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POTENTIAL OF INTER-SUBSPECIFIC CROSSES IN GENERATING ERECT BUNCH SEGREGATES WITH DORMANCY IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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ABSTRACT

Ten crosses involving nondormant Spanish bunch cultivars of groundnut as female and dormant Virginia cultivars as male parents were assessed for seed dormancy on 10th day after harvest in F_2 generation. The Virginia cultivars recorded less than 40% germination and clearly differed from Spanish bunch (> 50% germination). The germination of F_2 plants showed continuous distribution from 0 to 100%, indicating segregation for the character. Only 7% plants were erect, of which 38% were dormant. But the frequency distribution of erect plants among different germination categories revealed independent genetic control of dormancy and growth habit. Thus, it is possible to increase the frequency of erect bunch dormant plants either by increasing the population size or through backcrossing with the erect bunch parents.

Key words: Dormancy, growth habit, Spanish bunch, Virginia, groundnut.

The two subspecies of cultivated groundnut (*Arachis hypogaea* L.) differ significantly in the intensity and duration of seed dormancy after harvest. The cultivars of ssp. *fastigiata* generally lack in seed dormancy while those of ssp. *hypogaea* are characterized by long resting period [1]. The erect bunch cultivars of ssp. *fastigiata* are popular in the short growing conditions because of their early maturity and easy harvesting. Lack of seed dormancy in the erect bunch varieties is a major problem resulting in 20–50% loss in pod yield due to in situ germination [2, 3]. A short period of dormancy for 2–3 weeks in these cultivars would be advantageous to avoid this loss. Although Virginia runner types of ssp. *hypogaea* form a good source of dormancy, they are not preferred by the grower because of long duration. Thus, there is a need for intersubspecific hybridization to develop dormant type erect bunch cultivars. In order to assess the potential of such crosses an attempt is made in the present

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investigation to study the pattern of segregation for dormancy vis-a-vis growth habit in F_2 generation.

MATERIALS AND METHODS

The material comprised 2216 F_2 plants representing 10 inter- subspecific crosses. The crosses were made using nondormant Spanish bunch cultivars (JL 24, Dh 3-30 and Dh 40) as female and four dormant Virginia cultivars (Makalu Red, TMV 10, Bh 8-18 and TG 7) as male parents.

The F_2 generation was evaluated in single replication. All the available seeds in each cross were sown at 60 cm spacing between rows and 20 cm between plants. All F_2 populations had their respective parents at their borders. Standard agronomic practices were followed to raise the crop.

All F_2 plants and 10 random plants of each parent were evaluated for germination on 10th day after harvest to determine seed dormancy. The pods were shade dried to constant moisture before subjecting them to germination test. Ten plump seeds from each plant were glanced on soaked germination paper, incubated for 4 days, and the germinating kernels were counted. Depending on the frequency (%) of germinated seeds, the plants were categorised into 11 germination groups ranging from 0 to 100% with class intervals of 10%. Based on the germination behaviour of dormant and nondormant parents, all F_2 plants giving 50% or more germination were considered as non dormant and the remaining ones as dormant. The F_2 plants with erect growth habit and sequential branching with or without flowering of the main stem classified as erect bunch, and were further grouped into erect dormant and erect nondormant plants.

RESULTS AND DISCUSSION

The dormant Virginia parents recorded characteristic germination of 0–40% and differed markedly from the nondormant erect bunch parents which recorded 50–100% germination (Fig. 1). Generation in F_2 exhibited continuous distribution of plants from 0–100%, indicating segregation for the character (Fig 2). When the germination in the two sets of parents was taken as the criterion for classification a large proportion (61.5% of plants) turned out to be nondormant (Table 1). The inheritance pattern of dormancy is not yet clear. It has been reported to be either partially or completely dominant over nondormant [4, 5], recessive [6], or under the control of multiple factors [7]. However, Hemant [8] after a detailed analysis of F_2 and F_3 plants, questioned the validity of the approaches used and conclusions drawn because of the interaction between maternal and offspring genotypes in the seeds of segregating generations. The main objective of this investigation was to assess the potential of the Spanish x Virginia crosses to generate erect bunch segregates with dormancy.

