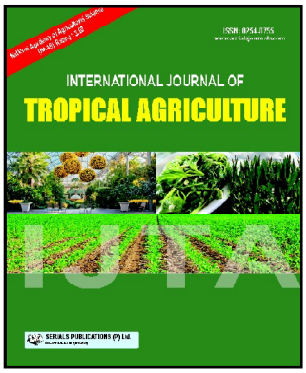

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Genetic Variability and Heritability Estimates in Large Seeded Groundnut (*Arachis Hypogaea* L.) Genotypes

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Abstract: An experiment was carried out at R & D Farm, Bombay Super Hybrid Seeds Limited kuvadva Rajkot. Groundnut is one of the most important cash crops of our country. It is a low priced commodity but a valuable source of all the nutrients. Groundnut is the sixth most important oilseed crop in the world. It contains 48-50% of oil and 26-28% of protein, and is a rich source of dietary fiber, minerals, and vitamins. The world wide groundnut is grown in 26.4 million hectares with a total production of 37.1 million metric tonnes and an average productivity of 1.4 metric t/ha. Worldwide ground nut is grown over 100 countries. Developing countries constitute 97% of the global area and 94% of the global production of this crop. The production of groundnut is concentrated in Asia and Africa with 56% and 40% of the global area and 68% and 25% of the global production, respectively. In developing new varieties with quality characteristics for confectionary products seed size is one of the important traits. In Canada there is a trend to consume jumbo type groundnut products. Hence there is a need for developing varieties which can fulfill the market demand as well as adaptable to local cropping systems. Department of Agriculture, Canada has received confectionary type/large seeded groundnut accessions from various foreign sources. There is a need to evaluate the available large seeded groundnut genotypes to identify the extent of genetic variability within them and heritability of pod and kernel yield, for developing groundnut varieties. 4 exotic groundnut genotypes were evaluated at ICRISAT, Hyderabad, 5 exotic groundnut genotypes were evaluated at BARC, Mumbai AND 5 exotic groundnut genotypes were evaluated at MORS, Junagadh for their agronomic and yield performances. Results revealed that growth and yield parameters tested were significantly different among lines indicating that there is a significant amount of variability among the genotypes. Significant (p=0.01) differences among groundnut genotypes for characters such as number of pods per plant, height of main stem, plant spread, days to 50% flowering, 100 seed weight and days to maturity were observed. All the genotypes tested were taken more than 100 days to mature Genotypes TLG-45, TG-37A, SB-11, SG-99, TLG-45 and TPG-41. Were TAG-24,

BOMBAY SONA, GG-5, GJG-31, J-88 and J-89 genotypes were matured earlier than other types. This is one of the important traits, which can influence on the acceptability of the local farmers. Among the genotypes, BOMBAY-SONA has yielded the highest pod weight per plant. Significant amount of variability was shown for this character. Pod yield were ranged from 1 500 to 4500 kg/ha. BOMBAY-SONA and SG-99 has high pod yields of more than 4000 kg/ha. The recommended variety BOMBAY-SONA has yielded around 1200 to 3100 kg/ha, while the yields of most of the other lines varied from 1500 to 2000 kg/ha. 100 seed weight and days to maturity were highly heritable characters while pod weight per plant and number of pods per plant were controlled by environmental factors for about 50%. The results can be used in decision making in order to make improvements of the groundnut breeding program.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a member of *Papilionaceae* subfamily of *Fabaceae* family which comprises important edible oil seed crops in the world. India, China, Nigeria, Senegal, Sudan, Burma and the USA are the major groundnut producing countries of the world. These countries together accounts for a total area of 18.9 M ha and a production of 17.8 M tonnes *i.e.*, 69% of the area and 70% of the production. In terms of cultivated area and production in the world, India is one of the largest producers of groundnut. In india, it is estimated that nine oilseeds namely groundnut, rapeseed-mustard, soybean, sunflower, safflower, sesame, niger, castor and linseed, accounted for an area of 26.71 M ha with the production of 32.88 M tonnes (Anon., 2015). Groundnut is called as the 'King' of oilseeds. It is one of the most important food and cash crops of our country.

