

***Begonia* “Tuti Siregar” (*Begonia listada* Smith & Wasshausen x *Begonia acetosa* Vellozo): a new cultivar from Bali Botanic Garden, Indonesia**

HARTUTININGSIH-M. SIREGAR^{1,2}, I MADE ARDAKA¹, MUSTAID SIREGAR^{1,2}

¹Bali Botanic Garden, Indonesian Institute of Sciences (LIPI), Candikuning, Baturiti, Tabanan 8219, Bali, Indonesia.

²Centre for Plant Conservation-Bogor Botanic Gardens, Indonesian Institute of Sciences LIPI, Jl. H. Juanda 13, Bogor 16122, West Java, Indonesia, Tel. +62-251-8322187; Fax. +62-251 8322187, email: hartutiningsih@yahoo.co.id

Manuscript received: 9 September 2009. Revision accepted: 28 December 2009.

ABSTRACT

Siregar HM, Ardaka IM, Siregar M (2010) Begonia “Tuti Siregar” (Begonia listada Smith & Wasshausen x Begonia acetosa Vellozo): a new cultivar from Bali Botanic Garden, Indonesia. Biodiversitas 11: 15-18. A new *Begonia* cultivar was generated by crossing *Begonia listada* Smith & Wasshausen with *Begonia acetosa* Vellozo at Bali Botanic Garden began in 2005. The female flowers of *B. listada* were pollinated with pollen grains from *B. acetosa*. *Begonia listada* is characterized by the following characters: erect, non rhizomatous, branched subshrub to 1 m tall; leaves: blade above bronze, beneath purple with two pale green veins. *B. acetosa* has the following characters: creeping rhizomatous perennial to about 1 m tall; leaves: thick, blade above olive green, beneath bright red, both surfaces with a dense covering of short stiff white hairs. The results of crossing is, herb, erect, non-rhizomatous, 40-75 cm height, stem brownish green, hairy, stipules in pairs, marcescent, ascending, membranous. Leaves, beautiful asymmetrical leaves intermediate between both parents; petiole deeply red, covered with wooly hairs, veins yellow like *B. listada*. The new cultivar, *Begonia* “Tuti Siregar”, has the American *Begonia Society* registration number 1001 (Salisbury 2008).

Key words: *Begonia* “Tuti Siregar”, Bali Botanic Garden, Indonesia, new cultivar.

INTRODUCTION

Wild begonias are very abundant in Indonesia, especially in the herb layers of mountain rainforests (Tebbutt 2005). There are more than 200 indigenous Indonesian begonias, which are distributed in Java, Sumatra, Kalimantan, Sulawesi and Papua. Papua is the most species-rich region with 70 species. More than 1600 species of *Begonia*, which show a pantropical distribution, have been described (Kiew 2005). In the tropical zone, begonias can grow and adapt well from the lowland up to the highland. At 1400 m above sea level (m a.s.l), these plants need light intensities between 30-60%.

Begonias can be quickly propagated and grown at Bali Botanic Garden in Indonesia. This Garden encompasses 154 ha at an altitude of 1250 m a.s.l. The propagation of begonias commonly requires well-lit conditions, the light usually filtered by netting which absorbs 70% of the light intensity. Researchers of Bali Botanic Garden have conducted floristic explorations of the entire Indonesian archipelago collecting begonias for ex-situ conservation. More over, seed exchange with both national and international conservation institutions and seed donations have increased the species number in the collection. In 2009 the collection comprised 81 indigenous Indonesian species and 213 exotic. These collections have a great potential for the generation of cultivars, and make Bali Botanic Garden as a center for conservation of *Begonia* in Indonesia (Hoover et al. 2006). The objectives are to save

Begonia species from the threat of extinction, and to cultivate and propagate them. In addition to the conservation research, the potential of begonias as ornamental plants, and the generation of cultivars, either directly or through a cross-breeding approach, have been investigated. These cultivars can be used for commercial purposes.

The aims of these studies were to obtain a new hybrid of *Begonia* amalgamating the characters of both parents and to create unique character combinations including erect, ovate leaves with yellow veins and a bright red lower leaf surface.

MATERIALS AND METHODS

Crossbreeding research on two species of *Begonia* (*B. listada* and *B. acetosa*) has been conducted at the nursery of Bali Botanic Garden since 2005. The garden is located at 1250 m a.s.l, with day time temperatures of 24-26°C, 18-20°C in the night, and 70-90% of humidity.

