Annals of Parasitology 2016, 62(1), 33–38
doi: 10.17420/ap6201.29

Original papers

First detailed data on metazoan parasites of the rare species short beaked garfish *Belone svetovidovi* (Teleostei: Belonidae) from Tunisian coast, Central Mediterranean Sea

Manel Châari, Hela Derbel, Lassâd Neifar

Laboratory of Biodiversity and Aquatic Ecosystems, Department of Life Sciences, Faculty of Sciences of Sfax, University of Sfax, BP 1171, 3000 Sfax, Tunisia

Corresponding Author: Manel Châari; e-mail: htchaari.m@gmail.com

ABSTRACT. Forty five specimens of the short beaked garfish *Belone svetovidovi*, a rare belonid species largely confused with the garfish *Belone belone* from Tunisian coast Sea were examined for metazoan parasite. Nine metazoan parasites species were identified: one monogenean (*Axine* sp.), 4 digeneans (*Lecithostaphylus retroflexus*, *Tergestia acanthocephala*, *Aponurus laguncula* and *Condylocotyla pilodora* metacercaria), one copepod (*Bomolochus bellones*), one isopod (*Irona nana*), one acanthocephalan (*Telosentis exiguus*) and one nematod *Hysterotylacium* sp. Most of parasite species were new records for *B. svetovidovi* in Tunisia. In the parasite fauna of *B. svetovidovi*, digenean *C. pilodora* metacercaria was the most prevalent species (42%) followed by Monogenea *Axine* sp. (36%). The total length of the host did not influence parasitic infection in *B. svetovidovi*. The metazoan parasite composition of *B. svetovidovi* revealed great similarity than those of *B. belone* from Tunisia supporting same ecological behavior of both hosts.

Key words: *Belone svetovidovi*, metazoan parasite, Tunisia, Mediterranean Sea

Introduction

The short beaked garfish *Belone svetovidovi* Collette and Parin, 1970 is an epipelagic teleost marine fish from the Belonid family. This species distributed worldwide in the eastern Atlantic Ocean and the Mediterranean Sea [1]. In Tunisia, *B. svetovidovi* was recorded by Collette and Parin in the southern coast from Gabes [2]. It was observed by Kartas and Trabelsi in the north and the center, from coast of Bizerte and Monastir and also in lagoon from the Lake of Bizerte and Ichkeul [3]. Generally, belonids are considered of minor commercial importance in Tunisian fish landings. The yield of all species combined represents 0.15% of the total production of pelagic fish and 0.02% of Tunisian fisheries [4]. The rare species *B. svetovidovi* occurs with two others more common belonids, *Tylosurus acus imperialis* (Rafinesque, 1810) and *Belone belone gracilis* Lowe, 1839 (recently reported valid endemic species as *Belone belone* (Linnaeus, 1761) in Froese and Pauly [5]). *Belone svetovidovi* has undoubtedly been mistaken with *B. belone* due to the morphological similarity between the two garfishes [2]. It can be easily distinguished by its smaller and closely spaced teeth on the jaws, lack of vomerine teeth and the high number of gill rakers [6].

In spite of its worldwide distribution, current state of knowledge of *B. svetovidovi* is still incomplete and scarce. The available data on the biological characteristics of this fish is limited to records of the species and to some data on its biometrics [7,8]. So far, in the state of our knowledge there is no complete data on parasitic fauna from *B. svetovidovi* worldwide. The purpose of this paper is to provide the first detailed data on metazoan parasite fauna and infection indices of *B. svetovidovi* from Tunisian coast, central Mediterranean Sea. We also attempt in this study to analyze the parasitism of the host, to evaluate the impact of host's size on some characteristics of the infection, such as prevalence and mean abundance.

Materials and Methods

Between 2004 and 2009, 45 specimens of *Belone svetovidovi* (22.6–44.7 cm) of total length, caught from local fishermen in the eastern coast of Tunisia were examined (Fig. 1). Samples were identified using Collette and Parin [2] and Bauchot [6]. Specimen of *B. svetovidovi* collected from Mahdia in August 2004 was deposited in the National Museum of Natural History of London under the number 381313 USNM.

