

Sources of new ornamental plants: the importance of heritage plants and plant relicts from historic places and old gardens

Lorraine Middleton

Department of Biology, University of Limpopo (Medunsa Campus)

Email: Lorraine.Middleton@ul.ac.za

Piet Vosloo

Department of Architecture (Programme in Landscape Architecture), University of Pretoria

Email: piet.vosloo@up.ac.za

Mankind has enjoyed a long historical relationship with plants, using them as objects of beauty, sculpting gardens into a form of art and fashioning them into expressions of philosophical belief. From the 1970s onwards there has been a remarkable resurgence in worldwide interest in ornamental plants which resulted in renewed efforts to search for and develop new ornamental plants. This trend is continuing to this day. Apart from collecting new indigenous plants from the wild, other important alternative sources for new ornamental plants exist and were researched by means of a literature review followed by a survey questionnaire sent out country wide to ornamental plant growers in South Africa. Botanical gardens, plant collectors, specialist nurseries, heritage plants and relicts from old gardens and historic places, fashion revivals, new applications for known plants, the rediscovery of species previously neglected by the horticulture industry and new cultivars of existing ornamental plants, are all recognised as sources for new ornamental plants in South Africa and internationally. The conservation of botanical gardens, old and historic gardens and plant collections of note has become important in South Africa, not only because of their historical value, but also as genetic resources for the future. The results of the survey confirmed that there is a revival of interest in heritage plants and old cultivars, and was voted as an important source for new plants by 73% of ornamental plant growers in South Africa.

Keywords: ornamental plants, South Africa, indigenous plants, horticulture, heritage plants

Nuwe sierplantbronne: die belangrikheid van erfgoedplante en plantrelikte in geskiedkundige plekke en historiese tuine

Die mensdom het 'n lang geskiedkundige verband met plante, deur hul gebruik as pragobjekte, deur die verfyning van tuinskeppings tot 'n kunsvorm en as die versinnebeelding van filosofiese oortuigings. Sedert die 1970s was daar 'n merkwaardige herlewing in die belangstelling in sierplante en dit het opnuut gelei tot 'n soeke na en die ontwikkeling van nuwe sierplante. Hierdie tendens duur tot vandag toe voort. Benewens die insameling van nuwe inheemse plante vanuit die veld, bestaan daar etlike belangrike alternatiewe bronne van nuwe sierplante. Botaniese tuine, plantversamelaars, gespesialiseerde kwekerie, erfgoedplante en plantoorblyfsels in ou tuine en op geskiedkundige plekke, mode-herlewings, nuwe aanwendingsmoontlikhede vir reedsbekende plante, die herontdekking van spesies verwaarloos deur tuinboukundiges en nuwe kultivars van bestaande sierplante is almal erkende bronne van nuwe sierplante, hier te lande en wêreldwyd. Die bewaring van botaniese tuine, ou en historiese tuine en beduidende plantversamelings het in Suid-Afrika in belangrikheid toegeneem, nie alleen vanweë hul geskiedkundige waarde nie, maar ook as bronne van plantgene vir die toekoms. 'n Onlangse meningspeiling onder sierplantkwekers in Suid-Afrika het getoon dat 73% van respondente glo dat 'n herlewing in die belangstelling in erfgoedplante en ou kultivars 'n belangrike bron van nuwe plante kan ontsluit.

Slutelwoorde: sierplante, Suid Afrika, inheemse plante, tuinboukunde, erfgoedplante

The purpose of this article is to examine the various sources of new ornamental plants and to demonstrate their relative importance for the future cultivation of such plants in South Africa. The data used for this task have been collated through a review of relevant sources in the academic and technical literature. The authors collected further data and information to aid

in the identification of plant sources by visiting a number of relevant institutions and by attending specialised events that had a bearing on this study. The study revealed a wide range of important plant sources, namely: New plants from the wild, botanical gardens, plant collectors, specialist nurseries, plants cultivated as part of fashion revivals and the re-introduction of plant species, heritage plants and relicts from old gardens and historic places, finding new applications for existing plant species and those neglected by the horticulture industry, as well as new cultivars of existing ornamental plants (Middleton, 2011).

