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REVUE ROUMAINE DE BIOLOGIE

SÉRIE DE BIOLOGIE ANIMALE

TOME 34, N° 1 janvier—juin 1989

SOMMAIRE

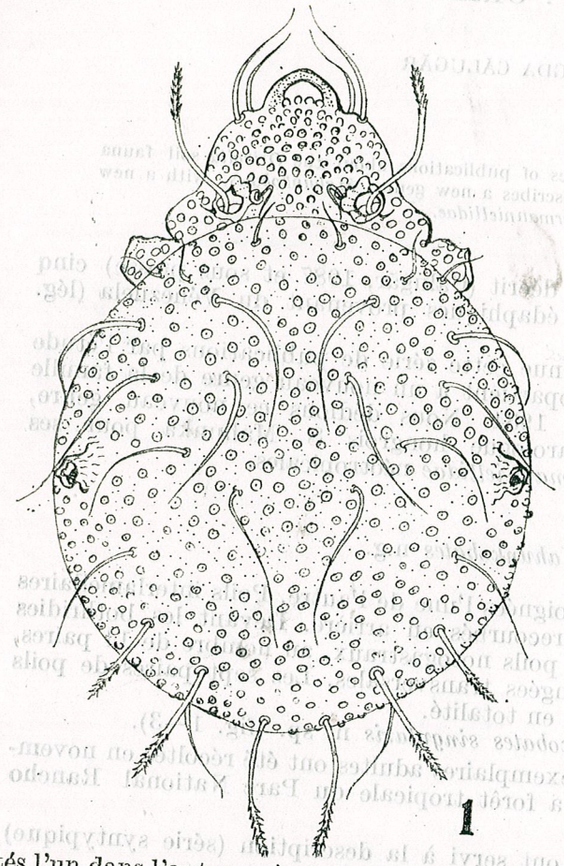

Fig. 1. — *Mahunkobates singularis* n.g., n.sp., adulte, corps, vue dorsale.

1

tés l'un dans l'autre, près du bord rostral ; ils sont semblables, peu courbés, effilés et lisses. Les bothridies globuleuses, sont éloignées entre elles par un espace qui est le double du diamètre de chaque coupe. Le sensillus est un poil non élargi vers l'extrémité, garni de nombreuses barbules. Les poils interlamellaires s'insèrent entre les bothridies, tout près d'elles, sur les très petites saillies parabothridiques. Grâce à leur finesse, ces poils sont mis en évidence avec difficulté ; ils sont effilés, lisses et fléchis en arrière. Les poils exobothridiaux sont les plus courts et épointés. Devant les bothridies il n'y a pas une paire des carènes comme chez les *Hermannobates* Hammer 1962.

Le notogaster, est très bombé et arrondi. On observe difficilement, par transparence, que les saccules intratégumentaires sont disposés sur toute la surface dorsale. Il existe 14 paires de poils gastronotiques de dimensions et aspects différents. Tous ces poils sont filiformes et lisses, sauf les poils postéro-marginaux qui resemblent aux épines ciliées et robustes. De même, les poils *c* sont les plus fins et les plus courts poils gastronotiques. Les glandes latéro-abdominales volumineuses, comme chez tous les genres de cette famille, sont situées au-dessous des poils e_2.

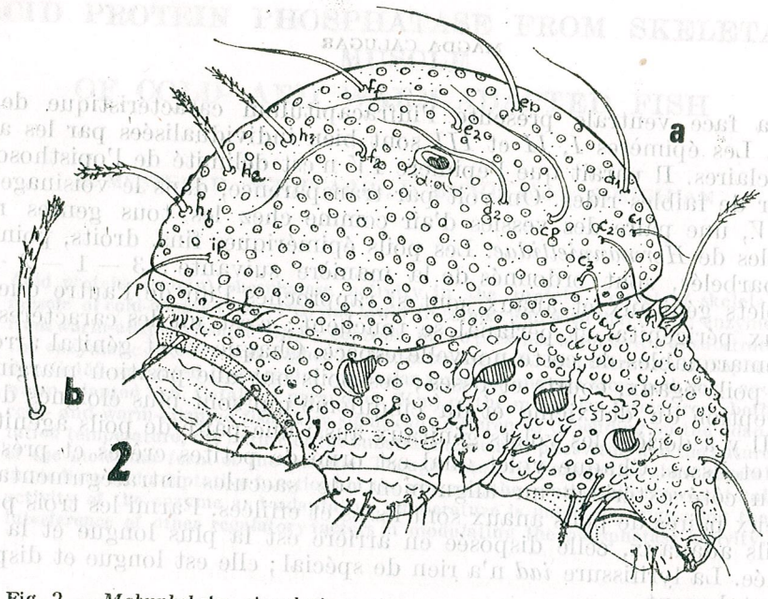

Fig. 2. — *Mahunkobates singularis* n.g., n.sp., adulte : a. Corps, vue latérale. b. Poil postéro-marginal, détail.

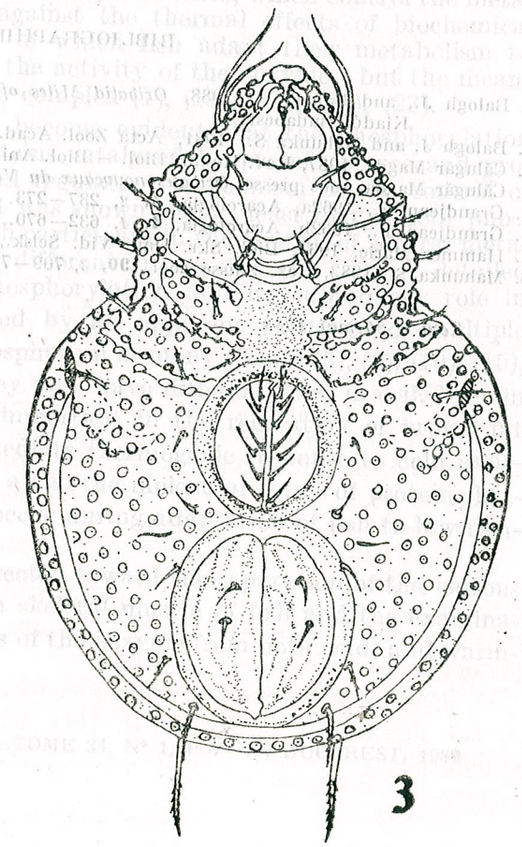

Fig. 3. — *Mahunkobates singularis* n.g., n.sp., adulte, corps, vue ventrale.

3

La face ventrale présente l'infracapitulum caractéristique de la famille. Les épimères *I*, *II* et *III* sont bien individualisées par les apodèmes claires. Il paraît que l'épimère *IV* n'est délimité de l'opisthosoma que par de faibles rides. On voit par transparence, dans le voisinage du coxa *IV*, une paire des vessies d'air comme chez les tous genres néotropicales de *Hermanniellidae*. Les poils épimériques fins, droits, pointus, mais barbelés, sont ordonnés de la manière suivante : 3 — 1 — 2 — 2. Les volets génitaux et anaux sont si rapprochés l'un de l'autre que les anneaux périgénital et périanal se touchent ; c'est un des caractères les plus remarquables de cette nouvelle espèce. Chaque volet génital arrondi a sept poils égaux, courts et lisses ; ces poils ont une position marginale, à l'exception du deuxième et du cinquième qui sont plus éloignés de ce bord. Il y a dérière les volets génitaux aussi une paire de poils agénitaux effilés et lisses. Chaque volet anal est orné de petites crêtes et présente sur son côté extérieur un alignement de saccules intratégumentaires. Les deux paires de poils anaux sont lisses et effilées. Parmi les trois paires de poils adanaux, celle disposée en arrière est la plus longue et la plus barbelée. La lyrifissure *iad* n'a rien de spécial ; elle est longue et disposée horizontalement.

Les pattes sont monodactyles.

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Reçu le 20 mai 1988

Centre de recherches biologiques
Iași, Calea 23 August 20A

ACID PROTEIN PHOSPHATASE FROM SKELETAL MUSCLE OF COLD- AND WARM-ADAPTED FISH

R. MEȘTER, D. SCRIPCARIU, D. BICHIȘ and L. SIMIGHIAN

Acid protein (casein) phosphatase activity in the proteic extract of skeletal muscle of cold-adapted fish (4°C) was lower in comparison with that of the enzyme from warm-adapted fish(18° C). By contrast, in the presence of phosvitin as substrate the enzymatic activity was higher in cold-adapted fish. Gel filtration on Sephadex G-150 separated three major molecular forms of enzyme from both cold- and warm-adapted fish. Catalytic parameter (Km) of the molecular forms from both cold- and warm-adapted fish show significant differences depending on the adaptation temperature, the nature of the substrate (casein or phosvitin) and the nature of the molecular form of the enzyme. Though catalytic parameters show several immediate and adaptative functions of the enzyme, the relationship between total activity of the enzyme and adaptative temperature is not clear, suggesting the interference of other regulatory factors in modulating the phosphatase activity.

The mechanism of thermal acclimation in poikilotherms involves the intervention of several regulatory phenomena, which control the metabolic rate by compensating against the thermal effects of biochemical processes. The principal way in which fish adapt their metabolism to temperatures is by modifying the activity of the enzymes, but the means of achieving these changes are complex (1), (11), (17), (20), (23).

In the last years it has become evident that the phosphorylation and dephosphorylation of proteins catalyzed by protein kinase and protein phosphatase is a principal regulatory mechanism in the control of almost all cellular processes. It was shown that at least four protein phosphatase catalytic subunits which participate in the control of several metabolic pathways are present in different tissues (4), (6), (22). A detailed investigation on protein dephosphorylation and its subsequent role in cellular regulation is hampered by an apparent existence of multiple molecular forms of protein phosphatase in many tissues (5), (9), (10), (15), (18). It was suggested that they may have different roles in cell. Protein phosphorylation seems to be important in the regulation of brown fat metabolism as well as its immediate thermogenic response to cold exposure (7), (8). Nothing is known about the molecular forms of protein phosphatase and the changes that occur during adaptation of fish to low temperature.

Our studies have been directed toward the separation of the various acid protein phosphatases from skeletal muscle of fish and the examination of some catalytic properties of the enzyme from both cold- and warm-adapted fish.

MATERIALS AND METHODS

Animals. Goldfish (*Carassius auratus* L.), 18—23 cm total length, were obtained from piscicultural station Nucet (Dîmbovița) and were maintained at 4° C and 18°C in the laboratory. Groups of 6—8 fish were held in aquaria throughout acclimation period of 3 weeks.

Enzyme preparation. Skeletal muscle from cold- and warm-adapted fish was minced, washed with saline solution of NaCl 0.6% and homogenized in a Waring blender in 10 volumes of acetate buffer 0.2 M pH 5.0 containing NaCl 0.8 M, 2 mM EDTA, 5 mM mercaptoethanol, 5% glycerol and 0.1% Triton X—100. The homogenate was centrifuged at 6000 g for 20 min. The supernatant was collected and was used in all studies related to crude proteic extract.

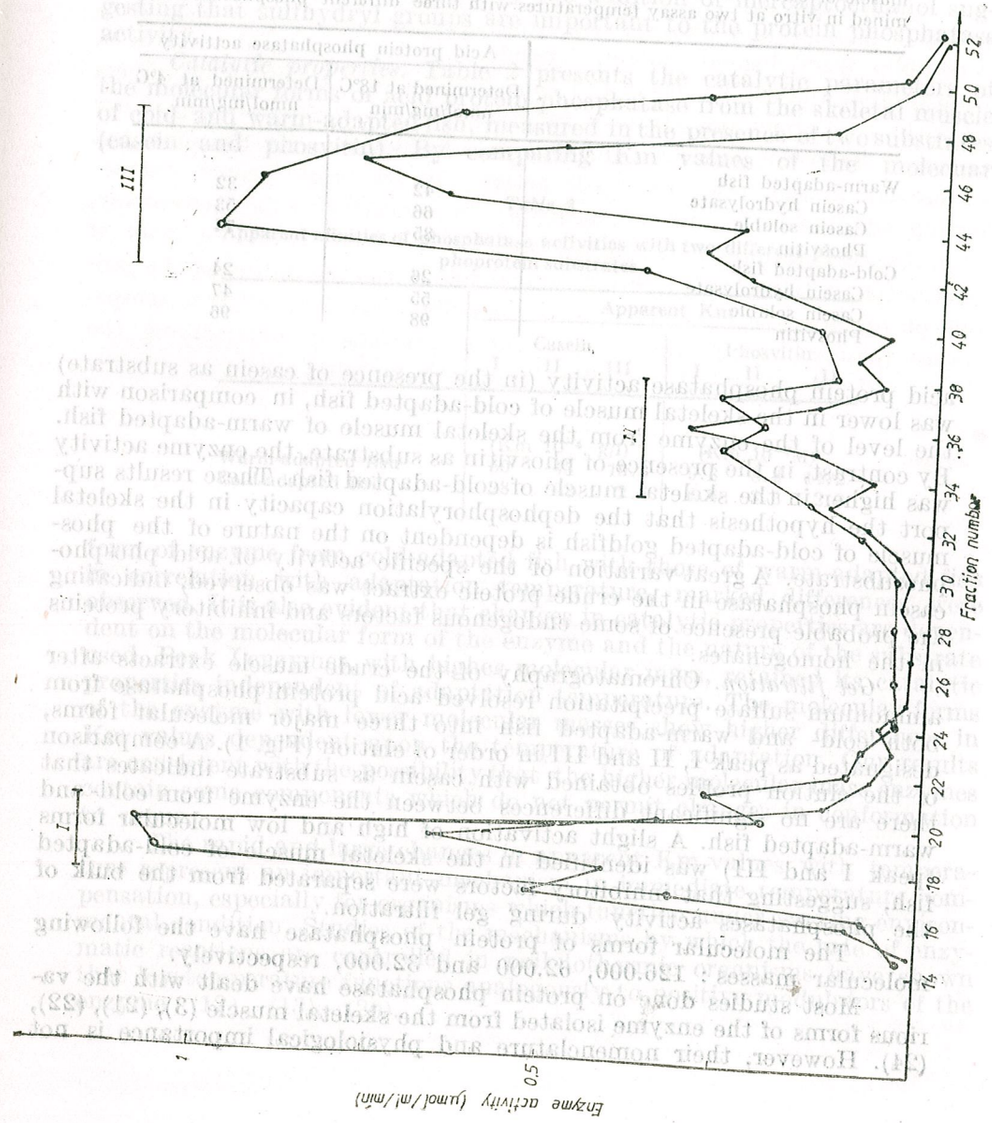
Partial purification of acid protein phosphatase was achieved by precipitation with ammonium sulfate and gel filtration. To the clear supernatant, solid ammonium sulfate was added to 80% saturation and the precipitate was collected by centrifugation at 10.000 g for 10 min. The precipitate was dissolved in Tris-HCl buffer 50 mM pH 7.4 containing 1 mM mercaptoethanol, 1 mM EDTA and 5% glycerol and was dialyzed overnight against the same buffer. The enzyme solution was applied on a Sephadex G—150 column (3 × 30 cm) equilibrated with Tris-HCl buffer 50 mM, pH 7.4 containing 5% glycerol and 1 mM mercaptoethanol. The enzyme was eluted with the same buffer. The active fractions (Fig. 1) were pooled and employed for the characterization of molecular forms of the enzyme from cold- and warm-adapted fish.

Enzyme assay. The acid protein phosphatase activity was determined in vitro at 4°C and 18°C corresponding to the adaptation temperature of fish. The assay mixture contained 50 mM acetate buffer, pH 5.0, 1 mM mercaptoethanol and 1 mg/ml casein in a total volume of 2.0 ml. The reaction was started by the addition of enzyme solution and was stopped after 10 min by the addition of 1 ml trichloroacetic acid (10%). The released orthophosphate was determined according to Fiske and Subbarow (2). Blank values were subtracted from all experimental values. A unit of acid protein phosphatase activity was defined as that amount of enzyme which catalyzed the production of 1 nmole orthophosphate per min. The specific activity of the enzyme was defined as the number of units per mg protein. Casein was dialized against 50 mM acetate buffer, pH 5.0, before enzyme assay. We also employed as substrate phosvitin (Serva) in concentration of 0.25 mg/ml and casein soluble (BDH) in standard assay conditions.

Determination of the molecular masses. The molecular masses of the molecular forms of protein (casein) phosphatase were estimated by gel filtration on Sephadex G-200 column, employing the following proteins : phosphorylase b (92.500), bovine serum albumin (68.000), ovalbumin (44.000) and myoglobin (17.000).

Protein determination. The concentration of protein was determined by the method of Lowry et al. (14), using bovine serum albumin as standard.

Fig. 1. — Elution profile on Sephadex G-150 of acid protein (casein) phosphatase from the skeletal muscle of warm-adapted fish (— — —) and cold-adapted fish (0— — — 0).



RESULTS AND DISCUSSION

Protein phosphatase activity in crude proteic extract. Table 1 illustrates the total acid protein phosphatase activity in crude proteic extracts from the skeletal muscle of fish adapted to two different temperatures. As indicated in Table 1, independent of assay temperature, the total

Table 1

Acid protein phosphatase activity in the crude protein extract of the skeletal muscle of cold- and warm-adapted goldfish. The enzymatic activity was determined in vitro at two assay temperatures with three different phosphosubstrates

	Acid protein phosphatase acttivity	
	Determined at 18°C nmol/mg/min	Determined at 4°C nmol/mg/min
Warm-adapted fish		
Casein hydrolysate	42	32
Casein soluble	66	53
Phosvitin	85	74
Cold-adapted fish		
Casein hydrolysate	26	24
Casein soluble	55	47
Phosvitin	98	96

acid protein phosphatase activity (in the presence of casein as substrate) was lower in the skeletal muscle of cold-adapted fish, in comparison with the level of the enzyme from the skeletal muscle of warm-adapted fish. By contrast, in the presence of phosvitin as substrate, the enzyme activity was higher in the skeletal muscle of cold-adapted fish. These results support the hypothesis that the dephosphorylation capacity in the skeletal muscle of cold-adapted goldfish is dependent on the nature of the phosphosubstrate. A great variation of the specific activity of acid phosphocasein phosphatase in the crude proteic extract was observed, indicating the probable presence of some endogenous factors and inhibitory proteins in the homogenates.

Gel filtration. Chromatography of the crude muscle extracts after ammonium sulfate precipitation resolved acid protein phosphatase from both cold- and warm-adapted fish into three major molecular forms, designated as peak I, II and III in order of elution (Fig. 1). A comparison of the elution profiles obtained with casein as substrate indicates that there are no significant differences between the enzyme from cold- and warm-adapted fish. A slight activation of high and low molecular forms (peak I and III) was identified in the skeletal muscle of cold-adapted fish, suggesting that inhibitory factors were separated from the bulk of the phosphatases activity during gel filtration.

