With considering the above discussed results, it could be concluded that days to maturity, seeds/capsule, 1000 seed weight and plant height are the major yield contributing characters in niger. Since late maturity and plant height beyond certain limit is not desirable, greater emphasis should be laid on seeds/capsule and 1000 seed weight.

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**References**

Borole, R.D. and Patil, H.S. (1997) Genetic variability, correlation and path analysis in niger. *J. Oilseed Res.* **14** (1): 40-43.

Burton, G.W. (1952) Quantitative inheritance in grasses. *Proc. Sixth Int. Grassl and Congress.* 1: 277-283.

Burton, G.W. and De Vane, E.H. (1953). Estimating heritability in tall fescue (*Festuca andinaceae*) from replicated clonal material. *Agron. J.* **45**: 478-481.

Chennarayappa (1987). Response to selection, correlation and path analysis in niger (*Guizotia abyssinica Cass). Mysore J. agric. Sci.* **21**: 92-93.

Deway, D.R. and Lu, K.H. (1959) Correlation and path coefficient analysis of crested wheat grass seed production. *Agron. J.* **51**: 515-518.

Getinet, A and Teklewold, A (1995). Agronomic and seed quality evaluation of niger (*Guizotia abyssinica cass*) germplasm grown in Ethiopia. *Plant Breeding* **114**: 375-376.

Goyal, S.N. and Kumar, S. (1985). Correlation and path analysis in niger *J. Oilseed Res.* 2:34-38.

Goyal, S.N. and Kumar, S. (1993). Correlation and regression studies in niger. *Gujarat Agric. Univ. Res. J.* **18**: 6-8.

Mishra, D. (1995) Variability and correlation studies in niger (*Guizotia abyssinica Cass*). *Environment and Ecology* 12(2) : 439-442.

Robinson, H.F., Comstock, R.E. and Harvey, P.H. (1951). Genotypic and phenotypic correlations in Corn and their implications in selection. *Agron. J.* **43**: 282-287.

Sahu, D.P. and Patnaik, M.C. (1981) Variability, correlation and path analysis in niger. *Indian J. Agric. Sci.* **51**: 287-291.

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# Genetic introgression from wild species into cultivated groundnut

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**Abstract :** The cultivated groundnut (*Arachis hypogaea L.*) suffers from many diseases and pests. The wild relatives of groundnut have been found to be number of diseases. The diploid (2n = 20) wild sp.*A.cardenasii* was hybridized with the CV. VRI 2 of *A. hypogaea* (2n=40) and the resultant triploids (2n=30) were studied. The progenies of the triploid gave rise to triploid, tetraploid and hexaploid (2n=60) progenies. The tetraploid progenies were again hybridized with the cultivated groundnut and the resultant $F_1$ plants were studied. The hybrids exhibited high level of resistance to rust and leafspot diseases which indicated the transfer of genes conferring resistance from *A. Cardenasii*. (*Key Words : Groundnut, A.cardenasii, Triploid, Tetraploid, Hexaploid, Foliar diseases, Resistance*).

Groundnut (*Arachis hypogaea L.*) suffers from many diseases and pests that cause serious yield losses. Wild relatives of crop species have been found to be potential sources of a number of desirable characters, especially resistance to diseases and pests (Knott and Dvorak, 1976). The genus Arachis contains number of such wild species. Gregory *et al.*, (1973) divided the genus into seven sections based on morphological affinities and cross compatibility. The section Arachis Krap. et. Greg. nom. nud. comprises the cultivated tetraploid species, *A.hypogaea*, and a number of compatible

diploid wild species. The diploid species are good sources of resistance to may groundnut diseases, such as rust (*Puccinia arachidis)*, early leaf spot (*Cercospora arachidiola* Hori) and late leaf spot (*Phaeoisariopsis personata*) and to insect pests, such as thrips (*Scirtothrips dorsalis* Wood) and aphids (*Aphis craccivora* Koch) (Subrahmanyam *et al.*, 1983; Amin 1985). Thus they have immediate potential as sources for the genetic improvement of groundnut. The results of an interspecific hybridization between *Arachis hypogaea* x *A.cardenasii* are presented.

