Research Reports

Hybridization Between Wild Species and Cultivated Varieties in Genus *Arachis*

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Wild *Arachis* species were introduced into China in 1981. Soon after their introduction, work began on hybridization between wild species and cultivated varieties. Various pathways to hybridization were followed. This paper summarizes the progress made in China during 1981–91 in interspecific hybridization using different approaches.

Triploid pathway. Eighteen crosses were made, of which only three (Huoyue no. 1 × *A. correntina*, Guangliu × *A. villosa*-1, Liuzhouzhenzhudou × *A. cardenasii*) produced hybrid progenies. Some triploids produced seeds, spontaneously changing their ploidy level. In early generations of these triploids, most of the plants were runner types, vigorous, and highly resistant to rust and leaf spot like their wild parents. Erect plants were observed in the F_5 generation, and the progenies became stable in F_9 or F_{10}. There were more two-seeded pods in advanced generations. High-yielding lines with superior seed quality and moderate resistance to rust and late leaf spot (mid-parent scores) have been obtained from the progenies of triploid hybrids. The seeds of some of these lines contain up to 59% oil.

Hexaploid pathway. One hundred and twenty-seven crosses were made using wild species (e.g., *A. stenosperma*, *A. correntina*, *A. villosa*-1) as male parents. The female parents were cultivated varieties (Xilong no. 6, Shanyou no. 14, Fuhuasheng, Silihong, Liuzhouzhenzhudou, Yueyou no. 116, etc). The central spikes in stems of triploid plants were treated with 0.25% hydrotropic solution of Colchicine to produce hexaploids. At present, in the self-pollinated progenies of hexaploid plants, there are 31 lines (F_3 to F_{10}) from 15 crosses. Before the F_6 generation there was too much segregation in progenies; most of them were runner types with many branches. A few erect plants observed before the F_7 generation were sterile. Similar to their wild parents, most of the runner derivatives have high resistance to leaf spot and rust. Stable, erect plants began to emerge in the F_7 generation. The pod characters of advanced-generation derivatives are similar to those of cultivated varieties. There are also lines in which the seeds have oil contents of up to 59%.

Autotetraploid pathway. Autotetraploids of *A. stenosperma* were produced, and 20 crosses were made with the autotetraploid as the male parent. The female parents were Huoyue no. 1, Yueyou no. 116, EC 76446, and Liuzhouzhenzhudou. Only one hybrid produced pods. Most pods were produced in the F_2 generation. F_5 progenies were sterile; in addition, the autotetraploid reverted to a diploid after four generations.

Tetraploid pathway. Sixteen crosses were made with *A. monticola* as the male parent. No superior lines were identified from this exercise.

Synthetic amphidiploid pathway. The amphidiploid of *A. correntina* × *A. batizocoi* was obtained with the pollen mentor method. Five crosses between the amphidiploid as the male parent and six cultivated varieties (Yueyou no. 223, Yueyou no. 116, Shanyou no. 523, Shanyou no. 27, Zhonghua no. 2, Liuzhouzhenzhudou) as female parents were made, but the hybrids were sterile.

Stability of Pod Yield in Foliar Disease-Resistant Groundnut Varieties

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Significant genotype × environment (G × E) interactions have been reported by several workers both for pod yield and yield components in groundnut (Tai and Hammons 1978, Wynne and Coffelt 1980, Shorter and Hammons 1985, Vindhiya Varman and Raveendran 1989). Groundnut varieties that show small G × E interactions are desirable because their performance is stable across a wide range of environments.

Rust (*Puccinia arachidis*), early leaf spot (*Cercospora arachidicola*), and late leaf spot (*Phaeoisariopsis personata*) are major fungal pathogens on groundnut worldwide. These, together with other biotic and abiotic stresses, contribute to instability in pod yields across locations and years. Foliar disease-resistant varieties can help improve yield stability in groundnut. This paper presents results from a study of pod yield stability in rust and late leaf spot resistant varieties developed at ICRISAT Asia Center.

Table 1. Mean pod yield and stability parameters of foliar disease-resistant groundnut varieties.