A country-wide survey was conducted by the authors among 151 South African ornamental plant growers of which the majority were situated in the Gauteng, Western Cape and Kwa-Zulu Natal provinces, in order to confirm the validity, or otherwise, of previously identified plant sources and to determine their relative importance as alternative sources. Responses were received from 65 participants in the survey and were subjected to a statistical analysis, which generated the quantitative data used in determining the relative importance of each of the identified sources of new ornamental plants.

An examination of the statistically analysed data may lead researchers to reach further conclusions and detect further trends which could support the authors' recommendations and justify further investigations into this and related fields of horticultural studies.

South Africa's indigenous flora, with its rich diversity, is regarded as a major source of new ornamental plants the world over. On the other hand, Brits, Selchau & Van Deuren (2001: 165) contend that relatively few species with commercial potential remain in the wild.

They point out that natural resources are finite and that the botanical diversity of any region, however richly endowed, has its limits. According to them, these limitations further compound the challenges faced by private growers wishing to introduce new cultivars to markets at home and abroad. The cited particular constraints faced by growers include distant markets, the absence of a culture of market-oriented cultivar improvement, difficulties in accessing legal and technical resources, as well as a lack of marketing experience.

Historical background

Plants have formed part of the human existence since time immemorial. This enduring bond between mankind and plants has flowered into a profound human appreciation of plants as objects of beauty and of gardens as works of art. Almost all of us seem to have an intrinsic yearning for contact with nature. Plants exercise a strong, positive influence on human behaviour (Kaplan & Kaplan 1989: 173; Harris 1992: 11; Lohr & Relf 1993: 106). Ornamental plants bring aesthetic, physical and psychological enhancements to our surroundings and add economic value to them. In a world that is increasingly becoming urbanised, plants very often provide an important link with the natural world.

According to Simpson & Ogorzaly (2001: 419), the cutting of flowers and foliage for personal and ceremonial use dates back to prehistoric times. Excavations of Palaeolithic burial sites from the early part of the Stone Age from 750,000 up to 15,000 years ago, have shown that placing sprigs of flowers around corpses were important features of the burial rites of the ancients.

The development of gardens, however, had to wait until humans abandoned their nomadic lifestyles and started settlements. Once these settlements were established, the early humans

could engage in agriculture, animal husbandry, and, more importantly for our purposes, the lay out gardens, the planting of flowers and trees and tending to them. Horticulture thus became a cornerstone of civilisation and urbanisation, the former developing hand in hand with the latter. Indeed so strong was the link between horticulture and civilisation, that the two concepts almost became synonymous, and remain so to this day. Conversely, it is virtually inconceivable that human beings should settle in any one place without engaging in some form of cultivation (Burchett 1995: 81; Simpson & Ogorzaly 2001: 402).

Horticulture should be understood as an expression of the human desire not only to improve the quality of life but also to ensure survival. This may include everything from producing a steady, secure supply of selected and improved fruits, vegetables and other crops, to the creation of beauty, concentrated in a given location, in the form of a garden as a work of art (Burchett 1995: 81).

Gardens throughout history have been designed and used for a variety of practical and spiritual purposes (King 1985:1; Burchett 1995:81) which include:

- Cultivating plants for food and medicine.
- Providing pleasure and enjoyment of beauty, colour, shade and fragrance.
- Displaying wealth and well-being.
- Contrasting wilderness with order, by imposing order upon untamed nature.
- Satisfying intellectual needs by collecting rare and unusual plants.
- Creating idealised landscapes to create symbols and allegories of religious and philosophical beliefs, aesthetic values and as a form of visual art.

Gardens enjoy a unique status among the other forms of art, because of the living, earthy and spatial qualities they bring to our daily reality (Miller 1993: 178). Ross (2008: 175) argues that the greening of art through ecological art works, such as gardens and landscaped areas, is the result of an interdisciplinary approach based on collaboration across many disciplines and biodiversity. Furthermore, these works of art are inevitably subject to the natural processes and cycles occasioned by the passage of time; and so they provide new ways to fuse art, science, nature and life into unique syntheses of expression, while conveying to the beholder a heightened awareness of nature's fragility.

