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"IN VIVO" AND "IN VITRO" TUMOR INDUCTION BY AGROBACTERIUM TUMEFACIENS IN VITIS VINIFERA L.

ALEXANDRINA PĂTRAȘCU-CĂLIN, PETRUȚA CORNEA, AURELIA BREZEANU

Tumors were induced on "in vitro" leaves and shoots of *Vitis vinifera* and "in vivo" material of the same cultivars (Traminer roz, Fetească albă and Fetească regală) with *Agrobacterium tumefaciens* C₅₈ strain. Several inoculation procedures were evaluated. The most efficient way of infection was the method of inoculation at the wounding site on stem. *Agrobacterium tumefaciens* C₅₈ strain is virulent for the three tested cultivars especially for the autochthonous Fetească albă and Fetească regală.

Many roots developed from induced tumors so that the tumor phenotype is a "rooty tumor" one. The electrophoresis and paper chromatography methods revealed the synthesis of opines which together with the neoplastic growth and the possibility of cultivation of tumors on medium without hormones prove the transformed state of the analysed tissues.

The virulent strains of the *Agrobacterium tumefaciens* proved to be broad-host-range pathogens, inducing tumors (crown galls) on many dicotyledonous and some monocotyledonous plant species (1). The causal agent of crown gall tumorigenesis is a plasmid (Ti = tumor inducing) and the molecular basis of this process is the transfer and integration of a definite segment located on Ti plasmid (T-DNA) in the plant genome. Two main functions of T-DNA are distinguished (11).:

- oncogenicity (onc) — responsible for the tumor morphology;
- opine biosynthesis (ops) which determines the synthesis of opines — small molecules resulted from the condensation of the primary products of metabolism under the action of specific enzymes.

A region essential for tumorigenicity is vir region located outside of the T-DNA which is never integrated in the plant genome. T-DNA from Ti plasmid codes for some enzymes for biosynthesis of phytohormones, namely cytokinin (tmr) and auxin (tms) implied in morphogenesis. The inactivation of this kind of genes determines the modification of cytokinin/auxin balance (C/A) and a modified tumor phenotype, "rooty tumors" when is affected the gene for cytokinin synthesis or "shooty tumors" when the gene for auxin synthesis is affected respectively (6).

The *Agrobacterium* — plant cell interaction and the transfer of the neoplastic information by Ti plasmid represents the first example of naturally occurring genetic engineering. Recent advances in plant tissue culture techniques, recombinant DNA technology and bacterial genetics have made it feasible to isolate specific genes, manipulate them "in vitro" and introduce them into plant cells.

The grape vine (*Vitis vinifera* L.) has not yet been intensively used as subject and model for this type of research but it is expected that these conceptual methods and the practical achievements already obtained with model plants (tobacco, potato, carrot, Petunia, etc.) should be applied to *Vitis* species too. *V. vinifera* comprises the basic conditions for the *Agrobacterium* mediated transformation, namely it is susceptible to infection with this bacteria and it is possible to regenerate plants "in vitro" conditions (4), (7), (9), (10). The gene transfer and the cellular selection

are considered to be the two forms of genetic manipulations for the grape vine. The main goal is the transfer of genes conferring resistance to pathogens from wild species to cultivated ones. The major impediment is that these genes were not isolated yet and they could not be used in the genetic transformation process of this species (3).

MATERIALS AND METHODS

In our experiments the strain of *Agrobacterium tumefaciens* C 58 (a gift from dr. Mlinarova—Czechoslovakia) which contains p Ti 58 (nos+tm+) was tested. The bacterial suspension was obtained by cultivation for 48 hours in nutritive broth and used for plant infection. The infection was performed both "in vivo" on plants grown in green house and "in vitro" on plants regenerated from meristem cultures on Murashige — Skoog basal nutritive medium supplemented with 0.2 mg/l Benzylaminopurine (BAP).

The tumors were induced on grape vine plants belonging to the following cultivars: Traminer roz, Fetească albă and Fetească regală.

The infection of plants cultivated "in vitro" was realised in 3 ways:

- by inoculation of bacterial suspension at a wounding site on the midrib of the leaf;
- by dipping of leaf explants for 8 minutes in the bacterial suspension;
- by wounding of the stem followed by infection.

The infected material was cultivated on Murashige — Skoog (MS) medium (5) without hormones and after 48 h was transferred on same medium but supplemented with carbenicillin (500 mg/l) or a mixture of carbenicillin + ampicillin (500 mg/l + 500 mg/l). After 3 subcultures on MS medium with antibiotics which eliminate the bacteria, the tumors were transferred on MS medium without antibiotics.

The tumors obtained were analysed for opine biosynthesis by paper electrophoresis and paper chromatography by ninhydrine staining (8) by comparison with two controls:

- an explant of grape-vine Fetească albă cv. (MII) which was not infected;
- roots (RII) appeared "in vitro" on the same uninfected grapevine plants cultivated on a special rooting medium (MS medium containing kinetin — 0.022mg/l and IAA — 1.8 mg/l).

The presence of opine was tested in tumor extracts (II A 20) and in extracts from roots developed on these tumors (RA 20).

Histological analyses of tumors were performed according to standard techniques, namely a fixation in Navashin — Brown's solution and hemalaun — eosine staining.

RESULTS AND DISCUSSION

Small tumors were observed on the infected plants at the wounding site both on the midrib of the leaf (Fig. 1) and on the stem (Fig. 2). The tumors grew rapidly and after several subcultivations on MS medium with

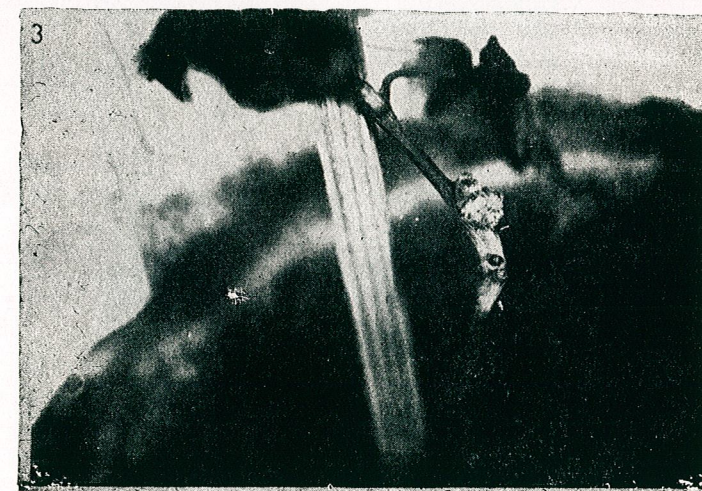
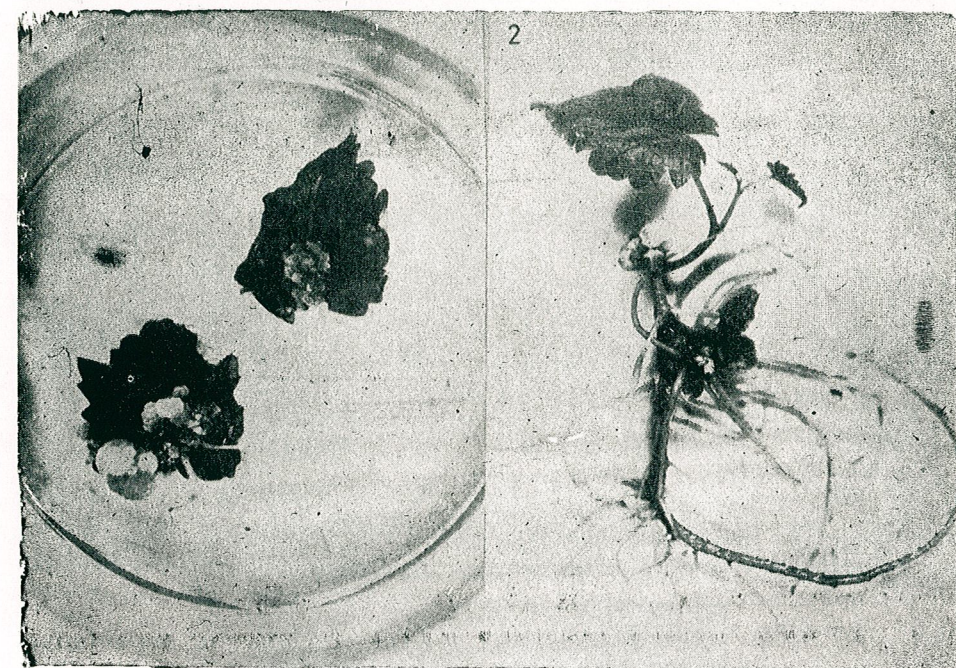


Fig. 1. — Tumors on the midrib of the leaf — Fetească albă cv.

Fig. 2. — Tumors and roots developed from them — Fetească regală cv.

Fig. 3. — "In vivo" induction of tumors on the plant of Fetească albă cv.

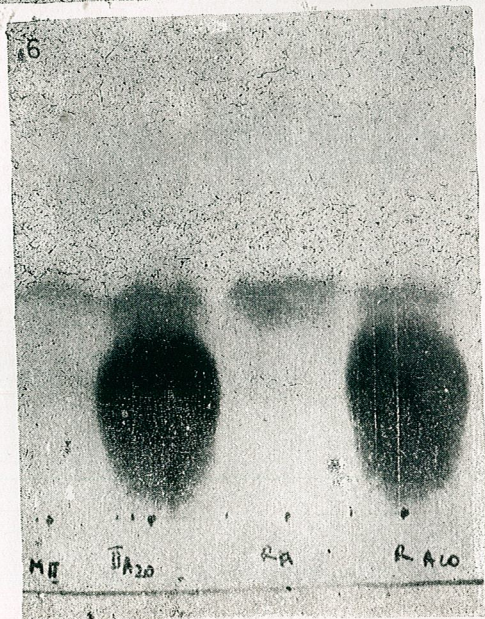
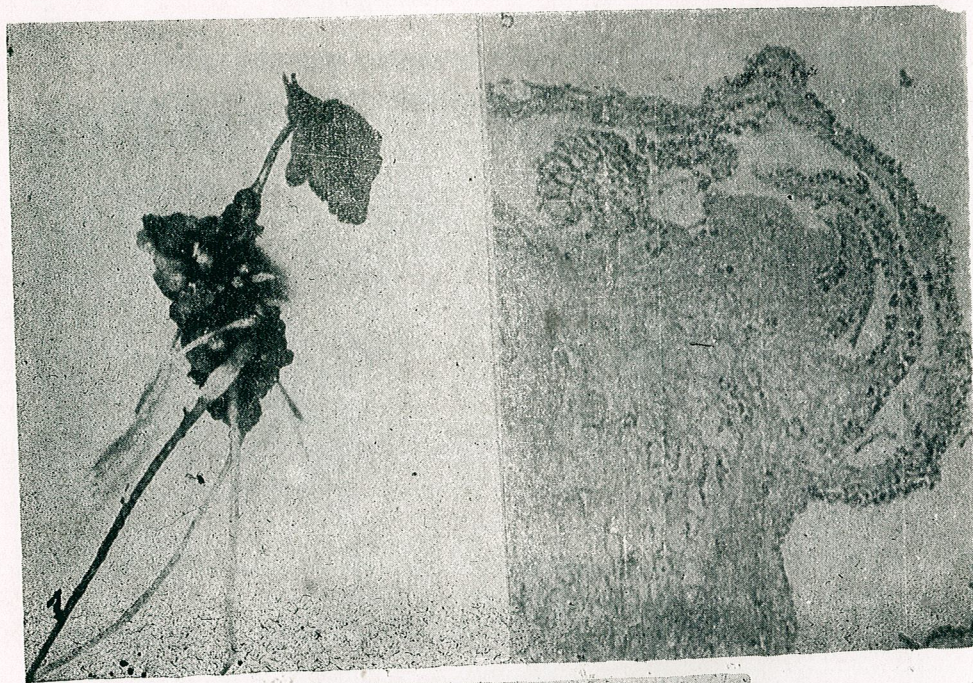


Fig. 4. — Tumor and roots appeared "in vitro" by inoculation at the wounding site on the stem Fetească albă cv.

Fig. 5. — Histological aspect of the caulinary buds differentiation.

Fig. 6. — Paper chromatography of infected material presented in Fig. 4 (II A 20 and R A 20) and of controls (M II and R II).

antibiotics they were excised and placed on the same basal medium but without antibiotics and hormones where a good proliferation was observed. The most efficient combination of antibiotics which inhibits the multiplication of bacteria was carbenicillin (500 mg/l + ampicillin (500 mg/l); it stops the multiplication after the first subcultivation.

The "in vivo" infections were made on plants belonging to cultivars: Fetească albă and Fetească regală, but the tumors which appeared (Fig. 3) were lost after 2 weeks. It is generally appreciated in the literature that "in vivo" is not possible to induce tumors because of the dehydration of the tissue at the site of inoculation (12).

The most efficient way of infection considered by us, both for the tumors obtaining and for the further development of them, was the method of inoculation at the wounding site on stem. In this case we obtained tumors which furtherly proliferated. The neighbouring tissue remained normal, they were not necrosed as it happened in the case of immersion of leaf fragments in the bacterial suspension. Our data are similar to those obtained by Hemstad and Reisch (2).

The results were appreciated as positive after 6 weeks of incubation and 3 subcultivations on MS basal medium without hormones. The strain *A. tumefaciens* C 58 was able to induce rooty tumors at all of the three cultivars tested (Fig. 4). Their aspect was correlated indifferent of infection modality with the cultivar. This phenotype — rooty tumors — was also observed by YANOFSKY et al (13), (14), in experiments with biotype 3 of *A. tumefaciens* strain which contains the pTiAg162 LHR plasmid; this phenotype is due to a *tmr* mutation which affects the gene for the biosynthesis of the cytokinin precursor. All the three grape vine cultivars tested presented a differentiate response as regards the tumor inducing as a consequence of the infection, with the same strain of *A. tumefaciens* C 58, the cultivar Fetească albă being the most sensitive to infection.

The histological analyses of the tumors show at the same time the caulinary buds differentiation which did not develop in shoots (Fig. 5).

The biochemical studies by electrophoresis and chromatography of these tumors (Fig. 6) revealed the presence of the additional spots both for tumor extract and for the roots developed from it, by comparison with the uninfected tissues. The synthesis of opines, the neoplastic growth and the possibility of cultivation of tumors on a medium without hormones prove the transformed state of the analysed tissues. The roots developed from tumors induced by *A. tumefaciens* are similar to those induced by *A. rhizogenes* (hairy roots) due to their morphological aspect, independence to phytohormones and to ability to opine producing.

As a conclusion, the strain *A. tumefaciens* C. 58 is virulent for the Traminer roz cv. and for autochthonous cultivars Fetească albă and Fetească regală.

Notably, the tumor phenotype is the same as that produced by a *tmr* mutant of *A. tumefaciens* strain which contains in T— DNA a gene defective for cytokinin synthesis.

The experiments regarding the ability of *A. tumefaciens* C 58 for tumor inducing to other two plant species as tobacco and potato and their characterisation are in progress.

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A CHECKLIST OF THE BENTHIC MARINE ALGAE (EXCEPT THE DIATOMS) ALONG THE ROMANIAN SHORE OF THE BLACK SEA

A. BAVARU¹, A. S. BOLOGA², H. V. SKOLKA²

Key Words: Algology, macrophyta, taxonomy, Black Sea, Romanian coast
On the basis of consulting the complete algological bibliography available for the Romanian Black Sea coast, an inventory of the benthic marine algae is presented, which for the last five decades, has included: 36 Cyanophyta, 47 Chlorophyta, 2 Xanthophyta, 30 Phaeophyta and 75 Rhodophyta.

Après avoir consulté la bibliographie algologique complète disponible concernant le littoral roumain de la Mer Noire, l'inventaire des algues benthiques marines est présenté: 36 Cyanophycées, 47 Chlorophycées, 2 Xanthophycées, 30 Phaeophycées et 75 Rhodophycées ont été totalisés pendant les cinq dernières décennies.

More than a century has already passed since marine algae were mentioned for the first time on the Romanian Black Sea coast by Schaar-schmidt (in Kanitz, 1879—1881). The first works consist only of the identification of some algological materials which were received by the author in order to be determined. The period of a rigorously scientific study of the Romanian marine algal flora was started by Teodorescu (1907) and carried out by Celan over a period of five decades between 1935—1983.

Tarnavski and Oltean (1956, 1958) published a prestigious conspectus in two parts on all the alga groups identified across the Romanian territory and along the marine littoral. Later on Busnita and Serbănescu (1965) and Busnita *et al.* (1967) also mentioned some marine and brackish water algae in their survey on the Romanian hydrobiological literature.

After the occasional contribution to the knowledge of Cyanophyta (Gruia, 1968) and the checklist of macrophytes (Skolka, 1969), complete lists on the benthic marine algae of Romania were made up for the first time by Bavaru, concerning the Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta (1977 a), and only the Phaeophyta and Rhodophyta with the publication of the second volume of the "Treatise on Algology" (1977 b).

Afterwards a lot of new contributions on the marine macrophyto-benthos has been exhaustively reviewed by Bologa (1987), beside a historical survey on the development of marine benthic algology in Romania (Bologa, 1989).

That is why, having in view the whole set of modern exigencies for botanical nomenclature (e. g. Dixon and Irvine, 1977; Christensen *et al.*, 1985; South and Tittley, 1986; Athanasiades, 1987; Boudouresque and Perret-Boudouresque, 1987; Fletcher, 1987; Kornmann, 1989), we consider it useful that a critical synthesis on the inventory of benthic marine algae should be brought up to date. As to the total of 36 Cyanophyta, 47 Chlorophyta, 2 Xanthophyta, 30 Phaeophyta and 75 Rhodophyta men-

tioned along the Romanian shore beginning with 1935, only 18, 31, 1, 14 and 41, respectively, were still found after 1960. It appears that since 1980 even less taxa are to be found, but it is not excluded that similarly to some marine molluscs, new species entered meanwhile too.

Fil. CYANOPHYTA

I. Div. CHROOCOCCEAE

Ord. CHROOCOCCALES

Group STEREOMETREAE

Fam. COCCOBACTREACEAE

1. *Synechocystis* sp. (GRUIA, 1968).

Fam. MICROCYSTIDACEAE

2. *Microcystis anodonta* (Hansg.) Elenk. var. *marina* (Frémy) Kossinsk. (CELAN, 1959).
3. *Microcystis concharum* (Hansg.) Kossinsk. (CELAN, 1962).
4. *Microcystis minuta* Kylin var. *aeruginosa* Lindstedt (CELAN, 1962).
5. *Microcystis minuta* Kylin var. *violacea* Lindstedt (CELAN, 1962).

Fam. GLOEOCAPSACEAE

6. *Gloeocapsa crepidinum* (Thur.) Born. et Thur. (TEODORESCU, 1907)

Ord. ENTOPHYSALIDALES

Fam. CHLOROGLOEACEAE

7. *Chlorogloea* sp. (CELAN, 1962), very similar with *C. endophytica* Howe from the Peruvian coast.

Fam. ENTOPHYSALIDACEAE

8. *Entophysalis granulosa* Kütz. (CELAN, 1958 a).

II. Div. CHAMAESIPHONEAE

Ord. PLEUROCAPSALES

Fam. PLEUROCAPSACEAE

9. *Pleurocapsa fuliginosa* Hauck (CELAN, 1962).
10. *Hyella caespitosa* Born. et Flah. (CELAN, 1959).

III. Div. HORMOGONEAE

A. Subdiv. HETEROCYSTEAE

Ord. STIGONEMATALES

Fam. NOSTOCHOPSIDACEAE

11. *Mastigocoleus testarum* Lagerh. ex Born. et Flah. (CELAN and BAVARU, 1973).

Ord. NOSTOCALES

a. Subord. SYMMETREAE

Fam. NODULARIACEAE

12. *Microchaete grisea* Thur. ex Born. et Flah. (CELAN, 1958 a).

b. Subord. ASSYMMETREAE

Fam. RIVULARIACEAE

13. *Calothrix aeruginea* (Kütz.) Thur. (GRUIA, 1968).
14. *Calothrix crustacea* Thur. in Born. et Thur. (CELAN, 1958 a).
15. *Calothrix scopulorum* (Weber et Mohr) C. A. Ag. (TEODORESCU, 1907).
16. *Isactis plana* (Harv. in Hook. ex Born. et Flah.) Thur. (CELAN, 1959).
17. *Rivularia atra* Roth ex Born. et Flah. f. *hemisphaerica* (Kütz.) Kossinsk. (TEODORESCU, 1907).

B. Subdiv. AHETEROCYSTEAE

Ord. OSCILLATORIALES

Fam. PSEUDONOSTOCACEAE

18. *Isocystis lithophila* Erczeg. (CELAN, 1962).
19. *Oscillatoria acutissima* Kuff. (GRUIA, 1968).
20. *Oscillatoria agardhii* Gom. f. *gomontii* Elenk. (GRUIA, 1968).
21. *Oscillatoria amphibia* (C. Ag. ex Gom.) Gom. (GRUIA, 1968), previously found in sulphurous springs near Mangalia (TEODORESCU, 1907).
22. *Oscillatoria corralinae* (Kütz.) Gom. (CELAN, 1962).
23. *Oscillatoria nigroviridis* Thwaites in Harv. ex Gom. (BAVARU, 1977 a).
24. *Spirulina breviararticulata* (Setch. et Gardn) Geitler (BAVARU, 1977 a), erroneously published as *Rivularia bullata* (Poir.) Berk. (CELAN, 1958 c).
25. *Spirulina tenuissima* (Kütz.) f. *versicolor* (Cohn) Kossinsk. (CELAN and BAVARU, 1973), previously published as *S. versicolor* Cohn (CELAN, 1936 b).
26. *Phormidium mycoideum* Frémy (GRUIA, 1968).
27. *Phormidium* sp. (GRUIA, 1968).
28. *Lyngbya aestuarii* (Mert. in Jörg.) Liebm. ex Gom. (GRUIA, 1968), previously found in the brackish water littoral lake Tuzla (TEODORESCU, 1907).
29. *Lyngbya confervoides* (C. A. Ag. ex Gom.) Gom. (CELAN, 1958 a).
30. *Lyngbya limnetica* Lemm. (GRUIA, 1968).
31. *Lyngbya lutea* (C. Ag.) Gom. ex Gom. (GRUIA, 1968).
32. *Lyngbya nordgaardii* Wille (CELAN, 1958b).
33. *Lyngbya perelegans* Lemm. (GRUIA, 1968).

Fam. SCHIZOTRICHACEAE

34. *Microcoleus chthonoplastes* (Mert. in Hornem.) Thur. ex Gom. (CELAN, 1958 a), previously found in the brackish water lake Lacul Sărat (TEODORESCU, 1907).
 35. *Microcoleus tenerrimus* Gom. (CELAN, 1962).

Fam. PLECTONEMATACEAE

36. *Plectonema calothrichoides* Gom. (CELAN, 1958 a).

Fil. CHLOROPHYTA

Cl. CHLOROPHYCEAE

Ord. ULOTRICHALES

Fam. ULOTRICHACEAE

1. *Ulothrix flacca* (Dillw.) Thur. in Le Jol. (CELAN and BOLOGA, 1981).
U. pseudoflacca Wille (CELAN, 1959) is also included in *U. flacca* according to CHRISTENSEN et al. (1985).
 2. *Ulothrix implexa* (Kütz.) Kütz. (CELAN and BOLOGA, 1981), previously published as *U. subflaccida* Wille (CELAN, 1959).

Fam. CHAETOPHORACEAE

3. *Pseudopringsheimia confluens* (Rosenv.) Wille, published for Cape Caliacra — Bulgaria (CELAN, 1938 b).
 4. *Ulvella lens* P. Crouan et H. Crouan (CELAN, 1962).
 5. *Phaeophila dendroides* (P. Crouan et H. Crouan) Batt., published as *P. engleri* Reinke (CELAN, 1962).
 6. *Acrochaete viridis* (Reinke) R. Nielsen, published as *Endoderma viride* (Reinke) Lagerh. and *Entocladia viridis* Reinke (CELAN, 1936 b).

Ord. ULVALES

Fam. MONOSTROMATACEAE

7. *Ulvaria oxysperma* (Kütz.) Bliding, published as *Monostroma wittrockii* Born. (CELAN, 1962). This species is also cited as *Gayralia oxysperma* (Kütz.) Vinogr. by CHRISTENSEN et al. (1985) and *Monostroma oxyspermum* (Kütz.) by SOUTH and TITTLE (1986).

Fam. ULVACEAE

8. *Percursaria percursa* (Ag.) Bory (CELAN, 1979 b).
 9. *Blidingia marginata* (J. Ag.) P. Dang. (CELAN and BAVARU, 1973), previously published as *Enteromorpha marginata* J. Ag. (CELAN, 1962).
 10. *Enteromorpha ahlneriana* Bliding (CELAN and BAVARU, 1973).
 11. *Enteromorpha clathrata* (Roth) Grev. (TEODORESCU, 1907).
 12. *Enteromorpha compressa* (L.) Grev. (TEODORESCU, 1907), also published as *E. compressa* f. *lingulata* (J. Ag.) Hauck (CELAN, 1958 a).
 13. *Enteromorpha flexuosa* (Wulf. ex Roth) J. Ag. (CELAN et al., 1969).

14. *Enteromorpha flexuosa* (Wulf. ex Roth) J. Ag. subsp. *flexuosa* Bliding (CELAN, 1979 a).
 15. *Enteromorpha flexuosa* (Wulf. ex Roth) J. Ag. subsp. *paradoxa* (Dillw.) Bliding typus II (CELAN, 1979 a), previously published as *E. hopkirkii* M'Calla ex Harv. (CELAN, 1936 b) and considered synonymous with *E. clathrata* (Roth) Grev. var. *hopkirkii* (CELAN, 1936 b).
 16. *Enteromorpha flexuosa* (Wulf. ex Roth) J. Ag. subsp. *pilifera* (Kütz.) Bliding (CELAN, 1979a).
 17. *Enteromorpha intestinalis* (L.) Link (TEODORESCU, 1907).
 18. *Enteromorpha kylinii* Bliding, published as *E. lingulata* J. Ag. (TEODORESCU, 1907).
 19. *Enteromorpha linza* (L.) J. Ag. (TEODORESCU, 1907).
 20. *Enteromorpha maotica* Pr. Lavr., found only in the brackish water littoral lake near Eforie Nord (BAVARU, 1977 a), and considered endemic for the Black Sea and Azov Sea (ZINOVA, 1967).
 21. *Enteromorpha prolifera* (O. F. Müll.) J. Ag. (CELAN et al., 1979), initially found in the brackish water littoral lake Gargalicul mic (TEODORESCU, 1907).
 22. *Enteromorpha torta* (Mert. in Jürg.) Reinb. (SKOLKA, 1969).
 23. *Ulva lactuca* L. (CELAN, 1958 a). CELAN reconsidered this species, together with *U. lactuca* L. var. *lactuca* (L.) Le Jolis, as being *Enteromorpha intestinalis* (L.) Link. We consider that *U. lactuca* L. does not exist along the Romanian coast, but it deals about *U. rigida* Ag.
 24. *Ulva rigida* Ag., published as *U. lactuca* L. f. *rigida* (Ag.) Le Jolis (CELAN, 1948).

Ord. CHLOROCOCCALES

Fam. GOMONTIACEAE

25. *Gomontia polyrhiza* (Lagerh.) Born. et Flah. (CELAN, 1959).

Ord. CLADOPHORALES

Fam. CLADOPHORACEAE

26. *Chaetomorpha aerea* (Dillw.) Kütz. (TEODORESCU, 1907).
 27. *Chaetomorpha capillaris* (Kütz.) Börg. (CELAN and BOLOGA, 1983).
 28. *Chaetomorpha crassa* (Ag.) Kütz. (SKOLKA, 1969).
 29. *Chaetomorpha linum* (O. F. Müll.) Kütz. (CELAN, 1936 b).
 30. *Rhizoclonium riparium* (Roth) Kütz. ex Harv., published as *R. hieroglyphicum* var. *riparium* (Harv.) Stockm. in the brackish water littoral lakes at Mangalia (TEODORESCU, 1907). This species is considered by NIENHUIS (1975) synonymous with *R. implexum* (Dillw.) Kütz. (CELAN and BAVARU, 1973), previously published as *R. kochianum* Kütz. (CELAN, 1958 c). *R. tortuosum* (Dillw.) Kütz. (SKOLKA, 1969) is also included in *R. riparium* according to SOUTH and TITTLE (1986).
 31. *Cladophora albida* (Huds.) Kütz. (CELAN, 1962), previously published as *C. hamosa* Kütz. (CELAN 1936 b), *C. refracta* (Roth) Kütz. (CELAN, 1936 b) and *C. glaucescens* (Griff. ex Harv. (CELAN, 1962); these last species are considered by HOEK (1963) synonymous with *C. albida* (Huds.) Kütz. and *C. sericea* (Huds.) Kütz.

32. *Cladophora dalmatica* Kütz. (*C. globifera* (Kütz.) Kütz.) (CELAN, 1938 b).
33. *Cladophora fracta* (O. F. Müll. ex Vahl) Kütz. (TEODORESCU, 1907).
34. *Cladophora glomerata* (L.) Kütz. (CELAN, 1936 b).
35. *Cladophora hutchinsiae* (Dillw.) Kütz., published for Balchic — Bulgaria (CELAN, 1938 b).
36. *Cladophora laetevirens* (Dillw.) Kütz. (CELAN and BAVARU, 1973), previously published as *C. utriculosa* Kütz. (TEODORESCU, 1907).
37. *Cladophora liniformis* Kütz. (CELAN and BAVARU, 1973).
38. *Cladophora ruchingeri* (Ag.) Kütz., published as *C. sericea* (Huds.) Kütz. f. *ruchingeri* (C. Ag.) Hamel (CELAN, 1948).
39. *Cladophora rupestris* (L.) Kütz. (CELAN, 1936 b), also published as *C. rupestris* (L.) Kütz. var. *mediterranea* Kütz. (CELAN, 1958 a), that proved to be an elderly form of *C. vagabunda* (L.) Hoek (BAVARU, 1977 c).
40. *Cladophora sericea* (Huds.) Kütz. (CELAN, 1936 b), previously published as *C. rudolphiana* (C. Ag.) Kütz. (VORONIKHIN, 1925).
41. *Cladophora sivashensis* C. Meyer (CELAN and BOLOGA, 1983, according to ZINOVA, 1967). Its description is considered by HOEK (1963) rather suggestive of *C. liniformis* Kütz. Endemic in the Black Sea and Azov Sea (ZINOVA, 1967).
42. *Cladophora vagabunda* (L.) Hoek (CELAN and BAVARU, 1973); the species *C. fracta* (Fl. dan.) Kütz. (TEODORESCU, 1907) and *C. bertolonii* Kütz. var. *elongata* Ardiss. (TEODORESCU, 1907) are included by HOEK (1963) within this species.

Fam. ACROSIPHONIACEAE

43. *Urospora penicilliformis* (Roth) Aresch. (TEODORESCU, 1907), also published as *U. mirabilis* Aresch. (CELAN, 1958 a).

Ord. SIPHONALES

Fam. BRYOPSIDACEAE

44. *Bryopsis adriatica* (J. Ag.) Menegh. (CELAN and BOLOGA, 1983).
45. *Bryopsis hypnoides* Lamour. (CELAN and BAVARU, 1973).
46. *Bryopsis plumosa* (Huds.) Ag. (TEODORESCU, 1907).

Fam. PHYLLOSIPHONACEAE

47. *Ostreobium quekettii* Born. et Flah. (CELAN, 1962).

Fil. XANTHOPHYTA

Cl. HETEROSIPHONOPHYCEAE

Ord. BOTRYDIALES

Fam. VAUCHERIACEAE

1. *Vaucheria dichotoma* (L.) Martius var. *submarina* Lyngb., published as *V. dichotoma* (L.) Ag. f. *marina* Hauck (CELAN, 1962). Following CHRISTENSEN (1987) it is doubtful what this var. covers.

2. *Vaucheria piloboloides* Thur., published for the northern part of Zernov's "field of *Phyllophora*" — USSR (SKOLKA and BODEANU, 1971).

Fil. PHAEOPHYTA

Cl. PHAEOSPOROPHYCEAE

Ord. ECTOCARPALES

Fam. ECTOCARPACEAE

1. *Ectocarpus caspicus* Henck. (BAVARU, 1980), previously described as a particular form of *E. siliculosus* (Dillw.) Lyngb. found in the brackish water littoral lake Mangalia (CELAN and BAVARU, 1967a), and considered endemic for the Caspian Sea (ZINOVA, 1967) and a ponto-caspian relict (BAVARU, 1980).
2. *Ectocarpus siliculosus* (Dillw.) Lyngb. (CELAN, 1958a).
3. *Ectocarpus siliculosus* (Dillw.) Lyngb. var. *siliculosus* (Dillw.) Kjellm., published as *E. confervoides* (Roth) Le Jol. (TEODORESCU, 1907).
4. *Feldmannia irregularis* (Kütz.) Hamel (CELAN et al., 1969), previously published as *Ectocarpus lebelii* Crouan var. *agigensis* Celan (CELAN, 1964).
5. *Phaeostroma bertholdii* Kuck. (SKOLKA, 1969).
6. *Pilayella litoralis* (Lyngb.) Kjellm. (SKOLKA, 1969).

Ord. CHORDARIALES

Fam. MYRIONEMATACEAE

7. *Myrionema strangulans* Grev. (TEODORESCU, 1907).
8. *Myrionema orbiculare* J. Ag., published as *Ascocyclus orbicularis* (J. Ag.) Magn. (CELAN, 1964).

Fam. RALFSIACEAE

9. *Ralfsia verrucosa* (Aresch.) J. Ag. (CELAN, 1936b).

Fam. STREBLONEMATACEAE

10. *Streblonema effusum* Kylin, published as *Entonema effusum* (Kylin) Kylin (CELAN and BOLOGA, 1983).
11. *Streblonema oligosporum* Strömf., published as *Entonema oligosporum* (Strömf.) Kylin (BAVARU, 1977a).
12. *Streblonema parasiticum* (Sauv.) Levr., published as *S. parasiticum* De Toni (CELAN, 1959) and *Entonema parasiticum* (Sauv.) Hamel (BAVARU, 1977a).
13. *Streblonema stilophorae* (P. Crouan et H. Crouan) Hamel (CELAN, 1964).
14. *Streblonema tenuissimum* Hauck, published as *Phycocelis tenuissima* (Hauck) Kuck. (CELAN, 1964).

Fam. CHORDARIACEAE

15. *Corynophlaea umbellata* (Ag.) Kütz. (SKOLKA, 1969), previously published as *Leathesia umbellata* (Ag.) Menegh. (CELAN, 1936b).

Fam. SPERMATOCHNACEAE

16. *Stilophora rhizodes* (Turn.) J. Ag. (CELAN, 1964).

Ord. CUTLERIALES

Fam. CUTLERIACEAE

17. *Zanardinia prototypus* Nardo (ZINOVA, 1967), not to be found in the Romanian bibliography (BAVARU, 1977a).

Ord. DICTYOTALES

Fam. DICTYOTACEAE

18. *Dilophus fasciola* (Roth) Howe (CELAN, 1964).
19. *Dilophus fasciola* (Roth) Howe f. *repens* (J. Ag.) Feldm. (BAVARU, 1977 a), previously published as *D. repens* J. Ag. (CELAN, 1938 b).

Ord. SPHACELARIALES

Fam. SPHACELARIACEAE

20. *Sphacelaria cirrhosa* (Roth) Ag. (CELAN, 1936b).
21. *Sphacelaria cirrhosa* (Roth) Ag. f. *irregularis* (Kütz.) Hauck (TEODORESCU, 1907).
22. *Cladostephus spongiosus* (Huds.) C. Ag., published as *C. verticillatus* (Lightf.) Ag. (TEODORESCU, 1907), synonymous with *C. hirsutus* (L.), Boud. et Perret ex Boud. et al. and *C. spongiosus* (Huds.) C. Ag. f. *verticillatus* (Lightf.) Prud'homme van Reinke according to BOUDOURESQUE and PERRET-BOUDOURESQUE (1987).

Ord. SCYTOSIPHONALES

Fam. SCYTOSIPHONACEAE

23. *Scytosiphon lomentaria* (Lyngb.) Link (TEODORESCU, 1907).
24. *Petalonia zosterifolia* (Reinke) O. Kuntze (SKOLKA, 1969).

Ord. PUNCTARIALES

Fam. PUNCTARIACEAE

25. *Punctaria latifolia* Grev. (TEODORESCU, 1907).
26. *Punctaria tenuissima* (C. Ag.) Grev., published as *Desmotrichum undulatum* (J. Ag.) Reinke (CELAN and BAVARU, 1976). The erroneously as nov. sp. considered species *Ectocarpus caliacrae* Celan (CELAN, 1938b) and *Ectocarpidium pitracanum* Sperr (CELAN, 1960 a) have been recognized by ZINOVA (1967) as development stages of *D. undulatum* (J. Ag.) Reinke. This species was previously also published as *Punctaria latifolia* Grev. (CELAN, 1964), with which it is very similar (BAVARU, 1977a)*. As a matter of fact, according to RIETEMA and HOEK (1981), it could even belong to the life cycle of *P. latifolia*.

* In the past, TARNAVSCHI and OLTEAN (1956) erroneously mentioned *Desmotrichum balticum* Kütz., at present synonymous with *D. undulatum* (J. Ag.) Reinke, as being published by TEODORESCU (1907) (BAVARU, 1977 a).

Fam. STRIARIACEAE

27. *Striaria attenuata* (Grev.) Grev. f. *crinita* (Ruch.) Hauck (CELAN, 1964).
28. *Stictyosiphon adriaticus* Kütz. (CELAN, 1964).

Cl. CYCLOSPOROPHYCEAE

Ord. FUCALES

Fam. SARGASSACEAE

29. *Cystoseira barbata* (Good. et Wood.) Ag. (CELAN, 1935). Further researches have not confirmed the existence of *C. hoppii* C. Ag. (TEODORESCU, 1907) and *C. barbata* (Good. et Wood.) Ag. var. *hoppii* (CELAN, 1936 b) which are considered by ZINOVA (1967) synonymous with *C. barbata* (BAVARU, 1977a). Also synonymous with *C. humilis* Kütz. according to SOUTH and TITTLE (1986).
30. *Cystoseira crinita* (Desf.) Duby f. *bosporica* (Sauv.) A. Zin. et Kalug. (BAVARU, 1977a), previously published as *C. bosporica* Sauv. (CELAN, 1935).

