Table 1 *Some physical and chemical properties of the soils examined in this study*

Soil type	pH	Total nitrogen (%)	Organic carbon (%)	Electrical conductivity (mmho × cm^{-1})	CEC (m.e./100 g/ of soil)
Alluvial soil (clay)	8 5	0.12	0 68	0.37	33.9
Laterite soil	6 0	0 10	0 60	0 09	19 3
Red loam	7 1	0 08	0 84	0 10	15 4

Table 2 *Adsorption of Azospirillum and heterotrophic bacteria to soil particles*

Soil type	*Azospirillum* (× 10^6)			Heterotrophic bacteria (× 10^6)		
	Initial	Final	Adsorbed cells (%)	Initial	Final	Adsorbed cells (%)
Alluvial soil (clay)	21	17.4	82 8	36.0	29 6	82.2
Laterite soil	21	12 0	57 1	28 8	18 4	63 8
Red loam	21	8 2	39.0	17.0	6.8	40 0

Bacterial numbers are per gram of soil on oven dry weight basis. Each figure is mean of three estimations.

are protection and proximity to a suitable environment[6].

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MULTIPLE XANTHINE DEHYDROGENASE ISOZYMES IN THE EXOTIC CARP *CTENOPHARYNGODON IDELLA* (CYPRINIDAE: PISCES)

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XANTHINE dehydrogenase (XDH; E.C. 1.2.3.2) is a polymorphic enzyme involved in purine metabolism[1]. From the available data on XDH isozymes in fish[2–3], two codominant alleles at an autosomal locus are believed to be involved. XDH activity is known to respond to nutritional status of the organism[1] and is independent of age and sex[3]. Usually, homozygotes show one XDH band on electrophoresis, and heterozygotes three bands, suggesting dimeric structure of the enzyme[3]. So far as the authors are aware, XDH isozyme patterns in fish have not yet been reported from India. During our studies on the XDH isozyme patterns of some fishes, we came across multiple XDH isozymes in the exotic carp, *Ctenopharyngodon idella*.

Ten adult living specimens of *C. idella*, collected from the local fish farm (Ganga Matsya Utpadan Kendra, Rathtala), served as the material for the present study. Muscle, heart, liver, eye, kidney and brain were dissected out quickly and homogenized separately in cold (4°C) distilled water. The homogenate was centrifuged at 11,000 *g* at 4°C for 30 min. Known amount of supernatant was immediately subjected to polyacrylamide slab gel electrophoresis[4,5] at a constant current of 3 mA/slot and 200 V in the cold (6–7°C) using Tris–glycine (pH 8.6) as the running buffer. Staining for detection of XDH activity was done following Nakano and Whiteley[6].

Four or five XDH bands were observed in the zymograms (figure 1A, B) of all tissues examined, except liver, which showed two bands. Except for the slowly anodal band in kidney which showed intense

