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ENVIRONMENTAL ENZYMOLOGY

ŞTEFAN KISS*, MIHAIL DRĂGAN-BULARDA* and DANIELA PAŞCA**

SUMMARY. — Definition of the environmental enzymology is given. This is a science dealing with the enzymes present and active in the environment. It comprises: 1. soil enzymology, 2. peat enzymology, 3. enzymology of natural waters and bottom sediments, 4. enzymology of waste waters and activated sludges, 5. compost and farmyard manure enzymology, 6. humus enzymology, 7. clay enzymology, and 8. a chapter with miscellaneous topics. Environmental enzymology is, *par excellence*, an interdisciplinary science. In Romania, researches were carried out concerning all chapters of environmental enzymology. Some examples of these researches are presented, mainly in relation to environmental protection.

The environmental enzymology studies the enzymes present and active in the environment and comprises: soil enzymology, peat enzymology, enzymology of natural waters and bottom sediments, including therapeutic muds, enzymology of waste waters and activated sludges and compost and farmyard manure enzymology. Humus enzymology and clay enzymology are related to the enzymologies specified before, but they can be regarded as independent chapters of environmental enzymology. Humus enzymology deals with the enzymes involved in the synthesis and degradation of humic compounds, with the effects of these compounds on enzymes of microbial, plant and animal origin and with the state of humus-enzyme complexes. Clay enzymology studies the effects of clay minerals on the activity, synthesis and degradation of enzymes. Other topics such as enzyme activities in biodeteriorated stones are included in a miscellaneous chapter of the environmental enzymology.

Environmental enzymology is, *par excellence*, an interdisciplinary science.

The enzymes present and active in the environment play a key role in the biological cycles of elements and, consequently, in the maintenance and perpetuation of life on our Planet [14, 15]. The determination of their activities may give an idea of the overall state of the environment and the disturbances of this state due to pollution and degradation.

In Romania, researches have been carried out covering all main aspects of the environmental enzymology [13]. Some examples of these researches are presented in this paper. The examples are related mainly to environmental protection.

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1. SOIL ENZYMOLOGY

The effect of heavy metal pollution on the overall biological state of soil can be detected enzymologically by two methods. The first is a comparison of the enzyme activity in polluted and unpolluted soils. In the second method, soil samples are amended with the enzyme substrate and incubated for 3 weeks to induce the microbial synthesis of the enzyme, then analysed to determine the enzyme activity. Our results [8] showed that the microbial saccharase synthesis, as studied by the second method, is a more sensitive indicator of the mercury pollution than the activity of the saccharase accumulated in soil, as studied by the first method (Table 1).

Table 1

Saccharase activity and synthesis in $HgCl_2$-treated samples of a leached chernozem [8]

$HgCl_2$-treatment	Experimental variants	Saccharase activity ($\Delta\alpha°$)*
None	Not wetted	1.01
	Wetted	1.03
	Wetted and amended with saccharose	1.60
150 mg $HgCl_2$/100 g dry soil	Not wetted	0.69
	Wetted	0.77
	Wetted and amended with saccharose	1.09

* *Difference in optical rotations measured before and after the incubation of the reaction mixtures.*

The side effects of the pesticides or the lack of these effects can also be evaluated by the soil enzyme analysis. Thus, soil samples treated with high doses of the herbicide 2,4-D retained completely their saccharase activity and this compound did not prevent the induction of microbial saccharase synthesis in soil samples amended with saccharose [10]. At the same time, another herbicide, bromoxynil, used at a concentration of 1 ppm or in higher doses decreased the soil dehydrogenase activity [4] (Table 2).

Table 2

Dehydrogenase activity in bromoxynil-treated samples of a leached chernozem [4]

Herbicide dose (ppm)	Dehydrogenase activity (mg formazan/100 g dry soil)
0	13.95
0.1	19.16
1	7.86
10	6.12
100	6.33

The negative effect of some fertilizers on the soil can also be indicated by enzyme analysis. In a long-term field experiment, stress phenomena appeared in the development of young wheat and maize plants grown on a leached chernozem which had been fertilized annually with a high dose of NH_4NO_3 (N_{240}) for 5—7 years. Dehydroge-

nase and urease activities of this soil decreased significantly as compared to the unfertilized control (Table 3). Substantial decreases occurred in the crop yields, too [22]. But the long-term mineral fertilization of an *Agrostis tenuis* and *Festuca rubra* grassland (P_2O_5: 60; K_2O: 60; NH_4NO_3—N: 53.3 × 3 or 107 × 3 kg/ha/year) increased both the yield potential and the dehydrogenase activity of the soil [21] (Fig. 1).

Table 3

Influence of a long-term NH_4NO_3-fertilization on the enzymatic activities of a leached chernozem [22]

Fertilization	Dehydrogenase activity (mg formazan/100 g dry soil)	Urease activity (mg NH_4/100 g dry soil(
None	11.40	59.10
NH_4NO_3 (N_{240})	3.78	34.00

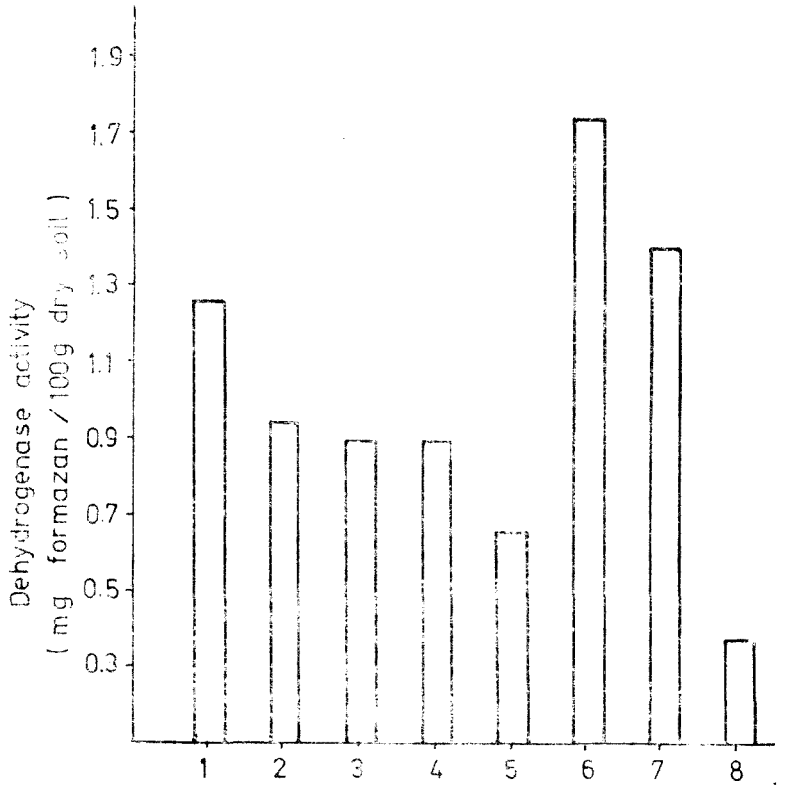

Fig. 1. *Influence of a long-term mineral fertilization on the dehydrogenase activity of a grassland soil* [21]

1 — Unfertilized. 2 — P_2O_5: 60 + K_2O: 60. 3 — P + K as in 2 + NH_4NO_3 — N: 160. 4 — P + K as in 2 + NH_4NO_3 — N: 320. 5 — P + K as in 2 + NH_4NO_3 — N: 480. 6 — P + K as in 2 + NH_4NO_3 — N: 53.3 × 3. 7 — P + K as in 2 + NH_4NO_3 — N: 107 × 3. 8 — P + K as in 2 + NH_4NO_3 — N: 160 × 3.

Rates are expressed as kg/ha.

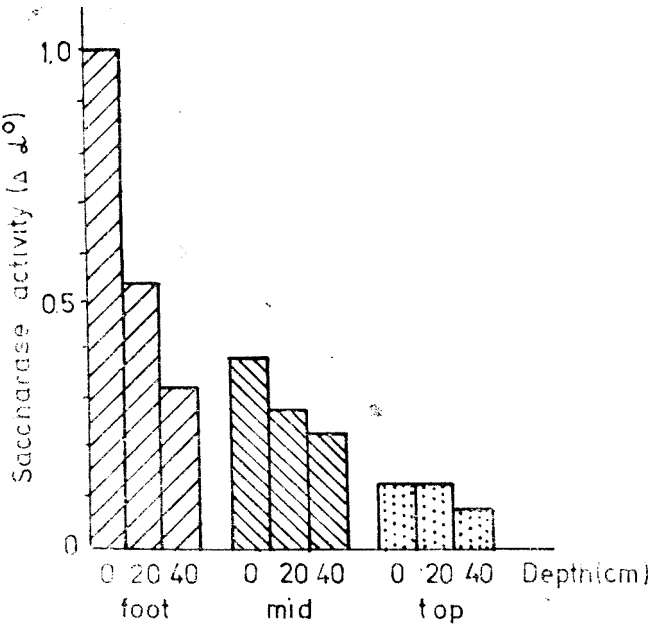

Fig. 2. *Saccharase activity in a slope hopyard soil* [12].

Even an incipient phenomenon of soil erosion can be detected through the determination of enzyme activity. Thus, in slope hopyard and vineyard soils saccharase activity was lower at the top than at the foot of the slope [11, 12] (Fig. 2).

Soil-enzymological analyses have also been carried out in connection with an experiment started on an irrigated leached chernozem 6 years before to assess the effect of 3 ploughing depths (15, 25 and 35 cm, respectively) and fertilization on plants and soil. Dehydrogenase activity of the 0—40 cm layer gave the highest values in the soil ploughed at 15 cm depth, and the lowest values in the variant of 35 cm deep ploughing (Table 4). Saccharase, urease and phosphatase activities

Table 4

Influence of ploughing depth and fertilization on the dehydrogenase activity of an irrigated leached chernozem [23, 25]

Fertilization	Dehydrogenase activity (mg formazan/100 g dry soil)		
	Ploughing depth (cm		
	15	25	35
None	9.20	5.15	6.25
N_{100}	8.87	5.64	5.14
$N_{100}P_{50}$	8.53	7.46	5.92
$N_{100}P_{50}$ + 20 t farmyard manure/ha	11.49	8.33	7.02
$N_{100}P_{50}$ + 5 t crop residues/ha	13.08	9.30	7.96

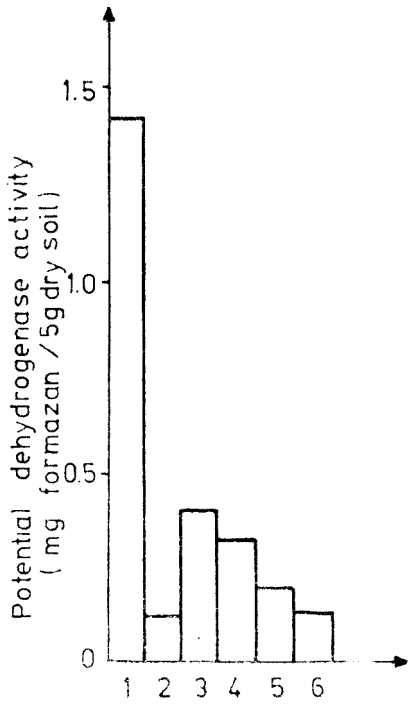

Fig. 3. *Potential dehydrogenase activity in waste dump material cultivated with sainfoin* (Onobrychis viciaefolia) *and orchard-grass* (Dactylis glomerata) *for 3 years* [3].

1 — Control soil. 2 — Waste dump material (w.d.m.) not submitted to cultivation. 3 — W.d.m. cultivated with sainfoin; sample from the 0—20 cm depth. 4 — W.d.m. cultivated with sainfoin; sample from the 20—40 cm depth. 5 — W.d.m. cultivated with orchard-grass; sample from the 0—20 cm depth. 6 — W.d.m. cultivated with orchard-grass; sample from the 20—40 cm depth.

behaved like dehydrogenase activity. In other words, ploughing at 15 cm depth gave the best results from soil-enzymological viewpoint, but the poor permeability of the soil ploughed at this depth should be improved by subsoiling to 40—60 cm depth applied periodically (once in 3—5 years) [23—25].

The enzyme methods can also be used for studying the evolution of mine spoils submitted to cultivation. With the aim to transform into soil the waste dump material from the surface mining of iron ores in Căpuș, Cluj County, different cultivation variants were experimented in which, as the results showed, a parallelism was evident between plant biomass and soil enzyme activity [1, 3] (Fig. 3).

The possibilities of utilization of enzymatic indicators for soil mapping, classification and fertility evaluation have also been demonstrated [5].

2. PEAT ENZYMOLOGY

Many enzyme activities have been analysed in the main peat deposits of our country. The analyses have proved that our peats exhibit an important enzymatic potential [20] (Fig. 4).

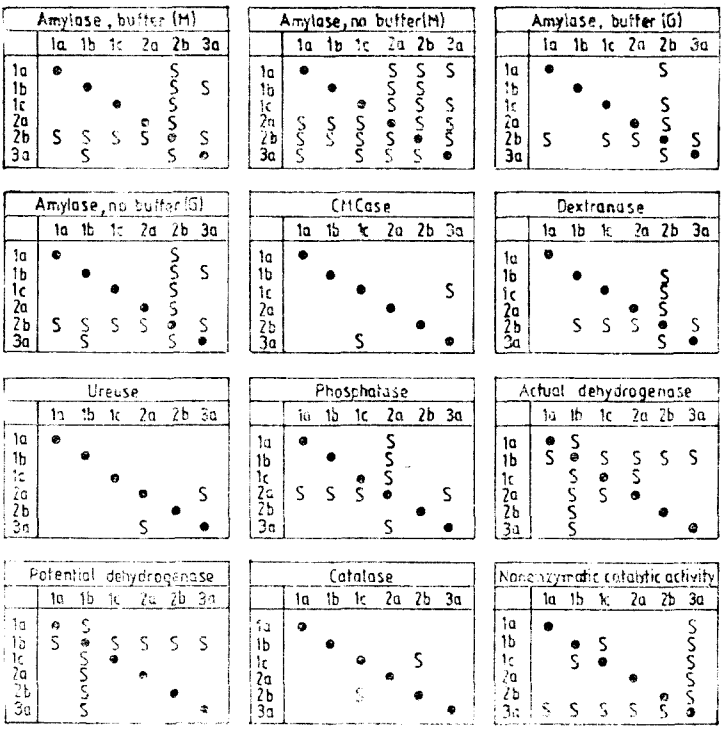

Fig. 4. *Enzymological comparison of peat samples originating from different moor types in Romania* [20].

1 — High moors. 1a — Luci I. 1b — Poiana Stampei-Căsoi. 1c — Poiana Stampei-Pilugani. 2 — Mesotrophic moors. 2a — The Retezat National Park. 2b — Luci II. 3 — Low moor. 3a — Lozna. M and G — Maltose and glucose were used as reference substances in the analysis of the hydrolytic products of starch. CMCase — Carboxymethylcellulase. S indicates that the difference between the compared peats is significant at $P = 0.05$ level.

3. ENZYMOLOGY OF NATURAL WATERS AND BOTTOM SEDIMENTS

Our laboratory worked out an enzymological classification of the majority of salt lakes in Romania, based on the determination of 7 enzymatic and nonenzymatic catalytic activities of their bottom sediments. The enzymatically most active sediments can be used as therapeutic muds. The low activity in sediments of some salt lakes indicates deep disturbances in the life of these lakes [17, 19] (Table 5).

4. ENZYMOLOGY OF WASTE WATERS AND ACTIVATED SLUDGES

Dehydrogenase and catalase activities proved to be valuable indicators of the purification efficiency of waste water treatment plants.

Table 5

Position of different salt lakes in respect of the quality of their muds as evaluated by enzymological methods [19]

Position	Salt lake	Locality	Enzymatic indicator of mud quality
1	Horea	Ocna Sibiului	549.82
2	Baia Roşie	Slănic Prahova	493.84
3	Roşu	Ocna Şugatag	474.87
4	Techirghiol	Techirghiol	472.79
5	Aluniş	Sovata	472.78
6	Cloşca	Ocna Sibiului	468.80
7	Băile	Cojocna	455.82
8	Crişan	Ocna Sibiului	442.96
9	Nr. 3	Cojocna	429.86
10	Baia Baciului	Slănic Prahova	402.71
11	Pinzelor	Ocna Sibiului	387.42
12	Ursu	Sovata	348.02
13	Sărat 1	Brăila	310.93
14	Bătrîn	Ocna Şugatag	292.09
15	Verde	Sovata	283.81
16	Mierlei	Sovata	281.60
17	Roşu	Sovata	277.10
18	Sinoe	Sinoe	264.27
19	Costineşti	Costineşti	249.51
20	Balta cu nămol	Ocna Sibiului	239.05
21	Nuntaşi	Nuntaşi	234.52
22	Ocniţa	Ocna Sibiului	232.55
23	Nou format	Ocna Sibiului	228.43
24	Fără fund	Ocna Sibiului	227.90
25	Negru	Sovata	218.21
26	Balta Albă	Balta Albă	206.89
27	Găvrilă	Ocna Şugatag	196.62
28	Poporului	Ocna Sibiului	194.31
29	Minei Mari	Ocna Dejului	176.65
30	Baia Neagră	Slănic Prahova	174.99
31	Cabdic	Ocna Dejului	133.36
32	Sf. Ioan	Ocna Sibiului	111.94
33	Baia Verde 3	Slănic Prahova	96.42
34	Ocna de apă	Coştiui	88.00
35	Auster	Ocna Sibiului	78.25
36	Baia Verde 2	Slănic Prahova	67.93
37	Grota Miresii	Slănic Prahova	66.26

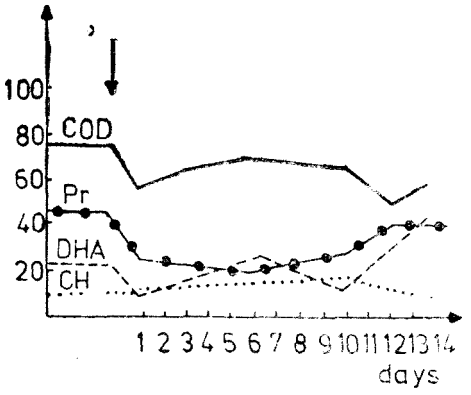

Fig. 5. *Dynamics of the chemical and biochemical indicators during continuous feeding of the activated sludge with toxicant-containing nutrient solution* [26].
COD — Chemical oxygen demand. Pr — Proteins. DHA — Dehydrogenase activity. CH — Carbohydrates. The arrow indicates the beginning of the toxicant addition.

They indicate, for example, the degree of intoxication of activated sludge with heavy metal ions or with organic pollutants [26] (Fig. 5).

5. COMPOST ENZYMOLOGY

For controlling the composting of the sludges from the purification plants of the industrial swine-breeding complexes, the enzyme activity was found to be a valuable parameter [7, 18]. Composting of swine-sludge not only reduced the environmental pollution but also resulted in an organic fertilizer which improved the biological properties, including the enzyme activity of a reddish-brown forest soil [2] (Fig. 6)

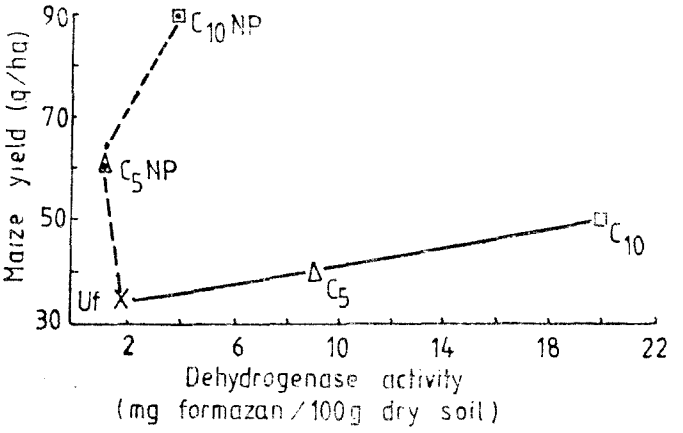

Fig. 6. *Relation between maize yield and dehydrogenase activity in a reddish-brown forest soil fertilized with composted swine-sludge* [2].
Uf — Unfertilized. C_5 — Fertilized with 5 t compost/ha. C_{10} — Fertilized with 10 t compost/ha. C_5NP — Fertilized with 5 t compost and with $N_{100}P_{50}$/ha. $C_{10}NP$ — Fertilized with 10 t compost and with $N_{100}P_{50}$/ha.

6. HUMUS ENZYMOLOGY

It is known that some phenolic compounds serve as substrates in the enzymatic synthesis of humic acids which with levan and other polysaccharides contribute to the aggregation of soil particles. Our observation [16] that some phenolic compounds inhibit the activity of the levan-synthesizing soil enzyme (levansucrase) indicates the existence of a relationship between two enzymatic processes whose products (humic acids and levan, respectively) play a role in the aggregation of soil particles because the phenolic compounds can act both as substrates in the enzymatic synthesis of humic acids and as inhibitors of the levansucrase activity.

7. CLAY ENZYMOLOGY

The clay minerals kaolinite and bentonite inhibit the activity of yeast saccharase. The inhibition does not occur when the yeast enzyme solution is added to clay mineral-soil mixtures (Fig. 7). In other words, the soil protects the enzyme against the inhibiting effect of clay minerals [9].

8. MISCELLANEA

The biodeterioration of stone monuments can easily be indicated by detecting enzyme activities in their samples. For the enzyme analysis, only small amounts of stone samples are needed [6].

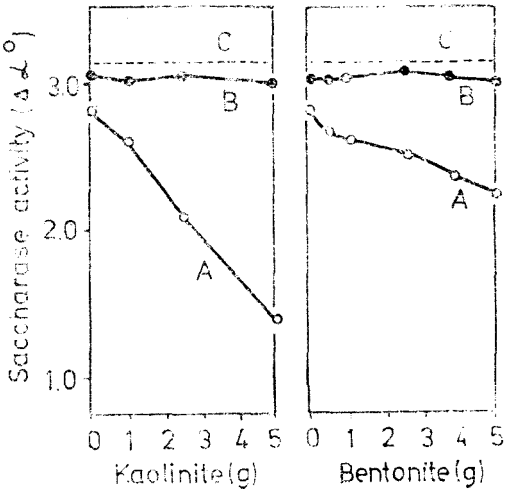

Fig. 7. *Activity of yeast saccharase ni the presence of clay minerals* **(A)** *and clay mineral-soil mixtures* **(B)** [9].

C shows the sum of the separately measured activities of the yeast and soil saccharases.

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FLORISTIC DIVERSITY INDICES OF SOME PLANT ASSOCIATIONS IN THE RETEZAT NATIONAL PARK

IOAN HODIŞAN* and MONICA BOŞCAIU*

SUMMARY. — The paper deals with a comparative study of the floristic diversity indices of some plant associations in the Retezat National Park. The authors' attention was focused on the Shannon—Wiener indices (Shannon diversity, maximum and relative information, redundance) and on the Simpson—Onicescu ones (regarding informational energy). For counting the individuals representing the identified species, the point-area sampling procedure was applied. The results obtained have shown that the floristic diversity indices represent the structural features of the plant associations, having a discriminatory value for their syntaxonomy. The highest redundance was revealed in the *Loiseleurietum procumbentis* association that forms the climax of the windswept alpine ridges, while the lowest one — in *Junipero-Bruckenthalietum*, which is a serial association installed after clearing of *Pinetum mugi*. The impact of tourist pressure seems to reduce the redundance of plant associations, situated outside the scientific reservation of the National Park.

