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SOMMAIRE

REV. ROUM. BIOL. — BIOL. VÉGÉT., TOME 31, N° 2, P. 83—168, BUCAREST, 1986

NEW DATA ON THE ANATOMY OF THE ROOT OF *PISTIA STRATIOTES* AND *EICHHORNIA CRASSIPES*

G. DIHORU

The longitudinal septa among the aeriferous channels at the root of *Pistia stratiotes* L. and *Eichhornia crassipes* (Mart.) Solms are evidently different: in the first species they are simple, in the second they have a special structure. Worthy of mention are the large vertical parenchymatic cells closed together at the ends where they include small rigid horizontal cells, which seem to be osteosclerites, displayed in a network playing mechanic role.

The anatomy of the root of aquatic species is relatively similar because of water, the dominant ecological factor. As it was previously noticed (2) in *Pistia stratiotes* L. and now in *Eichhornia crassipes* (Mart.) Solms the structure of their root is included in the general diagram : well-developed and differentiated cortex, outside a parenchyma without intracellular spaces, in the middle numerous aquiferous channels separated by walls of only one cellular layer; in cross section it is displayed from end to end, with larger cells inside and constant rhombic and dense intercellular spaces. In the middle there is a central cylinder.

The cross section of the root does not present, however, some structures which we noticed when examining laterally the longitudinal septa of the central cortex, that is by practicing a radial section or detaching the unistratified septa with a spatulated needle. Tangent sections were also performed for interpretation.

Laterally examined, the longitudinal septa reveal wholly different structures in the two species : simple for *Pistia stratiotes* and complex in *Eichhornia crassipes*.

a. The *simple septa* have a structure typical of the epidermic one, being formed of narrow, long cells, palisadic displayed, horizontally from the center to the periphery (Fig. 1). Some of them can be more intensely

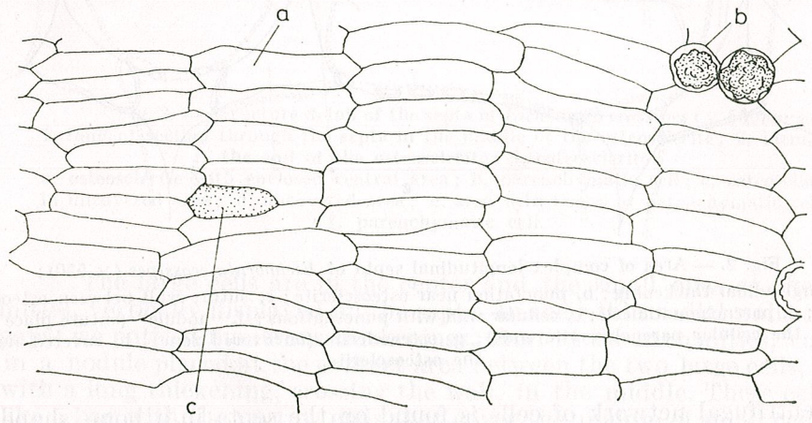

Fig. 1. — Simple longitudinal septa in *Pistia stratiotes* (× 280); a, parenchymatic cell ; b, cell with druse of calcium oxalate ; c, intensely stained cell.

stained (with methylene blue). The cells are of the following sizes, 58.6—112.2/10.2—30.6 μ. If the root is thin, the cells are shorter and wide on the septa; besides the main cells some with round shape of about 30 μ, full with druses of calcium oxalate, as well as long cells which cross the septa reaching the two neighbouring channels (idioblasts), full with raphides of calcium oxalate are noticed. Apically viewed (from the extremities) they seem to have a round or elipsoidal shape.

b. The *complex septa* have a special construction, hard to interprete as there is no other model in the literature. They are made of two elements : small cells weakly sclerified and large parenchymatic cells (Figs 2, 3).

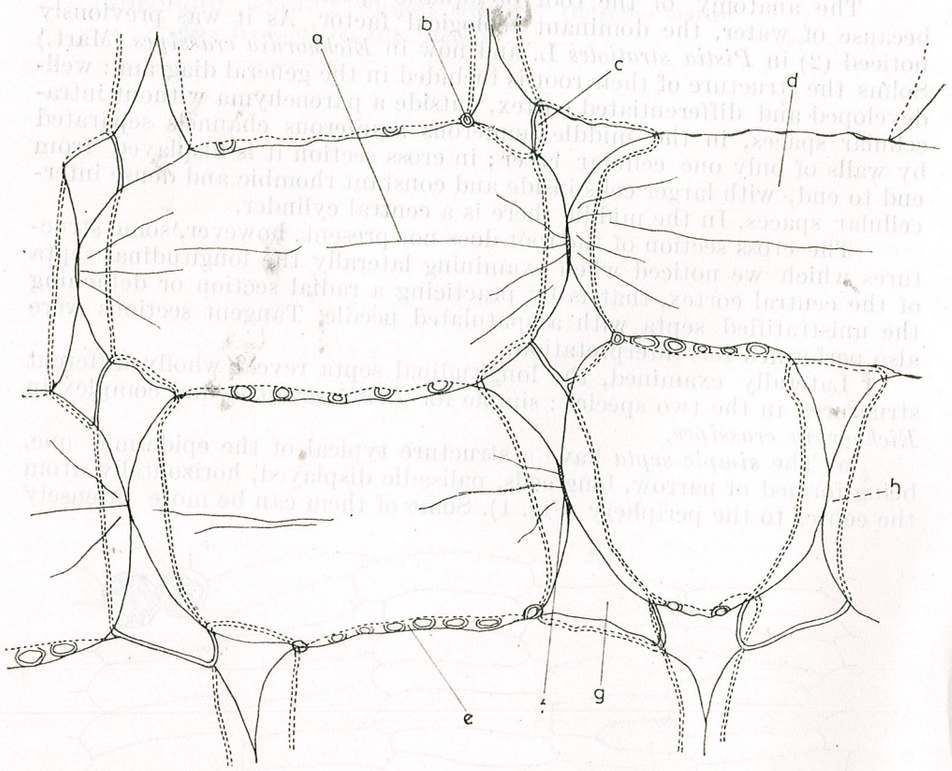

Fig. 2. — Area of complex longitudinal septa of *Eichhornia crassipes* (× 550);
a, longitudinal thickening; b, punctation near osteosclerite; c, suture wall between osteosclerites; d, parenchamatic cell; e, cellular wall with punctuations; f, "nodule" (suture place between the cellular parenchymatic ends); g, osteosclerite (uncovered zone); h, covered area of the osteosclerite.

A centrifugal network of cells is found on the septa in a bone shape or arrow, half-moon, reeling device or T, closed together at the extremities and horizontally displayed (Figs 4—7). This network overlaps the contact areas between parenchymatic cells. They seem to have a mechanical

role, to rigidify the septa and to preserve their fixed position lest the lumen of the channel should be hurt and consequently the air stock. These cells have thicker and stiffer walls. As to their role, they seem to be analogous to the stellate cells in other aquatic plants (*Nymphaea alba* L.) (1), (6). The cellular wall in the contact area with the neighbouring parenchymatic cells presents punctuations (Fig. 2).

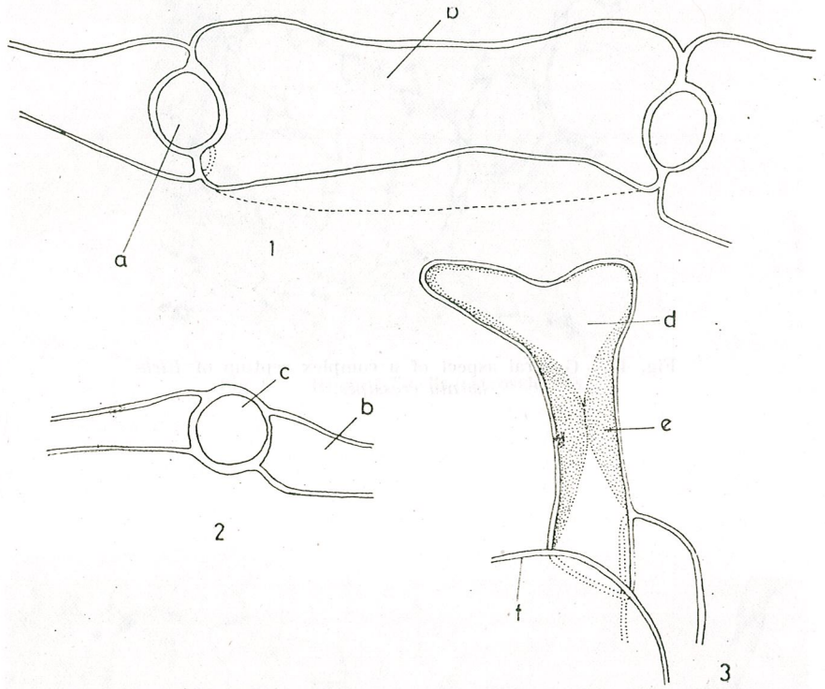

Fig. 3. — Structure detail of the septa of *Eichhornia crassipes* (× 550);
1, tangent section through the septa in the middle of the osteosclerite; 2, idem, at the end of the osteosclerite; 3, osteosclerite;
a, osteosclerite with enclosed central area; b, parenchymatic cell; c, osteosclerite in uncovered area; d, uncovered area; e, area with traces of parenchymatic cells; f, parenchymatic cell.

The large cells are in the center and the small ones at the extremities, vertically displayed on the septa. In their thin radial walls (to two gaps) we noticed numerous thickenings, short at the extremities, collected in a nodule placed at the contact area between the two large cells, always with a long thickening, crossing the wall, in the middle. These cells look like a bag with the narrow ends that cover the middle of small cells. This is the reason why the small cells appear as a closed tube between the ends of two large cells and covered only partially to extremities (Fig. 3). The tangent walls (between two large cells) have numerous punctuations.

The sizes of the small cells are in general 96—114.6/25.5—28 μ.

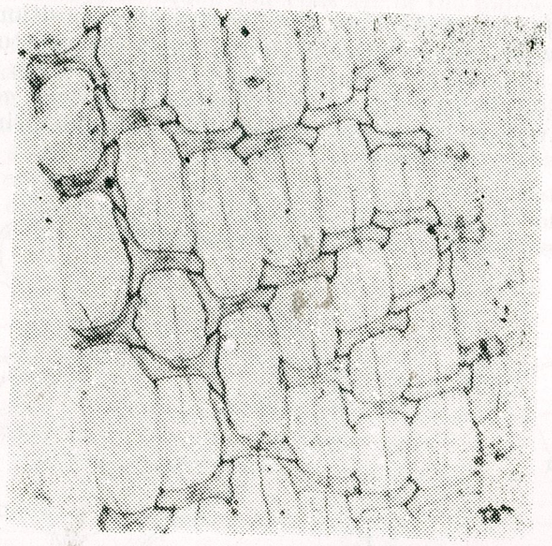

Fig. 4. — General aspect of a complex septum of *Eichhornia crassipes*.

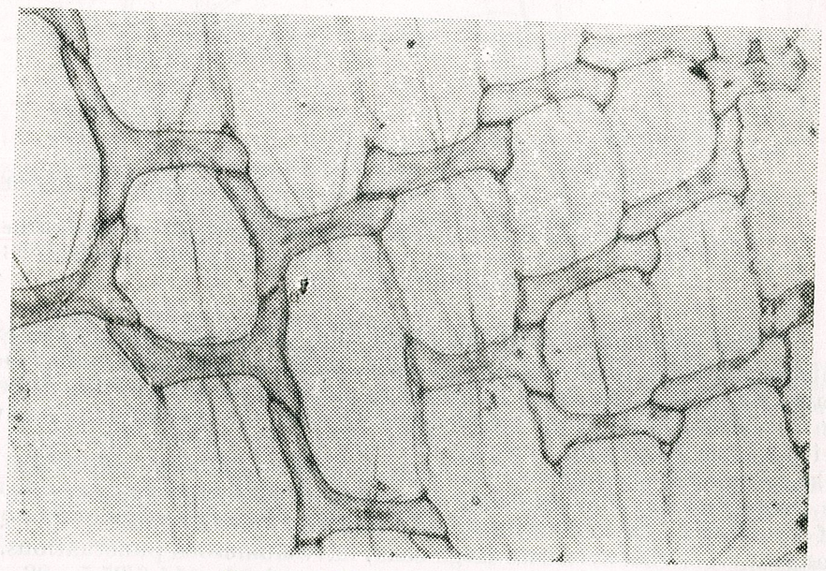

Fig. 5. — Area of the same septum.

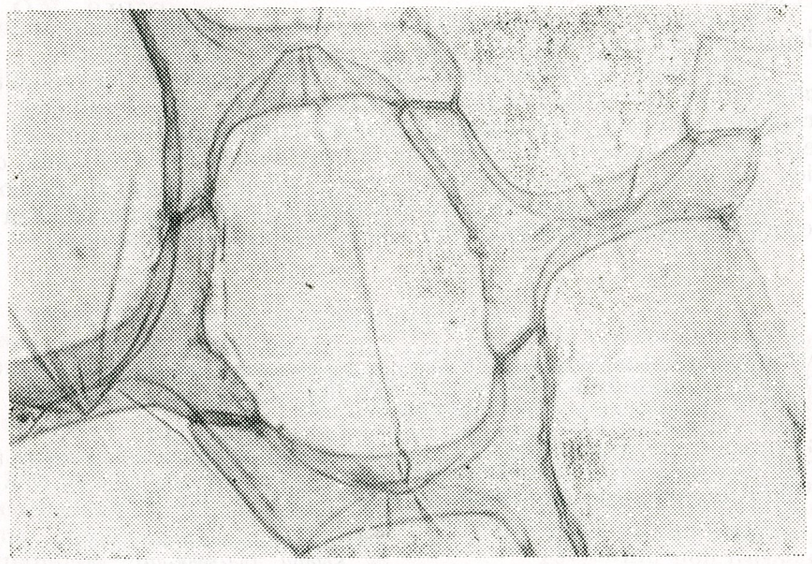

Fig. 6. — Ring of T-cells (osteosclerites).

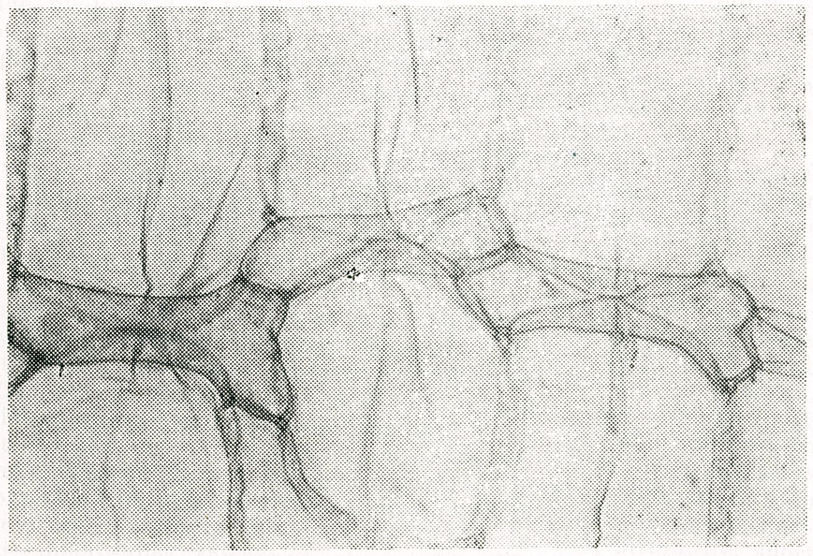

Fig. 7. — Cell range in a bone shape (osteosclerites)
(Photo by H. Tiţu)

The large cells are of a larger size and more variable, mainly in terms of length, 68.8—158.1/66.3—81.6 μ.

In the septa of *Eichhornia crassipes* the idioblasts of the type *Pistia stratiotes* were not noticed excepting the longer cells, with round ends, full of raphides. No cells with druses as in the simple septa were noticed. By stretching the septa, the parenchymatic cells detach from the small ones which are more rigid, leaving visible traces when examined microscopically. Because of the walls rigidity the small cells may be included in the category of sclereids perhaps even osteosclereids (osteosclerites).

REFERENCES

1. ANDREI M., *Anatomia plantelor:* Ed. didactică şi pedagogică, Bucureşti, 1978.
2. DIHORU G., DIHORU A., St. Cerc. Biol., Seria Biol. Veget. 36 (1): 3—19, 1984.
3. ESAU K., *Anatomia rastenii.* Izd. "Mir", Moscow, 1969.
4. FAHN A., *Plant anatomy* (Second ed.). Pergamon Press, Oxford, 1977.
5. GAYRAL, P., VINDT J., *Anatomie des végétaux vasculaires,* 1, 2. G. Doin & Cie, Paris, 1961.
6. TARNAVSCHI T. et al., *Practicum de morfologie şi anatomie vegetală.* Bucureşti, 1974.
7. WEBER H., Abh. Akad. Wiss. Mainz, math.-nat. Kl. 6: 134—161, 1950.

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A NEW *EPIPOLAEUM* (DIMERIACEAE, ASCOMYCETES) ON *BRUCKENTHALIA SPICULIFOLIA* (SALISB.) REICHENB. (ERICACEAE) FROM ROMANIA

A. RICHIŢEANU * and G. NEGREAN **

Epipolaeum bruckenthaliae A. Richiteanu et G. Negrean occurring on *Bruckenthalia spiculifolia* (Salisb.) Reichenb. (Ericaceae) from Romania is described and illustrated as new.

During the study of parasitic fungi on *Ericales* in Romania, an *Epipolaeum* occurring on *Bruckenthalia spiculifolia* (Salisb.) Reichenb. apparently not referable to any existing species, was collected. Its morphological characters are considered sufficiently distinct to describe it as a new species.

Epipolaeum bruckenthaliae A. Richiteanu et G. Negrean sp. nov. Figs 1, 2; Pl. 1. Maculae nullae. *Mycelium* paucum, superficiale vel raro intracuticulare, ex hyphis pallide brunneis, septatis, 2—3 μm latis compositum. *Ascocarpi* discreti, solitarii, globosi vel pyriformi, non ostiolati, brevipapillati, 70—130 μm crassi, 70—150 μm alti, in dimidio superiore setosi; paries ascocarpi 2(—3) stratosus, 7—10 μm crassus, e cellulis brunneis, applanatis, polygonoidibus, extra obscuris et crassoparietalibus compositus; setae numerosae, castaneae, rectae vel curvatae, rigidae, 20—80 μm longae, apice versus attenuatae. *Asci* octospori, clavulati vel leniter saccati, bitunicati, breviter stipitati, membrana sursum inspissata, 30—45 × 10—13 μm; pseudoparaphyses numerosae, filiformes, septatae, hyalinae, 1—1.5 μm crassae. *Ascosporae* plus minusque biseriatae, primo hyalinae, deinde dilute virides, leves, ellipsoideae vel obclavatae, utrinque rotundatae, circa vel paullo infra medio septatae et leniter constrictae, cellula superiore leniter longiore et latiore, 11—15 × 4.5—6 μm. *Anamorphosis* ignota.

Hab. in foliis et caulibus vivis et languidis *Bruckenthaliae spiculifoliae* (Salisb.) Reichenb., distr. Prahova, in pratis subalpinis montium Bucegi prope "Cabana Piatra Arsă", 45°23′...N, 25°29′...E alt. cca 1900 m.s.m., 28.VII.1970, leg. A. Richiţeanu, BUCM 82.701, holotypus.

Leaf spots none. *Mycelium* reduced to a few radial superficial or rarely intracuticular, 2—3 μm wide hyphae, septate every 7—30 μm. *Ascocarps* superficial, visible as minute black dots, borne on the hyphae, readily loose, scattered, free from each other, globose to pyriform, with a short papillate apex but without a distinct ostiole, 70—130 μm in diam., 70—150 μm high, setose in the upper half; wall 2(—3) layered and 7—10 μm thick, composed of polygonal, flattened, brown cells with walls which become thicker and darker towards the outside of the ascocarp; setae numerous, chestnut brown, septate, straight or curved, rigid, 20—80 μm long, base 5—8 μm wide, gradually tapered towards the subacute to rounded apex. *Asci* 8-spored, clavulate to slightly saccate, bitunicate, short stalked, membranes thickened above, 30—45 × 10—13 μm; pseudo-

paraphyses numerous, mostly filamentous, septate, hyaline, 1—1.5 μm diam. *Ascospores* biseriate or nearly so, hyaline when young, pale greenish when mature, wall smooth, ellipsoidal or obclavate, with rounded ends, two-celled, the distal cell 0.5—1.5 μm longer and 0.5—1 μm broader than the basal one, slightly constricted at the septum, 11—15 × 4.5—6

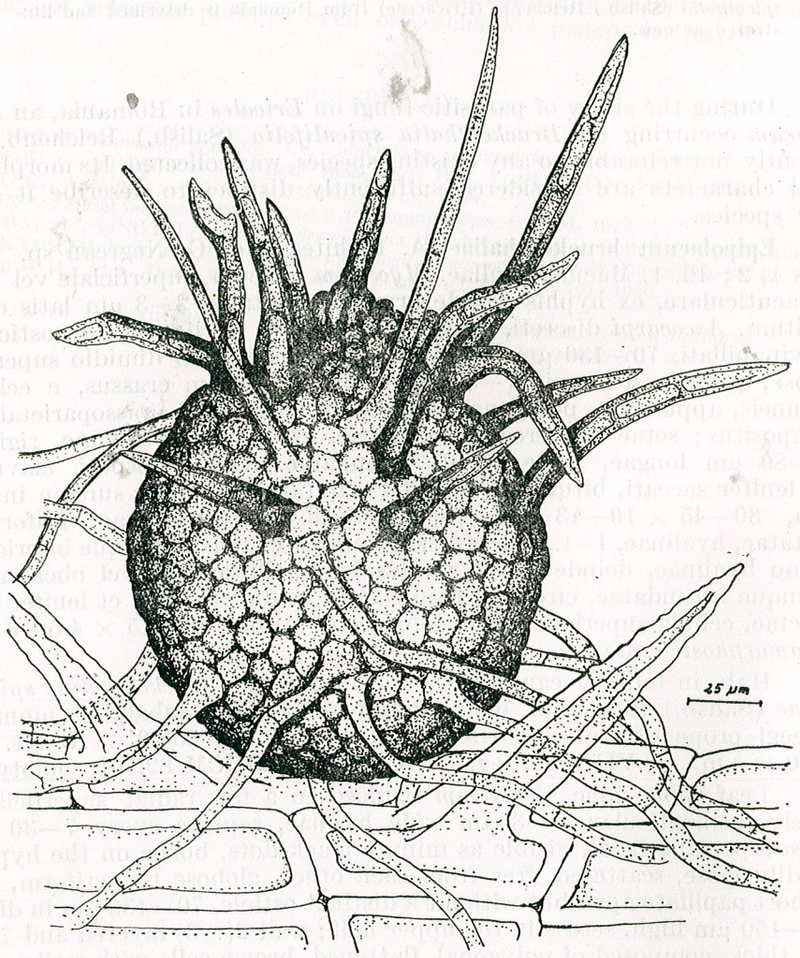

Fig. 1. — Ascocarp and superficial mycelium sitting on leaf surface.

μm. *Anamorph* unknown. On living and dying leaves and twigs of *Bruckenthalia spiculifolia* (Salisb.) Reichenb., Prahova county, in subalpine pastures of the Bucegi Mts near "Cabana Piatra Arsă", 45°23′ ...N, 25°29′ ...E, alt. circa 1900 m, 28.VII.1970, A. Richiţeanu, BUCM 82.701, holotype.

Specimens examined : ROMANIA : Suceava county : Dealu Gârbeni (BUCM 95.889). *Munţii Apuseni* : Muntele Peana (BUCM 95.890); Muntele Scărişoara-Belioara (BUCM 95.891, 95.892); Muntele Mare (BUCM 95.893); between Gaureasa and Dameş (BUCM 82.707); propre Cabana Băişoara (BUCM 82.704). *Munţii Cindrel* : Răşinari (BUCM 95.894);

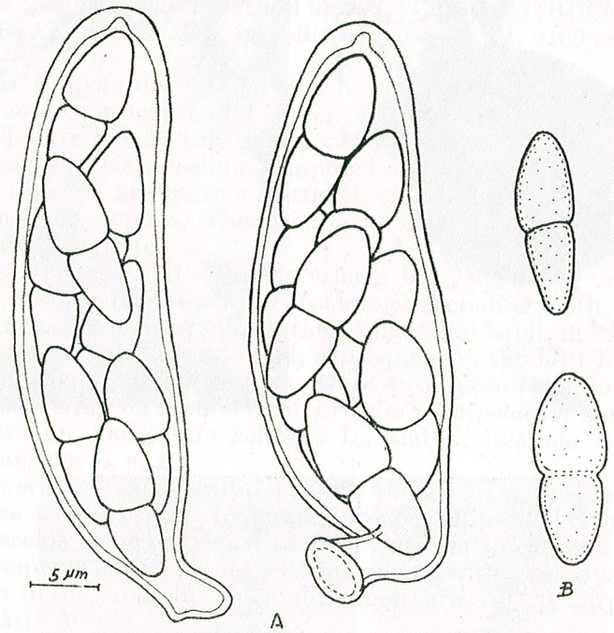

Fig. 2. — A — Asci ; B — Ascospores.

Păltiniş (BUCM 95.895); Iezerul Mare (BUCM 95.896). *Munţii Parîng* : Muntele Parîng (BUCM 95.897, 95.898, 95.899); supra Rînca (BUCM 82.702); Muntele Buliga (BUCM 95.900). *Munţii Căpăţînii* : Muntele Năruţ (BUCM 95.901, 95.902); prope Balneas Olăneşti (BUCM 95.903); Muntele Galbenu (BUCM 95.904). Muntele Cozia (BUCM 95.905, 95.906); Poiana Bobolea (BUCM 95.907); vîrful Cozia (BUCM 95.908); Izvorul Armăsarului (BUCM 95.909). Dealul Negru, Plaiul Vătafului (BUCM 95.910); Muntele Pârcălabul (BUCM 95.911). *Munţii Făgăraş* : Fruntea Moaşii (BUCM 95.912). Muntele Zănoaga-Muscel (BUCM 95.913). Munţii Iezer-Păpuşa : Muntele Iezerul Mare, Valea Jepilor (BUCM 82.705); Muntele Colţii lui Andrei Mari (BUCM 82.706). *Munţii Perşani* : Vlădeni-Codlea (BUCM 95.914). *Munţii Bîrsei* : Muntele Ramuri prope Braşov (BUCM 95.915 & 95.916); Hangenstein prope Braşov (BUCM 95.917); Muntele Piatra Mare, prope cacumen (BUCM 92.987); inter Piatra Mare et Predeal (BUCM 92.986). *Munţii Bucegi* : (BUCM 95.918); latura transilvăneană (BUCM 95.919); Muntele Bucşoiu, Brîna Caprelor (BUCM 95.920); Pîrîul Vîlcelul spre Cocora (BUCM 95.921); inter Piatra Arsă

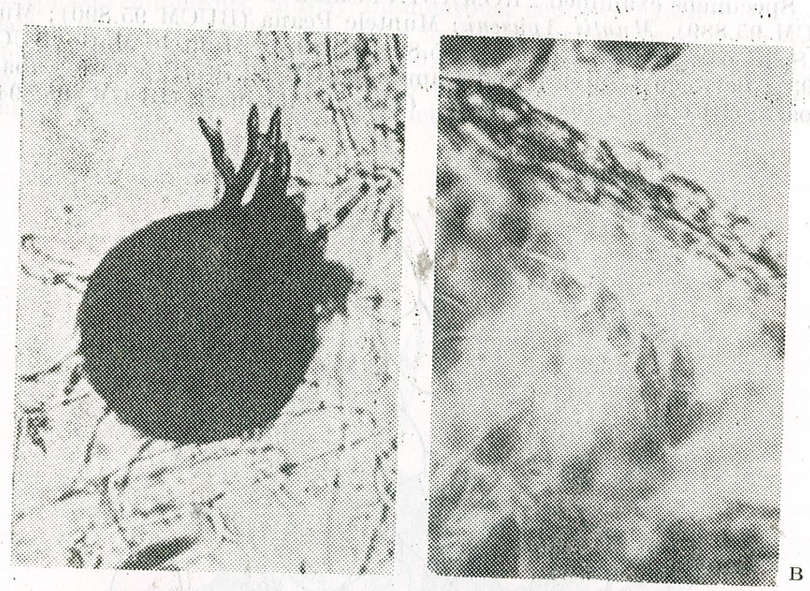

Plate 1

A — Whole mount of mature ascocarp.
B —Part of vertical section of ascocarp showing the wall structure and an ascus (stained in lactic blue).
C — Mature asci with spores (in lactic blue).

et Peștera Ialomiței (BUCM 82.703); Muntele Piatra Arsă (BUCM 95.922); prope Cabana Piatra Arsă (BUCM 82.801 — HOLOTYPE); prope Poiana Stînii (BUCM 95.923); Muntele Jepi (BUCM 95.924&95.925); Muntele Jepii Mici, Cascada Urlătoarea (BUCM 95.926); Valea Urlătoarei ut Piatra Arsă (BUCM 95.927); Muntele Furnica (BUCM 95.928&95.929); Valea Izvorul Dorului (BUCM 95.930); Muntele Păduchiosul (BUCM 95.931). *Munții Gîrbovei*: Muntele Turcu (BUCM 95.932); Cumpătul (BUCM 95.933)

BULGARIA: Montes Rila, in vallis Sara-Ghiol, alt. 2100 m (BUCM 95.934).