Due to the variety of values attributed to plants, gardens matter to people for different reasons while they have also played distinct cultural roles and served as representations over the ages. In a simplistic sense, the enjoyment of nature and of art is drawn together in a garden; however Cooper (2008: 150) identifies garden appreciation as a special human phenomenon distinct from both the appreciation of art and the appreciation of nature. Gardens of bygone ages frequently expressed an image of paradise for the people who created them, such as Islamic gardens. Consequently, the historical development of gardening styles often paralleled that of the philosophical thinking of civilisations (Simpson & Ogorzaly 2001: 402).

Over the ages gardens have also taken on significant cultural roles and have served as representations of cultural identity, aspirations and achievement. Apart from enjoying gardens as manifestations of ordered nature, their cultural benefits allow us to marvel at them as a particular form of art.

The Chinese began cultivating food and medicinal plants in enclosed garden areas four centuries before the Egyptians. Although both the Chinese and Egyptian gardens were carefully designed, the visual effect of Chinese gardens differed completely from those found along the Mediterranean. The Chinese were the first to create true pleasure gardens and by 190 BC they were constructing extensive parks and public gardens. The Chinese conceived landscaping as a fine art form, interrelated with poetry and landscape painting, and considered the plants they used as symbolic, rather than architectural objects (Simpson & Ogorzaly 2001: 409).

The first true Western gardens were planted in ancient Egypt. Egyptian interest in botany and gardens is well recorded on wall paintings and in hieroglyphs drawn as early as 2200 BC. The Egyptians independently developed the concept of the garden as an enclosed space, and they surrounded their houses with garden walls to keep out intruders and provide protection from the desert winds. The geometric, stylised forms of the paths and planting beds were consistent with the formal architectural style of other forms of Egyptian art. In their search for plants to use in their gardens, the Egyptians mounted the first known plant-collecting expeditions (Brickell 2001: 159, Simpson & Ogorzaly 2001: 402-403).

The Egyptians' concept of formal gardens gradually spread to Syria and Persia in the Middle East and to parts of the Western world. In Persia, autocratic rulers ordered their subjects to plant groves of trees that became pleasure gardens and hunting preserves. These gardens were the forerunners of modern public parks (Simpson & Ogorzaly 2001: 403).

The Roman Empire lasted long enough for the development of a distinctive style of garden art. The Romans drew much inspiration for their gardens from the tales brought back by their soldiers from other parts of the Empire in Europe, Asia Minor, the Middle East and North Africa (Simpson & Ogorzaly 2001: 405). The Roman Empire was predominantly an urban civilisation, and most of its citizens lived in large city apartment buildings. Their inhabitants brought nature into this new urban world by planting window boxes and painting flowers on courtyard walls. Wealthy Romans had their gardens designed to suit the grounds of their villas outside the city and, for the first time, city planners incorporated greenbelts in urban design.

Plants and ideas brought to Europe by explorers of the New World, Asia and Africa had a great impact on 17th century gardens. The wealthy began to maintain large private gardens in which they displayed new plants and animals. Public gardens such as the Royal Botanic Gardens at Kew are legacies of this era. For the most part, however, exotic plants in these gardens were like rare animals in zoos (Simpson & Ogorzaly 2001: 406).

The Cape of Good Hope remained a largely unexplored botanists' paradise until 1772 when three notable men arrived at the Cape in search of botanical treasures. They were Messrs Masson, a Scot from Aberdeen sent by Kew, and two Swedes, Sparrman and Thunberg. Their work marked a changing point in the annals of South African flora, while the new plant acquisitions from the Cape helped to propel Kew to a position of pre-eminence in the botanical world. In the years following their arrival, other botanists working in the Cape started sending seeds and cuttings direct to Kew Gardens and so it became the main centre for the propagation and hybridisation of South African plants during the 17th and 18th centuries (Lighton 1960: 2).