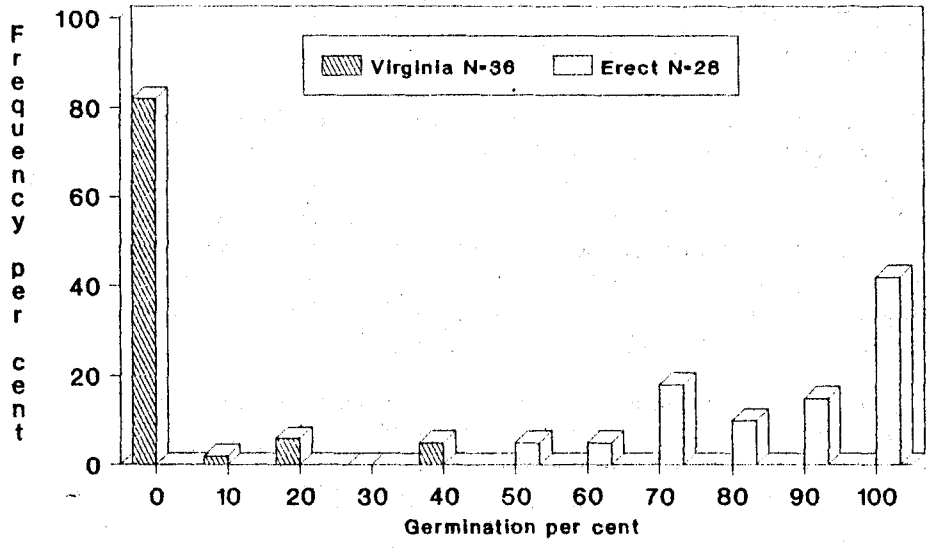

Fig. 1. Frequency distribution of dormant and non-dormant parents for germination at tenth day after harvest.

The F_1 in all the crosses were characterised by the absence of flowers on main stem, alternate branching and by procumbent or decumbent growth habit, indicating recessive nature of erect habit, sequential branching and main stem flowering. The frequency of erect bunch plants combining erect habit and sequential branching was quite low (7%) in the F_2

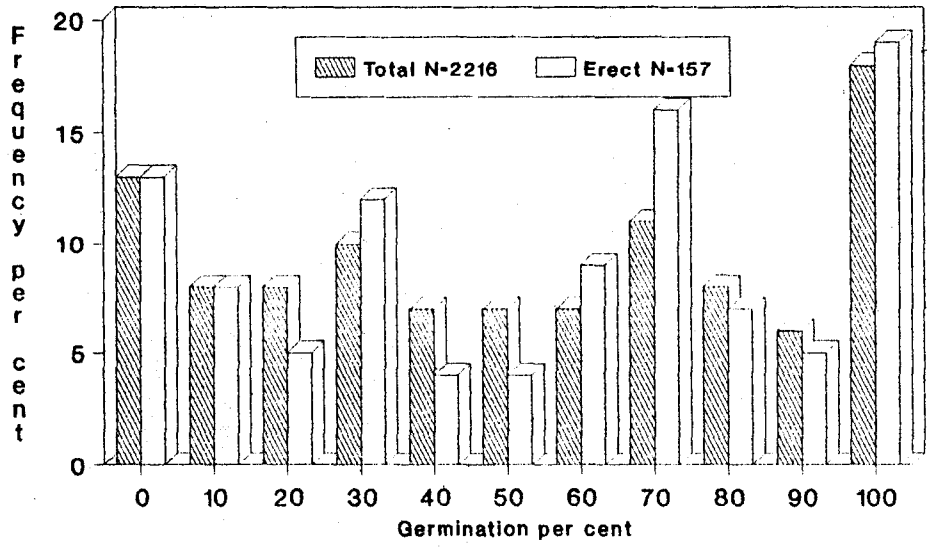

Fig. 2. Frequency distribution of plants in F_2 generation for germination percent at tenth day after harvest.

generation (Table 1). Earlier studies on the inheritance of these characters have revealed the involvement of duplicate sets of genes and thus recovery of few recessive types [9].

