Delhi1, 34 pp.

Gauthier, H. (1928a) *Recherche sur la faune des eaux continentales de l'Algérie et de la Tunisie.* Imprimerie Minerva, Alger, 419 pp.

Gauthier, H. (1928b) Ostracodes et Cladocères de l'Afrique du Nord (Première note*). Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 19, 10–19.

Gauthier, H. (1928c) Ostracodes et Cladocères de l'Afrique du Nord (2e note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 19, 69–79.

Gauthier, H. & Brehm, V. (1928) Ostracodes et Cladocères de l'Afrique du Nord (3e note*). Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 19, 114–121.

Ghaouaci, S., Yavuzatmaca, M., Külköylüoğlu, O., Amarouayache, M. & Gouasmia, G. (2015) *Checklist of the living non-marine Ostracoda (Crustacea) of Algeria*. *In*: 8th European Ostracod Meeting, Tartu, Estonia, July 22–30, 2015, pp. 27.

A checklist of recent non-marine Ostracoda (Crustacea) of Turkey with three new records (PDF Download Available). Available from: https://www.researchgate.net/publication/298344433_A_checklist_of_recent_non-marine_Ostracoda_Crustacea_of_Turkey_with_three_new_records (accessed 9 May 2017)

Green, A.J., Frisch, D., Michot, T.C., Allain, L.K. & Wylie, C. (2013) Endozoochory of seeds and invertebrates by migratory waterbirds in Oklahoma, USA. *Limnetica*, 32 (1), 39–46.

Hammer, U.T. (1986) *Saline lakes ecosystems of the world*. Dr.W. Junk, Dordrecht, 616 pp.

Hussein, M.A., Obuid-Allah, A.H., Mahmoud, A.A. & Mohammad Fargary, H. (2004) Ecology of eight species of freshwater Ostracods (Crustacea) from Qena Gouernorate. Upper Egypt. *Egyptian Journal of Aaquatic Biology Fisheries*, 8 (4), 107–122.

Karanovic, I. & Pesce, G.L. (2000) *Martenscypridopsis* a new ostracod genus (Crustacea: Ostracoda) from African inland waters. *Annals of Limnology*, 36 (3), 149–155. https://doi.org/10.1051/limn/2000012

Karanovic, I. (2012) *Recent Freshwater Ostracods of the World: Crustacea, Ostracoda, Podocopida*. Springer, Heidelberg, Dordrecht, London & New York, 608 pp. https://doi.org/10.1007/978-3-642-21810-1

Klie, W. (1938) Krebstiere oder Crustacea III. Ostracoda, Muschelkrebse. *In*: Dahl, F. (Ed.), *Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise*. Gustav Fischer Verlag, Jena, pp. 1–230.

Külköylüoğlu, O. (2000) The importance of cosmopolitan and indicator species of Ostracoda (Crustacea) in Turkey based on some water variables. *Water Product Conference*, Sinop Turkey, 2000, 421–437. [abstract in English]

Külköylüoğlu, O. (2003) First report of the genus *Isocypris* (Ostracoda) from Turkey: taxonomy, ecology, and general distribution. *Crustaceana*, 75 (9), 1083–1093.
https://doi.org/10.1163/156854002763270482

Külköylüoğlu, O. (2004) On the usage of Ostracoda (Crustacea) as bioindicator species in the different aquatic habitats in the Bolu region, Turkey. *Ecology Indicators*, 4, 139 –147.
https://doi.org/10.1016/j.ecolind.2004.01.004

Külköylüoğlu, O. (2005a) Factors effecting Ostracoda (Crustacea) occurrence in Yumrukaya Reedbeds (Bolu, Turkey). *Wetlands*, 25, 224–227.
https://doi.org/10.1672/0277-5212(2005)025[0224:FATOOO]2.0.CO;2

Külköylüoğlu, O. (2005b) Ecological requirements of freshwater Ostracoda (Crustacea) in two limnocrene springs (Bolu, Turkey). *International Journal of Limnology*, 41, 237–246.
https://doi.org/10.1051/limn/2005016

Külköylüoğlu, O. (2007) Ostracod Pseudorichness: Is it real? *In: European Ostracodologists Meeting (EOM VI)*, 19th International Senckenberg Conference, Frankfurt, Germany, 5–7 September 2007, Abstract Volume, pp. 6.

Külköylüoğlu, O. (2013) Diversity, distribution and ecology of nonmarine Ostracoda (Crustacea) in Turkey: Application of pseudorichness and cosmoecious species concepts. *Recent Research in Development & Ecology*, 4, 1–18.

Külköylüoğlu, O., Akdemir, D., Yavuzatmaca, M. & Yılmaz, O. (2015) A checklist of recent non-marine Ostracoda (Crustacea) of Turkey with three new records. *Review of Hydrobiology*, 8/2, 77–90.

Külköylüoğlu, O., Dügel, M. & Kılıç, M. (2007) Ecological requirements of Ostracoda (Crustacea) in a heavily polluted shallow lake, Lake Yeniçağa (Bolu, Turkey) *Hydrobiologia*, 585, 119–133.
https://doi.org/10.1007/s10750-007-0633-6

Külköylüoğlu, O. & Yılmaz, F. (2006) Ecological requirements of Ostracoda (Crustacea) in three types of springs in Turkey. *Limnologica*, 36, 172–180.
https://doi.org/10.1016/j.limno.2006.03.003

Li, X., Liu, W., Zhang, L. & Sun, Z. (2010) Distribution of Recent ostracod species in the Lake Qinghai area in Northwestern China and its ecological significance. *Ecological indicators*, 10, 880–890.
http://dx.doi.org/10.1016/j.ecolind.2010.01.012

Lucas, P.H. (1849) Histoire naturelle des animaux articulés. *In*: *Exploration scientifique de l'Algérie, pendant les années 1840, 1841 et 1842. Tome 2.* Imprimerie Nationale, Paris, pp. 1–456.

Martens, K. (1998) *Sex and parthenogenesis. Evolutionary ecology of reproductive modes in non-marine ostracods*. Backhuys, Leiden, 335 pp.

Martens, K. & Savatenalinton, S. (2011) A subjective checklist of the Recent, free-living, non-marine Ostracoda (Crustacea). *Zootaxa*, 2855, 1–79.

Martens, K., Schön, I., Meisch, C. & Horne, D.J. (2008) Global biodiversity of non-marine Ostracoda (Crustacea). *Hydrobiologia*, 595, 185–193.
https://doi.org/10.1007/s10750-007-9245-4

Martins, F., Namiotko, M.J., Cabral, T., Fatela, M.C. & Boavida, M.J. (2010) Contribution to the knowledge of the freshwater Ostracoda fauna in continental Portugal, with an updated checklist of Recent and Quaternary species, *Journal of Limnology*, 69 (1), 160–173.
https://doi.org/10.4081/jlimnol.2010.160

McGinnis, M.R. (1980) Laboratory Handbook of Medical Mycology. Academic Press, New York, NY, 661 pp.

Meisch, C. (2000) *Freshwater Ostracoda of Western and Central Europe*. *In*: Schwoerbel, J. & Zwick, P. (Eds.), *Süßwasserfauna von Mitteleuropa 8/3*. Spektrum Akademischer Verlag, Heidelberg, Berlin, pp. 1–522.

Meisch, C., Wouters, K. & Martens, K. (1990) Liste annotée des ostracodes actuels non-marins trouvés en France. *Travaux Scientifiques du Parc National de la Vanoise*, 15, 1–48.
https://doi.org/10.2307/1549241

Mezquita, F., Griffiths, H.I., Sanz, S., Soria, J.M. & Pino, A. (1999) Ecology and distribution of ostracods associated with flowing waters in the eastern Iberian Peninsula. *Journal of Crustacean Biology*, 19 (2), 344–354.
https://doi.org/10.2307/1549241

Moniez, R. (1891) Faune des lacs salés d'Algérie. *Mémoires de la société zoologique de France*, 1891, 246–257.

Okubo, I. & Terauchi, M. (1992) Freshwater Ostracoda from the Southwestern Islands of Japan. *Proceedings of the Japanese Society for Systematic Zoology*, 46, 101–108.

Ozawa, H. (2013) Chapter 4. The history of sexual dimorphism in Ostracoda (Arthropoda, Crustacea) since the Palaeozoic. *In*: Moriyama, H. (Ed.), Biochemistry, Genetics and Molecular Biology. *Sexual Dimorphism*. [published online]
https://doi.org/10.5772/55329

Pieri, V., Martens, K., Meisch C., Rossetti, G. (2015) An annotated checklist of the Recent non-marine ostracods (Ostracoda: Crustacea) from Italy. *Zootaxa*, 3919 (2), 271–305.

https://doi.org/10.11646/zootaxa.3919.2.3
Quézel, P. & Santa, S. (1962-1963) *Nouvelle Flore de l'Algérie et des régions désertiques méridionales.* CNRS, Paris, 170 pp.
Ramdani, M. (1982) Les entomostracés de la merja Sidi Bou Ghaba. *Bulletin de l'Institut Scientifique*, *Rabat*, 6, 105–117.
Ramdani, M., Flower, R.J., Elkhiati, N., Kraïem, M.M., Fahti, A.A., Birks, H.H. & Patrick, S.T. (2001) North African wetland lakes: characterization of nine sites included in the CASSARINA Project. *Aquatic Ecology*, 35, 281–302.
https://doi.org/10.1023/A:1011957324901
Roca, J., Baltanás, A. (1993) Ecology and distribution of Ostracoda in Pyrenean springs. *Journal of Crustacean Biology*, 13 (1), 165–174.
https://doi.org/10.2307/1549131
Rossetti, G., Bartoli, M. & Martens, K. (2004) Limnological charateristics and recent ostracods (Crustacea, Ostracoda) of freshwater wetlands in the Parco Oglio Sud (Northern Italy). *Annales de Limnologie*, 40 (4), 329–341.
https://doi.org/10.1051/limn/2004030
Rossetti, G., Martens, K., Meisch, C., Tavernelli, S. & Pieri, V. (2006) Small is beautiful: diversity and distributional patterns of ostracods (Crustacea, Ostracoda) in marginal freshwater habitats of the province of Parma (Northern Italy). *Journal of Limnology*, 65 (2), 121–131.
https://doi.org/10.4081/jlimnol.2006.121
Rossi, V., Benassi, G., Veneri, M., Bellavere, C., Menozzi, P., Moroni, A. & McKenzie, K.G. (2003) Ostracoda of the Italian ricefields thirty years on: new synthesis and hypothesis. *Journal of Limnology*, 62 (1), 1–8.
https://doi.org/10.4081/jlimnol.2003.1
Samraoui, B. & de Bélair, G. (1998) Les zones humides de la Numidie orientale. Bilan et perspectives. *Synthèse*, 4, 1–90.
Samraoui, B., Segers, H., Maas, S., Baribwegure, D. & Dumont, H.J. (1998) Rotifera, Cladocera, Copepoda, and Ostracoda from coastal wetlands in northeast Algeria. *Hydrobiologia*, 386, 183–193.
https://doi.org/10.1023/A:1003538730152
Schön, I., Gandolfi, A. & di Masso, E. (2000) Persistence of asexuality through mixed reproduction in *Eucypris virens* (Crustacea, Ostracoda). *Heredity*, 84, 161–169.
https://doi.org/10.1046/j.1365-2540.2000.00647.x
Semenova, L.M. (2005) Fauna and distribution of the Ostracoda (Crustacea, Ostracoda) of inland waterbodies of Russia and contiguous states. *Inland Water Biology*, 3, 17–26.
Van Damme, K. & Dumont, H.J. (2010) Cladocera of the Lençois Maranhenses (NE-Brazil): faunal composition and a reappraisal of Sars' Method. *Brazilian Journal of Biology*, 70 (3), 755–779.
https://doi.org/10.1590/S1519-69842010000400008
Véla, E., Benhouhou, S. (2007) Evaluation d'un nouveau point chaud de biodiversité végétale dans le Bassin méditerranéen (Afrique du Nord). *Comptes Rendus Biologies*, 330, 589–605.
https://doi.org/10.1016/j.crvi.2007.04.006
Williams, W.D. (1998) The Management of Inland Saline Waters. Guide lines of Lake Management. Vol. 6. ILEC/UNEP, Kusatsu, 23 pp.
Yacoubi-Khebiza, M., Messouli, M., Coineau, N. & El Abiari, A.F. (2001) Contribution to the knowledge of the groundwater communities from Northern Morocco. *In:* Rasteiro, N.A. (Ed.), *Proceedings, 13th International Congress of Speleology*, 4th Speleological Congress of Latin América and Caribbean, 26th Brazilian Congress of Speleology, SBE (Sociedade Brasileira de Espeleologia), pp. 407–410.
Zacharias, I., Dimitriou, E., Dekker, A. & Dorsman, E. (2007) Overview of temporary ponds in the Mediterranean region: Threats, management and conservation issues. *Journal of Environmental Biology*, 28 (1), 1–9.
Zaibi, C., Scharf, B., Viehberg, F.A., Keyser, D. & Kamoun, F. (2013) Preliminary report on the living non-marine Ostracoda (Crustacea) from Tunisia with the description of a new *Psychrodromus* species. *Zootaxa*, 3626 (4), 499–516.
https://doi.org/10.11646/zootaxa.3626.4.5

APPENDIX 1. Site number (Site no), Site name (Type), Province, Coordinates, Altitude (m), Surface area (km^2), Salinity (‰) and Species (Sp. code) found in 117 sampling sites from 18 provinces in Algeria. Abbreviations: *Candona neglecta* (Cn); *Cypridopsis vidua* (Cv); *Cypris bispinosa* (Cb); *Cypris pubera* (Cp); *Eucypris kerkyrensis* (Ek); *Eucypris lilljeborgi* (El); *Eucypris virens* (Ev); *Herpetocypris chevreuxi* (Hc); *Heterocypris barbara* (Hb); *Heterocypris incongruens* (Hi); *Heterocypris rotundata* (Hr); *Heterocypris salina* (Hs); *Ilyocypris decipiens* (Id); *Ilyocypris getica* (Ige); *Ilyocypris gibba* (Ig); *Ilyocypris* cf. *japonica* (Ij); *Isocypris beauchampi* (Ib); *Limnocythere inopinata* (Li); *Plesiocypridopsis newtoni* (Pn); *Potamocypris arcuata* (Pa); *Potamocypris smaragdina* (Ps); *Potamocypris variegata* (Pva); *Potamocypris villosa* (Pv); *Prionocypris zenkeri* (Pz); *Sarscypridopsis aculeata* (Sa); *Tonnacypris lutaria* (Tl); *Trajancypris clavata* (Tc); Valve (v); Juvenile (j); Male (M). Number represents females. Sebkha and Chott indicate the huge temporary saline lakes in Algeria.