The molecular forms of protein phosphatase have the following molecular masses : 126.000, 62.000 and 32.000, respectively.

Most studies done on protein phosphatase have dealt with the various forms of the enzyme isolated from the skeletal muscle (3), (21), (22), (24). However, their nomenclature and physiological importance is not

firmly established (19). The multiple forms of skeletal muscle phosphoprotein phosphatase either derive from different regulatory proteins attached to a catalytic protein, or represent a series of oligomeric enzymes.

Effect of pH. The pH optimum of the enzyme with casein as substrate ranged between pH 4.5 and 5.0, and with phosvitin as substrate it was between pH 5.0 and 5.5. The observed pH profile of activity was similar for both molecular forms of cold- and warm-adapted fish and appears to be due to the ionization of the amino acid residues of the enzyme or to the enzyme binding sites of the substrates.

The role of sulfhydryl groups. The acid protein phosphatase activity assayed with casein as substrate, was inhibited by N-ethylmaleimide. The inhibition can be reversed by the addition of mercaptoethanol suggesting that sulfhydryl groups are important to the protein phosphatase activity.

Catalytic properties. Table 2 presents the catalytic parameters of the molecular forms of acid protein phosphatase from the skeletal muscle of cold- and warm-adapted fish, measured in the presence of two substrates (casein and phosvitin). By comparing Km values of the molecuar

Table 2

Apparent afinities of phosphatase activities with two different phosphoprotein substrates

	Apparent Km					
	Casein			Phosvitin		
	I	II	III	I	II	III
	(Km 10^{-4} g/l)			(Km 10^{-7}M)		
Warm-adapted fish	50	45	15.3	9.8	8.2	14.2
Cold-adapted fish	28	22	2.4	6.6	3.3	2.3

form of enzyme from cold-adapted fish with those of warm-adapted fish in correlation with adaptation temperature, marked differences were observed. It is also evident that changes in catalytic properties are dependent on the molecular form of the enzyme and the nature of the substrate used. Peak I enzymes, with higher molecular mass, retained its catalytic properties independent of adaptation temperature. The molecular forms of the enzyme with lower molecular masses show higher differences in Km values dependent upon the temperature of adaptation. Our results are consistent with the possibility that the higher molecular mass enzymes contain some components which do not permit changes in conformation to occur.

The rapid and large changes in apparent Km values with temperature represent an important mechanism in immediate temperature compensation, especially for organisms which function under varying environmental condition. Studies of the mechanisms by which the rate of enzymatic reactions are controlled in poikilothermic organisms have shown that low temperature functions analogously to positive modulators of the enzyme (12), (13), (20).

Low and Somero (12), studying the adaptation of muscle pyruvate kinase from fish to enviromental temperature, suggested that the enzyme can exist in two temperature-dependent conformational states. To answer this question of protein phosphatase, we calculated the values of constant rates (k1 and k2) of the interconversion between two states of the enzyme and the concentration of the two conformers at an intermediary temperature, according to Nickerson (24). The results show that kinetic difficulties appear for the higher molecular forms of the enzyme and suggest that these proteins are metastable. By contrast, the lower molecular forms of acid protein phosphatase from both cold- and warm-adapted fish present characteristics of multistable proteins.

Our results are consistent with the possibility that the molecular forms of acid protein phosphatase from skeletal muscle be subjected to a complex physiological control, dependent on the structural features of each protein and the nature of the phosphosubstrate. Temperature affects both the regulatory and catalytic functions of each molecular form of the enzyme. Moreover, our data do not provide evidence for the observed differences in the total enzymatic activity in the crude proteic extract during adaptation to low temperature. The reason of this discrepancy, is probably determined by the presence in the crude proteic extract of modulator proteins, which play a central role in the regulation of the protein phosphatase activity (4). It is very possible that adaptation to temperature requires the participation of these proteins in determining the degree of dephosphorylation of different phosphoproteins.

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Received November 9, 1988

Faculty of Biology,
Bucharest, Splaiul Independenţei 91—95

ATTENUATION OF THE STRESS-INDUCED HYPERGLYCEMIA, THYMOLYSIS, ADRENAL HYPERTROPHY AND LIVER ADENYLATE CYCLASE ACTIVITY BY PROPRANOLOL IN IMMATURE AND MATURE YOUNG RATS

J. MADAR, VICTORIA MARIA RUSU, NINA ŞILDAN and ANA ILONCA

In immature (35-day-old) and mature (60-day-old) male albino Wistar rats hyperglycemia, thymus involution, adrenal hypertrophy and enhanced liver adenylate-cyclase activity were produced by formalin stress. When daily stress-induction for 5 days was associated with propranolol administration (50 micrograms s.c./100 g b.w. per day, for 5 days), in both age-groups of rats the above mentioned parameters were significantly attenuated as compared to the corresponding stressed controls. It is concluded that the beta-adrenoceptor stimulation significantly participates in stress-induced hyperglycemia, thymolysis, adrenal hypertrophy and enhanced liver adenylate-cyclase activity in young rats.

There is evidence that in stress-induced hyperglycemia of white rats the anti-insulin effects of excessively released catecholamines are appreciably involved (7), (8), (9), (14), (24).

In previous papers we noticed that, during formalin stress, the hyperglycemia of young rats was strongly associated with thymolysis, adrenal hypertrophy and insulin resistance at the level of the striated muscle (19), (20), the latter phenomenon being significantly attenuated by propranolol administration against the background of stress induction (17).

It is well established that beta-adrenoceptors are activated at the same degree by epinephrine and norepinephrine, and propranolol is a specific beta-adrenoceptor blocking agent without sympathomimetic activity (15).

In order to test the possible role of beta-adrenoceptor mediated effects of acute formalin stress upon glycemia, and thymus and adrenal weights in immature and mature young rats, in the present study the dynamics of these parameters was compared in stressed and propranolol-treated stressed groups. Simultaneously, the liver adenylate-cyclase activity in these age-groups was followed, since this enzyme is a component of the beta-adrenoceptor adenylate-cyclase system (22) and is evaluably activated by catecholamines in stressed rats (23).

MATERIALS AND METHODS

The experiments were carried out on groups of normal, stressed, and propranolol-treated immature (35-day-old) and mature (60-day-old) inbred male Wistar rats. They were reared in the stockfarm of our laboratory and kept at standardized feeding and bioclimatic laboratory conditions, as described previously (17), (19), (20).

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The daily stress-stimulus for 5 days was produced by subcutaneous injection of 0.25 ml formalin 2% ("Chemapol", Czechoslovakia) per 100 g b.w. in the interscapular region.

Propranolol (1-isopropylamino/-3/-1-naphthyloxy/-2-propanol), "I.M.B.", Bucharest, was injected subcutaneously in daily doses of 50 micrograms/100 g b.w. for 5 days, immediately after stress-induction. Normal and stressed controls were injected with 0.25 ml saline.

The rats were sacrificed by cervical dislocation and exsanguination. Before sacrification they were fasted for 18 hours, with free admission to drinking water.

Blood was collected and the thymus and the adrenals quickly removed and weighted on an analytical balance.

Blood glucose levels were determined enzymatically by using GOD-Perid Kit ("Boehringer", GmbH, Mannheim, FRG), according to Werner's mathod (28). The optical densities of samples and glucose standards were read spectrophotometrically at 610 nm, using a "Specol" apparatus (Carl Zeiss, Jena, GDR), and glucose concentrations expressed in mg/100 ml blood.

Relative adrenal and thymus weights are given in mg gland/100 g b.w.

For histoenzymatical studies, liver pieces from a definite lobe were rapidly isolated, blotted on filter paper, frozen in liquid nitrogen and sectioned with a "Slee" (London) cryotom. Cryostat sections (10 μm) from frozen samples served for the enzymatical detection of adenylate-cyclase activity (AdCy) by the method of Howell and Whitfield (10), using ATP as substrate.

Excepting the histoenzymatical results, all the data are expressed as mean values ± S.E. The data were analyzed by Student's t test, the differences between means being considered statistically significant when $p < 0.05$.

RESULTS AND DISCUSSIONS

The dynamics of blood glucose levels and of relative thymus and adrenal weights are given in Table 1.

Under normal conditions the fasting glycemia level in both age-groups of rats is similar. In stressed groups, a marked hyperglycemia appears, the circulating glucose being raised by 46.9 and 45.9%, respectively, as compared to the corresponding normal values. These modifications are in good agreement with the reduction of insulin secretion and induction of insulin resistance at the level of the striated muscle in formalin-stressed young rats, as reported elsewhere (16), (17), (18), (19).

From the present investigations it results that in propranolol-injected immature and mature stressed rats hyperglycemia is significantly reduced (−24.6 and −11.8%, respectively), as compared to the corresponding controls, but glycemia levels remain elevated by 10.8 and 28.7% respectively, versus the corresponding normal controls. As reported previously (17), propranolol administration in stressed young rats attenuates muscular insulin-resistance. On the other hand, it is known

Table 1

Mean values ± S.E. of glycemia and relative thymus and adrenal weights in normal (N), stressed (S) and propranolol-treated stressed immature (35-day-old) and mature (60-day-old) male Wistar rats (PS)

Groups	Glycemia (mg%)	Thymus weight (mg/100 g b.w.)	Adrenal weight (mg/100 g b.w.)
35-day-old animals			
N	83±1.27 (12)	371±10.94 (11)	30±0.92 (11)
S	122±1.40 (11) +46.98%[a] P < 0.001[a]	272±8.81 (11) −26.68%[a] P < 0.001[a]	40±1.65 (11) +33.35%[a] P < 0.001[a]
PS	92±2.51 (12) +10.84%[a] P < 0.001[a] −24.59%[b] P < 0.001[b]	301±5.62 (11) −18.86%[a] P < 0.001[a] +10.66%[b] P < 0.01[b]	32±0.95 (11) +6.65%[a] P> 0.10[a] −20.00%[b] P < 0.001[b]
60-day-old animals			
N	87±2.81 (13)	352±9.93 (12)	31±1.57 (12)
S	127±2.95 (13) +45.97%[a] P < 0.001[a]	259±8.60 (12) −26.42%[a] P < 0.001[a]	42±1.82 (12) +35.48%[a] P < 0.001[a]
PS	112±2.46 (12) +28.73%[a] P < 0.001[a] −11.81%[b] P < 0.001[b]	289±7.26 (12) −17.89%[a] P < 0.001[a] +11.58%[b] P < 0.02[b]	32±1.97 (12) +3.22%[a] P> 0.50[a] −23.80%[b] P < 0.001[b]

Number of experiments is given in brackets. [a] Reported vs. normal values; [b] Reported vs. the values obtained in stressed rats. Relative adrenal weights are given for both glands.

that the insulin-stimulated entry of glucose into the muscle "in vivo" is a major factor in the regulation of the blood glucose homeostasis in white rats and other mammals (5), (16). On this basis, it is pertinent to assume that under our experimental condition, in the reduction of stress-induced hyperglycemia by propranolol a limitation of beta-adrenoceptor mediated muscle insulin-resistance essentially participates. It has been reported that beta-adrenoceptor activation induces impairment in the glucose metabolism (25), while epinephrine administration (6) or beta-adrenergic stimulation in man lead to insulin resistance (1).

The data concerning the relative weights of the thymus and the adrenals show that in both stressed age-groups of rats there is a marked

thymus involution (−26.7 and −26.4%, respectively) and adrenal hypertrophy (+33.4 and +35.5%, respectively). As we have recently pointed out, these responses in young rats are strongly associated with the hyperglycemic effect and insulin-resistance producing action of formalin-induced stress (17), (19), (20).

As one can see, in immature and mature stressed animals, against the background of propranolol administration, the thymus involution is attenuated by 10.66 and 11.58% respectively, in comparison with the stressed control values. At the same time, in both stressed age-groups a propranolol treatment normalizes the relative adrenal weights. This fact suggests the possibility that under formalin-induced stress conditions in young rats the beta-adrenoceptor stimulation plays a major conditioning role both in adrenal hyperactivity and in the thymolytic effect of excessively released corticosterone and catecholamines. In fact, there is evidence that beta-adrenoceptor blockade with propranolol reduces the hyperactivity of the hypothalamo-pituitary-adrenal axis in human subjects (13), while adrenaline administration stimulates the ACTH and cortisol release in man (11), and intracerebroventricular infusion of adrenaline enhances the release of corticotropin-releasing-hormone of unanesthetized rats (2). Beside, it has been recently reported that adrenaline exerts direct stimulatory effects on steroidogenesis in primary cultures of bovine adrenocortical cells (12).

Table 2

The intensity of histoenzymatic reaction of liver adenylate-cyclase (AdCy) activity in normal (N), stressed (S) and propranolol-treated (PS) groups of immature (35-day-old) and mature (60-day-old) male albino Wistar rats

Age	AdCy reaction		
	N	S	PS
35-day	1.0	3.0	1.5
60-day	1.0	2.5	1.0

The reaction intensity is expressed in arbitrary values: 1.0 — 1.5 = positive reaction; 2.0 — 2.5 = intense positive reaction; 3.0 = very intense reaction

From the analysis of the histoenzymatic data summarized in Table 2 and Fig. 1—3, it is obvious that the liver adenylate-cyclase activity (AdCy) of immature and mature normal rats is similar. The reaction of this enzyme is mainly localized in the hepatocyte membranes and in the wall of larger lobular blood vessels. It is well established that adenylate-cyclase is a major generator of intracellular cyclic-AMP, which is a chief messenger of beta-adrenoceptor activation by catecholamines at the level of rat hepatocytes and other target cells (3), (4), (21), (22), (26), (27).

Our data show that formalin stress in both age-groups of rats induces an accentuated liver AdCy activity. This modification well agrees

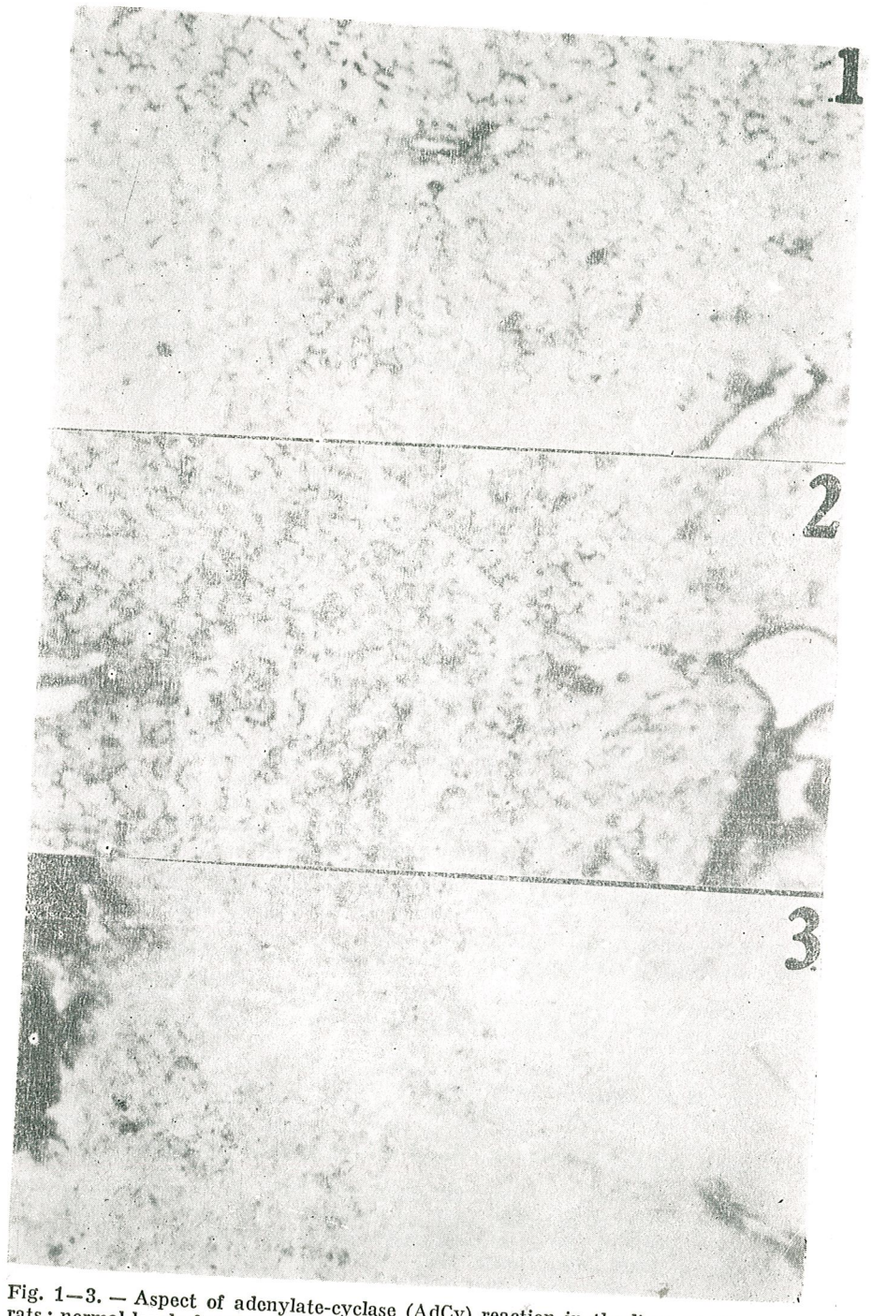

Fig. 1—3. — Aspect of adenylate-cyclase (AdCy) reaction in the liver of 35-day-old rats; normal level of reaction in control group (1); increased reaction in stressed rats (2); depressed reaction in propranolol-treated stressed rats (3).

with the stress-induced hyperglycemia in these groups and reflects the role of adrenergic stimulation and cyclic-AMP formation in hepatic glucose production and output in rats (3), (21), (23), (27).

In the case of propranolol-treated stressed immature and mature young rats there appears a depressed AdCy activity in the hepatocytes. In this respect, there is a direct correlation between the hyperglycemia reducing effect of propranolol. This alteration suggests that the enhanced AdCy activity in hepatocytes essentially participates in the beta-adrenoceptor mediated blood glucose elevation in young rats during repeated acute formalin stress.

In conclusion, in stress-induced hyperglycemia, thymolysis, adrenal hypertrophy and enhanced liver adenylate-cyclase activity of immature and mature young rats the beta-adrenoceptor activation is mainly involved.