## Materials and Methods

A diploid (2n=20) wild species *A.cardenasii* Knap et Greg. non.nud. belonging to section Arachis was selected for the study. It is a perennial type and prostrating in habit. It is highly resistant to rust, early and late leaf spot diseases, besides the sucking pests *viz.*, thrips and leafhopper (Stalkar and Moss, 1987). The cultivar VRI 2 of *Arachis hypogaea* L. (2n=40) was utilised as female parent and hybridized with the pollen of *A.cardenasii* during summer '95 at Regional Research Station, Vridhachalam. The crossed seeds were raised during Kharif '95 season. The resultant triploid (2n=30) plants were studied during summer '97 season. The resultant triploid ($F_2$ generation) were studied. There were segregations for triploid, tetraploid and hexaploid plants. The tetraploid plants were crossed with *A.hypogaea* during *kharif* '97 season. The resultant $F_1$ progenies of the cross was studied during summer '98 season. The schematic representation of the crosses are presented in Fig.1.

## Results and Discussion

### *Triploids*

The triploid plants were vigorous, prostrating with profuse branches. The morphological traits recorded are presented in Table 1. There were abundant flowers in the triploids, however the peg formation was rare. The pollen stainability ranged from 8-12%. The partial fertility may be due to unequal chromosome segregation which resulted in the formation of haploid to hyperdiploid gametes and spindle breakdown which resulted in the formation of restitution nuclei and unreduced gametes. Fertilization between such viable gametes resulted in the partial fertility of triploids (Singh, 1985). The pods of triploids are mostly single seeded and very small in size. The triploids were resistant to foliar diseases *viz.*, rust and late leafspot diseases as was also observed by Company *et al.*, (1982).

The $F_2$ plants obtained from the triploids were of different ploidy levels viz., triploid, tetraploid and hexaploid. Raman (1976) also observed such type of ploidy plants in an entirely different combination of interspecific crosses in groundnut among which 80 per cent of the plants were hexaploids. It suggested the greater success of unreduced gametes than other types of gametes in fertilization. Those hexaploid resulting form pairing and crossing over between the chromosomes of wild and cultivated species. Only two tetraploid plants were obtained in the progenies.

### *Hexaploid*

The hexaploid plants were more robust with thicker stems, petioles, leaflets, calyx tubes, petals and pegs compared to the triploids. The leaves were longer and broader and dark green with uneven surface and margins of leaflets. The flowers were characterised by broader petals and short calyx tubes.

### *Tetraploid*

The tetraploid had a shorter but thicker main stem, longer and thicker primary branches and leaves of reduced size compared to the bunch groundnut employed as the female parent in crosses with *A.cardenasii*. The habit of growth was spreading, the stem being purple pigmented and highly hairy. The pods were one seeded, size and shape of which resembled those of *A.monticola*, the only tetraploid species of section *Arachis*. The tetraploid plants exhibited resistance to rust and late leaf spot diseases. The pollen of the tetraploid plants were utilised for hybridization with the cultivar VRI 2 of *A.hypogaea.*

### *$F_1$ of tetraploid and A.hypogaea.*

It is as well a first back cross of the interspecific hybrid with *A.hypogaea* parent. The $F_1$s were spreading in habit and the plants were compact with bushy appearance. The number of branches and the length of the branches were lesser than the interspecific tetraploid form. However, there was not much deviation in respect of the leaf and flower size. The pods were small but all the pods were two seeded in nature. However, the kernels were small but plumpy with rose testa colour. The plants were highly resistant to rust and leafspot diseases which indicated the transfer of genes conferring resistance from *A.cardenasii*. Similar gene transfer had also been reported by Stalker (1985); Murthy and Jahnavi (1985) in groundnut. To further improve the agronomic traits of the hybrid, keeping the high level of resistance intact back crossing with *A.hypogaea* parent is in progress.