An important aspect in the study of biocoenotic systems is the determination of the diversity of taxonomic composition. The interest in studying this structural feature of the biocoenoses has much increased since M a r g a l e f [4] pointed out that the diversity of the component species and the stability of a biocoenotic community can be considered as two sides of one and the same medal. Diversity and stability, taken together, become expressions of the organization degree of biocoenotic systems [2, 5, 7].

The study of diversity acquires special practical importance in the case of biological communities subjected to ecological management in view of their protection. Maintenance of an optimum diversity enables these communities to use the environmental resources more efficiently. Thus, it is known that the biocoenoses with high taxonomic diversity are more stable and productive than those with simplified composition. There is a parallelism between the number of interspecific connections, achieved within an optimized diversity, and the stability of biocoenoses. Consequently, diversity indices have proved to be quite good indicators of the stresses provoked by pollution or other impacts which destabilize the composition of biocoenoses. It has also been found that the determination of diversity can often be more conclusive than the measurement of the concentration of pollutants or the intensity of impacts, mainly when their action is not recurrent [6].

Diversity increases the number of interactions achievable between the components of the system, i.e. the quantity of information available

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within the system. From this viewpoint, diversity becomes an expression of the quantity of information through which the components of the system are interconnected [1]. Therefore, adoption of some basic concepts of information theory makes possible the quantitative evaluation of the structural indetermination and of the organization degree of the biological communities, respectively.

Study sites and methods. In the summer of 1985, we initiated the study of floristic diversity of the following plant associations in the scientific reservation of the Retezat National Park:

1. *Loiseleurietum procumbentis* (Kerner 1863) Rübel 1931: Şaua Retezatului (the Retezat Saddle), 2,150 m;
2. *Caricetum curvulae* (Kerner 1863) Brockm.-Jer. 1907, facies with *Campanula alpina:* Platoul Şesele (Highlands Plateau), 2,100 m; facies with *Primula minima:* the Retezat Saddle, 2,200 m;
3. *Calamagrostetum villosae* Zlatnik 1925 s.l., facies with *Gentiana punctata:* above the Gemenele (She-twins) Lake, 1,970 m; facies with *Crepis conyzifolia:* between the Gemenele Lake and the Tăul Negru (Black Pool), 2,050 m; facies with *Centaurea nervosa;* above Şurlău towards the Retezat Saddle, 2,100 m;
4. *Junipero-Bruckenthalietum spiculifoliae* Horv. 1936: above the laboratory-house, 1,850 m.

It is known that in the study of plant associations or of the vegetal components of biocoenoses, the determination of diversity often raises serious technical problems owing to the difficulties encountered in establishing the relationships between the number of individuals representing the species that make up the plant cover, especially when this is compact and thick. For obviating these difficulties we applied the point-area sampling procedure as indicated by Gounot [3]. This procedure consists in counting the contacts of some metal needles with the species to be found throughout the area of an association. In the case of alpine- and subalpine-level plant associations, more often characterized by a small number of species and pronounced homogeneity, the aleatory contacts of the various species have been identified by resorting to effectives of 300 points each, distributed linearly at every 10 cm, which proved to be conclusive enough for statistical processing. The tables exhibiting the floristic composition of the studied associations — what will be the subject of a next paper — indicate: number of tested points, number of recorded species, number of recorded contacts, percentage coverage of species by relating the contacts to the total number of tested points and, finally, frequency related to the ensemble of recorded contacts.

The results of samplings have allowed the determination of the following diversity indices:

— *informational diversity,* expressed through structural entropy by the Shannon—Wiener formula:

$$H(S) = -\sum p_i \log_2 p_i$$

where p_i is the probability of recording contacts for the various species of the association, and $\log_2$ is the binary logarithm;

composition diversity of the studied associations. Thus, the Shannon—Wiener for-association would be equi-probable, i.e. represented by the same number of individuals and contacts, respectively:

$$H(S)_{max} = \log_2 S$$

where S is the number of species in the association;

— *relative information* or „causalization degree", expressing the ratio between the calculated quantity of information and the absolute information:

$$H(S)_r = H(S)/H(S)_{max};$$

— *redundance*, indicating the occurrence of phytocoenotic connections that restrict the associating freedom of the species, limiting thus the information quantity:

$$R = 1 - H(S)_r.$$

The Simpson—Onicescu indices have also been calculated, represented by:

— *informational energy*, corresponding to the concentration degree of the probabilities of occurrence of the various species:

$$E = \Sigma p_i^2;$$

— *Simpson diversity index*, i.e. the probability that two vegetal individuals recorded at random points would belong to distinct species:

$$D = 1 - \Sigma p_i^2.$$

Despite their close significance, these indices reveal different aspects of the composition diversity of the studied associations. Thus, the Shannon—Wiener formula is a diversity index whose values correspond to high diversity, while its low values indicate that one or a few species dominate in the association [6]. Equitability shows the distribution way of the species in the association, having maximum value when all the species are represented by the same number of individuals [1]. The Simpson—Onicescu indices (informational energy), in their turn, are indices of dominance, since their maximum value is achieved when the association is dominated by a single species, while the minimum value characterizes an association made up of numerous species, each of them being represented by a low number of individuals. When we refer to the revealing of the diversity, it is recommended to express this index by the difference 1—D; in this case, the association diversity is proportionate to the value of this index. One should note that the Shannon—Wiener indices are ponderated in favour of rare species, while the Simpson—Onicescu ones in favour of common species.

Results and discussion. The overall results (Table 1) are in accord with Thienemann's principle — the more reduced is the number of species, the more severe are the ecological conditions of the association. Thus, in the case of the association *Loiseleurietum procumbentis*, installed on windswept exposed ridges in alpine environment, only 14 species have been recorded, while in the case of *Junipero-Bruckenthalietum* association, on the south-sloping places, more sheltered from the wind, 32 species have been identified (that is 114% more). With all the studied associations, some direct relationships were found between the number of component species and their diversity indices.

At the same time, comparison of the various facies of the same associations has shown that their indices have very close values even if the proportions of the individuals representing the constituent species differ within quite wide limits. Therefore, one can draw the conclusion that these indices represent structural characteristics that can be used in separating the associations. In this respect, our preliminary results ciations has shown that their indices have very close values even if the Simpson diversity index appear to be more sensitive syntaxonomic discriminating criteria of the associations of the climax and subclimax stage than the Shannon—Wiener indices.

Stability of the associations depends, to a large extent, on the stability of the mutual relationships between their constituent species [7]

Table 1

Floristic diversity indices of some plant associations in the Retezat National Park

Association Facies	Loiseleurietum procumbentis	Caricetum curvulae		Calamagrostietum villosae			Junipero-Bruckenthalietum
		Campanula alpina	Primula minima	Gentiana punctata	Crepis conyz.	Centaurea nervosa	
Points tested	300	300	300	300	300	300	300
Species recorded	14	23	21	25	24	20	32
Contacts recorded	568	705	566	720	640	675	640
Shannon-Wiener indices							
Informational diversity H(S)	2.1195	3.6531	3.8341	2.8811	3.0403	3.1800	4.1288
Equitability $H(S)_{max}$	3.8073	4.5236	4.5923	4.6939	4.5850	4.3219	5.0000
Relative information $H(S)_r$	0.5570	0.8076	0.8729	0.6204	0.6631	0.7358	0.8258
Redundance	0.4430	0.1924	0.1271	0.3796	0.3369	0.2642	0.1742
Simpson-Onicescu indices							
Informational energy E	0.3131	0.1158	0.1697	0.2090	0.2136	0.2123	0.0866
Simpson diversity 1—E	0.6888	0.8842	0.8303	0.7910	0.7864	0.7877	0.9134

which is characterized by the redundance values. Occurrence of the connections („associations") between the different species restricts the number of possible combinations and, concurrently, the quantity of information is also diminished. The highest value of redundance was found with *Loiseleurietum procumbentis*, exposed to cryothermal rigours and a strong deflation, while the lowest redundance appeared with *Junipero-Bruckenthalietum*, representing an unstable serial stage, installed after clearing of *Pinetum mugi*. It is also noted that for the facies with *Primula minima* of the *Caricetum curvulae* association in the Retezat Saddle, at the outskirts of the reservation, affected by a strong tourist impact, the redundance has a lower value than in the case of the facies with *Campanula alpina* of the same association, situated under conditions of full protection.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

COLEOPTERE DIN ZONA SUBCARPATICĂ DE NORD-VEST A TRANSILVANIEI

MIHAI TEODOREANU*

SUMMARY. — Coleoptera in the North-Western Subcarpathian Zone of Transylvania. Some Coleoptera communities have been identified in the Iaz-Plopiş pond (1), the Ceheiu Şimleul Silvaniei lake (2), the Cehu Silvaniei hygrophilous hayfields (3) and the rockland of Stana Cliţului (4), places where they had not yet been recorded (Table 1).

The species *Phytobius velaris* Gyll. was found for the first time in the fauna of the S. R. Romania; it was sampled from the vicinity of a pond with therapeutic properties in Iaz-Plopiş, Sălaj district.

În scopul delimitării de rezervaţii naturale şi în judeţul Sălaj, de curînd au fost efectuate cercetări ecologice la balta Iaz-Plopiş, lacul Ceheiu Şimleul Silvaniei, fînaţul higrofil Cehu Silvaniei şi stîncăria de la Stana Cliţului, ecosisteme care au fost găsite ca reprezentative pentru această parte a zonei subcarpatice de nord-est a Transilvaniei şi propuse ca rezervaţii.

În cadrul acestor cercetări au fost colectate şi coleoptere, grup nestudiat pînă acum în aceste locuri.

Rezultatele analizelor calitative ale acestor insecte, prezentate în această lucrare, atestă valoarea ecologică deosebită a ecosistemelor susmenţionate.

Metoda de lucru. Ecosistemele cercetate au fost numerotate de la 1 la 4, în ordinea citării lor mai sus.

Insectele au fost colectate în august 1980. De pe plante au fost culese cu fileul entomologic, trăgîndu-se în acelaşi loc de 25 de ori, din 5 puncte în ecosistemele notate cu 1, 2 şi 3, iar de pe sol au fost culese tot din 5 puncte, dar numai în ecosistemele notate cu 3 şi 4 (tabel 1).

Analiza coleopterelor a fost făcută cu microscopul stereoscopic, urmărind componenţa specifică. Pentru determinare au fost folosite toate lucrările indicate în bibliografie.

Rezultate. În cele 4 ecosisteme au fost identificate 62 de specii de coleoptere, ce se grupează în 38 de genuri şi 11 familii (Tabel 1).

Mai bine reprezentate au fost familiile *Carabidae* cu 17 specii, *Curculionidae* cu 15 specii şi *Chrysomelidae* cu 13 specii. Toate speciile din familiile *Carabidae* şi *Staphylinidae* s-au găsit numai pe sol, iar speciile din celelalte familii numai pe plante.

Cea mai numeroasă comunitate de coleoptere, considerată după numărul speciilor, a existat la Ceheiu, iar cea mai săracă la stîncăria de la Stana Cliţului.

Phytobius velaris Gyll. a fost găsită pentru prima oară în ţară pe vegetaţia de lîngă ochiul de apă terapeutică de la Iaz-Plopiş.

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Tabel 1

Coleoptere din cîteva ecosisteme (jud. Sălaj)

Familii şi specii	Ecosisteme				Coleoptere de pe	
	1	2	3	4	Plante	Sol
Carabidae						
Elaphrus riparius L.			+			+
Loricera pilicornis F.			+			+
Clivina fossor L.			+			+
Tachys bistriatus Duft.			+			+
Bembidion lampros Herbst.			+			+
,, quadrimaculatum L.			+			+
,, quadripusulatum Serv.			+			+
,, articulatum Panz.			+			+
Anisodactylus nemorivagus Duft.				+		+
Harpalus affinis Schrk.				+		+
Poecilus cupreus L.			+			+
Pterostichus chamaeleon Motsch.			+			+
,, vernalis Panz.			+			+
Calathus metallicus Dej.				+		+
,, melancephalus L.				+		+
Agonum sexpunctatum L.				+		+
Amara similata Gyll.			+			+
Staphylinidae						
Paederus litoralis Grav.		+				+
,, limnophilus Er.			+			+
Cleridae						
Trichodes apiarius L.	+				+	
Cantharidae						
Cantharis lateralis L.		+			+	
,, fulvicollis F.			+		+	
Nitidulidae						
Meligethes solidus Kugel.		+			+	
,, coracinus Sturm.	+	+			+	
,, atramentarius Först.	+	+			+	
,, erythropus Marsh.		+			+	
,, subrugosus Gyll.	+		+		+	
Helodidae						
Cyphon padi L.		+			+	
,, variabilis Thunb.	+				+	
Scirtes hemisphaericus L.		+			+	
Coccinellidae						
Subcoccinella 24-punctata L.		+			+	
Propylaea 14-punctata L.		+			+	
Oedemeridae						
Oedemera croceicollis Gyll.		+			+	
Mordellidae						
Modellistena parvula Gyll.		+			+	
Chrysomelidae						
Donacia semicupraea Panz.		+			+	
Cryptocephalus octacosmus Bed.		+			+	
Chrysomela diversipes Bed.	+				+	
,, polisa L.	+				+	
Galerucella calmariensis L.		+			+	
Phyllobrotica quadrimaculata L.		+			+	
Phyllotreta diademata F.	+				+	

Tabel 1 (continuare)

Familii şi specii	Ecosisteme				Coleoptere de pe	
	1	2	3	4	Plante	Sol
Longitarsus holsaticus L.	+				+	
,, nigrofasciatus Goeze.	+				+	
,, atricillus L.			+		+	
Haltica oleracea L.	+	+			+	
Crepidodera transversa Marsh.	+				+	
Chaetocnema concinna Marsh.		+			+	
Curculionodae						
Sitona cambricus Steph.		+			+	
,, humeralis Steph.		+			+	
Tanymecus palliatus F.		+			+	
Ceuthorrhynchus kraatzi Bris.		+			+	
,, floralis Payk.	+				+	
,, pollinarius Forst.	+				+	
,, erysimi F.	+				+	
Ellescus scanicus Payk.		+			+	
Apion spencei Kirb.		+			+	
,, punctigerum Payk.		+			+	
,, onopordi Kirb.		+			+	
,, flavipes Payk.		+	+		+	
,, apricans Herbst.		+			+	
,, minimum Herbst.		+			+	
Phytobius velaris Gyll.	+				+	

Concluzii. În ecosistemele din nord-vestul Transilvaniei există comunităţi caracteristice de coleoptere, nesemnalate pînă acum. Structura calitativă a acestor grupuri de insecte reflectă calitatea bioecologică a ecosistemelor din care fac parte, şi vin în sprijinul propunerii ca aceste ecosisteme să fie declarate rezervaţii naturale.

Phytobius velaris Gyll., specie central-europeană, este nouă pentru fauna R. S. România. Prezenţa ei arată că ecosistemul în care a fost găsită are calităţi ecologice deosebite faţă de celelalte şi din punct de vedere al coleopterofaunei.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

DYNAMICS OF THE FATTY ACID CONTENT IN THE WHOLE ORGANISM OF THE OAK HAIRY CATERPILLAR *(LYMANTRIA DISPAR)* DURING ITS DEVELOPMENTAL CYCLE

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SUMMARY. — By means of gas chromatography, the following fatty acids were identified from the lipids present in the whole organism of *Lymantria dispar* during its developmental cycle: lauric, myristic, palmitic, palmitoleic, stearic, oleic, linoleic, eicosenoic and lignoceric acids. In this species, the dominant fatty acid is palmitic acid, followed by the oleic and stearic acids. The other fatty acids are present in much lower amounts. The palmitic acid content decreases immediately after moulting.

The investigations performed up to the present on the insect fatty acids led to some important findings.

For all the species studied, the linoleic and linolenic acids are essential [7]. For *Culex pipiens* the arachidonic acid is also essential [3]. This acid is a precursor of prostaglandins, which have been shown to be present in insects, too. It seems that their role is related to reproduction, as in mammals [2].

Beside being essential sources of energy (especially in *Lepidoptera* and *Orthoptera*), the fatty acids, mainly the unsaturated ones, are phospholipid constituents, with an essential role in the structure of cell membranes [2].

The fatty acids are also components of certain chemical messengers, endohormones and exohormones [6].

The aim of the present work is to obtain data to be used for correlating fatty acid composition of insects with their taxonomic position, the fatty acid composition being considered as one of the biochemical criteria that can be used by systematicians [8].

Material and methods. Data regarding the biological material were presented in a previous paper [5]. The extraction of total lipids, their hydrolysis and gas-chromatographic analysis were also described in a study dealing with the Colorado beetle [4].

Results and discussions. The moments of analyses and the results obtained are presented in Table 1.

From the total fatty acids, as an average on the developmental cycle, 92% were identified as lauric (0.72%), myristic (1.32%), palmitic (32.27%), palmitoleic (1.19%), stearic (16.14%), oleic (24.31%), linoleic (5.00%), linolenic + eicosenoic (9.00%) and lignoceric (2.17%) acids. The

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Tabel 1

Dynamics of the fatty acid content in the whole organism of the oak hairy caterpillar (Lymantria dispar) **during its developmental cycle**

Stage of development	Content of the different fatty acids* (%)												
	12 : 0	Ui.	14 : 0	Ui.	16 : 0	16 : 1	Ui.	18 : 0	18 : 1	18 : 2	18 : 3 20 : 1	24 : 0	Ui.
1st i. l., 2nd d.**	0.44	0.36	1.56	0	17.69	0.64	0	9.16	19.92	14.11	35.36	0.41	0
2nd i. l., 2nd d.	0.48	0.32	4.28	0	20.62	1.61	0	8.20	34.01	14.56	15.28	0	0
3rd i. l., 2nd d.	0.60	0.50	2.50	0.82	15.11	0.22	0	14.77	14.19	15.32	34.40	1.51	0
4th i. l., 1st d.	1.75	2.78	2.66	0	32.15	1.03	0	23.99	17.21	8.00	8.94	1.03	0
4th i. l., 2nd d.	0.78	0.80	1.00	0.16	34.69	2.17	2.08	18.42	26.23	4.59	6.35	2.35	0
4th i. l., 4th d.	0.78	1.67	1.01	2.63	36.29	1.75	4.91	15.19	24.01	2.41	8.14	1.18	0
5th i. l., 1st d	1.23	1.04	1.39	2.13	30.06	0.67	2.82	24.02	15.58	2.11	8.00	7.57	1.07
5th i. l., 2nd d.	0.36	3.64	0.57	1.96	52.05	0.79	4.81	8.52	22.83	0.85	1.47	0.45	1.10
5th i. l., 5th d.	0.64	1.56	0.61	1.47	39.57	0.82	6.33	13.98	22.05	4.20	3.71	3.16	1.11
6th i. l., 1st d.	0.36	0.09	0.64	1.23	36.55	1.83	3.00	20.78	28.04	4.43	1.71	1.34	0
6th i. l., 7th d.	0.27	0.40	0.52	2.59	34.04	0.75	5.59	26.93	22.69	1.61	3.62	0	0
6th i. l., 12th d.	0.24	0.69	1.00	0.10	42.96	0.68	3.19	15.00	29.60	1.36	2.80	0.51	1.65
Pupae, 1st d.	0.28	0.60	0.21	0.54	37.83	1.92	5.57	17.37	30.14	1.04	2.84	0.06	1.50
Pupae, 12th d.	2.18	0.42	1.48	0.61	39.64	2.14	2.59	8.22	25.71	0.29	1.77	5.12	3.83
Adult, 1st d.	0.36	2.82	0.35	0.99	30.42	0.77	5.74	17.60	29.52	1.19	6.17	3.47	0.51
Mean values	0.72	1.18	1.32	1.42	32.27	1.19	4.24	16.14	24.31	5.00	9.00	2.17	0.72

* The number preceding the colon gives the number of carbon atoms in the fatty acid chain. The number of double bounds is shown by the figure following the colon. Ui. — Unidentified fatty acid fractions.

** ... i. l., ... d. — ... instar larvae, ... day.

fatty acids found in *Lymantria dispar* are present in the majority of insect species studied so far [3, 6]. *Lymantria dispar* is characterized by the fact that the palmitic, oleic and stearic acids are predominant in the composition of total lipids. These three fatty acids taken together represent more than a half of the total amount of fatty acids. It follows from this that among the reserve lipids they represent the principal energy sources.

The lauric, myristic and palmitoleic acids are present in low quantities. This is also valid for the majority of the insect species, except *Diptera,* that have a high content of palmitoleic acid [1] and aphidoidea *(Homoptera),* with a high content of myristic acid [8].

With regard to the categories of fatty acids, saturated and unsaturated, the saturated ones are predominant at an average of 53%. The unsaturated fatty acids are present in a proportion of 39%, as an average on a developmental cycle.

The linoleic and linolenic acids are known to be essential fatty acids [7]. Although these acids cannot be synthesized by insects, they are present in relatively high amounts in *Lymantria dispar:* the linoleic acid constitutes 5% and the linolenic + eicosenoic acids 9% of the total fatty acid content. The quantity of these fatty acids is higher in the first three larval instars.

With respect to the correlation of the identified fatty acids with the moulting process, the only one that exhibits remarkable quantitative variations is the palmitic acid, whose amount usually increases during the second half of the larval instars and decreases immediately after moulting. From this point of wiew, dynamics of the palmitic acid during the larval instars is similar to that of the total lipids [5].

Conclusions. The fatty acid composition of total lipids of *Lymantria dispar* is characterized by the presence of lauric, myristic, palmitic, palmitoleic, stearic, oleic, linoleic, linolenic, eicosenoic and lignoceric acids. The palmitic, oleic and stearic acids represent more than 50% of the total fatty acid content. The other fatty acids are present in much lower amounts. The palmitic acid content decreases immediately after moulting.

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ASPECTE ALE RESURSEI DE HRANĂ A RÎULUI NIRAJ, UN AFLUENT AL MUREŞULUI

ŞTEFAN GYURKÓ*, ZOLTAN MEZEI*, ZOLTAN NAGY* şi IOAN NÉMETH**

SUMMARY. — Some Aspects on the Food Resource of the Niraj Stream, an Affluent of the Mureş River. This paper presents the first results of a study dealing with the food resource of the Niraj stream, which has not been investigated by ichtyologists until now. Analysis of the benthic samples indicates that the food resource of this stream in the Mătrici-Găleşti zone (where the samples were taken) is qualitatively similar (9 components of animal and plant origin — periphyton) and quantitatively mediocre. But the benthic fauna presents, in concordance with the local abiotic conditions, remarkable differences not so much qualitatively as quantitatively (1,910—37,240 individuals of animal organisms/m^2 and 6,807—25,960 mg biomass/m^2). Our data suggest that the Niraj stream is not polluted and possesses an abundant supply of food for fish. The food resource of this stream is practically identical to the trophic base of fish from other streams in the studied zone.

În literatura de specialitate găsim date puţine şi sporadice privind ihtiofauna rîului Niraj [2, 3], iar în ce priveşte baza trofică şi diferite aspecte ale ecologiei peştilor în general şi ale relaţiilor trofice, datele lipsesc cu desăvîrşire. Avînd în vedere importanţa teoretică şi practică a problemei menţionate, precum şi faptul că Nirajul este un afluent însemnat al Mureşului, în plin centrul Transilvaniei, care în mod curios pînă în prezent a scăpat atenţiei ihtiologilor, cu cercetările începute urmărim umplerea acestui gol.