Fil. RHODOPHYTA

Cl. BANGIOPHYCEAE

Ord. GONIOTRICHALES

Fam. GONIOTRICHACEAE

1. *Chroodactylon ornatum* (C. Ag.) Bassan, published as *Asterocytis ornata* (Ag.) Hamel (CELAN, 1960 b) and *A. wolleana* (Hansg.) Lagerh. (ZINOVA, 1967), the last one not to be found in the Romanian bibliography (BAVARU, 1977a).
2. *Stylonema alsidii* (Zanard.) Drew, published as *Goniotrichum elegans* (Chauv.) Zanard. (CELAN, 1936b).

Ord. BANGIALES

Fam. ERYTHROTRICHIACEAE

3. *Sahlingia subintegra* (Rosenf.) Kornm., published as *Erythrocladia subintegra* Rosenf. for Cape Caliacra — Bulgaria (CELAN, 1938b).
4. *Erythrotrichia bertholdii* Batt., published for Cape Caliacra — Bulgaria (CELAN, 1938 b). According to HEEREBOOUT (1968) the species *E. bertholdii* and *E. investiens* (Zanard.) Born. are included in *E. carnea*.
5. *Erythrotrichia carnea* (Dillw.) J. Ag. (SKOLKA, 1969).

Fam. BANGIACEAE

6. *Bangia atropurpurea* (Roth) Ag., published as *B. fuscopurpurea* (Dillw.) Lyngb. (TEODORESCU, 1907).
7. *Porphyra leucosticta* Thur. in Le Jol. (CELAN, 1958a).

Cl. FLORIDEOPHYCEAE

Ord. NEMALIONALES

Fam. ACROCHAETIACEAE

8. *Acrochaetium* * *daviesii* (Dillw.) Näg. (SKOLKA, 1969).
9. *Acrochaetium hallandicum* Kylin f. *parvula* (Kylin) Rosenv. (CELAN, 1938 b), synonymous with *Audouinella parvula* (Kylin) P. Dixon in Parke et P. Dixon).
10. *Acrochaetium mahumetanum* Hamel (CELAN, 1938b), according to ZINOVA (1967) synonymous with *A. humilis* (Rosenv.) Papenf. (= *Audouinella humilis* (Rosenv.) Garb.
11. *Acrochaetium savianum* (Menegh.) Woelk., published as *A. thuretii* (Born.) Coll. et Harv. (CELAN, 1936b) and *A. thuretii* (Born.) Coll. et Harv. f. *agama* Rosenv. (CELAN, 1958a). ZINOVA (1967) considered *A. savianum* and *A. thuretii* distinctly.
12. *Acrochaetium secundatum* (Lyngb.) Näg. (CELAN, 1959), previously published as *Chantransia secundata* (Lyngb.) Thur. (TEODORESCU, 1907) and *A. virgatulum* J. Ag. f. *secundata* (?) (CELAN, 1938b).
13. *Acrochaetium virgatulum* J. Ag. (CELAN, 1936b), previously published as *Chantransia virgatula* (Harv.) Thur. (TEODORESCU, 1907).

Ord. GELIDIALES

Fam. GELIDIACEAE

14. *Gelidium latifolium* (Grev.) Born. et Thur., published for Cape Caliacra — Bulgaria (CELAN, 1938b).
15. *Gelidium pussillum* (Stackh.) Le Jol., published as *G. crinale* (Turn.) Lamour. in Bory (ZINOVA, 1967), not to be found in the Romanian bibliography (BAVARU, 1977a).
16. *Gelidiella antipai* Celan, published for Cape Caliacra — Bulgaria (CELAN, 1938a).

Ord. CRYPTONEMIALES

Fam. SQUAMARIACEAE

17. *Peyssonnelia dubyi* Pan Crouan et H. Crouan (CELAN, 1948), also published as *Cruoriella dubyi* (Crouan) Schmitz (CELAN, 1959).
18. *Peyssonnelia rubra* (Grev.) J. Ag. (CELAN, 1958a).
19. *Peyssonnelia squamaria* (Gmel.) Decne. (CELAN, 1948).

Fam. HILDENBRANDIACEAE

20. *Hildenbrandia rubra* (Sommerf.) Menegh., published as *H. prototypus* Nardo (TEODORESCU, 1907).

Fam. CORALLINACEAE

Subfam. MELOBESIOIDEAE

21. *Titanoderma cystoseirae* (Hauck) Huvé, published as *Melobesia cystoseirae* Hauck (CELAN, 1948) and *Dermatolithon cystoseirae* (Hauck) Huvé CELAN and BAVARU, 1967b).

* SOUTH and TITTLE (1986) consider the genus *Acrochaetium* Näg. in Näg. et C. Cramer synonymous with *Audouinella* Bory.

22. *Titanoderma pustulatum* (Lamour.) Wölk et al., published as *Melobesia pustulata* Lamour. (TEODORESCU, 1907) and *Dermatolithon pustulatum* (Lamour.) Foslie (SKOLKA, 1969).
23. *Fosliella farinosa* (Lamour.) Howe in Britton et Millspaugh., published as *Melobesia farinosa* Lamour. (TEODORESCU, 1907).

Subfam. CORALLINOIDEAE

24. *Corallina elongata* Ellis et Solander, published as *C. mediterranea* Aresch for Cape Caliacra — Bulgaria (CELAN, 1938b).
25. *Corallina officinalis* L. (BAVARU and VASILIU, 1985).
26. *Jania rubens* (L.) Lamour. (BAVARU, 1981).

Ord. GIGARTINALES

Fam. CRUORIACEAE

27. *Cruoriella armorica* Crouan (CELAN, 1936b), also published as *Cruoriopsis rosenvingii* Börg. (CELAN and BAVARU, 1978).

Fam. PHYLLOPHORACEAE

28. *Phyllophora nervosa* (DC.) Grev. ex J. Ag. (TEODORESCU, 1907), also published as *P. rubens* (Good. et Wood.) Grev. f. *nervosa* Hauck (CELAN, 1936 b). DIXON and IRVINE (1977) consider it synonymous with the closely related Atlantic species *P. crispa* (Huds.) P. Dixon.
29. *Phyllophora pseudoceranoides* (Gmel.) Newr. et A. Tayl., published as *P. membranifolia* (Good. et Wood.) J. Ag. (SKOLKA, 1969).
30. *Phyllophora truncata* (Pallas) A. Zin. f. *brodiaei* Turn., published as *P. brodiaei* (Turn.) J. Ag. by CELAN (1938a) who specified that several samples of the alga originated in the stomach of a sturgeon that had been fished off Portitza; later on SKOLKA (1956, 1969) found it in the southern part of Zernov's "field of *Phyllophora*" (BAVARU, 1977a).

Ord. RHODYMENIALES

Fam. LOMENTARIACEAE (CHAMPIACEAE)

31. *Lomentaria clavellosa* (Turn.) Gail. (CELAN, 1977), previously published as *Chylocladia clavellosa* J. Ag. (TEODORESCU, 1907).

Ord. CERAMIALES

Fam. CERAMIAEAE

Subfam. CROUANIOIDEAE

32. *Antithamnion cruciatum* (Ag.) Näg. (CELAN, 1936b).

Subfam. CERAMIOIDEAE

33. *Ceramium circinatum* (Kütz.) J. Ag. (CELAN and SERBĂNESCU, 1959).
34. *Ceramium circinatum* (Kütz.) J. Ag. f. *densecorticata* Voronikh. (CELAN and SERBĂNESCU, 1959).

35. *Ceramium diaphanum* (Lightf.) Roth (CELAN, 1936b).
36. *Ceramium diaphanum* (Lightf.) Roth var. *strictum* Celan et Șerbănescu (CELAN and ȘERBĂNESCU, 1959).
37. *Ceramium elegans* (Roth) Ducl. (TEODORESCU, 1907).
38. *Ceramium elegans* (Roth) Ducl. var. *diaphanoideum* Celan et Șerbănescu (CELAN and ȘERBĂNESCU, 1959).
39. *Ceramium elegans* (Roth) Ducl. var. *fastigiatum* Celan et Șerbănescu (CELAN and ȘERBĂNESCU, 1959), previously published as *C. fastigiatum* Harv. (CELAN, 1936 b); due to its particular ecology (being found in littoral lakes too) it made CELAN think that it could be a ponto-caspian relict spread in brackish water areas (BAVARU, 1977a).
40. *Ceramium elegans* Ducl. f. *litorale* Celan et Șerbănescu (CELAN and ȘERBĂNESCU, 1959).
41. *Ceramium elegans* Ducl. f. *longearticulata* Celan et Șerbănescu (CELAN and ȘERBĂNESCU, 1959).
42. *Ceramium pedicellatum* (Duby) J. Ag. (SKOLKA, 1969); it might be *C. rubrum* (Huds.) C. Ag. var. *pedicellatum* J. Ag. published by VORONIKHIN (1909) and signalled by CELAN and ȘERBĂNESCU (1959) as being frequent along the Romanian coast (BAVARU, 1977a).
43. *Ceramium rubrum* (Huds.) C. Ag. (TEODORESCU, 1907). *C. arborescens* J. Ag. * (ZINOVA, 1967) and *C. secundatum* Lyngb. (SKOLKA, 1969) are both included in *C. rubrum* according to SOUTH and TITTLE (1986).
44. *Ceramium rubrum* (Huds.) C. Ag. var. *implexocontortum* Solier (CELAN and ȘERBĂNESCU, 1959).
45. *Ceramium rubrum* (Huds.) C. Ag. var. *pedicellatum* J. Ag. (CELAN and ȘERBĂNESCU, 1959).
46. *Ceramium rubrum* (Huds.) C. Ag. var. *tenue* C. Ag. (CELAN and ȘERBĂNESCU, 1959).
47. *Ceramium rubrum* (Huds.) C. Ag. f. *decurrens* J. Ag. (TEODORESCU, 1907).
48. *Ceramium strictum* Harv. (TEODORESCU, 1907). *C. corticatum* Kylin (CELAN, 1936b) is included in *C. strictum* according to SOUTH and TITTLE (1985).

Subfam. CALLITHAMNIOIDEAE

49. *Callithamnion corymbosum* (J. E. Smith) Lyngb. (CELAN, 1936b).
50. *Callithamnion granulatum* (Ducl.) Ag. (CELAN and BAVARU, 1973).

Subfam. SPERMOTHAMNIOIDEAE

51. *Spermithamnion strictum* (Ag.) Ardiss. (CELAN, 1936b).

Fam. DASYACEAE

* Not to be found in the Romanian bibliography. Although not mentioned, this species must be identical, considering its description, with *C. circinatum* f. *densecorticata* Voronikh. Adopted by CELAN and ȘERBĂNESCU (1959) as well (BAVARU, 1977 a).

52. *Dasya baillouviana* (Gmel.) Montagne, published as *D. elegans* (CELAN, 1938b).

Fam. RHODOMELACEAE

Subfam. POLYSIPHONIOIDEAE

53. *Polysiphonia brodiaei* (Dillw.) Spreng. (CELAN and BAVARU, 1973).
54. *Polysiphonia denudata* (Dillw.) Grev. ex Harv. in Hook. (CELAN et al., 1969), previously published as *P. variegata* (Ag.) Zanard. (TEODORESCU, 1907).
55. *Polysiphonia denudata* (Dillw.) Kütz. f. *fragilis* (Sperk) Voronikh. (CELAN, 1936a). Endemic in the Black Sea (ZINOVA, 1967).
56. *Polysiphonia elongata* (Huds.) Spreng. (TEODORESCU, 1907).
57. *Polysiphonia elongata* (Huds.) Spreng. f. *denudata* (Harv.) Ag. (TEODORESCU, 1907).
58. *Polysiphonia opaca* (C. Ag.) Mor. et De Not. (CELAN, 1936a).
59. *Polysiphonia sanguinea* (C. Ag.) Harv. (SKOLKA, 1969).
60. *Polysiphonia spinulosa* Grev. (SKOLKA, 1969).
61. *Polysiphonia subulifera* (C. Ag.) Harv. (CELAN, 1936 a).
62. *Polysiphonia violacea* (Roth) Spreng., published for Balchic — Bulgaria (CELAN, 1936a).
63. *Pterosiphonia pennata* (C. Ag.) Falkenb. (SKOLKA, 1969).

Subfam. LOPHOSIPHONIOIDEAE

64. *Lophosiphonia reptabunda* (Suhr. in Kütz.) Kylin, published as *L. obscura* (C. Ag.) Falkenb. (SKOLKA, 1969).

Subfam. CHONDRIOIDEAE

65. *Chondria dasyphylla* (Wood.) Ag. (ZINOVA, 1967), not to be found in the Romanian bibliography (BAVARU, 1977a).
66. *Chondria tenuissima* (Good. et Wood.) Ag. (CELAN, 1936b).
67. *Chondria tenuissima* (Good. et Wood.) Ag. f. *divergens* Hauck (CELAN, 1936 b).

Subfam. LAURENCIOIDEAE

68. *Laurencia caspica* A. Zin. et Zaberzh. found only in brackish water littoral lakes (CELAN and BAVARU, 1972), previously identified in the lake Mamaia and erroneously considered by SKOLKA (1961) as nov. sp. (*L. lacustris* Skolka). Endemic in the Caspian Sea (ZINOVA, 1967) and considered a pontocaspian relict BAVARU, 1980).
69. *Laurencia coronopus* J. Ag., considered endemic for the Black Sea CELAN, 1936b).
70. *Laurencia obtusa* (Huds.) Lamour. (CELAN, 1948).
71. *Laurencia obtusa* (Huds.) Lamour. var. *genuina* Kütz. (TEODORESCU, 1907).
72. *Laurencia obtusa* (Huds.) Lamour. var. *gracilis* Kütz., found only in brackish water littoral lakes, initially in the lake Mangalia (TEODORESCU, 1907).

73. *Laurencia obtusa* (Huds.) Lamour. var. *pulvinata* Feldm., published for Cape Caliacra — Bulgaria (CELAN, 1938b).
 74. *Laurencia paniculata* (C. Ag.) J. Ag. (CELAN et al., 1969).
 75. *Laurencia pinnatifida* (Gmel.) Lamour. (SKOLKA, 1969).

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NEW TO ROMANIA SPECIES OF GENUS *RAMULARIA* UNGER

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Thirteen species of genus *Ramularia* Unger are reported as new to Romania parasiting on some vascular plants from different families.

During a taxonomic revision of *Ramularia*-like herbarium specimens deposited in the Mycological Herbarium of the Institute of Biological Sciences, Bucarest (BUCM), thirteen new to Romania species of genus *Ramularia* Unger were established.

RAMULARIA AGRIMONIAE SACC.

Leaf spots small (1—5 mm), angular, irregular, vein limited, greyish-brown. Caespituli hypogenous, effuse, not dense, whitish. Conidiophores 20—30 × 2—4 μm, aggregate in fascicles, emerging through stomata, unbranched, nonseptate, hyaline, straight or geniculate, with slightly prominent conidial scars in the apical part. Conidia 8—19.5 × 2—3.5 μm, ovoid, cylindrical to fusiform, 0—1 — septate, hyaline, single or catenulate.

On living leaves of *Agrimonia eupatoria* L. — Distr. Giurgiu: Gara Vlad-Tepeș, 44° 08' 14" N, 26° 07' 15" E, alt. 80 m, 5.08.1986, G. Negrean (BUCM 99, 081).

RAMULARIA CERVINA SPEG.

Leaf spots 2—15 mm, at first not distinct, later angular, irregular, vein limited, single or confluent, effuse, brown, greyish-brown in the centre. Caespituli hypogenous, not dense, whitish. Conidiophores 35—78 × 3—4 μm, fasciculate, branched, aseptate, hyaline, straight or slightly geniculate, with some conidial scars in the apical zone. Conidia 16—28 × 3—4 μm, ellipsoid to cylindrical, 0—3 — celled, hyaline, straight or slightly curved, single or catenulate.

On living leaves of *Homogyne alpina* (L.) Cass. — Distr. Suceava: Vatra Dornei, Dealul Negru, 11.08.1980, G. Negrean (BUCM 68, 733). Distr. Maramureș: Munții Rodnei, Piciorul crestei Hotarului, 47° 36' 25" N, 24° 35' 50" E, alt. 1300 m, G. Negrean (BUCM 104, 943) Jud. Vilcea: Mtele, Cozia, vers N, prope cabana Cozia 29.06.1976, G. Negrean (BUCM 46, 775).

RAMULARIA HYPOCHOERIDIS MAGN.

Leaf spots 3—11 mm, not distinct, almost circular, single or confluent, effuse, brownish. Caespituli mostly hypogenous, dense, white. Conidiophores 30—62 × 2—3.5 μm, aggregate in fascicles, unbranched, 1—3 — septate, hyaline, straight or geniculate, towards the apex with thickened conidial scars. Conidia 15—32 × 3—4 μm, cylindrical or fusiform, straight or slightly curved, 1—2 — celled, hyaline, catenulate.

REV. ROUM. BIOL.—BIOL. VÉGÉT., TOME 36, N°s 1—2, P. 23—27, BUCAREST, 1991

On living leaves of *Hypochoeris radicata* L. — Distr. Caraş-Severin : Moldova Nouă W, Dealul Vârful Gol, 44° 44' 08" N, 21° 39' 21" E, alt. 200 m, 9.05.1989, G. Negrean (BUCM 111,917). Distr. Gorj : Cloşani N, Poienile de Sus, Lunca Motrului, 44° 07' 06" N, 22° 48' 33" E, alt. 440 m, 12.06.1983, G. Negrean (BUCM 76,984). *H. uniflora* Vill. — Distr. Suceava : Munţii Obcina Mestecăniş, Lucina, inter vallis Lucava et vallis Găina, 47° 39' 07" N, 25° 11' 18" E, alt. 1190 m, 14.07.1986, G. Negrean (BUCM 99,301).

RAMULARIA JURINEAE HOLLÓS

Leaf spots 2–11 mm, circular, brown, almost black in the centre. Caespituli mostly epigenous, not dense, whitish. Conidiophores 20–58 × 3–4 µm, fasciculate, unbranched, 1–2-celled, hyaline, straight or geniculate, with 2–3 conidial scars in the apical part. Conidia 18–28 × 5–7.5 µm, ellipsoid, cylindrical to obclavate, 1–2-celled, straight, hyaline, catenulate.

On living leaves of *Jurinea mollis* L. subsp. *transsilvanica* (Sprengel) Hayek — Distr. Hunedoara : Geoagiu-Băi E, in pratis, 45° 56' 08" N, 23° 10' 20" E, alt. 325 m, 8.06.1986, G. Negrean (BUCM 98,074).

RAMULARIA PAEONIAE VOGL.

Leaf spots 4–10 mm, angular, irregular, vein limited, single or confluent, greyish-brown. Caespituli hypogenous, dense, white. Conidiophores 31–50 × 3–4 µm, fasciculate, numerous, unbranched, 1-celled, hyaline, straight or slightly geniculate, with conidial scars towards the apex. Conidia 10–16 × 3–4 µm, ellipsoid or cylindrical, 1–2-celled, straight, hyaline, catenulate.

On living leaves of *Paeonia peregrina* Miller — Distr. Constanţa : Pădurea Hagieni, "La cazan", 8.06.1977, G. Negrean (BUCM 68,561). Distr. Galaţi : Pădurea Gârboavele, 11.06.1978, G. Negrean (BUCM 68,575).

RAMULARIA PIMPINELLAE JAAP

Leaf spots small (2–5 mm), angular, irregular, vein limited, single or confluent, effuse, yellowish-brown, greyish-brown to grey-whitish. Caespituli amphigenous, not dense, effuse, whitish. Conidiophores 20–34 × 3–4 µm, mostly in fascicles, numerous, unbranched, aseptate, straight or geniculate, with conidial scars in the apical zone, hyaline. Conidia 15–41 × 3–4 µm, cylindrical, 1–4-celled, hyaline, single or catenulate.

On living leaves of *Pimpinella saxifraga* L. — Distr. Prahova : Gara Crivina N, 44° 46' 15" N, 26° 01' 38" E, alt. 114 m, 28.10.1984, G. Negrean (BUCM 86,540). Distr. Prahova : Munţii Bucegi, Valea Largă, 12.10.1981, G. Negrean (BUCM 68,661).

RAMULARIA PRENANTHIS JAAP

Leaf spots 2–5 mm, angular, irregular, vein limited, pale-brown to whitish. Caespituli hypogenous not dense, effuse, whitish. Conidiophores

20–38 × 2.5–3.5 µm, fasciculate, unbranched, 1–2-celled, straight or slightly tortuous, with some conidial scars in the apical region. Conidia 12–25 × 3.5–5.5 µm, ovoid, ellipsoid, fusiform or cylindrical, 1–2-celled, hyaline, catenulate.

On living leaves of *Prenanthes purpurea* L. — Distr. Gorj : Cloşani N, Valea Runcul de Socet, 45° 05' 27" N, 22° 49' 20" E, alt. 600 m, 12.07.1984, G. Negrean (BUCM 84,107). Distr. Hunedoara : Parcul Naţional Retezat, Valea Dobrunul, 45° 22' 48" N, 22° 48' 25" E, alt. 1300 m, 14.08.1985, G. Negrean (BUCM 89,859).

RAMULARIA RUMICIS-SCUTATI ALL.

Leaf spots 5–8 mm, almost circular, pale-brown to ochre-yellowish, with purple brown border. Caespituli amphigenous, not dense, effuse, whitish. Conidiophores 21–47 × 3–4 µm, aggregate in fascicles, unbranched, 1–4-celled, straight or geniculate, with slightly prominent conidial scars in the apical region, hyaline. Conidia 12–27 × 2.5–4 µm, ellipsoid to cylindrical, straight, 1–2-celled, hyaline, catenulate.

On living leaves of *Rumex scutatus* L. — Distr. Bistriţa-Năsăud : Munţii Rodnei, Muntele Negoiasa, 47° 33' 30" N, 24° 41' 14" E, alt. 1940 m, 24.08.1987, G. Negrean (BUCM 104,892). Distr. Braşov : Munţii Făgăraş, Valea Sâmbetei, 45° 38' 53" N, 24° 47' 31" E, alt. 1000, 25.08.1987, G. Negrean (BUCM 104,373). Distr. Caraş-Severin : Muntele Ţarcu, ad Sopot, 3.09.1967, G. Negrean (BUCM 90,233). Distr. Argeş : Muntele Piatra Craiului, Marele Grohotiş, 31.08.1972, G. Negrean (BUCM 68,569).

RAMULARIA SALVIAE A. BOND.

Leaf spots small (3–5 mm), angular, irregular, single or often confluent in large spots (up to 15–20 mm), scattered, greyish brown. Caespituli amphigenous, not dense, whitish. Conidiophores 25–40 × 3–4 µm, fasciculate, unbranched, 1–4-celled, straight or subundulate-denticulate, with conidial scars in the apical region, hyaline. Conidia 11–23 × 2.5–3.5 µm, ellipsoid to cylindrical, straight, 1–3-celled, hyaline, catenulate.

On living leaves of *Salvia pratensis* L. — Distr. Giurgiu : Pădureni SW, Pădurea Gâsteşti, 44° 19' 45" N, 25° 47' 36" E, alt. 91 m, 5.08.1984, G. Negrean (BUCM 84,643).

RAMULARIA SAUSSUREAE THÜM.

Leaf spots 5–20 mm, almost circular, at first brown, later greyish, with dark-brown border. Caespituli amphigenous, not dense, effuse, whitish. Conidiophores 16–35 × 3–4 µm, aggregate in fascicles, emerging through stomata, unbranched, mostly 1-celled, straight or flexuous with conidial scars in the apical zone. Conidia 18–28 × 2.5 × 3.5 µm, ellipsoid, hyaline, straight, 1–4-celled, catenulate.

On living leaves of *Saussurea alpina* (L.) DC subsp. *alpina* — Distr. Prahova : Munţii Bucegi, Valea Jepilor, sub Caraiman, 10.09.1973, G. Negrean (BUCM 94,160). *S. discolor* (Willd.) DC. — Distr. Sibiu : Munţii

Făgăraș, Căldarea Doamnei, 14.08.1983, G. Negrean (BUCM 94,330). Munții Făgăraș, Lacul Bălea, vers. W, 45°36'02"N, 24°36'41"E, alt. 2200 m, 13.08.1983, G. Negrean (BUCM 94,329).

RAMULARIA SCOPOLIAE VOSS

Leaf spots 5–10 mm, angular, vein limited, greyish-brown. Caespituli not-dense, amphigenous, effuse, whitish. Conidiophores 16–38 × 3–4 μm, fasciculate, unbranched, 1–3-celled, hyaline, straight or slightly geniculate. Conidia 12–35 × 3.5–4.5 μm, cylindrical, straight, 1–3-celled, hyaline, catenulate.

On living leaves of *Scopolia carniolica* Jacq. — Distr. Caraș-Severin: Munții Locva, Moldova Nouă E, Ogașul Sec, 44°43'18"N, 21°44'21"E, alt. 450 m, 30.07.1989, G. Negrean (112,658). Distr. Caraș-Severin: Băile Herculane E, Muntele Domogled, Valea Jelărau, 44°52'21"N, 22°27'20"E, alt. 800 m, 12.07.1979, G. Negrean (BUCM 83,109).

RAMULARIA SIDERITIDIS HOLLÓS

Leaf spots 5–12 mm, angular, sometimes almost circular, single or confluent, brown. Caespituli amphigenous, not-dense, effuse, whitish. Conidiophores 17–38 × 2.5–3.5 μm, fasciculate or single, 1–3-celled, unbranched, straight or flexuous, sometimes slightly geniculate, with conidial scars in the apical region. Conidia 8–30 × 2.5–3.5 μm, ellipsoid to cylindrical, straight, 1–2-celled, hyaline, catenulate.

On living leaves of *Sideritis montana* L. — Distr. Constanța: Mangalia, 10.05.1977, G. Negrean (BUCM 68,586). Distr. Neamț: Piatra-Neamț, 30.08.1950, leg. C. Sandu-Ville & I. Rădulescu (BUCM 38,051), det. T. Săvulescu.

RAMULARIA THESII SYD.

Leaf spots angular, irregular, single or confluent, brown. Caespituli amphigenous, dense, white. Conidiophores 25–68 × 2.5 × 3.5 μm, fasciculate, straight or slightly geniculate, with conidial scars, 1–4-celled, hyaline. Conidia 11–21 × 3.5–5.5 μm, ovoid, ellipsoid or cylindrical, 1–2-celled, straight, hyaline, single or catenulate.

On living leaves of *Thesium alpinum* L. — Distr. Hunedoara: Munții Retezatul Calcaros, Cheile Iarei, 45°16'10"N, 22°51'11"E, alt. 1400 m, 17.08.1982, G. Negrean (BUCM 72,592). Distr. Dâmbovița: Munții Bucegi, Valea Ialomiței, Peștera Ialomiței, 21.07.1902, leg. G. Grințescu (BUCM 81,556). Distr. Neamț: Muntele Ceahlău, Stănilă, alt. 1700 m, 13.07.1921, leg. G. Grințescu (BUCM 81,555). Distr. Suceava: Vatra-Dornei, Muntele Runcu, 47°21'23"N, 25°20'46"E, alt. 970 m, 18.07.1986, G. Negrean (BUCM 99,527). *T. arvense* Horvátovszky. — Distr. Mehedinți: Buicești NE, Lunca Motrului, 44°34'13"N, 23°22'49"E, alt. 110 m, 17.05.1983, G. Negrean

(BUCM 83,111). Distr. Dâmbovița: Teiș, alt. 286 m, 17.05.1909, leg. G. Grințescu (BUCM 81,557). *T. bavarium* Schrank — Distr. Vâlcea: Muntele Cozia prope cacumen, 1974, leg. R. Wallfisch (BUCM 74,227).

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PARASITIC MICROFUNGI FROM NORTH ALGERIA

ANGHEL RICHÎTEANU

The paper contains 41 species of parasitic microfungi belonging to Peronosporales, Erysiphales, and Ustilaginales, collected by the author from 60 host plants in North Algeria. Notes on morphology, taxonomy, and host problems are given for most species.

As a partial result of author's mycological investigations in North Algeria during 1983–1985, is previously published "Uredinales from North Algeria" (Richîteanu, 1990). In this second paper some parasitic microfungi other than Uredinales are treated and discussed, e.g. with respect to morphology, taxonomy and nomenclature. The enclosed inventory contains 41 species of Peronosporales, Erysiphales and Ustilaginales collected from 60 host plants.

Both papers are based upon the author's own collections preserved in the Mycological Herbarium of the Institute of Biological Sciences, Bucharest (BUCM), or in the Botanical Department of the National Institute of High Education in Agronomy of Blida, Algeria.

The BUCM accession number for each collection is given in round brackets.

The nomenclature of the vascular plants follows "Flora Europaea".

The genera, species and the hosts under each species are arranged alphabetically.

All microscopic measurements were taken from slide preparation in lactophenol cotton blue.

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PERO NOSPORALES

1. *Albugo candida* (J. F. Gmelin : Fr.) Kuntze

On *Capsella bursa-pastoris* (L.) Medicus, Blida county, Blida, residential district "1st May", alt. c. 200 m, 1. IV. 1984 (115. 222); 26. IV. 1984, together with *Pernospora parasitica*, on leaves; Beni-Mered, alt. c. 180 m, 23. IV. 1984; residential district Ben Achour, on the wadi Beni Aza, alt. c. 220 m, 30. IX. 1984 (115. 223).

On *Hirschfeldia incana* (L.) Lagrèze-Fossat, Blida county, Souma, alt. c. 180 m, 22. IV. 1984 (115. 224); 6. VI. 1984.

Reported by Maire (1915) from Blidean Atlas on *Sinapis pubescens* L.

2. *Albugo tragopogonis* (Pers.) Gray

On *Phagnalon saxatile* (L.) Cass., Blida county, Mt. Chr  a, on the wadi Beni Aza, alt. c. 350 m, 20. IV. 1984, together with *Erysiphe cichoracearum* DC. (115. 225).

Conidia 14–19 μm in diam. Oospores globose, 53–64 μm .

Known on the same host from Algiers (Maire, 1915).

On *Senecio vulgaris* L., Blida county, Blida, alt. c. 200 m, 2. IV. 1984 (115. 226).

3. *Bremia lactueae* Regel

On *Galactites tomentosa* Moench (= *Lupsia galactites* (L.) O. Ktze), Blida county, Souma alt. c. 180 m, 15. XII. 1984 (115. 227).

Conidia 14–19 $\times$ 12–15 μm .

On *Senecia* sp., Blida county, residential district Ben Achour, alt. c. 210 m, 20. IV. 1984 (115. 228).

Conidial size 16–22 $\times$ 14–18 μm .

On *Sonchus* sp., Blidean Atlas, Mt. Chr  a, Bou Tseldja Hill, alt. c. 600 m, 1. VI. 1984 (115. 229).

Conidiophores 300–460 μm . Conidia 15–23 $\times$ 14–20 μm . Oospores not seen.

4. *Peronospora aestivalis* H. Sydow

On *Medicago littoralis* Rohde, Blida county, Meftah, in the park of the sanatorium, 31. III. 1985 (115. 230).

Conidiophores 340–420 μm . Conidia (15–) 20–30 $\times$ (13–) 16–21 μm .

On *Melilotus infesta* Guss., Blida county, Meftah, in the park of the sanatorium, 31. III. 1985, together with *Erysiphe pisi* DC. and *Uromyces pisi* Schroet. (115. 231).

Conidiophores 350–400 μm . Conidia 20–25 $\times$ 16–19 μm .

5. *Peronospora affinis* Rossm.

On *Fumaria capreolata* L., Blidean Atlas, Mt. Chr  a, Bou Tseldja Hill, alt. c. 350 m, 1. VI. 1984.

6. *Peronospora alsinearum* Casp.

On *Stellaria media* (L.) Vill. s.l., Blida county, Souma, alt. c. 180 m, 26. I. 1984.

Maire (1915) reports this downy mildew species on *Cerastium atlanticum* as *matrix nova* from Maison Carr  e (act. El Harrach).

7. *Peronospora astragalina* H. Sydow

On *Astragalus* sp. (probably chiefly *A. pentaglottis* L. = *A. echinatus* Murray), Blidean Atlas, Mt. Chr  a, Bou Tseldja Hill, alt. c. 450 m, 1. VII. 1984 (115. 232).

Conidial size (15–) 21–25 (–30) $\times$ 13–21 μm . Oospores not seen.

8. *Peronospora coronillae* G  um.

On *Coronilla atlantica* Boiss. et Reut., Blida county, Mt. Chr  a, Bou Tseldja Hill, alt. c. 540 m, 1. VI. 1984 (115. 233).

Conidia broadly ellipsoidal or subglobose, 18–25 $\times$ 15–18 μm . Oospores globose, brown yellowish, 23–42 μm in diam.; endospore 2–3 μm thick.

9. *Peronospora coronopi* G  um.

On *Coronopus didymus* (L.) Smith, Blida county, Blida, residential distr. "1st May", on the wadi Beni Aza, alt. c. 200 m. 19. III. 1984.

10. *Peronospora farinosa* (Fr.) Fr. (= *P. chenopodii* Schlecht., *P. schachtii* Fuck.).

On *Beta vulgaris* L. subsp. *maritima* (L) Arcangeli, Tipasa county, Bou Haroun, alt. c. 3 m, 23. XI. 1984; B  rard, alt. c. 4 m, 23. XI. 1984.

Conidial size 28–36 $\times$ 18–21 μm .

On *Chenopodium album*, L., Blida county, Blida, residential district Ben Achour, alt. c. 230 m, 22. V. 1984 (115. 234); Souma, alt. c. 180 m, 6. VI. 1984.

Conidiophores 200–450 μm . Conidia 25–31 $\times$ 18–23 μm . Oospores not found.

P. farinosa is here regarded as a collective species, containing a number of "small" species occurring on *Chenopodiaceae*. Yerkes & Show (1959) recommend the collective use and give a full synonymy list of *P. farinosa* s. l.

11. *Peronospora ficariae* Tul. ex de Bary

On *Ranunculus macrophyllus* Desf., Blida county, Mt. Chr  a, Bou Tseldja Hill, alt. c. 600 m, 1. VI. 1984 (115. 235).

Conidiophores 260–380 μm , branched in their 1/2–1/3 upper part. Conidia 17.5–28 $\times$ 12.5–20 μm . Oospores not seen.

12. *Peronosporia lamii* A. Braun

On *Lamium amplexicaule* L., Blida county, Blida, Ouled Ya  ch, on the wadi Mered, alt. c. 170 m, 19. II. 1984 (115. 236).

Conidiophores 240–420 μm , dichotomously divided in their 1/3–1/3 part. Conidia broadly ellipsoidal or subglobose, 21–26 $\times$ 15–18.5 μm .

Reported from Algeria by Maire (1919) as collected on this host from Affr  ville (act. Khemis Miliana) and Algiers.

13. *Peronospora parasitica* (Pers.: Fr.) Fr.

On leaves of *Capsella bursa-pastoris* (L.) Medicus, Blida county, Blida, residential distr. "1st May", alt. c. 200 m, 26. IV. 1984, together with *Albugo candida*.

Reported by Maire (1919) on *Camelina silvatica* Wallr.

14. *Peronospora polycarponis* Mayor & Vien.-Bourg.

On *Polycarpon tetraphyllum* (L.) L., Blida county, Blida, residential distr. "1st May", alt. c. 200 m, 30. V. 1984 (115. 237).

Conidiophores 155–260 μm , base usually swollen, branched on their 1/3–1/2 upper part. Conidia ellipsoidal, 17–25 $\times$ 15–19 μm . Oospores not found.

Reported by Maire (1915) from Algiers as *Peronospora scleranthi* Rabenh.

15. *Peronospora radii* de Bary (= *P. radii* f. *foliicola* Lind ex Syd., *P. radii* var. *epiphylla* Poirault, *P. dannica* Gäum.)

On leaves of *Chrysanthemum segetum* L., Blida county, Souma, alt. c. 180 m, 7. III. 1984 (115.238), 30. III. 1984 (115.239).

Conidiophores 250–540 µm long, ramified in their 1/3–1/2 upper part. Conidia brownish, obovoid to broadly ellipsoidal, conical rounded or rounded at the apex, 24–41 × 18–28 µm (averages: 32.1 × 21.8 µm, quotient length/width: 1.47). Oospores not found.

Previously reported by Maire (1919) as *P. radii* var. *epiphylla* Poirault on leaves and branches of *Chrysanthemum segetum* from Algiers, the valley of the wadi Kerma. Of common occurrence on this host in North Algeria. *Calostephus myconis* (L.) Reichenbach fil., *Leucanthemum vulgare* Lam., and *Chamomilla recutita* (L.) Rauschert are potential hosts of *P. radii* in this country. According to Ben-Ze'ev, Kenneth & Bonde (1987) and Constantinescu (1989) this downy mildew fungus shows a great morphological variability, the average quotients length/width of conidia on different hosts of Anthemideae ranging from 1.29–1.83. Our measurements of conidiophores and conidia from leaves of *Ch. segetum* approach those found by Kochman & Majewski (1970) and Constantinescu (1989).

16. *Peronospora trifoliorum* de Bary

On *Trifolium* sp., Blida county, Mt. Chr  a, Bou Tseldja Hill, alt. c. 400 m, (115.240).

Oospores present, 25–38 µm in diam.

Maire (1919) reports this species on *Medicago murex* from Z  ralda.

17. *Plasmopara viticola* (Berk. & Court.) Berl. & de Toni

On *Vitis vinifera* L. (escaped from culture), Blidean Atlas, Mt. Chr  a, Bou Tseldja Hill, alt. c. 350 m, 23. X. 1984 (115.241).

Conidial size 24–35 × 15–24 µm. Oospores not seen.

18. *Pseudoperonospora urticae* (Lib. ex Berk.) E. Salmon & Ware

On *Urtica dioica* L., Blida county, Blida, residential distr. Ben Achour, on the wadi Mered, alt. c. 210 m, 19. V. 1984.

Constantinescu (1985), based upon a examination of herbarium specimens and a review of the literature, showed that *Pseudoperonospora urticae* is restricted to perennial Urticas, whereas *Peronospora debaryi* is confined to *Urtica urens* L. However, Maire (1919) reported *Peronospora urticae* on *Urtica urens* L. in Algiers.

ERYSIPHALES

19. *Blumeria graminis* (DC.) Speer (= *Erysiphe graminis* DC.)

On *Desmazeria rigida* (L.) Tutin (= *Scleropoa rigida* (L.) Griseb.), Blida, county, Mt. Chr  a, on the wadi Beni Aza, alt. c. 250 m, 20. IV. 1984 (115.242).

On *Hordeum murinum* L., Blida county, Blida, Ouled Ya  ch, 21. V. 1984 (115.243).

Cleistothecia were found on both hosts.

