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GROWTH POTENTIAL OF TWO SPECIES OF BASIL IN SANDY SOIL OF KARACHI

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Abstract

Studies were carried out to examine the growth potential of the two species of Basil viz., *Ocimum basilicum* L., and *Ocimum sanctum* L., in sandy soil of Karachi. Basil seeds were imported from U.S.A and various stages of their life cycle were investigated in open field. It is shown that both species not only successfully completed their life cycle (germination, vegetative /reproductive growth and seed production) but produced higher amount of viable seeds. It is suggested that these important herbs may be cultivated successfully in Karachi region.

Introduction

Basil *(Ocimum basilicum* L.) is one of the most famous, annual or perennial herb belonging to the family Lamiaccae.It is a native of Africa, India and Asia, cultivated in temperate climate throughout the world with about 150 varieties. In India and Pakistan, it is called "Tulsi" and like Greek, Serbian and Macedonian orthodox churches has religious significance as in Hindu religion. The genus *Ocimum*, a member of the Lamiaceae family, contains between 50 and 150 species of herbs and shrubs (Simon, *et al.*, 1999). A number of phenolic compounds with strong antioxidant activity have been identified in these plant extracts (Nakatani, 1997).

Many beliefs and rituals are associated with Basil. In Italy it is a symbol of Love, in France it is called as a herb of royal and during Victorian time it was used as a sign of good wishes. Jewish people used it to get strength during fasting while an African legend claims that basil protects against Scorpio. However, a group of European thinks that it is a symbol of Satan.

Basil has great medicinal importance. Basil is used in traditional medicines, as a culinary herb and a well-known source of flavoring principles (Javanmardi *et al*., 2003). The cosmetic industries use basil in soap, shampoos, lotions, oils and perfumes. Its oil has many aromatherapies uses and as a medicine for stress, migraine, cold and hay fever. Basil tea is good for digestion, to expel gases, stomach cramps, constipation, diarrhoea and vomiting. It is used to treat mental fatigue, nervous conditions and hyssop for cough. Thai basil oil derived from the aerial parts of Ocimum *basilicum* L., and *Ocimum amricana* L., has been used since ancient time as traditional medicines for various tropical applications, such as poultice or slave for insect bites and ring worm **(**Viyoch *et al*., 2006). Seed extract has been shown to have antibacterial properties. The preservative effect on many plant species and herbs suggests the presence of antioxidative and antimicrobial constituents in their tissues (Hirasa & Takemasa, 1998). It is a good insect repellant for white flies, aphid, fruit fly, moth and house fly. Basil leaves are used on insect bite to reduce itching.

Basil leaves may be added to potpourri. Some varieties add a beautiful accent and fragrance to bouquet. Fresh sweet basil has a pungent, aromatic and spicy flavor that resembles cloves. It is an outstanding choice as a home cuisine herb among the various medicinal and culinary herbs. Some endemic species are of particular interest because that may be used for the production of raw materials or preparations containing phytochemical with significant antioxidant capacities and health benefits (Exarchou *et al*., 2002**).** It has a special affinity for tomatoes and tomatoes flavored dishes and an essential ingredient to make pesto sauce. It can also be added to bean, cheese, chicken, eggs, fish, marinads, marrows, mushroom, pasta, pasta salads and sauces. It is used to make herb vinegar and herb butter. Basil leaves combine well with garlic, parsley, rosemary, oregano, thyme and sage and added just before serving to cooked dishes. The potential of the antioxidant constituents of plant material for the maintenance of health and protection from coronary heart disease and cancer is also raising interest among specific health effects (Loliger, 1991). A lot of work has been published to describe its chemical composition, chemistry and chemical compounds (Skaltsa *et al*., 1990). However little is known about the autecology and biology of this commercially and medicinally important herb. Therefore, present investigations were carried out to study the various stages of life cycle and to see the growth potential of species in sandy soil of Karachi.

Materials and Methods

This experiment was conducted in the Botany Department, Federal Urdu University of Arts, Science and Technology Karachi. The Experiment was started in late September in sunlight. Seeds of Genovese Basil (*Ocimum basilicum*) and Sweet basil (*Ocimum sanctum*) were imported from U.S.A. Seeds were placed equidistantly in 15g soil as seeds bed, in Pertri dish of equal size. Each species was replicated 7 times having 5 seeds. Each Pertri dish was provided with (15ml) equal amount of tap water and wrapped by masking tape. Observations were recorded regularly, regarding the rate of germination, length of radical and plumule elongation.