În lucrarea de faţă prezentăm primele rezultate obţinute privind condiţiile ecologice locale referitoare la baza trofică a peştilor, punct de plecare obligatoriu în abordarea restului problemelor mai sus amintite.

Izvoarele Nirajului sînt pe versanţii nord-vestici ai Munţilor Gurghiului, rîul prezentînd pînă în dreptul comunei Eremitu (cca. 30—35 km) un caracter de curs superior, iar de aici pînă la vărsare în Mureş, la Ungheni (cca. 56—60 km) un caracter de curs mijlociu. Albia rîului este preponderent pietroasă, dar în aval de Eremitu cu porţiuni de fund nisipos sau mai în aval chiar mîlos.

Material şi metodă. Seriile de eşantioane analizate au fost ridicate la 2 octombrie 1981, în zona Mătrici-Găleşti (aval de Eremitu) din biotopurile caracteristice, cu ajutorul unui bentometru dreptunghiular de 0,1 m^2 [7], înregistrîndu-se şi principalele caracteristici ale apei, natura fundului etc. (Tabel 1). La prelucrarea în laborator, am utilizat metode cantitative [6], componenţii fiind separaţi sub binocular şi cîntăriţi la balanţa de torsiune cu precizie de 0,1 mg.

În Tabelul 2 am prezentat pe grupe de componente (ordine) numărul de indivizi pe m^2 — abundenţa (A), dominanţa numerică în % (D), biomasa (producţia) componentelor în mg/m^2 (P) şi dominanţa de biomasă în % (G) [1].

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Rezultate și discuții. Primele două serii de eșantioane, ridicate în dreptul localității Mătrici, prezintă în medie asemănări sensibile datorită condițiilor abiotice asemănătoare ale biotopurilor din care au fost luate și care sînt caracteristice și dominante ca extindere pe zona respectivă, și anume: lățimea albiei între 6—8 m, cu fund pietros, diametrul pietrelor variind între 1—20 cm. Adîncimea apei la locul luării eșantioanelor a fost de 0,3—0,4 m; viteza apei de 0,8—0,9 m/sec; temperatura apei 15°C; pH = 6,5—7; distanța de la mal 1—3 m (Tabel 1). Menționăm că vegetația submersă lipsește pe această zonă.

În aceste condiții am identificat pe m^2 în medie aproximativ 2000 organisme animale cu biomasa între 9.614—25.960 mg și o cantitate de perifiton de 42.410—58.530 mg.

Dintre organismele animale, nu prea variate calitativ, se evidențiază ca abundență și dominanță numerică în ordine larvele de diptere, de tricoptere și de efemeroptere, iar ca producție și dominanță de biomasă, larvele de tricoptere și de efemeroptere și mai puțin cele de diptere (Tabel 2). Aceste trei componente constituie baza resursei de hrană a rîului și, totodată, datorită accesibilității lor, și grosul bazei trofice a majorității populațiilor locale de pești.

În prezenta lucrare utilizăm termenii de resursă de hrană și bază trofică în concepția lui B o r u ț k i i [4, 5].

Larvele de tricoptere (*Hydropsyche* sp. de 2—8 mm și *Rhyacophyla* sp.) sînt dominante în primul rînd cu biomasa (G) (între 74,57—86,64%). Faptul se datorește numărului însemnat al indivizilor de *Hydropsyche* de 6—8 mm. Ca abundență și dominanță numerică, ele sînt de asemenea componente remarcabile ale resursei de hrană (560—590 indivizi pe m^2, respectiv 25,00—29,37%). Larvele de diptere în aceste eșantioane se remarcă doar ca abundență numerică (920—1460 exemplare/m^2, respectiv 48,16—61,86%). Acestea sînt larve de tendipedide mărunte, majoritatea de 1—3 mm lungime și cîteva larve de tabanide. Dintre larvele de efemeroptere (D = 4,66—15,18%), cele mai frecvente sînt cele de *Caënis* sp. de 2—8 mm și *Rhithrogena* sp. de 2—6 mm, pe lîngă care am identificat și reprezentanți ai genurilor *Baëtis, Heptagenia, Ecdyonurus, Torleya* și *Paraleptophlebia*. Larve de plecoptere

Tabel 1

Principalele caracteristici ale apei rîului Niraj pe sectorul Mătrici-Gălești, la 2.X.1981

Caracteristici	Seria I (Mătrici)	Seria II (Mătrici)	Seria III (Gălești)
Lățimea albiei (m)	6—8	7	15
Adîncimea apei (m)	0,40	0,30	0,25
Distanța de la mal (m)	3	1	2
Temperatura apei (°C)	15	15	17
pH apei	6,7—7	6,5—7	6,5—7
Viteza curentului (m/sec)	0,8	0,9	0,5
Mărimea pietrelor (cm)	2—20	1—10	0,5—6

Tabel 2

Mediile seriilor de eşantioane bentonice ridicate din diferite biotopuri ale albiei riului Niraj pe sectorul Mătrici-Găleşti, la 2.X.1981

Seriile de eşantioane	Seria I (Mătrici)				Seria II (Mătrici)				Seria III (Găleşti)			
Componente	A (nr./m²)	D (%)	P (mg/m²)	G (%)	A (nr./m²)	D (%)	P (mg/m²)	G (%)	A (nr./m²)	D (%)	P (mg/m²)	G (%)
Efemeroptere (larve)	110	4,66	463	1,78	290	15,18	647	6,73	270	0,72	215	3,16
Plecoptere (larve)	30	1,27	25	0,10	—	—	—	—	—	—	—	—
Tricoptere (larve)	590	25,00	19360	74,57	560	29,37	8330	86,64	540	1,45	1030	15,13
Coleoptere (larve + adulţi)	130	5,51	124	0,48	60	3,14	47	0,49	100	0,27	34	1,24
Diptere (larve)	1460	61,86	158	0,61	920	48,16	94	0,97	35800	96,13	5202	76,43
Acarieni acvatici	40	1,70	40	0,16	30	1,58	16	0,17	160	0,43	70	1,03
Oligochete	—	—	—	—	40	2,20	14	0,15	290	0,78	180	2,63
Nematode	—	—	—	—	10	0,52	16	0,17	80	0,22	26	0,38
Detritus animal	—	—	5790	28,30	—	—	450	4,68	—	—	—	—
Total organisme animale	2360	100,00	25960	100,00	1910	100,00	9614	100,00	37240	100,00	6807	100,00
Perifiton	—	—	58530	—	—	—	42410	—	—	—	27200	—

apar doar ocazional în biotopurile cu cea mai mare viteză a curentului. Coleopterele sînt reprezentate prin larvele și adulții de *Helmis* sp., *Limnius* sp., importanța lor ca elemente ale biocenozelor bentonice fiind modestă, mai ales în ce privește biomasa. Acarienii acvatici, oligochetele și nematodele sînt componente rare și neînsemnate ale resursei de hrană. Cantitatea apreciabilă de detritus animal, fiind în mare măsură de origine alohtonă, poate fi considerată ca un semnal de alarmă.

Seria de eșantioane din dreptul localității Gălești arată un tablou calitativ asemănător cu precedentul, dar diferit din punct de vedere cantitativ. Aici biomasa este dominată calitativ și cantitativ de diptere (Tabel 2), preponderent de tendipedide de 1,5—4 mm lungime, pe lîngă care apar larvele diferitelor tipulide și limnobiide. Abundența acestui component este remarcabilă: 35.800 exemplare pe m^2, ceea ce îi conferă o dominanță numerică de 96,13% și una de biomasă de 76,43%. Urmează ca importanță larvele de tricoptere ($A = 540$ și $G = 15,13\%$), dintre care se remarcă cele de *Hydropsyche* sp., forme libere, fără căsuță, de 2—8 mm și *Hydroptila* sp. Larvele de efemeroptere identificate aparțin, în marea lor majoritate, genului *Caënis*, pe lîngă care se mai găsesc reprezentanți ai genurilor *Potamanthus, Torleya* și *Habrophlebia*. Acarienii acvatici, oligochetele și nematodele apar și în acest caz în cantități și biomasă neînsemnate.

Concluzii. Analiza eșantioanelor bentonice ne arată că resursa de hrană a rîului Niraj în zona Mătrici — Gălești este puțin variată (9 componente de origine animală și vegetală — perifitonul), iar din punct de vedere cantitativ este mediocră. Ea prezintă, în funcție de condițiile concrete abiotice locale, diferențe remarcabile, nu atît calitative, cît cantitative (de la 1.910 la 37.240 indivizi de organisme animale pe m^2, cu o biomasă între 6.807—25.960 mg pe m^2).

Datele noastre indică absența poluării și o bună asigurare cu hrană a peștilor, resursa de hrană a rîului fiind practic identică cu baza trofică a peștilor din zona studiată.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

VARIATIONS DES CARACTÈRES BIOMÉTRIQUES DE LA GRENOUILLE RIEUSE, *RANA RIDIBUNDA* PALLAS, DANS LE SUD-EST DE L'EUROPE

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SUMMARY. — Variations of the Biometric Features of the German River-Frog, *Rana Ridibunda* Pallas, in South-East Europe. Quantitative analysis has shown that in frogs the variations of some biometric features (head + trunk length and femur length) are clinal with a south-to-north trend. At the same time, the variations of the indices head + trunk length per head length and femur length per tibia length are not clinal.

Depuis Boulenger [3], c'est déjà un fait bien établi que les grenouilles vertes d'Europe sont divisées au moins en deux taxons distincts. Mais leur rang taxonomique n'est pas encore définitivement clarifié. Certains auteurs [1, 4, 6—8, 11, 12] reconnaissent deux espèces valides: la Grenouille verte proprement dite (*Rana esculenta* L.) et la Grenouille rieuse (*R. ridibunda* Pall.). Pour d'autres [3, 5, 9], ce ne sont que des sous-espèces de la même espèce, nommée par raison de priorité *R. esculenta* L. Mais Berger [2] en reconnaît plusieurs espèces, notamment *R. esculenta*, *R. ridibunda*, *R. perezi* (en Espagne), *R. lessonae*, auxquelles il ajoute une espèce d'Italie et une autre de Grèce. La divergence provient d'une interprétation différente du même fait, notamment la coexistence de ces formes en certains habitats. D'après la théorie de Rensch [10], deux sous-espèces de la même espèce ne sont jamais sympatriques. Les adeptes de cette théorie [4, 6] affirment donc que la présence de *R. esculenta* et de *R. ridibunda* dans le même étang à Caraorman (Delta du Danube) est un fort argument a l'appui de l'idée qu'il s'agit de deux espèces indépendantes. Au contraire, une situation identique observée sur l'île danoise de Bornholm est interprétée comme la conséquence d'une variation graduelle de grande amplitude, dont *R. esculenta* et *R. ridibunda* ne sont que les extrêmes [5].

Nous allons considérer *R. esculenta* et *R. ridibunda* provisoirement comme d'espèces valides. Mais ce n'est pas dans cet article qu'on veut solutionner ce problème. Nous essayons seulement de décrir la variation de quelques caractères biométriques des populations de Grenouille rieuse de Grèce et de Transylvanie, dont l'appartenance à la forme *ridibunda* correspond à la lettre avec la diagnose de Boulenger [3].

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Matériel et méthode. Notre matériel, conservé dans le Musée zoologique de l'Université „Babeş—Bolyai", Cluj-Napoca, appartient aux 4 populations localisées dans le Péloponèse, en Épire, en Macédoine et en Transylvanie (Fig. 1):

1. Kalamata, au bord du Golf de Messénia, Péloponèse, à 37° lat. N et 22° long. E; 20 spécimens, dont 9 juvéniles; Leg. N. Agadakos, juin 1983;

2. Paramythia, province de Thésprotia, Épire, à 39° 30′ lat. N et 20° 15′ long. E; 23 spécimens, dont 2 juvéniles, 16 ♂♂ , 5 ♀♀ ; Leg. Khristina Markou, juillet 1983;

3. Drama, Macédoine, à 41° lat. N et 24° long. E; 18 spécimens, dont 10 ♂♂ 8 ♀♀ ; Leg. Khristina Markou, août 1983;

4. Săcuieni, lacs sur la Valea Erului, departement Bihor, Transylvanie, Roumanie, à 47° 15′ lat. N et 22° long. E; 146 spécimens, dont 68 ♂♂ , 78 ♀♀ ; Leg. Lavinia Iluţa, août-septembre 1980.

Nous avons mesuré, pour les échantillons provenant de Grèce, la longueur tête + tronc (LTT) et la longueur du fémur (F) et du tibia (T). Pour les spécimens de Transylvanie on n'a pas mesuré le tibia. L'échantillon de Kalamata ayant un nombre trop réduit d'adultes, on pas séparé les mâles de femelles. On a calculé également les indices LTT/LT (LT étant la longueur de la tête) et F/T d'après la méthode de Terent'ev et Chernov [13].

Résultats. Pour les grenouilles vertes de Grèce, la plupart des spécimens sont rangés dans les classes inférieures du LTT. Par contre, pour

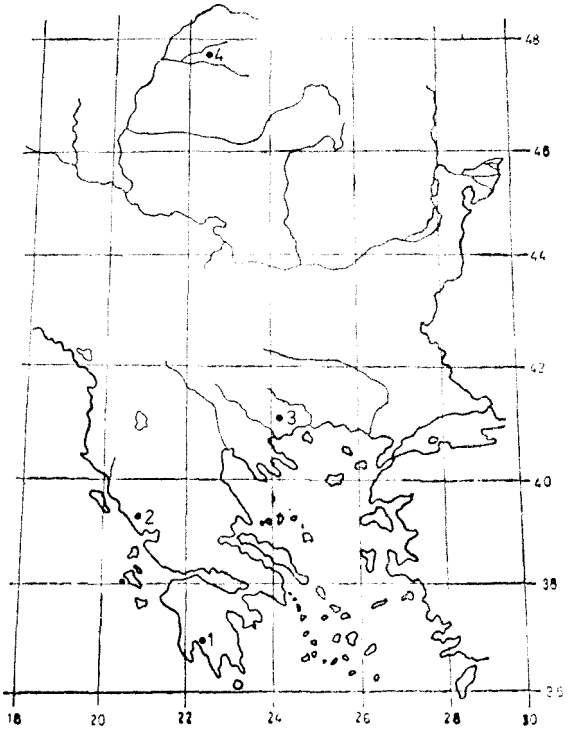

Fig. 1. *Localisation des populations étudiées.*
1 — Kalamata. 2 — Paramythia. 3 — Drama.
4 — Săcuieni.

les grenouilles vertes de Transylvanie, la plupart des spécimens est rangée dans les classes supérieures du LTT. Les grenouilles vertes provenant des localités septentrionales sont donc plus grandes que les grenouilles vertes des localités méridionales (Fig. 2). Le caractère LTT augmente donc du Sud vers le Nord. Le caractère F augmente dans la même direction, sa moyenne étant de 26,90 mm à Kalamata en Péloponèse, de 21,90 mm pour les mâles et de 29,20 mm pour les femelles à Paramythia en Épire, de 41,30 mm et respectivement de 40,62 mm pour les mâles et les femelles de Drama, en Macédoine. Dans l'échantillon de Transylvanie, les moyennes du F sont de 34,10 mm pour les mâles et de 44,00 mm pour les femelles (Tableau 1).

Discussions. Les données présentées ci-dessus et les données de la littérature [1, 4, 12, 15] démontrent que la taille de la Grenouille rieuse subit une variation clinale, en direction Sud—Nord. L'idée que les spécimens de Grèce sont plus petits que ceux de Roumanie et de l'URSS devient ainsi une certitude. Le spécimen le plus grand de notre collection d'Amphibiens de Grèce (une femelle de Drama) ne dépasse pas 110 mm. Nous n'avons pas d'informations sur la taille de *R. ridibunda* de Bulgarie. En Roumanie [4], la taille la plus fréquente est de 90—

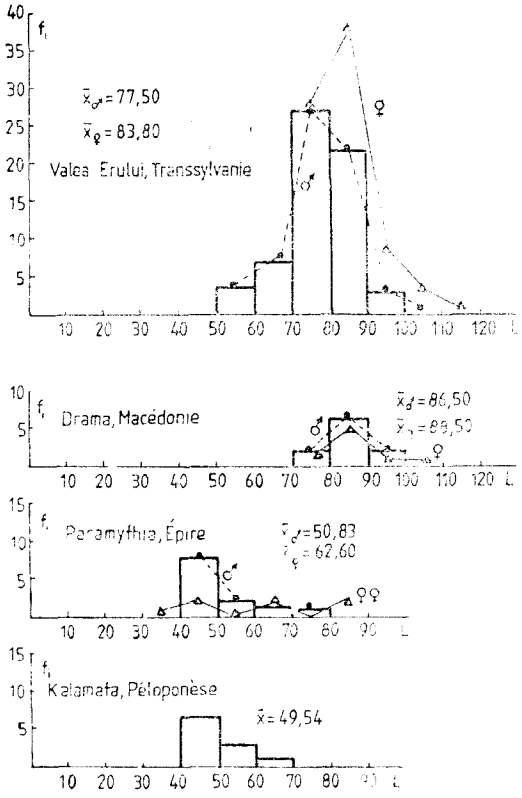

Fig. 2. *Distribution des classes de variation du caractère biométrique LTT de la Grenouille rieuse de Grèce et de Roumanie.*
L — Longueur totale tête+tronc.
f_i — Fréquence des classes de variation.
$\bar{x}$ — Moyenne arithmétique.

Tableau 1

Certaines caractéristiques biométriques de quelques populations de *Rana ridibunda* dans le Sud-Est de l'Europe

Population	Nombre des spécimens	LTT(mm) min.—$\bar{x}$—max.	LT(mm) min.—$\bar{x}$—max.	LTT/LT min.—$\bar{x}$—max.	F(mm) min.—$\bar{x}$—max.	T(mm) min.—$\bar{x}$—max.	F/T min.—$\bar{x}$—max.
Kalamata	11 ad.	45—49,54—62	10—13,72—19	3,06—3,74—4,80	23—26,90—29	25—27,72—36	0,92—0,97—1,04
Paramythia	16 ♂♂	36—50,83—76	9—10,15—24	1,83—4,63—5,90	17—21,90—37	17—22,37—34	0,71—0,97—1,15
	5 ♀♀	37—62,60—84	8—14,16—23	3,65—4,38—4,94	18—29,20—43	20—33,60—48	0,80—0,87—0,90
Drama	10 ♂♂	73—86,50—96	18—21,10—25	3,63—4,43—6,91	35—41,30—46	38—41,40—47	0,89—0,99—1,13
	8 ♀♀	80—88,50—110	16—20,12—25	3,81—4,42—5,00	35—40,62—50	37—41,75—50	0,87—0,97—1,07
Valea Erului, Transylvanie	68 ♂♂	51—77,50—106	—	—	23—34,10—46	—	—
	78 ♀♀	76—83,80—112	—	—	33—44,00—52	—	—

$\bar{x}$ — Valeur moyenne.

130 mm, mais dans le Delta du Danube elle est de 170 mm. En URSS, la taille en est d'habitude de 80—100 mm [1]. En Afrique du Nord [14, 15], la taille des grenouilles adultes est seulement de 50—70 mm.

Quant aux indices LTT/LT et F/T, leurs oscillations restent entre d'étroites limites et ne présentent pas une variation géographique.

Conclusions. La Grenouille rieuse du Sud-Est de l'Europe présente une variation clinale pour les caractères LTT et F, dont le sens est Sud—Nord. Mais les indices LTT/LT et F/T n'en sont pas soumis à une variation clinale.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

INFLUENCE OF FOOD ON THE SERUM PROTEIN LEVEL OF CHICKENS AND HENS

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SUMMARY. — Chickens fed exclusively on vegetable fodder suffered a significant decrease in their serum protein level. When methionine was added to this fodder, the serum protein level of chickens increased to a considerable extent and exceeded that of the chickens fed on standard fodder. In the case of hens, addition of methionine to the standard fodder led to a slight decrease in the serum protein level.

Serum protein level is a very important constant of the blood plasma of all homeotherm animals. In starvation and under conditions of feeding on rations in which the proportions or the nature of the organic nutrients are changed, these organisms maintain, through homeostatic mechanisms, their serum protein level at relatively constant values.

The plasmatic proteins are an immediate protein reserve available for other parts of the body. Blood serves as carrier of proteins to the tissues metabolizing them. The tissular proteins are more stable in this respect, and of the blood proteins only the fibrinogen is not transferred outside the vascular system.

The periods of maximum milk and egg production of the domestic animals are accompanied by an intense transfer of proteins to the product-forming tissues and by a protein deficit reflected in the serum protein level, too. This deficit can be amended if the fodder of the animals is supplied with proteins and essential amino acids in optimum proportion. In such a way, the normal protein level of serum will be re-established [1, 3].

Subnormal or over-normal values of the serum protein level not only impair the development of the organism, but also affect the main physical constants of the blood, such as colloido-osmotic pressure and viscosity. These, in their turn, bring about circulatory deficiencies which disturb the normal exchange between blood and tissues [2, 3].

The present paper reports on modifications of the serum protein level in chickens and hens fed on fodder rations containing vegetal and animal proteins in different amounts. The final aim of these experiments is to establish some fodder rations, in which the animal proteins are partly replaced by vegetal ones, without diminution of the production in industrial fowl-breeding enterprises.

Materials and methods. The experiments were carried out on 5 groups of chickens and on two groups of hens. The chickens of the control group were fed on standard fodder, while those of the experimental groups on rations containing

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vegetal proteins without or with addition of a premix. The premix used contained 10% methionine. Rate of the methionine addition was 1, 1.5 or 2 g/kg fodder. An antibiotic was also added at a ratio of 200 mg per kg of fodder.

One of the two hen groups served as control, the hens having been fed on standard fodder. A methionine-containing premix was added to the standard fodder of the hens of the second experimental group.

The serum protein level was determined from fresh serum at the temperature of 18°C, by means of an Abbé refractometer and is expressed in g/kg water.

Results and discussion. The results obtained are presented in Table 1. They show that there are statistically significant differences between the experimental and the control groups.

The lowest value of the serum protein level, namely 30.6 g proteins/kg water, was recorded in chickens fed exclusively on vegetable fodder (group 2). When a methionine-containing premix was added to this fodder, the serum protein levels of the chickens (groups 3—5) increased significantly in comparison with that of chickens of both group 2 and group 1, i.e. the control group fed on standard fodder. The highest increase occurred in group 5, the fodder of which contained the largest amount of added methionine (2 g methionine/kg fodder).

The hens fed on standard fodder with an addition of methionine-containing premix (group 7) presented — in comparison with the hens of the control group (group 6, fed only on standard fodder) — a decrease in their serum protein level.

While the methionine-containing premix brought about approximately a 20—30% increase in serum protein level of chickens, the same premix caused only a ~ 10% decrease in serum protein level of hens.

