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Research Article

Dactylogyrus cornu Linstow, 1878 (Monogenea) Infestations on Vimba (*Vimba vimba tenella* (Nordmann, 1840)) Caught in the Sinop Region of Turkey in Relation to the Host Factors

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Abstract: The infestation by a relatively less known monogenean, *Dactylogyrus cornu* Linstow, 1878, was investigated on vimba, *Vimba vimba tenella* Nordmann, 1840 in a small stream pouring into the Black Sea in Sinop, Turkey. A total of 122 fish specimens were examined in June 2000. The overall infestation prevalence and mean intensity levels were 100% and 147.7 ± 7.9 parasites per infested fish, respectively. *D. cornu* was recorded only on the gills of host fish and possible site specificity to the filaments of the second gill arches of the left and right gill arch sets was recorded. The parasite was also found to be settled more on female and larger host fish.

Key Words: *Dactylogyrus cornu*, Monogenea, *Vimba vimba tenella* infestations, vimba

Konakçı Faktörlerine Bağlı Olarak *Dactylogyrus cornu* Linstow, 1878 (Monogenea)'nın Türkiye'nin Sinop Bölgesinden Yakalanan Eğrez Balığı'ndaki (*Vimba vimba tenella* (Nordmann, 1840)) Enfestasyonu

Özet: Nispeten az bilinen bir monogenean olan *Dactylogyrus cornu* Linstow, 1878'in Türkiye'nin Sinop bölgesindeki Karadeniz'e dökülen küçük bir derede bulunan eğrez balığı *Vimba vimba tenella* Nordmann, 1840'taki infestasyonu araştırıldı. Haziran 2000 tarihinde toplam olarak 122 adet balık incelendi. Ortalama infestasyon oranı ve yoğunluğu, sırasıyla % 100 ve 147,7 ± 7,9 parazit / infekte balık olarak belirlendi. *D. cornu* konak balığın sadece solungaçlarında bulundu ve sol ve sağ taraftaki solungaç yaylarından sadece ikinci solungaç yayındaki filamentlere olan muhtemel bir yer seçiciliği tespit edildi. Parazitlerin dişi ve daha büyük balıklarda yerleştiği görüldü.

Anahtar Sözcükler: *Dactylogyrus cornu*, Monogenea, *Vimba vimba tenella*, Eğrez Balığı

Introduction

Monogeneans are widespread parasites throughout freshwater and marine habitats and dactylogyrids are frequently occurring monogeneans that show strict host and site specificity. Interactions between species of the genus Dactylogyrus, their relationships, microhabitat distribution, coexistence, seasonal occurrence and reproduction have been well studied (1-11). The microhabitat of gill-living monogeneans has also been demonstrated by a number of authors (6,10,12-15).

Dactylogyrus cornu Linstow, 1878 is a relatively little known parasite species (4,16,17) and, as far as we are aware, there is no published study on the parasite fauna of *V. vimba tenella*, which is a common fish species in western Turkey. *V. vimba tenella* inhabits brackish coastal waters of the Black Sea for most of the year and its diet includes copepods, crustaceans and benthic worms (18). The vimba breeds between May and July and temperature may be an influential factor in its growth (18). The chemical composition and meat yield of *V. vimba tenella* are valuable for human consumption and it should be considered a valuable cyprinid species (19).

Therefore, there was an opportunity to investigate and obtain more information about the infestations by *D. cornu* of a relatively less studied fish species and the occurrence on females and males as well as different length classes of the host fish.

Materials and Methods

Specimens of *V. vimba tenella* were collected by cast netting in Sırakırkağaçlar stream, which connects with the Black Sea at Sinop. The stream has a brackish water character, especially during autumn, winter and early spring when the water level rises and the stream mouth connects with the Black Sea. In late spring and summer, the stream mouth becomes blocked and the water level drops drastically and turns into fresh water. A total of 122 fish were investigated in June 2000. Caught fish were transported live in aerated local water directly to the Sinop Fisheries Faculty Parasitology Laboratory for parasitological examination. The fish were sacrificed, and weighed, the total length was measured and their sex was determined post-mortem. The gill arches were sequentially dissected from each side and placed onto separate glass microscope slides and the gill filaments were excised from the gill arches. The filaments were wet mounted using local water to obtain thin preparations and studied using a compound microscope (x20). Some specimens were also fixed under the cover slip by adding a drop of ammonium picrate-glycerin to the edge of the cover slip (20). All monogeneans were counted and identified according to the keys given by Yamaguti (16) and Bykovskaya-Pavlovskaya et al. (17). Infestation prevalence (%) and mean parasite intensities are in accordance with Bush et al. (21).