Maire (1915) reports this common powdery mildew fungus as *Erysiphe graminis* on *Triticum sativum* Lam., *Phalaris brachystachys* Link, and *Phalaris caerulea* Desf. from Algiers and Maison Carr  e (act. El Harrach).

20. *Erysiphe cichoracearum* DC.

var. *cichoracearum*

On leaves of *Hedipnois cretica* (L.) Dum.-Courset, Blida county, Blida, Ouled Ya  ch, on the wadi Mered, alt. c. 170 m, 22. V. 1984 (115.244). Cleistothecia 95–160 µm with 7–20 young asci.

On *Leontodon* sp., Blida county, Souma, alt. c. 180 m, 6. VI. 1984.

On *Phagnalon saxatile* (L.) Cass., Blidean Atlas, Mt. Chr  a, on the wadi Beni Aza, alt. c. 350 m, 20. IV. 1984, together with *Albugo tragopogonis* (Pers.) Gray (115.245).

On *Xanthium spinosum* L., Tipasa county, Bou Haroun, at the mouth of the wadi Sa  dia, alt. c. 4 m, 23. XI. 1984 (115.246).

Conidia only, 27–35 × 13–17 µm.

Reported by Maire (1919) as *E. compositarum* Duby on *Senecio lividum* L. from Djebel Bou-Maad, N. of Miliana.

21. *Erysiphe convolvuli* DC.

var. *convolvuli*

On *Convolvulus arvensis* L., Blida county, Blida, residential distr. "1st May", alt. c. 200 m, 5. XII. 1983; Ouled Ya  ch, alt. c. 200 m, 22. V. 1984; Mt. Chr  a, Quessia Hill, alt. c. 250 m, 30. XI. 1984 (115.247).

22. *Erysiphe cruciferarum* Opiz ex Junell (= *E. communis* auct. p.p.)

On *Hirschfeldia incana* (L.) Lagr  ze-Fossat subsp. *geniculata* (Desf.) Maire (= *Sinapis geniculata* Desf.), Blida county, Souma, alt. c. 180 m, 6. VI. 1984 (115.248).

23. *Erysiphe cynoglossi* (Wallr.) U. Braun (= *E. asperifolium* Grev., *E. horridula* (Wallr.) Rabenh.)

On *Echium plantagineum* L., Blida county, Souma, alt. c. 180 m, 6.V.1984.

24. *Erysiphe heraclei* DC. (= *E. umbelliferarum* de Bary f. *scandicis* Jacz.)

On *Scandix pecten-veneris* L., Blida county, Mt. Chr  a, Haraza Hill, alt. c. 300 m, 7.VI.1984, conidia only (115.250); Chlef county, on the valley of the wadi Djer, near Bou Medfaa, alt. c. 250 m, 1.V.1985 (115.249).

Conidia 25–33 × 10–15 µm. Cleistothecia 95–145 µm in diam. Asci 3–5, shortly stalked, 65–77 × 27–40 µm, with 3–5 spores, 19–27 × 10–14 µm.

25. *Erysiphe orontii* Cast. (= *E. tabaci* Sawada, *E. polyphaga* Hammarlund, *E. cucurbitacearum* Zheng & Chen, *E. cichoracearum* auct. p.p.)

On *Acanthus mollis* L., Blida county, El Affroun, on the valley of the wadi Bou Roumi, alt. c. 200 m, 1.V.1985 (115.251).

Conidia 25–40 × 13–16 μm. Cleistothecia 96–125 μm in diam. Asci stalked, 47–63 × 24–32 μm. Spores not formed.

26. *Erysiphe pisi* DC. (= *E. macropus* Mart., *E. martii* auct. p.p. *E. communis* auct. p.p., *E. polygoni* auct. p.p.)

var. *pisi*

On *Lathyrus ochrus* DC., Blida county, El Affroun, on the valley of the wadi Bou Roumi, alt. c. 200 m, 1.V.1985 (115.252).

Conidia 24–45 × 12–18 μm. Cleistothecia 120–145 μm in diam. Asci 4–7, shortly stalked, 53–66 × 17–35 μm, Spores 16–22 × 10–14 μm.

On *Medicago littoralis* Rhode, Blida county, Meftah, in the park of the sanatorium, 31.III.1985 (115.253).

Conidia only, 26–35 × 12–15 μm.

On *Melilotus infesta* Guss., Blida county, Meftah, in the park of the sanatorium, 31.III.1985, together with *Peronospora aestivalis* H. Sydow and *Uromyces anthyllidis* Schroet. (115.254); El Affroun, on the valley of the wadi Bou Roumi, alt. c. 200 m, 1.V.1985 (115.255).

Conidia 32–40 × 13–16 μm. Cleistothecia were not seen.

On *Pisum sativum* L. (cult.), Chlef county, on the valley of the wadi Djer, near Bou Medfaa, alt. c. 250 m, 1.V.1985 (115.256).

Conidial size 29–40 × 12–15 μm.

var. *cruchetiana* (Blumer) U. Braun

On *Lathyrus articulatus* L., Chlef county, on the valley of the wadi Djer, near Bou Medfaa, alt. c. 250 m, 1.V.1985 (115.257).

Conidia 33–41 × 10–15 μm. Cleistothecia 112–137 μm in diam. with frequently irregularly branched appendages. Asci 45–62 × 20–33 μm. Spores 16–23 × 10–14 μm.

On *Lupinus angustifolius* L., Blida county, Souma, alt. c. 180 m, 24.IV.1985 (108.941).

Conidia 27–40 × 13–16 μm. Cleistothecia gregarious, 90–150 μm in diam. Asci 53–65 × 23–47 μm. Ascospores 17–22 × 9–13 μm.

According to Braun (1987) this variety differs from var. *pisi* by frequently irregularly branched cleistothecial appendages. He reported var. *cruchetiana* on species of the genera *Lathyrus* and *Ononis* only.

27. *Erysiphe polygoni* DC.

On *Polygonum aviculare* L., Blida county, Souma, alt. c. 180 m, 15.XII.1984 (115.258).

Conidia only, 28–38 × 12–15 μm. Apparently of common occurrence on this host in Algeria.

28. *Erysiphe sordida* Junell (= *E. lamprocarpa* auct. p.p., *E. plantaginis* (Link) U. Braun).

On *Plantago coronopus* L., Tipasa county, Bou Haroun, alt. c. 10 m, 23.XI.1984, conidia only (108.942).

On *Plantago lagopus* L., Blida county, Souma, alt. c. 180 m, 12.V.1984 (115.259); 25.V.1984.

Conidia 26–37 × 11–14 μm. Cleistothecia 100–150 μm in diam. Asci stalked, 52–60 × 26–33 μm. Ascospores 19–24 × 12–15 μm.

On *Plantago* sp., Setif county, Djemila, on Roman ruins, 7.XII.1984 (115.260). Conidia only.

29. *Leveillula lanuginosa* (Fuck.) Golovin (= *E. lichenoides* Trab.& Sacc., *E. taurica* f. *foeniculi* (Jacq.) Golovin, *E. taurica* f. *foeniculi* Jacq.)

On stems of *Foeniculum vulgare* Miller, Blidean Atlas, Mt. Chr  a, on the wadi Beni Aza, near Ben Achour, alt. c. 250 m, 23.X.1984 (115.261).

Conidia cylindric, cingulate, 40–55 × 13–15 μm. Cleistothecia 230–270 μm in diam. Asci very numerous, stalked, 83–105 × 28–35 μm. Spores ellipsoid-ovoid, 35–44 × 16–21 μm.

On this host are reported two species of *Leveillula*: *L. taurica* (L  v.) Arnaud, a collective, very polyphagous species characterized by lanceolate primary conidia, and *L. lanuginosa* (Fuck.) Golovin, distinguished by its cylindrical conidia with cingulum-like rings near the ends, and restricted to some genera of *Apiaceae* (*Ammi*, *Daucus*, *Foeniculum*, *Petroselinum*). Trabut & Saccardo (Sacc., 1895) described *Erysiphe lichenoides* on fennel, from Algiers, 1904. Braun (1987) studied the type material from FH (ex herb. Patouillard), and decided that this species should be regarded as a synonym of *L. lanuginosa*.

30. *Leveillula taurica* (L  v.) Arnould

On *Scolymus hispanicus* L., Blida county, Blida, residential distr. SONATRACH, alt. c. 200m, 5.X.1984 (115.262).

Primary conidia ± lanceolate, apically pointed, secondary conidia ellipsoid to cylindric, 50–65 × 13–21 μm. Cleistothecia 130–180 μm in diam. Asci numerous, stalked, 70–95 × 30–38 μm. Ascospores ellipsoid-ovoid, 33–37 × 14–18 μm.

31. *Microsphaera euonymi* – *japoniei* Viennot-Bourgin

On *Euonymus japonicus* L. fil., Blida county, Blida, in the park "Patrice Lumumba", alt. c. 200 m, 25.IV.1984.

32. *Microsphaera trifolii* (Grev.) U. Braun (= *Erysiphe trifolii* Grev.,

E. martii L  v., *E. communis* f. *onbrychidis* Jacq.)

var. *trifolii*

On *Onobrychis caput-galli* (L.) Lam., Blidean Atlas, Mt. Chr  a, Hara-za Hill, alt. c. 250 m, 7.VI.1984 (115.263).

Conidia 28–35 × 12–15 μm. Cleistothecia 130–160 μm with 5–9 asci, 56–65 × 24–32 μm. Ascospores 3–6, 22–28 × 10–14 μm.

33. *Oidium ceratoniae* Comes

On *Ceratonia siliqua* L., Blida county, Blida, residential distr. "1st May", alt. c. 200 m, 30.IV.1985 (115.264).

Conidia 24–32 × 10–13 μm.

34. *Oidium* sp.

On *Chrysanthemum segetum* L., Blida county, Souma, alt. c. 180 m, 6.VI.1984, (115.265).

On *Lupinus angustifolius* L., Blida county, Souma, alt. c. 180 m, 6.VI.1984 (115.266).

On *Xanthium italicum* Moretti, Blida county, Blida, residential distr. "1st May", alt. c. 200 m, 12.XI.1984 (115.267).
Conidial size 18–29 × 13–18 µm.

35. *Phyllactinia fraxini* (DC.) Fuss (= *P. suffulta* var. *blumeri* (de Mendonca & Sequ.) U. Braun, *P. guttata* var. *blumeri* (de Mendonca & Sequ.) U. Braun).

On *Fraxinus angustifolia* Vahl., Blidean Atlas, Mt. Chr  a, on the wadi El-Kebir, alt. c. 250 m, 20.X.1984 (115.268). Conidia only.

36. *Phyllactinia mali* (Duby) U. Braun (= *Ph. mespili* (Cast.) Blumer)

On *Crataegus monogyna* Jacq., Blidean Atlas, Mt. Chr  a, Quessia Hill, alt. c. 300 m, 3.XI.1984 (115.269).
Cleistothecia abundant, 135–175 µm in diam. Asci stalked, 55–75 × 30–35 µm, 2-spored. Spores 27–35 × 13–22 µm.

36. *Sphaerotheca fugax* Penz. & Sacc. (= *S. humuli* auct. p.p., *S. macularis* f. *geranii* Poteb.)

On *Geranium molle* L., Blida county, Meftah, in the park of the sanatorium, 31.III.1985 (115.270).

Conidial size 20–29 × 16–21 µm. Apparently not previously reported in Algeria.

38. *Sphaerotheca pannosa* (Wallr. : Fr.) L  v.

On *Rosa* sp. (cult.), Blida county, on the way of Souma, alt. c. 180 m, 15.X.1984; 24.IV.1985 (115.271). Conidia only.

USTILAGINALES

39. *Ustilago bullata* Berkeley (= *U. bromivora*. (Tul.) Fischer v. Waldh.)

On *Bromus madritensis* L., Blida county, Souma, alt. c. 180 m, 31.V. 1984; 24.IV.1985 (115.272); Mt. Chr  a, Bou Tseldja Hill, alt. c. 350 m, 23.X.1984.

Reported by Maire (1915) as *U. bromivora* on *Bromus rubens* L. from Saint-Arnaud, and by V  nky (1985 b) on *Brachypodium distachyon* (L.) Beauv. from "montium Constantine, Djebel Thaya".

40. *Ustilago cynodontis* (P. Hennings) P. Hennings

On *Cynodon dactylon* (L.) Pers., Blida county, Blida, residential distr. "1st May", alt. c. 200 m, 25.X.1983.

Previously reported by Maire (1915) from Maison Carr  e (act. El. Harrach).

41. *Ustilago tritici* (Pers.) Rostr. (= *U. nuda* (Jens.) Rostr.)

On *Hordeum vulgare* L., Blida county, Souma, alt. c. 180 m, 25.IV.1984.

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DIRECT AND INDIRECT ORGANOGENESIS IN *POPULUS ALBA* L. CULTIVATED "IN VITRO"

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The paper presents the results of investigations on the possibility of white poplar (*Populus alba* L.) plant regeneration by direct and indirect organogenesis in order to use the somaclonal variability in breeding programs of this species. The stage of development of the plants which were used as inoculum source and the best conditions for adventive shoots induction from foliar explants and callusal tissue cells were established. The cytological, histological and anatomical aspects at the level of foliar explant during the morphogenesis process and neoformation of adventive buds are described. Regenerated plants were successfully transplanted in the field and investigated as regards the stability of phenotypical characters.

The interest in the study of plant regeneration by direct and indirect organogenesis is stimulated by the possibility of inducing genetic variability in this way. Considering the variety of cellular types, in the leaf structure or in the callusal tissue that may develop the adventive buds and the fact the differentiation of adventive buds, namely offshoots, is obtained in the presence of high quantities of cytokinines introduced in the culture medium, we may expect the incidence of somaclonal variation among regenerated plants.

In case of white poplar (*Populus alba* L.), an important species for biotechnological programs of Romania, the material with genetic variability, especially as regards the resistance to pathogens, stress of drought, etc., is of special interest. "In vitro" morphogenetic potential of poplar somatic tissues explants in various experimental systems like plants regeneration and rapid clonal multiplication by the meristem and bud cultures (1), (6), (8), (11), (12), (14), (15), neoformation of caulinary buds in callus culture (2), (3), (5), (10), (14), differentiation of adventitious buds directly from foliar explants (1), (2), was pointed out.

In this paper the best parameters for "in vitro" plant regeneration by direct and indirect organogenesis as well as the cyto-anatomical analysis of the morphogenetical phenomenon are presented.

MATERIAL AND METHOD

The source of material consisted in sterile plantlets obtained from the *P. alba* L. (4 clones), the *P. alba* L. $\times$ *P. grandidentata* Michx cv. "Favorit" hybrid and *P. nigra* L. R 1029, by "in vitro" buds culture* (Table 1). The fragments of about 0.5 cm length of stem axes and foliar tissue (petiole and limb fragments) as well as the callus obtained from the same type of tissues were used as inoculum source.

The nutrient media were: Murashige-Skoog (1962) and Aspen Culture Medium (1), with additional Gamborg (B₅) vitamins and growth factors as in Table 2.

* The clones of white poplar belong to the Collection of the Institute for Research of Poplar Culture, Cornetu - ICAS.

Table 1

"In vitro" morphogenetic capacity of white poplar experimented clones

Species	Clone	Number of inoculated explants	Number of explant with morphogenetic capacity	%
<i>P. alba</i>	R 345	12	5	41 %
	R 361	6	4	40
	R 366	14	5	36
	D 18	15	6	40
<i>P. alba</i> × <i>P. grandidentata</i>	Favorit	14	4	28
<i>P. nigra</i>	R 1029	16	6	37

For the histological study the biological material was fixed in the Navashin's solution, according to the standard method, embedded in paraffin, sectioned at 10–12 μ m, and stained with toluidine blue. For ino-

Table 2

Nutrient media used in experiments of *P. alba* direct and indirect organogenesis

Basal media	Vitamins	Hormones	mg/l	Morphogenetic response
MS (1962)	Gamborg (B ₅)	2,4-D	1.0–5.0	Callus induction and proliferation
MS (1962)	Gamborg (B ₅)	BAP	1.0–2.0	Differentiation
ACM *	Gamborg (B ₅)	IAA	0.1–0.2	and morphogenesis
		BAP	1.0–2.0	Differentiation
MS (1962) (1/4–1/5)	Gamborg (B ₅)	IAA	0.1–0.2	and morphogenesis
		IBA	0.5–1.0	Rhizogenesis

* — Aspen culture medium (Ahuja — 1983)

culum culture, Petri plates ($\varnothing$ 6 cm) and Erlenmeyer flasks of 100 ml as well as growth chambers were used; the cultures were maintained under 16h day length of white fluorescent light with illuminance of 3,500 lx and under temperature of $25 \pm 3^\circ\text{C}$. For acclimatisation to septical conditions, the plants regenerated "in vitro" conditions were transplanted into the mixture of soil, sand and perlite (1:1:1 v/v/v) and grown under high humidity (95–98%) for 10–12 days.

RESULTS AND DISCUSSIONS

A) THE INITIATION OF ADVENTITIOUS BUDS FROM FOLIARY TISSUES

Segments of young leaves with or without petiole were placed on nutritive media for cytodifferentiation and morphogenesis inducing (Table 2). In the first 10 days a hypertrophy of explants is noticed as they are easily breaking and yellow-green in colour. After 3–4 weeks, in various areas

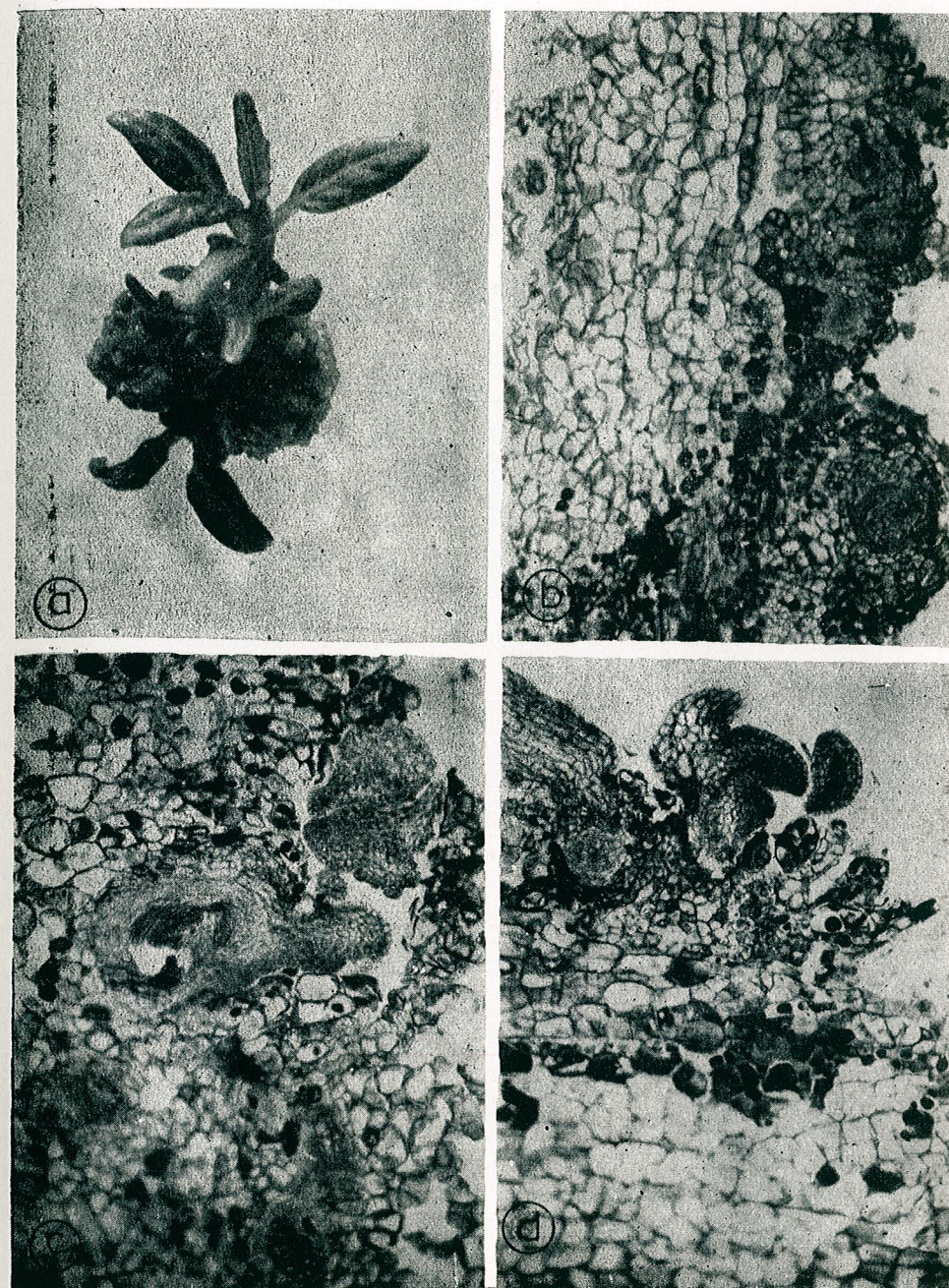


Plate I. — Differentiation of adventitious shoots on explants of foliar tissue of *Populus* sp. a. — macroscopic aspect of proliferative areas; b, c, d. — successive stages of adventitious offshoots differentiation pointed out histologically.



Plate II. — Direct organogenesis on foliar explant of *Populus alba* L. (a, b);
Differentiation of adventive offshoots on petiole explants;
c — macroscopical aspects; d — histological image with presentation of incipient stages of
adventive caulinary differentiation.

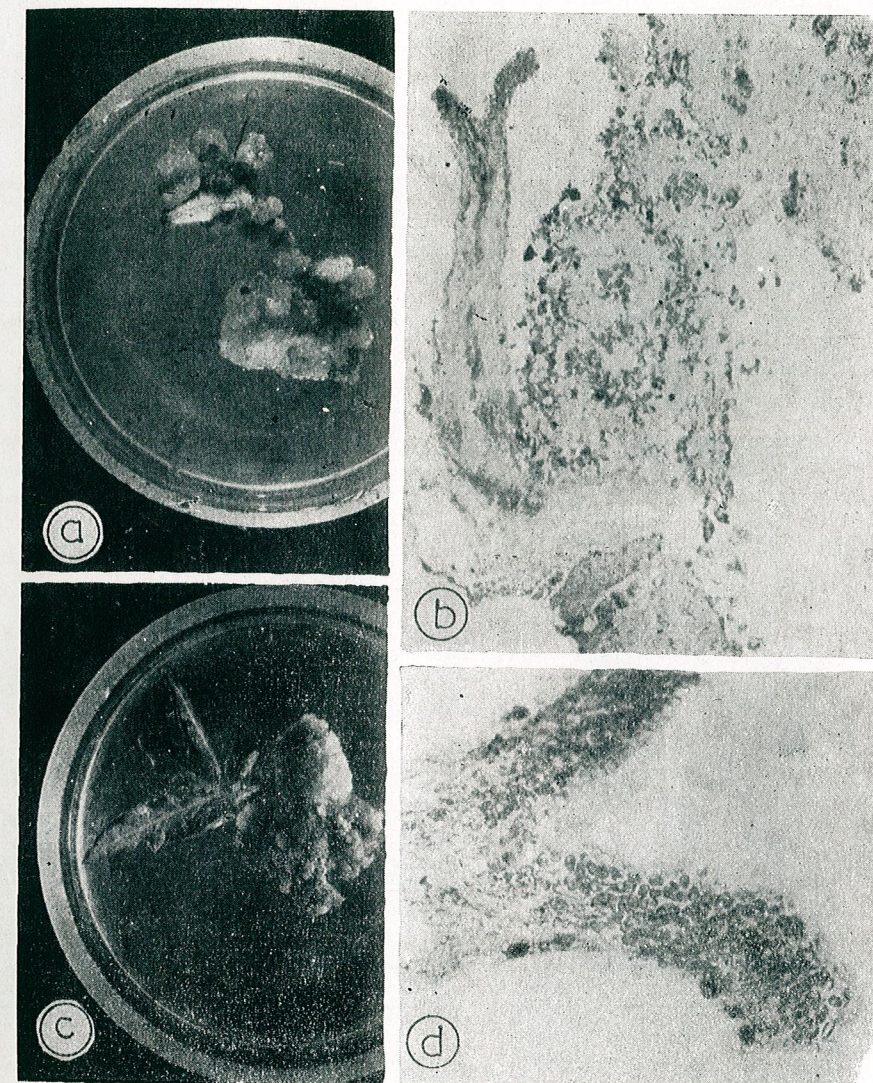


Plate III. — Aspects of white poplar plants regeneration by indirect organogenesis (via callus).
a, c — macroscopical aspect of buds differentiated in the callusal tissue; b — differentiation of
meristemoid and offshoots in the callus mass; d — structure detail of foliar primordia.



Plate IV. — Successive stage of white poplar (*P. alba* L.) regeneration from foliar explants.

of the foliar limb, mainly in the marginal ones, a number of light-yellow nodules appear. After the transfer on the same nutrient medium, they evolute into caulinary buds from which offsprings are differentiated. They can be detached and transferred on special nutrient media, for rooting. Similar phenomena were noticed in our previous experiments that had in view the "in vitro" micromultiplication of this species. Therefore, we often noticed that leaves that are in contact for a longer time with the nutritive medium, rich in cytokinines, develop numerous proliferative structures. These proved to be neoformed epiphyll buds in various areas of the foliar hypertrophied limb.

After a number of subcultivations on the culture medium supplemented with a high level of cytokinine (BAP), the percentage of explants carrying epiphyll buds is higher, being in agreement with BONGA's observations (4); according to him, young tissues are capable of additive organogenesis. Similar remarks were made by Fouret and collab. (7) in some clones of *Sequoia*, rejuvenilized by "in vitro" cultures, where caulinary neoformed primordia on external bud leaves were observed.

The histological analysis of proliferative areas of leaf explants reveals the origin of these adventitious buds in the subepidermal cells of young leaves (Pl. I).

The cytological study of some foliar areas with morphogenetic capacity pointed out the existence of a process of dedifferentiation of some cells in the foliar parenchyma, intense division and formation of meristematic nodules (meristemoids) followed by intense cellular redifferentiation and formation of some morphogenetic centers of redifferentiation. These centers contain an ever greater number of new adventive buds and offshoots (Pl. IV, a, b). Intense morphogenetic processes were also noticed at the level of the petiole (Pl. II c, d).

B) NEOFORMATION OF ADVENTIVE BUDS IN THE CALLUS TISSUE

The callusal tissue was initiated on media with auxin, 2, 4-D only, from explants of young leaves and stem axes. After 3–4 weeks callus was transferred on media with cytokinine (BAP) and auxin (IAA) for morphogenesis induction. After 3 weeks the appearance of caulinary primordia in the callusal tissues was noticed. The histological analysis of the morphogenetic callus revealed the presence of some meristematic centres (meristemoids) that evolute into adventitious buds and further in offshoots (Pl. III). After the neoformed offsprings detaching the rest of the explant were transferred on fresh media with some hormonal composition, new offsprings continue to develop. It seems that only the first differentiated offshoots originate from the callus cells. The other series of offshoots may originate both in the cells of the callus tissue or in axillary buds at the bottom of the newly differentiated offshoots. This aspect requires additional investigations to evaluate the presence of somaclonal variability.

C) MULTIPLICATION OF REGENERATED PLANTS

The adventitious offshoots of about 2–3 cm in length were detached and transferred on rooting media. For the multiplication rate increasing part of them were segmented in minicuttings (4–6) and were again inocu-

lated on fresh growth media. The initial explant was maintained on the same nutritive medium where new offshoots continued to develop. After 2–3 transfers, the explant transforms itself in a compact proliferative tissue, with many buds of various sizes, from which offsprings may be detached. The multiplication rate was of about 4–15 offsprings for each passage at every 20–25 days. Because of the intense proliferation of the explant, the fragmentation into 2–4 parts was necessary, each being an additional source of offshoots.

D) ROOTING

Offshoots longer than 3 cm could be directly rooted in soil. Those of smaller dimensions (1–2 cm) were passed on specific rooting media and later adapted to septic conditions (Pl. IV).

The rooting percentage was higher than 95% in both variants for all tested clones. However, a more rapid growth rate was noticed in shoots rooted under sterile conditions. These differences are reduced after acclimatisation under septic conditions. Significant differences were manifest among clones as regards the capacity of adaptation under septic conditions. The plants adapted to greenhouse were transferred in the field for the phenotypical analyses and biological performances testing in order to appreciate the genetic stability.

CONCLUSIONS

1. The *Populus alba* L. species presents "in vitro" high morphogenetic potential expressed by the regeneration of adventitious offsprings, directly on foliar segments or indirectly (via the callus). These are a premise for a potential use of somaclonal variability in the breeding programs of white poplar.

2. The clones of *P. alba* L. exhibited a differentiated morphogenetic potential. The variations among clones are expressed in the reactivity to the culture conditions, offshoots growth rate, multiplication rate and the adaptation capacity.

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ULTRASTRUCTURAL PECULIARITIES OF THE PLASTIDIAL SYSTEM IN *VITIS VINIFERA* L. CELLS FROM CALLUS CULTURE

AURELIA BREZEANU

The ultrastructural heterogeneity of the plastidial system in callus culture cells, in the stationary phase of growth, in four grape vine cultivars are discussed. The presence in the same callus of the plastids in initial stage of differentiation as well as ameboid or cup-shaped plastids and chloroplasts with an apparent normal structure are observed.

Plastid polymorphism appeared like a complex phenomenon which could be determined by the biotic and abiotic factors. Thus, the asynchrony of the culture which determines a heterogeneity of the cells type regarding differentiation stages, the rate and intensity of the dedifferentiation and redifferentiation processes, spatial localisation of the cell in the callus tissue, hormonal balance of the nutrient media, are put in discussion.

Despite the advances in the knowledge of the structure and function of the plastidial system their origin and development is still obscure. The tissue culture system has proved to be a facile tool for the studies regarding the "ontogeny" and development of plastids to the way in which the thylacoidal structures arise in embryonic systems and fully totipotent cells, in different experimental conditions. There are numerous studies which described the effect of some factors like growth regulators (4), (7), (8), irradiation (7), concentration of glucides (5), etc., a plastidial system differentiation in callus culture from various plant species.

In cells from grape vine callus culture these kinds of studies are scarce (6), (1), (2), (3). From these instances we considered opportune to initiate an ultrastructural study regarding the particularities of the plastidial system in the callus culture of some cultivars of *Vitis vinifera* L.

MATERIAL AND METHODS

The biological material was represented by four *Vitis vinifera* L. cultivars respectively Fetească regală, Riesling italian, Coarna neagră and Ananas.

The explants used for callus induction were represented by small pieces of about 0.2—0.5 mm of somatic tissue excised from very young shoots obtained by forcing in the laboratory.

Shoots were superficially sterilized by submerging in 5 g% calcium hypochlorite. For callus initiation explants were aseptically inoculated on Murashige-Skoog (1962) and, Linsmaier and Skoog, basal nutritive medium supplemented with auxins * — 2,4-D (1 mg/l), IAA (1—30 mg/l), NAA (1.0—2.0 mg/l) and cytokinins ** — BAP (0.1 mg/l) and K (0.5—10.0 mg/l). For callus growth and maintenance in culture, variants of the

* 2,4-D-dichlorophenoxy acetic acid; IAA — Indolylacetic acid; NAA — naphthyl acetic acid

** BAP — benzylaminopurine; K — kinetine

same basal media with hormonal modified composition were tested (1), (2).

The incubation was made at $26 \pm 2^\circ\text{C}$ and at the variations of the luminous intensity at 2,500–3,000 lx. for 16 hours daily.

For electronmicroscopic studies the samples were taken 3, 7, 10, 20 days after the inoculation from various parts of the callus. Specimens were fixed in 3% glutaraldehyde solution in 0.05 M phosphate buffer at the pH—6.8, for 3 hours, washed and included in 2.5 g % agar in the same buffer, postfixed in a solution of OsO_4 —2% for 4 hours at room temperature, then included in Epon resine. The ultrasections were contrasted according to the Reynolds method and examined under a JEM — 7 and Phyllips electron microscope at an acceleration voltage of 80 kV.

RESULTS AND DISCUSSIONS

The experiment carried out led to the remark that the plastid structural heterogeneity represents a general characteristic of the species under study callus cells. These phenomena were evidenced under all experimental conditions and appeared even in the first stages of callus initiation (Pl. I). So, in the same callus tissue the presence of proplastids as well as ameboid or cup-shaped plastids and chloroplasts with an apparent normal structure are observed. Plastid polymorphism in grapevine callus cells culture appeared like a phenomenon determined by a complex of biotic and abiotic factors.

A) THE INFLUENCE OF THE ABIOTIC FACTORS ON THE PLASTID HETEROGENEITY IN GRAPE VINE CALLUS CULTURE

Regarding the abiotic factors we consider that the chemical composition of the nutritive medium, especially at hormone level, plays an important role.

Generally, in the stationary phase of callus growth most of the cells are of a parenchymatic nondifferentiated type, characterized by a thin primary cell wall, little cytoplasm with a parietal disposition and a large vacuole. The high accumulation of osmiophilic precipitate in the vacuum, probably tannic, anthocyanic and phenolic compounds are conspicuous. Plastids in various stages of differentiation represent one of the most significant organelles of these cells.

In our experimental conditions, media with a small level of the hormones (1 mg/l—2,4—D, 0.1—0.5 mg/l—K) stimulated a chlorophyllaceous callus development, which contained predominantly chloroplasts (Pl. II, Fig. 2). The high level of kinetine (5—10 mg/l) and NAA (1—2mg/l) favored on achlorophyllaceous callus differentiation which contained cells with numerous amyloplasts. Elimination of hormones and sucrose concentration diminution from 30 g/l to 20—15 g/l, stimulated plastid polymorphism. At the same time coexist plastids with a poor lamellae system differentiation, chloroplasts with numerous plastoglobules and chloroplasts with a characteristic structure (Plate II, Figs. 1,2,3). Increasing of the sucrose concentration from 30 g/l to 50 g/l stimulated the amyloplasts differentiation (Plate II, Fig. 3).

PLATE I

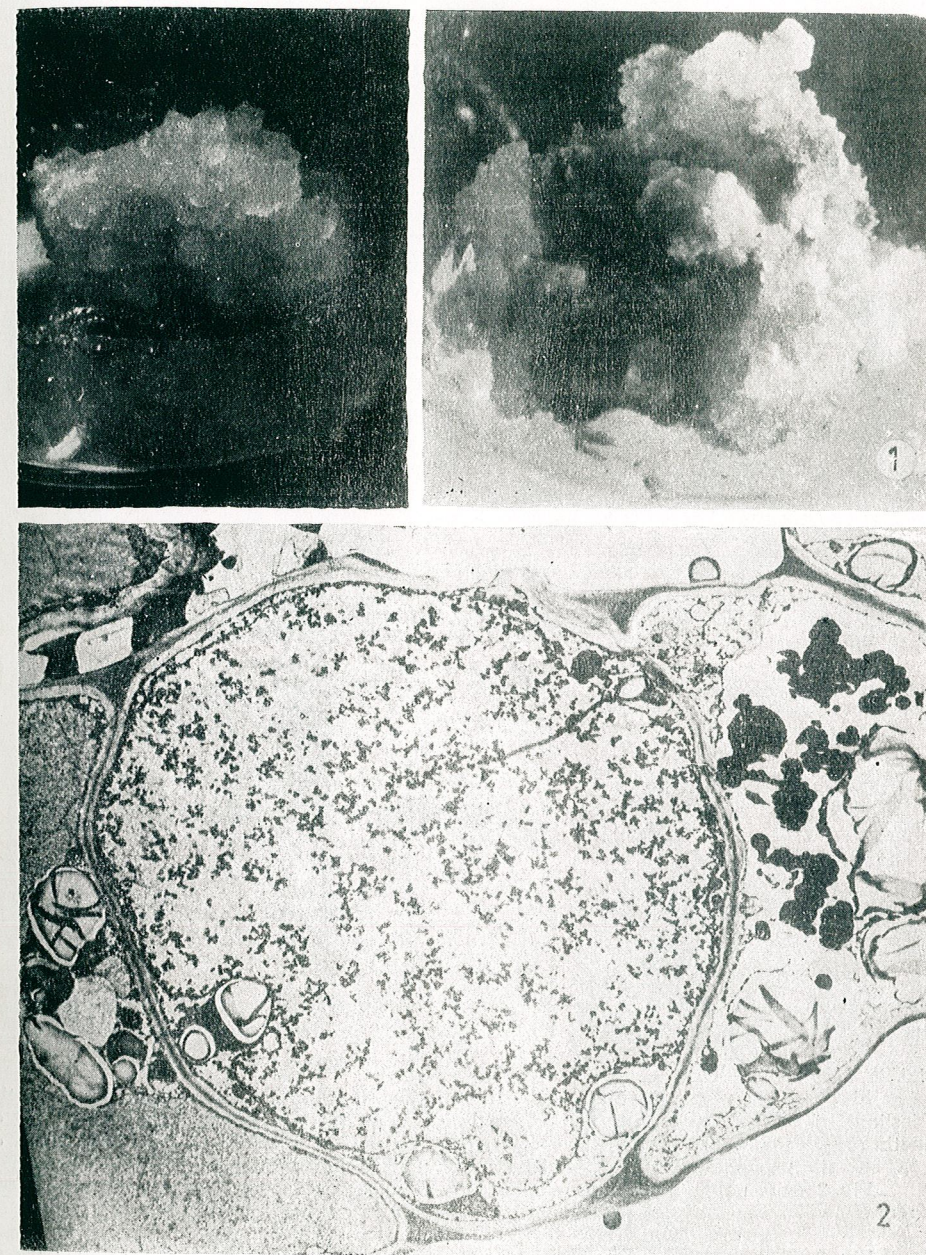


PLATE I.
Morphological aspect of the intense proliferative grape vine callus and the ultrastructural characteristics of its cells.

