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Short Communication

Clonal propagation of *Pelargonium sidoides*: A threatened medicinal plant of South Africa

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Pelargonium sidoides **is used in herbal medicine for the treatment of various infections. Apart from the local uses, the roots are being indiscriminately harvested for local and export trade. A study was conducted to determine the appropriate plant part and the minimum vine length suitable for the clonal propagation of *P. sidoides* in two separate experiments. In the first experiment, three vine tip cuttings (2, 4 and 6 cm) of the species were rooted in potted experiment in a green house. In the second experiment, ten days old petioles were excised from their mother plants and rooted alongside 6 cm vines length to assess suitable plant part for vegetative propagation of the species. Data were collected and analyzed on various growth and development indices. In the first experiment, the 6 cm vine length exhibited best result for different parameters measured. Petioles gave significant yield difference over 6 cm vine length and generally showed high potential for vegetative propagation in terms of rooting ability and survival rate. The importance of these findings on the propagation and conservation of *P. sidoides* is discussed.**

Key words: Clonal propagation, *ex situ* conservation, medicinal plant, *Pelargonium sidoides*, stem cutting.

INTRODUCTION

The current trade in medicinal plants in Africa has negatively affected the demography of most plant species harvested from the wild (Cunningham, 1988; Lange, 1997) and many workers have reported unsustainable harvesting of some of these species (Ake-Assi, 1988; Kokwaro, 1991; Cunningham and Mbenkum, 1993; Gu, 1998; Ghimire et al., 2005; Tang et al., 2005). Amongst these is *Pelargonium sidoides* DC. It is a rosette-like plant with thickened underground roots and sparsely branched stems from the base. At flowering, the velvety stem is about 20-50 cm high carrying the heart-shaped leaves tangentially to its length. The species is indigenous and widely distributed in South Africa. It is found in several provinces including Free State and Gauteng Provinces but very prominent in the Eastern Cape. It occurs naturally in short grasslands and sometimes on stony soils that vary from sand to clay-loam, shale or basalt. It is found at altitudes ranging from near the sea level to 2300 m in Lesotho.

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P. sidoides is used in traditional medicine for the treatment of different infections including cough, fever, tuberculosis, sore throat, fatigue and weakness of the body. Apart from the local uses, the root is being indiscriminately collected in large quantity to meet the current demand for local and export trade. The increased rate of harvesting and number of plant gatherers has made its exploitation unsustainable. Our preliminary survey revealed a negative trend in the demography of the species. With the current increase in the number of plant gatherers and lack of organized cultivation, the species appears threatened in its natural habit. Although, the South African Department of Agriculture recently introduced the use of permit as a control measure against the unsustainable harvesting of *P. sidoides* from the wild, this measure, like other medicinal plants (O'Brien and Kinnaird, 1996; M^{c}Kean, 2003), has not stopped the illegal removal of the species especially from unprotected lands.

Naturally, regeneration of the species is by seed and from the development of perennates through the underground root system. However, the root is removed during harvesting which threatens the opportunity for perennial rejuvenation. Our ongoing studies indicate that

Table 1. Means of various growth parameters of *Pelargonium sidoides* raised from different vine lengths.

Length of vines (cm)	Plant height (cm)	Root length (cm)	Number of roots	Number of leaves	Survival rate (%)
2	4.572b	5.40b	1.00b	8.00b	15.56c
4	7.35a	5.39b	1.25b	10.00a	31.67b
6	8.63a	8.56a	4.25a	11.50a	56.89a

Means with the same letter in a column are not significantly different at p<0.05.

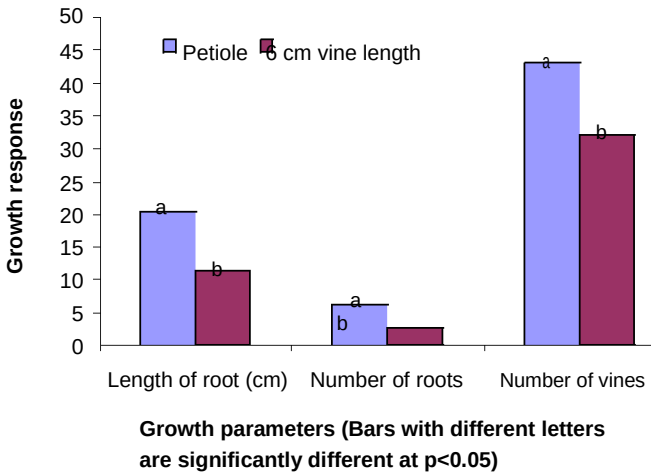

Figure 1. Growth parameters of *Pelargonium sidoides* raised from petioles and 6 cm vine length.

the viability of seeds collected from the wild is low coupled with very low seed germination. One of the most pragmatic measures against over exploitation of plant natural resources is to improve propagation and encourage cultivation, especially at the village level. This in turn, helps in the reduction of poverty related pressure on plant natural resources. The objective of this study was to determine the appropriate plant part and the minimum vine length suitable for the clonal propagation of *P. sidoides,* for the purpose of encouraging *ex situ* conservation of the species.