The influx of new plants in Europe reached a peak in the 19th and early 20th century with the arrival of thousands of new species from China, Japan, North and South America, Africa and Australasia (Brickell 2001: 160). The Victorians became experts in cultivating potted plants. While the house plant fervour of the Victorian era cooled off in the early part of the 20th century, hundreds of new hybrids started to appear. In the 1930s the African violet rose to fame, and

the post-war 1950s saw house plants flourishing in many homes (Simons & Ruthven 1995: 20).

Many momentous changes in the worldwide development of horticulture started to occur in the mid-1960s and beyond. Several new ornamental plant cultivation companies were established, especially in the field of cut flower production (Cadic & Widehem 2001: 76). These changes came about after a long hiatus during the Second World War and the ensuing years of post-war reconstruction. Thereafter the changes in horticulture tracked changes in consumer demand resulting from rising living standards, especially in Europe, from the 1970s onwards. During this time there was renewed interest in new ornamental plants, especially in pot plants. These trends triggered a fresh search for and the development of new plants for markets in these increasingly prosperous regions (Von Hentig 1998: 65).

Heritage plants and relicts from old gardens and historic places

According to Brickell (2001: 161), the importance of historic gardens and those of old settlements as sources of genetic plant material has only been realised comparatively recently. This has given rise to a movement to conserve botanical gardens, old and historic gardens, including some private gardens, gardens belonging to corporations and other bodies, as well as gardens of note. Apart from the significant legacies bequeathed to us by these gardens, whether cultural, spiritual, recreational, aesthetical, or functional, they have also provided safe havens for the preservation of neglected or forgotten plant species across the world. According to Brickell (2001: 161), several old cultivars and species survived only thanks to these gardens.

There is a clear need to promote the *ex situ* conservation (conservation away from of the plant's natural location) of ornamental plants in national and international collections. Up to now considerable attention has been paid to the conservation of cultivated plants yielding food for human and animal consumption and other economically important crops.

The emphasis of the agriculture and horticulture industry has been on conserving primitive cultivars, which represent the core of genetic diversity, and which show promising potential for successful cultivation. Regrettably, there are no organisations at present which review and publish comparable conservation policies for ornamental plants (Brickell, 2001: 161).

Garden plants of the genus *Clivia* that had not been genetically improved before 1990 are now considered to be heritage plants (Fisher 2005). Such plants may still be found among old plant collections, old gardens, people of note who collect clivias, growers of note, nurseries of note, habitats the exact location of which are no longer known or which have been destroyed, and plant materials confiscated from illegal collectors, especially if the exact location of their origin cannot be determined.

Clubs and organisations collecting certain plants, like *Clivia* species, should be encouraged to keep registers for recording the heritage plants they find. They should also record those distinct features and characteristics of the plants in their possession, which growers elsewhere may want to pursue through cultivation programmes (Fisher 2005).

A good example of how old gardens could provide sources of “new” ornamental plant material is the historic gardens on the shores of Lake Maggiore in Northern Italy. For example, *Camellia japonica* was brought to Italy around 1760, but the plant only became popular in the 19th century. Many Italian nurserymen started cultivating camellias at that time as trade in the plants and flowers had become a lucrative business. In her study of these old cultivars, Remotti

(2002: 179) focussed on rediscovering forgotten ones, setting guidelines for their phenotypic characterisation and for re-introducing them to commercial use.

One of the reasons for conducting floricultural research is to safeguard cultivar variability. Declining genetic variability among some highly cultivated species is a major problem at present. Some plants which have disappeared carried features and characteristics that had been the result of many unique genetic improvements over long periods of time and which cannot always be replicated. Their disappearance constitutes an irreparable loss to overall genetic plant diversity. By the same token, the successful development and cultivation of new introductions depend on sound genetic variability. The adverse consequences of genetic erosion are self-evident and they assume an even more alarming significance with regard to those species which have given rise to a very large number of new cultivars through intensive genetic improvement programmes (Remotti 2002: 179).

The survival of those *Camellia japonica* cultivars for more than a century in the historical gardens of Northern Italy demonstrates the hardiness of these plants and their adaptability to the strict selective requirements according to which they had been cultivated. These old plants therefore represent a true botanical heritage, they became adapted to their local climatic conditions and disease resistant. Even if these cultivars may not all be suitable for the ornamental plant market of today, they could be used as a source for extracting valuable characteristics in genetic improvement programmes (Remotti 2002: 187).