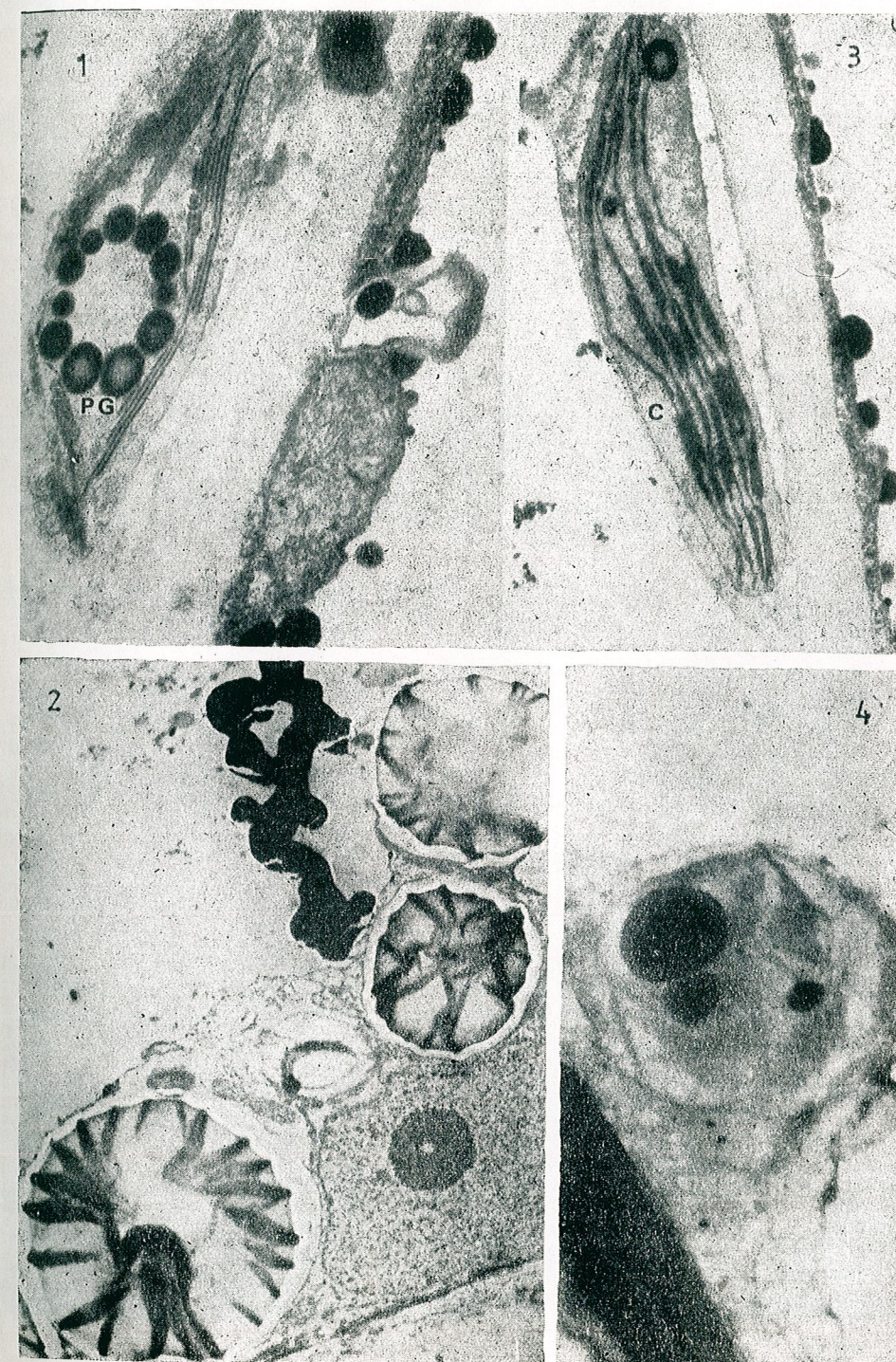
PLATE II.

Fig. 1 — The ultrastructural peculiarities of plastids from the achlorophyllous callus cells (Riesling Italian cv.). Callus initiation was realised on the nutritive media with a high level of kinetin (5–10 mg/l). The particular aspects of the thylakoidal lamellae and the abundance of plastoglobules are noticed (10 days after inoculation) $\times 21.000$;

Fig. 2 — The abundance of amyloplasts in the cells of an achlorophyllous callus (Coarnă neagră cv) which was initiated and subcultivated on a nutrient medium with a high level of sucrose (50 mg/l) (10 days after inoculation) $\times 25.000$;

Fig. 3 — The ultrastructural characteristics of the chloroplast from the green part of the callus (Riesling italian cv.) 10 days after inoculation. $\times 21.000$;

Fig. 4 — The morphological peculiarities of plastids in the cells of the pigmented callus (violet colour) from Ananas cv. (10 days after inoculation). A poor differentiation of the lamellae system and the abundance of plastoglobules are noticed. $\times 31.000$;



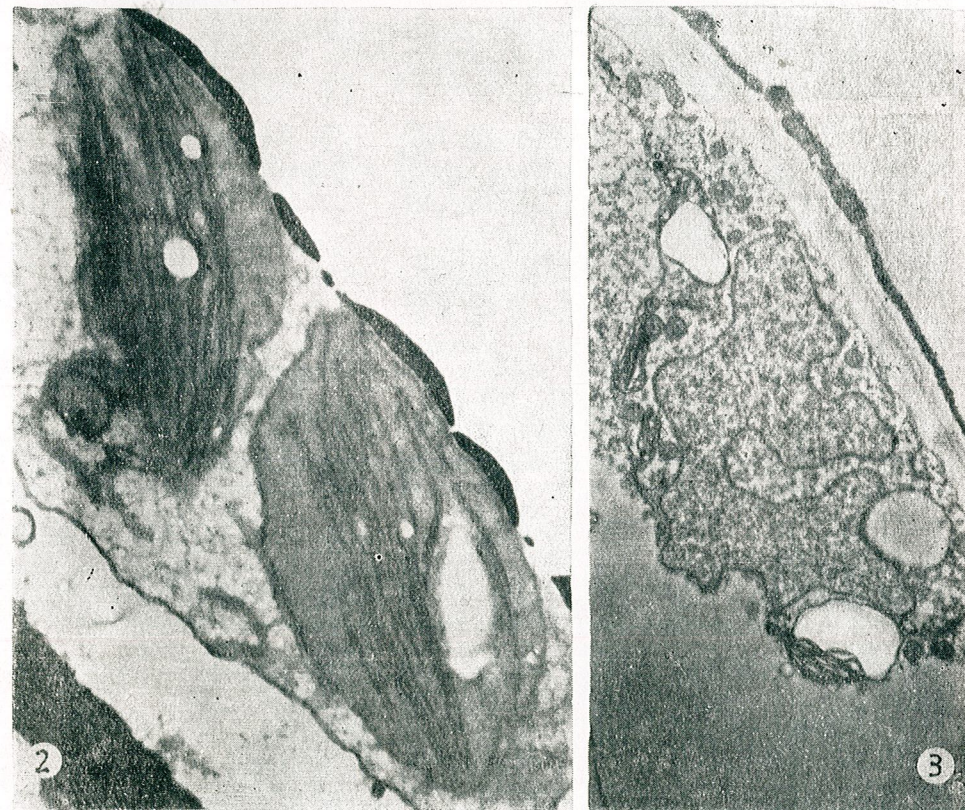
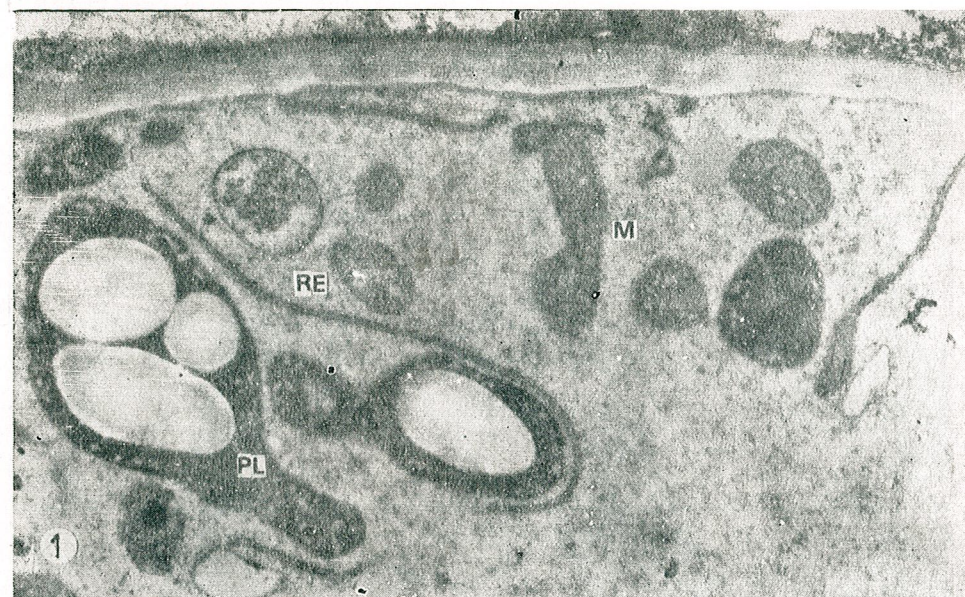


PLATE III

The space localisation of the cells in the callus tissue represents another factor which probably determines the structural heterogeneity of plastids. In the peripheral areas of the callus, elongated chloroplasts are predominant (Plate III, Fig. 2). In the central zone of the callus tissue, plastids with an extremely polymorphic aspect are presented. The proplastids with electronodense stroma and a poor lamellae system development as well as amyloplasts with large starch inclusions can be observed. Generally in the base of the callus in direct contact with nutritive media the presence of the amyloplasts with large starch inclusions and a disorganized lamellae system (Plate III, Fig. 3) are observed. Our results are similar from many points of view with JASIK and HUDAK's studies regarding plastid polymorphism in *Vitis labrusca* X, *V. riparia* tissue culture. As an interesting phenomenon we mention the cases in which the same callus has various areas with different colours, namely a basal white area in direct contact with the medium, an intermediary violet area and the central intensely green region. We thought that the various colours of the same callus may indicate, probably, a differentiated physiological activity of the cells (1). The histological observations correlated with electronmicroscopical studies support this idea. The particular aspects of the plastids in cells from different zones of the callus could be mainly determined by two factors: a differentiated level of nutrient supply and of light irradiation intensity in different areas of the callus tissue.

B) THE INFLUENCE OF SOME BIOTIC FACTORS ON THE PLASTID HETEROGENEITY IN GRAPE VINE CALLUS CULTURE

An important biotic factor which determines the ultrastructural peculiarities of the plastidial system in callus cells could be represented by the culture asynchrony. This made possible that cells in different stages of cytodifferentiation to exist in the same callus tissue. Each stage presents its characteristic plastic types. We also suppose that plastid polymorphism in callus culture and the predominance in some instances of one or other type of plastids could be determined by the rate and intensity of the dedifferentiation and redifferentiation processes which appeared even in the first days after inoculation. In the incipient phase of callus initiation and growth, amyloplasts and proplastids in different stages of differentiation are expected to appear. When redifferentiation and some morphogenetical processes were initiated the diversity of plastid types was larger. In these cases many meristematic centers of proliferation (meristemoids) appeared. Regularly meristemoids are surrounded by the parenchyma cells very rich in amyloplasts. So, in this type of morphogenetic

PLATE III.

Fig. 1 — Plastids population in the cells from the central area of an intense proliferative callus (Riesling Italian cv.) The electronodense stroma and an incipient stage of membrane system development as well as the presence of starch inclusions are observed ($\times 23,000$);

Fig. 2 — Plastids with an apparent normal membrane system in the cells from the peripheral layers of the green callus, ($\times 28,000$);

Fig. 3 — Peculiar aspect of plastids in the cells from the basal area of the callus culture. The vacuolated aspect of plastids and disorganisation of the thylakoidal system are observed ($\times 15,000$).

callus proplastids in various stages of differentiation as well as amyloplasts and chloroplasts may be present.

In our experiments the genotype influenced in some cases the plastids ultrastructural peculiarities. For instance, callus initiated from somatic explants of Ananas and Coarnă neagră cultivars manifest a characteristic violet colour in culture. In their cells plastids with a poor lamellae system and a large accumulation of osmiophilic globules similar to chromoplasts are frequent (Plate II, Fig. 4).

From the experimental results obtained in our experiments we can draw the conclusion that ultrastructurally speaking the plastids from the grape vine callus cells present "in vitro" culture a great heterogeneity as regards the structural peculiarities and stage of differentiation, even if they belong to the same cultivar and are in the same growth phase of culture.

Plastid polymorphism appeared like a complex phenomenon which could be determined by biotic and abiotic factors. The asynchrony of the culture which determines a heterogeneity of the cells type regarding differentiation stages, the rate and intensity of the dedifferentiation and redifferentiation processes which appeared in the callus culture even in the early stages of culture, spatial localisation of cells in the callus tissue, hormonal balance of nutrient media, all present a great importance.

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LA CÉNOTAXONOMIE DES PHYTOCÉNOSES HALOPHILES (PUCCINELLIO-SALICORNIEA ȚOPA 39) DE ROUMANIE (II)

V. SANDA, A. POPESCU

Le travail fait l'analyse cénotaxonomique, aréalographique et présente la dynamique et les tendances d'évolution de 23 associations halophiles comprises dans les alliances : *Juncion gerardii*, *Cypero-Spergularion*, *Festucion pseudovinae* et *Beckmannion eruciformis*, appartenant à l'ordre *Puccinellietalia* Soó 40.

Juncion gerardii Wendelbg. 43

Comprend des prairies ayant une humidité accentuée et une faible salinité du sol. Les espèces caractéristiques : *Juncus gerardii*, *Scorzonera parviflora*, *Triglochin maritima*, *Aster tripolium* ssp. *pannonicus*.

1. *Juncetum gerardii* (Warming 1906) Nordh. 23 ; Wenzl 34

Juncus gerardii est une espèce répandue dans tout le pays, peuplant pendant une bonne partie de la saison de végétation les endroits dont l'humidité est excessive. Elle forme des phytocénoses compactes autour des marais, des étangs et des surfaces marécageuses plus ou moins salées.

L'association pousse assez bien sur les sables halophiles continentaux et marins mais aussi sur les sols lourds, marécageux. Dans la composition des phytocénoses de *Juncus gerardii* on rencontre un nombre assez grand d'espèces halophiles et non halophiles. De la première catégorie nous mentionnons : *Spergularia media*, *Crypsis aculeata*, *Puccinellia distans* et quelque fois même *Suaeda maritima* et *Salicornia europaea*, lorsque les phytocénoses sont installées sur des terrains très salés.

Les espèces non halophiles, dans la plupart pallustres et mésophiles se trouvent en grand nombre, distribuées particulièrement à la périphérie des phytocénoses. L'association est utilisée en tant que pâturage avec un pourcentage de consommation satisfaisant. Dans l'association on mentionne les suivants cénotaxa inférieurs : *asteretosum tripolii* Vicherek 61, *puccinellietosum limosae* (Vicherek 61) Soó 64 et faciès avec *Trifolium fragiferum* Slavnić 48.

2. *Caricetum divisae* Slavnić 48

Carex divisa est une espèce de salaisons faibles ou modérées qui pénètre rarement, comme individu isolé, dans les salaisons puissantes. Elle participe dans la composition de plusieurs associations et forme rarement des phytocénoses dans lesquelles la plupart des espèces sont mésophiles et halophiles. Les halophytes les plus représentatives dans l'association de *Caricetum divisae* sont : *Halimione pedunculata*, *Spergularia media*, *Crypsis aculeata*, *Taraxacum bessarabicum*. Y participent, en tant qu'individus isolés *Suaeda maritima* et *Salicornia europaea* ce qui prouve que l'espèce caractéristique supporte des concentrations plus élevées en sels, dans le sol. L'association es répandue d'habitude dans les anciennes prairies des

rivières et dans leurs vallées affluentes, étant liée aux sols sablonneux, toujours en excès d'humidité.

3. *Agrostio-Peucedanietum latifoliae* Turenski (66) 68 corr. Dobrescu et Kovács 72.

C'est un groupe qui habite les sols marécageux en train de salinisation, ayant un contenu de sels solubles à la surface, d'environ 150 mg %, rapport qui augmente en fonction de la profondeur du profil de sol. Dans de pareilles conditions, au fond de l'association *Agrostetum stoloniferae* au sud de Ghicani (Plateau de Birlad) c'est *Peucedanum latifolium* qui s'est développé abondamment, ce qui indique un haut degré de salaison. Le manque d'espèces halophiles au système racinaire superficiel indique une salinisation de profondeur mise en évidence par les halophytes au système racinaire développé verticalement.

E. Turenschi (1968) différencie dans l'association 2 faciès : avec *Cirsium canum* et avec *Geranium palustre*.

4. *Triglochineto (palustris) - Asteretum (pannonici)* Sanda et Popescu 79. (Syn : As. *Triglochin palustris* Asvadurov et al. 65 n. n.)

L'association végète sur des sols humides jusqu'à fort humides pendant toute l'année. Les deux espèces caractéristiques, codominantes, réussissent à former des phytocénoses bien distinctes signalées par nous à Lacul Lutul Alb (Județul Brăila) surtout dans sa partie sud-ouest, ainsi qu'à Valea Iencii. Les espèces les plus fréquentes, rencontrées dans l'association sont : *Spergularia marina*, *Acorellus pannonicus*, *Puccinellia distans*, *Trifolium fragiferum*, *Suaeda maritima*, *Taraxacum bessarabicum*.

L'association s'interpose entre *Acorelletum pannonicum* qui végète au bord du lac Lutul Alb et les associations installées dans les terrains plus hauts : *Camphorosmetum annuae* et *Artemisietum maritimae*.

5. *Caricetum distantis* Rapaics 27 (Syn : *Agrostio-Caricetum distantis* (Rapaics 27) Soó 30).

Préfère le même type de sol que l'association *Juncetum gerardii* avec cette différence qu'elle occupe les endroits plus élevés ayant une structure plus ameublie en contribuant de la sorte à la formation et à la friche du sol. Parmi les espèces rencontrées dans l'association les plus fréquentes sont : *Triglochin palustris*, *Plantago maritima*, *Holoschoenus vulgaris*, etc. On a signalé dans l'association les sous-associations : *ononetosum* Dihoru 70, *agrostetosum* Soó 57 et les faciès avec *Plantago cornuti*, *Juncus gerardi*, *Cirsium canum* Turenschi 70.

6. *Carici (distantis) - Festucetum arundinaceae* Rapaics 27 (Syn. : *Festucetum arundinaceae* (Tx. 37) Nordh. 40 *maritimum* Popescu et Sanda 75).

C'est une association bien répandue sur les sables maritimes de Mamaia et du Delta du Danube, y contribuant en grande mesure à la consolidation du substrat sur lequel elle se développe. Dans la structure de l'association on trouve un grand nombre d'espèces halophiles, parmi lesquelles les plus fréquentes sont : *Juncus acutus*, *J. gerardi*, *Carex distans*, *Centaureum spicatum*, *Agrostis pontica*, *Hordeum maritimum*, etc.

Tableau 1

La structure cénotique des groupes compris dans l'alliance *Cypero-Spergularion* Slavnić 48

Nombre d'ordre	1	2	3	4	5	6	7
Nombre de relèvement	12	7	62	3	—	13	9
Cypero-Spergularion							
<i>Spergularia marina (media)</i>	V	III	III	3	I	IV	IV
<i>Crypsis aculeata</i>	II	II	V			IV	
<i>Spergularia salina</i>		V	I			II	
<i>Heleochoa schoenoides</i>			I	3			
<i>Heleochoa alopecuroides</i>			I		V		
<i>Acorellus pannonicus</i>						V	I
<i>Polypogon mospeliensis</i>							V
Thero-Salicornion							
<i>Suaeda maritima</i>	III	III	III			III	
<i>Salicornia europaea</i>	I	I	II			I	
<i>Salsola soda</i>			I				
Puccinellion limosae							
<i>Halimione pedunculata</i>	II	I	I			I	
<i>Puccinellia limosa</i>		V	I			II	
<i>Bassia sedoides</i>		I	I			I	
<i>Camphorosma annua</i>		III	I			I	
<i>Hordeum hystrix</i>		I			V		
<i>Plantago tenuiflora</i>					I		
Juncion gerardii							
<i>Juncus gerardi</i>	II	I	III	3		II	I
<i>Triglochin palustris</i>						III	
Puccinellietalia							
<i>Taraxacum bessarabicum</i>	I		II				
<i>Aster tripolium</i>	II	II	II			IV	II
<i>Lepidium rudemale</i>	I		I	3	II		
<i>Chenopodium glaucum</i>		III	I	3		II	IV
<i>Agropyron elongatum</i>			I			I	
<i>Atriplex hastata</i>	I		I				IV
<i>Lotus tenuis</i>					I		
<i>Bupleurum tenuissimum</i>					I		
Puccinellio-Salicornietea							
<i>Puccinellia distans</i>	III	II	II	3	III	II	V
<i>Artemisia maritima</i>	I		I				
<i>Statice gmelini</i>	I		I				
<i>Matricaria chamomilla</i>	I		I	1			I
<i>Taraxacum bessarabicum</i>		I				IV	
<i>Cynodon dactylon</i>	I	II	I		IV	II	II
<i>Polygonum aviculare</i>	I	I	I	2	IV		
<i>Inula britannica</i>			I				
<i>Gypsophila muralis</i>					I		
Accompagnatrices							
<i>Heleocharis palustris</i>			I				I
<i>Xanthium italicum</i>						I	

Nombre d'ordre	1	2	3	4	5	6	7
<i>Typha laxmannii</i>			I		II	I	
<i>Cyperus fuscus</i>			I		II		
<i>Xanthium strumarium</i>			I	2		I	I
<i>Atriplex tatarica</i>	III	I	I			III	I
<i>Phragmites australis</i>	I		I				
<i>Scorzonera austriaca</i>	I		I				
<i>Xanthium spinosum</i>	I						
<i>Cardaria draba</i>	I						
<i>Cardus nultans</i>							
<i>Bolboschoenus maritimus</i>		I	I	1		II	I
<i>Trifolium fragiferum</i>		I	I		V		II
<i>Agrostis stolonifera</i>			I	1			I
<i>Plantago major</i>			I				I
<i>Taraxacum serotinum</i>			I				
<i>Agropyron repens</i>	I		I				
<i>Echinochloa crus-galli</i>		I	I	1	IV		I
<i>Eragrostis minor</i>	I		I				
<i>Salsola ruthenica</i>	I		I				
<i>Rumex stenophyllus</i>				1			
<i>Pulicaria vulgaris</i>					III		

Espèces dans un relèvement : 1 : *Convolvulus arvensis*, *Gagea arvensis*, *Holosteum umbellatum*, *Lamium amplexicaule*, *Medicago lupulina*, *Portulaca oleracea*, *Peucedanum latifolium*; 2 : *Rumex crispus*, *Solanum nigrum* (1); 3 : *Atriplex littoralis*, *Aeluropus littoralis*, *Bidens tripartita*, *Chlorocyperus glomeratus*, *Dichostylis micheliana*, *Petrosimonia trianadra*, *Rorippa kernerii*; 4 : *Capsella bursa-pastoris*, *Rumex maritimus*; 5 : *Lactuca serriola*, *Digitalis sanguinalis*, *Setaria viridis*, *Erigeron acer*, *Plantago media*, *Medicago sativa*, *Malricaria inodora*, *Setaria glauca*, *Lotus corniculatus*, *Kickxia elatine*, *Bidens tripartita*; 7 : *Ranunculus sceleratus*, *Rumex limosus*, *Sonchus arvensis*.

Provenance des relèvements : 1 — *Spergularietum marginatae*, Popescu et al. 84 Cîmpia Munteniei; 2 — *Spergularietum salinae*, Sanda, Popescu, 84, Cîmpia Brăilei; 3 — *Crypsidetum aculeatae*, Popescu et al. 84, Cîmpia Munteniei; 4 — *Heleochoëtum schoenoidis*, Popescu et al. 84, Cîmpia Munteniei; 5 — *Heleochoëtum alopecuroides*, Păun et Popescu, 74, Filiași et Lișteava; 6 — *Acorelletum pannonicus*, Sanda, Popescu, 84, Cîmpia Brăilei; 7 — *Polypogonetum monspeliensis*, Popescu et al. 80, Nisipurile României.

Note : Cîmpia Munteniei = Plaine de Muntenia; Cîmpia Brăilei = Plaine de Brăila; Nisipurile României = Sables de Roumanie.

7. *Plantaginetum schwarzenbergianae-cornuti* (Borza 31 n. n.) *banaticum* Grigore 69, 71

Les phytocénoses de cette association, spécifiques pour notre pays, sont décrites par St. Grigore (1969, 1971), et encadrées dans la variante régionale *banaticum* St. Grigore 69, 71. Elles végètent sur les solontchaks de Cruci, Foeni et Diniși (l'interfluve Timiș-Bega). L'association forme un tapis végétal généralement achevé, ayant un recouvrement entre 60—100%, bistratifié et ayant comme espèces de reconnaissance *Plantago schwarzenbergiana*, *Puccinellia limosa*, *Poa bulbosa* var. *vivipara* et *Festuca pseudovina*. Par les espèces composantes l'association présente une valeur fourragère limitée.

Cypero-Spergularion Slavnić 48

Comprend des prairies halophiles cantonnées dans des microdépressions et des terrains plans imbibés d'eau tout le printemps, mais arides pendant

la saison sèche. Espèces caractéristiques : *Acorellus pannonicus*, *Crypsis aculeata*, *C. alopecuroides*, *C. schoenoides*, *Spergularia media*, *S. marina* (Tableau n° 1).

8. *Spergularietum marginatae* I. Șerbănescu 65

Spergularia marginata forme des phytocénoses sur des sols modérés ou fortement salés, humides. Les espèces térophytes y sont prépondérantes. L'association est répandue dans toutes les salaisons chloruriques du pays et surtout dans celles de la partie d'est de la Plaine Roumaine. Dans les salaisons de Caraorman, au bord de la partie sud-ouest du village, on a identifié des cénoses de cette association (Popescu, Sanda, Doltu, 1980) qui réalisent un faible recouvrement du sol. Parmi les espèces accompagnatrices les plus fidèles nous rappelons : *Puccinellia limosa*, *Aster tripolium*, *Suaeda maritima*, *Plantago maritima*, *Crypsis aculeata*, etc.

9. *Spergularietum salinae* Tx. et Volk. 37

L'association est mentionnée dans le conspectus concernant les associations de Banat et Crișana, dressé par P. C. Popescu (1963, pg. 810).

Dans la Plaine de Brăila (Sanda, Popescu, 1984) les phytocénoses de *Spergularia salina* ont un recouvrement de jusqu'à 90%, étant cantonnées au fond des microdépressions séchées à la fin de l'été, là où la sol est couvert d'une croûte évidente de sels. Parmi les accompagnatrices fréquentes, avec une présence significative dans les 7 relevés, nous mentionnons : *Puccinellia limosa*, *Aster tripolium*, *Puccinellia distans*, *Spergularia media*.

10. *Crypsidetum aculeatae* (Bojko 32) Topa 39

L'espèce caractéristique est très répandue sur les terrains salés de l'est de la Plaine Roumaine ainsi que de l'Oltenie (Gighera). La plupart des espèces qui participent à la composition des phytocénoses de *Crypsis aculeata* sont obligatoirement halophiles, quelques-unes étant adaptées aux salaisons puissantes. De cette dernière catégorie nous rappelons : *Suaeda maritima*, *Salicornia europaea*, *Salsola soda*, *Spergularia media*, *Puccinellia distans*, etc. Les stations occupées par l'association sont couvertes d'eau en excès au cours du printemps et à la fin de l'été le sol présente une croûte épaisse de sels qui crèvent à cause du manque d'humidité. Dans les salaisons de Munteni-Buzău (départ. d'Ialomița) on a identifié la sous-association *crypsidetosum* Soó 64, faciès avec *Chenopodium glaucum* Wendelbg. 50 apud Soó 57 (Syn : *Crypsis aculeata*-*Chenopodium glaucum* ass. Wendelbg. 50; *Chenopodietum glauci* Bojko 32; *Crypsis-Chenopodium glaucum* ass. Klika 35).

11. *Heleochoëtum schoenoidis* Topa 39

Est rencontrée fréquemment sous forme de fragments purs, s'installant dans les salaisons de prairie dans les endroits dépressionnaires, marécageux, inondés au printemps et séchés vers l'automne. Elle est spécifique pour les fonds des lacs séchés. Dans la prairie de Birlad (C. Dobrescu, 1970, pg. 341) elle végète de pair avec : *Cerastium dubium*, *Atriplex littoralis*, *Spergularia marina*, *S. media*, *Myosurus minimus*, *Aster tripolium*

ssp. *pannonicus*, *Puccinellia distans*, *Limonium gmelinii*, *Artemisia maritima* ssp. *salina*, *Taraxacum bessarabicum*, *Aster sedifolius*, *Bupleurum tenuissimum*.

Les phytocénoses identifiées par I. Pop (1968) de la Plaine des Criș sont fortement rudéralisées.

12. *Heleocholetum alopecuroides* Rapaics 27

Végète dans les petites dépressions là où l'eau a constitué des étangs au cours du printemps. Les terrains présentent un commencement de salinité et ils sont dominés par *Heleochoa alopecuroides* qui étend ses tiges à la surface du sol. On y trouve isolément des groupes de *Hordeum hystris*, et dans les endroits où le processus de salinité est avancé, apparaît *Crypsis aculeata*. Les phytocénoses de cette association sont fréquemment rencontrées (M. Păun et Gh. Popescu, 1974) dans la plaine de Jiu entre Filiași et Lișteava, végétant souvent parmi les cultures des bineuses ou des céréales dans les mêmes conditions écologiques.

13. *Acorelletum pannonicum* Soó 39

L'association se développe sur des sols plus ou moins sablonneux, faibles et modérés-salés, humides jusqu'à très humides. L'espèce dominante forme souvent toute seule des phytocénoses compactes. Sur les sables de la partie de l'île Sacalin (A. Popescu, V. Sanda, M. I. Doltu, 1980) faiblement et modérément salés, très humides, *Acorellus pannonicus* pousse vigoureusement, ce qui suppose qu'elle y trouve de bonnes conditions de développement. Dans la composition des phytocénoses on rencontre un nombre assez grand de plantes halophiles, à savoir : *Spergularia media*, *Bassia sedoides*, *Chenopodium glaucum*, *Puccinellia limosa*, *Salicornia europaea*, etc.

Là où la concentration des sels du substrat est plus réduite, ce sont les espèces de la classe *Bidentetea* qui apparaissent dans un grand nombre, et nous en mentionnons : *Bidens tripartita*, *Ranunculus sceleratus*, *Bidens cernua*, *Polygonum hydropiper*. Il est très intéressant de constater à Sacalin la présence dans l'association, quelque fois dans une assez grande quantité, de l'espèce *Eleocharis parvula*, plante connue seulement à Sulina. L'installation des espèces non-halophiles, caractéristiques, à la classe *Bidentetea*, est favorisée ici par les eaux douces du bras Sfintu Gheorghe, qui déposent d'importantes quantités d'alluvions sur les sables maritimes.

14. *Polypogonetum monspeliensis* Morariu 57; Borza et Boșcaiu 65

I. Morariu (1957) la décrit à Techirghiol et Constanța où elle colonise les bords des ruisseaux d'eau douce. C'est une association hygrophile, faiblement nitrophile, avec une nuance thermophile, sous-méditerranéenne. Dans sa structure floristique entre peu d'espèces, de point de vue écologique halophiles, supportantes ou glycophiles, qui la séparent autant des associations arénaires que de celles halophiles proprement dites. Entre Mamaia et Năvodari (I. Șerbănescu 1970) l'association est rencontrée sous forme de fragments, les phytocénoses étant détruites au cours des aménagements faits dans cette région.

15. *Atriplicetum hastatae-littoralis* Fl. Diaconescu 78

A été identifié par Florița Diaconescu (1978) dans une culture de maïs, sur des sols argileux-sablonneux, colluvionnaires, humides et faiblement salés, entre Cotnari et Ceplenita et sur les bords des bassins piscicoles de Podul Iloaiei. Les phytocénoses sont bistratifiées ; dans la première couche se trouvent : *Atriplex littoralis*, *Plantago cornuti*, *Spergularia marina*, *Cynodon dactylon*, *Matricaria chamomilla*, *Lepidium rudérale*, et dans la deuxième, plus haute, où participe d'une manière codominante *Atriplex hastata*, on trouve encore *Sonchus arvensis*, *Chenopodium album*, *Ch. glaucum*, *Ch. urbicum*, etc. Le degré d'achèvement des phytocénoses est baissé, la végétation paraissant dans un état de pionnier sur les substrats rappelés.

Festucion pseudovinae Soó 33

Groupe les prairies haloxérophiles de steppe et sylvestre, sèches cantonnées sur des sols peu salés et plus humides. Les espèces caractéristiques : *Festuca pseudovina* var. *salina*, *Limonium gmelinii*, *Lotus angustissimus*, *Plantago schwarzenbergiana*, *Trifolium angulatum*, *T. micranthum*, *T. retusum*, *T. striatum*, *T. strictum*, *T. subterraneum*, *T. vesiculosum*.

16. *Artemisio-Petrosimonetum triandrae* Soó 27

(Syn. : As. de *Petrosimonia triandra* Șerbănescu 65)

Se développe sur des salaisons échloruriques, moyennes jusqu'à forte humidité réduite en été. De point de vue floristique, les phytocénoses d'*Artemisio-Petrosimonetum triandrae* sont caractérisées par la prédominance des halophytes obligatoires ou préférantes, comme : *Puccinellia distans*, *Suaeda maritima*, *Limonium gmelinii*, *Bassia sedoides*, *Spergularia media*, *Halimione verrucifera*, *Camphorosma annua*, *Salicornia europaea*, *Salsola soda*, *Bassia hirsuta*, etc.

Dans le bassin de Crasna (Gh. Vițalariu, 1976) végètent encore, avec des indices phytocénologiques élevés, hormis les espèces caractéristiques à l'association, *Artemisia santonicum* et *Petrosimonia triandra*, quelques différentielles régionales comme *Dianthus guttatus*, *Agropyron triticum*, *Camphorosma monspeliaca*, qui ont mené à la description d'une nouvelle variante régionale, nommée avec *Dianthus guttatus* Vițalariu 76.

17. *Artemisio-Festucetum pseudovinae* (Magyar 28) Soó (33) 45

S'installe sur des sols salés, secs, surtout des solonchets. Les espèces caractéristiques à l'association sont : *Festuca pseudovina* et *Artemisia santonicum*. Les accompagnatrices les plus constantes sont : *Bromus hordeaceus*, *Poa bulbosa*, *Scleranthus annuus*, *Scorzonera cana*, *Plantago maritima*, *P. tenuiflora*, *Gypsophila muralis*, *Trifolium parviflorum*, *T. fragiferum*, *T. ornithopodioides*, *Camphorosma annua*, *Polycnemum arvense*, *Limonium gmelinii*.

Dans l'association on a identifié les suivantes sous-associations : *artemisietosum* Soó 71, *alopecuretosum* Bodrogk. 62, *festucetosum pseudovinae* (Wendelbg. 43,50) Soó, 64, *puccinellietosum* Soó 64, *camphorosmetosum* (Slavnić 48) Soó 64, *achilletosum* Bodrogk. 65, *pannonicum* Soó 64, *limonietosum* Bodrogk. 62, *camphorosmetosum monspeliacae* Soó 45.

En tant que faciès on a signalé les : *Lepidium ruderales* V. Oprea 76 ; *Bromus hordeaceus*, *Poa bulbosa*, *Lotus angustissimus*, *Camphorosma annua*, *Plantago maritima*, *Limonium gmelinii*, *Artemisi maritima* I. Pop 69.

18. *Achilleo-Festucetum pseudovinae* (Magyar 28) Soó (33)45

Les plantes caractéristiques à l'association sont *Festuca pseudovina*, comme espèce edificatrice, et *Achillea setacea* et *A. collina* comme espèce indicatrice. Les espèces mésophiles et celles mésohygrophiles peuvent végéter auprès de celles xérophytes, grâce à la couche fréatique qui se trouve à la surface. Parmi les espèces les plus fréquentes dans l'association et qui présentent en même temps un rôle phytocénétique particulier, nous mentionnons : *Alopecurus pratensis*, *Trifolium strictum*, *T. micranthum*, *T. parviflorum*, qui composent des faciès caractéristiques. La physionomie de l'association est accordée par la graminée au buisson dense, qui lui imprime un caractère de plaine plus ou moins achevée. A la suite du pacager intense, ces plaines passent à travers de diverses phases de rudéralisation, marquées par la présence des espèces de *Bromus hordeaceus*, *Polygonum aviculare*, *Europhobia cyparissias*, *Cardaria draba*, *Erodium cicutarium*, *Eryngium campestre*, *Convolvulus arvensis*, *Plantago media*.

En tant que sous-association, nous signalons : *koelerietosum cristatae* Sănda et Popescu 78, *limonietosum* Soó 64, *artemisiotosum* Soó 64, *achilletosum* Soó 64, *alopecuretosum pratensis* Soó 64, normale Bodrogk. 64, *cynodontetosum* Borza 59; Bodrogk. 65 (Syn. : *Festucetum pseudovinae cynodontetosum* Borza 59), *transsilvanicum* Soó 47.

Dans l'association on signale les suivants faciès : avec *Euphorbia cyparissias* Soó 73, *Hrifulium strictum*, *T. micranthum*, *T. parviflorum* I. Pop 63.

19. *Peucedano-Festucetum pseudovinae* (Rapaics 27) I. Pop 68 (Syn. : *Peucedano-Asteretum punctati* (Rapaics 27) Soó 47).

Elle est caractéristique aux sols faiblement salés. Auprès les deux espèces codominantes—*Festuca pseudovina* et *Peucedanum officinale*—se mettent en évidence : *Poa pratensis*, *Carex praecox*, *Potentilla argentea*, *Achillea collina*, *Bupleurum tenuissimum*, *Aster linosyris*, *A. sedifolius*, *Scorzonera cana*, etc.

Dans l'association on signale les suivantes sous-associations : *alopecuretosum pratensis* Grigore 71, *festucetosum pseudovinae* Grigore 71, *asteretosum punctati* (I. Șerbănescu 63) Sănda, Popescu, Doltu 80 (Syn. : As. de *Aster punctatus* Șerbănescu 63) *festucetosum sulcatae* Zólyomi ap. Soó 57, *nardetosum strictae* Kovács 68 *mesophilum* Kovács 68 (Syn. : *Festucetum pseudovinae mesophilum* Kovács 65).

Beckmannion eruciformis Soó 33

L'alliance réunit les associations de plaines mésohygrophiles des boursiers faiblement salés et temporairement embourbés. Les espèces caractéristiques : *Beckmannia eruciformis*, *Glyceria fluitans*, *Ranunculus lateriflorus*, *Rorippa sylvestris* ssp. *kernerii*, *Rumex stenophyllus*.

20. *Agrostio-Alopecuretum pratensis* Soó (33)47

(Syn. : *Alopecureto-Rorippetum kernerii* (Soó 33)I. Pop 68)

Compose des prés mésophiles sur des terrains humides marécageux étant constitués des graminées de haute taille comme *Alopecurus pratensis*, *Agrostis stolonifera*, *Poa pratensis*, *Beckmannia eruciformis*. Parmi les autres espèces qui l'accompagnent sur les terrains salés de Salonta (Départ. de Bihor) (I. Pop 1959) nous rappelons : *Carex parecox*, *C. caryophyllea*, *Eleocharis palustris*, *Trifolium repens*, *Lotus corniculatus*, *Rorippa sylvestris* ssp. *kernerii*, *Lysimachia nummularia*, *Mentha pulegium*, *Veronica arvensis*, *Plantago lanceolata*. L'association représente une phase de transition entre *Alopecuretum pratensis* et *Agrostio-Beckmannietum*.