The Kruskal-Wallis test (nonparametric ANOVA) was performed to find out the preference of *D. cornu* for particular gill arches and length classes of host fish. The differences in parasite loading on the combined 4 left and 4 right gill arches as well as on male and female fish were tested statistically by the Mann-Whitney U test (22). All statistical analyses were performed at the significance level of 5% using the program GraphPad InStat 3.00.

Results

Dactylogyrus cornu (Figure) was the only monogenean parasite in the gill filaments of *V. vimba tenella* in the present study. The overall infestation prevalence and mean intensity values were 100% and 147.7 ± 7.9 parasites per infested fish, respectively. The distribution on each gill arch filament was also determined and the data are given in the Table. While there was no statistically significant difference in the mean intensities between the left and right set of gill arch filaments ($P > 0.05$), there was a significant difference between individual arch filaments ($P < 0.05$) (Table).

The distribution of *D. cornu* on male and female fish was recorded and the female had a higher mean intensity value ($P < 0.05$) (Table). It should also be noted that the body length of infested females was larger than that of males, with a statistically significant difference ($P < 0.05$).

Of the 3 different fish length classes studied, 100% infestation prevalence and very close mean intensity values on each length class of fish were determined without any statistically significant preference for any of the length classes ($P > 0.05$) (Table).

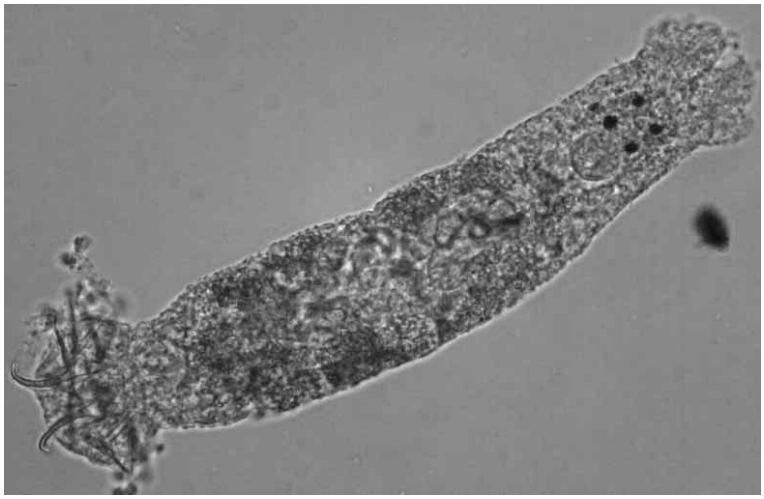

Figure. An individual of *Dactylogyrus cornu* Linstow, 1878. Scale bar = 50 µm

Table. Infestation prevalence (%) and mean intensity levels of *Dactylogyrus cornu* determined from the vimba (*Vimba vimba tenella*) caught in Sırakırkağaçlar stream in Sinop, Turkey.

	Infestation prevalence (%)	Mean intensity ± S.E
Gills		
Left 1	98.4	20.3 ± 1.2^{b}
Left 2	96.7	25.3 ± 1.3^{c}
Left 3	95.1	17.8 ± 1.1^{ab}
Left 4	95.1	14.4 ± 1.1^{a}
Total left	98.4	76.4 ± 4.4^{a}
Right 1	96.7	21.1 ± 1.2^{bc}
Right 2	100	23.3 ± 1.3^{c}
Right 3	93.4	18.8 ± 1.1^{b}
Right 4	95.1	11.8 ± 0.9^{a}
Total right	100	72.6 ± 3.8^{a}
Overall (n = 122)	100	147.7 ± 7.9
Sex of fish		
Female (n = 92)	100	159 ± 8.9^{b}
Male (n = 30)	100	113 ± 15.7^{a}
Length classes of fish (mm)		
≤ 94 (n = 28)	100	145.1 ± 18.3^{a}
95 – 104 (n = 48)	100	129.2 ± 11.4^{a}
≤ 105 (n = 46)	100	168.6 ± 12.9^{a}

Same superscript letter in any statistical comparison shows no significant differences ($P > 0.05$).

