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A Chemosystematic Study in *Panicum* subgenus *Eupanicum*

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Panicum miliaceum P. sumatrense P. maximum P. repens and *P. coloratum* were investigated for phenols in their flag leaxes. *P. miliaceum* and *P, sumatrense* are closely related with reference to phenols. *P. repens* is closer to *P. miliaceum* and *P. sumatrense* than to *P. maximum* and *P. coloratum*.

Key Words - Chemotaxonamy Panicum Phenol

The genus *Panicum* comprises ca. 500 species of annual and perennial grasses confined mainly to the tropics and warm temperate regions. It occupies a central position in the tribe Paniceae of the subfamily Panicoideae. Hitchcock & Chase (1917) subdivided the genus *Panicum* into *Paurochaetium*, *Dichanthelium* and *Eupanicum*. The four American species included in the subgenus *Paurochaetium* were later transferred to the allied genus *Setaria* (Hitchcock, 1953). The validity of the other two subgenera remains unchallenged of which *Dichanthelium* is predominantly confined to North America. The subgenus *Eupanicum* includes the largest number of species extending over all regions of the world. The most common basic chromosome numbers in this subgenus are $\underset{\sim}{x} = 9$ and 10 though $\underset{\sim}{x} = 8$ has been reported (Rau, 1929; Ramnathan, 1950; de Wet Anderson, 1956; Chandola, 1959; Singh Godward, 1963; Jauhar & Joshi, 1968). The inter-relationships between species included in the two subgenera are obscure.

The present investigation was undertaken to study distribution of phenolic compounds for deducing phylogenetic trends and inter-relationships between some species of *Panicum* belonging to the subgenus *Eupanicum*.

MATERIALS & METHODS *Panicum miliaceum* L. and *P. sumatrense* Roth ex Roem. et Schult. are small millets cultivated as cereals whereas *P. maximum* Jacq., *P. repens* L. and *P. coloratum* L, are highly valued as forage plants. The last two are also known as efficient soil binders. The *Panicum* species were obtained from the Forage Section, Birsa Agricultural University, Kanke (Ranchi) and maintained in the Gardens of B. N. College, Patna. To minimize variations due to environment, only flag leaves were used to analyze for phenols following the two dimensional thin layer chromatographic technique (Nybom 1964). The solvent systems used were formic acid and distilled water (1:50 v/v) for the first direction and benzene, propionic acid and distilled water (20:42;18 v/v) for the second direction. The plates were sprayed with 1% $ALCL_3$ in methanol and examined under UV light. On the basis of colour and position, spots assumed to be identical in two or more species were assigned the same number. The paired affinity (PA), group affinity (GA) and isolation values (IV) were calculated following the method of Ellison *et al.* (1962).

RESULTS & DISCUSSION The data on the phenolics of the species of *Panicum* are presented in Tables 1 & 2. Chromatographic spots are excellent markers and are much more important than merely knowing the chromosome numbers of the species (Grant, 1968). The chromatographic patterns from leaves of one and the same plant vary with the age of the leaf and environment (Frost & Holm, 1973). Hence, in the present study, flag leaves were used to minimize the effects of environmental variation.

A minimum of four common spots was recorded and this may be taken as the generic number of the genus *Panicum*. A higher PA value is indi-

Table 1 Colour, Concentration and Relative Distribution of Phenolic Spots in Five Species of *Panicum*.

Spot Nos.	Spot colours	Rf values Solv. I	Rf values Solv. II	*P. miliaceum*	*P. sumatrense*	*P. maximum*	*P. repens*	*P. coloratum*
1	Bl	0.04	0.15	+	+	+	+	–
2	Vi	0.15	0.36	–	+	–	–	+
3	Bl	0.23	0.14	+	–	++	–	–
4	Or	0.28	0.43	–	–	–	+	+
5	Vi	0.35	0.23	–	++	–	++	–
6	Bl	0.42	0.18	+	+	–	–	–
7	Ye	0.47	0.42	+	+	+++	++	++
8	Ye	0.48	0.52	–	–	+	–	++
9	Bl	0.53	0.72	++	+++	–	–	–
10	Ye	0.58	0.74	–	–	–	+	–
11	Gr	0.59	0.63	++	+	++	+++	+
12	Ye	0.65	0.82	+	–	–	+	+
13	Bl	0.73	0.64	++	+	++	+	+++
14	Gr	0.74	0.48	++	+++	–	–	–
15	Or	0.79	0.46	–	+	+	–	+
16	Bl	0.84	0.76	+	++	++	++	+++
17	Or	0.85	0.44	+	–	–	++	+
18	Ye	0.89	0.70	++	++	–	+	–
19	Vi	0.92	0.62	–	–	–	+	+
20	Vi	0.95	0.78	–	–	+++	–	–
21	Gr	0.97	0.84	+	–	–	–	–

Colour of the spots: Bl= Blue, Vi=Violet, Or=Orange, Ye=Yellow, Gr=Green. Concentration of the spots: +++=High, ++=Medium, +=low, –=absent.

Table 2 Paired Affinity (PA), Group Affinity (GA) and Isolation Values (IV) of Phenolic Compounds in Different Species of *Panicum*.

	P. miliaceum	*P. sumatrense*	*P. maximum*	*P. repens*	*P. coloratum*
	56.25	40.00	31.25	53.33	33.33
Paired	+37.50	+41.17	+42.85	+47.05	+35.29
Affinity	+47.05	+35.29	+37.50	+41.17	+42.85
(PA %)	33.33	+56.25	+40.00	+31.25	+53.33
Group Affinity (GA %)	274.13	272.71	251.60	272.80	264.80
Isolation value	4.54	0.00	4.54	4.54	0.00

cative of closer relationship and value above 50% is considered as a marker in this direction. *P. sumatrense* showed the highest PA value of 56.25% with *P. miliaceum* and lowest with *P. coloratum* (33.33%). The data clearly support that the two cultivated species, *P. miliaceum* and *P. sumatrense*, are closely related. Out of 21 spots noticed in these two species 9 were common to both in which three spots were exclusive to the two species. The evolutionary lines along which these two species appear to have progressed from their putative parents were (i) annual growth, (ii) non-shattering of inflorescence and seed maturity at a fixed time, (iii) increase in seed size, etc. It is clear that these two species were domesticated from a common ancestor which had a restricted distribution in Asia. The other 3 species are of African origin. These 3 species show the same pairing affinity with both *P. miliaceum* and *P. sumatrense*. It is also clear from the result that *P. repens* is close to *P. miliaceum* and *P. sumatrense*, compared with the other two species. The GA values also support that *P. miliaceum* and *P.sumatrense* are closer to *P. repens* than to *P. maximum* and *P. coloratum*.

The presence of unique spot no. 20 in *P. maximum*, spot no. 21 in *P. miliaceum* and spot no. 10 in *P. repens* is of interest. Once these spots are identified with specific phenols it would be easier to work out the biochemical pathways along which the divergence had occured in *P. miliaceum* and *P. sumatrense* which may have been preceded or followed by their reproductive isolation resulting in speciation from a common ancestor.

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