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
1	Les Salines (temporary marsh)	Annaba	36°50'34.00"N 07°47'46.00"E	1	0.01	0.84-2.98	Cp (1); Ev (280; 51j; 33v); Id (4); Ij (1;1v); Ib (2; 2j); Pn (140); Pa (17); Sa (104); TI (3)
2	Boukhadra (temporary marsh)	Annaba	36°51'50.76"N 07°43'3.09"E	2	0.03	0.45	Cb (31); Ev (223; 21j); Ig (8; 4j)
3	El-Rym (temporary marsh)	Annaba	36°52'44.38"N 07°43'42.70"E	2	0.01	3-6	Cn (1M); Ev (153; 60j); Hi (1)
4	Laalalig (permanent pond)	Annaba	36°51'13.55"N 07°45'21.63"E	2	0.02	4.55	Cv (3); Ev (75: 2j; 2v); Hi (30; 20j); Ig (15;20)
5	Sidi Salem (temporary pond)	Annaba	36°50'30.72"N 07°49'37.52"E	2	0.0005	0.35	Cn (1; 1j); Cv (8); Ev (112; 20j; 4v); Hi (1); Ig (1); Pn (20); Sa (2)
6	Kherraza (temporary pond)	Annaba	36°50'3.70"N 07°39'35.01"E	16	0.0004	0.34	Ev (70)
7	El Bouni1(ditch)	Annaba	36°51'51.47"N 07°43'36.36"E	21	0.000006	0.27	Cn (19); Ev (334; 37j)
8	Bouzaaroura (temporary pool)	Annaba	36°50'35.22"N 07°44'59.61"E	10	0.0005	0.26	Cn (4)
9	Les Salines (temporary pool)	Annaba	36°50'4.87"N 07°47'59.32"E	2	0.0003	0.84	Ev (25: 39j)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
10	Oued El Nil (temporary pool)	Annaba	36°49'53.01"N 07°38'2.78"E	21	0.00002	0.15	Cn (2)
11	Boukhadra (El-Rym) (temporary pool)	Annaba	36°52'18.33"N 07°43'28.77"E	2	0.00001	1.04	Cn (3); Ev (89; 5j)
12	Boukhadra (temporary pool)	Annaba	36°52'19.64"N 07°43'32.19"E	4	0.000025	0.45	Ev (48)
13	Hdjar-Diss (ditch)	Annaba	36°47'36.14"N 07°36'28.03"E	33	0.00001	0.59	Ev (6; 2v); Hi (4; 1v)
14	Berrehal (basin)	Annaba	36°48'58.20"N 07°26'7.13"E	45	0.0001	0.18	Cv (1); Ev (24)
15	Boukhmira 1(temporarypool)	Annaba	36°51'3.43"N 07°48'8.54"E	1	0.00002	0.43	Hi (1); Sa (195; 97j)
16	Boukhmira 2(temporary pool)	Annaba	36°51'3.41"N 07°48'11.13"E	1	0.00001	0.31	Ev (3; 10j); Sa (111)
17	Les Ruines (rocky basin)	Annaba	36°52'59.50"N 07°45'7.11"E	12	0.0001	0.57	Cb (2; 1j)
18	El-Chorfa (ditch)	Annaba	36°42'59.24"N 07°33'27.75"E	15	0.00005	0.43	Cb (6); Ev (28; 6j)
19	El-Karma 1(basin)	Annaba	36°45'26.97"N 07°40'55.66"E	15	0.000006	0.54	Ev (1M; 4; 1j)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
20	El-Karma 2 (basin)	Annaba	36°45'27.80"N 07°40'57.02"E	16	0.000006	0.32	Ev (2; 11j); Hr (7)
21	El-Karma 3 (temporary pool)	Annaba	36°45'34.93"N 07°40'41.43"E	20	0.0001	0.48	Ev (16; 8j)
22	El-Eulma (temporary pool)	Annaba	36°41'37.37"N 07°35'9.85"E	90	0.0001	0.83	Ev (23; 1j)
23	Chbaita Mokhtar (temporary pool)	Annaba	36°46'7.04"N 07°44'17.16"E	10	0.0005	0.21	Ev (18; 6j)
24	El Frine (peanut field)	El-Tarf	36°50'17.35"N 08°25'19.45"E	30	0.01	0.15	Cv (1) ; Cb (2 ; 1j) ; Cp (18) ; Ev (11M ; 279 ; 3j) ; Pz (4)
25	Mridima (temporary pool)	El-Tarf	36°52'42.21"N 08°24'10.19"E	41	0.0017	0.12	Cb (115 ; 3j) ; Ev (10j)
26	El-Guentra (temporary pool)	El-Tarf	36°46'49.37"N 08°18'49.56"E	25	0.014	0.12	Cb (20; 19j)
27	Sidi Mbarek (temporary pool)	El-Tarf	36°49'51.55"N 07°55'58.63"E	5	0.00054	0.32	Cb (12; 3v)
28	El-Feid (marsh)	El-Tarf	36°44'59.79"N 08°4'5.99"E	2	0.10	0.25	Ev (22)
29	El-Battah (temporary pool)	El-Tarf	36°50'33.29"N 07°56'57.19"E	2	0.014	0.49	Ev (1; 3j)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
30	El Oued (temporary pool)	El-Tarf	36°46'53.87"N 08°18'50.29"E	30	0.012	0.07	Cv (3); Ev (4j); Ig (3; 5v); Ib (1); Ps (3)
31	Dey Lagraa (temporary pool)	El-Tarf	36°50'21.56"N 08°25'39.41"E	32	0.0061	0.25	Cn (1); Cv (3); Cb (1); Ev (91)
32	Souk Rguibet (temporary pool)	El-Tarf	36°53'41.91"N 08°17'29.27"E	6	0.0017	0.09	Ev (9; 2j); Pn (3)
33	El Qriaat (temporary pool)	El-Tarf	36°48'23.20"N 07°59'26.60"E	12	0.0038	0.22	Cb (1); Ev (7)
34	Ain Khiar (temporary pool)	El-Tarf	36°48'25.36"N 08°19'33.07"E	42	0.0078	0.09	Cv (1)
35	Sebaa (temporary pool)	El-Tarf	36°50'51.86"N 08°4'28.50"E	27	0.0032	0.30	Ev (2M; 6)
36	El Malha (temporary pool)	El-Tarf	36°52'3.03"N 08°20'22.83"E	5	0.0046	0.21	Hc (1; 4j)
37	El Henaya (temporary pool)	El-Tarf	36°53'47.90"N 08°8'31.39"E	16	0.0052	0.21	Ev (1M); Hc (4; 15j)
38	Faid El Gharnoug (temporary pool)	El-Tarf	36°50'36.00"N 08°10'42.92"E	23	0.001	0.08	Ev (1)
39	Houaychia (ditch)	El-Tarf	36°49'5.28"N 08°37'7.83"E	265	0.000006	0.16	Ev (35)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
40	Boutheldja 1(ditch)	El-Tarf	36°46'36.88"N 08°13'17.04"E	16	0.000006	0.09	Ev (28; 9j)
41	Boutheldja 2 (temporary pool)	El-Tarf	36°46'34.31"N 08°13'17.73"E	17	< 0.01	0.07	Ev (62; 2j)
42	El Frine 2 (peanut field)	El-Tarf	36°50'21.96"N 08°25'21.36"E	25	< 0.01	0.32	Ev (223)
43	Draouche (peanut field)	El-Tarf	36°50'48.47"N 08°4'29.37"E	31	< 0.01	0.17	Ev (2j)
44	Berrihane (temporary pool)	El-Tarf	36°50'1.23"N 08°6'43.94"E	16	< 0.01	0.07	Cb (2); Ev (24); Ib (1)
45	El Asfour (temporary pool)	El-Tarf	36°39'10.22"N 07°56'37.29"E	70	< 0.01	0.10	Ev (48; 1v); Ib (1)
46	Jnene Echouk (temporary pool)	El-Tarf	36°40’53.35”N 07°43’59.22”E	20	< 0.01	0.16	Ev (64; 16j)
47	Oum Tboul (Dghidgha) (temporary pool)	El-Tarf	36°53'24.29"N 08°36'40.74"E	116	< 0.01	0.09	Cb (33; 13j); Ev (243; 44j)
48	Essouarekh (temporary pool)	El-Tarf	36°53'0.26"N 08°34'15.31"E	14	< 0.01	0.19	Cb (3); Ev (33); Sa (1)
49	La Messida (temporary pool)	El-Tarf	36°53'2.71"N 08°31'54.88"E	1	< 0.01	0.07	Ev (46; 6j); Ig (1)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
50	El –Aioun (ditch)	El-Tarf	36°49'20.49"N 8°36'14.50"E	240	< 0.01	0.17	Ev (129; 6j)
51	Oum Tboul (temporary pool)	El-Tarf	36°52'57.60"N 08°34'28.40"E	34	< 0.01	0.09	Ev (37); Ib (1)
52	Ain Ben Beida1(ditch)	El-Tarf	36°37'59.06"N 07°42'0.95"E	85	< 0.00001	0.24	Ev (16; 1j)
53	Ain Ben Beida2 (temporary pool)	El-Tarf	36°36'32.29"N 07°41'54.16"E	112	< 0.01	0.43	Ev (17; 3j); TI (2); Ige (9)
54	El-Chatt (ditch)	El-Tarf	36°49'38.26"N 07°51'18.07"E	2	< 0.01	0.25	Ev (3)
55	El Frine (peanut field)	El-Tarf	36°49'46.44"N 08°25'16.01"E	27	< 0.01	0.08	Ev (24)
56	lac Oubeira (a pond)	El-Tarf	36°52'1.74"N 08°22'28.44"E	27	< 0.01	0.16	Ev (1)
57	Garaa Bechna (marsh)	Skikda	36°53'23.54"N 07°17'50.64"E	10	< 0.01	0.23	Cb (83; 5j); Ev (17j)
58	Aïn Nechma (temporary pool)	Skikda	36°50'18.64"N 07°16'59.46"E	18	< 0.01	0.38	Cb (2; 2j); Ev (3M; 107; 3j; 2v)
59	Lemsaousa (temporary pool)	Skikda	36°56'35.98"N 07°15'8.76"E	20	< 0.01	0.14	Ev (40; 15j)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
60	Garaa Beni- Mohamed (marsh)	Skikda	36°56'19.82"N 07°15'46.14"E	3	0.0001	0.61	Cn (1j); Cb (1j); Ev (111; 15j)
61	Deyar El Jedri (ditch)	Skikda	36°57'59.38"N 07°19'8.04"E	13	< 0.00001	0.22	Cn (1); Ev (190)
62	Mgez Stah (temporary pool)	Skikda	36°57'20.26"N 07°17'50.38"E	2	< 0.01	0.15	Ev (28; 25j)
63	El Hamma (temporary pool)	Skikda	36°48'17.82"N 07°16'46.71"E	21	< 0.01	0.51	Ev (2; 5v)
64	Hdjar –Soud (temporary pool)	Skikda	36°46'55.84"N 07°17'17.16"E	29	< 0.01	0.18	Ev (35; 4j)
65	Garaa Rmaila (marsh)	Skikda	37° 0'52.96"N 07°15'25.02"E	5	< 0.01	0.32	Ev (3)
66	Ras El Maboun (ditch)	Skikda	37° 0'37.44"N 07°15'48.68"E	16	< 0.00001	0.11	Ev (3; 46j; 2v); Ig (3; 3v)
67	Akarom (temporary pool)	Skikda (Collo)	37° 3'33.47"N 06°30'44.39"E	932	< 0.01	0.15	Hr (27); Ig (1)
68	Teza (temporary pool)	Skikda (Collo)	37° 1'46.10"N 06°30'22.46"E	823	< 0.01	0.18	Hi (33)
69	El-Mraige (temporary pool)	Skikda (Collo)	36°57'26.99"N 06°32'39.60"E	758	< 0.01	0.22	Hi (7)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
70	Bouchegouf 1 (temporary pool)	Guelma (Bouchegouf)	36°31'14.80"N 07°43'19.66"E	82	0.00003	0.26	Ev (52)
71	Bouchegouf 2 (temporary pool)	Guelma (Bouchegouf)	36°30'49.45"N 07°42'56.03"E	84	0.00003	0.19	Cn (3) ; Ev (4 ; 8j)
72	Tamlouka temporary pool	Guelma (Tamlouka)	36° 8'45.00"N 07° 8'45.00"E	745	< 0.01	1.22	Ev (2)
73	Hammam Dbegh (thermal pool 28°C)	Guelma	36°27'50.00"N 07°16'1.00"E	335	0.00001	1.27	Hb (23; 9j)
74	Guerrah 1 (temporary pool)	Constantine (Guerrah)	36° 6'44.00"N 06°36'4.00"E	757	0.02	0.45	Ev (17) ; Hb (8)
75	Guerrah (ditch)	Constantine (Guerrah)	36° 8'48.00"N 06°37'23.00"E	755	0.000004	0.17	Ev (26 ; 7j)
76	Safsaf (temporary pool)	Tébessa	34°57'9.03"N 08°13'42.10"E	866	0.00002	0.54	Pa (10); Tc (5; 5v; 4j)
77	El-Doukken (temporary pool)	Tébessa	35°23'20.46"N 08°4'49.75"E	922	0.0001	0.65	Ev (4); Ige (16)
78	El-Malabiod (temporary pool)	Tébessa	35°10'20.72"N 08°9'35.94"E	1000	< 0.01	1.23	Ige (7 ; 2v)
79	Hamiet (Chott)	Sétif	35°55'27.43"N 05°32'53.46"E	903	25.09	4-7	Ev (14) ; Hi (1)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
80	Oued Aissi (temporary pool)	Tizi Ouzou	36°42'23.64"N 04°7'45.02"E	74	0.00001	0.19	Hi (39; 5j)
81	Illoula Ou Malou (temporary marsh)	Tizi Ouzou	36°35'9.21"N 04°27'3.38"E	592	0.0021	0.19	Cv (5); Ev (1, 5j)
82	Bouguezoul (Chott)	Medea	35°43'60.00"N 02°46'60.00"E	700	90.58	3.00	Ev (2; 3j); Ig (93)
83	Tizourite (temporary pool)	Batna	35°48'57.55"N 06°20'48.91"E	798	0.0011	2.12	Ev (12; 11j)
84	Draa-Boultif (temporary pool)	Batna	35°50'6.60"N 06°22'25.56"E	797	0.0096	2.23	Ev (17; 2j); Li (3); Pv (5)
85	Djendli (Sebkha)	Batna	35°41'60.00"N 06°31'55.40"E	900	70.00	0.53	EI (1); Ev (15M; 236; 87j); Sa (1)
86	Es-Shari (Chott)	Batna	35°49'50.00"N 06°23'24.00"E	794	25.00	0.12	Hi (6); Pv (4);
87	Tinsilt (Chott)	Oum El Bouaghi	35°53'15.89"N 06°28'37.16"E	900	21.54	14.51	Ev (45M ; 434 ; 39j) ; Ek (3) ; EI (2)
88	Timerganine (Chott)	Oum El Bouaghi	35°39'24.10"N 06°57'46.80"E	900	5.7	0.56	Ev (2 ; 2j) ; Ig (1M) ; Tc (2)
89	El-Tarf (Chott)	Oum El Bouaghi	35°38'42.00"N 07°1'28.10"E	900	334.60	8.00	Ev (154 ; 27j)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
90	El-Maghssel (Chott)	Oum El Bouaghi	35°49'58.10"N 06°43'52.90"E	828	1.1	0.15	Ev (10 ; 3j) ; Hb (2)
91	Ourkis (Reservoir)	Oum El Bouaghi	35°56'1.00"N 06°56'13.00"E	993	0.55	0.38	Cv (1); Ev (1; 1j); Hs (31); Pva (2)
92	Guellif (Chott)	Oum El Bouaghi	35°45'22.50"N 06°54'44.20"E	829	55.00	10.00	EI (1; 1j); Hr (15; 1j)
93	M'Toussa (Chott)	Khenchela (M'Toussa)	35°37'49.00"N 07°13'54.93"E	837	0.01	0.64	Hi (4)
94	Melah (Chott)	Oum El Bouaghi	35°36'44.60"N 07°5'13.60"E	840	0.85	0.12	Cv (12); Hi (3)
95	Ez-Zemoul (Sebkha)	Oum El Bouaghi	35°53'13.70"N 06°30'20.00"E	785	64	4.20	Hi (42; 5j)
96	Ouled M'barek (Sebkha)	Khenchela	35°20'45.67"N 07°15'42.85"E	1000	3.4	7.50	Ev (14; 6j; 2v)
97	Zahres El-Chergui (Chott)	Djelfa	35°12'12.67"N 03°29'57.93"E	750	509.85	3-4	Ev (2); Hb (1M; 13)
98	Zahres El-Guarbi (Chott)	Djelfa	34°54'48.83"N 2°50'31.46"E	837	522	3-4	Hr (58)
99	Tindla (Chott)	El Oued	33°39'48.63"N 06°3'8.84"E	6	1.8	1.50	Hi (2)