Variety	Mean pod yield (kg ha-1)	b_i	s^2d
ICGV 87155	1479	1.101	−21951.750
ICGV 87156	1697	1.155	12749.547
ICGV 87157	1619	1.012	−31339.750
ICGV 87158	1444	1.050	−30648.152
ICGV 87159	1327	0.745	41219.195**
ICGV 87160	1252	0.324**	308743.188
ICGV 87161	1266	0.949	−35002.152
ICGV 87162	1271	0.793	−28055.652
ICGV 87163	1299	0.872	117466.242**
ICGV 87164	1455	0.969	50451.547**
ICGV 87165	1481	0.683*	−26511.703
ICGV 87166	1564	0.970	−37459.852
ICGV 87167	1431	0.978	−15363.551
ICGV 87168	1337	0.958	2673.445
ICGV 87169	1822	1.255	−14413.453
ICGV 87170	1407	1.149	149816.750**
ICGV 87171	1460	1.259	119483.742**
ICGV 87172	1010	0.209**	260562.969**
ICGV 87173	1699	1.247	−32104.051
ICGV 87174	1439	1.118	−26817.652
ICGV 87175	1718	1.171	33405.352**
ICGV 87176	1577	0.777	7561.852
ICGV 87177	1709	1.190	−16544.250
ICGV 86022	1530	0.874	−4426.250
ICGV 87178	1214	0.876	−19535.551
ICGV 87179	1655	1.042	154361.656**
ICGV 87180	1613	1.070	130080.742**
ICGV 87181	1601	1.053	−9069.551
ICGV 87182	1724	1.393*	39009.148
ICGV 87183	1880	1.117	141832.250**
ICGV 87184	1600	1.306*	12929.945
ICGV 86021	1449	0.934	53335.750**
ICGV 87185	1594	0.934	63335.750**
Controls			
NC Ac 17090 (resistant)	1667	1.106	20486.445**
JL 24 (susceptible)	1875	1.307*	283800.969**
Grand mean	1519		
SE	±135		

* Significant at 5% probability level, ** significant at 1% probability level

Thirty-three groundnut varieties tolerant of rust and late leaf spot, along with a resistant germplasm line ICG 1697 (NC Ac 17090) and a susceptible cultivar JL 24, were tested in seven environments in an International Foliar Diseases Resistance Groundnut Varietal Trial. These environments included Yezin, Myanmar (1987, 1988), Magwe, Myanmar (1988), Philippines (1989), Sudan (1988), and the Republic of Guinea (1987, 1988). Plot size in the trial was 5.0 × 1.2 m^2; there were three replications in a randomized block design. No fungicides were used, thus facilitating the natural occurrence of foliar diseases. Late leaf spot incidence was scored on a 1–9 field scale, where 1 = no disease and 9 = 50% foliage damaged. At maturity, dry pod yields were recorded for each plot, and pod yield stability was estimated following the method suggested by Eberhart and Russell (1966).

Late leaf spot incidence was low across the test environments; mean scores for the resistant varieties ranged from 3.3 to 5.3, compared to 6.0 for the susceptible variety JL 24. Analysis of variance revealed significant differences among genotypes and environments, but G × E (linear) interaction was not significant. Hence the stability parameters were not calculated for disease incidence.

Analysis of variance for pod yield revealed highly significant differences among genotypes and environments. G × E interaction was also highly significant. The linear component of G × E interaction was highly significant against the pooled deviations, suggesting the possibility that most of the variation could be predicted.

Mean pod yields of 35 varieties, regression coefficients (b_i), and deviations from regression (s^2d) are shown in Table 1. On the basis of the three stability parameters—mean performance across environments, linear regression, and deviation from the regression—ICGV 87169 was found to be both stable and high-yielding. ICGV 87183 and JL 24 were high-yielding but unstable, with significant deviations from regression. However, ICGV 87183, with a nonsignificant regression value close to unity, was more stable than JL 24. Many foliar disease-resistant varieties including ICGVs 87166, 87169, 87173, 87177, 87157, and 87181 had above average pod yields and good stability, with b_i values close to unity and low nonsignificant negative deviations from regression. Some other foliar disease-resistant varieties (ICGVs 87155, 87161, 87167, 87168, 87174, and 87178) were stable but had below average yields. Such varieties can be utilized in a breeding program for transferring stability characteristics into high-yielding cultivars.

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Release of Cultivar Zhonghua 117 in China

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Zhonghua 117, a spanish groundnut cultivar, was developed at the Oil Crops Research Institute (OCRI) of the Chinese Academy of Agricultural Sciences (CAAS). It was bred from a multi-way cross (Ehua 4 × Taishan Sanlirou) F_2 × (Ehua 3 × Xiekangqing) F_2 using the modified pedigree method. It was released in 1993 by the Guangxi and the Hubei Provincial Crops Variety Committees and in 1994 by the National Committee.

In various yield trials in central and southern China during 1985–92, Zhonghua 117 outyielded the local cultivars by 10–46%. Under natural conditions it showed moderate resistance to rust (scored 4.5 on a 1–9 scale, where 1 = no damage, and 9 = 81–100% foliage damaged). Moderate resistance to rust was also confirmed under artificial inoculation. Zhonghua 117 is also moderately resistant to bacterial wilt and tolerant of the acid soils in southern China.

Zhonghua 117 contains 51% oil and 30% protein. It has uniform pods and seeds, with 72% shelling, 100-pod