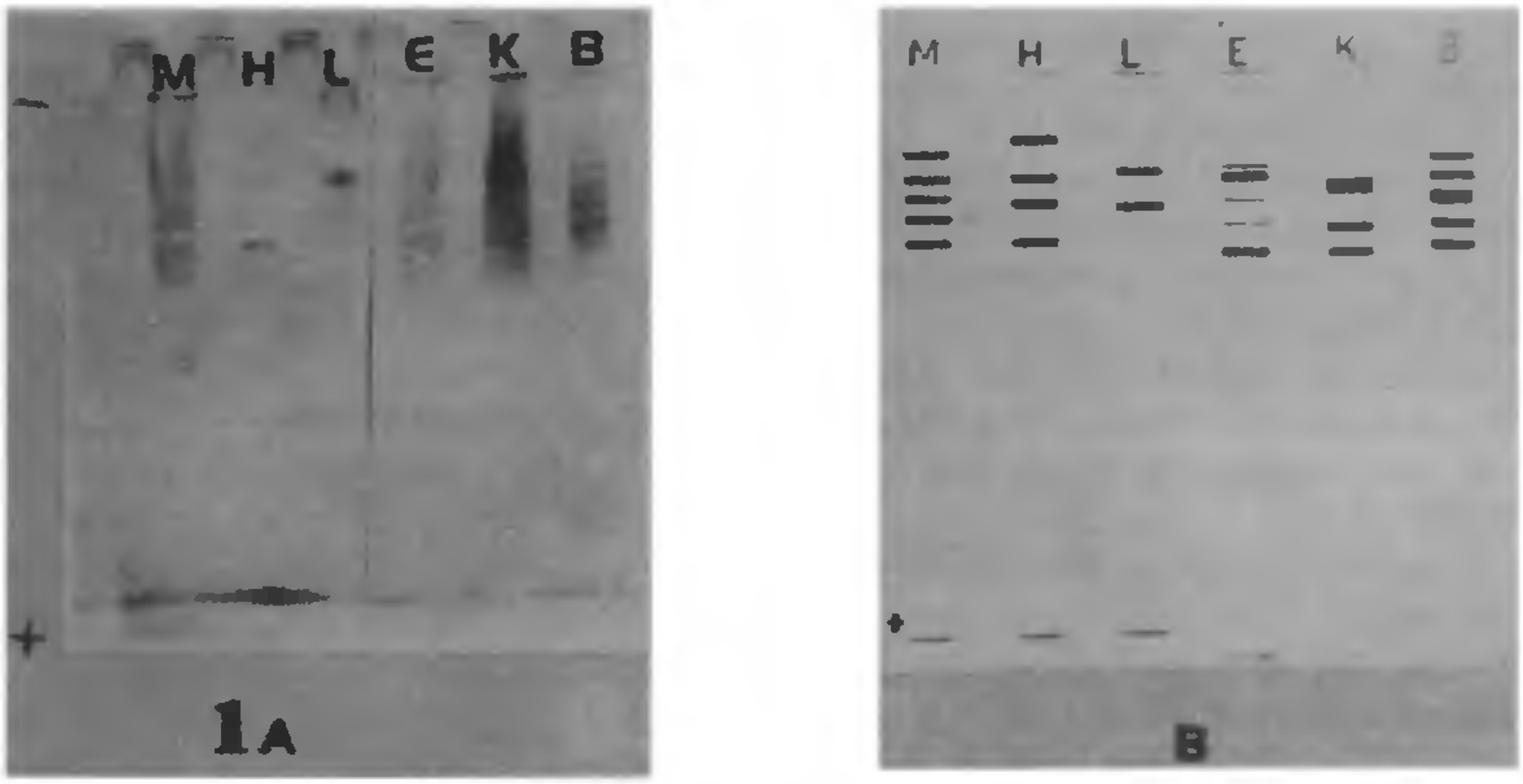

Figure 1. (A) Photograph and (B) diagrammatic representation of XDH zymogram of *C. idella* (M, muscle; H, heart; L, liver; E, eye; K, kidney; B, brain).

Table 1 *Number of XDH bands in zymograms of tissues of Ctenopharyngodon idella, their Rd values and intensity of staining*

Tissue	No. of bands	Rd values	Staining intensity
Muscle	5	0.146	1+
		0.191	1+
		0.224	1+
		0.258	1+
		0.303	1+
Heart	4	0.123	1+
		0.196	1+
		0.235	1+
		0.303	2+
Liver	2	0.179	2+
		0.241	1+
Eye	5	0.155	1+
		0.182	1+
		0.215	1+
		0.258	1+
		0.311	1+
Kidney	4	0.204	3+
		0.225	1+
		0.268	1+
		0.311	1+
Brain	5	0.150	1+
		0.182	1+
		0.220	1+
		0.258	1+
		0.301	1+

1+, Faint (marginal presence), 2+, moderate (intermediate abundance), 3+, intense (most abundant).

staining, all the bands were faintly or moderately stained. In all the tissues, the anodal migrations of the bands were more or less similar although the migration of individual bands differed slightly in different tissues (table 1).

In view of the dimeric structure of XDH, the expression of which is believed to be controlled by two codominant alleles at an autosomal locus[3], it is difficult to understand and explain the expression of 4 to 5 electrophoretically separable components in several tissues of *C. idella*. It may, however, be possible that conformational changes of the isozymes owing to physical/physiological factors could be responsible for the appearance of the extra bands in some tissues, as was also speculated by Shinoda and Glassman[7] in *Drosophila* and Waud and Rajagopalan[8] in a similar situation in mice. Alternatively, epigenetic modification during the synthesis of the isozymes in different tissues could also lead to the appearance of the unorthodox XDH patterns in this species. Another possibility, though remote, could be that the multiple bands represent activity of two homologous loci which might have arisen by duplication. Anyhow a detailed study on different populations, kinetic properties of the isozymes, amino acid sequence analysis, etc. are warranted to understand the genetic mechanism for the appearance of the multiple XDH bands in this species more precisely.

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STUDIES ON ELECTROPHORETIC PATTERN OF SERUM PROTEINS OF THE TOAD *BUFO ANDERSONII*

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AMPHIBIANS are cold-blooded vertebrates and are known to hibernate and aestivate during winter and summer seasons respectively. Atmospheric physical factors influence the physiology of the animals. Therefore it was proposed to study the serum protein fractions of toad by agar gel electrophoresis during winter and summer seasons.

Ten male and ten female toads were procured during winter and summer months. The animals were killed and blood was collected immediately from the heart into sterile tubes for serum separation. The serum was assayed for various protein fractions by agar gel electrophoresis[1] using barbiturate buffer (pH 8.6). The gels were stained with amido black and scanned on a densitometer.

The serum showed four distinct fractions, viz. albumin and alpha-, beta- and gamma-globulins. The proportions of these fractions are shown in table 1.

All the four serum protein fractions of toad were cathodic (figure 1). In fish[2], sheep[3], and buffalo[4] gamma-globulin is anodic.