Table 1

Serum protein level of chickens and hens as influenced by their differentiated feeding

Group number	Animals	Fodder	Number of individuals	Serum protein level (g/kg water)	SE	Difference (%)	P
1	Chickens	Standard fodder	5	34.5	0.68	—	—
2		Rations containing vegetal proteins	5	30.6	0.60	−11.3	<0.01
3		Rations containing vegetal proteins and a premix with 1 g methionine/kg fodder	5	37.6	0.55	+22.9	<0.01
4		Rations containing vegetal proteins and a premix with 1.5 g methionine/kg fodder	5	36.3	0.54	+18.6	<0.01
5		Rations containing vegetal proteins and a premix with 2 g methionine/kg fodder	5	39.5	0.90	+29.0	<0.01
6	Hens	Standard fodder	7	67.3	0.90	—	—
7		Standard fodder with a methionine-containing premix	7	59.9	0.90	−11.0	<0.01

The overall results revealed by serum protein level determinations indicate a certain degree of "protein starvation" that may be caused by the too reduced amount of animal proteins in the standard fodder used for feeding of chickens and hens under industrial conditions. The protein deficit in the blood of chickens becomes more pronounced when they are fed exclusively on vegetable fodder. But our results show that this situation can be improved by adding methionine-containing premix to the vegetable fodder. In other words, our results suggest a way of partial replacement of the animal proteins in fodder with vegetal ones, without affecting negatively the serum protein level of chickens, and thus providing the food base for the normal development of chickens bred under industrial conditions.

Conclusions. 1. Serum protein level in chickens and hens fed on standard fodder under industrial conditions indicated a certain degree of "protein starvation".

2. Feeding of chickens exclusively on vegetable fodder brought about a protein deficit in their blood.

3. Addition of a methionine-containing premix to the vegetable fodder led to a considerable (20—30%) increase in the serum protein level of chickens. At the same time, a slight (10%) decrease occurred in the serum protein level of hens, when a methionine-containing premix was added to their standard fodder.

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Ca-Mg-GLUCONOLACTATE TREATMENT OF ALLYL ALCOHOL-INTOXICATED RATS RESTORES NORMAL BEHAVIOUR OF LIVER MITOCHONDRIA WITH RESPECT TO CALCIUM FLUXES

CORNELIU TARBA* and PAVEL ORBAI**

SUMMARY. — Starting from the interrelationship that exists between respiration, membrane potential and Ca fluxes in mitochondria, and from the observation that in perfectly normal mitochondria, in the presence of magnesium and inorganic phosphate, a limited Ca efflux takes place, with the preservation of the integrity and functions of mitochondria, the authors employed this phenomenon as a test of the degree of mitochondrial recovery in mitochondria of allyl alcohol-intoxicated rats, either under free recovery or under the effect of certain treatments. The Ca-Mg-gluconolactate and the Romanian preparation Trofopar® were used as treatment factors.

The results obtained lead to the conclusion that the efficacy of these adjuvants regarding the regulation of Ca fluxes, which is higher in the case of Ca-Mg-gluconolactate, depends, in the first place, on their Mg content.

We have reported in a previous work [11] that the treatment of allyl alcohol-intoxicated rats with either Ca-Mg-gluconolactate, Trofopar® or a combination of the two restores certain functional indices of the liver mitochondria, such as the respiratory control and the membrane potential, to normal values. In the present work we have further investigated the effect of treatment with Trofopar® and especially with Ca-Mg-gluconolactate on the behaviour of rat liver mitochondria with respect to Ca^{2+}-fluxes.

There is at present an impressive accumulation of data regarding the importance, the role and the possible mechanism of action of Ca^{2+} in a series of biochemical, biophysical and physiological processes, ranging from the regulatory effect of calcium on the activity of certain intramitochondrial enzymes to the implication of this ion in the regulation of muscle contraction and, more generally, in the process of excitation-secretion coupling in different glands [4].

The concentration of ionic calcium in the mitochondria and in the cytoplasm, respectively, is a very important factor in the regulation of such complicated processes. Even the accumulation and release of Ca^{2+} from the mitochondrion, one of the important places of calcium control in the cell [6], are very complicated processes, involving Mg^{2+} as a modulator [3, 7], inorganic phosphate [7, 9, 12] and the use of energy, either in the form of ATP or more directly as a membrane potential diffe-

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rence [2, 10]. Adenine nucleotides, generally, may also play a regulatory role in this process [4].

In order to understand the whole complexity of the problem, it must be mentioned that under normal conditions (high membrane potential, generated by respiration or utilization of ATP) Ca^{2+} enters mitochondria through a so-called uniporter, driven by the membrane potential, negative inside [10]. Although at low membrane potential values the sense of Ca^{2+}-current through the uniporter can be reversed, a separate efflux route, independent of the uniporter, has also been described [5]. In fact, there is an indefinite and massive release of Ca^{2+} from the mitochondria, occurring in the absence of Mg^{2+}, if inorganic phosphate (P_i) is added to the suspending medium. This process is accompanied by the collapse of the membrane potential and by a series of other phenomena such as swelling, oxidation of pyridine nucleotides, loss of respiratory control, etc. [8]. It is evident that this type of release can not have any regulatory role. However, under certain circumstances, in the presence of Mg^{2+} and P_i, through a limited calcium efflux, a new steady-state concentration of Ca^{2+} is attained, this time with the preservation of the membrane potential and the phosphorylating ability of the mitochondria [1, 2]. It is this type of efflux, which is present only in perfectly regulated mitochondria, that has been exploited in the present work and utilized as a test of mitochondrial recovery.

Materials and methods. Male Wistar rats of about 150 g, kept on a normal diet, were intoxicated with allyl alcohol (group A) and part of them additionally treated with Ca-Mg-gluconolactate (group A + G) or Trofopar®(group A + T), as previously described [11]. In each group, a number of 3 rats were sacrificed after 1, 3, 7 and 16 days, respectively, from the moment of the administration of the last allyl alcohol dose, so that the free recovery of A could be used as a reference for the other groups. A total number of 6 control rats (group C) were also sacrificed during this period, in order to have an absolute reference for all groups (especially for A).

Preparation of rat liver mitochondria and oxygraphic and spectrophotometric measurements were performed as previously described [11], with the following modifications:

— the preparation medium contained 5 mM HEPES, pH 7.3, instead of 10 mM TRIS buffer, pH 7.5;

— the basic suspending medium for all measurements consisted of "100 mM sucrose + 75 mM KCl + 5 mM HEPES", to which additions were made as specified in appropriate places;

— for measurements of respiration and phosphorylation the suspending medium also contained 5 mM KP_i, 2 mM $MgSO_4$ and 0.5 mM EDTA (or EGTA);

— the respiratory substrates were in the form of K^+-salts.

Spectral recordings for membrane potential and Ca^{2+} were performed with a Specord M 40 split-beam spectrophotometer, at 660 nm, using diS-C_2-(5) as a potential probe and antipyrylazo III as a calcium indicator. The instrument was adapted by us so as to permit kinetic recordings with repetitive additions and special precautions were taken, in order to minimize the artifacts that usually appear in this type of recordings, by having the indicator dyes present only in one cuvette and making all the other additions concomitantly to both cuvettes. Also, the baseline displacement was adjusted by proper selection of the "zero adjustment" setting.

All chemicals used were of analytical grade. The spectral probe for membrane potential, 3,3'-diethylthiadicarbocyanine iodide (standard abbreviation: dis-C_2-(5))

was purchased from Eastman—Kodak, antipyrylazo III, ADP and rotenone from Sigma and allyl alcohol from Loba. Ca-Mg-Gluconolactate and Trofopan® are Romanian products (Biofarm, Bucharest).

Results and discussion. The behaviour of mitochondria with respect to membrane potential and calcium fluxes was assessed on parallel samples, taken under identical conditions, as specified either in the text or in the figure legends.

Group **C.** A typical behaviour of the control mitochondria is shown in Fig. 1. Fig. 1A exhibits the creation of a membrane potential difference of about 180 mV upon addition of succinate as a respiratory substrate. In the absence of P_i this potential difference is very stable for long periods of time (up to tens of minutes). However, the addition of P_i elicits an apparent transient increase in membrane potential, followed by a slow decrease, until a new steady-state value is usually attained. If Ca^{2+} is added at this time, the membrane potential is usually collapsed. On the contrary, if a calcium chelator is added, such as EDTA or EGTA, the membrane potential regains its original value. This can be interpreted as an indication that the decrease of membrane potential upon addition of P_i is most probably due to calcium uptake, although this is not completely confirmed by the recording of Fig. 1B, where calcium fluxes are monitored under conditions identical to those in Fig. 1A. However, in other recordings, such as in Fig. 2, one can see that the decay of the membrane potential (trace A) as well as the massive calcium release is preceded by a transient but quite impressive calcium

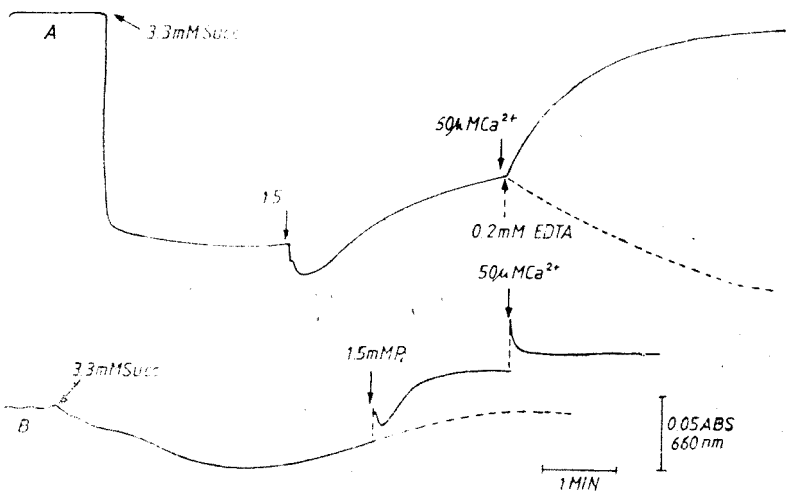

Fig. 1. *Kinetics of membrane potential (A) and calcium fluxes (B) in control mitochondria. Effect of* P_i *and* Ca^{2+}.

1.5 mg rat liver mitochondria are suspended in each cuvette in 2 ml basic medium (see „Materials and methods") supplied with 2 mM $MgSO_4$, 1.5µM diS-C_2-(5) (in A) or 50µM antipyrylazo III (in B) are added to the sample cuvette, followed by the additions specified in the figure, wich are made concomitantly to both cuvettes. ABS — Absorbancy.

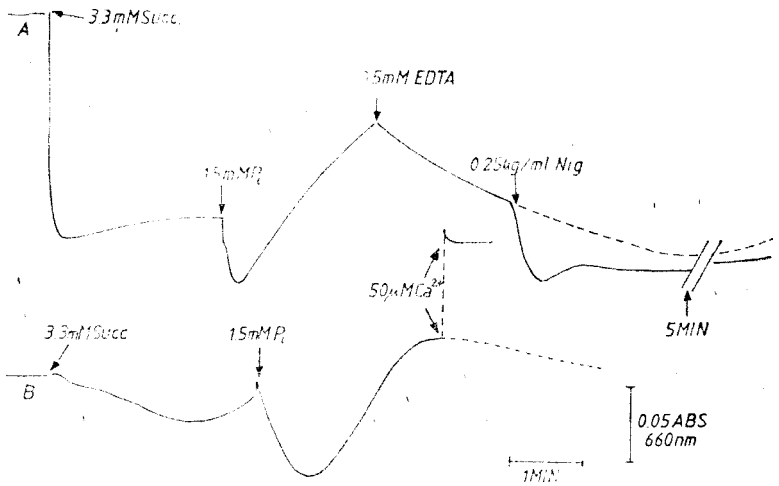

Fig. 2. *Membrane potential (A) and calcium fluxes (B) in control mitochondria. Effect of* P_i, *EDTA and nigericin (Nig).*
Conditions identical to those in Fig. 1.

uptake (trace B). It is also visible from this figure that calcium uptake is not the only factor responsible for the decay of membrane potential, but there is also a building of a pH gradient at the expense of the membrane potential, as indicated by the faster recovery of the membrane potential in the presence of the nigericin, an electroneutral ionophore (K^+/H^+ exchanger). We should stress at this point that the behaviour of our control mitochondria is not completely satisfactory, considering the fact that the addition of P makes them rather unstable with respect to the membrane potential, especially if P_i is followed by calcium addition. However, the observations made later in the course of this study will provide a reasonable explanation for such a behaviour (see explanations to Fig. 6).

Group **A.** The behaviour of mitochondria from allyl alcohol-intoxicated rats is presented in Fig. 3. With or without Mg^{2+}, the membrane potential is smaller than that of the control mitochondria, exhibiting a large increase upon addition of P_i, followed by a rapid collapse (trace A). The same type of phenomena are visible on trace B, where calcium movements are monitored. It is clear that mitochondria are not able of retaining even the relatively small quantity of calcium accumulated from the suspending medium before the addition of P_i. The small difference between the trace recorded in the presence of Mg^{2+} (dotted line) and the one recorded without Mg^{2+} (continuous line) is due to the fact that some indicator dye binds to Mg^{2+} and thus the relative change of absorbance elicited by calcium decreases.

No sign of recovery is visible after 1 day and practically none after 3 days from the termination of intoxication, either. Nevertheless, after 7 days the mitochondria have recovered substantially, as appreciated by

the respiratory control index (4.4 with glutamate-malate and 3.6 with succinate, as compared with 4.9 and 3.9, respectively, for the control, and with 3.2 and 2.6 for the allyl-alcohol intoxicated animals). However, we should remember that these values were recorded in the presence of EDTA and may not reflect the possible inability of mitochondria to withstand calcium. This is in fact demonstrated by membrane potential recordings and traces of calcium movements similar to those in Fig. 3. Only after 16 days of recovery the behaviour of the mitochondria is similar in every respect to that of the control, as demonstrated by re-recordings practically indistinguishable from those in Figs. 1 and 2.

Group **A + T.** In this case, the first signs of recovery are already visible after 3 days. As can be seen in Fig. 4, the behaviour of membrane potential and calcium fluxes is not too far from that observed in Fig. 1 (control mitocondria). Even in the absence of Mg^{2+} (Fig. 5), the membrane potential is relatively stable before the addition of P_i. Fig. 5 is in fact a perfect illustration of the interrelationship between the membrane potential and Ca^{2+}-fluxes. The transient increase in membrane potential (upon addition of P_i) is paralleled by a calcium influx. Nevertheless, this influx does not stop when the membrane potential begins to decrease: it stops only after it has decreased below a critical limit (cca 130 mV). Further decrease of membrane potential results in a massive release of accumulated Ca^{2+}. Although the respiratory control index after 7 days of recovery is very close to the control (EDTA present!), the mitochondria are still incompletely recovered, as deduced from spectrophotometric recordings of membrane potential and calcium fluxes (not presented here).

Group **A + G.** The mitochondria from this group show a remarkably good overall recovery after 7 days. Not only the respiratory control index has increased to normal values, but the membrane potential and calcium fluxes are perfectly regulated, which is not the case with the previous groups. Moreover, as can be seen from Fig. 6, the membrane potential is even more stable and the calcium fluxes are better regulated than in the case of the control mitochondria (cf. Fig. 1). It can be seen from Fig. 6B that the addition of P_i leads to a limited calcium efflux and that a further pulse of calcium can be taken up without destabilizing the mitochondria. There is only a steady-state shift. Such a behaviour is indeed characteristic of perfectly normal, well-prepared mitochondria, as described in the literature [1, 2]. Curiously enough, however, after 16 days of recovery the mitochondria of this group show a behaviour which is practically indistinguishable from that of the control. Nevertheless, this is not totally unexpected and it may be explained in terms of the transient effect of the magnesium supplied by the treating agent, in conjunction with the assumptiom that the imperfect behaviour seen in our control rats is probably due to a lightly magnesium-deficient diet. Indeed, Ca-Mg-gluconolactate contains 5% Mg, compared to 1.4% of the Trofopar®, and therefore it has a stronger effect on the regulation of calcium fluxes. The effect is maximum after about one week from the administration of the treating agent, when the free re-

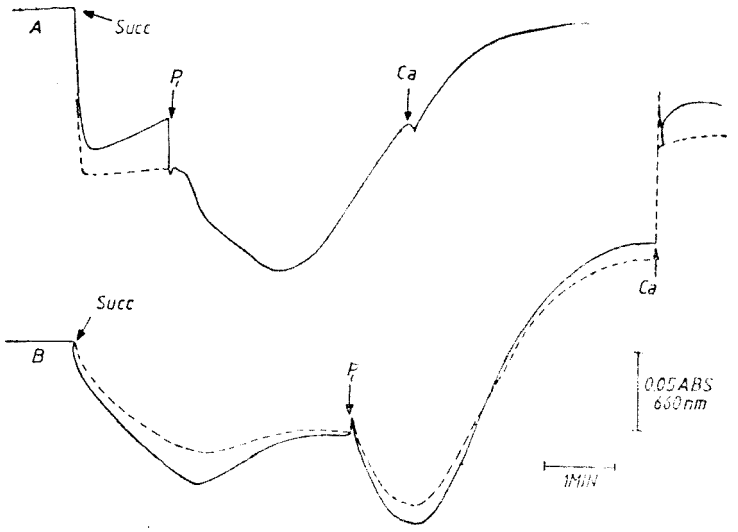

Fig. 3. *Membrane potential (A) and calcium fluxes (B) in mitochondria from allyl alcohol-intoxicated rats.*
Conditions identical to those in Fig. 1, except that the continuous line is recorded in the absence of Mg^{2+}.

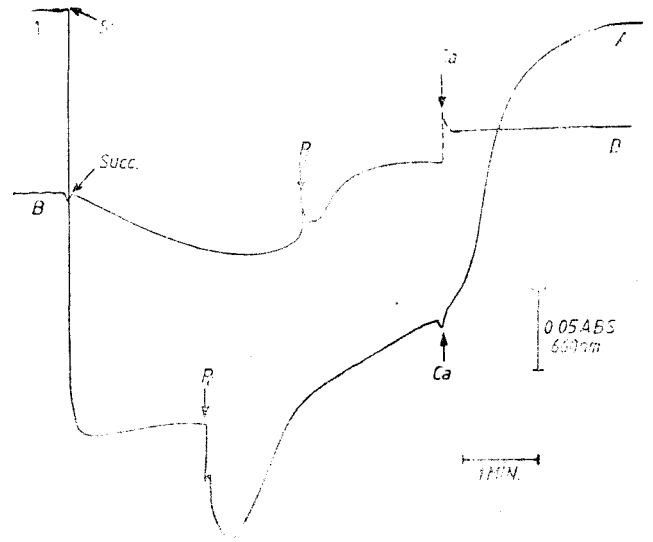

Fig. 4. *Membrane potential (A) and calcium fluxes (B) in mitochondria from allyl alcohol-intoxicated rats treated with Trofopar.*
Conditions identical to those in Fig. 1, except that 3 μM diS—C_2—(5) are added in (A).

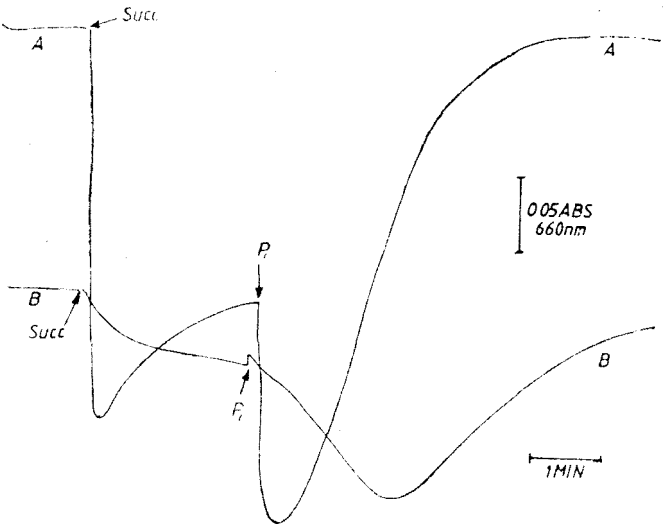

Fig. 5. *Membrane potential (A) and calcium fluxes (B), in the absence of Mg^{2+}, in mitochondria from allyl alcohol-intoxicated rats treated with Trofopar.*
Same conditions as in Fig. 4, but no Mg^{2+} present.

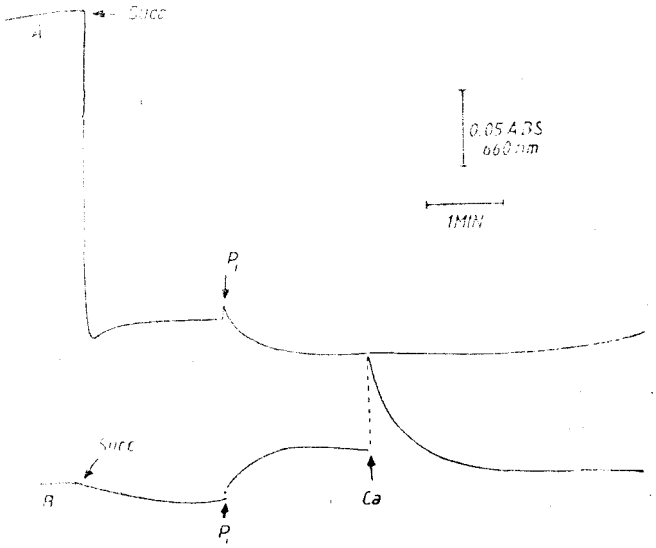

Fig. 6. *Membrane potential (A) and calcium fluxes (B) in mitochondria from allyl alcohol-intoxicated rats treated with Ca—Mg-gluconolactate.*
Conditions identical to those in Fig. 1, except that 2 μM diS—C_2-(5) are present in (A).

covery itself is reasonably advanced (as demonstrated by the mitochondria of group A) and the concentration and effect of the Mg^{2+} supplied by gluconolactate are probably still relatively high. Since the concentration (like the effect) of Mg^{2+} is expected to decrease in time, it is no wonder that after 16 days mitochondria actually show a less perfect behaviour than after 7 days. However, this behaviour is in fact identical to that of the control, which is absolutely normal. This line of reasoning, totally supported by our results, points to the importance of the Mg^{2+} for both the normal and the intoxicated rats. A more directed evidence would be provided by pretreatment with a magnesium-rich diet of the rats used for experimentation and/or treatment of the intoxicated animals with a magnesium source devoid of certain ingredients found in the treating agents utilized in the present experiment.

Conclusion. The treatment with Trofopar® and especially with Ca-Mg-gluconolactate of allyl alcohol-intoxicated rats improves the behaviour of hepatic mitochondria with respect to the membrane potential and Ca^{2+}-transport. Mitochondria obtained from rats treated with Ca-Mg-gluconolactate are completely recovered after about one week from the administration of the treating agent, whereas the free recovery is less efficient and takes a longer time (at least two weeks).

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CONTRIBUTIONS À LA VALORIFICATION SUPÉRIEURE DES ESSENCES VOLATILES AZULÉNIQUES

I. Préparation des onguents utiles dans le traitement des brûlures

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SUMMARY. — Contributions to High Level Valorification of Azulenic Volatile Oils. I. Preparation of Ointments Useful in the Treatment of Burns. Ointments of original formulations were prepared from azulenic volatile oils (Aeth. Millefolii or Aeth. Chamomillae), beeswax, paraffin oil, 2% $NaHCO_3$, 0.4% pectin and 0.1% methylcellulose solutions and mineral salts [4—6, 8—13].

