REMARKS ON THE EVOLUTION TENDS OF AQUATIC AND PALUDICOLOUS VEGETATION IN THE MAIN ACCUMULATION LAKES IN TIMIS COUNTY

Alina NEACŞU, G. – G. ARSENE

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timişoara, Aradului Street, no. 119, RO- 300645, Romania
E-mail: alne76@yahoo.com

Abstract: *Our research were carried out in the period 2004-2010 and had in view establishing the vegetal associations and indicating the evolution trends of aquatic and paludicolous vegetation in the main artificial water accumulations in Timis County. The data were collected from the accumulation lakes Surduc, Pişchia, Liebling and Sânandrei. In substance, we performed trips on the field during the period indicated, on which occasion we performed phytocoenologic sampling upon which we drew up synthetic charts. The information in these tables was subsequently processed in laboratory. The methodology for field data sampling and processing complied with the principles of the Central-European Phytocoenologic School, established by BRAUN-BLANQUET. Thus, in the area of the above mentioned accumulations were identified 29 vegetal associations, and, also, due to the research period, the vegetation evolution trends could be delineated. Generally, the vegetation succession is the following: it starts from free natant aquatic communities, and, as the aquatic environment enriches in substances, fixed submerse and submerse-natant phytocoenoses appear, then the immerse aquatic vegetation develops and installs, afterwards the paludicolous one. Among the remarks, we noted that the vegetation structure for two of the accumulation lakes studied, more precisely the accumulations Sanandrei and Pischia, has been profoundly changed in the last years, being subject to drainage, for various reasons. These actions had negative impact upon vegetation and biodiversity as a whole. In the past, in the area of these accumulations, suitable growth conditions were encountered by aquatic and paludicolous associations such as those edified of Lemna minor L., Spirodela polyrhiza (L.) Schleichen, Ceratophyllum demersum L., Myriophyllum spicatum L., Polygonum amphibium L., Trapa natans L., Potamogeton natans L., Potamogeton crispus L., Iris pseudacorus L., Glyceria maxima (Hartm.) Holmberg a.o. Following drainage, these associations are not encountered anymore, we noticed that instead a series of weeds appeared. From the biodiversity perspective, this aspect represents a regress, translated into the loss of certain vegetal communities deemed representative for these humid areas.*

Key words: *artificial humid area, aquatic and paludicolous vegetation, dynamics*

INTRODUCTION

From the beginning of the 20th century until today, in Banat continued the works to control and rationally use waters. It was aimed damming up and reducing the surface of streams, blocking floods, eliminating floodable lands, of flood outpour areas, disproportionate decrease of river holms, drying surface ponds, eliminating reeds and marshy areas, etc. Today, in Banat, the surfaces occupied by natural humid areas were considerably reduced. The main natural humid areas are represented by the marshes at Satchinez. In parallel to their decrease in surface, artificial retention accumulations were created, having considerable surfaces (KISS, 1999). Set up mainly to reduce and prevent floods, for hydrotechnical purposes, for fishing or entertainment, these ecosystems are considered only from the viewpoint of their economic relevance and they have never been studied from geo-botanic perspective. The flora and vegetation studies carried out by us in four of the most representative accumulation lakes in

Timis County: Surduc, Pischia, Liebling and Sanandrei (as well as monitoring some chemical parameters of water out of whose analysis it was able to establish its quality) drew our attention upon the diversity of plants communities formed in the area of these accumulations, at all neglectable. The characteristic flora and vegetation are represented mainly by aquatic and paludicolous species and phytocoenoses but also by many segetal and ruderal species originated from neighbouring ecosystems, that influence the floristic composition of the phytocoenoses and that indicate potential evolution trends of the vegetation.

MATERIAL AND METHODS

Our research for sampling and processing of vegetation data took place during the period 2004-2010. The research methodology adopted is that of the Central-European Floristic School of BRAUN-BLANQUET, according to which the basic unit in the study of vegetation is the vegetal association, in fact a community of plants with unitary floristic composition, with characteristic physiognomy and structure. The field data were noted in phytocoenologic sheets, consisting in mentioning the geographical location, the biotope conditions, followed by the list with the species in the sample area, for which abundance-dominance and frequency grades were awarded (according to BRAUN-BLANQUET 1928, in CRISTEA, 1993). On the grounds of these sheets, processing comparatively and synthetically the data obtained, we drew up the synthetic charts of the associations. Once the associations were established, we continued to create the vegetation evolution trends.

