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Original Research Article

EFFECT OF ABIOTIC FACTORS ON COPEPOD PARASITES FROM BENI-HAROUN DAM (MILA CITY) NORTH- EAST OF ALGERIA.

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Abstract: Copepod parasites are among the highly ubiquitous and abundant organisms in the planet, although they cause marked ecological and economic damages in the world, including Algeria. This work was therefore, aimed to study the copepod parasites in gills of 776 individual freshwater fishes belonging to four caught fishes (*Luciobarbus callensis, Carassuis carassuis, Cyprinus carpio* and *Abramis brama*) from Béni-Haroun dam of Mila city (northeast of Algeria) during four seasons over two years (2015 & 2016). Here, the parasites have been collected and identified, the epidemiological indices were determined and the effect of water physico-chemical parameters on parasites was examined using principal component correlation analysis (Statistica, Ver 8). Moreover, the morpho-anatomical criteria of 249 collected parasites promoted us to identify eight species (*Ergasilus sieboldi, Ergasilus peregrinus, Ergasilus briani, Neoergasilus japonicus, Ergasilus megaceros, Neoergasilus longispinosus, Paraergasilus brevigiditus* and *Lernea cyprinacea*) related to four genera and two families. Thus, the study appears that the effect of physico-chemical parameters on parasitic infestation and number of parasites is positively correlated with temperature, dissolved oxygen, orthophosphate, nitrite and ammonium contents, and negatively correlated with pH and nitrates during summer and autumn.

Keywords: Copepod paraistes, Beni-Haroun dam, parasitic indices, physico-chemical parameters.

Introduction: The water quality can not only be expressed by the combination of inorganic and organic substances at various concentrations, but also by the presence of animals and aquatic plants **(Wachington, 1984).** As previously reported **(Rottmann, 1992; Lio-Po et Lim),** the anthropogenic pollutants may result in environmental changes, serious stress to fishes and decrease of fish resistance, leading consequently to various diseases including mainly parasitic infections. In addition, the surface water in Algeria are vulnerable to the various contaminants and, so it may contain

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a non negligible quantity of organic matters, either natural (e.g, humid substance) or artificial matters resulting from adverse pollutant wastes **(Achour, 2001).** In fact, the physico-chemical parameters are valuable tool to understand composition and function of the aquatic ecosystems **(Guendouz, 1985; Guendouz *et al.*, 2003; Tabouche et Achour, 2004; Chebbah et Allia, 2015).** In this regards, several studies have been conducted for good appreciation of the physico-chemical qualities and water pollution levels in dams of Algeria, and among which those conducted by **Harrat and Achour (2010; 2011)** in Mexa, Chefia and Zit El-Emba dams, **Ouahchia and *al.*, (2015)** in Boukourdane lake, **Mouaissia (2016)** in Beni-Haroun dam, **Allalgue et *al.*, (2017)** and **Boucenna (2017)** in Ain Dalia and Foum El-Khanga dams, **Boucenna (2017)** and **Khelifi (2018)** in Ain Dalia and Béni-Haroun dams. The present study was aimed to investigate the effect of physicochemical parameters of Beni-Haroun waters on copepod parasites infesting host fish populations, and the effect of abiotic factors on the total number of parasites with matrix of centralized and reduced data of 10 variables (physico-chemical parameters) during four seasons. The results were tested by Principal Component Analysis (PCA) using software Statistica (Statsoft, v. 8.0)

