

long periods. In related species, mature larvae extend their larval period under adverse conditions, e.g., *T. inclusum*, upto 3.5 years; *T. tarsale*, 5 years^{1,2}. Beck¹⁻⁴ in an extensive study of the growth and retrogression of larvae of *T. glabrum* has reported that mature larvae of this insect undergo long period of starvation (26 weeks) and they pupated when food was available (after 6 weeks of feeding). The present study was undertaken to find out the impact of prolonged starvation on the rate of pupation and fecundity in *T. granarium*.

Female diapausing larvae were collected from stock culture at 30°C. Larvae which were in diapause state for 3 months were isolated and kept without access to food. After a period of 13 months, starved larvae were selected and fed on crushed wheat and reared under diapause breaking conditions. Rate of molting and pupation were recorded. Resulting pupae were collected and emerged adults were utilized for fecundity study.

During starvation, larvae molted repeatedly and diminished in size and weight. Starvation for six months showed a reduction in body weight from 5.7 mg to 2.4 mg⁷. On introduction to food the starved larvae fed voraciously and started molting on the 5th day. 72% of the larvae molted within 12 days after food was made available. 28% larvae pupated without molt. Diapause larvae with access to food were used as controls. They pupated by the 5th day in a diapause-breaking condition. Though pupation was initiated in starved larvae on the 5th day, major part (81%) pupated between the 5th and 10th day after feeding had initiated (Fig. 1).