RESULTS AND DISCUSSIONS

After processing the data collected in the field, in the area of the accumulations studied, there were identified 29 vegetal associations. In the following we presented the summary of the main cenoetaxonomic units (according to SANDA *et al.*, 1998) and then we discussing a own scheme with vegetation dynamics. Similar schemes they proposed other authors (BURESCU, 1999, POP, 1968, PEIA, 1983 etc.). Some particular aspects noticed by as in the plant communities from the accumulations Sanandrei and Pischia are also presented.

The summary of the main cenotaxonomic units:

Cls. LEMNETEA W. Koch et Tx. 1934

Ord. *Lemnetalia* W. Koch et Tx. 1954

Al. *Lemnion minoris* W. Koch et Tx. 1954

1. *Lemnetum minoris* (Oberd. 1957) Müller et Görs 1960
2. *Lemno minoris – Spirodeletum* W. Koch 1954 = *Spirodeletum polyrrhizae* W. Koch 1954

Ord. *Hydrocharietalia* Rübel 1933

Al. *Ceratophyllion* Den Hartog et Segal 1964

3. *Ceratophylletum demersi* (Soó 1927) Hild 1956

Cls. LITTORELLETEA UNIFLORAE Tx. 1947

Ord. *Littorelletalia* Uniflorae Koch 1926

Al. *Eleocharition acicularis* Pietsch 1967

4. *Eleocharidetum acicularis* W. Koch 1926 em. Oberd. 1957

Cls. POTAMOGETONETEA PECTINATI R. Tx. et Prsg. 1942

Ord. *Potamogetonetalia pectinati* W. Koch 1926

Al. *Potamogetion pussili* Vollmar em. Hejný 1978

5. *Myriophyllo – Potametum* Soó 1934
6. *Najadetum minoris* Ubrizsy 1948, 1961

Al. *Trapo – Nymphoidetum* Oberd. 1957

7. *Trapetum natantis* Müller et Görs 1960

Cls. POTAMETEA Tx. et Prsg. 1942

Ord. *Potametalia* W. Koch 1926

Al. *Nymphaeion* Oberd. 1957 emend. Neuhäusl 1959

8. *Polygono – Potametum natantis* Soó 1964 = *Polygonetum natantis* Soó 1927

Cls. PHRAGMITETEA Tx. Et Prsg. 1942

Ord. *Phragmitetalia* W. Koch 1926 emend. Pign. 1953

Al. *Phragmition australis* W. Koch 1926

9. *Scirpo – Phragmitetum* W. Koch 1926 = *Phragmitetum communis* (All. 1922) Pign. 1953 = *Phragmitetum australis* Schmale 1939 = *Scirpo – Phragmitetum austro-orientale* Soó 1957 = *Phragmitetum natans* (Borza 1960) Nedelcu 1967
10. *Typhaetum angustifoliae* Pignatti 1953
11. *Typhaetum latifoliae* G. Lang 1973
12. *Glycerietum maximae* Hueck 1931 = *Glycerietum aquaticae* Nowinski 1928
13. *Schoenoplectetum lacustris* Eggler 1933
14. *Iretum pseudacori* Eggler 1933 = *Irido – Sietum latifoliae* Dobrescu et Vițălariu 1979

Al. *Bolboschoenion maritimi continentale* Soó (1945) 1947 emend. Borhidi 1970

15. *Eleocharidetum palustris* Schennikow 1919 = *Eleocharidetum palustris – uniglumis* Dihoru (1969) 1970 = *Alismato – Eleocharidetum* Máthé et Kovács 1967

Al. *Phalarido-Glycerion* Pass. 1964

16. *Leersietum oryzoides* Krause 1955 em. Pass. 1957 = *Bidenti – Leersietum* (Poli et J. Tx. 1960) Oberd. Et al. 1967

Ord. *Magnocaricetalia* Pign. 1953

Al. *Magnocaricion elatae* W. Koch 1926

Caricenion gracilis Neuhäusl em. Bálátová-Tulácková 1963

17. *Phalaridetum arundinaceae* (Horvatič 1931) Libbert 1931
18. *Caricetum ripario – acutiformis* Kobenza 1930 = *Caricetum ripariae* Knapp et Stoffer 1962