The genus *Epipolaeum* was erected by Theissen and Sydow (1918, p. 7) for *E. irradians* on leaves of *Liabum*. As defined by Müller and von Arx (1962) and Farr (1965), this genus includes epiphytic fungi developing a superficial reduced mycelium composed of septate, branched, brown hyphae. The ascocarps are quite superficial, thin-walled, smooth or provided with setae or hyphae. The ascospores are hyaline, greenish on brownish, usually 1-septate.

As far as we know, hitherto there have been described 28 species of *Epipolaeum*, recorded from a wide host range including both Gymnospermae and Angiospermae. In spite of their superficial habit, many species of this genus appear to be specific and, consequently, the host has a certain value when defining fungal taxa. Only two species of *Epipolaeum* are known as occurring on members of *Ericales*: *Epipolaeum andromedae* (Rehm) von Arx on *Andromeda polifolia* L., and *E. sulcicola* B. Erikss. on *Empetrum nigrum* L. s. l.

Epipolaeum bruckenthaliae differs from these two species mainly by its larger, setose ascocarps, and by having broader ellipsoidal or obclavate ascospores. It seems to be restricted to *Bruckenthalia spiculifolia* (Salisb.) Reichenb., a frequent native plant in Romania, and with a relatively limited distribution in the subalpine and mountainous areas of the Carpathians, Balkans and Asia Minor.

E. bruckenthaliae is certainly much more common than it appears from the present list of collections; probably it has been overlooked owing to the absence of host symptoms, or not collected for want of interested mycologists in many areas.

REFERENCES

1. ARX, J. A. von, MÜLLER, E., Stud. Mycol. Baarn, 9: 1—159, 1975.
2. CONSTANTINESCU, O., NEGREAN, G., Nova Hedwigia, 38: 741—745, 1983.
3. FARR, M. L., Taxon, 14: 18—21, 1965.
4. FARR M. L., Mycologia, 58: 221—248, 1966.
5. MÜLLER, E., ARX, von J. A., Beitr. KryptogFlora Schweiz, 11(2): 1—922, 1962.
6. SHOEMAKER, R. A., Canad. J. Bot., 43: 631—635, 1965.
7. THEISSEN, F., SYDOW H., Ann. Mycol., 16: 1—34, 1918.

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HORDEUM JUBATUM L. NEW SPECIES FOR THE ROMANIAN FLORA

V. SANDA and A. POPESCU

A new species for the flora in our country *Hordeum jubatum* L. was identified on bank Stipoc in the Danube Delta, during the investigations carried out to give ecological characterisation and to show the evolution of vegetation in some areas subjected to the antropic influence. The species vegetates within the association *Puccinellietum limosae* delimiting the microdepressions occupied by the cenotaxa characteristic for the class *Phragmitetea*, explaining therefore the presence of many moso-hygrophile species previously mentioned by us.

Hordeum jubatum L. Sp. pl. (1753) 85 ; *Critesion geniculatum* Rafin. Journ. Phys. LXXXIX (1819) 103 ; *Critesion jubatum* (L.) Nevski, Fl. U.S.S.R., II (1934) 721.

It is a perrenial plants, densely cespitose organised into compact bushes with many fertile stems and sterile shoots. The culms are relatively thin, glabrous, as tall as 25—50 cm, ascendent and not thicker at the bottom (fig. 1 a).

The stem leaves and those of the offsprings are scabrous both on the vagine and on the blades. The vagines of the stem leaves are longer than the distance between the two nodes. The 3—5 stem leaves are uniformly distributed on the whole stem, the last one being at a distance of 2—4 cm from the spike.

The spike is cylindrical, with a glabrous axis, only the segments edges being slightly scabrous. The spike axis is fragile, easy to break at maturity. Each segment carries three spikelets inserted in the same place. The two marginal spikelets are male and steriles, slightly pedicelated, the pedicel being of 1—1.5 mm. The spikelet in the middle is fertile, sesile and much longer than the two lateral ones.

The glumes, those of fertile spikelets and the sterile ones are aristiformic, as long as 5—7 cm, scabrous on their whole length. In a young stage the glumes are close to the spikelet and at maturity they become squarrose giving the spike a pinnate and extremely decorative aspect (fig. 1 b).

Exterior palea of the lateral spikelets is subulated and ends with an arista as long as 1—1.5 cm, also scabrous on its whole length. The middle fertile flower has a lanceolated exterior palea, as long as 8—10 mm, glabrous in basal half and scabrous in the higher part. It continues with a scabrous aristam as long as 5—6(7) cm, being generally longer than the aristiformic glumes. Interior palea (Lemma) as long as 7—8 mm is covered by the exterior palea.

At the bottom of the fertile flower there is the aristiform rudiment of the second flower which is as long as 3—4 mm.

Hordeum jubatum L. was collected by us (13.07.1985) on the island Stipoc where it grows as bushes, few in number, on the fields wet and poor

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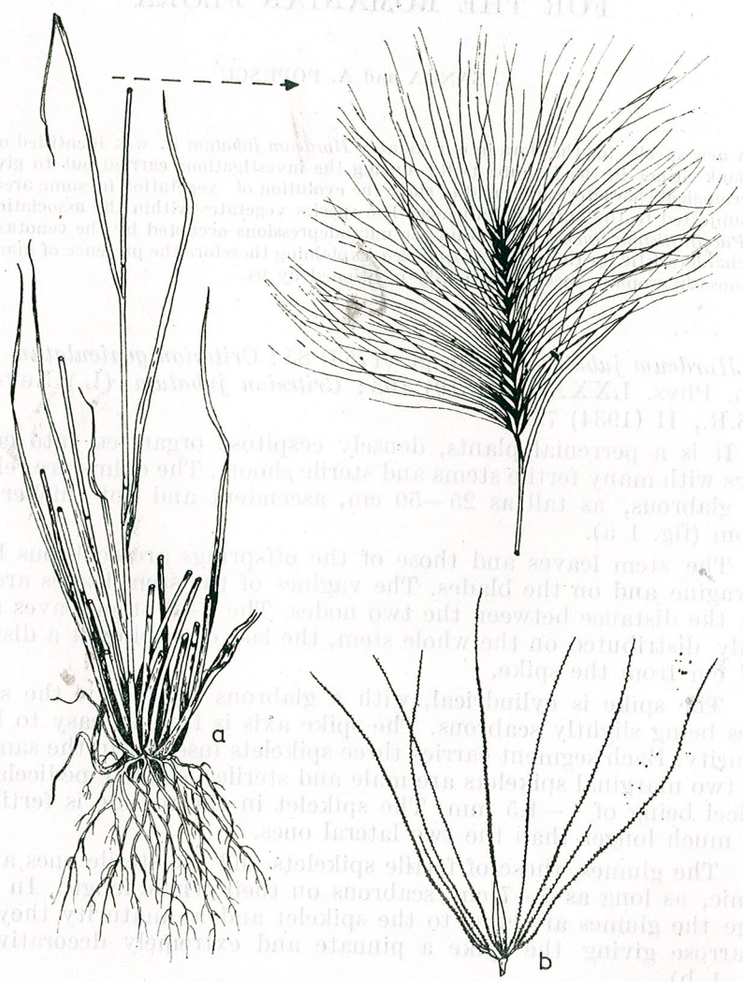

Fig. 1. — *Hordeum jubatum* L.
a) General aspect of the plant ; b) Group of the three spikelets placed on the same node.

in salts, within the association *Puccinellietum limosae* Rapaics 27. The floristic composition of phytocenoses where species *Hordeum jubatum* L. was identified is relatively rich, because within them both species characteristics for class *Puccinellio-Salicornietea* and *Phragmitetea* are favored by the excessive water along the whole vegetation season (table 1).

This taxon, described in Canada and found also in North America and Asia is naturalised also in Central and North Europe, being known

Table 1

Puccinellietum limosae Rapaics 27

Biological form	Floristic element	Number of survey	1	2	3
		Surface (so.m)	150	150	200
		Covering (%)	95	85	95
		Puccinellion limosae + Pucinellietalia			
H	Pn	Puccinellia limosa	4	4—5	4—5
H	Eua(Md)	Aster tripolium	+	+	+1
H	Ec	Lotus tenuis	+		
G	Eua	Aeluropus littoralis	+	+	+
G	Cs	Cynodon dactylon	+	+	+
H	E-Md	Carex distans		+	
		Thero-Salicornion			
Th	E	Salicornia europaea	+	+	+
Th	Cp	Suaeda maritima	+	+	+
		Juncion gerardi + Beckmannion			
G	Cs	Juncus gerardi	+1	+1	+
H	Eua	Trifolium fragiferum	+	+	
		Cypero-Spergularion			
Th	Atl-Md	Spergularia media	+	+	+
		Pucinellio-Salicornietea			
H	Cp	Agrostis stolonifera	+		+
		Phragmitetea			
H	Cp	Juncus articulatus	+	+	
HH-G	Cs	Phragmites communis	+	+	+
HH-G	Cs	Bolboschoenus maritimus	+	+	
HH	Eua	Alisma lanceolatum	+		
H(G)	Cp	Mentha arvensis	+		
		Accompanying species			
H	Eua	Plantago media	+		
Th	Cs	Xanthium strumarium	+		+
H	Cp(Adv)	Hordeum jubatum		+	
H	Eua(Md)	Teucrium scordium	+		
H	Cs	Potentilla reptans	+		

Data and place of surveys : 1, 2, 3-Island Stipoc at 2 km SW of the IAS Farm Periprava department Stipoc.

also in Belgium, Holland, Denmark, Germany, Switzerland, Norway, Sweeden and the North of U.S.S.R. (1—7).

The Danube Delta is the Southern point in Europe for the areal of this extremely spectacular species where it finds favourable conditions of development.

The two plates, representing the material collected by us are found in the Herbarium of the Institute of Biological Sciences of Bucharest (BUCA) recorded under the number 145567 and 145568.

REFERENCES

1. BRITTON N., BROWN A., *An Illustrated Flora of the northern United States, Canada and the British possessions*, New York, 1913, **1**, 287.
2. CLAPHAM R. A., TUTIN G. R., WARBURG F. E., *Flora of the British Isles*. Ed. II. Cambridge 1962, 1160.
3. HEGI G., *Illustrierte Flora von Mittel-Europa*. Ed. München, 1936, 509.
4. HUMPHRIES C. J., *Genul Hordeum* L., in *Flora Europaea*, Cambridge, 1980, **5**, 204—205.
5. LEDEBOUR C. F., *Flora Rossica*, Stuttgartiae, 1853, **4**, 329.
6. NEVSCHII S. A., *Tribul Hordeeae*, in *Flora USSR*, Leningrad, 1934, **2**, 721—722.
7. STANCOV S. S. TALIEV V. I., *Opredelitel vjšhih rastenii evropeiskoi chasti SSSR*, Moscow, 1949, 1043.

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BUCEGIA ROMANICA RADIAN IN RODNA MOUNTAINS, THE ORIENTAL CARPATHIANS IN ROMANIA; ECOLOGICAL, CENOLOGICAL AND CHOROLOGICAL CONSIDERATIONS

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The publication of the monotype genus *Bucegia* Radian with the species *B. romanica* Radian by Sim. Șt. Radian, Bucharest (1903) in the usual place Bucegi Mountains (Vl. Cerbului) was a real bryological revelation in the world. *Bucegia* was unanimously recognised by the bryologists and we focused our attention on it (1940—1986), after it had also been discovered in the Făgăraș (1949) and the Piatra Craiului Mountains (1951) of the South Romanian Carpathians, and recently (1982, 1983) in the first stations of the Oriental Carpathians in Romania — the Rodna Mountains (Pietrosu Rodnei). A chorological diagram with *Bucegia* in the Romanian Carpathians has been presented as well as data on its area generally known till now.

In the Rodna Mountains the stations (2260—2280 m s.m.) with *Bucegia* whose bryocenosis crystalline rocks have been included into ass. *Bucegietum romanicae* Ștefureac 1984 *jungermannietosum sphaerocarpae* subass. nova have been analysed ecologically (climatically and edaphical-pedologically) as well as cenologically (*Bryophyta*, *Cormophyta*).

Bucegia romanica Radian represents both a holarctic element and a subarctic alpine one as well as a tertiary relict with disjunct area which has the south limit of its European area in Romania. Its existence in the Rodna Mountains covers a chorological gap (about 80 years) between the South Carpathians and the Tatra Mountains.

The studies have attested its scientific value in the universal hepaticology and it has been included in the newly created *Bucegioideae* Schuster (1983) subfamily, thus enriching the natural reservations genofound of its area; it has also been proposed to represent a biosphere bryofloristic monument (J. of Bryology, 1982) to honour the memory of the well-known Romanian bryologist, prof. dr. Sim. Șt. Radian.

The bryological investigations at the beginning of the century performed by prof. Sim. Șt. Radian of the University of Bucharest had as main result the discovery and description in the Romanian bryoflora of a new genus and species among the eutalic hepatics *Bucegia romanica* Radian (syn. *Radiania rumaenica* Schiffn. ex Györffy, nom. illeg.)

Caryological investigations : n = 8 mi Eftimiu — Romania; n = 9 Mueller 1954—1957.

Its discovery in the Bucegi mountains, the South Romanian Carpathians (1899), and its publication with the diagnosis (1903)(10) by Sim. Șt. Radian were a real bryological revelation arousing the scientific interest in the world. The holotype of this taxon with the original Schedae was noticed by us in the herbarium of prof. Sim. Șt. Radian in the Botanical Institute of the University of Bucharest (destroyed in 1944).

The thorough study of prof. Sim. Șt. Radian on this hepatic species is based on a careful analysis of female samples, collected by the author (4.VII.1899) instead of the usual place Valea Cerbului in Bucegi mountains as well as the male ones, collected 2 years before by K. Loitlesberger

(21.VII.1987) on the peak Bătrîna also from the Bucegi mountains, mentioned however in the herbarium as *Preissia quadrata* (Scop.) Nees. The female and male gametophytes of this taxon were analysed in detail by Sim. Șt. Radian as regards all morpho-anatomical aspects of the thallus accompanied by numerous images resulting from the monographical paper, under this aspect, published in 1923 (12).

Sim. Șt. Radian has the special merit to have established the intergeneric morpho-anatomical peculiarities with clear differentiations between *Preissia* Corda and *Bucegia* Radian. They consist in the absence in the case of *Bucegia* (different from *Preissia* with which it was for a while mistaken) of assimilatory ("Opuntia-like") filaments in the stomatic aeriferous chambers and the absence of sclerenchymatious fibres from the structure of thallus, and the thallus costa in *Bucegia* (in the cross section) (10), (11), (12) is much more evident and deeper than in *Preissia*.

This hepatic, well known by the famous hepaticologists (V. Schiffner (13), K. Mueller (9)) has preserved its taxonomic description (R. Grolle (4), R. M. Schuster (14), (15)), being recently ascribed to the newly established subfamily *Bucegioideae* Schuster (1983)(15) to fam. *Marchantiaceae* (Bisch.) Lindley and mentioned in the treatises of world hepaticology (Fr. Verdoorn., ed., 1932 (24)).

Rediscovered and investigated under various aspects in many stations, sometimes on the slopes of Bucegi mountains (1940—1976), *Bucegia romanica* Radian was found in other massifs of the South Carpathians : Făgăraș (Tr. I. Ștefureac, 1949) (17) and Piatra Craiului (Tr. 1. Ștefureac, 1951), (18), (20), (22) not being mentioned however in any station of the Oriental Carpathians of Romania, although many bryologists tried to find it in higher mountains (Rodna, Călimani, Ceahlău mountains).

By our recent investigations (1982, 1983) carried out in Rodna mountains species *Bucegia romanica* Radian was found for the firsttime in two stations in the Oriental Carpathians, namely in Pietrosu Rodnei (Pietrosu Mare) (21) absolutely accidentally and only sterile (Figs. 1—3).

The stations are found at altitudes 2260 and 2280 m s.m. below the top of Pietrosu Rodnei on crystalline rocks, rocky almost vertical stipes (N.N.—V) [1].

From an e c o l o g i c a l point of view *Bucegia* represents in the Romanian bryoflora, an evident mesophile, heleo-sciaphilous saxi-terri-humicole, basiphile, slightly alkaline, psychrophile, often cryophile. It grows almost on lime rocks, dolomites and conglomerates (Bucegi, Piatra Craiului); also on crystalline rocks (Făgăraș, Rodna). It belongs as an arctic-alpine dizonal element in the Romanian Carpathians, subalpine and alpine level between (1300) 1500 and 2320 m s.m.

In the Rodna mountains, *Bucegia* grows in bryocenosis from places with temporary water floods and from snow, under fog conditions and heavy rains, low temperatures, high altitudes and continuous and serious humidity (edaphic and telluric).

[1] In the field investigations from Rodna mountains carried out in 1982 and 1983, I was accompanied by dr. eng. Gh. Pânzariu, from the Forestry Department of Borșa; we thank him for his support as well as all forestry workers of Pietrosu Rodnei Laboratory.

Fig. 1. — Station with *Bucegia romanica* Radian side of top Pietrosu Rodnei (Rodna mountains) altitude 2280 m s.m. (photo Tr. I. Ștefureac)

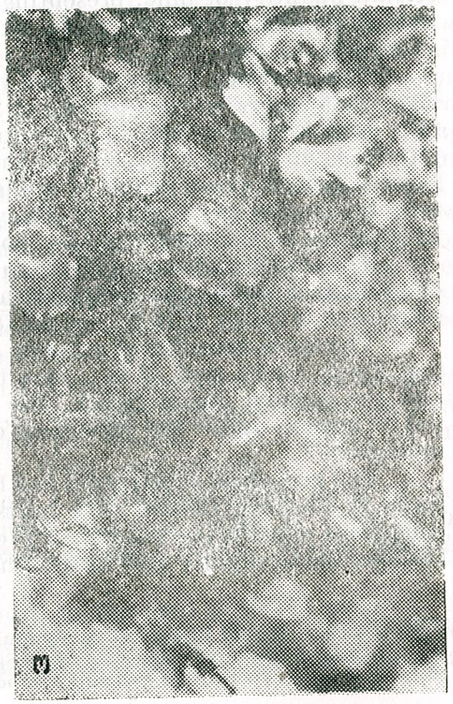

Fig. 2—3. — Bryocenosis (samples) with *Bucegia romanica* Radian from Rodna mountains (Pietrosu Rodnei) of the Oriental Carpathians of Romania in association with *Jungermania sphaerocarpa*, *Dicranum fuscescens*, *Primula minima* etc., altitude 2260 m s.m. (photo Tr. I. Ștefureac)

From an e d a p h i c point of view, the analysis of two soil samples (R7 and T10) reveals the following data regarding some essential elements of pedological factors (table 1).

Table 1

Pedological analysis of two soil samples in the bryocenosis with *Bucegia romanica* Radian in Rodna (Pietrosu) mountains

Soil sample Date of collection Altitude m s.m.	I(R7) 4.IX,1982 2280	II(R10) 31.VIII, 1983 2260
pH	6.23	5.72
Humus %	23.90	21.26
Sum of the bases (SB)	30.58	28.58
Hydrolytical acidity (Ah)	6.36	9.72
Capacity of cationic exchange (T)	36.94	38.30
Saturation in bases (VAh)%	82.78	74.62
Carbonates	0	0

Both lithosol samples, collected at 1—3 cm depth (bryorhizoidal layer) on August 31, 1983 on a crystalline rock (2260 and 2280 m s.m.) have a moderate acid (pH 5.72) reaction up to slightly acid reaction (pH 6.23).

The value of this pH points out that, although the stations with *Bucegia* are in Rodna mountains on crystalline rocks, the soil contains a certain quantity of lime, presenting therefore a certain ecological amplitude (lime and crystalline rocks, existing as a matter of fact in the area in general as well.

The quantity of humus, high in percentage, supplies a good humus layer that varies between 21.26 and 23.90%. The rough humus, formed of rich organic matter with a participation in the biomass of some bryophytes, is mixed with the rock in the substratum. Therefore, an isolating layer is formed which just as in similar cases supplies the conditions necessary to develop the thallus of *Bucegia*, being in fact a humicol species, irrespective of the nature of the geological substratum layer.

The sum of the bases (SB) from the analysed samples presents values of 28.58 and 30.58; the hydrolytical acidity (Ah) of 6.36 and 9.72, the saturation in bases of 74.62 and 82.78%.

The total capacity of cationic exchange (T) is higher than the normal limits (36.94 and 38.30) since the mineral part has a finer texture and the organic one is richer. The carbonates absence is explained by soil levigation under the conditions of heavy rains and humidity in Rodna mountains [2].

The geological substratum and the pedological data on the crystalline rocks in Pietrosu Rodnei with parts of lime, together with the climate conditions explain the affinity of the species *Bucegia romanica* related to the alkaline to slightly acid substratum. Recording these factors we notice,

[2] Thanks are due to prof. dr. N. Barbu, Iassy University "Al. I. Cuza" and to dr. N. Geambașu in the Experimental Station of Spruce Fir Culture, Cîmpulung Moldovenesc for their assistance as regards the pedological aspects.

as regards the thallus, some adaptative modifications of edaphomorphoses and photomorphoses (1) in comparison with the nature of the substratum and stational climate.

The assumptions made by numerous bryologists (9), (13) that this hepatic species can also be found in the Alps, Balkans a.s.o. did not prove true; but those regarding the Romanian Carpathians (11), (12), (17), (18) were true as they can be found in other massifs of the Carpathian systems of Romania (either on lime rocks, dolomites and conglomerates, or in crystalline). Therefore, after almost 50 years since its discovery (1903) (10) *Bucegia* was mentioned by us in some stations both in Făgăraș mountains (Tr. I. Ștefureac, 1949) (17) with compact bryocenosis in Piatra Craiului (Tr. I. Ștefureac, 1951) (18) of the South Carpathians of Romania and after about 80 years in the first stations of the Oriental Carpathians in Pietrosu Rodnei (21).

B r y o c e n o l o g i c a l and p h y t o c e n o l o g i c a l because of its ecological amplitude, *Bucegia romanica* was denoted as (11), (12), (17), (18), (19) in different bryocenoses and phytocenoses (22) in comparison with the nature of the substratum of the respective massifs such as the association *Bucegietum romanicae* Ștefureac 1984 (22). It is remarkable that no cenological study was carried out on this important hepatic species in Romania or abroad.

The cenological data of the two stations (table 2) with *Bucegia* from Rodna mountains reveal the component elements of bryocenosis after 4 records. Some of the species are identical such as *Jungermannia sphaerocarpa* Hook., *Dicranum fuscescens* Sm., *Leskuraea mutabilis* (Brid.) Lindb. ex I. Hag. var. *saxicola* (B., S. & G.) Mol. *Drepanocladus uncinatus* (Hedw.) Warnst. f. *plumulosa* (B., S. & G.) Moenk., *Pohlia drummondii* (c. Müll.) Andr. It is also remarkable that in these 2 stations with *Bucegia* the bryocenoses have a differentiated cenotic character. Therefere in records 1 and 2, *Bucegia* is associated with *Tritomaria scitula* (Tayl.) Joerg., *Tayloria froelichiana* (Hedw.) Mitt. ex Broth, *Marsupella brevissima* (Dum.) Grolle, *Amblystegium* sp. (Table 2, rec. 1, 2), while in records 3 and 4 their absence is noticed in association with *Polytrichum alpinum* Hedw., *Lophozia wenzelii* (Nees) Steph. var. *wenzelii*, *Philonotis tomentella* Mol., *Blepharostoma trichophyllum* ssp. *trichophyllum*, *Lophozia sudetica* (Nees in Hueb.) Grolle (Table 2, rec. 3, 4). In this bryocenosis with *Bucegia* from Rodna mountains we include as a subassociation *Bucegietum romanicae*, Ștefureac 1984 *jungermannietosum sphaerocarpae* subass. nova.

Among the species noticed in 3 records, the following can be mentioned: *Pohlia cruda* (Hedw.) Lindb., *Campylium stellatum* (Hedw.) J. Lange & C. Jens., *Plagiochila asplenioides* (L. emend. Tayl.) Dum., or only in two *Cephalozia bicuspidata* (L.) Dum. and others.

Most of these taxa have, from a phytogeographical point of view, a mountainous-subalpine circumpolar character, some of them with a disjunct character, e.g. *Pohlia cruda* (Hedw.) Lindb. *Bryum flaccidum* Brid.

Among cormophytes some bush species such as *Salix retusa* L. ssp. *kitaibeliana* (Willd.) Rchb., *Rhododendron kotschyi* Simk., and numerous herbs as *Rhodiola rosea* L., *Cerastium alpinum* L. ssp. *lanatum* (Lam.)

Table 2

Cenological data on two stations with *Bucegia romanica* Radian of the Rodna Mountains (Pietrosu) and Carpathians of Romania : *Bucegietum romanicae* Ștefureac 1984 *jungermannietosum sphaerocarpae* subass. nova)

Station	I		II	
Date	4.IX,1982		31.VIII,1983	
Altitude m s.m.	2280		2260	
Number of record	1	2	3	4
Exposure	N-V	N-V	NN-V	NN-V
Angle °	55	60	80	85
General cover %	30	35	80	70
Bryophyta	20	20	55	45
Cormophyta	10	15	25	25
Surface of record	0.25	0.25	0.25	0.25
Bryophyta				
Bucegia romanica	1.2	+.1	2.3	+.2
Jungermannia sphaerocarpa	+.3	2.2	1.2	2.3
Dicranum fuscescens	+.1	+.2	1.3	1.2
Leskuraea mutabilis var. saxicola	2.2	+.3	+.1	+
Drepanocladus uncinatus f. plumulosa	+.2	+.1	1.1	+
Pohlia drummondii	+.1	+	+.3	+
Pohlia cruda	1.2	–	1.2	+.2
Distichium capillaceum	–	+	+.1	1.2
Campylium stellatum	+	–	+	+.1
Plagiochila asplenioides	+	+	+	–
Cephalozia bicuspidata	+	–	–	+
Tritomaria scitula	1.2	+.1	–	–
Tayloria froelichiana	+.2	+.1	–	–
Marsupella brevissima	+	+.3	–	–
Amblystegium sp.	+	+	–	–
Polytrichum alpinum	–	–	1.2	+.1
Lophozia wenzelii	–	–	+.2	+.2
Philonotis tomentella	–	–	+.1	+
Blepharostoma trichophyllum	–	–	+	+
Lophozia sudetica	–	–	–	+.1
Cormophyta				
Silax retusa sp. kitaibeliana	–	+.1	1.2	+.1
Rhododendron kotschyi	+	–	1.2	+.2
Rhodiola rosea	–	+	+	+.1
Cerastium alpinum ssp. lanatum	+	–	+.1	+.1
Saxifraga pedemontana ssp. cymosa	–	+.1	+	+.1
Saxifragla moschata	+.1	–	+.1	+
Soldanella hungarica ssp. hungarica	–	+	+	+.1
Primula minima	+.1	+	–	+
Veronica baumgartenii	–	–	+.1	+
Saxifraga carpathica	–	+	–	–

Species from one record : Fissidens osmundoides var. microcarpa (1), Kiaeria starkei (3), Hylocomium splendens (3), Bryum flaccidum (4), Cephaloziella sp. (2), Parmelia sp. (2), Peltigera sp. (3), Plagiothecium sp. (4), Festuca supina 3), Carex sempervirens (3), Euphrasia sp. (2).

A. & G., *Saxifraga pedemontana* All. ssp. *cymosa* Engl., *S. moschata* Wulf., *Soldanella hungarica* ssp. *hungarica*, *Primula minima* L., *Veronica baumgartenii* Roem. & Schult., *Saxifraga carpathica* Rchb.

