GM 4-31, GM 12-19 and GM 15-1: Garden pea lines suitable to sandy soil conditions

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Abstract: The pea lines GM 4-31,GM 12-19 and GM 15-1 were developed in a long-term breeding program that employed the cross Master-B (dwarf) x Gaint Climber (tall) followed by pedigree selection , under the new land condition (West Nubaria District). Seed of 15 F_6 lines were planted along with check cv. in the field (new land) in winter season 2007-2008 and five lines were selected .In winter season 2008-2009 these lines, in addition to three check *cvs* which are wildly grown in Egypt, were planted in an evaluation field trial experiment. GM 4-31, GM 12-19 and GM 15-1 were selected for earliness, dwarf plants, long pods, high number of pods/plant, high number of seeds/pod and high seed yield / plant. The lines GM 4-31, GM 12-19 and GM 15-1 surpassed the highest check *cvs,* Victory Frizer. Therefore these lines well be recommended as new cultivars in the sandy soil conditions.

Keywords: GM 4-31, GM 12-19, GM 15-1, Garden pea, *Pisum sativum L,* Sandy Soil.

INTRODUCTION

Garden pea (*Pisum sativum L.*) is an important vegetable crop of temperate regions of the world and was originally cultivated in the Mediterranean basin (Smart 1990). Its adaptation to relatively cool conditions has enabled its cultivation to spread beyond the area of initial domestication into Europe, Africa and Asia. In Egypt, pea is grown in an area of 61640 feddans with production of 262987 tons green pods and productively of 4.27 tons/feddan. It is mostly grown in old land 44571 feddan with production 214087 tons and productively of 4.8 tons/feddan, where as in new land is grown 17069 feddans with production 48900 tons and productivity of only 2.86 tons/feddan (According to Ministry of Agriculture statistics, 2007).

Unfortunately, the yield of pea is low in the sandy soil as compared to the old land and its attributable to the lack of suitable improved cultivars for sandy soils (new lands).

One of the major goals of any plant improvement program is to increase profitability of the crop. Since yield is a major component of profitability, improvement in yield is a major concern in developing new pea cultivars. At the same time, quality of the shelled peas must be maintained or improved to encourage consumption. Yields of peas for the garden have been improved through the development of cultivars that bear more pods per node. Production of two or more pods is necessary for high yields, and these pods should be well filled with a high number of peas. Because peas rapidly pass through the optimum harvest stage (within 24 hr during hot, dry weather), the pods from only a limited number of nodes contribute to yield. In the field, generally only three to four nodes have peas that contribute to the yield, since peas at the upper nodes will not have developed sufficiently to be acceptable. Although height or vine length is less critical than for field – grown plants, it has bean generally reduced, and many dwarf cultivars growing only 2-2.5 ft tall have been developed. Further refinements are to have a dwarf vine, bearing double pods and resistant to the prevalent diseases, especially powdery mildew. Of course, all these must be accomplished while maintaining the excellent flavor that helped make this cultivar successful. (Grition, 1986).

The present investigation aimed at finding out the most suitable genotypes of garden pea adapted to the sandy soil (new lands) of Egypt. The agronomic performance of advanced breeding lines were compared in experimental trail under new lands conditions in order to employ the most successful lines in breeding program for the improvement of new pea cultivars suitable to grow in the new lands.

MATERIALS AND METHODS

This study was carried out at a private farm in west Nubaria district, El-Behira Governorate, Egypt during the winter seasons 2007-2008 and 2008-2009.

The study was started with seed of 15 F_6 lines which were obtained from previous study .These lines were derived by pedigree selection after crossing two cultivars of garden pea, the first was Master-B (dwarf) which is widely grown in Egypt, and the second was Gaint Climber (tall). Five generations of pedigree selection were conducted in the field under conditions of the sandy soil to get new lines of pea having intermediate vegetative growth and desirable yield traits. These lines were sown on 10 November 2007 in an augmented randomized complete block design (Federer, 1956) with four replicates , each replicate is containing 15 lines and check *cv.* (Master-B) which widely grown in Egypt .Each genotype was represented by one trellis and each trellis was 6 meters long and 90 cm. wide, the spacing between plants 20 cm. apart. This relatively low plant population will permit the plants to develop and product to their maximum potential. It will also permit the breeder to make detailed observations and measurements of individual plants .The standard package of practices were followed to raise a good crop. Observations were recorded on quantitative traits viz., vine length, primary branches/plant, first blossom node, pods/plants, pods length, seeds/pod, 100- seed weight and seed yield/plant on five randomly selected plants (Table 1).

Table (1): Agro-morphological characters in pea genotypes

S. No.	Character	Character description
1	Vine length(cm.)	Measured from the ground to the tip of the plant at maturity (average of 5 random plants /plot).
2	Primary branches /plant	Counted on the main stem, the number of primary branches on a plant (average of 5 random plants /plot).
3	First blossom node	Recorded from ground level to the node which bore the first flower.
4	Pods/plant	Recorded at complete pod formation stage (average of 5 random plants / plot).
5	Pod length(cm.)	Recorded at complete pod formation stage (average of 5 random plants / plot).
6	Seeds /pod	No.of seed bearing pods counted at harvesting stage (average of 5 random plants).
7	100-seed weight (g.)	Weight of 100 random seeds (average of 5 random samples).
8	Fresh seed yield/plant (g.)	Average of 5 random plants at harvesting stage.