Cls. BIDENTETEA TRIPARTITI Tx., Lohm. Et Prsg. 1950

Ord. *Bidentetalia tripartiti* Br. – Bl. et Tx. 1943

Al. *Bidention tripartiti* Nordh. 1940

19. *Bidentetum tripartiti* W. Koch 1926 = *Polygono hydropiperi – Bidentetum* Lohm. 1950 = *Bidenti – Polygonetum hydropiperis* Lohm. in T.Tx. 1950

Al. *Chenopodion fluviatile* (*rubri*) Tx. 1960

20. *Echinochloo – Polygonetum lapathifolii* (Ujvárosi 1940) Soó et Csűrös (1944) 1947 = *Echinochloo crus galli – Galinsogetum parviflorae* Burduja et Diaconescu Florița 1976, incl. *Malachio – Polygonetum mite* Mititelu 1982 non. Pass. 1964

Cls. ATREMISIETEA Lohm., Prsg. Et Tx. 1950

Ord. *Artemisietalia* Lohm. Et Tx. 1947

Al. *Arction lappae* Tx. 1937 emend. Siss. 1946

21. *Conietum maculati* I. Pop 1968 = *Hyoscyamo – Conietum maculati* auct. Rom. Non Slavnič 1951
22. *Sambucetum ebuli* (Kaiser 1926) Felföldy 1942

Cls. SALICETEA PURPUREAE Morr 1958

Ord. *Salicetalia purpureae* Morr 1958

Al. *Salicion albae* (Soó 1930 n.n.) Müller et Görs 1958

23. *Salicetum albae* Issler 1924 s.l. = *Salicetum albae – fragilis* Issler 1926 em. Soó 1957 = *Salix alba – Polygonum hydropiper* Doniță et Dihoru 1961 = *Hydroherbo – Salicetum albae* Doniță et al. 1966 = *Salici – Populetum* (Tx.1931) Mejer Drees 1936

= *Populetum albae* (Br. – Bl. 1931 p.p.) Borza 1937 = *Saliceto – Populeto – Alnetum* Slavnič 1952

Cls. ALNETEA GLUTINOSAE Br.-Bl. et Tx. ex Westhoff et al. 1946

Ord. *Salicetalia auritae* Doing 1962

Al. *Salicion cinereae* Müller Th. et Görs ex Pass. 1961

24. *Rubo – Salicetum cinereae* Sonasak 1963 = *Rubo caesii – Salicetum cinereae* Rațiu et Gergely (1979) = *Alno – Salicetum cinereae* (Kobenza 1950) Pass. 1956

Cls. MOLINIO – ARRHENATHERETEA Tx. 1937

Ord. *Molinietalia coeruleae* W. Koch 1926

Al. *Agrostion stoloniferae* Soó (1933) 1971

25. *Agrostidetum stoloniferae* (Ujvárosi 1941) Burduja et al. 1956 = *Agrostideto – Caricetum distans* Soó 1940 = *Agrostis alba – Carex distans* ass. Soó 1928 = *Ranunculo – Agrostietum stoloniferae* Resmeriță 1977 = *Agrostidetum pluritrifolietosum* Borza 1953 n.n. conf. Borza 1963 = *Agrostidetum albae substepposum* Borza 1962 = *Lolio – Agrostetum stoloniferae* Dihoru 1969, 1970
26. *Poëtum pratensis* Răv., Căzăc. et Turenschi 1956 = *Trifolio – Poëtum pratensis* (Răv. et al. 1956) Resmeriță 1975

Ord. *Deschampsietalia caespitosae* Horvatič 1956

Al. *Alopecurion pratensis* Pass. 1964

27. *Alopecuretum pratensis* Regel 1925 = *Agrosti – Alopecuretum pratensis* Resmeriță 1963 = *Lolio – Alopecuretum pratensis* Bodrogközy 1962
28. *Festucetum pratensis* Soó 1938 = *Festucetum pratensis mezophilum* Csürös 1970

Cls. QUERCETEA PUBESCENTI-PETRAEAE (Oberd. 1948) Jakucs 1060

Ord. *Prunetalia* Tx. 1952

Al. *Prunion spinosae* Soó (1930, 1940) 1950

29. *Pruno spinosae – Crataegetum* Heuck 1931 = *Carpino – Prunetum* Tx. 1952, *Rubo caesii – Prunetum spinosae* Rațiu & Gergely 1979, *Prunetum moldavicae* Dihoru (1969) 1970, *Crataego – Prunetum dasyphyllae* Jurko 1964, *Crataegetum danubiale* Jurko 1958

