New Clones of *Nierembergia linariaefolia* Bred from Population Native to Argentina

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**Abstract**

*Nierembergia*, a Solanaceae, includes many species having ornamental value for their purple or white flowers with a long flowering period.  

Three new clones of *Nierembergia*, ‘Luna INTA-JICA’, ‘Estrella INTA-JICA’ and ‘Nube INTA-JICA’, were bred from wild populations located in Argentina. These clones can be distinguished by both floral and vegetative traits. ‘Luna INTA-JICA’ has white flowers with a clearly defined lilac spot and small yellow center, whereas ‘Estrella INTA-JICA’ has white flowers with a spot similar to a star and big yellow center. The flowers of ‘Nube INTA-JICA’ are larger than that of ‘Luna INTA-JICA’ and ‘Estrella INTA-JICA’ and show a strong contrast with the dark green leaves. Growth habits are similar among them and very easy to be cultivated. Propagation by cuttings evaluated using two different substrates (perlite and peat moss: perlite) was successful. Short photoperiod (9 h) prevents flowering while long photoperiod (10 h) promotes flowering at temperatures above 18°C.

**INTRODUCTION**

The genus *Nierembergia*, a member of *Solanaceae*, comprises about 20 species, mainly native to South America except for one from Mexico (Cocucci, 1995). The center of diversification is in Argentina with 15 spp. and many species in this genus are well known for their toxic properties. *N. linariaefolia* and *N. repens* Ruiz et Pav., and two or three other species, common known as "cup flower", are used as ornamental plants mainly in gardens in northern hemisphere. Most of *Nierembergia* species have ornamental value for their purple or white flowers and long flowering period. In addition, others salient qualities are their ease to cultivate and propagate by stem cuttings. A few species with no or little breeding improvement have been used commercially worldwide as -pot plants, rock garden, mixed borders, etc. The commercial breeding of *Nierembergia* was initiated in U.S.A and a few years later in Japan.  

*N. linariaefolia* (“Cupflower”) is herbaceous with unusually beautiful flowers in violet, white and yellow colors. In Argentina, the species shows vast polymorphism among populations in plant shape, leaf size, and other morphologica characters. *Nierembergia* is hardy and perennial. In mild climate, it can be grown outdoors as perennials. In cold climate plants can be lifted from the soil in the fall, pruned back, potted and kept in cold frame or greenhouse during the winter.  

The breeding program has focused on the combination of favorable ornamental characteristics such as flower shape and color, length of flowering period and growth habit. The propagation of clones of *Nierembergia* by seeds has serious problems because the establishment of the seedlings takes more than one month and they are very weak.  

Thus, in this investigation propagation by cuttings of newly bred 3 clones of *Nierembergia* was evaluated.
MATERIALS AND METHODS

Breeding

The selection was performed on 200 plants grown in greenhouse of the Technological Center on Floriculture, Fruticulture and Horticulture of JICA in Argentine (34° 36' south latitude, 58° 40' west longitude). These plants were collected from two natural populations of *N. linariaefolia* distributed in Entre Ríos and Tucumán province, Argentine. Superior individuals were used as parents in the crossing program with a commercial cultivar, 'Mount Blanc' released by TAKII Seed Company, Japan. In the F2 generation, selection was carried out to obtain 'Luna INTA-JICA' and 'Estrella INTA-JICA' clones. The third clone, 'Nube INTA-JICA' was selected from self-fertilized polyplody plants obtained from a population of colchicines-induced mutants (Serpa, 2001).

Cultivar Characterization

The 3 *Nierembergia* clones were described for the following morphological characteristics: growth habit, number and shape of stem, leaf size, flower size, flower color, distribution and shape of flower. The length of flowering period in greenhouse under natural photoperiod conditions from October to March was also recorded. Ten plants and 100 flowers from each clone were measured. Color descriptions are based on the RHS Color Chart (Royal Horticultural Society, 1966).

Propagation

One year old individuals of the 3 *Nirembergia* clones were used. Cuttings were obtained from mother stock plants grown under short photoperiod (9 hours) to avoid flowering and promote vegetative growth. Rooting was evaluated in two different substrates, perlite and peat moss: perlite = 1:1 v/v and under two light intensity conditions, 2400 lux and 14000 lux, in a growth chamber. Temperature was kept at 25°C relative humidity 80% and photoperiod of 9 h.