...continued on the next page

APPENDIX 1. (continued)

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
110	Ettouama (Sebkha)	Souk-Ahras	36°11'39.07"N 07°39'22.43"E	888	0.0005	0.21	Hs (1 ; 1j)
111	Telamine (Sebkha)	Tébessa	35°22'9.83"N 07°34'51.31"E	1114	< 0.01	0.32	Hi (3M; 6; 3j; 7v)
112	Sidi Chami (Sebkha)	Tébessa	35°22'3.38"N 07°24'52.22"E	1064	< 0.01	0.16	Tc (1; 2v)
113	Daya Bagrat (Sebkha)	Tébessa	35°13'25.54"N 07°37'33.84"E	1144	0.25	0.27	Tc (1)
114	La Macta (marsh)	Tébessa	35°52'49.92"N 07°50'46.45"E	713	0.012	0.22	Cv (1; 1j); Pva (18; 12j; 3v)
115	Ain-Sadik (temporary pool)	Tébessa	35°52'17.04"N 07°53'39.98"E	643	0.000006	0.08	Hs (24; 37j)
116	Oum-Arroudj (pond)	Tébessa	35°57'52.40"N 08° 2'52.93"E	539	0.00005	2.32	Ev (1); Ig (1M; 1)
117	Bazer (Sebkha)	Sétif	36° 3'8.85"N 05°40'38.81"E	907	43.79	11.55	Hb (1; 3j)

Zootaxa 0000 (0): 000–000
http://www.mapress.com/j/zt/

Erratum

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.0000.0.0
http://zoobank.org/urn:lsid:zoobank.org:pub:00000000-0000-0000-0000-00000000000

SOUAD GHAOUACI, MEHMET YAVUZATMACA, OKAN KÜLKÖYLÜOĞLU & MOUNIA AMAROUAYACHE (2017) An annotated checklist of the non-marine ostracods (Crustacea) of Algeria with some ecological notes. *Zootaxa*, 4290: 140–154.

The following is the missing sites 100-109 of appendix 1.

Site no	Site name (Type)	Province	Coordinates	Altitude	Surface area	Salinity	Sp. code
100	Ettouama (Sebkha)	Oran	35°34'43.00"N 00°30'1.00"W	92	0.15	5.59	Ev (14); Hb (5M; 9); Hi (8M; 8)
101	Telamine (Sebkha)	Oran	35°4'34.22"N 00°2'32'5.03"W	78	24	3.20	Ev (8M; 10; 8j); Hi (11; 5j)
102	Sidi Chami (Sebkha)	Oran	35°39'36.03"N 0°31'52.76"W	87	0.1	6.75	Ev (3; 5j); Hb (11; 2j); Hi (46; 3j); Hr (16); Pn 2j)
103	Daya Bagrat (Sebkha)	Oran	35°3'33.72"N 00°3'34'2.30"W	98	2.0	0.81	EI (5); Hb (1)
104	La Macta (marsh)	Oran	35°42'60.00"N 0°43'60.00"W	5	190	2.40	Hi (3)
105	Sidi Bouziane	Rélizane	35°5'0'37.08"N 00°3'9'22.40"E	33	17.4	8.04	Ev (2)
106	Oued El Besbes(ditch)	Oran	35°1'5'1.23"N 0°49'37.12"W	514	0.001	1.29	Hi (5)
107	El Chara (Séraidi) (lake)	Annaba	36°5'6'10.10"N 07°4'0'41.34"E	630	0.0003	0.80	Cv (1); Hc (10; 14j)
108	El-Manjra (Séraidi) (Temporary pool)	Annaba	36°5'5'58.91"N 07°4'0'11.81"E	578	0.000006	0.12	Hi (1); Ig (1)
109	Bourgas (Temporary pool)	Souk-Ahras	36° 9'13.27"N 07°5'9'28.53"E	713	0.0004	0.09	Cv (1)

 Accepted by R. Matzke-Karasz: 7 Nov. 2017; Published: ?? Month 2017

Zootaxa 0000 (0): 000–000
http://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.0000.0.0
http://zoobank.org/urn:lsid:zoobank.org:pub:00000000-0000-0000-0000-00000000000

An annotated checklist of the Algerian Cladocera (Crustacea: Branchiopoda)

SOUAD GHAOUACI[1], MOUNIA AMAROUAYACHE[1*], ARTEM Y. SINEV[2], NIKOLAI M. KOROVCHINSKY[3] & ALEXEY A. KOTOV[3,4]

[1]*Marine Bioresources Laboratory, Annaba University Badji Mokhtar, BP12 El-Hadjar, Annaba 23000, Algeria*
[4]*Department of Invertebrate Zoology, Biological Faculty, M.V. Lomonosov Moscow State University, Leninskie Gory, Moscow 119991, Russia*
[3]*A. N. Severtsov Institute of Ecology and Evolution, Leninsky Prospect 33, Moscow 119071, Russia*
[4]*Kazan Federal University, Kremlevskaya Str. 18, Kazan 420000, Russia.*
**Corresponding author. E-mail:m.derbal@yahoo.fr*

Abstract

We present an annotated checklist of the Cladocera (orders Ctenopoda and Anomopoda) from the continental waters of Algeria, based on published records and original data from analysis of samples from 112 water bodies collected in 2012-2016 in humid and semi-arid regions of the country. Thirty six species have been identified in this study. Three taxa (*Daphnia obtusa, D. mediterranea* and *Ceriodaphnia* cf. *quadrangula*, being an undetermined taxon belonging to the *Ceriodaphnia* genus) are new to Algeria and eight (*Daphnia curvirostris, D. galeata, Macrothrix dadayi, Scapholeberis rammneri, Acroperus angustatus, Ovalona nuragica, O. orellanai* and *Coronatella anemae*) are new to the Maghreb in general. The number of Cladoceran species recorded in Algeria has been raised to 81. More sampling efforts are needed to make this list more complete.

Key words: Cladocera, species checklist, continental waters, Africa, Algeria

Introduction

In general, about 620 species of Cladocera (Crustacea: Branchiopoda) were reported by Forró *et al*. (2008) for the world fauna, and then some extra taxa (Kotov *et al*. 2013a) were added to this list. Among them, about 250 species from about 60 genera are present in the Palearctic (Forró *et al.* 2008). Cladocerans live in various biotopes in the continental water bodies at different environmental condition: in small and large pools (freshwater, brackish and saline), in open water of large lakes, in the bottom sediments and among vegetation, in littoral zone of running waters of different types, and even in phytotelmata and other exotic localities (Dumont & Negrea 2002; Forró *et al.* 2008). Cladocerans are remarkable by their parthenogenetic reproduction, either obligate or cyclic with periodical gamogenetic reproduction (Dumont & Negrea 2002; Smirnov 2013). The latter is associated with the formation of resistant dormant eggs, which withstand the unfavorable environmental conditions (Dumont & Negrea 2002).

The African cladocerans have not been well studied adequately and due to this, Africa is the continent with the smallest number of known species (Forró *et al*. 2008). The first taxonomic studies of African cladocerans were carried out in the second half of the 19th century (e.g., Klunzinger 1864; Richard 1896; Sars 1895; Weltner 1899) and then, continued in the beginning of the 20th century (e.g., Gurney 1904, 1909; Methuen 1910; Brady 1913; Sars 1916; Gauthier 1928a). Some publications dealt with particular species or species groups (Harding 1961; Chiambeng & Dumon 2004; Korovchinsky *et al.* 2017). Revisions of several genera and species groups have been conducted with a reference to African material (Dumont & Pensaert 1983; Frey 1982, 1993; Smirnov *et al*. 2006; Smirnov 2007; Van Damme *et al.* 2011; Neretina & Kotov 2015; Neretina & Sinev 2016). Recently genetic methods were effectively used in the studies of African cladocerans (Mergeay *et al.* 2005; Kotov & Taylor 2010; Crease *et al.* 2012).

Only few publications contained detailed information on the African cladoceran fauna as well as the detailed

Accepted by M. Alonso: 1 Dec. 2017; published: ?? Month 2018

morphological descriptions of particular taxa from this continent. Weltner (1899) and Brehm (1913) were the first authors who focused on the cladocerans of Central Africa; Dumont (1981), Dumont *et al*. (1981), Chiambeng & Dumont (2005) reported and analyzed species lists from West Africa; Daday (1910), Harding (1942), Brunelli & Cannicci (1940) studied the freshwater microfauna of East Africa. Kořínek (1984) recorded Cladocera of Lake Bangweulu and Luapulu River Basin and then provided a guide to the African limnetic species of this group (Kořínek 1999). Summaries of the taxonomic information on the cladocerans of South Africa were published by Noble & Schaefter (1967a, b), Seaman *et al.* (1999) and Smirnov (2008). This region was found to be a center of the cladoceran endemism (Forró *et al.* 2008; Van Damme *et al.* 2013) together with high mountain areas of the continent (Kotov & Taylor 2010; Van Damme & Eggermont 2011). Some biogeographic conclusions concerning Africa were made by Dumont (1980, 1982), Chiambeng & Dumont (2005), Van Damme & Dumont (2009).

In North Africa (Moroco, Algeria, and Tunisia), extensive studies were initially performed by Gauthier (1928a, b, 1929, 1930, 1931, 1933a, b, 1934, 1937, 1938) and Brehm (1954, 1958). The following great contribution was made by Dumont with his collaborators (Dumont 1979, 1980, 1982, 1987; Dumont *et al.* 1979), but many taxonomic problems remain unresolved and adequate faunistic lists are still lacking for many regions.

Diversity and distribution of the Algerian cladocerans are still poorly studied, taking into consideration the large area of this country (2.4×10^6 km^2) with its various climates, landscapes, and existing of many types of inland waters (Gagneur & Kara 2001). The first information on this group in Algeria was provided by Blanchard & Richard (1890, 1891), Blanchard (1891) and Richard (1896). Then Gurney (1909) studied the aquatic fauna from Biskra (Sahara) and Algiers oases, and Gauthier (1928a, b, c, 1929, 1930, 1931, 1933a, b, 1934, 1937, 1938) and Gauthier & Brehm (1928) published the results of their important studies of the North-African cladocerans covering all types of water bodies situated in different parts of the country. Beadle (1943) focused on aquatic fauna of saline waterbodies of Northern Sahara (mainly Oued Righ, Biskra and El Golea) and of the semi-arid Algerian regions (Orania and High Plateaus of Constantine). H.J. Dumont, in his Dissertation (Dumont 1979), mainly addressed the Sahara region, however, only a part of these data on Tunisian microcrustaceans was published thereafter (Dumont *et al.* 1979). Since that time, the microcrustacean taxonomy and faunistics have not been documented until the publication by Samraoui *et al*. (1998) who presented the lists of cladocerans, copepods, and ostracods from Numidia (see geographic subdivisions by Quézel & Santa (1962-1963)), a region situated in the Northeast of Algeria (including the provinces of Annaba, Skikda, and El-Tarf). Later on, these data were supplemented by Samraoui (2002). In addition, Mouelhi *et al.* (2000) compiled a list of cladocerans and copepods of Maghreb (Algeria, Morocco and Tunisia). Finally, De Los Rios Escalante & Amarouayache (2016) listed species from some saline lakes of the Algerian semi-arid and arid regions. Sporadic information on the cladocerans could be also extracted from some ecological papers (see Ramdani *et al*. 2001; Chakri *et al*. 2010; Amar *et al*. 2012), but the taxon identification in such papers is frequently suspected to be incorrect.

The aim of the present study is to update the list of Cladocera reported from the continental waters of Algeria based on both published and original data from the northern portion of the country.

Materials and methods

The present checklist of the cladoceran fauna of Algeria is only partly based on published records. We also examined original samples collected from 112 water bodies located from 1 m to 1149 m a.s.l., which were collected during the wet seasons (from November to May) in 2012–2016 in humid and semi-arid regions of Northern Algeria (see Anonymous 1998, 2001, 2004), i.e. in the provinces of Annaba, El-Tarf, Skikda, Guelma, Souk-Ahras, Constantine, Algiers, Tébessa, Tizi Ouzou, Medea, Sétif, Batna, Oum El Bouaghi, Khenchela, Oran, Relizane, Sidi Bel Abbes, and Mascara (Fig. 1, Table 1). Among the sampling sites, a variety of different types of aquatic habitats such as temporary pools, marshes, ditches, lakes, reservoirs, Sebkhas (Chotts) were investigated. The latter two names refer to the Arabic names of huge and shallow saline lakes (Demnati *et al.* 2017). Cladocera samples were collected using a hand-net (125 µm mesh size) and fixed in 4 % formaldehyde. Additionally, the salinity (mg/L) was measured with a multimeter Hanna (HI 9829) (Table 1). The most intensive sampling was performed in the northeastern region of the country (Annaba and El-Tarf provinces) due to the high number of water-bodies present there. If Sebkhas were dry in winter, the cladocerans were reared from mud according to Sars' method (see Van Damme & Dumont 2010): each upper sediment sample (300 g) collected in different parts of water body

depressions was placed in a 5 L plastic aquarium filled with 3 L of comparatively cool (10-20°C) distilled water (taking into consideration that the filling up of Sebkhas usually occurs in winter and spring).

Specimens were identified under a light microscope (Olympus BX-51), using standard taxonomic keys and recent taxonomic revisions: Smirnov (1971, 1976, 1992, 1996), Amoros (1984), Alonso (1996), Benzie (2005), Sinev (2001a, b, 2009a, b, 2014, 2015), Korovchinsky (1992) and Kotov & Štifter (2006). If only few juvenile specimens were present, they were identified only up to generic level.

