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THE FOOD AND FEEDING HABITS OF THE SCULPIN-PERCH OR ROMANIAN DARTER *ROMANICHTHYS VALSANICOLA* (PISCES: PERCIFORMES: PERCIDAE)

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L'analyse du contenu des intestins chez des exemplaires de collection de *Romanichthys valsanicola* et l'application de tests statistique pour les données obtenues ont démontré certaines préférences trophiques ainsi que pour l'habitat. Les observations effectuées sur le terrain *(in situ)* concernant l'éthologie de l'espéce, corrélées avec la morphologie du tractus digestif confirment les particularités du mode de se nourrir.

Due to a continuous deterioration of its habitat, especially by hydrotechnical works, the area of the endemic species *Romanichthys valsanicola* Dumitrescu, Bănărescu and Stoica, 1957, (Fig. 1) is very

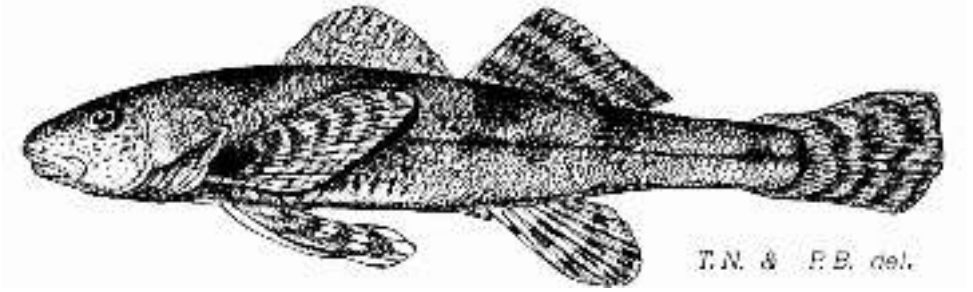

Fig. 1 – *Romanichthys valsanicola*, River Vâlsan, Muşeteşti, adult male, 108 mm standard length (in pen and ink by Petru Bacalu after a pencil drawing of Teodor T. Nalbant).

restricted to a single river, Vâlsan, in the cachement of river Argeş. At present this unique population is very poor due to local pollution, a dam built upstream of Brădet which retain a great amount of water, local exploatation of the big stones for constructions, occasional poisoning etc. Although the sculpin-perch never represented a species with fishing

interest, it was occasionally caught by local fisherman. Therefore the size of Vâlsan population was drastically reduced.

In order to evaluate the present state of this population, two major expeditions were performed in October-November 1989 and in October 1992. Both expeditions were organised by Dr Adrian Georgescu (NGO "People and Environment", Ploiești) and were made along the Vâlsan river between Brădet and Mușetești. In both expeditions 12 specimens were collected in all (see Perrin and all., 1993, Bănărescu and all., 1994 and Stănescu, 1995).

Unfortunately, the sculpin-perch was discovered too late (1956) when already it was relatively a rare species, present only in three rivers: Argeș, Vâlsan and Doamnei. Therefore no aspect of its life history was studied.

Since in the ichthyological collection of the Institute of Biology, Bucharest, the stomach and gut contents of 34 specimens of sculpin-perch were preserved in ethanol 72%, we are able to study some aspects in the feeding of this species. All these specimens were collected in the river Argeș, around the locality Oiești between 1959 and 1961. The specimens are now in different collections from Romania or other countries (see Table 1).