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Received July 15, 1988

Biological Research Centre,
Cluj-Napoca, Republicii 48

MODIFICATIONS DANS LES RYTHMES DES INDICATEURS HÉMATOLOGIQUES SOUS L'ACTION DES POLLUANTS

SIMONA APOSTOL*

Studies into the chronopathology are recent and of particular interest. In an experiment performed in adiurnal biorhythm model the actions of dinitrophenols upon the most sensitive haematological indicators — red cells and haemoglobin — were tested. As test-animal served the white rat (*Rattus norvegicus L., albinos form*, Wistar). The wave amplitude is modified — more visible at some experimental moments — and sometimes dephasing was registered. In this way we may explain the existence of hours with less resistance and at which the organism is affected by the pollutant agents.

La chronopathologie — l'étude de l'altération pathologique de la structure temporelle de l'organisme — est encore à son début, et l'on ne connaît jusqu'à présent que certains de ses aspects par des investigations sporadiques.

Vu qu' à présent, ainsi que dans le proche avenir, l'un des principaux problèmes de l'humanité est la pollution du milieu et de l'organisme, nous avons considéré que l'étude de l'action exercée sur les biorythmes des organismes animaux par les agents polluants du milieu environnant serait intéressante et inédite.

Les recherches expérimentales ont été effectuées dans un modèle de biorythme diurne, utilisant comme organisme-test le rat blanc — *Rattus norvegicus*, la forme *albinos-Wistar*. Parmi les polluants «modernes» nous avons choisi pour les expériments les dinitrophénols — l'arétite et le dinitrochlorebensène (DNClB) — des produits largement utilisés dans l'agriculture.

L'administration des solutions a été effectuée *per os* par la sonde, pour nous assurer qu'une quantité exacte — 1 ml pour 100 g poids corporel — serait introduite dans le corps. On a utilisé des lots formés de 10 animaux, les tests étant effectués parallèlement sur des femelles et des mâles ; chaque lot expérimental a été doublé simultanément d'un lot de contrôle. Les doses choisies ont été de 25 mg/Kg pour l'arétite et 50 mg/Kg pour le DNClB.

Les unités chronologiques étants les heures, les temps expérimentaux ont été distancés à des intervalles de 4 heures : 8°° heures, 12°° heures, 16°° heures et 20°° heures. Après l'intervalle de 24 heures, les rats ont été décapités et le sang collecté pour les analyses hématologiques.

Nous avons choisi les indicateurs qui ont été les plus sensibles — ce qui a été verifié dans nos recherches precédentes (5). Vu que le principal effet dû au groupe nitro- est la transformation de l'hémoglobine en méthémoglobine (10), ces indicateurs, directement intéressés dans l'intoxication avec les produits dinitrophénoliques, sont les hématies et l'hémoglobine, respectivement l'index de couleur.

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* Assistance technique : Veronica Bulimar

Considérant que les biorythmes saisonniers de ces indicateurs — établis antérieurement — ont presenté au printemps les plus grandes valeurs du nombre des hématies (et aussi de la quantité de l'hémoglobine), que pendant l'été il y a les quantités d'hémoglobine les plus réduites et qu'en automne on enregistre les plus pétits nombres d'éléments figurés, mais les plus élevées valeurs de l'index de couleur, nous avons effectué les recherches expérimentales pendant l'hiver (en février), quand les valeurs des indicateurs hématologiques sont les plus constantes et répresentent une moyenne.

Comme il resort de la figure 1, le rythme normal des hématies présente l'accrophase avec un pic à 16 heures, mais sous l'action des polluants l'allure de l'onde se modifie avec certitude. On constate des modifications d'amplitude, plus évidentes et constantes chez les mâles, tandis que chez les femelles s'installent spécialement des phénomènes typiques de déphasage. Il est intéressant de remarquer l'action en sens inverse produite par les deux dérivés dinitrophénoliques.

Ainsi qu'ont constaté d'autres auteurs aussi (7), l'hémoglobine présente, normalement, des biorythmes semblables aux hématies (fig. 2), mais sous l'action exercée par les deux polluants, l'amplitude diminue fortement surtout quant les expérimentations ont commencé à 12°°—16°° heures. De cette manière se sont confirmés les résultats que nous avons obtenus antérieurement (4), par les dosages du DNBP (la substance active du l'arétite), puisque nous avons dosé les plus grandes valeurs du produit dans le sang des animaux qui ont reçu le produit à 8°° et, spécialement, à 12°° heures, les pics maximaux étant enregistrés chez les femelles.

Les calculs de l'index de couleur ont mis en évidence la diminution de l'amplitude, surtout sous l'action du DNClB, ce qui dénote l'existence d'une tendance vers l'anémie hypochrome chez les organismes intoxiqués. Les moindres valeurs ont été enregistrées aussi chez les femelles à 12°° heures. Les valeurs des déviations standard ont été réduites dans tous les cas, ce qui dénote l'uniformité des lots.

Il faut considérer le fait que le rythme représente une forme finie de l'extériorisation du temps, tout comme la cellule représente aussi une forme finie de l'extériorisation de l'espace et que l'activité rythmique de l'organisme est liée à l'activité rythmique de la cellule qui ne peut pas réaliser simultanément toutes les fonctions, mais elle est programmée génétiquement en temps (6, 9, 11, 13, 14, 15). Comme nous avons constaté, les hématies et l'hemoglobine ont les pics placés à 16°° heures. En ce qui concerne les leucocytes, l'accrophase est placée entre 8°°—12°° heures (5).

Dans les expérimentations effectuées avec les agents polluants nous avons enregistré des modifications similaires à celles signalées par certains auteurs (8) sous l'action d'autres facteurs extérieurs. L'anormalité des biorythmes circadiens a inclu des troubles divers de l'amplitude et de phase. Mais, bien que les deux produits étudiés — l'arétite et le dinitrochlorebensène — appartiennent à la même catégorie (dinitrophénols), ils ont une action différente sur les divers indicateurs biochimiques et hématologiques, dépendante des rythmes spécifiques.

Les données obtenues dans les recherches effectuées antérieurement (4), quand nous avons constaté que les plus grandes quantités d'arétite

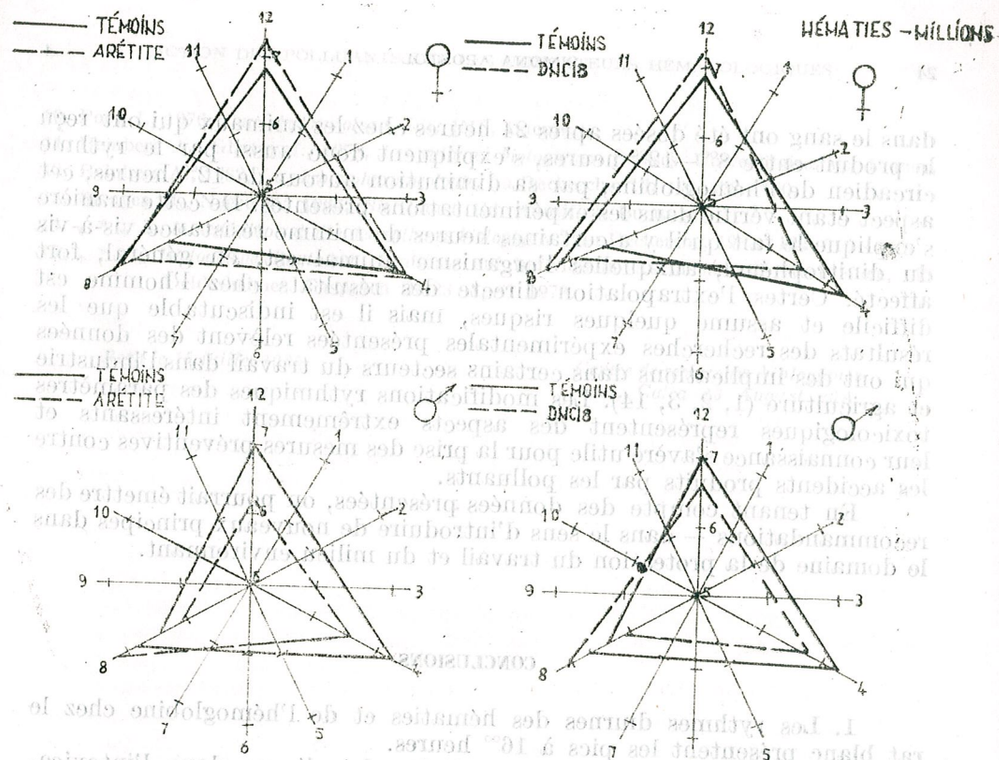

Fig. 1.—Le biorythme circadien du nombre des hématies et les modifications produites par les dinitrophénols.

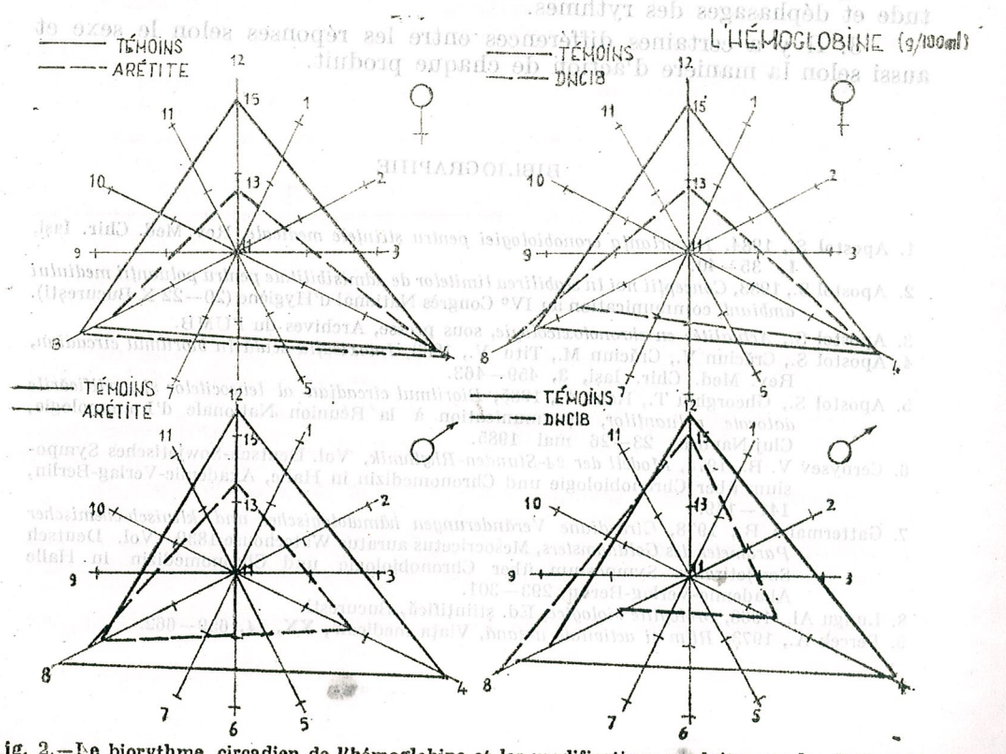

Fig. 2.—Le biorythme circadien de l'hémoglobine et les modifications produites par les dinitrophénols.

dans le sang ont été dosées après 24 heures chez les animaux qui ont reçu le produit entre 8°°—12°° heures, s'expliquent donc aussi par le rythme circadien de l'hémoglobine, par sa diminution autour de 12°° heures, cet aspect étant vérifié dans les expérimentations présentes. De cette manière s'explique le fait qu'il y a certaines heures de minime résistance vis-à-vis du dinitrophénol, auxquelles l'organisme animal est, en général, fort affecté. Certes l'extrapolation directe des résultats chez l'homme est difficile et assume quelques risques, mais il est indiscutable que les résultats des recherches expérimentales présentées relèvent des données qui ont des implications dans certains secteurs du travail dans l'industrie et agriculture (1, 2, 3, 14). Les modifications rythmiques des paramètres toxicologiques représentent des aspects extrêmement intéressants et leur connaissance s'avère utile pour la prise des mesures préventives contre les accidents produits par les polluants.

En tenant compte des données présentées, on pourrait émettre des recommandations — dans le sens d'introduire de nouveaux principes dans le domaine de la protection du travail et du milieu environnant.

CONCLUSIONS

1. Les rythmes diurnes des hématies et de l'hémoglobine chez le rat blanc présentent les pics à 16°° heures.

2. Les actions des composés dinitrophénoliques dans l'intoxication aiguë (dose unique) se manifestent par des modifications d'amplitude et déphasages des rythmes.

3. Il y a certaines différences entre les réponses selon le sexe et aussi selon la manière d'action de chaque produit.

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Reçu le 15 juillet 1985

Centre de recherches biologiques,
Iași, Calea 23 August 20A

INFLUENCE OF THE A.12.3 TREATMENT, ASSOCIATED WITH VARIOUS VEGETAL PRODUCTS, ON SOME SERUM LIPID COMPOUNDS

P. ROTINBERG, GABRIELA AGRIGOROAEI, ȘT. AGRIGOROAEI, I. NEACȘU, SMARANDA KELEMEN and C. BÂRCĂ

When administering an original biosynthesis antibiotic, A.12.3 (400 u/kg body/day), as powder, associated with ergosterol (0.5 mg/kg body/day) or with the original vasoactive product, rutacyl (4.5 mg/kg body/day), to Chinchilla rabbits subjected to an atherogenic regimen, the reduction of the concentration of free fatty acids, total phospholipids and beta-lipoproteins in the serum, which had high values caused by the atherogenic regimen, is to be observed. Generally, the effects of such products on the free fatty acids and phospholipids are similar or slightly weaker than those of the chlofibrate drug (25 mg/kg body/day), while the effects on beta-lipoproteins are much stronger.

It is known that, under atherogenic conditions, there occur a series of modifications, both of total lipids and of different lipid compounds in the serum, similar to those characterizing pathological dislipidemia (1—4), (6), (8), (11), (17), (18).

Concomitantly, certain investigations have established that polyene antibiotics possess hypolipemiant and hypocholesterolemiant properties, based on their interaction with sterols from the structure of cell membranes (9), (12—15), (18), (21); they have been already evidenced in our previous papers on nystatin and A.20.5 polyenes (1—4).

Other papers discussed the positive effects of ergosterol in atherosclerosis (10), (20), upon the intensifying of the hypocholesterolemiant action of some polyenes (2), as well as upon vasoactive properties, to be used in cardiovascular affections, of rutacyl, an original diacetylate derivative of rutosid flavonoid (16).

Starting from these observations, we have investigated the action of the original antibiotic of bio-synthesis, A.12.3, associated with ergosterol or rutacyl, upon free fatty acids (FFA), total phospholipids (TPL) and beta-lipoproteins (B—LP) from the serum of rabbits subjected to an atherogenic regimen.

MATERIALS AND METHODS

Investigations were performed in Chinchilla rabbits of about 2.0 kg body weight, divided into four groups of 10 individuals each. All of them had been subjected to a uniform atherogenic regimen, each rabbit being orally administered a cholesterol dose of 0.125 g/kg body/day, in the whole period of treatment.

In the first stage of the atherogenic regimen (from the moment T_0 to T_1), all groups were given only cholesterol, without any other treatment. In the following stages ($T_1 - T_3$), the groups were treated differently, thus, group I was administered only cholesterol, up to the end of the

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experiment, group II was orally treated with A.12.3 (powder) in a dose of 400 u/kg body/day, associated with 0.5 mg/kg body/day ergosterol, group III received (again orally) the same dose of A.12.3, associated with 4.5 mg/kg body/day rutacyl, while group IV was also treated orally with 25 mg/kg body/day chlofibrate — as reference drug (8).

The effects of the applied treatments were followed by analyses performed in the beginning of the experiment (T_0), after a fortnight of atherogenic regimen (T_1), after a fortnight of treatment (T_2), as well as after a four-week treatment (T_3). Determinations were made of the serum free fatty acids by the spectrophotometric method of R. C. B. Barreto and D. B. Mano (5), serum total phospholipids according to the Gomori spectrophotometric method (19) and beta-lipoproteins, by the spectrophotometric method of M. Burstein and E. Samaille (7).

RESULTS

Throughout the treatment period, a series of variations of the concentration of serum free fatty acids, total phospholipids and beta-lipoproteins was observed in all animal groups, as depending on the applied treatment.

Thus, the initial normal values of serum free fatty acids ranged, within the four groups, between 63.60 and 98.50 mg/100 ml serum while, after a fortnight of atherogenic regimen, they showed higher values, between 98.50 and 139.40 mg/100 ml serum. In the case of the control group, the free fatty acids evidenced a continuous increase, so that the final value represents 207.76%, as compared with the initial one, and 140.70%, as compared with that of the T_1 moment. With the treated groups, all values show a strong decrease at the T_2 moment (Fig. 1), increasing afterwards and representing, as compared with those of the T_1 moment, 127.21% in group II, 147.71% in group III and 93.47% in group IV at the T_3 moment.

Serum total phospholipids showed normal initial values, ranging between 178.70 and 206.20 mg /100 ml serum; they increased, after the first stage of atherogenic regimen, in all groups, ranging between 204.90 mg/100 ml serum and 243.70 mg/100 ml serum. In the case of the control group, there was a continuous increase of serum phospholipid concentration, the final value representing 118.56%, as compared with that at T_0 and 112.12%, as compared with that of T_1 (Fig. 2). In the treated groups, a significant decrease of serum phospholipids occurs, the final values representing, against those of the moment T_1, 63.60% in group II, 84.33% in group III and 50.51% in group IV.

Serum beta-lipoproteins had normal initial values in all animal groups, ranging between 168.72 and 226.44 mg/100 ml serum.

In the case of the control group, a continuous increase of the beta-lipoproteins concentration occurred, so that the value recorded at the end of the atherogenic regimen represents 208.66% as compared with the normal one, and 121.62% as compared with that of the T_1 moment (Fig. 3). Treatments applied to the other groups induced a decrease of the serum beta-lipoproteins concentration as against the control group, the final values representing, compared with those of the T_1 moment, 84.96% in group II, 86.31% in group III and 106.11% in group IV.

