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Evaluation and Screening of Suitable Vines for the Arid Conditions of Kuwait

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Abstract

Vines offer an interesting variation in plant form. They are valuable in the landscape for their practical and aesthetic qualities. If vines are to be satisfactory in the landscape, they must be well adapted to the environment in which they are to be grown. Especially in Kuwait, where the atmospheric temperature is too high during the months of June to August and frost and cold winds during the winter months, it is important to adapt the suitable vines that are compatible with other components of landscapes. With this view in mind a study was initiated on eight species of vines namely, *Clematis microphylla, Clerodendrum thomsoniae, Cryptostegia grandiflora, Ficus pumila, Hardenbergia violacea, Ipomoea horsfalliae, Pandorea jasminoides*, and *Petrea volubilis* were tested in the inland and coastal sites. These vines were subjected to the arid climates of Kuwait and evaluated for their suitability. It was observed that the except *Cryptostegia grandiflora*, all other vines species were susceptible to the harsh weather prevailed during the summer in Kuwait. Four vine species had 0 % survival percentage. *Ipomoea horsfalliae* and *Petrea volubilis* exhibited a negative growth rate and *Pandorea jasminoides* was found to have a slow growth rate.

Keywords: Vines, landscape, aesthetic quality, frost, harsh weather, survival percentage, growth rate.

Introduction

Kuwait is an arid country with harsh climate, where the temperature means range from 8o to 44o in January and July respectively. The soil is sandy in texture. To ensure successful landscape, one should consider the type of soil, water quality and availability. Desert soil in general are short of organic matter, sandy with sparse vegetation, low in nitrogen, low in phosphorus, alkaline due to high content of calcium and often contains sodium (Khalil et al, 2003). The selection of plants best suited to these types of soils and climate is an important criteria. Along with trees, shrubs and ground cover, vine is also an important component of landscape gardening.

Vines include all plants, whether woody or herbaceous, that requires some support for their development. Vines are versatile and can grow quickly as a groundcover, a screen in trellis, a cascade of foliage and flowers against a wall, a leafy cover on an arbor, or a climber on a wall or a tree (Harris, 1992). Vines can form excellent screen plants for fences, and add appeal when grown on trees or shrubs. Combined with overhead structure, vines can provide delightful shade areas. They also perform well as windbreaks. There are annual and perennial vines, woody and herbaceous vines, evergreen and deciduous vine, flowering vines and vines grown primarily for their foliage. We may use vines in several ways. They include using on walls or other overhead structures and as groundcovers. The trees, shrubs and vines have some effects on the space cooling requirements of a building in a warm humid environment (Parker, 1981).

The study was conducted in the urban demonstration garden in Kuwait (coastal site) and in a commercial garden (inland site). The eight species of vines listed in Table 1 were tested for their suitability to the harsh climates of Kuwait was evaluated. These plants were imported from Australia and India. The plant species were known to survive under similar climatic conditions in their respective countries.

Materials and Methods

Eight vines namely, *Clematis microphylla, Clerodendrum thomsoniae, Cryptostegia grandiflora, Ficus pumila, Hardenbergia violacea, Ipomoea horsfalliae, Pandorea jasminoides,* and *Petrea volubilis* were selected for screening for their suitability to Kuwait's climatic conditions. The land was thoroughly prepared before planting. All weeds, trash, rocks and other debris were cleared and removed from the sites. Chemical analysis of water was also done prior to planting. 30 cm of the top layer was back filled with agricultural soil and peat moss. The sites were fine graded and leveled. Soil was disinfected and weed treated. Soil was irrigated before planting to leach salts from the soil and was followed by a drying period of two days. The plants after were allowed to harden in the greenhouses before planting in the field. The hardened plants were then transplanted in the field and a complete randomized block design was used. The transplanted plants were medium in size and had a healthy green appearance.

A complete randomized block design with five replications of all experimental plant species in both sites was used. Optimum cultural practices were carried out for the transplanted plants. The vines were trailed on the supports such as fence, bamboo stalks and tied. The unwanted and dried branches were removed. Experimental plant species were covered with shade net to protect the plants from high temperature and hot winds. Irrigation water amounts were regulated to meet the plants requirements according to the season. Data on survival, plant height, stem diameter and visual observations were documented on bi-monthly basis.