The vegetation evolution trends was drawn up based on the personal observations and on referring to specialized literature and it is discussed summarily in what follows (see also the figure 1). So we noticed that the first phytocoenoses appearing at water surface are the natant, free edified ones of *Lemna minor* L. (*Lemnetum minoris* (Oberd. 1957) MÜLLER *et* Görs 1960) and *Spirodela polyrhiza* (L.) Schleichen (*Spirodeletum polyrrhizae* W. Koch 1954). In time, they leave the spot for fixed (submerse and natant-submerse), edified phytocoenoses of *Ceratophyllum demersum* L., *Myriophyllum spicatum* L., *Potamogeton natans* L., *Potamogeton crispus* L., *Najas minor* All., *Trapa natans* L., *Polygonum amphibium* L. (the associations: *Ceratophylletum demersi* (Soó 1927) Hild 1956, *Myriophyllo – Potametum* Soó 1934, *Najadetum minoris* Ubrizsy 1948, 1961, *Polygonetum natantis* Soó 1927, *Trapetum natantis* Müller et Görs 1960).

Non-fixed natant phytocoenoses may remain spread among them or they might withdraw towards the shore. There are situations where populating waters starts from submerse phytocoenoses. As organic substances accumulate, there exists the possibility of appearance of immerse vegetation, from which virtually begins the distribution of vegetation in lakes. This means mainly the associations of *Scirpo-Phragmitetum* W. Koch 1926, *Typhaetum angustifoliae* Pignatti 1953 and *Typhaetum latifoliae* G. Lang 1973. At the shelter of macrophite vegetation, arranged as strips or clusters, continues to develop aquatic phytocoenoses, most advantaged by the presence of macrophites being the non-fixed natant ones that are now protected against waves and currents.

From the willow associations, in the cases studied by us, the vegetation can move on three evolution trends. In the first situation, it may evolve towards *Salix* species (*Salicetum albae* Issler 1924 s.l., *Rubo – Salicetum cinereae* Sonasak 1963), which are progressively replaced by blackhorn bushwood (*Pruno spinosae – Crataegetum* Heuck 1931).

The second possibility of succession undergoes towards the installation of the edified associations of large bulrush (*Schoenoplectetum lacustris* Eggler 1933), replaced by phytocoenoses of water manna grass (*Glycerietum maximae* Hueck 1931), small bulrush (*Eleocharidetum palustris* Schennikow 1919, *Eleocharidetum acicularis* W. Koch 1926 em. Oberd. 1957), rice cutgrass (*Leersietum oryzoides* Krause 1955 em. Pass. 1957), that can be replaced by edified associations of *Phalaris* (*Phalaridetum arundinaceae* (Horvatič 1931) Libbert 1931, or the succession go to *Bidentetum tripartiti* W. Koch 1926 or *Echinochloo – Polygonetum lapathifolii* (Ujvárosi 1940) Soó *et* Csűrös (1944) 1947.

The third succession, and maybe the most obvious one, is towards the installation of mesophilic meadows. On the spot of reeds, a series of associations alternate. It usually starts from edified associations of sedge (*Caricetum ripariae* Knapp *et* Stoffer 1962). Most frequently, they are replaced by meadow grass (*Agrostidetum stoloniferae* (Ujvárosi 1941) Burduja *et al.* 1956), or smooth-stalked meadowgrass (*Poëtum pratensis* Răv., Căzăc. *et* Turenschi 1956), foxtail (*Alopecuretum pratensis* Regel 1925) or hack (*Festucetum pratensis* Soó 1938).

