

## ***Lachenalia* – breeding, culture and usage of a new ornamental bulbous plant**

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**Abstract:** *Lachenalia* – breeding, culture and usage of a new ornamental bulbous plant. *Lachenalia* is a bulbous plant which origins from South Africa. It is a well known commercial plant in African area but new to the international flower market. By hybridization this flower bulb has been significantly improved. For recent years the researchers from South Africa have been promoting attractive hybrid crosses known as the African Beauty® series, available in different shades and colours: red, yellow, orange, purple. The breeding programme contributed to the development of interest in the cultivation of *Lachenalia* in European countries. *Lachenalia* can be recommended as a pot plant and also for the garden, as a tender perennial which will not survive frost. Not only the flowers are attractive but also shoots and leaves which are frequently spotted. *Lachenalia* delights with its exotism, colouring and flower shape and certainly can be used as a new cut flower in floristic compositions. New hybrids should be surely introduced to Polish growers and the Polish flower market.

*Key words:* cape cowslip, cultivation, breeding, propagation, tender perennial, cut flower, pot plant.

### INTRODUCTION

The genus *Lachenalia* J.F. Jacq ex Murray (*Hyacinthaceae*) is a bulbous geophyte that includes more than 100 described species (Kleynhans, 2006). The bulbs are not resistant to frost and they can be grown in the areas where the temperature fall  $-5^{\circ}\text{C}$  and even then they should be

protected in cold seasons. Other common name for *Lachenalia* is Wild Hyacinth, Cape Cowslip (superficial resemblance to genus *Primula*), Leopard Lily (Bryan, 1989) or in Afrikaans: “viooltjies” or “kalossies” (Crosby, 1986). The genus is named after Werner de Lachenal (1736–1800), a Swiss professor of botany (Bryan, 1989).

*Lachenalia* is endemic to South Africa and Namibia with the largest concentration of species in the Western Cape Province, on the areas with a winter rainfall (Duncan, 1996). Most of the species follow a winter growing cycle (vegetative growth in autumn and winter, flowering in late winter and spring) with a pronounced dormant period during hot summer (Kleynhans, 2006). In 1985 The Indigenous Bulb Growers Association of South Africa, appreciating unusual character and beauty, indicated the genus *Lachenalia* as the second most popular plant in the world, behind the genus *Gladiolus* (Duncan, 1988).

### DEVELOPMENT AND COMMERCIALIZATION

In catalogues of ornamental plants *Lachenalia* is recommended as an attractive new pot plant and garden

plant as well as for cut flower production. In South Africa, exceptional plant diversity and endemism (Helme and Trinder-Smith, 2006), intensive research on new methods of propagation, conditions of bulb storage and cultivation, have been in progress (Sochacki, 2003). In 1966 Agricultural Research Council (ARC-Roodeplaat) started a breeding programme in order to convince commercial growers to increase pot plant and flower production of *Lachenalia* (Du Preez et al., 2002). Early attempts of commercialization were unsuccessful because the information on cultivation and virus control was scarce and propagation material was in insufficient quantities. Also political isolation of the country until the early 1990's slowed down the progress in breeding research. The year 1992 was a turning point for *Lachenalia* programme, because a large team working under ARC-Roodeplaat leadership speeded up the development of technology and production of disease free propagation material. In following years about 250 crosses per year were carried out that resulted in establishing a hybrid evaluation system with selection criteria: desired phenotype and multiplication. Moreover, *Lachenalia* was registered as "Cape Hyacinth" (trade name) and in Holland a commercial pot grower was appointed (Kleynhans, 2006). During 1998 and 1999 ARC-Roodeplaat developed production system to satisfy the commercial growers' requirements. The production system consists of three types of growers. First is the propagator who multiplies mother material through leaf cuttings. The second in this link is the market bulb grower who grows small bulblets to marketable size. The last one

