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Research Article

Studies on Inheritance Pattern of Non Spiny Character in Spiny Brinjal

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Abstract

An objective to develop non spiny brinjal without deletion of quality characters of spiny brinjal for consumer's preference and also avoid hitting of spines to harvesters. Spiny brinjal (VRM-1 Mullukathiri) is a pure line selection from Elavambadi village of Vellore district of Tamil Nadu. Spines are present in the leaf, stem and calyx of the fruit. The crosses were attempted to develop non-spiny brinjal with spiny quality. The both parents of non spiny and spiny are pure for spiny and non spiny respective characters. There is no problem for cross ability. Studied two types of crosses i.e., Spiny x Non-spiny and Non-Spiny x Spiny were made for their inheritance of non-spiny and spiny nature in leaf, stem and fruits in brinjal. The true F1 was tagged in both crosses combination. From this study in both cases spiny plants are observed in F1 generation which indicates spiny is expressed as dominant characters. In both cases spiness, fruit shapes and flower colors shown dominance in respective parents are used as female. The gene expression of 3:1 ratio was recorded for all qualitative traits as mendelian ratio.

Study of dominance of deep violet flower over slight violet, presence or absence of spines on leaves, calyx and stem, monogenic or pleiotropic in gene action; fruit shape and round shape dominant over oval (pear and club shaped) fruit shape; deep violet calyx color dominant over slight violet and fruit color ranging from light purple to dark purple showing quantitative nature of gene expression.

Keywords: Brinjal; Qualitative traits; spines; Flower color; Fruit shapes; Inheritance characters

Introduction

The brinjal is one of the most important vegetable used by the consumers in India. Preference for brinjal consumption is varied based on location. Many brinjal types are available in Tamil Nadu. Within 50 kilometers distance consumption of brinjal preference is completely changed. Spiny brinjal having peculiar habit even in maturity stage we can use for culinary purpose. The area for spiny brinjal cultivation is very high northern Tamil Nadu and also this types fetching high price comparatively with other brinjal at the rate of at least Rs. 5 per kg. Market value also very high in these types. All the spiny brinjal growers happy with spiny brinjal cultivation because continues demand. The drawback for spiny brinjal is always giving trouble to harvesters. To prevent this problem farmers are requested to scientist to eradicate this types without changing of color, taste and qualities. Because of enquiries by the farmers through suitable research was started for developing Non spiny type without changing of characters. The research has been started in 2012 at TNAU, Agricultural Research Station, Virinjipuram, and Vellore and continued to proceed up to 2015 at same research station for inheritance studies for some characters.

Materials and Methods

The experimental materials namely VRM1 Spiny brinjal and non spiny local types 1,2,3 were taken for the research. Non spiny brinjal local types and *Spriny brinjal variety VRM1* were raised during Rabi 2012-2013 in a crossing block. The direct and reciprocal crosses were affected following the method suggested by Boling et al. for hybridization.

The crosses were attempted between non spiny with spiny and also spiny with non spiny *vice versa* (Table 1).

The number of plants survived over germinated seeds were taken to assess the lethality of F1 hybrids.

$$\text{Hybrid lethality} = \frac{\text{No. of plants died}}{\text{No. of seeds germinated}} \times 100$$

The fruit set from the above mentioned crosses were sown in two rows along with one row of male and female parents with spacing of 75 x 30 cm during rabi season.

The following quantitative traits were studied for all F1 hybrids. Plant height (cm), Number of branches per plant, Length of branches (cm), Days to 50 per cent flowering ,Number of flower per plant , flower color, leaf spineness, stem spines, calyx spiness, peduncle spines, intensity of leaf spineness, fruit shape, fruit stripe, calyx color, calyx spineness, fruit color at commercial harvesting, fruit color at physiological maturity. Number of fruits per branch, Number of fruits per plant ,Fruit weight (g), Fruit length (cm), Number of seeds per fruits, 1000 seed weight (g) , Fruit yield per plant (g). Dry matter

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production and Days to maturity.

The observations were recorded on five randomly selected competitive plants of each experimental unit.