The female flowers of *B. listada* were pollinated with pollen grains from *B. acetosa*. *Begonia listada* is characterized by the following characters: erect, non rhizomatous, branched subshrub to 1 m tall; leaves: blade above bronze, beneath purple with two pale green veins. *Begonia acetosa* has the following characters: creeping rhizomatous perennial to about 1 m tall; leaves: thick, blade above olive green, beneath bright red, both surfaces with a dense covering of short stiff white hairs.

The *Begonia* crossbreeding was conducted in the morning at 09.00-10.00 a.m. The crossing method followed Hooley (1999) and Siregar (2008a,b). Pollen was taken using a cotton bud and smeared directly on the stigma of *B. listada* flowers. The flowers were then wrapped with clear plastic bags. After fruit production the plastic bags were opened and the fruits left to ripen. A label was put on the plants, which contained information about the female and male parents, the crossing time and the breeder's name.

The crossing was repeated six times. The fruit ripening time, the picking time, and the time it took to raise the seedlings were documented. The seedlings were raised following Siregar et al. (2007). Sterile organic fertilizer (Kompenit, trade mark of organic fertilizer, produced by Bali Botanic Garden) was used. The pots were placed into container containing water to maintain high humidity. The pots were sealed and only opened after the seeds had germinated. After the development of two leaves the plants were transferred into trays with a substrate containing 75% organic fertilizer. After they developed four leaves they were planted in pots or poly bags.

RESULTS AND DISCUSSIONS

Crossing time

There was a high rate of successful crosses. From six repeats, 50% of the hand-pollinated flowers developed into mature fruits. The reasons for this are the good growing conditions at Bali Botanic Garden, especially the glass house temperatures. Optimum temperatures for most begonias are in the range of 13-29°C. The vast majority of them require a relative humidity between 40 and 60% (Tebbitt 2005). Some studies indicate that pollination is more successful in the morning than in the early evening. Sanusie et al. (2008) showed that pollination of *Anthurium* reached a success rate of 90% in the morning, while the success rate in the early evening was only 70%. Successful pollination depends on several factors such as cleanliness of the tools to avoid contamination, the timing, and the crossing protocol. Failure of pollination is indicated by wilting and falling of the flowers, and the lack of fruit set.

Fruits ripened in 30-45 days after fertilization. The color of the fruit changed from green to brownish. The mature brownish fruit was picked and placed into an envelope to avoid seed release. The next step was to open the fruits and to separate the seeds from the pericarp.

Time after harvest and cultivation of seedling

Fruit harvesting was conducted when the fruits were physiologically ripe, as indicated by a brownish or yellow color and wilted peduncles, but before the seeds were released. The usage of specific materials helps to accelerate the seed germination. The seed germinated about 11-40 days after they were sown. A flexible watering regime and fertilization are essential for the care of the seedlings. Numerous factors including the climate, and the growing medium influence how much water a plant needs at a particular time. Over watering and a lack of adequate atmospheric humidity are probably the two most common reasons why begonias and other cultivated tropical plants

are lost. The most common symptoms of over watering among begonias are dropping of leaves, root rot, and wilted stems.

Hybrid morphology

The morphology of about 60 seedlings has been documented and four different groups can be recognized: (i) Group with asymmetrical leaves. The leaf color is intermediate between both parents, the blade is ovate like in *B. acetosa* and fused with yellow veins like in *B. listada*. Blade green above, hairy, ovate, 15-17 x 10-11 cm, venation palmate, primary veins 7-8, bright yellow; beneath deeply red with pink hairs. This group shows characters which are intermediate between the two parents. Seedlings of this group grew in thirty pots. (ii) Group with symmetrical leaves. Crossing of the two species resulted in plants with symmetrical, orbicular leaves, which are unusual in *Begonia*. Blade green above, veins pale. The habit in this group is cane-like, erect, with flat stems. Seedlings of this group grew in ten pots. (iii) Group with leaf asymmetry resembling *B. acetosa*. Blade green above, hairy, beneath bright red, veins invisible. Seedlings of this group grew in ten pots. (iv) Group with not uniform leaves. Blade green above, hairy, beneath bright red, veins invisible. Seedlings of this group grew in ten pots.

To avoid the generation of hybrids which are not of interest for the breeder, groups two, three, and four were destroyed, while the first group was maintained and continually propagated.