21. *Agrostio-Eleochariti-Alopecuretum geniculati* (Magyar 28) Soó 39

(Syn. : *Heleocharis palustris-Alopecurus geniculatus* Soó 40)

Les espèces caractéristiques de l'association, *Eleocharis palustris* et *Alopecurus geniculatus* se trouvent en différentes proportions ; d'habitude y prédomine *Eleocharis palustris*. Un rôle phytocénétique est détenu aussi par *Glyceria fluitans*, *Cerastium dubium*, *Callitriche polymorpha*, *Ranunculus aquatilis*, *R. lateriflorus*, *Rorippa sylvestris* ssp. *kernerii*, *Lysimachia nummularia*, *Gratiola officinalis*, *Veronica scutellata*, *Mentha pulegium*. En tant qu'infra-cénotaxa deux sous-associations sont indiquées dans la végétation de la Roumanie : *alopecuretosum* Soó 57 et *eleocharetosum* Soó 57 (Syn. : *Heleocharidetum palustris* Rapaics 27).

22. *Agrostio-Beckmannietum* (Rapaics 16) Soó 33

(Syn. : *Oenanthe silaifolia-Beckmannia* ass. Slavnic 48)

L'association végète sur les marécages plus ou moins salés, temporairement embourbés et chaussés à la suite du pacage. Les espèces edificatrices *Agrostis stolonifera* et *Beckmannia eruciformis* sont fréquemment accompagnées de : *Eleocharis palustris*, *Alisma lanceolatum*, *Trifolium fragiferum*, *Oenanthe aquatica*, *Teucrium scordium*, *Galium palustre*, etc.

Selon le degré de concentration des sels du substrat, les deux espèces caractéristiques peuvent dominer successivement.

La sous-association *beckmannietosum* Soó 64 est répandue dans la Plaine de Munténie, dans les prés des rivières Neajlov, Sărata, Ialomița, etc. Elle peut apparaître aussi à l'intérieur de la forêt de *Quercus robur*, cantonnée en microdépressions où l'eau reste pendant l'entière période de la saison de végétation.

La sous-association *agrostetosum* Sănda, Popescu, Doltu 80 caractérise les terrains humides, moins salés, où l'espèce dominante *Agrostis stolonifera* pousse en masse. Les espèces *Oenanthe silaifolia*, *Bolboschoenus maritimus*, *Carex melanostachya* indiquent un haut degré d'humidité du sol au cours de l'année toute entière et une salaison réduite, au moins dans la partie supérieure du sol. En profondeur, le sol contient de grandes quantités de sels qui favorisent le développement d'espèces halophiles comme par exemple : *Aster tripolium*, *Limonium gmelinii* etc.

On mentionne aussi dans l'association les suivantes sous-associations : *alopecuretosum* Bodrogk. 65 (Syn. : *alopecuretosum pratensis* Grigore 71), *trifolietosum fragiferi* (Ubrizsy 48) Bodrogk. 65 (Syn. : *trifolietosum fragiferi* Grigore 71), *rorippetosum kernerii* Grigore 71.

23. *Trifolietum angulati* I. Șerbănescu 65

L'association apparaît sur les salaisos faibles, humides, en formant souvent dans les prairies larges d'importants pâturages des espèces mésophiles, halophiles et héliophiles. Les sols sont en général alluviaux ou marécageaux faiblement salés. L'association abrite aussi certaines espèces méditerranéennes, comme: *Trifolium resupinatum*, *Medicago arabica*, *Trifolium michelianum*, *Zingeria pisdica* (espèce caractéristique pour le podzol de dépression). *Zingeria pisdica* indique certaines conditions de rapprochement entre les salaisos et les podzols de dépression, où cohabitent quelquefois les phytocénoses de l'association *Agrostio-Beckmanietum*. L'association présente une grande valeur fourragère.

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COENOTAXONOMY OF CORNFIELD-PLANT VEGETATION (CLASS *SECALIETEA* BR.—BL. 31 EMEND. 51) IN ROMANIA

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The paper analyses the cornfield-plant phytocoenoses signaled in Romania so far. As the agrotechnical works always more complicated administered on these cultures greatly influence their structure, there appears an accentuated diminution of the component number of species or even of the characteristic ones.

On the basis of comparative studies of annotation, a uniform treating of all groups signaled in our country was succeeded and there were many synonymies or coenotaxonomical reinstatements made.

Class *Secalietea* Br.—Bl. 31 emend. 51 is grouping the antropophilous nitrophilous associations, variated as aspect, floristic composition and phytocoenotic structure but unitary considering a group of characteristic species by most similar ecototypes achieved in crops, stubble fields, ploughed fields, fallow grounds there where they develop owing to the origin character of these associations "created by man" (Ana Paucă, 1941). The associations are spread in the whole Europe but mostly they do not get to fully recover because of the agrotechnical works applied on these cultures; thus, the phytocoenoses are hardly outlined by the scarce presence of some or other characteristic species. The associations generally include therophyte species to which the hemicryptophytic and geophyte species different in number from one phytocoenosis to another are added.

Recognition species: *Adonis aestivalis*, *Agrostemma githago*, *Ajuga chamaepitys*, *Allium atropurpureum*, *A. vineale*, *Anagallis arvensis*, *Anthemis cotula*, *Apera spica-venti*, *Aphanes arvensis*, *Arabidopsis thaliana*, *Bromus secalinus*, *Bifora radians*, *Camelina microcarpa*, *Turgenia latifolia*, *Caucalis platycarpa*, *Centaurea cyanus*, *Consolida regalis*, *C. orientalis*, *Digitaria ischaemum*, *Eragrostis ciliaris*, *Euphorbia exigua*, *E. helioscopia*, *Fumaria vaillantii*, *Gagea arvensis*, *Galeopsis ladanum*, *Galium tricornutum*, *Heliotropium europaeum*, *Kickxia elatine*, *Lathyrus aphaca*, *L. tuberosus*, *Lepidium perfoliatum*, *Linaria arvensis*, *Lamium purpureum*, *Melampyrum arvense*, *Myagrum perfoliatum*, *Neslia paniculata*, *Nigella arvensis*, *Ornithogalum pyramidale*, *Papaver rhoeas*, *Ranunculus arvensis*, *Rubus caesius*, *Raphanus raphanistrum*, *Rumex acetosella*, *Setaria glauca*, *S. viridis*, *Sinapis arvensis*, *Scleranthus annuus*, *Stachys annua*, *Thlaspi arvense*, *Torilis arvensis*, *Vaccaria pyramidata*, *Veronica hederifolia*, *V. opaca*, *V. polita*, *V. triphylos*, *Vicia angustifolia*, *V. hirsuta*, *V. pannonica*, *V. striata*, *V. villosa*, *Viola arvensis*.

A P E R E T A L I A R. et J. Tx. 60 (Syn.: *Aperion spicae-venti* Soó 50, Oberd. 57).

Characteristic species: *Apera spica-venti*, *Scleranthus annuus*, *Aphanes arvensis*, *Vicia tetrasperma*, *Rumex acetosella*, *Spergula arvensis*, *Raphanus raphanistrum*, *Trifolium arvense*, *Anthemis arvensis*.

REV. ROUM. BIOL.—BIOL. VÉGÉT., TOME 36, N°S 1—2, P. 59—69, BUCAREST, 1991

Aphanion J. et R. Tx. 60

Characteristic species: *Cirsium arvense*, *Aphanes arvensis*, *Veronica arvensis*, *Arenaria serpyllifolia*, *Myosotis arvensis*, *Papaver dubium*, *Anagallis arvensis*, *Matricaria perforata*, *Chamomilla recutita*.

1. *Aphani-Matricarietum chamomillae* Tx. 37 corr. Soó 60
(Syn.: *Matricarietum chamomillae* Tx. 37 em. Pass. 57 s. 1.)

In Muntenia Plain, the association is spread around the hollows and microdepressions, on podsol grounds, temporary marshed by waters that come from the precipitations in spring time. It is an association that makes the transition towards the proper cornfield-plant vegetation. The characteristic species, *Aphanes arvensis*, grows abundantly covering almost completely appreciable surfaces. The *Aphanes arvensis* phytocoenoses with *Chamomilla recutita* are circularly disposed forming the external border of the associations belonging to the class *Isoëto-Nanojuncetea* that vegetates in the fallows of the Romanian Plain. There is a rather limited number of species that takes part in this association from which we mention: *Scleranthus annuus*, *Gypsophila muralis*, *Anthemis arvensis*, *Filago arvensis*, etc.

2. *Sclerantho-Trifolietum arvensis* Morariu 43

The association is characteristic for the agricultural lands, growing especially in the places where cereals are cultivated as well as on the fallow grounds and the edge of the ploughed field. The plants with in these phytocoenoses are totally annual, the perennial ones being not capable of fixing because of the agricultural works. On the lands left uncultivated the vegetation evolves towards the installing of the associations specific to the *Chenopodietea* class.

The phytocoenoses of this association are frequent both on forest brown-reddish soils and on chernozems. Along the *Scleranthus annuus* and *Trifolium arvense* which are codominant species and edifying for the association there may be also found: *Centaurea cyanus*, *Viola arvensis*, *Filago arvensis*, *Cirsium arvense*, *Consolida regalis*, *Gypsophila muralis*, *Anthemis arvensis*, *Polygonum aviculare*, *Brassica nigra* etc.

3. *Dauco-Salvietum verticillatae* Soran 62
(Syn.: As. *Salvia verticillata*-*Daucus carota* Soran 62)

The association may be found on fallow grounds, developing on brown-reddish soils, strongly podsoled. The recognition species are: *Salvia verticillata*, *Daucus carota* and *Lepidium campestre* and as local recognition species for the Apuseni Mountains is *Sanguisorba minor* ssp. *muricata*.

Among the other accompanying species with abundance-dominance indexes we may also remind: *Echium vulgare*, *Rumex acetosella*, *Scleranthus annuus*, *Vicia angustifolia*, *Plantago lanceolata*, *Setaria pumila*, etc. The presence of numerous perennial plants within the association indicates the tendency of evolution and replacement of it with lawn associations.

4. *Echio-Rumicetum acetosellae* Soran 62
(Syn.: As. *Rumex acetosella*-*Echium vulgare* Soran 62; As. de *Rumex acetosella* I. Șerbănescu 64).

The association *Echio-Rumicetum acetosellae* replaces the *Sclerantho-Trifolietum arvensis* Morariu 43 association in the mountains, that was signaled out in plain regions. It usually forms after cereal cultures, especially spring wheat culture on soils that remain in a fallow ground state. The soil is usually the culture podsol or the light grey degrading one with a rich skeleton content. The recognition species of the association with great dominance and abundance are: *Rumex acetosella* and *Echium vulgare*. Among the species of local recognition and differentiation we remind: *Veronica officinalis*, *Chrysanthemum leucanthemum* and *Silene gallica*. In some conscriptions there appears a facies with *Echium vulgare* that is met on soils poorer in skeleton, with a small quantity of humus cultivated before with potatoes.

The analysis of the floristic composition of the association draws the attention on the numerous presence of some species like *Agrostis capillaris* and *Trifolium repens*. This testifies the short time the association occupies, maximum two years; it constitutes a passing stage towards the natural hayfields populated by *Agrostis capillaris*.

5. *Vicietum tetraspermae* Krusemann et Vlieger 39

The association is quoted in our botanical literature in Moldavia (N. Barabaș, 1978; D. Mititelu and Gh. Vițalariu, 1967; D. Mititelu et al. 1969; D. Mititelu and N. Barabaș, 1978). The phytocoenosis belonging to this association may be met especially in cereal cultures on forest soils. It comprises a great number of plants (41 species, N. Barabaș, 1978) among which the dominant species is sometimes distinguished by an excessively great density in which case the crop being compromised it must be moved and administered as fodder. With great constancy within the association the following are registered: *Bromus secalinus*, *Anagallis arvensis*, *Lathyrus tuberosus*, *Veronica arvensis*, *Vicia villosa*, *Apera spica-venti*, *Avena fatua*, *Centaurea cyanus*.

6. *Spergulo-Aperetum spicae-venti* Soó (53) 62

Frequent on the sandy soils in cereal cultures (wheat, rye, barley) (Erika Senheider-Binder, 1976). It is also cited in our papers but conscriptions are not given (Gh. Popescu, 1975; I. Șerbănescu, 1957).

7. *Setario-Digitatrietum* Felföldy 42 emend. Soó 61

It is frequent especially in the corn cultures and on vine plantations where *Setaria pumila* and *Digitaria sanguinalis* as characteristic and edifying species of the association are more frequently accompanied by *Hibiscus trionum*, *Portulaca oleracea*, *Amaranthus albus*, *A. retroflexus*, *Polygonum aviculare*, *Convolvulus arvensis*, *Sinapis arvensis*, *Chondrilla juncea*, *Xanthium strumarium*, *Euphorbia virgata*, *Rubus caesius*, *Echinochloa crus-galli*, *Amaranthus blitoides* (Corn cultures, Măldăieni, Department Teleorman, V. Sanda, A. Popescu, 1987, inedited).

LOLIO-LINETALIA J. et R. Tx. 61

Lolium remotae-Linion Tx. 50

Characteristic species for the order and alliance: *Camelina alyssum*, *Cuscuta epilinum*, *Eruca sativa*, *Galium spurium*, *Lolium remotum*, *L. temulentum*.

8. *Polygono lapathifoliae*-Linietum (Denissow 30) Tx. 50

The association is signaled out in our works by N. Barabaş (1978) in the Tazlău basin and is characteristic for the flax cultures. It has in its composition besides the dominant species *Polygonum lapathifolium* and *Lolium remotum* some extremely injurious plants such as *Cuscuta epilinum* which form circular places large enough in the flax cultures and which together with *Spergula arvensis*, *Anagallis arvensis*, *Brassica nigra*, *Cirsium arvense*, *Lathyrus tuberosus*, contribute to the degradation of flax cultures.

The association is rich in Eurasiatic species having a substantial fund of cosmopolitan and submediterranean species. It generally comprises therophyte species and is rather persistent owing to the agrotechnical works of soil preparation and maintenance of the cultures when they are low as qualitative level.

SECALIETALIA Br.—Bl. 31 emend. J. et R. Tx. 60 ex Lohm. 62

Triticum sativae Krusem. et Vlieg. 39

Recognition species: *Ranunculus arvensis*, *Chamomilla recutita*, *Vicia tetrasperma*.

9. *Ranunculetum arvensis* Pass. 64

It forms phytocoenoses on the edge of the cultures or in small hollows where the culture species has disappeared because of the water stoppage during spring time. Among the most frequent accompanying species of the association we may remind: *Sinapis arvensis*, *Cardaria draba*, *Lathyrus tuberosus*, *Vicia striata*, *Nigella arvensis*, *Papaver dubium*, *Caucalis platycarpus*, *Convolvulus arvensis*, *Polygonum aviculare*, *Chondrilla juncea*, *Bilderdykia convolvulus*. St. Grigore (1971) signals out two subassociations within this association: *ranunculetosum arvensis* and *ranunculetosum sardoi*.

Caucalidion platycarpus Tx. 50 corr. Soó 71

Recognition species: *Asperula arvensis*, *Caucalis platycarpus*, *Conringia orientalis*, *Legousia speculum-veneris*, *Scandix pecten-veneris*, *Torilis arvensis*.

10. *Caucalidi-Adonietum* Tx. 50

The *Caucalis platycarpus* and *Adonis aestivalis* phytocoenoses develop especially on wheat cultivated soils, rich in calcarous stone and strongly sun-lit. The most frequent species within the association are: *Con-*

solida regalis, *Bilderdykia convolvulus*, *Camelina microcarpa*, *Euphorbia virgata*, *Centaurea cyanus* and other species growing in cornfields largely spread in the agricultural cultures.

11. As. *Lathyrus aphaca*-*Lathyrus tuberosus* (Kuhn 37) Tx. 50

It prefers moist soils, rich in nutritive substances, the two *Lathyrus* species taking part rather actively in nitrogen fixing in the substrate where it develops. The association vegetates on rather restricted surfaces. Among the species more frequently met within the association we may remind: *Convolvulus arvensis*, *Centaurea cyanus*, *Anthemis austriaca*, *Delphinium consolida*, *Bilderdykia convolvulus* and other.

12. *Consolido-Polygonetum convolvulus* (Morariu 43) Morariu 67 (Syn.: *Biforo-Vicietum pannonicae* A. Nyár. et al. 69; As. *Caucalis*

lappula Morariu 43; *Bilderdykia-Convolvuletum arvensis* Fl. Diaconescu 78; *Fagopyro convolvulus-Convolvuletum arvensis* Burduja et Fl. Diaconescu 76; As. *Sinapis arvensis-Bifora radians* (Morariu 43) Soó 47; Borza et Boscaiu 65; *Adonieto-Delpinietum consolidae banaticum* Borza 62; *Caucalidi (lappulae) -Setarietum* (Klika 35) Soó 64 p. p.; *Adonieto-Delpinietum consolidae transilvanicum* Borza 59; *Setaria glauca-Stachys annua* ass. Felföldy 42; *Camelina microcarpa-Euphorbia falcata* ass. Tx. 50). Association prevalent in wheat, stubble and fallow ground cultures 1–2 years old where *Consolida regalis* and *Bilderdykia convolvulus* are frequently accompanied by *Adonis aestivalis*, *Papaver rhoeas*, *Capsela bursa-pastoris*, *Caucalis platycarpus*, *Setaria pumila*, *Stachys annua*, *Hibiscus trionum*, *Lathyrus tuberosus*, *Sinapis arvensis* and other. It develops on levi gated chernozems.

As infracoenotaxons we remind: *polygonetosum convolvuli* Todor et al. 71, *lathyretosum hirsutae* Todor et al. 71, *salvietosum reflexae* (Vițalariu et Leucov 71) Popescu, Sanda, Doltu 83 (Syn.: As. de *Salvia reflexa* Vițalariu et Leucov 71), variant *thymelaetosum* Borza 59 and facies *Sinapis arvensis* and *Cirsium arvense* Grigore 68.

13. *Trifolium (arvensi) -Legousietum speculi veneris* Spiridon 70.

It installs on grounds with weak acid reaction in wheat, rye cultures. The majority of species that are comprised in the phytocoenoses composition are annual and autumn annual.

The association is described in the agricultural cultures around Bucharest on the levigated chernozems. Although appropriated to the *Scleranthus annuus-Legousia speculum veneris* (Br.—Bl. 15) Tx. 49 and *Scleranthus annuus-Trifolium arvense* Morariu 43 association, by its component species, the association described by Lucreția Spiridon (1970) affiliates to the *Caucalidion platycarpus* alliance and to the *Aphanion* one as the two mentioned above.

14. *Matricarietum inodora* Cirtu 71 = *Matricarietum perforatae* nom. nov.

It occupies grounds slightly uneven where, as a result of water marsh, a good part of the cultivated plants has disappeared and *Matricaria perforata* has installed. The association occupies considerable surfaces in the

Muntenia Plain in the area of forest brown-reddish soils, North-Western Bucharest (Bildana-Răcari), where it suffocates the cultures poorly maintained. It also installs on grounds poorly dug generally along the collecting channels of waters in this area with lots of hollows.

Within the association there appear subhygrophilous species such as: *Ranunculus repens*, *Lythrum hyssopifolia*, *Ranunculus lateriflorus*, most of the species are mesophyll, frequently spread in the cereal cultures.

15. *Adonieto (flammeae) - Valerianelletum lasiocarpae* (Morariu 59)

Popescu, Sanda, Doltu 83 (= As. *Adonis flammea - Valerianella eriocarpa* Morariu 59).

It is a synantherous association, rich in thermophilous elements, quartered on fallow grounds and in young curtains of protection sometimes on fields or stubble fields. Among the thermophilous elements most important part is played by: *Adonis flammea*, *Scandix pecten-veneris*, *Glaucium corniculatum*, *Valerianella lasiocarpa*, *Androsace maxima*, *Althaea hirsuta*.

16. As. *Delphinium orientalis - Vicia striata* (Slavnić 44) Soó 47

(Syn.: *Consolida orientalis - Stachyetum annuae* (Soó 47) Timár 57; *Stachyeto-Setarietum viridis* Ujv. 54; *Vicio (striatae) - Anthemitetum austriacae* Spiridon 70).

It is the most spread association within the cereal cultures known under several denominations: *Anthemis austriaca - Consolida orientalis* ass. Slavnić 44, *Consolida orientalis - Vicia striata* Soó 47, *Vicio (striatae) - Anthemitetum austriacae* Spiridon 70, and others.

The association is rich in species as a result of the fact that it develops on moist soils, rich in nutritive substances. The characteristic species of the association are: *Consolida orientalis*, *Vicia striata*, *Anthemis austriaca* but *Vicia angustifolia*, *V. sativa*, *Centaurea cyanus*, etc., are frequently met. It is spread both on brown reddish forest soils and on chernozems along the whole Danube Plain. It is frequent in wheat cultures causing damages especially in the case of a cultivation for several years with the same cultures.

As infracoenotaxons we remind: subass. *biforetosum radiantis* Vițalariu 74 and the facies with: *Vicia villosa*, *Cirsium arvense*, *Aristolochia clematitis*, *Rubus caesius* Spiridon 70, *Ranunculus arvensis*, *Veronica hederifolia*, *Stachys annua*, *Vicia striata*, *V. hirsuta* St. Grigore 68.

17. *Kickxieta - Scutellarietum hastifoliae* Paucă 41

(Syn.: As. *Kickxia elatine - Scutellaria hastifolia* Paucă 41; *Kickxiatum elatinae* (Borza et Boșaciu 65 n.n. sub *Linaria elatine* Burduja et al. 71). This association was signaled out by Ana Paucă (1941) in Codru-Moma Mountains and has diagnosis species as *Erigeron canadensis*, *Scutellaria hastifolia*, *Kickxia elatine*, *Setaria pumila*. It is very much similar to *Kickxieta - Aperetum* Oberd. 57. It vegetates on stubble fields, on clayey soils, poor, formed in quartz terrace broken stones.

18. *Lathyro aphacae - Aperetum* Tx. et Rochow 50

The association was identified by D. Mititelu and the collaborators (1986) in the wheat cultures in Preluca Veche and Răzoare (Maramureș

district) where the two codominants *Lathyrus aphaca* and *Apera spica-venti* are more frequently accompanied by *Lathyrus tuberosus*, *Scherardia arvensis*, *Anthemis arvensis*, *Bifora radians*, *Filago arvensis*, *Galeopsis ladanum*, etc.

19. *Lathyro-Avenetum fatuae* Pass. 75

It vegetates on the oat and rye cultures of Frătăuții Vechi and Iaslovăț where *Lathyrus tuberosus* and *Avena fatua* are accompanied by *Tripleurospermum inodorum*, *Adonis aestivalis*, *Bifora radians*, *Galeopsis ladanum*, *Stachys annua*, etc.

Trifolio-Medicaginetum sativae Balázs 44 emend. Soó 59

Recognition species: *Cuscuta campestris*, *C. trifolii*, *Helminthia echinoides*, *Lolium multiflorum*, *Orobancha lutea*, *O. minor*.

20. *Aristolochio-Convolvuletum arvensis* Ubrizsy 67

(Syn.: *Setario-Aristolochietum clematitis* Fl. Diaconescu 78).

The association was identified by Gh. Vițalariu (1974) in our country on fallow grounds, stubble fields, unworked vines and on slope chernozems. The characteristic and useful species to the association are: *Aristolochia clematitis* and *Convolvulus arvensis*. It is frequently accompanied by: *Fumaria schleicheri*, *Sinapis arvensis*, *Hibiscus trionum*, *Bilderdykia convolvulus*, *Solanum nigrum*, *Senecio vernalis*, *Sonchus arvensis*, *Stellaria media*, *Thlaspi arvense*, etc.

21. *Plantagini lanceolatae - Medicaginetum* (Balázs 44) Soó et Timár 54.

The weeds of *Plantago lanceolata* vegetate in weeded out yellow clover lucerne areas, on humid phreatic soils and were signaled out in our country in the Timiș-Bega - interstream (S. Gtrigore, 1968) and in Transylvania (Sărățel-Chiraleș-Lechința (Att Szabó, 1971).

St. Grigore (1968) signals out the facies with: *Verbena officinalis*, *Erophila verna* and *Taraxacum officinale*.

22. *Bromo japonico-Aristolochietum clematitis* Ubrizsy 64

Is characteristic for the cultivated lands with an addition of humidity during the dry season. *Aristolochia clematitis*, by its underground system offers resistance to the works of maintenance of cultures protecting the new individuals in the rhizomes that are fixed at high depth in the soil.

Within these phytocoenoses there are numerous species growing in cornfields that participate such as: *Setaria pumila*, *Eragrostis cilianensis*, *E. minor*, *Echinochloa crus-galli*, *Digitaria sanguinalis*, *Portulaca oleracea*, *Sonchus oleraceus*, *Abutilon theophrasti*, *Hibiscus trionum* and others. The association is signaled out by Cl. Horeanu (1975) in Dobrudgea the Casimcea plateau.

ERAGROSTETALIA J. Tx. 61 emend. Soó 68

(Syn.: *Amarantho-Chenopodion* Morariu 43)

It comprises associations of waste lands, frequently dug and vegetable cultures.

Consolido-Eragrostion pooidis Soó et Timár 57

Recognition species for *Consolido-Eragrostion pooidis* Soó et Timár 57 and *Tribulo-Eragrostion pooidis* Soó et Timár 57 are: *Bifora radians*, *Consolida orientalis*, *Eragrostis cilianensis*, *E. minor*, *Hibiscus trionum*, *Orobancha cumana*, *Panicum capillare*, *Papaver hybridum*, *Stachys annua*, *Tragus racemosus*, *Tribulus terrestris*.

23. *Amarantho-Chenopodietum albi* (Morariu 43) Soó (47)57

(Syn.: *Amaranthus albus-Eragrostis poaeoides* ass. Morariu 43; *Galinsogeto-Portulacetum transsilvanicum* Borza 59; *Galinsogeto-Portulacetum valachicum* Borza 66 n. n.).

Spread at the edge of cultures and especially at the edge of the gardens where the soil is rich in nitrogenous substances, the association is habitual for all the provinces in the country. In its phytocoenosis there is a great number of plants growing in cornfields that take part such as *Amaranthus albus*, *A. blitoides*, *A. hybridus*, *Hibiscus trionum*, which may become codominants within the association.

As subassociations the following are signaled out: *eragrostetosum* Bodrogl. 55, *xanthetosum italicum* Burduja et Horeanu 76, *digitarietosum* Soó 61, *amaranthetosum albi* (Morariu 43) Spiridon 70 (Syn.: *As. Amaranthus albus-Eragrostis poaeoides* Morariu 43), *amaranthetosum hybridum* Morariu 43, *amaranthetosum blitoidis* Spiridon 70 (Syn.: *Portulaco-Amaranthetum blitoidis* Mititelu 72), *malvetosum silvestre* Szabó 71, *dobrogicum* Dihoru (69)70, *graminetosum* Slonovschi 77, *euphorbietosum maculatae* Vițalariu 73, *panicetosum capillaris* (Mititelu et Ștefan 88) comb. nova (Syn.: *Eragrostio(poaeoidis) Panicetum capillaris* Mititelu et Ștefan 88).

The variant with *Solanum triflorum* Burduja et al. 71 and the facies with *Amaranthus crispus* Ubrizsy 49,50 are also signaled out.

24. *Heliotropio-Cynanchetum acuti* Mititelu 71

Is described by D. Mititelu (1971) in vines and corn cultures and has the following recognition species: *Cynanchum acutum* and *Heliotropium europaeum*.

Tribulo-Eragrostion pooidis Soó et Timár 57

25. *Vicia-Eragrostietum pooidis* Timár (53)57

The recognition and characteristic species of the association *Eragrostis minor*, *Vicia villosa* and *Vicia hirsuta* are rather spread in the wheat, barley cultures, at the edge of the fields or on the lands that had been watered during spring. It also may be found around the hallows occupying their highest area where water has subsided as far back as during spring time. These species take part in the association: *Veronica triphyllos*, *Lamium amplexicaule*, *Descurainia sophia*, *Digitaria sanguinalis*, and others.

In the microdepressions in Săbăreni-Răcari area (Western Bucharest), the higher humidity of their central part allows the abundant installing of the species *Juncus bufonius*, stage known in literature as the *juncetosum bufonii* Timár (55)57 subassociation.

26. *Digitario-Portulacetum* (Felföldy 42) Timár et Bodrogl. (53)55 (Syn.: *Convolvuleto-Portulacetum* Ubrizsy 49, 50 p. p.).

It is an association of loose, sandy lands developing in the weeder out cultures weakly maintained. The most frequently met species in the compo-

sition of phytocoenosis are: *Eragrostis minor*, *Convolvulus arvensis*, *Hibiscus trionum*, *Setaria pumila*, *S. viridis*, etc. The greatest part of the species are annual and only a few perennial (*Cirsium arvense*, *Convolvulus arvensis*, *Chondrilla juncea*, etc.). The *amaranthetosum crispum* Grigore 68 subassociation and the facies with *Hibiscus trionum*, *Datura stramonium* and *Urtica urens* Oprea 76 are described within the association.

27. *Hibisco-Eragrostietum pooidis* Soó et Timár (51)57

(Syn.: *Amarantho-Chenopodietum albi hibiscetosum trionii* Spiridon 70; *As. Panicum sanguinalis-Eragrostis megastachya* (Felföldy 42) Tx. 50) The weeds of *Hibiscus trionum* with *Eragrostis minor* vegetate in weeder out cultures on clayey-sandy soils often with holes. Among the frequent companies of the association we may remind: *Amaranthus retroflexus*, *Solanum nigrum*, *Echinochloa crus-galli*, *Digitaria sanguinalis*, *Cirsium oleraceum*, *Galinsoga parviflora*, *Papaver rhoeas*, *Anthemis arvensis*, *Datura stramonium*, *Amaranthus hybridus*, *Stellaria media*, etc.

28. *Vicia-Polygonetum arenarii* Timár (53)57

It vegetates at the edge of cultures, sometimes inserted among *Dasyphyretum villosae* which determined by some Romanian authors (M. Păun et al. 70) to consider the tens of hectares invaded by *Vicia cracca* as a facies belonging to the above mentioned association. It prefers lands with Southern, South-Eastern or South-Western exhibition, more or less dry which favours the installing of some elements with a more xerophilous character, too. Besides *Vicia hirsuta*, *V. villosa* and *Polygonum arenarium* we may also meet: *Arabidopsis thaliana*, *Arabis auriculata*, *Portulaca oleracea*, *Eragrostis minor*, *Agrostemma githago*, etc.

29. *Tribulo-Tragetum* Soó et Timár 54

Both characteristic species are adapted to higher conditions of temperature and increased luminosity. The association installs on sandy, little worked lands, on higher terraces or commons and less on agricultural soils, in corn, sunflower, vine cultures. The more often met species within the association are: *Digitaria sanguinalis*, *Heliotropium europaeum*, *Setaria pumila*, *Convolvulus arvensis*, etc.

30. *Amaranthetum deflexi* St. Grigore 68

It installs on waste and ruderal lands especially on intravillanous surfaces with more or less sandy dry and sunny soils. Among the more frequent species of the association we may remind: *Amaranthus crispus*, *Chenopodium vulvaria*, *Oxalis corniculata*, *Eragrostis pilosa*, *Portulaca oleracea*, *Cardaria draba*, *Cynodon dactylon*, etc.

Matricario-Chenopodion albi Timár 54

Recognition species: *Chamomilla recutita*, *Chenopodium album*, *Atriplex littoralis*, *Lepidium ruderae*, *L. perfoliatum*, *Gypsophila muralis*.

31. *Matricario (chamomillae)-Atriplicetum littoralis* Timár, 54, Pop 68.

It populates both slightly salty, secondary barren soils and fallow grounds often corn and sugar beet cultures. The phytocoenoses are poor

as they are constituted of: *Atriplex littoralis*, *A. hastata*, *Polygonum aviculare*, *Rumex stenophyllus*, *Spergularia salina*, *Bupleurum tenuissimum*, *Daucus carota*, *Achillea setacea*, *Crypsis alopecuroides*, *Juncus gerardi*, *Hordeum hystrix*, *Puccinellia distans*.

32. *Dauco-Matricarietum inodorae* I. Pop 66, 68

(Syn.: As. *Daucus carota-Matricaria inodora* I. Pop 68)

The association is characterized by the edifying *Daucus carota* and *Matricaria perforata* beside which a coenotic part is played by *Pastinaca sativa*, *Achillea collina*, *Lotus tenuis*, *Medicago lupulina*, *Trifolium fragiferum*, *T. repens*, *Convolvulus arvensis* and *Plantago major*.

The slight salinity of the soil is rendered evident by the halophytes *Rumex stenophyllus*, *Atriplex hastata*, *A. littoralis*, *A. tatarica*, *Lotus tenuis*, *Trifolium fragiferum*, *Teucrium scordium* and *Hordeum hystrix*. After 3, 4 years, on the place occupied by this association *Achilleo-Festucetum pseudovinae* or *Lolietum perennis* install.

33. *Lepidio-Matricarietum* St. Grigore 68

It vegetates on ploughed fields, fallow grounds and scarce sowings of cereals on cultivated solonchaks. The edifying species *Chamomilla recutita*, *Lepidium rudernale* and *Lepidium perfoliatum* cohabit along with *Gypsophila muralis*, *Ranunculus sardous*, *R. arvensis*, *Capsella bursa-pastoris*, *Cardaria draba*, *Polygonum aviculare*.

The subassociation *pholiuretosum pannonicae* St. Grigore 68 installs later, on the water drained surfaces.

Setario-Thlaspiion arvense Slonovschi 77

Characteristic species to the alliance: *Capsella bursa-pastoris*, *Veronica polita*, *Arenaria serpyllifolia*, *Sinapis arvensis*, *Thlaspi perfoliatum*, *Th. arvense*, *Convolvulus arvensis*, *Bilderdykia convolvulus*, *Digitaria sanguinalis*, *Setaria viridis*, *Amaranthus retroflexus*.

34. *Erigero-Setarietum glaucae* Slonovschi 77

It was identified in the lucerne cultures of chernozems poorly towards medium levigated. The two edifying species *Erigeron canadensis* and *Setaria pumila* are accompanied by the species characteristic to the *Setario-Thlaspiion arvense* alliance such as: *Veronica polita*, *Capsella bursa-pastoris*, *Arenaria serpyllifolia*, *Sinapis arvensis*, *Thlaspi perfoliatum*, *Convolvulus arvensis*, *Bilderdykia convolvulus*, *Digitaria sanguinalis*, *Setaria viridis*, *Amaranthus retroflexus*, etc. The facies with *Taraxacum officinale* Slonovschi 77 is described within the association.

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THE BIOSYNTHETICAL CAPACITY OF THE ACTIVE PRINCIPLES OF "IN VITRO" REGENERATED SOLENOSTEMA ARGEL (SEL.) HAYNE. CALLUS AND SHOOTS

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Testing the morphogenetical reaction of several *Solenostema argel* (Sel.) Hayne explants on different hormonal variants of the culture medium, we induced calli and shoot regeneration.

Both the callus and the shoots showed a biosynthetic capacity of active pharmaceutical compounds some of them being identified in quantities similar or superior to the control.

The plant cell and tissue cultures do not only permit the investigation of some fundamental aspect but also the study of some problems of applicative interest: to obtain active principles by means of unconventional ways or to find new sources of compounds valuable in the food production industry, in the pharmaceutical and cosmetics industry. From this point of view we took interest in studying the *S. argel* species, known as hargal in folk medicine, a half-bush from the north-eastern part of Africa, from the *Asclepiadaceae* family, a family also comprising other therapeutically valuable representatives: *Clossonema edula* N. E. Br., *Leptodenia pyrotechnica* (Forsch.) Decne. (5), *Cynanchum vincetoxicum* (L.) Pers., *Periploca graeca* L. (3).

The chemical screening of the *S. argel* leaves proved the existence of lipids, flavones, antocian-oxides, mucilages, tanines, aminoacids. The richness of its active principles confer the polyholosidic, polyphenolic, phytosterolic and carotenoidic extracts an accumulated anti-inflammatory, anti-ulcerous and immunostimulating action important because of its total lack of toxicity (7).

We aimed to test the biosynthetic capacity of the active pharmaceutical compounds in the callus and shoots of hargal obtained "in vitro". Although other species of the same family: *Asclepias rotundifolia* Mill. (6), *Pergularia minor* Andr., *Tylophora indica* Men. (4) have been investigated from the point of view of the plant regeneration potential and the possibility of its use, we did not find in the studied literature references to the "in vitro" behaviour of the *S. argel* species.

MATERIAL AND METHODS

Seeds of *S. argel* were sterilized in T-Chloramine for 15–20 minutes, and germinated on Murashige-Skoog basal medium (1962), solidified 0.6% agar.

The explants of leaves, apical and axillary buds, nodal-segments, internodes and roots were inoculated in Erlenmeyer flasks containing 25

ml medium each, and incubated in semi-climatized culture room ($24 \pm 1^\circ\text{C}$, 1000 lux illumination, with a 16 hour light period). Seven hormonal variants of the culture medium were used and the passage rhythm was of six weeks (Table 1).

From the callus and shoots the following active pharmaceutical compounds were determined: polyphenols, flavones, carotenoids, pigments and phytosterols (Table 2).

The qualitative determinations were chromatographically performed. In case of the sterolic and carotenoid compounds we used G-Kiesel-gel plates and MN-261 chromatography paper for the polyphenols. The solvent system was tetrachloromethylen-chlorophorm (75-25) for carotenoidic fractions, chlorophorm-metanol (85-15) for sterolic compounds and the Partridge solvent system for polyphenols. The revelation was also differentially performed: white light for carotenoids, with chlorosulphonic acid (105°C) for phytosterols and with aluminium-chloride (UV-light) for the polyphenols.

RESULTS AND DISCUSSIONS

In a first stage we studied the morphogenetic reaction of different *S. argel* explants on distinct hormonal variants of the basal medium (Table 1). Two experimental series were established to check both callus induction and the "in vitro" multiplying potential.