Results and Discussion

The data on plant height, plant girth, plant canopy and other visual observations were tabulated and their mean and standard deviation were calculated. It was observed that the vine *Cryptostegia grandiflora* showed hundred percent survivals both in the inland and coastal site (Table 1). *Ipomea horsfalliae* also showed about 40 % survival in the inland site. All other plant species died indicating their unsuitability to Kuwait's weather. In the coastal site the plants Ipomea horsfalliae and Pandorea jasminoides showed cent percent survival. *Clematis microphylla, Clerodendrum thomsoniae* and *Hardenbergia violacea* died in the coastal site. A graphical representation of the survival percentages of the vines are presented in Fig 1.

Table 2 indicates the mean plant height, standard deviation and growth rate of the vines in the inland and in the coastal site. The vine *Cryptostegia grandiflora* exhibited the highest growth rate of 178.90% and 213.76% in the inland and coastal site respectively (Fig 2).In the inland site the species *Ipomea horsfalliae* showed negative growth rate. All other plants died in this site due to the extreme heat in summer.The vine species *Ipomoea horsfalliae* and *Petrea volubilis* exhibited negative growth rate in the costal site. *Pandorea jasminoides* showed very slow growth rate in summer. Table 3 represents the plant caliper and table 4 is the plant canopy of the experimental plants in both sites. The effect of temperature on the growth and development of the vines are indicated in Table 5 and 6.

Table 1: The Survival Percentages of Vines in the Coastal Site and Inland Site

Plant Species	Inland Site	Coastal Site
Clematis microphylla	0	0
Clerodendrum thomsoniae	0	0
Cryptostegia grandiflora	100	100
Ficus pumila	0	40
Hardenbergia violacea	0	0
Ipomea horsfalliae	40	100
Pandorea jasminoides	0	100
Petrea volubilis	0	40

Table 2: Mean, Standard Deviation and Growth Rate of Vines in the Inland and Coastal Site

	Initial		120 DAP		240 DAP		360 DAP		420 DAP		Growth rate
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Inland Site											
Clematis microphylla	13.40	4.67	17.00	14.28	Dead	Dead	Dead	Dead	Dead	Dead	Dead
Clerodendrum thomsoniae	27.80	12.54	33.20	9.44	17.50	7.78	Dead	Dead	Dead	Dead	Dead
Cryptostegia grandiflora	79.20	10.57	85.40	10.57	162.20	41.17	182.80	25.81	182.40	25.24	178.90
Ficus pumila	15.00	9.27	32.50	17.68	40.00	0.00	Dead	Dead	Dead	Dead	Dead
Hardenbergia violacea	26.40	10.88	43.60	10.01	Dead	Dead	Dead	Dead	Dead	Dead	Dead
Ipomea horsfalliae	60.60	36.15	48.60	37.13	76.75	78.64	Dead	Dead	22.00	1.41	-46.60
Pandorea jasminoides	14.20	5.50	24.50	23.33	62.50	43.13	Dead	Dead	Dead	Dead	Dead
Petrea volubilis	40.60	6.88	46.67	14.22	50.50	13.44	Dead	Dead	Dead	Dead	Dead
Coastal Site											
Clematis microphylla	17.60	9.32	138.20	48.39	10.80	4.60	Dead	Dead	*Dead*	*Dead*	Dead
Clerodendrum thomsoniae	22.40	9.71	27.20	10.83	Dead	Dead	Dead	Dead	*Dead*	*Dead*	Dead
Cryptostegia grandiflora	65.40	7.13	91.80	11.34	191.20	71.91	231.20	65.17	205.20	59.81	213.76
Ficus pumila	7.00	1.41	14.80	4.97	19.00	4.64	Dead	Dead	Dead	Dead	Dead
Hardenbergia violacea	39.60	16.74	63.80	22.08	Dead	Dead	Dead	Dead	Dead	Dead	Dead
Ipomoea horsfalliae	41.20	65.34	17.40	5.32	105.40	64.64	17.00	7.81	14.50	7.78	-64.81
Pandorea jasminoides	42.40	21.52	44.40	13.90	70.40	59.63	52.60	15.50	56.25	8.10	32.67
Petrea volubilis	43.20	15.17	48.60	18.51	46.00	17.05	32.00	19.80	31.50	21.92	-27.08

DAP= Days after Planting, SD= Standard Deviation, Growth rate= $\frac{\text{Final Height-Initial Height}}{\text{Initial Height}} \times 100$

Table 3: Mean and Standard Deviation of Plant Caliper of the Vines in the Inland and Coastal Site