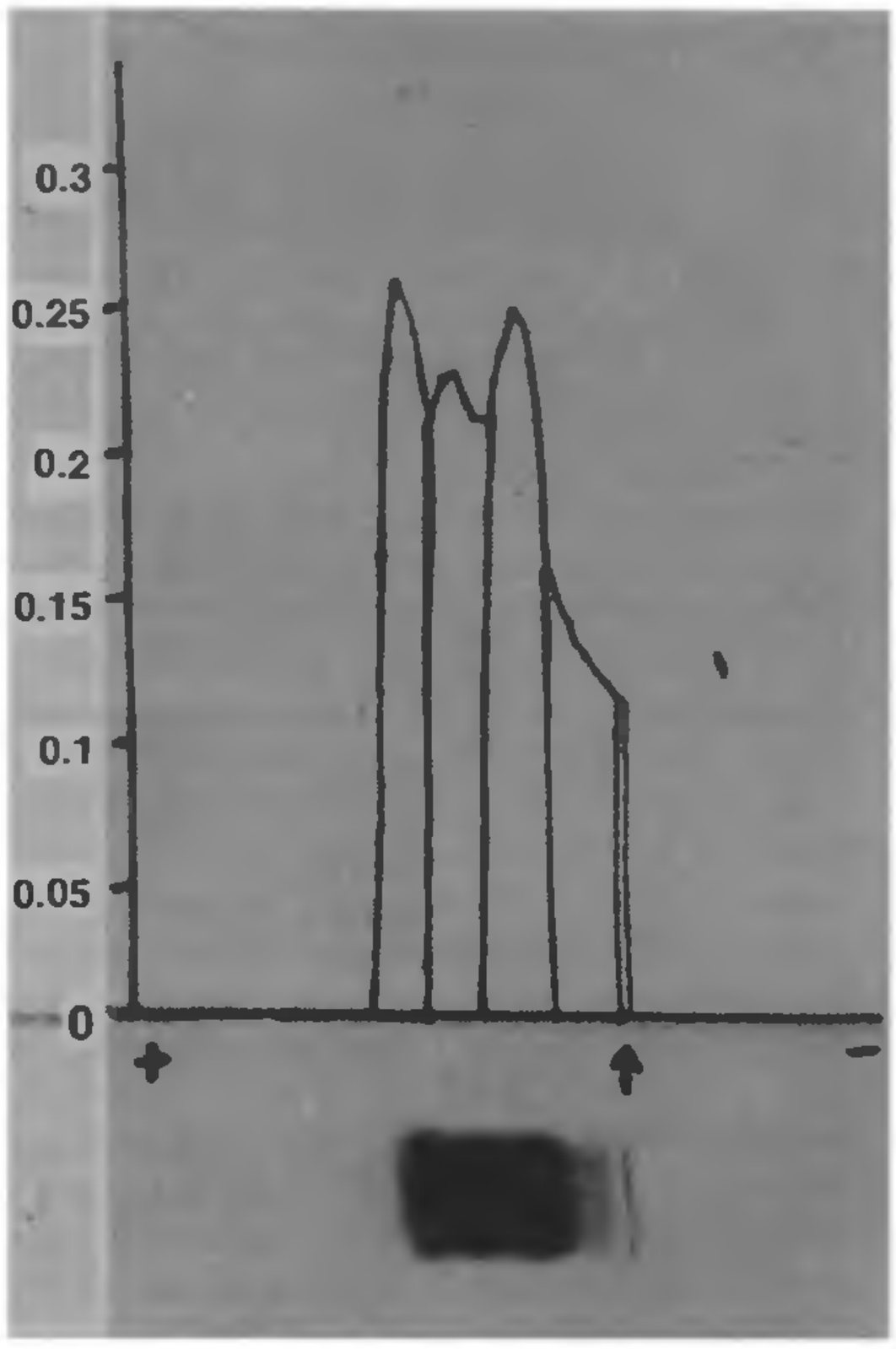

Figure 1. Agar gel electrophoretic pattern of serum of *Bufo andersonii*.

Table 1 *Proportions of various serum protein fractions of toad*

Sex	Season	Protein fraction*				Albumin/ globulin ratio
		Albumin	Alpha-globulin	Beta-globulin	Gamma-globulin	
Male	Summer	23.89 ± 0.715	25.51 ± 0.598	32.44 ± 0.674	18.14 ± 0.493	0.31
(n = 10)	Winter	23.27 ± 0.626	25.00 ± 0.556	32.75 ± 0.810	18.98 ± 0.515	0.30
Female	Summer	24.17 ± 0.462	21.38 ± 1.031	34.37 ± 0.651	20.06 ± 1.08	0.31
(n = 10)	Winter	24.09 ± 0.382	28.91 ± 0.993	31.72 ± 0.835	15.26 ± 1.189	0.31

*Values expressed as mean ± S.E.