Table 1

Collection Data

Nr.	Sex	S.L. (mm)	Scientific collection	Trophic preference	Collectind data
1	2	3	4	5	6
4	♂	90.8	LU Moskov	P	June-August, 1959
6	♀	99.0	NHM, Budapest	P	„
77	♂	81.5	NHM, Budapest	P	„
8	♂	94.5	USNM; Washington	P, T	„
10	♀	84.5	University Hanoi	P, E, T, B, C	„
11	♀	82.5	University Hanoi	E, T, B	„
13	♀	91.0	BMNH, London	P, E	„
14	♀	97.2	BMNH, London	P, E, T, B	„
15	♀	90.0	BMNH, London	E, T, B	„
19	♂	94.0	UMMZ, Ann Arbor	G, P, E, T	„
20	♀	91.0	CNMH, Chicago	P, E, B	„
21	♀	91.0	CNMH, Chicago	E, B, C	„
22	?	72.5	CNMH, Chicago	O, E	„
–	♀	86.0	MNHN, Paris	P, E, B	„
36	♀	84.8	UCMZ, Cluj	E, T, C	August, 1960 May, 1961
40	♀	78.5	TU, New Orleans	P, E	„
27	♂	82.0	CU, Praha	P, E, T, C	–
28	♂	70.0	LR, Bratislava	E	–
29	♀	62.8	LR, Bratislava	E	–
30	♀	64.0	UBU, Ulan-Bator	P, E, C	October, 1960
31	♂	62.0	UBU, Ulan-Bator	P, E	„
32	♀	90.0	AMNH, New York	E, T, B, C	June-July, 1961

33	♂	83.0	AMNH, New York	T, B	"
34	♀	84.0	AMNH, New York	E, T, B, C	"
37	♀	87.0	RMNH, Leiden	P, E, T, C	"
38	♀	84.0	RMNH, Leiden	P, E, T, B, C	"
39		83.0	RMNH, Leiden	E, T, B	"
41	♀	82.0	TU, New Orleans	P, E, C	August, 1960
					May, 1961
43	♂	78.0	Prof. H. Kobayasi	P	
44	♂	88.3	Prof. H. Kobayasi	–	"
45	♀	67.0	LU, Moskow	E, C	March-July, 1960
46	♀	62.5	LU, Moskow	P, E, C	"
47	♂	61.5	LU, Moskow	P, E, C	"
48	♀	79.0	–	G, E, B	1961–1962, winter

Abbreviations:
O = Oligocheta; G = Gammaridae; P = Plecoptera; E = Ephemeroptera; T = Trichoptera; B = Blehariceridae; C = Chironomidae.

For the present contribution we have studied also the morphology of digestive tract (Fig. 2) of the following species and specimens:

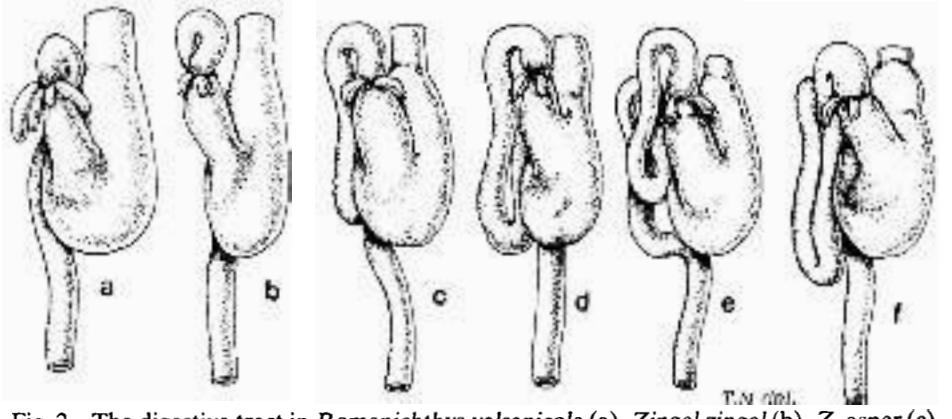

Fig. 2 – The digestive tract in *Romanichthys valsanicola* (a), *Zingel zingel* (b), *Z. asper* (c), *Z. streber* (d) *Z. nerensis* (paratype, e), *Z. balcanicus* (f).

Romanichthys valsanicola, Romania: river Vâlsan, Muşeteşti, two: 76.5 and 81.2 mm SL.

Zingel zingel, Romania: river Timiş, Cruceni, one: 76.0 mm SL.

Zingel streber, Romania: river Timiş, Peciul Nou, one: 93.0 mm SL.

Zingel nerensis, Romania: river Nera, Sasca Montana, one (Paratype): 90.0 mm SL.

Zingel balcanicus, Macedonia: river Vardar, two: 99.0–126.0 mm SL.

Zingel asper, France: river Rhone, Canal Miritrel, one 100.0 mm SL.

Morphology of digestive tract

In *Romanichthys valsani*cola the digestive tract is similar enough in shape and size with those of the species of its closely related genus *Zingel.*

The tongue is a relatively thick muscular mass covered by numerous taste buds. In all species of the genus *Zingel* the tongue is more slender.

