FOLIA MALACOLOGICA
Folia Malacol. 3: 139–147
Cracow, 1989
http://dx.doi.org/10.12657/folmal.003.011

BIOMETRICS AND LIFE CYCLE OF *PHYSA ACUTA* DRAPARNAUD, 1805 (GASTROPODA: BASOMMATOPHORA: PHYSIDAE) UNDER HUMAN IMPACT

†Włodzimierz Serafiński, Izabela Rembecka, Małgorzata Strzelec

Faculty of Biology, Silesian University, Bankowa 9, 40-007 Katowice, Poland

Abstract: Alterations in the shell dimensions of *Physa acuta* Draparnaud, 1805 were studied from May to September in a sinkhole pond with very hard water in Siemianowice-Bytków (Upper Silesia, Southern Poland). This Mediterranean species turned out to be well adapted to the climate of Southern Poland and resistant to industrial water pollution. A biometrical analysis indicated the occurrence of two breeding periods in the studied population.

Key words: shell variability, industrial water pollution, temperature effect, invasive species

Folia Malacologica 3/1989 was originally published as No. 1216 of Scientific Bulletins of University of Mining and Metallurgy, Cracow. This digitalised version was prepared by the Association of Polish Malacologists and first published on-line on December 30th, 2016.

Ministry of Science and Higher Education
Republic of Poland

This digitalised version of Folia Malacologica is funded by the Ministry of Science and Higher Education, Republic of Poland under the agreement no. 646/P-DUN/2016 allocated to the activities of disseminating science and by the courtesy of the Rector of the AGH University of Science and Technology, Cracow

ZESZYTY NAUKOWE
AKADEMII GÓRNICZO-HUTNICZEJ IM. STANISŁAWA STASZICA

Nr 1216 Folia Malacologica z. 3 Kraków 1989

WŁODZIMIERZ SERAFIŃSKI, IZABELA REMBECKA
AND MAŁGORZATA STRZELEC

BIOMETRICS AND LIFE CYCLE OF PHYSA ACUTA DRAPARNAUD, 1805 (GASTROPODA: BASOMMATOPHORA: PHYSIDAE) UNDER HUMAN IMPACT

Abstract: Alterations in the shell dimensions of Physa acuta Draparnaud, 1805 were studied from May to September in a sinkhole pond with very hard water in Siemianowice-Bytków (Upper Silesia, Southern Poland). This Mediterranean species turned out to be well adapted to the climate of Southern Poland and resistant to industrial water pollution. A biometrical analysis indicated the occurrence of two breeding periods in the studied population.

INTRODUCTION

Physa acuta Draparnaud, 1805 is a freshwater basommatophoran pulmonate snail occurring in Upper Silesia in several water bodies. It is a Mediterranean species introduced in Poland about 80 years ago. At present the species seems to occur in various habitats, there being, however, still only a few localities it is known from (Feliksiak 1939, Dutkiewicz 1959, Wiktor 1959, Zięba and Zaćwilichowska 1966, Piechocki and Potocki 1976, Strzelec and Serafiński 1984, Rembecka, Serafiński and Strzelec 1986).

The shell variability and biology of Ph. acuta are poorly known (Duncan 1959, Piechocki 1979) and only in 1986 a series of shells collected in recent sediments of the River Vistula (Southern Poland) was described by Alexandrowicz (1986), considering also some biometrical data on the species the present paper deals with. The aim of our study was to describe a life cycle pattern of Ph. acuta.

MATERIAL AND METHODS

The material was collected in a 50 years old sinkhole pond situated in Siemianowice-Bytków in the central part of the Upper Silesian Industrial Region (Southern Poland). The area of the pond was 1.1 ha., the maximum depth: 2 - 3 m. The bottom was sandy-muddy. The physico-chemical characteristics of the water were as follows: pH: 7.9, Ca^{++}: 105 mg/l, Mg^{++}: 96.6 mg/l, Cl^{-}: 37.4 mg/l, Fe^{++}: traces, total hardness: 36.98°dH. The vegetation consisted of Typha latifolia L., Acorus calamus L., Potamogeton natans L., Lemna minor L., Ceratophyllum demersum L., Elodea candensis Rich., Alisma plantago-aquatica L., and Juncus sp.