The seeds from individual F1 plant fruits were collected separately and were sown as progeny rows during kharif 2013. Observation for all the quantitative traits as that of F1 generation, F2 generations was also continues to study the inheritance patterns of non spiny into spiny and spiny into non spiny cross combinations.

Result and Discussion

The result of this parental crosses pertaining to qualitative traits of F2 morphology of ten characters studies were carried out and revealed. The successful direct and reciprocal crosses between *three non spiny brinjal 1,2,3* and *one spiny brinjal VRM1* and the results were obtained. Two types of brinjal comprised of four genotypes (only one pure variety is available in spiny brinjal namely VRM1 used as parent), three local non spiny brinjal types were used as parents.

Spines is present in all the parts of the brinjal plants *viz.*, leaf, stem, leaves veins, peduncle, calyx, pre calyx, deep violet color flower and ovate, , calyx color is green fruit shape is oval, no fruit stripes in spiny brinjal. Non spiny brinjal is concern the flower is light violet color and spines are not present in leaf, stem, calyx, peduncle, fruits, fruit shape is round, no fruit stripes, calyx color is green and there is no spine in calyx.

There are three phenotypically distinct characters namely spines in plants, flower color and fruit shape were taken into account for inheritance of gene action study and along with quantitative characters.

Spiny nature

F1s of the non spiny x spiny crosses almost all the F1 plants are intermediate in height and small not prominent spines are scatterly occur in the plants.

F1s of the spiny x non spiny crosses all the plants are intermediate in height and spiny is prominent occurs in all the plant parts like spiny parent.

Flower color

F1s of the non spiny x spiny crosses almost all the F1 plants are intermediate in height and flower color is slightly violet.

F1s of the spiny x non spiny crosses all the plants are intermediate in height and flower color is deep violet.

Fruit shape

F1s of the non spiny x spiny crosses almost all the F1 plants are intermediate in height and fruit shapes also intermediate between round and ovate.

F1s of the spiny x non spiny crosses all the plants are intermediate in height and ovate and round.

Ten qualitative characters were studied in the cross combination, the female parent contribution is high in the expression for particular characters when parent is used as female Table 2. The inheritance of the characters and how influenced the cross combination is discussed as follow the mendelian characters.

Table 1:

Sl.No	Direct cross		
1	Non spiny brinjal local 1	x	Spiny brinjal VRM1
2	Non spiny brinjal local 2	x	Spiny brinjal VRM1
3	Non spiny brinjal local 3	x	Spiny brinjal VRM1
	Reciprocal cross		
4	Spiny brinjal VRM1	x	Non spiny brinjal local 1
5	Spiny brinjal VRM1	x	Non spiny local 2
6	Spiny brinjal VRM1	x	Non spiny local 3

Table 2: Summary of results of three characters.

Parents	Dominant	Recessive	Ratio
Spiny: Spiny X Non spiny plants	155	58	3:1
Fruits shape: Round x oval shape fruits plants	3265	1260	3:1
Flower colour: Deep violet X light violet color flowers	6800	2252	3:1

There are no observable difference between one parent and the other or between the parents and the offspring with reference to a particular character, it is not possible to find out whether the offspring have inherited the character from one parent or the other parent or both. Hybridization between parents that differ in some way with reference to a character is therefore the best method of studying the mode of inheritance of a character.

For this hybridization experiments four varieties of brinjal (*Solanum melangenam*) that differed from one another constantly in one more characters. The characters which were selected for this experiments are Spiny: (Spiny and non spiny), Flower color: Deep violet and light violet and Fruit shape: Oval and round.

This inheritance study was crossed one genotypes with another and observed the appearance of the resulting hybrids in the first and succeeding generations. Thus, for instance, crossed a variety having round fruit with a variety having oval fruit, spiny with non spiny and deep violet color flower with light violet color flower.

In the case of each of the three crosses, found that all the offspring (the first filial generation or F1) were uniform and resembled one of the parents so closely that the character of the other parent escaped observation completely. Those parental characters which appeared in the F1 were termed dominant and those parental characters which entirely disappeared in the F1 were termed recessive. Thus, for example, all of the hybrid resulting from a cross between Non spiny x spiny plants were non spiny and spiny cross with non spiny plants were spiny, a character round-fruits plant and a oval fruit plants were round, a cross between deep violet flower color and light violet flower color plants were deep violet color.