Table 1. shows the characters of the new cultivar and the characters of the two parents. Characters of the new cultivar are: shrub-like habit (SL), erect, non-rhizomatous, height 40-75 cm, internodes 3-4 cm. These are the dominant characters of *B. listada*. Thomson (2007a,b) showed that a cross using the cane-like type (CL) as either the female or the male parent with the rhizomatous type (Rh) will always result in a new plant with the CL type.

The new cultivar at Bali Botanic Garden has been propagated using cuttings, and more than 200 pots were available at the time of writing. The next step was to register the cultivar with the *American Begonia Society*, providing data like the name of the hybrid plant, data of the parents, the breeder's data, the time of pollination, first flowering data, the date of request, the plant description, photographs, illustrations, and herbarium voucher details.

The cultivar name "Tuti Siregar" was chosen as reference to the breeder. Crossbreeding of *Begonia* is common abroad, but for me and Bali Botanic Garden, this was the first time to obtain a new hybrid name from a legal institution. There are some necessary requirements for designating a name for a hybrid in accordance with the regulations of the *American Begonia Society*: the hybrid plant name must be original, it the prefix of *the*, and some other requirements. At the time of writing, the name of *Begonia* "Tuti Siregar" was registered less than a year ago and it is now legitimately registered with the *American Begonia Society, USA*, as a new cultivar with the registration number 1001 (Salisbury, 2008). Herbarium specimen collector Hartutiningsih no. HK 866, kept in Herbarium of Bali Botanic Garden as a reference this new cultivar.