The callus induction was easily attained by the four tested explant types, especially under the combined action of BAP and 2,4-D (Table 1,

Table 1
The "in vitro" morphogenesis in *Solenostema argel* (Sel.) Hayne

Effect of <i>Solanum elaeagnifolium</i> (Ser.) Hayne										
Explant		Basal solidified MS medium Hormones mg/l NAA 2,4 D BAP K				Va- riant	Morphogene- tic reaction and intensity of develop- ment	Characteris- tics		
1	2	3				4	5	6		
Callusogenesis	root	—	0,5	1,5	—	1 2 3	C+++ C++ C+	yellowish, friable callus		
		0,5	1	—	0,5					2
		—	1	—	2					
	node	—	0,5	1,5	—	1 2 3	C+++ C++ C++	half-hard green callus with embryoid areas		
		0,5	1	—	0,5					2
		—	1	—	2					
	internode	—	0,5	1,5	—	1 2 3	C++ C+ C+	friable, pale-green callus		
		0.5	1	—	0.5					2
		—	1	—	2					
	leaf	—	0.5	1.5	—	1 2 3	C++ C+ C+	,,		
		0.5	1	—	0.5					2
		—	1	—	2					

1	2	3			4	5	6
Callusogenesis	apical and axillary	—	—	2	—	4	L+++
		0.25	—	0.5	1.5	5	L++
		0.1	—	—	1	6	L+
	bud	0.3	—	7		7	L+

NAA: α Naphthalene acetic acid
2,4 D: 2,4-D, chlorophenoxyacetic acid
BAP: 6 Benzylaminopurine;

C: callus
L: shoots
K: 6—Furfurylaminopurine

var. 1) favorable to both the differentiation process and the further callus biomass accumulation. The root explants (Photo 1) and the stem-nodes (Photo 2) proved the best callus morphogenetic reaction.

The primary callus colour varied from pale yellow to green and it was friable (Photo 3), except for the node-explant induced callus which presented embryogenic areas which differentiated shoots in the presence of cytokinines.

Shoot induction (Photo 4) was determined by direct organogenesis starting from apical and axillary bud explants (Table 1, var. 4-7). The number of shoots obtained was related to the increase of the cytokinine concentration, the optimum ratio (8-10/explant) being produced by the variant with 2 mg/l BAP; although kinetines also stimulate shoot induction (4-5 shoots/explant), their development is less rapid and it is not able to sustain an as rapid growth as BAP.

NAA induces a decrease of the bud number possibly due to its partially antagonistic action as compared to BAP because the NAA action is different, being able to stimulate or annihilate bud differentiated dependent on the species (2).

The biochemical assays tested the biosynthetic capacity of the *S. argel* "in vitro" regenerated callus and shoots compared with that of the leaves of the control plants from their original country. The active pharmacological compounds identified at the level of these structures were: flavones, polyphenols, carotenoids, phytosterols (Table 2) and polyholosides.

The polyphenolic content of the callus and shoots is 5 times higher than that in the leaves and the content of the flavonoides is sensibly equal. These results as perspective valuable as is known that the calli only exceptionally accumulate great quantities of active principles, their formation and accumulation being a characteristic of organised tissues (shoots, leaves, roots), (1).

Chromatographically the three samples proved a different flavonoidic pattern: the rutoside which did not exist in the control is present in the shoots and the callus, in which we registered fewer components (Fig. 1).

We also chromatographically identified three carotenoid pigments, β -carotene being present in all the three samples (Fig. 2).

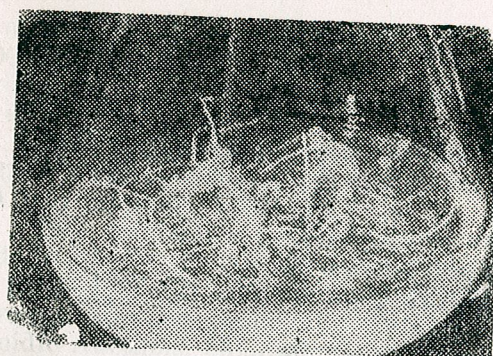


Photo 1. — Callus induction from root explants.

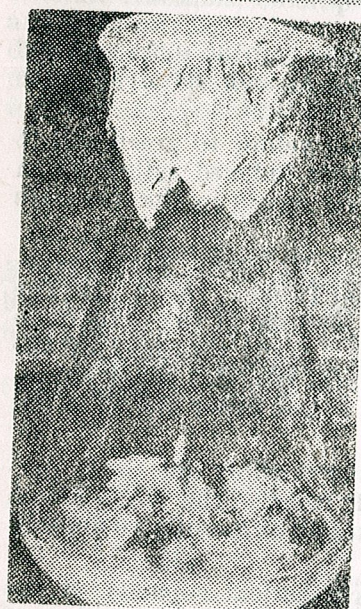


Photo 2. — Callogenesis in stem-node explants.

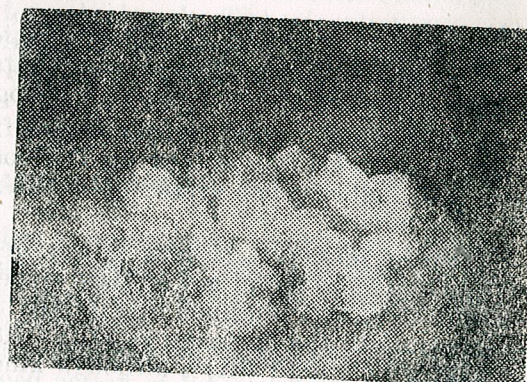


Photo 3. — Intense proliferation of friable callus.



Photo 4. — Shoot regeneration from apical and axillary bud explants.

The quantitative determination of the phytosterols attested their major presence in the control and shoots but also in the callus, proving the biosynthetic and accumulation capacity at the level of the "in vi-

Table 2

Active pharmacological compounds identified in *S. argel* samples

<i>Solenostema argel</i> samples	Flavones rutin g% s. u.	Polyphenols catechin g% s. u.	Carotenoids β - carotene mg% s. u.	Phytosterols β - sitosterol mg% s. u.
Leaves (control)	0.4675	0.3250	2.9000	50.3700
Callus	0.3011	1.3030	2.4790	10.1480
Shoots	0.4300	1.3840	16.8230	40.9300

tro" induced structures. Chromatographically, a rich spectrum of phytosterols appears, the major being β -sitosterol (Fig. 3).

The less numerous biochemical compounds identified in the callus and shoots permit the isolation, in the desired respect, of only one compound.

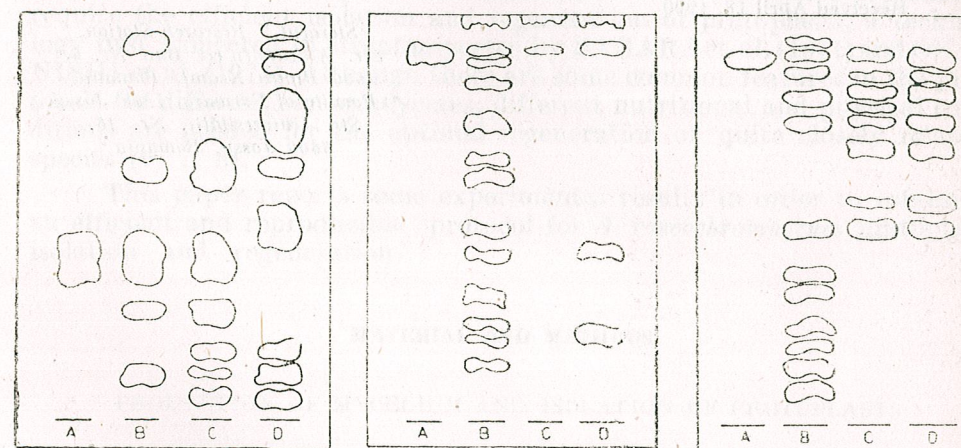


Fig. 1. — Flavone paper chromatogram.

A: rutin; B: callus; C: shoots; D: leaves.

Fig. 2. — Carotenoid fraction chromatogram.

A: β - carotene; B: leaves (control); C: callus; D: shoots.

Fig. 3. — Sterolic compound chromatogram.

A: β - sitosterol; B: leaves (control); C: callus; D: shoots.

CONCLUSIONS

1. Testing the morphogenetic reaction of different *S. argel* explants, on distinct hormonal variants of the culture medium, we obtained both callus induction and shoot regeneration.

2. The "in vitro" obtained callus and shoots proved to have the capacity to synthesize active pharmacological compounds some of them being identified in quantities close or superior to that of the control.

3. The presence of active pharmacological compounds in the callus obtained from roots and nodeexplants, its friable consistency, recommend it to be used in cell suspension cultures as a potential source of active principle.

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PROTOPLAST ISOLATION AND REGENERATION IN *STREPTOMYCES ROSEOCHROMOGENES*

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Taking into account the importance of the bacteria belonging to the genus *Streptomyces* for antibiotic and enzyme production, an improved procedure for protoplast isolation and regeneration was developed.

The most efficient method for *S. roseochromogenes* protoplast isolation involved the incubation of the mycelium (precultivated in medium containing 1.2% glycine with lysozyme in MP medium). The regeneration of streptomycetes protoplasts is a major step following genetic manipulation such as fusion and DNA-mediated transformation. In our studies the optimal reversion of protoplasts (16—20%) was obtained on a modified regeneration medium. These improved procedures for protoplast isolation and regeneration proved to be suitable for other streptomycete species.

The Gram-positive mycelial bacterium *Streptomyces roseochromogenes* produces glucose-isomerase, an enzyme which converts glucose to fructose, with application in food industry. Since *Streptomyces* lacks any natural transformation system, protoplasts manipulation represents the only modern way to improve the industrial strains (6). These procedures require the efficient isolation and regeneration of protoplasts, a technology first pioneered in streptomycetes by SAGARA et al. (1971) and OKA-NISHI et al. (1974). Although there are some common features in the protocols for different streptomycetes, different nutritional and physical conditions are needed for the optimal regeneration of quite closely related species (6, 7, 8).

This paper reports some experimental results in order to establish an efficient and reproducible protocol for *S. roseochromogenes* protoplast isolation and regeneration.

MATERIAL AND METHODS

PRODUCTION OF MYCELIUM AND ISOLATION OF PROTOPLASTS

Spores from fresh cultures of *S. roseochromogenes* grown on Gause medium were inoculated into 250 ml Erlenmeyer flasks containing S medium (12) and cultured for 72 h at 28°C. A small quantity of suspension (0.1 ml) was transferred to fresh S medium supplemented with various concentrations of glycine (0.5—1.4%) and shake cultured 20 h at 28°C.

The mycelium was harvested by centrifugation (4000 rpm, 10 minutes), washed in 10.3% sucrose (7) and then resuspended in 5 ml of isolation solution consisting of: 0.5 M sucrose, 0.01 M $MgCl_2 \cdot 6H_2O$, 0.02 M $CaCl_2 \cdot 2H_2O$; 0.07 M NaCl; 0.02 M phosphate buffer pH 7.2 (100 ml/l) (MP medium) which contains lysozyme (2 mg/ml). Incubation was performed at 28°C for a period of 2 h and the protoplast formation was judged by phase-contrast microscopy.

Reversion of protoplasts was tested on different regeneration media: R₂YE (2), R₅(8) and MRM containing: 0.5 M sucrose, 2 g/l K₂SO₄; 8.1 g/l MgCl₂ · 6H₂O; 2.2 g/l CaCl₂ · 2H₂O; 10 g/l glucose; 0.5 g/l casamino acids; 4 g/l polypeptone; 4g/l yeast extract; 0.02 M phosphate buffer pH 7.2 (100 ml/l); 20 g/l agar. The protoplasts were harvested gently by centrifugation (3000 rpm, 7 minutes) and suspended in 5 ml MP medium. Dilutions of protoplasts were prepared in the same MP medium and 0.1 ml samples were inoculated onto regeneration media in two ways: spreading directly on the surface of the medium or by embedding protoplasts in soft agar overlays (MRM with 0.4% agarose instead of agar).

Isolation of DNA. Plasmid DNA was isolated from wild strain used in experiments and from some regenerants using the method of Kieser (9).

Electron microscopy. The electronmicroscopic study was carried out by freshly isolated protoplasts fixing in a solution containing 20% (w/v) sucrose, 2% (v/v) glutaraldehyde in 0.02 M phosphate buffer pH 7.2, followed by postfixation with 2% osmium tetroxide and inclusion in Epon 812. The ultrathin sections obtained with a Tesla ultramicrotome were stained with 2% (w/v) uranyl acetate and 1% (w/v) lead citrate and examined under Phillips electronmicroscope (15).

RESULTS AND DISCUSSIONS

OPTIMAL CONDITIONS FOR PROTOPLAST FORMATION

Most of the current techniques for genetic manipulation of streptomycetes are dependent upon the efficient isolation, maintenance and regeneration of protoplasts (6).

In preliminary experiments (3) we tested different conditions and some media to obtain the biological material for protoplast isolation from some strains of *Streptomyces* (*S. griseus*, *S. rimosus*, *Streptomyces* sp. IV11, *Streptomyces* sp. RS13). In this paper our attention was concerned on a strain of *S. roseochromogenes*.

Various concentrations of glycine (0.5–1.4%) in nutrient medium used for mycelium development were tested to allow a good protoplast formation. The best results were obtained when the mycelium was precultivated for 20 h in S medium containing 1.2% glycine, at 28°C. These conditions of cultivation permit a good and homogeneous growth and make mycelium sensitive to lysozyme.

The mycelial pellet was washed with a solution of 10.3% sucrose and suspended in MP medium containing lysozyme (2 mg/ml). The MP medium is more advantageous because it is more simple than other reported in literature (12,7) and permits a very good conversion of mycelium to protoplasts. Similar results in protoplast formation using phosphate buffer in protoplasting medium were reported for *Bacillus subtilis* (15).

The time required for the conversion of mycelium to protoplasts (more than 99%) is 2 h of incubation at 28°C. The frequency of protoplast formation was estimated by comparing the number of colonies appeared

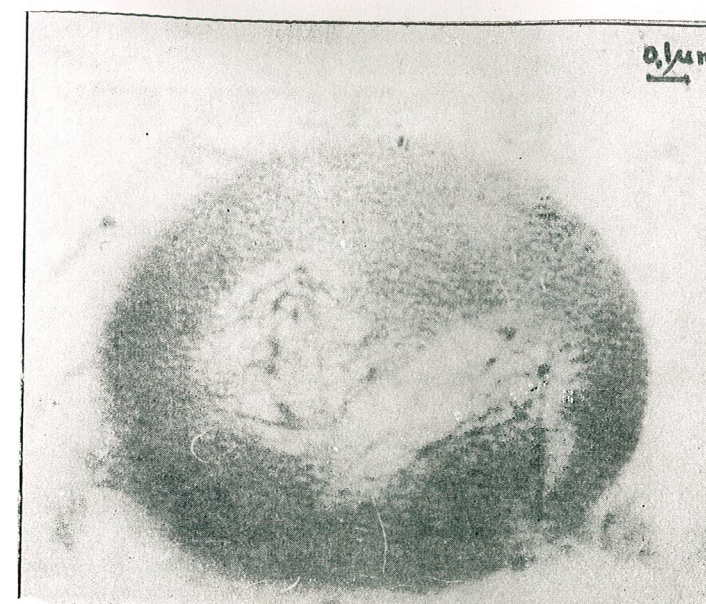


Fig. 1. — *Streptomyces roseochromogenes* protoplast exhibiting complete wall removal leaving a cell with a chromosome and a cytoplasm rich in ribosomes. Bar: 0.1/μm.

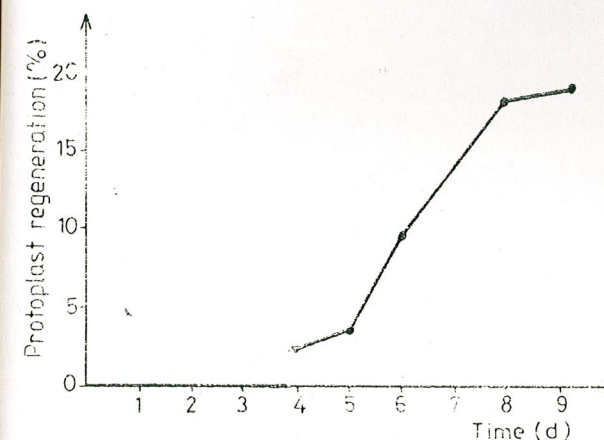


Fig. 2. — Dynamics of protoplast regeneration on MRM medium.

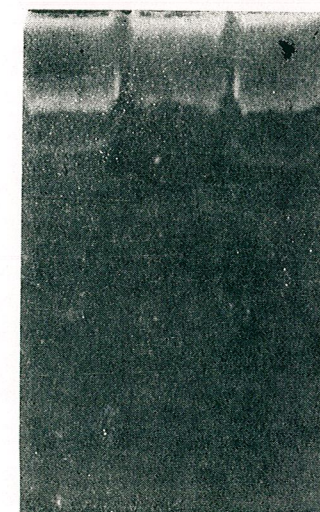


Fig. 3. — Plasmids profile of *Streptomyces roseochromogenes* (lane 1) and of two regenerants (lanes 2 and 3) shows the loss of a plasmid (lane 2) during protoplasting/regeneration processes.

on medium without osmotic stabilizer and those appeared on regeneration medium. Protoplast formation was observed under a phase-contrast microscope. Presence or absence of cell wall was investigated on micro-electronographs of protoplast suspension of *S. roseochromogenes* (Fig. 1). In section of intact mycelium the wall layer and lamella-like structures (mesosomes) were observed distinctly. In the protoplast formed by lysozyme treatment the wall layer and mesosomes were not observed. Furthermore, the protoplasts were not uniform as size: their diameters varied between 4 and 7.5 μm .

REVERSION OF PROTOPLASTS

Several media described in the literature were tested for their ability to support the regeneration of *S. roseochromogenes* protoplasts. Aliquots of 0.1 ml from serial dilutions of the protoplast suspension in MP medium were placed on plates with R2YE medium, R5 medium and MRM medium. The frequencies of regeneration varied between 2% on R2YE to 2.3% on R5 and 5% on MRM. The frequencies increased to 16–20% when the protoplast suspension was embedded in 3 ml of soft agarose MRM medium, mixed well and spread on the surface of the same media (R2YE, R5 and MRM). Better results, in both variants, were obtained when MRM medium was used.

MRM medium is a variant of the R3 medium (11) and contains a higher concentration of osmotic stabilizer (0.5 M sucrose instead of 0.3 M in R3), casaminoacids (0.05%) and 0.02 M phosphate buffer pH 7.2 instead of TES buffer pH 7.2. The results obtained in these conditions are comparable with those cited in literature (5, 11, 8).

The process of cell regeneration from, *S. roseochromogenes* protoplasts was asynchronous. The first visible colonies from regenerated protoplasts appeared after three days of incubation while the last appeared after 5 to 9 days (Fig. 2). Similar observations were reported for other species (*S. fradiae*, *S. griseofuscus*, *B. subtilis*) (1, 4, 6)). The modified regeneration medium (MRM) reported in this paper was also tested for the regeneration of protoplasts from other strains of *Streptomyces* (*S. rimosus*, *S. griseus*, *Streptomyces* sp. RS13): it seems to be effective in each case.

LOSS OF PLASMID BY PROTOPLASTING

It is reported in literature (14) that *S. roseochromogenes* has five plasmids with the following molecular weights: 10 kb, 10.5 kb, 15 kb, 31 kb and 40 kb. In our experiments we could separate only three bands after electrophoresis of plasmid DNA. One of these bands lacks in some regenerants (fig. 3). We have not investigated yet the correlation between the loss of some plasmids and phenotypic modifications of bacteria. It seems that plasmid loss occurred during regeneration rather than during protoplast formation, especially because no plasmid DNA was detected in supernatants of protoplasts and because many regenerating colonies consisted of mixtures of plasmid-containing and plasmid-free cells (6, 10).

CONCLUSIONS

The experimental data obtained allow us to formulate the following conclusions:

1. The most efficient method for *S. roseochromogenes* protoplast isolation involved the incubation of mycelium precultivated in medium containing 1.2% glycine with lysozyme in MP medium;
2. The optimal reversion of protoplasts (16–20%) was obtained on MRM medium;
3. The process of cell wall regeneration from *S. roseochromogenes* protoplasts was asynchronous;
4. Our results indicate the possibility of the loss of some plasmids residents in the strain of *S. roseochromogenes*, probably during regeneration;
5. Further experiments are necessary to understand precisely the mechanisms involved in protoplasts fusion and fusion products regeneration.

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GENETICAL BIORHYTHMS AT *PISUM SATIVUM* L.

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Biorhythmogenetics is now developing as a new halting place of genetics, using the "biological time" concept. In experiments accomplished with *Pisum sativum* L. there were revealed circadian biorhythms of the germinate, growth and mitotic indices, their patterns in continuous light or dark, and under natural conditions. The time of experiments start is very important for each genetical index.

INTRODUCTION

Rhythmical functions represent a characteristic of the beings, of the living matter, but at present there are only few studies concerning the genetical biorhythms.

Studies into the temporal mitosis are of special scientific interest, revealing important intracellular phenomena, and certain biorhythmogenetical laws.

The 24-hour rhythms are the most spread, especially in the plants world, owing to the daily alternate of the light and dark periods.

The circadian rhythm of cell division is a phenomenon, closely associated with a variety of biochemical and physiological processes occurring in the organism (5). A rhythmic period consists of an active and a rest phase (3).

There are certain programmed patterns for the different activities of biosystems. The rhythmical activities have a certain sequence, a specific organization in time, the oscillators being interdependent and hierarchic (1, 2, 7).

MATERIALS AND METHODS

The experiments were performed with *Pisum sativum* L., *viride* variety. For germination, 10–15 exemplars of beans were introduced in a vessel with distilled water. After 48 h, the germination and grow indices were calculated and the roots were separated and fixed * for mitotic index determinations.

The first experiment was accomplished in a special room, provided with neon "Electrofar Day light 40 w—made in Romania" and "Electrofar white 40 w", under conditions of continuous illumination at approx. 3000 lx/48 h and 23°C±1°C temperature.

The second experiment was performed under continuous dark conditions for 48 h, at 23°C±1°C.

The third experiment was accomplished in laboratory, under natural illumination. Concomitantly, there were recorded the daily rhythms of light intensity with PU 150 luxmeter and of temperature, too (with 0.5°C precision).

* Fixative — absolute ethanolum 3 p. and acidum aceticum glacial 1 p.

The experiments were made in a circadian rhythm model, the initial and final hours of the biotests being: 8 (8^{15} – 8^{30}), 13 (13^{00} – 13^{15}), 18 (18^{00} – 18^{15}) and 1 (1^{00} – 1^{15}).

For mitotic index determination, squash preparations effectuated with the peaks of roots were coloured by using a Schiff reactive. The phases of the cells in mitosis were registered on microscopic slides.

The mitotic index (M.I.) was calculated considering the formula $\frac{\text{number of cells in mitosis}}{\text{number of cells analysed}} \cdot 100$. For each slide, 1500 cells were analysed.

All indices of germination and mitosis were expressed as percentages for an objective comparison and characterization of each experiment.

RESULTS AND DISCUSSIONS

1. THE GERMINATION INDEX

In continuous illumination, the circadian rhythm has the acrophase at 8^{15} h (then toward early morning) and the minimum values at 1^{15} o'clock, after 24 h and 48 h, too (Fig. 1).

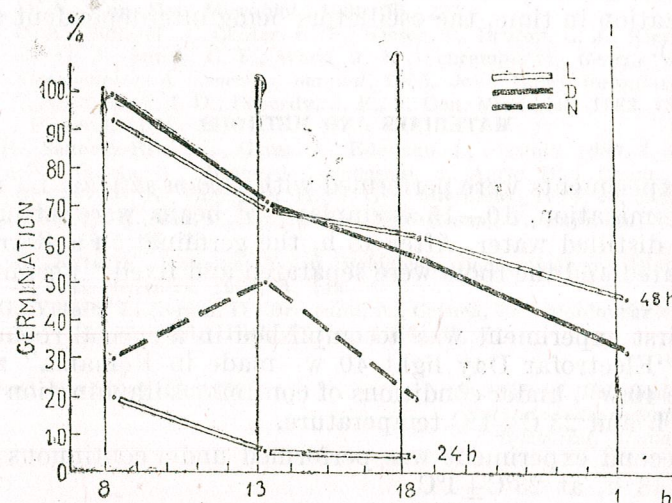


Fig. 1. — The germination index at different starting hours. L = continuous artificial light; D = continuous dark; N = natural diurnal rhythm light-dark.

In continuous dark conditions, the germinate index has a pattern of the circadian biorhythm deployed under constant condition, with the acrophase at approx. 8 o'clock and diminution towards 1^{00} o'clock.

During the natural illumination experiments, the diurnal rhythms of the luminosity intensity and temperature presented a reduced amplitude, as shown in Table 1, yet the pattern of the diurnal normal biorhythm of the germinate index/48 h is different, compared with those registered under constant environmental conditions, the acrophase being placed at 13^{00} o'clock (then towards the middle of the day).

Table 1

Date and hour		Lx	°C
9.VII.1987	9	650	24,0
	13	340	24,5
	18	240	23,5
11.VII.1987	8	360	20,0
	13	520	22,0
	18	250	—

2. THE GROWTH INDEX OF THE ROOTS

Under continuous illumination it has a similar pattern to that of the germinate index circadian biorhythm, with the acrophase placed at 8^{15} o'clock (Fig. 2).

Under continuous dark, the growth index of the roots rhythm has the acrophase placed at 13^{15} o'clock, as in natural environmental condition.

Under natural illumination, the diurnal biorhythm of the growth index is entirely similar to those of the germinate index diurnal biorhythms (considering the 8 o'clock values as 100%). In the figure there were represented concomitantly the individual values for the appreciation of the variability of this phenomenon.

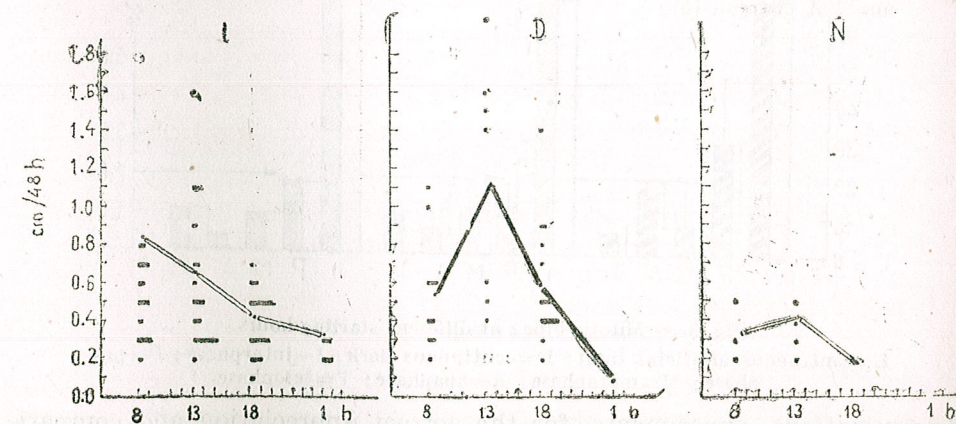


Fig. 2. — Root growth at different starting hours. L = continuous artificial light; D = continuous dark; N = natural diurnal rhythm light-dark

3. THE MITOTIC INDEX

For *Pisum sativum* L. the number of chromosomes is $n = 7$ (haploid), $2n = 14$ (diploid) (4) and is considered that at 22.5°C , the duration of the mitotic cycle is 13–14 hours ($G_1 = 4-5$, $S = 4.5$, $G_2 = 3-3.3$, $M = 1.2-1.4$) (8).

In our studies, the mitosis phases (interphase, prophase, metaphase, anaphase, telophase) were registered for organisms at which the germination processes started at different times, in 24 hours periods. Thus, it is revealed a new aspect, very important — the percentages of different phases of the cell division, have statistical significant differences (more than 10%) between lots following up the “starting time” of the experiments, for example (Fig. 3), in experiments made in the light started at 8¹⁵ o'clock comparatively with those started at 13¹⁵ o'clock for interphases and pro-phases. At the same time, the light regime plays an important role — for the same “starting time”, for example as 13⁰⁰ h in the light or dark regime influenced differently the values of the mitosis index, but for the organisms in experiments at 1 o'clock the values are almost the same in the light or dark.

Certain modifications in the distribution of the mitotic index phases seem significant for the characterization of the genetical biorhythms. For example, in the dark, or towards the middle of the night, the interphases are the most numerous ones.

For a correct characterization of the genetical indices in all vegetal or animal beings, these must be determined in a biorhythm model. One must underline the importance of the “starting time” for all the analyses,

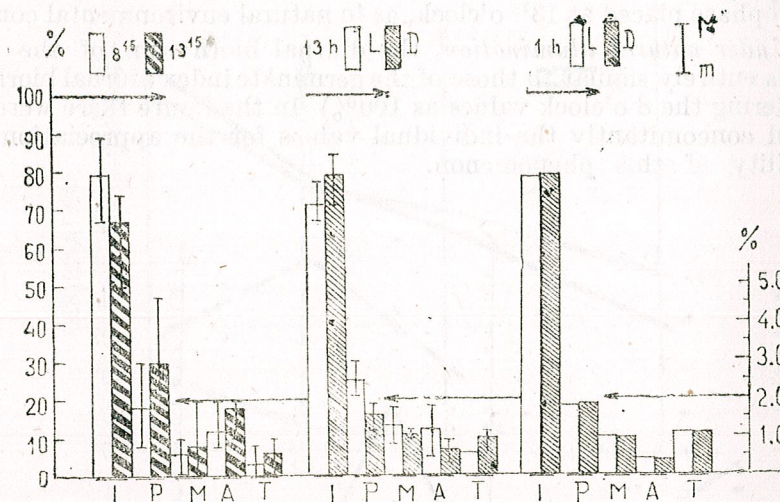


Fig. 3. — Mitotic index at different starting hours.

L=continuous artificial light; D=continuous dark; I=interphase; P=prophase; M=metaphase; A=anaphase; T=telophase.

determinations, experiments, for the correct appreciation and comparison of the index values. This aspect was revealed by us in previously effectuated experiments, with other organisms, for example algae.

Practically, these aspects present a great importance for the characterisation of the “light-plants” or “long-short day plants”, the optimum conditions for their cultivation.

CONCLUSIONS

1. Genetical circadian biorhythms in organisms, following the light regime, are revealed.
2. At *Pisum sativum* L. there were revealed circadian biorhythms of the germinate, growth and mitotic indices and their typical patterns in continuous light or dark, under natural conditions.
3. The biorhythmical experiments give important results from practical and theoretical points of view, thus BIORHYTHMOGENETICS is developing.

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MODIFICATIONS BY POLLUTANTS OF THE GENETICAL BIORHYTHMS AT *PISUM SATIVUM* L.

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Biorhythmogenetical experiments accomplished with carbamic pesticides, using *Pisum sativum* L. as test-organism, revealed certain modifications concerning the amplitudes, and phases in the circadian biorhythmus of the germinate, growth and mitotic indices.

The theoretical and practical importance of the ecological genetics and biorhythmogenetics is discussed.

INTRODUCTION

Biorhythms of the genetical indicators are at present known in different organisms, bioperiodicity having a genetical character, corresponding to the temporal organization of species. At the same time, the actions of the external agents have a great importance, modifying the normal patterns

At present, as ecological factors are included many chemical products, the pesticides being among the most important (1).

The alternation of light and dark in the picture-frame of the 24 hours-cycle is one of the most important synchronizers of biorhythms (2, 4, 7, 8) but the powerful agents, at different "biological time" can modify the normal rhythms. To this aim, *in vivo* genetical studies have a great theoretical and practical importance. For protecting the human being and the organisms state of health, the new chemical products synthesized must be checked, mainly from the ecochronotoxicological points of view, because as revealed in previous works (3), the results have great differences as biological time function.

MATERIALS AND METHODS

Three laboratory experiments for each product — Olticarb, Diprocarb and Diempropilamine (emulsifier) — were accomplished in continuous illumination (at 3000 Lx and $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$), in continuous dark, and in natural light rhythm.

The beans of *Pisum sativum* L., *viride* variety, were distributed in lots of 10—15 exemplars in 0.25%, 0.5% or 1.0% concentrations made in distilled water (used for control tests, too). After 48 h, the germinate and growth indices were calculated and the roots were separated and fixed for normal and pathological genetic determinations. The mitotic index for different various readings of the experimental biological times was calculated for control tests and treated young organisms.

All the normal and modified indices were registered according to the biological time, the initial and final hours of the biotests being: $8(8^{15}-8^{30})$, $13(13^{00}-13^{15})$, $18(18^{00}-18^{15})$ and $1(1^{00}-1^{15})$.

RESULTS

THE GERMINATE INDEX

In continuous illumination, the circadian rhythm has the acrophase (93.3%) at 8¹⁵ o'clock and the minimum values at 1⁰⁰ o'clock (33.3%). Under the action of 3 tested products, the normal biorhythm is modified, the modifications being more evident at increased concentrations (Fig. 1).

In Olticarb 0.5 % conc. the pattern of the circadian biorhythm is maintained, but the amplitude is diminished, the differences of the percentages being between 20% (8 o'clock) and over 60% (18 o'clock). In the 1% concentrations, the germination is produced only at 8 o'clock and in small percentages.

The Diprocarb determined very large variations of the germinate index in connexion with the hours, with the "biological time" of the beans. At 18 o'clock it is registered even a stimulation of the germinate, with 30%, but at 1⁰⁰ o'clock the process is entirely stopped. Actions of the toxicological agents inversed the normal pattern of germinate rhythm — it is dephased, as compared with control lots.

Diempropylamine in both concentrations tested reduced the amplitude of biorhythms and there is even dephasage between 8–13 h.

The experiments performed in continuous dark conditions releaved interesting aspects, too. The germinate rhythm at the control lots confirmed the pattern of a circadian biorhythm deployed in constant conditions with the acrophase at 8 o'clock and continuous diminution towards 1⁰⁰ o'clock.

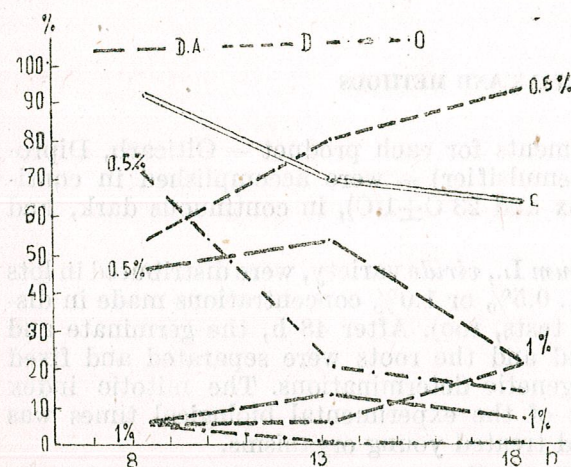


Fig. 1. — The germinate index at different starting hours, in continuous artificial light. C = control; O = Olticarb; D = Diprocarb; D. A. = Diempropylamine.

In previously effectuated experiments, in 1% concentrations of the tested products, the germinate percentages being small, we used a new concentration, 0.25%.

The Olticarb, Diprocarb and Diempropylamine in both concentrations (0.5% and 0.25%) determined a reduction of the amplitude at 8 o'clock the differences being largest as compared with the control lots, but Diempropylamine stimulated the germinate at 18⁰⁰ and 1⁰⁰ h.

At the same time dephasage of the biorhythmus occurs at certain hours, of special interest being the observation that dephasages occur between different concentrations, too.

In natural light, the acrophase of the control lots was placed at 13 o'clock. In these experiments, there were registered the smallest values of the germinate index. With the same 0.5% concentrations, the percentages were of 0–20%, while in Olticarb solutions germination was stopped.

THE GROWTH OF THE ROOTS

In continuous light, all average values recorded in 48 hours were situated under those of the control lots (average differences between 0.1–0.84 cm, more than 11%), the maximum average value of the controls, considered 100%, being at 8 o'clock, and decreasing towards the evening hours. The modifications of the rhythm consisted of amplitude variations and dephasages. The Olticarb in 1% concentrations inhibited wholly the growth (Fig. 2).

In natural light, at certain experimental times there were registered stimulated growths in solutions of 0.5% Diprocarb and Diempropylamine.

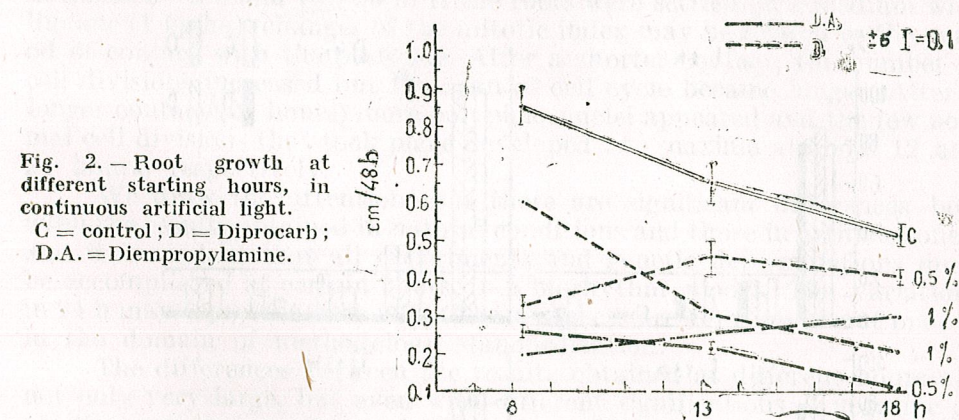


Fig. 2. — Root growth at different starting hours, in continuous artificial light. C = control; D = Diprocarb; D. A. = Diempropylamine.

THE MITOTIC INDEX

Certain modifications in the distribution of the mitotic index phases seem significant for the characterisation of the genetical biorhythms, as, in the dark or toward the middle of night, the interphases and telophases are the most numerous. For example, the results obtained at 8¹⁵ o'clock in continuous light are presented graphically in figura 3. The increase of interphases and reduction of prophase numbers in 1% concentrations of Olticarb are significant.

The importance of the light regime is presented in figure 4. In experiments made at the same hours (1⁰⁰ or 13⁰⁰ o'clock) in continuous light or dark the modifications of the mitotic index are different, almost all actions of the noxious agents have an inversed sense in light, comparatively with those registered in dark.