Fresh fish were subsequently examined for ecto- and endoparasites. Parasitological examination using a stereomicroscope under incident light included the skin, fins, gills, eyes, body cavity and visceral organs (stomach, intestine, liver, swimbladder, gallbladder and gonads). Platy - helminthes were fixed between slide and coverslip in 70% alcohol or in Bouin's fluid. Fixed specimens were stained with Semichon's acetic carmine, dehydrated using a graded ethanol series then cleared in clove oil and mounted in Canada balsam. Other parasites such as, copepod, isopod, nematod and acanthocephalan were directly fixed in 70% alcohol for later examination. Parasites were identified to the lowest taxonomic level possible.

Infection parameters; prevalence (P), mean intensity (MI) and mean abundance (MA) were determined following Margolis et al. [9] and Bush et al. [10]. Analysis was performed to evaluate the infection only for parasites with prevalence > 10%

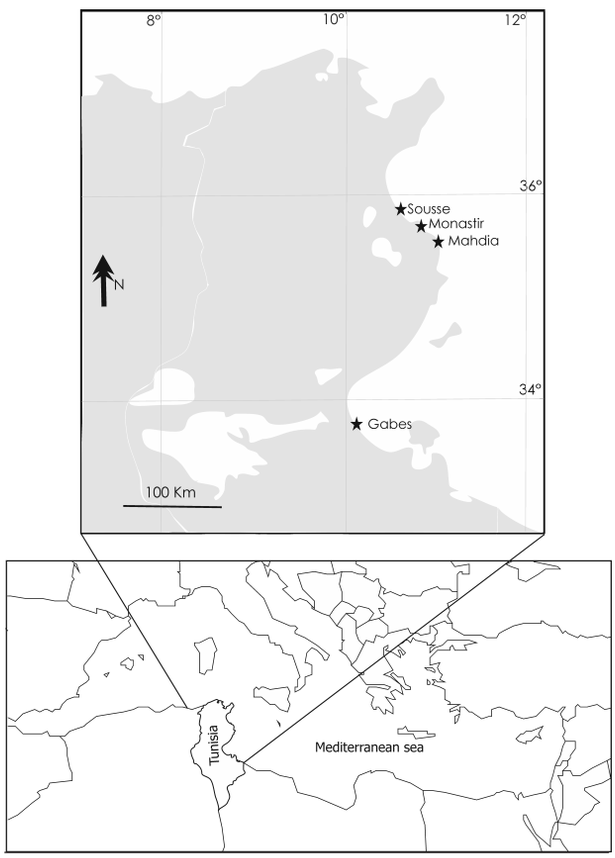

Fig.1. Study area and sampling sites of *Belone svetovidovi* fromTunisia

[11]. Spearman's correlation coefficient (r_S) was used to determine possible correlation between the total length of the host and abundance of parasite. Pearson's correlation coefficient (r) was used as an

Table 1. Prevalence, mean intensity, mean abundance and infection site of the metazoan parasites of *Belone svetovidovi* fromTunisia

Parasite	Site of infection	NHI	P%	MI	MA
Monogenea					
Axine sp.	Gills	16	35.55	4.87	1.73
Digenea					
Condylocotyla pilodora metacercaria	Pericardial sac, Digestive tract	19	42.22	18.68	7.88
Lecitostaphylus retroflexus	Digestive tract	7	15.55	2.57	0.4
Tergestia acantocephala	Digestive tract	4	8.88	1	0.08
Aponurus laguncula	Digestive tract	3	6.66	1.33	0.09
Copepoda					
Bomolochus bellones	Gills	3	6.66	1.66	0.11
Isopoda					
Irona nana	Gills	1	2.22	1	0.02
Acanthocephala					
Telosentis exiguus	Digestive tract	3	6.66	1	0.06
Nematoda					
Hysterotylacium sp.	Digestive tract, Liver	2	4.44	1	0.04