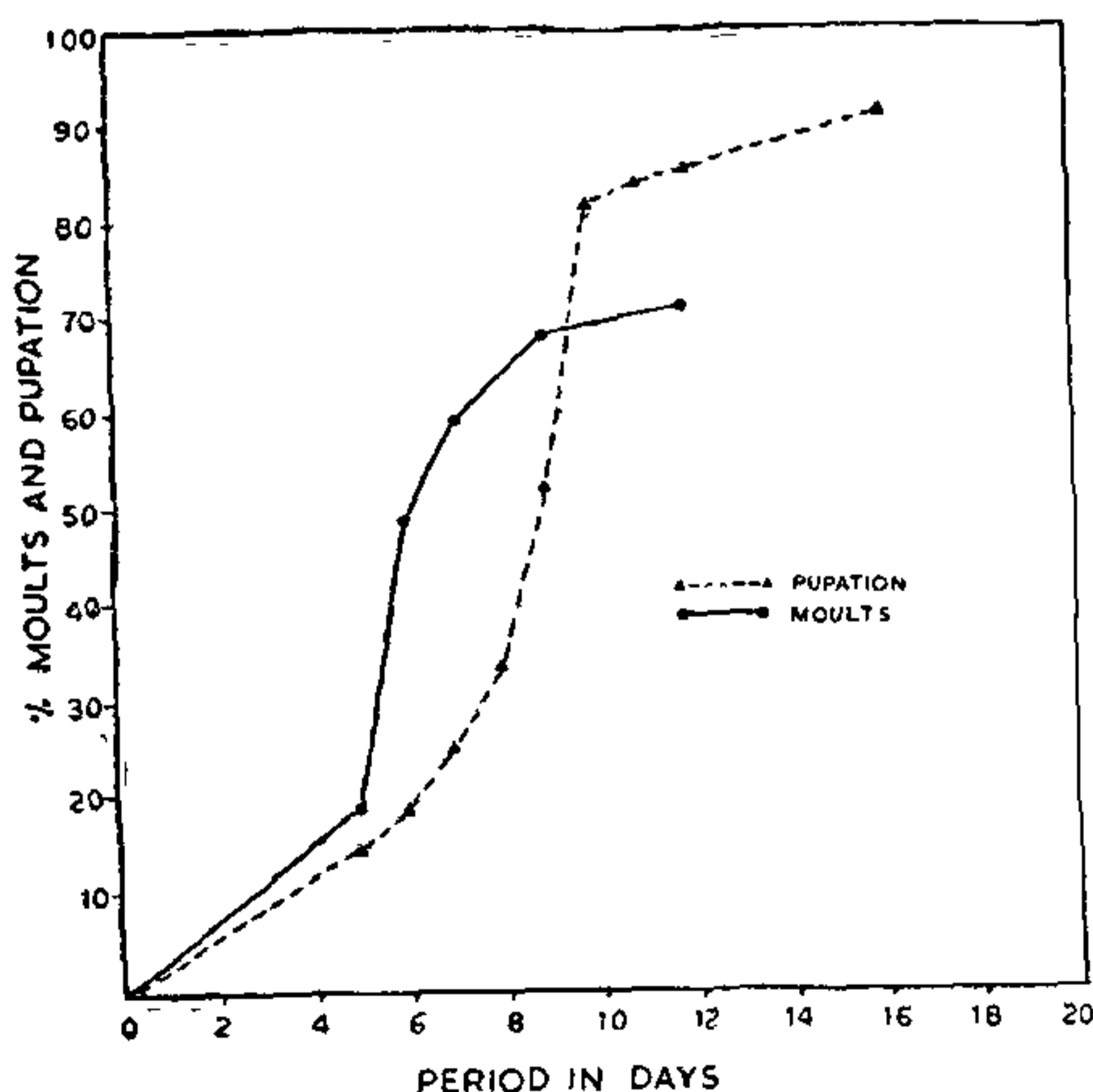


Fig. 1

11% larvae completed their larval life within 16 days and the rest 8% by 21st day. In the related species, *T. glabrum*, mature starved larvae, after 6 weeks of feeding and a number of molts, reached the original condition and then pupated. Beck¹⁻⁴ has reported that the starved larvae repeat several larval stages normal to the species. However, starved *T. granarium* larvae molted only once before pupation at diapause-breaking conditions.

Adults derived from starved and refeed diapause larvae produced on an average 45 ± 9.8 eggs, whereas adults derived from diapausing larvae with access to food laid 109 ± 19.41 eggs after a second mating⁶. In the present study, since the pair was left in the medium till death, the chances for a second mating and production of maximum eggs were great. The ability of *T. granarium* to produce a fairly large number of eggs (41% of the normal number) even after a long period of starvation is notable; as also the fact that the period required for the starved larvae to feed and resume normal development is very short. Thus the potency of this insect as a pest is aggravated by its ability to starve and to produce substantial number of eggs within a short period of food supply.

I wish to express my gratitude to Prof. K. K. Nayar for his interest in this study and U.G.C. for financial assistance.

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GLUTAMIC ACID-EFFECTS ON THE NERVOUS ACTIVITY OF THE AESTIVATING SNAIL, *PILA GLOBOSA*

THE electrical activity of the nervous system in *Pila globosa* was found decreased during aestivation¹. This preliminary study indicated a decrease in spontaneous activity along with a decrease in conduction velocities and an increase in threshold of different nerves¹⁻². The decrease in electrical activity was correlated to the diminished metabolism of the snail in torpid state. Since it was suggested that some factor released by the nervous system into the body fluids might be responsible for the

diminished tissue metabolism during aestivation³, it was felt essential to investigate the nature of the factor responsible for the lowered level of electrical activity. This aspect has been pursued, taking into consideration one of the essential neurotrophic agents such as glutamic acid⁴⁻⁵.

Ethanollic extracts of the nervous tissue including all ganglia, connectives and commissures were prepared for two-dimensional chromatograms in solvents *n*-butanol : acetic acid : water (12 : 3 : 5), and phenol : water (4 : 1). The location agent was 0.5% ninhydrin in 95% acetone. Colorimetric readings after quantitative elution of the amino-acid spots with 75% alcohol have shown a 5-fold increase of glutamic acid content during aestivation (Table I). Similar increase in glutamic acid content was noticed in the body fluids during aestivation of *Pila globosa*⁶.

TABLE I

Glutamic acid content in the nervous tissue and body fluid of the normal and aestivated *Pila globosa*, expressed as μ moles of glutamic acid, per gm wet wt for nervous tissue and per ml for body fluid. Each value is the average of 6 separate analyses

	Normal snails	Aestivated snails	't' test
Nervous tissue	2.5 \pm 0.5	12.5 \pm 1.0	P>0.001
Body fluid*	82 \pm 6.5	155 \pm 12.25	P>0.001

* From Ramana Rao, 1973.