According to our cenological records on species *Bucegia romanica*, we may notice according to the geological layer that in lime dolomites, and conglomerate massifs (Bucegi, Piatra Craiului) *Bucegia* is associated mainly with some eutalic hepatics, most of them with an alpine-arctic character as *Sauteria alpina* (Nees in Nees & Bisch.) Nees, *Peltolepis quadrata* (Sauter) K. Muell., *Asterella lindenbergiana* (Corda in Ness) Lindb., *Mannia pilosa* (Hornem.) Frye & Clark ; some of them with subarctic-subalpine character *Athalamia hyalina* (Sommerf.) Hatt. in Shim & Hatt. var. *hyalina* or boreal alpine *Preissia quadrata* (Scop.) Nees. That is different from the bryocenosis with *Bucegia* from Rodna mountains on crystalline rocks (table 2) where the cormoid hepatics with boreal mountainous character *Jungermannia sphaerocarpa* Hook., *Lophozia wenzelii* (Nees) Steph. var. *wenzelii*, *L. sudetica* (Nees in Hueb.) Grolle, are prevalent ; arctic-alpine *Tritomaria scitula* (Tayl.) Joerk., *Marsupella brevissima* (Dum.) Grolle and others.

Among *Musci* (*Bryopsida*) the following should be mentioned, in the bryocenosis with *Bucegia* on crystalline rocks from Rodna mountains as well as in Făgăraș mountains the species mountainous-subalpine and alpine-circumpolar *Distichium capillaceum* (Hedw.) B., S. & G., *Tayloria froelichiana* (Hedw.) Mitt. ex Broth., *Drepanocladus uncinatus* (Hedw.) Warnst. f. *plumulosa* (B., S & G.) Moenk., *Polytrichum alpinum* Hedw. and disjunct circumpolar *Pohlia cruda* (Hedw.) Lindb. among the cormoid hepatics appear in both massifs *Lophozia sudetica* (Nees in Hueb.) Grolle.

From a c h o r o l o g i c a l point of view, regarding its spreading in the Romanian bryoflora (see the chorological diagram, fig. 4) as well as a r e a g e o g r a p h i c in general, *Bucegia romanica* Radian is a disjunct holarctic alpine subarctic element with circumboreal fragmentary area and accidental spreading as regards the territory in very remote areas. It is a tertiary relict, being preserved in areas where the ecological conditions are favourable in stations with evident traces of glaciation and elements of the postglacial climate namely : low and cold temperature, frost most of the year ; generally high altitude and evident humidity.

Bucegia romanica was known so far in its general area, in the following systems of mountains and regions :

Romanian Carpathians (South-East Carpathians) :

South Carpathians :

B u c e g i, in numerous stations, almost in the whole massif, especially along upper vallies of altitude, most often fertile, between 1500 and 2200 m s.m. : Vl. Cerbului, Vrf. Bătrîna, Coștila-Bucșoiu-Omul, Gaura, Vl. Mălăești, Obârșia Ialomiței, Vl. Jepilor and others (Sim. Șt. Radian 1899, 1903, 1920, 1923 ; Z. Zsák 1906 ; A. Degen 1914 ; A. Vlădescu 1938 ; Tr. I. Ștefureac 1940—1976 and others) ;

F ă g ă r a ș, in several stations at altitudes between 1950 and 2340 m s.m. sometimes fertile ; below and above Lake Bîlea and Lake Avrig, below Ciortea mountain and others (Tr. I. Ștefureac 1949) ;

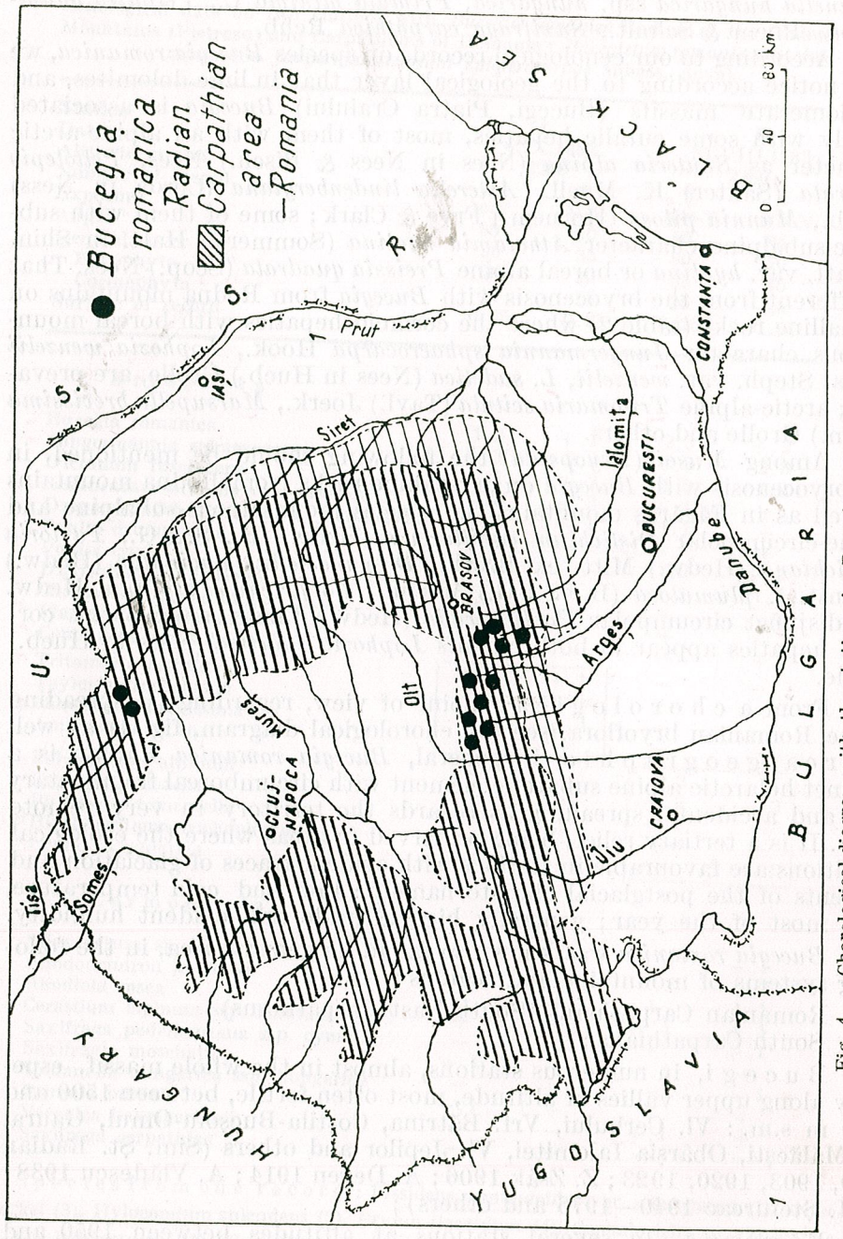

Fig. 4. — Chorological diagram with the stations in *Bucegia romanica* Radian of the massifs of the Romanian Carpathians (orig.)

P i a t r a C r a i u l u i, at altitudes between 1300 and 2244 m s.m. frequent and quantitative in the whole massif especially at the foot of slopes, on places with accumulated humus recorded in 46 stations : Brîul Ciorînga, Padina Călineț, Brîul Răchita-Cabana Ascunsă, Vl. Popii, Șeaua Zaplaz, Vl. Vlădușca, Westwand, Padina închisă, Cabana Diana, Vl. Riia, Curmătura and others (Tr. I. Ștefureac, 1951, 1974) representing a strong center of spreading and perhaps generic in its appearance often very fertile ;

Oriental Carpathians :

R o d n a m o u n t a i n s (Pietrosu Rodnei, Pietrosu Mare) accidentally, sterile, found recently in two stations (Tr. I. Ștefureac, 1982, 1983) at altitude of 2260 and 2280 m s.m.

The Southern limit of its general European area of distribution is found in the South Carpathians in Romania, not being mentioned transdanubian in Bulgaria (S. Petrov, 1975) or Yugoslavia (Z. Pavletić, 1968).

By its recent discovery (Tr. I. Ștefureac, 1982, 1983) in Rodna mountains, chorological gap as old as 80 years between South Carpathians and Tatra mountains belonging to the same general Carpathic system is covered.

North Carpathians, massif Tatra, both in Poland (mainly district of Cracovia) and Czekoslovakia (in White Tatra) collected by numerous bryologists and synthesised for Tatra mountains by J. Szweykowski, 1959 ; J. Váña and J. Duda and others. It is remarkable that the stations in Galitia (today USSR) are chorologically the closest to the ones in Rodna mountains.

The Rocky mountains (Canada) on the North American Coast in three massifs situated between 50° and 60° latitude : British Columbia and Alberta, Horn-Glacial, Robson (C. Haynes, 1915) (6), A. W. Evans, 1917, 1923) (3), A. H. Brinkman 1937), T. C. Freye & Cl. Clark, 1949), W. B. Schofield, 1968) and others and more recently collected by R. M. Schuster and D. M. Harton [3].

Arctic Siberia (subdistrict Lenski) and north-east Asia extremity, Cioukotska peninsula (USSR) (C. J. Ladyzhenskaja (1970) (8), R. N. Sliakov (1982) (16), J. Duda (1982) (2), belonging sometimes to the vegetation of tundra.

Bucegia romanica Radian represents by its genesis, and its morpho-anatomical peculiarities as well its ecology and phytogeography as a subarctic alpine element, tertiary relict and because of all these considerations this eutalic hepatic species was and continues to be multilateral, under various aspects of bryology in general, studied by numerous bryologists, botanists and geographers etc.

The scientific interest on *Bucegia* is reflected therefore by a rich bibliography of more than 120 titles of publications signed by about 70 authors. It is relevant for the scientific attention paid to the discovery and description of this taxon by prof. Sim. Șt. Radian.

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[3] For some bryogeographical data we express our gratitude to Dr. D. G. Harton, Department of Botany University of Iowa, U.S.A.

In our country special attention (1940—1986) was paid to the study of this hepatic species in Romanian Carpathians including its area in general supported a synthetical monograph to be later published.

It is mentioned that *Bucegia romanica* Radian contributes to the bryofloristic genofound of some natural reservations in the country (Bucegi, Piatra Craiului, Făgăraş-Bîlea, Pietrosu Rodnei) as well as the Tatra mountains, the mountains in North America; because of its value and its phytogeographical characters it was proposed to be recorded on the "red lists", to be a bryofloristic monument of the biosphere (Tr. I. Ştefureac, J. of Bryology, 1983) (22) thus honouring the memory of well-known Romanian prof. dr. Sim. Şt. Radian.

REFERENCES

1. AMANN J., *Bryogéographie de la Suisse*, 1928, Fretz Frères, Zürich.
2. DUDA J., *Proceedings of the Third Meeting of the Bryologists from Central and East Europe* (J. Váňa ed.), 1984.
3. EVANS A. W., The Bryologist, 1917, **22**, 2, 17—18.
4. GROLLE R., Acta Botanica Fennica, 1983, **121**, 8, 34.
5. GYÖRFFY, J., PÉTERFI M., Bot. Muz. Füzetek, 1915, **1**, 24—32.
6. HAYNES C. C., The Bryologist, 1915, **18**, 93—94.
7. HERZOG TH., *Geographie der Moose*, 1926, G. Fischer, Jena.
8. LADYZHENSKAJA, C. I., *Novitates systematicae plantarum non vascularium*. Inst. Bot. Acad. Scient. U.R.S.S., 1970, **7**, 300—305.
9. MÜLLER, K., *Die Lebermoose Europas. Rabenhorst's Kryptogamenflora*, 1954—1958, VI, 3, Geerst Portig, Leipzig.
10. RADIAN, S. ŞT., Bull. herb. Inst. Bot. Bucureşti, 1903, **3—4**, 3—7.
11. RADIAN S. ŞT., Public. Nat. din Romania, 1920, **4**, 72—84.
12. RADIAN S. ŞT., Public. Soc. Nat. din Romania, 1923, **6**, 3—77.
13. SCHIFFNER, V., Mag. Bot. Lapok, 1911, **10**, 279—291.
14. SCHUSTER R. M., *The Phyllogeny of the Hepaticae*, in *Bryophyte Systematics*, 1979, ed. by G.C.S. Clarke and J. G. Douchett, Acad. Press, London and New York, 41—82.
15. SCHUSTER R. M., *New Manual of Bryology*, 1983, Hattori Bot. Laboratory, Kagoshima, Japan.
16. SLIAKOV R. N., Izd. Nauka, 1982, Leningrad, 115.
17. ŞTEFUREAC TR. I., Bul. şt. Acad. R. P. Romîne, 1949, **1**, 3, 288—291.
18. ŞTEFUREAC TR. I., Bul. şt. Acad. R. P. Romîne, 1951, **3**, 2, 256—257.
19. ŞTEFUREAC TR. I., Ocrot. Nat. Acad. R. P. Romîne, 1963, 7, 85—108.
20. ŞTEFUREAC TR. I., Cumidava, Culeg. de studii şi cercet., S. şt.-nat., 1975, **9**, 2, 141—149.
21. ŞTEFUREAC TR. I., Journal of Bryology, 1983, **12**, 509—511.
22. ŞTEFUREAC TR. I., *Cercetări asupra speciei Bucegia romanica Radian şi valoarea sa în hepaticologia universală*, 1984, com. Conf. a II-a de ecologie, Sibiu 11—14, IX, 1984.
23. SZWEYKOWSKI J., *Lebermoosflora des Tatragebirges*, 1959, Poznań.
24. VERDOORN FR. (ed.), *Manual of Bryology*, 1932, The Hague.

DEVELOPMENT OF PERENNIAL FORAGE SPECIES *BROMUS INERMIS* LEYSS. AND *ONOBRYCHIS VICIIFOLIA* SCOP. GROWN ON A QUARTZ WASTE

LUCIA STOICOVICI

The paper deals with the study of two forage species, *Bromus inermis* Leyss. and *Onobrychis viciifolia* Scop., grown in pots on a quartz waste material. The waste has been treated with three ammonium nitrate levels on a mineral fertilizer basis. At three harvest dates the grass species has responded favourably as regards the growing parameters and the dry matter production at the N_{120} kg/ha and N_{240} kg/ha ammonium nitrate levels. The maximum dry matter increase was obtained on the 75th and the 108th days from seeding. A whole assessment of the macroelements and microelements in the grass species and in the sterile is given. The cultivation in the same conditions of the leguminous species *Onobrychis viciifolia* has been a failure.

This study gives an account of the growth and development of awnless brome-grass and common sainfoin sown on a waste resulting from the kaolin quartz sand mining. The investigation takes into account the nutritional requirements of these plants when the used substrate is very different from an ordinary soil. The experiment was carried out in pots. Valuable morphological and productive characteristics recommended that both species should be set up, near other species of pastures, on fallow land. The integration of fallow areas in the turnover is a matter of wider interest which would require investigations on a large agricultural scale.

MATERIALS AND METHODS

Both the pots (plastic containers with the vessel surface = 314 cm²) and the waste material were prepared in the usual way. Each pot was filled with a 5 kg air-dried sterile collected from a dump. The following basal dressing of mineral fertilizers was applied on a volume basis (≡kg/ha): superphosphate 20% P_2O_5 (P_{80}kg/ha); potassic salt 40% K_2O (K_{120} kg/ha). Three levels of ammonium nitrate, 33.5% NH_4NO_3 (N_{60}, M_{120}, N_{240}) were added to the sterile nearby the control (N_0). Three replicates for each variant were given. The seeds were put to germinate on 4 June 1982. The seeds originated in the agricultural station Podu Iloaie (1981 harvest). After thinning out the maximum density was confined to 24 plants per pot (replicate). The cultural scheme of the two species grown in various ratios is given in table 1.

During the experiment, it was intended to maintain the waste humidity at 70% from the water holding capacity. This fact was not possible due to the unusual physical features of the material. The presence of bentonite with inflation characteristics hindered to an equal extent the penetration of water as well as its release. At intervals of 2—3 days a measured quantity of water was supplied.

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While the first crop was harvested 47 days from seeding, the subsequent ones were harvested at one month intervals. Each time measurements were made, the aboveground plant material from three replicates was dried in an oven at 80° C for 24 h and the dry weights were determined. The material made into powder was ignited in a muffle furnace

Table 2

Cultural scheme for species *Bromus inermis* and *Onobrychis viciifolia*

Variant	kg/ha NH_4NO_3 treatment	Seed percent representation		
		Bromus inermis	*Onobrychis viciifolia*	
1	N_0, N_{60}, N_{120}, N_{240}	100(24 seeds)	0(0 seeds)	For each variant three harvest data
2	N_0, N_{60}, N_{120}, N_{240}	25(6 seeds)	75(18 seeds)	
3	N_0, N_{60}, N_{120}, N_{240}	0(0 seeds)	100(24 seeds)	

at 500°C. Several macro and microelements of the ash were analysed. Chemical analyses related to some treatment variants and to the first harvest were performed on mean samples.

We add to the chemical data in table 2 some information concerning the sterile. From the chemical analysis it results that the coarse residue left after the leaching parts (LP) were removed, is a material with

Table

Chemical characteristics of the waste

pH	Ca	K	P	Na	Mg	Si	Al	Fe	Mn
8.4 8.9	1—3	~1	—	~1	0.1— 0.3	>5	>3	0.3— 1	~0.01

Note: The macroelements and microelements in % are determined by qualitative spec-

72.7% silicon in excess and with an important content of Al_2O_3 (13.89%) and of alkaline $K_2O + Na_2O$ (5.6%). The CaO content (2.03%) and also that of TiO_2 (0.48%) is remarkable. A moderate content of Fe_2O_3 (0.97%) and a low content of MgO (0.27%) can be noticed. The feldspar total content is 51.3% from which 13.6% is potassium (orthoclase), 28% sodium (albite) and 9.7% is calcium (anorthite). The content of montmorillonite is 16.8%. It is a medium coarse material whose texture is sandy-argillaceous (5).

RESULTS AND DISCUSSION

The physical anomalies of the sterile as its low permeability degree for water and air have determined to a certain extent the modification of the initial objectives. Thus the seedling emergence especially that of

common sainfoin was uneven. This has prevented a correct assessment of the species behavior in monoculture or in mixtures. During the vegetation period no diffrence was recorded in the species growth at various levels of treatment with ammonium nitrate. For example, at the first harvest (July 21, 1982) in the third variant, the average height of the species was 12.53 cm; 14.59 cm with a total weight (for 10 plants) of 0.40 g, respectively 0.55 g at the highest level N in the substrate. At the third harvest (Sept. 20, 1982) in the same variant (N_{240}), the plant height was 15.62 cm; 16.43 cm, with a total weight of 0.88 g, respectively 1.00 g (for 7—8 plants) with insignificant growth in time. In the check variant the species had a poorer development. For this reason in the case of common sainfoin the observations were temporarily interrupted and the monoculture was given up for a while. Accordingly, in this paper the growing type of *Bromus* is examined. But first of all it would be necessary to justify the choice of the two species. Although awnless brome-grass like other perennial grasses with compact habit (tussocks) and long underground rhizomes enhances the soil much less than the lax growth-form grasses it is more important for pasturing and even for extensive grazing. The species has a strong root system penetrating as deep as 270 cm in the soil. This characteristic feature grants it resistance to drought (1). The species occurs most frequently on carbonatic soils (the chestnut chernozem), eroded (pH 6.5—8.0) (3) and gradually sliding down areas (slopes). The sainfoin improves the soil properties but at the same time it needs a substrate well supplied with calcium. Through the extension of the rich root ramifications under the plough layer, the mixed grass sword with common sainfoin has been successfully used in the employment of large quantities of soil,

1

from Popești-Seacă valley (I-a demp)

Cu	Ti	Pb	B	Ba	Cr	Zr
~0.0001	~0.1	~0.003	~0.001	<0.001	—	—

tral analysis and semiquantitative analysis.

as well as in its deep drainage (2). A mixed sword with *Bromus inermis* and *Onobrychis viciifolis* was introduced in pasture farming on the eroded soils from Perieni (Bîrlad plateau), with a significant increase in dry matter. The mixture of 60% grass + 40% leguminous species has yielded the best results (4).

According to the information provided by Erdélyi (2) the common sainfoin also grows well in sites with a low content in Ca, but with a good soil aeration and a high content in nutritive substances. The plant is considerably susceptible to insufficient aeration, changing humidity and stagnant water in the soil. This sensitiveness is linked to the activity of nodule bacteria which is influenced by the photosynthesis, oxygen, temperature, pH and nutritive substances. Phosphorus is very important while potassium is harmful (2). These conditions of insufficient aeration, subsidence, water persistance, the high K proportion (as shown in our

analysis) have certainly led to the failure of this species cultivation, though the calcium content in the sterile is high. As stated by Apostol et al. (1) awnless brome-grass would not stand subsidence conditions because it would

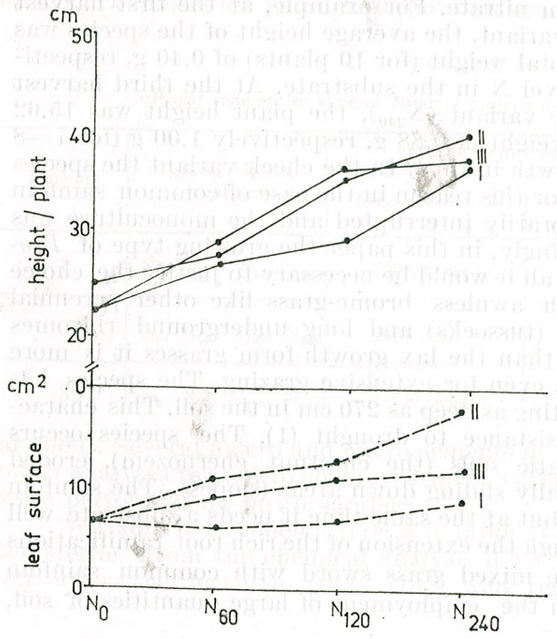

Fig. 1. — *Bromus inermis* in monoculture (first variant). Mean height/plant (cm) (.—.) and mean leaf surface (cm^2) (.— — — —.) at the 4th leaf from the shoot top, recorded at three successive harvests and related to the three levels of NH_4NO_3 applied to the sterile.

Table 3

Dry matter yield in monoculture with *Bromus inermis*. First variant

NH_4NO_3 treatment	Dry matter of aboveground parts in g/100 plants		
	I harvest (July 21/82)	II harvest (Aug. 18/82)	III harvest (Sept. 20/82)
N_0 (control)	3.72±1.61	9.51±3.84	6.15±0.73
B_{60}	5.69±1.05	11.33± 4.19	14.31±3.73
N_{120}	6.63±3.28	14.47± 2.38	19.09±1.91
N_{240}	10.82±0.78	28.34±12.51	27.06±3.65

Table 4

The content in chemical elements in aboveground parts in *Bromus inermis*

Treatment	Si	Al	Ca	Fe	Na	K	Ti	Mn	Mg	P	Pb	Cr	B	Ba	Zr	Cu
N_0	~0.3	~0.03	1—3	⩽0.01	⩾1	⩾1	~0.001	~0.001	0.1—0.3	~0.01	~0.003	~0.001	~0.001	<0.001	—	~0.0001
N_{120}	~0.1	⩽0.01	1—3	⩽0.01	⩾1	⩾1	~0.001	~0.001	0.1—0.3	~0.01	—	~0.001	~0.001	<0.001	<0.001	~0.0001
N_{240}	~0.3	⩽0.01	~3	⩽0.01	⩾1	⩾1	~0.001	~0.001	0.1—0.3	~0.01	~0.001	~0.001	~0.001	<0.001	<0.001	~0.0001

Note: Qualitative spectral analysis and semiquantitative analysis were performed on mean samples (on three replicates). Determinations are expressed in % from the ash content

also require a loosening of the soil. In pots this species has an autumn development, it does not ear in the sowing year.

The growth in height of Bromus (in monoculture) has been recorded in three harvests under the effects of varying nitrogen supply (Fig. 1). It is evidently a progressive increase in height from the check to the maximum NH_4NO_3 level. In the case of the second harvest (Aug. 18, 1982) and partly of the third harvest at the N_{120} and N_{240} levels the species growth is more intensive.

The leaf surface (length × breadth in cm^2 for the 4th leaf) also exhibits a progressive increase of the photosynthetic surface depending on the nitrogen contribution from the sterile. In contrast to the plant height, the leaf surface decreases at the third harvest due to the aging of the plant (Fig. 1), especially at the N_{120} anf N_{240} levels.

The dry matter production of the aboveground components of this culture is set out in Table 3. If in the control (N_0) the highest weight increase is 5 g at the highest N_{240} level, the increase between the first and the second harvests is of 17 g representing 340%. By comparing the N_0 and N_{240} variants the highest increase of 19 g representing 311% is recorded in the second harvest.

The ash content in % of the aboveground parts (in the first variant of this species) has a linear increase recorded together with the nitrogen supply at various degrees in the substrate, as it is shown below:

Treatment	% Ash
N_0	9.45
N_{120}	10.58
N_{240}	12.30

The chemical elements contained in the green aboveground parts at the first harvest (on the 47th day from seeding) are presented in Table 4. A clear-cut distinction between the control and the treated variants for the same macro and microelement cannot be rendered evident. But an assessment of the elements contained in plants as compared to the same elements in the sterile might be possible (Table 2). Thus a group with Na and K elements is higher in plants than in the sterile. The second group contains elements whose proportions are equal or almost equal to those in the sterile: Cu, Ba, B, Pb, Mg, Ca. The third group includes elements with a lower content in the plant than in the waste: Si, Al, Fe, Ti, Mn. The data in Table 4 are insufficient for us to consider the way in which chemical elements accumulate in the plant in relation to the varying

nitrogen supply, their dynamics in time or to find out nutritional deficiencies. Symptoms of shortage or excess apparent at the foliar level in both species entail deficiencies such as the leaf yellowing, reddening or turning brown followed by its drying up, twisting of lamina and leaflets (from the top to the bottom). The symptom of chlorosis of the aboveground parts in the control versus the dark green colour in the fertilized plants with the highest N level is well known on account of the nitrogen absence in the waste.

CONCLUSIONS

The cultivation of *Bromus inermis* and *Onobrychis viciifolia* in monoculture and in mixtures on the Popești sterile, has shown that only the grass species is adapted to improved conditions with fertilizers (NPK). Common sainfoin at varying nitrogen supply does not respond favourably, being sensitive to deficient aeration conditions and to the persistance of water in the sterile.

Bromus inermis had a favourable response as regards the growing parameters, the growth in height, the increase in leaf area (photosynthetic surface) and the dry weight production at the 120 kg/ha and 240 kg/ha ammonium nitrate levels on a nutrient supply basis composed of P_{80} kg/ha superphosphate and K_{120} kg/ha potassic salt. The dry matter production reaches 2,659 kg/ha at the N_{240} kg/ha level after 75 or 108 days from sowing. The dry weight increase versus the control (the untreated variants) is 311% and 366% for the same number of days. This would suggest that the above mentioned fertilizers should be used for the species cultivation in the field in order to obtain a maximum of biomass during the second and the third grazing periods.

We appreciate that a successful result in common sainfoin cultivation in the field could be obtained only by adequate agrotechnical methods as well as by managing higher concentrations of superphosphate. Since the waste is well supplied with potassium the potassic salt fertilizer may be excluded.

Aknowledgments. I greatly appreciate the help of I. Ivan and T. Harko from ICPMSN Cluj-Napoca who made chemical spectral analyses in plants and in the sterile.

REFERENCES

1. APOSTOL TH., BĂLAN C., BONTEA V., CONESCU N., CULICA S. and col., *Agrotehnica ierburilor perene.* Ed. Academiei, 1961, 397 p.
2. ERDÉLYI ȘT., *Contribuții la studiul sparcelei.* Doctoral thesis, Inst. Agron. "Dr. P. Groza", Cluj, 1972.
3. POPOVICI D., KELLNER E., CIUBOTARIU C. and col., Lucrări științifice Măgurele—Brașov, 4, 49—68, 1978.
4. POPOVICI D., POP M., CIUBOTARIU C., Lucrări științifice Măgurele—Brașov, 5, 21—32, 1979.
5. STOICOVICI E., TRIF A., Studii și cerc. șt., Inst. chimie, Cluj, 15, 99—115, 1953.

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RESEARCHES INTO THE MERISTEMATIC CELL'S ONTOGENESIS WITH *JUGLANS REGIA* L.*

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The paper makes a contribution to the study of the main stages of the meristematic cell ontogenesis with *Juglans regia* L. The investigation refers to the sphearule stage as well as those of the protobiont, the eukaryote cell and gymnoplast coenobes ones. A sequence of the stages in its cell ontogenesis briefly reviews the phylogeny that in fact represents both the cell origin and its historical development.

The paper points out the main stages of the meristematic cell's ontogenesis including the sphaerule' stages as well as those of the protobiont and of the eukaryote cell. The experiments carried out on the meristematic cell's ontogenesis with *Juglans regia* L. have shown a sequence of stages in its cell's ontogenesis rendering a brief review of the phylogenesis that in fact represents both the cell's origin and its historical development (11), (12).

It should be remarked that only in our century the theoretical and the experimental efforts (1), (3), (5), (6), (8), (9) have been joined to solve the problem of the origin of life and to follow up the difficult route of imitating the processes which finally might lead to the generation of living matter. The main theories are based on experimental findings such as the Thermal Theory (7), (8), (10), the Adsorbtion Theory (2), the Cold Theory (9) and the Biostructural Theory of Living Matter (4).