NHI: number of hosts infected, P: prevalence, MI: mean intensity and MA: mean abundance

Table 2. Spearman's correlation coefficient (r_S) and Pearson's correlation coefficient (r) values used to evaluate possible correlation between the total length of *Belone svetovidovi* and mean abundance and prevalence respectively of its parasite species from Tunisian coast

Parasites	rs	*P*	r	*P*
Monogenea				
Axine sp.	0.10	0.493	0.113	0.459
Digenea				
Condylocotyla pilodora metacercaria	0.10	0.510	-0.065	-0.039
Lecitostaphylus retroflexus	0.17	0.260	0.153	0.315

Significant values, $P \leq 0.05$.

indication of the relationships between the total length of the host and prevalence of parasite with previous partition of fish samples into 5 cm length intervals.

Results

In samples of *B. svetovidovi* examined, 70% were found to be infected with parasites. A total of 470 individual parasites present with mean of 10 ± 6 parasites/fish (1–121) was collected. Nine metazoan parasites species were identified in *B. svetovidovi* from Tunisia (Table 1). Infected organs and infection parameters (prevalence, mean abundance and mean intensity) with parasites in *B. svetovidovi* were given in Table 1. Digenean parasites were the most important in the number of individual parasites collected (81% of the total) and in species richness (four parasites species). *C. pilodora* metacercaria was the most prevalent species (42%) followed by monogenean *Axine* sp. (36%) (Table 1).

Spearman's rank (*rs*) and Pearson's (*r*) correlation coefficients indicated no significant correlation of the total host length with the prevalence and the mean abundance of parasites (Table 2).

Excepting copepod *Bomolochus bellones* previously reported by Cressy and Collette (1970), parasite species founded in *B. svetovidovi* are new host records for *Axine* sp., *Lecithostaphylus retroflexus*, *Tergestia acanthocephala*, *Aponurus laguncula*, *Condylocotyla pilodora* metacercaria, *Telosentis exiguus*, *Irona nana*.

Discussion

In this study, we provided the first detailed data on metazoan parasite and infection indices of *B. svetovidovi* from Tunisian coast. Our findings showed that *B. svetovidovi* from Tunisia hosted 9 parasites species (Table 1). Excepting copepod *B. bellones,* parasite species are new records for *B. svetovidovi* in Tunisia. Cressy and Collette reported