Self-fertilised the first-generation hybrids and found that, unlike the F1 which was uniform, the second generation or the F2 consisted of two different kinds. In the F2 the recessive character reappeared, together with the dominant character. Three-quarters of the F2 showed the dominant character and one quarter the recessive character.

For example, from 213 plants raised from the hybrid of a cross between the spiny variety and the non spiny variety, in these 213

Table 3: Qualitative characters of different crosses of F1 of Non spiny x Spiny and spiny x non spiny crosses.

Sl.No		1. Flower color	2. Leaf spineness	3. Stem spines	4. Calyx spiness	5. Peduncle spines	6. Intensity of leaf spineness	7. Fruit shape	8. Fruit stripe	9. Caly x color	10. Caly x spineness
1	***1. Non spiny x Spiny VRM***	Slight violet	less spine	Less spine	No spine	No spine	Less intensity	Round oval	No strips	Green	No spines
2	***2. Non spiny x Spiny VRM***	Slight violet	less spine	Less spine	No spine	No spine	Less intensity	Round oval	No strips	Green	No spines
3	***3. Non spiny x Spiny VRM***	Slight violet	less spine	Less spine	No spine	No spine	Less intensity	Round oval	No strips	Green	No spines
4	***Spiny VRM1 x 1. Non spin***	Deep violet	spine	spine	spine	Spine	High intensity	Oval round	No strip	Green	Spine
5	***Spiny VRM1 x 2. Non spin***	Deep violet	spine	spine	spine	Spine	High intensity	Oval round	No strip	Green	Spine
6	***Spiny VRM1 x 3. Non spin***	Deep violet	spine	spine	spine	Spine	High intensity	Oval round	No strip	Green	Spine

plants received 155 spiny plants and 58 non spiny plants. Obtained an F2 generation of 4525 fruits. Among these plants, 3400 were round and 1125 were oval. The ratio of 3.00 round : 1.00 oval is very close to the ratio of 3 round : 1 oval.

Another character deep violet flower color crossed with light violet color, in F2 generation of same cross obtained 9052 flowers and segregate 6800 deep violet color flower color and 1260 light flower color in F2 generation.

The data obtained by this study of three traits of above crosses are summarized in Table 3.

These crosses found that the F2 recessives, when self-fertilised bred true. One-third of the F2 dominants bred true while the remaining two-thirds yielded offspring which displayed the dominant and recessive characters in the proportion of 3:1. There were, thus, three classes in the F2, *viz*., pure dominant, hybrid dominant and pure recessive in the proportion of 1:2:1. For example, among 213 plants raised by this cross from these pure spiny 60 plants dominant , 100 plant hybrid dominant and 53 plants pure recessive of the F2 generation, for another character 1135 pure dominant round fruits , 2260 hybrid dominant and 1130 pure recessive oval fruits. Flower color is concern, obtained 2280 pure dominant deep violet color flowers,4522 hybrid dominant and 2250 pure recessive slight violet color.

In the all cross combinations for many qualitative characters are dominant in nature. The contributing characters express its dominance towards female parents.

The F1 crosses between three parents of non spiny with only one parent of spiny VRM1 studied for many characters The expression of characters in F1s like their female parents. Slight violet flower color, as spiny nature is concern very sparly spines are present in leaf, stem, calyx, peduncle, fruits, fruit shape are roundish oval, no fruit stripes, calyx color is green and there is no spine in calyx as that of non spiny parents.

