in *G.barbadense* cotton (23.85) which may be a reason for high yield in *G.hirsutum* cotton because ovules will ultimately develop into seed and lint.

REFERENCES

BANERIJI, I. (1929) Studies in cotton pollen. **Agric. J.India 24:** 332-340

NARAYANAN, S.S. (1972) Cytogenetical investigations on amphiploids and derivatives of *Gossypium anomalum* W & P and cultivated species of cotton. M.Sc (Ag) Thesis, Tamil Nadu Agricultural University, Coimbatore.

NEELAKANTAN, L. and PALANIAPPAN, K.K. (1958) Variation in the degree of exsertion of stigma in *arboreum* cottons. **Ind.Cott. Gr.Rev.12:** : 376

PRASAD, R. (1923) Note of the probability of an interrelation between the length of the stigma and that of the fibre in some forms of the genus *Gossypium* **Agric. Res. Instt., Pusa Bull., 137:**1-7

SHROFF, V.N. DUBEY, S., RAJESH JULKA and PARMER, S.L. (1982) Effect on cytoplasmic and cytoplasmic nuclear interaction on petal size and anther numbers in cotton. **J.Indian Soc. Cott. Improv., 7:**4-7

SINGH, V.V. (1987) Note on reproductive potential in *Gossypium hirsutum* Linn and *G.herbaceum* Linn. **J.Indian Soc.Cott. Improv, 12:** 142-143.

TURNER, J.H. STEWART J.M. HOSKINSOW, P.E. and RAMEY, H.H. (1977) Seed setting efficiency in eight cultivars of upland cotton. **Crop Sci., 17:** 769-772.

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ALLELOPATHIC SIGNIFICANCE OF SIX AGROFORESTRY TREES ON *Casuarina equisetifolia* GROWTH AND NODULATION

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ABSTRACT

Allelopathic influence of six agroforestry tree species *viz., Eucalyptus tereticornis, Leucaena leucocephala, Ailanthus excelsa, Gliricidia sepium, Acacia nilotica* and Tectona grandis were tested. The leaf extract of six trees were used for germination test with *Casuarina equisetifolia* and the effect was measured in terms of germination, root and shoot length, drymatter production and vigour index. In an another experiment different concentrations of the above mentioned tree leaves were prepared by mixing them with pot mixture at the leaf: pot mixture ratio of 1:2, 1:1 and 2:1 and is utilised as a medium for *C.equisetifolia* seedling growth. The result of both experiments explained highest deleterious effect of*E.tereticornis* and *L.leucocephala* on *C.equisetifolia* germination and nodulation. Moderate effect was found in *A.excelsa* and *Acacia nilotica*. However less depressed effect was exerted by *G.sepium* Among the different leaf concentrations, 1:2 and 1:1 were suitable for *C.equisetifolia* seedling growth.

KEY WORDS: Allelopathy, Forestry Trees, *Casuarina equisetifolia*

Accumulated tree litters under tree farming mostly favour soil nutrient enrichment through effective nutrient cycling. But it also has the ill effect of lethalising other annual and perennial crops: allelopathy, which is defined as a chemical warfare between plants in the field (Putnam, 1983). Allelopathic effects have been exhibited by many species of perennial (Stachon and Zindahl, 1978) and annual crop plants (Rice, 1978). In field it is released by decomposition (Parker, 1962) or leaching by water from plant canopy and finally inhibits crop growth and yield (Elliot *et al.*, 1978). Though large volume of evidence are available for agricultural crops, little is known for tree allelopathy (Malkania, 1987). The present study investigates allelopathic influence on casuarina growth and nodulation caused by six multipurpose tree species.

MATERIALS AND METHODS

Six tree species: *E.tereticornis, L. leucocephala, A. excelsa, G.sepium, Acacia nilotica* and *T.grandis* were examined for their allelopathic effect on *Casuarina equisetifolia* germination, growth and nodulation. Matured leaves of each tree species collected from the Tamil Nadu Agricultural University campus Coimbatore were used for the study.