Another experiment was conducted in Plastic pots of 30cm height and 19cm diameter in open field. Sandy soil was collected and passed through 2 mm sieve. All pebbles and stones were removed from the soil; 20g manure was added and mixed to ensure the physical and chemical uniformity. After 7 days, all germinated seeds were transplanted in pots. Seedling height was recorded every week. For determination of leaf area ratio of these two species, 18 fully expended leaves from each species were collected from several plants (Samarakoon *et al*., 1990). Leaf area was determined by following Ahmed (1973). Leaf area ratio and root/shoot ratio were determined by following Atiq-ur-Rehman *et al*., (2007).

On 3rd February 2008, total number of inflorescence and flowers were also recorded. Before terminating the experiment, the seeds were collected from both species and stored in polythene bags to repeat the cycle. The size, color and weight of seeds were observed again. All plants were uprooted from the pots, and were washed with gentle stream of tap water to protect the roots from damage. Plants were than taken to laboratory to record the data. Roots and shoots were separated to measure their length and fresh weight. They were air dried to observe the dry weight and moisture content. After air drying the roots and shoots were ground in an electrical grinder and 3 g material from each was kept in the furnace at 450-500C for 5 hours. The ash was collected and remeasured for knowing

the total organic content. The viability of first generation seeds was estimated. Results were statistically analyzed by student's test (Overnell *et al.*, 1975) through a computer program, Statistical Package for Social Sciences (SPSS).

Results and Discussion

Morphological differences indicates that the seed color in both varieties is black with oval shape and verticellaster inflorescence Table 1. Sweet basil has green leaf color while Genovese basil acquires purplish white. There is also dissimilarity in their leaf margin. Sweet basil has slightly undulate leaf margin whereas basil has serrate type. Both species are also different in color of flowers. Sweet basil has white flower though Genovese basil has purplish white flower. Figs. 1 to 4 show the morphological differences of two species.

The germinating and other characteristics of the imported and F1 generation seeds are presented in Table 2. It describes the total germination, length/breadth/area/weight of seeds and the length of radical of both species of basil. The average length of seeds was calculated as 0.19±0.03 in Sweet basil while 0.22±0.01 in Genovese basil. Both species showed the similar average breadth of seeds as 0.14±0.02. The recorded weight of seeds of both species is 0.06 to 0.07. It was observed that imported seeds of both varieties successfully germinated 100% while seeds collected from first generation showed 91% to 93% germination. After germination the radical length was also calculated as 3.53±0.1 in Sweet basil and 3.82±0.2 in Genovese basil. Seeds collected from first generation plants were subjected to viability test, which showed that both varieties produced higher amount of viable seeds. The higher number of germinating seedlings and radical elongation test give additional support to the opinion. Therefore it is suggested that both varieties completed their life cycle successfully providing higher amount of viable seeds hence could be cultivated commercially in Karachi soil and climate.

Up to 22 weeks data was being recorded, calculating the mean values of vegetative growth of the plants. The height, leaf length, breadth and area are presented in Table 3. However, there is a difference in mean height and mean leaf area of both species. The mean height of Sweet basil was 46±2.6 though Genovese basil has 49.16±1.9.The obtained result indicated that there was no significant difference in mean height of both species (Fig. 5). The mean values of leaf length of sweet basil and Genovese basil were 8.06±0.39 and 6.46±0.12 simultaneously and leaf breadth was recorded 3.79±0.2 and 3.71±0.08 in chorus. However both parameters were very close and did not possess any significant difference. The mean value of the leaf area of sweet basil was 20.38±0.91 while Genovese has 15.98±0.58 nevertheless both species have no significant difference. In late December 2007, the budding started in Genovese basil and sweet basil. After 7 to 10 days, both species covered with flowers (Fig. 6). It was recorded that the mean number of inflorescence in sweet basil was15±3 while Genovese basil had 22±4 however the t-test has showed that in this regard both species are statistically similar (Fig. 7).

The fresh weight of all plants, roots and shoots were measured after harvesting while their dry weights were measured after complete air drying Table 4. The mean value of fresh weight and dry weight of plant of sweet basil is 27.75±2.12 and 11.45±1.20 while Genovese basil has 19.24 ±2.63 and 10.33±1.32, respectively. Regardless of apparent morphological dissimilarity, both species did not show any significant difference in their fresh and dry weight contents.

Table 1. Comparison of morphologicl differences of two species of basil.

