Bulletin of Pure and Applied Sciences
Zoology (Animal Science), Vol.41A, No.2,
July-December 2022: P.211-215

Print version ISSN 0970 0765
Online version ISSN 2320 3188
DOI: 10.5958/2320-3188.2022.00026.2

Content Available online at: https://www.bpasjournals.com/zoology

Original Research Article

The Population Variability of the Reproductive Tract of Land Mollusks *Pseudonapaeus albiplicatus* (Gastropoda, Enidae) of the Zarafshan Ridge

[1,2]J.A. Kudratov*, [1,2]A. Pazilov

Author's Affiliation:
[1]Gulistan State University, Guliston, Uzbekistan.
[2]Samarkand State University, Samarkand, Uzbekistan.

***Corresponding author:**
J.A. Kudratov
Gulistan State University, Guliston, Uzbekistan.
E-mail:
jkudratov@samdu.uz

Article Info:
Received on 10.04.2022
Revised on 10.06.2022
Accepted on 05.09.202
Published on 15.12.2022

ABSTRACT:
The population variability of the reproductive tract of *Ps. albiplicatus* in three populations of the Zarafshan Range, which is expressed in the internal structures of the penis, the reduction of certain adnexal organs (the penial sections of the genital apparatus) and the entrainment or reduction in the length of the three distal sections of the penial appendix.

Keywords: Mollusk, Population, Conchological Variability, Reproductive Tract, Penial Appendix, Penis, Hapilla, Spermathecal Reservoir, Upper- Division of Vagina.

How to cite this article: Kudratov J.A., Pazilov A. (2022). The Population Variability of the Reproductive Tract of Land Mollusks *Pseudonapaeus albiplicatus* (Gastropoda, Enidae) of the Zarafshan Ridge. *Bulletin of Pure and Applied Sciences-Zoology*, 41A (2), 211-215.

INTRODUCTION

Pseudonapaeus albiplicatus, an extremely variable species, both biotopic and population, which, living in two biotopes, not far from each other, differ extremely sharply in conchological characters. The variability of the conchological features of this species is given in the work of A.A. Shileiko, A. Pazilov, F. Gaibnazarova, A. Kuchbaev. However, to date, the variability of the reproductive organ of this species has not been studied (A.A. Shileiko, 1984, A. Pazilov, 1992, A. Pazilov, 2005).

It should be noted that in the fauna of Central Asia, studies of terrestrial mollusks (primarily of a taxonomic nature) cannot be limited to studying the variability of conchological parameters alone, since cases of convergent shell similarity are very often observed (*Higromiidae, Enidae*). Therefore, in terrestrial mollusks in Central Asia, such a wide conchological variability is found that sometimes closely related species of the same genus were described as representatives of different genera. In connection with these, of undoubted interest is a comparative analysis of the anatomical variability of terrestrial mollusks living in different populations.

MATERIAL AND METHODS

The collection of mollusks was carried out on the Zarafshan ridge, on the territory of the Kitab geological reserve; northern slope of the Zarafshan ridge, Urgutsay gorges; southern slope, Zarafshan ridge, Alakuylak gorges (Fig. 1). A total of 350 *Ps. albiplicatus*. When studying the population variability of the reproductive tract of *Ps. albiplicatus*, the following parameters were measured under a binocular microscope Olympus SZ (according to the method of Shileyco and Kramarenko: penis length (Pe), epiphallus length (Ep), length of the lower (Nov) and upper section of the vagina (Vov), the length of the diverticula of the seminal receptacle (Dsp), the length of the penial appendix (A1 + A2 + A3 + A3 + A4 + A5). All static processing of the material was carried out using the static software package "TIBCO Software Statistica 13.5.0.17 for Windows" based on the generally accepted methods of Lakin (G.F. Lakin, 1980).