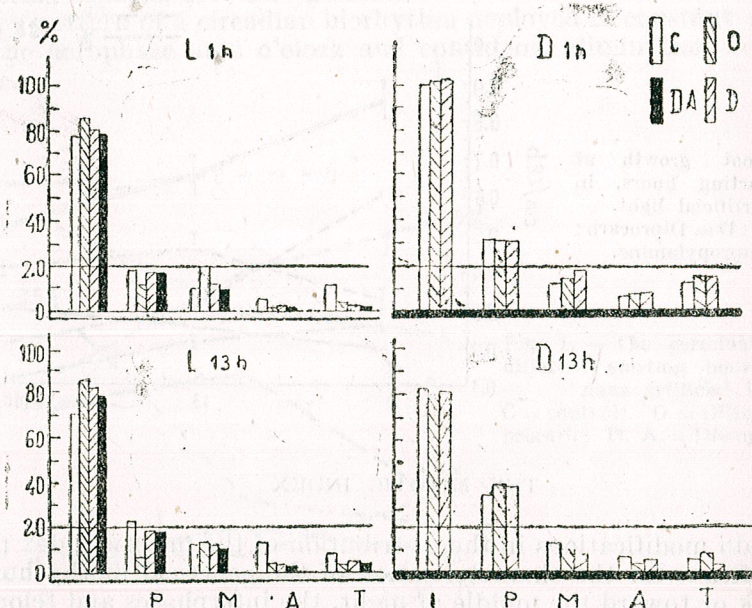
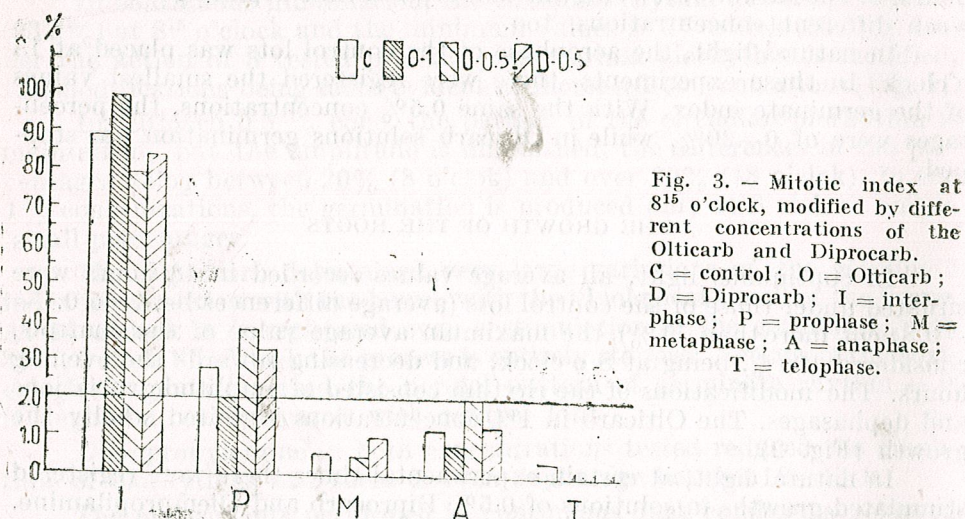


Fig. 4. — Mitotic index in experiments started at 1 o'clock or 13 o'clock in continuous light or dark and the modifications produced by pesticides. C = control; O = Olticarb; D = Diprocarb; D. A. = Diempropylamine; I = interphase; P = prophase; M = metaphase; A = anaphase; T = telophase.

The largest number of variations for the mitotic index are produced under the action of Olticarb product, the deviations comparatively with control lots being $\pm 10\%$. As it is considered that the synchronizer agent is strong a mitotic index double to the control is produced, we can consider the tested products having an attenuate mitotic action.

DISCUSSIONS

It is very interesting the fact that the organisms with the same or almost the same genetical material, in different environmental light conditions have different responses to the same pollutant factors. The importance of the light rhythm is revealed clearly in studies concerning the germinate index; for this reason the results are graphically presented. In constant light or dark conditions, the maximum values are registered at 8 o'clock, but in the natural light cycle the maximum values are toward 13 o'clock. These aspects have a practical value, for agriculture, the differences of the results between different hours for seedtime being large. In all cases, the worst results are obtained when the beans commence the hydration in the evening and at night hours.

Similarly, the growth of young organisms is different, depending on the hours at which the germinate processes are started.

Concerning the mitotic index, other authors (5) for *Triticum vulgare* L. root meristem revealed for normal circadian rhythms two peaks, at about 6–8 h and 18–20 h. If the roots were settled on a medium with lindane (1 kg/ha), changes of the mitotic index may be related to the period of contact with the pesticide. After a shorter contact, the number of cell divisions increased but the span of cell cycle became longer. After a longer contact (24 hours) more polyploid nuclei appeared and the few normal cell divisions that took place developed two maxima at about 12 and 24 hours, respectively.

We draw the attention that there are significant differences between the results obtained in natural conditions and those in artificial ones, and it is evident that all experiments and genetic determinations must be accomplished at certain hours, in a biorhythm model. The variations in 24 h may represent even 90%. These aspects are very important mainly in the domain of methodology standardization.

The differences between the results obtained at different hours are not only very large, but even with different significations — negative or positive actions — certain eckochronotoxicological laws are releaved (3). These experiments reveal, at the same time, a new aspect of the variability phenomenon, new ways for its production being the environmental pollutants, actioning at different hours.

CONCLUSIONS

1. The genetical biorhythms can be modified by the pollutants of the environment, the modifications of their amplitude, phase or period being dependent not only on the concentrations, but also on the "biological" time", too.

2. The pesticides Olticarb, Diprocarb and the emulsifier Diempro-pilamine, in 0.25%, 0.5% or 1% concentrations, produce variable modifications of the normal circadian rhythms of the germinate, growth and mitotic indices, the most noxious being Olticarb.

3. In the studies of the ecological genetics, there must be considered the echochronotoxicological laws, for a correct characterisation of the actions of the external agents; thus, the same concentrations can produce positive or negative effects at different times.

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LA PRODUCTIVITÉ PRIMAIRE ET LE RENDEMENT D'UTILISATION DE L'ÉNERGIE DE LA LUMIÈRE SOLAIRE PAR LE PHYTOPLANCTON DANS UN ÉCOSYSTÈME ANTHROPIQUE

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Le travail présente la dynamique de la productivité primaire phytoplanctonique du lac de Dimbovița et l'efficacité d'utiliser l'énergie solaire incidente, au cours de l'année 1989.

Le bassin de Dimbovița est un lac d'accumulation, construit en 1987, à la place de l'ancien chenal de la rivière de Dimbovița à l'entrée de Bucarest, zone de Crîngăși. Le lac a une surface de 24 ha, une profondeur moyenne de 5,5 m et un volume de 14 millions mc. L'alimentation du lac est faite par la rivière de Dimbovița et par un canal qui lui apporte de l'eau de la rivière d'Argeș.

Le phytoplancton, en tant que producteur primaire de substance organique, fixe l'énergie radiante et les éléments chimiques biogènes en réalisant dans des écosystèmes, des stocks de substances avec une valeur énergétique élevée qui peuvent être recyclés à grande vitesse.

Le présent travail comprend les résultats obtenus en 1989, portant sur la productivité primaire phytoplanctonique de ce lac et sur l'efficacité d'utiliser l'énergie solaire incidente.

MATÉRIAUX ET MÉTHODE

On a mesuré la productivité primaire phytoplanctonique en 1989 mensuellement, à partir du mois de mars; les déterminations ont été faites en 4 stations fixées dans des endroits que nous avons considérés comme importants. De la sorte, la station n° 1 a été fixée devant le canal qui amène l'eau de la rivière d'Argeș, la deuxième à l'entrée de la Dimbovița dans le lac. On a considéré nécessaires ces stations comme voies d'importation phytoplanctonique qui peuvent amener des espèces algales de différente capacité productive. La station «centre», n° 3 a été fixée presque à la moitié de la distance de l'entrée de Dimbovița et le barrage, près de l'ancien chenal de la rivière. Une quatrième station a été fixée dans le voisinage du barrage, à la sortie des eaux du lac. Pour déterminer la productivité primaire phytoplanctonique on a utilisé la méthode Gaardner-Gran et le dosage de l'oxygène dissout par la méthode Winkler. Le matériel biologique soumis à l'expérimentation a été collecté de chaque station, dans trois horizons (surface, milieu et fond), mélangé pour l'obtention d'une preuve moyenne; l'installation en terrain des flacons blancs et noirs a été faite en deux répétitions dans un seul horizon, à moins d'un mètre profondeur, en connaissant le fait que la zone située entre 1 et 5 m profondeur est celle

où se réalise la production maximale ; l'illumination trop profonde inhibe la photosynthèse. Dans le cas particulier du lac de Dimbovița, la transparence a été pendant toute l'année et dans toutes les stations tout au plus de 1 m (l'installation des expérimentations faite à la surface ou bien aux profondeurs dépassant 1 m aurait conduit à l'obtention de faux résultats).

Simultanément au mesurement de la productivité primaire on a récolté de toutes les stations des épreuves de phytoplancton pour l'analyse de la structure qualitative et quantitative.

Les valeurs de la productivité primaire ont été exprimées en $\text{mg O}_2/1/24 \text{ h}$.

L'analyse quantitative du phytoplancton a été faite par le comptage dans la chambre Kolkwitz et l'évaluation de la biomasse phytoplanctonique par l'établissement des poids moyens par espèces alguales par rapport aux densités de chaque espèce. Les résultats ont été totalisés en vue d'exprimer la biomasse totale en mg substance humide / l.

L'évaluation de la productivité nette a été faite par réduction de 20% des valeurs de la productivité planctonique brute (2), (3), (4).

Pour calculer le rendement d'utiliser l'énergie incidente par le phytoplancton dans le lac de la Dimbovița, les données obtenues dans les recherches concernant la productivité primaire planctonique brute (par la méthode Gaardner-Gran) ont été utilisées pour évaluer les valeurs de la production primaire brute du phytoplancton, exprimée en $\text{cal}/\text{m}^2/24 \text{ h}$ ou $\text{mg C org.}/\text{l}$. Pendant l'entière période de lumière de la journée au cours des intervalles de 24 heures, c'est-à-dire l'entière durée des déterminations de la productivité primaire planctonique, on a déterminé l'intensité de la lumière, pour chaque heure, à l'aide d'un luxmètre qui mesure le flux lumineux aux longueurs d'onde qui couvrent l'entier domaine visible. Conformément aux déterminations de la courbe de distribution spectrale relative de la sensibilité du luxmètre on a calculé le flux énergétique, exprimé en $\text{cal}/\text{m}^2/24 \text{ h}$ pour les intervalles de temps correspondant aux périodes où l'on a déterminé la productivité planctonique brute (1).

RÉSULTATS ET DISCUSSIONS

En tant que fonction du plancton en totalité, la productivité primaire dépend non seulement de la structure des populations phytoplanctoniques, qui varie en temps et espace, mais elle est facteur du milieu externe, parmi lesquels les plus importantes sont les variations de l'intensité de la lumière, les modifications de la transparence de l'eau, la température et les modifications de la composition chimique de l'eau.

Dans le lac de Dimbovița, la productivité primaire appartient dans la plupart au phytoplancton, sur l'entier lustre du lac, la présence des macrophytes étant accidentelle.

De l'analyse des résultats présentés dans la figure n°1 on constate que les valeurs de la production primaire brute, respectivement nette, présentent une augmentation progressive dans toutes les stations de printemps (mars) en été (juin). Cette courbe ascendante correspond autant aux modifications des facteurs physico-chimiques (hausse progressive de la

température de l'eau du lac de 10°C à 22°C , qu'à l'illumination par l'augmentation du nombre d'heures d'illumination par jour et de l'intensité de la lumière de $3789 \times 10^3 \text{ calories}/\text{m}^2/24 \text{ heures}$ en mars à $5939 \times 10^3 \text{ calories}/\text{m}^2/24 \text{ heures}$ en juin ; on y ajoute l'augmentation de la biomasse

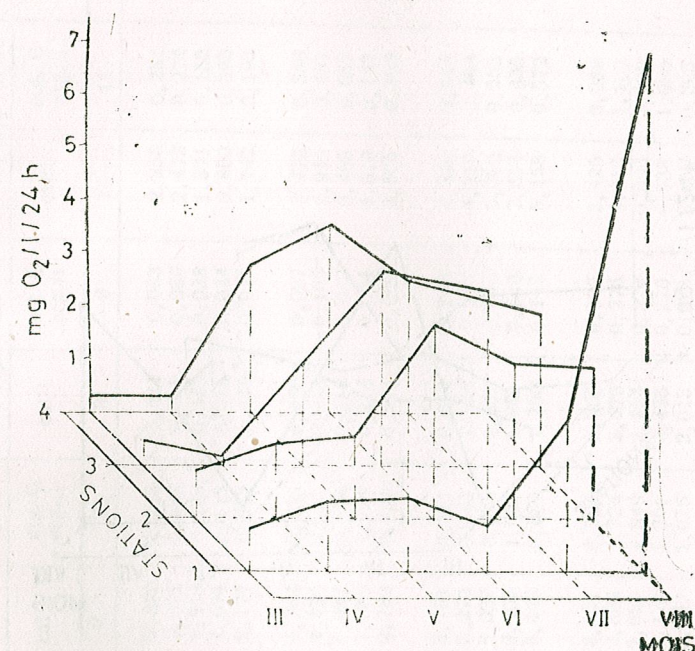


Fig. 1. — Production primaire-brute phytoplanctonique du lac Dimbovița en 1989.

phytoplanctonique d'une moyenne par lac de 1,209 mg substance humide/l en mars à 33,572 mg substance humide/l en juin. Au mois de juillet, exceptant la station n° 1 (entrée de l'Argeș) dans laquelle la courbe de la production brute est maintenue ascendante, dans toutes les autres stations on enregistre une baisse significative du point de vue des valeurs enregistrées qui peut être expliquée par la baisse marquée de la biomasse alguale retrouvée dans le lac au cours de ce mois. Au mois d'août, les valeurs de la production primaire brute enregistrent une augmentation dans toutes les stations, correspondant à un redressement de la biomasse phytoplanctonique aux valeurs plus élevées que celles enregistrées au mois de juin. En ce qui concerne la consommation d'oxygène, avec de rares exceptions, on a enregistré dans toutes les stations et pendant l'entière période d'expérimentation de grandes valeurs, rapprochées des valeurs de la production primaire nette (fig. 2) ce qui peut être expliqué par l'intense activité bactérienne du lac.

Les données présentées dans les tableaux 1 et 2 comprennent les paramètres du budget énergétique de l'association phytoplanctonique du lac de Dimbovița au cours de l'année 1989 (le rapport P/B et B/P). Pour la période de printemps, la durée du remplacement de l'entière biomasse

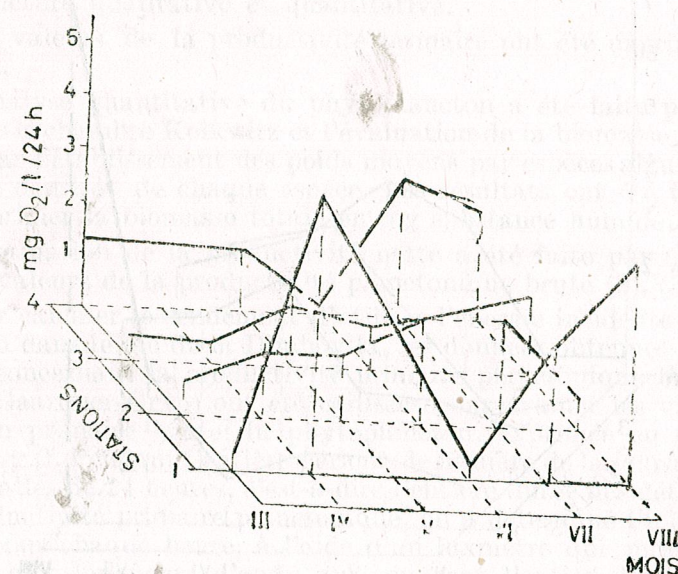


Fig. 2. — Consommation d'oxygène par le phytoplancton du lac Dimbovița en 1989.

de 0,425 à 0,095 jours (mars-avril). A partir du mois de mai cette valeur augmente de 1,423 jours à 4,678 jours en août. Ce fait est déterminé par le changement de la composition algofloristique du phytoplancton de l'écosystème du lac de Dimbovița. Conformément aux valeurs mensuelles de la lumière incidente on a calculé les rendements d'utilisation de l'énergie incidente par stations, les moyennes mensuelles et les moyennes mensuelles par lac. En faisant l'analyse des données présentées dans les tableaux 3 et 4 on constate que l'efficacité d'utiliser l'énergie incidente est plus réduite (en moyenne 0,335—0,325%), elle est maintenue relativement constante aux mois de printemps (mars-avril) et augmente à 0,683 au mois de mai. La courbe du rendement augmente pendant les mois d'été en atteignant la valeur maximale de 1,993% en août. Même si l'on enregistre pour le mois de juillet une baisse du rendement comparativement aux autres mois d'été (juin et août), il est maintenu à une valeur moyenne bonne (0,969%).

Tableau 1

Les paramètres du budget énergétique des populations phytoplanctoniques du lac Dimbovița en 1989

Mois	Station	Biomasse			Production brute		Respiration		Production nette		P/B	B/P jours
		mg. s. humide/l	cal/l	mg. C org./l	cal/l	mg. C org./l	cal/l	mg. C org./l	cal/l	mg. C org./l		
1	2	3	4	5	6	7	8	9	10	11	12	13
Mars	1	1,138	0,695	0,077	2,822	0,313	0,564	0,063	2,258	0,251	3,260	0,307
	2	1,369	0,836	0,093	3,091	0,343	0,618	0,069	2,473	0,274	2,946	0,339
	3	0,730	0,446	0,049	1,714	0,183	0,343	0,038	1,371	0,152	3,102	0,322
	4	1,600	0,978	0,109	1,075	0,115	0,215	0,024	0,860	0,095	0,872	1,147
	X̄	1,209	0,739	0,082	2,177	0,233	0,435	0,048	1,742	0,193	2,354	0,425
Avril	1	0,840	0,513	0,057	4,384	0,435	0,870	0,097	3,478	0,386	6,772	0,148
	2	0,497	0,003	0,034	4,928	0,527	0,986	0,109	3,943	0,437	12,853	0,078
	3	0,500	0,306	0,034	0,581	0,064	0,116	0,013	0,465	0,052	1,529	1,529
	4	0,370	0,226	0,025	1,068	1,114	0,214	0,024	1,319	0,143	5,840	0,171
	X̄	0,552	0,337	0,037	2,732	0,292	0,546	0,060	3,505	0,389	10,514	0,095
Mai	1	9,318	5,693	0,632	4,781	0,511	0,956	0,106	7,330	0,813	1,286	0,777
	2	10,369	6,353	0,703	5,272	0,563	1,054	0,117	4,218	0,468	0,666	1,502
	3	15,585	9,522	1,056	6,327	0,676	1,265	0,140	5,062	0,562	0,532	1,879
	4	13,064	7,982	0,886	8,405	1,005	1,881	0,209	7,524	0,835	0,942	1,061
	X̄	12,084	7,383	0,819	6,448	0,689	1,290	0,143	5,158	0,572	0,698	1,432
Juin	1	19,266	11,772	1,306	3,031	0,324	0,606	0,067	2,425	0,269	0,206	6,340
	2	33,699	8,370	0,929	12,392	1,324	2,479	0,275	9,913	1,100	1,188	0,845
	3	34,497	21,078	2,339	12,620	1,349	2,524	0,270	10,096	1,120	0,479	2,088
	4	46,826	28,611	3,174	12,173	1,301	2,435	0,270	9,738	1,080	0,340	2,939
	X̄	33,572	20,512	2,276	10,063	1,076	2,013	0,223	8,050	0,893	0,392	2,549
Juillet	1	13,428	8,205	0,910	9,912	1,059	1,982	0,220	7,930	0,880	0,967	1,034
	2	30,687	17,750	1,969	3,871	0,414	0,774	0,086	3,097	0,344	0,175	5,724
	3	17,239	10,533	1,169	—	—	—	—	—	—	—	—
	4	13,102	8,005	0,888	8,548	0,914	1,710	0,190	6,838	0,759	0,855	1,170
	X̄	18,614	11,373	1,269	7,442	0,795	1,488	0,165	5,954	0,661	0,524	1,909

Tableau 1 (suite)

1	2	3	4	5	6	7	8	9	10	11	12	13
	1	50,105	30,614	3,397	32,941	3,521	5,588	0,731	26,353	2,924	0,861	1,162
	2	69,146	42,248	4,687	13,067	1,397	2,613	0,290	10,434	1,160	0,247	4,041
	3	37,497	22,900	2,541	9,791	1,046	1,958	0,217	7,833	0,869	0,342	2,924
	4	41,469	25,338	2,811	7,782	0,832	1,556	0,173	6,226	0,891	0,246	4,068
	$\bar{X}$	49,550	30,275	3,359	8,091	0,865	1,618	0,180	6,473	0,718	0,214	4,678

NOTE : Station : 1 = Entrée Argeș; 2 = Entrée Dâmbovița; 3 = Centre; 4 = Barrage.

Tableau 2

Les paramètres du budget énergétique des populations phytoplanctoniques, du lac Dâmbovița en 1989 (moyennes mensuelles/lac)

Mois	Biomasse		Production brute		Respiration		Production nette		P/B	B/P jours
	mg. s. humide/l	cal/l	mg. C org./l	cal/l	mg. C org./l	cal/l	mg org./l	cal/l		
Mars	1,209	1,035	0,115	3,048	0,609	0,608	0,271	2,439	2,357	0,424
Avril	0,552	0,472	0,052	3,825	0,764	0,085	0,544	4,907	10,462	0,096
Mai	12,084	10,336	1,147	0,027	1,806	0,200	0,801	7,221	0,698	1,432
Juin	33,572	28,717	3,186	14,088	2,818	0,313	1,250	11,270	0,392	2,549
Juillet	18,614	15,922	1,766	10,419	2,083	0,231	0,925	8,336	0,524	1,909
Août	49,550	42,385	4,702	11,327	2,265	9,251	1,005	9,062	0,214	4,678

Tableau 3

L'efficacité de l'utilisation de l'énergie lumineuse incidente par le phytoplancton du lac Dâmbovița en 1989.

Mois	Station	Profondeur m	Illumination cal/m ² /24 heures	Production brute cal/m ² /24 heures	Rendement d'utili- sation de l'énergie incidente (%)
Mars	1	4,75	3789 × 10 ³	16452,26	0,434
	2	4,00		18020,53	0,476
	3	4,60		9992,62	0,264
	4	8,00		6267,25	0,165
	$\bar{X}$			12691,91	0,335
Avril	1	5,00	4896 × 10 ³	25348,84	0,518
	2	4,50		28736,07	0,587
	3	5,50		3387,23	0,069
	4	8,00		6226,44	0,127
	$\bar{X}$			15927,56	0,325
Mai	1	3,80	5503 × 10 ³	27873,23	0,507
	2	6,50		36866,41	6,670
	3	6,50		30735,76	0,559
	4	8,00		54831,15	0,996
	$\bar{X}$			37591,84	0,683
Juin	1	4,00	5939 × 10 ³	17670,73	0,298
	2	5,00		72245,36	1,216
	3	6,00		73574,60	1,239
	4	8,50		70968,59	1,195
	$\bar{X}$			58667,29	0,988
Juillet	1	6,00	6269 × 10 ³	57786,96	0,922
	2	4,30		22567,96	0,360
	3	5,30			
	4	4,20		49834,84	0,795
	$\bar{X}$			43386,86	0,692
Août	1	4,50	3313 × 10 ³	192046,03	5,797
	2	4,75		76180,61	2,2999
	3	3,70		57081,10	1,723
	4	6,00		45469,06	1,369
	$\bar{X}$			47170,53	1,424

NOTE : STATION : 1 = Entrée Argeș; 2 = Entrée Dâmbovița; 3 = Centre; 4 = Barrage

Tableau 4

L'efficacité de l'utilisation de l'énergie lumineuse incidente par le phytoplancton du lac Dâmbovița en 1989 (Moyennes mensuelles /lac)

Mois	Illumination cal/m ² /24 heures	Production brute cal/m ² /24 heures	Rendement d'utilisation de l'énergie incidente %
Mars	3789 × 10 ³	17979,72	0,475
Avril	4896 × 10 ³	22299,75	0,455
Mai	5503 × 10 ³	52627,41	0,956
Juin	5939 × 10 ³	82133,04	1,386
Juillet	6269 × 10 ³	60742,77	0,969
Août	3313 × 10 ³	66036,41	1,993

CONCLUSIONS

1. Dans le lac de Dimbovița la courbe de variation du rendement d'utilisation de l'énergie de la lumière suit fidèlement les variations de densité de la biomasse. Les accroissements accentués, pendant l'été, de la biomasse sont accompagnés des accroissements correspondants du rendement d'utilisation de l'énergie de la lumière. Les valeurs accrues du rendement d'utilisation de l'énergie radiante, pendant la chaude saison de l'année reflètent une plus grande capacité productive de la cénose alguale spécifique pour cette saison.

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SPECIES OF PLANTS CONSUMED IN WINTER BY PHASIANUS COLCHICUS IN ROMANIA (I). DIVERSITY OF VEGETAL FOOD

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The list of the plants fed in the winter 1988/89 and 1989/90 by *Phasianus colchicus* in natural conditions is presented. The collected samples (520 crops and gizzards) from the almost entire Romanian land where it lives show that it prefers to feed more frequently on species of shrubs and trees (38 sp.), but herbaceous species are more diverse (135 sp.) especially weeds (75 sp.). The shrub and tree species are more constantly consumed than the herbaceous ones. The seed (84 %), leaf (7 %), fruit (5 %), seedling (3 %), bulb and rhizome (1 %) are the parts of plant consumed.

Phasianus colchicus, bird introduced in the fauna of Romania as a species of cynegetic interest, is now spread on the whole field and hill area. It habitates, may be most constantly of all animals, on the ecotone areas — the edge of forests or shrubs as well as the limits of agricultural cultures and the spaces between them.

The paper was possible owing to the researches made by ICAS Bucharest (under the guidance of D. H. Almășan) to discover the optimum food with a view to increasing the number of pheasants for hunting. Ecosystemically there is an at least equal interest in the trophic relation established by the reevaluation (by natural means) of the primary producers by one of the consumers of medium size in the mentioned conditions.

The food investigation by pheasant — species with an omnivorous feeding — has aroused the Romanian zoologists' attention for a long time (Almășan, Scărlătescu 1961, Kiss, Rékási, Sterbetz 1976, 1985) in the context of a concern for food determination of other bird species too, such as the woodcock, the wild duck, the wood-pecker (Pașcovești 1937, Filipașcu 1960, Ceaușescu, Năstăsescu, Țițeica 1979, Kiss, Sterbetz 1985).

The large variability of the obtained results in the previous works, but especially the new data obtained made us try to complete the knowledge in this field.

MATERIAL AND METHODS

The plants consumed by pheasant have been identified from the material extracted from the crop and stomach from pheasants hunt during December—February 1988—1989 and 1989—1990; 161 samples in the first year and 360 samples in the second year have been used. The pheasant came from 72 hunting funds belonging to 31 forest districts from 14 districts: *dis. Iași*: f. d. Iași, Hârlău, Răducăneni, Ciurea; *dis. Buzău*: f. d. Buzău, Rîmnicu-Sărat; *dis. Călărași*: f. d. Bărăgan, Lehliu, Mitreni, Chiciu; *dis. Ialomița*: f. d. Slobozia; *dis. Giurgiu*: f. d. Comana, Bolintin, Ghimpați; *dis. Ilfov*: f. d. Ștefănești, Snagov; *dis. Prahova*: f. d. Ploiești; *dis. Dimbovița*: d. f. Răcari; *dis. Argeș*: f. d. Costești; *dis. Timiș*:

f. d. Lugoj, Făget, Lunca Timișului, Timișoara; *dis.* Arad: f. d. Ceala; *dis.* Alba: f. d. Blaj; *dis.* Cluj: f. d. Gilău, Gherla, Cluj; *dis.* Mureș: f. d. Luduș, Tg. Mureș, Tîrnăveni.

The plant determination and their presence into the samples were established only for the well-preserved material, the one that had a more advanced degree of digestion has been considered as "nonidentifiable" and only the part of plant from which it came, and in case of leaves the large categories of Graminaceae or Dicotyledons to which it belonged were established.

RESULTS AND DISCUSSIONS

The pheasant's food is approximately formed of 68.66% vegetal material (Almășan, Scărlătescu 1961). During winter months it comes to be constituted of 80–97% vegetal material even when the snow covers less of the soil. The vegetal material belongs to a greater number of species (Table 1). We have identified 171 species among which 99 unreported yet in literature and in the previous papers other 48 species we did not meet have been cited. Therefore we may consider that up to the present the vegetal material that belongs to 219 species represents food for this bird. Although the list is long we must notice that only 10 species are most frequently consumed (10–40%) and only other 30 are rather frequent (>3%). This means that the species scarcely met in the pheasant's food are not chosen but consumed strictly for survival.

The consumed species are both wood and herbaceous plants framed in the forest shrub and grassland biocoenoses but also in weeds or cultivated plants biocoenoses.

We remark that both as abundance of species and as frequency, the cultured plants are little consumed so that we may firstly consider that the pheasant represents no danger for the culture and secondly that it is perfectly identified itself with the present natural ecosystem structure in Romania.

The richness of species in the Romanian flora is well known, the maximum heterogeneity in the country being of 0.99972. For the pheasant consumed species the heterogeneity reaches values between 0.99415 if we consider only those identified by us and 0.99554 if we add the species cited in literature. Taking into account only the presence of the species in its nourishment the heterogeneity of segetal flora is the highest — 0.98215 followed by the forestry one — 0.97675 and the shrub one — as vegetal structure but especially as bioform — 0.97059. The quantitative aspect of the consumption (that we are about to discuss later) changes the relation among these categories of plants, categories that reflect in reality the biocoenoses where the pheasant acts as a consumer within the trophic chain. The most frequently consumed species are those of shrubs from the forestry structure as well as those of shrubs framed in the second class of frequency (in the five stages classification), while the weeds or cultured plants do not level under any circumstances the characteristic level of shrubs (although we notice some species with higher frequency).

Table 1

The plant species fed of *Phasianus colchicus* in winter period (Dec. — Febr. 1988–1990)

Species	Frequency (analysed samples)	
	1988/89	1989/90
1	2	3
I. Forest plants		
a) Trees		
<i>Robinia pseudacacia</i>	42.23	37.77
<i>Prunus mahaleb</i>	7.45	7.22
<i>Prunus avium</i>	4.34	1.38
<i>Carpinus betulus</i>	1.24	1.66
<i>Quercus robur</i>	0.62	0.83
<i>Acer platanoides</i>	0.62	—
<i>Celtis australis</i>	0.62	—
<i>Tilia cordata</i>	—	0.83
<i>Ailanthus altissima</i>	—	0.55
<i>Quercus borealis</i>	—	0.28
<i>Quercus cerris</i>	—	0.28
<i>Celtis occidentalis</i>	—	0.28
<i>Malus sylvestris</i>	—	0.28
<i>Acer campestre</i>	—	0.28
<i>Quercus sp.</i>	—	0.28
b) Shrubs		
<i>Cornus sanguinea</i>	19.87	25.00
<i>Ligustrum vulgare</i>	11.83	16.39
<i>Rubus caesius</i>	5.59	0.83
<i>Viburnum lantana</i>	3.72	0.28
<i>Evonymus verrucosa</i>	1.24	—
<i>Viburnum opulus</i>	0.62	—
<i>Sambucus nigra</i>	0.62	—
<i>Cornus mas</i>	—	1.94
c) Herbs		
<i>Asperula odorata</i>	3.72	—
<i>Lithospermum purpureo-coeruleum</i>	2.48	0.28
<i>Ornithogalum sp.</i>	1.24	—
<i>Asarum europaeum</i>	1.24	—
<i>Glechoma hirsuta</i>	0.62	0.83
<i>Stellaria nemorum</i>	0.62	—
<i>Stellaria holostea</i>	0.62	—
<i>Polygonatum officinale</i>	0.62	—
<i>Chrysanthemum sp.</i>	0.62	—
<i>Solanum dulcamara</i>	0.62	0.83
<i>Gagea sp.</i>	0.62	—
<i>Galium schultesii</i>	—	1.38
<i>Prunella vulgaris</i>	—	1.38
<i>Poa nemoralis</i>	—	0.56
<i>Corydalis cava</i>	—	0.28
<i>Euphorbia amygdaloides</i>	—	0.28
<i>Lapsana communis</i>	—	0.28
<i>Luzula sp.</i>	—	0.28
<i>Potentilla recta</i>	—	0.28
<i>Milium effusum</i>	—	0.28

1	2	3
II. Shrubs		
<i>Rosa canina</i>	28.57	22.70
<i>Crataegus monogyna</i>	21.12	16.11
<i>Crataegus pentagyna</i>	5.59	16.11
<i>Cytisus hirsutus</i>	3.72	—
<i>Berberis vulgaris</i>	3.10	—
<i>Hippophae rhamnoides</i>	3.10	0.56
<i>Prunus spinosa</i>	2.48	1.94
<i>Rosa gallica</i>	1.86	0.28
<i>Clematis vitalba</i>	—	1.39
<i>Prunus fruticosa</i>	1.24	—
<i>Prunus serotina</i>	0.64	1.11
<i>Eleagnus angustifolia</i>	—	0.83
<i>Rhamnus cathartica</i>	0.62	—
<i>Rosa dumetorum</i>	0.62	—
<i>Amorpha fruticosa</i>	0.62	—
III. Pasture plants		
<i>Bothriochloa ischaemum</i>	8.07	4.16
<i>Vicia tetrasperma</i>	3.73	3.89
<i>Crocus variegatus</i>	3.10	0.56
<i>Poa angustifolia</i>	2.48	—
<i>Cynodon dactylon</i>	1.86	0.28
<i>Festuca pratensis</i>	1.84	—
<i>Onobrychis sp.</i>	1.84	—
<i>Vicia sativa</i>	1.84	—
<i>Daucus carota</i>	1.24	—
<i>Stellaria graminea</i>	1.24	—
<i>Trifolium fragiferum</i>	1.24	—
<i>Tragopogon pratensis</i>	1.24	—
<i>Lotus corniculatus</i>	—	1.11
<i>Festuca rupicola</i>	0.62	—
<i>Juncus sp.</i>	0.62	—
<i>Lolium perenne</i>	0.62	0.28
<i>Phleum pratense</i>	0.62	—
<i>Poa pratensis</i>	0.62	—
<i>Coronilla varia</i>	0.62	—
<i>Rumex acetosa</i>	0.62	—
<i>Melampyrum arvense</i>	0.62	—
<i>Trifolium arvense</i>	0.62	—
<i>Cardamine pratensis</i>	0.62	—
<i>Trifolium repens</i>	—	0.28
<i>Rumex crispus</i>	—	0.56
<i>Juncus gerardi</i>	—	0.28
IV. Cultivated plants		
<i>Triticum vulgare</i>	11.80	9.40
<i>Zea mays</i>	6.21	17.22
<i>Hordeum vulgare</i>	2.48	0.83
<i>Helianthus annuus</i>	1.86	0.28
<i>Sorghum bicolor</i>	1.86	0.56
<i>Glycine hispida</i>	1.24	1.11
<i>Panicum miliaceum</i>	1.24	—
<i>Vitis vinifera</i>	0.62	4.44
<i>Avena sativa</i>	0.62	1.11
<i>Phaseolus vulgaris</i>	—	1.11
<i>Cucurbita pepo</i>	0.62	0.28
<i>Pisum sativum</i>	—	0.56

Table 1 (Continued)

1	2	3
V. Segetal weeds		
<i>Sorghum halepense</i>	13.66	8.61
<i>Setaria glauca</i>	13.04	6.94
<i>Amaranthus retroflexus</i>	12.40	5.55
<i>Brassica nigra</i>	6.83	8.07
<i>Stellaria media</i>	7.45	2.22
<i>Cirsium arvense</i>	4.97	0.83
<i>Chenopodium album</i>	4.97	0.56
<i>Atriplex patula</i>	4.34	0.28
<i>Setaria verticillata</i>	3.72	3.05
<i>Sinapis arvensis</i>	3.10	1.66
<i>Amaranthus crispus</i>	3.10	3.05
<i>Lithospermum arvense</i>	3.10	0.28
<i>Setaria viridis</i>	2.48	0.83
<i>Bilderdykia convolvulus</i>	2.48	3.61
<i>Astragalus sp.</i>	2.48	1.38
<i>Lathyrus tuberosus</i>	2.48	1.11
<i>Anthemis arvensis</i>	1.86	0.83
<i>Digitaria sanguinalis</i>	1.24	1.84
<i>Solanum nigra</i>	0.62	2.22
<i>Echinochloa crus-galli</i>	—	2.22
<i>Datura stramonium</i>	—	1.66
<i>Euphorbia helioscopia</i>	1.24	—
<i>Bromus arvensis</i>	0.62	1.24
<i>Cannabis ruderalis</i>	1.24	—
<i>Melilotus officinalis</i>	1.24	—
<i>Hibiscus trionum</i>	1.24	—
<i>Vicia hirsuta</i>	1.24	—
<i>Anagallis arvensis</i>	1.24	1.11
<i>Sonchus arvensis</i>	—	1.11
<i>Veronica arvensis</i>	0.62	1.11
<i>Bromus tectorum</i>	—	1.11
<i>Vicia cracca</i>	0.62	0.83
<i>Viola arvensis</i>	—	0.83
<i>Geranium pusillum</i>	—	0.83
<i>Chenopodium polyspermum</i>	0.62	0.55
<i>Raphanus raphanistrum</i>	0.62	—
<i>Malva neglecta</i>	0.62	—
<i>Poa annua</i>	0.62	—
<i>Agrostemma githago</i>	0.62	—
<i>Euphorbia falcata</i>	0.62	—
<i>Chorispota tenella</i>	0.62	—
<i>Portulaca oleracea</i>	0.62	0.62
<i>Amaranthus blitoides</i>	0.62	0.56
<i>Amaranthus albus</i>	—	0.56
<i>Bifora radians</i>	—	0.28
<i>Galium tricorutatum</i>	—	0.28
<i>Stachys arvensis</i>	—	0.28
<i>Veronica hederifolia</i>	—	0.28
<i>Silene noctiflora</i>	—	0.28
<i>Cerastium glomeratum</i>	—	0.28
<i>Vicia angustifolia</i>	—	0.28
<i>Leonurus cardiaca</i>	—	0.28
<i>Lamium purpureum</i>	—	0.28
<i>Lamium amplexicaule</i>	—	0.28
<i>Neslia paniculata</i>	—	0.28
<i>Delphinium consolida</i>	—	0.28
<i>Bidens tripartita</i>	—	0.28

Table 1 (continued)

1	2	3
VI. Ruderal plants (growing among rubbish)		
<i>Sambucus ebulus</i>	6.83	9.44
<i>Polygonum aviculare</i>	5.59	2.78
<i>Capsella bursa-pastoris</i>	5.59	0.28
<i>Arctium lappa</i>	4.34	0.56
<i>Plantago lanceolata</i>	1.83	—
<i>Galium aparine</i>	1.24	—
<i>Arctium minor</i>	1.24	—
<i>Matricaria perforata</i>	0.62	—
<i>Sisymbrium sp.</i>	0.62	—
<i>Atriplex tatarica</i>	0.62	—
<i>Urtica dioica</i>	—	0.56
<i>Plantago media</i>	—	0.56
<i>Arctium tomentosum</i>	—	0.56
<i>Centaurea calcitrapa</i>	—	0.28
<i>Xanthium spinosum</i>	—	0.28
VII. Hygrophilous weeds		
<i>Polygonum persicaria</i>	4.96	2.22
<i>Echinochloa oryzoides</i>	1.86	—
<i>Polygonum amphibium</i>	0.62	—
<i>Myosotis sp.</i>	—	0.56

Within the natural vegetation the most frequently consumed species is a tree species hence from the forestry structure *Robinia pseudacacia* a species introduced from America in the forestry culture (the pheasant was brought from Asia). The other autochthonous tree species are rather occasionally used as food.