The teeth are relatively small, uniform but very acute and slightly curved, present on premaxillaries dentaries, premover, palatines and pharyngials. There are no canines on the jaws.

The oesophagus is a short tube, the stomach is syphonal and the pylor area with a few short coeca. The intestine is straight, without loops (Fig. 2 a). Among the species of *Zingel* only *Z. zingel* has no loops.

The habits of larval stages in the water

During the last expedition on the river Vâlsan (1992, *"The Expedition of the Last Chance")* one of us (T. T. N.) made a number of dives, together with Dr K. P. Zsivanovits, near Brădet, especially in the points where the first specimens of sculpin-perch were collected. These dives were made in order to observe the diurnal activity of lotic invertebrates, especially of the larval stages of aquatic insects.

We have seen, due to the strong current of water, a continuous "horizontal rain" of larval stages of Trichoptera (caddisflies, mainly Rhyacophilidae) and Plecoptera (stoneflies, only Perlidae). The larvae of these two groups are moving on the surface of stones and then are snatched by the water current and drifted until a new hard support. The current is so strong that it can transport the rhyacophilid larvae together their heavy tubes or relatively large pebbles on the ground or can move in their place, in a hellicoidal motion, the plate-like stones with about 12–15 cm diameter.

This horizontal rain of insect larvae possibly is due to the diurnal activity of these animals. In this mode the larvae can move from place to place in searching food or other shelter. It is very interesting that we have not seen, (or very seldom) ephemeroptera larvae, although these are permanently present under the stones. We think that it is due to a nocturnal activity of these insects. During the night they leave their shelters and grazing the epibiose on the surface of the stones.

The composition of food in *Romanichthys valsanicola*

The analyse of stomach contents revealed from 552 specimens of invertebrates contained in 34 samples, 67% belong to larval may flies (Ephemeroptera) and 10.9% to larval stoneflies (Plecoptera) (Table 2, Table 3). The rest of 21.5% belong to other groups of invertebrates: net-winged midges (Blephariceridae) 10%, caddisflies (Trichoptera) 7%,

Table 2

Check-list of the identified taxa

OLIGOCHAETA

1. Fam. Lumbricidae Gen. Sp.

CRUSTACEA AMPHIPODA

2. Fam. Gammaridae Gen. Sp.

INSECTA

PLECOPTERA

Fam. Leuctridae

3. *Leuctra sp.*

Fam. Nemouridae

4. *Nemurella pictetii* (Klapalek, 1900)
5. *Protonemura intricata* (Ris, 1902)

Fam. Perlidae

6. *Perla bipunctata* Pictet, 1833
7. *Perla marginata* (Panzer, 1799)

Fam. Chloroperlidae

8. *Chloroperla tripunctata* (Scopoli, 1763)

EPHEMEROPTERA

Fam. Baetidae

9. *Baetis sinaicus* (Bogoescu, 1931)
10. *Baetis lutheri* Muller-Liebenan, 1967
11. *Baetis rhodani* Pictet, 1843–45
12. *Baetis buceratus* Eaton, 1870

Fam. Heptageniidae

13. *Epeorus sylvicola* (Pictet, 1865)
14. *Rhithrogena semicolorata* (Curtis, 1834)
15. *Ecdyonurus dispar* (Curtis, 1834)
16. *Ecdyonurus venosus* (Fabricius, 1775)

Fam. Ephemerellidae

17. *Ephemerella ignita* (Poda, 1761)

Fam. Ephemeridae

18. *Ephemera danica* Muller, 1764

TRICHOPTERA

Fam. Rhyacophilidae

19. *Rhyacophila nubila* (Zetterstedt, 1840)
20. *Rhyacophila sp.*

Fam. Philopotamidae

21. *Philopotamus montanus* (Donovan, 1813)
22. *Wormaldia occipitalis* (Pictet, 1834)