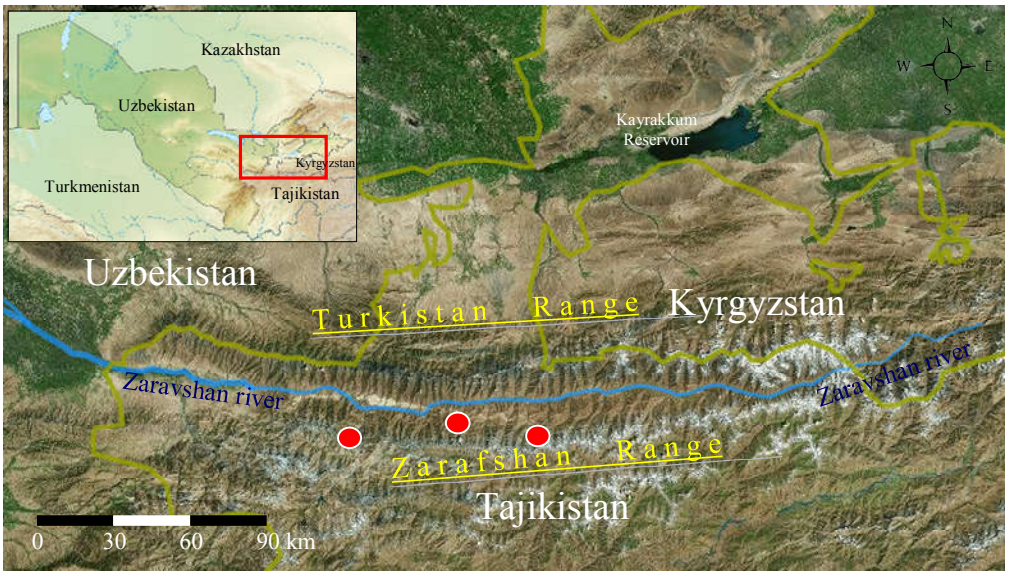

Figure 1: Map and ground mollusk collection points

RESULTS AND DISCUSSION

Ps. albiplicatus, an extremely variable species both biotopically and populationally. This species, living in two biotopes, not far from each other, differ extremely sharply in conchological features. However, after studying all the available material, it turned out that variability is also manifested in the reproductive tract.

Population 1: Zarafshan ridge, on the territory of the Kitab geological reserve, mollusks have a protein gland without notch (Fig. 2.A). The lower part of the vagina is 1.5 times shorter than the upper part. The vas deferens enters slightly shifted down the epiphallus, resulting in a very short, rounded whip. A well-developed caecum is located in the middle of the epiphallus. The penis is almost cylindrical. There are two V-shaped folds inside the penis (Fig. 2B). All parts of the penial appendix (A1+A2+A3+A3+A4+A5) are well developed. The branches of the genital retractor are brought together to varying degrees on the diaphragm. One branch of the retractor is attached to the middle of A1, the second - to the middle of the penis. The reservoir of the seed receptacle is well developed. Always has a clearly defined own short duct. The diverticulum of the seminal receptacle is always well developed, sometimes reaching the protein gland.

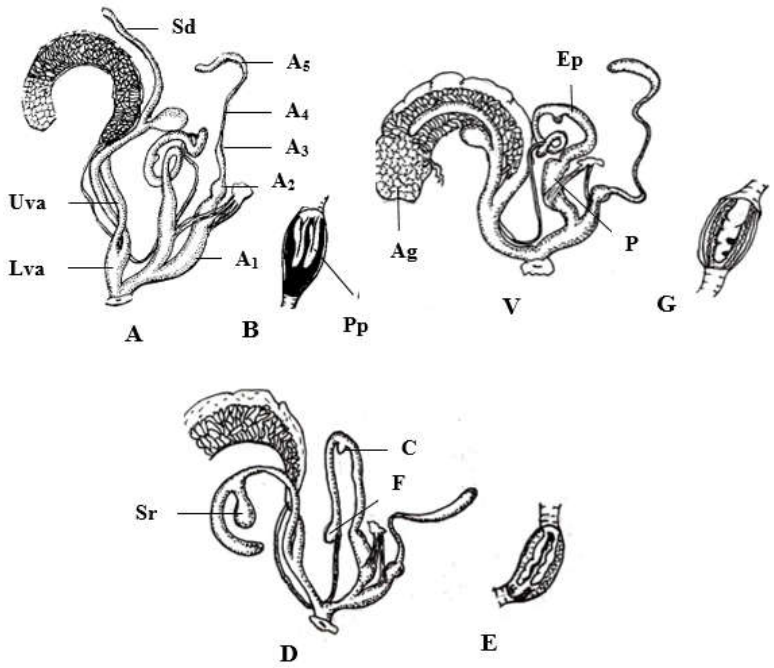

Figure 2: Variability of the reproductive tract of *Pseudonapaeus albiplicatus* (A, *B - 1 population; V, G - 2 populations; D, E - 3 populations. Ag- albumen glang; A1-A5 - divisions of penial appendix; C- caecum; F- flagtllum; P -penis; Pp- hapilla; Sr- spermathecal reservoir; Sd-spermathecal diverticle; Uva- upper- division of vagina; Lva- lower division of vagina*)