MATERIAL AND METHODS

The medium has been prepared from 5—10 ml. suspension out of shoot apex meristematic area with *Juglans regia* L. The suspension was centrifugated and the supernatant was kept in a "wet room".

For light microscopic examination the material was fixed in the Navashin fixative, embedded in paraffin, sectioned at 3—5 μ and stained with hemalaun Mayer and eosin.

RESULTS AND DISCUSSIONS

The first stage of meristematic cell's ontogenesis occurs in a liquid medium where the structural and functional biopolymers of polypeptidicitic type, the nucleic acid, the polysaccharides and the lipoid type have been synthetized. Nucleoproteide coacervates having self-reproduction properties multiply themselves in suitable conditions, further preserving their properties. The next stage is represented by the biopolymers arrangement in microsystems, their assembling in supramolecular structures which afterwards constitute themselves into sphaerules (Pl. I, Fig. 1—a, b, Pl. II, Fig. 4—a). At this precellular stage there has been achieved the tran-

* The paper has been translated into English by prof. DOINA TĂBĂCARU

REV. ROUM. BIOL. — BIOL. VÉGÉT., TOME 31, N° 2, P. 117—119, BUCAREST, 1986

sition from the chemical mixtures' one to that of the microsystems which in fact represent the sphaerules surrounded by a very thin membrane. The membrane itself has been formed through the spontaneous condensation of the liquid's constituents out of the supernatant while the sphaerules separate themselves from the rest of the liquid. The external molecules of these vesicles are arranged in a selective-permeable membrane having osmotic properties through which macromolecules and great particles are selectively passing through. The macromolecules having been included, the sphaerules increase their volume and under these conditions their nutrition is heterotrophic ; they become thus dependent on the substance supply out of the medium liquid they are existing in. The functional and structural biopolymers' inclusion by the protomembrane (compounds of polypeptidic and polysaccharidic type) promoted the development of the first electronic transfer processes through the membrane as well as the sphaerules' resistance to the osmotic pressure and explosion. The first membrane's emergence has conveyed both to the molecular suprastructure and the metabolic adjustment a self-preservation character as well as a mobile one. In this metabolic adjustment an energetic flow (dependent on the electronic transport through the plasmatic protomembrane) is initiated alonside with the accomplishment of biochemical and energetic cycles. Due to the inner energetic motion of the sphaerules' components, their catalytic activity is weak [1]. The sphaerules' spherical form is determined by the necessity of achieving a minimum surface which is to enable the superficial tension to accomplish an equilibrium between the inner and the outer pressure of the sphaerules. Plates I, Fig. 1—a, b, II, Fig. 4—a, point out that the sphaerules in their initial stage are unstructured homogeneous corpuscles (i.e., they lack nucleus as well as cellular organellae). In the sphaerule the nuclear substance has a diffuse character. Due to these characteristics the sphaerules resemble Haeckel's hypothetical moners. The initial sphaerules (Pl. I, Fig. 1—a, b, Pl. II, Fig. 4—a) represent a first and simple pattern, very important in explaining the origin of life because they make the transition from the chemical mixtures to the organized systems. In the process of the sphaerules' formation and growth, inner differentiation of some active substances, different ions as well as organic compounds occur. In the sphaerules' evolution to protobionts, spaces for retaining aqueous suspensions and solutions come into being. The microscopic images reveal this partition by means of various vacuolization degrees of the successive transient form from the sphaerule to the protobiont (Pl. I, Figs 2—6, Pl. II, Figs 1—3, 4—b). These vacuoles start increasing, some of them disappear while the others keep on increasing, a greater one resulting at last. These vacuoles are separated from the protoplasmatic interstices (Pl. I, Figs 2, 5—6). The sphaerules' growth, their inner organization in different areas as well as these first life forms' maintenance having an outset of external organisation are achieved due to the exchange reaction and the energy transfer that are taking place between the inner and the outer medium. By means of this exchange there has been achieved an open, self-regulating and living system which

[1] I have a film showing the components' motions in the ontogenesis including all these stages. The film is to be found with the Botanical Gardens, Iaşi.

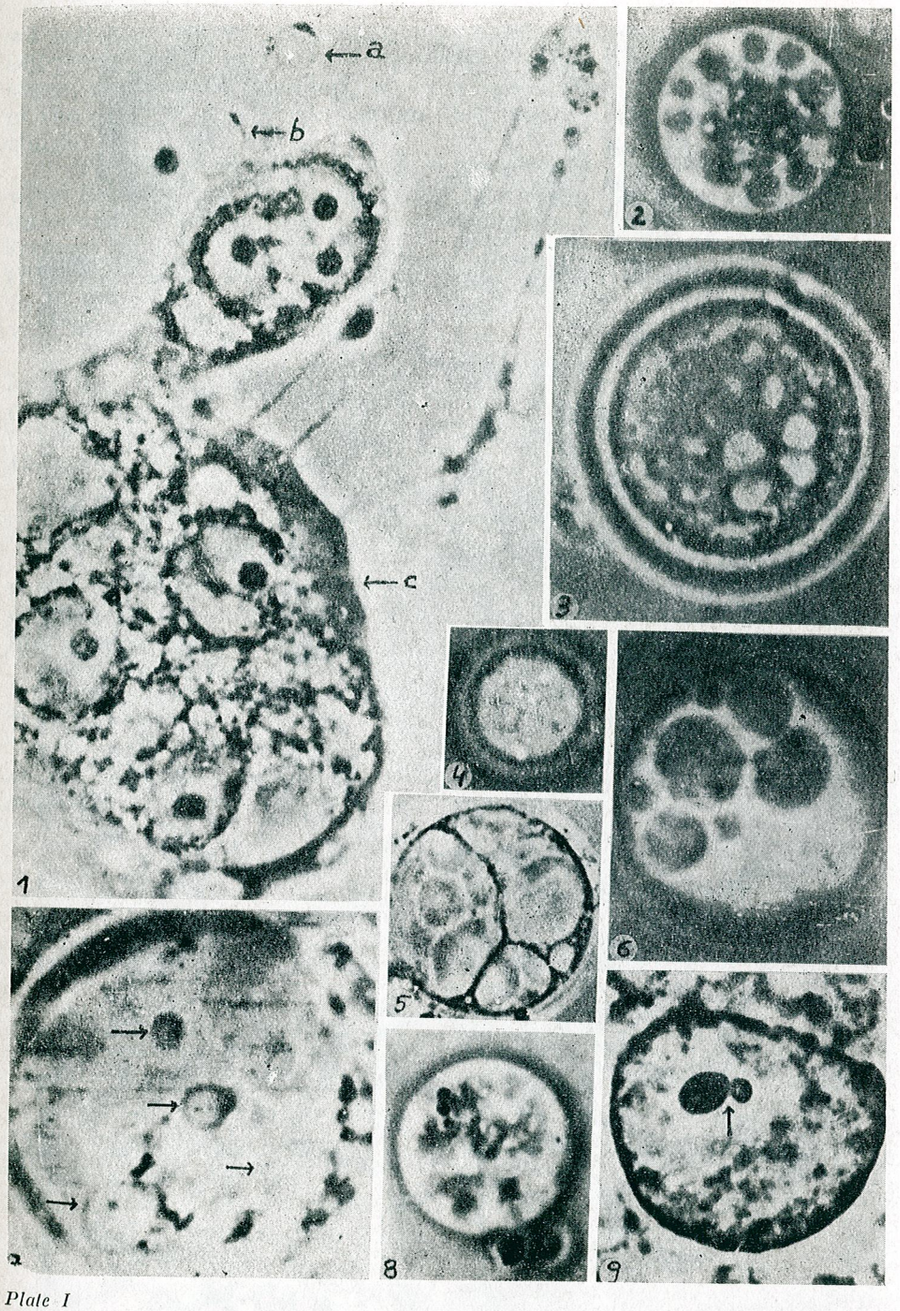

Plate I

The stages of the meristematic cell's ontogenesis with *Juglans regia* L. : Fig. 1. a—b — The sphaerule stage ; c — The coenobe stage of differentiated gymnoplasts ; Figs 2—6 — The protobiont differentiation stages ; the vacuolization stages ; Figs 7—8 — Glomerules, vesicles and tubules' formation inside the initial stage of eukaryote cell ; Fig. 9 — The nucleole gemmation (× 600) (orig.)

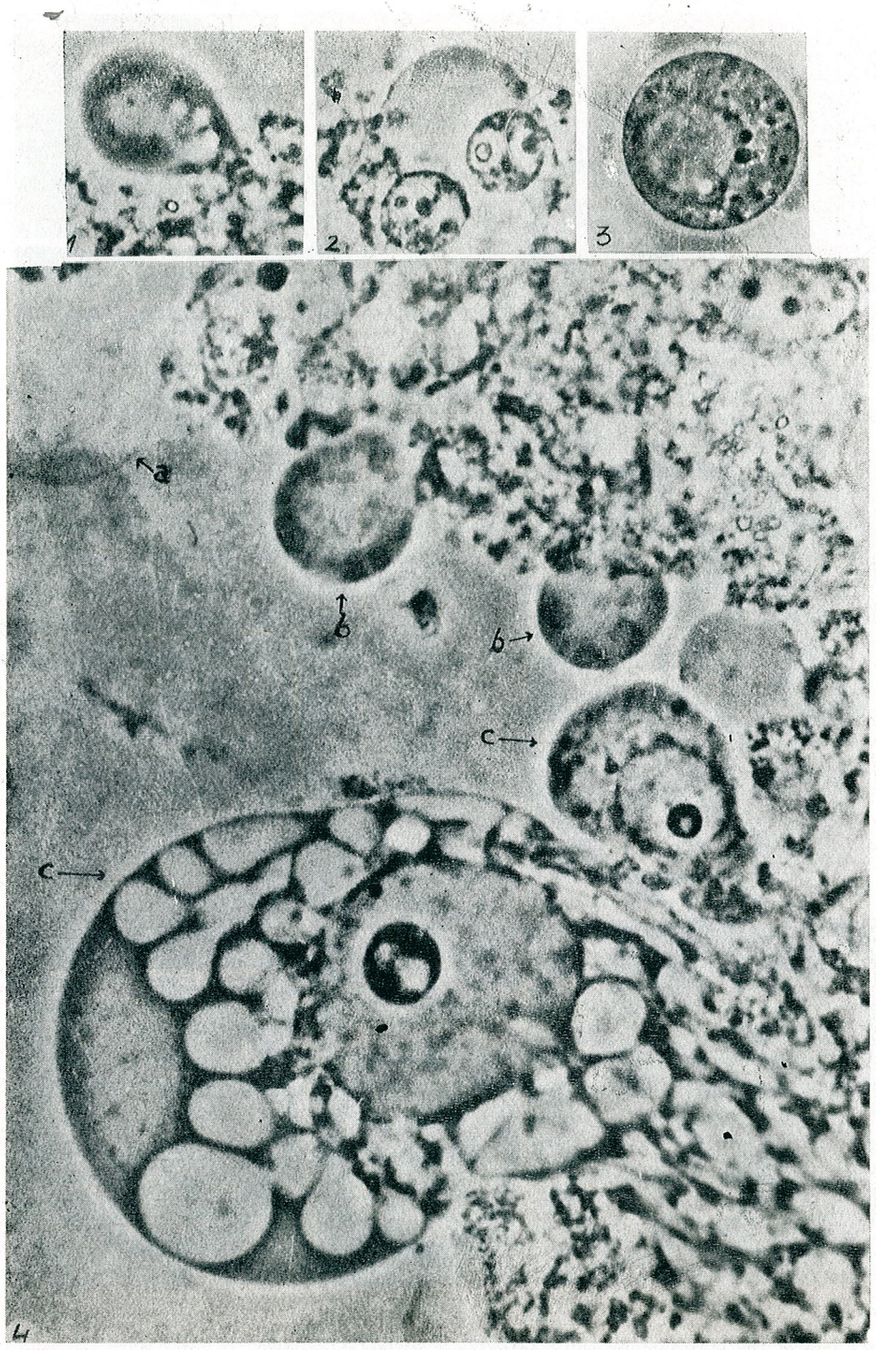

Plate II

The stages of the meristematic cell's ontogenesis with *Juglans regia* L. : Figs 1—3 — The protobiont differentiation stages; Fig. 4 — a — The sphaerule stage; b — The protobiont stage; c — The eukaryote cells's differentiation stages (× 600) (orig.)

we call "protobiont". The membrane's selective property increased the self-preservation possibilities. The protobionts' function (with separate stages as well as membrane properties) points out both the development of the primary energy tranersducs and the start of the first and the simplest cyclic processes.

The eukaryote cell's creation is another stage in the cell's ontogenesis when the inner differentiation occurs, the cytoplasm becomes more abundant and the vacuoles individualize themselves. At the same time, the internal molecules organize themselves in glomerules, vesicles and tubules (Pl. I, Figs 7—8). The big nucleus with its inside nucleole obviously appears in Pl. II, Fig. 4—c. Pl. I, Fig. 9 displays cases of nucleole' gemmation, very frequent in this ontogenetic stage.

The next stage is the coenobial one where the gymnoplast coenobes have been formed (Pl. I, Fig. 1—c) in which numerous amitotic divisions can be noticed.

An advanced stage in the plant's ontogenesis is considered to be the pluricellular unvascular one.

CONCLUSIONS

1. The meristematic cell's ontogenesis with *Juglans regia* L. has shown a sequence of stages in its cell's ontogenesis rendering a brief review of the phylogenesis that in fact represents both the cell's origin and its historical development.

2. The initial sphaerules represent a first and simple pattern, very important in explaining the origin of life because they make the transition from the chemical mixtures to the organized systems.

3. One can distinguish the following stages in the meristematic cell's ontogenesis with *Juglans regia* L. : the sphaerule, the protobiont, the eukaryote gymnoplast and the differentiated eukaryote cell.

REFERENCES

1. FOX S. W. DOSE K., *Molecular Evolution and the Origin of Life*, revised ed., Dekker New York, 1977.
2. KATCHALSKY A., AILAM G., Biochim. Biophys. Acta, 1967, 1, 140.
3. LEPEŞINSCAIA O. B., *Geneza celulelor din substanţa vie şi rolul substanţei vii în organism*, Ed. Academiei, Bucureşti, 1952.
4. MACOVSCHI, E., *The Origin of Life in the Light of Biostructural Theory*, Bucureşti, 1978.
5. MILLER S. L., ORGEL L. E., *The Origins of Life on the Earth*, Prentice-Hall, Inc., Enghelwood Cliffs, New-Jersey, 1974, p. 49.
6. OPARIN A. I., *The Origin of Life on Earth*, Pergamon Press, London, 1959.
7. ORGEL L., Biochemical Science, 1 (3) : 54—55, 1976.
8. PONNAMPERUMA C., KIRK P., Nature, 203, 400, 1964.
9. SIMIONESCU C. I., DÉNES F., *Originea vieţii*, Ed. Academiei, Bucureşti, 1983.
10. STEINMAN G. D., KENYON D. H., CALVIN M., Biochim. Biophys. Acta, 124, 339, 1966.
11. ŞTEFUREAC TR. I., TĂBĂCARU C. D., Rev. Roum. Biol. — Biol. végét., 27 (2) : 105—110, 1982.
12. TĂBĂCARU C. D., Doctoral paper, Bucureşti, 1984.

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RECHERCHES SUR LE TÉGUMENT SÉMINAL DANS LE CADRE DES ESPÈCES DE LA SECTION *TRIONYCHON* WALLR. DU GENRE *OROBANCHE* L.

LIVIA UNGUREAN

The seed coat has been investigated in the species of the *Trionychon* Wallr. Section of the genus *Orobanche* L. (*O. ramosa* L., *O. mutelii* Schtz. ssp. *brassicae* Novopokr., *O. aegyptiaca* Pers., *O. purpurea* Jacq., *O. arenaria* Borkh., *O. caesia* Rchb.). Researches have led to the conclusion that the two reticula of the seed coat have a differential taxonomic value, the principal reticulum helping to partially differentiate some taxa, and the secondary reticulum helping to differentiate all the taxa in the *Trionychon* Section.

Chez les espèces du genre *Orobanche* L. les graines ont l'aspect d'une poudre noirâtre, étant très petites, de 0,3 à 0,7 mm. Pourtant, ce sont des graines complètes, présentant tégument séminal, périsperme (nucelle) et embryon (proembryon).

Comme l'attestent les données de la littérature de spécialité, l'embryon et l'endosperme se constituent dans des formations spécifiques de la famille *Orobanchaceae* B. Juss. (G. Privat, 1960 (3); P. Maheshwari, 1967 (2)) et le tégument séminal, outre la spécificité, présente une certaine variabilité dans le cadre du genre *Orobanche* (G. Privat, 1960 (3); A. Falah, 1977 (1)).

Afin d'établir le degré de variabilité et de signification des divers caractères du tégument séminal chez les espèces d'*Orobanche* de Roumanie, on a effectué une analyse morpho-anatomique détaillée de ce tégument (L. Ungurean, 1985 (5)).

En tenant compte de cette analyse, nous présentons les résultats de l'étude du tégument séminal chez les espèces de la Sect. *Trionychon* Wallr. (*O. ramosa* L., *O. mutelii* Schultz ssp. *brassicae* Novopokr. (Tr. I. Ştefureac, L. Ungurean, 1985 (4)), *O. aegyptiaca* Pers., *O. purpurea* Jacq., *O. arenaria* Borkh., *O. caesia* Rchb.).

LA MÉTHODE D'ÉTUDE

A l'aide de l'hypochlorite de sodium, on a réalisé l'élimination des substances polyphénoliques des parois cellulaires du tégument séminal. Après, en utilisant le vert d'iode, on a établi le degré de lignification des parois cellulaires du tégument séminal.

Chez chaque espèce on a analysé 100 graines, où l'on a enregistré les dimensions du réticule principal et du réticule secondaire. Les données obtenues sont analysées mathématiquement.

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LES RÉSULTATS DE LA RECHERCHE

Des graines, en général pyriformes planes du côté dorsal et convexes du côté ventral ont le tégument séminal représenté par la testa unistratifiée, formée de cellules grandes, grossies aux parois latérales et intérieures.

La lignification l'impregnation avec des substances polyphénoliques et la résorbtion des amyloplastes comme d'ailleurs de tout le contenu vivant des cellules de la testa sont declenchées par l'achèvement des processus embryogénétiques (fig. 1).

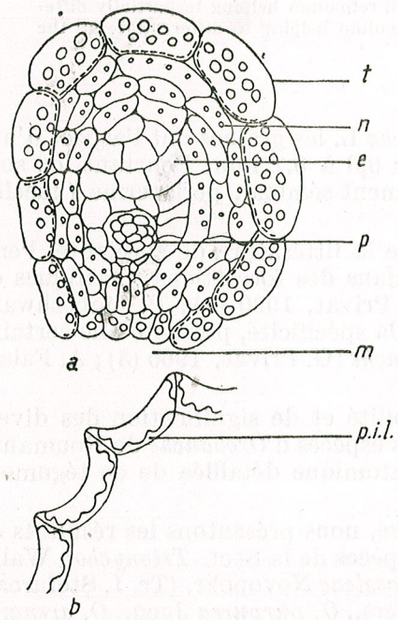

Fig. 1. — La structure de la graine à la fin de l'embryogenèse (a) et la structure des parois cellulaires de la testa (b) dans la période de la déhiscence de la capsule chez *Orobanche ramosa* : t — testa ; n — la nucelle (le périsperme) ; e — endosperme ; p — proembryon ; m — micropyle ; p.i. l — paroi intérieure et latérale grossies (orig.).

La lignification inégale des parois latérales et intérieures des cellules de la testa contribue à la réalisation d'un aspect doublement réticulé du tégument séminal. Pour les deux réticules identifiés dans la structure du tégument séminal on a considéré nécessaire l'introduction des termes de réticule principal (R I) et réticule secondaire (R II) (L. Ungurean 1985 (5)). Le premier se réfère à l'aspect réticulé que les parois latérales grossies des cellules de la testa donne au tégument séminal et le deuxième se réfère aux pores (G. Privat, 1960 (3)) des parois intérieures et latérales des mêmes cellules.

La forme des éléments du réticule principal et de celui secondaire ainsi que leur volume ont constitué l'objet essentiel de nos recherches sur le tégument séminal.

On a constaté que les éléments des deux réticules sont plus constants du côté ventral convexe de la graine et plus variables autour du micropyle et sur la partie dorsale plane de la graine.

Chez toutes les espèces de la Sect. *Trionychon* les cellules de la testa (les éléments du réticule principal) sont en général isodiamétriques et représentent 1/4 ou 1/5 de la longueur de la graine (pl. I fig. 1—6) ayant des valeurs entre 77 et 121 μ (tableau 1).

Tableau 1

Les différences entre les espèces de la Sect. *Trionychon* Wallr. synthétisées, compte tenu des deux réticules du tégument séminal.

Les espèces comparée/les caractères	La graine							
	Le réticule principal				Le réticule secondaire			
	x_2-x_1	d_1	DL la signif. 0,1 %		x_2-x_1	d_1	DL 0,1 %	la sign.
Orobranche ramosa (x_1)	107,75—	27,95	6,72	×××	12,15—	6,02	1,53	×××
O. mutelii ssp. *brassicae* (x_2)	79,80				6,13			
O. ramosa (x_1)	77—	2,8	—	—	8,61—	2,48	0,5	×××
O. aegyptiaca (x_2)	79,8				6,13			
O. mutelii ssp. *brassicae* (x_1)	77—	30,72	9,91	000	8,61—	3,44	1,56	000
O. aegyptiaca (x_2)	107,75				12,15			
O. purpurea (x_1)	121,25—	33,45	10,85	×××	25,8—	11,2	5,09	000
O. caexia (x_2)	87,8				37,0			
O. arenaria (x_1)	87,8—	0,6	—	—	37,0—	19,36	4,5	
O. purpurea (x_2)	87,2				17,64			×××
O. caesia (x_1)	87,2—	34,05	11,26	000	17,61—	8,16	3,38	000
O. arenaria (x_2)	121,25				25,8			

DL — différence limite
d — différence

Les valeurs les plus basses des éléments du réticule principal ont été enregistrées chez *O.aegyptiaca* — 77 μ et chez *O. ramosa* — 79 μ, et les plus hautes chez *O. mutelii* ssp. *brasicae* — 107 μ et *O. caesia* — 121 μ.

Les cellules de la testa étant isodiamétriques, la délimitation des espèces de la Sect. *Trionychon*, vu le réticule principal, a été réalisée ayant en considération exclusivement la taille de ses éléments. Ainsi, on a constaté que les différences entre certains taxons sont grandes et significatives : *O. ramosa* (79 μ) — *O. mutelii* ssp. *brassicae* (107 μ) ; *O. mutelii* ssp. *brassicae* (107 μ) — *O. aegyptiaca* (77 μ) etc.

Mais on a enregistré aussi des cas sans la signification de la différence entre *O. ramosa* (79 μ) — *O. aegyptiaca* (77 μ) ; *O. arenaria* (87,2 μ) — *O. purpurea* (87, 8μ).

Bien que variable, le réticule principal présente les amplitudes de variation entre des limites communes chez certaines espèces, ce qui a conduit à déterminer son utilisation partielle dans la délimitation des taxons de cette section.

En échange, le réticule secondaire est très variable, surtout au niveau interspécifique. Selon les amplitudes de variation des valeurs individuelles du réticule secondaire (fig. 2) à six taxons de la Sect. *Trionychon*, on peut grouper en deux catégories de valeurs : des espèces ayant les éléments du réticule secondaire petits et nombreux, situés entre 6—12 μ (*O. ramosa* — 6 μ, *O. mutelii* ssp. *brassicae* — 12 μ, *O. aegyptiaca* — 8μ) et des espè-

ces ayant des éléments du réticule secondaire grands et peu nombreux, dont les valeurs moyennes se situent entre 17 et 37 μ (*O. arenaria* — 17 μ, *O. caesia* — 25 μ, *O. purpurea* — 37 μ).

Pour confirmer la valeur taxonomique des particularités de ce réticule, on a testé ses valeurs à l'aide du test "la différence limite" ce qui a facilité l'évaluation du degré de signification de la différence entre deux espèces proches. Quant à ce réticule, tous les couples de l'espèce se distinguent d'une manière très significative, même dans le cas des

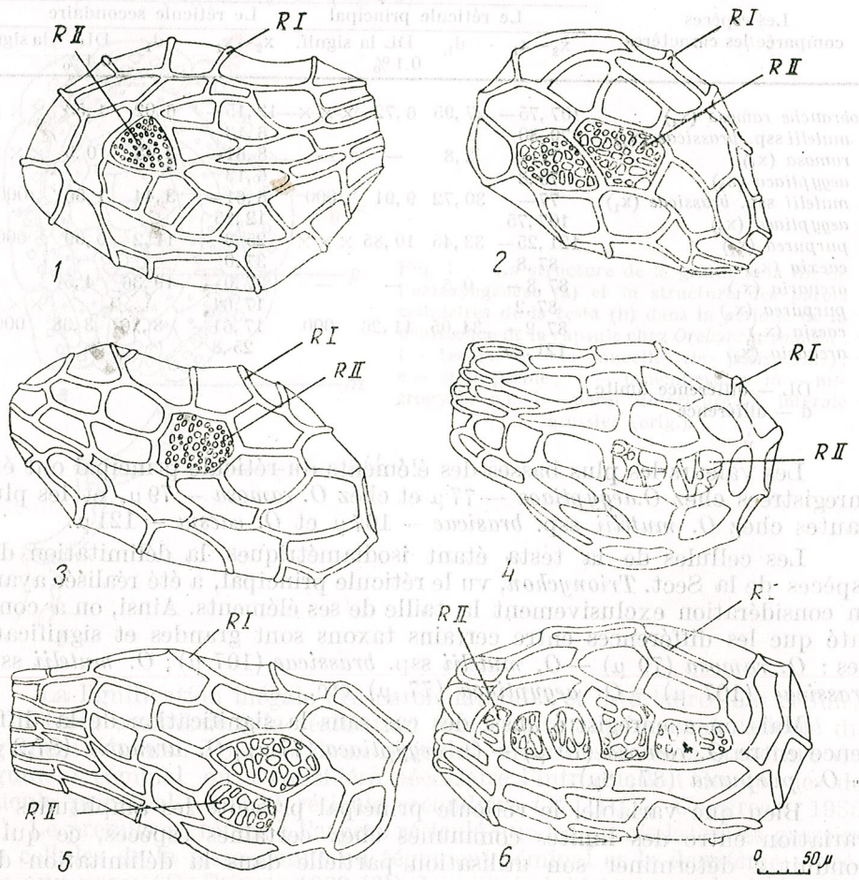

Planche I

1—6 : La structure du tégument séminal chez les espèces de la Sect. Trionychon Wallr. du genre Orobanche L. : 1 — *O. ramosa* ; 2 — *O. mutelii* ssp. *brassicae* ; 3 — *O. aegyptiaca* ; 4 — *O. purpurea* ; 5 — *O. arenaria* ; 6 — *O. caesia* ; RI — réticule principal ; R II — réticule secondaire (orig.).

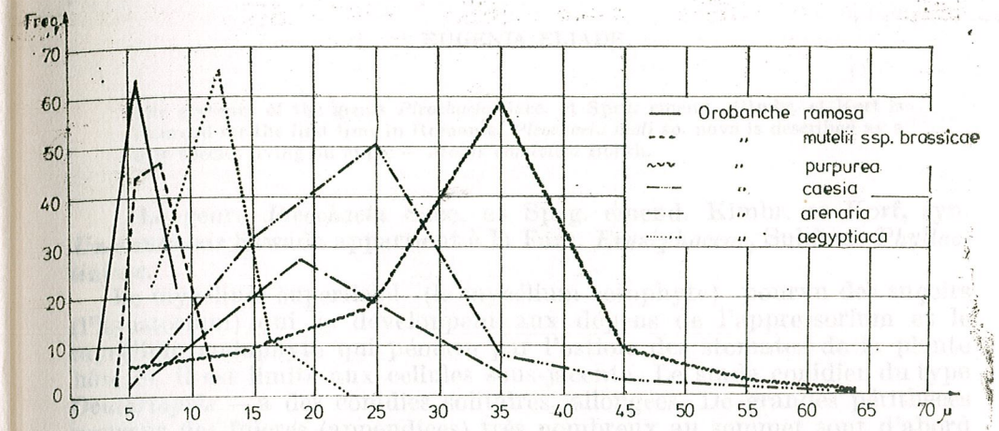

Fig. 2. — Graphique : la variabilité du réticule secondaire chez les espèces de la Sect. Trionychon Wallr. du genre Orobanche L. (orig.).

espèces à des valeurs plus rapprochées : *O. ramosa* (6 μ) — *O. mutelii* ssp. *brassicae* (12 μ) ; *O. ramosa* (6 μ) — *O. aegyptiaca* (8 μ) ; *O. mutelii* ssp. *brassicae* (12 μ) — *O. aegyptiaca* (8 μ). Quant aux autres espèces, les différences en sont si grandes, qu'elles apparaissent nettement évidentes, sans que l'on utilise le test ci-haut mentionné [1].