Materials and Methods

Study zone

Geographical description: Beni-Haroun dam of Mila city is located in the downstream of the confluence of Rhumel river from the west and Endja river from the northwest of Graram Gouga region (Mila city), forty kilometres away from north of Constantine city along with an equivalent distance from the moth of Kebir river (Jijel city, northeast Algeria), and is 114 m high on top of the river bed, 100m wide at the base and 710 m long in crest. Also, the dam makes a part of a large surface water mobilization program and their inter-basin transfer in order to mitigate the strong hydraulic inequalities (**Benayache, 2014 ; Mebarki *et al.*, 2005).** Additionally, it is one of the 85 dams currently exploited in Algeria, classified as the 2nd dam in Africa after El Alli dam (Egypt), received waters from August 2003, stores 997.9 cubic matters of water reserve, and this storage capacity has recently reached the maximal level of one billion cubic matters. Moreover, the difficult topography of the study region imposes the establishment of complex technical system, including a huge pumping station, three regulatory dams and more than 600 kilometres of transfer and adduction pipes. Further, big urban centres and large irrigable lands which might not satisfied by the local resources are located in the south part of the dam **(Mebarki *et al.*, 2008; Mebarki, 2005) (Figure 1).**

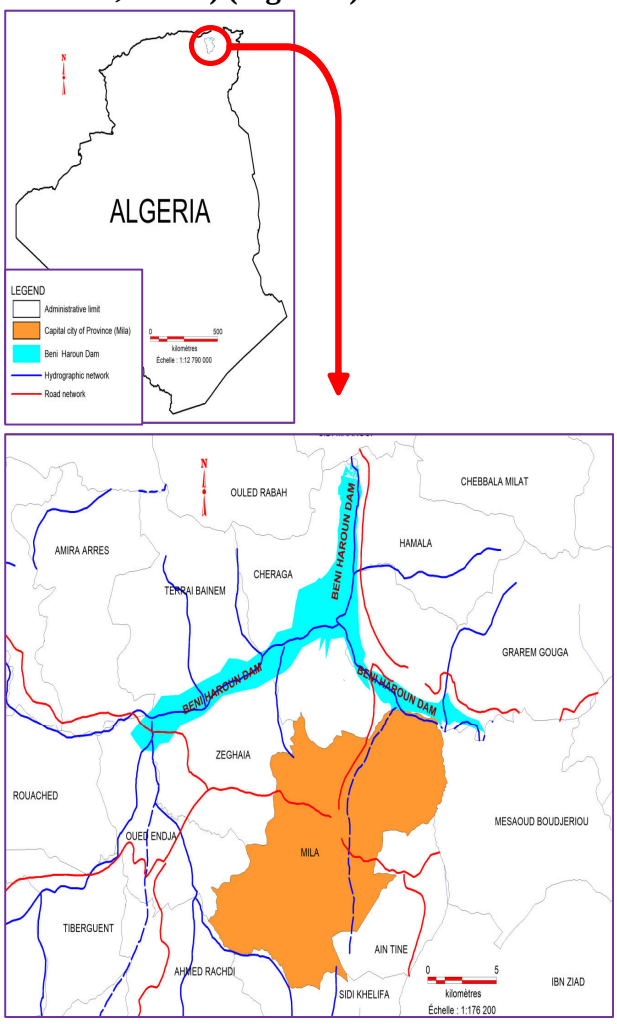

Figure 1: Map of sampling site (Dam Beni-Harroun) Mila –Algeria-

Water physico-chemical analysis: The monitoring of water physico-chemical parameters are performed according to the members of the National Hydraulic Resource Agency (ANRH), leading thus to monitor the quality of dam water intended to drinking water supply from a station at the dam providing a free access to agency members. The monthly determined physico-chemical parameters during the study period (2015 - 2016) as about one ecological year are; temperature (T), potential of hydrogen (pH), dissolved oxygen (O_2), nitrites (NO^{3-}), nitrites (NO_2), ammonium (NH_4), organic matter contents (OM), phosphate (PO_4), biological oxygen demand (BOD) and dry residues (DR).

Data treatment procedures:

Statistical Multivariate Analysis: Principal Components Analysis (PCA)

The use of Principal Components Analysis is not only as a preliminary descriptive approach, but also an exploratory approach leading to display the seasonal variation of parasites in function of a set of abiotic variables measured in Beni-Haroun dam. Also, the PCA promotes, at one part to establish the existence of possible similarities and at the other part, to model and synthetize the linear relationships existing between the studied abiotic variables. The results of PCA are expressed by the factorial axes associated with confidence eclipses for each of the two factors (season and species parasites), and by correlation circles of the ten-above mentioned quantitative variables.