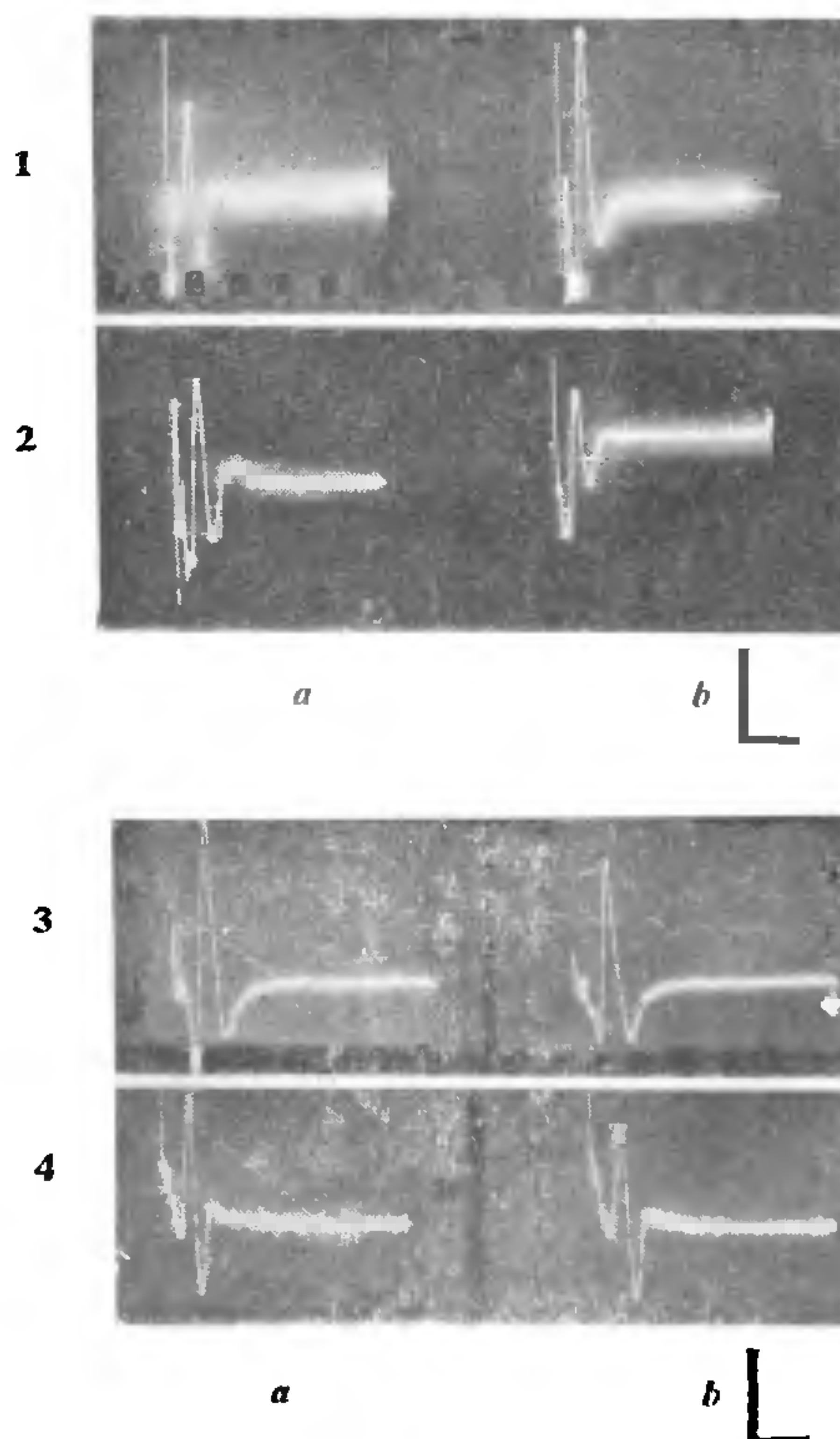
Since glutamic acid content was found to increase at a time when the electrical activity was reduced, it is likely that the pattern of activation of this neurotrophic agent could be different in aestivation dynamics. This aspect has been tested on the activity of the left pleurovisceral connective of normal and aestivated snails.