Although the erect plants were very few, pattern of their distribution in different germination categories was similar to the whole population (Fig. 2). Further, χ^2 analysis for the independence (P = 0.7 – 0.9) of the data on growth habit and dormancy revealed their independent genetic control. Thus, in spite of low frequency of erect bunch dormant plants (2.66%) it is possible to increase their recovery either by increasing the population size or through an additional backcross to the erect bunch parents. Among the crosses, Dh 40 x Makalu Red, Dh 3-30 x TG 7, Dh 3-30 x Makalu Red and Dh 3-30 x Bh 8-18 gave relatively higher frequency of erect bunch dormant segregates.

Table 1. Frequency distribution of plants segregating for dormancy and plant habit in F_2 generation of groundnut

Cross	Distribution of plants over phenotypes					
	total	dormant	non-dormant	erect	dormant erect	non-dormant erect
JL 24 x TMV 10	259	120	139	21	5	16
		(46)	(54)	(8)	(2)	(6)
JL 24 x Makalu Red	176	61	115	0	0	0
		(35)	(65)	(0)	(0)	(0)
JL 24 x Bh 8-18	104	50	54	1	1	0
		(48)	(52)	(1)	(0)	(0)
Dh 3-30 x TMV 10	174	85	89	5	2	3
		(49)	(51)	(3)	(1)	(2)
Dh 3-30 x Makalu Red	29	17	12	3	1	2
		(59)	(41)	(10)	(3)	(7)
Dh 3-30 x Bh 8-18	553	173	380	51	14	37
		(32)	(69)	(9)	(3)	(7)
Dh 3-30 x TG 7	496	189	307	53	27	26
		(38)	(62)	(11)	(5)	(5)
Dh 40 x Makalu Red	25	15	10	6	5	1
		(60)	(40)	(24)	(20)	(4)
Dh 40 x Bh 8-18	114	49	65	2	0	2
		(43)	(57)	(2)	(0)	(2)
Dh 40 x TG 7	286	94	192	15	4	11
		(33)	(57)	(5)	(1)	(4)
Total	2216	853	1363	157	59	98
		(39)	(62)	(7)	(3)	(4)

Values in parentheses represent percentage of total plants.

REFERENCES

1. A. Krapovickas. 1968. The origin, variability and spread of the groundnut (*Arachis hypogaea* L.). *In:* The Domestication and Exploitation of Plants and Animals. Gerald Duck Worth Ltd., London: 427–441.

2. P. S. Reddy. 1982. Problems of groundnut cultivation. Indian Farming, **32**(8): 37–42.

3. N. Nagarjun and G. D. Radder. 1983. Studies on induction of seed dormancy in bunch type groundnut. Seed Res., **11**: 24–31.

4. N. E. Stokes and F. H. Hull. 1930. Peanut breeding. Amer. J. Agron., **22**: 1004–1008.

5. Hising Lin and Ching-Yu-Lin. 1971. Studies on seed dormancy in groundnut. II. The effect of seed maturity on dormancy and sprouting of peanuts. J. Taiwan Agric. Res., **26**: 49–53.

6. C. P. Cheng. 1972. Current situation of food legume crops production in Taiwan, The Republic of China. Trop. Agric. Res. Ser., **6**: 11–12.

7. C. M. John, C. R. Seshadri and M. B. Rao. 1948. Dormancy of the seed in groundnut. Madras Agric. J., **35**: 159–167.

8. Hemant. 1990. Evaluation of Early Generation for Dormancy and Productivity in Erect Bunch Groundnut (*Arachis hypogaea* L.). M.Sc. (Agri.) Thesis. University of Agricultural Sciences, Dharwad: 156.

9. J. C. Wynne and T. A. Coffelt. 1982. Genetics of *Arachis hypogaea* L. *In:* Peanut Science and Technology (eds. H. E. Pattee and C. T. Young). American Peanut Research and Education Society, Yoakum, Texas, USA: 50–94.