The effect of these ointments was tested on thermic burns induced experimentally on the skin surface (380 mm^2) of Westar rats. When the ointments were applied immediately after provoking the burn and the treatment was carried on daily, a slightly anaesthetic effect could be immediately noticed, the further evolution of the wound being very good with a complete healing after 6 days of treatment. When the ointments were applied after 24 hours since the moment of burning and then daily, the process of re-epithelization started after 5 days and the healing was complete after 12 days of treatment. The ointments were also applied after 48 hours since the moment of burning. In this case, the re-epithelization started after 7—8 days and the complete healing took place after 13—15 days of treatment.

Due to their re-epithelizing, anti-inflammatory, antimicrobial and slightly anaesthetic effects, these azulenic ointments of original formulations can be used as first aid and also for the treatment of burn wounds of different etiologies.

À cause de leur contenu élevée en azulènes et surtout en chamazulène, les essences volatiles extraites des fleurs de camomille (*Matricaria chamomilla* L.) et d'achillée (*Achillea millefolium* L.) sont appréciées pour leur effet anti-inflammatoire efficace et rapide, par exemple dans le cas de érythèmes provoqués par les brûlures [7, 15, 16], ainsi que pour leur effet anti-allergique [7, 15, 16] et de protection anti-bactérienne [16] et anti-fongique [14]. Dans les essences isolées par distillation avec vapeurs d'eau à partir de 90 échantillons divers d'inflorescences d'*Achillea millefolium L.* appartenant à la flore spontanée de notre pays [7] furent identifiés pour la première fois, par chromatographie sur couche mince et spectroscopie en IR, les composés suivants: acétate de linalyl, citral,

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géraniol, linalol et nérol, à côté de l'acétate de bornyl, bornéol, caryophylène, camphre, 1,8-cinéol, limonène, α-pinène, β-pinène, terpinéol et thuyone [7], ainsi que la chamazulène, qui se trouve dans un large domaine de concentrations (depuis 1,4% jusqu'à 30,2%).

En partant de ces prémisses, nous avons essayé d'obtenir, à l'aide des essences volatiles azuléniques, des préparations pharmaceutiques utiles dans le traitement des brûlures. Dans ce but, nous avons associé pour obtenir des onguents: de la cire d'abeille partiellement neutralisée, des essences azuléniques (Aetheroleum Millefolii ou Aetheroleum Chamomillae), des solutions de pectine, de la méthylcellulose et des sels minéraux [4—6; 8—13].

La cire est couramment utilisée dans les formules de liniments, crèmes, gels, etc., pour des raisons de techniques pharmaceutiques [2, 3, 17, 18]. Les qualités d'émoliant de la cire sont universellement reconnues, ainsi que les résultats positifs obtenus dans le processus d'épithélisation des brûlures lorsqu'elle est englobée dans les crèmes et les onguents [2, 3]. Dans la composition complexe de la cire, les cérides à myricine représentent 70—75%. À son tour, la myricine est un mélange de l'ester myricyl-palmitique avec une quantité infime de stéarate de myricyle [1]. La cire contient aussi d'autres alcools à chaîne libre, estérifiée, puis environ 14% acides libres, 12% hydrocarbures à C_{25-31} et des stérides [1]. D'autre part, dans les préparations pharmaceutiques, la cire participe avec ses propriétés nutritives, ayant un effet de stimulation sur la réépithélisation, ainsi que des qualités légèrement anesthésiques [1—3]. La neutralisation partielle de l'acidité de la cire est faite avec du hydrocarbonate de sodium [4—6; 8—13], afin d'en augmenter la tolérance vis-à-vis de la cire, même à une concentration plus élevée que celle utilisée couramment dans la pratique pharmaceutique [17—19].

Les essences azuléniques (Aeth. Millefolii ou Aeth. Chamomillae) apportent dans la composition médicamenteuse leurs effets réépithélisants [7, 15, 16], de protection contre les bactéries [16], etc. En outre, afin de favoriser la conservation à long terme des azulènes dans les onguents (parce qu'il est bien connu que les azulènes sont sensibles à l'action de l'air [16]), l'anhydride carbonique résulté de la réaction de neutralisation de la cire avec l'hydrocarbonate de sodium a été maintenu en grande quantité dans l'onguent [4—6, 8—13].

La solution de pectine (0,4%) et de méthylcellulose (0,1%), ainsi que le complexe de sels minéraux (Na, K, Ca, Mg) utilisés dans certains onguents [4—6, 9] assurent dans la composition médicamenteuse la capacité d'hydratation prolongée des tissus blessés [18].

Nous avons étudié l'effet de ces onguents aux azulènes dans le traitement des brûlures expérimentales d'origine thermique, produites aux animaux de laboratoire (des rats Wistar).

Matériaux et méthode. Nous avons préparé huit formules originales d'onguents réépithélisants, contenant dans leur composition les substances suivantes, associées et combinées en divers proportions: essences azuléniques (Aeth. Millefolii, Aeth. Chamomillae), cire, huile de paraffine pour usage interne, solution d'hydrocarbonate de sodium 2%, solution de pectine 0,4% et de méthylcellulose 0,1%, sels minéraux [4—6, 8—13] (Tableau 1).

Les onguents réépithélisants sont préparés de la manière suivante [4—6, 8—13]: on met ensemble la cire et l'huile de paraffine au bain-marie et on mélange jusqu'à ce que la cire soit fondue et le mélange homogène. On laisse cette masse homogène se refroidir jusqu'à 70° C, puis on ajoute doucement, en agitant en permanence, la solution chaude d'hydrocarbonate de sodium. On continue à toujours mélanger, pour faire incorporer petit à petit les solutions de pectine et de méthylcellulose (qui contiennent aussi les sels minéraux); au moment où la température atteint 30—35° C, on ajoute peu à peu, en mélangeant sans cesse, les essences volatiles azuléniques jusqu'au refroidissement du produit.

De cette manière, on obtient des onguents homogènes, d'une belle couleur bleue azurée, avec pH neutre et arôme caractéristique [4—6, 8—13].

L'effet des onguents préparés (Tableau 1) a été observé chez les rats Wistar sur des brûlures thermiques provoquées expérimentalement. La brûlure est provoquée avec une pièce métallique ayant une surface de contact de 380 mm², chauffée à rouge pendant 3 minutes, puis appliquée sur une zone de la région dorsale, dépilée au préalable, zone inaccessible à l'animal. On maintient le fer à rouge pendant 30 sec. sur cette surface de la peau.

Les animaux d'expérience sont divisés en plusieurs lots, pour chaque onguent étudié, à savoir:

— lot de contrôle: les animaux pour lesquels, après avoir provoqué la brûlure, on n'applique aucun traitement;

— lot A: les animaux pour lesquels l'onguent étudié a été appliqué immédiatement (dans les premières minutes) après avoir provoqué la brûlure et puis chaque jour jusqu'à la guérison;

— lot B: l'onguent réépithélisant a été appliqué 24 heures après la brûlure et puis chaque jour de suite;

— lot C: l'onguent réépithélisant a été appliqué 48 heures après la blessure et puis chaque jour de suite.

Chacun des lots expérimentaux comprenait 5 animaux adultes; l'onguent a été appliqué en dose de 2 g/animal/jour, jusqu'à la guérison complète de la blessure. Le degré de guérison de la plaie a été estimé par comparaison avec le lot de contrôle.

Résultats et discussions. Nous avons préparé huit recettes (Tableau 1) d'onguents homogènes, de type émulsion de consistance molle, de couleur bleue azurée, avec réaction chimique neutre et arôme spéci-

Tableau 1

La composition des onguents réépithélisants, contenant de l'essence azulénique

Ingrédients	Variantes des 8 recettes originales d'onguents (quantités en g)							
	1	2	3	4	5	6	7	8
Cire	15	15	15	15	15	15	15	15
Huile de paraffine	60	60	60	60	60	60	60	60
Aeth. Millefolii	1	1	1	1	—	—	—	—
Aeth. Chamomillae	—	—	—	—	1	1	1	1
$NaHCO_3$ sol. 2%	10	10	10	10	10	10	10	10
Pectine sol. 0,4% contenant des sels dissous: KBr anh. 2 mg; $MgCl_2$ anh. 9 mg; NaCl anh. 2 mg; $CaCl_2$ anh. 4 mg.	14	—	7	—	14	—	7	—
Méthyl-cellulose sol. 0,1% contenant les mêmes sels dissous	—	14	7	—	—	14	7	—
Solution des mêmes sels dissous dans l'eau dist	—	—	—	14	—	—	—	14

fique, dans lesquels peut être déterminé un contenu minimum de 0,06% d'azulène et 15% de cire [5—13]. La haute proportion de cire assure pour toutes les variantes de préparations obtenues des propriétés émolliantes, anti-bactériennes et de stimulation de l'épithélisation.

Les essences azuléniques confèrent aux onguents réépithélisants des effets anti-inflammatoires et anti-allergiques, ainsi qu'une protection contre les champignons parasites [1, 7, 14—16]. La solution de pectine, ainsi que celle de méthylcellulose et les sels minéraux assurent l'hydratation durable des tissus lésés [5, 6, 18].

Par le traitement des animaux présentant des brûlures thermiques expérimentales avec les onguents azuléniques étudiés (Tableau 1), on obtient les résultats spécifiés en Tableau 2.

Pour les animaux du lot A, traités avec onguent dès les premières minutes après la brûlure, l'évolution ultérieure a été très bonne, avec indices évidents que la douleur s'est calmée. La guérison totale est obtenue après 6 jours de traitement, l'épiderme regagnant son aspect normal.

Pour les animaux du lot B, traités avec onguent appliqué 24 heures après la brûlure, la régression de l'érythème a commencé 3 jours après l'application de l'onguent. L'épithélisation a commencé après 5 jours de traitement avec les onguents. Après 9 jours de traitement, la réépithélisation a été presque complète, les animaux présentent une croûte d'approximativement 30 mm^2; 12 jours plus tard, les animaux étaient complètement guéris, l'épiderme regagnant son aspect normal. L'effet le plus rapide a été obtenu par l'onguent no. 5 (Tableau 1), qui a produit une ébauche d'épithélisation 4 jours après, la réépithélisation totale 8 jours après et la guérison complète après 11 jours de traitement.

Pour les animaux du lot C, traités avec l'onguent 48 heures après la brûlure, l'érythème commence à diminuer après 4—5 jours d'application des onguents. Le début de la réépithélisation a été observé après

Tableau 2

Effet des onguents azuléniques sur les brûlures thermiques expérimentales

L'effet obtenu	Lot expérimental	Quantité (en g) de l'onguent utilisé per animal*							
		1	2	3	4	5	6	7	8
Début de l'épithélisation	A	4	4	4	4	4	4	4	4
	B	10	10	10	10	8	10	10	10
	C	16	14	16	16	14	16	16	16
Réépithélisation presque totale (cca 30 mm^2 de croûte)	A	8	8	8	8	8	8	6	8
	B	18	18	18	18	16	18	18	18
	C	24	20	24	24	20	22	24	24
Guérison totale	A	12	12	12	12	12	12	10	12
	B	24	24	24	22	22	24	24	24
	C	30	26	30	30	26	28	30	30

* Le numéro d'ordre correspond à celui du Tableau 1.

7—8 jours. La réépithélisation presque totale survient après 10—12 jours, les animaux présentant encore des croûtes d'approximativement 30 mm². La guérison totale est obtenue après 13—15 jours, la peau revenant au normal. Dès les premiers jours de traitement, les animaux ont commencé à être vivaces pour que, après la guérison complète de la blessure, leur comportement soit redevenu normal sous tous les aspects. Deux semaines après la cessation du traitement, on ne pouvait signaler aucun phénomène secondaire et il n'existait aucun indice d'infection.

Les animaux du lot de contrôle (le lot non-traité) présentaient une réaction de brûlure plus forte, avec extension de la plaie, qui devient surinfectée, purulente, après 6 jours de la brûlure. Ce processus a duré jusqu'au dixhuitième jour, puis on a observé une stagnation, suivi d'une légère diminution de la blessure. Après 24 jours on a pu remarquer des points de réépithélisation sur l'aire infectée, la situation restant inchangée durant un mois encore.

Conclusions. Nos résultats expérimentaux mettent en évidence les effets réépithélisants remarquables produits par les onguents azuléniques, lorsqu'ils sont appliqués dès que la brûlure a été provoquée. Ces résultats suggèrent la recommandation d'utiliser les onguents azuléniques comme premier soin, pendant les premières minutes après une brûlure, d'autant plus qu'ils possèdent également un léger effet anesthésiant et calmant. Leur effet réépithélisant est présent même si ces onguents sont appliqués 24 ou 48 heures après la brûlure. Afin d'augmenter l'efficacité du traitement, on recommande d'appliquer plusieurs fois par jour ces produits (Tableau 2).

Compte tenu des effets réépithélisants, anti-inflammatoirs, antimicrobiens et légèrement anesthésiques des onguents azuléniques préparés d'après nos méthodes originales, ces résultats peuvent être utilisés pour le traitement des brûlures de diverses étiologies.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

EFECTUL EPITELIZANT AL UNOR EXTRACTE VEGETALE ÎN TRATAMENTUL ARSURII PROVOCATE LA ŞOBOLANI ALBI

ZOLTAN KIS* şi ERNEST MACALIK**

SUMMARY. — **The Epithelizing Effect of Some Plant Extracts in the Treatment of Burns Provoked on White Rats.** The authors have studied the therapeutic effect of some plant extracts on the wounds produced experimentally by burns applied on the skin of white rats. The best effect was obtained with the mixture, prepared in equal proportions, from extracts of *Mycelis muralis* and *Alchemilla vulgaris*. Epithelization of the wounds treated with this mixture was nearly as quick as that recorded in the treatment of burns with Sulfamilon — a substance widely used in curing burns.

Traumatismele provocate de arsuri constituie o problemă specifică a secolului nostru datorită tehnicităţii dezvoltate, ceea ce uneori poate fi sursa accidentelor de acest gen. Deşi arsurile pot fi considerate ca sterile, ele totuşi constituie o poartă largă de infecţie, determinînd totodată şi eliberarea unor substanţe (histamină, bradikinină etc.), care cu efectele lor asupra vasomotricităţii şi permeabilităţii intervin în dinamica schimburilor de substanţe la nivel tisular şi celular [1, 4].

În cazurile de arsuri mai puţin grave, cînd nu se distrug elementele germinative ale tegumentului, se practică numai un tratament cu antiseptice, analgezice şi epitelizante. În această ordine de idei, în medicina populară se cunosc numeroase specii de plante care se utilizează în vindecarea rănilor, în general, sau a arsurilor, în special. Dintre acestea amintim *Achillea millefolium* (coada şoricelului), *Chamomilla recutita* (muşeţelul), *Hypericum perforatum* (pojarniţa sau sunătoarea), *Calendula officinalis* (gălbinele), *Cnicus benedictus* (schinelul), *Populus nigra* (plopul negru), *Urtica dioica* (urzica), *Alchemilla vulgaris* (creţişoara) [2, 3, 5].

În cursul cercetărilor etnobotanice din Valea Trotuşului, unul din autorii lucrării a observat că localnicii folosesc susaiul pădureţ *(Mycelis muralis)* — plantă larg răspîndită pe aceste meleaguri — ca un mijloc foarte eficient în tratamentul rănilor purulente. Pornind de la aceste observaţii autorii lucrării de faţă au iniţiat cercetarea efectelor diferitelor plante folosite în acest scop, comparîndu-le cu acţiunea Sulfamilonului (o substanţă sintetică larg folosită în tratamentul arsurilor).

Material şi metodă. Experimentele au fost efectuate pe 12 şobolani albi, adulţi, grupaţi în două loturi. La primul lot a fost cercetată eficienţa diferitelor extracte (apoase şi acetonice) din *Achilea millefolium, Hypericum perforatum, Calendula officinalis, Alchemilla vulgaris* şi *Mycelis muralis*. Rezultatele au fost comparate între ele în vederea stabilirii gradului de eficacitate [6—8]. În acest scop, la fiecare animal din acest lot s-au practicat cu un electrocauter (în narcoză

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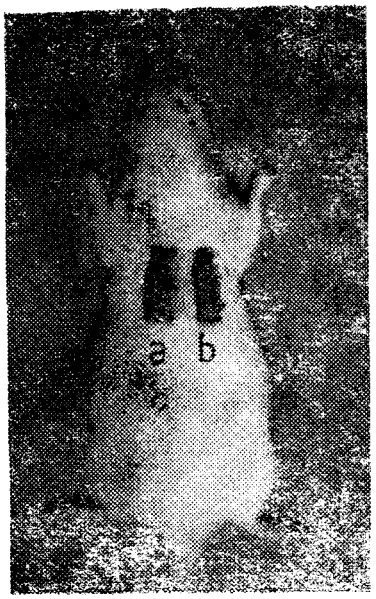

Fig. 1. *Rănile de arsură în prima zi.* a — Rană pentru studierea efectului epitelizant al extractelor vegetale; b — Rană netratată.

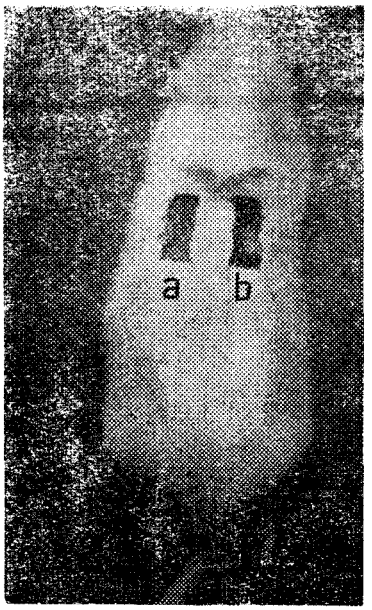

Fig. 2. *Efectul tratamentului cu extracte de* Mycelis muralis *și* Alchemilla vulgaris. a — Rană tratată, b — Rană netratată.

cu nembutal) trei răni de arsură de aceleași dimensiuni, în regiunea cefei. Prima din aceste răni, nefiind tratată, a servit drept martor, iar celelalte două au fost tratate zilnic cu extractul apos și acetonic din plantele amintite mai sus. Ambele categorii de extracte au fost incluse în unguent hidrofil neionic. Animalele au fost izolate în vederea asigurării condițiilor optime pentru vindecarea rănilor.

Pe baza observațiilor, extractele acetonice din *Alchemilla vulgaris* și *Mycelis muralis* s-au dovedit cele mai eficace, prin urmare, experimentul a fost continuat cu cercetarea acestor substanțe aplicate separat, precum și în amestec în proporții egale. Pentru compararea eficacității, ca etalon a fost folosit Sulfamilonul. La acest lot au fost practicate doar două răni de arsură, în condițiile arătate mai sus.

Rezultate. După 15 zile s-au putut observa deosebiri evidente în vindecarea rănilor. Rezultatele cele mai bune s-au obținut la animalele tratate cu amestecul extractului din *Alchemilla* și *Mycelis* (Fig. 1 și 2). Acțiunea extractelor aplicate separat nu a fost atît de evidentă ca în amestec, combinație în care eficacitatea lor a fost apropiată de cea obținută cu Sulfamilon, substanță sintetică importată din S.U.A.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1986

L'ECG COMME EXPRESSION DES DEUX SITUATIONS STRESSANTES DIFFÉRENTES CHEZ L'HOMME

MIRCEA POP*

SUMMARY. — ECG as an Expression of Two Different Stress Situations in Humans. Stimulation stress and pain stimulation waiting stress were analyzed in human subjects, based upon ECG data. Tachycardia was not found to be a conclusive differential index. S—T interval and especially P/T ratio showed more significant modifications. The results obtained are discussed in the light of literature data.

Dans le stress émotionnel de l'homme on peut distinguer deux situations stressantes dont les dimensions et les significations psychophysiologiques peuvent être différentes. L'une comporte des réponses directes et immédiates aux stimuli émotionnels („stress sous stimulation"), l'autre — des réponses aux stimuli attendus („stress d'attente"). La première situation correspond au stress classique bien connu; la deuxième a constitué également objet d'étude [3, 5, 6, 9], mais ses particularités neurophysiologiques et ses caractères distinctifs restent encore à préciser. Dans ce but nous avons effectué une série d'expériences avec l'enregistrement de l'ECG chez des sujets soumis aux agents stressants directs et attendus.

Méthodes. Les expériences ont été faites sur 14 sujets humains âgés de 22—23 ans. Comme agent stressant on a choisi le choc électrique sur le bras droit du sujet. L'attente du même stimulus nociceptif, après l'avertissement verbal, a constitué ce qu'on appelle „stress d'attente" [6]. L'ECG a été enregistré durant 5 sec. après l'avertissement verbal, et dans le cas du „stress sous stimulation" — immédiatement après l'action brusque du stimulus nociceptif. On a évalué la fréquence cardiaque (R—R), l'intervalle du segment S—T, le rapport P/T et les amplitudes des ondes R. Sporadiquement on a enregistré les réponses EEG en dérivation pariéto-occipitale.

Résultats et discussions. On remarque une assez grande variation individuelle des paramètres étudiés. L'augmentation de la fréquence cardiaque, phénomène que certains auteurs mettent en évidence dans des situations semblables [1, 3, 5, 7, 9], ne constitue pas un indice relevant dans nos expériences. Les modifications de l'amplitude des ondes R ne peuvent non plus être prises en considération (Tableaux 1 et 2). Les seuls paramètres qui puissent nous fournir un certain renseignement sur la différence entre les deux catégories de situations stressantes sont l'intervalle S—T et surtout le rapport P/T (Tableau 2). On sait d'ailleurs que ces deux paramètres de l'ECG sont particulièrement sensibles aux excitations émotionnelles [2, 6]. Dans nos expériences, on remarque

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Tableau 1

Variations individuelles des paramétres de l'ECG par rapport au nombre des expériences effectuées

Paramètres	Stress sous stimulation			Stress d'attente*		
	Augmentation (%)	Diminution (%)	Sans modifications (%)	Augmentation (%)	Diminution (%)	Sans modifications (%)
Fréquence	50,0	21,4	28,6	64,3	14,3	21,4
Rapport P/T	57,1	28,6	14,3	85,7	14,3	—
Intervalle S — T	21,4	28,6	50,0	8,3	50,0	41,6

* Pendant le stress d'attente on remarque 5 cas d'arythmies cardiaques.

Tableau 2

Variation des valeurs moyennes des paramètres de l'ECG par rapport au normal

Paramètres	Stress sous stimulation (%)	Stress d'attente (%)	P
Fréquence	+ 13,2	+ 16,7	$>0,05$
Rapport P/T	+ 12,8	+ 20,5	$<0,05$
Intervalle S — T	— 1,6	— 6,0	$<0,05$
Amplitude de l'onde R	— 1,2	— 1,6	$>0,05$

une tendance évidente de raccourcissement de l'intervalle S—T et de l'augmentation du rapport P/T pendant le stress d'attente. Non seulement le nombre des cas où le rapport P/T apparaît élevé est plus grand durant le stress d'attente (Tableau 1), mais aussi son niveau en comparaison avec la situation normale (Tableau 2). Dans la grande majorité des cas, l'augmentation du rapport P/T est due à l'aplatissement des ondes T et ce n'est que dans un petit nombre de cas (surtout pendant le stress sous stimulation) que le rapport augmente par l'accroissement de l'amplitude des ondes P.