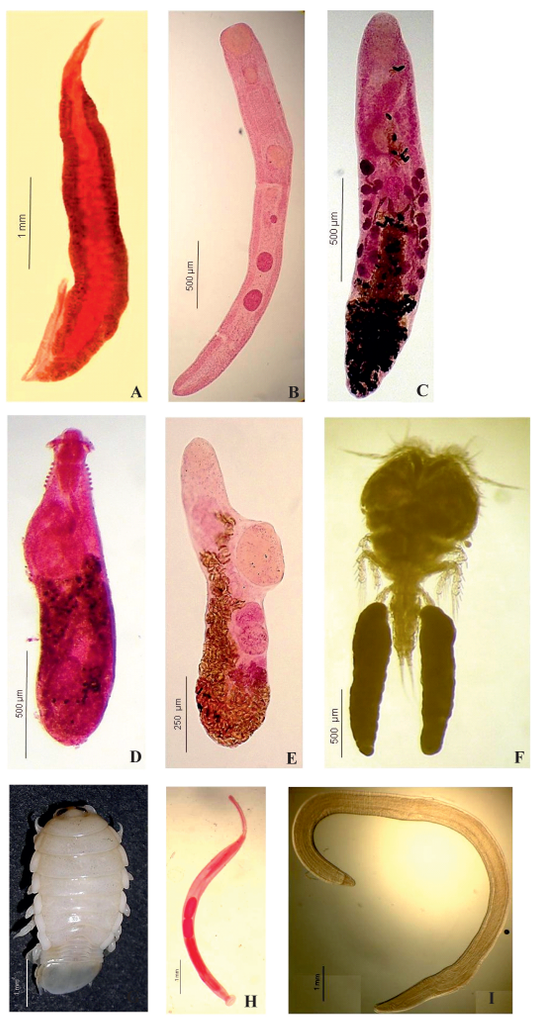

Fig. 2. Photos of metazoan parasites of *Belone svetovidovi* from Tunisia.
A: *Axine* sp., B: *Condylocotyla pilodora* metacercaria, C: *Lecitostaphylus retroflexus*, D: *Tergestia acantocephala*, E: *Aponurus laguncula*, F: *Bomolochus bellones*, G: *Irona nana*, H: *Telosentis exiguous*, I: *Hysterotylacium* sp.

copepods *B. bellones* and *Nothobomolochus gibber* from *B. svetovidovi* of Tunisian and Italian coasts from the Mediterranean Sea and from the Spanish Atlantic coast [12].

The metazoan parasite community of *B. svetovidovi* from Tunisia revealed endoparasite dominance. Indeed, digenean parasites were founded the most abundant in species richness (four parasites species) and in the number of individuals collected (81% of the total). Diversity of Digenea can be related to the diversity of intermediate hosts ingested and therefore a varied hosts diet associated to the carnivorous behavior. Generally, belonids are carnivorous feeding primarily on small fishes which they catch sideways in their beaks [1]. Diet of *B. svetovidovi* has not been previously studied detailly but Dorman just suggested that the diet of *B. svetovidovi* from northern European waters was based on small organisms such as copepods [7]. In the parasite fauna of *B. svetovidovi*, digenean metacercaria *C. pilodora* is the most abundant species. The high infection with *C. pilodora* could be explained by the long life of encysted parasites which may be longer than those of intestinal parasites. Encysted parasites, mainly in muscles and abdominal cavity cannot be released from the host and are therefore accumulated in the organism [13]. The success of *C. pilodora* metacercaria to reach its definitive host could be explained by the pelagic life and the shoaling behavior of this belonids. Pearson and Prévot demonstrated that the life-cycle of *C. pilodora* involves the snail *Cerithium vulgatum*, metacercaria in the pericardial sac of *B. belone*, and adults in the herring gull *Larus argentatus* from the Bay of Marseille, France [14].

In the parasite community of *B. belone* from Tunisia digenean endoparasites have been also founded the most dominant [15]. It has been demonstrated that the diet for *B. belone* is varied in several studies. It is based mainly on crustaceans (amphipods, isopods) and Pisces (Gasterosteidae, Clupeidae, Ammodytidae) in Swedish waters [16]. *Belone belone* from the Aegean Sea is carnivorous based mainly on crustaceans (brachyura, copepod and decapod) followed by teleost fish and other items of terrestrial origin, including insects [17]. Zorica and Cikes Kec founded that most frequent prey items were copepods and decapods in *B. belone* from the Adriatic Sea [18].

The metazoan parasite composition of *B. svetovidovi* revealed great resemblance to those of *B. belone* from Tunisia. Indeed, we identified ten parasite species in *B. belone*: one monogenean *Axine belones*; 4 digenans *Lecithostaphylus retroflexus*, *Tergestia acanthocephala*, *Aponurus laguncula* and *Condylocotyla pilodora* metacercaria; one nematod Anisakid larvae; one acanthocephalan *Telosentis exiguus*; one copepod *Bomolochus bellones* and 2 isopods *Irona nana* and *Nerocila orbignyi* [15]. In addition, Digenea *C. pilodora* metacercaria is the most abundant species in the parasite fauna of both species [15]. Similarity in the parasite infection in both garfishes could be an indicator of their diet resemblance and consequently same ecological behavior but further investigations are needed to confirm this. Dorman mentioned that diet of *B. svetovidovi* is similar to that of *B. belone* but is not enough evidence as yet to confirm due to the few guts available examined [7]. Parasitism similarity in *B. belone* and *B. svetovidovi* advocate that ethological and phylogenetic filters seem not operating. Indeed, hosts which are phylogenetically close share common parasites because of a shared recent evolutionary history. According to Lovejoy et al., both host species have close phylogenic relationship [19].

