

activities might be due to the increased locomotor activity³, and metabolism². Moreover, these results are in agreement with the earlier investigations on dehydrogenases^{1,2} and esterases¹. Based on these observations it may be suggested that the alkaline phosphatase activity followed a regular circadian rhythm.

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A COMPARATIVE STUDY OF THE EFFECTS OF PALMITATE AND ACETATE FORMS OF VITAMIN A ON TOAD TADPOLES

VARIOUS forms of vitamin A given in excess differ in their toxicity and biological effects produced¹⁻³. In studies on amphibians also different forms of this vitamin are found to vary in their effect¹. The present study was undertaken to compare the effect of the two esters of vitamin A, palmitate and acetate, on the tadpoles of *Bufo andersonii* Boulenger of identical age in equal periods of time. Two age groups of the tadpoles, 4 and 7 days old after hatching from the same spawn, were divided into groups of 50 individuals each. One group each was reared in solutions containing 1, 5, 10, 15, 20 and 30 I.U./ml of vitamin A palmitate (Arovit-Roche) and vitamin A acetate (Glaxo) and in tap water (controls). Known quantities of the vitamins were dissolved in small amounts of ethanol and the solutions were then diluted with water to the required concentrations. The animals were transferred to fresh media every two days and fed maximally with boiled spinach. The experiments carried out at room temperature lasted for 10 days in each case.

The numbers surviving on the 10th day in each experiment are shown in Table I. The older tadpoles were in general much more tolerant to the toxic effects of the two vitamins as compared to the younger ones. However, the acetate was far