Discussion

Dactylogyrus cornu is a natural, but lesser known, monogenean parasite of vimba, *Vimba vimba* L., 1758 (23) and was found to be the only monogenean species in the present study. The overall infestation prevalence and mean intensity levels of *D. cornu* recorded in June were quite high and agree with the findings of a previous study (4), i.e. that the maximum prevalence and intensities were recorded in May and June on *Blicca bjoerkna* L., 1758 and *V. vimba tenella*, and the finding presented by Wierzbicka (24), who noted the highest levels, up to 100%, in late spring and summer on *B. bjoerkna*. The quite high infestation prevalence and intensity levels recorded in the present study could be a result of the high temperature in June (26.4 °C). In addition, possible low water quality, especially during late spring and summer, when the water level dropped considerably and the connection with the Black Sea was broken, caused by some discharges from the scarce settlements around the stream, may be another factor. At this point, a solution to be recommended to decrease the prevalence and parasite intensity may be the re-establishment of the connection to assure water current between the stream and the Black Sea.

Most species of monogeneans are restricted not only to a particular host but also to a particular part of the host body. Wiles (14) for *Diplozoon paradoxum*, Wootten (3) for *D. amphibothrium* and Buchmann (6) for *Pseudodactylogyrus bini* and *P. anguillae* reported a preference for either the left or right set of gills. However, it was not the case for *D. cornu* in the present study that no significant preference was found for either set of gills of *V. vimba tenella*. On the other hand, similarly greater and statistically significant numbers of *D. cornu* occurred on the filaments of the second gill arches of both sides. Wootten (3) and Paling (25) experimentally found that greater volumes of water passed over the second and third gill arches. Differences between the distribution of monogenean species and site specificity on the gill arches have also been suggested to be influenced by the hydrostatic pressure of the branchial pump, coughing action and water current over the gill surface during the respiratory cycle (3,25,26). The result obtained in this study that the greatest number of *D. cornu* occurred on the filaments of the second gill arches of both sides could be explained by the reasons mentioned above.

The physiological state of the host has a very important influence on infestation with Dactylogyrus. Pickering and Christie (27) suggested that factors such as mucus, colour and hormonal status of fish are also important in the infestation of fish of both sexes. According to their findings on the skin parasites of spawning mature male brown trout, *Salmo trutta*, these males had higher prevalences and intensities of infestation over levels observed for females and immature fish. The reason given by Pickering (28) for this is that the epidermis of the fish undergoes rhythmical changes in thickness during successive spawning cycles, but males have a significantly thicker epidermis than females for most of the year. During the spawning period, however, the number of mucous epidermal cells in the male drops significantly. On the other hand, Yoon (29) found that *Entobdella hippoglossi* had higher

infestation levels on females than those recorded on males of the Atlantic halibut, *Hippoglossus hippoglossus* L., 1758, and attributed this difference to the active spawning behaviour of males making it difficult for oncomiracidia to settle on *E. hippoglossi* or causing the parasite fall off. Özer and Erdem (11) observed 6.7% of Dactylogyrus post-larvae on the skin of carp, *Cyprinus carpio* L., 1758, and noted that Dactylogyrus species used the skin as an initial attachment site until they migrated to their final place, the carp's gills. In the case of gill-living *D. cornu*, female fish had higher infestation intensity than the males, with statistically significant levels contrary to the findings of Özer (10) for *D. extensus* and *D. anchoratus*. However, it is not clear how the oncomiracidia of *D. cornu* reached the gills of the host fish and settled especially on the filaments of the second gill arches of both sides of the gill sets.