Results: The examination of gills of 776 individual fishes promotes to collect 249 copepod parasites and identify eight species belonging to two families **(Table. 1).**

Table 1. List of identified parasites in four host species

Parasites			Hosts
Family	**Genus**	**Species**	
Ergasilidae (Thorell, 1859).	*Ergasilus* (Nordmann, 1832).	*Ergasilus peregrinus* (Haller, 1865).	*Luciobarbus callensis*
		Ergasilus briani (Markewitsch, 1933).	*Luciobarbus callensis* *Carassuis carassuis* *Cyprinus carpio* *Abramis brama*
		Ergasilus megaceros (Willson, 1916).	*Luciobarbus callensis* *Carassuis carassuis*
		Ergasilus sielboldi (Nordmann, 1832).	*Luciobarbus callensis* *Carassuis carassuis* *Cyprinus carpio* *Abramis brama*
	Paraergasilus (Markevich, 1937).	*Paraergasilus brevigiditus* (Yin, 1954).	*Luciobarbus callensis* *Carassuis carassuis*
	Neoergasilus (Yin, 1956).	*Neoergasilus longispinosus* (Yin, 1956).	*Luciobarbus callensis* *Cyprinus carpio*
		Neoergasilus japonicus (Harada, 1930).	*Luciobarbus callensis;* *Carassuis carassuis ;* *Cyprinus carpio*
Lernaeidae (Coddold, 1879).	*Lernea* (Linnaeus, 1758).	*Lernea cyprinacea* (Linnaeus, 1758).	*Luciobarbus callensis;* *Carassuis carassuis.* *Cyprinus carpio*

Season	*Parasites*	*NP*
Springer	*Ergasilus megacers*	1
	Ergasilus sieboldi	2
	Neoergasils longispinosus	1
	Neoergasilus japonicus	10
	Lernea cyprinaca	5
Summer	*Ergasilus peregrins*	1
	Ergasilus briani	15
	Ergasilus megaceros	2
	Ergasilus sieboldi	6
	Neoergasils longispinosus	2
	Neoergasilus japonicus	48
	Paraergasilus brevigiditus	1
	Lernea cyprinaca	13
Autumn	*Ergasilus briani*	57
	Ergasilus sieboldi	42
	Neoergasils longispinosus	5
	Neoergasilus japonicus	25
	Lernea cyprinaca	3
Winter	*Ergasilus briani*	5
	Neoergasilus japonicus	3
	Lernea cyprinaca	2

Table 2: Seasonal list of the identified parasites in the four host species

Physico-chemical characterisation of Beni-Haroun dam waters

• **Temperature:** The monitoring of Beni-Haroun dam water temperature revealed close variations during spring and winter (T= 13, 73 °C ; T=13,76 °C), meanwhile the highest temperature values were recorded during summer and autumn (T=24,76°C ; T=25,82 °C) **(Table 3).**

• **Hydrogen Potential (pH) :** No significant variations in water pH of Beni-Haroun during the four seasons of study were noticed, and so the water was found overall, basic with maximum pH value of 7,68 in winter and minimum value of 7,43 in springs. These values comply with the accepted quality norms (6,5-9) **(Table 3).**

• **Dissolved oxygen (DO):** The dissolved oxygen levels in Beni-Haroun dam waters show no significant variations from season to other, since the results show a peak of DO concentration during summer (116,16 g/l) along with lowest value during winter (95,49 g/l) **(Table 3).**

• **Nitrate (nitric nitrogen) NO_3^-**

The nitrite content of Beni-Haroun dam water shows marked variations from season to other, while the lowest value was recorded during autumn (4,66 mg/l) and the highest one is noticed during springer (12,06 mg/l) **(Table 3).**