The reciprocal crosses between spiny VRM1 with three non spiny parents for all the characters expressed in F1s are towards spiny plants like deep violet flower color, spines are present in leaf, stem, calyx, peduncle, fruits, fruit shape is oval with round, no fruit stripes, calyx color is green and spine in calyx as that of spiny

In general spiny character is dominant over non spiny especially leaf spineness was dominant over non spineness. However it was not conclusively proved whether other factors such as pleotropism was not influencing the expression of this characters. Stem spines also dominant over non stem spines. Spiny x non spiny crosses produced strong spineness on calyx, leaf, stem and weak spines in non spiny with spiny crosses. Khapre, et al., [1] reported that spines on calyx. The same results were agreed with Rangaswami and Kadam bavanasundaram [2] reported monogenic inheritance for the inheritance of the said character. The similar result was shown in this study. The leaf spine is dominant over than nons piny parents crosses in F1s. The non spiny parents involved with spiny parents in the F1 population having slight spine in the leaf, stem, calyx sparely which showed the spiny is dominant over non spiny. These results are in coincidence with findings of Rangaswami and Kadam Bavanasudaram [2]. Nimbalkar and More [3] reported that the presence or absence of spines was controlled by single gene, and was pleiotropic in action. Patil and More [4] reported that the spines on stem, leaf and petioles had monogenic inheritance and were controlled by Single gene (Sp), which was also responsible for pleiotropism of these characters. The spiny leaf parent VRM1 had high intensity of spines, while other parents were of no leaf spines. The Fi's of the crosses between VRM1 and non spiny parents showed leaf spine intensity showed slight spines. In present study, uniform only in height but not in all the location of spiny character in the plants. Spiny x non spiny crosses produced small to large spineness on all the parts of plants especially in calyx. The same result agreed with Savitha et al., and Pandiyan et al.

Present study flower color is concern; the deep violet is dominant over light violet color. Spiny parent produced deep violet color flower and non spiny parents produced slight flower color. In the cross combination deep violet produced deep violet color where as slight violet female parent with deep violet color parent produced slightly deep violet color (not so deep violet) but deep slight violet color than slight violet color (parent). It is considered as partial dominant characters expressed. The same results were revealed for many other characters that purple flower was controlled by nuclear genes and dominant in nature. Nolla, Sinha, Swamy Rao, [5-7] and parents which shows monogenic action of 3.1 ratio in F2. Wanjari and Khapre [8] reported that purple corolla as monogenically dominant over non pigmented corolla. Rao et al., [9] reported multi factorial basis of gene action for flower color. Patidar, reported that corolla color come out of interaction of three or more non-allelic genes.

In present study, fruit character is concern, all of the non spiny female genotypes had round types of fruits. In the cross combinations roundish oval types fruits were produced with many colors of fruits like green, purple, deep violet and light purple. In this study found round fruit is dominant over oval and oval is dominant over round its due to their dominating of respective female parental characters. Similar characters of fruit shape result were revealed in most of the

crosses of different genotypes. The earlier studies had depended on limited number of categories for the character fruit shape i.e. elongated, oval and round, Swamy Rao [7] and Choudhary had reported that elongated (ellipsoid and cylindrical) fruit shape was dominant over round (globular, ovoid and obovate) fruit shape. Nimbalkar and More [3]; Patil and More [4] had reported round shape as dominant over oval (pear and club shaped) fruit shape and the hybrids developed in present study also followed the same pattern.

Present study also revealed that the inheritance of fruit color at commercial maturity as well as physiological maturity showed that most of the cross combination has purple color fruits but with varying level of intensity of color ranging from light purple to dark purple at commercial maturity and brown fruit color at physiological maturity. The pattern of expression of this trait indicated the role of oligogenes or polygenes in the inheritance of fruit color. Regarding the character fruit shape, it was observed that elongated fruit shape was dominant over round, and round was dominant over oval. The above results of inheritance for different characters were well explained by various authors reported in different crops by Pandiyan et al., [10,11] reported in 3:1 for monogenic characters for MYMV resistance in mungbean and mungbean with trilobata cross and Pandiyan et al., [12] for monogenic character of 3:1 ratio observed in mutated plants in mungbean MYMV resistance. Rangaswamy Kadam Bavansundaram, reported on the inheritance of certain qualitative charactersin the cross between *S. indicum* x *S. melongena*. Rao and Kumar [13]. Some observations on interspecific hybrids of *Solanum melongena L.* Rao et al., [9] reported on the inter specific hybrids of non-tuberiferous species of S. *melongena* L., Prabhu et al., [14] reported inter-specific progenies in eggplant. Preneetha [15,16] shoot and fruit borer resistance in brinjal (*Solanum melongena L* for monogenic control. Patil and More [4]. Inheritance studies of some characters in brinjal. Wanjari and Khapre [8]. Inheritance of pigmentation in *S. melongena* x *S. indicum*. Swamy Rao [7] studied the inheritance of qualitative characters in brinjal (*Solanum melongena L.*) [6]. Linkage study in brinjal (*Solanum melongena L.).*