In the present study, correlations between host total length and prevalence and mean abundance of parasites species in *B. svetovidovi* were not observed. The absence of correlation between host length and parasitism levels may be due to physiological properties of larger individuals. For example, if the physiologic properties of host tissue can not supply the demands of parasitism, growth and development may be limited [20]. Additionally, larger fish may have lower levels of intensity and prevalence due to immunological responses of the hosts [21,22].

Our findings showed that prevalence of infection with monogenean *Axine* sp. in *B. svetovidovi* is more important in the spring season (43%) and less important in the summer (15%). It seems that this monogenean parasite is better suited to lower temperatures. Previous studies have shown that the high temperature of the water appears to act negatively on infestation with Monogenea. Indeed, Bilong-Bilong and Njiné noted mortality of adult monogenea when water temperatures reach 25–26°C in *Hemichromis fasciatus* Peters, 1857 [23]. In addition, the increasing prevalence of Monogena during the rainy season has already been found by Blahoua et al. [24] in *Seratherodon melanotheron* (Ruppel, 1852) from Ivory Coast and

by Obiekezié et al. [25] in *Chrysichthys nigrodigitatus* (Lacepède, 1803) from Nigeria. Moreover, high prevalence of infection with *Axine* sp. in the coldest season may be related to the period of maturation and emission of gametes of *Belone svetovidovi* such as in *B. belone* (March–May) but future research on the reproduction of this species by examining a larger sample is needed. Seasonal changes in the host during reproduction are probably an important factor influencing the host-parasite interaction. In fact, the fish are more susceptible to parasitic infection during periods of reproduction [26].

Acknowledgments

We would like to thank Dr Bruce B. Collette for confirming our initial identification of *B. svetovidovi*.

References

[1] Collette B.B. 2003. Family Belonidae (Bonaparte, 1832) needlefish. Annotated checklist of fish. *Proceedings of the California Academy of Sciences* 16: 1-22.

[2] Collette B.B., Parin N.V. 1970. Needlefish (Belonidae) of the Eastern Atlantic Ocean. Scientific results of the Danish expedition of the coasts of tropical West Africa 1945-1946. *Atlantic Report* 11: 7-60.

[3] Kartas F., Trabelsi M. 1988. Données sur quelques caractères numériques des espèces du genre *Belone* (Poissons, téléostéens) des côtes tunisiennes. *Rapport Communication Internationale de la Mer Méditerranée* 31: 258-258.

[4] Anonymous 2011. Annuaires statistiques des produits de la pêche en Tunisie. Direction Générale de la pêche et de l'aquaculture du ministère de l'Agriculture à Tunis.

[5] Froese R., Pauly D. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (12/2015).

[6] Bauchot M.L. 1987. Vertébrés, Poissons osseux. In: *Fiches FAO d'Identification des Espèces pour les Besoins de la Pêche. Méditerranée et mer Noire. Zone de pêche 37*. (Eds. W. Fischer, M.L. Bauchot, M. Scheinder). Vol. 2, Rome: 976-980.

[7] Dorman J.A. 1987. *Belone svetovidovi* Collette and Parin: a species of garfish new to northern Europe. *Journal of Marine Biology* 67: 679-685.

[8] Meriç N., Altun Ö. 1999. The Garfish, *Belone svetovidovi* Collette and Parin, 1970, new to the Aegean Sea. *Israel Journal of Zoology* 45: 423-426.

[9] Margolis L., Esch G.W., Holmes J.C., Kuris A.M., Schad G.A. 1982. The use of ecological terms in parasitology. *Journal of Parasitology* 68: 131-133.