Another surprising aspect is the fact that by this much consumed plant the so much appreciated seeds contain a toxalbumin that makes for man uneatable the oil extracted from it. Most interesting is the fact that the same situation is signaled by other species frequently consumed such as: *Cornus sanguinea*, *Ligustrum vulgare*, *Sambucus ebulus* species whose seeds and fruits are avoided not only by man but also by other animals although they are not included in the category of plants with recognized toxicity. Under these circumstances the enzyme equipment involved in the pheasant's digestion comprises elements that may block and use also these compounds considered toxic for the other consumers. Also, as a confirmation in this line we may notice other species with high recognized toxicity among the list of plants reevaluated by the pheasant (*Datura stramonium*, *Agrostema githago*, *Delphinium consolida*, *Stellaria graminea*, *Solanum dulcamara*, *S. nigra*, *Euphorbia* and *Corydalis* species, and other authors cite *Ranunculus* species too. These last species do not constitute their alimental basis and in smaller doses they may be less dangerous even for other beings.

We may also point out other adventitious plants in the pheasant's nourishment especially among weeds but also among the shrubs and trees brought into the culture (*Elaeagnus angustifolia*, *Celtis* sp., and incertain-

ly *Amorpha fruticosa*); the last species also cited by Kiss and coll in the Danube Delta was refound by us in a single case where the seeds might have been particular cases of *Robinia pseudacacia*.

The constancy of using certain plant species appreciated by us so, by their rediscovery in the pheasant's food during the two consecutive years, showed us that the species mostly used also keeps the character of permanent or constant consumption to which a few other species with a more seldom use are also added.

From the whole of 171 species only 38% of them were identified in the pheasant's nourishment both in 1989 as well as in 1990 and the other species only in 1989 or in 1990. In this direction among different categories of plants the cultivated ones are the most constantly used (75% from the species), although with reduced individual frequency, followed by forestry shrubs (50%) and shrubs (47%) the last two being frequently met in nourishment. The wooden species are more constantly used than the herbaceous ones.

The part of plants most intensely consumed from the mentioned species are the seeds. They represent 84% in the ensemble of our list from the total of species. The vegetal material under the form of leaves is less, consumed, but represents 7%, followed by the fruits (5%), seedlings little grown (3%) and the rest of 1% is represented by bulbs, rhizomes, fragments of floral parts (glumes, aristate, pappus, perigon) and even a freshly bloomed flower (*Chorispora tenella*). Small fragments of branches (*Evo-nymus verrucosa*) and *Cynips* sp. on the leaves are met.

As for the grassland plants grown on fragmented pasture or in the other vegetation structure, the highest consumption is done by the leaf (43%) and very little by the seed (47% of grassland plants).

With segetal and especially ruderal weeds the highest consumption has been identified as seedlings (6–27%) and to some extent as leaves (11%) — the frequency was calculated within each plant category where they have been included. The segetal weeds are consumed by all ways shown above and those in humid areas have been identified as seeds only. The bulbs and rhizomes were consumed only from herbaceous forestry plants or from segetal weeds.

The fruits are rather little used as food comparatively with the seeds which they find themselves associated with. For example we may frequently meet seeds of *Rosa canina* or *Prunus mahaleb* without the fruit even in the corp where the material is well preserved; in this situation we suggest the alternative, if these eatable for man fruits do not contain undigestible elements for the pheasant and if as a result it avoids them.

Generally, the proportions concerning the consumption of different parts of the plants at different vegetation categories kept during the two years of research, proving that the necessity of this proportion truly exists and there is no hazard in discovering them.

In conclusion, the plants generally considered useless to man in the natural vegetation (forest shrubs, shrubs, weeds) represent the food most frequently consumed by the pheasant.

There is a high heterogeneity of the vegetal food of the pheasant in Romania but from the 219 identified species up to the present, only 10

species are frequently used and 30 species are used in more than 3% of the cases. The pheasant frequently consumes toxic for man plants or parts of them that other birds avoid.

The most frequently used vegetal material are the seeds (84%) and leaves (7%); their digestion is shown during winter.

By the ingested foods pheasant's area of nourishment may be established at the limit between ecosystems.

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RELICTES DANS LA FLORE DE ROUMANIE. NOTES BRYOLOGIQUES. V—VI

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V. *PLAGIOBRYUM DEMISSUM* (Hook.) Lindb., Oefv. K. Vet. — Akad. Foerh. 19 :606, 1863 (Bryum, 1819); Brothrus Pfzf. ed. 1 :563, 1903, ed. 2, 10 :372, 1924; P. v. Wijk, W. D. Margadant, P. A. Forschütz, Index Muscorum, t. IV (P—S), 1967, p. 86, appartient au genre *Plagiobryum* Lindb., fam. *Bryaceae* Schwaegr. (subfam. *Bryoideae*), Ord. *Bryales*.

Synonymes : l'espèce a été insérée, antérieurement, dans d'autres genres de diverses familles apparentées : *Meesia demissa* Hoppe & Hornsch., Flora p. 106, 1819; *B. demissum* Hook., Musci exot., 2, 16, t. 99, 1820; *Pohlia demissa* Hübner., Muscol. germ. p. 466, 1833; *Zieria demissa* Schimp., Coroll., 69, 1856; G. Limpricht, Die Laubmoose, II Abtg., p. 228, 1895.

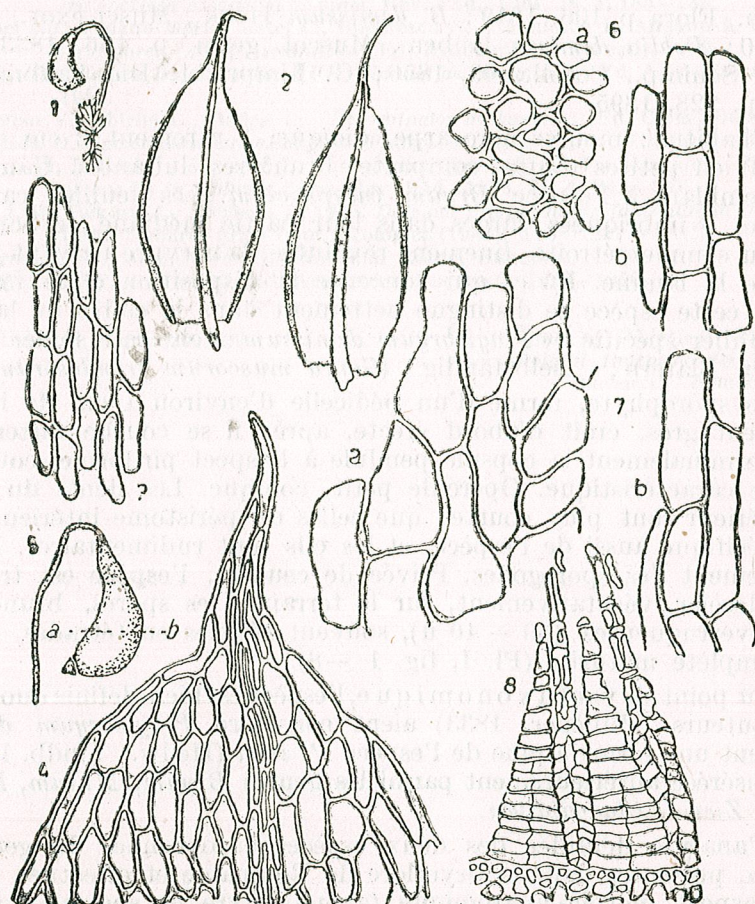
L'habitus : mousse acrocarpe, dioïque, 1 rarement 2 cm de haut, croissant en petites touffes compactes brunâtres, luisantes. Gamétophyte ressemblant à l'espèce *Bryum caespitium*. Les feuilles caulinaires disposées en imbriquées, larges dans leur partie médiane, le bord allant jusqu'au sommet, étroite, finement révolutée, la nervure arrivant jusqu'au bout de la lamine. En ce qui concerne la disposition et la forme des feuilles, cette espèce se distingue nettement dans le cadre de la famille et C. Müller spécifie : « *Plagiobryum demissum* steht mit seiner zart begrenzten Blättern . . . selbständig » (*Genera muscorum frondosorum*, 1901).

Le sporophyte, formé d'un pédicelle d'environ 1 cm de haut relativement gros, croît d'abord érecte, après il se courbe fortement et porte terminalement la capsule pendule à l'aspect piriforme, courbée de manière caractéristique. Opercule petit, conique. Les dents du péristome extérieur sont plus courtes que celles du péristome intérieur, caractère spécifique aussi de l'espèce, et les cils sont rudimentaires. Elle forme rarement des sporogones. Privée de ceux-ci, l'espèce est très difficile à déceler, végétativement, sur le terrain. Des spores, brunes, rous-sâtres, verruqueuses (30 — 40 u), souvent réunies en tétrades, même à leur complète maturité (Pl. I, fig. 1 — 8).

Du point de vue taxonomique, l'espèce est bien définie quoique certains auteurs (Hübner, 1833) aient considéré *Plagiobryum demissum* seulement une forme alpine de l'espèce *P. zieri* (Hedw.) Lindb. l.c. 1863, étant insérée antérieurement parmi les genres *Bryum*, *Mnium*, *Hypnum*, *Pohlia*, *Zieria*, *Cladodidium*.

L'analyse détaillée des deux espèces européennes du genre *Plagiobryum*, présentes dans la bryoflore de Roumanie et effectuée par nous sous l'aspect morpho-anatomique (gamétophyte et sporophyte), écologique (édaphique et climatique), bryocénologique (Mousses, hépatiques), phytocénologique et géographique (altitude, exposition et autres), a rendu concrètes et a conduit à les caractériser différenciellement, par comparaison de leurs particularités (Tr. I. Ștefureac, 1945, tabl. p. 342

— 345), ainsi qu'à la précision taxonomique distincte des espèces *Plagiobryum zieri* (Hedw.) Lindb. (*Zieria julacea* Schimp.), fréquemment répandue chez nous et *P. demissum* (Hook.) Lindb., tout à fait sporadique en général, comme dans la bryoflore de Roumanie. Les caractères différentiels de ces deux espèces consistent également dans le type varié des stomates : phanéropores chez *P. demissum* et cryptopores chez *P. zieri*; de même, la forme des cellules et le grossissement de leurs parois (théca ou l'épicarpe de la capsule diffère dans la structure des deux courbures) (Pl. I, fig. 6 et 7 a, b).



Pl. I. *Plagiobryum demissum*: 1, habitus; 2, feuilles caulinaires supérieures; 3, cellules médianes du limbe foliaire; 4, bout d'une feuille caulinare avec le réseau cellulaire et la terminaison de la nervure; 5, forme de la capsule avec l'opercule; 6, différence entre la dimension, la forme et l'épaisseur des membranes cellulaires de la courbure externe (b) et interne (a) de la théca (pericarpium) de *P. demissum*; 7, idem de *P. zieri*; 8, dents du péristome externe et interne de *P. demissum* (orig., Tr. I. Ștefureac, 1955, pl. 1).

Caryologiquement, *Plagiobryum demissum* n'a pas encore été étudiée, sous l'aspect sporologique non plus.

Du point de vue écologique, elle croît en petites touffes compactes sur du humus noir, fin, sec, pauvre en calcaire et faiblement acide, dans des microstations cachées, bien baritées, dans de petites niches sous des seuils herbeux, en marge des sentiers profondément érodés par les eaux et les neiges (Monts Bucegi) ou bien sous des touffes (aux racines) de graminées (Monts Piatra Craiului) des Carpates méridionales de Roumanie (1960 et 2200 — 2230 m s.m.).

Corologiquement, *Plagiobryum demissum*, espèce rarissime dans la bryoflore de Roumanie, est connue jusqu'à présent, d'après nos recherches seulement dans les deux massifs des Carpates méridionales.

— Les Monts Bucegi: signalée (29, VI, 1943) sur le plateau alpin de la partie supérieure de Valea Ialomicioara-Obârșia, au-dessus de la Cascade (environ 2200 m s.m.), en face de Mecetul turcesc, dans deux microstations des versants ensoleillés, dans des niches cachées ombrées (Tr. I. Ștefureac, 1945, p. 334 — 345), massif noté dans la corologie de cette espèce par J. Podpera (*Conspectus muscorum europaeorum*, 1954, p. 329);

Les Monts Piatra Craiului, versant S-Sud-Ouest du grand abrupte, dans une seule station (10 — 17, VIII, 1948), sur du humus des roches de Ciorânga, situé à une altitude relativement basse (1650 m s.m.) et croît sous forme de petites touffes, ayant quelques sporogons sur un sol noir, fin, calcaire, dans des niches de graminées, dans des endroits ombrés, abrités, d'une humidité relative, épargnés de l'insolation directe (Tr. I. Ștefureac, 1951, p. 258 — 259).

Du point de vue bryocénologique dans les deux massifs carpatiques de Roumanie, l'espèce a été étudiée dans la composition de ses bryocénoses qui la caractérisent écologiquement et cénologiquement. Ainsi, dans les stations des deux relevés (1/2 m² et 0,20 m²) des Monts Bucegi, *Plagiobryum demissum* croît associée, codominante soit à *Drepanocladus uncinatus* (2, 3), *Hypnum hamulosum* (2.3), *Polytrichum piliferum* (2.2), *Encalypta ciliata* (1 — 2.2), *Bartramia ithyphylla* (1.2) et autres soit à *Distichium capillaceum* (2.3), *Bartramia ithyphylla* (2.2), *Encalypta ciliata* (1.1), *Myurella julcea* (+ .1) et autres. Dans la station des Monts Piatra Craiului (0,20 m²) elle est en association avec *Saetania glaucescens* (1 — 2.3), *Bryum caespitium* (1.2), *Encalypta ciliata* (+ .1), *Bartramia ithyphylla* (+). On remarque cénologiquement sa composition dans les deux massifs mentionnés. L'association de l'espèce *Plagiobryum demissum* est caractérisée avec *Bartramia ithyphylla* (silicicole), *Encalypta ciliata* (sous-neutrophile) et *Saetania glaucescens* (de substratum neutre, faiblement acide). On constate ainsi l'amplitude écologique du substratum et des éléments composants, dans la définition et la délimitation des bryocénoses avec *Plagiobryum demissum*, dans les deux massifs avec des espèces neutre et sous-neutrophiles sur un substratum en général pauvre en calcaire ou bien sur le sol des rochers siliceux.

Phytocénologiquement, les bryocénoses à *Plagiobryum demissum* des Monts Bucegi appartiennent cénotaxoniquement à la zone avec *Loiseleurieto-Vaccinion* Br. -Bl. 1926, et à Piatra Craiului, dans l'étage

sous-alpin, avec *Juniperus*, *Rhododendron* et autres, y compris *Abies alba*, sur le versant abrité à une plus haute altitude (1650 m s.m.).

Du point de vue aréalographique, le genre *Plagiobryum* Lindb. à 6 espèces, est répandu dans les deux hémisphères, ainsi que dans la Nouvelle Zélande. Seule espèce européenne, *Plagiobryum demissum* a un aréal arctique, espèce rare, relativement peu signalée. Elle est connue dans l'Europe Centrale et celle de l'Ouest (Alpes, Carpates, Pyrénées) de même que, et surtout, dans les pays scandinaves du nord du continent, en U.R.S.S., en Asie Centrale, en Amérique du Nord, en Groenland, représentant un élément monozonal dans son aréal général. Dans les Carpates de Roumanie, cet élément peut être considéré dizonal. *Plagiobryum demissum* constitue un important élément boréal relictair, sous-arctique alpin et sous-nival.

VI. CONOSTOMUM TETRAGONUM (Hedw.) Lindb. Oefv. K. Vet. — Akad. Foreh 20: 392, 1863 (*Bryum*, 1801); Brothérus Pfzf ed. 1. 641, 1904; ed. 2, 457, 1924; P. v. Wijk, Margadant, P. A. Forschütt Index muscorum, t. I (A — C) Utrecht, p. 504 — 505, 1959, appartient au genre *Conostomum* Sw. in Web & Mohr, Nat. Reise Schwed., 1804; *Conostomum* Swartz in Schrad. Journ. f. Botan. L, P. III, 26, 1806, fam. *Bartramiaceae* Schwaegr., subor. *Bartramiinae*, ord. *Bryales*.

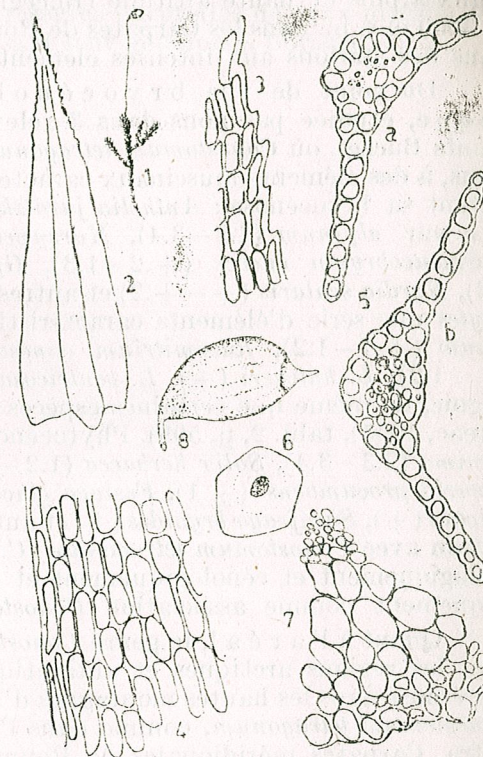
Synonymes: l'espèce a été intégrée antérieurement parmi plusieurs genres de diverses familles apparentées: *Bryum tetragonum* (Haud Villars 1786) Dicks. Fl. crypt. Brit. fasc. II, p. 8, t. 4, f. 9, 1790; *Grimmia conostoma* Smith. Fl. Brit. III, p. 1169, 1804; *Conostomum boreale* Swartz l. c., t. 5, 1806; *C. arcticum* Sw. in Brid Spec. musc., I, p. 127, 1826; *Bartramia conostoma* Bryol. eur. fasc. 12, 16, t. 7, 1842.

L'habitus, mousse acrocarpa, dioïque, aux feuilles finement lancéolées aigües et à la capsule ovoïdale asymétrique, sous-terminalement striée, opercule rostré, péristome simple, caractéristique. Elle forme des touffes feutrées enfoncées ou partiellement couvertes (fixateurs) de sables glaciaires. La tige ramifiée monopodiale ou dichasiale, en coupe ayant 5 angles évidents et les feuilles dans la partie supérieure (trait caractéristique) 5-sériées. Anneau central bien délimité. L'écorce extérieure, formée de quelques rangées de cellules aux parois grossières, colorées en brun, à l'aspect sphagnoïde. Les feuilles denses imbriquées insérées sur la tige, droites (érectes) ou légèrement recourbées, au sommet faiblement denticulé, la nervure marquée arrive jusqu'au sommet de la lamine ou bien exerce; du côté dorsal les cellules sont mamillées (Pl. II, fig. 1—8).

Du point de vue taxonomique, *Conostomum tetragonum* est une espèce bien délimitée, à caractères adaptatifs écologiquement, relictair, fixée aux conditions édaphiques et climatiques de l'étage alpin, en tant que seule espèce en Europe comme en Roumanie; étant insérée (intégrée) dans la famille des *Bartramiaceae*, comme type de croissance, particularités du gamétophyte (les cellules de la lamine semblables à celles de *Bartramia*) et du sporophyte (la forme de la capsule et ses caractéristiques). Elle se distingue nettement, par la disposition des feuilles 5-sériées, la tige avec 5 angles, légèrement fragile, avec le feutre de rhizoïdes nets, densément disposés et al., qui en définissent en même temps le caractère arctique glaciaire boréal relictair, étant dénommée d'abord, d'une manière significative, *Conostomum boreale* Sw.

Caryologiquement, *Conostomum tetragonum* a été analysée par deux auteurs (Steere 1954; S. Inoue, 1974) de l'USA — Alaska n = 16 (R. Fritsch, p. 106, 1982) et sporologiquement par A. Boros & M. Járαι-Komlódi, 1975, p. 276, pl. 131 a).

Pl. II. *Conostomum tetragonum*: 1, habitus; 2, feuille caulinaire; 3, bord supérieur de la feuille; 4, réseau cellulaire dans la partie basale-marginale de la feuille; 5, coupes par feuilles au sommet (a) et la partie médiane (b) avec la structure cellulaire de la nervure et de la lamine; 6, section schématique à travers la tige (grandie); 7, section transversale partielle par la tige (grandie); 8, forme de la capsule avec l'opercule (orig., Tr. I. Ștefureac, 1985, pl. III).



Du point du vue corologique, *Conostomum tetragonum* est signalée jusqu'à présent comme une grande rareté bryologique dans la flore de Roumanie, sans sporogones, seulement dans deux massifs d'altitude des Carpates méridionales (esquisse corologique, fig. 2):

— Les Monts Bucegi, du côté nord-ouest du massif signalé par nous (23—24, VII, 1950, dans trois microstations (2320—2420 m s.m.), à savoir: Șaua Mare au-dessus de la Vallée Țigănești, vers Gaura (2320 m s.m.), la dépression (la selle) entre Gaura et Mălăești (2390 m s.m.) et dans la large dépression du Mont Buceioiu (2420 m s.m.). Cette espèce croît; édaphique, sur un substratum de pierreries rocheuses et de sables alpins, résultant de la désagrégation des grès et des conglomérats cénozoïques et, quant au climat, dans des stations avec les plus grandes amplitudes des facteurs atmosphériques de ce massif (courants d'air, neiges, brouillard) (Tr. I. Ștefureac, 1955, 1963);

— Les Monts Retezat, dans la zone alpine supérieure, espèce rare, qui croît sur des terrains froids en marge des «gisements de neiges», en amont de Adăptorile caprelor, la côte Judele-Birlea située à environ 2200 m s.m., découvert (23—24, VII, 1950) par E. Plămadă (1974, 1975, 1977).

Écologiquement, espèce terri-saxicole, croissant sur un sol humide de pierreries rocheuses (moraines) fines et de sables alpins d'altitude, sur des roches siliceuses (grès et conglomérats), espèce mésohygrophile, héliophile, chionophile, psychrophile, acidophile, Brche, sur des plateaux alpins de haute altitude (Bucegi, Retezat); aux Alpes, entre 1850 et 3000 m s. m. dans les Carpates de Roumanie entre 2200 et 2420 m s. m., dans des stations aux intenses éléments climatiques.

Du point de vue bryocénologique et phytocénologique, étudiée par nous dans 3 relevés de l'étage alpin supérieur des Monts Bucegi, où *Conostomum tetragonum* est associé dans toutes les notations, à des éléments muscinaux caractéristiques (I) codominants, qui délimitent sa bryocénose: *Anthelia juratzkana* (1.2-3.4), *Diphyscium foliosum* var. *alpinum* (1.2-3.4), *Marsupella brevissima* (varians) (1.2-1.3), *Paraleucobryum enerve* (+.2-1.3), *Gymnomitrium concinnum* (+.1-1.2), *Nardia scalaris* (+-+.2) et autres étant notées aussi parmi les Bryophytes une série d'éléments caractéristiques (II) tel *Polytrichum juniperinum* (+.1-1.2), *Racomitrium canescens* (+-+.2) *Lophozia sudetica* (+-1.2), *L. hatcheri* (+), *L. ventricosa* (+) et autres y compris en compagnie, de même que certaines espèces de lichens et d'algues (Tr. I. Ștefureac, 1955), tabl. 2, p. 599). Phytocénologiquement sont notées: *Primula minima* (2.3-3.4), *Salix herbacea* (1.2-2.2), *Carex curvula* (+-1.1), *Loiseleuria procumbens* (+.1), *Festuca glacialis* (+), *F. supina* (+), *Luzula spicata* (+), *Saxifraga bryoides* (+) et autres constituant en ensemble l'association avec *Conostomum tetragonum* (*C. boreale*) Ștefureac 1955, délimitée écologiquement et cénologiquement et que nous actualisons, cénotaxonomiquement comme association *Conostometum tetragonae* Ștefureac 1986.

Quant à l'aire, le genre *Conostomum* Sw. a 13 espèces répandues dans les régions arctiques et antarctiques des deux hémisphères; il est représenté dans les hautes montagnes d'Europe bien que par la seule espèce *Conostomum tetragonum*, comme dans l'Europe Centrale (Alpes, Carpates, Tatra, Carpates méridionales de Roumanie et surtout dans les pays du Nord et de l'ouest de continent, en Asie et en Amérique septentrionale.

Cette espèce constitue un élément boréal relicté arctique alpin, limité à la zone alpine et nivéale des hautes montagnes, bien connue dans les zones arctiques et antarctiques ayant fréquemment des sporogons.

Conostomum tetragonum est considérée parmi les espèces arctiques-alpines, formant rarement des sporogones en Europe, avec migration nord-sud, remontant (d'après J. Amann, 1928) à la première époque post-glaciaire. On peut admettre que, à la suite de la dernière glaciation, cette espèce s'est conservée comme relicté glaciaire arctique-alpin dans les Carpates de Roumanie (Bucegi), dans des stations à d'intenses phénomènes de glaciation, existant peut-être aussi dans d'autres massifs de haute altitude (Ștefureac, 1955, 1963), fait confirmé par la découverte de ce relicté, également dans une station d'altitude des Monts Retezat (E. Plămadă, (1974, 1975, 1977).

La valeur bryogéographique des espèces rares dans les Carpates de Roumanie, *Plagiobryum demissum* et *Conostomum tetragonum*, qui représentent des éléments boréaux arctiques alpins relictaires, signalés tout à fait sporadiquement dans la bryoflore des Carpates de Roumanie (Car-

pates méridionales) et seulement dans le deux massifs à haute altitude (Bucegi et Retezat) caractérise la végétation muscinale non seulement du point de vue bryogéographique et cénologique, mais aussi en général, par leur signification phytogéographique historique, leur flore et leur végétation. À remarquer en même temps le fait que les deux espèces ont été signalées dans des stations appartenant aux réserves naturelles de deux massifs carpatiques de Roumanie, en enrichissant leur génofonds floristique.

Reçu le 26 septembre 1989

Progress in Plant Cellular and Molecular Biology, Proceedings of the VIIth International Congress on Plant Tissue and Cell Culture, Amsterdam, The Netherlands, 24 — 29 June, 1990, edited by H. J.J. Nijkamp, L.H.W. Van Der Plas and J. Van Aartrijk, Kluwer Academic Publishers, Dordrecht-Boston-London, 810 p., 1990

The Proceedings contain the full text of 120 key-notes and plenary lectures that have been orally presented in Amsterdam. They provide the specialists with the new findings in the field and draw the possibilities of the future development in the plant cell and tissue culture techniques. From the crop melioration to the molecular biology, a lot of theoretical and applicative studies were presented in 4 different sections.

A. *Genetic Manipulation and Propagation* — includes 46 papers about plant regeneration via the meristem, ovary, anther, pollen, callus, cell suspension or protoplast culture. Of special interest are the results of the genetic transformation, leading to herbicides, antibiotics or disease resistant plants. The partial genome transfer by somatic hybridization was also studied and successful results were registered in some species as potato, tomato, tobacco etc.

B. *Morphogenesis and Metabolism* — presents 36 papers focussed on the elucidation of the mechanism of the lipid, protein and enzyme biosynthesis during the somatic embryogenesis. Some molecular, physiological and biochemical aspects are analysed in non-embryogenic and embryogenic cell or callus lines, phenomena which are associated with cell division, cell elongation and morphogenetic process.

C. *Secondary Metabolites* — includes 34 very interesting papers, all of them giving solutions for the improvement of the production of secondary metabolites. Using the elicitors, immobilized cell and organ transformed cultures, the scientists reported better results with more than 15 species. The bioconversion, the identification of some new products, their transport and accumulation in cell or tissue culture and the strategies for the industrial applications are also presented.

At least, Section D-*Biotechnology and Developing Countries* — refers to the prospects of plant cell and tissue culture applications in the developing countries, presenting the impact of biotechnology on their industry and agriculture.

Tatiana Onisei

DONIȚĂ N., CHIRIȚĂ C., STĂNESCU V. (edited by, *Tipuri de ecosisteme forestiere din România* (Forestry ecosystem types in Romania), Centrul de Material Didactic și Propagandă Agricolă, București, 1990, 389 p.

The work represents the results of a numerous and competent team made up of silviculturists, pedologists, biologists, (H. Almășan, C. Arion, S. Armășescu, C. Bindiu, V. Caracș, I. Ceianu, C. Chiriță, Gh. Coldea, A. Costea, N. Doniță, I. Florescu, Viorica Honciuc, Doina Ivan, T. Ivansch, V. Leandru, V. Mihăciuc, N. Nanu, Liliana Oromulu, V. Pașcovici, N. Pătrășcoiu, Mihaela Paucă-Comănescu, V. Pop, A. Popescu, Iuliana Popovici, C. Rang, C. Roșu, V. Sanda, I. Secăleanu, P. Scutăreanu, V. Stănescu, Aurica Tăcină) that succeeded to reveal both a synthesis in the field of the forestry ecosystemic typology in Romania and a valuable scientific paper of a larger interest (theoretical and applied ecology, environment protection, geobotany and phytocoenology, etc.)

After a brief presentation of the history of forest classification systems, in general, as well as in Romania, the authors define extremely clean the ecosystemic conception, the way it has been applied in our forestry ecosystemic typology, the theoretical premises and the criteria that stood at the basis of defining the ecosystemic types.

REV. ROUM. BIOL.—BIOL. VÉGÉT., TOME 36, N^{os} 1—2, P. 117—119, BUCAREST, 1991

The fact that the authors of the work naturally adopted the qualitative estimation in the line of classification, respectively and not in that of a quantitative setting in order which does not watch the forestry formation in the temperature zone is a significant and praiseworthy fact that should be appreciated. This means has led to the outlining of the main typological units: of superior rank (the forestry ecosystemic structure), fundamental (the forestry ecosystem type) and of inferior rank (the geographic variant of the forestry ecosystem type). Determinant components of the station factors (groups of humification) were added to the basis criteria.

Codification criteria as well type characterization are well established and contain even more new qualitative elements in the activities of typification of vegetal cover. The work has approached not only the units of natural forests but also the problem of glades of derived and artificial forests, the problems of age stadia and transitions which led in the end to the achievement of a complex and complete paper opening large outlooks in the development of forestry typology in Romania.

The greatest part of the volume deals with the description of the main types of forestry ecosystems as it represents the part with the highest volume of work and the highest original quality. At the end of the paper the authors have added a series of lists and synthetic tables that also bring along a lot of new elements of great use both for the silviculturists and for a large circle of experts in the field of biology and vegetal ecology.

N. Român

GIURGIU V. (ed), *Fundamente ecologice pentru silvicultură și praticultură*, (Ecological foundation for silviculture and praticulture) ICAS, Centrul de Material Didactic și Propagandă Agricolă, 1990, 200 p.

The volume has come out as a synthesis of opinions of different ecology, biology, silviculture, praticulture, pedology experts gathered in order to comment on the subjects announced above at the scientific session organized by the Ecological Committee in Romania, in September 1988. As a result, all the materials presented require an ecological foundation of the whole activity of maintenance and operation of forests and pastures of Terra, implicitly in Romania. All these results from the primordial character of forests and pasture — that of terrestrial ecosystem — where the two subsystems, biocoenosis and biotope (station), are to be found in a close interdependence and mutual conditioning. The large body of authors, by personal experience and ample documentation concretizes each separately in their speciality the report between ecology and economy. For example, N. Doniță shows that the new forestry typology on ecosystemic basis grounds forests careful management on nature laws and impedes adopting unlike measures. I. Florescu, D. Târziu present the ecological directions of the silviculture towards a natural regeneration of the forests as well as towards works of maintenance and management of it with results in constituting the "gardened" forest based on ecological arguments such as the use of autochthonous genetic elements, valuable and varied well, adapted to environment conditions specific to our forests or obtainance of efficient forest structures stable and resistant by copying those in the natural or seed-regenerated forests. Parallel to these general problems of the forestry ecology to which those concerning the natural equilibrium in the ecosystem are added: (V. Soran, I. Puia), the nature protection (V. Soran, Margareta Borcea, V. Giurgiu), the forest pollution (M. Ianculescu, Al. Tisescu), forest protection and pest danger (P. Scutăreanu), forest restoration on degraded soils (C. Traci), problems of details on forestry ecosystem are dwelled upon: the ecophysiology of the seedling of dominant trees, the part played by the herbaceous layer in the selfregulation of the forestry ecosystem (Mihaela Paucă-Comănescu, Aurica Tăcină) or the accumulation of radionuclides from uncontrolled emissions (A. Popa, O. Constantinescu). The forestry soil as well as the agricultural one with specific degrading problems, monitoring (C. Răuță, Șt. Cirstea and C. Roșu) were discussed too.

Pratological problems are less dealt with; they reduce to V. Cardașol's contribution referring to the ecological groups of species that make the pasture in Birsă Depression. More theoretical is A. Covacs' article concerning the origin of adaptation of the grassy populations as starting point in choosing the mixture of seeds used in the sowing of artificial meadows correlated with the indicator value of certain praticol plants used in the improvement of profile technology.

In the end, as a completion of the complex image of the ecology as part of the human economy, N.N. Constantinescu and M. Petrescu analysed the ecological functions of the forest from the point of view of economy.

By dwelling on different aspects of forestry and praticol ecological ecosystems in a logical scientific joining the volume has a unitary aspect although it presents independent contributions of different experts achieving thus an extra value.

Ecaterina Fodor

EUGENIA ELIADE, *Monograph on Erysiphaceae in Romania*, Acta Botanica Horti Bucurestiensis, 1989 — 1990, București, 1990, page 107 — 574, 4 tables, 45 figures, 28 plates.

The name of Eugenia Eliade Dr. doc., a close disciple and collaborator of the great scientist Traian Săvulescu, is well known in the Romanian and international mycology. The specialists who have waited for a long time for a monograph on Erysiphaceae are quite sure now they are confronted with an exceptional achievement. And, actually, after a 35 year work, Eugenia Eliade succeeded in printing a volume of great scientific value, both for the critical analysis of this interesting group of fungi and the great original contribution to the knowledge of Erysiphaceae in Romania.

The work is divided into two parts, the content of which will be referred to in the lines below.

In the first part of the book, based on an exhaustive documentation and personal research knowledge, the author deals, within an organical structure, with aspects regarding the morphology and ontogeny of these fungi, the relations between Erysiphaceae and their hosts Erysiphaceae and other parasites, with the geographical distribution of Erysiphaceae as well as with their taxonomy and systematics.

Thus, within the chapter dealing with the morphology and ontogeny of Erysiphaceae we can find data on the mycelium, the fixation and absorption organs, the asexual and sexual organs, the overwintering, the perpetuation, parasiting features and biological specialization of these fungi. Within the next chapter, the relations between Erysiphaceae and their hosts are analysed, taking into account the susceptibility and resistance reactions, then the relations between Erysiphaceae and other parasites, a short presentation of the relations between Erysiphaceae, viruses, phytopathogenous bacteria, and other fungi being made, and on that occasion the phenomenon of mycoparasitism as well as the fauna accompanying these fungi is analysed.

Then the geographical distribution of Erysiphaceae, the analysis of the numerical composition of these fungi within Romania's flora, the influence of the environmental (biotic and abiotic), factors on Erysiphaceous fungi are presented. The problem of Erysiphaceous taxonomy is discussed starting with Linné, who described the first erysiphaceous fungus, up to the present, when a complex of morphological, physiological and biochemical factors must be taken into account in order to describe a species.

The second part of this monograph includes the general characteristics of the Erysiphaceae order, of the Erysiphaceae family, the keys to determining the sub-families, sections, genera and species and a biogeographical material is presented. There are presented, for each species, the (selective) literature, synonyms, diagnosis, their distribution throughout the world and in Romania. Until January 1989, within the mycological flora of Romania, the known Erysiphaceae belonged to 12 genera, 147 species parasiting, 1,272 taxons (species, sub-species, varieties, forms) of 419 genera, of 76 angiospermous families. The author's contribution to the knowledge of Romania's Erysiphaceae is great, Mrs. Eugenia Eliade devoting, in fact, almost all her life scientific activity to the knowledge of this group of fungi, being thus one of the world outstanding specialists in Erysiphaceae.

The work, shortly presented by us, will be a source of ample documentation for all mycologists in Romania and other countries, as well.

Alexandru Manoliu
Taliaha Șesan

AVIS AUX AUTEURS

La « Revue roumaine de biologie — Série de biologie végétale » publie des articles originaux d'un haut niveau scientifique, de tous les domaines de la biologie végétale : morphologie, systématique, géobotanique, physiologie, écologie, génétique, microbiologie, phytopathologie. Les sommaires des revues sont complétés par d'autres rubriques, comme : 1. *La vie scientifique*, qui traite des manifestations scientifiques du domaine de la biologie : symposiums, conférences, etc. 2. *Comptes rendus* des livres de spécialité parus en Roumanie. Les auteurs sont priés d'envoyer leurs articles, notes et comptes rendus dactylographiés en deux exemplaires. Les tableaux et l'explication des figures seront dactylographiés sur pages séparées et les diagrammes seront exécutés à l'encre de Chine noire, sur papier calque.

Les tableaux et les illustrations seront numérotés avec des chiffres arabes. La répétition des mêmes données dans le texte, dans les tableaux ou dans les graphiques sera évitée.

Les références bibliographiques, citées par ordre alphabétique, comporteront le nom de l'auteur, l'initiale du prénom, le titre de la revue abrégé conformément aux usances internationales, l'année, le tome, le numéro, la page. Les travaux seront accompagnés d'un court résumé de maximum 10 lignes, en anglais. Les textes des travaux ne doivent pas dépasser 7 pages dactylographiées (y compris les tableaux, la bibliographie et l'explication des figures). La responsabilité concernant le contenu des articles revient exclusivement aux auteurs.