One of the most important factors influencing the composition of the parasite fauna is age or size of host. The prevalence and abundance of Dactylogyrus are often higher on older rather than younger fish. In some cases this may simply reflect the greater surface area of gill available for the establishment of the parasites (8), an increase in water flow over the gills in older fish (30) and larger individuals having higher physical (ventilation volume) and chemical (mucus) stimuli which increase gill's attractiveness by providing more food (31). Yunchis (32) found that the intensity of several Dactylogyrus species, such as *D. nanus* and *D. crucifer*, is higher on older roach, *Rutilus rutilus* L., 1758. Lo et al. (33) reported a positive relationship between 3 different monogenean species (*Heliotrema* sp1, sp2, sp3) in respect of their abundance and host body length for 3 coral reef fish species. *D. cornu* was also recorded at its highest prevalence and intensity on the largest host fish in the present study in agreement with the above-mentioned authors and possibly for the reasons given above.

In this study, the infestation by *D. cornu* of *V. vimba tenella*, a relatively less studied fish species, is determined in all means in a precise part of Sinop and this study is the first giving information of this kind in Turkey. According to the findings of Diler and Becer (19) on the chemical composition and meat yield of *V. vimba tenella* in Karacaören I Dam Lake, this fish species should be considered a valuable cyprinid species, at least in that region, and it has a valuable meat composition for human consumption. Thus, research studies should be expanded to help us understand such a valuable fish species' parasitological fauna.

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References

1. Paperna, I.: Competitive exclusion of *Dactylogyrus extensus* by *Dactylogyrus vastator* (Trematoda, Monogenea) on the gills of reared carp. J. Parasitol., 1964; 50: 94-98.
2. Paperna, I.: Adaptation of *Dactylogyrus extensus* (Mueller and Van Cleave, 1932) to ecological conditions of artificial ponds in Israel. J. Parasitol., 1964; 50: 90-93.
3. Wootten, R.: The spatial distribution of *Dactylogyrus amphibothrium* on the gills of ruffe, *Gymnocephalus cernua* and its relation to the relative amount of water passing over the parts of the gills. J. Helminthol., 1974; 48: 167-174.
4. Chubb, J.C.: Seasonal occurrence of helminths in freshwater fishes Part I. Monogenea. Adv. Parasitol. 1977; 15: 133-199.
5. Hanzelova, V., Zitnan, R.: Epizootiologic importance of the concurrent monogenean invasions in the carp. Helminthology, 1985; 22: 277-342.
6. Buchmann, K.: Spatial distribution of *Pseudodactylogyrus anguillae* and *P. bini* (Monogenea) on the gills of the European eel, *Anguilla anguilla*. J. Fish Biol., 1988; 32: 801-802.
7. Koskivaara, M.: Environmental factors affecting monogeneans parasitic on freshwater fishes. Parasitol. Today, 1992; 8: 339-342.
8. Koskivaara, M., Valtonen, E.T., Vouri, K.M.: Microhabitat distribution and coexistence of Dactylogyrus species (Monogenea) on the gills of roach. Parasitology, 1992; 104: 273-281.
9. Pojmanska, T.: Infection of common carp and three introduced herbivorous fish from Zabienic fish farm in relation to their sizes. Acta Parasitol., 1994; 39: 16-24.
10. Özer, A.: Co-occurrence of *Dactylogyrus anchoratus* Dujardin, 1845 and *Dactylogyrus extensus* Mueller & Van Cleave, 1932 on common carp (*Cyprinus carpio* L., 1758). Helminthology, 2002; 39: 45-50.
11. Özer, A., Erdem, O.: The relationship between occurrence of ectoparasites, temperature and culture conditions; a comparison of farmed and wild common carp (*Cyprinus carpio* L., 1758) in the Sinop region of northern Turkey. J. Nat. Hist., 1999; 33: 483-491.

12. Llwellyn, J.: The host specificity, micro-ecology, adhesive attitudes and comparative morphology of some trematode gill parasites. J. Mar. Biol. Ass. U.K., 1956; 35: 113-127.

13. Llwellyn, J., Owen, I.L.: The attachment of the monogenean *Discocotyle sagittata* Leuckart to the gills of *Salmo trutta* L. Parasitology. 1960; 50: 51-59.