Living snail specimens were collected every two weeks from May to September, the area along the North-western water-side being sampled. The shell parameters measured were the same as in the paper of Alexandrowicz (1986): Fig 1.

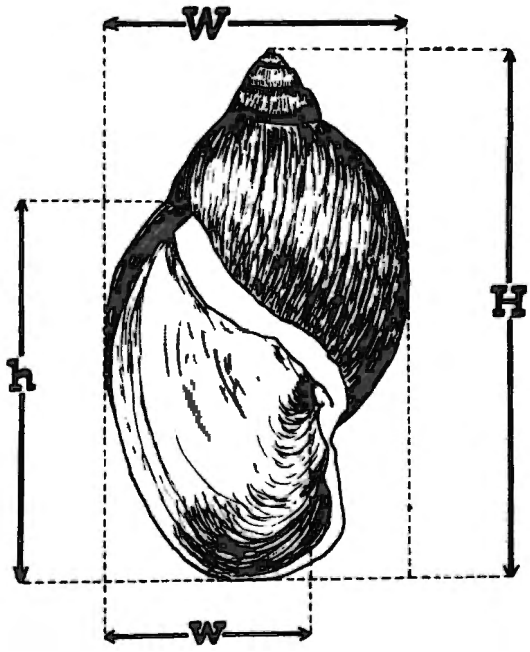

Fig. 1. Measured shell parameters of Physa acuta. H - shell height, W - shell width, h - aperture height, w - aperture width

RESULTS

328 individals of Ph. acuta were found altohether during the whole sampling period. A biometrical characteristics of the shells is presented in Tables 1 - 8. The smallest specimens were found in June and Spetember (2.4 and 2.3 mm high respectively). Beginning with July an increase in all the

Table 1

Biometrics of Physa acuta shell (n = 328)

	Min.	Max.	$\bar{X}$	$SD^{\pm}$	Variability coefficient
Shell height (H)	2.3	14.4	6.2	1.8	28.6
Shell width (W)	1.2	8.1	3.5	1.0	29.7
Aperture height (h)	1.4	10.0	4.3	1.2	28.5
Aperture width (w)	0.6	4.1	1.8	0.5	29.6
$S = \frac{H-h}{H} \times 100$	16.2	41.7	29.8	6.5	21.8
$E = \frac{H}{W}$	1.5	3.8	1.8	0.2	12.4
$A = \frac{w}{h} \times 100$	36.5	58.1	41.2	8.0	19.5

