Table 1 *Lesion size and depth in coconut stem (West Coast Tall variety) of different ages, inoculated with Thielaviopsis paradoxa during different periods*

		Palms of 10–12 years				Palms of 45–60 years			
Date of inoculation	Months after which observations were taken*	Palm no.	Duration (months) for appearance of first symptoms	Lesion depth (cm)	Lesion size (cm)	Palm no.	Duration (months) for appearance of first symptoms	Lesion depth (cm)	Lesion size (cm)
26.11.1985	24	Not inoculated				1, 2, 3, 4	1½–2	4.5 3.5 5.5 4.5	7 × 3 5 × 2.5 17 × 3 12 × 2
28.4.1986	20	Not inoculated				1		0	0 × 0
						2		0	0 × 0
29.5.1986	19	1, 2	6	2.5 3.0	4 × 2.5 4 × 2.0	1, 2	6–8	0.5 2	4 × 2.5 3.5 × 2.5
31.7.1986	17	1, 2	2	4.0 0.5	6.5 × 2.5 7.5 × 2.5	1, 2	2	3.5 5	5 × 2.5 7 × 3.5
27.9.1986	15	1, 2	1½–2	6 3	7 × 2 5 × 2.5	Not inoculated			
29.11.1986	13	1, 2	2	7 7	7 × 2 5 × 2	1, 2, 3	2–2½	2 3 2	5.5 × 2 12 × 6 5.5 × 2.5
6.4.1987	9	1, 2, 3**, 4**	6–7	3.5 2 2 1.5	4.5 × 2 3 × 2.5 3 × 2 3.5 × 2	Not inoculated			
4.7.1987	6	1, 2	2	3 3	3.5 × 2.5 3 × 2	1, 2	2–2½	3 4	2.5 × 2 4.5 × 2.5

*Observations were taken on 22 December 1987; **Chowghat Orange Dwarf.

of the age of the test palms. Young palms tend to be more susceptible than the older ones. Enhanced decay in palms inoculated in July–November may be due to prevalance of high humidity and comparatively moderate temperature during this period (table 2). The present finding is significant in the context of standardizing techniques for screening coconut germ plasm for resistance to stem bleeding disease.

Table 2 *Meteorological data (mean temperature and relative humidity) during the period of the experiment*

	Temperature (°C)		Relative humidity
Month	Minimum	Maximum	range (%)
November 1985	21.5	32.9	59–89
January 1986	20.0	32.8	53–85
April '86	25.1	34.0	62–83
May '86	25.8	34.0	61–79
July '86	23.5	30.1	78–92
September '86	22.9	30.0	75–93
November '86	21.9	31.9	64 88
January 1987	20 0	32.9	47–82
April '87	24.9	33.9	59–80
July '87	24.3	31.2	74–87
December '87	21.2	33.7	52–80

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EFFECT OF 2,4-D ANALOGUES ON CALLUS CULTURES IN MAIZE

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IN VITRO culture of higher plant cells and tissues has gained tremendous importance in view of the pros-

pects for genetic manipulation. In general, auxins like 2,4-D, IAA, NAA, IBA, etc. have been studied in different tissue culture systems and only 2,4-D has been the potential auxin for callus induction in cereals[1]. In maize tissue culture, there are problems related to growth of unorganized tissue, establishment of single cell suspensions, protoplast cultures and morphogenesis[2]. The present work was undertaken to study the effect of 2,4-D analogues in callus initiation, callus growth and clumping pattern in cell suspension cultures of maize.

Maize inbred A188 and sweet corn, (obtained from the Maize Research Station, Hyderabad) were used in the study. Mature seeds were washed in teepol detergent solution followed by tap-water. Seeds were sterilized in 0.1% mercuric chloride for 6–7 min and were rinsed in sterile distilled water thrice. The seeds were then placed on wet filter papers in sterile test tubes for germination. Root explants were cut from germinated seedlings and inoculated onto Linsmaier and Skoog (LS) media[3], supplemented with 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and 2,4,5-trichlorophenoxypropionic acid (2,4,5-P) in concentrations ranging from 0.5 to 4 mg/l. An average of 25–30 cultures were examined for the response in each case.