plants dry bulbs in pots and finally sells *Lachenalia* as potted plant (Kleynhans et al., 2002). All breeding efforts were concentrated on getting hybrids with wide range of colours suitable for cut flower production and on working out the schedule of methods used during yearlong controlled cultivation system (Bach, 2001). The commercial availability of a new cultivar is possible after a long time and encompasses a 13–15 year period of intense procedure (Kleynhans, 2006). Hybrid crosses known as the African Beauty® series were promoted in Keukenhof in 1999 and one of them – 'Rupert' was rewarded as the best bulbous pot plant (Sochacki, 2003). Other hybrids also received prizes on this show in various categories reserved for flower bulb crop. The success of this true South African product was expected earlier because a market study in 1993 estimated the potential market for *Lachenalia* in Europe at 20 million bulbs per annum but still only a limited number of commercial growers have exclusive rights to produce *Lachenalia* bulbs (Kleynhans, 2006). This fact points that in the future Polish commercial growers could become important partners for ARC-Roodeplaat in commercial production of *Lachenalia*.

## MORPHOLOGY AND CULTIVATION

There is an unusual morphological diversity in genus *Lachenalia*. The fleshy bulb is covered with soft or hard tunics, and vary in shape and size: from 5 mm to 35 mm in diameter. The leaves differ in shape, length, width and number. The foliage usually occurs in pairs but there are single-leaved species. In majority of species leaves are wide and flashy,

though there are exceptions, for example *L. contaminata* produces grass-like leaves. The foliage is arranged in an upright or spreading position, but *L. latifolia* produces leaves lying on the ground. Leaves can be spotted, banded, smooth or hairy – these features are characteristic of a concrete species. The flowers can be tubular or bell-shaped arranged in three types of inflorescences: the spike, the subspicate inflorescence and the raceme. Flowers are long lasting: 6–8 weeks. Some species have fragrant flowers, for example *L. convallariodora*. Flowers produce many seeds and in selected species (*L. algoensis*) seeds are adapted (elaiosome) to be spread by ants (Duncan, 1988; Bryan, 1989).

In Holland the bulb for pot production are planted from January to November but it is still a problem to obtain plants blooming simultaneously therefore bulbs in the same phase of flowering are transplanted to bigger pots ready for sale (Sochacki, 2003). As Kleynhans (2006) emphasizes, each grower should adapt the production to his specific conditions because the microclimate in production area has a significant influence on the quality of pot plant, moreover the cultivars differ in their growth habit. The bulb storage and forcing temperatures have an influence on *Lachenalia* growth. Roh (2005) claims that the bulb storage and temperature are the main factors which determine the number of florets. During bulb storage at 10–15°C floret initiation can stop but it may continue at 20°C or 25°C. Inflorescence initiation is also influenced by temperature before bulb harvest: the lower temperature regime during the active growing season, the higher quality of inflorescences with the

long keeping ability. Also simultaneous flowering can be obtained in following season due to low temperatures (Du Toit et al., 2004).

*Lachenalia* should be grown in sun but if the temperatures are high it prefers shade in the hottest part of the day. During active growth plants require moderate moisture and good drainage, watering should be decreased after flowering and stopped when the leaves become yellow (Bryan, 1989). In pot plants industry *Lachenalia* bulbs are obtained in the nursery phase from bulblets. This phase of enlargement is very important in whole process of production so fertilization has a significant effect on the growth and flowering of pot plants. The trials show that *Lachenalia* has low phosphorus and magnesium requirements (Roodbol and Niederwieser, 2002) but nitrogen applied in the nursery and pot plant phases positively affects the number of florets formed per inflorescence (Engelbrecht et al., 2008).