Specie	Seed colour	Seed shape	Leaf colour	Leaf margin	Flower colour	Type of inflorescence
Sweet basil	Black	Oval	Green	Slightly undulate	White	Verticellaster
Genovese basil	Black	Oval	Purplish white	Serrate	Purplish white	Verticellater

Fig. 1. Inflorescence in genovese basil.

Fig. 2. Inflorescence in sweet basil.

Fig. 3. Leaves of genovese basil.

Fig. 4. Leaves of sweet basil.

Morphological differences between two species of Basil

Both species have no significant change in their root, shoot, ash content and in total organic matter Table 5.

Table 2. Total seed germination in imported seeds, area, weight, total germination and length of radical in harvested seeds of two species.

Specie	T.G. imported seeds %	Length of seed mm	Breadth of seeds mm	Area of seed mm	weight of seeds g	T.G. F1 generation seeds %	Radical length cm
Sweet basil	100	0.19 ± 0.03	0.14 ± 0.02	0.02 ± 0.01	0.06 ± 0.00	91	3.53 ± 0.1
Genovese basil	100	0.22 ± 0.01	0.15 ± 0.01	0.02 ± 0.01	0.07 ± 0.00	93	3.82 ± 0.2
Significant or Non- significant	NS	NS	NS	NS	NS	NS	NS

T.G. =Total germination

Table 3. Comparison of growth characteristics of plants of two species of basil.

Specie	Height of plant cm	Leaf length cm	Leaf breadth cm	Leaf area cm	Leaf area ratio cm	Number of inflorescence	Total no. of flower
Sweet basil	46 ± 2.6	8.0 ± 0.39	3.79 ± 0.2	20.38 ± 0.91	1.77 ± 0	15 ± 3	92 ± 18
Genovese basil	49.16 ± 1.9	6.46 ± 0.12	3.71 ± 0.08	15.98 ± 0.58	1.54 ± 0	22 ± 4	134 ± 22
Significant or Non- significant	NS	NS	NS	NS	NS	NS	NS

Table 4. Comparison of fresh and dry weight of two species of basil.

Specie	Fresh weight of plant g	Total dry weight of plant g	Fresh weight of shoot g	Dry weight of shoot g	Fresh weight of root g	Dry weight of root g	Root/ shoot ratio g
Sweet basil	27.75±2.12	11.45±1.20	13.79±1.18	4.97±0.47	13.79±1.10	6.17±0.82	1.24±0
Genovese basil	19.24±2.63	10.33±1.32	11.52±1.53	6.35±0.80	7.37±1.17	4.32±0.74	0.68±0
Significant or Non- significant	NS	NS	NS	NS	NS	NS	NS

Table 5. Comparison of ash contents and total organic matter of two species of basil.

Specie	Total ash content g	Shoot ash content g	Root ash content g	Total organic matter		
				Shoot g	Root g	Total plant g
Sweet basil	3.62 ± 0.10	2.28 ± 0.08	1.33 ± 0.08	0.71 ± 0.07	1.66 ± 0.08	2.38 ± 0.34
Genovese basil	3.32 ± 0.17	2.18 ± 0.06	1.14 ± 0.11	0.82 ± 0.06	1.85 ± 0.11	2.67 ± 0.45
Significant or Non-significant	NS	NS	NS	NS	NS	NS