Selon l'hypothèse de Volkind [8], la variation du rapport P/T serait un indice de la prédominance du tonus sympathique ou parasympathique au cours des excitations émotionnelles. L'hypothèse est bien séduisante surtout pour l'interprétation des variations individuelles signalées dans nos expériences, mais à défaut de données expérimentales supplémentaires, nous nous limitons à constater les faits. Toutefois, il n'est pas dépourvu d'importance de signaler une relation possible entre le stress émotionnel et les réactions des systèmes cholinergiques et sympatho-adrénergiques. Vedyaev et Samokhvalov, par exemple, mettent en cause la perturbation des processus neurochimiques des systèmes adrénergiques du cerveau dans le cas pathologique du stress d'attente [6].

Ce que nous pouvons affirmer avec certitude, c'est que le stress d'attente retentit d'une manière plus évidente, plus marquée sur l'acti-

vité cardiaque que le simple stress sous stimulation. En ce qui concerne l'étude de l'EEG, elle ne nous fournit pas d'autres informations que celles qui ont déjà été signalées dans la littérature [5]. Notons cependant que l'allure générale du phénomène d'arrêt des ondes alpha est à peu près semblable à celle obtenue pendant l'ouverture des yeux.

Conclusions. 1. On remarque une assez grande variation individuelle des paramètres de l'ECG chez les individus soumis au „stress sous stimulation" et au „stress d'attente". 2. Les indices qui marquent une certaine différence entre les deux situations stressantes sont l'intervalle S—T et surtout le rapport P/T de l'ECG.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

FRÉQUENCE ET DISTRIBUTION DE L'ANÉMIE FALCIFORME DANS LA RÉPUBLIQUE POPULAIRE DE CONGO

MANUELA DORDEA*, NICOLAE COMAN* et GERMAINE OKEMI**

SUMMARY. — Frequency and Distribution of the Sickle-Cell Anemia in the People's Republic of Congo. By using the Emmel test and the method of electrophoresis on cellulose acetate, the authors have determined the frequency and distribution of the sickle-cell anemia within some ethnic groups in the P.R. of Congo.

Sickle-cell anemia is not a sex-linked disease, as its frequency is statistically the same in both sexes. But the ethnic distribution points out the fact that the frequency of this disease differs among different populations; sickle-cell anemia is most frequent among the populations living in the northern, southern and coastal parts of the country. A significantly lower incidence is met with the individuals belonging to the Bateke group inhabiting the central part of the P.R. of Congo. This distribution can easily be explained if we accept Lehman's hypothesis concerning the origin of sickle-cell anemia in the Near East and its spreading directions which coincide with that of the zebu cattle.

Living in the equatorial forest, the Bateke population had only sporadic contacts with the cattle-breeding populations who migrated searching for pastures. Therefore, in spite of the fact that malaria is very spread in the region inhabited by the Bateke population, the frequency of sickle-cell anemia is here low. It follows thus that the distribution of this disease within different ethnic groups depends not only on the ecological conditions under which the respective population lives, but especially on the frequency of the gene within the population.

L'anémie falciforme, connue également sous le nom de syclémie, de drépanocytose ou d'hémoglobinose S, n'est autre que l'hémoglobinopathie qualitative, caracterisée par la présence dans les érythrocytes d'une hémoglobine anormale (HbS) qui détermine dans les conditions d'hypoxie la forme en faucille des érythrocytes.

L'anémie falciforme est une maladie héréditaire, la présence de l'hémoglobine S étant déterminée par un gène autosomal, qui se transmet avec dominance incomplète [2, 4]. La mutation, du type des „point-mutations", est due au fait que l'uracile remplace l'adénine dans la position centrale des séquences GAA ou GAG, séquences occupant la sixième position dans l'ARNm, qui détermine la synthèse de la chaîne β de l'hémoglobine. Cette modification induit le remplacement de l'acide glutamique par la valine dans la sixième position de la chaîne polypeptidique β. À cause de cette substitution, la configuration moléculaire de l'hémoglobine S est modifiée, le résidu acide hydrophile de la chaîne normale β étant remplacé par un neutre, hydrophobe [3, 8]. Cela

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explique le comportement électrophorétique différent de l'hémoglobine S par rapport à l'hémoglobine normale. Sous la forme oxygénée, la molécule de l'hémoglobine S a des propriétés normales, mais la désoxygénation détermine sa cristallisation ou sa polymérisation et la formation de zones d'adhérence des chaînes contigues, favorisant ainsi la formation des soi-disant tactoides [9]. Simultanement, la membrane érythrocytaire est soumise à une déformation, qui détermine la forme en faucille des érythrocytes, ceux-ci devennant par la suite des drépanocytes.

Le processus de falciformation est réversible, étant influencé par une série de facteurs extra- et intra-érythrocytaires: la pression partielle de l'oxygène (les drépanocytes étant plus nombreuses dans le sang veineux que dans celui artériel), l'abaissement du pH, l'augmentation de la viscosité du sang et de la quantité d'hémoglobine S dans les érythrocytes (les sujets hétérozygotes detiennent 22—45 % HbS, le reste étant de l'hémoglobine A —. normale, tandis que les homozygotes detiennent 76—100 % HbS, le reste étant de l'hémoglobine F).

L'anémie falciforme est très répandue en Afrique [1, 5], dans les territoires situés entre 15° latitude nord est 20° latitude sud, zone géographique que L e h m a n n [7] a nommée la „ceinture séclémique". Dans ces régions, l'état hétérozygote de l'anémie falciforme apparaît dans les populations humaines avec une fréquence de jusqu'à 40% [1]. L'état homozygote se rencontre, par contre, dans une très faible fréquence (0,3—2 %), parce que les sujets en question meurent prématurément, avant d'arriver à se reproduire.

Les drépanocytes ne permettent pas le développement de l'agent de la malaria — *Plasmodium falciparum*, et à cause de cela les individus touchés d'anémie falciforme sont résistants à cette maladie. Par la suite, l'anémie falciforme, malgré tous ses effets négatifs, devient un facteur qui contribue à l'augmentation du degré de survivance dans le cadre des populations humaines qui occupent les zones ravagées par le paludisme.

Matériel et méthodes. Des recherches ont été effectuées sur 2796 enfants âgés d'au plus de 5 ans, internés dans la section de pédiatrie de l'Hôpital Général de Brazzaville. Les enfants appartenaient à quatre groupes ethniques (Fig. 1):

— le groupe Bateke, de la région de plateau, du centre du pays;
— le groupe Mboshi, Sangha et Maka, du Nord;
— le groupe Lari, Bembe, Kamba et Konco, du Sud;
— le groupe Vili et Mayombe de la côte de l'Océan Atlantique.

Deux méthodes ont été utilisées: l'une par la mise en évidence des cellules falciformes, l'autres — électrophorétique — utilisée d'habitude pour diagnostiquer toutes les hémoglobinopathies.

Pour la mise en évidence des cellules falciformes, le test utilisé est celui d' E m m e l [6]. La méthode se base sur l'examen au microscope, à 37°C, dans une atmosphère anaérobique et en présence du métabisulfite de sodium 2%, de la capacité de falciformation dans une quantité donnée de sang. Le sang se récolte dans des conditions de stérilité et doit être analysé immédiatement après la récolte. Dans des conditions anaérobiques, les cellules avec un potentiel de falciformation se déforment dans un pourcentage plus élévé ou plus bas, en fonction de la quantité d'hémoglobine S qu'elles contiennent. Le comptage des cellules falciformes se

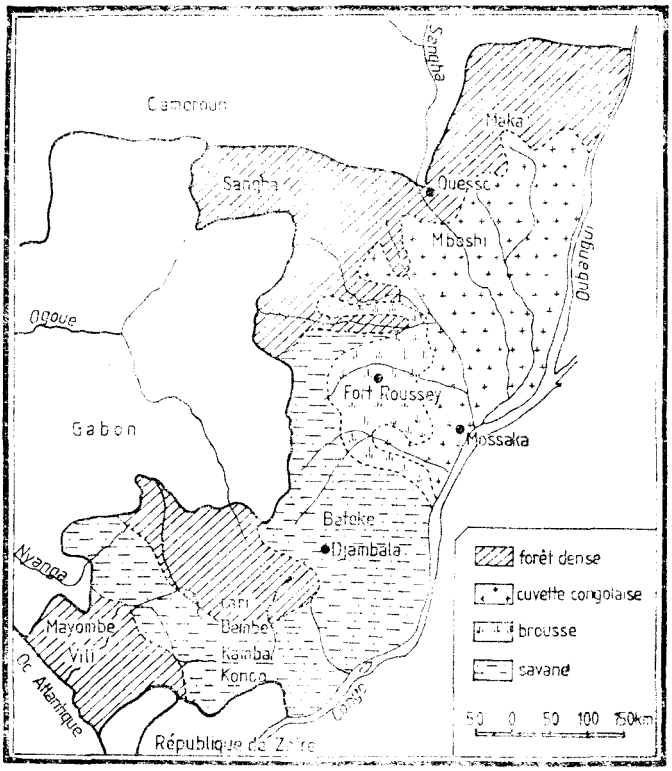

Fig. 1. ***Répartition géographique des groupes ethniques de la République Populaire de Congo.***

fait 24 et 48 heures après. Cette méthode ne met pas en évidence l'état homo- ou hétérozygote de la maladie, et c'est pour cela qu'elle nécessite en parallèle une étude électrophorétique. La méthode électrophorétique permet la mise en évidence de l'hémoglobine S qui, dans les conditions de pH = 8,6—9, a une plus faible vitesse de migration que celle de hémoglobine A normale. Dans nos études nous avons utilisé l'électrophorèse sur acétate de cellulose qui présente l'avantage de permettre une très bonne séparation des principales hémoglobines pathologiques qui peuvent être déterminées ensuite quantitativement, par densimétrie, suivie de planimétrie à l'aide d'un enregistrement intégrateur automatique Cellomatic. Les résultats ainsi obtenus permettent de distinguer les homozygotes des hétérozygotes.

Résultats et discussions. Des 2786 enfants étudiés, 958 ou 34,3% étaient malades, ayant un test d'Emmel positif, les autres — 1838, soit 65,7%, étant sains.

En utilisant le même test, la répartition par sexes se présente comme il s'en suit (Tableau 1). Comme ces données le montrent, l'anémie falciforme n'est pas une maladie héréditaire liée au sexe.

La répartition ethnique de la maladie indique que sa fréquence diffère d'une population à l'autre (Tableau 2). Il apparaît clairement que la fréquence la plus grande de la maladie apparaît aux populations du Nord,

Tableau 1

Répartition par sexes de l'anémie falciforme

Test d'Emmel	Garçons		Filles	
	No. de sujets	%	No. de sujets	%
(+)	526	54,9	432	45,1
(−)	994	54,1	844	45,9

Tableau 2

Distribution ethnique de l'anémie falciforme d'après le test d'Emmel

Groupe ethnique	Total sujets étudiés	Test d'Emmel (−)		Test d'Emmel (+)	
		No. de sujets	%	No. de sujets	%
Bateke	532	390	73,3	142	26,7
Mboshi, Sangha et Maka	357	226	63,4	131	36,6
Lari, Bembe, Kamba et Konco	1843	1180	64,1	663	35,9
Vili et Mayombe	64	42	65,6	22	34,4
Total	2796	1838	65,7	958	34,3

Tableu 3

Distribution ethnique de l'anémie falciforme établie d'après la méthode électrophorétique

Groupe ethnique	Total sujets étudiés	Sujets sains		Sujets malades			
		AA		AS-hétérozygotes		SS-homozygotes	
		No. de sujets	%	No. de sujets	%	No. de sujets	%
Bateke	217	158	72,8	39	18,0	20	9,2
Mboshi, Sangha et Maka	134	85	63,4	30	22,4	19	14,2
Lari, Bembe, Kamba et Konco	577	369	64,0	126	21,8	82	14,2
Vili et Mayombe	28	18	64,3	6	21,4	4	14,3
Total	956	630	65,9	201	21,1	125	13,0

du Sud et de la zone côtière du pays. Une incidence significativement plus faible se rencontre chez le groupe Bateke.

Les résultats obtenus à l'aide du test d'Emmel sont confirmés par les recherches électrophorétiques (Tableau 3). Celles-ci montrent également que la population Bateke de la zone Centrale de la R. P. Congo est la moins affectée par la maladie.

La distribution de l'anémie falciforme est fonction de la fréquence des gènes dans la population et des conditions écologiques dans lesquelles vit cette population. La population Bateke vit dans la zone de forêt

équatoriale humide, le long du fleuve de Congo. Dans ces conditions écologiques, le paludisme à une fréquence particulièrement élevée. Malgré cela, l'anémie falciforme apparaît chez cette population avec une fréquence significativement plus faible par rapport aux autres populations étudiées. Vivant dans la forêt équatoriale, la population Bateke n'a eu que des contacts sporadiques avec le reste des populations d'éleveurs de bétail, que ont migré à la recherche de pâturages.

Si nous acceptons l'hypothèse de Lehmann [7] en ce qui concerne l'origine de l'anémie falciforme du Proche Orient et les directions de propagation de celle-ci, qui se sont superposées celles des zébus, on peut expliquer la fréquence elevée de l'anémie falciforme dans les zones du Nord, de Sud et côtières de la R. P. Congo, où existaient des conditions d'élevage du bétail.

La fréquence relevée dans les populations d'enfants ne correspond à celle qu'on rencontre chez les adultes, qu'en ce qui concerne la fréquence des hétérozygotes, aussi bien dans la R. P. Congo que dans la zone de Kinshasa, au Zaïre, où la population Konco est prédominante. La fréquence des homozygotes ne correspond plus, parce que ceux-ci meurent, en général, avant d'atteindre la maturité sexuelle (conformément aux données statistiques de l'Hôpital Lovanium de Kinshasa et de celui de Brazzaville).

Conclusions. 1. La fréquence de l'anémie falciforme jusqu'à l'âge de 5 ans est plus élevée dans les populations ethniques de la R. P. Congo.

2. La distribution de l'anémie falciforme est fonction aussi bien de la fréquence génique dans les populations, que des conditions écologiques.

3. L'apparition de l'anémie falciforme n'est pas liée au sexe.

4. La fréquence des hétérozygotes chez les enfants est similaire à celle qu'on rencontre chez les adultes.

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STUDIA UNIV. BABEŞ—BOLYAI, BIOLOGIA, XXXI, 1, 1986

SCIENTIFIC COLLECTIONS IN THE ZOOLOGICAL MUSEUM OF THE BABEŞ-BOLYAI UNIVERSITY IN CLUJ-NAPOCA

LUCIA DUŞA*, PANTE GHERGHEL* and DAN F. SÎRBU*

SUMMARY. — The paper is a short description of those scientific collections of different animal groups *(Oligochaeta, Isopoda, Chilopoda, Geophylomorpha, Diplopoda, Ephemeroptera, Plecoptera, Orthoptera, Neuroptera, Bombyliidae, Amphibia* and *Reptilia)*, the acquisition of which was achieved by the Zoological Museum during the last 15 years. For each collection, data are presented concerning the number of species and individuals; the species new for science are nominalized; the period of time in which the biological material was collected is also mentioned.

In addition to the exhibitory collection, rich in species originating from different parts of the world, the Zoological Museum of the Babeş-Bolyai University of Cluj-Napoca also possesses numerous scientific collections. Some of them such as those of crustaceans, arachnids, molusces and birds are older, being conceptually tributary to the times of their realization.

Valuable acquisitions to the scientific collections were achieved during the last 15 years. They are to a great extent donations of the teaching personnel in the Zoology Department of the Biology-Geography-Geology Faculty of our University. Besides the fact that these collections represent the crowning of a long and hard work through doctoral theses and often also through publication of a fascicle of the "Fauna of the Socialist Republic of Romania", they are of an inestimable value as a documentary scientific material. In addition to the biological material from our country, in many cases they also contain allochthonous species obtained either through exchange or retained following the process of identification for which our specialists had been solicited.

These collections are unique in our country, their value resulting from the great number of species and individuals and also of the new species for science.

I. COLLECTION OF **OLIGOCHAETA** — PROFESSOR DR. VICTOR POP

This collection was taken over after the death of its author and it was processed by the personnel of the museum in 1977. The collection consists of a single family with 8 genera and 52 species. Among them, the following 7 species are new for science:

1. *Allolobophora dobrogeana* Pop 1938
2. *Eiseniella oltenica* Pop 1938

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3. *Octolasium grădinescui* Pop 1938
4. *Octolasium racovitzai* Pop 1938
5. *Dendrobaena clujensis* Pop 1941
6. *Eiseniella balatonica* Pop 1942
7. *Octodrilus robustus* Pop 1973

The collection comprises 4,427 individuals from all parts of the country, collected between 1929 and 1970.

II. COLLECTION OF **ISOPODA** — PROFESSOR DR. VASILE GH. RADU

The collection was taken into custody after the author's death and processed in 1982. It consists of 10 families with 28 genera and 70 species. Among them, the genus *Bifrontonia* and the following 21 species are new for science:

1. *Porcellio racovitzai* Radu 1947—48
2. *Porcellio vareae* Radu 1949
3. *Protracheoniscus similis* Radu 1949
4. *Trachelipus vareae* Radu 1949
5. *Tracheoniscus vareae* Radu 1949
6. *Lygidium intermedium* Radu 1950
7. *Porcellio bujori* Radu 1950
8. *Tracheoniscus bujori* Radu 1950
9. *Tracheoniscus pleonglandulatus* Radu 1950
10. *Cylisticus major* Radu 1951
11. *Haplophthalmus orientalis* Radu 1951
12. *Platyarthrus dobrogicus* Radu 1951
13. *Haplophthalmus coecus* Radu 1955
14. *Platyarthrus coronatus* Radu 1959
15. *Platyarthrus reticulatus* Radu 1959
16. *Tracheoniscus spinulatus* Radu 1959
17. *Androniscus roseus* Radu 1960
18. *Bifrontonia feminina* Radu 1961
19. *Monocyphoniscus babadagensis* Radu 1965
20. *Haplophthalmus banaticus* Radu 1967
21. *Hyloniscus borceai* Radu 1974

The collection comprises 20,885 individuals collected from all parts of the country in the interval 1938—1978. Based on this material its author contributed two fascicles to the "Fauna of the Socialist Republic of Romania" [5], one of them still in press.

III. COLLECTION OF **CHILOPODA** — PROFESSOR DR. ZACHIU MATIC

The collection was handed over by its author to the museum in 1975 and processed by its personnel. It consists of 9 families, 30 genera and 157 species. Among them, the genera *Thracolithobius* and *Dacolithobius* as well as the following 33 species are new for science:

1. *Lithobius decapolitus* Negrea, Matic and Prunescu 1953
2. *Lithobius anophthalmus* Matic 1957

3. *Harpolithobius banaticus* Matic 1958
4. *Harpolithobius intermedius* Matic 1958
5. *Harpolithobius radui* Matic 1958
6. *Harpolithobius tridentatus* Matic 1958
7. *Lithobius beskoffi* Matic and Golem. 1958
8. *Lithobius jeanneli* Matic 1958
9. *Lithobius alavicus* Matic 1959
10. *Lithobius leptotarsis* Matic 1959
11. *Lithobius pedemontanus* Matic 1960
12. *Lithobius christovici* Matic and Golem. 1961
13. *Lithobius croaticus* Matic 1961
14. *Lithobius ognianovensis* Matic and Golem. 1961
15. *Dacolithobius domogledicus* Matic 1961
16. *Harpolithobius triacanthos* Matic 1962
17. *Thracolithobius inspectatus* Matic 1962
18. *Thracolithobius dacicus* Matic 1962
19. *Cryptops rucneri* Matic 1964
20. *Lithobius arganoi* Matic 1966
21. *Lithobius paradisiacus* Matic 1966
22. *Lithobius alpinus* Matic 1967
23. *Lithobius incertus* Matic 1967
24. *Lithobius oraniensis* Matic 1967
25. *Lithobius uniungulatus* Matic and Golem. 1967
26. *Lithobius quadaramus* Matic 1968
27. *Lithobius rucneri* Matic 1968
28. *Lithobius antipai* Matic 1969
29. *Lithobius bicuspidatus* Matic 1970
30. *Lithobius quadaramensis* Matic 1970
31. *Lithobius uludagensis* Matic 1970
32. *Monotarsobius acanthinus* Matic 1970
33. *Lithobius castamonuensis* Matic 1973

The collection comprises 4,582 individuals. Their majority was collected from various parts of our country between 1950 and 1973. Some of them originate from Italy, Bulgaria, Turkey, Spain, Yugoslavia, Greece, Hungary, Austria, Korea and the Islands of Crete and Saint Helena. Based on this material its author elaborated two fascicles of fauna [3, 4].

IV. COLLECTION OF **GEOPHYLOMORPHA** — DR. CORNELIA DĂRĂBANȚU

This collection was donated to the museum in 1978 and processed by its personnel. It consists of 4 families, 12 genera and 37 species. Among them, the following 4 species are new for science:

1. *Clynopodes intermedius* Dărăb. and Matic 1959
2. *Brachyschendyla dobrogica* Matic and Dărăb. 1967.
3. *Brachyschendyla căpușei* Dărăb. and Matic 1969
4. *Brachyschendyla negreai* Dărăb. and Matic 1969

The collection comprises 598 individuals collected in the country between 1951 and 1970. Based on this material its author elaborated a doctoral thesis.

V. COLLECTION OF **DIPLOPODA** — PROFESSOR DR. TRAIAN CEUCA

The collection was donated by its author to the museum in 1983 and jointly processed with the personnel of the museum. It consists of 18 families, 42 genera and 102 species. Among them, the genus *Romanosoma* and the following 7 species are new for science:

1. *Typhloiulus șerbani* Ceuca 1956
2. *Karpatophyllon dacicus* Ceuca 1964
3. *Entomobielzia getica* Ceuca 1964
4. *Polydesmus brachidesmoides* Ceuca 1966
5. *Romanosoma cavernicola* Ceuca 1967
6. *Romanosoma oltenica* Ceuca 1967
7. *Mastigophorophyllon bănărescui* Ceuca 1976

The author also separated the genus *Hungarosoma* Verh. 1928 as a new family for science, Fam. *Hungarosomidae*. The collection comprises 8,826 individuals collected in the country between 1949 and 1976. Based on this material the author elaborated a fascicle of fauna which is in press.

VI. COLLECTION OF LARVAE OF **EPHEMEROPTERA** — BIOLOGIST ZOE BUCȘA-COROIU

The collection was donated to the museum in 1980 and processed by its personnel. It consists of 17 genera, 44 species and 7,656 individuals collected in the Apuseni Mountains between 1972 and 1974. This collection served as a basis for the elaboration of a diploma thesis.

VII. COLLECTION OF **PLECOPTERA** — LECTURER DR. BÉLA KIS

It was donated completely processed by its author, in 1979. It consists of 7 families, 16 genera and 77 species, among which the following 14 are new for science:

1. *Isoperla flava* Kis 1963
2. *Leuctra quadrimaculata* Kis 1963
3. *Nemoura fusca* Kis 1963
4. *Nemoura transsylvanica* Kis 1963
5. *Leuctra transsylvanica* Kis 1964
6. *Nemoura longicauda* Kis 1964
7. *Nemoura ovoidalis* Kis 1965
8. *Nemoura hamata* Kis 1965
9. *Protonemoura aestiva* Kis 1965
10. *Protonemoura illiesi* Kis 1965
11. *Protonemoura pseudonimborum* Kis 1965
12. *Leuctra carpathica* Kis 1966
13. *Isoperla carpathica* Kis 1971
14. *Siphonoperla transsylvanica* Kis 1971

The collection comprises 18,224 individuals collected from different parts of the country between 1954 and 1977. It served as a basis for the elaboration of a fascicle of fauna [1].