## PROPAGATION

*Lachenalia* can be propagated through offsets, bulbils, stolons, bulblets, leaf cuttings, seeds and tissue culture methods (Duncan, 1988). Small underground bulbs are called bulblets but if they develop at the periphery of the mother-bulb – they are called offsets. Some bulbous species may occasionally produce aerial bulblets (bulbils) on the floral parts or on the edge of the leaf (De Hertogh and Le Nard, 1993). *L. bulbifera* can produce bulblets above ground level and others (*L. namaquensis*) reproduce by stolones which push the bulblets away from mother-bulb (Duncan, 1988). These methods are too slow for

commercial production and are species-specific (Kleynhans, 2006). Most species can be propagated through leaf cuttings (Duncan, 1988) – this is the commercial method of production. The leaf is cut off above ground level and placed vertically in a rooting medium. A leaf cutting starts to form bulblets and roots after one month. It is important to cut off the leaf in a suitable physiological stage of mother plant – best before flowering (when the inflorescence is visible between sheaths of the leaves), the least suitable stage of donor plant is in full flowering (Ndou et al., 2002).

*Lachenalia* can be propagated through seeds – the main mechanism by which plants spread in their natural environment. Seed production eliminates Ornitogalum Mosaic Virus (OMV) (Kleynhans, 2006) and it is important for every flower bulb grower to produce disease free material that will give the best quality flowers. Moreover, the virus-free bulbs can weight 15–20% more than normal commercial stocks so it can be economically profitable to produce the high quality planting stock even though such bulbs are more expensive (De Hertogh and Le Nard, 1993). Last year also symptoms of Freesia sneak virus (FreSV) on *Lachenalia* cultivars were reported (Vaira et al., 2007). Results from commercial growers indicate that bulbs treated in a wrong way can be infected by fungi such as *Fusarium*, *Pythium*, *Penicillium* although some cultivars are more susceptible to fungal disease than others. The losses in production caused by this fungus can be extremely high (50% of the commercial bulb production). *Lachenalia* is easy to grow from seeds because the germination process does not require stratification nor

other procedures. In 10–20°C the seeds germinate after 2–4 weeks depending on a species and a hybrid (Kleynhans, 2006).

Tissue culture propagation of *Lachenalia* is recommended for the large scale multiplication (Ault, 1995; Slabbert and Niederwieser, 1999). As mentioned above, the plants cultivated for commercial production are frequently infected by OMV. Its symptoms are visible on the leaves as mosaic patterns and on flowers as deformations. The virus concentrates mainly in bulb growing points (Burger and Von Wechmar, 1988) therefore leaf explants are the best source for the *in vitro* culture. Buds in leaf tissue form from epidermal cells, most (90%) from single cells. The tissue age as well as the regeneration potential of species and hybrids (genotype) have a pronounced effect on number of buds and size of bulblets (Niederwieser and Ndou, 2002) and it appears that each *Lachenalia* genotype may require different medium for micropropagation (Ault, 1995). The components are correlated to the size of the bulblets: larger bulblets are formed on medium with high sucrose concentration (60 g/l). Length of explant shoots is an important factor affecting *in vitro* culture – shoots shorter than 4 mm do not form bulblets. The acclimatization of new bulbs is directly correlated with their size (Slabbert and Niederwieser, 1999).

## CONCLUSION

South Africa is extremely rich in flower bulb species but despite this fact its contribution in the international flower bulb industry is relatively small. Only few flower bulb species (gladiolus, freesia,

nerine, ornithogalum) indigenous to Southern Africa are treated as commercial crops and have been introduced to the foreign markets. *Lachenalia* appears as perfect plant with potential to be developed into a new crop (Niederwieser and Kleynhans, 2002). Extensive work has been done to obtain new better-adapted hybrids but future perspective for *Lachenalia* breeding have to concentrate on understanding the relations between species and on overcoming the pre and post-fertilisation barriers. These are important problems that require investigation because 35% of inter-specific crosses carried out by ARC-Roodplaat resulted in production of non-viable seeds. Better-adapted hybrids should be characterized by higher production rates, increased longevity and general difference from any current hybrid, that means new colour and flower form (Kleynhans, 2006). *Lachenalia* can become a welcome novelty for international floriculture market which still requires new products. The cut flower production is a very important part of bulb forcing (De Hertogh and Le Nard, 1993) but it is necessary for growers to be given a precise description of growth and development cycle in order to control flowering.