FIGURE 1. Map of Algeria with 18 provinces sampled during this study. 1: Annaba (26 samples), 2: El-Tarf (33 samples), 3: Skikda (11 samples), 4: Guelma (2 samples), 5: Constantine (1 sample), 6: Tébessa (10 samples), 7: Sétif (1 sample), 8: Tizi Ouzou (1 sample), 9: Medea (1 sample), 10: Batna (5 samples), 11: Oum El Bouaghi (7 samples), 12: Khenchela (2 samples), 13: Algiers (1 sample), 14: Souk -Ahras (3 samples), 15: Oran (4 samples), 16: Rélizane (1 sample), 17: Sidi Bel Abbes (3 samples), 18: Mascara (1 sample).

Results

In total, 36 species belonging to 18 genera and seven families (Sididae, Daphniidae, Bosminidae, Chydoridae, Ilyocryptidae, Moinidae and Macrothricidae) were identified. Among them, 11 species (*Ceriodaphnia* cf.

quadrangula (O.F. Müller, 1785), *Daphnia curvirostris* Eylmann, 1887, *D. galeata* Sars, 1864, *D. mediterranea* Alonso, 1985, *Daphnia obtusa* Kurz, 1874, *Macrothrix dadayi* Behning, 1941, *Scapholeberis rammneri* Dumont & Pensaert, 1983, *Acroperus angustatus* Sars, 1863, *Ovalona nuragica* Margaritora, 1971, *O. orellanai* (Alonso, 1996), *Coronatella anemae* Van Damme et Dumont, 2008) are new to Algeria. Thus, adding these taxa to the 70 species already known in Algeria, we have yielded an updated list of 81 cladoceran taxa known from the country. The highest number of observed taxa per site was eight (El Frine, El-Tarf province) and seven (Kalitoussa pool, Annaba province), respectively. Among the observed taxa, *Simocephalus vetulus* (O.F. Müller, 1776) was the most frequently encountered species being recorded in 35 sites, followed by *Daphnia magna* Straus, 1820 found in 25 sampling sites. On the other hand, the following 11 rare species have been found in a single locality or in few localities each: *Diaphanosoma brachyurum* (Liévin, 1848), *Acroperus angustatus* Sars, 1863, *Alona affinis* (Leydig, 1860), *Ovalona nuragica* (Margaritora, 1971), *O. orellanai* (Alonso, 1996), *Bosmina longirostris* (O.F. Müller, 1776), *Coronatella rectangula* (Sars, 1862), *Ilyocryptus* sp., *Macrothrix spinosa* King, 1853, *Oxyurella tenuicaudis* (Sars, 1862), *Scapholeberis rammneri* Dumont & Pensaert, 1983.

An updated checklist of the Algerian cladocerans is presented below; the nomenclature of species is based on Kotov *et al.* (2013a).

Really adequately identified taxa are marked with an asterisk in list below; all other identifications need to be regarded as problematic.

Order Ctenopoda Sars, 1865

Family Sididae Baird, 1850

1. *Diaphanosoma brachyurum* (Liévin, 1848), recorded by Blanchard (1891), Blanchard & Richard (1890, 1891), Gauthier (1928a, 1931), Beadle (1943), Samraoui *et al.* (1998) and Samraoui (2002). In the course of the present study this species was found in site 42 only. This species is regarded as Palearctic (Korovchinsky 1992), but similar forms have been reported from the Nearctic and Neotropical regions, forming a complex of cryptic species (Korovchinsky 2004; Kotov *et al.* 2013b). It is quite probable that in previous studies in Algeria other species were reported under this name; but further works are needed to study adequately the genus diversity in Algeria.

2. *Diaphanosoma mongolianum* Uéno, 1938*, recorded by Korovchinsky (2004) in Keddara Dam, Boughzoul Dam, and guelta Efenni (rockpool in Sahara). This species is distributed in Afrotropical and Palearctic regions (Kotov *et al.* 2013a).

Order Anomopoda Sars, 1865

Family Daphniidae Straus, 1820

3. *Ceriodaphnia affinis* Lilljeborg, 1901, recorded by Gauthier (1929, 1931, 1934). Smirnov *et al.* (1995) did not recognize this species as valid; according to Kotov *et al.* (2013a) this is a junior synonym of *C. dubia*. Further studies are needed to resolve the taxonomic problems of the *Ceriodaphnia* species belonging to the *dubia*-group.

4. *Ceriodaphnia cornuta* Sars, 1885, recorded by Samraoui *et al.* (1998) in Lake Oubeira and Bordj du Cantonnier. This taxon is widely distributed in the tropics and subtropics of all continents (Smirnov *et al.* 1995). It definitively represents a group of closely-related species with more restricted distribution (Sharma & Kotov 2013).

5. *Ceriodaphnia dubia* Richard, 1894, recorded by Gurney (1909), Gauthier (1928a) and Dumont (1987). This species is widespread throughout the world, and it is currently considered a true cosmopolitan species (Smirnov *et al.* 1995; Chatterjee *et al.* 2013).

6. *Ceriodaphnia laticaudata* P. E. Müller, 1867, recorded by Gauthier (1928a) in a single locality, and in some further localities during this study (sites 4, 23, 25, 35, 46, 54, 61, 64, 73, 85, 102). Widely distributed in the Holarctic, Oriental biogeographical region, Africa and Australia (Smirnov *et al.* 1995; Chatterjee *et al.* 2013). This taxon needs a taxonomical revision since under this binomen several different species might be currently lumped.

7. *Ceriodaphnia megops* Sars, 1862*, recorded by Dumont *et al.* (1979) in swamps bordering Lac des Oiseaux and Northern edge of Lake Oubeira. The species is reported for the Palearctic and Nearctic regions (Kotov *et al.* 2013a).

8. *Ceriodaphnia* cf. *quadrangula* (O. F. Müller, 1785), newly recorded species in Algeria (sites 1, 4, 14, 24, 25, 29, 32, 38, 46, 69, 71, 86, 88). It is a cosmopolitan taxon (Kotov *et al*. 2013a), probably represented by a group of closely-related species which need a revision. Moreover, the taxon present in Algeria should likely correspond to a yet undescribed species of *Ceriodaphnia* reported as "*C. quadrangula*" in the book of Alonso (1996).

9. *Ceriodaphnia reticulata* (Jurine, 1820), recorded by Gurney (1909), Gauthier (1928a, 1929), Samraoui *et al.* (1998) and Samraoui (2002), and in the present study (sites 2, 12, 14, 17, 21, 30, 32, 35, 40, 41, 44, 50, 53, 57, 58, 79). It is a paracosmopolitan taxon widely distributed everywhere except for Australia (Smirnov *et al*. 1995; Chatterjee *et al.* 2013).

10. *Ceriodaphnia rigaudi* Richard, 1894, recorded by Gauthier (1928a, 1931). This author considered the taxon as valid, while Kotov *et al.* (2013a) mentioned it as a *species inquirenda*; its differences from *C. cornuta* are unclear. Rzóska (1956) concluded that *C. rigaudi* should be regarded as a synonym of *C. cornuta* (but see the *cornuta* section above).

11. *Ceriodaphnia rotunda* (Straus, 1820), recorded by Gauthier (1928a) in a single site, and by Samraoui (2002) in pond Berrihane-Sud. Almost cosmopolitan taxon (Kotov *et al.* 2013a).

12. *Daphnia* (*Ctenodaphnia*) *atkinsoni* Baird, 1859, recorded by Gauthier (1928a, 1934) and Beadle (1943), and in the frame of the present study (sites 71, 75, 76, 77). It is a Palearctic taxon (Kotov *et al.* 2013a), apparently represented by a number of cryptic species (Petrusek *et al*. 2009).

13. *Daphnia (Ctenodaphnia) barbata* Weltner, 1898*, recorded by Dumont (1979) in Righia. Predominantly Afrotropical species (Benzie 2005; Kotov *et al.* 2013a).

14. *Daphnia* (*Ctenodaphnia*) *carinata* King, 1853, recorded by Gauthier (1928a, b, 1929, 1931). This taxon is distributed in Australasia, Southern Asia and Africa and it apparently includes a number of different species (Adamowicz *et al*. 2009). The presence of a member of this group in Africa is confirmed by genetic methods (see Mergeay *et al*. 2005).

15. *Daphnia* (*Ctenodaphnia*) *chevreuxi* Richard, 1896*, described by Richard (1896a) based on Algerian samples from Annaba, the species was found in Algeria by Gauthier (1928a), Samraoui *et al.* (1998), Samraoui (2002) and in this study (sites 4, 6, 46, 47, 53, 56, 69). It is a Mediterranean species (Benzie 2005). The biology of the Algerian populations has been studied by Touati & Samraoui (2002).

16. *Daphnia (Ctenodaphnia) deserti* Gauthier, 1937*, initially described from "Abancor Ahetes (Hoggar, Tifidest)" in Southern Algeria (Gauthier 1937) and then found by Brehm (1958) in Hoggar and Tassili. Its distribution is restricted to Sahara region (Hudec 1993).

17. *Daphnia (Daphnia) ambigua* Scourfield, 1947, recorded by Amar *et al*. (2012) in Hammam Boughrara Dam (Tlemcen province). This record is doubtful because no description was given for this record. It is a Nearctic, Neotropical and Palearctic species (Kotov *et al.* 2013a), but its presence in the Palearctic is a result of anthropogenic introduction (Benzie 2005).

18. *Daphnia (Daphnia) curvirostris* Eylmann, 1887*, it is a newly recorded species for Algeria, where it was collected in sites 4, 8, 12, 13, 21, 56, 67, 86. Palearctic species, which also occurs in the north-western part of North America (Kotov *et al.* 2013a; Popova & Kotov 2013).

19. *Daphnia (Daphnia) galeata* Sars, 1864, newly recorded species for Algeria (sites 109–112); considered to be mostly Palearctic (Benzie 2005), but it has also been recorded in the Nearctic (Ishida & Taylor 2007).

20. *Daphnia (Daphnia) hyalina* Leydig, 1860, recorded only by Bidi-Akli *et al*. (2014) in the Dam of Zeralda, unfortunately without providing a description. Palearctic species (Kotov *et al.* 2013a) which is considered as an ecological morph of *D. longispina* O.F. Müller by Petrusek *et al.* (2008), however, this conclusion should be revised (Kotov 2015).

21. *Daphnia* (*Daphnia*) *longispina* (O. F. Müller, 1776) was recorded by Gauthier (1928a) in three sites. Under this binomen, it is currently included an almost cosmopolitan species group (Benzie 2005) with a confused taxonomy (Petrusek *et al*. 2008; Kotov 2015).

22. *Daphnia* (*Ctenodaphnia*) *magna* Straus, 1820, recorded by Blanchard (1891), Blanchard & Richard (1890, 1891), Gurney (1909), Gauthier (1928a, 1931), Beadle (1943) De Los Rios-Escalante & Amarouayache (2016) and present study (sites 1, 3, 9, 10, 12, 14, 16, 18-20, 23, 25, 32, 44, 46, 59, 78-80, 84, 87, 88, 100, 103, 106). Distributed in the Holarctic region and Africa (Benzie 2005; Kotov *et al*. 2013a). Some aspects of the biology of Algerian populations were studied by Chakri *et al*. (2010). It is shown genetically that at least some North African populations are conspecific with the European ones (De Gelas & De Meester 2005), although the taxon *D. magna* could include a series of different cryptic (or pseudo-cryptic) species.

23. *Daphnia (Ctenodaphnia) mediterranea* Alonso, 1985*, species newly recorded for Algeria (sites 74, 89, 90, 97, 104-108). Earlier Gauthier (1928, P. 360) mentioned the presence of *Daphnia* cf. *dolichocephala* (most likely *D. mediterranea*) in the Sebkha d'Oran. It has a Mediterranean distribution (Alonso 1985; Benzie 2005).

24. *Daphnia (Ctenodaphnia) similis* Claus, 1876, recorded by Dumont (1979) in Hoggar; it was also found in the frame of the present study (sites 75, 83, 110). It is a widespread species group known from North and South America, Eurasia and Africa (Benzie 2005) and considered as cosmopolitan (Kotov *et al.* 2013a). The actual distribution of the members of the *similis*-group is unknown (Chatterjee *et al*. 2013; Popova *et al*. 2016). Algerian populations must be checked genetically and/or based on the male morphology, as another species from this group, *D. sinensis* Gu, Xu, Li, Dumont, Han, 2013, is detected at least in Ethiopia by genetic methods (Popova *et al.* 2016).

25. *Daphnia (Daphnia) obtusa* Kurz, 1874, newly recorded species in Algeria (sites 7, 15, 25, 26, 35, 42, 43, 50, 51, 63, 69); it is an almost cosmopolitan species recently introduced to Australia (Benzie 2005). Under this binomen is currently lumped a group of closely-related species in need of a revision worldwide (see Adamowicz *et al.* 2009).

26. *Daphnia (Daphnia) pulex* Leydig, 1860, recorded by Gauthier (1928a, 1929, 1931), Beadle (1943), Dumont *et al.* (1979), Samraoui *et al.* (1998), Samraoui (2002) and in present study (sites 7, 26). According to recent genetic studies (Crease *et al.* 2012), this taxon is represented by a complex of species.

27. *Megafenestra aurita* (Fischer, 1849)*, recorded by Gauthier (1928a), by Dumont *et al.* (1979) and in the present study (sites 3, 4, 47). Afrotropical and Palearctic species (Kotov *et al.* 2013a).

28. *Scapholeberis kingi* Sars, 1888 recorded by Dumont (1979), Dumont *et al.* (1979), Samraoui *et al.* (1998) and Samraoui (2002). Widely distributed species (Kotov *et al.* 2012; 2013a).

29. *Scapholeberis mucronata* (O. F. Müller, 1776)*, recorded by Gauthier (1928a) in Oued Réghaia. Mostly occurring in Palearctic and Nearctic regions, also known in the Neotropics (Kotov *et al.* 2013a).

30. *Scapholeberis rammneri* Dumont et Pensaert, 1983*, newly recorded species (site 29), known from Nearctic and Palearctic regions (Dumont & Pensaert 1983; Kotov *et al.* 2013a).

31. *Simocephalus exspinosus* (De Geer, 1778), recorded by Gauthier (1928a), Beadle (1943), Samraoui *et al*. (1998), Samraoui (2002) and in this study (sites 1–3, 8, 9, 32, 33, 38, 39, 46, 50, 60–62, 67, 88, 93). Almost cosmopolitan taxon (Orlova-Bienkowskaja 2001).

32. *Simocephalus vetulus* (O. F. Müller, 1776), recorded by Gurney (1909), Gauthier (1928a), Dumont (1979), Dumont *et al.* (1979), Samraoui *et al.* (1998), Samraoui (2002) and in this study (sites 5, 11, 13, 14, 17, 21, 22, 25, 29–32, 36, 40, 44, 47, 49, 50, 52, 53, 57, 58, 61, 64, 65, 68, 71, 79, 81, 82, 86, 92, 94, 101, 102). This taxon is widely distributed in the Palearctic region (Kotov *et al.* 2013a), being represented by a group of closely related species (Huang *et al*. 2014).