According to Leszczynska-Borys (1995: 252), ornamental plants are plentiful in the gardens of rural ethnic communities in Mexico and they are widely used during community festivals. Many of their cemeteries are adorned by an abundance of flowering plants. These communities are the depositaries of precious indigenous knowledge about the plant species found in that country: one must therefore assume that should this valuable, but still largely untapped font of knowledge be opened up sometime in the future, it could provide a most useful resource in the development of new plant varieties for ornamental horticulture (Leszczynska-Borys 1995: 259).

As a result of her study of old roses in the Cape, Fagan (1988: 7) identified old cemeteries and old towns a potential sources of rose species and cultivars dating back to 1657 until 1910. She comments that

“Cape gardeners have always been as fashion conscious as rosarians in other parts of the world and have eagerly followed the changing shapes set by the prize-winning show roses. While the older varieties were edged out by new kinds, however, they continued to find a refuge in the simple cottage gardens of small mission villages, in old graveyards, country lanes and tucked-away towns and farms, where I found them when I started my search for old roses.”

The same may apply to the hitherto unexplored treasure troves of old cultivars of other ornamental parts, as well as indigenous plant knowledge here in South Africa and in other parts of the world

Botanical gardens, collectors and specialist nurseries

Botanical gardens and specialised plant collectors constitute a rich source of plant material, which can be used for cultivating new ornamental plant crops (Halevy 1999: 408). Individuals, societies and (usually small) specialist nurseries often cultivate rare plants which are not normally available to the public, commercially or otherwise. In South Africa it is particularly true in the case of some indigenous plants which are only cultivated by local growers with a special interest

in plants found in their own regions. The cultivation of such relatively rare indigenous plants is usually focussed on special types of plants such as herbs or succulents.

Botanical gardens and seed banks contain up to one third of the world's stock of vascular plant species. Botanical gardens are usually rich sources of many kinds of plants, because they often contain plant species collected from all over the world. Some botanical gardens and seed banks have therefore started to draft guidelines for genetic resource utilisation (Dove 1998: 1273).

Plant utilisation is a core activity of the South African National Botanic Gardens (NBGs). The NBGs were given a mandate in terms of the Forestry Act of 1984 "to promote the conservation of, and research in connection with, southern African flora" and furthermore to investigate the economic potential of indigenous plants and promote their utilisation (Eloff 1987: 123).

The Kirstenbosch Botanical Garden is famed for its horticultural knowledge and expertise. When the Kirstenbosch Botanical Garden was established in 1913, plants were primarily cultivated for economic purposes and by 1933 the Garden already contained 222 economically valuable species. This endeavour was later scaled down, because of other, higher priority objectives imposed on the Garden. Nonetheless, the Garden has over the years continued to increase its cultivation of indigenous plant seeds, as well as cut flowers, and continues to supply them to local and overseas markets.

During the late 1980s the NBGs resumed, as one of their core functions, the task of identifying indigenous plants which may have economic, horticultural or medicinal value. Although hybridising has never been a priority of the NBGs, the selection of superior plant forms continues afoot, with many excellent forms of indigenous plants being cultivated at Kirstenbosch and at other botanical gardens. With its world-renowned floral diversity, horticulturalists from abroad regularly visit South Africa to source and collect plants (Eloff 1987: 125).

Although some South African plants are propagated and hybridised fairly easily, the cultivation of most of the approximately 30 000 species of indigenous plants are more difficult. Horticultural research programmes and trials will have to be continued in order to ensure a steady supply of exciting new introductions to the horticulture industry in South Africa and abroad (Powrie 1998: 2).

The work of horticulturists at South Africa's eight National Botanical Gardens is steadily expanding and they have so far built up a knowledge base and cultivation guidelines on more than 2 200 species. This figure of over 2 200 species still make up less than 10% of the South African flora, which means that relatively few plants in our vast flora kingdom are currently being purposefully cultivated. Powrie (1998: 4) observes that many of the new plants she lists in "Grow South African Plants" are fairly new to cultivation and have not been subjected to extensive suitability trials in varied and potentially adverse climatic conditions.