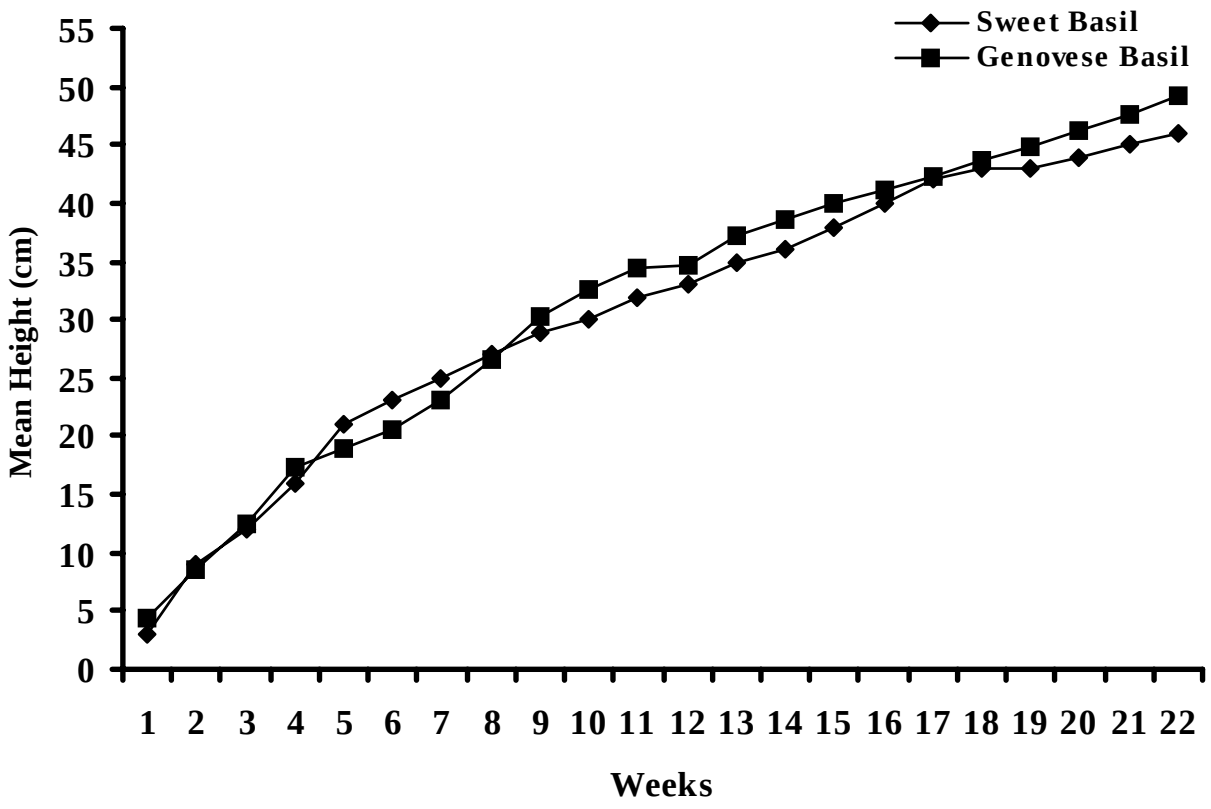

Fig. 5. Mean height vs. weeks.