The left pleurovisceral connective of active and 3 months aestivated snails was exposed and washed with *Pila* Ringer⁷. Paired platinum electrodes were used for stimulating and recording. The potentials were amplified by a Grass (Model P9) preamplifier and were displayed on a Tektronix Type 502-A dual-beam oscilloscope. Grass (Model S4) stimulator was used to obtain square wave pulses for stimulation. Photographic recordings were made with a Grass Kymograph camera. Separate animals were used for the study of each effect.

The body fluids of normal and aestivated snails were collected, by breaking open the shell, into ice-jacketed dry pyrex glass tubes, stoppered tightly and kept in cold. At the time of study they were brought back to the physiological temperature.

The addition of normal body fluid to the left pleurovisceral connective of aestivated snail (Fig. 1)

increased the amplitude response by about 100%. The addition of aestivated body fluid to the left pleurovisceral connective of normal snail (Fig. 2) resulted in a 20% decrease in the amplitude response. The addition of glutamic acid (10^{-3} M) induced about 25% and 15% decrease in the amplitude response in normal (Fig. 3) and aestivated (Fig. 4) snails respectively.



FIGS. 1-4. Recordings showing the effects of normal body fluid (Fig. 1), aestivated body fluid (Fig. 2), and Glutamic acid (Figs. 3, 4) on the amplitude responses to electrical stimulation of the left pleurovisceral connective. Fig. 1, Normal body fluid; on aestivated snail; Fig. 2, Aestivated body fluid; on normal snail; Fig. 3, Glutamic acid; on normal snail; Fig. 4, Glutamic acid; on aestivated snail. (a) Control response; (b) Response on treatment with the test solution.

Calibrations: Time 50 m sec, Amplitude 200 mV.

In the light of these findings, it may be presumed that the higher level of glutamic acid in the body fluids as well as in the nervous system during aestivation could have an inhibitory influence on the electrical alertness of the snail.

This work was supported in part by a Grant (FG-In-395, Project A7-ADP-31) made by the United States Department of Agriculture under P.L. 480.

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A HAEMATOLOGICAL STUDY ON THE FRESH-WATER TELEOST, *CATLA CATLA*

THE fresh-water fishes, *C. catla*, were collected from the tanks of the Government Fish Farm, Cuttack, and the blood samples were collected according to the method adopted by Quayyum and Naseem⁶.

The haemoglobin concentration (Hb conc.) in *C. catla* ranged from 7.2 to 11.0 gm per 100 ml of blood with an average of 9.14 gm/100 ml. The mean Hb conc. was higher in males (9.4 gm) than in females (8.9 gm) (Table I).

The clotting time of *C. catla* varies from 44 to 68 secs with an average of 53.5 secs.

The total number of R.B.C. in *C. catla* varied from 1.76 to 2.89 million/cmm with an average of 2.28 million. The R.B.C. count was higher in males (2.41 million) than in females (2.18 million).

The erythrocytes are elliptical in shape with centrally located nucleus (Fig. 1). The average

