Table 1 *Per cent ustilospore germination of smuts in different dilutions of saponins*

Plant and family	Different dilution* (%)	*C. limitata*	*U. cynodontis*	*U. tritici*	*U. scitaminea*
M. butyracea	100	28.7 ± 1 6	59.7 ± 2.2	12.0 ± 3.6	—
(Sapotaceae)	50	23.3 ± 2.1	31 4 ± 1.6	33 5 ± 2.5	—
	25	50.2 ± 3.0	41.1 ± 1.5	45.7 ± 2.3	—
	1	62.3 ± 4.2	09.6 ± 1.6	70.0 ± 2.2	—
M. littoralis	100	45.7 ± 1.1	88.3 ± 4 4	—	76.0 ± 3.4
(Sapotaceae)	50	30.0 ± 2.6	35 5 ± 2.7	3.7 ± 0.4	43.3 ± 2.8
	25	24.4 ± 0.7	24.8 ± 1.2	3 0 ± 4.0	40.0 ± 0.6
	1	15.5 ± 0.7	22.1 ± 4 6	50.5 ± 3.4	26.3 ± 2.5
C. speciosus	100	—	—	—	—
(Zingiberaceae)	50	—	—	—	—
	25	—	—	—	—
	1	—	28.1 ± 3 4	54.3 ± 3.2	—
M. charantia	100	—	5.1 ± 0.8	26.0 ± 1.2	8.3 ± 0.4
(Cucurbitaceae)	50	2.1 ± 0.2	46 4 ± 2.9	63.0 ± 4.9	61 6 ± 1.6
	25	40.0 ± 1.4	69.5 ± 1.5	63.3 ± 3.6	66.4 ± 1.8
	1	58.0 ± 8.4	20.6 ± 4.2	—	33.9 ± 1 5
E. scandens	100	8.6 ± 0.3	71.2 ± 1.1	7.9 ± 1.1	72.1 ± 4.3
(Mimosaceae)	50	10 0 ± 0.9	64.5 ± 2.7	56.2 ± 2.7	55.9 ± 4.4
	25	30.0 ± 2 6	63.3 ± 4.0	59.2 ± 2.2	44.3 ± 1.7
	1	60.6 ± 2.4	5.1 ± 1.1	86.0 ± 2.9	38.0 ± 1.5
Control		82.2 ± 2.8 (Potato ext)	86.2 ± 3.1 (Water)	53.1 ± 2.8 (Water)	64.0 ± 3.0 (Water)

*100% = 1.1 (w/v).

the saponins of *E. scandens*, *M. butyracea* and *M. charantia* accelerated the ustilospore germination of *U. tritici* and *M. littoralis* and *E. scandens* also promoted the germination of *U. scitaminea* (table 1).

The saponins have been reported to exhibit antimicrobial and antifungal activities[8] but Wolters[9] reported the fungistatic action of many saponins against 15 phytopathogenic fungi and observed varied sensitivity to different saponins. The most sensitive fungi were *Sclerotinia fruticola*, *Claviceps purpurea*, *Trichothecium roseum*, *Piricularia oryzae* and *Fomes officinalis*.

It can, however, be concluded from these studies that the inhibitory effect of the saponins from *M. butyracea* and *C. speciosus* was most pronounced. Moreover, the saponins in terms of inhibition were most effective against *Cintractia* as compared to the species of *Ustilago*.

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INTRASPECIFIC NUCLEAR DNA VARIATION IN *COLEUS FORSKOHLII* (LAMIACEAE)

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INTERGENERIC and interspecific variations in DNA content per nucleus among diploid plants have been

Table 1 *Absolute 4c DNA content and total chromosome length in eight diploid and two autotetraploid clones of Coleus forskohlii*

Genotype	Locality	Ploidy status	4c DNA (pg) $\bar{x} \pm$ S.E.[a]		Duncan's group[b]	TCL[c] (μ)
C-1	—	$2n=4x=60$	14.277	0.176	A	138.29
C-2	—	$2n=4x=60$	14 060	0.094	A	127.46
KM-24	Kuridimalai, Coimbatore, T.N.	$2n=2x=30$	8.937	0.163	B	99.77
KM-13	Kuridimalai, Coimbatore, T.N.	$2n=2x=30$	8.455	0.177	C	92.42
LD-1	Lovedale, Nilgiris, T.N.	$2n=2x=30$	7.780	0.097	D	88.44
PG-1	Pithoragarh, U.P.	$2n=2x=30$	7.357	0.157	DE	81.24
KM-8	Kuridimalai, Coimbatore, T.N.	$2n=2x=30$	7.205	0.047	E	73.22
BH-6	Bhimtal, Nainital, U.P.	$2n=2x=30$	7.087	0.161	EF	71.14
KM-2	Kuridimalai, Coimbatore, T.N.	$2n=2x=30$	6.702	0.012	F	67.55
IH-1	Iduhatti, Nilgiris, T.N.	$2n=2x=30$	5.910	0.132	G	58.71

