THE IMPORTANCE OF FISH IN THE SPREAD OF THE ROMANIAN UNIONIDS

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Abstract. The spread throughout the whole Dacian basin of the „carved" Romanian unionids has been attributed to the attachment of glochidia (larvae of unionids) to the gills or fins of the fish from the hydrographical network. From the analysis of the parasitosis process with glochidia at current freshwater fish, it results that this is the propagation mechanism of unionids, but it mostly occurs in stagnant waters and to a lesser extend in rivers.

Keywords: Romanian, "carved" unionids, *Glochidium*, the importance of fish in the spread of unionids.

Rezumat. Importanța peștilor în răspândirea unionidelor romaniene. Răspândirea în tot Bazinul Dacic a unionidelor „sculptate" romaniene a fost pusă pe seama atașării glochidiilor (larve de unionide) de branhiile sau aripioarele peștilor din rețeaua hidrografică. Din analiza procesului de parazitoză cu glochidii la peștii dulcicoli actuali, rezultă că acesta este mecanismul de înmulțire a unionidelor, dar că el se realizează cel mai mult în ape stătătoare și mult mai puțin în fluvii și râuri.

Cuvinte cheie: Romanian, unionide „sculptate", *Glochidium*, importanța peștilor în răspândirea unionidelor.

INTRODUCTION

The last stage of the Pliocene (Romanian), which lasted almost 2 My, from 4.5 to 2.5 My ago, is characterized by the presence of fossil-bearing levels with so-called 'carved' unionids and viviparids with decorated shells, characteristic to this stage within the whole Dacian Basin. Spreading bivalves in the Dacian Basin was explained by the attachment of glochidia (larvae of Lamellibranchiata) to the gills of fish, which carried them through the major hydrographical network, represented by rivers, on long distances (from Oltenia in the west to Slobozia in the east.

By explaining the mechanisms the parasitosis caused by the freshwater fish spread, we try to clarify the importance but also the limits of this phenomenon in the Dacian Basin within the whole spreading area of the Romanian.

MATERIAL AND METHOD

Starting from the life environment of current unionids from the hydrographic network of Romania and from the analysis of their reproductive way, we extrapolated these findings to the Romanian unionids. We also analysed the possible spreading areas of the fluvial and lagoon deposits during the Romanian, based on the facial analysis of these deposits and their extent.

RESULTS AND DISCUSSIONS

There is evidence in references (ROMAN, 1955; GROSSU, 1961; BOGATU & MUNTEANU, 2008) that *Glochidium*, larvae of bivalves as *Unio* and *Anadonta*, constitutes the etiological agent of glochidiosis (parasitosis observed at freshwater fish caused by *Glochidium*). Glochidia are under 1 mm in size and present 2 valves prolonged with a sharp peak bent on the ventral edge, with the aspect of a hook (Fig. 1), with which they attach to the fins or gills of fish.

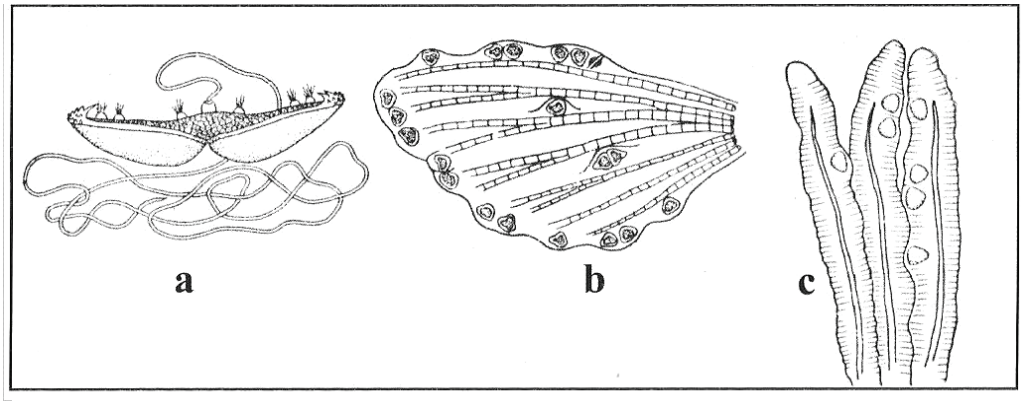

Figure 1. Glochidia of unionids
a – general aspect; b – fixed on the fins of fish; c – fixed on gills (after BOGATU & MUNTEANU, 2008).