CONCLUSIONS

1. Les grossissements inégaux des cellules du tégument séminal lui confèrent un aspect doublement réticulé.

2. Le réticule principal présente chez les espèces de la Sect. *Trionychon* Wallr. des éléments isodiamétriques de 77—121 ὸ. Par ce réticule, on peut délimiter seulement quelques taxons de cette section.

3. On peut réaliser la délimitation de tous les taxons de la Sect. *Trionychon* Wallr. en utilisant les particularités du réticule secondaire dont les éléments présentent une variabilité interspécifique significative caractéristiques qui peuvent être introduites dans la clé de détermination des espèces.

BIBLIOGRAPHIE

1. FALAH A., *Morphologisch-Anatomische Untersuchungen über den Parazitismus, die Entwicklungsweise und die Struktur der haustorial Organe von Orobanche-Arten sowie über Samenstrukturen bei Orobanchaceae*, Univ. Giesen, 1977, 26—45.
2. MAHESHWARI P., *Embryology in relation to taxonomy*, Pergamon, 1963, 81.
3 PRIVAT, G., *Recherches sur les Phanérogames parasites (Etudes d'Orobanche hederae Duby)*. Ann. Sc. Nat. Bot. Biol. vég., 1960, **1,** 4, 721—871.
4. ȘTEFUREAC TR. I., UNGUREAN L., *Considérations critiques sur quelques taxons du genre Orobanche* L. Rev. Roum. de Biologie, S. de biol. végét., 1985, **30,** 1 3—6.
5. UNGUREAN L., *Cercetări monografice asupra speciilor genului Orobanche L. din România*. Rez. tezei, București, 1985, 1—26.

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UNE NOUVELLE ESPÈCE DE PLEOCHAETA (ERYSIPHACEAE)-P. MALI ELIADE

EUGENIA ELIADE

The presence of the genus *Pleochaeta* Sacc. et Speg. emend. Kimbr. et Korf is recorded for the first time in Romania. *Pleochaeta mali* sp. nova is described as a new species living on apple — *Malus domestica* Borkh.

Le genre *Pleochaeta* Sacc. et Speg. emend. Kimbr. et Korf, syn. *Uncinulopsis* Sawada appartient à la Fam. *Erysiphaceae*, Subfam. *Phyllactinieae*.

Le mycélium superficiel (le mycélium ectophyte) pourvu des suçoirs (l'haustorium) qui se développent aux dépens de l'appressorium et le mycélium endophyte qui pénètre par l'ostiole des stomates de la plante hôte et il est limité aux cellules sous-jacente. Le stade conidien du type *Ovulariopsis* — a des conidies solitaires, allongées. De grandes périthèces pourvus des fulcres (appendices) très nombreux au sommet sont d'abord rectilignes, puis arqués ou spiralés. Plusieurs asques par périthèce, ovales, subovés ou clavés forment un hyménium bien distinct. Les ascospores sont en nombre de 2 ou 3, rarement 4—5.

Les espèces de *Pleochaeta* parasitent des arbres de la Fam. *Ulmaceae (Celtis)* et *Salicaceae (Salix, Populus)*.

Jusqu'à present ont été décrites dans la littérature spécialisée, les suivantes quatre espèces de ce genre :

— *Pleochaeta polychaeta* (Berk. et Curt.) Kimbr. et Korf sur *Celtis occidentalis* L., *C. misissippiensis* Bosc. et *C. reticulata* Torr. en Amérique du Nord et Amérique du Sud.

— *Pleochaeta shiraiana* (P. Henn.) Kimbr. et Korf sur *Celtis laevigata* Willd. en Asie.

— *Pleochaeta salicicola* Zheng et Chen sur *Salix capraea* L. et *S. fargasii* Burk. en Chine.

— *Pleochaeta populicola* Zhang sur *Populus davidiana* Dode en Chine.

Le matériel très riche, que nous avons collecté et analysé — de feuilles de pommier d'un jardin privé de la ville de Tîrgoviste — sur des pommiers épars, parmi lesquels les uns ont fleuri pour la deuxième fois en automne de l'année 1977, a été déterminé comme appartenant au genre *Pleochaeta*.

Pleochaeta mali Eliade sp. nova

Le mycélium sur la partie supérieure des feuilles, persistant, se développe sous forme d'une pellicule blanche, plus rarement sur la face inférieure des feuilles. Les conidies sont allongées ou ovoides, solitaires, incolores, de 15—30 μm (du type *Ovulariopsis*). Les périthèces épiphylles ou hypophylles, disséminés ou groupés, brun foncé, globuleux, de 110—200 μm diamètre, avec des fulcres (appendices) nombreux 150—200, fragiles, incolores, droits et rigides, plus rarement courbés, non cloisonnés,

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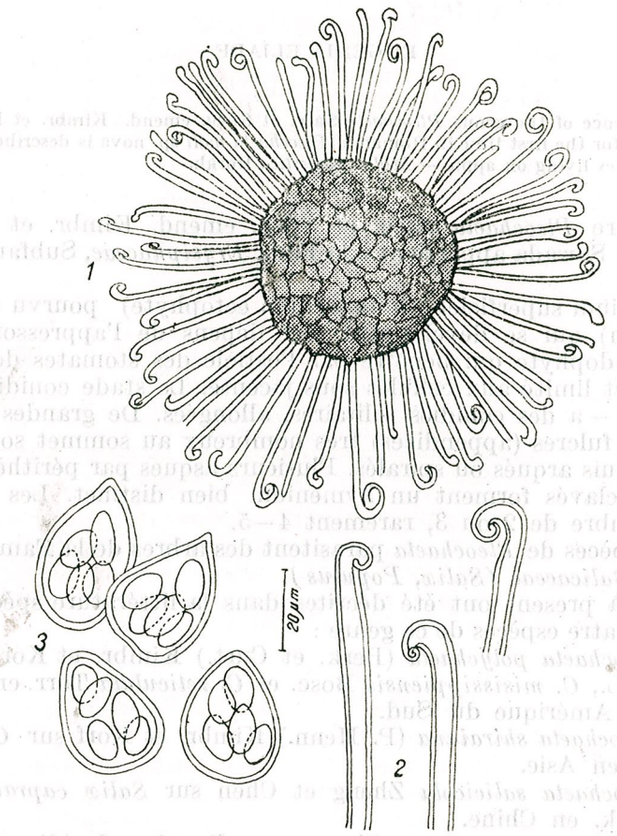

Planche I

1 — périthèce ; 2 — fulcres ; 3 — asques avec ascospores

de 100—120 µm de longueur, au sommet oncinés ou spiralés. Les asques 10—20, ovales ou subovés, sessiles ou indistinctement court-pedicelés, de 70—90 × 40—50 µm ; les ascospores 3—5, ovoïdes ou lato-ellipsoïdales, de 20—24 × 10—15 µm, incolores (Planche 1).

Habitat : sur les feuilles vivantes de *Malus domestica* Borkh. Tîrgoviște, dép. de Dîmbovița, le 16 octobre 1977.

Mycelium epiphyllum persistens pelliculae albas efformans vel raro, hypophyllum. Conidia oblonga vel ovoidea, solitaria, pariete hyalino, 15—30 × 10—20 µm (*Ovulariopsis* — Typus). Perithecia epiphylla vel hypophylla, sparsa vel gregaria, atro-brunnea, globosa, 110—200 µm diametro ; appendices numerosae 150—200, fragiles, hyalinae, rectae et rigidae, raro curvatae, aseptatae, 100—120 µm longae, apice simpliciter uncinatae distinctae vel spiraliter. Asci 10—20, ovalibus vel subovalibus,

sessiles vel indistincte breviter pedicellati, 70—90 × 40—50 µm ; ascosporae 3—5, ovoidai vel late-ellipsoideae, 20—25 × 10—15 µm, hyalinae.

Habitat : in foliis vivis *Mali domesticae* Borkh., Tîrgoviște, distr. Dîmbovița, 16.X.1977.

BUC, no 350.283 (Typus).

Les plantes attaquées par ce champignon se trouvent aussi dans la Collection « Erysiphaceae Romaniae — Herb. Eugenia Eliade » du laboratoire de Phytopathologie et Mycologie de la Faculté de Biologie, Université de Bucarest.

BIBLIOGRAPHIE

1. BLUMER S., 1967, *Echte Mehltaupilze (Erysiphaceae)*. G. Fischer, Jena.
2. HIRATA K., 1966, *Host range and geographical distribution on the powdery mildews.* Niigata University, Niigata.
3. KIMBROUGH J. W. 1963, Mycologia **55** : 608—618.
4. KIMBROUGH, J. W. and KORF R. P., 1963, Mycologia **55** 19—626.
5. ZHANG X. L. 1983. Mycologia **75** (*3*) : 547—551.
6. ZENG R.-Y and CHEN, G.-Q., 1978, Acta Microbiol Sinica **18** : 118—121.
7. ZENG R.-Y and CHEN G.-Q., 1978, Acta Microbiol. Sinica **18** : 181—198.
8. YARWOOD, C. E., 1973, *Pyrenomyceles* : *Erysiphales*. in : *The Fungi*. Eds. G. C. AINSWORTH et al. **IV A** : 71—86. Academic Press, London, New York, San Francisco.
9. YARWOOD C. E., 1978, *History and taxonomy of powdery mildews.* In : *The powdery mildews*. Ed. D. M. SPENCER : 1—37. Academic Press, London, New York, San Francisco.

SEA WATER USED FOR THE CULTURE OF ALGA *SPIRULINA PLATENSIS*

GH. POPOVICI, O. BOLDOR *, TEODORA TOMA, N. NICOLA and H. TIȚU

Under laboratory conditions, we performed experiments on the use of Black Sea water for preparing the nutritive medium to grow alga *Spirulina platensis*. The algal cultures grown on nutritive media prepared with sea water offer a possibility to obtain biomass at a low price.
The nutritive media with sea water 40—55% and Zarrouk medium proved to be the most adequate for growing alga *Spirulina platensis*. The crops are similar to the control cultures.

The culture of alga *Spirulina platensis* on an industrial scale aroused the interest of most specialists, to find the technology and waters which by their composition and concentration of elements necessary for alga growth should be used in the alga culture either as replacive of the nutritive medium or in its preparation with lower percentages of the elements than in the usual Zarrouk medium (2—8). To this purpose our investigations tried to test the possibilities of using Black Sea water for the culture of *Spirulina platensis*.

MATERIAL AND METHODS

The experiments were carried out on a strain *Spirulina platensis* (Gom) Geitler from Egypt.

The algal cultures were grown in an installation formed of a glass container with a volume of the algal suspension of 2.5 l (Fig. 1).

A fluorescent tube of 20 W was placed inside the container protected by a glass tube The light intensity outside the culture container was of 3 000 lux during the experiment.

The temperature of the algal suspension was constantly of 30°C by means of an electric resistance of 60 W and a contact thermometer placed in the suspension which kept the electric resistance warming.

The cultures were permanently aired by means of a vibratory pump.

The culture of alga *Spirulina platensis* was initiated on a Zarrouk standard medium (10); after 7 days it was harvested. From the harvested algal suspension the necessary quantity of dry biomass was taken away and preserved to be used as inoculum for the following test. The same method was applied for each successive culture. Therefore we could obtain a culture growth in a continuous flux.

Every seven days a new culture was initiated according to the following diagram.

Variants : I : usual medium (Zarrouk); II : sea water (SW) 5% + Zarrouk medium (ZM) 95%; III. : (SW) 10% + ZM 90%; IV : SW 15% + ZM 85%; V : SW 20% + ZM 80%; VI : SW 25% + ZM 75%;

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VII : SW 30 % + ZM 70 %; VIII : SW 35 % + ZM 65 %; IX : SW 40 % + ZM 60 %; X : SW 45 % + ZM 55 %; XI : SW 50 % + ZM 50 %; XII : SW 55 % + ZM 45 %; XIII : SW 60 % + ZM 40 %; XIV : SW 65 % + ZM 35 %; XV : SW 70 % + ZM 30 %; XVI : SW 75 % + ZM 25 %; XVII : SW 80 % + ZM 20 %; XVIII : SW 85 % + ZM 15 %; XIX : SW 90 % + ZM 10 %; XX : SW 95 % + ZM 5 %.

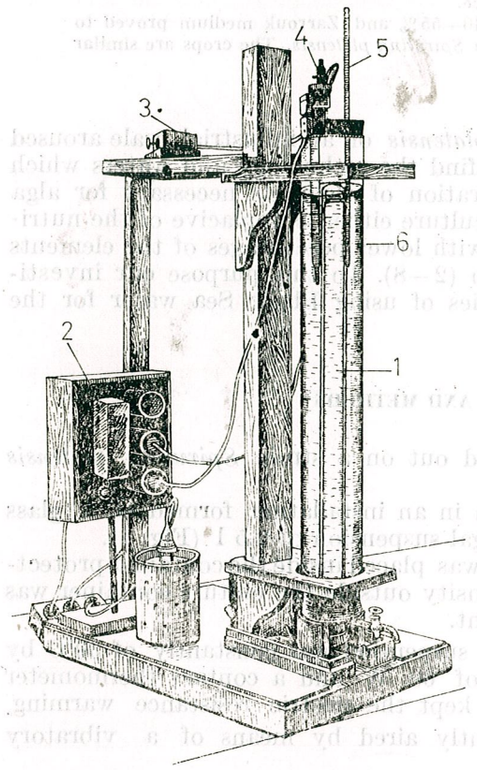


Fig. 1. — Installation for *Spirulina platensis* culture

1. flourescent tube of 20 W to l ght the culture inside ; 2. equipment for constant temperature of algal suspension ; 3. vibrator to air the algal suspension ; 4. contact thermometer to preserve constant the temperature of the algal suspension ; 5. thermometer to control the temperature of the algal suspension ; 6. glass reservoir for culture.

The culture behaviour was appreciated daily according to the accumulation of dry biomass and the morphological and electron microscopy aspects of the algal filaments (9).

RESULTS AND DISCUSSION

Our data presented in table 1 point out a group of variants with a higher growth rate.

The algal cultures grown on the nutritive medium prepared with 5%—15% SW and those with 40—60% SW reveal a higher growth in comparison with the cultures grown on the nutritive medium prepared with 20—35% SW and those with 65—90% SW.

The groups of algal cultures according to the daily growth rate correspond to the variations of final accumulation of biomass. The data on the final quantity of biomass show a lower accumulation in the algal cultures grown on the nutritive medium prepared from sea water in comparison with the control culture. According to the concentration of sea

Table 1

Accumulation of biomass in *Spirulina platensis* grown on the nutritive medium of sea water

Variants	Relationship sea water/Zarrouk medium (%)	Quantity of dry biomass (%) as compared	
		to the innoculum	to the control
I The control (ZM)		720	100.00
II	5/95	554	76.94
III	10/90	420	58.33
IV	15/85	394	54.72
V	20/80	193	26.81
VI	25/75	97	13.47
VII	30/70	213	29.58
VIII	35/65	220	30.56
IX	40/60	530	73.61
X	45/55	563	78.19
XI	50/50	550	76.39
XII	55/45	527	73.19
XIII	60/40	337	46.81
XIV	65/35	283	36.53
XV	70/30	230	31.94
XVI	75/25	280	38.89
XVII	80/20	253	35.14
XVIII	85/15	183	25.42
XIX	90/10	217	30.14
XX	95/5	—	—

water in the nutritive medium we noticed that the maximum accumulation of final biomass reached 78% in comparison with the control, being related to the excess of biomass of 56.3% in variant X, performed on the nutritive medium prepared with 45% sea water and 55% usual medium (table 1).

The behaviour of the algal culture grown on nutritive media prepared with sea water in partly continuous systems reveals the fact that according to its concentration the biomass accumulation has two maximum values : one corresponding to nutritive media with 5% sea water and another one to the media containing 40—55% sea water (Fig. 2). The ever lower rate of biomass accumulation in cultures grown on nutritive medium prepared with sea water in concentrations between 10% and 35% can be accounted for by the slow adaptation of the ever higher concentrations of sea water in the culture medium. In the concentrations of 40% to 55% sea water in the culture medium, the alga present an increasing accumulation of biomass, estimated at 73—78% in comparison with the control (table 1) and corresponding to the maximum accumulation of biomass.

For a concentration higher than 55% sea water in the nutritive medium, the biomass accumulation begins to reduce again reaching 25% in comparison with the control (Fig. 2).

From the morphological point of view of the algal filaments grown on nutritive media prepared with increased concentrations of sea water,

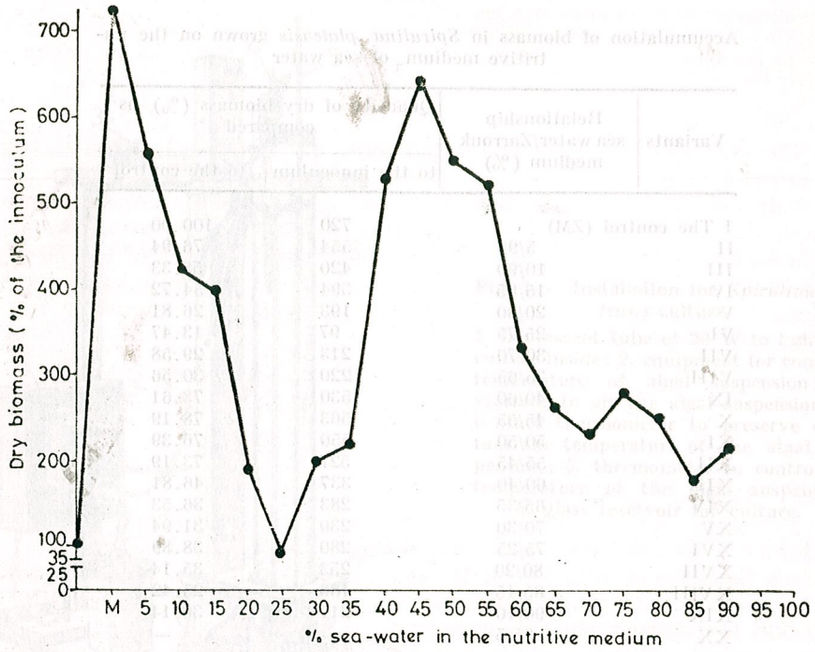


Fig. 2. — Accumulation of final biomass of *Spirulina platensis* grown on nutritive medium with sea water.

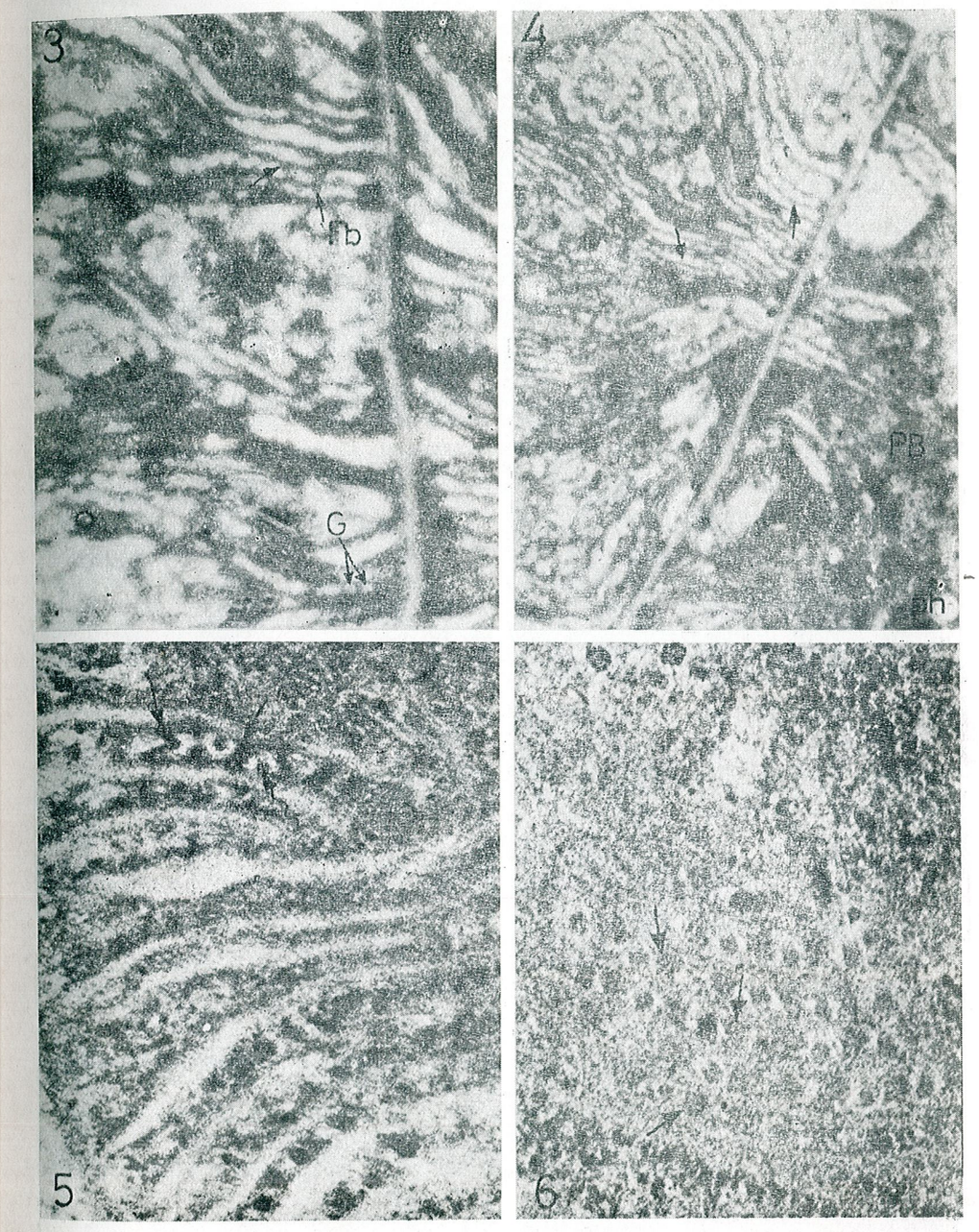
some modifications in comparison with the organisms grown on the usual medium were noticed. Table 2 shows the parameters of the helicoid namely the length, number of spires, outer diameter and the pitch. The data show that while the sea water concentration increases in the culture me-

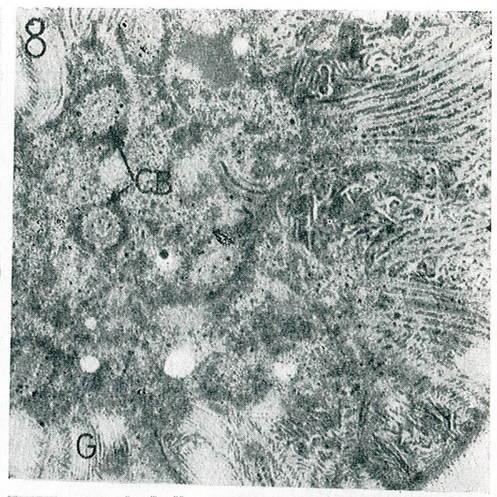
Fig. 3. — Cellular ultrastructure in the organism of control culture (Zarrouk medium) Fb, phycobilisomes; G, granules of polyglucoside 32 000 ××.

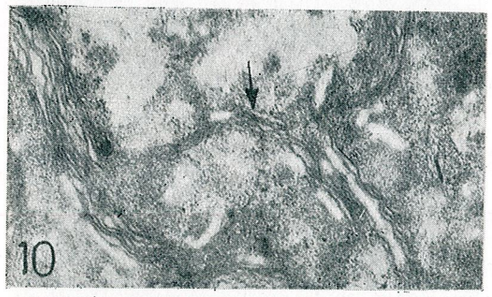
Fig. 4. — Thylacoids with phycobilisomes (arrows); PB-polyhedral body; ph-polyphosphate body. 32 000 × (5% SW + 90% ZM).

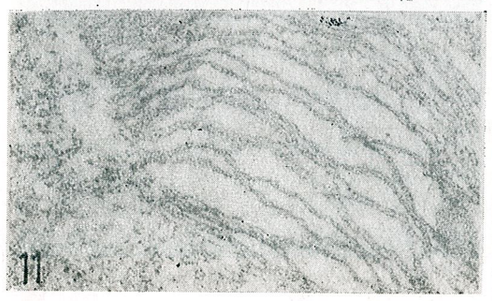
Fig. 5. — Phycobilisomes attached to thylacoids (straight arrows) and granules of polyglucoside (waved arrows) 78 000 × (20% SW + 80% ZM).

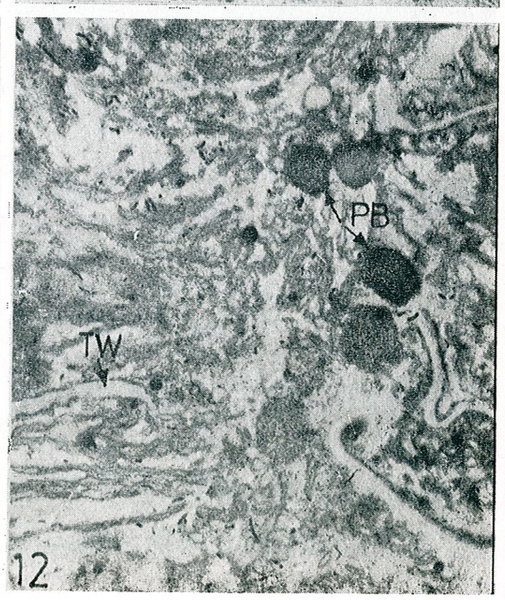
Fig. 6. — Rows of phycobilisomes (arrows) on less contrasting thylacoidal membranes. 73 400 × (30% SW + 70% ZM).











dium the algal filaments are longer, establishing the values between 403—425 μ in the variants grown on media prepared with sea water in concentrations between 30% and 50%. In concentrations higher than 60% sea water in the nutritive medium the algal filaments are as long as 340—386 μ.

The helicoid lengthening in cultures grown on ever higher concentrations of sea water in the nutritive medium is an adaptative response of the organisms to the growth under unfavourable conditions (1).

Together with the algal filament lengthening, the number of spires increases, the distance between them reduces as well as the outer diameter of the helicoid.

The fact that sea water can be used to prepare the culture medium to grow alga *Spirulina platensis* was also tested by cytological analysis. Figs 4—6 represent electron micrographs of the organisms grown on the

Table 2

Variation of the morphological parameters of the helicoid in *Spirulina platensis* grown on the nutritive media with sea water

Variants	Relationship sea water/Zarrouk medium (%)	Lengths of filaments $\bar{X}$ (μ)	Number of spires $\bar{X}$	Pitch $\bar{X}$ (μ)	Outer diameter (μ)
I The control (ZM)		295	5	54	40
II	5/95	308	5	52	38
III	10/90	300	5	49	38
IV	15/85	318	6	49	42
V	20/80	365	6	55	42
VI	25/75	356	6	52	41
VII	30/70	403	7	52	41
VIII	35/65	421	8	48	34
IX	40/60	408	8	44	38
X	45/55	418	14	20	27
XI	50/50	425	12	23	26
XII	55/45	408	15	23	22
XIII	60/40	412	10	42	32
XIV	65/35	386	10	35	38
XV	70/30	382	7	40	38
XVI	75/25	350	7	45	39
XVII	80/20	368	7	52	39
XVIII	85/15	355	7	50	40
XIX	90/10	348	6	50	37
XX	95/5	340	7	55	37

Fig. 7. — CB-cylindric bodies in longitudinal section. G-polyglucosidic inclusions of filamentous form. 28 000 × (40% SW + 60% ZM).
Fig. 8. — Numerous polyglucosidic inclusions are noticed displayed in parallel with the thylacoidal membranes. CB-cylindric bodies in transversal section. 23 000 × (50% SW + 50% MZ).
Fig. 9. — SG-granules of cyanophycine and G-polyglucosidic inclusions. 23 400 × (60% SW + + 40% ZM).
Fig. 10—11. — Photosynthetic membranes without phycobilisomes (70% SW+30% ZM).
Fig. 12. — Destruction of the photosynthetic apparatus and of the cross walls (Tw). Polyhedral bodies remained unchanged (80% WS + 20% ZM).

nutritive medium prepared with concentrations of 5%—30% sea water, and reveal the presence of numerous thylakoidal membranes and less frequent storage products. The algal cultures grown on nutritive media prepared with concentrations of 40%—60% sea water and the photosynthetic apparatus preserve their integrity, but the phycobilisomes are more difficult to notice (Figs 7—9). In case of increased sea water concentrations (60%—80%) we noticed the evident reorganisations of the cellular content, illustrated by the presence of numerous inclusions and degradative modifications of the photosynthetic apparatus (Figs 10—12).

