

lacks reference to anal openings and precise extent of excretory bladder because the excretory system was not studied either from live specimens or sectioned material. A restudy of Sinha's material, therefore, appears essential to clarify these points.

Among the species reported from other countries, as cited by Yamaguti<sup>8</sup>, Thatcher<sup>6</sup>, in the description of *A. megastomum* (from Mexican Indigo snake), likewise includes, amongst specific characters, variable diameter of intestinal caeca, presence of anal openings and y-shaped excretory bladder with collecting canals extending to near the oral sucker. The piscine species, *A. bagri* from *Bagarus docmac*, according to Thomas<sup>7</sup>, has anal openings and y-shaped excretory bladder extending behind seminal vesicle. Fischthal and Kuntz<sup>3</sup> too have reported the finding of anal opening in each caecum, particularly visible in younger forms of *A. spiniceps*, from *B. bayad* (from Egypt) and anal openings in *A. absconditum*.

The present findings record 9 of our freshwater fishes as second intermediaries of *A. burminis* which requires 3 hosts for completion of its life-cycle.

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## EFFECT OF NONIONIC SURFACTANTS ON POLLEN GERMINATION AND POLLEN TUBE GROWTH

In recent years the use of surfactants, which were initially used to enhance the penetration and effectiveness of foliar applications of herbicides and pesticides, has been extended to various biological investigations involving interaction of many growth substances<sup>1</sup>. Investigations have shown that many of the surfactants have independent biological effects in animal and plant systems<sup>2-4</sup>. This communication reports the effect of two nonionic surfactants, Tween 80 (Polyoxyethylene sorbitan monooleate) and Triton X-114 (Alkyl phenoxy polyethoxy ethanol), on pollen germination and pollen tube growth in *Trigonella foenum-graecum* Linn.

Three concentrations of Tween 80 and Triton X-114 (10, 100 and 200 ppm v/v) were added to the pollen culture medium containing sucrose (10%) and boric acid (100 ppm). Hanging drop cultures of pollen grains collected from just dehisced anthers were raised in cavity slides and incubated at 22 ± 2° C under diffuse light conditions (100–200 Lux). Two cultures were raised for each treatment. Three observations were taken for all the treatments 1, 2 and 3 hours after culture. For each treatment, at least 200 pollen grains and 50 pollen tubes were scored for germination and tube length, respectively, using both the cultures. The experiment was replicated 5 times.

TABLE I

Effect of Tween 80 and Triton X-114 on pollen germination and pollen tube growth in *Trigonella foenum-graecum*

Treatment	Percentage germination*			Tube length (in μ)*		
	1 hr	2 hr	3 hr	1 hr	2 hr	3 hr
Control	100	100	100	118.5	267.0	593.0
Tween 80						
10 ppm	100	100	100	135.4	327.0	572.5
100 ppm	100	100	100	156.0	372.0	575.0
200 ppm	100	100	100	127.5	355.5	623.0
Triton X-114						
10 ppm	80.7	100	100	100.5	238.5	429.0
100 ppm†	12.6	20	28.5	46.6	79.5	111.0
200 ppm†	0	0	0	..	..	..

\* Average of all replicates, † In these treatments cultures were maintained up to 8 hr to see if delayed germination occurs; in 100 ppm it reached 32% and in 200 ppm there was no germination.

In *Trigonella foenum-graecum* pollen grains are shed at the 2-celled stage. Acetocarmine preparations of mature pollen, however, show only the generative nucleus. The table gives the percentage

germination of pollen grains and length of pollen tubes in the various treatments. The results show that in both control and the three Tween 80 concentrations, pollen germination was 100%. The latter considerably hastened the rate of pollen tube growth in the first 2 hr. Triton X-114 caused a slight delay in pollen germination at 10 ppm and drastically reduced both pollen germination and pollen tube growth at 100 ppm and totally inhibited pollen germination at 200 ppm. In control as well as in all the treatments in which pollen germination occurred, the pollen tubes were normal, the generative nucleus entered the tubes in which length exceeded  $150\ \mu$ , but the division of the generative cell was not initiated.

The mechanism of the biological action of surfactants is not clearly understood. Many hypotheses have been put forward to explain the promotory and the inhibitory effects of the surfactants<sup>1-4</sup>. The pollen germination system can be used for elucidating the mechanism of action of surfactants because it is simple to set up, is easy to handle and is of short duration.

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### TERTIARY TRISOMIC IN *TRIGONELLA CORNICULATA*

SPONTANEOUS triploids in *Trigonella corniculata* L. ( $2n = 16$ ), known as 'Kasuri Methi' in India, has been reported by Singh and Saini<sup>1</sup>. Out of 60 seeds produced by one triploid, 34 germinated; seventeen of them were found to be primary trisomics, one tertiary trisomic, one double trisomic and one triploid. The remaining 14 plants were diploid. The second triploid produced 30 seeds out of which 13 germinated and all were diploid.

Ninety-six cells were studied at metaphase I of the tertiary trisomic which had  $2n = 17$ . The typical pentavalent ( $\bigcirc-\bigcirc$ ) formed by tertiary trisomics<sup>2</sup> is shown in Fig. 1. The most frequent configuration was  $8_{II} + 1_I$  (Fig. 2) though  $1_{IV} + 6_{II} + 1_I$  (Fig. 3) and  $1_{III} + 7_{II}$  (Fig. 4) were also observed, the later being the next most

frequent configuration. The associations of chromosomes at metaphase I are shown in Table I. Rarity

TABLE I  
Different chromosomal associations at metaphase I of the tertiary trisomic and chiasma frequency in the diploid and the tertiary trisomic of *T. corniculata*

Configuration	No. of cells	Per cent of cells	Mean Nta/cell in	
			Diploid	Tertiary trisomic
$1_V + 6_{II}$	.. 4	4.17		
$1_{IV} + 6_{II} + 1_I$	.. 2	2.08		
$1_{III} + 7_{II}$	.. 36	37.50		
$1_{III} + 6_{II} + 2_I$	.. 1	1.04	$14.3 \pm 0.65$	$12.5 \pm 0.45$
$8_{II} + 1_I$	.. 45	46.87		
$7_{II} + 3_I$	.. 8	8.34		

of pentavalent at metaphase I is due to terminalization or non-formation of chiasmata<sup>3</sup>. However, an association of five chromosomes may be quite frequent at diplotene and diakinesis but poor staining and inconsistency of the nucleolar number rendered the study at these stages difficult in this material. Chiasma frequency in the tertiary trisomic is lower than that of the diploid (Table I). An uncommon configuration of  $1_{III} + 6_{II} + 2_I$  is shown in Fig. 5. If the two univalents shown in



FIGS. 1-5. Meiosis in the tertiary trisomic in *T. corniculata*,  $\times 1,200$ . Fig. 1. Metaphase I with  $1_V + 6_{II}$ . Fig. 2. Metaphase I with  $8_{II} + 1_I$ . Fig. 3. Metaphase I with  $1_{IV} + 6_{II} + 1_I$ . Fig. 4. Metaphase I with  $1_{III} + 7_{II}$ . Fig. 5. Metaphase I with  $1_{III} + 6_{II} + 2_I$ .

this cell go to one pole and the resultant gametes are able to take part in fertilization, primary triso-