Groundnut can be categorized in to two main groups according to the utilization pattern of the consumers. These are the oil types and confectionary types. Confectionary type groundnuts have some distinct characteristics, such as bigger seed size (>70 g/100 seeds), low oil content (30-35 per cent), rich in carbohydrates, high protein content with better blanching property (easy removal of the testa after roasting). Shape and size of pods as well as seeds are the important determinant factors of market price, particularly when the peanuts are used as food. Consequently, development of genotypes having high yield potential coupled with appropriate pod and kernel physical characteristics, which are the important attributes that always fetch premium price in the market, is the important objective in peanut breeding (Chuni et al., 2014). In India the majority of groundnuts are consumed as seeds without any value addition. Therefore it is very important to develop varieties which are suitable for preparing value added products and develop methods for value addition. In recent years Jumbo peanuts has become popular within the country. Still the total requirement for the jumbo peanut production is imported from other countries. As there is a demand for confectionary type groundnut at present, development of varieties to address the needs of local growers, manufactures and consumers is a timely requirement. Department of Agriculture, India has received confectionary type/large seeded groundnut accessions from various foreign sources. There is a need to evaluate the available large seeded groundnut genotypes to identify the extent of genetic variability within them and heritability of pod and kernel yield, for developing groundnut varieties. Therefore present study was carried out to identify the genetic variability of the large seeded groundnut genotypes available in India.

RESULTS AND ANALYSIS

Growth and yield parameters were significantly different among lines indicated that there is a significant amount of variability among the

genotypes. Significant (p=0.01) differences among groundnut genotypes for characters such as number of pods per plant, height of main stem, plant spread, days to 50% flowering, 100 seed weight, days to maturity and pod length (Table 1) were observed. The existence of higher magnitude of genetic variability for these traits has also been reported by Reddy (1995) suggesting ample scope for selection to improve these traits. Characteristics namely, Pod length, pod width, seed width, leaflet length, leaflet width and seed width were found to be significantly different among the accessions at p value of 0.05 level. Number of days to flowering is one of the early indicators of the maturity of the genotype. The days to 50% flowering have been varied between 32 days to 43 days. Variety sona, TLG-45, J-88, and J-89 number having were early flowering genotypes , while genotype SB-11, SG-99, TPG-41, TLG-45 and TG-37A having taken a long time for 50% flowering to other genotypes. All the genotypes tested were taken 90 to 116 days to mature. Were TAG-24, BOMBAY SONA, GG-5, GJG-31, J-88 and J-89 genotypes were matured earlier than other types. Genotypes TLG-45, TG-37A, SB-11, SG-99, TLG-45 and TPG-41 were have been mature at more than 100 days. Early maturing varieties are important as the most of the groundnut cultivation is done under rain fed conditions. Therefore 3 or 3.5 month age varieties are the most suitable for the cropping systems. The genotypes harvested within 4 months are needed to consider in the breeding program for further improvement. On the other hand longer aged varieties may be important if irrigated water is unlimited and the yield capacity of those lines is high.

Large variation was observed among the genotypes for pod weight per plant. This is may be due to the variation of the pod yield and the weight of the individual pod. Among the genotypes, BOMBAY SONA has yielded the highest pod weight per plant. Significant amount of variability was shown for this character, while genotype GG-2 was recorded the lowest pod weight per plant (Table 2). 100 seed weight of the genotypes were varied from 31 g to 45g. Were BOMBAY SONA, TLG-45 and TG-37A number genotype was recorded a significantly high 100 seed weight comparing to others. These yield were ranged from 1200 to 3100 kg/ha. BOMBAY SONA, J-88 and J-88 has high pod yields of more than 2000 kg/ha. And two genotypes SB-11 and GG-2 were low yielding genotypes according to the analysis (Table 2).

Table 1
Analysis of variance for different characteristics of groundnut genotypes

Characteristic	*Mean Squares Replication*	*Geno-type*	*Error*	*CV%*
Height to main stem (cm)	3.1	98.5**	10.1	9.9
Plant spread (cm)	42.6	269.6**	85.2	13.8
Leaflet length (cm)	6.1	10.9	9.1	10.8
Leaflet width (cm)	10.2	7.4	5.5	9.5
Days to 50% flowering	2.3	10.4**	1.6	3.9
Days to maturity	3	136.2**	2.1	1.2
100 seed weight (g)	40.7	442.2**	25.1	7.1
Pod length (mm)	20.8	25.5*	13.4	10.7
Pod Width (mm)	0.14	4.2	2.4	9.5
Seed Length (mm)	3.3	5.8	4.1	11.6
Seed Width (mm)	0.13	2.6*	1.1	13.3
Number of pods/plant	236.9	469.8**	91.9	21.4
Pod Weight /plant	967.3	1330.1	183.7	22

Days to maturity showed high heritability (92.22%) where genetic variance and the environmental variance were 262.89 and 22.16 followed by height of main stem (92.02) and pod weight per plant respectively. Though number of pods per plant (64.95) and 100-seed weight (79.31%) showed the heritability more than 50%, these characters are controlled by environment for a significant amount. Though 50% flowering is one of the parameters for early maturity, it is also controlled by the environment for a considerable

