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Propagation of Noble Dendrobium (*Dendrobium nobile* Lindl.) by cutting

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ABSTRACT. The Noble Dendrobium orchid (*Dendrobium nobile* Lindl.) is an ornamental species usually propagated by leaf axillary shoots called "Keikes", but cutting is possible although, many do not produce leaves or roots and eventually rot. To increase the proportion of successful stalk cuttings, two substrates were evaluated in the present study (gravel and a 1:1 tree-fern shredded trunk:palm seed mixture) in interaction with the application of nitrogen fertilizer (urea 2 g L^{-1}) and a commercial leaf fertilizer made from kelp seaweed ("Kelpak" a 2 mL L^{-1}). Only water was applied for the control treatment. The evaluated parameters included the proportion of successful cuttings, vigor, the proportion of rotten stalks, the number of roots/plant and root length/per plant. The gravel was found to be the best substrate for the rooting and/or shoot production (37.2% in average) of the cuttings. The application of urea or Kelpak induced vigor in the obtained plantlets, but the dosage required for a greater efficiency was not reached. The cuttings layered on gravel plus the application of urea at a concentration of 2 g L^{-1} was the most effective treatment, with 40.7% successful cuttings.

Keywords: Kelpak, orchids, rot, urea.

Propagação de Olho-de-Boneca (*Dendrobium nobile* Lindl.) por estaquia

RESUMO. A orquídea "olho-de-boneca" (*Dendrobium nobile* Lindl.), é uma espécie ornamental usualmente propagada por brotações que aparecem nas gemas axilares das folhas chamadas de "keikes", mas a estaquia é possível, porém, muitas não brotam e eventualmente apodrecem. Com o intuito de aumentar a proporção de pegamento de mudas obtidas de estacas, no presente trabalho foram avaliados dois tipos de substratos (seixo rolado; e mistura 1:1 de pó de xaxim com sementes de palmiteiro) em interação com a aplicação de adubo nitrogenado (ureia a 2 g L^{-1}); e um produto comercial, feito a partir da alga kelp ("Kelpak" a 2 mL L^{-1}). No tratamento controle aplicou-se somente água. Os parâmetros avaliados foram: proporção de estacas pegas, vigor, proporção de estacas apodrecidas, número de raízes e comprimento de raiz por planta. O seixo rolado foi o melhor substrato para a emissão de raízes e/ou ramos das estacas (em média 37,2%). A aplicação da uréia ou do Kelpak induziram vigor nas plantas, porém a dosagem de maior eficiência aparentemente não foi atingida. A estaquia feita sobre seixo rolado com a aplicação da uréia, na dosagem de 2 g L^{-1}, foi considerado o tratamento mais eficiente, com 40,7% das estacas pegas.

Palavras-chave: Kelpak, orquídeas, apodrecimento, ureia.

Introduction

Flower cultivation is a profitable and attractive agricultural sector that involves significant manpower (approximately 15 persons ha^{-1} in intensive systems and 3 persons ha^{-1} in semi-intensive systems) but generates high incomes and does not require large planting areas. Therefore, flower cultivation is a business that is self-sustainable, able to generate many labor positions and is accessible to family micro entrepreneurs. The Noble Dendrobium orchid (*Dendrobium nobile* Lindl.) (Figure 1a) is one of the three species used in the formulation of "Shi-Hu" (with *D. tosaense* and *D. moniliforme*) (LO et al., 2004; YE; ZHAO, 2002), which is an antipyretic and tonic drink that is also described as an aphrodisiac in traditional Chinese medicine (HANELT; IPK, 2001). Noble Dendrobium is a fast-growing orchid with flowers of a diameter between 3-8 cm naturally found in Southeast Asia, including Nepal, Bhutan, Northeast India (the state of Sikkim), Burma, Thailand, Laos, Vietnam and Southern China (BAKER; BAKER, 1996; HANELT; IPK, 2001; SILVA, 1986). The blossom colors are variable and present a dark spot at the bottom of the labellum, making it look like an eye. This species vegetates from plains to altitudes of 2000 m. The plant withstands temperatures up to 1°C, but requires temperatures above 22°C for good vegetative development; low temperatures induce flowering that occurs from late

winter to early summer (BAKER; BAKER, 1996). Indeed, Noble Dendrobium is one of the easiest orchids to grow (CAMPOS, 1998; SILVA, 1986).