Plant Species	Initial		240 DAP		360 DAP		120 DAP		420 DAP	
	Mean	SD	SD	Mean	Mean	SD	Mean	SD	Mean	SD
Inland Site										
Clematis microphylla	_		0.89	2.40	Dead	Dead	Dead	Dead	Dead	Dead
Clerodendrum thomsoniae	2.80	0.45	0.55	5.40	5.50	0.71	Dead	Dead	Dead	Dead
Cryptostegia grandiflora	7.40	0.89	0.89	9.40	12.00	0.71	14.80	1.30	15.00	1.00
Ficus pumila	2.60	2.19	0.71	5.50	5.00	0.00	Dead	Dead	Dead	Dead
Hardenbergia violacea	2.00	0.71	1.00	4.00	Dead	Dead	Dead	Dead	Dead	Dead
Ipomea horsfalliae	3.20	0.84	1.73	4.00	5.00	0.82	Dead	Dead	6.50	0.71
Pandorea jasminoides	2.00	0.71	2.12	3.50	4.00	1.41	Dead	Dead	Dead	Dead
Petrea volubilis	5.80	2.68	1.73	9.00	10.00	0.00	Dead	Dead	Dead	Dead
Coastal Site										
Clematis microphylla	1.40	0.55	0.00	3.00	4.00	0.00	Dead	Dead	Dead	Dead
Clerodendrum thomsoniae	3.60	0.55	0.84	3.80	Dead	Dead	Dead	Dead	Dead	Dead
Cryptostegia grandiflora	8.00	0.71	0.84	8.20	11.20	1.30	14.40	1.14	14.40	1.14
Ficus pumila	1.80	0.84	0.00	2.00	3.80	0.45	Dead	Dead	Dead	Dead
Hardenbergia violacea	3.00	1.00	3.03	6.80	Dead	Dead	Dead	Dead	Dead	Dead
Ipomoea horsfalliae	3.40	0.55	0.45	4.80	6.00	1.00	6.00	1.00	7.00	0.00
Pandorea jasminoides	3.40	0.55	0.55	3.40	4.40	1.14	4.80	0.84	4.75	0.96
Petrea volubilis	6.40	2.30	2.17	7.20	7.75	0.96	8.00	1.41	8.00	1.41

DAP= Days after Planting, SD= Standard Deviation

Table 4: Mean and Standard Deviation of Plant Cover of the Groundcovers in both Inland and Coastal Site

Plant Species	120 DAP		240 DAP		360 DAP		420 DAP	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Inland Site								
Clematis microphylla	9.00	Dead	Dead	Dead	Dead	Dead	Dead	Dead
Clerodendrum thomsoniae	11.60	4.56	4.50	3.54	Dead	Dead	Dead	Dead
Cryptostegia grandiflora	25.20	5.26	56.60	16.92	82.20	6.02	83.80	4.92
Ficus pumila	18.00	0.00	28.00	0.00	Dead	Dead	Dead	Dead
Hardenbergia violacea	24.40	7.38	Dead	Dead	Dead	Dead	Dead	Dead
Ipomea horsfalliae	12.60	6.22	2.00	0.00	Dead	Dead	8.00	0.00
Pandorea jasminoides	15.50	9.90	17.00	5.66	Dead	Dead	Dead	Dead
Petrea volubilis	25.33	0.71	28.00	9.90	Dead	Dead	Dead	Dead
Coastal Site								
Clematis microphylla	47.60	41.73	8.00	8.25	Dead	Dead	*Dead*	*Dead*
Clerodendrum thomsoniae	7.20	12.73	Dead	Dead	Dead	Dead	*Dead*	*Dead*
Cryptostegia grandiflora	30.40	11.67	77.40	7.54	94.40	10.90	89.80	7.12
Ficus pumila	15.40	2.88	18.40	2.30	Dead	Dead	Dead	Dead
Hardenbergia violacea	53.40	22.43	Dead	Dead	Dead	Dead	Dead	Dead
Ipomea horsfalliae	17.20	3.51	15.60	5.03	6.40	5.22	6.50	6.36
Pandorea jasminoides	14.20	3.11	16.00	4.58	22.40	5.32	21.00	3.83
Petrea volubilis	8.00	3.78	17.50	3.42	18.00	2.83	20.00	5.66

DAP= Days after Planting, SD= Standard Deviation

Figure 1: The survival percentages of groundcover plants in the inland and coastal site.