Table 1. Casuarina seedling characters as influenced by allelopathy

Tree Species	Seedling characters				
	Shoot length (cm)	Root length (cm)	Dry matter (gm)	Vigour index	Germination %
E. tereticornis	1.2	0.6	20	12.6	7
L. lecocephala	1.7	0.7	28	14.4	6
A. excelsa	2.6	1.1	83	148.0	40
G. sepium	3.8	2.4	153	489.8	79
A. nilotica	2.9	1.1	77	132.0	33
T. grandis	3.2	2.0	148	338.0	65
Control	4.6	2.6	160	590.4	82
CD (5%)	1.0	0.5	9.5	14	2.7

Aqueous extracts of each tree species were prepared by thorough soaking of leaves for 24 h in distilled water at the ratio of 1:10 weight/volume (Richardson and Williamson, 1988). The extracts were filtered using fine cloth. Germination test was conducted adopting slanting plate method at 25 ± 5^0C and 90±3 per cent relative humidity in three replicates with 50 seeds each. Aqueous extract of each tree species was used as a separate treatment by saturating the germination paper and sufficient moisture content of the paper was maintained throughout experiment. Distilled water served as a [illegible] The count on normal seedling was made [illegible] seed in percentage (ISTA, 1985). The shoot and root and vigour index were calculated (Abdul-[illegible] Anderson, 1973)

The collected leaves of the above trees were dried and mixed with pot mixture in the ratio of 1 :1,1:2 and 2:1. The pot mixture contains sand, red soil and farm yard manure at the ratio of 1:1:1 respectively. *C.equisetifolia* seedlings of uniform sized and same age were raised in the different concentration of leaf, pot mixture media while pure pot mixture served as control. The treatments were replicated thrice and after 150 days various growth parameters *viz.*, shoot length, root length, total biomass (dry weight basis) and nodulation attributes (nodule number, nodule dry weight and nodule nitrogenase activity) were estimated. To ensure good nodulation the seedlings were inoculated with CCI_3 *Frankia* strain The CCI_3 obtained from the Department of Botany, University of Glasgow, United Kingdo[illegible] The nodule nitrogenase activity was estimate[illegible] using acetylene reduction method (Hardy *et al* 1[illegible]68) and expressed in moles of C_2H_2 formed /g dry weight of nodule/hour.

RESULTS AND DISCUSSION

Germination

The reduced germination of *C.equisetifolia* was more by *L.leucocephala* (6%) and *E.tereticornis* (75). Moderate allelopathic effect was exhibited by *A.excelsa* (40%) and *Acacia*

Table 2. Allelopathic influence on *Casuarina* growth attributes (150 days after planting)

Tree Species	Seedling height (cm)				Seedling drymatter (g/plant)			
	1:2	1:1	2:1	Mean	1:2	1:1	2:1	Mean
E. tereticornis	13.92	10.86	1.87	8.91	3.64	0.81	0.54	1.66
L. leucocephala	22.56	14.03	5.53	14.04	4.35	2.75	0.82	2.64
A. excelsa	74.09	66.54	51.01	63.88	10.44	8.26	5.21	7.97
G. sepium	111.84	131.06	138.40	127.10	20.55	23.45	26.58	23.53
A. nilotica	82.86	82.86	38.05	67.92	10.79	10.33	6.44	9.19
T. grandis	105.01	107.33	110.63	107.66	13.85	16.04	16.06	15.32
Control	119.69	119.69	119.69	119.69	19.65	19.65	19.65	19.65
Mean	75.71	76.05	66.45	72.74	11.90	11.61	10.76	11.42
		SED		CD (5%)		SED		CD (5%)
Trees (T)		1.24		2.51		0.58		1.17
Concentration (C)		0.82		1.64		0.38		0.76
T x C		2.15		4.35		1.01		2.03

Table 3. Allelopathic influence on *Casuarina* growth nodulation (150 days after planting)

