Table 1 *Micronuclei induced in foetal liver cells following maternal administration of $HgCl_2$ in rats*

Sets studied	Total aberrant cells (mean ± SD)	Type of cells affected	
		Large	Small
Control	0.36 ± 0.51	0.21 ± 0.32	0.14 ± 0.19
Treatment 1 1/20th LD_{50} (1.85 mg/kg body weight)	0.26 ± 0.28	0.16 ± 0.22	0.15 ± 0.21
Treatment 2 1/15th LD_{50} (2.47 mg/kg body weight)	1.13 ± 0.67	0.68 ± 0.24*	0.56 ± 0.56
Treatment 3 1/10th LD_{50} (3.70 mg/kg body weight)	1.14 ± 0.55*	0.65 ± 0.23*	0.64 ± 0.62

df = 8; $^*P < 0.05$

prepared following the usual fixative-flame drying schedule and stained in Giemsa.

500 cells were scanned from each set. The liver cells were categorized into two types, large and small according to their diameters.

The percentage of micronuclei recorded in the liver cells of the foetuses obtained 11 days after the administration of $HgCl_2$ to the pregnant mothers ranged from 0.21 in control to 1.14 with the maximum dose (1/10th LD_{50}). The difference was statistically significant indicating that $HgCl_2$ in higher doses induces chromosomal breaks resulting in micronuclei. The breaks were more frequent in the larger cells (table 1).

Several external agents have been shown to cause transplacental micronuclei which may be either detected from foetal bone marrow or liver[4-6, 10-13].

The induction of micronuclei in the foetal liver cells following the administration of $HgCl_2$ to pregnant rats even after eleven days of recovery indicates the placental permeability of the salt and its toxicity even at low doses to the foetal organs.

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INFLUENCE OF GROWTH REGULATORS ON POLLEN VIABILITY AND POLLEN TUBE GROWTH IN TWO SPECIES OF *CLEOME*

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ATTEMPTS have been made to overcome the lack of pollen tube growth with the use of various chemicals by a number of workers[1]. While much information on the effect of plant growth regulators in plant systems is available, the effect on pollen viability and pollen tube growth has received inadequate attention. Considerable knowledge has accumulated on the constituents and exogenous chemicals affecting pollen viability and tube growth[2]. The present study was undertaken to assess the effect of growth regulators, individually or in combination, on the pattern of pollen tube growth *in vitro* in two members of Capparidaceae (now, Cleomaceae) namely, *Cleome gynandra* Linn and *Cleome viscosa* Linn.

Pollen grains of *C. gynandra* and *C. viscosa* were freshly collected soon after anthesis (around 05.30 hr for *C. viscosa* and 06.00 hr for *C. gynandra*). The nutrient medium for germinating pollen grains was prepared according to the method described earlier[3] with varying concentration of sucrose to ascertain the optimum level essential for realizing maximum viability and pollen tube elongation. The pH of the medium was adjusted to 7.3. The sucrose concentration in the medium varied between 2 and 10%. The pollen grains were cultured by the 'hanging drop' method. The basal nutrient medium (having sucrose concentration which gave maximum tube growth) was supplemented with indole acetic acid (IAA), kinetin (KN), gibberellic acid (GA_3) and abscisic acid (ABA), individually or in combinations at different concentrations, and the aqueous extracts of stigmatic tissue (five stigmas in 5 ml of distilled water). The observations were recorded as above at room temperature ($25 \pm 1°C$) for each of these treatments. For each treatment, three replicates were run and the mean length of 10 pollen tubes was taken from each replicate. In addition to pollen viability and tube length, the time of emergence of the pollen tubes was also recorded. The pollen viability and the tube length were recorded after 3 hr.

The range of the concentration tried for each chemical, the maximum mean viability of the pollen and the maximum tube length (in μ) obtained in the optimum concentration are given in tables 1 and 2.

As shown in table 1, the pollen grains of *C. viscosa* and *C. gynandra* differ in their requirement of sucrose concentration i.e. 8% and 6% respectively. *C. gynandra* showed higher pollen viability (79%) and tube growth (114 μ) than *C. viscosa*. For both the plants the pollen tubes emerged after a minimum period of 45 sec. Maximum pollen viability and pollen tube growth for both the plants were obtained in the aqueous extracts of stigmatic tissues, (table 2). Stigma provides a physically and chemically suitable medium for pollen germination. On its surface, substances produced within the stigmatic exudate, react with substances released from pollen to stimulate pollen germination. KN, GA_3, IAA and ABA have shown variable influence on the pollen viability and tube growth. The response of pollen to these growth regulators tested over a wide range of concentrations showed that the effect of these regulators varied with the concentration. KN, IAA and ABA were tested over a range of concentrations (1–10 ppm), from which 1 ppm, 2 ppm and 1 ppm concentrations respectively were chosen as optimum, while for GA_3 (1–20 ppm range), 10 ppm served as the optimum concentration.