Based on agro- morphological traits and the preliminary yielding ability, five lines with desirable traits were subsequently selected for further studies and harvested separately at the end of the growing season. Traits used to selected these lines were stiff and non-lodging plant habit, early maturity, first blossom on 6^{th} to 8^{th} node, high number of primary branches and pods per plant, long pods with filled seeds and high seed yield/plant.

In winter season 2008/2009, the selected lines were sown along with three check cultivars viz, Master-B, victory Frizer and Lincoln in an evaluation field trial experiment in a randomized complete design with four replications. Plot size was the same as given above .These check cultivars were widely grown in Egypt .Five random plants from each plot were used to record the data on quantitative traits viz, vine length, primary branches/plant ,first blossom node, pods/plant , pods length, seeds/pod, 100- seed weight and seed yield/ plant .Data were statistically analyzed firstly according to Cochran and Cox (1957), to obtain the analysis of variance and its components. The least significant difference (L.S.D) was used to compare the mean values (Snedecor, 1962).

RESULTS

The mean performances for different traits of the evaluated lines and check cultivar are given in Table 2 . Data revealed that high significant differences among the studied lines for all studied traits .Regarding to vine length it was ranged from 55.0 to 95.9 cm, with mean 74.8 cm, in the studied lines. On the other hand, check *cv* was 48.5 cm. For primary branches per plant, lines were ranged from 1.2 to 3.4 branches with mean of 1.9, whereas the check *cv* was 2.0 branches/plant. With respect to first blossom node, lines were ranged from 7.3 to 10.3 nodes with mean 8.3 nodes but the check *cv* was 8.0 node. Data concerning pods per plant, the studied lines showed pods per plant ranging from 9.0 to 35.0 pods with mean 15.1 pods. The lines 12-19 and 15-1 possessed the highest values for number of pods per plant and recorded 35.0 and 33.8 pods, respectively .On the other hand, check *cv* possessed the lowest value for the number of pods per plant (9.0). For pod length, the lines, 4-31, 4-29 and 11-10 possessed the highest values for pod length and recorded 11.1, 10.1 and 9.4 cm, respectively. On the other hand, check cv. possessed the value 10.0 cm. Regarding to seeds per pod, lines were ranged from 6.0 to 7.8 seed with mean 6.8 seed per pod. Whereas the check cv. possessed the value 7.5 seed per pod. For 100 seed weight, line 4-31 possessed the heaviest seed weight (66.9 g) among the genotypes whereas the line 4-24 possessed the lowest value (32.4 g) .On the other hand, check *cv.* possessed the value 45.5 g. Concerning to the fresh seed yield per plant, lines 12-19, 15-1, 4.31 and 11.10 exhibited the highest values (108.9, 100.1, 50.9 and 43.8 g), respectively .On the other hand, check cv. possessed the value 31.5g.

From the above mentioned results, it could be concluded that lines 4-29, 4-31, 11-10, 12-19 and 15-1 showed the earliest flowering plants, highest number of pods, seeds weight and fresh seed yield per plant .

Data in Table 3 showed the mean performances for different traits of five selected lines compared with other check cultivars. Comparisons of the lines studied with the check *cvs.* Showed that, for the vine length, lines ranged from 68.5 to 70.7 cm with mean 68.9 cm., while , the check *cvs.* ranged from 29.4 to 70.7 cm. with mean 55.2 cm. Concern to primary branches per plant and first blossom node, there was no significant differences between lines studied and check *cvs.* .Results showed that lines MG 4-31, MG 12-19 and MG 15-1 exceeded the check *cvs.* for pods per plant , seeds per pod and fresh seed yield per plant. The line MG 4-31 possessed values for number of pods, seeds and seed weight/plant 11.6, 6.8 and 50.6 g, respectively. Line MG 12-19 possessed the values for number of pods per plant 15.6 pods, 6.9 seeds per pod and 49.9g fresh seed yield/plant. Line MG 15-1 exhibited values for number of pods per plant, seeds per pod and fresh seed yield per plant 16.1, 7.2 and 44.1 g, respectively.

From the above mentioned results, it could be concluded that the three lines MG 4-31, MG 12-19 and MG 15-1 were exceeded for the final fresh seed yield / plant above the highest check *cv* (Victory Frizer) by 57.1, 55.0 and 37.0 %, respectively. Many investigators among them Davis et *al.* (1995), Kuo Chun Yi (1998), Liu Ying et al. (1999), Deng-JinBing (2008) developed new lines and cultivars of pea through pedigree selection methods.

Of the present study, lines MG 4-31, MG 12-19 and MG 15-1 represent the most balanced forms for plant growth and yield components .Thus, these three pea lines are proposed for intensive production in the sandy soil.