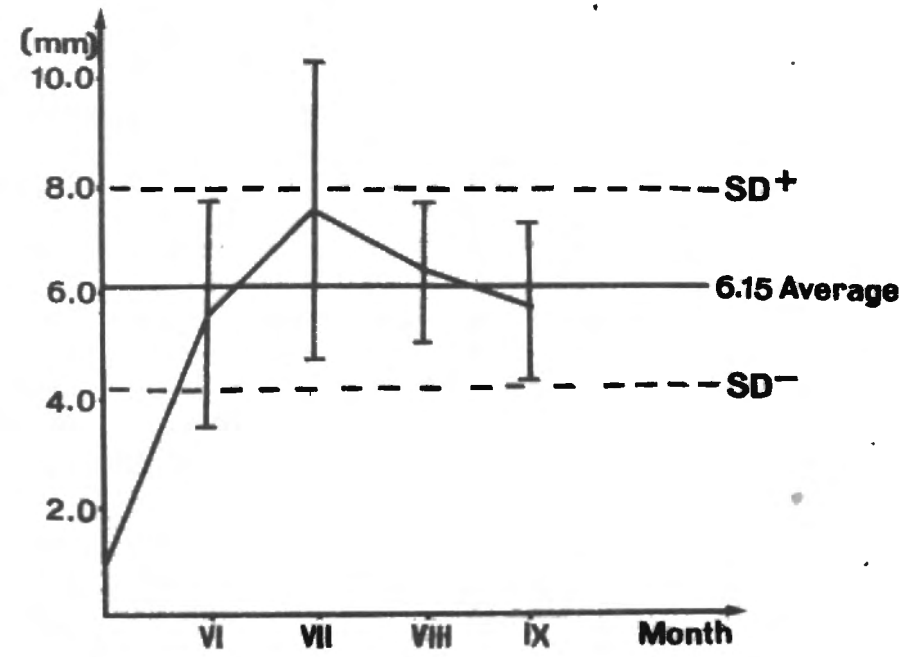

Fig. 2. Shell height in particular months

Table 2

Shell height (H) in particular months

Month / Value	VI n=26	VII n=25	VIII n=126	IX n=151
Min.	2.4	3.2	3.0	2.3
Max.	8.6	14.4	10.0	11.2
$\bar{X}$	5.6	7.5	6.4	5.9
$SD^{\pm}$	2.1	2.8	1.3	1.5
Variability coefficient (%)	36.9	37.8	21.2	26.1

Table 3

Shell width (W) in particular months

Month / Value	VI	VII	VIII	IX
Min.	1.2	1.8	1.7	1.2
Max.	5.4	8.1	5.8	6.0
$\bar{X}$	3.1	4.5	3.7	3.3
$SD^{\pm}$	1.2	1.8	0.8	0.9
Variability coefficient (%)	38.6	39.4	22.1	27.5

Table 4

Aperture height (h) in particular months

Value \ Month	VI n=26	VII n=25	VIII n=126	IX n=151
Min.	1.8	2.0	3.0	1.4
Max.	6.3	10.0	6.8	7.8
$\bar{X}$	3.9	5.3	4.4	4.1
$SD^{\pm}$	1.6	2.1	1.0	1.1
Variability coefficient (%)	40.0	39.9	23.0	26.2

Table 5

Aperture width (w) in particular months

Value \ Month	VI n=26	VII n=25	VIII n=126	IX n=151
Min.	0.8	1.1	1.0	0.6
Max.	3.1	4.1	2.8	2.5
$\bar{X}$	1.7	2.4	1.9	1.6
$SD^{\pm}$	0.7	0.9	0.4	0.4
Variability coefficient (%)	41.5	37.8	18.9	26.2

Table 6

Relative height of spire $S = \frac{H-h}{H} \times 100$

Value \ Month	VI n=26	VII n=25	VIII n=126	IX n=151
Min.	16.2	18.9	25.4	23.4
Max.	37.8	40.3	33.8	41.7
$\bar{X}$	30.1	30.2	29.1	29.9
$SD^{\pm}$	5.5	6.9	9.5	2.5
Variability coefficient (%)	18.2	23.1	32.5	8.4

measured dimensions was observed being reflected in higher mean values. Only in September a decrease in the mean values of the dimensions was observable resulting from small individuals having appeared in that month (Fig. 2).

Table 7

Elongation indicator $E = \frac{H}{B}$

Value \ Month	VI n=26	VII n=25	VIII n=126	IX n=151
Min.	1.5	1.5	1.5	1.5
Max.	3.8	2.0	1.9	2.0
$\bar{X}$	1.9	1.7	1.7	1.8
$SD^{\pm}$	0.4	0.14	0.01	0.01
Variability coefficient (%)	21.0	8.2	0.6	0.6

Table 8

Relative aperture width A = $\frac{w}{h}$

Value \ Month	VI n=26	VII n=25	VIII n=126	IX n=151
Min.	38.0	40.0	33.0	28.0
Max.	53.0	54.0	53.0	44.0
$\bar{X}$	45.0	46.0	43.0	38.0
$SD^{\pm}$	11.0	4.0	3.0	8.0
Variability coefficient (%)	24.0	8.2	7.5	21.9

The studied population of Ph. acuta was quite variable with respect to its biometrical characters which varied from month to month. This resulted in very high values of the variability coefficient, except for the series collected in August. In that series there were no specimens of the smallest and largest size classes, and the average height of the shells approached the mean value of this dimension for the entire material.