VIII. COLLECTION OF **ORTHOPTERA** — LECTURER DR. BÉLA KIS

It was donated completely processed by its author, in 1982. It consists of 6 families, 65 genera and 148 species. Among them, the following 6 species are new for science:

1. *Mishtshenkotetrix transsylvanica* Bazyluk and Kis 1960
2. *Odontopodisma carpathica* Kis 1961
3. *Odontopodisma acuminata* Kis 1962
4. *Odontopodisma montana* Kis 1962
5. *Zubovskia banatica* Kis 1965
6. *Isophya harzi* Kis 1966

The collection comprises 4,375 individuals collected from different places in our country. This material served as the basis for a doctoral thesis.

IX. COLLECTION OF **NEUROPTERA** — LECTURER DR. BÉLA KIS

It was donated completely processed by its author, in 1976. It consists of 5 families, 23 genera and 75 species. Among them, the following 4 species are new for science:

1. *Chrysopa commata* Kis and Ujh. 1965
2. *Coniopterys arcuata* Kis 1965
3. *Coniopterys aspoecki* Kis 1967
4. *Wesmaelius transsylvanicus* Kis 1968

The collection comprises 5,685 individuals collected from all parts of the country between 1952 and 1974. Based on this material its author elaborated a fascicle of fauna [2].

X. COLLECTION OF **BOMBYLIIDAE** — SENIOR MUSEOLOGIST DR. LUCIA DUŞA

This collection was handed over to the museum in 1969. It consists of 30 genera and 101 species, one of them, *Petrorossia dobrogica* Duşa 1966, being new for science. The collection comprises 475 individuals collected in the country, especially in Dobrogea. Part of the species were obtained by exchange from U.S.A., Brazil, Chile, Mozambique, Italy, France, Switzerland. Among them, it is worth mentioning the species *Pantarbes pusio* Osten Sacken, originating from North America. As it is mentioned in the literature, only a few specimens of this species exist now in Europe, namely in the British Museum.

XI. COLLECTION OF **AMPHIBIA** — ASSOCIATE PROFESSOR DR. BOGDAN STUGREN

The collection was donated to the museum in 1975 and processed by its personnel. It consists of 14 families, 34 genera, 53 species and 2,634 individuals. Most of this material was collected from different parts of

the country or obtained by exchange from U.S.A., Vietnam, Austria, U.S.S.R., German Democratic Republic, Czechoslovakia, between 1951 and 1983. A smaller part of the material was obtained from Greek students studying in our country: they brought many specimens of amphibians from Greece to be used for the elaboration of their diploma theses. Some specimens were brought from Crete; amphibians from this island are not often encountered in the world's museums. A special mention is also due to the presence in the collection of *Paramesotriton delaustali*, an endemic species for Vietnam and a rarity in the museums.

XII. COLLECTION OF **REPTILIA** — ASSOCIATE PROFESSOR DR. BOGDAN STUGREN

This collection was also donated to the museum in 1975 and processed by its personnel. It consists of 8 families, 11 genera, 19 species and 604 individuals collected mainly in the country between 1951 and 1983. A few species are from U.S.A. and Crete.

For a good preservation of these greatly valuable collections a special room was arranged within the museum, where the specialists may consult them.

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RECENZII

G. Zarnea, **Tratat de microbiologie generală. II** *(Treatise of General Microbiology. II)*, Editura Academiei R. S. România, Bucureşti, 1984, 474 pages (including 246 figures and 43 tables) and 64 plates with electron micrographs and photographs enclosed.

Volume I, consisting of two parts (General Virology and Bacterial Anatomy), appeared in 1983 and was reviewed in this journal (Stud. Univ. Babeş-Bolyai, Biol., 1985, 30, 75—76).

Volume II consists of four parts.

The first part, *Physiology of Microorganisms* (pages 15—321 and plates 1—28), comprises the following chapters: metabolism of microorganisms; nutrition of microorganisms; autotrophy; diffusion and transport of substances through cell membranes; metabolism of carbohydrates in microorganisms; energetic metabolism of microorganisms; production and conservation of metabolic energy; mechanism of the ATP-mediated energy transfer in cells; biosynthetic metabolism in microorganisms; photosynthesis; conversion of light energy in halobacteria; bioluminescence, luminescent bacteria; microorganisms utilizing C_1 compounds; microbial assimilation of C_1 compounds; methanogenesis and methanogenic bacteria; biological fixation of nitrogen; assimilation of ammonia into organic compounds; microorganisms oxidizing nitrogen compounds; microbial reduction of nitrates; microbial degradation of proteins; microbial utilization of amino acids; biosynthesis of amino acids in microorganisms; microbial secretion of extracellular enzymes; metabolism of lipids; bacteria oxidizing molecular hydrogen; metabolism of sulphur; bacteria utilizing iron compounds; products of microbial metabolism; co-metabolism; endogenous metabolism in microorganisms.

The second part (pages 323—386 and plates 29—56) is devoted to the *Growth and Multiplication of Bacteria*, dealing with the following topics: growth of bacteria; multiplication of bacteria; dynamics of bacterial multiplication in cultures; factors influencing the growth of microorganisms; multiplication by budding; multiplication by fragmentation; multiplication by spores; estimation of bacterial growth; measurement of bacterial populations; synchronous cultures; continuous cultures; death of microorganisms.

Part 3, *Principles of Microbial Systematics and Taxonomy* (pages 387—420), deals with the following problems: terminology; concept of bacterial species; types of classification; molecular and genetic approaches in taxonomy; chemical bases of molecular phylogeny, molecules as documents of evolutionary history; base composition of DNA; DNA hybridisation; taxonomic significance of genetic material transfer and of genetic recombination; establishment of genealogical relationships between species and of their evolutionary filiation by means of rRNA; taxonomic significance of epigenetic data; numerical taxonomy; general norms of bacterial nomenclature; systems of bacterial classification; criteria for identification of bacteria; culture collections.

Part 4, entitled *„Origin and Evolution of Microorganisms"* (pages 421—474 and plates 57—64), includes a general presentation of this topic, followed by chapters dealing with: the period of chemical evolution; prebiological evolution; appearance of biological information; appearance of the first living organisms; appearance of photosynthesis; arguments concerning the primordial character of the prokaryotic cells; microfossils and their biological significance; appearance of eukaryotic cells; archaebacteria.

Each part of the volume contains a list of selected bibliography, totalizing nearly 300 books, monographs, reviews and other papers quoted.

Volume II of the first Romanian Treatise of General Microbiology, like its volume I, is characterized by a valuable and up-to-date scientific content and iconography, a severely logical structure and excellent style. Volume II is of a major interest for a wide circle of readers: students and specialists in microbiology, general biology, genetics, biochemistry, biotechnology and paleontology.

Considering the exceptional value of the *Tratat de microbiologie generală*, I reiterate the recommendation, already made

in the review of the first volume, concerning the translation of Professor G. Zarnea's work into world-wide spoken languages.

ŞTEFAN KISS

C. V. Oprea, L. Calancea, **Complexele bioenergetice ale solului şi capacitatea sa de producţie** *(Bioenergetic Complexes of the Soil and Its Productive Capacity)*, Editura Facla, Timişoara, 1985, 206 pages including 39 tables, 37 figures and a list of selected bibliography with 114 titles.

Professors C. V. Oprea and L. Calancea published this book with three principal objectives: to draw the attention on the biomass as a permanent and important source of energy (bioenergy); to emphasize the significance of the conversion of solar energy into biomass through photosynthesis; to evidence the caloric potential of the soils in our country and the technico-scientific possibilities for their improvement.

In concordance with these objectives, the book is divided into 5 chapters.

Chapter I, entitled *„The Soil as a System of Reception. Production and Cycling of Energy"*, deals with the external and internal sources of energy influencing the soil and its capacity to produce biomass. We quote some of the topics within this chapter: the environment, its dynamics, ecosystems and their bioproductivity; solar radiations as source of energy; effect of radiations on plants; absorption of solar radiations by phytocoenoses; effect of solar radiations on soil; plants with energetic vocation (energetic plants).

Chapter II presents the fundamental aspects of *Photosynthesis — the Principal Means of Solar Energy Conservation* (importance of photosynthesis; mechanism of photosynthesis; types of photosynthesis; photosynthetic potential and productivity of plant mass; bioproductivity of plants as a function of ecological conditions; the approximate amount of solar energy conserved by plants on the Globe and in the S. R. Romania, respectively).

Chapter III, *Biomass*, comprises the following topics: amount and role of biomass in the biological cycles of elements and perpetuation of life on our Planet; characteristics of biomass; utilization of biomass for producing energy.

Chapter IV is a comprehensive description of the *Humus*. The problems treated in this chapter include the following: physical and biochemical definition of humus; interactions of organic matter in soil; polysaccharides, lipids and steroids, tannins and resins, plant pigments, amino acids, proteins, nucleic acids, alkaloids and other organic compounds and their role in the formation of humus; degradation of plant residues and of compounds of plant origin; synthesis of humic substances; influence of clay minerals on the formation of humic substances; fractionation and isolation of organic compounds from soil; functional groups in humic substances; humus types formed under different conditions; humin, fulvic acids, hymatomelanic acids, humic acids; spectroscopic characterization of humic constituents; interaction of humic compounds and their analogues with amino acids and proteins; colloidal properties of humic substances; clay-humic complexes; humic substances as chelates; role of humic substances in plant nutrition.

Chapter V, *Balance of the Humic Substances and Their Bioenergetics*, covers a lot of topics directly related to the agricultural practice (humus as the energetic reserve of soil; zonality of the organic matter reserve and soil fertility; annual losses of organic matter from soil; an example for humic balance; restoration of humus reserve in soil; biological, chemical, biochemical and physical methods for conservation of humic substances in soil; humic fertilizers).

The book is written in an easily accessible style. It constitutes a valuable source of information for students and specialists in agronomy, animal breeding, biology, energetics, ecology, meteorology and related domains.

ŞTEFAN KISS

Soil Reclamation Processes: Microbiological Analyses and Applications, Edited by Robert L. Tate III and Donald A. Klein, Marcel Dekker, Inc., New York and Basel, 1985, X + 349 pages, including 66 tables, 40 figures and a subject index.

Land reclamation, the economic importance of which is growing all over the world, involves the need to manage a broad spectrum of environments. This

can range — as the editors emphasize — from strip mine rehabilitation to simple procedures needed to counteract the effects of roadside spills of xenobiotics. The investigations carried out in the last 15—20 years have indicated that, although the disturbed ecosystems subjected to reclamation processes are diverse in physical, chemical and biotic traits, a common predictor of successful reclamation relates to the status and potential development of the microbial community.

The work consists of 10 chapters which, of course, could not cover all topics of the land reclamation microbiology and biochemistry; they deal, however, with a variety of specific examples, selected to provide an indication of the ways in which microorganisms can play key roles in design, management, and monitoring of reclamation.

We specify the titles and authors of the 10 chapters: Microorganisms, Ecosystem Disturbance and Soil-Formation Processes (R. L. Tate III); Acid Mine Waste Drainage: Microbial Impact on the Recovery of Soil and Water Ecosystems (A. L. Mills); Diagnostic Aspects of Algal Ecology in Disturbed Lands (L. E. Shubert and T. L. Starks); Microbial Development on Oil Shale Wastes: Influence on Geochemistry (R. E. Wildung and T. R. Garland); Soil Enzymes: a Predictor of Reclamation Potential and Progress (D. A. Klein, D. L. Sorensen and E. F. Redente); Mycorrhizae and Reclamation of Stressed Terrestrial Environments (R. M. Danielson); Management of Microbial Processes in Surface Mined Land Reclamation in Western Canada (S. Visser); Microbial Technology for Aggregation and Dewatering of Phosphate Clay Slimes: Implications on Resource Recovery (C. L. Brierley and G. R. Lanza); Low-Level Radioactive Wastes in Subsurface Soils (A. J. Francis); General Interactions of Microbes in Reclamation Processes (D. A. Klein and R. L. Tate III).

The work is a valuable source of information for environmental scientists, especially for environmental microbiologists and biochemists. At the same time, the well-documented suggestion, made by the editors and individual chapter authors that microorganisms and their biochemical potential should play a greater consideration in future reclamation activities, is of a great practical value for successful, environmentally effective reclamation of all disturbed ecosystems.

ŞTEFAN KISS

N. P. Rukosueva, A. B. Gukasyan, **Biologicheskaya aktivnost' pochv gornykh lesov Sibiri** *(Biological Activity in Mountain Forest Soils of Siberia)*, Izdatel'stvo „Nauka", Sibirskoe Otdelenie, Novosibirsk, 1985, 88 pages including 28 tables and 18 figures.

The work is a monograph describing the microbiological and biochemical activities of the main soil types of the mountain-taiga coniferous and subalpine belts in the Western Sayan region of Siberia. These soils correspond to a vertical zonation ranging between 480 and 1500 m above sea level. The rhizosphere microflora of Siberian pine (one of the most important forest-forming species in this region) and the soil-biological effects of clear cuttings of different forests have also been described.

For the researches a complex methodology was applied, comprising microscopic and plate countings of soil bacteria, actinomycetes and fungi, determination of their biomass, identification of a great number of bacterial species, quantitative study of microorganisms belonging to different physiological (ammonifying, nitrifying, denitrifying, N_2-fixing, organophosphate-mineralizing, mineral phosphate-solubilizing, cellulolytic etc.) groups; activity of many soil enzymes, both oxidoreductases and hydrolases, and soil respiration (CO_2-evolution) were also estimated. All research data were submitted to statistical processing.

The results obtained are valuable contributions to a better understanding of the microbial and enzymatic processes taking place in the mountain forest soils. They have a practical significance, too, by proving that in evaluating the anthropogenic effects on forest ecosystems the microbiological and biochemical activities can serve as sensitive indicators of the biological status of soils.

ŞTEFAN KISS

Ekologiya i faunistika amfibii i reptilii SSSR i sopredel'nykh stran *(Écologie et faunistique des Amphibiens et des*

Reptiles de l'URSS et des pays voisins), Coordinnateur: L. Ya. Borkin, Institut Zoologii Akademii Nauk SSSR, Leningrad, 1984, 150 pages, avec 8 planches, 42 figures et 19 tableaux dans le texte.

Le volume est une collection d'articles indépendants. À mon avis, la contribution la plus intéressante pour le lecteur qui travaille sur les vertébrés de l'Europe et de l'Asie orientale est l'article signé par Leo Ya. Borkin, concernant les aires de répartition disjointes euro-est-asiatiques chez les amphibiens et les reptiles. L'auteur a démontré que l'hypothèse qui considère les glaciations sibériennes comme seules causes de la rupture des aires de répartition est insuffisante, la rupture étant à son avis plus ancienne que les temps glaciaires.

BOGDAN STUGREN

Bohumil Losos, Ján Gulička, Jan Lelląk, Jaroslav Polikán, **Ekologie živočichu** *(Écologie des animaux)*, Státni Pedagogické Nakladatelství, Praha, 1984, 316 pages, avec 123 figures et 38 tableaux dans le texte.

Parmi les écologistes, la Tchécho slovaquie est connue comme un pays dont les recherches d'Écologie animale, surtout sur les rongeurs, relèvent d'une école célèbre. Mais, malgré le fait qu'un abrégé d'Écologie animale fut publié en langue tchéque déjà en 1924, dans les universités l'écologie animale était étudiée surtout d'après la traduction d'un ouvrage américain (E. P. Odum). L'écologie végétale était mieux représentée dans l'enseignement universitaire grâce à l'ouvrage de A. Zlatnik, daté 1973. Mais voilà qu'un livre récent vient de présenter l'écologie des animaux en langue tchéque, et n'est plus une traduction de l'anglais, mais un livre original. Ses auteurs sont des zoologistes bien connus de Prague, Brno et Bratislava. La structure du livre est la classique, utilisée dans la plupart des manuels d'écologie d'Europe centrale: on commence par la description du milieu physique, pour finir par l'écologie de l'homme. Les idées sont développées d'après un plan rigoureux de logique inductive, en passant des notions simples (facteurs écologiques) aux notions complexes (écosystèmes et biosphère). Mais le mérite le plus grand du livre est que les faits écologiques, les exemples ne sont pas copiés d'après les ouvrages étrangers, mais sont des données provenant des milieux naturels du pays.

BOGDAN STUGREN

Rudolf Piechocki, **Makroskopische Präparationstechnik,** *Teil II, Wirbellose*, Dritte Auflage *(Tehnica preparării macroscopice, partea II-a, Nevertebrate*, ediția a treia), VEB Gustav Fischer Verlag, Jena, 1984, 308 pagini, cu 155 figuri în text, 27 pagini bibliografice, registru de termeni.

Pentru zoologii care lucrează în muzee, tehnica preparării este o specializare de însemnătate primordială. Prepararea macroscopică, adică prepararea organismului animal întreg ca piesă de muzeu și nu ca lamă pentru microscopie, este o specialitate ce se reduce adeseori în practică la naturalizarea vertebratelor, mai ales a păsărilor. Dar în fauna oricărei regiuni naturale, nevertebratele sînt mai numeroase decît vertebratele și, de aceea, nu pot fi neglijate în colecțiile muzeale. Adeseori, tehnica preparării macroscopice a nevertebratelor diferă foarte mult după grupul luat în studiu, mediul de viață și comunitatea biotică din care provine animalul conservat. Din această cauză, zoologul muzeograf, strict specializat și el într-un grup definit de animale, are nevoie stringentă de un manual tehnic pentru prepararea pieselor de muzeu.

Un asemenea manual de interes european este cartea semnată de Rudolf Piechocki, custode al colecției didactice de zoologie de la Universitatea din Halle-Wittenberg (R.D.G.), el însuși un cunoscut entomolog. Cartea este o operă de referințe, organizată după principiul clasificării filogenetice a nevertebratelor, utilizate în manualele de zoologie de limbă germană. După o concisă introducere în care sînt expuse principiile generale ale recoltării nevertebratelor terestre, dulcicole și marine, conservarea și transportul materialului, urmează descrieri ale tehnicilor speciale de preparare ale materialului din diverse grupe și anume: spongieri, celenterate, plathelminte, nemertieni, nemathelminte, priapulide, moluște, sipunculide, echiuride, anelide, onicofore, pentastomide, artropode, tentaculate, branhiotremate, pogonofore, chetognate, echinoderme. Tot aici sînt tratate și protocordatele. Din listă rezul-

tă că autorul nu s-a limitat la descrierea tehnicilor de preparare pentru grupele terestre de nevertebrate, bogat reprezentate în muzee, ci a dat și recomandări tehnice pentru prepararea nevertebratelor din grupe marine, mai rar reprezentate în muzeele de zoologie, cum sînt pogonoforele. Totuși, cum era și firesc, în economia lucrării insectele ocupă locul cel mai important (cca 100 pagini). Pe lîngă tehnicile generale pentru prepararea insectelor, autorul dă și tehnici speciale pentru prepararea materialului din anumite ordine de insecte ca lepidoptere, himenoptere, diptere, blatoide, ortoptere, odonate, neuroptere, efemeroptere, plecoptere, tricoptere, mecoptere.

Cartea se întemeiază în mare măsură pe experiența de muzeograf dobîndită de autor în activitatea sa, dar și pe o bibliografie judicios aleasă, în sensul că pentru fiecare grup de nevertebrate se fac referiri la lucrări de bază publicate de specialiști de renume mondial în grupul respectiv. Remarcăm că nu este o bibliografie exclusiv central-europeană în limba germană, ci o bibliografie cu adevărat internațională. În lista de autori sînt prezenți și doi români: Paul A. Bujor și Mihai A. Ionescu.

BOGDAN STUGREN

P. J. B. Slater, **An Introduction to Ethology,** Cambridge University Press, Cambridge, London, New York, New Rochelle, Melbourne, Sydney, 1985, 195 pages, with 106 figures.

The book comprises fundamental notions concerning animal behaviour. First, the author defines the concept of „ethology", the physiological basis of behaviour and the movements correlated with different behavioural patterns. Further on, the organs of sense in vertebrates, the motivation of different behavioural manifestations accompanying biological activities, the evolution of behaviour and its genetic basis, the language used by animals for intra- and interspecific communication, social organization within different vertebrate groups are described. As it deals with basic notions in this field, the book is a valuable bibliographical source.

NICOLAE TOMESCU

Culturi de celule și țesuturi vegetale. Aplicații în agricultură *(Plant Cell and Tissue Cultures. Application in Agriculture),* Editura Ceres, București, 1984, 255 pages including 40 figures, 33 tables and a list of selected bibliography with 107 titles.

The book, unique in its field, is a very interesting treatise on vegetal cell and tissue cultures with reference to their practical importance for biology and agriculture.

The first chapter, written by Dorina Cachiță (94 pp.), comprises general considerations on the technique of „in vitro" cell and tissue cultures. Thorough information is given regarding the organization of a tissue culture laboratory as well as the technique of obtaining tissue cultures from roots, embryos, endosperm, ovaries, ovules, nucellar tissue, meristem, callus, cells, a.s.o.

Chapters 2 to 6 were written by Elena Badea and Petre Raicu (156 pp.). Chapter 2 refers to plant differentiation and regeneration in cell and tissue cultures. Some aspects concerning chromosome variability in callus cultures and cell suspensions, the differentiation of „in vitro" cultivated cells, the creation of new genotypes, etc. are being presented.

Chapter 3 acquaints the reader with experimental haploidy by anther and pollen cultures as well as with the factors influencing androgenesis.

Chapters 4 and 5 deal with somatic hybridization by protoplast fusion and with genetic operations at protoplast level.

Chapter 6 presents the induction and selection of mutations in „in vitro" cultures.

This technology, which is in itself a revolution for classical biology, makes possible the creation of haploid plants, of new hybrids with great economic value, of virus- and pest-free plants highly resistant to drought and cold, and even allows genome recombination in some incompatible species. The book, a synthesis of the researches carried out in this field all over the world, is, therefore, a valuable bibliographical source for students and specialists in agriculture and biology.

MARIA LAZĂR

C. M. Chadwick, D. R. Garrod (Editors), **Hormones, Receptors and Cellular Interactions in Plants** *(Hormones, récepteurs et interactions cellulaires chez les plantes)*, Cambridge University Press, Cambridge, London, New York, New Rochelle, Melbourne, Sydney, 1986, XII + 375 pages.

Le livre que nous venons de présenter est le premier tome d'une série initiée sur le sujet des communications intercellulaires et intracellulaires. La signification de ce livre est exposée dans la Préface et elle peut être rencontrée, évidemment, tout le long du contenu de l'ouvrage.

Le livre soumet à une analyse critique les processus de communication intercellulaire et intracellulaire dans le monde végétal; une telle communication au niveau cellulaire, exprimée aussi par le concept de „reconnaissance cellulaire", implique un „langage" pour transmettre des signaux et des messages d'une cellule à l'autre, ou entre une cellule et un corp étranger, ou encore entre une cellule et une molécule. L'analyse du langage moléculaire représente un courant majeur dans la biologie du XX-ème siècle. Parmi les auteurs du livre édité par Chadwick et Garrod peuvent être retrouvées 23 personnalités de la science mondiale, des reputés biologistes et biochimistes.

