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Genetic variability for seed, biochemical and seedling attributes in neem *(Azadirachta indica* A. Juss).

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Abstract : **Genotypic and Phenotypic co-effecients of variation, heritability, and genetic advance were estimated in Seventy three single parent families of neem on Twenty six different seed, biochemical and seedling attributes. The analysis of variance indicated significant differences among the single parent families for all the characters. The GCV and PCV were the maximum for total azadirachtin and its fractions aza A, B, D and H. Heritabilitiy values were high for all the parameters except for root fresh weight, shoot fresh weight and total fresh weight. High heritability combined with high genetic advance as percentage of mean was observed for all the seed parameters, total azadirachtin and its fractions, number of leaves, root to shoot ratio and total dry weight.**

Key Words: Neem, PCV, GCV, Heritability, Genetic advance.

Introduction

Forest trees harbour greater variability and the major job of a breeder is to recognize the variability, isolate it and pack it in a desired individual (Zobel and Talbert, 1986). For any tree improvement programme studies of variability is of prime importance. Estimation of heritable portion of variation would help in selection. Hence, it is worthwhile to determine variability, heritability and genetic advance, for which detailed studies are lacking in neem. Therefore the present study was taken up to estimate the heritability and genetic advance for different seed, biochemical and seedling attributes in neem.

Materials and Methods

Seventy three single parent families were identified from all over the country and the seeds were collected in two seasons during 1996 and 1997 (36 and 37 single parent families respectively).

Part of the seeds were stored in airtight containers and the remaining seeds from each location were sown in the nursery, where uniform cultural practices were followed. Observations were recorded on seed traits *viz.* seed length, seed breadth, seed length to seed breadth ration and 100 seed weight, biochemical traits *viz.* kernel oil content, seed oil content, total azadirachtin, its fractions *aza* A, B, D and H, kernel protein, oil free meal protein, total amino acids and free fatty acids; seedling attributes *viz.* shoot length, root length, root to shoot ratio, collar diameter, number of leaves, shoot fresh weight (SFW), root fresh weight (RFW), total fresh weight (TFW), shoot dry weight (SDW), root dry weight (RDW), and total dry weight (TDW). The data were utilized to analyse genotypic and phenotypic co-efficients of variation (Burton, 1952), heritability in broad sense (Robinson, 1966) and genetic advance (Johnson *et al.* 1955).

Results and Discussion

The analysis of variance indicated significant differences among the single parent families for both 1996 and 1997 collections. The genotypic and phenotypic co-effecients of variation (GCV, PCV), heritability and genetic advance as percentage mean (GA) are presented in Tables 1 and 2 (1996 and 1997 collections respectively).

Among the seed parameters studied, seed length to breadth ratio recorded moderate PCV, GCV, heritability and genetic advance (GA) as percentage mean. This is in close proximation with the findings of genetic parameters in *Azadirachta indica* (Kumaran, 1997).

The phenotypic (PCV) and genotypic (GCV) coefficients of variation were the maximum for total azadirachtin and its fractions *aza* A, B, D and H for both 1996 and 1997 collection. As such, there is enough scope for improvement of azadirachtin through selection. The existence of such a high genetic variation , in neem especially for azadirachtin has been recently reported by

Table 1. Genetic parameters for seed, seedling and biochemical attributes (1996 collections)