Family Moinidae Goulden, 1968

33. *Moina belli* Gurney, 1904*, recorded by Dumont (1979) in Tassili n'Ajjer. This species was described from the Republic of South Africa (Gurney 1904) and then found in other regions, even in Central Asia (Smirnov 1976). This is a valid taxon, but its distribution range needs to be adequately studied.

34. *Moina brachiata* (Jurine, 1820), recorded by Gauthier (1928a) in a number of sites, it is also found during the present study (sites 1, 4, 9, 14, 20, 32, 48, 56, 64, 72, 87, 108, 110). It is a Palearctic taxon which has also been reported from subsaharian Africa (Goulden 1968). This taxon definitively includes some species with unknown distribution ranges (Nédli *et al.* 2014; Bekker *et al*. 2016).

35. *Moina dubia* Guerne & Richard, 1892, recorded by Gauthier (1929, 1931). This is an Afrotropical and Palearctic species (Kotov & Ferrari 2010; Kotov *et al*. 2013a) belonging to the *M. micrura* species group (see below).

36. *Moina lateralis* Brehm, 1958 described by Brehm (1958) from Tassili in Algeria. This is probably a junior synonym of *M. belli* (Smirnov 1976).

37. *Moina macrocopa* (Straus, 1820)*, recorded by Blanchard (1891) and Dumont (1979). Its distribution is restricted to Europe, Africa, and Southern Asia (Smirnov 1976). Most Palearctic populations belong to the nominal subspecies *M. macrocopa macrocopa,* which is confirmed by genetic methods (Bekker *et al*. 2016), however, the African populations have not been studied to date.

38. *Moina micrura* Kurz, 1874, recorded by Dumont (1979), Samraoui *et al.* (1998) and Samraoui (2002). A cosmopolitan species group needing a detailed revision (Petrusek *et al*. 2004; Kotov *et al*. 2013a; Bekker *at al.* 2016).

39. *Moina rectirostris* (Strauss, 1820), recorded by Bidi-Akli *et al*. (2014) from Zeralda Dam as "*M. rectorostris*" (sic), but without providing any description. This is a dubious record, see the discussion of the "*M. rectirostris*-problem" by Goulden (1968).

40. *Moina salina* Daday, 1888, recorded by Gauthier (1928a), Beadle (1943) as *Moina salinarum*, Amarouayache *et al.* (2012), De Los Rios-Escalante & Amarouayache (2016), also in this study (sites 89, 92, 95, 96, 105–107). The name *M. mongolica* Daday, 1901 is still widely used, however, it is a presumable junior synonym of the former species (Negrea 1984). The *salina*-group is represented in the Palearctic by at least two species (Bekker *et al*. 2016), therefore African populations need to be revised.

Family Ilyocryptidae Smirnov, 1976 sensu Smirnov, 1992

41. ***Ilyocryptus sordidus*** (Liévin, 1848), recorded by Gauthier (1928a). This species is distributed in the Northern Palearctic, but close forms are widely distributed worldwide and need to be revised (Kotov & Štifter 2006).

Family Macrothricidae Norman et Brady, 1867

42. *Bunops serricaudata* (Daday, 1888)*, recorded by Samraoui *et al.* (1998) in Lac Bleu. Palearctic species (Kotov *et al*. 2013a).

43. ***Lathonura rectirostris*** (O. F. Müller, 1785)*, recorded by Samraoui *et al.* (1998) in Bou Redim marsh. Holarctic species (Kotov *et al.* 2013a), occurring also in South Africa (Hart & Dumont 2005).

44. ***Macrothrix dadayi*** Behning, 1941*, newly recorded species in Algeria (sites 23, 24, 48, 72). Palearctic species (Kotov 2008).

45. ***Macrothrix hirsuticornis*** Norman and Brady, 1867, recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891), Gurney (1909), Gauthier (1928a, 1931, 1934), Beadle (1943), Dumont *et al*. (1979) and in this study (sites 19, 51, 71, 77). Only Palearctic populations could be regarded as *M. hirsuticornis* (Smirnov 1992), non-Palearctic records belong to other taxa (Kotov 2007).

46. ***Macrothrix laticornis*** **(**Jurine, 1820)*, recorded by Gauthier (1928a) in Oubeira Lake. It is known almost over the whole temperate Eurasia, with populations occurring even in Central Nepal (Silva-Briano *et al.* 1999).

47. ***Macrothrix rosea*** (Jurine, 1820), recorded by Gauthier (1928a) and Samraoui *et al.* (1998). Holarctic taxon in need of being revised (Kotov *et al*. 2012).

48. ***Macrothrix spinosa*** King, 1853, recorded by Samraoui *et al.* (1998) and in this study (site 85). Pantropical taxon (Smirnov 1992) in need of being revised.

Family Bosminidae Baird, 1845 sensu Sars, 1865

49. ***Bosmina (Eubosmina) coregoni*** Baird, 1857, recorded by Amar *et al.* (2012) in Hammam Boughrara Dam (Tlemcen province). This record needs to be confirmed by new findings, no description was given. At the same time, it is known that *B.* (*E.*) *coregoni* has started to invade the Iberian Peninsula recently, and now it becomes to be more and more common (Geraldes & Alonso 2014). Therefore, it could arrive to North Africa also. This is a Palearctic species (Kotov *et al.* 2013a).

50. ***Bosmina* (*Bosmina) longirostris*** (O. F. Müller, 1776)*, recorded by Samraoui *et al*. (1998) in Lac Bleu and in this study (site 37). Cosmopolitan species (Kotov *et al.* 2013a).

Family Eurycercidae Kurz, 1875 emend. Dumont et Silva-Briano, 1998

51. ***Eurycercus (Eurycercus) lamellatus*** (O. F. Müller, 1776)*, recorded by Gauthier (1928a) and Samraoui (2002) in Tonga Lake and Oued Bouaroug. Widely distributed Palearctic species (Frey 1971; Bekker *et al*. 2012); the records in other biogeographical regions are mainly due to anthropogenic invasions.

Family Chydoridae Dybowski et Grochowski, 1894

Subfamily Aloninae Dybowski et Grochowski, 1894 emend Frey, 1967

52. *Acroperus angustatus* Sars, 1863*, newly recorded species in Algeria (site 37), definitely known only from the Palearctic region (Sinev 2009b).

53. *Acroperus harpae* (Baird, 1834)*, recorded by Dumont *et al.* (1979), Samraoui *et al.* (1998) and Samraoui (2002). Definitely known only from the Palearctic region (Sinev 2009b).

54. *Alona affinis* (Leydig, 1860)* was recorded by Gauthier (1928a), Dumont (1979), Samraoui *et al.* (1998), and in this study (site 45). Distributed in Eurasia and Africa (Sinev 2009a), tropical populations need to be revised (Kotov *et al.* 2013b).

55. *Alona elegans* Kurz, 1875* was recorded by Blanchard (1891) and Blanchard & Richard (1890, 1891), Gurney (1909), Dumont (1979, 1987), Samraoui *et al.* (1998) and in this study (sites 19, 46, 70, 78, 79, 82, 88). Palearctic species (Kotov *et al.* 2012).

56. *Alona guttata* Sars, 1862, recorded by Samraoui *et al.* (1998). Under this binomen is included a cosmopolitan species complex (Smirnov 1971) with an unresolved taxonomy; real species distribution ranges are to date unknown.

57. *Alona striolata* Sars, 1916, recorded by Brehm (1958) in Tassili (Sahara). It is a *species inquirenda* (Kotov *et al.* 2013a). It could be an inadequately described South African endemic species (Van Damme *et al.* 2010, 2013), whose presence in Algeria seems dubious.

58. *Camptocercus rectirostris* (Schödler, 1862)*, recorded by Gauthier (1928a,1931, 1938). Common Palearctic species (Smirnov 1998).

59. *Camptocercus uncinatus* Smirnov, 1971*, recorded by Dumont *et al.* (1979), Samraoui *et al.* (1998) and Samraoui (2002). It is distributed in East, Central and South Asia, South Europe, North-East and East Africa; in the Mediterranean region, it was also recorded from Turkey, Israel, Egypt and Italy (Kotov *et al.* 2012; Sinev 2014).

60. *Coronatella anemae* Van Damme & Dumont, 2008*, newly recorded species in Algeria (sites 14, 88). Recorded from North–East Africa, Arabian Peninsula, and Central Asia (Van Damme & Dumont 2008).

61. *Coronatella bukobensis* (Weltner, 1898), recorded by Gauthier (1928a) in Oubeira Lake and in a number of other sites. *Species inquirenda* (Kotov *et al.* 2013a).

62. *Coronatella rectangula* (Sars, 1862)*, recorded by Gauthier (1928a, 1931), Beadle (1943), Dumont (1979), Dumont *et al.* (1979), Samraoui *et al.* (1998), Samraoui (2002) and in this study (site 65). Palearctic species (Sinev 2001a; Van Damme & Dumont 2008).

63. *Graptoleberis testudinaria* (Fischer, 1851), recorded by Gauthier (1928a), Dumont *et al.* (1979) and Samraoui *et al.* (1998). This taxon is regarded as cosmopolitan (Smirnov 1971), but probably represents a species complex.

64. *Karualona karua* (King, 1853) recorded by Gauthier (1929, 1931, 1933b) in Hoggar, and by Brehm (1958) as *Alonella karua* from Tassili. In fact, *K. karua* is not present in the Mediterranean region, being substituted here by *K. iberica* (Alonso & Pretus 1989). Therefore previous records need to be re-checked.

65. *Leydigia acanthocercoides* (Fischer, 1854)*, recorded by Gauthier (1928a) and Samraoui *et al.* (1998). Palearctic species (Kotov 2009).

66. *Leydigia leydigi* (Schödler, 1863)*, recorded by Gauthier (1928a), as *Alona leydigi,* and Dumont *et al.* (1979). Palearctic species (Kotov 2009).

67. *Oxyurella tenuicaudis* (Sars, 1862), recorded by Blanchard (1891) and Blanchard & Richard (1890,1891), Gauthier (1928a, 1931), Beadle (1943), Dumont (1979), Samraoui *et al.* (1998) and in this study (site 65). Palearctic species (Kotov *et al.* 2013a).

68. *Ovalona azorica* (Frenzel & Alonso, 1988), recorded by Samraoui (2002) in pond Fedjoudj as *Alona azorica*. According to a recent revision (Sinev *et al.* 2012), *Ovalona azorica* is confined to Azores and humid regions of West Iberia, while in the dry regions of West Mediterranean it is substituted by its sibling-species, *O. anastasia* Sinev, Alonso, Miracle & Sahuquillo, 2012. The status of Algerian populations needs to be confirmed by an examination of original samples.

69. *Ovalona cambouei* (Guerne & Richard, 1893)* recorded by Samraoui *et al.* (1998) in Sidi Freitis Lake. The species is known to occur in the Mediterranean region, Africa, Madagascar, Iraq, Central and Southern Asia (Sinev 2001b, 2015).

70. *Ovalona nuragica* (Margaritora, 1971)*. Alonso (1996) proposed that this taxon was reported by Gauthier (1928) "from North Africa" (= Tunisia + Algeria) as *Alona pulchella*. Here we confirm its presence in Algeria (sites 34, 61). Mediterranean taxon (Sinev 2015).

71. *Ovalona orellanai* (Alonso, 1996)*, newly recorded species for Algeria (site 27). This species was previously known from Spain only (Alonso 1996).

72. *Ovalona* cf. *pulchella* King, 1853, recorded by Gauthier (1928a, 1929, 1931) as *Alona pulchella,* O. *pulchella* s. str. is restricted to Australia (Sinev 2001b, 2015). The records need to be re-checked, most probably they belong to its sibling species *O. cambouei*, though Alonso (1996: p. 327) ascribed the Algerian record of the species to *Ovalona nuragica*.

73. *Tretocephala ambigua* (Lilljeborg, 1901)*, recorded by Gauthier (1928a) and in this study (sites 65, 102). Palearctic species (Kotov *et al.* 2013a).

Subfamily Chydorinae Dybowski et Grochowski, 1894

74. *Alonella excisa* (Fischer, 1854), recorded by Gauthier (1928a), Dumont *et al.* (1979), Samraoui *et al*. (1998) and in this study (sites 5, 55, 65, 66). Cosmopolitan species complex (Smirnov 1996) with probably more than one species in the tropics (Kotov *et al.* 2013b).

75. *Chydorus sphaericus* (O. F. Müller, 1776) s. lat., recorded by Gurney (1909), Gauthier (1928a), Dumont (1979), Dumont *et al*. (1979), Samraoui *et al.* (1998) and in this study (sites 12, 14, 29, 30, 34, 37, 38, 55, 56, 61, 64, 65, 68, 73, 79, 82, 98, 101, 103, 106). Recent genetic investigations of *C. sphaericus* complex (Belyaeva & Taylor 2009; Kotov *et al*. 2016) have revealed a number of sibling species within the Palearctic region, which can be recognized either by morphology of males and ephippial females, or genetically. The taxonomic status of Algerian populations needs to be clarified.

76. *Dunhevedia crassa* King, 1853, recorded by Gauthier (1928a, 1931, 1934), Samraoui *et al.* (1998), Samraoui (2002) and in this study (site 34). It is distributed "worldwide, at warm latitudes" (Smirnov 1996) and in need of a taxonomical revision (Van Damme *et al.* 2013b).

77. *Ephemeroporus barroisi* (Richard, 1894), recorded as *Chydorus barroisi* by Gauthier (1928a, c), Dumont (1979) and Samraoui *et al.* (1998). A complex of *Ephemeroporus* species was revealed to be present in the

Mediterranean region (Frey 1982; Alonso 1987); the taxonomic status of Algerian and other populations needs to be clarified (Kotov & Ferrari 2010).

78. *Ephemeroporus phintonicus* (Margaritora, 1969)*, recorded by Frey (1982) referring to Gauthier's (1928a) description of *E. barroisi* from the Réghaia area (Algiers province). It is a species limited to the Mediterranean region (Frey 1982).

79. *Picripleuroxus laevis* (Sars, 1862)*, recorded by Gauthier (1928a), Dumont *et al.* (1979) and Samraoui *et al.* (1998). Palearctic species, similar forms occur in Australia (Smirnov 1996) and tropical Africa (Chiambeng & Dumont 2004).

80. *Pleuroxus aduncus* (Jurine, 1820)*, recorded by Gurney (1909), Gauthier (1928a, 1929, 1931), Dumont (1987), Samraoui *et al.* (1998), Samraoui (2002) and in this study (site 52). Cosmopolitan species complex (Kotov *et al.* 2013a). The populations studied here belong to *P. aduncus* s. str. instead of some other taxa revealed in other African countries (Smirnov *et al.* 2006; Smirnov 2007, 2008).

81. *Pleuroxus letourneuxi* (Richard, 1888)*, recorded by Blanchard (1891), Blanchard & Richard (1890, 1891), Gurney (1909), Gauthier (1928a, 1934), Dumont (1979) and in this study (sites 9, 20, 24, 68, 73, 88). This taxon was described from Tunisia, see comments in Kotov & Ferrari (2010). West Mediterranean species (Smirnov 1996).