Tree Species	Seedling height (cm)				Seedling drymatter (g/plant)				Nodule nitrogenase activity µ mol. C_2H_2/g/h			
	1:2	1:1	2:1	Mean	1:2	1:1	2:1	Mean	1:2	1:1	2:1	Mean
E. tereticornis	2.63	2.43	1.30	2.12	1.67	1.18	0.56	1.37	0.71	0.38	0.15	0.41
L. leucocephala	2.66	2.09	1.25	2.00	2.27	1.42	0.92	1.54	1.74	0.71	0.46	0.97
A. excelsa	6.27	4.52	4.52	5.10	7.44	4.94	3.35	5.24	2.41	1.47	0.79	1.56
G. sepium	23.41	24.93	27.90	25.41	19.95	19.46	23.53	20.98	3.94	5.16	6.02	5.04
A. nilotica	8.17	5.43	2.96	5.52	7.34	5.24	3.88	5.49	2.04	1.52	1.35	1.64
T. grandis	17.21	16.29	12.75	15.42	12.41	10.03	8.27	10.24	2.09	1.79	1.11	1.66
Control	23.50	23.50	23.50	23.50	19.53	19.53	19.53	19.53	4.27	4.27	4.27	4.27
Mean	11.98	11.31	10.60	11.30	10.09	8.83	9.20	9.20	2.46	2.19	2.02	2.22
		SED		CD (5%)		SED		CD (5%)		SED		CD (5%)
Trees (T)		0.67		1.25		0.45		0.94		0.16		0.33
Concentration (C)		0.44		0.88		0.30		0.62		0.11		0.22
T x C		2.41		3.18		0.81		1.63		0.28		0.57

nilotica (33%). *T.grandis* was less inhibitory, and *G.sepium* had no effect at all (Table 1). Phytotoxic effects of *E.tereticornis* (Srinivasan *et al.*, 1990), *L.leucocephala* (Chaturvedi and Jha, 1992), *A.excelsa, A.nilotica* and *T.grandis* (Swaminathan *et al.*, 1993) have already been reported inhibitory effect of the extract was directly related to its phenolic content Joshi *et al.*, (1992).

Growth and nodulation attributes

The presence of allelochemicals in the leaves and their subsequent exertion to growth media significantly depressed the seedling height and seedling dry matter production (Table 2) In all the tree species tested it is evident that among different leaf and pot mixture concentration, 2:1 concentration effected negative influence on seedling height and dry matter production. Like germination test, the species tested had shown similar phytotoxic effect on seedling height and dry matter production. The seedling nodulation assay (Table 3) revealed that depressed *Frankia* activity i.e reduced nodule number, nodule dry weight and nodule nitrogenase activity were evident in 2:1 concentration which is found to be unfavourable for *Frankia* infection. However leaves *E.tereticornis* and *L.leucocephala* significantly reduced the nodulation of *C.equisetifolia* but *G.sepium* increased the nodulation.

The highest inhibition of both seedling and nodulation attributes by *E.tereticornis* is attributed to the presence of eight phenolic acids (gentisic, vanillic, caffeic, *P.coumaric, Ferulic, gallic* and cinnamic acids) besides an unidentified one (Kholi 1990). The presence of the mimosine in *L.leucocephala* leaves was believed to be responsible for the inhibition of *C.equisetifolia* growth and nodulation (Suresh and Vinaya Rai, 1987). The inhibitory effect shown by *T.grandis* and *Acacia nilotica* is not fully understood yet.

REFERENCES

ABDUL-BAKI, A.A. and ANDERSON, J.D. (1973) Physiological and biochemical deterioration of seeds. IN:**Seed Biology Vol.II** (KOZLOWSKI, T.T.,) Academic Press, New York, 283-315.

CHATURVEDI, O.P. and JHA, A.N. (1992) Studies on allelopathic potential of an important agroforestry species. **For Ecol.Mgmt., 53**: 91-98

ELLIOT, L.F., Mc CALLA, T.M. and WARIS, A. (1978) Phytotoxicity associated with residue management **Amer. Soc. Agron. Spec. Publ., 31:** 131-146.

HARDY, R.W.F., HOLSTEN, R.D., JACKSON, E.K. and BURNS, R.C. (1968). The acetylene, ethylene assay for nitrogen fixation-laboratory and field evaluation. **Pl.Physiol., 43:** 1185-1207

ISTA. 1985. International rules for seed testing. **Seed Sci. Technol., 12:** 299-355.