• **Dry residues (DR) :** The seasonal variation of dry residues in Beni-Haroun dam water showed its importance during the four seasons, indicating also maximal level in autumn (809 mg/l) and minimal level of DR in springers (718,32 mg/l) **(Table 3).**

• **Chemical oxygen demand (COD):** The COD contents in Beni-Haroun dam water are generally, similar during the four seasons or are ranging between the maximal value of 36,22 mg/l during winter and the minimal value of 29,98 mg/l during springers **(Table.3).**

• **Biological oxygen demand (BOD5) :** The BOD_5 contents in Beni-Haroun dam water did not show big variations during the four study seasons, and so they range between a maximal value of 3, 04 mg/l during winter and a minimal value of 1,83 mg/l during springers **(Table 3).**

• **Ammonium concentration NH_4^+ :** The concentrations of ammonium in Beni-Haroun dam water were found between 0,01mg/l in winter and 0,097mg/l in summer **(Table 3).**

• **Soluble orthophosphates (PO_4^{-3}) :** The concentration of orthphosphate exhibited maximal values in summer (0,044mg/l) and very low values in winter (0,018 mg/l) **(Table 3).**

• **Nitrite contents (nitrous nitrogen) NO_2^- :** The nitrite content in Beni-Haroun dam waters varies throughout the study period from 0, 174 mg/l to 0, 390 mg/l. **(Table 3).**

Table 3. Seasonal evaluation of physico-chemical parameters (abiotic) in Beni-Haroun dam water.

Parameters Seasons	T	pH	O_2 dissous	NO_3 (mg/l)	DR (mg/l)	COD mg/l	BOD5 mg/l	NH_4 mg/l	PO_4 mg/l	NO_2 mg/l
Winter	13,73	7,68	95,49	7,37	796,7	36,22	3,04	0,01	0,0187	0,174
Springer	13,76	7,43	111,13	12,08	718,32	29,58	1,83	0,055	0,033	0,225
Summer	25,82	7,45	116,11	5,6	765,9	31,91	2,75	0,097	0,044	0,390
Autumn	14,76	7,62	101,98	4,66	809	32	2	0,064	0,032	0,221

Table 4. Correlation of the total individuals and each parasitic species with abiotic variables following the two axes (axis 1 and axis 2).

Variables	Axis 1	Axis 2
Ergasilus peregrins	-0,980253	-0,104572
Ergasilus briani	0,231953	-0,967487
Ergasilus megaceros	-0,950212	0,127713
Ergasilus sieboldi	0,317849	-0,947446
Neoergasils longispinosus	0,080398	-0,986178
Neoergasilus japonicus	-0,843630	-0,536296
Paraergasilus brevigiditus	-0,980253	-0,104572
Lernea cyprinacae	-0,994303	0,069142
*NP	0,192056	0,981003
*T°C	0,517290	0,845132
*pH	-0,603042	0,07353
*O_2	0,844522	0,517152
*DR	-0,357398	0,469478
*NO_3^-	-0,182591	-0,743009
*NH_4^+	0,745733	0,583562
*$PO4^{-3}$	0,729291	0,672572
*BOD	0,296087	-0,260413
*COD	-0,015411	-0,062452
*NO_2^-	0,981014	0,187759

***NP :** Number of total parasites

2. Principal Component Analysis (PCA)

2.1. Effect of physico-chemical parameters on the total individual parasites

The correlation matrix between various abiotic factors known as, physico-chemical parameters and the total parasites indicates that:

✓ The first axis (factor 1) is negatively correlated with pH (r = - 0,60) and positively correlated with orthophosphate (r=0,72), nitrites (r=0,98), dissolved oxygen (r=0,84) and ammonium (r= 0,74).