[a]S.E. = Standard error; [b]$P<0.05$; [c]TCL = Total chromosome length.

widely reported[1,2]. However, the information available on nuclear DNA variation within species is rather limited. In view of a large extent of morphological variation observed in germplasm stocks of *Coleus forskohlii* (Willd.) Briq., an important source of coleonol (Forskolin) which is being used as a drug for glaucoma, congestive cardio-myopathy and asthma[3-6], quantitation of nuclear DNA among different morphotypes was undertaken. The present communication reports on the nuclear DNA content and total chromosome length in eight morphologically distinct diploid clones ($2n=2x=30$) of *C. forskohlii* (BH-6, IH-1, KM-2, KM-8, KM-13, KM-24, LD-1 and PG-1) collected from different regions (table 1) and two induced autotetraploids (C-1 and C-2, $2n=4x=60$) of clone 'KM-8'.

Actively growing root tips were fixed in acetic-alcohol (1:3) for 24 h after pretreatment with saturated solution of para dichlorobenzene for 3 h at 15 C and were stained following usual Feulgen staining procedure[7]. Quantitative nuclear DNA measurements of at least 20 interphase nuclei (4c) from each genotype were made using Vickers M85 Microdensitometer. In most of the cases 2c nuclei at anaphase I were also measured from the same slide to confirm the values obtained for 4c nuclei. Slides in each replication were prepared separately along with control (*Allium cepa*) and four slides were prepared for each genotype. The arbitrary values were converted into picograms (10^{-12} g) using *A. cepa* as standard whose 4c nuclear value was taken as 67.08[8].

For somatic chromosome studies, the root tips were squashed in 1% acetocarmine. Total chromosome length was measured from Camera Lucida drawings/enlarged microphotographs of well-spread metaphase cells.

Nuclear DNA amount (4c) and total chromosome length of the 10 clones are presented in table 1. In diploids, nuclear DNA amount varied between 8 973 and 5.910 pg. While autotetraploids showed almost double the amount of diploid parental clone 'KM-8'. A one way ANOVA with nuclear DNA values as a response variable and the different genotypes as