CONCLUSIONS

1) The sea water utilisation to prepare the nutritive medium for the culture of alga *Spirulina platensis* represents a cheaper solution of biomass for intensive cultures.

2) The nutritive medium prepared from sea water in concentrations of 40—55% proved to be the most adequate for the cultivation of *Spirulina platensis* the crops obtained on these media being similar to the control culture.

REFERENCES

1. BUSSON F., *Spirulina platensis* (Gom.) Geitler et *Spirulina geitleri* J. de Toni : *Cyanophycées alimentaires*, Service de Santé, 1971.
2. CLEMENT G., Ann. Nutr. Alim., 29 : 477—488, 1975.
3. FAUCHER O., COUPAL B. and LEDUY A.. Canadian J. Microbiology, 25 (6), 752—759, 1979.
4. PETERFI St. L., BERCEA V., DRAGOȘ N., VERES M., *Agricultură, alimentație, ambianță*, Cluj-Napoca, 33—35, 1982.
5. PETERFI ST. L., DRAGOȘ N., BERCEA V., NICOARĂ ANA, GILĂU G., *Contribuții botanice*, Cluj-Napoca, 1984, 175—180.
6. POPOVICI GH. and BOLDOR O., Rev. roum. Biol., Biol. végét., 28 (1) : 23—27, 1983.
7. RICHMOND A., Annual Report, Inst. Desert, Res Sede, Boquer, Jehiel R., Elychiar Centre for Res Appl. Algology, 1—19, 1977.
8. RICHMOND A., Biotechnology, vol. 3, 1983, 138—139, Ed. H. Dellveg, Verlag Chemie, Weinheim Durfield Beach, Florida, Basel.
9. TITU H., POPOVICI GH., STANCA DOINA, Rev. roum., Biol., Biol. végét 30 (1) : 33—38, 1965.
10. ZARROUK C., Doctoral Thesis, Fac. Sci. Univ. Paris, 1966.

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LA DYNAMIQUE DES ÉLÉMENTS MINÉRAUX AU COURS DE LA PÉRIODE DE VÉGÉTATION DES DRAGEONS DE LA VIGNE

ANCA ANTOHE

The study is a continuation of a previous experiment (1, 2, 3) carried out in the North-East of Moldavia, dealing with two types of *Vitis vinifera* (Aligoté and Fetească neagră).
The dynamics of the mineral elements in the course of the vegetation period in *Vitis vinifera* reflects the physiological differences between types and ecological peculiarity of adaptation of the autochthonous type.

Le contenu en substances minérales des organes de la vigne se trouve sous l'influence des différents facteurs, qui varient selon les étapes physiologiques de la croissance et du développement de la plante.

La domination d'un certain élément dans un organe confirme que chacun de ces éléments a une importance bien déterminée dans l'activité physiologique de la plante, aussi y-a-t-il une absorption sélective des éléments.

Le contenu en substances minérales n'est pas statique, il se modifie pendant la période de végétation. Parallélement à l'accumulation des éléments mineraux a lieu aussi l'accumulation de la matière organique ; mais l'intensité du développement de ce processus n'est pas identique.

L'accumulation de la substance organique se passe plus intensément que l'accumulation des éléments minéraux. En calculant la substance absolument sèche, on constate la diminution continuelle du contenu relatif de substances minérales, bien que le contenu absolu augmente toujours.

Une sorte de « dilution » des substances minérales a lieu dans la matière organique qui s'accumule beaucoup plus rapidement.

D'autre part, certains des éléments minéraux, étant volatilisables, passent d'un organe à un autre, à différents moments. Un élément nutritif assimilé par les plantes peut prendre part à la formation des nouveaux composés nécessaires au processus de croissance ou de formation de la substance fonctionelle, peut passer dans de substances de réserve et ainsi de suite.

Les recherches effectuées dans ce domaine (4, 5, 6) se sont axées spécialement sur l'action des engrais minéraux sur la vigne. On a étudié le rythme de l'absorbtion des éléments minéraux au cours d'un cycle végétatif de même que le contenu de nitrogène, de phosphore et de potassium dans les principaux organes de la vigne (4, 5, 6).

En Moldavie on n'a pas entrepris de telles recherches.

MATÉRIEL ET MÉTHODE

On a effectué cette étude dans la Station Expérimentale de Horticulture et de Viticulture Iași, dans des condition d'expérimentation identiques à celles rappelées dans les travaux antérieurs (1, 2, 3). Les recherches représentent une étude plus complexe sur les particularités biologiques des crus : Aligoté et Fetească neagră.

On a suivi la dynamique des éléments minéraux dans les feuilles, dans les internoeuds et dans les bourgeous avec leurs noeuds d'insertion, sur trois catégories de drageons : ceux de la base, ceux du milieu et du bout du sarment. On a prélévé des échantillons en fonction de la présence ou l'absence de l'inflorescence et on a homogenisé 3—4 feuilles, 3—4 internoeuds et 3—4 bourgeons avec leurs noeuds.

On a pris des échantillons pendant les phénophases de cette manière : la croissance active de la plante, la grande période de croissance en longueur des drageons, la période qui suit la floraison, le mûrissement, la maturation des fruits et le commencement de la chute des feuilles.

On a établi l'appréciation du contenu des éléments minéraux par la minéralisation dans l'humidité avec acide sulfurique et on a détermine : le nitrogène total par la méthode Kjeldahl, le phosphore colorimétrique, le potassium, le sodium, le calcium par la photométrie à flamme. Les résultats ont été exprimés en grammes éléments pour 100 grammes substance sèche.

RÉSULTATS ET COMMENTAIRES

La dynamique du nitrogène (fig. 1) dans les feuilles des drageons présente des variations selon la phénophase. Pendant la période de la croissance active où les feuilles sont jeunes et manifestent une croissance intense, la quantité de nitrogène dans les feuilles est grande. Pendant la floraison, le nitrogène des feuilles diminue étant utilisé dans le développement des organes qui produisent des fruits. Lorsqu'on passe à la phénophase de la formation des fruits, la quantité de nitrogène des feuilles augmente pour diminuer ensuite en passant en partie des feuilles dans les organes de la plante qui restent pendant l'hiver.

En ce qui concerne l'espèce Fetească neagră, les feuilles situées aux noeuds à inflorescence se caractérisent par la présence d'une quantité plus grande de nitrogène. Pour le cru Aligoté ces différences présentent un caractère variable au cours des phénophases.

Les feuilles des drageons situées au milieu et au bout du sarment ont une quantité plus grande de nitrogène durant les premières phénophases de la période de végétation.

De ces deux crus, le cru Aligoté contient plus de nitrogène dans les feuilles, situation qui coïncide avec le fait que les feuilles de ce cru sont plus pauvres en glucides.

La variation quantitative du nitrogène des internoeuds pourrait être mise en corrélation avec les processus de croissance en longueur et en épaisseur de l'axe des drageons. Au cours de la croissance de l'axe la quantité de nitrogène est plus grande mais quand la croissance cesse (surtout en épaisseur), les glucides commencent à se déposer, fait qui détermine la diminution de la quantité de nitrogène. De même que pour les feuilles, des internoeuds de cru Fetească neagră qui correspondent avec la présence au noeud respectif de l'inflorescence se caractérisent par une grande quantité de nitrogène. Pour l'Aligoté ces differences sont moins significatives, étant en corrélation avec le prolongement de la croissance chez cette espèce.

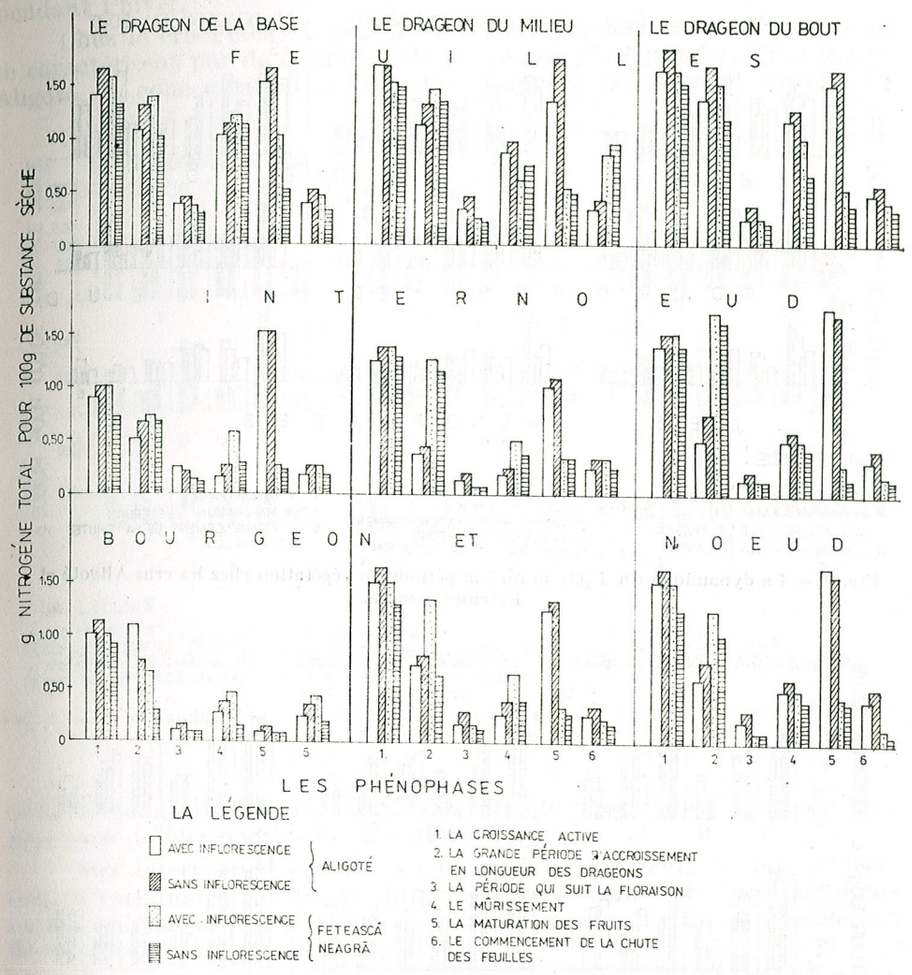

Fig. 1. — La dynamique du nitrogène durant la période de végétation chez les crus Aligoté et Fetească neagră.

Pour ce qui est des bourgeons avec leurs noeuds d'insertion, la diminution pregnante de la quantité de nitrogène dans la première moitié de la période de végétation peut être mise en corrélation avec la croissance des bourgeons dont les tissus méristématiques sont riches en substances protéiques.

Pour le cru Aligoté dans les bourgeons et dans les noeuds la quantité de nitrogène est plus grande par rapport au cru Fetească neagră.

La dynamique du phosphore (fig. 2). Dans les feuilles la quantité la plus grande de phosphore se trouve pendant la phase de croissance active. A mesure que les feuilles mûrissent et surtout lorsqu'elle vieillissent la

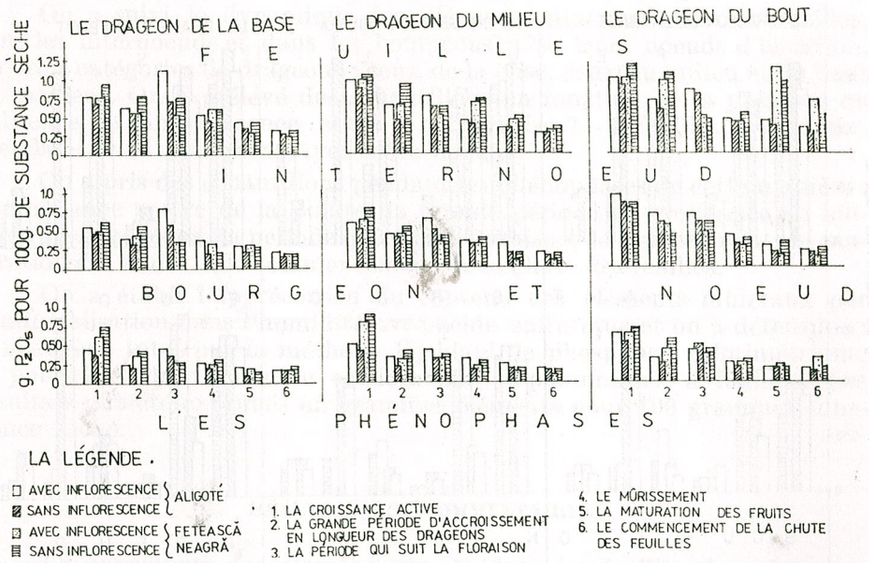

Fig. 2. — La dynamique du P_2O_5 durant la période de végétation chez les crus Aligoté et Fetească neagră.

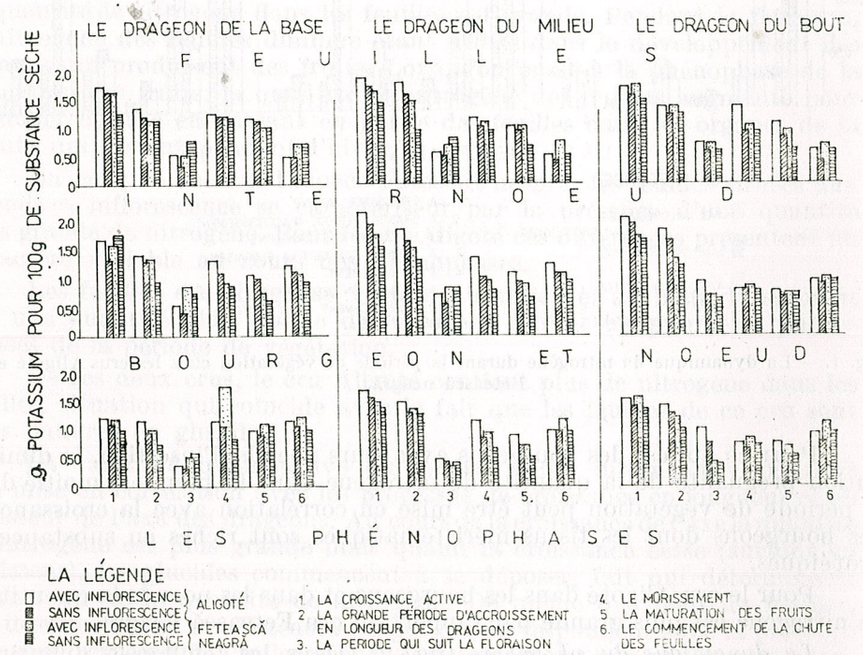

Fig. 3. — La dynamique du potassium durant la période de végétation chez les crus Aligoté et Fetească neagră.

quantité de phosphore diminue pour passer dans les organes qui restent pendant l'hiver.

Chez le cru Fetească neagră les feuilles dépourvues d'inflorescences se caractérisent par de quantités de phosphore plus grandes. Chez le cru Aligoté, la concentration réduite du phosphore est mise en corrélation

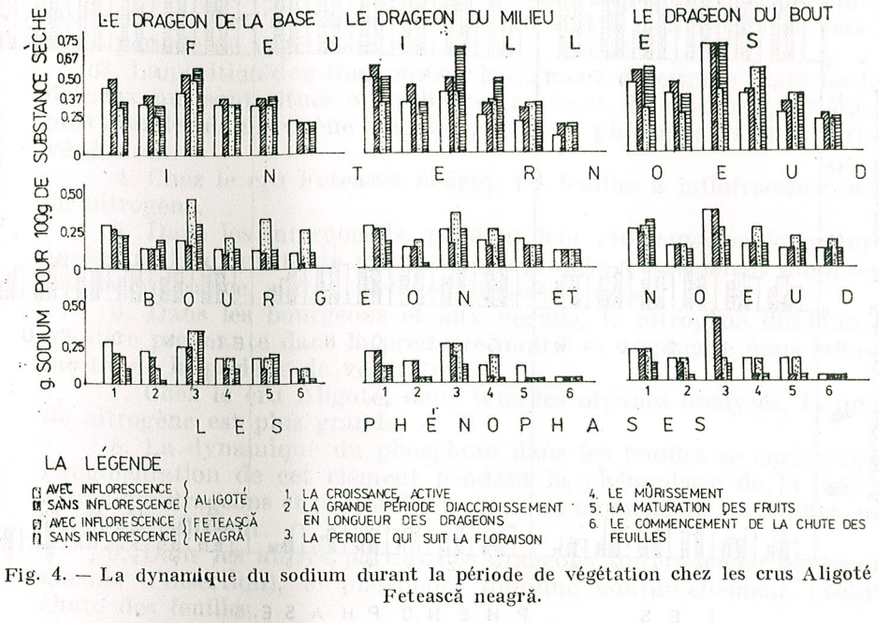

Fig. 4. — La dynamique du sodium durant la période de végétation chez les crus Aligoté et Fetească neagră.

avec les quantités plus petites de glucides (le phosphore participant aux processus de phosphorisation des glucides).

Aux internoeuds et dans les bourgeons avec leurs noeuds d'insertion la variation quantitative du phosphore se caractérise par une diminution qui va jusqu'à la chute des feuilles, ce qui est lié au phénomène de réutilisation de cet élément.

Chez le cru Aligoté, la courbe de la diminution du phosphore a une marche sinueuse marquant une petite amplification temporaire après la floraison, liée au dévéloppement de l'appareil qui produit des fruits.

La dynamique du potassium (fig. 3). Le potassium est l'élément très mobile des tissus de la plante. La vigne est connue comme une espèce qui contient de grandes quantités de potassium.

On constate d'après les données acquises la présence en grande quantité du potassium dans les feuilles, aux internoeuds et même dans les bourgeons, spécialement pendant les phases de la croissance active de ces organes.

La diminution de la quantité de potassium dans les organes analysés a lieu lentement et plus tard que celle des autres éléments.

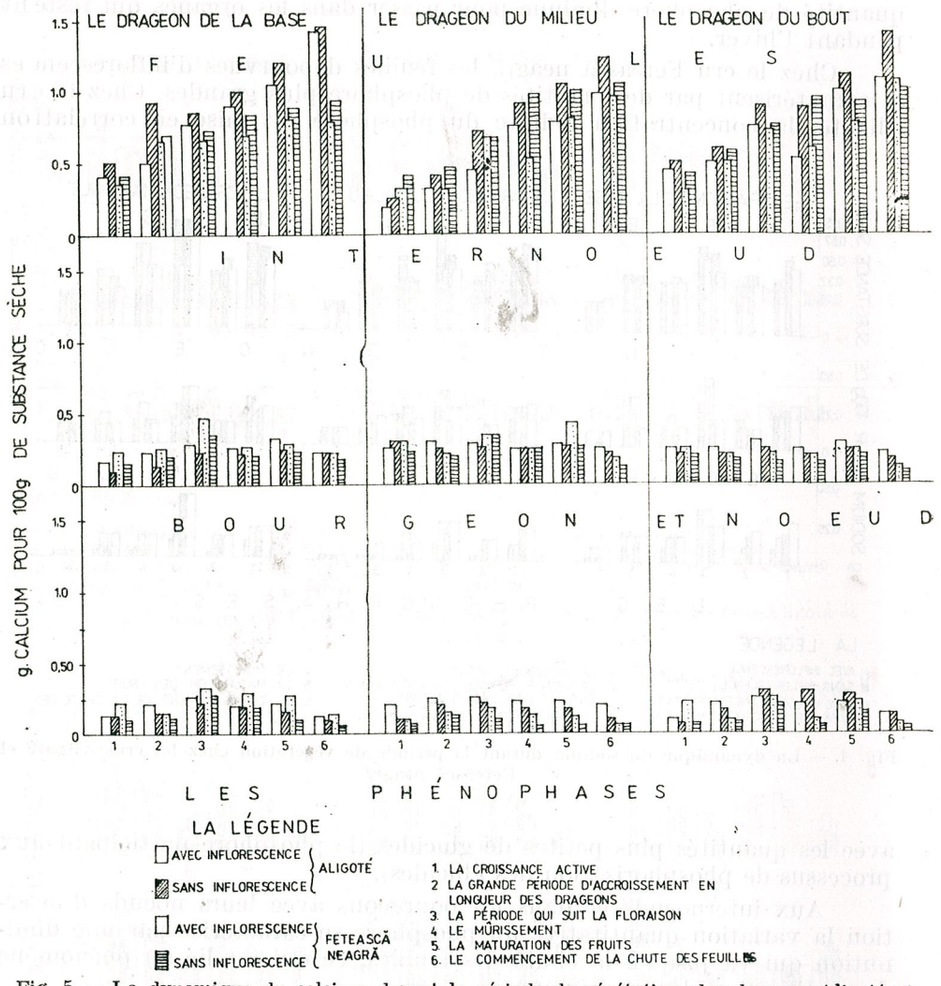

Fig. 5. — La dynamique du calcium durant la période de végétation chez les crus Aligoté et Feteasca neagră.

La dynamique du sodium (fig. 4) varie en sense inverse par rapport au potassium. Bien qu'il apparaisse en quantité plus grande que le potassium, juste au moment où l'on utilise au maximum celui-ci, le sodium ne peut pas remplacer le potassium en ce qui concerne son rôle physiologique.

La dynamique du calcium (fig. 5). Cet élément augmente du point de vue quantitatif dans les feuilles jusqu'à leur chute. En participant à la formation des membranes squelettiques, le calcium est un élément qui ne peut être réutilisé. Dans le cadre de l'axe des sarments, l'action de déposer les substances de réserve fait que la variation calculée en pourcent du calcium soit moins évidente.

CONCLUSION

1. L'amplitude des oscillations du nitrogène total est plus grande par rapport aux autres éléments, à cause du fait que le nitrogène total comprend le nitrogène organique et le nitrogène minéral.

2. Dans les feuilles, le nitrogène diminue pendant la période de la croissance active, durant la période qui suit à la floraison et vers la fin de la période de végétation.

3. La position des drageons sur le sarment détermine dans les feuilles de ceux qui sont situés au milieu et au bout du sarment, des quantités plus grandes de nitrogène dans les premières phénophases de la période de végétation.

4. Chez le cru Feteasca neagră, les feuilles à inflorescence ont plus de nitrogène.

5. Dans les internoeuds, pendant leur croissance en longueur et en épaisseur, la quantité de nitrogène est grande. Cet élément diminue lorsque la croissance, surtout celle en épaisseur, cesse.

6. Dans les bourgeons et aux noeuds, le nitrogène diminue d'une manière pregnante dans la première moitié et augmente dans la seconde moitié de la période de végétation.

7. Chez le cru Aligoté, dans tous les organes analysés, la quantité de nitrogène est plus grande.

8. La dynamique du phosphore dans les feuilles se caractérise par l'augmentation de cet élément pendant la phénophase de la croissance active des drageons et par sa diminution au moment où les feuilles mûrissent et vieillissent.

9. Dans les autres parties des drageons (internoeuds, bourgeons et noeuds d'insertion), le phosphore diminue continuellement jusqu'à la chute des feuilles.

10. Le potassium se trouve dans de grandes quantités dans les feuilles, dans les internoeuds et dans les bourgeons.

11. Le calcium augmente du point de vue quantitatif dans les feuilles, jusqu'à leur chute.

BIBLIOGRAPHIE

1. ANTOHE ANCA, Rev. Roum. de Biologie, 1983, **28**, 2, 77.
2. ANTOHE ANCA, Rev. Roum. de Biologie, 1984, **29**, 2, 177.
3. ANTOHE ANCA, Travaux du Muséum d'Histoire naturelle Gr. Antipa, 1984, **XXV**, 379.
4. CONDEI GH., Inst. de cercet. pt. vitic. și vinif., 1970, **2**, 289.
5. PANAIT ELISABETA, Lucr. șt. Inst. Agr. Iași, 1966, **9**, 595.
6. POENARU I., CORBEANU STELA, LĂZĂRESCU V., St. și Cercet. de Biolog. veget., 1959, **1**, 83.

CORRELATION BETWEEN MORPHINE PRODUCTION AND CAPSULE AREA IN *PAPAVER SOMNIFERUM* L.

ION I. BĂRA and TEODOR T. POPESCU

A close correlation between the capsule area and the capsule weight was noticed. Self-pollinated capsules were found to have generally a bigger area than free-pollinated ones. The capsule area is correlated with the diameter, but slighty correlated with the height. The total morphine content, per capsule, is directly proportional to the weight of capsule walls. There is a positive correlation between morphine content and capsule area.

Inevitably, the results of any research activity have, finally, practical results. In biology, the investigations made on different species from the culture or the natural flora are meant to establish maximum efficiency uses or to improve bioproductivity. On the other hand, selection and amelioration when scientifically employed presuppose a good knowledge of the correlations between different traits (morphological, anatomical, biochemical etc.). In this way the time necessary to obtain new lines, hybrids or cultivars is reduced, and laborious, accurate, expensive investigations are no longer necessary.

The interest in *Papaver somniferum* L. is due to the morphinic alkaloid produced by this species which has many pharmaceutic uses. Many authors tried to pinpoint the correlations between the morphine content and the most different phenotypic features (morphological, anatomical, biochemical, phenological etc.) and the production variations in accordance with the dynamics of the abiotical factors.

So we noticed positive correlations between the capsule number in a plant and the morphine production (1). This is very interesting especially because the number of capsules proved to be a stable hereditary feature (2). So, the selection of some plants with a high number of capsules per individual means, implicitly, the selection for high morphine productivity. We have also found positive correlations between the morphine production and the capsule weight (3), the investigations for noticing the interdependence between the morphine quantity and the dry substance quantity, or between the latter and the number of stigmatic rays of the capsules etc. being already known (4). At the same time we pointed out another interrelation, triple, between the casule number and the morphine quantity and the vegetation period. In plants with long vegetation period the morphine content is negative correlated with the capsule number (1). The correlation between the number of days necessary for blooming and the morphine production is also negative (3). On the contrary, the morphine content rises proportionally with the plants ageing (especially after blooming) as well as with the density (up to the optimum) of plants (5).

Another aim of our investigations was finding out the correlations between the type and the dose of some mineral nutrients and the mor-

REV. ROUM. BIOL.—BIOL. VÉGÉT., TOME 31, N° 2, P. 145—152, BUCAREST, 1986

phine production. We noticed that NO_3^- has a stimulating effect while NH_4^+ plus urea have a depressive effect (6). Na^+ also stimulates the morphine accumulation. The N and P administration raises the opium and morphine content (7), and some micronutrients (individual or in combination) contribute to the growth of the morphine content, still depending on the variety or cultivar used in the experiment (8). Correlations between L-dopa-decarboxylase and morphine in latex were also noticed (9).

As to the interdependence between the climatic factors and the morphine production, it was established (10, 11) that a small quantity of water during anthesis and a great period of sunshine have positive effects.

When trying to establish connections between the morphine production and the growth of the meristematic activity (12) we could not find any parallelism.

Taking into account the fact that the morphine synthesis and accumulation are characterised by weak heritability and superdominance (13) we proposed to investigate some possible correlations between the morphine quantity of one capsule and its surface (area).

In our previous investigations we could not establish correlations between other morpho-anatomic features (capsule height or diameter, number of stigmatic rays) and the morphine content.

MATERIAL AND METHODS

We investigated 33 variants of *P. somniferum* L. (different cultivars, hybrids etc.) cultivated in the field of the Experimental Station — Secuieni (Roman), in 1982. The material proper was used to obtain 2 categories of variants — one in which the seeds were from self-pollinated capsules in 1981, and the other in which the plants were free pollinated. The high diversity of the material proper (19 variants) was determined by the desire to investigate individual variability as much as possible (the material originated from the growing together and the free pollination for 4 years of the cultivars : De Botoşani, Olanda 245, K 103, Mahndorfer and Extaz).

The measures of the capsule diameter and height were done separately on the capsule plot obtained by self-pollination, and the capsule plots of the I—IV order. The data were statistically worked out.

In order to notice some possible correlations between the morphine production and the capsule surface we devised a programme on a computer. In accordance with the results of the statistic processing of capsule diameter and height we made the numeric determination of the form of the variation curves of the capsule area (diameter function for different heights) and we calculated the capsule area in the approximation of an ellipsoid (tables 1 and 2, Fig. 1).

The programme for the numeric determination of the form of the variation curves of the capsule area as a function of the diameter for different heights is shown in table 1 and that for the capsule area in the approximation of an ellipsoid in table 2.

The statistic values of capsule area and weight are shown in table 3, and the correlation between the morphine production and the capsule area in table 4. The morphine content was determined by the chromatographic method.