Discussion

Present study have been resulted in identification of 36 species, 11 of which are new to the country and eight are new to the whole Maghreb (Morocco-Algeria-Tunisia) (see Mouelhi *et al*. 2000; Turki &Turki 2010; Aoujdad *et al*. 2014). Thus, the overall recorded Algerian cladoceran species richness has increased up to 81 taxa belonging to 27 genera. This number exceeds that of Tunisia, where Turki & Turki (2010) reported 49 species belonging to 19 genera, and of Morocco with 53 known species belonging to 21 genera (Aoujdad *et al*. 2014). The genus *Daphnia* is the most speciose genus in Maghreb, being represented by 13 species.

At this time, it should be stressed that the amount of the 81 cladoceran species is not formal because it includes a number of doubtful taxa (potential junior synonyms of other taxa, probably misidentified species etc.) whose validity should be checked further. In total, there are 11 such taxa: *Ceriodaphnia affinis, C. rigaudi, Daphnia ambigua, D. hyalina, D. longispina, Moina lateralis, M. rectirostris, Bosmina coregoni, Alona striolata, Karualona karua* and *O. pulchella.* After the exclusion of the aforementioned taxa from the list, 70 valid species remain to be included in it. Among them, 59 were known in Algeria before and 11 are added as a result of present survey.

In the course of the modern taxonomic works on Cladocera (Frey 1987; Forró et al. 2008), many taxa of the group were revised and their validity was either confirmed or rejected. Taking the information on recent cladoceran revisions in consideration, it may be concluded that about half of the valid known Algerian species (33) need further detailed taxonomic study whereas other 36 may be considered better investigated in this respect (marked with an asterisk In the above species list).

In general, 43 species recorded previously (of them, 31 valid species) were not found again in the frame of our study when only the lentic waters of the Northern part of the country were considered. Apart from the localization of the sampling efforts, the climatic and anthropogenic changes, which caused the disappearance of many water bodies throughout the country, could be responsible for these differences. Most species were found in the humid region in Northeast of Algeria (Annaba, previously Bône and El-Tarf provinces), which is characterized by the greatest number of water bodies in the country (De Bélair 2005). These water bodies are filled during about eight months, from November to June. This region is considered a biodiversity hotspot of the Mediterranean (Véla & Benhouhou 2007; Belouahem-Abed *et al.* 2011) harboring about 80 % of the total species richness of the country (Samraoui & de Bélair 1998). We detected the highest species richness in Kalitoussa pond (Annaba), it contains seven cladoceran species, and most revealed taxa are currently considered widespread (Alonso 1991; Kotov *et al.* 2013a). Some common taxa, as *Daphnia magna,* were always represented by few specimens in each sample. This

could partly explain its absence in some recent lists, i.e., by Samraoui *et al.* (1998) and Samraoui (2002), as their authors had a chance to overlook at least a part of rare species in course of routine hydrobiological work.

Huge and shallow saline lakes, locally called Sebkhas or Chotts are very characteristic of the semi-arid region (35-36 °N), forming a belt along the Eastern and Western high plateaus between the Tellian and the Saharan Atlas (Gagneur & Kara 2001). They are characterized by great daily and seasonal temperature and salinity differences, the latter can vary from few to several dozens of mg/L, sometimes reaching the complete saturation. They are considered unstable environments, harboring a peculiar Cladocera fauna well adapted to such conditions (De Los Rios Escalante & Amarouayache 2016). The halophilic *Moina salina* is a common inhabitant of these saline lakes, being found at 255 mg/L in Sebkha Ez-Zemoul (Amarouayache *et al.* 2012). *Daphnia mediterranea*, reported for the first time from the Sebkhas of the region, was found at moderate salinity (22 mg/L). This species was previously confused with *D. dolichocephala* Sars, 1895 (Alonso 1985). *D. mediterranea* occurs in the saline lakes of the Mediterranean region, experiencing a wide salinity range between 10 and 60 mg/L (Alonso 1990). Other reported species are weakly represented in the saline environments, although their occurrence in brackish waters is more or less common especially in euryecious and widely distributed taxa (e.g. *Chydorus sphaericus* and *Daphnia atkinsoni*). The low species richness of the saline lake fauna is well known: a negative correlation between salinity and species richness is well documented (see e.g. De Deckker & Geddes 1980; Hammer 1986; Williams *et al.* 1990).

The absence of some species in Algeria that were occurring in Morocco and/or Tunisia is probably an artifact of insufficient sampling efforts. For example *Daphnia lumholtzi* Sars, 1886, a common African species, have been recorded from Morocco (Brehm 1954) but to date it was not found in Algeria. *Ceriodaphnia setosa* Matile, 1890, *Alonella nana* (Baird, 1843), *A. costata* Sars, 1862 and *Leydigia ciliata* (Gauthier, 1939), which are absent in the Algerian species list, were recorded from Morocco also (Ramdani 1982), although no descriptions were provided and at least some of the aforementioned identifications need to be confirmed. Such taxa as *Daphnia dolichocephala* (Sars, 1895) or *Alona quadrangularis* (O. F. Müller, 1776) were recorded from Tunisia (Gauthier & Brehm 1928; Turki & Turki 2010), but such records could be erroneous.

Mouelhi *et al.* (2000) reported the Western-Eastern climatic gradient in the Maghreb and concluded that a higher diversity of habitats is characteristic of Morocco, which is influenced by the Atlantic Ocean, as compared with Algeria with its arid climate dominance. However, this observation could explain only in part the higher diversity of the freshwater fauna in Morocco: such phenomenon might be also explained by insufficient sampling efforts, taking into consideration the lack of such taxa as *Ilyocryptus sordidus*, *Daphnia similis* and *Moina belli* in the species lists of the aforementioned authors which dealt with North Africa. *Daphnia* cf. *similis* Claus, 1876 reported for the first time by Dumont (1979) from Algeria about 40 years ago has never been mentioned again until the present study. In some cases it was probably confused with *D. carinata* (see Gauthier 1929). The genus *Ilyocryptus*, being recorded for the first time by Gauthier (1928a) in the Saharan El-Chaib marsh (Saida province), was then overlooked until the present survey. Algeria (including Sahara desert) is rich in water bodies which have not been sampled yet.

The number of 81 species (only 70 of them are valid) seems to be rather low for such a large country as Algeria, when it is compared to the species richness reported for other Mediterranean regions: 103 species were recorded from Turkey (Ustaoglu 2015), 102 from Italy (Margaritora 2005), 92 from France (Amoros 1984), and 88 from the Iberian Peninsula (Alonso 1996); 57 and 43 species were recorded from such relatively small area as Sicily (Marrone *et al.* 2005; Marrone 2006) and the Balearic Islands (Pretus 1990), respectively. In fact, the knowledge of species richness of any country seems to be more dependent on number of surveys rather than on its size.

Acknowledgements

We are very grateful to Prof. N. N. Smirnov for his help with literature. The Algerian authors thank the Algerian Ministry for Higher Education MESRS who financed this study within the framework of the CNEPRU project. AAK was supported by Russian Government Program of Competitive Growth of Kazan Federal University. NMK was partly supported by the grant from the Russian Foundation for Basic research (grant 16-04-00165).

References

Adamowicz, S.J., Petrusek, A., Colbourne, J.K., Hebert, P.D.N. & Witt, J.D.S. (2009) The scale of divergence: a phylogenetic appraisal of intercontinental allopatric speciation in a passively dispersed freshwater zooplankton genus. *Molecular Phylogenetics and Evolution*, 50, 423–436.
https://doi.org/10.1016/j.ympev.2008.11.026

Alonso, M. (1985) *Daphnia* (*Ctenodaphnia*) *mediterranea*: a new species of hyperhaline waters, long confused with *D.* (*C.*) *dolichocephala* Sars, 1895. *Hydrobiologia*, 128, 217–228.
https://doi.org/10.1007/BF00006817

Alonso, M. (1987) Morphological differentiation of two new *Ephemeroporus* species (Cladocera, Chydoridae) belonging to the *barroisi* complex: *E. margalefi* and *E. epiaphantoii*, in Spain. *Hydrobiologia*, 145, 131–146.
https://doi.org/10.1007/BF02530273

Alonso, M. (1990) Anostraca, Cladocera and Copepoda of Spanish saline lakes. *Hydrobiologia*, 197, 221–231.
https://doi.org/10.1007/BF00026952

Alonso, M. (1991) Review of Iberian Cladocera with remarks on ecology and biogeography. *Hydrobiologia*, 225, 37–43.
https://doi.org/10.1007/BF00028383

Alonso, M. (1996) *Fauna Iberica. Crustacea Branchiopoda*. Consejo Superior de Investigaciones Cientificas, Madrid, 486 pp.

Alonso, M. & Pretus, J.L. (1989) *Alona iberica*, new species: first evidence of non cosmopolitanism within the *A. karua* complex (Cladocera: Chydoridae). *Journal of Crustacean Biology*, 9, 453–476.
https://doi.org/10.2307/1548571

Amar, Y., Djahed, B., Lebid, S., Anani, M., Moueddene, K. & Mathieu, C. (2012) Impact of industrial pollution on the zooplankton population diversity of the Hammam Boughrara Dam. *Journal of Environmental Science and Engineering*, Series A, 1, 527–532.

Amarouayache, M., Derbal, F. & Kara, M.H. (2012) Note on the carcinological fauna associated with *Artemia salina* (Branchiopoda: Anostraca) from Sebkha Ez-Zemoul (northeast Algeria). *Crustaceana*, 85, 129–137.
https://doi.org/10.1163/156854012X623728

Amoros, C. (1984) Introduction pratique à la systématique des organismes des eaux continentales françaises. Crustacés Cladocères. *Bulletin de la Société linnéenne de Lyon*, 5, 72–145.
https://doi.org/10.3406/linly.1984.10627

Anonymous (1998) Atlas des zones humides algériennes. MADR Algérie, 46 pp. [Direction Générale des Forêts (Eds.)]

Anonymous (2001) *Atlas des zones humides algériennes d'importance internationale*. MADR, Algérie, 56 pp. [Direction Générale des Forêts (Eds.)]

Anonymous (2004) *Atlas (IV) des zones humides algériennes d'importance internationale*. MADR, Algérie, 107 pp. [Direction Générale des Forêts (Eds.)]

Aoujdad, R., Maqboul, A., Driouich, A., Rhiat, M., Labioui, H. & Fadli, M. (2014) Biodiversity and seasonal dynamics of the cladoceran community in the wetlands of the Gharb and Loukkos plains in Morocco. *Journal of Biodiversity and Environmental Sciences*, 4 (2), 104–110.

Beadle, L.C. (1943) An ecological survey of some Inland Saline Waters of Algeria. *Zoological Journal of the Linnean Society*, 1943, 218–242.
https://doi.org/10.1111/j.1096-3642.1943.tb01698.x

Bekker, E.I., Karabanov, D.P., Galimov, Y.R. & Kotov, A.A. (2016) DNA barcoding reveals high cryptic diversity in the North Eurasian *Moina* species (Crustacea: Cladocera). *PLoS ONE*, 11 (8), e0161737.
https://doi.org/10.1371/journal.pone.0161737

Bekker, E.I., Kotov, A.A. & Taylor, D.J. (2012) A revision of the subgenus *Eurycercus* (*Eurycercus*) Baird, 1843 emend. nov. (Cladocera: Eurycercidae) in the Holarctic with the description of a new species from Alaska. *Zootaxa*, 3206, 1–40.

Belouahem-Abed, D., Belouahem, F., Benslama, M., De Bélair, G. & D. Muller, S. (2011) Les aulnaies de Numidie (N.E. Algérien): biodiversité floristique, vulnérabilité et conservation. *Comptes Rendus Biologies*, 334, 61–73.
https://doi.org/10.1016/j.crvi.2010.10.005

Belyaeva, M. & Taylor, D.J. (2009) Cryptic species within the *Chydorus sphaericus* species complex (Crustacea: Cladocera) revealed by molecular markers and sexual stage morphology. *Molecular Phylogenetics and Evolution*, 50, 534–546.
https://doi.org/10.1016/j.ympev.2008.11.007

Benzie, J.A.H. (2005) The genus *Daphnia* (including *Daphniopsis*) (Anomopoda: Daphniidae). *Guides to the identification of the microinvertebrates of the continental waters of the world. Vol. 21*. Kenobi Productions, Ghent & Backhuys Publishers, Leiden, 376 pp.

Bidi-Akli, S., Arab, A. & Samraoui, B. (2014) Variation spatio-temporelle du zooplancton dans le barrage de la réserve de chasse de Zéralda (Algérie). *Revue de l'Écologie, Terre Vie*, 69, 214–224.

Blanchard, R. (1891) Résultats d'une excursion zoologique en Algérie. *Mémoires de la Société zoologique de France*, 4, 208–245.

Blanchard, R. & Richard, J. (1890) Sur les crustacés des Sebkhas et des Chotts d'Algérie. *Bulletin de la Société Zoologique de France*, 15, 136–138.

Blanchard, R. & Richard, J. (1891) Faune des lacs salés d'Algérie: cladocerès et copépodes. *Mémoires de la Société Zoologique*