14. Wiles, M.: The occurrence of *Diplozoon paradoxum* Nordmann, 1832 (Trematoda: Monogenea) in certain waters of northern England and its distribution on the gills of certain Cyprinidae. Parasitology. 1968; 58: 61-70.

15. Hanek, G., Fernando, C.H.: Seasonal dynamics and spatial distribution of *Urocleidus ferox* Mueller, 1934, a gill parasite of *Lepomis gibbosus* (L.). Can. J. Zool., 1978; 56: 1241-1243.

16. Yamaguti, S.: Systema Helminthum. Volume 4. Monogenea and Aspidocotylea. Interscience Publishers, New York, London. 1963.

17. Bykovskaya-Pavlovskaya, I.E., Gusev, A.V., Dubinina, N.A., Izyumova, T.S., Smirnova, I.L., Sokolovskaya, G.A., Shtein, G.A., Shulman, S.S., Epshtein, V.M.: Key to Parasites of Freshwater Fish of the U.S.S.R. Part I, Translated by Israel Program for Scientific Translations, Jerusalem, 1964.

18. Geldiay, R., Balık, S.: Türkiye Tatlısu Balıkları. Ege Üniversitesi Su Ürünleri Fakültesi Yayınları, No: 46, 1996.

19. Diler, A., Becer, Z.A.: Chemical composition and meat yield of *Vimba vimba tenella*, Nordmann, 1840 in Karacaören I Dam Lake. Turk. J. Vet. Anim. Sci., 2001; 25: 87-92.

20. Malmberg, G.: On a new genus of monogenic trematodes. Arkiv für Zool., 1957; 10: 317-329.

21. Bush, A.O., Lafferty, K.D., Lotz, J.M., Shostak, A,W.: Parasitology meets ecology on its own terms: Margolis et al. Revisited. J. Parasitol., 1997; 83: 575-583.

22. Zar, F.G.: Biostatistical Analysis. Prentice-Hall, Englewood Cliffs, N.J., 1984.

23. Gibson, D.I., Tatjana, T.A., Gerasev, P.I.: A catalogue of the nominal species of the monogenean genus Dactylogyrus Diesign, 1850 and their host genera. Syst. Parasitol., 1996; 35: 3-48.

24. Wierzbicka, J.: Monogenoidea of gills of certain Cyprinidae fish species. Acta Parasitol. Polon., 1974; 12: 149 -163.

25. Paling, J.E.: A method of estimating the relative volumes of water flowing over the different gills of a freshwater fish. J. Exp. Biol., 1968; 48: 533-544.

26. Hughes, G.M., Shelton, G.: The mechanism of gill ventilation in three freshwater teleosts. J. Exp. Biol., 1958; 35: 807-823.

27. Pickering, A.D., Christie, P.: Sexual differences in the incidence and severity of ectoparasitic infestation of the brown trout, *Salmo trutta* L. J. Fish Biol., 1980; 16: 669-683

28. Pickering, A.D.: Seasonal changes in the epidermis of brown trout, *Salmo trutta* (L.). J. Fish Biol., 1977; 10: 561-566.

29. Yoon, G.H.: Studies on the monogenean *Entobdella hippoglossi* Müller, 1776, parasitising a commercially important cultured fish, the Atlantic halibut, *Hippoglossus hippoglossus* L., 1758. PhD Dissertation. University of Stirling, U.K. 1998.

30. Beamish, F.W.: Respiration of fishes with special emphasis on standard oxygen consumption. II. Influence of weight and temperature on respiration of several species. Can. J. Zool., 1964; 42: 177-188.

31. Kearn, G.C.: Experiments on host finding and host-specificity in the monogenean skin parasite *Entobdella soleae.* Parasitology, 1967; 57: 585-605.

32. Yunchis, O.N.: Some ecological factors affecting the monogenean infection of roach. In: Investigation of Monogeneans in the USSR (Scarlato, O.A. Ed.) Leningrad: Vsesoyuznogo Simpoziuma po Monogeneyam. 1988: 62-65.

33. Lo, C.M., Morand, S., Galzin, R.: Parasite diversity/host age and size relationship in three coral-reef fishes from French Polynesia. Int. J. Parasitol., 1998; 28: 1695-1708.