appear to be V-shaped and rod-shaped respectively. The first division of anaphase is reductional and the two X chromosomes which behave as a unit, move together to the same pole. This results in two types of secondary spermatocyte metaphases → one with 15 (13 A + X_1X_2) and the other with 13 elements (13A) only. The second division of anaphase is equational.

The sex-determining mechanism is very interesting in aquatic spiders. The male shows X_1X_2O type of mechanism where the Xs are invariably acrocentric. These Xs show strong positive heteropycnosis during prophase stages of meiosis in the male. The orderly segregation of the Xs to the same pole is probably facilitated by the precocious polarization of the nucleus during the prophase stages of meiosis[9]. The proximal localization of chiasmata in spermatogenesis has imposed a major barrier to the establishment of centric fusions in spider phylogeny. Many species with acrocentric chromosomes have, however, undergone evolutionary decreases in chromosome number. In these, presumably centric fusion led to the production of metacentric elements which were later converted into acrocentrics by pericentric inversion. The pattern of chiasmata must have evolved as follows (proximal → distal → proximal localization)[10]. Since X_1X_2O mechanism has been found in the primitive families, there can be no doubt that it was the primitive sex-determining mechanism of the whole group, which has been handed down from Palaeozoic times[10].

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PATULIN TOXICOSIS IN CHICKS

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PATULIN is a potent mycotoxin and is toxic to a wide range of biological systems including microorganisms, plants and animals[1]. Dietary intake of mycotoxins has been linked to the high incidence of liver diseases in Uganda and Thailand[2]. It has been reported that amino acid transport across intestinal membrane is inhibited in patulin toxicity[3]. The present investigation reports the effect of patulin on membrane bound total ATPase and Na^+–K^+ dependent ATPase in the kidney and the intestine of chicks. These enzymes are involved in the transport mechanisms.

Patulin was isolated from the contaminated bread according to Scott and Kennedy[4] and its purity assessed by the characteristic R_f value on thin layer chromatography and its characteristic UV absorption maxima in comparison with authentic sample[5]. Thirty (one day old) white leghorn chicks, obtained from the Tamil Nadu Poultry Research Station, Madras were divided into two equal groups. One group having 15 birds was fed orally with 100μg of isolated patulin, every 48 hr by intubation. The other group served as control. Both the groups were fed with commercial chick diet and water. At the end of the 15th dose, the birds were fasted overnight and killed by a blow on the head. Kidney and intestine were removed and the tissues were homogenized in tris-HCl buffer, pH 7.5 (0.01 M) at 4°C and ATP phosphohydrolase was assayed following the method of Hokin *et al* [6]. For the assay of total ATPase activity, the incubation medium in a total volume of 1.0 ml contained the following: 0.1 ml of buffer, 0.1 ml of NaCl solution, 0.1 ml of KCl solution, 0.1 ml of $MgCl_2$ solution and 0.1 ml of enzyme extract. This mixture was incubated at 37°C for 30 min with and without 0.1 ml of

Table 1 *Activities of total ATPase, Na^+–K^+-dependent ATPase in kidney and intestinal tissue from control and patulin administered chicks (enzyme activities are expressed as μmol of product liberated/mg protein under incubation conditions)*

	Kidney		Intestine	
Enzyme	Control	Experimental	Control	Experimental
Total ATPase	2.1±0.19	1.3±0.09*	4.2±0.21	2.0±0.16*
Na^+–K^+-dependent ATPase	1.6±0.16	0.9±0.08*	2.9±0.20	1.3±0.11*

* $P<0.01$

ouabain solution. The reaction was started by the addition of 0.1 ml of ATP solution and allowed to proceed for 5 min at 37°C. The reaction was terminated by the addition of 2.0 ml of TCA. The suspension was centrifuged and the phosphorus content of the supernatant was measured. The activity shown by the sample without ouabain is considered as total ATPase activity. The difference between the values with and without ouabain is referred to as the Na^+–K^+ ATPase activity.

Table 1 shows the activities of total ATPase and Na^+–K^+-dependent ATPase in kidney and intestine of control and patulin fed chicks. The experimental chicks showed reduced enzyme activity. The reduction in the activity of total ATPase in kidney was 40% and in the intestine 52% while the reduction in the Na^+–K^+-dependent ATPase activity in kidney was 46% and in the intestine 55%.

The Na^+–K^+-dependent ATPase catalyses the outward flux of sodium ion across the cell membrane and the inward flux of potassium ion and this is responsible for the establishment of sodium gradient which facilitates the transport of ions[7]. The present study suggests that the Na^+–K^+-dependent ATPase of chick kidney and intestine was inhibited by patulin which might affect the sodium gradient as well as the transport of ions.

Dunham and Glynn[8] have shown that the inhibition of Na^+–K^+ transport in kidney as well as the inhibition of the erythrocyte Na^+-K^+-dependent ATPase[9] required the presence of lactone ring in the structure of the inhibitors. The cardiac glycoside, ouabain which has been established to be a sensitive and specific inhibitor of Na^+–K^+ transport in many tissues[10, 11] contains a lactone ring. It is interesting to note that patulin also has a lactone ring[12]. Ueno *et al*[13] has reported that patulin irreversibly binds with the sulphydryl groups of the rabbit reticulocyte cell membrane and inhibits the Na^+-dependent transport of glycine.

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