Table 1

Programme for the numeric determination of the form of variation curves of capsule area in accordance with the diameter for different heights

Entering data

0	gP/R	The diameter D_0 STO 0
1	RCL 0	The height I_0 STO 1
2	g PSE	
3	g PSE	
4	ENT	
5	X	
6	STO 2	
7	RCL 1	
8	ENT	
9	X	
10	STO 3	
11	RCL 2	
12	—	
13	ENT	
14	X	
15	f √	
16	RLC 0	
17	:	
18	STO 4	
19	ENT	
20	1	
21	+	
22	RCL 0	
23	X	
24	RCL 1	
25	:	
26	g ln	
27	RCL 3	
28	X	
29	RLC 4	
30	:	
31	RCL 2	
32	+	
33	RCL 5	
34	X	
35	STO 6	
36	g PSE	
37	g PSE	
38	1	
39	STO+0	
40	g GTO 01	
41	f 1	
42	gP/R $\frac{\pi}{2}$ STO 5	

Table 2

Programme for capsule area in ellipsoidal approximation

Entering data

0	gP/R	The diameter D_0 STO 0
1	RCL 0	The height I_0 STO 1
2	ENT	
3	X	
4	STO 2	
5	RCL 1	
6	ENT	
7	X	
8	STO 3	
9	RCL 2	
10	—	
11	ENT	
12	X	
13	f √	
14	RCL 0	
15	:	
16	STO 4	
17	ENT	
18	1	
19	+	
20	RCL 0	
21	X	
22	RCL 1	
23	:	
24	g ln	
25	RCL 3	
26	X	
27	RCL 4	
28	:	
29	RCL 2	
30	+	
31	RCL 5	
32	X	
33	STO 6	
34	f 1	
35	gP/R $\frac{\pi}{2}$ STO 5	

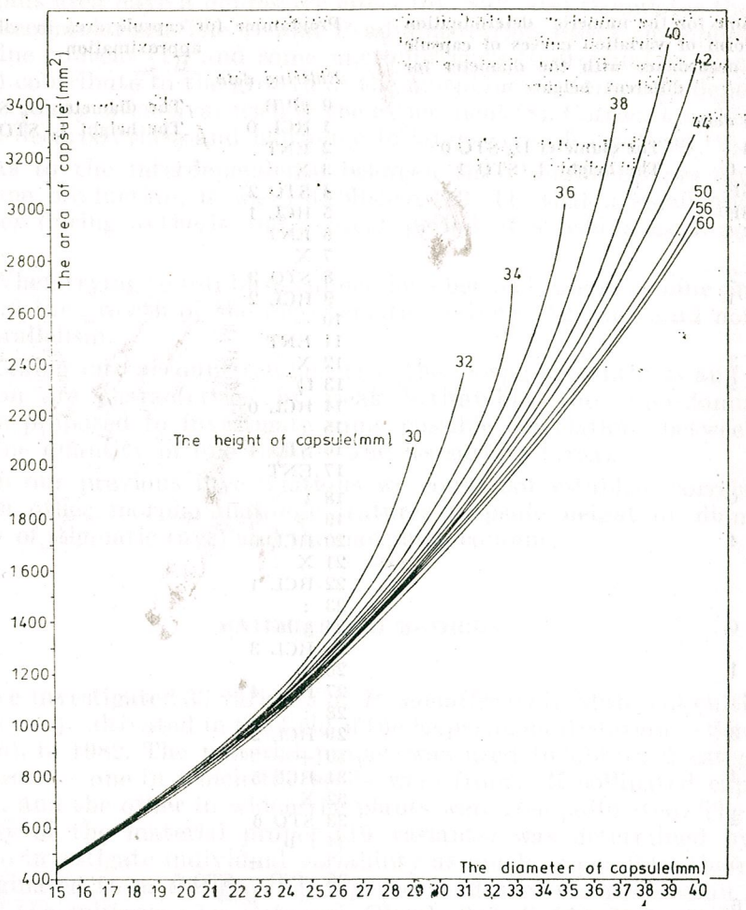

Fig. 1. — The variation curves of capsule area in ellipsoidal approximation for different heights.

RESULTS AND DISCUSSIONS

By introducing the data obtained from the statistic processing in the above-mentioned programmes, we noticed the existence of a close connection (correlation) between capsule area and weight. The correlation coefficient (r) has in many cases values near 1 (1 = maximum value). The biggest medium area of the capsules was found in a variant from the material resulting from seeds obtained by self-pollination in 1981 ($\bar{x}_a$ = = 3464.8 mm²) the smallest ($\bar{x}_a$ = 1490.5 mm²) being registered in another variant of the same source. If we take into account the cumulated values we notice that the biggest medium value is in the same variant, while the smallest medium value ($\bar{x}_a$ = 1043.7 mm²) is found in the variant obtained from seeds from the USSR. In general, in capsules obtained by

Table 3

The statistic value for some traits of poppy capsules

The variant	Self-pollinated capsules			Capsules of II—IV order			Cumulated values		
	$\bar{x}_a$	$\bar{x}_m$	r	$\bar{x}_a$	$\bar{x}_m$	r	$\bar{x}_a$	$\bar{x}_m$	r
GM (RPU) (1981)	1603.9	1.598	0.30	2005.9	1.555	0.65	1210.6	1.130	0.59	1687.7	1.477	0.54
GM (1980)	1519.3	1.578	0.70	1525.5	1.520	0.56	1385.8	1.325	0.92	1495.3	1.513	0.75
BC-2 (1980)	1914.6	1.494	0.70	1836.7	1.633	0.40	—	—	—	1888.4	1.549	0.61
U.S.S.R.	2688.0	2.110	0.85	1159.6	0.862	0.95	1373.0	1.104	0.89	1043.7	0.773	0.84
Kapeczky	2238.2	1.500	0.89	1993.7	1.614	0.87	—	—	—	2012.3	1.502	0.73
Jemciujnii	1816.4	1.291	0.86	2086.6	1.449	0.58	1606.4	1.257	0.96	1867.0	1.320	0.87
Ekendorf	—	—	—	1912.7	1.501	0.61	1302.4	1.070	0.92	1845.1	1.318	0.45
Modoronez	1606.1	1.090	0.88	2292.2	1.603	0.36	1263.3	0.776	0.81	1775.5	1.208	0.80
De Mureș	2147.8	1.803	0.51	2170.7	1.817	0.66	2440.0	1.850	0.43	2242.1	1.848	0.53
Jemciujnii	—	—	—	2589.7	1.812	0.90	1652.0	1.295	0.80	2403.0	1.827	0.83
Kapeczky × Jemciujnii	1979.0	1.174	0.54	1930.2	1.178	0.54	1798.6	0.748	0.88	1929.4	1.101	0.56
Eckendorf × Jemciujnii	2548.8	2.049	0.62	2085.1	1.931	0.45	2091.1	1.550	0.57	2284.7	1.925	0.60
Modoronez	1680.4	1.203	0.71	1746.0	1.384	0.83	1258.5	0.838	0.70	1560.7	1.109	0.77
Eckendorf	2450.0	1.688	0.64	2544.4	1.811	0.51	2222.5	1.654	0.71	2471.6	1.765	0.62
The seeds from the "Stejaru" Station field.	2200.5	1.875	0.83	1878.8	1.496	0.69	1936.3	1.590	0.75	1997.9	1.624	0.78
	2757.7	2.477	0.92	2437.3	2.021	0.81	2065.5	1.630	0.70	2442.2	2.045	0.89
	2246.5	1.677	0.77	2084.0	1.370	0.65	1551.8	0.979	0.89	2246.4	1.676	0.77
	2077.5	1.693	0.87	1841.0	1.783	0.90	—	—	—	1974.6	1.726	0.80
	2367.3	2.264	0.72	2287.8	1.967	0.91	—	—	—	2365.4	2.142	0.44
	2390.5	1.995	0.67	2089.5	1.624	0.30	2112.0	1.447	0.99	2242.7	1.819	0.76
	2017.8	1.443	0.62	1693.4	1.250	0.85	1726.6	1.030	0.67	2374.0	1.296	0.72
	2260.8	1.852	0.76	1891.0	1.590	0.79	1972.2	1.373	0.87	2052.9	1.679	0.78
	2230.3	2.154	0.93	—	—	—	1799.3	1.248	0.96	2094.2	1.870	0.91
	2362.2	1.986	0.78	1789.3	1.618	0.90	1880.7	1.674	0.95	2047.1	1.780	0.85
	2039.3	1.639	0.87	1620.6	1.324	0.96	—	—	—	1840.2	1.541	0.92
	2657.0	2.312	0.24	2383.8	1.886	0.52	2338.0	2.101	0.61	2455.3	2.062	0.50
Self-pollinated plants in 1981 (1)	2765.7	2.422	0.91	2258.8	1.233	0.84	2417.3	1.830	0.92	2497.2	2.243	0.85
	2570.4	2.204	0.86	2181.0	1.822	0.88	1869.3	1.444	0.86	2243.2	1.863	0.89
	3464.8	2.610	0.75	2592.7	2.074	0.56	2004.0	1.407	0.99	2871.2	2.204	0.79
	2905.0	2.078	0.93	—	—	—	—	—	—	—	—	—
	1490.5	1.252	0.79	—	—	—	—	—	—	—	—	—
	2226.6	1.882	0.65	—	—	—	—	—	—	—	—	—
	1852.8	1.771	0.96	—	—	—	1740.5	1.491	0.99	1838.7	1.732	0.97

$\bar{x}_a$ = the medium area of capsule; $\bar{x}_m$ = the medium weight of capsule;

Table 4

The correlation between the morphine production/capsule and the area of capsule at variants of *Papaver somniferum* L.

The variant	Self-pollinated capsules			Capsules of 1st order			Cumulated values		
	Mean area	—r—	Mean morphine production	Mean area	—r—	Mean morphine production	Mean area	—r—	Mean morphine production
GM (R.P.U.) 1981	1210.6		0.42	1687.7		0.48	1603.9		0.46
GM (1980)	1385.8		0.40	1495.3		0.56	1519.3		0.60
BC-2 (1980)	—		—	1888.4		0.52	1914.6		0.54
U.S.S.R.	1373.0		0.32	1043.7		0.22	2688.0		0.59
Kapeczky	—		—	2012.3		0.42	2238.2		0.39
Jemciujnîi	1606.4		0.36	1867.0		0.42	1816.4		0.41
Eckendorf	1302.4		0.52	1845.1		0.55	—		—
Modoronez	1263.3		0.23	—		—	—		—
De Mureș	2440.0		0.43	2242.1		0.63	2147.8		0.65
Jemciujnii	1652.0		0.22	2403.0		0.44	—		—
Kapecky × Jemciujnîi	1798.6		0.21	1929.4		0.46	1979.0		0.57
Jemciujnîi × Eckendorf	2091.1		0.23	2284.7		0.75	2548.8		1.04
Modoronez	1258.5		0.14	1560.7		0.26	1680.4		0.36
Eckendorf	2222.5		0.46	2471.6		0.51	2450.0		0.69
Seeds from the "Stejaru" station field	1936.3		0.46	1997.9		0.78	2200.5		0.97
" "	2065.5		0.90	2442.2		0.88	2757.7		0.94
" "	1551.8		0.23	2246.4		0.43	2246.5		0.58
" "	—		—	1974.6		0.45	2077.5		0.41
" "	—		—	2365.4		0.79	2377.3		0.95
" "	2120.0		0.39	2242.7		0.58	2390.5		0.74
" "	1726.6		0.22	2374.0		0.32	2017.8		0.43
" "	1972.2		0.51	2052.9		0.62	—		—
" "	1799.3		0.20	2094.2		0.30	—		—
" "	1880.7		0.55	—		—	2362.2		0.73
" "	—		—	1840.2		0.74	—		—
The seeds from self-pollinated plants in 1981	2338.0		0.92	2455.3		1.01	2657.0		1.16
	2117.3		1.21	2497.2		1.23	2765.7		1.06
	1869.3		0.84	2243.2		0.93	2570.4		0.75
	2004.0		0.42	2871.2		0.92	3464.8		1.20
	—		—	—		—	2905.0		0.68
	—		—	—		—	—		—
	—		—	—		—	—		—
	—		—	—		—	—		—
		0.45			0.60			0.72	

self-pollination the medium area is bigger than in those of the 1st order, and even more than in those of the II—IV order.

As regards the medium capsule weight, as it is quite natural the biggest medium value ($\bar{x}_m = 2.61$ g) was found in the same variant in which we noticed the biggest medium area, while the smallest was found in a variant from the Modoroneez cultivar. The cumulated values present another aspect, the biggest being registered in one of the variants proper, and the smallest in a variant from the USSR.

The capsule area proved to be highly correlated with the diameter and very little correlated with the height. Consequently, the weight of the capsule shell is correlated with the diameter. On the other hand, the total morphine content per capsule is positive correlated with the weight of the capsule shell.

In table 4 we showed the correlation existing between the total content or, better said, the morphine production (of each variant) and the capsule medium area.

From the point of view of the morphine crop per capsule the best behaviour was noticed in the variants obtained from our own material, in the case of self-pollination and that of the capsule of the 1st order. So, the morphine production per capsule, in the case of the variants from our own material, was found to vary between 0.20 % and 0.92 % in case of isolated capsules, between 0.41 % and 1.20 % for the capsules of 1st order, and between 0.30 % and 1.23 % for cumulated values. In all the other variants the values were much inferior, irrespective of the source or cultivar.

The correlation between the medium areas of capsules and the morphine content has positive values in all cases, the biggest ($r = 0.72$) being registered in capsules of the 1st order.

CONCLUSIONS

There is a close correlation between the capsule area and the capsule weight.

The area of the capsule obtained by self-pollination is, in general, bigger than in a free-pollinated plant.

Taking into account the different thickness (according to the cultivar) of the capsule walls, the correlation between the capsule weight and the area is not obligatory.

The capsule area is much correlated with the diameter and slightly correlated with the height.

The weight of the capsule wall is much correlated with the diameter. The total morphine content per capsule is directly proportional to the weight of the capsule walls.

REFERENCES

1. T. DENEVA, Genet. Sel., 8(6), 419—23, 1975.
2. U. S. KAICKER, H. C. SAINI, Indian J. Agric. Sci., 50(4), 331—33, 1980.
3. U. S. KAICKER, B. SINGH, K. A. BALAKRISHNAN, H. P. SINGH, B. CHOUDHURY, Genet. Agr., 29(3/4), 357—70, 1975.

4. K. R. KHANNA, H. P. SINGH, Planta med., 28(1), 92—6, 1975.
5. H. L. TOCKEY, G. F. SPENCER, M. D. GROVE, J. A. DUKE, Bull. Narc., 27 (4), 49—57, 1975.
6. C. COSTES, Y MILHET, C. CAUDILLON, G. MAGNIER, Physiol. Plant. 36 (2), 201—7 1976.
7. B. B. TURKHEDE, De RAJAT, V. A. RAMANATHAN, S. RAM, Indian J. Agric.Sci., 51(9), 659—662, 1981.
8. V. S. RAMANATHAN, Indian J. Agric. Res., 13 (2), 85—9, 1979.
9. MARGARET F. ROBERTS, M. D. ANTOUN, Phytochemistry (Oxf), 17 (7), 1083—88, 1978.
10. T. OHNO, K. KINOSHITA, T. KOMINE, Syoyakugaku Zasshi, 31 (1) 44—56, 1977.
11. T. OHNO, K. KINOSHITA, T. KOMINE, Syoyakugaku Zasshi, 35 (1), 38—42, 1981.
12. S. SÁRKÁNY, K. M. NYOMARKAY, P. GRACZA, Ann. Univ. Sci. Budap. Lorando Eotvos Nominatae Sect. Biol., 16 : 103—122, 1974.
13 Z. HALAVACKOVA, Sb. Uvti (Ustav Vedeckotech Inf) Genet Slechteni, 9 (1), 39—44, 1973.
14. A. GYÉRESI, G. RÁCZ, Lucr. Staț. "Stejaru", 299—306, 1980.

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RELICTES DANS LA FLORE DE ROUMANIE

IV

PALUDELLA SQUARROSA (Hedw.) Brid. Sp. Musc. III, p. 74(1817) appartient au genre monotypique *Paludella* Brid. Sp. Musc., 1817 (Paludella Ehrh. in Phytophyll. VII, 69, 1788), fam. *Meesiaceae* Schimp. constituant — avec les genres *Amblyodon* B.&S. nom. cons. (monotypique) et *Meesia* Hedw. nom. cons. (ayant 4 espèces) — des types à caractère sous-arctique expressivement relictaire dans la bryoflore de Roumanie.

Les caractéristiques diagnostiques essentielles du genre *Paludella* sont : feuilles caractéristiques squareuses recourbées ; les cellules de la lamine papilleuses ; la capsule ovoidale allongée avec de nombreux stomates ; péristome double ayant les dents (p. externe et p. interne) également longues, celles internes sans cils.

Synonymes de l'espèce : *Bryum squarrosum* L. Sp. pl. ed. 2, p. 1585 (1763) et Herb. ; *Mnium squarrosum* L. jun. Meth. musc., p. 364 (1787) ; *Bryum squarrosum* Hedw. Sp. Musc., p. 186 (1801) ; *Orthopyxis squarrosa* P. Beauv. Prodr., p. 72 (1805) = *Orthopyxidis sp.* in V. F. Brotherus, Pfzf., ed. 2, t. 10, 1, 1924, p. 443—444) ; *Hypnum paludella* Web.&Mohr, Bot. Taschenb., p. 274 (1807) ; *Meesia squarrosa* Wahlenb. Flora lappon., p. 356 (1812) et autres.

Du point de vue taxonomique, espèce relictaire, bien délimitée, strictement stabile et inconfondable (A. J. Grout Moss Flora of N. Am., II, 3, 1935, p. 181), le type décrit dans une localité d'Europe (Allemagne), mousse particulièrement caractéristique par ses feuilles, facile à reconnaître et stérile, dépourvue de variations infrataxonomiques essentielles n'étant décrit que f. *leptocarpa* Hagen D. K. Selck Schrift, 1908, no. 9, 1909.

Caryologiquement, espèce analysée relativement depuis peu : n = 10 mi S. Inoue 1979 — U.S.A. : Alas. (R. Fritsch, 1982, p. 164), significatif avec le même nombre de chromosomes que les relictes *Dichelyma falcatum* (Hedw.) Myr. avec n = 10 me Vaarama 1950 — Finlande, *Scorpidium scorpioides* (Hedw.) Limpr. avec n = 10 + m me Smith & Newton 1968 — Grande Bretagne, n = 10 mi Tsutsumi et al. 1973 — Suède, plus rarement n = 8 mi me Holmen 1958 — Danemark (R. Fritsch, 1982, p. 110, 202).

Habitus, *Paludella* est l'une des plus belles mousses, croît en touffes compactes ou lâches, non-incrustées, 5—10 (15) cm de haut, associée dans des bryocénoses turficoles (avec *Sphagnum* et autres), couleur verte, vert-pâle, vert-jaunâtre, ayant parfois des irisations vert-bleuâtres, à l'intérieur brun à noirâtre ; la tige régulièrement densifoliée, prévue (tomenteuse) d'un feutre dense de rhizoïdes, tige simple non-ramifiée ou présentant sous-terminal, des innovations, anneau central restreint,

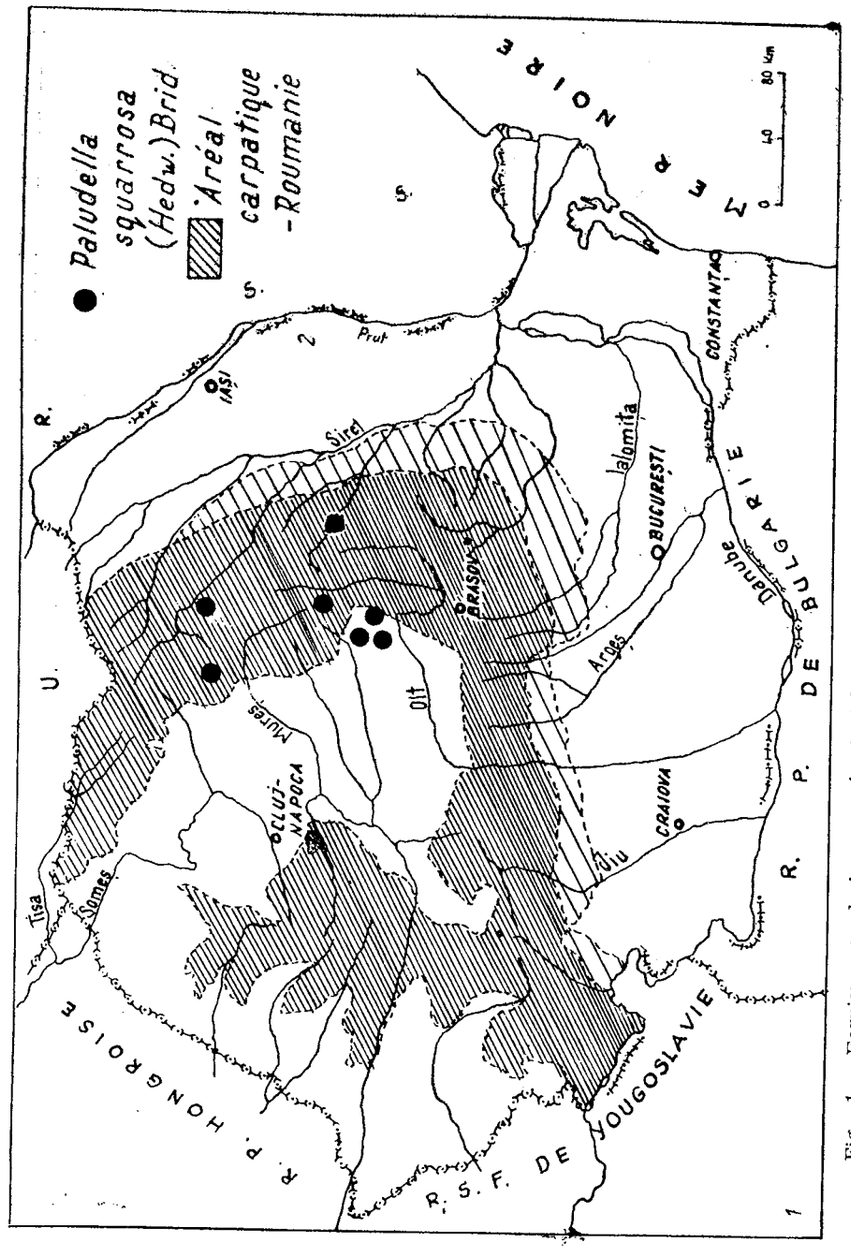

Fig. 1. — Esquisse corologique représentant les stations avec *Paludella squarrosa* (Hedw.) Brid. dans la bryoflore de Roumanie (orig.).

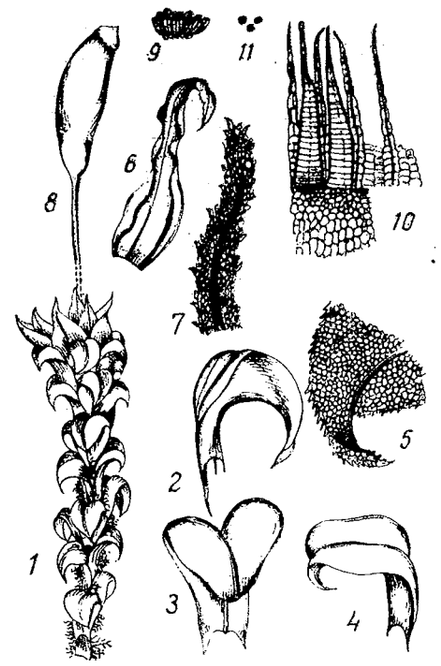

Planche I,

1—11 — *Paludella squarrosa* (Hedw.) Brid. : 1 — habitus (gamétophyte femelle); 2—4 — feuilles vues différemment; 5 — le bout d'une feuille au bord mamilleux denticulé; 6—7 — feuilles périchétiales; 8 — pédicelle avec capsule et opercule; 9 — anneau double; 10 — péristome double; 11 — spores (après A. J. Grout, Moss Flora of N. Am., II, 3, 1935, pl. 63 B, simplifié).

petit ; feuilles disposées 5-séries (2 mm de long et 1 mm de large), ovale allongées court acuminées, caractéristique squareux-carénées recourbées, decurrentes, le bord au sommet mamilleuse denticulé, la nervure mince sous-terminale, le limbe plan aux bords, convexe à partir de la nervure ; cellules parenchymatiques, au sommet de la lamine carré-hexagonal-arrondies, aux parois relativement épaisses, sur les deux faces, fortement papilleuses, au milieu de la lamine ovale, à la base très allongées hyalines, aux parois minces et purvues d'oreillettes brunâtres aux cellules plus courtes ; les feuilles périchétiales lancéolées, long-acuminées, érectes ou recourbées à bord (Pl. I).

Espèce dioïque, le pédicelle de 4—6 cm, 1-rarement 2 sporogones sur le gamétophyte, la capsule allongée ovoïde, légèrement arquée, oblique, lisse, ferrugineuse, rétrécie au bout, col court, opercule convexe brièvement apiculé, anneau double, péristome double, jaune pâle, les dents du péristome externe ± aussi longues que celles du péristome interne,

celles externes marginal finement papilleuses, avec de nombreuses (25—28) lamelles, celles internes perforées régulièrement, dépourvues de cils ; les sporogones parviennent à la maturité au moins de juin, spores petites, 14—18 (20) μ, nombreuses, sphéroïdales, jaunes, papilleuses, stériles dans quelques régions de l'aréal.

Du point de vue s p o r o l o g i q u e, des sporogones se forment rarement plus fréquents dans les régions boréal arctiques (Sibérie et Am. de N.). Des spores sous-fossiles peuvent être identifiées dans les gisements de tourbe avec *Sphagnum*. Analysées (A. Boros&M. J. Komlódi, 1975, p. 262, pl. 125) sur un échantillon de herb. (provenant de Finlande) — les spores ont comme ornementation, la sexine composée de formations semblables aux pils. Celles-ci sont plus petites, disposées régulièrement sur la face distale et sur l'autre face servant probablement de « leptome » dans l'aire centrale. En dehors de ces formations on trouve aussi des globules adhérents rares, séparés et disposés irrégulièrement. Caractéristique est le fait qu'il y a des différences non seulement en ce qui concerne l'ornementation des spores, mais aussi entre les spores elles-mêmes ; les unes ont en section optique (LO) une ornementation plus fine, due aux formations plus petites et plus denses ; d'autres en ont une ornementation plus distincte, à cause des formations plus libres disposées irrégulièrement, ce qui, estimons-nous, pourrait aussi être attribué au stades de maturation des spores [1].

Des restes du gamétophyte, surtout ceux des feuilles particulièrement caractéristiques et de leurs fragments aux cellules papilleuses, conduisent à l'indentification avec certitude, du matériel sous-fossile de ce relicte (Atlas des restes de plantes de la tourbe, par A. V. Dombrovskaia, M. M. Korinova et S. N. Tiuremnov, 1959, pl. 30, 36, 42).

É c o l o g i q u e m e n t, *Paludella* croît dans des marais tourbeux froids, faiblement acides, eutrophiques, dans des formations interzonales avec *Sphagnum* et d'autres mousses turficoles. Mousse hygrophile, palustre, héleophile terricole, turfophile, acidophile, psychrophile, des régions arctiques et alpines. En ce qui concerne le pH, *Paludella squarrosa* fait partie de la classe de pH 5.0—5.5 avec des variations dans l'amplitude comprises entre 4.6—5.6 (Finlande) et dans d'autres régions entre 5.8—6.8 et même 7.1. Conservée relictaire dans une partie de l'aréal, dans de petits plateaux ou dans des dépressions (« Schlechten ») très humides, riches en précipitations ou baignés de sources minérales alcaline, endroits souvent inondés temporairement, de même que dans des marais tourbeux bombeux (« sagnes »), dans de petites dépressions en Arctique sibérienne et autres. Elle représente dans la bryoflore de Roumanie un relicte glaciaire, une espèce boréale, indicatrice des bryocénoses (et des cénoses en général) minératrophes des marais à des altitudes de 650 à 1700 m s.m. Elément ± dizonal, poussant dans la zone montagneuse, rarement dans celle sous-alpine.

Du point de vue c o r r o l o g i q u e, en Roumanie, *Paludella* a été signalée, dans le passé, tout a fait sporadiquement, seulement dans quelques stations carpatiques des bassins tourbeux eutrophiques du nord

[1] Pour certains renseignements, discussions et précisions sporologiques nous remercions le dr. N. Rădulescu-Mitroiu (Université de Bucarest) et pour certaines données géographiques le dr. Ec. Muică (Institut de Géographie de Bucarest).

et du nord-est du pays (fig. 2) à végétation muscinale abondante appartenant en exclusivité aux Carpates Orientales et leurs dépressions de la courbure interne (Transylvanie et Moldavie). Espèce relictaire fréquemment citée (Boros, Nyárády, Pop, Papp, Ştefureac, Lungu, Plămadă, Coldea), dans certaines stations étant en voie de disparition. Documentaire conservé dans l'Herbier de l'Université de Cluj-Napoca, comme dans certains herbiers personnels (Tr. I. Ştefureac, E. Plămadă) ; relicte qui a survécu aux glaciations des Carpates de Roumanie.