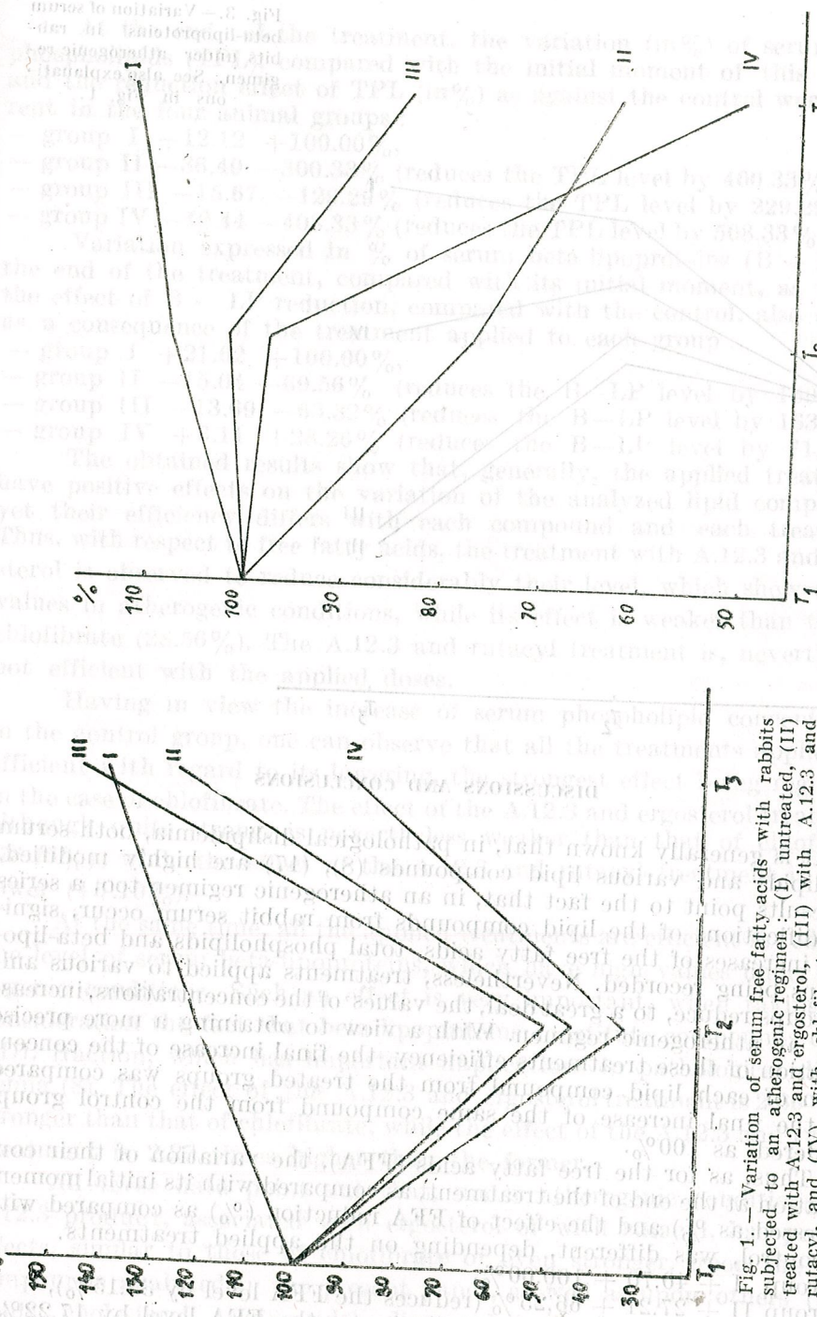

Fig. 2. — Variation of serum total phospholipids in rabbits subjected to an atherogenic regimen. See also explanations in Fig. 1.

Fig. 1. — Variation of serum free fatty acids with rabbits subjected to an atherogenic regimen: (I) untreated, (II) treated with A.12.3 and ergosterol, (III) with A.12.3 and rutacyl, and (IV) with chlofibrate; expressed in %, as compared with the value recorded in the beginning of the treatment. T_1, T_2, T_3 — stages of treatment.

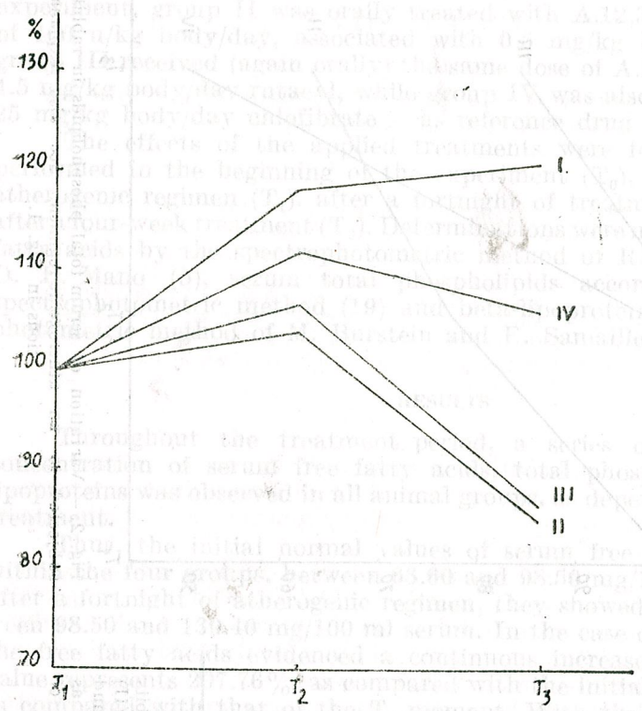

Fig. 3.—Variation of serum beta-lipoproteins in rabbits under atherogenic regimen. See also explanations in Fig. 1.

DISCUSSIONS AND CONCLUSIONS

It is generally known that, in pathological dislipidemia, both serum total lipids and various lipid compounds (8), (17) are highly modified. Our results point to the fact that, in an atherogenic regimen too, a series of modifications of the lipid compounds from rabbit serum occur, significant increases of the free fatty acids, total phospholipids and beta-lipoproteins being recorded. Nevertheless, treatments applied to various animal groups reduce, to a great deal, the values of the concentrations, increased in an atherogenic regimen. With a view to obtaining a more precise evaluation of these treatments efficiency, the final increase of the concentration of each lipid compound from the treated groups was compared with the final increase of the same compound from the control group, considered as 100%.

Thus, as for the free fatty acids (FFA), the variation of their concentration at the end of the treatment, as compared with its initial moment (expressed as %) and the effect of FFA reduction (%) as compared with the control, was different, depending on the applied treatments.

— Group I + 40.70 + 100.00%,
— Group II + 27.21 + 66.25% (reduces the FFA level by 33.15%),
— Group III + 47.71 + 117.22% (increases the FFA level by 17.22%),
— Group IV — 6.53 — 16.04% (reduces the FFA level by 116.04%)

At the end of the treatment, the variation (in%) of serum total phospholipids (TPL), compared with the initial moment of this period and the reduction effect of TPL (in%) as against the control were different in the four animal groups :

— group I +12.12 +100.00%,
— group II —36.40 —300.33% (reduces the TPL level by 400.33%)
— group III —15.67 —129.29% (reduces the TPL level by 229.29%)
— group IV —49.44 —408.33% (reduces the TPL level by 508.33%).

Variation expressed in % of serum beta-lipoproteins (B — LP) at the end of the treatment, compared with its initial moment, as well as the effect of B — LP reduction, compared with the control, also differs, as a consequence of the treatment applied to each group :

— group I +21.62 +100.00%,
— group II —15.04 —69.56% (reduces the B—LP level by 169.56%),
— group III —13.69 —63.32% (reduces the B—LP level by 163.32%),
— group IV +6.11 +28.26% (reduces the B—LP level by 71.74%).

The obtained results show that, generally, the applied treatments have positive effects on the variation of the analyzed lipid compounds, yet their efficiency differs with each compound and each treatment. Thus, with respect to free fatty acids, the treatment with A.12.3 and ergosterol is observed to reduce considerably their level, which showed high values in atherogenic conditions, while its effect is weaker than that of chlofibrate (28.56%). The A.12.3 and rutacyl treatment is, nevertheless, not efficient with the applied doses.

Having in view the increase of serum phospholipid concentration in the control group, one can observe that all the treatments applied are efficient with regard to its lowering, the strongest effect being registered in the case of chlofibrate. The effect of the A.12.3 and ergosterol treatment, although quite strong, is nevertheless weaker than that of chlofibrate (78.75%), while the effect of the A.12.3 and rutacyl treatment is much lower (45.10%).

At the same time, all the applied treatments are efficient in reducing the level of serum beta-lipoproteins, which have high values under atherogenic conditions. Such an effect is very important, when taking into consideration the fact that beta-lipoproteins constitute compounds of the LDL fraction, which has important implications in pathological dislipidemia (8). The effect of the A.12.3 and ergosterol treatment is 2.36 times stronger than that of chlofibrate, while the effect of the A.12.3 and rutacyl treatment is 2.27 times higher than the former.

All these data point out that, under atherogenic conditions, the A.12.3 product, associated with ergosterol or with rutacyl, has positive effects, similar to those of chlofibrate or even stronger, upon the lipid compounds analyzed in the present paper, as well as upon others (total lipids, cholesterol, triglycerids), discussed in various papers, which is ndicative of their possible use in therapeutics.

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Received June 5, 1987

Biological Research Center
Iași, Calea 23 August 20 A

WATER AND ION DISTRIBUTION IN TISSUES OF ANIMALS TREATED WITH VARIOUS HYPOCHOLESTEROLEMIANT PREPARATIONS

I. NEACȘU, ȘT. AGRIGOROAEI, GABRIELA AGRIGOROAEI, P. ROTINBERG, C. BÂRCĂ and SMARANDA KELEMEN

Experiments were performed on Chinchilla rabbits subjected to an atherogenic regimen, orally treated with the original biosynthesis antibiotic A.12.3 (400 u/kg body/day), associated with ergosterol (0.5 mg/kg body/day) or with the original vasoactive product rutacyl (4.5 mg/kg body/day). Such treatments evidenced positive effects, not only upon serum lipids, cholesterol and ions, but also upon the distribution of water and Na^+, K^+ and Ca^{2+} ions in the muscle extra- and intracellular compartment, modified under atherogenic conditions. These effects are similar to those induced by the chlofibrate drug (25 mg/kg body/day), especially in the treatment with A.12.3 and rutacyl.

The experimental animals subjected to an atherogenic regimen showed certain modifications, both of total lipids and of different lipid constituents and also of serum ions, similar to those recorded in pathological dislipemia (1—7), (10), (15), (17).

Due to their specific interaction with sterols from the structure of cell membranes (8), (12), (13), (17), (21), polyene antibiotics determine the lowering of hyperlipemia and hypercholesterolemia, as well as the modification of serum ion concentration, which are specific phenomena of the atherogenic regimen, as already stated in some of our previous papers dealing with the action of nystatin and A.20.5 polyens (1—5).

Other investigations also established that ergosterol has positive effects in atherosclerosis (9), (20), intensifying the hypocholesterolemiant action of polyenes (2), while rutacyl, an original diacetylated derivative of the rutosid flavonoid (19), shows some specific interactions with the ions of Na^+, K^+ and Ca^{2+}, as well as a series of pharmacological properties, to be used in cardiovascular affections (14).

In order to specify such therapeutic properties of some agents, we have studied the effects of an original biosynthesis antibiotic, A.12.3, associated with ergosterol or with rutacyl, upon the repartition of water and of the Na^+, K^+, and Ca^{2+} ions in tissues of rabbits, subjected to an atherogenic regimen.

MATERIALS AND METHODS

Experiments were performed on four batches of 10 rabbits each, with a bodily weight of 2.0 kg each. All animals were subjected to a uniform atherogenic regimen, each individual being orally administered a cholesterol dose of 0.125 g/ kg body/day, throughout the experiment.

The batches were treated differently. Batch I (control) was given only cholesterol, throughout the experiment, as to the other batches in the first stage of the atherogenic regimen (from T_0, the starting moment,

up to T_1). In the following stages, ($T_1 - T_3$), batch II was orally treated with A.12.3 as powder (400 u/kg body/day), associated with ergosterol (0.5 mg/kg body/day), batch III was also orally given the same dose of A.12.3, associated with rutacyl (4.5 mg/kg body/day), while batch IV was administered, again orally, chlofibrate (25 mg/kg body/day), the reference drug (7).

The effects of the applied treatments were followed upon the distribution of water and Na^+ K^+ and Ca^{2+} ions in the muscle extra- and intracellular compartment, analyses being performed at the beginning of the experiment (T_0 moment), a fortnight after the beginning of the atherogenic regimen (T_1), a fortnight after (T_2) and four weeks after the beginning of the treatment (T_3).

The amount of total water was determined by the difference between the weight of a fresh tissue sample and its weight after drying at 105°C. Starting from the dried and mineralized tissue, the total amount of Na^+, K^+ and C^{2+} was determined by flamephotometry (18). On another tissue sample, incubated at 37°C in Tyrode physiological solution, containing 1% inuline, we determined the amount of extracellular water, corresponding to the concentration of inuline in the tissue (the inulinic space). The difference between total and extracellular water gave the amount of intracellular water. Knowing the total content of ion in the tissue and in the Tyrode solution and the total, extracellular and intracellular water, we computed the total, extracellular and intracellular concentration of the Na^+, K^+ and Ca^{2+} ions. Average values for each batch were expressed in ml/100 g fresh tissue for water and in mg/100 g fresh tissue and mg/100 ml total, extracellular and intracellular water for ions.

RESULTS

The water content in the tissue varies, depending on the treatment applied to each animal batch. At the end of the treatment, values of total water (TW) decrease slightly, as compared with those registered at T_0 and T_1, both in the control batch and in the treated ones (Fig. 1—W). Extracellular water (EW) increases during the atherogenic regimen in the control batch and decreases in all the treated batches, depending on the applied treatment. Intracellular water (IW) decreases slightly in the control batch, while in the treated batches it shows different values, depending on the treatment, slightly decreasing in batch II and increasing in batch IV, remaining unchanged in batch III.

The total content of Na^+ (TNa) (mg/100 g fresh tissue) in the control batch has increased final values and different values in the other ones, depending on the applied treatment: high values in batch II and low ones in batches III and IV (Fig. 1—Na). Extracellular sodium (ENa) increases in the control batch and decreases in the treated ones. Intracellular sodium (INa) increases also in various degrees in the control, II and IV batches, and decreases in batch III.

Total potassium (TK) shows, in the control batch, a final value slightly decreased as compared with the initial one, yet higher than that of the T_1 moment (129.50%), while in the case of the treated batches, it also exhibits increased final values (Fig. 1—K). Extracellular potassium

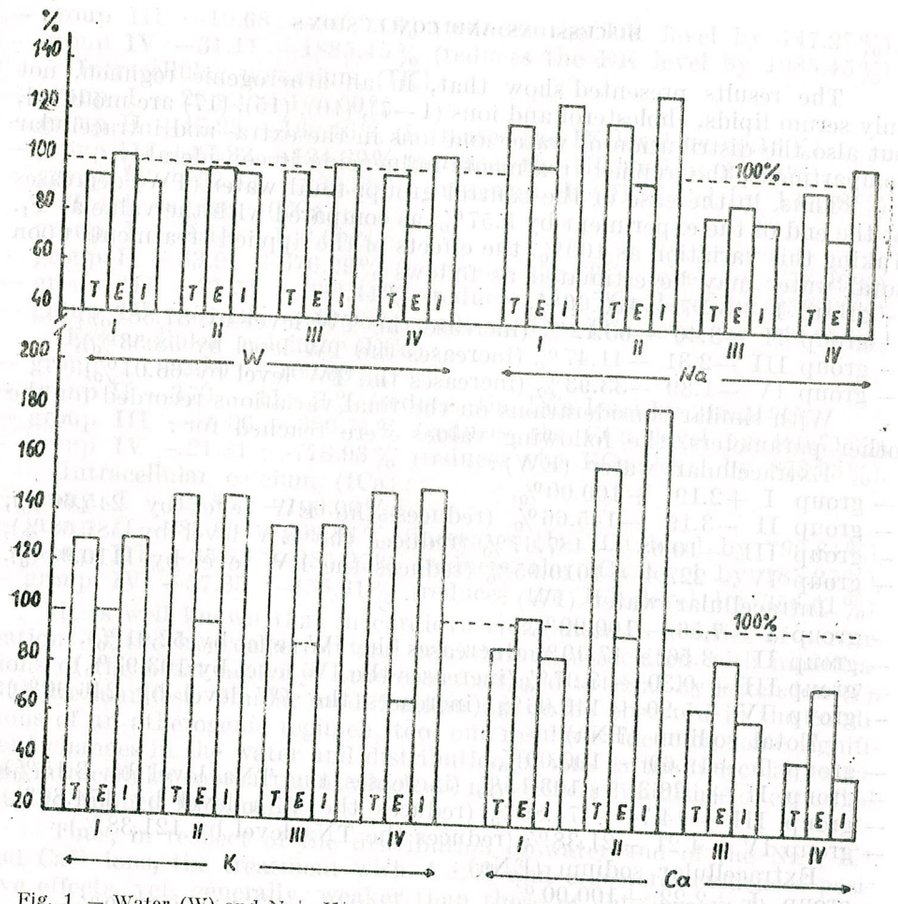

Fig. 1. — Water (W) and Na^+, K^+ and Ca^{2+} ion muscle distribution in rabbits subjected to an atherogenic regimen: untreated (I) treated with A.12.3 and ergosterol (II), with A.12.3 and rutacyl (III) or with chlofibrate (IV).
T — total; E — extracellular; I — intracellular (in % as compared with T_1 value).

(EK) increases in the control batch and decreases in the treated batches, in various degrees, depending on the applied treatment. Intracellular potassium (IK) similarly to total potassium shows, in the control batch, a final value lower than the initial one, yet higher than that of the T_1 moment. In the other batches, the final values are higher than those recorded at T_1, depending on the treatment applied to each batch.

Total calcium (TCa) in the muscle decreases in the control batch and also, in various degrees, in batches III and IV, while increasing in batch II (Fig. 1—Ca). However, extracellular calcium (ECa) exhibits higher final values in the control batch and slightly lower ones in the treated batches, while intracellular calcium (ICa) exhibits lower final values in the control, III and IV batches, and higher ones in batch II.

DISCUSSIONS AND CONCLUSIONS

The results presented show that, in an atherogenic regimen, not only serum lipids, cholesterol and ions (1—7), (10), (15), (17) are modified, but also the distribution of water and ions in the extra- and intracellular compartment, the applied treatments influencing it considerably.

Thus, in the case of the control group, total water (TW) decreases at the end of the experiment by 5.57%, as compared with the value at T_1. Taking this variation as 100%, the effects of the applied treatments upon total water may be estimated as follows :

— group I —5.57 —100.00%,
— group II —3.46 —63.12% (increase the TW level by 37.88%);
— group III —2.31 —41.47% (increases the TW level by 58.53%),
— group IV —1.89 —33.93% (increases the TW level by 66.07%).

With similar considerations on the final variations recorded for the other parameters, the following values were reached for :

Extracellular water (EW) :
— group I +2.19 +100.00%,
— group II —3.19 —145.66% (reduces the EW level by 245.66%),
— group III —10.68 — 487.67% (reduces the EW level by 587.68%),
— group IV —22.14 —1010.95% (reduces the EW level by 1110.95%).