The NBGs enjoy the advantage of their horticulturists and supporters often going on field trips which allow them to collect plants with exceptional qualities, as well as their seed and cuttings. These specimens are then later to be used for testing. Eloff (1987: 125) proposed that one should inquire what is needed, what is available, can it be cultivated, how valuable is the plant, and how does one market the plant to maximise its benefits, in order to help ensure that plants are utilised successfully.

Kirstenbosch sells surplus plants direct to the public. Other NBGs hold annual, monthly

or even daily plant sales. Eloff (1987: 128) anticipated that the South African botanical gardens and Kirstenbosch in particular, will in future evaluate, select, develop, and where feasible, grow and market plants with horticultural, medicinal and economic value. A seed bank has been established at Kirstenbosch in order to conserve genetic diversity and to make seed available for cultivation in other botanical gardens and in nurseries. Plants and flowers cultivated at Kirstenbosch that are otherwise unobtainable from commercial nurseries are offered for sale to the public on site (Eloff 1987: 128).

Fashion revivals and re-introductions

Fashion and fashion trends are important phenomena of the human existence. It is therefore small wonder that some ornamental plants gain or lose their fashionable appeal over time. As fashion cycles go, some plants, once out of favour, may sometimes become fashionable again. During the 1960s and 1970s aloe species collected from the veld were very much in the vogue, as were the many new hybrids or crosses developed by collectors and hobbyists. This fashion trend declined during the 1970s and 1980s, but the 1990s saw a notable revival of interest in aloes. These plants are usually intended as horticultural fashion statements, complementing modern architecture or adorning landscaped environments, or used as collectables for pot plants. The stark beauty of their often strange and inspiring architecture makes them suitable accent plants in a variety of settings. *Aloe barberae* has again become widely available and is commonly used as accent plants. Other aloe species and hybrids are increasingly being used in general gardening.

Aloe hybrids are quite common and most aloes interbreed easily. Hybrids are often more beautiful than their parents. They often grow more rapidly, flower sooner and produce more striking flowers than either of their parents. This phenomenon is known as “hybrid vigour” and this makes some of the hybrids highly sought-after (Van Wyk & Smith 1996: 22). The renewed public interest in aloes, combined with the ease with which they can be hybridised, renders them ideal for commercial cultivation programmes.

Sansevieria trifasciata was a favourite pot plant during the Victorian era, because it could withstand the toxic fumes emitted by coal fires and gas lamps (Simons & Ruthven 1995: 13). These plants started losing their appeal, because of increased competition from new plant varieties from all over the world and they were gradually replaced by other plant types.

Notwithstanding its earlier decline in popularity, there has been a resurgence of interest in *Sansevieria* since the 1990s. The beautiful architectural lines of their leaves perfectly match and complement contemporary architecture and interior design. With the increase in high-density living in many parts of the world, and hence, smaller living spaces, the indoor pot plant market seems assured of steady growth well into the future.

In Africa, as in many other parts of the world, the economic value of certain plants is sometimes determined by their medicinal and fibre applications in traditional practices. Overexploitation of such plant resources may lead to the extinction of some species, as has been the case in Zimbabwe where certain *Sansevieria* species have now vanished (Takawira & Nordal 2002: 189). Horticultural cultivation may therefore provide the only safe means through which some of these endangered wild plant species will be able to survive and thrive.

Horticultural neglected species

A good example of a species that has previously been neglected by the horticulture industry is the genus *Plectranthus*, which grows naturally in the understory of the subtropical forests in the South-Eastern parts of our country. Little or no cultivation improvements of the genus had been undertaken until fairly recently. Although the genus had been known to horticulturalists for a long time, the arrival of the first distinctive varieties of flowering pot plants, developed by a private South African grower, occurred only comparatively recently (Brits *et al.* 2001: 166)

The ensuing cultivation programmes focused on developing a variety of compact plants with large and floriferous flower types and beautiful foliage. Foliage characteristics that were improved through the cultivation programmes included foliage texture, shape, colour and fragrance. The research and development to achieve these improvements were undertaken by a group of specialist nurseries in South Africa, Europe, Japan, the USA and Australia (Brits *et al.* 2001: 167).