The above observations suggest that young individuals appeared in June and September, indicating two breeding seasons: April/May, and July/August. The population of Ph. acuta in the studied pond consisted probably of two groups of individuals. One group included individuals born in late summer, overwintering, breeding in spring and dying in early summer, while the other one comprised individuals born in spring, breeding in late summer and dying before winter. Both growth and sexual maturation must have been faster in the second than in the first group. The life span of the individuals of the first group was about 12 months, whereas that of the second group seemed to be only 7 - 8 months. These, however, are only suppositions to verify which a whole year of field observations is necessary. So far it has been concluded only from the fact that the largest shells were found in June.

DISCUSSION

The results presented above indicate that Ph. acuta can bear rather low temperatures characterizing the climate of Southern Poland. The adaptation to such conditions must have been a rather rapid process, because 50 years ago Ph. acuta in Poland occurred only in reservoirs with artificially heated water. Our observations confirm also the resistance of this snail to industrial water pollution.

The size of shells in the studied population was similar as that in populations from greenhouse tanks and heated industrial reservoirs, the maximum shell height being larger than that recorded by Alexandrowicz (1986) but smaller than the one observed within the natural distribution range of the species.

It is noteworthy that the life cycle of Ph. acuta in France is also annual, but with a single breeding season (Duncan 1959), while our results point out a probable occurrence of two breeding periods.

REFERENCES

ALEXANDROWICZ S. W. 1986. Physa acuta Draparnaud, 1805 (Mollusca, Gastropoda) from the recent Vistula sediments at Tyniec near Cracow. Acta zool. Cracov., 29: 355-372.

DUNCAN C. J. 1959. The life cycle and ecology of the freshwater snail Physa fontinalis (L.). J. Anim. Ecol., 28: 97-117.

DUTKIEWICZ J. 1959. Interesujące stanowisko ślimaka Physa acuta Drap. w Kombinacie Nowa Huta. Prz. Zool., 3: 185-187.

FELIKSIAK S. 1939. Physa acuta Draparnaud in den Fabrik-teichen von Łódź und ihre allgemeine Verbreitung. Fragm. faun. Mus. zool. Pol., 4: 243-258.

PIECHOCKI A. 1979. Mollusca - Mięczaki, Gastropoda - Ślimaki. Fauna Słodkowodna Polski, 7: 1-187, PWN, Warszawa - Poznań.

PIECHOCKI A., POTOCKI M. 1976. Nowe stanowisko Physa acuta Drap. i Gyraulus acronicus Férussac (Gastropoda, Basommatophora) w Parku Ludowym w Łodzi. Acta Univ. Lodz., Folia Limnologica, 9: 49-55

REMBECKA I., SERAFIŃSKI W., STRZELEC M. 1986. Cztery rzadkie gatunki ślimaków wodnych na Śląsku. Prz. Zool., in press.

STRZELEC M., SERAFIŃSKI W. 1984. Ślimaki (Gastropoda) zbiorników wodnych powstałych w wyniku eksploatacji górniczej w Górnośląskim Okręgu Przemysłowym. Prz. Zool., 28: 185-191.

WIKTOR A. 1959. Mięczaki strefy przełomów pod Książem koło Wałbrzycha. Prace Kom. Biol. Pozn. TPN, 19: 1-35.

ZIĘBA J., ZAĆWILICHOWSKA K. 1966. Fauna denna Wisły między Oświęcimiem a Krakowem. Acta Hydrobiol., Suppl., 1: 298-410.

Silesian University
Faculty of Biology
ul. Bankowa 9
40-077 Katowice, Poland

BIOMETRIA I CYKL ŻYCIOWY PHYSA ACUTA DRAPARNAUD, 1805 (GASTROPODA: BASOMMATOPHORA: PHYSIDAE) W WARUNKACH ANTROPOPRESJI

S t r e s z c z e n i e : Autorzy badali zmiany wymiarów muszli Physa acuta Draparnaud, 1805, w okresie od maja do września, w stawie zapadliskowym o bardzo twardej wodzie w Siemianowicach-Bytkowie. Stwierdzili, że ten śródziemnomorski gatunek jest dobrze przystosowany do warunków klimatycznych Południowej Polski i odporny na przemysłowe zanieczyszczenie wody. Analiza biometryczna wskazuje na występowanie u tego gatunku dwóch okresów rozrodczych.