Intracellular water (IW) :
— group I —7.56 —100.00%,
— group II —3.56 —47.09% (increases the IW level by 52.91%),
— group III + 0.30 + 3.97% (increases the IW level by 103.97%),
— group IV +5.20 +146.06% (increases the IW level by 246.06%).

Total sodium (TNa) :
— group I +19.69 +100.00%,
— group II + 20.31 +103.15% (increases the TNa level by 3.15%),
— group III —14.74 —74.86% (reduces the TNa level by 174.86%),
— group IV —4.21 —21.38% (reduces the TNa level by 121.38%).

Extracellular sodium (ENa) :
— group I +2.22 +100.00%,
— group II —3.19 —143.69% (reduces the ENa level by 243.69%).
— group III —10.68 —481.08% (reduces the ENa level by 581.08%),
— group IV —22.13 —996.84% (reduces the ENa level by 196.84%).

Intracellular natrium (INa) :
— group I +28.96 +100.00%,
— group II +33.23 +114.74% (increases the INa level by 14.74%),
— group III —16.68 —57.59% (reduces the INa level by 157.59%),
— group IV +6.18 +21.34 % (reduces the INa level by 78.66%).

Total potassium (TK) :
— group I +29.50 +100.00%,
— group II +47.00 +159.32% (increases the TK level by 59.32%);
— group III +36.49 +123.69% (increases the TK level by 23.69%),
— group IV +51.29 +173.86% (increases the TK level by 73.86%),

Extracellular potassium (EK) :
— group I +1.65 +100.00%,
— group II —3.43 —207.88% (reduces the EK level by 307.88%),

— group III —10.68 —647.27% (reduces the EK level by 747.27%),
— group IV —31.11 —1885.45% (reduces the EK level by 1985.45%).

Intracellular potassium (IK) :
— group I +29.92 +100.00%,
— group II +47.92 +160.16% (increases the IK level by 60.16%),
— group III +37.22 +124.39% increases the IK level by 24.39%),
— group IV +52.85 +230.58% (increases the IK level by 130.58%).

Total calcium (TCa) :
— group I —9.45 —100.00%,
— group II +63.91 +676.29% (increases the TCa level by 776.29%),
— group III —31.51 —333.44% (reduces the TCa level by 233.44%),
— group IV —51.12 —540.95% (reduces the TCa level by 440.95%).

Extracellular calcium (ECa) :
— group I +2.80 +100.00%,
— group II —3.31 —118.21% (reduces the ECa level by 218.21%),
— group III —10.66 —380.71% (reduces the ECa level by 480.71%),
— group IV —21.81 —778.93% (reduces the ECa level by 878.93%).

Intracellular calcium (ICa) :
— group I —12.56 —100.00%,
— group II +87.90 +699.84% (increases the ICa level by 799.84%),
— group III —35.83 —285.27% (reduces the ICa level by 185.27%),
— group IV —57.35 —456.61% (reduces the ICa level by 356.61%).

It is well known that in cardiovascular diseases a series of perturbations of the hydroelectrolytical equilibrium, associated with modifications of the heart activity, atherosclerosis and arterial hypertension (7), (11) are manifest. Similar modifications are to be observed in the conditions of an atherogenic regimen, too, our results evidencing some significant changes in the water and distribution of ions in the muscular extra- and intracellular compartment which are neverthless diminished or cancelled by the applied treatments.

Thus, in respect of the distribution of water and of the Na^+, K^+ and Ca^{2+} ions, the treatment with A.12.3 and ergosterol evidences positive effects, yet, generally, weaker than those of chlofibrate. The effects upon TCa and ICa are, nevertheless, stronger. The A.12.3 and rutacyl treatment has stronger effects than those of chlofibrate in the re-establishment of TNa (by 1.44 times) and INa (by 2.00 times), whereas the effects upon total, extra- and intracellular water, ENa, EK and ICa are similar to those exhibited by chlofibrate.

As a conclusion, the applied treatments have important positive effects upon the tissue distribution of water and ions.

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Received January 9, 1987

Biological Research Center,
Iași, Calea 23 August 20 A

LA PRODUCTION DU ZOOPLANCTON DANS LES LACS DE MATIȚA ET MERHEI (LE DELTA DU DANUBE) DANS L'INTERVALLE 1980—1983

V. ZINEVICI et LAURA TEODORESCU

La disparition des macrophytes submerses et l'installation du phénomène de la «floraison» alguale déterminent, à partir de 1981, d'importantes modifications dans la structure qualitative et quantitative du zooplancton des écosystèmes des lacs de Matița et Merhei. Ces modifications influencent d'une manière toute particulière l'équilibre écologique de l'écosystème de Merhei, fondé jusqu'en 1981 sur le développement massif de la végétation submerse et, dans une mesure plus réduite, celui de l'écosystème de Matița où les macrophytes étaient peu abondantes. Dans ces conditions, la dynamique annuelle (pour l'intervalle 1981—1983) du zooplancton c_1 présente un sens ascendant avec une augmentation importante en 1981 : de 2,13—18,12—34,15—36,65 g. substance sèche/m^2, dans le lac de Merhei et de 6,81—49,24—36,42—40,49 g/m^2 dans celui de Matița. La production annuelle du zooplancton c_2 de Matița présente un sens descendant (8,38—7,08—1,56—1,56 g/m^2) par rapport à celle de Merhei où l'évolution faiblement ascendante est maintenue (0,40—2,08—2,40—1,42 g/m^2).

La disparition des macrophytes submerses et l'installation du phénomène de « floraison » alguale déterminent, à partir de 1981, d'importantes modifications dans la structure qualitatives et quantitatives du zooplancton des écosystèmes des lacs de Matița et Merhei, localisés dans la zone fluviale du Delta du Danube. Le spectre taxonomique présente des diminutions successives, de 194 taxa (en 1980) à 68 (en 1983). Les formes phytophiles, de petite taille, dominantes auparavant, sont remplacées par des formes typiquement planctoniques de grosse taille. La densité numérique augmente de 4—8 fois. Ces changements affectent nottament l'équilibre écologiuqe de l'écosystème de Merhei, localisé dans un bassin ayant des profondeurs réduites (0,90—2,50 m) favorable au développement massif de la végétation submerse et, dans une mesure plus réduite, celui de l'écosystème de Matița où, dans les conditions des plus grandes profondeurs de l'eau (1,75—3,30 m), les macrophytes étaient moins abondantes.

Toutes ces modifications sont ressenties dans la dynamique des consommateurs zooplanctoniques primaires (c_1) et secondaires (c_2). Sous une forme concentrée, elles sont présentées dans ce travail.

MÉTHODES DE TRAVAIL

Les épreuves ont été prélevées mensuellement (l'intervalle avril—octobre) pendant 4 années (1980—1983) dans 3 stations, sur 3 horizons, pour chaque lac. La production a été déterminée au niveau d'espèce, en utilisant des méthodes graphiques (la méthode *Ilkowska-Stanczykowska* pour les larves véligères des lamellibranchiates, la méthode *Winberg* pour les rotiphères et la méthode *Winberg, Pechen et Suskina* pour les microcrustacées).

DISCUSSIONS

La dynamique annuelle de la production du zooplancton c_1 présente un sens ascendent, particulièrement évident dans le cas du lac de Merhei (2,13—18,12—34,15—36,63 g/m²). Dans le lac de Matiţa la production des années 1980, 1982 et 1983 s'inscrit dans une courbe ayant un sens similaire (6,88—36,42—40,49 g/m²) mais dont la valeur la plus élevée, qui a constitué d'ailleurs le maximum absolu du complexe de Matiţa-Merhei, a été enregistrée en 1981 (49,24 g/m²), ce qui a modifié d'une certaine manière la configuration de la courbe multiannuelle (tableau 1).

L'analyse des deux courbes met en évidence l'existence d'un décalage net entre les valeurs de l'année 1980 et celles des années 1981—1983, à la suite du bond enregistré en 1981 après lequel la production du zooplancton c_1 des lacs de Matiţa et Merhei augmente de 7,2 respectivement 8,5 fois.

Pour les 4 années ce sont seulement les valeurs de l'année 1980 qui sont comparables à celles antérieurement enregistrées dans d'autres zones du Delta (1), les autres étant évidemment plus grandes. De la sorte, si en 1980 la valeur de lac de Matiţa est 2,1 fois plus grande que la moyenne multianunelle des lacs de Roşu, Puiu, Porcu (3,19 g/m²) et celle du lac de Merhei 1,5 fois plus réduite, les valeurs annuelles des 3 ans suivants dans les deux lacs de la zone fluviale du Delta dépassent de 5,6—15,4 fois la moyenne multiannuelle des lacs mentionnés dans la zone maritime du Delta.

Dans son ensemble, la production c_1 du lac de Matiţa est 1,4 fois plus grande que celle de lac de Merhei.

La dynamique annuelle de la production c_1 présente des valeurs maximales en juillet (spécialement Matiţa), août et juillet (Merhei) et minimales pendant les mois froids. La valeur maximale absolue est de 23,85 g/m² pour Merhei et de 17,84 g/m² pour Matiţa.

L'analyse de la production au niveau des groupes taxonomiques met en évidence l'apport supérieur des cladocères (dans l'intervalle juillet—octobre), des rotiphères (avril—mai) et des copépodes (au cours de l'année toute entière mais particulièrement au commencement et à la fin de la période de végétation) (tableau 2).

Conformément à la pyramide trophique des écosystèmes aquatiques, la production des consommateurs zooplanctoniques secondaires de Matiţa et Merhei représente 13,98% respectivement 6,94% de la production des consommateurs primaires, au niveau des moyennes multiannuelles.

La production annuelle du zooplancton c_2 de Matiţa présente un sens descendant (8,38—7,08—1,56—1,56 g/m²) par rapport à celle de Merhei où, à part l'année 1983, une faible évolution ascendante est maintenue (0,40—2,08—2,40—1,42 g/m²) (tableau 1).

La moyenne multiannuelle de la production c_2 pour les lacs de Matiţa et Merhei est 10,8 respectivement 3,7 fois plus grande que celle des lacs de Roşu, Puiu et Porcu (0,43 g/m²) (1).

Dans son ensemble, la production c_2 du lac de Matiţa est 2,9 fois plus grande que celle de Merhei.

Tableau 1

La dynamique de la production mensuelle et annuelle (g substance sèche/m²) du zooplancton c_1 et c_2 des lacs de Matiţa et Merhei

Mois	Le lac de Matiţa — Année 1980	1981	1982	1983	$\bar{X}_a$	Le lac de Merhei — Année 1980	1981	1982	1983	$\bar{X}_a$
Consommateurs primaires (c_1)										
IV	0,14	0,16	1,61	1,25	0,79	0,40	0,08	0,76	1,72	0,74
V	0,59	0,43	0,18	5,49	1,67	0,29	0,51	5,79	2,50	2,27
VI	0,03	11,85	0,76	6,37	4,75	0,17	0,83	0,98	2,81	1,20
VII	2,67	17,84	5,00	17,31	10,71	0,29	2,78	3,63	23,85	7,64
VIII	1,66	7,98	10,78	1,49	5,48	0,28	7,63	17,99	1,78	6,92
IX	0,28	7,70	12,73	8,13	7,21	0,36	2,63	2,84	3,56	2,35
X	1,44	3,28	5,36	0,45	2,63	0,34	3,66	2,16	0,41	1,64
Σ	6,81	49,24	36,42	40,49	33,24	2,13	18,12	34,15	36,63	22,76
Consommateurs secondaires (c_2)										
IV	0,01	0,01	—	0,12	0,04	0,02	0,01	—	0,24	0,01
V	0,48	0,13	0,02	0,24	0,22	0,16	0,05	0,03	0,12	0,09
VI	0,13	5,36	0,49	—	1,50	0,03	0,15	1,01	0,47	0,42
VII	6,22	0,23	0,09	0,34	1,72	0,08	0,11	0,08	0,14	0,10
VIII	1,02	1,16	0,16	0,10	0,61	0,04	1,21	1,16	0,08	0,62
IX	0,37	0,15	0,79	0,45	0,44	0,06	0,52	0,10	0,34	0,26
X	0,15	0,04	0,01	0,31	0,13	0,01	0,03	0,02	0,03	0,02
Σ	8,38	7,08	1,56	1,56	4,65	0,40	2,08	2,40	1,42	1,58

Tableau 2

L'apport des groupes d'organismes (%) en niveaux trophiques, à la production zooplanctonique des lacs de Matiţa et Merhei

Année	Mois	c_1 Rot.	Lam.	Clad.	Cop.	c_2 Rot.	Clad.	Cop.
1	2	3	4	5	6	7	8	9
Le lac de Matiţa								
1980	IV	49,36	—	10,41	31,09	—	—	9,14
	V	15,00	—	14,49	25,61	29,76	—	15,14
	VI	12,03	0,88	16,21	55,06	1,67	—	14,15
	VII	17,23	0,01	10,70	2,07	69,23	—	0,76
	VIII	0,25	0,34	59,40	1,81	—	36,76	1,44
	IX	6,62	2,55	22,80	12,12	—	46,21	9,70
	X	44,26	2,62	15,67	27,99	0,79	8,60	0,07
1981	IV	74,57	—	1,18	20,76	3,49	—	—
	V	45,06	0,04	12,06	19,68	21,52	—	1,64
	VI	7,57	0,38	61,82	3,65	24,91	1,60	0,07
	VII	13,89	43,17	41,08	0,57	—	1,29	—
	VIII	11,06	—	64,19	12,06	0,27	10,17	2,25
	IX	4,74	—	82,82	10,56	0,69	0,69	0,50
	X	6,06	0,16	84,33	8,14	—	—	1,31
1982	IV	92,93	—	0,50	6,57	—	—	—
	V	4,76	0,24	0,03	94,14	0,04	—	0,79
	VI	26,60	8,10	39,77	9,78	4,93	10,65	0,17
	VII	10,50	2,63	81,08	3,95	—	1,59	0,25
	VIII	7,76	0,30	84,25	6,18	0,37	0,96	0,19
	IX	2,93	0,03	85,42	5,78	4,16	1,40	0,28
	X	0,37	—	96,55	2,93	—	—	0,15

1	2	3	4	5	6	7	8	9
	IV	14,83	—	39,13	37,02	3,48	—	5,54
	V	0,11	0,17	71,63	24,52	—	2,40	1,17
	VI	15,17	1,34	67,74	15,75	—	—	—
1983	VII	4,50	0,05	89,68	3,22	1,90	—	0,65
	VIII	8,17	—	46,74	31,72	7,16	6,21	—
	IX	9,92	—	29,01	55,86	3,98	—	1,23
	X	18,32	—	29,96	11,00	40,72	—	—
				Le lac de Merhei				
	IV	76,32	—	1,96	16,93	—	—	4,79
	V	27,38	—	7,68	28,67	28,23	—	8,04
	VI	10,40	0,03	22,85	52,02	—	—	14,70
1980	VII	5,23	0,24	44,89	27,10	2,71	—	19,83
	VIII	35,54	0,02	16,83	35,72	—	—	11,89
	IX	2,58	0,01	16,27	61,71	—	—	19,43
	X	27,33	0,05	11,23	60,18	—	—	1,21
	IV	57,46	—	2,92	28,90	0,77	—	9,95
	V	54,32	0,10	6,79	29,03	9,12	—	0,64
	VI	27,59	0,04	39,47	17,28	15,36	—	0,26
1981	VII	34,15	10,36	39,71	11,87	3,62	0,29	—
	VIII	29,25	—	41,25	15,85	11,52	—	2,13
	IX	11,23	—	52,56	19,71	12,92	—	3,58
	X	0,29	—	89,65	9,34	0,31	—	0,41
	IV	74,06	—	0,56	25,20	—	—	0,18
	V	92,65	0,01	0,54	6,26	0,54	—	—
	VI	10,50	0,21	26,88	11,45	36,72	13,05	1,19
1982	VII	8,62	0,03	69,83	19,22	—	0,49	1,81
	VIII	34,34	—	55,24	4,34	0,36	5,16	0,56
	IX	8,14	—	81,40	7,06	0,42	2,00	0,98
	X	0,30	—	93,45	5,31	—	—	0,94
	IV	16,29	—	39,80	31,03	4,73	—	8,15
	V	0,97	0,43	56,38	37,73	—	—	4,49
	VI	12,39	—	57,20	16,09	—	10,01	4,31
1983	VII	15,79	—	78,06	2,43	—	0,59	3,13
	VIII	6,86	—	62,65	26,23	—	—	4,26
	IX	22,50	—	54,08	14,76	4,09	—	4,57
	X	1,24	—	61,57	31,20	—	—	5,99

Rot. = Rotifera ; Lam. = Lamellibranchia ; Clad. = Cladocera : Cop. = copepoda

La dynamique annuelle de la production c_2 présente des valeurs maximales spécialement aux mois d'août (Merhei) et septembre (Matiţa) avec des valeurs minimales absolues au commencement et à la fin de la période de végétation ainsi qu'un minimum secondaire au cours de l'été. Le maximum mensuel absolu est de 6,2 g/m² pour Matiţa et de 1,2 g/m² pour Merhei.

L'analyse de la production c_2 des groupes taxonomiques montre un plus grand apport des rotiphères et cladocères dans le lac de Matiţa, des copépodes et rotiphères dans celui de Merhei (tableau 2).

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Reçu le 20 octobre 1988

Institut des Sciences Biologiques, Bucarest, Splaiul Independenţei 296

DIE STRUKTUR DER BENTHOS-ZOOZÖNOSEN AUS DER DONAU BEI CEATAL IZMAIL (km 80), IN DER ZEITSPANNE 1981—1985

VIRGINIA POPESCU-MARINESCU

Die Arbeit enthält Angabeen über die qualitative und quantiotative Struktur der Benthos-Zoozönosen (nummerische Dichte und Biomasse), beim Ceatal Izmail (km 80). Um das biozönotische Gleichgewcht klarer hervorzuheben wurden auch die Diversität und Echitabilität untersucht.

Die Untersuchungen über die qualitative und quantitative Struktur der Benthos-Zoozönosen aus der Donau bei Ceatal Izmail erlaubten uns, die Entwicklung der Populationen der einzelnen Arten, wie auch die der Zoozönosen in ihrer Gesamtheit während der Zeitspanne 1981—1985 zu verfolgen.