Table 2
Analysis of variance in agronomic and yield traits of groundnut genotypes

Accession number	*Days to 50% flowering*	*Days to maturity*	*Pod weight per plant(g)*	*100-seed weight (g)*	*Pod yield per ha*
GG-5	35.00	91.33	62.0	37.73	1488.0
TPG-41	38.67	101.00	66.8	36.80	1604.0
TG-37A	36.33	112.33	89.0	41.13	2136.0
GJG-31	34.33	95.00	70.8	31.83	1698.0
TAG-24	35.00	90.00	63.6	40.77	1526.0
SB-11	41.00	115.67	54.0	41.80	1296.0
SG-99	43.00	105.00	66.5	40.17	1596.0
GG-2	35.67	98.00	52.8	41.73	1268.0
BOMBAY SONA	32.33	92.00	94.1	44.80	3058.0
TLG-45	34.00	106.67	84.4	40.77	2026.0
J-88	37.33	116.00	84.5	42.27	2028.0
J-89	33.33	94.33	87.5	34.17	2100.0
ICGV-05170	33.33	95.33	77.8	35.30	1868.0
ICGV-05174	34.33	87.33	89.2	31.30	2140.0
ICGV-06188	37.33	107.67	88.1	40.87	2114.0
CV%	10.45	4.68	10.30	8.84	4.45

degree. Days to maturity are highly heritable character (95%) according to the analysis (Table 3). According to Makinde (2013) very similar heritability estimates were recorded for days to maturity and days to 50% flowering. Previous studies indicated that high heritability is recorded for protein content, Seed size, pod yield per plant and 100 kernel weight (Parameshwarappa, 2005), suggesting that these traits are less influenced by the environment. This is essential for the traits to maintain the desirable confectionery standards when grown under varied environments.

DISCUSSION

High level of genetic variability based on agro morphological characteristics was observed in the large seeded groundnut genotypes used in this study. According to qualitative characteristics, distinct variation can be observed among the genotypes. Plant height at maturity varied from 20 cm to more than 40 cm while plant spreading ranged from 30cm to 75 cm, revealing that most of the genotypes showed spreading nature. Days to maturity was significantly varied among the genotypes, which most of the lines showed early maturity than the recommended variety BOMBAY SONA. Number of pods per plant and pod weight per plant was significantly high in the genotypes namely BOMBAY SONA 100 seed weight, which is one of the important traits in large seeded groundnut types, ranged from 31 g to 45 g and BOMBAY SONA, TLG-45 and TG-37A recorded high 100 seed weight. When considering the pod yield per hectare, it ranged from around 1 200 to 3000 kg/ha, where BOMBAY SONA had high pod yields of more than 3000 kg/ha. 100 seed weight and days to maturity were highly heritable characters while pod weight per plant and number of pods per plant were controlled by

Table 3
Genetic parameters of some traits of groundnut genotypes

Trait	*Genotypic*	*Environmental*	*Phenotypic*	*Heritability (%)*
No: pods/plant	195.69	105.60	301.30	64.95
Height to main stem	3.1998	0.28	3.48	92.02
Plant spread	38.77	21.87	60.64	63.93
Days to 50% flowering	25.51	14.00	39.52	64.56
100 seed weight	45.06	11.75	56.81	79.31
Pod weight/plant	8803.50	964.74	9768.25	90.12
Days to maturity	262.89	22.16	285.05	92.22
Pod Length	6.09	3.16	9.26	65.82
Pod width	0.065	0.01	0.08	81.57

environmental factors for about 50%. It is evident that important traits such as 100 seed weight and day to maturity can be manipulated to a significant degree through conventional breeding procedures. Ten large seeded groundnut lines used in this study were comprised of 3 lines received from International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), one line from BOMBAY SONA , one lines and check variety Walawa, which is the only recommended large seeded variety by the Department of Agriculture, CANADA. The study was conducted at Grain Legumes and Oil Crops Research and Development Center, Angunakolapelessa, CANADA during 2014/15 maha and 2015 yala seasons. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Plot size was 3 ×1.8 m and each plot was spaced one meter apart. Manually ridges were constructed within the each plot with the space of 45 cm. All DOA recommended cultural practices were followed and Supplementary irrigation was provided whenever necessary using flood irrigation. Agronomic and yield data were collected according to the groundnut descriptor published by Plant Genetic Resources Center, Department of Agriculture, 1995. The analysis of variance for different characters was done using SAS statistical software and the means were separated by Duncan's method. Heritability (broad sense) was calculated according to the formula suggested by Hanson *et al.* (1956) for each character.

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