In the state of Santa Catarina, Brazil, Noble Dendrobium is commonly found in gardens as clumps, usually planted at the base of a tree, on poles or along fences. Improved cultivars and hybrids of this species began to be commercially produced in Brazil in the early 1990s, and its beauty, profuse flowering, hardiness and rapid growth made it the least expensive orchid available in the market and, therefore, one of the most commercialized. There are several systems used for the propagation of orchids; the simplest are some variation of asexual propagation, such as clump division (for most species) or cutting (less common). Asexual propagation has the advantage of procuring plantlets that are genetically identical to the mother plant and blossom more quickly than plants from seed, but the number obtained is low for commercial purposes for which seedlings or mericlones are preferred. However, *D. nobile* Lindl., is an exception because its propagation by cuttings and the shoots that appear in the axillary buds of leaves, called "Keikes", is easily obtained when compared to other orchids. Its propagation by seeds has only been adopted for purposes of genetic improvement. The production of plantlets by cuttings offers greater potential than Keikes, but rotting may occur (BAKER; BAKER, 1996), possibly due to unbroken bud dormancy and/or pathogen proliferation favored by the highly humid substrate. Nitrogen application has been reported as important for the commercial growth of Dendrobiums, causing more single-node cuttings to grow into vegetative shoots; however, nitrogen must be suspended to induce blooming (BICHSEL et al., 2008; MIWA; OZAKI, 1975). In the present study, a system that maximizes the propagation by cutting of the Noble Dendrobium orchid was developed by inducing the rapid growth of the shoots derived from axillary buds using nitrogen-rich fertilizers, one of which was associated with a growth stimulant, on 2 different substrates.

Material and methods

The experiment was established in November of 2002 in Florianópolis, Santa Catarina State, Brazil (27°50' South; 48°34' West), in a greenhouse covered with a milky plastic, which was able to block 60% of the incidental light. Stem cuttings of *D. nobile* Lindl., 3 to 4 nodes (~7 cm long), were placed on the two following types of substrate in plastic trays for rooting: a) gravel and b) a 1:1 mixture of tree-fern (*Dicksonia sellowiana* Hook.) shredded trunks:palm seed (*Euterpe edulis* Mart.) (Figure 1b). Every 2 weeks, the following fertilizer treatments were sprinkled on each substrate: urea (2 g L^{-1}) and growth stimulant "Kelpak" (2 mL L^{-1}) (Kelpak is a trade mark of Kelp Products (Pty.), Cape Province, South Africa). Only water was used for the control treatment. In the interval between the applications of the treatments, the following was applied as a maintenance fertilizer: 2 mL L^{-1} of "Ouro Verde", a foliar fertilizer containing NPK 6-6-8, plus 2 mL L^{-1} of "Supa-Potassium", a commercial fertilizer containing Si, associated with a fungicide (2 mL L^{-1} Manzate). Each plot was composed of approximately 40 cuttings (min. 33, max. 47), and each treatment was replicated three times.

Figure 1. General view of the Noble Dendrobium cultivar used in the present experiment (a). An experimental plot (b).

The treatments were applied in the first two months; for seven months thereafter, the cuttings received maintenance fertilizer and water only. The analyzed data were collected 9 months after the beginning of the experiment. The evaluated parameters were as follows: proportion of successful cuttings (considered when the stalks launched shoots and/or roots), vigor (subjectively evaluated by

assigning scores from 0 to 10), proportion of rotten stalks, number of roots/plant and root length/per plant. For statistical analyses, the proportion values were transformed to the square root of arcsine of p, where p = the proportion (SOKAL; ROHLF, 1981). The data were subjected to two-factor analysis of variance (substrates x fertilizers); the comparison of the means was performed using the Tukey test (SOKAL; ROHLF, 1981). The data were analyzed using Bioestat software (AYRES et al., 2007).

Results and discussion

There were no significant interactions between the substrate and fertilizer factors for any of the evaluated parameters; thus, only the averages of the evaluated parameters, by substrate and by fertilizer type used, are presented (Tables 1 and 2).

Table 1. Evaluation of cuttings from the stalks of Noble Dendrobium (*Dendrobium nobile* Lindl.) based on the substrate used. The values are averaged by parameter. *Significant difference at 0.5%; n.s. = Not significant. Values followed by same letter do not differ statically.

Parameter	Substrate	
	Gravel	Tree-fern shredded trunk:palm seeds
Proportion of successful cuttings (%)*	37.6 (a)	27.2 (b)
Vigor (score)n.s.	5.5 (a)	5.2 (a)
Proportion of rotten stalks (%)*	45.6 (b)	62.4 (a)
Number of roots emitted/cutting*	13.2 (a)	8.8 (b)
Length of roots emitted/cuttingn.s.	5.0 (a)	4.9 (a)

Table2. Evaluation of cuttings from stalks of Noble Dendrobium (*Dendrobium nobile* Lindl.) based on the fertilizer used. The values are averaged by parameter. *Significant difference at 0.5%; **Significant difference at 0.01%; n.s. = Not significant. Values followed by same letter do not differ statically.