So konnte festgestellt werden, dass am rechten Donauufer mit schlammig-toniger Fazies die grösste Dichte sowohl hinsichtlich der Individuen, als auch derjenigen der Biomasse *Limnodrilus hoffmeisteri* und *Hypania invalida* besassen, die konstante Arten mit einer Frequenz von 97% bzw. 70% während der gesamten analysierten Zeitspanne darstellen (Tabelle 1 Abb. 1). Relativ hohe Werte, mit einer Frequenz von 48%, erreichte auch *Obesogammarus obesus*, eine Art, die das Bestreben

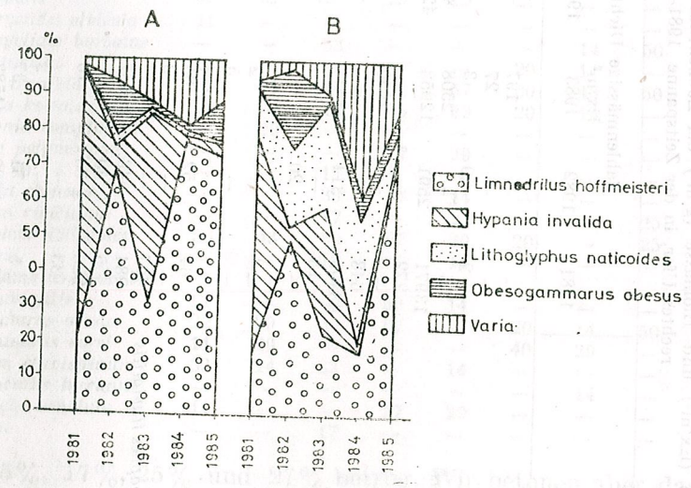

Abb. 1. — Abundenz der nummerischen Dichte (A) und Biomasse (B) der wichtigsten Arten der Benthos-Zoozönosen aus der Uferzone der Donau, beim Ceatal Izmail, in den Jahren 1981—1985.

hat, konstant zu werden (Tabelle 2). Bei diesen Arten wurde in den Jahren 1984—1985 eine Verringerung der nummerischen Dichte sowie der Biomasse beobachtet, was wir einigen Veränderungen abiotischer

Tabelle 1

Zahlenmässige Dichte (Ex/m²) und Biomasse (g/m²) der Zoobenthos-Organismen aus der Donau, in der Zone des Ceatal Izmail, rechtes Ufer, in der Zeitspanne 1981—1985 (Jahresmittelwerte)

Taxa	Zahlenmässige Dichte Ex/m²					Biomasse g/m²				
	1981	1982	1983	1984	1985	1981	1982	1983	1984	1985
Chlorohydra sp.	—	—	197	—	—	—	—	0,020	—	—
Planaria torva	—	—	27	—	—	—	—	0,005	0,001	0,002
Nematoda varia	—	—	3	—	—	—	—	—	—	—
Limnodrilus claparedeanus	2	29	—	424	42	—	0,001	1,462	0,385	0,059
Limnodrilus hoffmeisteri	—	—	2508	4266	1937	5,678	6,309	7,793	1,587	5,327
Psammoryctides albicola	13971	2591	12953	—	—	0,258	—	—	—	—
Psammoryctides barbatus	272	—	—	—	—	—	—	1,705	—	—
Tubifex tubifex	—	—	2650	—	—	0,333	—	—	—	—
Hypania invalida	648	—	—	57	100	18,443	0,329	12,004	0,068	0,065
Hypaniola kowalewskii	48409	314	22441	467	34	0,003	—	—	0,289	0,027
Glossiphonia complanata	18	—	—	—	—	—	0,114	—	—	—
*Dreissena polymorpha**	—	20	—	13	21	—	—	—	—	—
Pisidium sp.*	—	—	—	—	—	—	—	0,040	0,080	0,347
*Sphaerium corneum**	—	—	2	50	2	—	—	0,085	2,250	—
*Sphaerium riviculum**	—	—	5	—	1	—	—	0,002	—	0,008
*Lithoglyphus naticoides**	—	—	2	60	14	4,188	3,072	9,612	3,097	0,008
Jaera sarsi	64	52	85	—	6	—	—	0,002	—	0,287
Dikerogammarus haemobaphes fluviatilis	—	—	3	40	117	0,836	—	—	—	0,002
Obesogammarus obesus	407	—	—	103	312	0,854	2,583	—	0,217	0,162
Pontogammarus sarsi	284	646	657	—	—	0,017	0,149	0,439	0,497	0,487
Corophium curvispinum	5	40	—	—	6	0,138	0,080	—	—	—
Hydrepsyche ornatula	220	80	10	10	60	0,010	—	0,006	—	0,006
Bezzia sp.	33	—	—	—	—	—	—	—	0,042	0,352
Chironomidae varia	—	—	3	40	14	0,002	—	0,002	—	—
GESAMTZAHL	5	51	37	5537	2675	0,021	0,002	0,015	0,016	0,005
	64338	3823	41583			30,760	12,658	33,190	8,529	7,144

* Das Gewicht der Molusken schliesst das Gewicht der Schalen ein.

Faktoren, wie der Strömungsgeschwindigkeit und der Beschaffenheit des Substrates, zuschreiben. Ein gewisser Anteil in der Zusammensetzung der Biozönose des rechten Donauufers kam auch *Lithoglyphus naticoides* zu, eine konstante Art mit einer Frequenz von 56%, die eine geringere nummerische Dichte, aber wegen dem Gewicht ihrer Schalen eine höhere Biomasse aufwies.

In der Flussmitte bilden die Arten *Limnodrilus hoffmeisteri*, *Hypania invalida*, *Lithoglyphus naticoides*, *Obesogammarus obesus* und *Pontogammarus sarsi* die Komponenten der Benthos-Zoozönose, die einen grösseren Anteil haben (Tabelle 3), wobei ihre Häufigkeit in den Jahren 1981—1985

Tabelle 2

Frequenz (%) der Zoobenthos-Organismen aus der Donau, in der Zone des Ceatal Izmail, in der Zeitspanne 1981—1985.

Taxa	rechtes Ufer					Mitte				
	1981	1982	1983	1984	1985	1981	1982	1983	1984	1985
Chlorohydra sp.	—	—	17	—	—	—	—	—	—	—
Planaria torva	—	—	50	17	14	—	—	—	—	—
Limnodrilus claparedeanus	—	—	33	50	14	—	—	—	—	—
Limnodrilus hoffmeisteri	100	86	100	100	100	60	100	100	75	—
Nais bretscheri	—	—	—	—	—	—	—	—	100	33
Nais pardalis	—	—	—	—	—	—	—	—	—	17
Psammoryctides albicola	11	—	—	—	—	—	—	—	—	17
Psammoryctides barbatus	—	—	33	—	—	—	14	50	50	—
Tubifex tubifex	11	—	—	—	—	20	14	—	—	—
Hypania invalida	89	71	100	33	57	80	43	50	—	—
Hypaniola kowalewskii	22	—	17	66	29	20	14	—	—	—
Glossiphonia complanata	—	29	—	—	—	—	—	—	—	—
Dreissena polymorpha	—	—	—	17	29	—	—	—	—	—
Pisidium sp.	—	—	17	—	—	—	—	—	—	—
Sphaerium corneum	—	—	33	17	14	—	—	—	—	—
Sphaerium riviculum	—	—	17	—	14	—	—	25	—	—
Lithoglyphus naticoides	56	43	83	67	29	20	—	25	25	17
Jaera sarsi	—	—	17	—	14	—	—	—	—	—
Dikerogammarus haemobaphes fluviatilis	11	—	—	50	14	—	—	—	—	17
Obesogammarus obesus	22	29	50	67	71	20	14	50	—	40
Pontogammarus sarsi	11	29	—	—	—	40	29	—	50	17
Corophium curvispinum	33	14	33	—	14	—	—	—	—	—
Caspihalacarus hircanus	—	—	—	—	—	—	14	—	—	—
Hydropsyche ornatula	11	—	—	17	29	—	—	—	—	—
Bezzia sp.	—	—	17	—	—	—	—	—	25	17

79%, 35%, 17%, 25% und 27% betrug. Wir betonen aber, dass *Limnodrilus hoffmeisteri* die Hauptkomponente der Zoozönose und die einzige konstante Art ist (Abb. 2). Gleichzeitig führen wir an, dass die geringen Mengen der zoobenthonischen Organismen aus der Flussmitte den Einfluss der grösseren Strömungsgeschwindigkeit des Wassers deutlich zeigen (1), im Vergleich zu denjenigen am Ufer mit einer vorherrschend sandigen und etwas sandigschlammigen Fazies.

Aus der Zusammensetzung der Zoozönosen des Ceatal Izmail, ganz besonders am Ufer, fiel in den Jahren 1983—1985 die Anwesenheit der

Tabelle 3

Zahlenmässige Dichte (Ex/m²) und Biomasse (g/m²) der Zoobenthos-Organismen aus der Donau, in der Zone des Ceatal Izmail, aus der Donaumitte, in der Zeitspanne 1981—1985 (Jahresmittelwerte)

Taxa	Zahlenmässige Dichte Ex/m²					Biomasse g/m²				
	1981	1982	1983	1984	1985	1981	1982	1983	1984	1985
Nematoda varia	—	—	325	—	—	—	—	0,010	—	—
Limnodrilus claparedeanus	—	—	—	77	—	—	—	—	0,053	—
Limnodrilus hoffmeisteri	100	483	243	108	7	0,038	0,453	0,201	0,086	0,005
Nais bretscheri	—	—	—	—	20	—	—	—	—	0,005
Nais pardalis	—	—	—	—	20	—	—	—	—	0,005
Psammoryctides barbatus	—	214	132	40	—	—	0,143	0,072	0,016	—
Tubifex tubifex	28	9	—	—	—	0,011	0,003	—	—	—
Hypania invalida	256	74	1760	—	—	0,120	0,063	0,954	—	—
Hypaniola kowalewskii	8	329	—	—	—	0,001	0,197	—	—	—
*Sphaerium riviculum**	—	—	5	—	—	—	—	0,008	—	—
*Lithoglyphus naticoides**	4	—	60	5	30	0,212	—	3,755	3,310	1,355
Dikerogammarus haemobaphes fluviatilis	—	—	—	—	390	—	—	—	—	0,473
Obesogammarus obesus	28	3	195	—	1090	0,188	0,090	0,672	—	1,459
Pontogammarus sarsi	408	11	—	225	17	1,050	0,046	—	0,915	0,084
Caspihalacarus hircanus	—	3	—	—	—	—	0,001	—	—	—
Hydropsyche ornatula	—	—	—	—	16	—	—	—	—	0,086
Bezzia sp.	—	—	—	10	—	—	—	—	0,008	—
Chironomidae varia	4	3	—	5	10	0,001	0,001	—	0,002	0,002
Diptera varia	—	—	—	5	—	—	—	—	0,003	—
GESAMTZAHL	836	1129	2720	475	1609	1,621	0,916	5,674	4,393	3,474

* Das Gewicht der Molusken schliesst das Gewicht der Schalen ein.

Wir danken folgenden Spezialisten für die ausgeführten Bestimmungen: Maria Năstăsescu — Coelenterata, Turbellaria und Hirudinea; Fr. Botea und I. Diaconu — Oligochęta; I. Gruia — Lamellibranchia; Alexandrina Negrea — Gastropoda; PO. Ciolpan — Amphipoda.

Arten *Sphaerium corneum* und *S.rivicolum* auf, doch mengenmässig waren sie weniger relevant und von geringerem Körperausmass (die betreffenden Lamellibrancheaten aus der Zone des Eisernes Tores haben nach Schaffung des Stausees eine stürmische Entwicklung erfahren) (2).

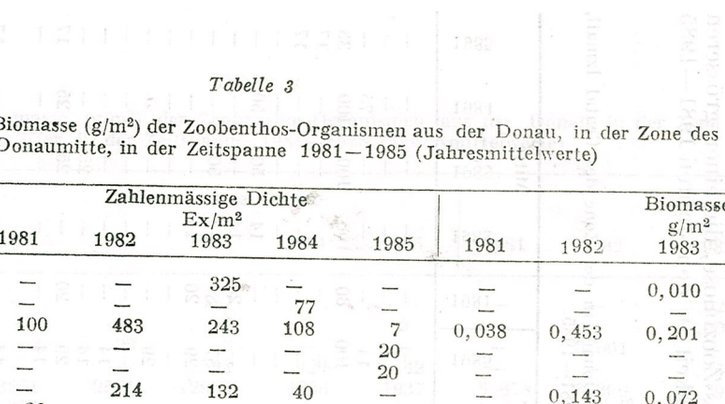

Abb. 2. — Abundenz der nummerischen Dichte (A) und Biomasse (B) der wichtigsten Arten der Benthos-Zoozönosen aus der Donaumitte, beim Ceatal Izmail, in den Jahren 1981—1985.

Ein klares Bild betreffend das biozönotische Gleichgewicht wird aber noch besser von den Diversitäts- (H') und Echitabilitätsindices (e) (Tabelle 4) gegeben. Analysiert man ganz besonders die Echitabilitätsindices, so geht hervor, dass diese in den letzten 5 Jahren am rechten Ufer zwischen weiten Grenzen schwankten, was auf eine Instabilität der Biozönose hindeutet. Wir möchten darauf hinweisen, dass im Falle des Werles 1 dieser Kennziffer (Juli 1981) die Zoozönose von der monospezifischen Population des *Limnodrilus hoffmeisteri* gebildet war. Diese Art wies eine stürmische Entwicklung auf und machte was die Frequenz anbelangt 98,91% der Gesamtheit der Individuen der Zoozönose aus, wobei die Indices der Echitabilität 0,0474 (September 1982) und 0,0867 (Oktober 1985) betrugen.

Die Anwesenheit der monospezifischen Population von *Limnodrilus hoffmeisteri* in der Flussmitte während den Jahren 1981—1985, häufig frühlings und sommers, was einem Diversitätsindex von 0 entspricht, wie auch die starke Schwankung der Echitabilitätsindices, deuten auf eine starke saisonbedingte Umgestaltung der Zoozönose hin.

Die allgemeinen Schlussfolgerungen, die sich aus unseren Untersuchungen ergeben, weisen darauf hin, dass die Benthos-Zoozönosen am rechten Donauufer beim Ceatal Izmail reichhaltiger sind, als in der Flussmitte und dass die strukturellen Veränderungen in der Flussmitte dank der hydrodynamischen Eigenheiten des Flussbettes tiefgreifender sind.

Tabelle 4

Diversität (H′) und Echitabilität (e) der Benthos-Zoozönosen aus der Donau beim Ceatal Izmail, in der Zeitspanne 1981—1985

Index	Jahr	Monat IV	V	VI	VII	VIII	IX	X
				rechtes Ufer				
H′	1981	−1,2231	−0,9667	−1,0095	0	−0,8434	−1,5875	−0,4222
	1982	−0,7670	−1,7453	−0,5654	−1,5530	−0,6823	−0,0947	−0,6255
	1983	−0,9826	−1,8606	−0,8733	−0,2986	−1,4680	−0,9790	—
	1984	−2,3566	—	−1,8599	−1,9383	−2,3137	−0,6305	−1,1514
	1985	—	0	−1,6746	−2,0606	−2,1626	−0,3591	−0,0867
e	1981	0,5268	0,4163	0,4348	1	0,8434	0,6141	0,1818
	1982	0,3835	0,8727	0,2827	0,7765	0,3412	0,0474	0,3128
	1983	0,4232	0,6627	0,2755	0,1493	0,4419	0,3787	—
	1984	0,9116	—	0,9300	0,8348	0,8241	0,2439	0,4959
	1985	—	1	0,6478	0,7971	0,6510	0,3591	0,0867
				Mitte				
H′	1981	—	—	—	—	−0,7219	−0,1930	−1,7457
	1982	0	−1,9998	−1,5610	0	−0,6033	−1,1198	−0,9159
	1983	—	—	−1,1069	0	−0,4395	−1,0567	—
	1984	—	—	−0,5916	—	−0,9999	−1,6297	−1,3314
	1985	—	0	—	0	−1,1972	0	−0,7219
	1981	—	—	—	—	0,7219	0,1930	0,7518
	1982	1	0,9999	0,9849	1	0,3806	0,7065	0,5779
	1983	—	—	0,4282	1	0,4395	0,5284	—
	1984	—	—	0,5916	—	0,9999	0,5805	0,6657
	1985	—	1	—	1	0,4264	1	0,7219

Anmerkung: War die Zoobenthos-Assoziation monospezifisch und die Diversität 0, so betrachteten wir die Echitabilität als 1.
Die Indice H′ und e wurden aufgrund der nummerischen Dichte der Taxa bestimmt.

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Eingegangen am 20. Oktober 1988

Institut für Biologische Wissenschaften, Bukarest, Splaiul Independenței, 296

STRUKTURELLE ASPEKTE BETREFFEND DIE ROTIFEREN AUS DER DONAU BEI IHREM EINTRITT INS DELTA (RUMÄNISCHER ABSCHNITT) IN DER ZEITSPANNE 1981—1985

ELENA PRUNESCU-ARION

In der vorliegenden Arbeit werden einige Betrachtungen angestellt über die Rotiferen, die Hauptgruppe, die an der Bildung der Plankton-Biozönose der Donau bei ihrem Eintritt ins Delta (Ceatal Izmail km 80, und Ceatal Sf. Gheorghe km 62) teilnimmt. Als charakteristische Parameter werden die zahlenmässige Dichte der Taxa (Ex/m³) sowie die strukturellen Indices, wie Dichte (H′), Echitabilität (e) in Betracht gezogen.

Die vorliegende Arbeit bezieht sich auf eine der Gruppen, welche die zooplanktische Biozönose der Donau bei ihrem Eintritt ins Delta (Ceatal Izmail, km 80 und Ceatal Sf. Gheorghe, km 62) bildet, eine bedeutende Gruppe aus der Biozönose, welche neben den anderen zooplanktonbildenden Gruppen zur Aufrechterhaltung der Integralität und Funktionabilität desselben beitragen.

Die an den Rotiferen der beiden Abschnitte während den Jahren 1981—1985 ausgeführten Untersuchungen erlauben es, aufgrund der nummerischen Dichte der Taxa (Ex/m³ — Jahresmittelwert) sowie auch der beiden strukturellen Indices, wie Diversität (H′) und Echitabilität (e) eine Reihe von Betrachtungen vorzunehmen.

Die zahlenmässige Dichte der wichtigsten Taxa zeigt keine bezeichnenden Unterschiede von einem Abschnitt zum anderen auf, während die Vorherrschaft in beiden Abschnitten die folgenden Arten innehaben *Brachionus angularis*, *Br. budapestinensis*, *Br. calyciflorus* var. *amphyceros*, *Br. calyciflorus* f. *anuraeiformis*, *Br. calyciflorus* var. *dorcas*, *Br. calyciflorus* f. *spinosa*, *Keratella cochlearis*, *K. quadrata*.