Table (2): Mean performance of the evaluated breeding lines and check cultivar for studied traits in 2007-2008.

No.	Genotype	Vine length (cm.)	Primary branches /plant	First blossom node	Pods/plant	Pod length (cm)	Seeds/pod	100-seed weight (g)	Fresh seed yield/plant (g)
1	**Mg 4-24**	85.5	1.5	9.1	12.3	8.2	6.8	32.4	29.1
2	**Mg 4-26**	75.9	1.9	8.2	14.3	8.7	6.8	36.6	35.9
3	**Mg 4-27**	66.6	2.2	7.9	13.6	8.1	6.7	36.2	32.9
4	**Mg 4-28**	63.4	1.8	8.3	9.6	7.4	6.0	33.4	19.1
5	**Mg 4-29**	75.9	1.3	7.6	10.9	10.1	7.6	36.8	36.1
6	**Mg 4-30**	66.0	1.9	8.1	12.3	8.9	6.0	37.5	27.6
7	**Mg 4-31**	86.6	1.2	7.4	11.1	11.1	7.0	66.9	50.9
8	**Mg 4-35**	70.3	1.4	8.2	9.0	8.1	6.3	36.9	20.5
9	**Mg 11-10**	80.2	1.5	7.5	14.0	9.4	6.5	43.8	41.4
10	**Mg 11-11**	63.0	1.7	7.8	9.9	7.7	7.0	39.9	27.6
11	**Mg 12-19**	95.9	2.4	8.6	35.0	8.8	7.1	44.5	108.9
12	**Mg 12-22**	55.0	2.8	7.3	12.8	8.3	6.5	35.1	28.1
13	**Mg 15-1**	79.1	3.4	8.7	33.8	8.6	6.9	43.1	100.1
14	**Mg 15-2**	84.9	1.9	10.3	15.2	8.5	7.8	32.6	39.3
15	**Mg 5-4**	74.1	2.0	9.2	12.7	7.8	6.8	38.5	33.4
16	**Master -B**	48.5	2.0	8.0	9.0	10.0	7.5	45.5	31.5
	L.S.D 0.05	8.5	0.1	0.2	0.8	1.1	0.2	5.3	7.6
	0.01	11.4	0.2	0.3	0.9	1.5	03	7.1	10.2

Table (3): The comparison among the five lines selected and the three check cultivars for studied traits in 2008-2009.

No.	Line/Cultivar	Vine length (cm.)	Primary branches /plant	First blossom node	Pods/plant	Pod length (cm)	Seeds/pod	100 - seed weight (g)	Fresh seed yield /plant (g)
1	Mg 4-29	70.1	2.0	8.0	15.0	7.7	7.2	37.6	40.2
2	Mg 4-31	68.4	1.9	8.5	11.6	8.4	6.8	64.6	50.6
3	Mg 11-10	71.6	1.8	7.9	11.6	8.2	7.6	33.5	28.8
4	Mg 12-19	65.7	1.9	7.4	15.6	9.0	6.9	36.7	49.9
5	Mg 15-1	68.5	1.8	8.4	16.1	8.8	7.2	38.4	44.1
6	Vicotry Frizer	70.7	1.8	8.4	11.6	7.3	5.9	34.5	32.2
7	Lincoln	65.4	1.8	8.7	11.1	7.8	5.8	45.4	28.9
8	Master -B	29.4	2.1	7.6	3.9	9.9	7.5	45.0	13.3
	L.S.D 0.05	6.1	N.S.	N.S.	2.5	0.5	0.5	12.4	7.2
	0.01	8.3			3.4	0.7	0.7	16.9	9.8

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سلالات بسلة تناسب الزراعة في الاراضى الرملية GM 15-1 ,GM 12-19 ,GM 4-31

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السلالات GM 4-31, GM 12-19, GM 15-1 استنبطت من خلال برنامج تربية طويل بدأ بالتهجين بين صنفي Master-B قصير x Gaint Clumber طويل والانتخاب تحت ظروف الحقل في الاراضى الرملية (منطقة غرب النوبارية).
أجريت هذه الدراسة فى مزرعة خاصة بمنطقة غرب النوبارية بزراعة ١٥ سلالة منتخبة الجيل السادس للهجين Master-B x Gaint Clumber مع صنف اختباري في تجربة حقلية في الموسم الشتوي٢٠٠٧ /٢٠٠٨ وتم انتخاب خمسة سلالات تم زراعتها في الموسم الشتوي ٢٠٠٨/٢٠٠٩ في تجربة تقييم حقلية مع ثلاثة أصناف اختيارية المنتشر زراعتها في مصر .
أوضحت النتائج :
السلالات GM 4-31, GM 12-19, GM 15-1 تفوقت على الصنف Victory Frizer أعلى أصناف المقارنة بالنسبة للمحصول ومكوناته لذلك يمكن إكثار بذور هذه السلالات لتصبح كل سلالة صنف جديد أو تستخدم في برامج التربية لتحسين إنتاجية محصول البسلة في الاراضى الرملية.