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**Streszczenie:** *Lachenalia* – hodowla, uprawa i zastosowanie nowej ozdobnej rośliny cebulowej. Rodzaj *Lachenalia* (*Hyacinthaceae*) obejmuje 100 gatunków roślin cebulowych znoszących spadki temperatury do  $-5^{\circ}\text{C}$ . Wszystkie gatunki są endemitami występującymi na obszarach Południowej Afryki i Namibii ze szczególną koncentracją na terenie zachodniej części prowincji Cape. W katalogach ogrodniczych roślina ta polecana jest jako niezwykle interesująca „nowość” zarówno do uprawy w doniczkach, jak i do ogrodów, a także do produkcji na kwiat cięty. W 1966 roku w Agricultural Research Council (ARC-Roodeplaat) rozpoczęto program badawczy mający na celu otrzymanie nowych odmian o korzystnych walorach dekoracyjnych, charakteryzujących się większymi kwiatami i liśćmi. Od momentu rozpoczęcia tego programu zarejestrowano wiele nowych odmian. Utrudnienia w szeroko zakrojonych badaniach hodowlanych były spowodowane dużą zmiennością w obrębie rodzaju. Obecne badania mają na celu uzyskanie form nadających się na kwiaty cięte, o szerokim zakresie barw kwiatów, a także opracowanie całorocznej (sterowanej) metody uprawy tej rośliny. Nowa seria odmian została na-

zwana 'African Beauty'. Do uprawy doniczkowej w Holandii cebule *Lachenalia* są sadzone do pojemników od stycznia do listopada. W warunkach holenderskich nie udaje się uzyskać roślin kwitnących równocześnie, dlatego okazy będące w tej samej fazie kwitnienia przesadza się do większych doniczek gotowych do sprzedaży. W zależności od gatunku kwiaty *Lachenalia* zebrane są po około 20 w kłosach lub gronach. Płatki korony tworzą kształt dzwonka lub rurki, mogą być jednolitego koloru lub wielobarwne, niektóre gatunki pachną. W zależności od odmiany nasiona kiełkują po 2–6 tygodniach. Optymalna temperatura kiełkowania wynosi  $10\text{--}20^{\circ}\text{C}$ . Rośliny z rodzaju *Lachenalia* można rozmnażać: generatywnie, przez cebule przybyszowe, sadzonki liściowe, a także w kulturach *in-vitro*. Coraz częściej do masowego rozmnażania zalecane jest rozmnażanie właśnie metodami kultur sterylnych, gdyż gatunki *Lachenalia* często porażane są wirusem mozaiki śniećka (*Ornithogalum Mosaic Virus*, OMV). OMV powoduje na roślinach szereg objawów mozaiki oraz deformacje kwiatów. Stwierdzono, że wirus ten koncentruje się głównie w wierzchołkach wzrostu cebul, dlatego do inicjacji kultur *in vitro* zaleca się używać fragmentów tkanki liściowej. Niezwykle ważne jest opracowanie precyzyjnych wskazań dotyczących rozmnażania *Lachenalia* metodą *in vitro* przy użyciu różnych eksplantatów, nie tylko dla poszczególnych gatunków, ale przede wszystkim odmian, które mogą mieć ogromne znaczenie w produkcji ogrodniczej. Rośliny z rodzaju *Lachenalia* zachwycają swoją egzotyką, kolorystyką, kształtem kwiatów i z pewnością powinny wzbogacić asortyment polskiego rynku kwiaciarskiego, niezmiernie otwartego na nowości. *Lachenalia* jako „nowość” ma szanse osiągać wyższe ceny i wpłynąć na dalszy rozwój polskiego rynku kwiaciarskiego, co ma ogromne znaczenie w dobie konkurencji na rynkach światowych.

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