JOSHI, P.C., OM PRAKASH and PRAKASH, O. (1992). Allelopathic effects of litter extract of some tree species on germination and seedling growth of agricultural crops. In. **Proceeding of the First National Symposium on Allelopathy in Agroecosystems,** (TAURO, P., and NARWAL, S.S. J. (eds) PP 127-128

KHOLI, R.K. (1990) Allelopathic potential of *Eucalyptus* Project Report. MAB-DOEN Project, India pp 199.

MALKANIA, N.P. (1987) Allelopathy and its significance on production of agroforestry plant association. In **Agroforestry for Rural Needs.** (KHOSLA, P.K. and KHURANA, D.K. eds) ISTS, Solan, pp. 211-224

PARKER, D. D. (1962). Decomposition in the field of buried and surface applied corn stalk residue. **Soil Sci. Soc. Am. Proc., 26:** 559-562

PUTNAM, R. (1983). Allelopathic chemicals-nature's herbicide in action, **Chem. Eng. News** April 4, 34-35 pp.

RICE, E.L. (1979). Allelopathy-an update. **Bot.Rev., 45:** 15-109.

RICHARDSON, D.R. and WILLIAMSON, G.B. (1988). Allelopathic effects of shrubs of the sand pine shrub on pine and grasses of the sand hill. **For.Sci., 34:** 592-605

SRINIVASAN, K., RAMASAMY, M. and SHANTHA, R. (1990). Tolerance of pulse crops to allelochemicals of tree species. **Indian J. Pulses Res., 3:** 40-44

STACHON, W.J. and ZINDAHL, R.L. (1978) Allelopathic activity of Canada Thistle *(Cirsium arvense)* in Colorodo. **Weed Sci., 26:** 83-84.

SURESH, K.K. and VINAYA RAI, R.S. (1987) Studies on the allelopathic effects of some agroforestry tree species. **Int. Tree Crops J., 4:** 109-115.

SWAMINATHAN, C., SIVAGNANAM, K. and SRIMATHI, P. (1993)Allepopathic proclivities of multipurpose trees **My Forest 29:** 147- 149

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GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT ANALYSIS IN KODO MILLET

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ABSTRACT

Fifteen Kodo millet genotypes were evaluated for genetic parameters. High heritability estimate combined with genetic advance was observed for plant height indicating the governance by additive genes. Ear head length had high direct as well as indirect effects through other characters on grain yield. Simultaneous selection for ear head length and 1000 grain weight will be useful in bringing higher yields.

KEY WORDS: Kodo millet, Variability, Correlation, Path Coefficients

The grain yield of Kodo millet *Paspalum scrobiculatum L.* is low and unstable. The productivity of this important minor millet is to be stepped up by evolving high yielding varieties. Therefore, to bring about any improvement in this crop. the knowledge of association of yield with other characters will be of immense help. With this main objectives 15 diverse genotypes of kodo millet were subjected to detailed investigation on variability. heritability, genetic advance, correlation coefficients and path coefficients.

MATERIALS AND METHODS

Fifteen genotypes of kodo millet were grown at the Regional Research Station. Tamil Nadu Agricultural University. Kovilangulam during October. 1993 in a randomised block design with three replications. The seeds of each genotype were sown with the spacing of 45 cm between rows and 15 cm between plants. At maturity, five plants were chosen at random and observation were recorded on plant height, number of productive tillers, ear head length, 1000 grain weight and grain yield.

The phenotypic and genotypic variances and genetic advance were calculated according to Johnson *et al.* (1955). Phenotypic and genotypic coefficients of variability (Burton, 1952) heritability in broad sense (Lush, 1940) and path coefficient analysis for grain yield per plant (Dewey and Lu, 1959) were analysed.

RESULTS AND DISCUSSION

The variances due to genotypes for all the six traits were found to be significant. The range, phenotypic and genotypic variance, PCV and GCV, heritability and genetic advance are furnished in Table 1.

The present study revealed wide range of phenotypic variability for almost all the traits. The genotypic coefficient of variation ranged from 1.77 for ear head length to 14.45 for plant height. The difference between PCV and GCV was minimum