✓ The second axis (factor 2) is positively correlated with ammonium (r = 0,58), dissolved oxygen (r = 0,51), temperature (r = 0,84) and the total parasites (r = 0,98) and negatively correlated with nitrites (r = 0,74) **(Table 4).**

This chemical analysis displays the relationship between the abiotic parameters, the total individuals and each parasitic species following seasons. The two first axes display 97,789% of total variance with respectively, 58,579 % (F1) for axis 1(F1) and 39,210 % for axis 2 (F2) **(Table 5.).**

Table 5. Proper values and percentages of the two first axes of PCA.

Axes	1	2
Proper values	4,686	3,136
% variance	**58,579**	**39,210**
Cumulative percentage (%)	58,579	**97,789**

The axis 1 (F1) explains itself 58,579 % of total variance, in addition to its negative correclation with pH and positive correlation with dissolved oxygen and nitrites. Here, it is the projected autumn season on this axis, evidenced by the high levels of dissolved oxygen and nitrites and by the low values of pH promoting the

appearance of copepod parasites, namely *Ergasilus briani, Ergasilus sieboldi* and *Neoergasilus longispinosus.* Besides, the axis 2 (F2) explains only 39,210% of total variance and is positively correlated with temprature, amomium and orthohosphate and negatively correlated with nitrites. Nevertheless, the summer is projected on axis 2 and indicated by the increased temprature, levels of amonium and orthophosphate, and by low values of nitate level, promoting thus the appearance of the following copepod parasites: *Ergasilus peregrinus, Ergasilus megaceros, Paraergasilus brevigiditus* and *Lernea cyprinacea.* Furthermore, the two axes reflect an obvious seasonal structuration, showing a significant number of parasites during autumn and summer as compared to those oberved in winter and springer **(Figure 2.).**

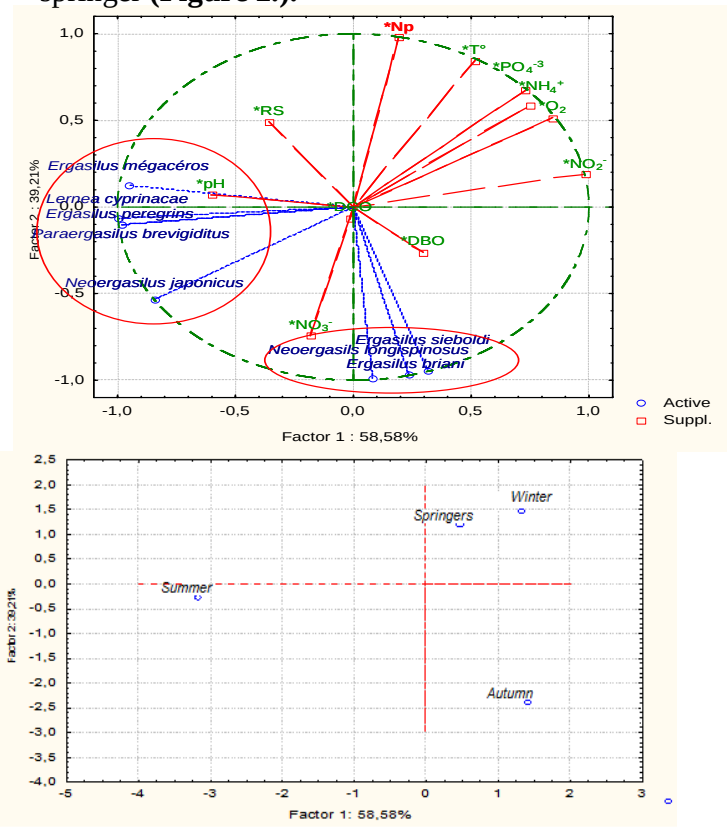

Figure 2: Correlation circle between abiotic factors and the number of individual parasites.

