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**Preliminary data on embryological and  
larval development of black scorpionfish  
*Scorpaena porcus* (Linnaeus, 1758)**

Preliminarni podaci o embrionalnom i larvalnom razvitku  
škrpuna *Scorpaena porcus* (Linnaeus, 1758)

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*Spontaneously spawned eggs of black scorpionfish (Scorpaena porcus) from aquarium were incubated of  $20.5 \pm 0.3^{\circ}\text{C}$ , ambient salinity (38 ‰), and natural light and photoperiod. Duration of embryogenesis from the time of stocking in the experimental jar (gastrulation stage) was 1.91 day. The total length of newly hatched larvae ranged from 2.21 to 2.33 mm (mean  $2.27 \pm 0.036$  mm).*

*Yolk-sac resorption time was 4.89 days. All postlarvae, kept on rotifers for four to five days after yolk-sac resorption, died. Growth parameters of larvae were approximated by Gompertz equation ( $a = 3.04$ ,  $b = 0.2535$ ,  $c = 0.6821$ ).*

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## INTRODUCTION

A number of reports have been published on black scorpionfish *Scorpaena porcus*: their spatial and temporal distribution in plankton, description of developmental stages.

The data on the appearance of the eggs and larval stages in plankton were published for the Mediterranean by Lo Bianco (1909), Fage (1918), Sparta (1956), Lee (1966), for the Adriatic by Karlovac (1967), Regner (1982), and for the Black and Azov Sea by Zernov (1913, after Dehnik, 1973), Borcea (1933), Vodianitzkii (1930, after Dehnik, 1973), Kosiakina (1938, after Dehnik, 1973), Oven (1959, after Dehnik, 1973), Dehnik and Pavlovskaja (1950, after Dehnik, 1973), Duka (1959) and Dehnik (1973).

According to Raffaele (1880), who first described their eggs, they were ellipsoid and planktonic, floating at the surface connected in mucus. Lo Bianco (1909) gave the first description of fry but only from 15 mm in length. Fage (1918) described larvae of scorpionfish from 4 to 15 mm in length. Detailed description of the eggs, larvae and fry, including meristic and morphometric characteristics was given by Sparta (1956). Irrespective of a large number of papers the data on the duration of developmental stages of black scorpionfish are rather rare and could be found in the paper by Dehnik (1973), dealing only with egg development duration.

Since the duration of egg development and larval and postlarval growth characteristics are necessary for the studies of survival of fish planktonic stages, we believed it useful to publish the data on egg development and larval growth rate of this species, irrespective of their preliminary character.

## MATERIAL AND METHODS

One female of black scorpionfish spawned spontaneously in the night of 18 June in the aquaria of the Institute of Oceanography and Fisheries in Split. Eggs floating at the surface of the tank were noticed about 12.30 p.m. Eggs were transferred to a 20 l glass tank. A constant temperature ( $20.5 \pm 0.3^\circ\text{C}$ ) of sea water was maintained using a quartz heater and contact thermometer. Eggs and larvae were kept at ambient salinity (38‰) and natural light and photoperiod.

Embryogenesis and larval growth were examined at different time intervals. The time in the Table 1, is the time of 50% of eggs reaching one of the successive developmental stages. Total length of larvae was measured on a

micrometer ocular scale of binocular microscope (to the nearest 0.0375 mm). About 20-30 larvae were separated for each measurement.

Food was distributed before mouth opening. The size of added rotifers ranged from 90-280  $\mu\text{m}$ . The attempt to feed scorpionfish larvae with rotifers was not successful. Four to five days after yolk sac resorption all postlarvae died showing empty guts.

## RESULTS AND DISCUSSION

Mean longest diameter of fertilized scorpionfish eggs was  $1.14 \pm 0.06$  mm, and mean shortest diameter  $1.09 \pm 0.04$  mm. These results are in agreement with the data of Dehnik (1973) who reported the longest diameter from 1.08 to 1.30 mm, and the shortest one from 0.90 to 1.15 mm.

Duration of embryogenesis from the time of stocking the experimental jars was 1.91 day (45.92 hours) at the temperature of 20.5°C. The time of reaching of each of the developmental stage is presented in Table 1.

Table 1. Time table of embryonic development of *Scorpaena porcus*.

Date	Hour	Description	Age		T°C
			hours	days	
18.06	12.30	gastrulation starts	0	0	20.8
	16.30	gastrula	4	0.17	20.6
19.06	07.00	somatic segmentation begins, formation of brain begins, periblast still not close	18.5	0.77	20.6
	18.00	embryo well developed and connected with the yolk sac, head close to tail	29.5	1.23	20.6
20.06	07.30	tail lifted clear of the yolk sac, tail tip almost touches the head	43.00	1.79	20.0
	10.25	all larvae hatched	45.92	1.91	20.2

Mean temperatures  $\pm$  standard deviation

20.5  $\pm$  0.3

The first observed embryological stage (starting of gastrulation) coincides with the third stage according to Dehnik (1973). The development from the third stage to the eclosion lasted 1.33 days (32 hours) at the mean temperature of 21.4°C. Temperature in the experiment of Dehnik was about 1° C higher so embryogenesis was shorter. According to his observations the duration of entire egg development was 1.96 days (47 hours), and the time from the fertilization to the beginning of gastrulation was about 67.91% of the entire embryogenesis. This relationship is always constant, in spite of different duration of the embryogenesis affected by different temperatures. This suggests that in our experiment scorpionfish spawned early in the morning, the day before the beginning of the observations. This is only a presumption since the temperature in Dehnik's experiment varied from 22.05 in the first, to 20.05°C in the last, sixth stage.

