pectoral fin, origin closer to vent than to tip of snout. *Scales* : minute, cycloid deciduous, so that the specimens are practically naked.

Colour : in alcohol, uniformly dark brown ; spinous dorsal fin dusky, other fins pale ; opercular lining dusky, inside of mouth somewhat so.

Remarks.—Grey[2] established two subspecies of *Epinula orientalis* Gilchrist and von Bonde based on material from the Pacific and Atlantic, and distinguished these subspecies from the typical form known from the western Indian Ocean, in having the ventral fin below the vertical from the middle of the pectoral fin (*versus* behind the tip of the pectoral fin). Apparently Grey[2] used only literature description for *E. orientalis orientalis* since Smith's[5] figure of a topotype clearly shows the ventral fin below the vertical from the midlength of the pectoral fin. The original description and figure of *E. orientalis* seems to be faulty in this character. In the specimens from the Bay of Bengal and also in the 26 specimens collected from off the south-west coast of India during 1971 by one of us (PKT) (ZSI regd. No. F. 6295/2), the ventral fin is also inserted below the vertical from the midlength of the pectoral fin. Comparison of the Indian material with the type descriptions of *E. orientalis pacifica* and *E. orientalis americana* indicates that they are conspecific since the Indian Ocean subspecies embraces the diagnostic characters of the Pacific and Atlantic Ocean subspecies ; the differences seem to be based on inadequate material and local variations.

The authors are grateful to Dr. A. G. K. Menon for kindly reading through the manuscript. The authors are also grateful to Dr. S. Khera, Zoological Survey of India and Shri D. A. S. Gnanadoss, Central Institute of Fisheries Operatives, Madras Unit, for their sustained encouragement.

Zoological Survey of India, Calcutta-13 — P. K. TALWAR.

and

Central Institute of Fisheries Operatives, Madras Unit, Royapuram, Madras-13, *May* 30, 1974. — R. SATHIARAJAN.

1. Herre, A. W. C. T., *Philippine J. Sci.*, 1950, 79 (2), 149.
2. Grey, M., *Copeia*, 1953, 3, 135.
3. Narayana-Rao, K. V., *J. mar. biol. Ass. India*, 1965, 7 (1), 217
4. Gilchrist, J. D. F. and von Bonde, C., *Fish. mar. Biol. Surv.*, Rep. 3, Spec. Rep. VII, 1924, 15.
5. Smith, J. L. B., *Sea Fishes of Southern Africa*, 1953, 311.

JUTE SEED STORAGE AND OXYGEN REQUIREMENTS

It is a common practice to store jute seeds loosely in containers and some open space is left deliberately on the supposition that jute seeds respire, though very feebly, during storage and their viability is affected if totally cut off from oxygen. In a seminar, the question was posed that if fungal spores remain viable for years under perfectly anaerobic conditions (as under paraffin oil) why jute seeds should need oxygen for respiration. It was said that fungal spores and jute seeds are morphologically quite different and so they are also different in their physiological activities.

In the light of the above discussions, it was thought necessary to study the point very critically. Two varieties of jute seeds were selected for testing ; they are *Corchorus olitorius* JRO-632 and *C. capsularis* JRC-321. The moisture contents of the two varieties were between 9–10%, which is known to be a range at which the viability of jute seeds during storage is not affected[1].

Three sets of experiments were carried out. In set No. 1 the seeds were very tightly packed in glass bottles and then sealed with wax. In set No. 2 the seeds were preserved in desiccators in which the air was replaced by nitrogen freed from oxygen by passing through pyrogallol solution and then drying by passing through a tower of calcium chloride. In set No. 3 the seeds were taken in 15 cm × 2·5 cm test tubes and completely immersed in sterile liquid paraffin as is used in the preservation of fungal subcultures and then corked. The three sets were stored for 6–9 months in room temperature and then taken out for testing viability in the usual way. Samples from set Nos. 1 and 2 were used straight for germination tests. The seeds from set 3 were taken out, excess paraffin was drained out and then the seeds rinsed quickly with three changes of alcohol-benzene mixture (1 : 2) to remove the residual paraffin. The seeds were then spread on a petri dish to allow the alcohol-benzene mixture to evaporate and thereafter used for testing viability. The results of the three sets are given in Table I, where it is seen that the viability of the seeds under all the three conditions of storage was practically unaffected.