Discussion : The water quality cannot be only expressed by presence of inorganic and organic substances, but also different concentrations of aquatic animals and plants in water **(Wachington, 1984).** Further, the anthropogenic pollutants were found to induce environmental changes and serious stress to fishes, in addition to fish resistance decrease leading consequently to various diseases and essentially, parasitic infections (**Lio-Po and Lim, 2002; Rottmann, 1992)**. The evaluation of physicochemical quality of water is a valuable process for better understanding of the aquatic ecosystem states, since the physicochemical parameters provide water quality indicators, although, they are susceptible to anthropogenic activity variations modifying the water characteristics (**Karrouche , 2007).**

• **Temperature:** The mean temperature during the study period was found to be ranged between 13,73 °C in winter and 25,82 °C in summer. These results are close to those reported mainly during summer period by some authors, including **Khélifi (2018)** in Beni-Haroun and Ain El-Dalia dams, **Mouaissia (2018)** in Beni-Haroun dam, and **Boucenna (2017)** in Ain El Dalia and Foum El Kanga dams. Additionally, **Angelier (2003)** has identified temperature as an important ecological parameter fluctuating in function of seasons and even during the hours of day, as well as it controls nearly the entire physical, chemical and biological reactions and acts against density, viscosity and gas solubility, like water oxygen acting on the development and growth of aquatic organisms. This abiotic factors are related with local climatic conditions, in particular air temperature and water evaporation, and here, **Chaibi, (2004)** has indicated a high air temperature effect on that of water and the existence of warm and cold periods

• **pH:** The pH values of Beni-Haroun dam water were found between 7,43 and 7,68, and are very close to those reported in the work of **Khélifi (2018)** conducted in the same study zone, suggesting that the obtained pH is generally alkaline. Our findings are in line with those of **Mouaissia (2018**) who has indicated that the water pH values of Beni-Haroun dam are ranged

between a minimum of 7,3 and maximum values of 7,9.

• **Dissolve Oxygen :** The dissolved oxygen is one of the useful indicator parameters for water quality and a sensible parameter to water pollution. Also, the oxygen level in the natural environment is somehow, related to the photosynthetic activity of aquatic plants and its dissolution from atmospheric oxygen **(Rodier and *al.*, 2009).**

According to previous researches, the Beni-Haroun dam waters are characterized by high level of dissolved oxygen (116.11mg/l), and hence our findings are in good agreement with those reported by **Khélifi (2018)** and **Mouaissia (2018)** indicating the highest values of dissolved oxygen in this dam waters during summer period (134,78 mg/l). Whilst, **Boucenna (2017)** has noticed low levels of dissolved oxygen in Foum El-Khanga dam due to organic and urban loads which can be reduced through the bacterial decomposition process of the organic matters. **Loup (1974)** has referred these results to the relationship between oxygen and chlorophyll function of aquatic plants, leading to increase dissolved oxygen level and may cause oxygen saturation phenomenon.

• **Nitrates :** Nitrates are considered as pollution indicator, resulting from urban discharges and nitrogen fertilizers used in agriculture, and can be metabolized into nitrite in the body making thus serious human health problems. Our results showed a marked variation in the level of nitrates in Beni-Haroun dam from season to other, i.e this parameter becomes low during autumn and summer and high during springers. Recently, the nitrogenous elements are gradually being consumed, due to the biological production following the rarefaction in these elements in water during the study period. In this regards, **Mouaissia (2018)** has found very significant nitrate levels in Beni-Haroun dam during springers, and **Rodier et *al.*, (2005)** have reported that maximal levels of nitrates during springers are likely related to vegetation abundance and temperature increase promoting the mineralization of organic nitrogen by nitrifying bacteria.

• **Nitrites :** The higher nitrite concentrations often indicates the presence of toxic substances, meanwhile nitrite was reported as a hazard chemical for young fishes, and mainly at concentrations higher than 3mg/l (**De Villers et *al.*, 2005)**. The obtained results showed that nitrite levels in Beni –Haroun dam are varied from 0, 174 mg/l in winter to 0, 390 mg/l in summer. In accordance with our results, **Khelifi (2018)** has reported that the maximal level of nitrite was found to be 0,31mg/l in Beni-Haroun dam during July and August, as well as **Mouaissia (2018)** has found that maximal nitrite levels (0,312mg/l) in the dam waters were significant in August.