[10] Bush A.O., Lafferty K.D., Lotz J.M., Shostak A.W. 1997. Parasitology meets ecology on its own terms: Margolis et al. Revisited. *Journal of Parasitology* 83: 575-583.

[11] Bush A.O., Aho J.M., Kennedy C.R. 1990. Ecological versus phylogenetic determinants of helminth parasite community richness. *Evolutionary Ecology* 4: 1-20.

[12] Cressy R.F., Collette B.B. 1970. Copepods and needlefishes: a study in host parasite relationships. *Fishery Bulletin* 68: 347-432.

[13] Muňoz G., Cribb T.H. 2005. Parasite communities and diet of *Coris batuensis* (Pisces: Labridae) from Lizard Island, Great Barrier Reef. *Memoirs of the Queensland Museum* 52: 191-198.

[14] Pearson J.C., Prévot G. 1985. A Revision of the Subfamily Haplorchinae Looss, 1899 (Trematoda: Heterophyidae). III. Genera Cercarioides and Condylocotyla n.g. *Systematic Parasitology* 7: 169-197.

[15] Châari M., Feki M., Neifar L. 2015. Metazoan parasites of the Mediterranean Garfish *Belone belone gracilis* (Teleostei: Belonidae) as a tool for stock discrimination. *Open Journal of Marine Science* 5: 324-334.

[16] Dorman J.A. 1991. Investigations onto the biology of the garfish, *Belone belone* (L.), in Swedish waters. *Journal of Fish Biology* 39: 59-69.

[17] Sever T.M., Bayhan B., Bilge G., Taskavak E. 2009. Diet composition of *Belone belone* (Linnaeus, 1761) (Pisces: Belonidae) in the Aegean Sea. *Journal of Applied Ichthyology* 25: 702-706.

[18] Zorica B., Cikes Kec V. 2012. Preliminary observations on feeding habits of Garfish *Belone belone* (L., 1761) in the Adriatic Sea. *Croatian Journal of Fisheries* 70: 53-60.

[19] Lovejoy N.R., Iranpour M., Collette B.B. 2004. Phylogeny and jaw ontogeny of Beloniform Fishes. *Integrative and Comparative Biology* 44: 366-377.

[20] Olsen O.W. 1974. Animal parasites: their life cycles and ecology. Third edition. Dover Publications, Inc. New York.

[21] Adams A.M. 1985. Parasites on the gills of the plains killifish, *Fundulus kansae*, in the South Platte River, Nebraska. *Transactions of the American Microscopical Society* 104: 278-284.

[22] Luque J.L., Oliva M. 1993. Analisis cuantitativa y estructural de la comunidad parasitaria de *Paralonchurus peruanus* (Pisces: Sciaenidae) en la costa peruana. *Parasitología al día* 17: 107-111.

[23] Bilong-bilong C.F., Njiné T. 1998. Dynamique de populations de trois monogčnes parasites d' *Hemichromis fasciatus* (Peters) dans le lac municipal de Yaoundé et intéręt possible en pisciculture

intensive. *Sciences Naturelles et Vie* 34: 295-303.
[24] Blahoua K.G., N'douba V., Kone T., Kouassi N.J. 2009. Variations saisonnières des indices épidémiologiques de trois Monogènes parasites de *Sarotherodon melanotheron* (Pisces: Cichlidae) dans le lac d'Ayamé I (Côte d'Ivoire). *Science et Nature* 6: 39-47.
[25] Obiekezié A.I., Moer H., Anders K. 1988. Diseases of the African estuarine catfish *Chrysichthys nigridigitatus* (Lacepede) from Cross River Estuary, Nigeria. *Journal of Fish Biology* 2: 203-209.
[26] Neary E.T., Develi N., Özgül G. 2012. Occurrence of *Dactylogyrus* species (Platyhelminths, Monogenean) on *Cyprinids* in Almus Dam Lake, Turkey. *Turkish Journal of Fisheries and Aquatic Sciences* 12: 15-21.

Received 5 January 2016
Accepted 28 February 2016