Table 1. Biometrical observations recorded on parents and different forms of inter specific hybrid derivatives.

| S.No. | Characters | *A.cardenasii* 2n = 20 | *A.hypogaea* 2n = 40 | Triploid 2n = 30 | Hexaploid 2n = 60 | Tetraploid 2n = 40 | F1 hybrid (tetraploid x *A.hypogaea*) |
|---|---|---|---|---|---|---|---|
| 1. | Height of main stem (cm) | 27.0 | 35.0 | 43.3 | 25.6 | 18.0 | 24.0 |
| 2. | No. of primary branches | * | 4 | 7 | 8 | 6 | 4 |
| 3. | No. of secondary branches | * | 1 | 42 | 39 | 26 | 21 |
| 4. | No. of tertiary branches | * | - | 93 | 83 | 44 | 32 |
| 5. | Length of Primary branches (cm) | | | | | | |
| | Mean | * | 34.0 | 143.3 | 90.6 | 103.5 | 60.3 |
| | Range | * | 30 - 36 | 77 - 210 | 50 - 130 | 60 - 108 | 57 - 65 |
| 6. | Length of Secondary branches (cm) | | | | | | |
| | Mean | * | 17.0 | 117.0 | 80.4 | 84.5 | 43.0 |
| | Range | * | 15 - 19 | 26 - 162 | 54 - 98 | 64 - 115 | 30 - 58 |
| 7. | Length of tertiary branches (cm) | | | | | | |
| | Mean | * | - | 62.2 | 28.9 | 38.2 | 15.4 |
| | Range | * | - | 30 - 109 | 13 - 42 | 34 - 43 | 10 - 27 |
| 8. | Length of pertiole (cm) | 3.6 | 4.8 | 3.4 | 2.3 | 2.5 | 3.3 |
| 9. | Leaf size (L x B) (cm) | 2.3 x 1.1 | 5.5 x 2.4 | 5.5 x 2.4 | 6.2 x 3.0 | 3.0 x 1.4 | 2.9 x 1.6 |
| 10. | Length of calyx tube (cm) | 4.4 | 3.5 | 4.2 | 2.5 | 3.2 | 3.0 |
| 11. | Standard petal size (L x B) (cm) | 1.1 x 0.9 | 1.3 x 1.1 | 1.1 x 1.0 | 1.5 x 1.3 | 1.1 x 1.3 | 1.5 x 1.4 |
| 12. | No. of pods/plant * | * | 15 | 12 | 19 | 25 | 26 |
| 13. | Pod size (L x B) (cm) | 0.8 x 0.5 | 3.8 x 1.2 | 1.5 x 0.8 | 1.4 x 0.6 | 1.4 x 0.6 | 2.2 x 0.8 |
| 14. | Kernel size (L x B) (cm) | 0.7 x 0.4 | 1.5 x 1.0 | 1.0 x 0.4 | 1.0 x 0.4 | 1.0 x 0.4 | 1.0 x 0.7 |
| 15. | Hundred kernel weight (g) | 5.4 | 46.5 | 10.0 | 10.4 | 10.3 | 13.2 |
| 16. | Kernel colour | Rose | Rose | Rose | Rose | Rose | Rose |
| 17. | Reaction to diseases (1-9 scale) | | | | | | |
| | Rust | 2.0 | 7.0 | 3.0 | 3.0 | 3.5 | 3.5 |
| | Late leaf spot | 2.5 | 7.5 | 3.5 | 3.5 | 3.5 | 4.0 |

* Perennial and indetermiate growth habit.

## References


Amin, P.W. (1985). Resistance of wild species of groundnut to insect and mite pests. In : Proceedings of an international workshop on cytogenetics of *Arachis*, 31 Oct.-2 Nov. 1983, INCRUST Centre, India. pp.57-60.

Company, M., Staiker, H.T. and Wynne, J.C. (1982). Cytology and leafspot resistance in *Arachis hypogaea* x wild species hybrids. *Euphytica.* **31**: 885-893.