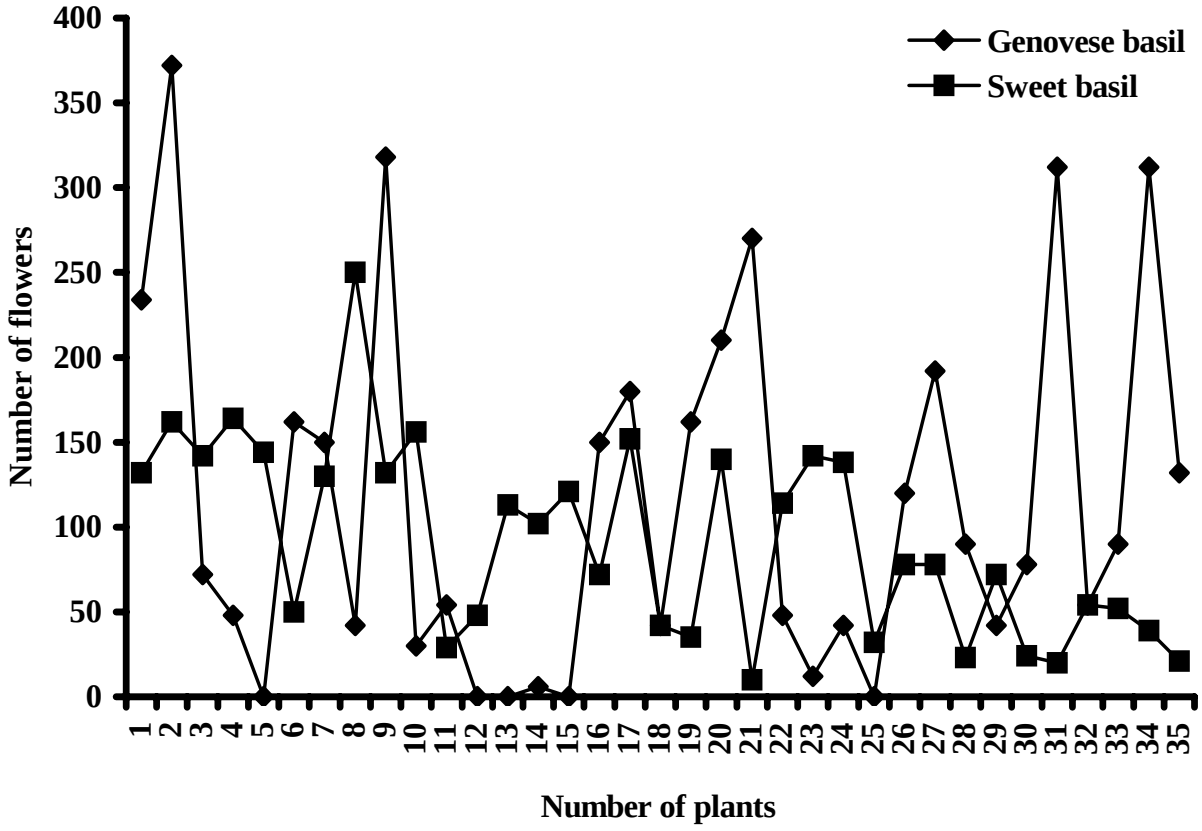

Fig. 6. Number of flowers of both species.

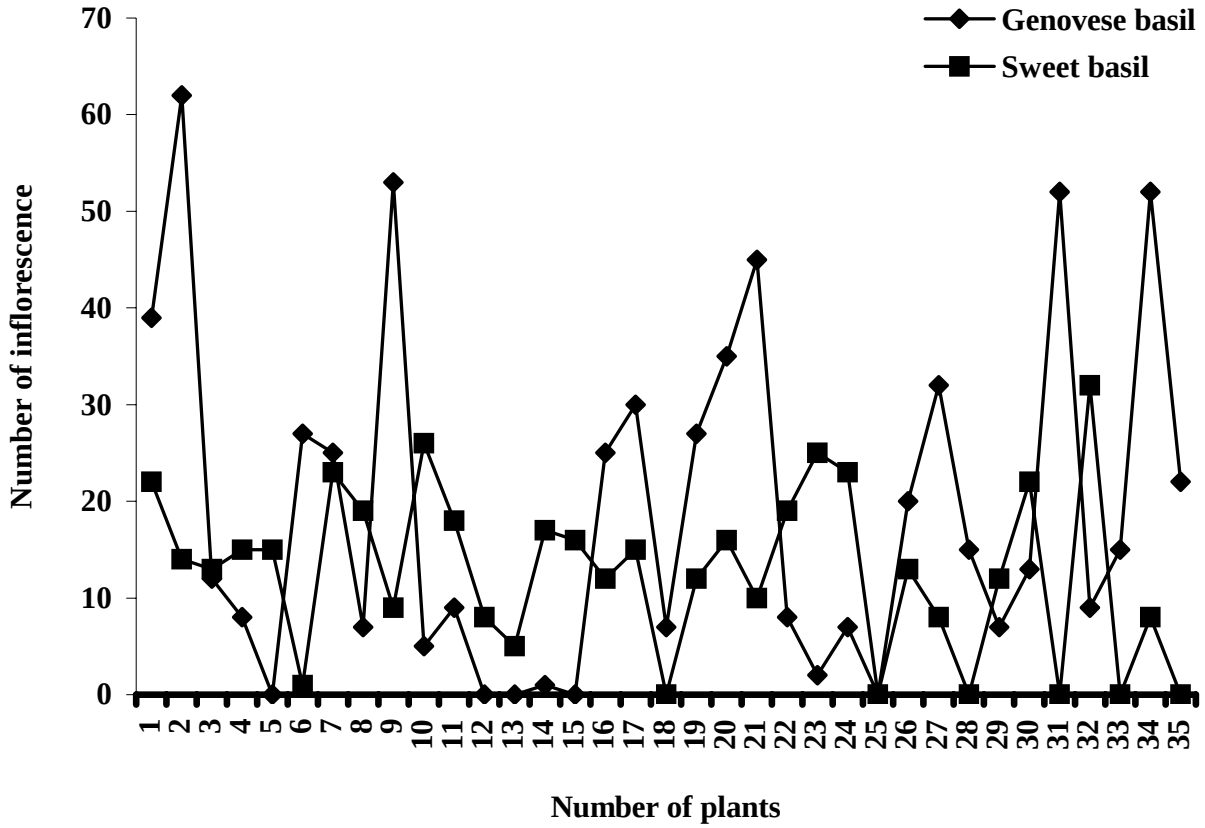

Fig. 7. Number of inflorescence of both species.

It would suggest that though there is no significant difference between two species of basil among different parameters with regards to height of plant, length /breadth/area of leaf, number of inflorescence, number of flowers, fresh weight, dry weight, ash content and total organic matter but morphologically they exhibit some differences. Since both species produced high number of viable seeds, they could be commercially planted in Karachi climate.

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