The analysis of the habitats of current freshwater fish leads to the conclusion that most of them live not only in rivers, but also in lakes, ponds, pools and even swamps. Some of them prefer lakes and ponds, as it is the case of bream, perch, sun perch (called the king of ponds), pike, catfish and zander.

The actual unionids from the fauna of Romania (*Unio tumidus, U. crasus, U. pictorum)* live, apart from flowing watercourses, in lakes, ponds, pools or swamps (GROSSU, 1961).

In the paper "Research of the parasite-fauna of the fish from the Danube", ROMAN (1955) argues that the parasitic larvae of unionids or anodontines (*Glochidium* sp.) were found at the following fish species: rudd, bream, sichel, perch, sun perch, located at level of the gills. These larvae parasitize only in spring and in the first half of summer. Formed in autumn, *Glochidium* sp. larva spends winter in the gills of the mothers' shell and, in spring, it gets out and falls to the bottom of the water; here, it can attach to fish with the help of the hooks of the valves It detaches from the fish gills 2-3 months later and falls on the riverbed (GROSSU, 1961). There, in 4-5 years, they get sexually mature. If in two weeks they do not get attached to a fish body, glochidia die. Although the unionids produce about 200,000 eggs, most of the encysted glochidia in fish tissues degenerate (BOGATU & MUNTEANU, 2008).

The spread of the unionids through the glochidia caught on the gills of fish occurs at random, as well as the spreading distance. It cannot be too long, fish usually staying within their habitat (lower course of the river, lake, pond).

Continuing the analysis of the possible habitat of the Romanian 'carved' unionids from the Dacian Basin, it can be said that they could have lived not only in rivers, but also in lakes and ponds.Moreover, their spreading through glochidia, which parasite fish for some time, was also at random and occurred only under certain conditions.

From the research done by ROMAN (1955), it results that out of 100 species of parasitized fish from the Danube, which were analyzed, only 0.92% were affected by *Glochidium.* Thus, it results that the parasitosis generated by *Glochidium* at the fish from the Danube is extremely reduced.

From the analysis of the outcrops and the drilling cores with Romanian deposits, it results that the lumachelles with 'carved' unionids, 1-5 m thick or even more, are found in the whole area in which these deposits exist. This spread cannot be explained only by the presence of fluvial bars.

Moreover, there are places where the shells are chaotically spread, in a stack of sandy deposits more than 20 m thick, as it is the case at Bâlta (Fig. 2) and Smadovița in Oltenia, with quasi horizontal deposits specific to lakes and not to fluvial bars in which the deposits are oblique. The predominance of a certain species, the chaotically spreading and the predominant vertical position of the shells in thick stack of sand arranged in horizontal layers cannot be assigned to a fluvial deposition, but to a quiet deposition on the bottom of the lake.

Figure 2. Bâlta outcrop with lamellibranchiate chaotically spread in horizontal sand deposits (photo C. Enache).

ENCIU (2007), a supporter of the theory of the lack of lacustrine deposits during the Romanian, mentions nevertheless the Romanian deltaic deposits in the area between Busu and Cernătești (Dolj), while Dan Jipa, even if he states that the Romanian deposits were placed in fluvial environment, remarks the possibility of the existence of a collector of the waters transported by the fluvial network (LUBENESCU, 2008).