Parameter	Fertilizer		
	Control	Kelpak	Urea
Proportion of successful cuttings (%)n.s.	38.1(a)	34.1 (a)	40.7 (a)
Vigor (score)**	3.9 (c)	5.4 (cb)	6.9 (ba)
Proportion of rotten stalks (%)n.s.	58.2(a)	48.4(a)	55.4(a)
Number of roots emitted/cutting (%)n.s.	44.4 (a)	47.5 (a)	44.9 (a)
Length of roots emitted/cuttingn.s.	10.0 (a)	9.7 (a)	13.3 (a)

For the parameter "proportion of successful cuttings", the substrates were found to be significantly different (p = 0.035), with averages for the gravel substrate of 37.6% and the tree-fern on shredded trunk:palm seeds of 27.2%. The substrates were not significantly different for "vigor" (p = 0.621). The substrates were significantly different (p = 0.012) for the variable "proportion of rotten stalks", with averages for the gravel of 45.6% and for the tree-fern shredded trunk:palm seeds substrate of 62.4%. For the variable "number of roots emitted/cutting", the substrates were significantly different (p = 0.020), with averages for the gravel substrate of 13.2 and the tree-fern shredded trunk:palm seeds of 8.8, where as the substrates were not significantly different for the "length of roots emitted/cutting" (Table 1). With regard to all the significantly different parameters (proportion of successful cuttings, proportion of rotten stalks and number of roots emitted/cuttings), the gravel substrate produced the best results (Table 1).

The fertilizer did not influence 4 of the 5 evaluated parameters and was significant for the vigor only (p = 0.006), with urea producing the highest effect (with a score of 6.9). Nevertheless, urea did not differ statistically from Kelpak (with a score of 5.4) (Table 2).

In general, gravel was the best substrate, and the application of urea or Kelpak resulted in higher plantlet vigor. Wang (2000) commented that there is no difference between fertilization with nitrogen in the form of urea or ammonia in the production of orchid flowers. Kelpak is produced from kelp (*Ecklonia maximum* Osbeck), which produces growth stimulants, such as cytokinins, auxins and gibberellins; it is also rich in vitamins and amino acids, although in small quantities, ultimately providing some nitrogen in an organic form (280 mg L^{-1} N equivalents in the commercial product, according to the manufacturer). The treatment that used urea supplied more nitrogen than the one that used Kelpak although results were similar, which may have been due to the hormones and amino acids present in Kelpak. The efficiencies of these two treatments was higher when compared with the control (average score of 3.9), which received nitrogen from the maintenance fertilization only. The nitrogen contents of the treatments in this experiment are lower than those suggested as more effective for *D.* Red Emperor 'Prince' (BICHSEL et al., 2008) and *D. nobile* (BERNARDI et al., 2004). Nitrogen, when applied to plants deficient in this nutrient, often induces a rapid and linear growth that is proportional to the administered dose until a maximum level of toxicity is reached (RUSSOWSKI; NICOLOSO, 2003); this was indicated by the vegetative growth of *D.* Red Emperor 'Prince' for which doses of 50 and 100 mg L^{-1} were effective but doses at 400 mg L^{-1} were disadvantageous (BICHSEL et al., 2008). Similar observations were reported for *D. nobile* in an experiment with fertigation using Sarruge solution at concentrations of 25, 50, 75, 100, 125 and 150% of the basic formulation (BERNARDI et al., 2004). Therefore, the maximum level of nitrogen was apparently not achieved in the present experiment; however, the stimulating growth compounds in Kelpak should not be disregarded because the nitrogen proportion

in this product is considerable below that in urea.

Hence, the conclusions are as follows: a) the best substrate for cuttings is gravel; b) the vigor was increased with N fertilization, although without a significant difference, apparently improving the proportion of successful cuttings and c) the growth compounds present in Kelpak were able to improve the N effect.

Conclusion

Propagation on gravel with the application of 2 g L^{-1} urea was considered the most effective treatment, achieving 40.7% of success.

A further study using higher doses of urea in combination (or not) with growth hormones is encouraged under the hypothesis that it could further increase the efficiency and vigor of the plantlets obtained by cuttings.

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