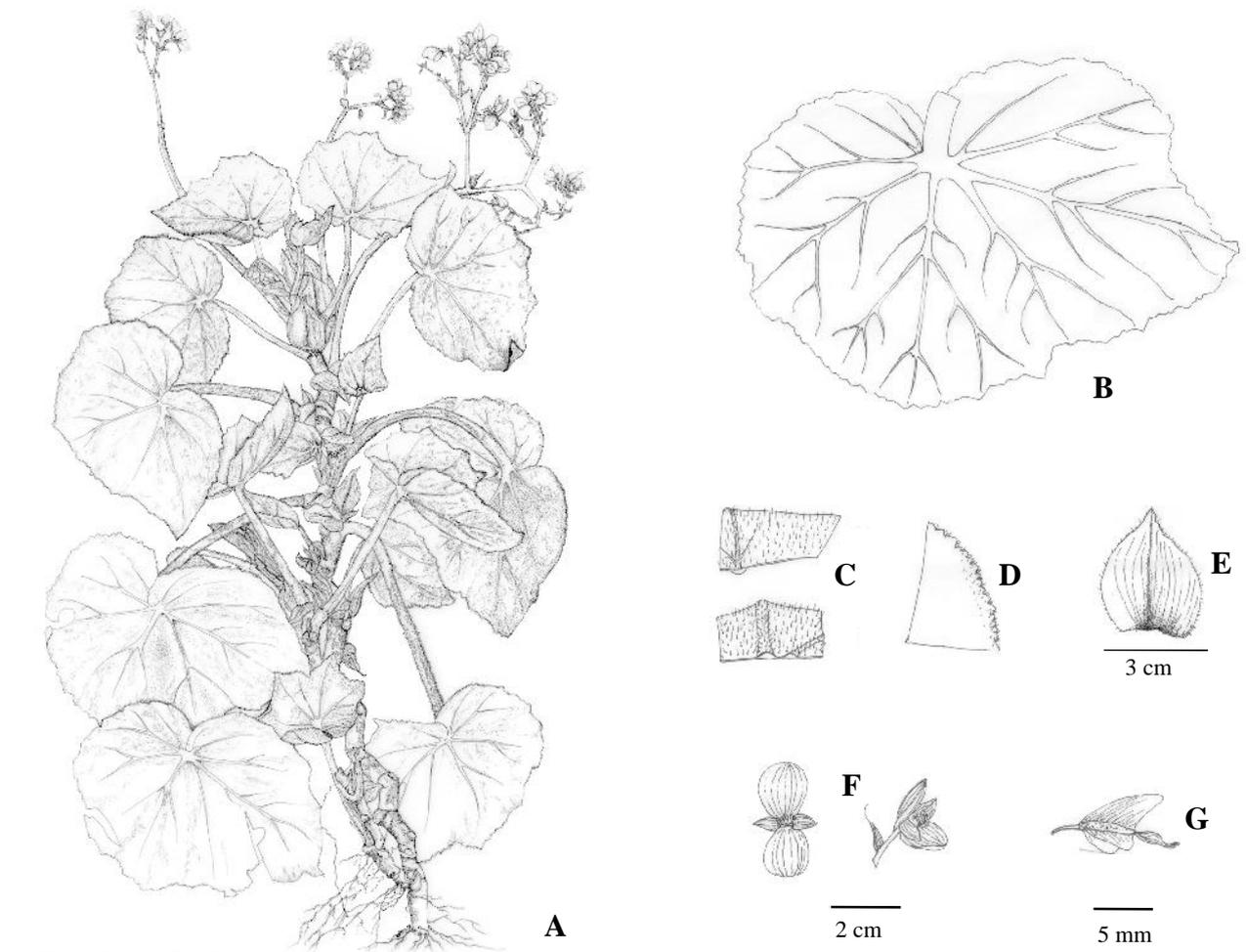


Figure 1. *Begonia* “Tuti Siregar”. A. General appearance, B. Entire leaf, C. Leaf cross section, D. Leaf margin, E. Stipule, F. Pistillate flower, G. Staminate flower.

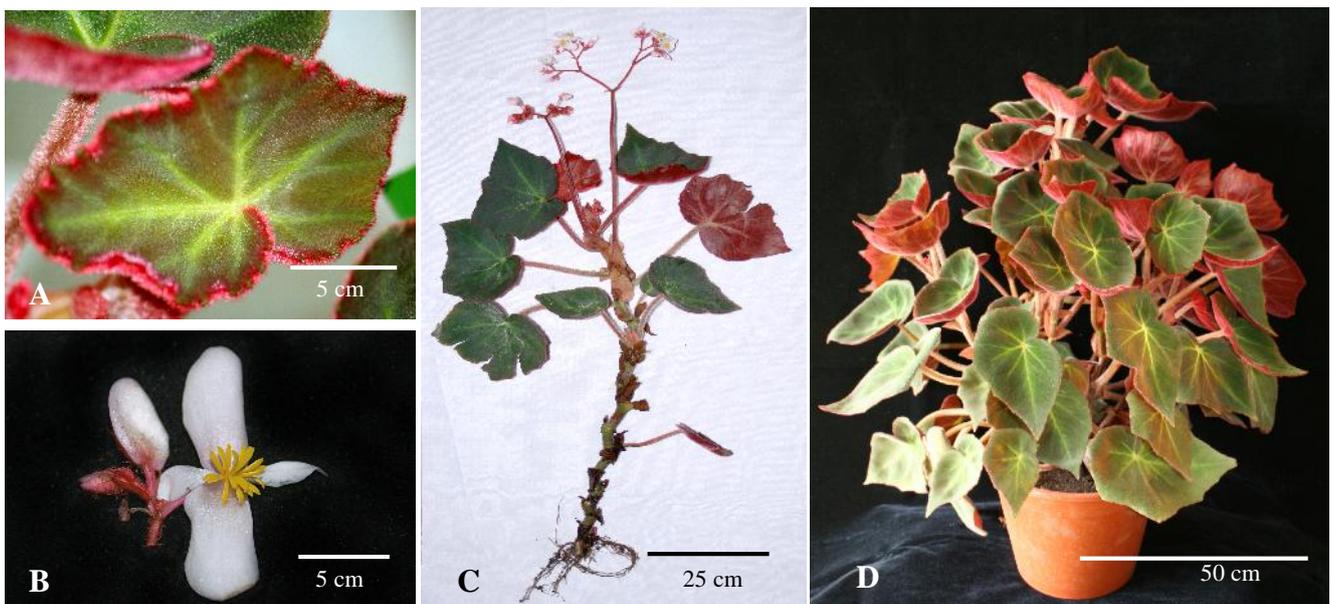


Figure 2. *Begonia* “Tuti Siregar”. A. leaf, B. flower, C and D. habit.