Conclusion

The characters expression in F2 based on the dominant and recessive nature of the parents involved. Over all the study understood, the spines character is dominant over non spiny characters where as other characters shown the inheritance depends on the female parent's domination.

References

1. Khapre PR, Wanjari KB, Deokar KB. Inheritance of some fruit color in *S. melongena* x *S. indicum*. J Mahar Agric Univ. 1986; 13: 97-98.
2. Rangaswamy P, Kadam Bavansundaram M. A study on the inheritance of certain qualitative characters in the cross between *S. indicum x S. melongena*. SouthIndian Hort. 1973; 21: 1-6.
3. Nimbalkar VS, More DC. Genetic studies in abrinjal cross Muktakeshi x White green. J Mahar Agric Univ. 1980; 5: 208-210.
4. Patil SK, More DC. Inheritance studies of some characters in brinjal. J Maharashtra Agric Uni. 1983; 8: 47-49.
5. Nolla JAB. Inheritance of color in eggplants (*S. melongena L.*). J. Dept of Agri Puerto Rio. 1932; 16: 19-30.
6. Sinha BK, Prakash R, Haque Md F. Linkage study in brinjal (*Solanum melongena L.*). Indian J Genet. 1966; 26: 223-226.
7. Swamy Rao T. A preliminary note on the inheritance of qualitative characters in brinjal (*Solanum melongena L.*). Madras agric. J. 1970; 57: 508-509.
8. Wanjari KB, Khapre PR. Inheritance of pigmentation in *S. melongena* x *S. indicum*. Genet Agraria. 1977; 31: 327-332.
9. Rao N, Ponnaiya BWX, Menon PM. Studies on the interspecific hybrids of non-tuberiferous species of *S. melongena L.* South Indian Hort. 1969; 17: 71-78.
10. Pandiyan M, Senthil N, Ramamoorthi N, Muthiah AR, Tomooka N, Duncan V, et al. Interspecific hybridization of Vigna radiata x 13 wild Vigna species for developing MYMV donar. Electronic Journal of Plant Breeding. 2010; 1: 600-610.
11. Pandiyan M, Senthil N, Suersh R, Chakravarthy N, Packiaraj D, Jagadeesh S. Interspecific hybridization of Vigna radiata x Vigna trilobata. Wudpecker Journal of Agricultural Research. 2012; 1: 233-234.
12. Pandiyan M, Ramamoorthi N, Ganesh SK, Jebaraj S, Nagarajan P, Balasubramanian P. Broadening the genetic base and introgression of MYMV resistance and yield improvement through unexplored genes from wild relatives in mungbean. Plant Mutation Reports. 2008; 2: 33-43.
13. Rao GR, Kumar A. Some observations on interspecific hybrids of Solanum melongena L. Proc Indian Acad Sci (Plant Sci). 1980; 87: 117-121.
14. Prabhu MS, Natarajan L, Pugalendhi M Prabhu, Natarajan S, Pugalendhi L. Mean performance of eggplant (*solanum melongena l.*) inter-specific progenies 2011. Indian J Agric Res. 2011; 45: 249-252.
15. Preneetha S. Breeding for shoot and fruit borer (*Leucinodes orbonalis G.*) resistance in brinjal (*Solanum melongena L.*). PhD (Hort) Thesis. Tamil Nadu Agricultural University. Coimbatore. 2002.
16. Amirthanayagam ERM. Genetic variability studies in F4 and F5 generations of okra (*Abelmoschus esculentus (L.) Moench.*). MSc. (Hort.) Thesis. Tamil Nadu Agricultural University. Coimbatore. 2001.