de France, 4, 512–535.
Brady, G.S. (1913) On freshwater Entomostraca from various parts of South Africa. *Annals of the Natal Museum*, 2 (4), 459–474.
Brehm, V. (1913) Cladoceren-Ergebnisse de zweiten deutschen Zentral Africa-Expedition 1910-1911. *Zoologie*, Teil l, 35–40.
Brehm, V. (1954) Sur quelques crustacés inférieurs du Maroc. *Bulletin de la Société des sciences naturelles et physiques du Maroc*, 34, 211–215.
Brehm, V. (1958) Die Cladoceren Fauna des Tassili Gebietes. *Mission scientifigue au Tassili des Alger. III. Zoologie pure et appliquée*, 3, 73–84.
Brunelli, G. & Cannicci, E.G. (1940) Le caratteristiche biologiche del Lago Tana. Missione di Studio al Lago Tana. Reale Academia d'Italia. *Centro Studi per l'Africa Orientale Italiana*, 4 (2), 71–115.
Chakri, K., Touati, L., Alfarhan, A.H., Al-Rasheid, K.A. & Samraoui, B. (2010) Effect of vertebrate and invertebrate kairomones on the life history of *Daphnia magna* Straus (Crustacea: Branchiopoda). *Comptes Rendus Biologies*, 333, 836–840.
https://doi.org/10.1016/j.crvi.2010.09.004
Chatterjee, T., Kotov, A.A., Van Damme, K., Chandrasekhar, S.V.A. & Padhye, S. (2013) An annotated checklist of the Cladocera (Crustacea: Branchiopoda) from India. *Zootaxa*, 3667 (1), 1–89.
https://doi.org/10.11646/zootaxa.3667.1.1
Chiambeng, G.Y. & Dumont, H.J. (2004) The genus *Pleuroxus* Baird, 1843 (Crustacea: Anomopoda: Chydoridae) in Cameroon, Central-West Africa. *Annales de Limnologie*, 40, 211–229.
https://doi.org/10.1051/limn/2004019
Chiambeng, G.Y. & Dumont, H.J. (2005) The Branchiopoda (Crustacea: Anomopoda, Ctenopoda and Cyclestherida) of the rain forests of Cameroon, West Africa: low abundances, few endemics and a boreal-tropical disjunction. *Journal of Biogeography*, 32, 1611–1620.
https://doi.org/10.1111/j.1365-2699.2005.01280.x
Crease, T.J., Omilian, A.R., Costanzo, K.S. & Taylor, D.J. (2012) Transcontinental phylogeography of the *Daphnia pulex* species complex. *PLoS One*, 7, e46620.
https://doi.org/10.1371/journal.pone.0046620
Daday, E. (1910) Untersuchungen über die Süsswasser-Mikrofauna Deutsch-Ost-Afrikas. *Zoologica*, 59 (1/5), 1–316.
De Bélair, G. (2005) Dynamique de la végétation de mares temporaires en Afrique du Nord (Numidie orientale, NE Algérie). *Ecologia Mediterranea*, 31 (1), 1–18.
De Deckker, P. & Geddes, M.C. (1980) Seasonal fauna of ephemeral lakes near the Coorong Lagoon, South Australia. *Australian Journal of Marine and Freshwater Research*, 31, 677–699.
https://doi.org/10.1071/MF9800677
De Gelas, K. & De Meester, L. (2005) Phylogeography of *Daphnia magna* in Europe. *Molecular Ecology*, 14, 753–764.
https://doi.org/10.1111/j.1365-294X.2004.02434.x
De Los Rios-Escalante, P. & Amarouayache, M. (2016) Crustacean zooplankton assemblages in Algerian saline lakes: a comparison with their Chilean Altiplano counterparts. *Crustaceana*, 89, 1485–1500.
https://doi.org/10.1163/15685403-00003581
Demnati, F., Samraoui, B., Allache, F., Sandoz, A. & Ernoul, L. (2017) *A literature review of Algerian salt lakes: values, threats and implications. Environmental Earth Sciences*, 76, 3.
https://doi.org/10.1007/s12665-017-6443-x
Dumont, H.J. (1979) *Limnologie van Sahara en Sahel*. Dr. Sci. Thesis. University of Ghent, 557 pp.
Dumont, H.J. (1980) Zooplankton and science of biogeography: the example of Africa. *In:* Kerfoot, W.C. (Ed.), *Evolution and Ecology of Zooplankton Communities*. University Press of New England, Hanover, pp. 685–696.
Dumont, H.J. (1981) Cladocera and free-living Copepoda from the Fouta Djalon and adjacent mountain ares in West Africa. *Hydrobiologia*, 85, 97–116.
https://doi.org/10.1007/BF00006620
Dumont, H.J. (1982) Relict distribution patterns of aquatic animals: another tool in evaluating late Pleistocene climate changes in the Sahara and Sahel. *Palaeoecology of Africa and the surrounding islands*, 14, 1–24.
Dumont, H.J. (1987) Region 2. Sahara. *In:* Burgis, M. & Symoens, J.J. (Eds.), *African wetlands and shallow waterbodies*. Directory ORSTOM, Paris, pp. 79–154.
Dumont, H.J., Laureys, P. & Pensaert, J. (1979) Anostraca, Conchostraca, Cladocera and Copepoda from Tunisia. *Hydrobiologia*, 66, 259–274.
https://doi.org/10.1007/BF00020908
Dumont, H.J. & Negrea, S.V. (2002) Introduction to the Class Branchiopoda. *In*: Dumont, H.J. (Eds.), *Guides to the identification of the microinvertebrates of the continental waters of the world. Vol. 19*. Backhuys Publishers, Leiden, 397 pp.
Dumont, H.J. & Pensaert, J. (1983) A revision of the Scapholeberinae (Crustacea: Cladocera), *Hydrobiologia*, 100, 3–45.
https://doi.org/10.1007/BF00027420
Dumont, H.J., Pensaert, J. & Van De Velde, I. (1981) The crustacean zooplankton of Mali (West Africa). *Hydrobiologia*, 80, 161–187.

https://doi.org/10.1007/BF00008434
Forró, L., Korovchinsky, N.M., Kotov, A.A. & Petrusek, A. (2008) Global diversity of cladocerans (Cladocera; Crustacea) in freshwater. *Hydrobiologia*, 595, 177–184.
https://doi.org/10.1007/s10750-007-9013-5
Frey, D.G. (1971) Worldwide distribution and ecology of *Eurycercus* and *Saycia* (Cladocera). *Limnology and Oceanography*, 16, 254–308.
https://doi.org/10.4319/lo.1971.16.2.0254
Frey, D.G. (1982) Relocation of *Chydorus barroisi* and related species (Cladocera, Chydoridae) to a new genus and description of two new species. *Hydrobiologia*, 86, 231–269.
https://doi.org/10.1007/BF00006141
Frey, D.G. (1987) The taxonomy and biogeography of the Cladocera. *Hydrobiologia,* 145, 5–17.
https://doi.org/10.1007/BF02530260
Frey, D.G. (1993) The penetration of cladocerans into saline waters. *Hydrobiologia*, 267, 233–248.
https://doi.org/10.1007/BF00018805
Gagneur, J. & Kara, M.H. (2001) Limnology in Algeria. *In*: Wetzel, R. G. & Gopal, B. (Eds.), *Limnology in Developing Countries. Vol. 3*. Schweizerbart'sche Verlagsbuchhandlungen, Stuttgart, pp. 1–34.
Gauthier, H. (1928a) *Recherche sur la faune des eaux continentales de l'Algérie et de la Tunisie*. Minerva, Alger, 419 pp.
Gauthier, H. (1928b) Ostracodes et Cladocères de l'Afrique du Nord (Première note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 19, 10–19.
Gauthier, H. (1928c) Ostracodes et Cladocères de l'Afrique du Nord (2e note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 19, 69–79.
Gauthier, H. (1929) Ostracodes et cladocères du Sahara Central. *Bulletin de la Société d'Histoire naturelle de l'Afrique du Nord*, 20 (2), 143–162.
Gauthier, H. (1930) Mission saharienne Augieras-Draper, 1927-1928: Cladocères, Ostracodes, Phyllopodes anostracés et conchostracés. *Bulletin du Museum National d'Histoire Naturelle, Paris*, 2, 92–116.
Gauthier, H. (1931) Faune aquatique du Sahara central. Récoltes de M.L. Seurat au Hoggar en 1928. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 22 (8), 350– 400.
Gauthier, H. (1933a) Nouvelles recherches sur la faune des eaux continentales de l'Algérie et de la Tunisie (introduction). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 24, 63–68.
Gauthier, H. (1933b) Faune aquatique du Sahara central. Récoltes de Th. Monod dans l'Emmidir et l'Ahnet. *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 24, 127–132.
Gauthier, H. (1934) Nouvelles recherches sur la faune des eaux continentales de l'Algérie et de la Tunisie (4e note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 25, 121–126.
Gauthier, H. (1937) Ostracodes et Cladocères de l'Afrique du Nord (4e note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 28, 147–156.
Gauthier, H. (1938) La vie désertique dans les déserts subtropicaux. *Mémoire de la Societé Biogéographique*, 6, 107–120.
Gauthier, H. & Brehm, V. (1928) Ostracodes et Cladocères de l'Algérie et de la Tunisie (3e note). *Bulletin de la Société de l'Histoire Naturelle de l'Afrique du Nord*, 19, 114–121.
Geraldes, A.M. & Alonso, M. (2014) *Bosmina (Eubosmina) coregoni* Baird, 1857 (Crustacea, Branchiopoda, Anomopoda): New planktonic invader in the Iberian peninsula. *Graellsia*, 70 (2), e015.
https://doi.org/10.3989/graellsia.2014.v70.114
Goulden, C.E. (1968) The systematics and evolution of the Moinidae. *Transactions of the American Philosophical Society Held at Philadelphia, New Series*, 58 (6), 1–101.
https://doi.org/10.2307/1006102
Gurney, R. (1904) On a small collection of a freshwater Entomostraca from South Africa. *Proceedings of the General Meetings from Scientific Business of the Zoological Society of London*, 2, 298–301.
https://doi.org/10.1111/j.1469-7998.1905.tb08339.x
Gurney, R. (1909) On the fresh-water Crustacea of Algeria and Tunisia. *Journal of the Royal Microscopical Society*, 2, 273–305.
https://doi.org/10.1111/j.1365-2818.1909.tb01699.x
Hammer, U.T. (1986) Saline lakes ecosystems of the World. *Monographic Biologicae*, 59, 1– 616.
Harding, J.P. (1942) Cladocera and Copepoda collected from East African Lakes by Miss C. K. Ricardo and Miss R. J. Owen. *Annals and Magazine of Natural History, 11th Series*, 9 (51), 174–191.
Harding, J.P. (1961) Some South African Cladocera collected by Dr A.D Harrison. *Annals of the South African Museum*, 46, 35–46.
Hart, R.C. & Dumont, H.J.F. (2005) A Holarctic taxon in the Ethiopian region – a first record of *Lathonura* (Crustacea: Cladocera: Macrothricidae) of the Okavango swamps of subtropical Africa. *South African Journal of Sciences*, 101, 565–567.
Huang, X., Shi, X., Kotov, A.A. & Gu, F. (2014) Confirmation through genetic analysis of the existence of many local phyloclades of the genus *Simocephalus* (Crustacea, Cladocera) in China. *PLoS ONE*, 9 (11), e112808.
https://doi.org/10.1371/journal.pone.0112808

Hudec, I. (1993) Redescription of *Daphnia deserti* (Gauthier, 1937) (Crustacea: Daphniiformes: Daphniidae). *Hydrobiologia*, 264, 153–158.
https://doi.org/10.1007/BF00007285
Ishida, S. & Taylor, D.J. (2007) Quaternary diversification in a sexual Holarctic zooplankter, *Daphnia galeata*. *Molecular Ecology*, 16, 569–582.
https://doi.org/10.1111/j.1365-294X.2006.03160.x
Klunzinger, F. (1864) Einiges zur Anatomie der Daphniden nebst kurzen Bemerkungen über Süsswasserfauna der Umgegend Cairo's. *Zetschrift für wissenschaftliche Zoologie*, 14, 167–173.
Kořínek, V. (1984) Cladocera. Hydrobiological Survey of Lake Bangweulu and Luapulu River Basin. *Journal of Symoens Cercle Hydrobiologique de Bruxelles,* 13 (2), 1–117.
Kořínek, V. (1999) A guide to limnetic species of Cladocera of African inland waters (Crustacea, Branchiopoda). *Occasional Publications SIL*, 1, 1–57.
Korovchinsky, N.M. (1992) Sididae and Holopediidae. *In:* Dumont, H.J. (Ed.), *Guides to the identification of the microinvertebrates of the continental waters of the world. Vol. 3.* SPB Academic Publishing, The Hague, 82 pp.
Korovchinsky, N.M. (2004) *Cladocera order Ctenopoda of the world: morphology, systematics, ecology and zoogeography.* KMK Publishers, Moscow, 410 pp.
Korovchinsky, N.M., Walsh, E.J. & Smolak, R. (2017) *Diaphanosoma* Fischer, 1850 (Crustacea: Cladocera: Sididae) of Lake Turkana (East Africa), with the description of a new species of the genus. *Zootaxa*, 4250 (1), 77–89.
https://doi.org/10.11646/zootaxa.4250.1.6
Kotov, A.A. (2007) Revision of the *hirsuticornis*-like species of *Macrothrix* Baird, 1843 (Cladocera: Anomopoda: Macrothricidae) from Subantarctic and temperate regions of the southern hemisphere. *Journal of Natural History*, 41, 2569–2620.
https://doi.org/10.1080/00222930701689937
Kotov, A.A. (2008) Importance of male and ephippial female characters for differentiating three Palearctic species of *Macrothrix* Baird, 1843 (Cladocera: Anomopoda), with a redescription of *Macrothrix dadayi* Behning, 1941. *Annales de Limnologie*, 44, 45–61.
https://doi.org/10.1051/limn:2008022
Kotov, A.A. (2009) A revision of *Leydigia* Kurz, 1875 (Anomopoda, Cladocera, Branchiopoda), and subgeneric differentiation within the genus. *Zootaxa*, 2082, 1–68.
Kotov, A.A. (2015) A critical review of the current taxonomy of the genus *Daphnia* O.F. Müller, 1785 (Anomopoda, Cladocera). *Zootaxa*, 3911 (2), 184–200.
https://doi.org/10.11646/zootaxa.3911.2.2
Kotov, A.A. & Ferrari, F.D. (2010) The taxonomic research of Jules Richard on Cladocera (Crustacea: Branchiopoda) and his collection at the National Museum of Natural History, U.S.A. *Zootaxa*, 2551 (1), 37–64.
https://doi.org/10.11646/zootaxa.2551.1.2
Kotov, A.A., Forró, L., Korovchinsky, N.M. & Petrusek, A. (2013a) World checklist of freshwater Cladocera species. Freshwater animal diversity assessment project. Belgium Biodiversity Platform. Available from: http://fada.biodiversity.be/group/show/17 (accessed 19 December 2017)
Kotov, A.A., Jeong, H.J. & Lee, W. (2012) Cladocera (Crustacea: Branchiopoda) of the south–east of the Korean Peninsula, with twenty new records for Korea. *Zootaxa*, 3368, 50–90.
Kotov, A.A., Karabanov, D.P., Bekker, E.I., Neretina, T.V. & Taylor, D.J. (2016) Phylogeography of the *Chydorus sphaericus* Group (Cladocera: Chydoridae) in the Northern Palearctic. *PloS ONE*, 11 (12), e0168711.
https://doi.org/10.1371/journal.pone.0168711
Kotov, A.A. & Štifter, P. (2006) Cladocera: family Ilyocryptidae (Branchiopoda: Cladocera: Anomopoda). *In:* Dumont, H.J. (Ed.), *Guides to the identification of the microinvertebrates of the Continental Waters of the world. Vol. 22.* Kenobi Productions, Ghent & Backhuys Publishers, Leiden, 172 pp.
Kotov, A.A. & Taylor, D.J. (2010) A new African lineage of the *Daphnia obtusa* group (Cladocera: Daphniidae) disrupts continental vicariance patterns. *Journal of Plankton Research*, 32, 937–949.
https://doi.org/10.1093/plankt/fbq018
Kotov, A.A., Van Damme, K., Bekker, E.I., Siboualipha, S., Silva-Briano, M., Adabache Ortiz, A., Galván de la Rosa, R. & Sanoamuang, L. (2013b) Cladocera (Crustacea: Branchiopoda) of Vientiane province and municipality, Laos. *Journal of Limnology*, 72 (Supplement 2), 81–108.
https://doi.org/10.4081/jlimnol.2013.s2.e6
Margaritora, F.G. (2005) Crustacea Branchiopoda Cladocera. *Memorie del Museo Civico di Storia Naturale di Verona, 2 Serie, Sezione Scienze della Vita*, 16, 87–89.
Marrone, F. (2006) The microcrustacean fauna of Sicily and the central Mediterranean Sea area: current knowledge and gaps to be filled. *Polish Journal of Ecology*, 54 (4), 681–685.
Marrone, F., Barone, R. & Naselli-Flores, L. (2005) Cladocera (Branchiopoda: Anomopoda, Ctenopoda and Onychopoda) from Sicilian inland waters: an updated inventory. *Crustaceana*, 78, 1025–1039.
https://doi.org/10.1163/156854005775361043
Mergeay, J., Verschuren, D. & De Meester, L. (2005) *Daphnia* species diversity in Kenya, and a key to the identification of