The auxin 2,4-D and its two analogues did not show significant differences in callus induction (90–100%). A range of concentrations of the three hormones (0.5–5 mg/l) tested for callus growth and maintenance indicated differential response. Of the four concentrations tested, 2 mg/l 2,4-D gave the maximum callus growth as compared to other concentrations. Increased concentration however, reduced the growth as evidenced by fresh and dry weights (figure 1). The analogues 2,4,5-T and 2,4,5-P differed considerably among themselves and also with 2,4-D. Low levels (0.5 mg/l) of 2,4,5-T and 2,4,5-P were superior to 2,4-D. Callus growth was higher with 0.5 mg/l, 2,4,5-T (1000.9 mg) and 2,4,5-P (853 mg) than 2,4-D (597.6 mg). The analogue 2,4,5-P was superior to 2,4,5-T and 2,4-D at concentrations of 1 and 4 mg/l, whereas 2 mg/l, of 2,4-D was better than 2,4,5-T (416.3 mg) and 2,4,5-P (368 mg) (figure 1).

Friable calli derived from seedling root of inbred A188 were transferred onto the liquid LS basal media containing 0.5–4 mg/l 2,4-D, 2,4,5-T and 2,4,5-P to establish fine cell-suspension cultures. Data were recorded on fresh weight and dry weight per ml suspensions. After 4–6 days in liquid media on gyratory shaker, the suspension consisted of a mixture of cell aggregates and single cells. Of the four concentrations of 2,4-D (0.5–4 mg/l) tested. 2 mg/l exhibited a fine suspension consisting of smaller cell aggregates (<2 mm) and single cells,