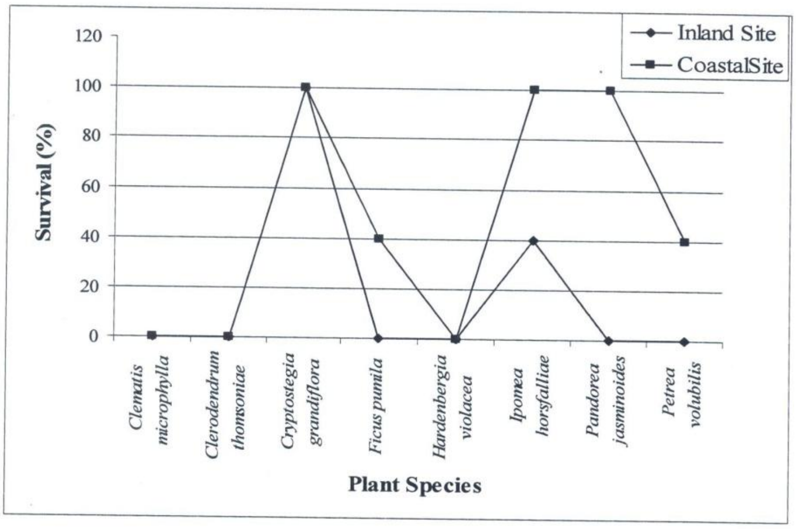

Figure 2: The growth rate of groundcovers in the inland and coastal site.

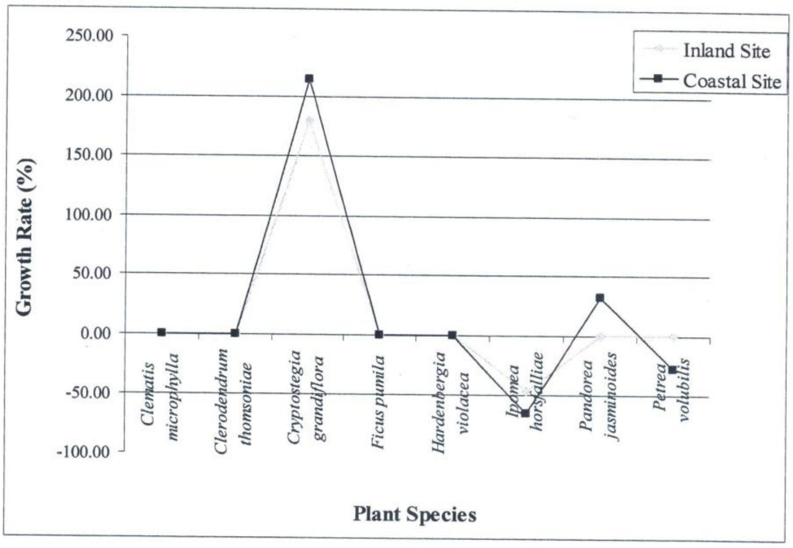

Table 5: Effect of High Temperature on the Growth and Nature of Original Experimental Plants

Plant Species	Effects of Low Temperature
Clematis microphylla	Total drying of plants due to excess heat. Could not with stand high temperature for continuous periods.
Clerodendrum thomsoniae	Total loss of plants.
Cryptostegia grandiflora	Excellent growth. More branches from all parts of main stem, which are trailing actively. Elongation of the inter-nodal region leads to increase in height of plants. The branches were growing at a faster rate than the main stem.
Ficus pumila	No growth. Total drying of leaves and branches.
Hardenbergia violacea	After a luxurious growth, plants were dead due to high temperature. The leaves first turn to pale green and then complete drying.
Ipomoea horsfalliae	Total drying of the leaves, but the vines remained healthy. The drying of vines starts from the tips leading to decrease in plant cover. But new growths can be seen from leaf axils.
Pandorea jasminoides	Not much effect. Drying of leaves can be seen.
Petrea volubilis	Drying can be seen on the margins of the leaves. New growth can be seen on stem axils. The plants lost their vigor and health.

Table 6: Effect of Low Temperature on the Growth and Nature of Original Experimental Plants

Plant Species	Effects of Low Temperature
Clematis microphylla	Total loss during summer.
Clerodendrum thomsoniae	Total loss of plants.
Cryptostegia grandiflora	Shredding of leaves from main stem. Healthy shoots were coming from the base. Upper part of the main stem was dried. New leaves were very healthy.
Ficus pumila	Total loss during summer.
Hardenbergia violacea	Total loss during summer due to high temperature.
Ipomoea horsfalliae	The wine length was reduced substantially due to the drying of wines. The leaves were dried.
Pandorea jasminoides	Almost retarded growth. The leaves showed chlorosis. The wine length was reduced.
Petrea volubilis	Good growth. New leaves were coming.

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