As the accumulations Sanandrei and Pischia were dried up during the study, we continue by presenting some particular aspects noticed by us within the phytocoenoses. The drainage works carried out around the accumulation lake Sanandrei (during the spring of 2007), had deep effects upon aquatic and paludicolous flora and vegetation. In fact, the aquatic flora and vegetation completely vanished. The species of pond smartweed, duckweed and arrowgrass that used to represent the vegetation of aquatic macrophites, due to the new environment condition (the lack of water) could not survive. Also, the surface of paludicolous vegetation that ued to exist in the close vicinity of the shore, at the borderline between water and land, is missing today. Even some common associations such as bulrush, sedge, that used to occupy considerable surfaces, are now encountered only sporadically, in some small depressions, they too feeling the lack of water. Cane seems to last although, physiognomically, there are some alterations. On the other hand, we found here a strong ruderalization of vegetation because the extension of the areas occupied by *Urtica dioica* L., *Cirsium arvense* (L.) Scop., *Ambrosia artemisiifolia* L., *Galium aparine* L., *Kochia scoparia* (L.) Schrader, *Sonchus arvensis* L., *Polygonum lapathifolium* L. All these species with high invasive potential, have been installed here quickly because the ecosystems fragility and the low specific competition. On the shore, luxuriantly grow edified phytocoenoses of blackhorn bushwood, nettle, hemlock and danewort. Here we mention that in the past, in the lake vicinity, there were animal farms and that the waste disposal was performed in an uncontrolled manner. That is another reason for the high presence of the above mentioned species growing on soils rich in nitrogen. The vegetation evolution trend is towards wood associations, pioneering; therefore we mention the expansion of *Salix* species growing on the drained area.

Regarding the accumulation lake Pişchia, drained in 2009 and filled again with water in 2010, the vegetation was, obviously, deeply changed. In fact, the lake being cleaned, both the aquatic and the shore vegetation have disappeared. Here, actually restarts the formation of phytocoenoses, reason for which we consider it interesting to keep observing this evolution. Just as information, we mention that in the fall of 2009 it was also intended the drainage of Liebling, with a view to dam improvement works. Though sometimes necessary, these drainage works profoundly influence the plant communities, most of them being endangered, reason for which we advise a careful assessment of the effect of these interventions.

CONCLUSIONS

The study of the vegetation in the accumulation lakes Surduc, Pischia, Liebling and Sanandrei were carried out during the period 2004-2010. We had in view identifying the aquatic and paludicolous associations and establishing their evolution trends. After processing the data collected in the field, 29 vegetal associations were established. Their evolution tendencies, going from normal successions up to the degradation of phytocoenoses structures and weeding-up of resorts, are related to the ecological status of waters, to the natural changes occurring, but mostly to man's impact on these eco-systems. These aspects were best observed in two of the accumulations studied, Sanandrei and Pischia, drained in the past years.

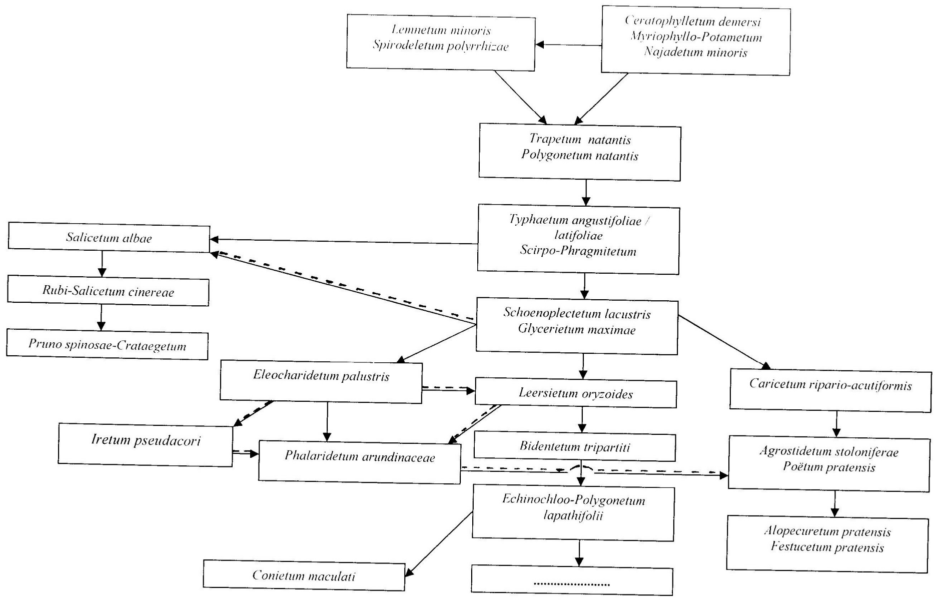

Figure 1. The vegetation dynamics - own scheme

ACKNOWLEDGEMENTS

This work was published during the project "POSTDOCTORAL SCHOOL OF AGRICULTURE AND VETERINARY MEDICINE", POSDRU/89/1.5/S/62371, co-financed by the European Social Fund through the Sectorial Operational Programme for the Human Resources Development 2007-2013.

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