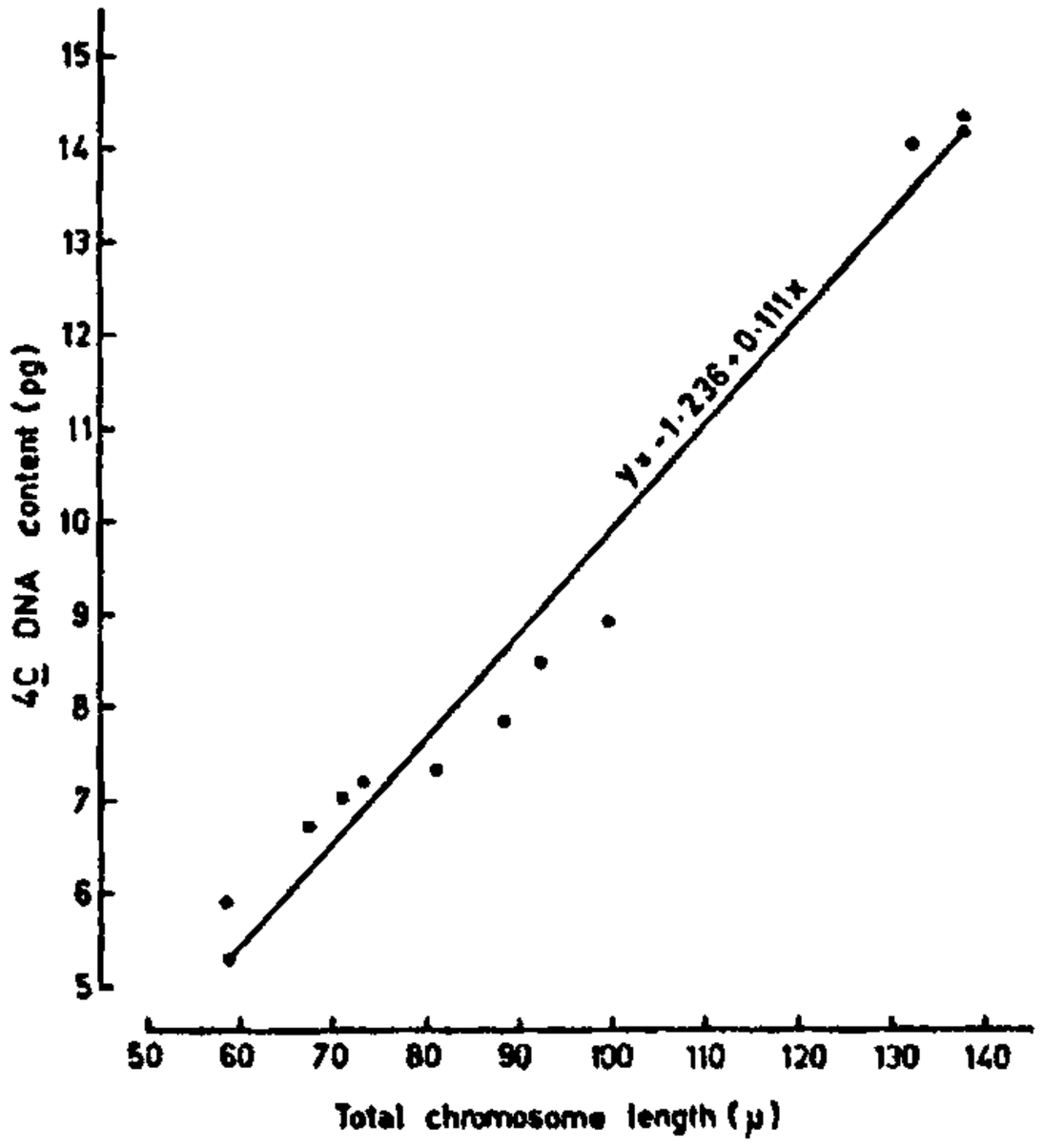

Figure 1. Mean 4c nuclear content (in pg) plotted against total chromosome length in 10 genotypes of *C. forskohlii*.

treatments was performed and was found to be significant at $P<0.01$ level. Comparison of mean 4c DNA values employing Duncan's Multiple Range Test revealed six distinct groups among diploids with some overlapping (table 1). Linear regression analysis of total chromosome lengths to the DNA amounts of the 10 genotypes showed a positive relationship ($r=0.973$, $P<0.01$; figure 1). A similar relationship between nuclear DNA amount and total chromosome length has also been reported in several other plant species[9-19].

The intraspecific nuclear DNA variation observed in the present study might have been brought about either due to tandem and/or structural alterations caused by duplications or deletions in different genotypes[9-11] or due to adaption to different climatic and other ecological situations[2,20].

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A FOSSIL MARINE BROWN ALGA FROM THE GANGAPUR FORMATION, PRANHITA–GODAVARI GRABEN

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A fossil marine alga *Padina* sp. has been described for the first time from the clay shales of Gangapur Formation. This alga is characterized by its fan-shaped thallus coupled with conspicuous zonation pattern. The recovery of this marine alga is significant and further concerted efforts are needed to trace such forms from the Early Cretaceous sediments of the Pranhita–Godavari Graben. A comparison with the living taxon is also attempted. Phaeophycophyta; Dictyotales; *Padina* Adanson; *Padina* sp.; (figures 1 and 2). Thallus 6 cm. in height, fan-shaped; frond thick, dark brown or slightly yellow, broadly fan-shaped, flat, 0.5–1.5 cm broad, dark and light bands distinct, concentric zones on fans several; hairs inconspicuous; surface smooth, uneven; sporangia not preserved; margin curved.

In general morphological appearance of fossil *Padina* sp. closely resembles[1] *Padina tetrastromatica* in the characteristic fan-shaped blades and conspicuous zonation of dark and light bands.

The present fossil impression was recovered from a clay quarry near the village Kondapalle (19°19': 79°24'), Adilabad District, Andhra Pradesh. *Padina* is the only marine benthic brown alga which is strictly calcified. $CaCO_3$ is precipitated over the surface of the frond blades. It usually occurs in tropical and subtropical seas throughout the world. The recovery of this doubtful marine alga is significant and an extensive search for such marine forms is essential to understand possible marine influence in the Pranhita–Godavari Graben during Early Cretaceous times[2].

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