• **Ammonium :** Ammonia-nitrogen is the highly reduced inorganic form of nitrogen in water, including dissolved ammonium and ammonium ions NH^{4+}, since the appreciable concentrations of ammonia nitrogen in surface waters indicate overall the proximity of important pollution sources, such as discharges of wastewater **(Etchemine et Boyer, 2002).** Our results revealed that the ammonium levels range from 0,01mg/l in winter to 0,097mg/l in summer, and this concords with the results of **Mouaissia (2018)** noticing, in the same study area, the maximal ammonium levels during August, but **Khélifi (2018)** has reported that the maximal values of ammonium levels in Beni-Haroun and Ain El Dalia dams were found during July and August.

• **Phosphate:** The phosphate element is naturally found in superficial waters at low quantities, determining the productivity of aquatic ecosystems, and it can play an important role in algae development (**Rodier et *al.*, (2005)**. In Beni-Haroun dam, the concentrations of phosphate were found to be 0,0187mg/l in winter and the maximal values were 0,044mg/l in summer, exactly as reported by **Mouaissia (2018)** who found that the highest phosphate concentrations were noticed during August, while **Khelifi (2018)** has found that maximal concentrations of orthophosphates were in July

in Beni-Haroun dam and in March, April and May in Ain El Dalia dam.

- **Dry Residues :** The dry residues were reported as the quantity of solid matter in water, and in other word, is the sum of substances in solution and in suspension containing dry residues, providing brownish and sometimes dark colours to water, leading subsequently to penetration of light in the environment and affect aquatic fauna and flora (**Rodier et *al*., 2005).** The levels of dry residues in Beni-Haroun dam exhibit very close values from season to other with maximal in springers (718mg/l) and minimal values in autumn (809 mg/l), and similarly **Mouaissia (2018)** and **Khelifi (2018)** have found close values to our results in Beni-Haroun dam during the study periods.
- **Chemical Oxygen Demand (COD) :** As previously reported **(Rodier et *al*., 2009),** the chemical oxygen demand (COD) corresponds to the level of the whole oxydable organic matters, expressed by the quantity of oxygen derived from potassium dichromate, and acting mainly in the oxidation process of organic substances (proteins ,carbohydrates, lipids…) present in wastes. Thus, the obtained COD results were defined as important indications of biodegradable pollutants. The average values of COD during the study period were found to be very close and varied from 29.58mg/l in springers to 36.22mg/l in winter, meanwhile **Mouaissia (2018)** and **Khélifi (2018)** have reported during their study periods that the values of COD were ranged from 40 to 44mg/l in Beni-Haroun dam waters.
- **Biological Oxygen Demand (BOD):** The biological Oxygen Demand (BOD5) is defined as the consumed dissolved oxygen by microorganisms in dark and at 20°C during 5 days to decompose the dissolved organic matters or in suspension contained in 1 litter of water, as well as it to evaluate the biodegradable organic matter. The values of BOD found in Beni-Haroun were less than 10mg/l, and so the relatively low values were ranged from 1,83 mg/l in springers and 3.04mg/l in winter. As found by **Khelifi (2018),** the BOD were 4mg/l and 3mg/l, respectively in Beni-Haroun and Ain El-Dalia dams. Regarding the results from grid quality, the waters of Beni-Haroun dam is of acceptable average quality needing simple treatment. In Algeria, the water surfaces are vulnerable to the various pollutions probably contain non-negligible quantities of organic matters either, natural like humid substances or artificial issued from various waste pollutants. Hence, the National Watershed Agency (NWA) (2009) has established a classification grid of superficial water quality in order to provide a good knowledge on the quality and the overall statue of watercourse. Moreover, the Surface Water Quality Assessment System (SWQA) has established an evaluation tool providing a clear and global image of water quality and defining the ability to satisfy the biological balances and the different uses of watercourses. Several previous studies were conducted for providing good appreciation of physico-chemical qualities and assessment of pollution levels of Algerian water dams, and among which those carried out in Mexa and Chefia dams (**Harrat and Achour, 2010),** Zit El-Emba dam (**Harrat et Achour, 2011),** Boukourdane dam (**Ouahchia et *al*., 2015**), Beni-Haroun dam (**Mouaissia, 2016)**, Ain Dalia and Foum El-Khanga dams (**Allalgua et *al*., 2017; Boucenna (2015)** and Ain Dalia and Beni-Haroun dam (**Khelifi, 2018).** Interestingly, some authors (**Guendouz, 1985 ; Guendouz et *al*., 2003; Tabouche and Achour, 2004; Chebbah and Allia, 2015)** have reported the importance of physico-chemical parameters in understanding the composition and function of the aquatic ecosystems.