Population 2: The northern slope of the Zarafshan ridge, Urgutsay gorges, in mollusks, the structure of the reproductive tract (Figure 2. C,D) has the following variability from the first population: protein glands with an apical notch; sections of the vagina are approximately equal in length; the penis is not long, at first glance it seems to be sitting in the middle of A1; inside the penis there is one longitudinal roller (Figure 2,D). One branch of the retractor is attached to the upper part of A1, the second - to the lower part of the penis. All sections of the penial appendix are well developed, but A1 is 1.5 times shorter than the first population.

Population 3: The southern slope, Zarafshan ridge, Alakuylak gorges, living mollusks in the structure of the reproductive tract (Fig. 2.E) have the following variability from other populations: the lower part of the vagina is longer than the upper and thinner than the first and second populations; section of the penial appendix A4 very short; inside the penis are two longitudinal ridges.

Having studied a huge amount of material, we became aware that in addition to the qualitative variability of the reproductive tract, we also found quantitative variability - the variability of various parts of the reproductive tract (Table 1).

As can be seen from the table for *Ps. albiplicatus* is also characterized by high interpopulation variability in the absolute sizes of some parts of the reproductive system. However, as was previously shown by Matekin for the Central Asian Enids. The absolute dimensions of the various departments of the copulatory apparatus *Ps. albiplicatus* are most often correlated with shell size (Matekin, 1959). This is especially true for the size of individual parts and the entire penial appendix as a whole.

As a result of the study of the variability of the reproductive tract of *Ps. albiplicatus*, it turned out that the variability is expressed in the internal structures of the penis, the reduction of certain adnexal organs (the penial sections of the genital apparatus) and the entrainment or reduction in the length of the three distal sections of the penial appendix.

Table 1: Population variability of different parts of the reproductive tract of terrestrial mollusks *Pseudonapaeus albiplicatus* in the Zarafshan Range

Population	N	Reproductive system parameters (mm)									Height shells (mm)
		A_1+ A_2	A_3	A_4	A_5	Pe	Ep	Nov	Vob	Dsp	
Territories Kitab geological reserve (Zarafshan ridge)	15	2	1.2	4.5	3	3	4	2.3	1.5	4	13
Gorges Urgut (Northern slope of the Zarafshan Range)	15	3	1.3	4	3	3.5	4.5	1.2	3	5	12
Beldirsaygorge (Chatkalranges)	15	2	1	2.5	2.5	2.7	6	2.2	4	4	10

Note: *N- number of individuals used to measure the copulatory apparatus. A_1+ A_5 - sections of the penile appendix, Pe-penis, Ep - epiphallus, Nov - lower vagina, Vob- upper vagina, Dsp - seminal diverticulum.*

As we know, in species of the genus *Pseudonapaeus*, the internal structure of the penis is quite diverse, but it seems that this diversity is of the same property as the diversity of shells, and certain details of the structure of the copulatory apparatus are characteristic of individual populations or groups of populations, but within these aggregates they remain relatively constant. . It is essential that there is continuity between different variants of the structure inside the penis. For example, inside the penis there are two V-shaped folds (Fig. 2, B), the inner branches of which go into the lumen of the epiphallus, and the outer ones close over the opening of this duct, observed in mollusks of the 1st population, in mollusks of the 2nd population, inside the penis there is one longitudinal roller (Fig. 2, D), while mollusks have 3 populations, inside the penis there are two longitudinal ridges.

CONCLUSION

It follows from the above that one of the important ways of the morphological evolution of terrestrial mollusks is to simplify the reproductive tract due to the reduction of certain accessory organs. As we know, since the named organs play one or another role in copulation and related processes. As noted by A.A. Shileiko that the main trend is to simplify these processes and reduce the frequency of mating (A.A. Shileiko, 1984). It is especially significant that the most intensive reduction of appendages, carried out in various ways, is characteristic of species that have mastered historically young arid landscape types, or species that are on the way to leaving mesophilic conditions for xerophilic ones.

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