Fam. Hydropsychidae

23. *Hydropsyche pellucidula* (Curtis, 1834)
24. *Hydropsyche sp.*

Fam. Limnephilidae

25. *Stenophylax permistus* McLachlan, 1895

Fam. Leptoceridae

26. *Athripsodes sp.*

DIPTERA

27. Fam. Blephariceridae Gen. Sp.
28. Fam. Chironomidae Gen. Sp.

Table 3

Numeric values of the identified taxons

Nr. crt.	Taxons identified in the gut content	*Rommichthys rubaricola* specimens																																Σ	F%
1	LUMBRICIDAE																							1										1	
2	GAMARIDAE	–	–				2											1																3	
3	*Leuctra* sp.	–	–	–	–	–	–	–	–	–	3																							3	
4	*Nemurella picteti*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	1	–	1	–	–	–	–	10	
5	*Protonemura lentiena*	–	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	
6	*Perla bipunctata*			4		4	–	–	1	–	–	–	2	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12	14
7	*Perla marginata*						–	–	–	–	–	–	–	–	2	2	1	–	2	–	–	1	1	–	1	8	1	1			1	1	1	1	22	41
8	*Chloroperla tripunctata*										1				2	2																		6	
9	*Baetis sinuatus*	2										1				1																		7	
10	*Baetis fuscatus*			3												2																		5	
11	*Baetis rhodani*	–	3	–	3	6	–	6	–	–	–	3	8	4	4	3	2	–	–	3	–	–	–	1	–	–	–	–	–	1	–	–	–	–	47	37
12	*Baetis buceratus*	–	–	–	3	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	
13	*Epeorus sylvicola*	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	2	
14	*Rhithrogena semicolorata*	4	31	3	37	53	–	6	15	–	–	19	6	8	5	3	6	1	1	3	25	–	–	3	–	–	3	10	8	2	1	6	1	2	13	3	259	83
15	*Ecdyonurus dispar*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	
16	*Ecdyonurus venosus*		2																																3	
17	*Ephemerella ignita*		1																																1	
18	*Ephemera danica*																									1	–	–	–	–	–	–	–	–	1	
19	*Rhyacophila nubila*																	1																	1	
20	*Rhyacophila* sp.	–	–	–	5	–	–	–	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	3	–	–	–	–	13	17
21	*Philopotamus montanus*	–	–	–	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	
22	*Wormaldia occipitalis*	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	
23	*Hydropsyche pellucidula*				2		–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	–	2	1			1	1			–	–	8	17
24	*Hydropsyche* sp.										1																								1	
25	*Stenophylax permistus*	1																																	1	
26	*Athripsodes* sp.	1	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	
27	BLEPHARICERIDAE	–	–	2	8	5	3	1	–	3	1	–	–	3	–	6	–	–	–	–	1	–	–	–	–	–	–	7	–		1	–	1			1	52	40
28	CHIRONOMIDAE	1	1	8	1	1	–	1	1	–	–	2	–	2	–	–	–	2	1	1	–								4	–	–	3	–	–	–	–	26	37
	Σ	12	62	48	80	72	4	16	17	4	2	31	21	17	14	19	11	4	5	7	27	1	1	8	1	11	6	20	21	4	6	8	3	2	13	4	552	4
	Abundance value for *R. semicolorata* (%)	33	82	27	54	72	–	37	88	–	–	61	28	47	35	16	54	25	20	42	92	–	–	63	–	–	50	50	38	50	16	75	33	100	100	75	100	75

nonbitflies (Chironomidae) 5.4%. Oligochaet-worms and gammarid amphipods have non-significant values. The group which dominate in diet of sculpin-perch is evidently those of mayflies. In this group, the greatest amount is given by *Rhithrogena semicolorata,* 78%. It is followed by *Baetis*