The above mentioned findings lead us to the conclusion that the discordant and transgressive layout in the western, southern and eastern extremities of the Dacian Basin of the 'carved' unionids deposits was possible through the ingression of a lacustrine domain (ENACHE, 2004) The existence of some deltas at the western extremity of the mouth of a river indicates the presence of a lake, in which they flowed; this entitles us to say that during the Romanian, there occurred a fast flooding at least in the southern part of the Dacian domain and a progressive formation of a lacustrine domain, through the invasion of the Dacian relief.

We consider also that during the Romanian (Pelendavian sub-stage), while within the northern part of the Dacian Basin, westwards of the Jiu, palustral cycles with the formation of lignite layers took place (ENACHE, 1976), south of Strehaia-Craiova line, there was a lake (Fig. 3) that gradually advanced westwards, southwards and eastwards.

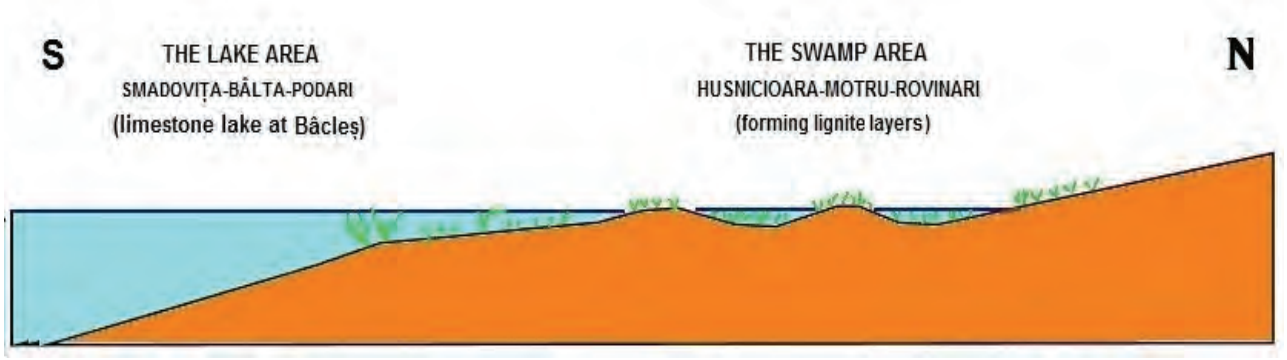

Figure 3. S – N section through the region west of the Jiu River during the Pelendavian stage.

CONCLUSIONS

The research regarding the importance of fish in the spreading of the Romanian unionids leads us to the conclusion that the shallow lacustrine environment, formed through the invasion of some plains, presents the most favorable environment for the massive spreading of these bivalves, because fish are forced to swim closer to the bottom, being more vulnerable to the *Glochidium* infection, which can easily attach to their gills or fins.

A confirmation of the link between the lacustrine fish and bivalves during the Pleistocene from Oltenia comes from the discovery of some fish remains in the Romanian lacustrine deposits with 'carved' unionids from Podari: *Esox* sp., *Tinca* sp., *Scardinius* sp., *Silurus* sp., which proves the existence of the Pliocene lake in southern Oltenia (TRIF et al., 2016).

Their current descendants also prefer stagnant waters.

The pike (*Esox lucius*) is a freshwater or blackish water predatory fish, spread in the stagnant or slowly flowing waters, with plenty of vegetation.

The tech (*Tinca tinca*) is a freshwater fish species that usually lives at the bottom of slowly flowing waters.

The rudd (*Scardinius erythrophthalmus*) is a fish that lives in groups, in stagnant freshwaters as lakes, ponds, pools or slowly flowing waters.

The catfish (*Silurus glanis*) is a large predatory fish, which frequently lives in ponds, lakes, lower course of large rivers, preferring deep places with mud and turbid waters.

In conclusion, it can be said that without the existence of fish, unionids cannot spread on large areas because their larvae need an intermediary host to carry them. The most favorable environment for the perpetuation of unionids is represented by shallow lakes and ponds, where fish are forced to swim near the bottom, being vulnerable to the parasitosis with *Glochidium*. This explains the excessive spread of unionids at Balta, where their valves do not form piles on river banks.

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