Characters	PCV (%)	GCV (%)	h^2 (%)	GA as % of mean
Seed attributes				
Seed length	10.01	9.99	99.67	20.55
Seed breadth	11.24	11.19	99.06	22.95
Seed L/B ratio	13.13	13.12	99.96	27.02
100 seed weight	10.53	9.31	78.19	16.96
Biochemical attributes				
Kernel oil content	3.70	3.16	73.09	5.57
Seed oil content	5.44	5.33	96.03	10.76
Total azadirachtin	34.47	34.46	99.97	70.98
Azadirachtin A	40.41	40.39	99.91	83.17
Azadirachtin B	40.01	39.80	98.59	81.41
Azadirachtin D	57.13	30.46	28.42	33.45
Azadirachtin H	76.24	76.10	99.64	56.49
Kernel protein	10.34	8.92	74.45	15.85
Oil free meal protein	12.74	12.71	99.63	26.14
Total amino acids	12.32	12.23	98.62	20.02
Total free fatty acids	14.97	14.81	97.84	30.18
Seedling attributes				
Shoot length	13.20	12.91	95.63	26.0
Root length	14.88	13.97	88.13	27.02
R/S ratio	11.70	11.35	93.99	22.66
Collar diameter	11.87	11.70	97.22	23.78
Number of leaves	21.67	20.48	89.36	39.89
Fresh shoot weight	8.29	3.13	14.27	2.43
Fresh root weight	8.58	3.34	15.19	2.68
Total fresh weight	5.70	3.03	28.29	3.32
Shoot dry weight	9.5	9.49	99.84	19.53
Root dry weight	12.66	12.65	99.80	26.03
Total dry weight	8.50	8.40	97.56	17.10

Kumaran (1997). There was a close correspondence between PCV and GCV with only a minor difference between the two, and this would indicate that there was little effect of the environment and most of these characters are stable.

Heritability estimates are useful in selecting the single parent families based on phenotypic performance. All the character except shoot fresh weight and root fresh weight recorded moderate to high heritability in both the collections. The low variation between the values of phenotypic and genotypic coefficients of variation also reflects high heritability of the characters. Genetic advance is a measure of genetic gain that can be expected in the process of selection. Genetic advance as percentage mean was high for all characters except kernel oil content, seed oil content, kernel protein, shoot fresh weight, root fresh weight, total fresh weight, and total dry weight for both the collection. High heritability combined with high genetic advance as percentage mean observed for all the seed traits, total azadirachtin and its fractions *aza* A, B, D, H oil free meal protein number of leaves and root dry weight in both 1996 and 1997 collection suggest that these characters are under the control of additive type of gene action.

Table 2. Genetic parameters for seed, seedling and biochemical attributes (1997 collections)

Characters	PCV (%)	GCV (%)	h^2 (%)	GA as % of mea
Seed attributes				
Seed length	7.73	7.66	88.22	22.83
Seed breadth	11.84	11.71	97.85	23.86
Seed L/B ratio	16.80	16.66	98.30	34.02
100 seed weight	13.50	12.34	83.62	23.25
Biochemical attributes				
Kernel oil content	3.38	3.28	94.54	6.58
Seed oil content	3.58	3.45	93.03	6.86
Total azadirachtin	22.72	22.71	99.96	46.78
Azadirachtin A	23.53	23.51	99.9	48.41
Azadirachtin B	21.56	21.45	98.96	43.96
Azadirachtin D	25.34	25.26	99.38	51.87
Azadirachtin H	44.34	44.19	99.34	90.74
Kernel protein	7.04	6.79	92.98	13.49
Oil free meal protein	13.09	13.06	99.67	26.86
Total amino acids	22.83	22.79	99.69	46.88
Total free fatty acids	8.36	8.20	96.21	16.58
Seedling attributes				
Shoot length	9.26	9.19	98.38	18.78
Root length	8.41	8.23	96.52	13.71
R/S ratio	12.11	11.97	97.71	24.38
Collar diameter	9.38	9.30	98.32	19.0
Number of leaves	21.12	20.21	91.59	39.85
Fresh shoot weight	5.68	2.75	23.37	2.73
Fresh root weight	6.94	6.45	17.06	17.37
Total fresh weight	7.81	6.62	72.04	11.59
Shoot dry weight	12.01	12.0	99.98	24.73
Root dry weight	15.62	15.61	99.93	32.16
Total dry weight	10.88	8.56	62.02	13.90

Among the qualitative traits both oil and azadirachtin, which are of prime economic importance, were found to record high heritability and hence, it is suggested that improvement of these traits are possible by selection. However, the selection of superior single parent families for azadirachtin content is more effective as this trait showed high heritability coupled with high genetic advance as percent of mean.

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