MATERIALS AND METHODS

Plant collection and preparation of growth pots

Matured plants were collected from Khayamnandi (32°09'S and 26°60'E; altitude 624 m) during the month of March 2005 from their natural habit. Plant materials were transported in polyethylene bags to the green house of the Faculty of Science and Agriculture, University of Fort Hare where the experiment was conducted. The green house was maintained at 18 - 26°C and at 60% relative humidity. The soil used in this experiment was obtained from the University of Fort Hare experimental farm. Topsoil (0-15 cm) were collected in polythene bags and spread in the drying room four 48 h (Anderson and Ingram, 1993). This was later sieved through a 2 mm wire mess, thoroughly homogenized and 8 kg of each soil samples was potted in polythene bags.

Determination of the minimum length of sproutable vines

Healthy vines of *P. sidoides* were cut into sections of 2, 4 and 6 cm rooted in potted soils. The experiment was laid out in a randomized complete design with three treatments replicated four times. Each treatment (2, 4, and 6 cm long vines) comprised 60 cuttings. All cultural practices were the same during the entire period of the experiment. Data on survival rate, number of roots, length of longest root, number of leaves and plant height were recorded after sixty 60 days by adopting standard procedures.

Determination of best plant part for clonal propagation

In another experiment, 10 days old petioles (excised from their mother vines) and 6 cm long vines were rooted directly in potted soils prepared as above. This experiment was aimed at assessing the best plant part for clonal propagation of *P. sidoides.* Both experiments were repeated twice.

Data were subjected to statistical analysis using the SAS package. Where significant difference was observed, means were separated by LSD at 5% level of probability (SAS, 1999).

RESULTS

Generally, the length of the shoot planted had significant effect on the growth parameters of the plant. The 6 cm shoot length exhibited the highest growth performance compared to the other shoot lengths planted. In addition, it showed significant yield differences, both in the number and length of roots, than the other vine lengths. In the case of seedling establishment, the 6 cm vine length also demonstrated significantly higher rate of survival than the other treatments. Although, there was no significant difference in biomass yield between the 6 and 4 cm shoot length, both were higher than the 2 cm vine length in terms of number of leaves and plant height (Table 1).

In the second experiment, the petioles excised from their mother plants 10 days after sprouting rooted successfully. Generally, the petioles showed high potential for vegetative propagation in terms of rooting ability. They showed significant higher yields over the 6 cm vine length in terms of length and number of roots. In fact, the petioles yielded twice the number of roots than the 6 cm vine length. The survival rate of the treatment propagated by petioles showed remarkable results much higher than the 6 cm vine length (Figure 1).

DISCUSSION

Recent reports on the clonal propagation of medicinal plants have exploited the use of chemicals, like the hormones, to improve rooting (Nadeem et al, 2000; Tchoundjeu et al., 2004; Isutsa, 2004) or increase the rate of production (Aslam Khan et al., 2004). However, resource poor farmers usually practice marginal input farming which results into low yields ((Sanchez et al., 1997; FAO, 1999). Yields from poor farmers' fields are largely at variance with scientific publications or with wealthy farmers' fields, mainly due to resource related factors (Crowley and Carter, 2000). The development of adaptable approach and low input propagation technique would better serve the need of the rural poor farmers.

This study has demonstrated the possibility of propagating *P. sidoides* through the use of its vegetative aerial parts. These parts are conventionally thrown away and wasted during the collection of the roots for medicinal trade. Although, 6 cm vine length showed good yield success and survivability, the result demonstrated a high potential for clonal propagation via the petioles both in terms of rooting ability and survival rate. In addition, the petioles of vigorously growing vines, with well established roots could be excised once in every 10 days and rooted directly in the nursery to produce healthy plants if properly managed.

This is the first report on the propagation of *P. sidoides* under marginal input. The results obtained from this work indicated that 6 cm vine length is the minimum length that could give substantial survivability and that the use of petioles, which are largely wasted during harvesting, has the best potential for rooting in the clonal propagation of *P. sidoides.* The encouragement of vegetative propagation of *P. sidoides* could serve as a viable option for the *ex situ* conservation of this plant in the Eastern Cape. Cultivation of the plant could be the alternative source of supply in order to take pressure off the wild stock.

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