C. gynandra showed higher pollen viability and longer tube length was obtained in KN treatment than in *C. viscosa*. Kinetin is involved in the mitotic-cytokinetic process of plant cells. A cytokinin-Ca^{2+} interaction appears to enhance ethylene production synergistically[4]. Ethylene is known to stimulate the growth of pollen tube[5]. IAA stimulates protein release which in turn causes wall loosening and extension. In *C. gynandra* the maximum pollen viability and tube growth was obtained in GA_3 treatment compared to *C. viscosa*. GA_3 is known to stimulate α-amylase

Table 1 *Effect of sucrose on pollen viability, pollen tube growth and emergence* (*values are mean* ($\pm SD$))

Sucrose concentration in the medium (%)	*Cleome gynandra*			*Cleome viscosa*		
	Pollen viability (%)	Time of emergence (sec)	Pollen tube growth (μ)	Pollen viability (%)	Time of emergence (sec)	Pollen tube growth (μ)
D.W.	6.8	360	14.71 ±1.15	5.0	540	9.36 ±0.13
2	22.4	90	98.07 ±1.46	18.1	90	35.38 ±1.51
4	43.2	60	100.04 ±1.32	26.2	90	53.86 ±1.58
6	79.5	45	165.95 ±1.43	32.6	60	60.83 ±2.83
8	36.3	60	97.55 ±0.99	68.6	45	113.92 ±6.03
10	23.2	60	74.64 ±1.06	22.0	60	36.58 ±1.16

Table 2 *Effect of growth regulators on pollen viability and tube growth (values are mean (± SD))*

Treatment	*Cleome gynandra*				*Cleome viscosa*			
	Optimum concentration of growth regulator (ppm)	Pollen viability (%)	Time of emergence (sec)	Pollen tube growth (μ)	Optimum concentration of growth regulator (ppm)	Pollen viability (%)	Time of emergence (sec)	Pollen tube growth (μ)
Sucrose (control)	6%	79.5	45	165.95 ± 1.43	8%	68.6	45	113.92 ± 6.03
GA_3	10	86.0	30	281.34 ± 7.86	10	83.0	30	213.43 ± 7.68
IAA	2	81.6	30	214.51 ± 9.92	2	79.3	30	163.00 ± 7.05
KN	1	91.2	30	345.86 ± 10.12	1	86.1	30	226.40 ± 8.20
ABA	1	38.0	150	82.69 ± 9.06	1	32.4	150	54.10 ± 7.40
Stigmatic extract		98.0	30	475.10 ± 9.95		93.0	30	313.47 ± 7.44
GA_3 + IAA	10+2	88.2	30	307.19 ± 10.36	10+2	85.6	30	221.57 ± 10.41
GA_3 + ABA	10+1	69.0	45	127.56 ± 11.71	10+1	61.0	45	91.95 ± 9.81
IAA + ABA	2+1	51.2	60	99.91 ± 13.22	2+1	43.3	60	63.63 ± 7.48

secretion to provide sugars from starch hydrolysis to sustain tube growth[6]. Pollen is a rich source of GA_3 and its content is reported to be 200-fold greater than that in ovary tissue both for *Petunia hybrida* and *Lilium*[7]. Pollen GA_3 should contribute little to total ovary level of GA at the time of pollination. Furthermore, only minor amounts of GA are known to diffuse from pine pollen into aqueous media during pollen germination[8]. The initial 'turnover' of GA during pollen viability and the formation of more active polar GA are correlated with rapid pollen tube growth[9].

ABA suppressed the elongation of pollen tube[10]. It has also been demonstrated in the present study that ABA has an inhibitory effect on pollen viability and tube growth in both the plants. The time of emergence of pollen tube was also delayed (150 sec) considerably when compared to control (45 sec). The inhibitory effect of ABA by exogenous application might be due to its interaction with endogenous ABA-like inhibitors, which suppress pollen tube growth.

As shown in table 2, the acceleration of tube growth was more evident in $GA_3 + IAA$ combination than in $ABA + GA_3$. The growth inhibition by ABA was overcome significantly in the presence of GA_3, rather than IAA, suggesting a favourable interaction between ABA and GA_3 in regulating pollen tube growth. ABA acts in a way antagonistic to the action of GA_3[11].

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STUDIES ON ZN DEFICIENCY IN DECIDUOUS SPECIES OF KUMAUN HIMALAYA I. EFFECT OF ZN ON CERTAIN FOLIAGE CHARACTERS OF *FRAXINUS MICRANTHA*

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THE relationship between nutrient status of the soil and foliage characteristic of woody plants is important both from the standpoint of nutrient cycling and as a specific plant adaptation[1]. In recent years studies have been made to examine the intraspecific responses of woody plants to nutrient status in terms of leaf longevity, leaf production and foliage constituents[2-5]. These studies indicate both increase and decrease in leaf longevity in response to increased level of macronutrients such as nitrogen, phosphorus and potassium. However, increased leaf production and nutrient enrichment of leaf are some of the consistent effects of mineral application.

The response of woody plants to micronutrient status in terms of foliage characters is less understood. The purpose of this communication is to determine the effects of Zn-status on leaf longevity, leaf production and foliage concentration of chlorophylls, protein and nucleic acids of *Fraxinus micrantha*. This species in certain forest stands, shows clear deficiency symptoms. The macronutrient status of the soil in these forest stands has been studied earlier (S. Yadav, Unpublished). In this study attempts have been made to understand whether or not the deficiency symptoms shown by *Fraxinus micrantha* are due to Zn. The effect of application of $ZnCl_2$, Zn EDTA and $ZnSO_4$ has also been studied.

Fraxinus micrantha Wall (ash) is a winter deciduous tree of the mid-montane region of Kumaun Himalaya. Leaf production starts in April and leaf drop com-