Was die Zusammensetzung der übrigen Taxa anbelangt, so war sie, mit geringen Unterschieden, ähnlich in den beiden Abschnitten.

Hervorzuheben ist die Tatsache, dass die Gesamtheit der zahlenmässigen Dichte mit Ausnahme des Jahres 1981 — im Ceatal Sf. Gheorghe, in den übrigen Jahren kleiner ist, im Vergleich zum Ceatal Izmail.

Wenn wir uns auf die Indices der Diversität und Echitabilität beziehen (Tabelle 3), so beobachtet man in engen Grenzen gehaltene Schwankungen besonders beim Echitabilitätsindex, was auf eine Stabilität der Rotiferen im Rahmen der planktischen Zoozönose hindeutet.

Wir zeigen dennoch auf die im Juli 1985 in den beiden Abschnitten beobachteten Daten hin. Die damals erzielten kleineren Werte des Echitabilitätsindexes zeigen auf eine etwas ausgeprägtere saisonbedingte Schwankung hin, als länger andauerendes Hochwasser eine Verdünnung der Rotiferenmenge pro m³ verursachte.

Die oben dargelegte allgemeine Lage der Rotiferen aus der Donau bei ihrem Eintritt ins Delta ist in vollkommener Übereinstimmung mit den Ergebnissen, die bei der Analyse anderer struktureller Faktoren der Biozönose, wie Häufigkeit und Beständigkeit in der Vorherrschaft erhalten wurden und früher veröffentlicht worden sind (1), (2).

REV. ROUM. BIOL. — BIOL. ANIM., TOME 34, Nº 1, P. 49—52, BUCAREST, 1989

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Tabelle 1

Zahlenmässige Dichte (Ex/m³) der wichtigsten Taxa der Rotiferen aus der Donau beim Ceatal Izmail in der Zeitspanne 1981—1985 (Jahresmittelwert)

Taxa	1981	1982	1983	1984	1985
Asplanchna herricki	379	586	1050	171	—
Asplanchna priodonata	519	331	64	614	386
Asplanchna sp.	210	97	79	86	—
Brachionus angularis	3536	2433	4464	1464	18007
Brachionus bennini	86	311	86	114	786
Brachionus budapestinensis	1288	960	2879	1671	18577
Brachionus calyciflorus	729	1491	2036	1050	1200
Brachionus calyciflorus var. *amphiceros*	1860	1607	2764	1743	2736
Brachionus calyciflorus f. *annuraeiformis*	2003	732	1500	1450	1467
Brachionus calyciflorus var. *dorcas*	—	124	322	1000	1836
Brachionus calyciflorus f. *spinosa*	2962	2450	6979	15807	12093
Brachionus diversicornis	141	29	64	79	86
Brachionus falcatus	—	461	286	29	121
Brachionus quadridentatus	186	81	207	179	36
Brachionus quadridentatus brevispinus	—	11	57	350	571
Brachionus quadridentatus, cluniorbicularis	1338	573	257	486	143
Brachionus leydigi	—	71	14	29	—
Brachionus leydigi tridentatus	—	141	286	114	86
Brachionus urceus	311	252	586	193	279
Brachionus urceus sericus	—	345	186	71	143
Epiphanes macrourus	4988	787	943	1236	229
Filinia longiseta	364	371	179	—	14
Filinia terminalis	653	888	236	207	314
Filinia sp.	—	—	443	379	71
Kellicottia longispina	279	—	—	121	29
Keratella cochlearis	22685	3604	2321	750	14714
Keratella quadrata	3918	9197	4429	4937	2936
Keratella valga	13129	1020	443	—	929
Notholca acuminata	25	129	29	43	14
Notholca squammula	50	—	—	29	—
Ploesoma sp.	12679	1721	—	114	71
Polyarthra remata	8259	121	1621	250	443
Synchaeta grandis	2818	107	814	171	—
Synchaeta oblonga	1068	137	250	—	471
Synchaeta sp.	3965	241	57	279	571
Testudinella patina	376	595	57	43	157
Testudinella sp.	100	86	57	321	—
Trichocerca iernis	—	507	14	107	764
Trichocerca pusilla	12370	304	—	—	38
Trichocerca sp.	1148	1510	36	100	693
Varia*	1802	1207	6940	23749	1942
	106224	35618	43035	59536	82933

* In der Gruppe Varia sind folgende Taxa enthalten : *Asplanchna brightwelli, Asplanchna agilis, A. clavula, Branchionus angularis aestivus, Br. angularis bidens, Br. forficula, Br. forficula inegalis, Br. quadridentatus mehleni, Br. leydigi quadridentatus, Br. leyidigi rotundus, Br. plicatilis, Cephalodella catellina,* C. sp., *Colurella colurus, Encentrum* sp., *Euchlanis deflexa, E. dilatata, Hexarthra fenica* v. *oxyuris, H. mira, Lecane luna, Notholca* sp., *Platyas quadricornis, Pompholyx complanata, P. sulcata, Proales* sp., *Polyarthra longiremis, P.* sp., *Trichocerca cylindrica, Tr. rattus, Tr. similis, Tr. stylata* etc.

Tabelle 2

Zahlenmässige Dichte (Ex/m³) der wichtigsten Taxa der Rotiferen aus der Donau Ceatal Sf. Gheorghe in der Zeitspanne 1981—1985 (Jahresmittelwert)

Taxa	1981	1982	1983	1984	1985
Asplanchna herricki	—	360	879	367	—
Asplanchna priodonta	798	339	—	25	379
Asplanchna sp.	1202	7	2714	6578	664
Brachionus angularis	4716	2191	2579	6775	664
Brachionus bennini	21	263	150	92	157
Brachionus budapestinensis	915	783	1836	1167	9889
Brachionus calyciflorus	929	1058	1829	967	636
Brachionus calyciflorus var. *amphyceros*	1971	503	329	842	279
Brachionus calyciflorus f. *anuraeiformis*	1505	1110	1779	758	771
Brachionus calyciflorus var. *dorcas*	—	1190	257	1091	536
Brachionus calyciflorus f. *spinosa*	2294	2719	3750	11183	5257
Brachionus diversicornis	71	29	—	150	29
Brachionus falcatus	—	157	64	—	—
Brachionus quadridentatus	71	89	136	150	29
Brachionus quadridentatus brevispinus	—	107	—	33	136
Brachionus quadridentatus cluniorbicularis	288	602	193	267	164
Brachionus leydigi tridentatus	—	33	150	100	14
Brachionus urceus	266	386	271	67	100
Brachionus urceus sericus	219	21	136	—	14
Epiphanes macrourus	3714	600	—	5400	1800
Filinia longiseta	—	36	—	225	36
Filinia terminalis	1196	132	229	100	86
Kellicottia longispina	286	57	100	125	86
Keratella cochlearis	26869	3292	2543	1058	1743
Keratella quadrata	5106	4412	5250	5333	2950
Keratella valga	15150	326	850	—	57
Notholca acuminata	50	24	279	50	14
Notholca squammula	—	125	21	—	14
Platyas patulus	71	14	—	—	36
Polyarthra dolichoptera	17115	1265	350	—	29
Polyarthra remata	7153	150	529	458	171
Synchaeta grandis	2379	—	493	—	—
Synchaeta oblonga	357	—	921	—	229
Synchaeta sp.	9408	24	57	—	214
Testudinella patina	—	884	—	500	314
Testudinella sp.	410	307	93	42	14
Trichocerca iernis	—	—	—	—	607
Trichocerca pusilla	13805	29	—	25	221
Trichocerca rattus	1835	870	—	—	7
Trichocerca sp.	—	14	50	533	53
Varia*	1413	1013	3733	9024	13073
	121583	25521	30550	47485	40808

* In der Gruppe Varia sind folgende: Taxa enthalten : *Asplanchna agilis, Asplanchna brightwelli, Asplanchnopus multiceps, Bdelloidea, Brachionus angularis aestivus, Br. angularis angularis, Br. angularis bidens, Br. dimidiatus, Br. diversicornis homoceros, Br. forficula Br. forficula inegalis, Br. leydigi, Br. leydigi rotundus, Br. quadridentatus mehleni, Br. plicatilis, Br. urceus urceus, Cephalodella* sp., *Euchlanis deflexa, Euchlanis* sp., *Filinia limnetica, Lecane luna, Hexarthra fenica oxyuris, Lepadella* sp. *Keratella valga monospina, K. valga heterospina, Ploesoma truncatum, Pl.* sp., *Pompholyx sulcata, P. sp., Proales* sp., *Polyarthra euryptera, P. longiremis.*

Tabelle 3

Diversität (H′) und Echitabilität (e) der Rotiferen aus der Donau beim Ceatal Izmail und Ceatal Sf. Gheorghe in der Zeitspanne 1981—1985

Indices	Jahr	Monat						
		IV	V	VI	VII	VIII	IX	X
		Ceatal Izmail						
H′	1981	−5,1653	−2,0709	−3,0917	−2,5649	−2,9283	−2,6290	−2,1317
	1982	−3,3983	−3,1349	−3,0538	−3,3239	−2,9956	−3,4674	−2,9346
	1983	−3,2817	−3,5266	−3,6046	−3,6166	−3,2352	−3,3963	−3,5202
	1984	−2,5174	−3,4605	−2,5027	—	−3,6797	−2,2486	−2,9542
	1985	−2,2144	−1,9849	−3,1714	−2,3476	−2,8206	−2,3669	−2,7502
H′	1981	0,7103	0,5776	0,6834	0,6038	0,7022	0,5985	0,6417
	1982	0,7317	0,6593	0,7323	0,8132	0,6622	0,7665	0,8834
	1983	0,7254	0,7918	0,8340	0,7995	0,7365	0,7064	0,9010
	1984	0,5824	0,7878	0,5532	—	0,7923	0,4677	0,9319
	1985	0,5310	0,5975	0,9167	0,4883	0,6639	0,5307	0,7432
		Ceatal Sf. Gheorghe						
H′	1981	−2,4576	−2,7199	−2,9415	−1,9875	−2,9977	−2,6848	−2,4968
	1982	−3,4153	−3,1605	−3,6697	−4,9221	−3,1562	−3,4050	−2,2337
	1983	−3,1479	−3,5452	−3,5827	−3,6930	−3,0748	−3,4801	−3,4967
	1984	−2,3008	−2,9060	−2,3131	—	−2,7582	−2,5888	−2,2573
	1985	−2,5330	−2,3118	−3,2047	−1,9101	−2,4180	−2,2131	−2,3028
H′	1981	0,6012	0,6799	0,7054	0,5546	0,6936	0,6212	0,6964
	1982	0,8190	0,6646	0,9333	0,8802	0,8078	0,7521	0,8641
	1983	0,7059	0,7949	0,8765	0,8856	0,7687	0,7693	0,8741
	1984	0,5889	0,6841	0,5352	—	0,6614	0,5805	0,7326
	1985	0,6197	0,7672	0,9263	0,4419	0,5594	0,5187	0,8908

* Die Indices H′ und e wurden aufgrund der zahlenmässigen Dichte der Taxa bestimmt.

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Eingegangen am 20. Oktober 1988

Institut für biologische Wissenschaften Bukarest, Splaiul Independenței 296

DIE ENTWICKLUNG DES BAKTERIELLEN PLANKTONS UND BENTHOS AUS DEM STAUSEE EISERNES TOR I IN DER ZEITSPANNE 1975—1986

DORINA NICOLESCU

Es wird der Gehalt an Bakterien aus der Donau (in der Zone des Stausees Eisernes Tor I) in der Zeitspanne 1975—1986 analysiert. Die vorliegende Arbeit zeigt die Entwicklung der heterotrophen Mikroorganismen aus den Wasser und dem Sediment und gibt auch die Gründe an, die diese Entwicklung verursacht haben.

Die ökologischen Unterschungen der Mikroorganismen der Donau in der Zone des Stausees Eisernes Tor I wurden beginnend mit dem Jahre 1975 ausschliesslich von dem Institut für biologische Wissenschaften aus Bukarest unternommen. Die Untersuchungen betrafen den Gehalt der Bakterien aus dem Wasser und den Ablagerungen sowie auch einige physiologischen Mikroorganismengruppen, die im Kreislauf wichtiger Elemente, wie N, C, S mitinbegriffen sind, um einerseits eine bedeutende, noch wenig studierte trofische Basis — die Mikroorganismen — von Wichtigkeit für die folgenden Glieder der trophischen Kette, hervorzuheben und andererseits die Zersetzbarkeit und Mineralisierungsfähigkeit der autochtonen und alochtonen organischen Stoffe aus der Donau festzustellen.

Die im Laufe von 11 Jahren ausgeführten Untersuchungen, erlaubten es uns, das Auftreten, die Entwicklung und die „Stabilisierung" einiger Bakterien-Gesellschaften in dem geschaffenen Ökosystem festzustellen sowie auch einige Prognosen auszuarbeiten.

Die in diesem Abschnitt der Donau wegen dem Bau des Wehrs eingetretenen Umwandlungen sowie dessen Folgen, wie : die Entstehung des Stausees (Veränderung des hydrologischen Haushaltes), die Besetzung neuer Oberflächen, Veränderungen im Chemismus des Wassers sowie auch der Beitrag der Nebenflüsse unter den Bedingungen des veränderten hydrologischen Haushaltes, führten zum Auftreten von bakteriellen Gesellschaften, die diesem neugebildeten Ökosystem eigen sind. So führten die vom hydroenergetischen System auferlegten physiohydrographischen und physiologischen Bedingungen zu einer Aufgliederung des Stausees Eisernes Tor I mit einer mehr oder weniger individuellen Evolution (Buchte).

Die vorliegende Arbeit bezieht sich auf die Entwicklung der heterotrophen Mikroorganismen aus dem Wasser und den Ablagerungen, die auf Gelose-Nahrböden bei 22°C aus drei transversalen Profilen : Mraconia (Km. 967), Cerna (Km.954), Bahna (Km.950) bestimmt wurden und sowohl aus den Buchten, als auch aus dem alten Flussbett der Donau (Mitte) herstammten.

Die in der Zeitspanne 1975—1986 ausgeführten Untersuchungen bewiesen, dass der Bakteriengehalt dieser Zone sowohl das Ergebnis des Beitrags der flussaufwärts gelegenen Zone der Donau (siehe Profil Mraco-

nia-Mitte) (Abb. 1) mit dem Beitrag der Zuflüsse ist, als auch den autochtonen Bedingungen der organischen Belastung in den Perioden, die auf die „Wasser blüte" folgen, zuzuschreiben ist.

Die zahlenmässige Darstellung der Entwicklung der heterotrophen (zersetzenden) Mikroorganismen aus Abb. 1 ist ein Beredter Beweis für einige Gesamtaspekte, wie :

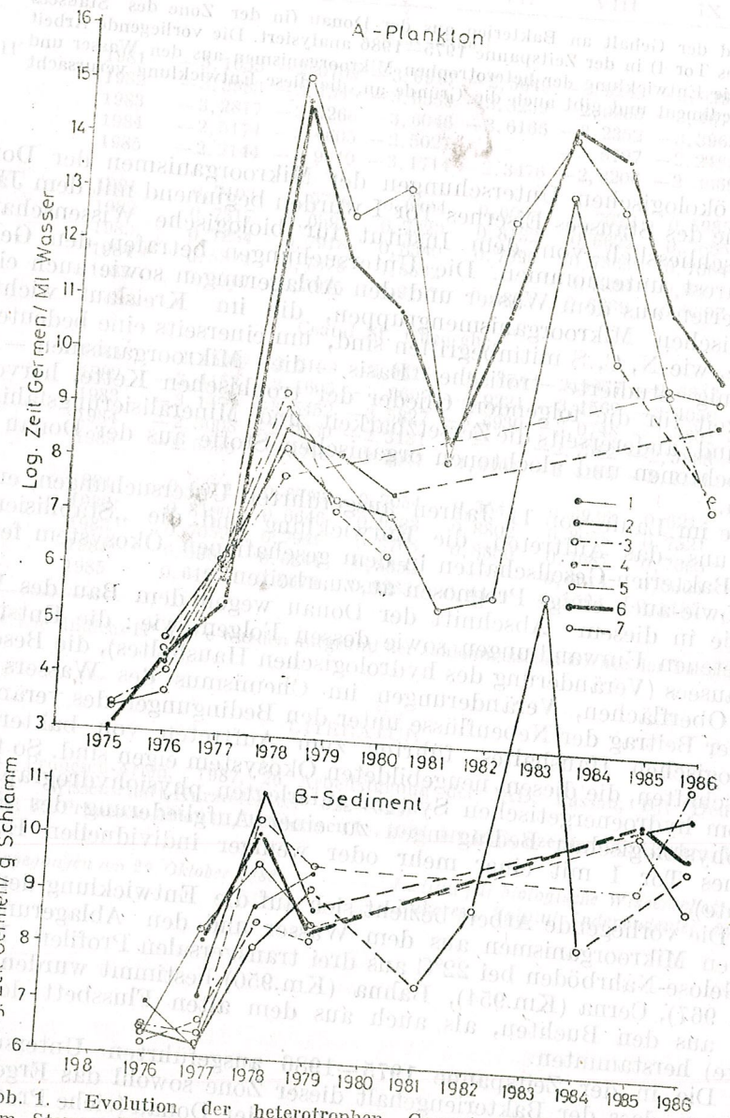

Abb. 1. — Evolution der heterotrophen Gesamtmikroorganismen aus dem Stausee Eisernes Tor I: 1. Macronia (Donau); 2. Cerna (Donau); 3. Bahna (Donau); 4. Mraconia (Bucht); 5. Cerna 1 (Bucht); 6. Cerna 2 (Bucht); 7. Bahna (Bucht).

— Tendenz einer Steigerung der zahlanmässigen Dichte der Mikroflora vom Jahre 1975 angefangen zum Jahre 1986 hin und dieses sowohl im Wasser, als auch im Sediment (3);

— Feststellung einer zyklischen Entwicklung der zersetzanden Mikroflora in inhrer Gesamtheit mit einer Periodizität von ungefähr 5 Jahren und Maxima in den Jahren 1978 und 1983; zu bemerken ist die Tatsache, dass sich die Jahre 1984—1986 im absteigenden Abschnitt der Kurve befinden, ähnich der in den Jahren 1979—1981 aufgetretenen Erscheinung (3);

— Hochstwerte in der Cerna-Bucht (die standig unter menschlichem Impakt stand) beginnend mit dem Jahre 1977 und in der Bahna-Bucht in den Jahren 1982—1983 (nach Praktizierung der Aquakultur), was auf die Individualität der Entwicklung der Buchte in der Gesamtheit des Sees hindeutet.