their ephippia. *Hydrobiologia*, 542, 261–274.
https://doi.org/10.1007/s10750-004-4952-6
Methuen, P.A. (1910) On a collection of freshwater Crustacea from the Transvaal. *Proceedings of the Zoological Society of London*, 1910, 148–167.
https://doi.org/10.1111/j.1096-3642.1910.tb01889.x
Mouelhi, S., Balvay, G. & Kraiem, M.M. (2000) Branchiopodes (Cténopodes et Anomopodes) et Copépodes des eaux continentales d'Afrique du Nord: inventaire et biodiversité. *Zoosystema*, 22, 731–748.
Nédli, J., De Meester, L., Major, Á., Schwenk, K., Szivák, I. & Forró, L. (2014) Salinity and depth as structuring factors of cryptic divergence in *Moina brachiata* (Crustacea: Cladocera). *Fundamental and Applied Limnology*, 184, 69–85.
https://doi.org/10.1127/1863-9135/2014/0462
Negrea, Ş. (1984) Redescription de *Moina salina* Daday, 1888 (Cladocera, Moinidae) d'Aprés des exemplaires trouvès en terra typica. *Crustaceana*, 47, 83–97.
https://doi.org/10.1163/156854084X00333
Neretina, A.N. & Kotov, A.A. (2015) A new species of *Acroperus* Baird, 1843 (Cladocera: Chydoridae) from Africa. *Zootaxa*, 4039 (4), 516–528.
https://doi.org/10.11646/zootaxa.4039.4.2
Neretina, A.N. & Sinev, A.Y. (2016) A revision of the genus *Leberis* Smirnov, 1989 (Cladocera: Chydoridae) in the Old World and Australia. *Zootaxa*, 4079 (5), 501–533.
https://doi.org/10.11646/zootaxa.4079.5.1
Noble, R.C. & Schaefter, H.W. (1967a) Keys to the freshwater Cladocera of Southern Africa. I. The families, and the genera and species of the family Sididae. *Limnological Society of Southern Africa Newsletter*, 8, 35–40.
Noble, R.C. & Schaefter, H.W. (1967b) Keys to the freshwater Cladocera of Southern Africa. II. Genera of the family Daphniidae and species of the genera *Scapholeberis* and *Daphnia*. *Limnological Society of Southern Africa, Newsletter*, 9, 62–79.
Orlova-Bienkowskaja, M.Y. (2001) Daphniidae: Genus *Simocephalus*. In: Dumont, H.J. (Eds.), *Guides to the identification of the Microinvertebrates of the continental waters of the world. Vol. 17*. Backhuys, Leiden, 130 pp.
Petrusek, A., Černy, M. & Audenaert, E. (2004) Large intercontinental differentiation of *Moina micrura* (Crustacea: Anomopoda): one less cosmopolitan cladoceran. *Hydrobiologia*, 526, 73–81.
https://doi.org/10.1023/B:HYDR.0000041612.08425.f0
Petrusek, A., Hobæk, A., Nilssen, J.P., Skage, M., Černý, M., Brede, N. & Schwenk, K. (2008) A taxonomic reappraisal of the European *Daphnia longispina* complex (Crustacea, Cladocera, Anomopoda). *Zoologica Scripta*, 37, 507–519.
https://doi.org/10.1111/j.1463-6409.2008.00336.x
Petrusek, A.R., Tollrian, K., Schwenk, A.H. & Laforsch, C. (2009) A ''crown of thorns'' is an inducible defense that protects *Daphnia* against an ancient predator. *Proceedings of the National Academy of Sciences USA*, 106, 2248–2252.
https://doi.org/10.1073/pnas.0808075106
Popova, E.Y. & Kotov, A.A. (2013) Latitudal patterns in the diversity of two subgenera of the genus *Daphnia* O.F. Müller (Crustacea: Cladocera: Daphniidae). *Zootaxa*, 3736 (2), 159–174.
https://doi.org/10.11646/zootaxa.3736.2.4
Popova, E.V., Petrusek, A., Kořínek, V., Mergeay, J., Bekker, E.I., Karabanov, D.P., Galimov, Y.R., Neretina, T.V., Taylor, D.J. & Kotov, A.A. (2016) Revision of the Old World *Daphnia* (*Ctenodaphnia*) *similis* group (Cladocera: Daphniidae). *Zootaxa*, 4161 (1), 1–40.
https://doi.org/10.11646/zootaxa.4161.1.1
Pretus, J.L.T. (1990) A commented Cheklist-list of the Balearic Branchiopoda (Crustacea). *Limentica*, 6, 157–164.
Quézel, P. & Santa, S. (1962–1963) Nouvelle Flore de l'Algérie et des régions désertiques méridionales. CNRS, Paris, 170 pp.
Ramdani, M. (1982) Les entomostracés de la merja Sidi Bou Ghaba. *Bulletin de l'Institut Scientifique, Rabat*, 6, 105–117.
Ramdani, M., Flower, R.J., Elkhiati, N., Kraïem, M.M., Fahti, A.A., Birks, H.H. & Patrick, S.T. (2001) North African wetland lakes: characterization of nine sites included in the CASSARINA Project. *Aquatic Ecology*, 35, 281–302.
https://doi.org/10.1023/A:1011957324901
Richard, J. (1896) Révision des Cladocères. Deuxième Partie. Anomopoda. Famille III. Daphnidae. *Annales des Sciences Naturelles*, Zoologie, Series 8, 2, 187–363.
Rzóska, J. (1956) On the variability and status of the Cladocera *Ceriodaphnia cornuta* and *C. rigaudi*. *Annales and Magazine of Natural History*, 12, 505–510.
https://doi.org/10.1080/00222935608655846
Samraoui, B. (2002) Branchiopoda (Ctenopoda and Anomopoda) and Copepoda from eastern Numidia (Algeria). *Hydrobiologia*, 470, 173–179.
https://doi.org/10.1023/A:1015640525662
Samraoui, B. & de Bélair, G. (1998) Les zones humides de la Numidie orientale. Bilan et perspectives. *Synthèse*, 4, 1–90.
Samraoui, B., Segers, H., Maas, S., Baribwegure, D. & Dumont, H.J. (1998) Rotifera, Cladocera, Copepoda, and Ostracoda from coastal wetlands in Northeast Algeria. *Hydrobiologia*, 386, 183–193.
https://doi.org/10.1023/A:1003538730152
Sars, G.O. (1895) On some South-African Entomostraca raised from dried mud. *Vidensklabs-selskabets skrifter. I. Klasse*

Mathematik-naturvidenskab, 1895 (8), 1–56.
Sars, G.O. (1916) The fresh-water Entomostraca of Cape Province. Part I. Cladocera. *Annals of the South African Museum*, 15, 303–351.
Seaman, M.T., Kok, D.J. & Watson, M. (1999) *Cladocera Guides to the freshwater invertebrates of South Africa. Crustacea I.* WRC Report, TT121/(00), 81–110.
Sharma, P. & Kotov, A.A. (2013) Molecular approach to identify sibling species of the *Ceriodaphnia cornuta* complex (Cladocera: Daphniidae) from Australia with notes on the continental endemism of this group. *Zootaxa*, 3702 (1), 79–89. https://doi.org/10.11646/zootaxa.3702.1.5
Silva-Briano, M., Dieu, N.Q. & Dumont, H.J. (1999) Redescription of *Macrothrix laticornis* (Jurine, 1820), and description of two new species of the *M. laticornis*-group. *Hydrobiologia*, 403, 39–61. https://doi.org/10.1023/A:1003776325401
Sinev, A.Y. (2001a) Distribution and polymorphism of *Alona rectangula* Sars, 1862 (Branchiopoda: Anomopoda: Chydoridae) in Russia and surrounding countries. *Arthropoda Selecta*, 10 (2), 83–86.
Sinev, A.Y. (2001b) Separation of *Alona cambouei* Guerne & Richard, 1893 from *Alona pulchella* King, 1853 (Branchiopoda: Anomopoda: Chydoridae). *Arthropoda Selecta*, 10 (1), 5–18.
Sinev, A.Y. (2009a) Cladocerans of the *Alona affinis* (Leydig, 1860) group from South Africa. *Zootaxa*, 1990, 41–54.
Sinev, A.Y. (2009b) Discrimination between two sibling species of *Acroperus* (Baird, 1843) from the Palearctic (Cladocera: Anomopoda: Chydoridae). *Zootaxa*, 2176, 1–21.
Sinev, A.Y. (2014) A comparative morphological analyses of four species of *Camptocercus* Baird, 1843 (Cladocera: Anomopoda: Chydoridae). *Zootaxa*, 3895 (2), 183–207. https://doi.org/10.11646/zootaxa.3895.2.3
Sinev, A.Y. (2015) Revision of the *pulchella*-group of *Alona* s. lato leads to its translocation to *Ovalona* Van Damme et Dumont, 2008 (Branchiopoda: Anomopoda: Chydoridae). *Zootaxa*, 4044 (4), 451–492. https://doi.org/10.11646/zootaxa.4044.4.1
Sinev, A.Y., Alonso, M., Miracle, M.R. & Sahuquillo, M. (2012) The West Mediterranean *Alona azorica* Frenzel & Alonso, 1988 (Cladocera: Anomopoda: Chydoridae) is composed of two species. *Zootaxa*, 3276, 51–68.
Smirnov, N.N. (1971) Chydoridae of the world fauna. *Fauna SSSR. Rakoobraznie*, 1 (2), 1–531. [in Russian]
Smirnov, N.N. (1976) Macrothricidae and Moinidae of the World fauna. *Fauna SSSR, novaya seriya. Rakoobraznye*, 1 (3), 1–237. [in Russian]
Smirnov, N.N. (1992) The Macrothricidae of the world. *In:* Dumont, H.J. (Ed.), *Guides to the identification of the microivertebrates of the continental waters of the world*. SPB Academic Publishing, The Hague, 143 pp.
Smirnov, N.N. (1996) Cladocera: the Chydorinae and Sayciinae (Chydoridae) of the world. *In:* Dumont, H.J. (Ed.), *Guides to the identification of the microivertebrates of the Continental Waters of the world. Vol. 11*. SPB Academic Publishing, Amsterdam, pp. 1–197.
Smirnov, N.N. (1998) A revision of the genus *Camptocercus* (Anomopoda, Chydoridae, Aloninae). *Hydrobiologia*, 386, 63–83. https://doi.org/10.1023/A:1003524414799
Smirnov, N.N. (2007) *Pleuroxus*-like chydorids (Crustacea: Anomopoda) from South Africa, with the description of *Dumontiellus africanus* gen. n., sp. n. *Hydrobiologia*, 575, 433–439. https://doi.org/10.1007/s10750-006-0275-0
Smirnov, N.N. (2008) Check-list of the South-African Cladocera (Crustacea: Branchiopoda). *Zootaxa*, 1788, 47–56.
Smirnov, N.N. (2013) *Physiology of the Cladocera*. Academic Press, London, 352 pp.
Smirnov, N.N., Glagolev, S.M., Korovchinsky, N.M., Kotov, A.A., Orlova-Bienkowskaja, M. Ya. & Rivier, I.K. (1995) *Cladocera. In*: Alekseev, V.R. (Ed.), *Guides to the identification of the freshwater invertebrates of Russia and surrounding territories. Vol.* 2. *Crustacea.* Zoological Institute of Russian Academy of Sciences, St Petersburg, pp. 34–74.
Smirnov, N.N., Kotov, A.A. & Coronel, J.S. (2006) Partial revision of the *aduncus*-like species of *Pleuroxus* Baird, 1843 (Chydoridae, Cladocera) from the southern hemisphere with comments on subgeneric differentiation within the genus. *Journal of Natural History*, 40, 1617–1639. https://doi.org/10.1080/00222930600958870
Touati, L. & Samraoui, B. (2002) The ecology of *Daphnia chevreuxi* Richard in Northeast Algeria (Crustacea: Anomopoda). *Sciences & Technologie*, Numéro Spécial-D (1), 75–81.
Turki, S. & Turki, B. (2010) Copepoda and Branchiopoda from Tunisian temporary waters. *International Journal of Biodiversity and Conservation*, 2 (4), 86–97.
Ustaoglu, M.B. (2015) An updated zooplankton biodiversity of Turkish inland waters. *Limnofish*, 1 (3), 151–159.
Van Damme, K., Bekker, E.I. & Kotov, A.A. (2013) Endemism in the Cladocera (Crustacea: Branchiopoda) of Southern Africa. *Journal of Limnology*, 72 (3), 440–463. https://doi.org/10.4081/jlimnol.2013.e36
Van Damme, K. & Dumont H.J. (2008) Further division of *Alona* Baird, 1843: separation and position of *Coronatella* Dybowski & Grochowski and *Ovalona* gen.n. (Crustacea: Cladocera). Zootaxa, 1960, 1–44.
Van Damme, K. & Dumont, H.J. (2009) Notes on chydorid endemism in continental Africa: *Matralona* gen. n., a monotypic Alonine from the Fouta Djalon Plateau (Guinea, West Africa) (Crustacea: Cladocera: Anomopoda). *Zootaxa*, 2051, 26–40.
Van Damme, K. & Dumont, H.J. (2010) Cladocera of the Lencois Maranhenses (NE – Brazil): faunal composition and a

reappraisal of Sars' method. *Brazilian Journal of Biology*, 70, 755–779.
https://doi.org/10.1590/S1519-69842010000400008
Van Damme, K. & Eggermont, H. (2011) The Afromontane Cladocera (Crustacea: Branchiopoda) of the Rwenzori (Uganda – D. R. Congo): taxonomy, ecology and biogeography. *Hydrobiologia*, 676, 57–100.
https://doi.org/10.1007/s10750-011-0892-0
Van Damme, K., Kotov, A.A. & Dumont, H.J. (2010) A checklist of names in *Alona* Baird 1843 (Crustacea: Cladocera: Chydoridae) and their current status: an analysis of the taxonomy of a lump genus. *Zootaxa*, 2330, 1–63.
Van Damme, K., Sinev, A.Y. & Dumont, H.J. (2011) Separation of *Anthalona* gen.n. from *Alona* Baird, 1843 (Branchiopoda: Cladocera: Anomopoda): morphology and evolution of scraping stenothermic alonines. *Zootaxa*, 2875, 1–64.
Véla, E. & Benhouhou, S. (2007) Evaluation d'un nouveau point chaud de biodiversité végétale dans le Bassin méditerranéen (Afrique du Nord). *Comptes Rendus Biologies*, 330, 589–605.
https://doi.org/10.1016/j.crvi.2007.04.006
Weltner, W. (1899) Zur Cladoceren fauna Africas. *Zoologischer Anzeiger*, 22 (577), 8–9.
Williams, W.D., Boulton, A.J. & Taaffe, R.G. (1990) Salinity as a determinant of salt lake fauna: a question of scale. *Hydrobiologia*, 197, 221–231.
https://doi.org/10.1007/BF00026955