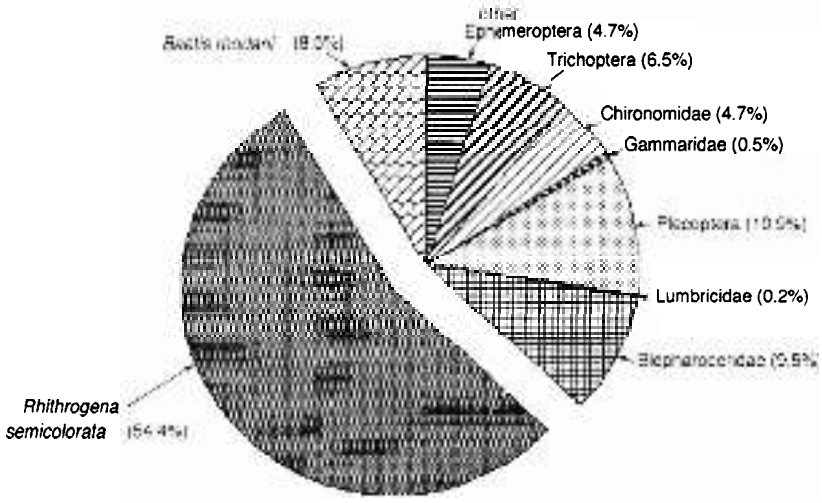

Fig. 3 – The food components of *Romanichthys valsanicola.*

rhodani (16%). In all samples the bodies or fragments of *R. semicolorata* appear with a frequency of 83%. It results that the sculpin-perch feeds preponderantly with this species or in other words it has a selectivity for this mayfly. It reveals on the other hand, an excellent ecological condition of the river. We tryed to identify some conections, according the habits of *Romanichthys valsanicola,* between the most frequent species *(Rhithrogena semicolorata)* and other species in order to evaluate its trophic preferance. Therefore, we utilized the rank correlation coeficient of Spearman (Daniel, 1987), i.e. the Fisher's test (see Gremy and Salmon, 1969).

An application of the statistical test on the food analyses gaves following results:

– the Sperman coefficient of ranks correlation between the number of the specimens of *R. semicolorata* and of Blephariceridae, in each sample, is 0.57. This represent a significant correlation if we assume the risk of 10%. On the other hand, the result confirms the assumations that the sculpin-perch is feeding especially with larvae strongly attached on hard surfaces or it is a night feeder.

– the same test confirmed the existance of a correlation between *R. semicolorata* and *Baetis rhodani* but with a smaller value (Rs = 0.42) with a risk of 0.2%. For chironomids there is no correlation.

Habits in feeding process of the sculpin-perch

The arrangemens of teeth in the mouth and pharyngeal area as well as the size of stomach and gut in *Romanichthys valsanicola*, denotes a carnivorous and voracious species which is feeding with lotic invertebrates.

According to analysed samples the adults of sculpin-perch are at first particulate feeders but the predation is not obligatory size-selective. On the other hand, observations in the aquaria of many specimens, revealed that it is a nocturnal-active species, moving constantly from place to place but without agitation (pers. inf. of Drs Adrian Georgescu, Rudiger Bless and Klaus Zsivanovits). We suppose that it is not a foraging species, the pray being individuality detected, attacked and rapidly engulfed. At night, during the searching for food, possibly the fish is not visually orientated but it fills the prey with numerous taste buds placed on its lips and around them including in the mouth cavity. On the other hand, the larval stages of mayflies, especially of *Rhythrogena semicolorata,* have also a nocturnal activity for feeding when leave their shelters and are moving on the surface of stones. Generally these sufaces are covered with a epibiose or a periphytal layer. This layer with very active algal life, mainly diatoms, is grazed by mayfly larvae. When leave their shelters (generally macroporal spaces such as tubes, underface of stones, crevices) the mayfly larvae reach in the zones of activity of sculpin-perch. It is easy for it to catch them.

It is very interesting that the sculpin-perch and the larval stages of perlid stoneflies are feeding with the same group of larvae, mayflies (obs. N. G.) but they have different strategies in catching the prey, in order to avoid the competition.

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HRANA ŞI OBICEIURILE DE HRĂNIRE LA ASPRETE *(ROMANICHTHYS VALSANICOLA)* (PISCES: PERCIFORMES: PERCIDAE)

REZUMAT

Este prezentată analiza stomacală a peste 30 de exemplare de *Romanichthys valsanicola* din râul Argeş. Peste 60% din hrana acestei specii a fost formată din exemplare de efemeroptere *(Rhithrogena*

semicolorata, Baetis rhodani şi alte specii). Autorii prezintă rezultatele unor observaţii directe în râul Vâlsan asupra activităţii diurne a unor larve de insecte care intră în componenţa hranei lui *Romanichthys valsanicola.*

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