Die Analyse des longitudinalen Profils, flussabwärts, entlang des gewesenen Donaulaufes (Flussmitte) (in Richtung Mraconia-Cerna-Bahna) hebt eine zeitliche Entwicklung des bakteriellen Planktons und Benthos hervor, die sich in den Jahren 1976—1977 von der aus den Jahren 1978—1986 unterscheidet und ein Ansteigen der Werte erkennen lässt. So beobachtet man in den ersten Jahren mit der Uberschwemmung neuer Oberflächenhöhere Werte in der flussabwärts gelegenen Zone (Bahna), im Vergleich zu Mraconia, dem am weitesten flussaufwärts gelegen Punkt (1). Vom Jahre 1978 an ändert sich das Verhältnis und zwar befinden sich nun die höchsten Werte flussaufwärts, erlärber sowohl durch das Anwachsen der mikrobiellen Belastung der Donau in disser Zone, als auch durch die Beschleunigung des Ablagerungsprozesses der kleinen Partikel in der flussabwärts gelegenen Zone und durch die Anlagerung der Mikroorganismen an diese Suspensionen mit dem Bestreben Suspensionen-Bakterien Agregate zu bilden (2). Übrigens geht aus Abb. 1 B das Anwachsen der zahlenmässigen Dichte der Mikroflora in den Ablagerungen in Richtung flussabwärts klar hervor.

Da wir den Stoffwechsel der Mikroorganismen kennen, können wir behaupten, dass die ansteigende mikrobielle Belastung der Donau im Laufe der Jahre der Vermehrung der autochtonen und allochtonen organischen Materie zu verdanken ist; die übermässige Entwicklung des Phytoplanktons in gewissen Zonen der Donau in den letzten Jahren, die rasche Aufeinanderfolge seiner Populationen führte zu einer beträchtlichen organischen Belastung der Donau, was von der in manchen Perioden kaum vorhandenen Strömung begünstigt wird. Die zyklische Entwicklung der heterotrophen Mikroorganismen mit einer Periodizität von 5 Jahren was die Maxima und Minima anbelangt, berechtigt uns zur Annahme, dass das Jahr 1988 ein neues Entwicklungsmaximum darstellen könnte, wobei

dieses Phänomen seine Erklärung in der Fähigkeit der Wiederherstellung der Ernährer aus dem Ökosystem findet, was die Entwicklung des Phytoplanktons, gefolgt von derjenigen der zersetzenden Mikroorganismen erlaubt.

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Eingegangen am 20. Oktober 1988

Institut für biologische Wissenschaften
Bukarest, Splaiul Independenței 296

LA DESTRUCTION DE LA MATIÈRE ORGANIQUE DANS LE SÉDIMENT DES ÉTANGS DE MATIȚA ET MERHEI

DOINA PEPTEA-IONICĂ

The dehydrogenase activity (DHA), a modality of measuring the intensity of microbian activity in sediment for the decomposition of organic matter using the Tetrazolium is presented. The variation of dehydrogenase activity in lakes Matița and Merhei shows that the maximum values are recorded in April and November and the minimum ones in December.
By determining the coefficient of multiple correlation it is noticed that: the DHA variation is explained by the simultaneous action of pH, temperature and to a lower extent of O_2 both in Matița and Merhei. However, temperature has the determining role among the three factors.

L'une des plus importantes fonctions des microorganismes hétérotrophes du milieu aquatique est représentée par la destruction du substrat organique, autant celui de l'eau que, surtout, celui du sédiment.

Les processus de décomposition de la matière organique constituent la source la plus importante pour l'obtention de l'énergie nécessaire à la réalisation de la biosynthèse et de la libération des nutrients minéralisés nécessaires aux producteurs primaires. Par conséquent, l'évaluation de l'activité des microorganismes du sédiment constitue l'un des problèmes essentiels dans l'étude des écosystèmes aquatiques.

Un moyen de mesurer l'intensité de l'activité microbienne du sédiment ayant pour résultat la décomposition de la matière organique est réprésenté par l'activité déhydrogénasique (ADH) (1).

C'est pourquoi nous nous proposons de présenter, à l'aide de la méthode de l'utilisation des sels de tétrasole, l'activité déhydrogénasique des microorganismes du sédiment en tant qu'indiquateur de l'oxydation biologique du sédiment et à la fin la destruction de la matière organique (4).

Nous présentons les résultats obtenus dans l'intervalle compris entre les mois d'avril et décembre 1981 dans les étangs de Matița et Merhei.

MÉTHODE DE TRAVAIL

Le principe de la méthode consiste dans la réduction du réactif 2, 3, 5-triphéniltétrasole (TTC) par l'hydrogène qui résulte après l'action des déhydrogénases sur le substrat, en passant en phormazan — composé colorié en rouge qui peut être extrait avec acétone; on mesure ensuite l'extinction de la solution de phormazan au spectrophotomètre (540 nm) par rapport au témoin (3). Les résultats s'expriment en mg phormazan/g vase humide.

RÉSULTATS ET DISCUSSIONS

La figure 1 représente la variation de l'intensité de l'ADH dans les étangs de Matiţa et Merhei par les valeurs moyennes mensuelles ; on constate, dans les deux étangs, des valeurs maximales enregistrées au mois d'avril, respectivement de novembre, et minimales en décembre. Les limites de variations des moyennes mensuelles sont comprises entre 0,85—8,42 pour Matiţa et 0,56—7,65 pour Merhei.

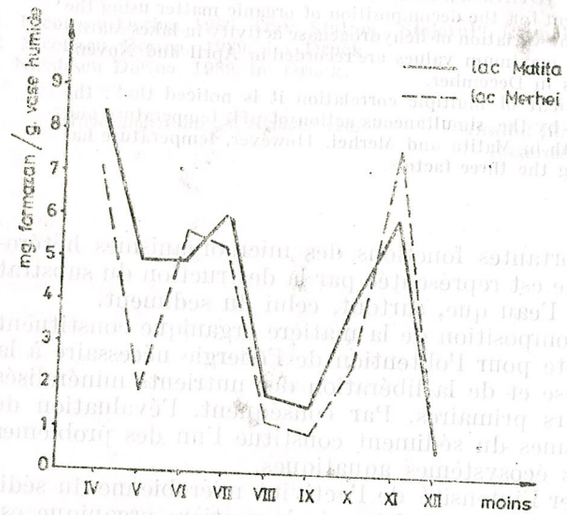

Fig. 1. — La variation de l'intensité de l'activité déhydrogénasique dans le sédiment des lacs de Matiţa et Merhei.

Le calcul des autres paramètres statistiques, à savoir la dispersion, la déviation standard et le coefficient de variation, conduit à l'idée que dans les étangs étudiés les valeurs individuelles ont une évolution différente : dans celui de Matiţa plus dispersées par rapport à la moyenne.

L'intervalle de confiance calculé à un niveau d'assurance de 95% conduit au résultat suivant : — pour Matiţa 4,656—4,925
— pour Merhei 3,807—4,093.

Le teste montre que la variation de l'intensité de l'ADH dans le sédiment à lieu après une distribution binomiale négative.

Des résultats obtenus dans les deux étangs on a calculé aussi le coefficient de corrélation multiple ($R_{yx_1x_2x_3}$) et l'équation de régression multiple, en essayant de la sorte de déterminer le sens et le degré de liaisons entre la variable dépendante (y = ADH) et trois variables indépendantes (x_1 = pH ; $x_2 = t°$; $x_3 = O_2$) (2) ainsi que l'intensité des liaisons entre ces paramètres. L'interprétation des données des deux étangs mène aux suivantes équations de regression : — pour Matiţa :

$$\log(y + 1) = 0{,}8201 - 0{,}00018x^2 - 0{,}05467 \log x_2 - 0{,}0008\, x_3^2$$

— pour Merhei :

$$\log(y + 1) = 1{,}7526 - 0{,}015\, x_1^2 - 0{,}2262 \log\log(x_2 + 1) + 0{,}0014\, x_3^2$$

En ce qui concerne les coefficients de corrélation multiple, il en résulte que dans l'étang de Matiţa $R_{yx_1x_2x_3} = 0{,}4104$ avec un coefficient de détermination D = 0,1684 et dans l'étang de Merhei $R_{yx_1x_2x_3} =$

= 0,5747 avec D = 0,3302, ce qui prouve que la variation de l'ADH s'explique dans un pourcentage assez réduit par l'action simultanée des trois facteurs abiotiques qui nous conduit à l'idée d'une action d'autres facteurs encore, qui peuvent y avoir un rôle décisif.

Dans ce complexe de facteurs, les coefficients de détermination partielle nous montrent que t° a un rôle décisif (p = 0,01) dans la variation de l'activité déhydrogénasique, O_2 ayant ici la signification la plus réduite.

On peut affirmer en conclusion que l'activité déhydrogénasique du sédiment dépend de nombreux facteurs, tant abiotiques que biotiques, de sorte que le décèlement de ces interactions est très difficile surtout *in situ*.

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Reçu le 20 octobre 1988

Institut des Sciences Biologiques
Bucarest, Splaiul Independenţei 296

Red blood cells as carriers for drugs. Potential therapeutic applications, edited by Ropars C., Chassaigne M., Nicolau C., Pergamon Press, Oxford, New York, 1987, 260 pp.

The present volume, published in Advances in Biosciences vol. 67, contains the proceedings of the 2nd International Meeting organized in Tours (France), April 1987.

The book includes 29 papers dealing with the latest results and ideas in the field of erythrocytes as carrier systems. It approaches some aspects concerning available methods for the preparation of resealed erythrocytes as potential carriers for drugs and other agents. Topics included : manipulation of the autologous red blood cells and their oxygen transport capacities following the encapsulation of an allosteric effector of haemoglobin (inositol-hexaphosphate), encapsulation of various enzymes to correct metabolic deficiencies with long-term efficacy in the circulation (glucose oxidase, arginase, aminolevulinate dehydratase), encapsulation of various drugs (adriamycin, methotrexate, mycotoxin, interleukin-2, antileishmanial agents) demonstrating the possible clinical uses of erythrocytes as encapsulating vesicles. Problems associated with the organisation of plasma membrane phospholipids and red blood cell recognition by the reticuloendothelial system are also examined.

The book gives a better understanding of the role of the resealed erythrocytes as potential slow release carriers for drugs and enzymes, being very helpful to scientists working in the field as well as to clinicians for treatment improvement.

Radu Meşter

Dynamic properties of glia cell II. Cellular and molecular aspects, eds Grisar T., Franck G., Hertz L., Norto W. T., Sensenbrenner M., Woodbury D. M., Pergamon Press, 1986, 424 p.

The book grew up of a symposium organized in 1985 by the Society of Neurochemistry at Liege, Belgium, and published in Advances in the Biosciences, volume 61. It consists of 61 studies written by numerous authors from several countries (USA, England, Belgium, France, Danemark, Sweden, Switzerland, F. R. of Germany, Japan, Canada, Poland). The book focuses on the following series of problems :

The first section deals with *Molecular aspects of glial development, and analysis of glial growth factors*, monoclonal antibodies to glial cells, properties and metabolism of cultured oligodendrocytes, the role of cyclic AMP, microtubule and microtubule-associated proteins on astrocyte differentiation, chemically defined media for growth and differentiation of CNS glial cells (astrocytes or oligodendrocytes from neonatal rat brain).

The second section, *Detection and role of glial cells specific proteins*, discusses glial fibrillary acidic protein in human astrocytes, the molecular cloning of cDNA for bovine glial fibrillary acidic protein, carbonic anhydrase in young and mature cultured rat glial cells, glycolipid marker in glial cells, expression of histocompatibility antigens on the oligodendrocytes surface, etc.

The third section, *Neuron-glia molecular relationships*, presents numerous studies (28) concerning four main processes : ion homeostasis, developmental aspects, metabolism and neurotransmission and myelination. Some interesting data are devoted to potassium channels and carriers in glial cell membranes, plasminogen activarors in brain development, influences of neurons on glial cells development in culture, potassium as a signal in metabolic interactions between neurons and astrocytes, receptor-mediated inositol phospholipid hydrolysis in CNS astrocytes, etc.

The fourth section, *The biochemical lesions and pharmacology of glia cells*, is concerned with the role of glial carbonic anhydrase in focal and generalized tonic-clonic seizures, early metabolic changes in astrocytes in experimental hepatogenic encephalopathy, cellular and molecular aspects of glial cells with aging, astrocyte response to cerebral ischemia, etc.

The book represents the last comprehensive summary of the various problems raised by one of the most fascinating and controversed subject, the properties and significances of glia cells, which appear to be important in cooperation with neurons in the properties of the nervous system. The results also demonstrate molecular abnormality of glial metabolism associated with pathological conditions.

Radu Meşter

Catalogue of Palaearctic Diptera, Volume 8, *Syrphidae — Conopidae* (L. V. PECK, USSR : *Syrphidae*; V. N. TANASIJTSHUK, USSR : *Pipunculidae*; M. CHVÁLA, Czechoslovakia and K. G. V. SMITH, England : *Conopidae*), Editor Á. SOÓS and Assistant editor L. PAPP, Zoological Department, Hungarian Natural History Museum, Budapest, Hungary; Ed. Akadémiai Kiadó, Budapest, Hungary and Elsevier Science Publishers, Amsterdam, The Netherlands, 1988, 363 pp.

Published and printed under conditions worth following, the volume belongs to an oustanding series of a high scientific level that offers comprehensive data concerning the over 100 Diptera families in the Palaearctic Region (13 volumes and an Index volume). Taxons as Complete and concise data afford, at a first sight, and absolutely clear synthetical idea about the concerned taxons (literature, type-locality, area, synonyms, homonyms, misidentifications, priority, emendations, nomina dubia, doubtful species s.o.).

SYRPHIDAE (Dr. L. V. Peck, Biological Institute, Academy of Sciences of the Kirghiz SSR, Frunze, USSR). As a specialist who has been following for about 30 years the situation of the syrphid flies in Romania, especially from a faunistic point of view, I will report especially on this group of Diptera. As an evidence of the rich fauna of Palaeactic Syrphidae and of the bulk of work invested into this book (363 pages), 220 pages, are dedicated to the syrphid flies.

In the well-known monograph of P. Sack, Syrphidae, in LINDNER E. (ed.): *Die Fliegen der palaearctischen Region* (1932) more than 2500 identified species in the world fauna and about 700 species in the Palaearctic Region are treated. Later researches into this Diptera family, one of the largest, maybe the most important one for the agricultural and forest economy (pollination, entomophagy), have demonstrated the existence, by now, in the world fauna of more than 5500 species, out of which about 1600 in the Palaearctic Region. The present catalogue records for the Palaearctic Region and among the three subfamilies Syrphinae, Milesiinae and Microdontinae, the existence of 120 genera and 1590 species. As for the subfamilies, tribes and genera, in Systematics and Taxonomy, the conclusions drawn by the well-known specialists, Vockeroth (1969), Thompson (1972) and Hippa (1978) are fololwed.

We have confronted our data on the Romanian area and those given in this new catalogue solving some of our questions about (spreading, synonyms s.o.), too. Yet, out of the 447 species, already known and published for Romania this catalogue lists only 335 species. If the absence of some species could be justified, by their being published after 1982 (because of printing difficulties), the lack of another 77 species, published up to 1982, could be accounted for solely by some difficulties of documentation, as for the syrphid flies the literature is extremely rich, they being sometimes reported in publications difficult to detect, e.g. : *Dasysyrphus friuliensis* (V. d. Goot, 1960), *Metasyrphus lapponicus* (Zetterstedt, 1838), *Chrysotoxum verralli* Collin, 1940, *Paragus oltenicus* Stănescu, 1977, *Cheilosia pini* (Becker, 1894), *Rhingia austriaca* Meigen, 1830, *Myolepta luteola* (Gmelin, 1788), *Merodon spinitarsis* Paramonov, 1929, *Eumerus sogdianus* Stackelberg, 1952, *Microdon latifrons* Loew, 1856 a.o. This situation will soon be clarified as a list of species occurring in Romania, worked out by myself, is in print.

PIPUNCULIDAE (Dr. V. N. Tanasijtshuk, Zoological Institute, Academy of Sciences of the USSR, Leningrad, USSR). Very important insects in the biological pest control, as endoparasiting for some of the families belonging to the homoptera, very noxious for cultivated plants. Out of the over 600 species known in the world fauna, the catalogue presents 11 genera with 165 species in the Palaearctic Region. For the Romanian fauna, 10 species are recorded.

CONOPIDAE (Dr. M. Chvála, Prírodovedecké Faculty University Karlovy, Praha, Czechoslovakia and Dr. K. G. V. Smith, British Museum (Natural History), Department of Entomology, London, England). The three subfamilies — *Conopinae*, *Myopinae* and *Dalmanniinae*, that is 20 genra, include 172 Palaearctic species. Pollenizing — floricolous insects, parasite, as larva, bumble-bees, wasps, bees and locusts. For the Romanian fauna 34 species are registered.

As expected, the catalogue includes an impressive bibliography (886 titles), of the literature for the three Diptera families. Perhaps, the mention of selective should have been added, and the number of works specified for each author could have been better balanced.

As the editors assure us, the Catalogue of Palaearctic Diptera, a very useful working tool, will soon be available to senior and junior specialists.

Vladimir Brădescu

AVIS AUX AUTEURS

La « Revue roumaine de biologie — Série de biologie animale» publie des articles originaux d'un haut niveau scientifique de tous les domaines de la biologie animale : taxonomie, morphologie, physiologie, génétique, écologie, etc. Les sommaires des revues sont complétés par d'autres rubriques, comme : 1. La vie scientifique, qui traite des manifestations scientifiques du domaine de la biologie : symposiums, conférences, etc. : 2. Compte rendus des livres de spécialité.

Les auteurs sont priés d'envoyer les articles, notes et comptes rendus dactylographiés à double interligne (31 lignes par page) en deux exemplaires.

La bibliographie, les tableaux et l'explication des figures seront dactylographiés sur pages séparées et les diagrammes exécutés à l'encre de Chine noire sur papier calque.

Les tableaux et les illustrations seront numérotés en chiffres arabes.

La répétition des mêmes données dans le texte, les tableaux et dans les graphiques sera évitée. Les références bibliographiques citées par ordre alphabétique comporteront le nom de l'auteur, l'initiale du prénom, l'année, le titre de la revue abrégé conformément aux usances internationales, le tome, le numéro, la page.

Les travaux seront accompagnés d'un court résumé de 10 lignes au maximum, en anglais. Les textes de travaux ne doivent par dépasser 7 pages (y compris les tableaux, la bibliographie et l'explication des figures).

La responsabilité concernant le contenu des articles revient exclusivement aux auteurs.

PRINTED IN ROMANIA