TABLE I

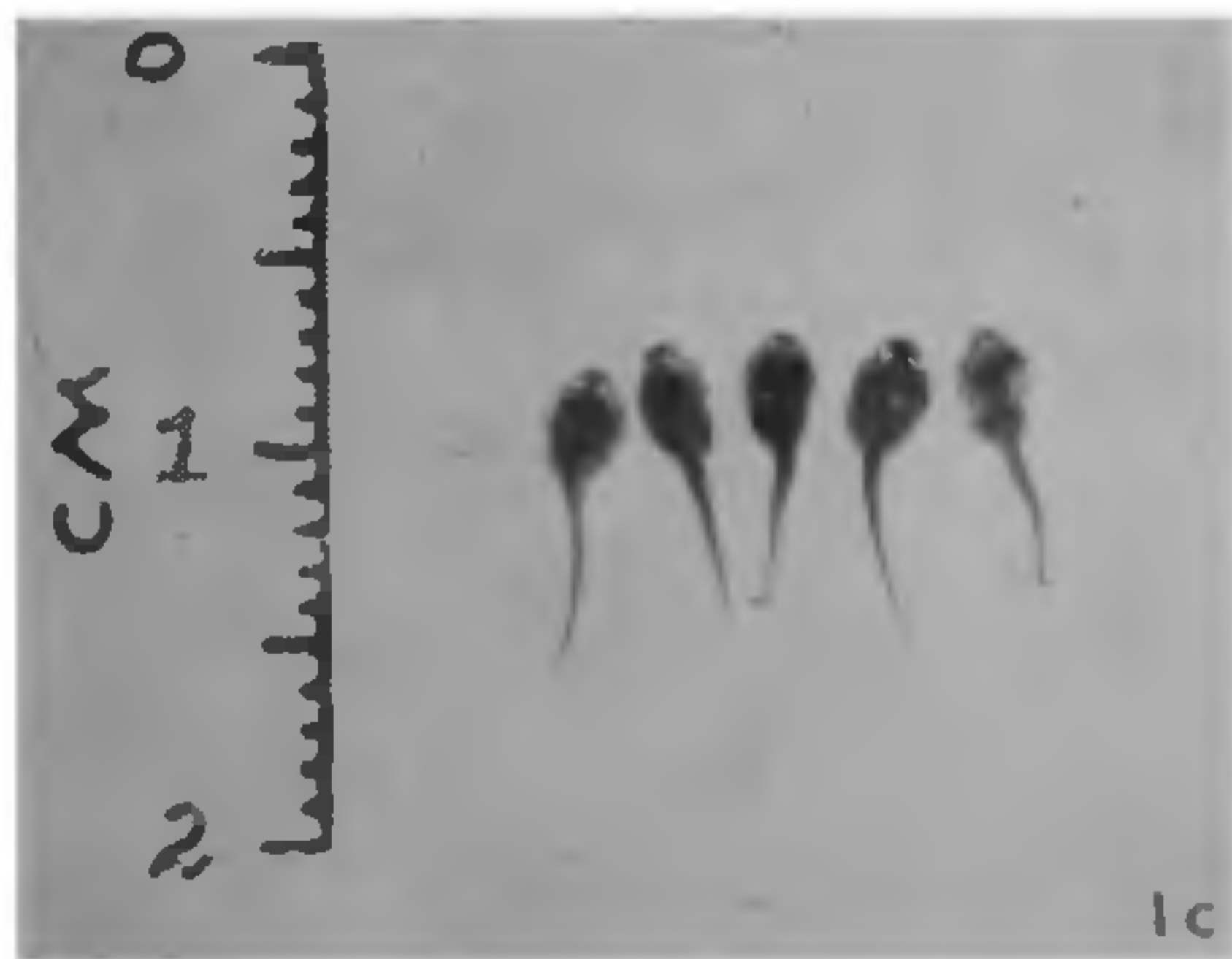
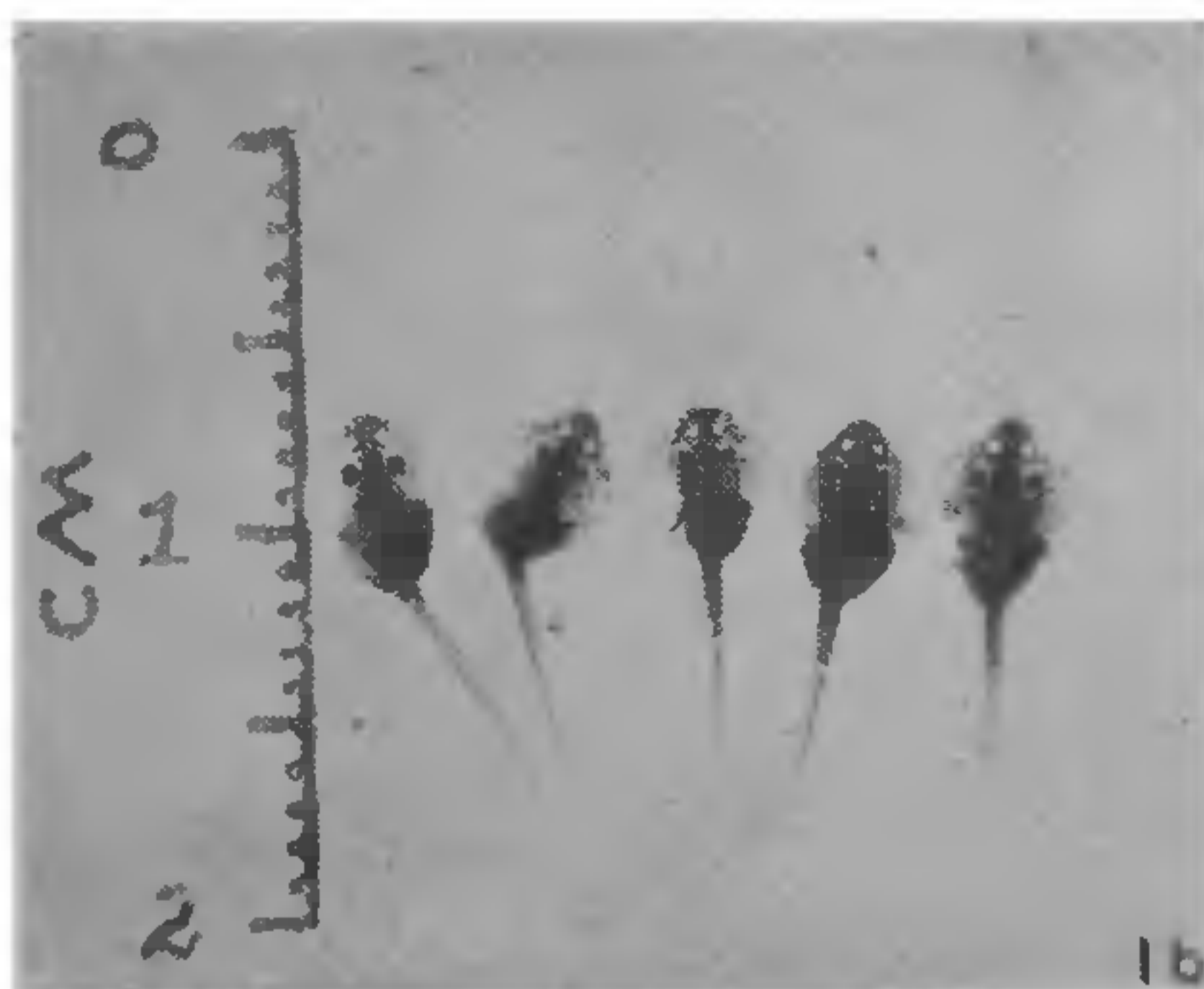
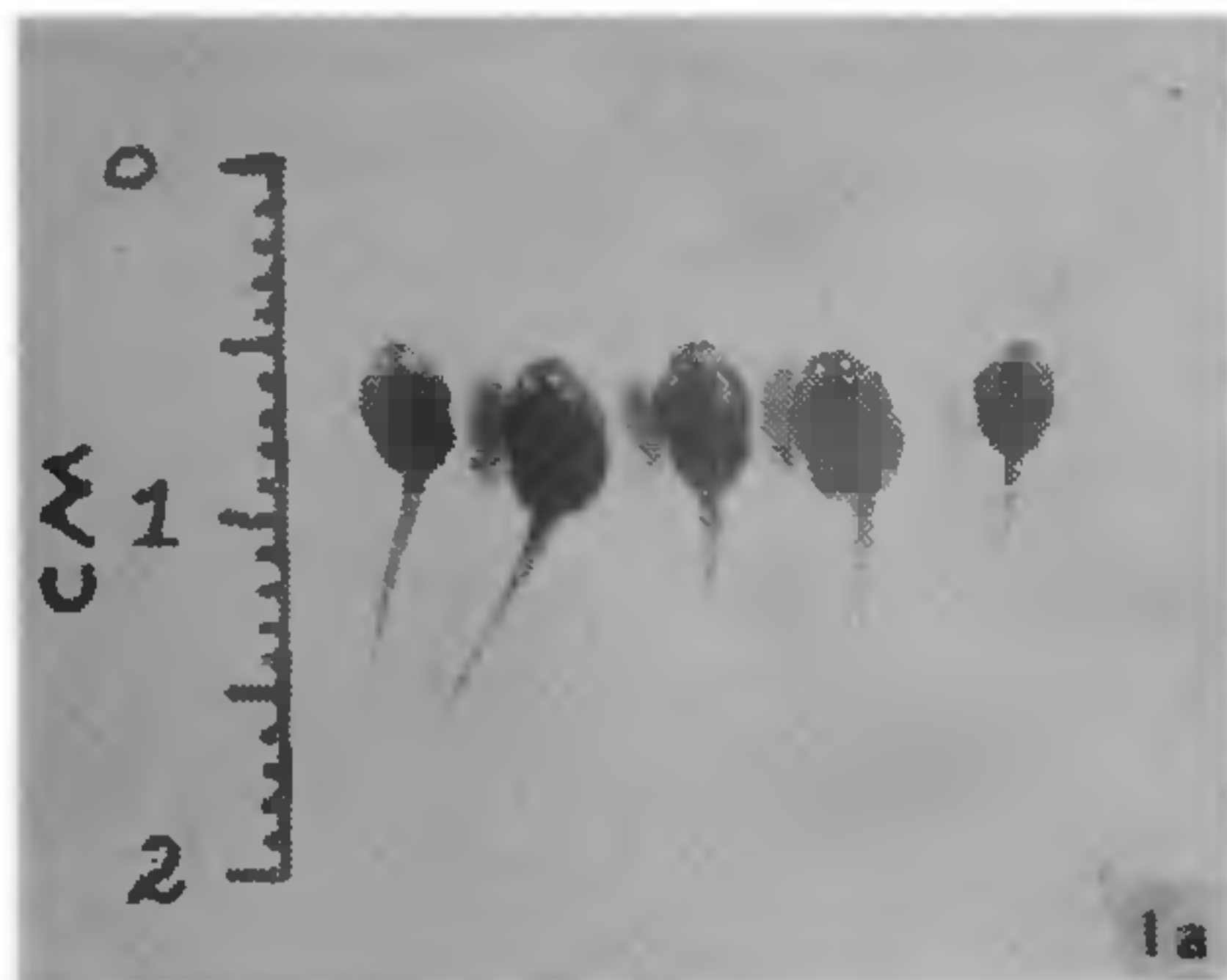
Percentage of *Bufo andersonii* tadpoles surviving after 10 days of treatment with vitamin A palmitate and vitamin A acetate