Le mécanisme fondamental d'un tel processus de communication intercellulaire et intracellulaire consiste, en somme, de la liaison complémentaire d'un ligand à un récepteur, c'est-à-dire des interactions moléculaires séquencielles. La relation ligand-récepteur coordonne le métabolisme cellulaire à l'intérieur du même organe, mais en même temps entre divers organes, s'impliquant dans les phénomènes d'organisation, de développement et de différenciation cellulaires. Tout processus de communication intercellulaire pour se réaliser implique la capacité de chaque cellule d'anticiper ses interactions avec le milieu par son approvisionnement avec des molécules spécifiques (les récepteurs) pour recevoir les stimuli du milieu (les ligands). Cette prédiction génétique est acquise par évolution et adaptation, idée qu'on peut surprendre dans le livre lui-même.

L'étude des interactions ligand-récepteur est très avancée pour les systèmes animaux, surtout dans le domaine d'action des hormones, en relation avec les facteurs de croissance et avec le système immunitaire. Dans le monde végétal, c'est à présent que telles études commencent à progresser.

Un des problèmes fondamentaux de cette étude est la localisation des récepteurs. L'existence d'une paroie cellulaire dure, distincte de la membrane plasmatique, représente, sans doute, une barrière laquelle empêche d'identifier les récepteurs cellulaires. Un chapitre du livre (chapitre 7) s'occupe du problème d'isolation des protoplastes vivants.

Les récepteurs hormonaux chez les plantes sont mis en discussion en relation avec l'activité des auxines (chapitre 1) et des gibbérellines (chapitre 3) et avec la production de l'éthylène (chapitre 2).

Parmi les récepteurs de ces hormones est analysée une très intéressante biomolécule, intensement étudiée dans la physiologie de l'homme, l'adénosine 3' : 5'-monophosphate cyclique (AMPc), identifiée aussi chez nombreuses espèces de plantes inférieures et supérieures, quelquefois même très abondante (chapitre 4).

Extrêmement intéressantes sont les interactions végétales soumises à une discussion scientifique dans le chapitre 9 (les interactions pollen-stigmate), le chapitre 10 (les interactions hôte-agent pathogène) ou le chapitre 11 (l'infection des poils radicaux par les bactéries azotofixatrices).

Dans le dernier chapitre du livre (chapitre 12) est traité un intéressant complexe moléculaire que la plupart, sinon tous les systèmes vivants possèdent, les lectines. Celles-ci possèdent, par excellence, les propriétés réclamées par les récepteurs. Les études entreprises dans cette direction sont bien au commencement, ainsi que leurs fonctions ne sont pas encore complètement connues.

Les idées inédites de ce livre et leur importance fondamentale représentent la valeur même de cet ouvrage, qu'il serait bon à exister dans la bibliothèque de chaque biologiste contemporain.

ANA FABIAN

Cécile Billy, **Glossaire de Zoologie,** Doins Éditeurs, Paris, 1985, 239 pages.

La tendance d'élargissement progressif du champ d'intérêt qui se manifeste actuellement dans l'évolution des sciences est une réalité qui ne demande plus à être démontrée: de gens de plus en plus nombreux sont devenus réceptifs aux découvertes modernes et les connaissances scientifiques occupent une place de plus en plus importante dans ce qu'on appelle couramment la culture générale. Cette tendance, d'ailleurs tout à fait naturelle, est accompagnée d'une augmentation à son tour progressive de la nécessité d'une compréhension aussi exacte que possible du langage scientifique et, par conséquent, les dictionnaires élaborés dans les domaines les plus divers de la science sont devenus une présence habituelle parmi les publications de spécialité.

C'est dans ce contexte que nous devons signaler l'apparition récente d'un nouveau glossaire de zoologie qui, quoiqu'il ne représente nullement une première dans la littérature biologique, doit être considéré comme particulièrement util. En effet, ce glossaire a comme principal but d'expliquer la terminologie zoologique en premier lieu au point de vue *étymologique*. Cette manière de résoudre un problème qui s'avère plutôt délicat est d'un très grand intérêt, car elle facilite énormément la présentation des mots les plus usuels employés dans les travaux de spécialité, de sorte que la lecture de ceux-ci devient bien plus accessible non seulement aux étudiants, mais aussi au grand publique. Comme l'auteur lui même le remarque dans les pages introductives, la présence quasi générale des racines grecques et latines dans la construction des termes zoologiques et le fait que ces deux langues classiques sont aujourd'hui à peu près abandonnées rendent bien difficile la compréhension de *l'essence* de la terminologie et c'est justement pour cette raison qu'une explication étymologique est pratiquement indispensable pour tous ceux qui désire travailler avec une telle terminologie et „faire appel à leur intelligence plus qu'à leur mémoire".

Ainsi, le glossaire de Cécile Billy comble une lacune bibliographique qu'on pourra être tenté à considérer comme mineure mais qui, en réalité, est d'une importance sur laquelle on ne saura jamais trop insister.

GHEORGHE RACOVIȚĂ

K. G. Grell, H.-E. Gruner, E. F. Kilian, **Lehrbuch der speziellen Zoologie,** *Band I: Wirbellose Tiere, 1 Teil: Einführung, Protozoa, Placozoa, Porifera (Textbook of Special Zoology, Volume I: Invertebrate Animals, Part 1: Introduction, Protozoa, Placozoa, Porifera),* Herausgeben von (Edited by) Hans-Eckhard Gruner, VEB Gustav Fischer Verlag, Jena, 1980, 318 pages with 115 figures and 5 tables.

This volume belongs to a series of four volumes of zoology and treats the general characters of animals and describes three phyla of Invertebrates.

In the introductory part, the authors present some general aspects of zoology and define it as a biological science. There are described: working methods in zoology, systematic categories based on phylogenetic relationships, the characteristics of animal evolution, the position of animals with regard to other organisms, structural archaetypes encountered in Metazoa, asexual and sexual reproduction, embryonic development.

In the second part there are described the phyla of Protozoa, Placozoa and Porifera. A description of the morphological and physiological characters of the anatomical systems and reproduction types is given in each phylum. The text is illustrated with numerous figures of exquisite clarity and execution. The index of scientific terms and taxonomic names at the end of the volume facilitates the use of the book by the specialists.

NICOLAE TOMESCU

G. Hartwich, E. F. Kilian, K. Odening, B. Werner, **Lehrbuch der speziellen Zoologie,** *Band I: Wirbellose Tiere, 2. Teil (Textbook of Special Zoology, Volume I: Invertebrate Animals, Part 2): Cnidaria, Ctenophora, Mesozoa, Plathelminthes, Nemertini, Entoprocta, Nemathelminthes, Priapulida,* Herausgeben von (Edited by) Hans-

Eckhard Gruner, VEB Gustav Fischer Verlag, Jena, 1984, 621 pages with 348 figures and 8 tables.

This volume is a continuation of the special zoology edited by H.-E. Gruner. It presents 8 phyla of Invertebrates (mentioned in the title).

In the description of each larger category (phylum, subphylum, class, subclass, order, suborder) the authors presented first a diagnosis and then the aspects of histology, anatomy, physiology, reproduction, biology and phylogeny. This is followed by the classification into lower systematic categories and the description of the species.

Classical zoological studies are completed by new data from the field of genetics, cell biology, cytology and especially by ultrastructural aspects.

The excellent figures, many of which are electron micrographs, facilitate the comprehension of the content.

Both volumes represent a rich and valuable source of zoological information.

NICOLAE TOMESCU

Hans-Albrecht Freye, Lothar Kämpfe, Gustav-Adolf Biewald, **Zoologie,** 8. Auflage *(Zoology,* 8th Edition), VEB Gustav Fischer Verlag, Jena, 1985, 420 pages with 114 figures and 32 tables.

The book is a succint but complex presentation of the animal world.

Chapter I treats some general aspects such as: fundamental forms of life, exchanges of matter and energy between organisms and their environment, the characteristics of the animal organisms, the common features of all organisms, differences between plants and animals. There are also mentioned in this chapter the branches of zoology and the recommendations concerning the methodology of study in this field.

Chapter II is a presentation of the taxonomic categories used in zoology, beginning with the animal kingdom and ending with the species, the approximate number of species in each phylum and a general characterization and classification of Protozoa, Metazoa and different phyla.

Chapter III comprises aspects concerning the comparative anatomy. The fundamental principles, the notions of homology and analogy and the terms which are used in comparative anatomy are presented and explained. There are also described in their evolution: the locomotory system, the skeleton, the skin and its derivatives, the system of orientation and equilibrium, the nervous, endocrine, circulatory, respiratory, digestive, excretory and reproductive systems.

Chapter IV explains the physiological properties of the animals.

Chapter V deals with different types of behaviour, such as: feeding, reproduction, orientation, learning aggressivity, territoriality, social hierarchy, etc.

Chapter VI describes the animal cells and tissues.

Chapter VII comprises genetics notions referring to the material bases of the heredity, Mendel's laws, extrachromosomal heredity, population genetics, hybridisation, etc.

Chapter VIII describes asexual and sexual reproduction in the animal kingdom, alternation of asexual and sexual generations and the embryonic development.

Chapter IX deals with animal spreading on earth, ecophysiological and historical premises of the species, spreading modalities and limits, zoogeographical zones of the earth.

The book represents a valuable source of scientific information for pupils, students, teachers of biology as well as for all those interested in studying the complexity of the animal world.

NICOLAE TOMESCU

Actualitate și perpspectivă în biologie. Structuri și funcții în ecosisteme terestre și acvatice *(Present State and Perspectives in Biology. Structures and Functions in Terrestrial and Aquatic Ecosystems),* Centrul de Cercetări Biologice, Cluj-Napoca, 1985, 308 pages with 38 figures and 47 tables.

This is one of the 3 volumes comprising the papers presented at the Scientific Seminar held in Cluj-Napoca in June 1984. The papers are written in Romanian and are all accompanied by a summary in a world-wide spoken

language. The editorial boards of the 3 volumes were co-ordinated by Professor I. Puia, Director of the Biological Research Centre.

This volume includes 40 papers, out of which 23 belong to researchers from the host institute, and the other 17 come from institutes, laboratories and economical units in Cluj-Napoca, București, Fundulea, Timișoara, Constanța, Piatra Neamț and Suncuiuș (Bihor district).

The volume starts with two reviews on general ecological problems: „The Interrelationships of Applied Ecology Researches" by S. Godeanu *et al.*, and „Ecosystems, Civilization and the Flux of Fertilizing Products" by L. Calancea. They are followed by original papers grouped into 4 sections: ecology of primary producers, ecology of consumers, aquatic ecology and microbiology-enzymology.

The papers belonging to the first section are devoted to forest ecology in our country (C. Bîndiu *et al.*), data on bryophytes from the Gilău Mountains (E. Plămadă) and macromycetes from the Bihor Mountains (A. Pop), a presentation of the vegetation in the area of lakes in Ocna Dej and Sic (I. Pop *et al.*), as well as a study on the vegetation of *Nardus stricta* from Muntele Mare (I. Resmeriță).

For the ecology of consumers, several results concerning edaphic protozoa (R. Tomescu), nematodes (I. Popovici), lumbricids (V. V. Pop), collembola (P. Weisner), colcoptera (M. Teodoreanu) and mites (A. Georgescu) from different forest ecosystems in Transylvania are presented. This section also comprises studies on certain insect pests (P. Scutăreanu; T. Perju and I. Moldovan), a physico-geographical, climatic and pedological approach to the Bihor Mountains (T. Piciu *et al.*; M. Preda *et al.*), as well as the comparative numerical analysis of the ichthyofauna from the Danube and neighbouring rivers (M. Șerban and P. Bănărescu).

The section for aquatic ecology starts with a retrospection on local algological achievements (L. S. Péterfi *et al.*) and with a general view on the present researches for the eutrophication of water reservoirs in our country (M. Florescu *et al.*). The passage to eutrophy of several water reservoirs is also investigated (R. Mărculescu and E. Mărculescu). Other papers analyse the primary productivity of some aquatic pools (A. S. Bologa; A. Marton and N. Bucur), or present the researches on the utilization of volcanic tuff in ponds (A. Bărbat and A. Marton), on the biological treatment of pulp industry waste waters (A. Iliescu *et al.*) and on the outdoor mass culture of *Spirulina platensis* in the ex-station Pingărați (I. Cărăuș). Finally, the biology of hypersaline lakes is presented (C. Pleșa).

The synthesis on „Environmental Enzymological Researches" (S. Kiss *et al.*) is a thoroughly documented presentation of a new science — environmental enzymology — which is an interdisciplinary science in the true sense of the word. It deals with the enzymes present and active in the environment, enzymes which have a leading role in the biological cycles of elements. By determining the activity of these enzymes it is possible to obtain an accurate image of the biological aspects of the environment and of the disturbances it may suffer as a result of pollution and degradation.

A very important paper, that could be considered as a pathfinder, is the one elaborated by P. Papacostea, in which the influence of ecological and anthropical factors upon the distribution of different microbial species is observed.

Some aspects of enzymological methodology are presented in the paper by G. Ștefanic and I. Chirnogeanu, where an original contribution to the determination of dehydrogenase activity is yielded.

The paper presented by A. Eminovici *et al.* refers to several modifications in the biochemical and microbiological characteristics of activated sludge under the influence of organic impurities in industrial waste waters.

Applied microbiological researches were carried out under semiindustrial conditions, with a view to obtaining high quality refractory clays (S. Kiss *et al.*). The same line of research is followed in the paper presented by E. Zborovschi *et al.*, where the soil-microbiological aspects of the utilization of Solacril as an additive to irrigation waters are described, with an emphasis on its biodegradability.

Enzymological and microbiological researches have become indispensable for obtaining information on the bio-

logical potential of therapeutic mud. The papers elaborated by D. Pașca *et al.*, M. Drăgan-Bularda *et al.*, R. Crișan *et al.* and H. Pintea *et al.* present fundamental and applied researches on the enzymological comparison of different areas of the Sinoe Lake (Constanța district), the influence of subsidence and clay formation, and of balneotherapeutic flux on the enzymatic potential of mud. Original laboratory experiments have revealed the influence of gamma radiations on the enzymatic potential of mud from the Sinoe Lake (M. Drăgan-Bularda *et al.*). Enzymological researches concerning the mud from the Băile Lake in Cojocna (Cluj district) were the subject of another paper (D. Pașca *et al.*) in which the possible mechanisms, through which the treatment with phosphorus compounds affects phosphatase activity in mud, were also presented.

The enzymatic activity in some peats from Harghita district was studied by R. Crișan *et al.*

The papers published in this volume are the result of recent studies in several fields of biological research, also drawing the perspective lines for future researches, both fundamental and applied.

DAN MUNTEANU and
DANIELA PAȘCA

Actualitate și perspectivă în biologie. Fiziologie animală cu implicații în zootehnie și medicină *(Present State and Perspectives in Biology. Animal Physiology with Implications in Zootechny and Medicine)*, Centrul de Cercetări Biologice, Cluj-Napoca, 1985, 230 pages with 17 figures and 64 tables.

The volume includes 27 papers, some of which are reviews. The papers are classified according to the field of possible practical application of the results: zootechny or medicine. 18 papers originate in other institutes or faculties, 9 in the host research centre.

A review and several papers (by S. Botărel and his collaborators) are centred upon the functional ontogenesis of farm animals: mechanism of secretion, development of glands, cell movements a.s.o. are investigated. An original classification of cell movements is proposed, and interesting data concerning cell "dysbiosis" are contributed.

Correlation of morpho-productive characteristics with some physiological and metabolic indexes in geese are the object of a series of papers by G. Băltan *et al.*, while P. Marian *et al.* deal with sheep.

Tissue metabolism in the fowl, its modifications under various nutritional conditions, as well as general aspects of the correlation between muscle physiology and meat production are dealt with by several contributors from our centre. The unavoidable correlation of fundamental and applied investigations is stressed.

The paper on muscle metabolism in developing trout also comes from our laboratory. It connects several lines of investigation, having a long tradition in the Biological Research Centre: studies on functional ontogenesis, investigation of muscle metabolism and experiments on fish. It brings new data on some peculiarities of tissue metabolism depending on age, season, muscle type a.s.o.

Other two papers of the same origin describe a new histologic technique and report on its first results.

An interesting review by G. Simu *et al.* deals with a very important aspect of the relations between immunity and cancer, and implicitly between biological and medical investigations.

Results of electrophysiological and molecular biochemical investigations on cell permeability and excitability are reported by J. László and M. Dandel *et al.* Of all the studies included in this volume, these short ones use the most elaborate methodologies.

A review (M. Timar *et al.*) and other 5 papers deal with problems of pharmacology, mainly when it overlaps toxicology and biochemistry. The papers have a multidisciplinary character, as they use radiobiochemical, histochemical, immunological and other kinds of methods. The problems are clearly practical, directly interesting the clinical medicine, but many results reported also have an evident fundamental value.

The volume as a whole illustrates the utility of the collaboration and dia-

logue between "fundamentalists" (*i.e.* biologists) and "applicationists" (*i.e.* zootechnists and clinicians).

CAROL WITTENBERGER

Actualitate și perspectivă în biologie. Ecofiziologie vegetală (*Present State and Perspectives in Biology. Plant Ecophysiology*), Centrul de Cercetări Biologice, Cluj-Napoca, 1985, 284 pages with 73 figures and 50 tables.

The topic of the papers is extremely varied, comprising researches in plant cytology and cytophysiology, algal physiology, physiological aspects of *in vitro* multiplication, physiological aspects in higher plants, ecophysiology and pollution problems a.s.o.

One of the general reviews (V. Soran *et al.*) deals retrospectively with the plant cytology and cytophysiology researches carried out in the Biological Research Centre of Cluj-Napoca ever since its foundation in 1958, exhaustively presenting the papers published in this field. It is shown that cytological and cytophysiological research topics include fundamental researches on the cytoplasmatic streaming within plant cells, aspects of vital staining, problems concerning ultrastructural organization, cytophotometrical and histoenzymological analyses as well as other researches meant to clarify the biological effects of several physico-chemical factors (such as ionizing radiation and UV, visible light, metabolic inhibitors, pesticides, etc.) on plant cells. The other general review (D. Cachiță-Cosma) delineates the main aspects of *in vitro* cultures of explants as means of fundamental and applied biological researches. The review is also outstanding by the emphasis laid on those aspects which are not sufficiently fundamented yet, and which make up the guideline for future researches in this field. The third general review (D. Cachiță-Cosma) contains the synthesis of the researches regarding the physiological effects of Procaine on plants and its practical implications for agriculture.

The original papers concerning mineral nutrition in plants (C. I. Milică *et al.*; G. Dumitru *et al.*) use modern nuclear techniques. Three other papers deal with the effects of certain physical factors (ionizing radiations, electromagnetic field) on plants (A. Zeriu *et al.*; M. Keul *et al.*; I. Bosica). The effects of some bioactive substances such as vitamins (L. D. Toma *et al.*), growth retardants (D. Cachiță-Cosma *et al.*; G. Țâra *et al.*) and different pesticides (R. Vintilă *et al.*; F. Zeriu *et al.*; I. Bosica) are presented in complex physiological and cytological studies. Of the papers closely connected to agricultural practice, outstanding are those devoted to the use of industrial waste waters rich in nutrients (M. Știrban *et al.*), the interrelation of climatic factors with fertilization and production (A. Donose-Pisică *et al.*) and the physiology of vine (A. Antohe).

The problem of tissue cultures is examined in 3 papers concerning micropropagation in potato (D. Cachiță-Cosma *et al.*), pine tree (M. Bârâ) and vine (S. Băcilă), in a balanced correlation of fundamental physiological researches and practice. The papers on the use of thermomineral waters for growing the blue-green alga *Spirulina* (N. Dragoș *et al.*) also exhibit this intermingling of fundamental and applied researches. The papers in the last part of the volume are dedicated to the study of the effect of heavy metal pollution on algae (N. Dragoș *et al.*), higher plants (M. Keul *et al.*; S. Hornung and V. Bud), and of air pollution from highly industrialized areas on several physiological indices in higher plants (A. Donose-Pisică *et al.*; M. Keul *et al.*).

The papers included in this volume bear the mark of a fruitful collaboration among scientists from all over the country in an effort to find scientific solutions to be applied in practice.

MARTIN KEUL and
ROZALIA VINTILĂ

D. B. Gray, R. J. Borden, R. H. Weigel, **Ecological Beliefs and Behaviors**, Greenwood Press, Westport, Connecticut; London, England, 1976, 281 pages, with 10 illustrations and 6 tables.

Chapter 1 is motivational, emphasizing ecological abuses which stimulated the interest for environmental re-

search and entailed a pro-ecological policy, an „environmetal ethic".

In chapter 2 Gray provides a review of the major approaches of measuring ecological attitudes and actions and gives an interesting model of the „ecological attitude domain (EAS)".

The next two chapters written by Borden and Weigel refer to the relationship between ecological attitudes and actions and to the linkage between personality and ecological concern, respectively, providing a comprehensive review of research in this field.

Gray integrates, in chapter 5, the theoretical perspectives of the social psychologists Milton Rokeach and Martin Fishbein to construct a „paradigm for ecological change". This model has the great advantage of integrating two bodies of research, that have heretofore proceeded in almost total isolation: efforts to measure ecological behaviours and cognitions (beliefs, attitudes, and values) in surveys of various populations, and efforts to modify ecological behaviours via laboratory or field experiments.

In the last two chapters Gray discusses specific and general ecological changes, emphasizing that environmental education offers the possibility for fostering a true environmetal ethic in our society.

The work by Gray *et al.* is a textbook as well as a research book, for undergraduate or graduate courses in ecology, psychology, sociology, environmental science. It provides a codification of what is known about ecological beliefs, attitudes, values and behaviours and offers guidelines for future research.

MANUELA DORDEA

Alison F. Richard, **Primates in Nature,** W. H. Freeman and Company, New York, 1985, 558 pages, with 201 figures and 44 tables.

In the 11 chapters contained in the book, A. F. Richard makes a complex and detailed description of the primates. At the beginning, the author describes the general common characteristics of the whole group, the ecological conditions under which they develop and the adaptation features existing in the morphology and behaviour of the different species of primates. Then there are presented the zoogeographical distribution in the past and in the present, as well as the ecological characteristics of their environmental conditions. There are also described the feeding behaviour, the nature of food and the reproduction, with the peculiarities found in different species.

Particularly valuable are the demographic aspects, as well as those regarding their social organization and social behaviour, through which a hierarchy of the individuals is manifested in the group. There are also described the interspecific relations, the competition for the ecological niche and food.

The text is illustrated with numerous figures, among which the majority are photographs made in the natural environment of the primates.

NICOLAE TOMESCU

INTREPRINDEREA POLIGRAFICĂ CLUJ,
Municipiul Cluj-Napoca c-da nr. 65/1986

Revista științifică a Universității din Cluj-Napoca, **STUDIA UNIVERSITATIS BABEȘ-BOLYAI**, apare începînd cu anul 1986 în următoarele condiții:

matematică — trimestrial

fizică — semestrial

chimie — semestrial

geologie—geografie — semestrial pentru geologie și anual pentru geografie

biologie — semestrial

filozofie — semestrial

științe economice — semestrial

științe juridice — semestrial

istorie — semestrial

filologie — semestrial

STUDIA UNIVERSITATIS BABEȘ-BOLYAI, the scientific journal of the University of Cluj-Napoca, starting with 1986 is issued as follows:

mathematics: quarterly

physics: biannually

chemistry: biannually

geology—geography: biannually on geology and yearly on geography

biology: biannually

philosophy: biannually

economic sciences: biannually

juridical sciences: biannually

history: biannually

philology: biannually

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