New cultivars

New cultivars are another major source of new ornamental plants (Brickell 2001: 160). Some genera, for example perennials such as *Pelargonium* and *Gerbera*, have undergone intensive cultivation programmes and selection over many years, with the result that today there is a bewildering choice of “novelties” of such genera available in the market. For instance, more than 35 million geranium plants (also known as *Pelargonium*) from about 250 cultivars are sold in the United States every year, both as bedding and potting plants (Anon 2003: 26).

In South Africa, the Agricultural Research Council (ARC) is responsible for much of the horticultural crop and technology development of a number of indigenous vegetable, flower and medicinal plants. Genebanks have been established, cultivar development is being undertaken and training for crop production is being provided by the ARC.

Despite the worldwide economic importance of the floriculture industry, strategies for developing new cultivars lag behind the more advanced ones devised for agricultural crops (Debener 2001: 121).

Ornamental plants offer a virtually limitless gene pool from which “novel” target genes can be extracted. Among the first genes transferred to ornamental plants other than marker genes, were genes for the modification of the colours of flowers, genes for the modification of ethylene biosynthesis of phyto-hormones, and genes for strengthening the plants’ defences against fungal pathogens.

The most common qualities that gene transfers seek to achieve are enhanced disease resistance, better stress tolerance, delayed senescence, improved post-harvest performance, the induction of novel colours and altered plant architecture. The results of these projects have also boosted technological developments, such as the advent of genetically modified plants, which will strongly influence ornamental plant cultivation in the foreseeable future.

According to the growing number of publications dealing with the application of molecular methods in ornamental plant genetics and cultivation, strategies for cultivation are already beginning to change which in turn are opening up new possibilities for the creation, selection and use of genetic variety in plant cultivation. This means that over the coming decades there will be a steady acceleration in the rate at which strategies for ornamental plant cultivation will

be adapted in line with new discoveries and new techniques (Debener 2001: 124).

Further excellent sources of new ornamental plants are induced mutations or those occurring naturally, such as variegated plants and multi-coloured flowers, stunted growth forms which may be regarded as unnatural, but which remain attractive to the human eye. These irregular plant forms should be registered as new cultivars.

Variegated forms are good examples of plant mutations that have ornamental value. It is generally accepted that variegation refers to foliage which bears white or cream markings owing to the absence of the green pigment chlorophyll. While viral infections inhibiting the formation of chlorophyll sometimes cause variegation, the more regular types of variegation are more commonly the results of mutation (Bradley 1993: 328).

While some viruses have no weakening effect on plants, they sometimes produce prominent white or yellow spots or blotches on dicotyledonous leaves and stripes on monocotyledonous leaves. Many of these specimens are highly desirable as ornamental plants.

Well-known or even lesser-known ornamental plants found in the wild which display unusual leaf colouration and unusual growth forms can contribute to the diversification and the extension of their use as ornamentals. Such plants may even provide a genetic source for hybridisation with other species.

A good example is *Cordyline australis* (New Zealand cabbage tree), which is extensively grown in temperate climates as garden and landscape subjects and as container plants. Discoveries of new specimens with unusual leaf colouration and growth forms have resulted in an increase in the plant's ornamental use (Harris 2001: 188).

“Freak” plants, which often occur when plants are propagated in nurseries, remain an important source of ornamental cultivars. For instance, a single variegated plant, propagated by cuttings, could provide the stock for a stable new cultivar. This is, however, a very slow method of propagation as it can take up to 50 years to produce a large enough stock of the new plant to warrant its commercial launch (Harris 2001: 189). It is, moreover, difficult to produce uniformly variegated plants through tissue culture propagation, because of the tendency of plants so produced to revert, to some greater or lesser extent, to their normal leaf type.