From the results of set No. 1, it is perfectly clear that jute seeds can be stored in tightly packed condition and there is no compelling need to leave any empty space. Results of set No. 2 show that oxygen is not necessary for jute needs during storage. But the condition of the experiment is open to the criticism that the oxygen of the desiccators had not been fully replaced by oxygen-free nitrogen. This point is, however, met by the

TABLE I

Storage of jute seeds in the absence of oxygen

Set No.	Condition of storage	Period of storage	Percentage of germination :		Vigour of germination	
			JRO-632	JRC-321	JRO-632	JRC-321
Control	..	..	97	98	Normal	Normal
1	Tightly packed in glass bottles	Six months	95	95	,,	,,
2	In desiccators in oxygen free dry nitrogen	,,	95	96	,,	,,
3	Under liquid paraffin	Nine months	93	95	,,	,,

results of set No. 3. At the same time, it should be noted that *small* decreases in viability have appeared in sets 1, 2 and 3 as against the control. It remains to be seen whether these differences are significant and get magnified on prolonged storage. Further work is in progress.

The authors are gratetul to Dr. T. Radhakrishnan, the Director, Indian Jute Industries' Research Association, for his kind permission to publish the results.

Indian Jute Industries' Research Association, Calcutta 700 053, *May* 9, 1974.

R. G. BOSE.
J. P. BHATTACHARYYA.

1. Bhattacharyya, J. P. and Dutta, A. K., *Jute Bulletin*, 1972, 35, 129.

X-RAY INDUCED CHANGES IN THE ACTIVITIES OF ACID AND ALKALINE PHOSPHATASE IN *PERIPLANETA AMERICANA*

CONSIDERABLE work exists to indicate the inactivation of enzymes following irradiation[1-3]. However, very little information is available on the sensitivity of enzymes to x-irradiation with respect to sex and tissue of the animal, in which the enzyme occurs.

In the present investigation adult cockroaches of either sex were subjected to whole body exposure of x-rays, at doses ranging from 1,200 to 9,600 rads. Following the exposure, the activity of acid and alkaline phosphatase, both in the midgut and hepatic caeca, was determined as described by Bodansky[4].

RESULTS AND DISCUSSION

Both the enzymes showed a decrease in activity with the increase in the dosage of x-rays. The acid enzyme activity was completely suppressed at 4,800 rads in the male hepatic caeca and in the female midgut and at 6,000 rads in the male midgut and the female hepatic caeca. However, alkaline enzyme in both the tissues, irrespective of the sex of the insect, exhibited some activity (Table I), even after an exposure a dose of 9,600 rads.

These observations clearly indicate that acid phosphatase, irrespective of the insect's sex, is more sensitive to x-irradiation than alkaline phosphatase. But, its sensitivity to radiation varies in the two tissues studied and also with respect to sex of the insect. Acid phosphatase was more sensitive to

TABLE I

Effect of x-rays on the activity of acid and alkaline phosphatase in cockroaches*

Dose in rads	Male cockroaches				Female cockroaches			
	Acid enzyme		Alkaline enzyme		Acid enzyme		Alkaline enzyme	
	Midgut	H. Caeca	Midgut	H. Caeca	Midgut	H. Caeca	Midgut	H. Caeca
Normal	50·3	7·1	62·8	37·5	22·8	12·5	101·8	64·1
1200	36·8	5·1	50·7	21·4	10·3	7·6	82·1	39·3
2400	16·4	2·3	37·8	12·8	8·9	4·3	62·5	26·8
3600	11·9	1·1	30·7	8·4	5·0	0·7	35·5	13·2
4800	1·8	..	21·8	4·6	..	0·3	19·8	7·8
6000	..	..	15·3	3·6	..	..	13·2	5·7
7200	..	..	9·6	1·2	..	..	9·6	2·4
8400	..	..	6·1	1·1	..	..	7·1	1·2
9600	..	..	2·1	0·9	..	..	2·7	0·4

* Enzyme activity expressed as μg of inorganic phosphorus liberated/ml homogenate/hour incubation.