Gregory, W.C., Gregory, M.P., Krapovickas, A., Smith, B.W. and Yarbrough, J.A. (1973). Structure and genetic resources of peanuts. In: Peanut - culture and uses. Stillwater, Oklahoma, USA: American Peanut Research and Education Association. pp. 47-133.

Knott, D.R. and Worak, J. (1976) Alien germplasm as a source of resistance to disease *Annual Review of Phytopathology,* **14**: 211-235.

Murthy, U.R. and Jahnavi, M.R., (1985). Breeding potential of interspecific tetraploid in *Arachis*. In: Proceedings of an international workshop on cytogenetics of *Arachis*, 31 Oct. - 2 Nov. 1983. ICRISAT Centre, India. pp. 125-130.

Raman, V.S. (1976). Cytogenetics and breeding in *Arachis*. New Delhi, India. Today and tomorrow printers and publishers, P. 36-37.

Singh, A.K. (1985). Genetic introgression from compatible wild species into cultivated groundnut. In: Proceedings of an international workshop on cytogenetics of *Arachis*, 31 Oct. - 2 Nov. 1983, ICRISAT Centre, India. p 107-117.

Stalker, H.T. (1985). Groundnut cytogenetics at North Carolina state University. In: Proceedings of an international workshop on cytogenetics of *Arachis*, 31 Oct. - 2 Nov. 1983, ICRISAT Centre, India. pp. 119-123.

Stalker, H.T. and Moss, J.P. (1987). Speciation Cytogenetics and utilization of *Arachis species. Advances in Agronomy,* **41** : 1-40.

Subrahmanyam, P., Moss, J.P. and Rao, V.R. (1983). Resistance to peanut rust in wild *Arachis species. Plant Diseases.* **67**: 209-212.


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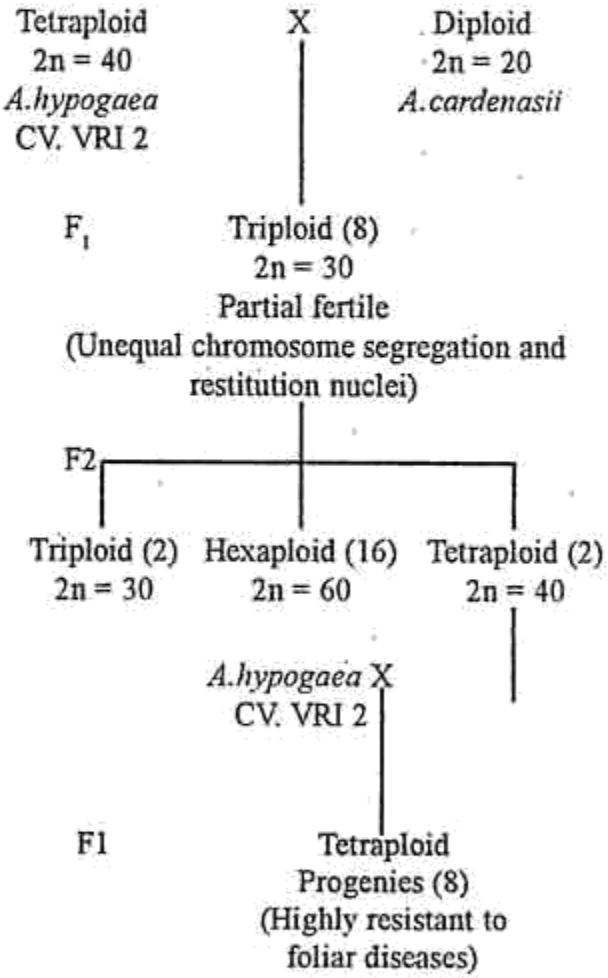
**Fig. 1** Schematic representation of genetic introgression from Arachis cardenasii to A.hypogaea.




Notes : Figures in paranthesis denotes number of plants studied.