Les stations ayant *Paludella squarrosa* de la bryoflore de Roumanie sont les suivantes :

— Les M o n t s H a r g h i t a, dans le marais légèrement bombé, à sources d'eau minérale alcaline de Dumbrava Harghitei (« Harghitaliget »), des pieds de ces montagnes à altitude de 786 m s.m., la commune Vlăhiţa (départ. de Harghita), signalée par Á. Boros (Bot. Közl., 38, 5—6, 1941, p. 363—366), station où l'on a trouvé auparavant aussi l'espèce relicte *Saxifraga hirculus* L. qui constitue en ensemble une rare cénose relictaire d'intérêt botanique international. Elle a été signalée aussi dans les marais de Moara Zugravului (« Festömalon »), Căpîlniţa, Lueta, Chiurui-Băi (ancien départ. de Odorhei, aujourd'hui départ. de Harghita) ; toujours dans les Monts Harghita elle a été signalée sur la cime Mădăraş (1750—1800 m s.m.) par T. Pócs (Ann. Hist. Musei Nat. Hung., S.n. IX, 1958, p. 112), stations notées dans le fichier des Bryophytes de Roumanie (Tr. I. Ştefureac).

Ces stations se trouvent dans la partie S—S.—E. du départ. de Harghita, limitrophes du départ. de Covasna, à une altitude de 650—1750—1800 m s.m., dans les bassins des rivières Homorodul Mare et Homorodul Mic, appartenant au complexe de marais tourbeux entre les rivières Tîrnava Mare et la Vallée de l'Olt ; elles sont situées dans l'aire des Carpates Orientales entre la latitude nord de 46° 36′ et la longitude est de 25° 31′.

— Les M o n t s C ă l i m a n i, le marais de Răchitiş sous la cime Cica, 1700 m s.m. où *Paludella* a été signalée (1942) par B. Zólyomi (Bot. Közl., 40, 1943, p. 129—130, 143), on l'a mentionnée (-c) comme très répandue sous des aspects de végétation pareils à celles du type des toundras de Fenoscandia avec de nombreuses espèces boréales de *Carex* et autres. Dans l'Herbier de l'Université de Cluj-Napoca il y a (sous le no. 571911, leg. 25, VII, 1942, B. Zólyomi) un échantillon de *Paludella* de cette station ; dans le même massif a été récoltée (25.VII.1972) et publiée (Stud. şi cercet. de Ocrot. Nat., 3, Suceava, 1973, p. 54, 59) par le dr. Gh. Coldea, determinée par le dr. E. Plămadă et existant dans l'herb. de celui-ci [2].

— Les M o n t s B i s t r i ţ e i, le marais tourbeux de la vallée Neagra Broştenilor-Cristişor, identifiée sous-fossile (L. Lungu, thèse, 1971, p. 262, fig. 35—37) dans plusieurs horizons (profil sporo-pollinique III, 340 cm) de la limite sud du marais tourbeux oligotrophe, datant postglaciaire dès le commencement de l'Atlantique, sans s'être maintenue, à cause des changements climatiques et de l'influence de l'homme, jusqu'a la végétation actuelle.

[2] Pour ces données nous remercions le dr. I. Gergely et l'ing. V. Farcaşiu, de même que de dr. E. Plămadă et le dr. Gh. Coldea.

En général, les stations avec ***Paludella***, des Carpates de Roumanie sont situées pour les Monts Bistriței et Călimani au nord entre la latitude nord de 47°24′ (extremité sud et 46°58′ (à leur limite du sud) et la longitude est entre 24°42′ et 24°57′; et au sud pour les Monts Harghita avec la latitude nord de 46°36′ (au nord) et 46°04′ (au sud) et la longitude est entre 25°31′ (au sud) et 25°51′ (vers l'est). Elles appartiennent, du point de vue phytogéographique, à la région central-européenne, province est-carpatique, sous-province des Carpates Orientales, aux deux districts, au nord les Monts Gurghiului et Harghitei, et au sud les Monts Perșani.

Cénologiquement, ***Paludella*** este mentionnée dans les marais tourbeux de Roumanie en associations semblables ± à celles de tout son aréal, avec des espèces de Bryophytes à caractère boréal; ainsi, dans Dumbrava Harghitei, elle est massivement associée à *Drepanocladus aduncus* (Hedw.) Warnst. et *Homalothecium nitens* (Hedw.) Robins. et moins à *Calliergonella cuspidata* (Hedw.) Loeske, *Campylium stellatum* (Hedw.) J. Lange & C. Jens., *Sphagnum flexuosum* Dozy & Molk. et autres (A. Boros, 1941; E. Pop 1960; Tr. I. Ștefureac, 1950 et parmi les Cormophytes, *Saxifraga hirculus* L., *Drosera rotundifolia* L., *Vaccinium oxycoccus* L., *Andromeda polifolia* L., *Ligularia sibirica* (L.) Cass.

Au bord sud-est du même marais avec *Picea* et *Alnus* un relevé phytocénologique (10.VIII, 1950, Tr. I. Ștefureac) a été noté pour la première fois sur 10 m² avec la briocénose : *Paludella squarrosa* (Hedw.) Brid. 3—4.5, *Sphagnum flexuosum* Dozy & Molk. 2.3, *Homalothecium nitens* (Hedw.) Robins. 1—2.3, *Aulacomnium palustre* (Hedw.) 1.1 et autres, en association avec *Drosera rotundifolia* L., *Menyanthes trifoliata* L., *Potentilla erecta* (L.) Räuschel, *Ligularia sibirica* (L.) Cass., *Succisa pratensis* Moench, *Dryopteris thelypteris* (L.) A. Gray, et sur le Mont Mădăraș (1750—1800 m s.m.) T. Pócs trouve (1958) *Paludella* en association avec *Drepanocladus vernicosus* (Mitt.) Warnst., *Calliergon stramineum* (Brid.) Kindb., *Stellaria alsine* Grimm, *Cardamine amara* L., *Carex canescens* L.

Dans les Monts Călimani, *Paludella* est mentionnée (B. Zólyomi) en association avec *Meesia triquetra* (Richter) Aongstr., aussi espèce relictaire, massif où a été signalée par le même auteur l'espèce relictaire rare *Carex heleonastes* Ehrh et par Gh. Coldea (1973) *Eriophorum gracile* Koch Roth. De ce massiv, Gh. Coldea décrit (R. 6 et R. 9, tab. II, 1973), *Paludella* avec *Sphagnum warnstorfii* Russ., *S. flexuosum* Dozy & Molk., *Climacium dendroides* (Hedw.) Web. & Mohr, *Aulacomnium palustre* (Hedw.) Schwaegr. et autres avec *Carex rostrata* Stokes, *C. stellulata* Good., *C. limosa* L., *C. pauciflora* Lightf., *Menyanthes trifoliata* L., *Potentilla palustris* (L.) Scop., *P. recta* (L.) Räuschel etc. (*Bryophyta* det. E. Plămadă). L'étude cénologique des stations avec *Paludella* de notre pays, nous préoccupe.

Dans les marais tourbeux de Slovaquie (Tchécoslovaquie) dont j'ai visité quelques-uns, *Paludella* provient également, en association avec *Meesia triquetra* (Richter) Aongstr., et aussi avec *Trichophorum alpinum* (L.) Pers. J. Smarda, 1954; K. Rybniček & E. Rybničová, 1965; K. Rybniček, 1958, 1966 et autres).

A remarquer, du point de vue phytocénologique, que dans cette partie carpatique *Paludella*, *Meesia* et autres Bryophytes relictaires pro-

viennent avec aussi des espèces relictaires des genres *Rhynchospora*, *Trichophorum* et autres. Dans les marais tourbeux de Roumanie, celles-ci sont beacoup plus, rares, sporadiques. Mais dans le marais tourbeux de Lueta (départ. de Harghita) avec *Paludella* est mentionnée aussi *Rhynchospora alba* L.) Vahl, espèce circumpolaire hygrophile, oligotrophe, mais non *Trichophorum alpinum* (L.) Pers., en échange, il faut souligner dans les marais tourbeux du départ. de Harghita, à Vlăhița, la présence de *Paludella* avec l'espèce relictaire circumpolaire boréale *Saxifraga hirculus* L. sporadique en Europe.

Paludella des montagnes Tatra (Rostoka) est notée en association avec *Aulacomnium palustre* (Hedw.) Schwaegr., *Homalothecium nites* (Hedw.) Robins., *Sphagnum palustre* L., *S. subsecundum* Nees et autres et significative avec *Helodium blandowii* (Web. & Mohr) Warnst., parmi les Phanérogames : *Carex pauciflora* Lightf., *Galium uliginosum* L. et bien d'autres parmi lesquelles l'espèce relicte *Trientalis europaea* L. à la lisière de la formation silvestre avec *Picea*, *Betula*, complexe on a mentionné l'association *Paludelletum squarrosae* (J. Györffy, Folia Cryptog., 2, 1935, p. 107—108).

Les bryocénoses avec *Paludella* de la Péninsule Scandinave ressemblent à celles de Sibérie. A Arctis, la plante croit en masse dans les marais tourbeux avec des mousses (T. Herzog, 1926, p. 127) ainsi que dans des bryocénoses avec *Aulacomnium*, *Homalothecium*, *Drepanocladus* et autres. À remarquer, dans toutes, l'association fidèle entre *Paludella*, *Meesia* et *Homalothecium nitens* (Hedw.) Robins, élément aussi sous-arctique, et qui existe de même dans les forêts rares de conifères marecagées de *Sphagnum* et fréquemment de *Meesia triquetra* (Richter) Aongstr. dans les marais humides des formations de toundra de la région holarctique, espèces qui ne manquent ni dans la flore nord-polaire.

En même temps, à remarquer le fait que dans le marais tourbeux entre Lueta et Căpîlnița, *Paludella* est mentionnée, parmi les hépatiques cormoïdes, avec l'espèce *Odontoschisma sphagni* (Dicks.) Dum. (sous *Jungermannia sphagni* Dicks., J. Chr. G. Baumgarten Enum. IV, no. 2547, 1846, p. 221—222, notée aussi par J. F. Schur, Enum. plant. Trans. 1866, no. 4621, p. 875 comme *Sphagnoecetis communis* Nees = *J. sphagni* L. dans des marais tourbeux avec *Sphagnum* de Büdöș, Lueta, Căpîlnița, ainsi que par Fr. Hazslinszky, 1885, 28, p. 49; comme *Sphagnocetis communis* Nees ab Es, syn. de *J. sphagni* Dicks, *Odontoschisma sphagni* Dum.). Selon certains auteurs (H. Gams, 1973, p. 68 et autres, *Sphagnocetis communis* var. *macrior* Nees est synonyme de *Odontoschisma denudatum* (Mart.) Dum.; selon d'autres, comme par exemple R. Duell et coll. (1983, p. 54), celle-ci est notée comme une espèce indépendante, les deux étant mentionnées dans la bryoflore de Roumanie, mais *O. denudatum* est notée avec le signe ?ce qui doit être précisé.

Paludella a été retrouvée, dernièrement, dans les stations du départ. de Harghita, notée et récoltée des marais tourbeux avec des sources d'eaux minérales alcalines (E. Pop, Tr. I. Ștefureac, E. Plămadă) à Dumbrava Harghitei (Vlăhița) et connue aussi dans les stations Căpîlnița, Lueta, Chirui-Băi. Nos investigations bryologiques, ainsi que celles de Gh. Mihai effectuées aux Monts Călimani n'ont pu retrouver des sta-

tions ayant *Paludella* dans ce massif, la station n'étant pas précisée de plus près par B. Zólyomi. E. Pop (1960, p. 128) inscrit ce relicte comme appartenant aux marais tourbeux oligotrophe (« tinov » avec ?) en ce qui concerne la formation dans laquelle il a été signalé dans les Monts Călimani. Nous considérons nécessaire l'exploration du terrain de ce massif, afin de dépister ce relicte, mentionné dernièrement (1973) par Gh. Coldea.

Sous l'aspect aréalographique, *Paludella*, élément circumpolaire se trouve fréquemment dans les régions arctiques et alpines et souvent, dans la zone boréale avec des sporogones, répandue massivement aussi dans les contrées sous-arctiques dans la végétation de toundra arctique européenne et sibérienne, de même que dans les forêts séculaires des zones arctiques. Du point de vue phytogéographique, *Paludella* appartient au groupe des mousses boréal-alpines et sous-arctique-alpines (J. Amann, 1928, p. 311). Dans certaines régions elle est connue seulement stérile.

En Europe, *Paludella* se trouve tant au nord et au centre, qu'à l'est et à l'ouest, vivant dans les marais tourbeux et dans les prairies avec *Sphagnum*, comme élément sous-alpin montagneux. L'espèce est limitée dans les zones préalpines et surtout aux extrémités des glaciations du nord dans une large zone, à partir de l'Allemagne de l'Ouest jusqu'en U.R.S.S. à l'Est (T. Herzog—Geographie der Moose, 1926, p. 127 ; A. L. Abramova, L. I. Savici—Ljubitzkaja, Z. N. Smirnova — Déterminateur des mousses de l'Arctique de U.R.S.S., 1961, p. 487—488). Fréquemment et en masse dans l'Europe du Nord dans la végétation de toundra de Fénoscandia (dans de nombreuses stations de Finlande, Norvège et Suède) comme en Europe centrale (Allemagne du Nord, rarement au sud et à l'ouest, en Tchécoslovaquie, Pologne, Autriche, Suisse (Alpes, jusqu'à 1850 m s.m., dans celles de l'Est jusqu'à 2100 m s.m. et très rarement dans celles de l'Ouest), en U.R.S.S. (Sibérie — Vallée de l'Jenisei), Asie (Altaï 2200 m s.m.), Afrique de Sud, Amérique du Nord, Groenlande, Spitzbergen, les Iles Beeren, Labrador.

En Europe centrale elle est répandue dans une zone continuelle de la Plaine du Nord de l'Allemagne jusqu'à la région préalpine ; en Asie, de l'Alaska jusqu'en Groenlande ; de la partie du nord de l'Amérique du Nord jusqu'au sud de Vermont, New-York et British-Columbia ; en Sibérie jusqu'à Ochotzk.

Paludella squarrosa constitue pour les Monts Sudeți, Alpes, Carpates et autres, un relicte sous-arctique glaciaire, nord-boréal, rarement avec des sporogones. Comme aréal, elle a sa limite au sud et à l'ouest en Europe. En Roumanie elle avance vers sa limite sud à la latitude de nord de 46°18′ 15″ (Dumbrava Harghitei). Plus vers l'est, transdanubienne, on la trouve sporadiquement en Yougoslavie (Z. Pavletić, 1986, p. 285) dans les terrains bombeux à la frontière entre la Slovénie et l'Autriche, mais elle n'est pas signalée dans les Monts Balkans (S. Petrov, 1975).

A notre proximité nord-carpatique, *Paludella* a été signalée auparavant par A. J. Žmuda (1911) de Galicie (U.R.S.S.) et insérée dans «Bryotheca polonica» (1916) et après publiée par J. Györffy de la localité Zips (Rostoka) des Monts Tatra (Folia Cryptog. 2, 1935, p. 105—102).

Bien que ce relicte, parmi les Briophytes ait été signalé des Carpates de Roumanie, il n'a pas été pris en considération dans les travaux actuels d'une certaine synthèse sur des aréals plus larges européens et cela d'autant plus que sur le territoire de Roumanie ce relicte se trouve à la limite sud de son aréal général.

Par sa rareté et par sa valeur scientifique, bryofloristique et historique, comme élément relictaire boréal, arctique glaciaire, relicte sporadique dans la bryoflore des Carpates de Roumanie, par endroits en voie de disparition, à cause de l'impact entre l'homme et la nature, *Paludella squarrosa* a été inscrite pour la Roumanie aussi dans les « listes rouges » pour être protégée et conservée dans les stations où, sporadiquement, on l'a conservée vivante.

Traian I. Ștefureac

VERA BONTEA, D. SC., AT THE AGE OF 75

TATIANA ȘESAN, LUCREȚIA DUMITRAȘ and AL. MANOLIU

A remarkable scientist and research-worker, VERA BONȚEA, D. Sc., has been serving the Romanian science for over five decades now. Her contributions to the fields of plant protection, phytopathology and mycology have been highly appreciated both in Romania and abroad.

Daughter of Andrew and Anastasya Shtchyurevych, Vera Bontea was born on April 13, 1911 in the village of Vadul-lui-Vodă, district of Lapushna. After attending the primary school in her native village, she took up courses at the college in Kishinev. In 1936 she graduated from the Faculty of Natural Sciences as well as that of Agronomy, in Jassy — the oldest university centre in Romania. She started her activity as chief of the rural district of the Agricultural Department of Dorohoi and then she worked as head of the domain office within the Agricultural Department of Lapushna. In 1941 she began to work in the Institute of Romanian Agricultural Researches (IRAR). She obtained the doctor's degree at the Institute of Biology "Traian Săvulescu" in Bucharest in 1964. Professionally well trained in biology and agriculture, throughout her career Vera Bontea, D.Sc., has developed and turned to good account her knowledge by carring out a rich and manyfold reaserch activity in the Institute of Romanian Agricultural Researches, the Institute of Biology "Traian Săvulescu" and the Research Institute for Plant Protection in Bucharest.

Scientific activity. As a mycologist, Vera Bontea had valuable contributions to the study of Romanian mycoflora by reporting numerous new micromicetae species found in our country. The results of her researches were published in 36 papers on various specific topics. Up to 1967 she coordinated the "Herbarium Mycologicum Romanicum Tr. Săvulescu". She also drew up a synopsis of Romanian mycoflora of more than 8,500, parasite and saprophyte fungus species on different substrates, which was issued by the Publishing House of the Academy of the S. R. Romania (1st ed. — 1953, 2nd ed. — 1985—1986). In cooperation with chemists she worked out physical and chemical methods for separating fungus species with morphological similarities.

As a phytopathologist, by individual as well as team investigations she studied the biology, spread and evolution of pathogens, as well as the chemical and agrophytotechnical pathogen contral methods suitable under the conditions in our country. She published 59 papers on this topic.

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She paid special attention to the dry rot of cabbage plants — induced by *Phoma lingam* a quarantine parasite which formed also the subject matter of her doctoral thesis in 1964. Other ample studies focussed on the hop downy mildew *(Pseudoperonospora humuli)* led to establishing methods of treatment, prognosis and warning, the most effective fungicides and their impact on beer quality, the variety resistance a.s.o. These results were highly appreciated at the International Congresses held in the USSR and GDR and she was awarded the "Em. Teodorescu" Prize of the Academy of S. R. Romania (1968). Another important disease studied was the vine downy mildew *(Plasmospora viticola)* for which Vera Bontea, D.Sc., and her team established prognosis and warning methods by taking into account the microclimate impact on the pathogen, the resistance to downy mildew of both the productive and the mother-plant varieties, the influence of treatment on the quality and quantity of wine and the agrobiological properties of direct producers. In case of the pathogenic agent of apple scab — *Venturia inaequalis* — the scientist paid extensive attention to the perfect form and its role in the disease perpetuation and set up efficient methods for prognosis and warning.

The list of phytopathological topics studied by Vera Bontea should also include : the sunflower white rot, the vine grey mould and powdery mildew, the apple powdery mildew, the barley helminthosporiosis, the physiological races of *Tilletia* species, the resistance of different cereal species to rusts, the peach leaf blister, the diseases of fodder plants, the diseases of field crops under irrigation conditions, the water melon anthracnosis, the rot of gladiole tuber-bulbs and others.

Ever since 1942 she has made valuable contributions to the "Phytosanitary Situation in Romania".

As a toxicologist, Vera Bontea, D.Sc., is the author of 19 scientific papers in which she elaborated or adapted various methods for investigating fungicides under laboratory, greenhouse and field conditions, for testing their effectiveness, toxicity and other characteristics with a view to applying them in production.

She also contributed to solving one of the keenest problems of reducing or even replacing the copper sulphate in plant protection especially in controlling the vine downy mildew, which needed higher quantities of copper sulphate. By using various adjuvants, the concentration of copper sulphate was reduced from 1—2% to 0.5—0.75%. In cooperation with a team of researchers from the Central Institute of Chemistry she succeeded in establishing the best formula for manufacturing the Romanian product "Carbadin". This new fungicide, totally devoid of copper, is fruitfully applied in downy mildew control, especially in vine nurseries. The same cooperation proved effective in obtaining other organic products, such as Merfazin — effective against apple scab, Hexadin and Hexadin D — for controlling stinking-smut and other wheat pests, Tiradin (TMTD) a.s.o.

The didactic activity carried out by Vera Bontea in parallel with her scientific research meant working as a teacher of agricultural sciences at the Normal School in Bucharest between 1942 and 1947. From 1970 up to 1975 she taught and organized practical demonstrations at the postgraduate courses for agricultural engineers and biologists from offices for plant protection and county quarantine and customs inspectorates of the Ministry of Agriculture.

From 1964 up to now she has carried on with academic proficiency, exigency and exceptional generosity, a tireless activity in her capacity as scientific head (coordinating the doctor's theses of a whole generation of scientific workers in the research and high school fields, etc.).

Vera Bontea's scientific activity has materialized in the publication, alone or in collaboration with other specialists, of a number of 119 scientific works, 19 papers of technical guidance, 15 popularization papers, 4 papers on various topics, 2 handbooks for secondary agricultural schools, 5 translations from the Russian biological and agricultural literature. She also published numerous reviews on books and articles in various Romanian and foreign journals. Her contributions to the Encyclopaedic Dictionary of the Academy (1962) and to the Dictionary of Phytopathological Terms (1983) should also be remembered. She also contributed by different papers at the national and international Congresses which she attended in GDR, the USSR, France, Belgium.

Vera Bontea's public activity is also very rich, ranging from the setting up of an agricultural museum of a didactic agrozootechnical farm at the Normal School (1942—1947) up to the setting up of a museum and a phytopathological herbarium at the Institute of Romanian Agricultural Researches (IRAR). She coordinated the activity of the insecticides and fungicide laboratories of the IRAR (1941—1960), of the mycology and general pathology laboratory in the Institute of Biology "Tr. Săvulescu" (1961—1969) and the mycology laboratory in the Research Institute for Plant Protection in Bucharest (1970—1975). For many years, as assistant, scientific head and laboratory head she devoted an immense volume of time, energy, and passion to initiating, coordinating and guiding the activity of various research nuclei and to forming younger staff. For many years she was a member of the Scientific Councils of the Institute of Biology "Tr. Săvulescu" and the Research Institute for Plant Protection in Bucharest.

She actively participated in organizing various national and international scientific manifestations in our country, such as the International Congress of Phytopathology, Entomology and Plant Protection in Bucharest (1949), the National Symposiums of General and Applied Microbiology (1968) and of Mycology in Bucharest (1970).

She was a member of the editorial boards and official reviewer of various scientific journals and works, i.e. : Studii și cercetări de biologie — Seria biologie vegetală, Revue Roumaine de Biologie — Série de Biologie Végétale, Omagiu lui Traian Săvulescu.

Vera Bontea, D.Sc., is member of the Society for Biological Sciences in Romania and of the Deutsche Phytomedizinische Gesellschaft in FRG.

Her public activity also includes her participation in the collectivization of the Romanian agriculture, her guiding of the activity of agricultural farms and of various agricultural campaigns.

For all her work Vera Bontea was awarded orders and medals, such as the Labour Medal (1954) and the Labour Order 3rd Class (1974).

On the occasion of her 75th birthday, her colleagues, collaborators, her ex-candidates for a doctor's degree and the present ones, her friends wish Vera Bontea, D.Sc., many healthy, happy and fruitful years from now on.

GHEORGHE ANGHEL "Pajişti intensive" (Intensive Matten odere Rasenplätze), die in der Editur "Ceres", 1984, erschien.

Die Abhandlung des Universitäts professor *Gheorghe Anghel* ist, im allgemeinen genommen, eine der ersten Erscheinungen, welche in einer zugänglichen Form einem grossem Kreise von Fachgenossen (spezialisten) besonders die Ergebnisse in Europa und in unserem Lande darbringt und in dem so wichtigen Gebiete die Kultur der "Intensiven Matten" erreicht wurden.

Gleichfalls ausgehend von den bekannten Massnahmen für die Vergrösserung der Produktion der Matten, welche wenigstens des Niveau von 10 T/Ha von trockener Substanz haben müssen und das als Vergleichs-Niveau für die intensiven Matten betrachtet wird, zeigt der Verfasser in seiner Arbeit die hauptsächlichen künftigen Arbeitsdirektionen um das zweifache dieser Produktion zu erreichen.

In der Einleitung schon wird bemerkt, dass sich die Arbeit auf eine kohe (reiche) wissenschaftliche Dokumentierung stützt u.zw.: betreffend die vorgelegten Materialien die auf den internationalen Kongressen dieser Spezialität vorgelegt wurden, bei denen der obgenannte Verfasser die Gelegenheit hatte teilzunehmen, sowie betreffend die Ergebnisse der Arbeit der Spezialisten, die im Rahmen des Forschungsinstitutes und der Produktion in der Kultur der Matten von Braşov (Institutul de cercetări şi Producţie pentru cultura pajiştilor Braşov), ein Institut dessen wissenschaftliche Tätigkeit von Professor *Gheorghe Anghel* begründet und koordiniert wird.

Das Werk besitzt 23 Kapitel (o. Abschnitte resp. Abtheilungen). Nachdem allgemeine Daten vorgelegt werden betreffend die Matten der ganzen Erde, werden in 8 Kapiteln (4—11) die hauptsälichsten Probleme der Kuktur der intensiven Matten in den Bedingungen des europäischen Erdteiles dargebracht. In diesen Kapiteln werden einige weniger bekannte Aspekte aus der Tätigkeit der europäischen Federation der Matten (E.G.F.) und der Arbeitsgruppe F.A.O. für die Bergmatten, die Federation Frankreichs für die Bergoekonomie, sowie anderer ähnlicher Organismen aus den Ländern Europa's behendelt. Ganz besonders von Interesse bildet die Forschungsthematik der Institute aus den Ländern, Teilnehmer von E.G.F., und die Mitarbeit Rumäniens, betreffend die internationalen Forschungen hinsichtlich der Matten.

In der Arbeit findet man auch die neusten Daten (Ergebnisse) der Arbeiten der Gräser und der perennen Leguminosen die in Europa kultiviert werden, sowie die Mischungen dieser für die Einführung der intensiven Matten, sowie exerimentelle Ergebnisse betreffend die Fruchtbarkeit der intensiven Matten in Europa und deren rationelle Brauchbarkeit zeigt. Die Aufmerksamkeit fällt auf die erhaltenen Ergebnisse der Matten die durch die Weide der Tiere, welche eine potentielle Produktions-Reelle der intensiven Grasmatten in den Weg bringen die 800—1000 kg/Ha Fleisch oder 10.000 l/Ha Milch erzielen können.

Die folgenden Kapitel (Kap. 12—23) betrifft in welchem Sinne die Ergebnisse und die Perspektiven der intensiven Gras-Matten in den Bedingungen unseres Landes sind. Es werden die erhaltenen Ergebnisse besprochen in der Amelioration der Gräser und der perennen Leguminosen der Matten die Experimentierung der Abarten und die Gemische von Gräsern und Leguminosen, sowie die Technologie der Samenproduktion, gedeutet.

In einem Sonderkapitel (Kap. 18) wird eine Synthese der experimetellen Resultat dargebracht, betreffend die Fruchtbarkeit (Fertilisation) der Matten in Rumänien.

Es ist die erste Synthese im nationalen Rahmen die bis heute gemacht wurde hinsichtlich der Fertilisation der Matten, welche die Möglichkeit gibt eine Technologieausarbeitung von Gras-Mattentypen anzufertigen und eine Verallgemeinung derselben mit grossen Produktionsflächen zu erzielen.

Die Arbeit enthält ebenfalls Grundelemente für die Kultivierung der intensiven Matten auf Stellen mit einer extremen Feuchtigkeit, sowie auf Salzböden.

Der Reichtum der wissenschaftlichen Daten die sehr gut selektiert und richtig gedeutet werden, die Wierdegabe der erhaltenen Resultate auf wissenschaftlichen Wege in den Produktionseinheiten unseres Landes, gleich denen die in entwickelten Ländern Europa's erzielwerden, als auch die Präzision der hauptsächlischen Richtungen einer Tätigkeit in der Zukunft, bringt die Arbeit von Professor *Gh. Anghel* einen überaus grossen Beitrag für eine gründliche Feststellung der gegenwärtigen und zu erwartenden Technologie betreffend die intensive Kultievierung der Matten und zur Orientierung der wissenschaftlichen Forschung, sowie zur wissenschaftlichen Ausbeutung in den Produktionseinheiten.

Die Arbeit wird, dem zur Folge, allen die sich mit der Vergrösserung einer Futterpflanzen-Produktion beschäftigen, empfahlem.

Gh. Motcă

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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.

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