Many dwarf conifers are the result of mutation (Bradley 1993: 329). Mutations of *Pinus halepensis* (Aleppo pine) are good examples of where witches' broom-like mutations have led to the introduction of new ornamental plants. In its normal state the tree produces both male and female flowers, while in its mutated state as witches' broom only females flowers reach full bloom. The occurrence of witches broom is not the result of parasitic activity, but is caused by genetic and, therefore, hereditary factors. Witches' broom provides a suitable source for the cultivation of progeny from which new cultivars can be selected (Vrgoc 2002: 203).

New applications for known plants

It is possible that old, familiar and well-known garden plants can find completely novel applications in ornamental horticulture. The potential of such new applications is amply demonstrated by certain types of trees being converted into successful indoor container plants. Forest tree seedlings in their young stage are obligate sciophytes (shade plants) and as such they are well adapted for low light environments. A good example is *Trichilia dregeana* (Forest mahogany) that has in the last 15 years been introduced as an indoor foliage container plant

(Middleton 1998: 77).

Some new ornamental cultivars have been derived from plants traditionally grown as agricultural crops and which have gained popularity as cut flowers, such as *Helianthus annuus* (sunflower), *Gossypium hirsutum* (cotton) and *Carthamus tinctorium* (safflower). There is also a trend to use some garden and landscaping plants, mainly woody or herbaceous perennials, for the production of cut flowers like the *Hypericum* species (Halevy 1999: 408).

Results and conclusions

The results of the authors' survey show that there are several alternative sources of new ornamental plants, besides obtaining new indigenous plants from the wild in South Africa.

Below is a list of sources of new ornamental plants that can be exploited in future, ranked in descending order of importance. The percentage of respondents concurring with each of the ratings listed in the survey questionnaire is indicated in brackets.

- New indigenous plants from the wild (92%).
- New cultivars of existing plants (85%).
- Fashion revivals and the reintroduction of previously neglected plants (both 84%).
- Specialist nurseries (80%).
- Botanical gardens and their nurseries (79%).
- Renewed interest in heritage plants and old cultivars (73%).
- Collectors of unusual plants (59%).
- New applications for existing plants (58%).

It can be concluded that growers in South Africa continue to regard indigenous plants gathered from the wild as the most important source of new ornamental plants, even though several other alternative sources are available. New plants from the wild are particularly important to the market, because they are adapted to cope with specific climatic conditions and soil types.

There are many indigenous plants well known to botanists and horticulturists, but which are not yet freely available in the trade. These plants should be made available to the public and promoted in the media.

New cultivars of existing species are another key source of new ornamental plants, especially if new varieties have improved horticultural performance properties.

The "recycling" of old plants is an additional source of new ornamentals. The use of indigenous plants in South Africa can be further enhanced by turning to heritage plants and garden relicts as sources of genetic material, by re-introducing old cultivars, by making improvements to previously neglected varieties, and through finding new, imaginative uses and locations for existing plants.

The conservation of botanical gardens, old and historic gardens and plant collections of note has therefore become important in South Africa, not only because of their historical value

as symbols of philosophical precepts, religious beliefs, aesthetic values and as a form of art, but also as genetic resources for the future.

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Lorraine Middleton holds a BSc degree in natural science; BSc Honours degrees in both botany and zoology and a Masters degree (*cum laude*) in botany. She has been involved in scientific research in the natural sciences since 1978 and has owned substantial business enterprises in the horticultural industry since 1989. From 1998 until 2009 she acted as the curator of the Manie van der Schijff Botanical Garden at the University of Pretoria where she also lectured plant sciences to undergraduate landscape architecture students. She is currently working on a PhD in Applied Science in the Programme of Landscape Architecture, University of Pretoria; and lectures botany to undergraduate as well as post-graduate BSc students at the University of Limpopo.

Prof. Piet Vosloo (BSc Building Science, BArch, ML, PhD) is a lecturer at the Department of Architecture (Programme in Landscape Architecture) at UP and is a registered professional architect, landscape architect and project manager. He lectures in all these disciplines and has published widely on landscape architecture. For the past seven years he has been the national coordinating judge for the annual merit awards competition for SALI and in the process travelled extensively in southern Africa to adjudicate landscape projects. As a practicing landscape architect his company, KWP Architects and Landscape Architects, has been the recipients of numerous professional awards and winners of competitions