Rearing medium	% of survivors on Day 10				
	I.U. of vitamin A/ml	4 days old tadpoles Palmitate treated	4 days old tadpoles Acetate treated	7 days old tadpoles Palmitate treated	7 days old tadpoles Acetate treated
Nil (water—controls)		100		100	
1	100	72	100	76	
5	100	42	96	50	
10	100	2	98	18	
15	96	0	84	2	
20	44	0	82	0	
30	4	0	74	0	

more toxic than the palmitate for both age groups. Even in 1 I.U./ml solution of the acetate only 72 to 76% of the two age groups survived the 10 days treatment and in concentrations of 15 I.U./ml and higher all or nearly all died during the same period. On the contrary, in all palmitate treated groups of 7 days old tadpoles the least number surviving in even the highest concentration of the drug was still as high as 74%. Even among the younger larvae the survivors on 10th day were less than 50% when the palmitate concentration was 20 I.U./ml; but the next higher concentration of this form also was extremely lethal to this age group. Most mortality occurred earlier in the acetate than in the palmitate treated groups.

The two esters affected the tadpoles in various other ways also but not identically. Growth of the larvae was retarded by both but it was particularly noticeable in the tadpoles treated by even a low concentration, 5 I.U./ml, of the acetate (Figs. (1a-c) which also caused severe haemorrhage in the head region and curving of the tail. Both acetate and palmitate produced general oedema and some depigmentation particularly of the head and branchial regions. However, while these changes occurred in tadpoles at high concentrations (15 I.U./ml and more) of palmitate, even low amounts of acetate produced similar effects; but higher concentrations of the acetate did not cause any noticeable changes of this nature. The tadpoles treated with 15-30 I.U./ml palmitate secreted large quantities

of mucus which was found oozing out from the cloaca, spiracle and mouth (Fig. 2) but this did not occur in any of the acetate treated larvae.



FIGS. 1a-c. Tadpoles reared for 8 days in (a) water (controls) and in 20 I.U./ml solutions of (b) vitamin A palmitate and (c) vitamin A acetate from 4 days after hatching.



FIG. 2. Mucus emerging from the mouth of tadpoles treated with 30 I.U./ml vitamin A palmitate.

The excessive mucus production in palmitate larvae must have been due to hyperplasia of the mucosal cells of the gastro-intestinal tract caused by the excess of vitamin A as has also been reported for *Xenopus* larvae fed vitamin A alcohol or acid¹. That this did not happen in the larvae given acetate may be attributed to the greater toxicity of this form which, even in small amounts, perhaps killed the cells rather than causing mucous hyperplasia. Vitamin A acetate has been reported to inhibit mucus secretion from even the normal mucoid epithelia in organ culture⁴.

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VARIABLE SEX RATIO IN SOME HIGH ALTITUDE LIZARDS FROM KASHMIR

AMONG the lizards in general, a normal 1:1 sex ratio has been reported^{1,2}. But the fluctuations with regard to this ratio have also been pointed out in some species^{3,4}. The population structure of *Agama tuberculata* (oviparous) and *Lygosoma himalayana* (ovoviviparous); the two commonly occurring high altitude lizards in Kashmir has been studied.

Live specimens of both sexes of the species were collected from their habitats in the valley of Srinagar (*A. tuberculata*, elevation of 1750-1900 m and *L.*