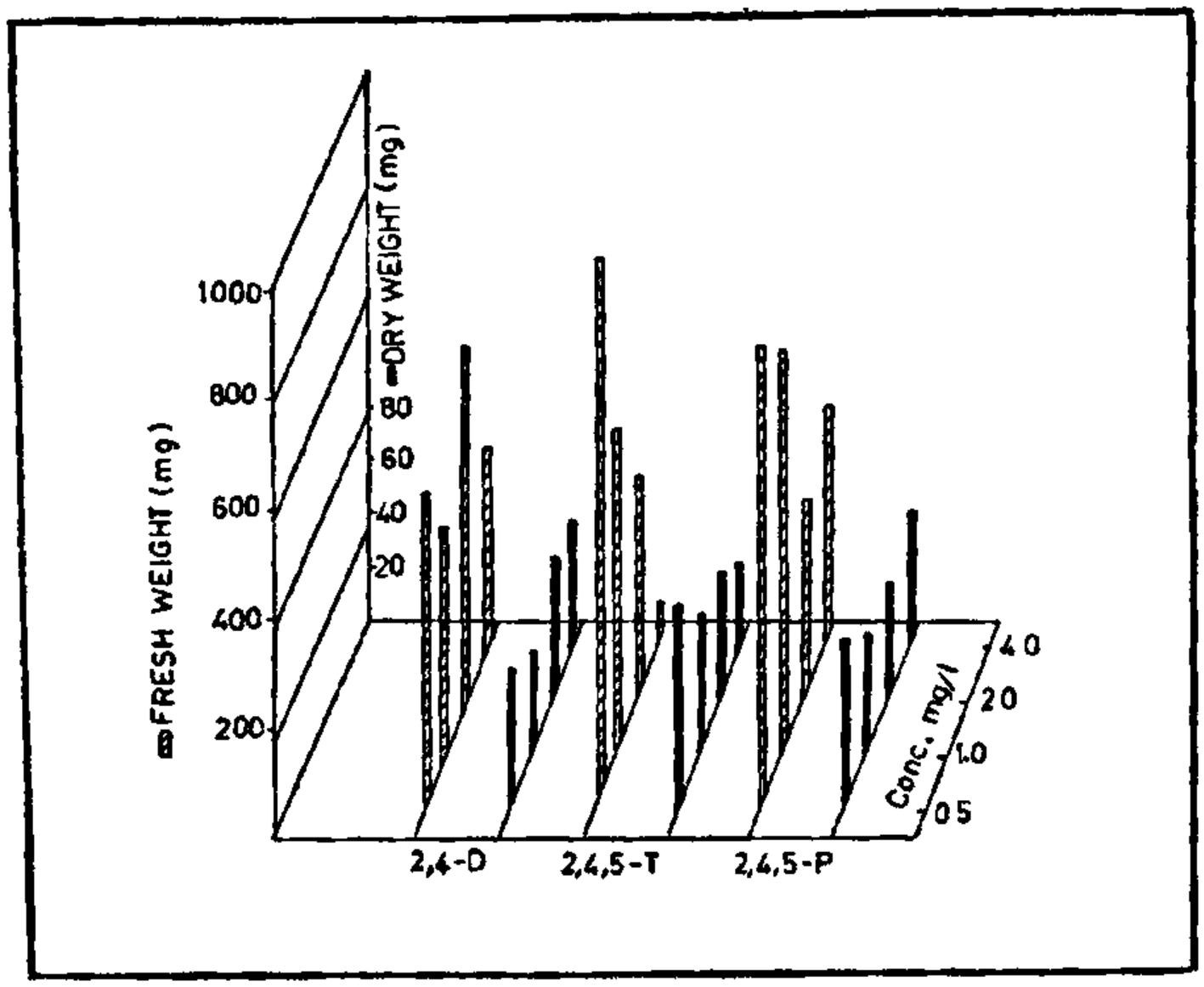

Figure 1. Effect of 2,4-D and its analogues on callus growth.

whereas in other concentrations larger aggregates (2–5 mm) appeared along with a few single cells. The two analogues, 2,4,5-T and 2,4,5-P were not effective in inducing a fine suspension of single cells compared to 2,4-D. Only the larger cell aggregates were observed without any suspension of single cells and small cell clumps.

The hormonal level in the medium was found to influence cell separation in cell suspensions. The 2,4-D analogues, 2,4,5-T and 2,4,5-P were found to be not efficient in inducing well dispersed fine cell suspension, whereas 2,4-D (2 mg/l) induced a fine cell suspension. These preliminary results suggest that the analogues may not be effective substitutes for 2,4-D in the growth and establishment of maize suspension cultures.

In cereals, 2,4-D has been used very frequently for callus induction[4]. In an earlier study, callus initiation and growth of most of the explants were favoured by 2 mg/l, of 2,4-D suggesting that 2,4-D is the choice of auxin required for callus induction in maize[5]. Analogues of 2,4-D have shown a wide range of response in cell and tissue cultures[6,7]. Superiority of 2,4-D analogues over 2,4-D was also observed in maize embryo cultures suggesting that probably auxin sites have more affinity to analogues than 2,4-D[8]. In the present investigation, 2,4-D analogues were superior to 2,4-D in callus growth and maintenance suggesting differential response of analogues in cultured tissue. It is possible that different auxins have different metabolic breakdowns and hence greater auxin activity of the analogues.

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EFFECT OF THYROID HORMONES ON THE ACTIVITIES OF HEPATIC ENZYMES IN THIOURACIL-TREATED TELEOST, *ANABAS TESTUDINEUS* (BLOCH)

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RECENTLY it has been reported that administration of physiological doses of thyroid hormones both T_4 and T_3 significantly influenced the activities of hepatic enzymes of *Anabas testudineus*[1]. However, the role of these hormones in thiouracil (antithyroid drug) treated fish has not been investigated. Since hormonal effects on energy metabolism is mainly brought about by altering enzyme activities involved in metabolic pathways, an attempt was made to study the activities of hepatic enzymes such as lactate dehydrogenase (LDH), cytosolic and mitochondrial malate dehydrogenases (cyt. MDH., mit. MDH), glucose 6-phosphate dehydrogenase (G 6-PDH) and mitochondrial catalase of thiouracil-treated *A. testudineus* after the administration of thyroid hormones.

Five groups of fish (comprising six each) each, weighing 50 ± 5g BW were kept in aquaria with water at 28 ± 1°C. Fish were fed with fish feed every other day and were starved for two days prior to sacrifice. Each fish of the groups 2, 4 and 5 was injected i.p with 100 μg thiouracil and group 3 fish received 300 μg thiouracil (Sigma Chemical Co., USA) per fish over a total of 10 days. The fish of group 2 & 3 received hormone vehicle thereafter, while each specimen of group 4 received 5 μg of l-T_3 and that of group 5 received 5 μg of l-T_4 for total 5 days. The first group, which received vehicle alone served as the control. The fish were sacrificed after 24 h of last injection and the liver was excised. The chilled liver was weighed and homogenised in 0.25 M sucrose and centrifuged to isolate mitochondria and cytosol at 4°C in Beckman J2 21 centrifuge[2]. The activities of LDH[3], cyt. MDH mit. MDH[4], G 6-PDH[5] and catalase[6] were assayed