Statistical analysis

The explanatory method by using Principal Component Analysis (PCA): As can be seen on the factorial card analysis, the first factorial axis is positively correlated with dissolved oxygen and nitrites, and negatively correlated with pH in autumn. The higher levels of dissolved oxygen were observed relatively in warm period of summer and autumn, and appeared likely following the chlorophyll function of aquatic plants, causing increase in the oxygen levels and

can even lead to saturation phenomena promoting the appearance of copepod parasites (*Ergasilus briani*, *Ergasilus sieboldi* and *Neoergasilus longispinosus*). Also, the same analysis has shown on the second axis, a positive correlation with temperature, ammonium and orthophosphate levels, and a negative correction with nitrates in summer. Importantly, the water temperature enhances the aquatic life, although the majority of physico-chemical parameters are strongly related to temperature, and accordingly, R**amadane et *al* (2013**) have suggested that temperature promotes the parasitic proliferation. The ammonium particles come mainly from metabolizing process of nitrogenous compounds and, thus ammonium transforms quickly enough to nitrites and nitrates by bacterial oxidation. The presence of higher concentrations of phosphate in natural waters is a typical index of pollution by synthetic- detergent or phosphate fertilizers, particularly that seen in Beni-Haroun dam. Several authors have reported that the parasitic pathogen effect is related to environment factors (stress and pollution), and therefore these physico-chemical parameters can contribute in the appearance of the copepod parasites (*Ergasilus mégacéros, Ergasilus perigrinis , Paraergasilus brevigiditus* and *Lernea cyprinacea*).

Conclusion and Prospects: The eexamination of 766 fishes belonging to four species; *Luciobarbus callensis, Cyprinus carpio, Carassuis carassuis* and *Abramis brama* from Beni-Haroun dam (Mila city, northeast Algeria) leads us to collect 249 copepod parasites belonged to eight species, namely *Ergasilus sieboldi, Ergasilus briani ,Neoergasilus japonicus Neoergasilus longispinosis* et *Lernaea cyprinacae. Ergasilus megaceros, Parergasilus brevigiditus* and *Ergasilus peregrinus.*

Conclusively, the Examination of the correlation matrix established between various abiotic factors (physico-chemical parameters) and the total parasites leads to highlight the following results:

- ✓ The first axis (factor 1) is negatively correlated with pH (r= -0,60) along with positive correlation with orthophosphate (r=0,72), nitrites (r=0,98), dissolved oxygen (r=0,84) and (r= 0,74).
- ✓ The second axis (factor 2) is positively correlated with ammonium (r=0,58), dissolved oxygen (r=0,51), temperature (r=0,84) and the number of total parasites (r=0,98), and negatively correlated with nitrites (r=-0,74).

Thus, it is noteworthy to focus on the three following points:

- ➢ Extend such a study to other freshwater surface, like dams, Lakes and even rivers in Algerian territories.
- ➢ Include in such a study other teleost fishes of several other families to search for their parasitic copepods.
- ➢ Study the effect of biotic parameters, including sex and age on the parasitic copepod infestations

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