Cuttings of 4 cm length and about 3 to 5 nodes were taken for each clone and planted vertically. The experiment was replicated two times and 15 cuttings were used per treatment. Rooting percentages were recorded 20 days after the cuttings were planted.

RESULTS

Propagation

The percentage of rooting was almost 100 % in both substrates under high light intensity whereas it was 0–7 % under low light intensity (Table 1). However, all perlite treatment showed slightly less rooting than peat moss: perlite substrate (data not shown). The optimal treatment condition for *Nirembergia* cutting establishment was high light intensity (14,000 lux) with peat moss: perlite substrate.

Clone Description

‘Estrella INTA-JICA’ is moderately tall with plant height of 10 to 15 cm. Its leaves are green (137B) and lanceolate in shape, measuring 22 to 25 mm long and 3 to 4 mm wide. The five white single-petal flower of 27 to 30 mm diameter has a yellow (14B) center with a violet dark border (87B) in star shape. The average diameter of the yellow spot is 8.14 mm (SD=0.03) and the violet border is 11 mm (SD=0.04) (Table 2).

‘Luna INTA-JICA’ is also moderately tall. Its plant height is 10 to 15 cm, leaves are green (137B) and lanceolate in shape measuring 12 to 15 mm long, and 3.5 to 5 mm wide, and flower diameter is 25 to 27 mm. The five white single-petal flower has a clearly defined purple-violet (82C) spot with a small yellow center (12A) of average diameter of 9.3mm (SD=0.06) and 4.75mm (SD=0.03), respectively (Table 2).

‘Nube INTA-JICA’ is also moderately tall with plant height of 10 to 15 cm. Its leaves are dark green (137A) and lanceolatein shape, measuring 20 to 25 mm long, and 3
to 5 mm wide, and its flower diameter is 37 to 40 mm. The five white single-petal flower has a violet spot (87A) with an average diameter is 11 mm (SD=0.06) and the yellow center (9A) is 4.75 mm (SD=0.03) in average diameter (Table 2).

CONCLUSION
Though there are some cultivars of Nierembergia released in the U.S.A. and Japan but their flowers are restricted to either white or purple. The breeding effort of our group is expected to release novel cultivars having various flower colors and growth habits. The ornamental value of our three Nierembergia clones is based on their flowering habit and flower characteristics such as size and colors. The flower size of ‘Nube INTA-JICA’ is bigger than the other two clones and will be used as breeding materials for “Giant Flower Nierembergia”. In addition, the corolla of ‘Luna INTA-JICA’ and ‘Estrella INTA-JICA’ have unique and conspicuous color and pattern combination such as ‘Moon’ and ‘Star’ shape, respectively. Further breeding program for the creation of new cultivars having great ornamental potential in Nierembergia is in progress.

ACKNOWLEDGEMENTS
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Literature Cited
## Tables

### Table 1. Rooting of the cuttings of three *Nierembergia* clones.

<table>
<thead>
<tr>
<th>Clones</th>
<th>No. of cuttings examined</th>
<th>% of rooted cuttings</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Estrella INTA-JICA”</td>
<td>30 HL ( \geq ) 30 LL</td>
<td>100.0 a</td>
</tr>
<tr>
<td>“Luna INTA-JICA”</td>
<td>30 HL</td>
<td>95.0 a</td>
</tr>
<tr>
<td>“Nube INTA-JICA”</td>
<td>30 HL</td>
<td>100.0 a</td>
</tr>
</tbody>
</table>

\( \geq \) Light condition : LL 2,400 lux and HL 14,000 lux, respectively.

\( a \) State the statistical test and the meaning of the letters.

### Table 2. Morphological characteristics of the three *Nierembergia* clones.

<table>
<thead>
<tr>
<th></th>
<th>Size (cm) ( \geq )</th>
<th>Color (RHSCC N°.) ( a )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Growth habit</td>
<td>Flower diameter</td>
</tr>
<tr>
<td>“Estrella INTA-JICA”</td>
<td>Semi-decumbent</td>
<td>2.89 b</td>
</tr>
<tr>
<td>“Luna INTA-JICA”</td>
<td>Erect</td>
<td>2.59 a</td>
</tr>
<tr>
<td>“Nube INTA-JICA”</td>
<td>Erect</td>
<td>3.87 c</td>
</tr>
</tbody>
</table>

\( a \) N°. of the Royal Horticultural Society Colour Chart.

State the statistical test and the meaning of the small letters.