The total length of newly hatched larvae ranged from 2.21 to 2.33 mm, with mean of 2.27 mm. This is in agreement with Dehnik (1973), in whose experiment larval length varied from 2.10 to 2.40 mm at hatching.

Table 2 shows larval growth from hatching to yolk sac resorption.

Table 2. Larval growth of *Scorpaena porcus* from hatching to yolk sac resorption.

Time (days)	Mean length (mm)	±s.d.	Length range (mm)	n
0.00	2.27	0.036	2.21 - 2.33	20
0.13	2.36	0.088	2.18 - 2.48	20
0.92	2.69	0.035	2.63 - 2.74	20
1.07	2.74	0.041	2.66 - 2.78	20
1.19	2.79	0.043	2.74 - 2.85	20
1.94	2.82	0.030	2.78 - 2.85	20
2.14	2.85	0.021	2.81 - 2.89	20
2.96	2.93	0.024	2.89 - 2.96	20
3.19	2.94	0.032	2.89 - 3.00	20
3.90	2.99	0.034	2.96 - 3.04	20
4.89	2.97	0.016	2.96 - 3.00	20

Total mean length increment up to the transition to postlarvae was 0.72 mm (Table 2) or 0.86 mm, calculated from the smallest larva at hatching to the biggest larva at yolk sac resorption.

Growth was approximated by Gompertz equation:

$$l_t = a e^{-be^{-ct}} \quad (1)$$

where  $l_t$  is the total length of larvae in the time  $t$ ,  $a$  the asymptote,  $b$  and  $c$  constants and  $t$  the time in days. Function parameters were estimated by earlier described iterative method (Regner, 1980). Calculations showed that growth of *Scorpaena porcus* larvae at mean temperature of 20.5°C, may be given by the function:

$$l_t = 3.04 e^{-0.2535 e^{-0.6821t}} \quad (2)$$

The relationship between calculated growth equation and measured larval lengths is presented in Fig. 1.

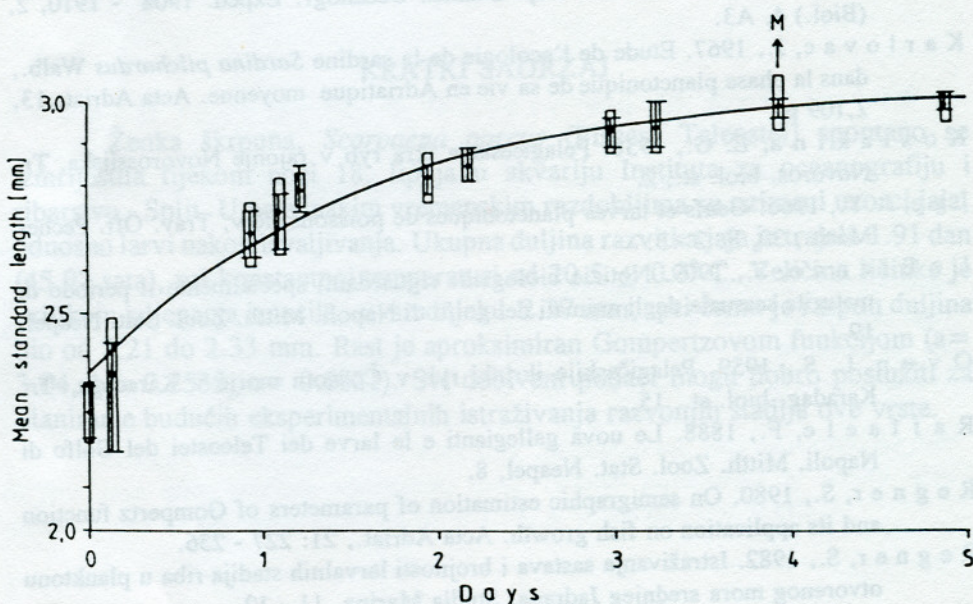


Fig. 1. Observed and estimated by Gompertz function growth of black scorpionfish *Scorpaena porcus* (L.) larvae.

Larval growth rate, that is the values of  $b$  and  $c$  exponents, and, to a certain extent of the asymptote in equation ( 1 ), are affected by temperature ( Z w e i f e l and L a s k e r, 1976 ; R e g n e r, 1979 ). From this viewpoint, obtained results can hardly be applied to the studies of the ecology of this species *in situ* or have practical significance for their eventual culture. However, they may provide the basis for planning future experimental studies of the developmental stages of this species.

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## PRELIMINARNI PODACI O EMBRIONALNOM I LARVALNOM RAZVITKU ŠKRPUNA *Scorpaena porcus* (Linnaeus, 1758)

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### KRATKI SADRŽAJ

Ženka škrpuna, *Scorpaena porcus* (Pisces, Teleostei) spontano se izmrijestila tijekom noći 18. lipnja u akvariju Instituta za oceanografiju i ribarstvo - Split. U nejednakim vremenskim razdobljima su uzimani uzorci jaja, odnosno larvi nakon izvaljivanja. Ukupna duljina razvitka jaja je trajala 1.91 dan (45.92 sata), pri konstantnoj temperaturi od  $20.5 \pm 0.3^{\circ}$  C. Veličina ličinke je prilikom izljevanja iznosila, u srednjaku 2.27 mm, pri čemu je raspon duljina bio od 2.21 do 2.33 mm. Rast je aproksimiran Gompertzovom funkcijom ( $a = 3.04$ ,  $b = 0.2535$ ,  $c = 0.6821$ ). Svi dobiveni podaci mogu dobro poslužiti za planiranje budućih eksperimentalnih istraživanja razvonjih stadija ove vrste.