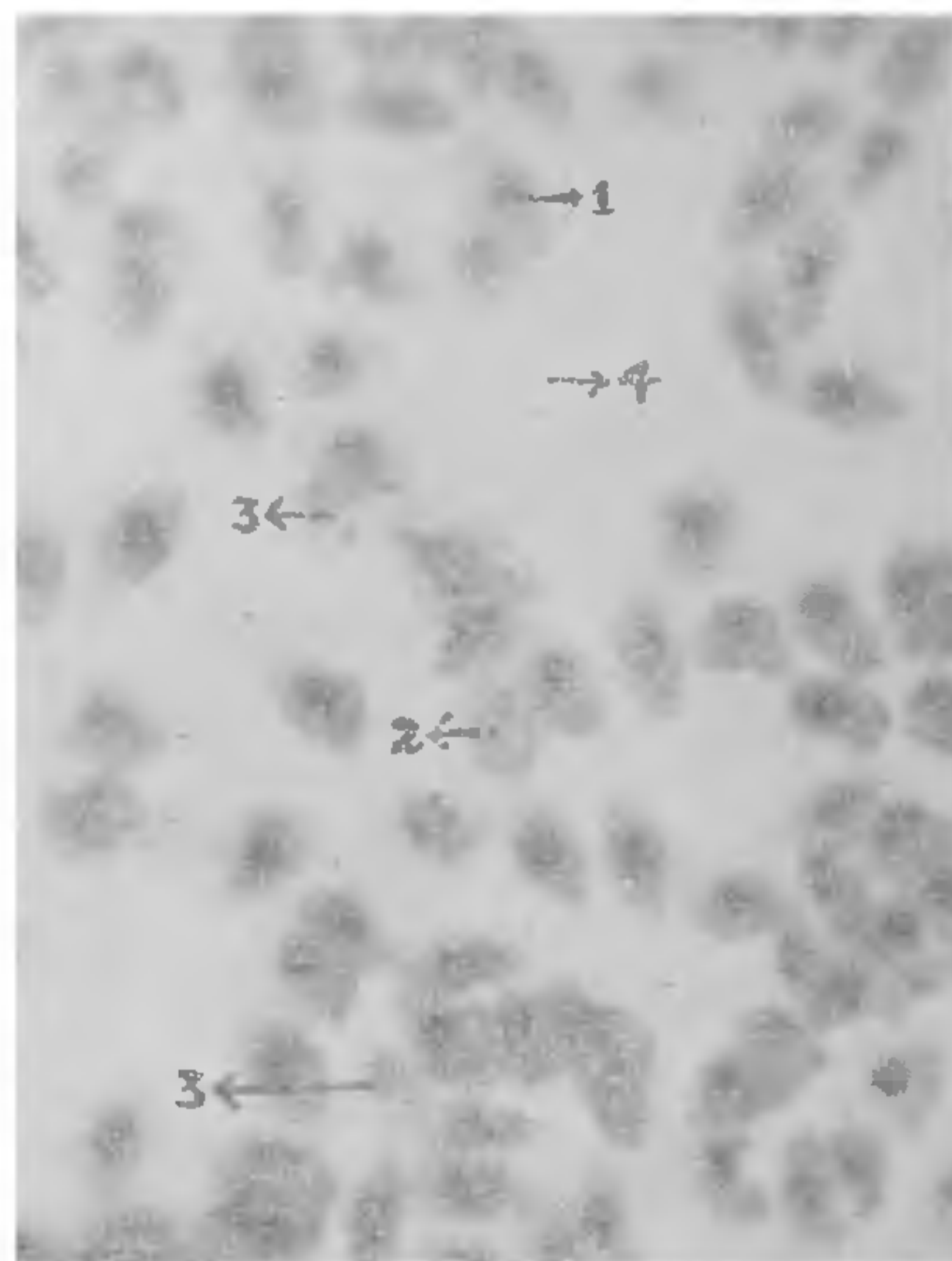


FIG. 1. Microphotograph showing the size of the blood cells in *Catla catla*, $\times 15,000$.

1. R.B.C.; 2. W.B.C.; 3. Erythroblast; 4. Plasma.

TABLE I

Results of haematological study on Catla catla

No. of fishes observed in each case : 12 (Males : 6 and Females : 6) Mean values are in parenthesis

		Male and Female combined	Male	Female
Haemoglobin in gm/100 ml of blood	..	7.5 to 11.0 (9.14)	7.8 to 11.0 (9.40)	7.2 to 10.0 (8.90)
Clotting time in secs.	..	44 to 68 (53.25)	46 to 66 (53.50)	44 to 68 (53.00)
R.B.C. in million	..	1.76 to 2.89 (2.28)	1.83 to 2.89 (2.41)	1.76 to 2.62 (2.18)
W.B.C. in thousands	..	7.4 to 11.5 (9.241)	8.4 to 11.5 (9.816)	7.4 to 9.8 (8.660)
R.B.C. percentage	..	97.8 to 99.2 (98.4)	98.0 to 99.2 (98.5)	97.8 to 99.1 (98.3)
Erythroblast percentage	..	0.8 to 2.2 (1.6)	0.8 to 2.0 (1.5)	0.9 to 2.2 (1.7)