Table 1. Morphological comparison of *B. listada*, *B. acetosa* and F1 *Begonia* "Tuti Siregar".

| Characters | <i>B. listada</i> | <i>B. acetosa</i> | F1 = <i>B. "Tuti Siregar"</i> (<i>B. listada</i> x <i>B. acetosa</i>) |
|------------------------|---|--|--|
| Plant shape | CL = cane-like | Rh = rhizomatous | SL = shrub-like |
| Plant height | 30-75 cm tall | 35-40 cm tall | 40-75 cm tall |
| Internodus | 3 cm | 1-2 cm | 3-4 cm |
| Stipules | White, small, 1.5x1 cm | Dry, small | Reddish, pairs, white hairy, 3.8-2.7 cm. |
| Leaves: | | | |
| Blade | Above bronze beneath purple Hastate, 6-10x3.5-5 cm, asymmetry | Above olive green, beneath bright red Ovate to almost orbicular, 4-18x3.3-13 cm, asymmetry | Above green, beneath deep red Ovate to almost orbicular, 15-17x10-11 cm, asymmetry |
| Margin | Very shallowly toothed and ciliate | Minutely toothed | Serrulate |
| Base | Very obliquely cordate | Cordate | Very obliquely cordate |
| Apex | Acuminate | Abruptly short acuminate | Truncate |
| Petiole | Pale green to pink with short white hairs, 4.5-15 cm long | Rust-brown to red, covered with wooly hairs, 6-30 cm long | Deep red, covered with wooly hairs, lanate, 12-15 cm long |
| Inflorescence | Axillary, few-flowered Bisexual Cymose | Axillary, many-flowered Bisexual Cymose | Axillary, many-flowered Bisexual Cymose |
| Male flowers: | | | |
| Tepals | Four, white Outer pair ovate-cordate to almost orbicular; 1.1-1.5x1.1-1.5 inner pair narrowly obovate 1-1.2x0.3-0.4 cm | Four, white Outer pair elliptic; 10-12x5-8 mm, inner pair narrowly elliptic, 7-14x1.5-3 mm | Four, white Outer pair ovate; 1.2x1.3 cm, inner pair obovate 0.8x0.4 cm |
| Stamens | About 25-35, arranged symmetrically, anther connectives projecting | About 20-30, arranged in a symmetric mass on top of a column, anther connectives projecting | Many, yellow, arranged symmetrically |
| Female flowers: | | | |
| Tepals | Five, white sometimes tinged red Narrowly to broadly elliptic, slightly unequal 0.7-1.5x0.4-1 cm | Five, white Outer two narrowly elliptic 0.6-10x0.15-2 cm, inner three elliptic 1-1.3x0.4-0.5 cm | Four, white Outer pair ovate, inner 0.6x0.3 cm, inner pair narrowly elliptic 0.4x0.2 cm |
| Ovary | Green with a pink tinge, hairy Unequally three-winged, 0.5-1x0.25-0.48 cm | White, hairy Unequally three-winged, 0.6-1.1x0.3-0.5 cm | White, hairy Unequally three-winged 0.9x0.5 cm |
| Peduncle | 20-25 cm tall | 28-57 cm tall | 16-24 cm tall |

obovate, 0.8x0.4 cm; stamens yellow, numerous. **Female flowers:** tepals 4, white, outer pair ovate, 0.6x0.3 cm, glabrous, inner pair narrowly elliptic, 0.4x0.2 cm; ovary white, glabrous, unequally three-winged, 0.9x0.5 cm. **Flowering season:** December-February. The propagation methods most commonly used for *Begonias* are stem and leaf cuttings, and division of a large plant into two or more smaller ones (Figure 1 and 2).

ACKNOWLEDGEMENTS

We are deeply indebted to Dr. Harry Wiriadinata, Herbarium Bogoriense, The Research Centre of Biology, The Indonesian Institute of Sciences; Dr. Scott W. Hoover, New England Conservatory, Vermont, USA, for their expertise, advice, and their essential support of our research. We are also very grateful to Daniel C. Thomas, Royal Botanic Garden Edinburgh, UK and Bramantyo T.A. Nugroho who had helped us to edit this paper.

CONCLUSIONS

Description of *Begonia* "Tuti Siregar" (*B. listada* Smith & Wasshausen collector Hartutiningsih, no HK 674 x *Begonia acetosa* Vellozo collector Hartutiningsih, no HK 676)

Herb, erect, non-rhizomatous, 40-75 cm height. Stem brownish green, hairy, 1-2 times branched. Stipules in pairs, marcescent, ascending, membranous, 3.8x2.7 cm. **Leaves:** beautiful asymmetrical leaves intermediate between both parents; 20-24 per stem; petiole deeply red, covered with wooly hairs, lanate, 12-15 cm long; blade almost circular like *B. acetosa*, veins yellow like *B. listada*, ovate, 15-17x10-11 cm, base very obliquely cordate, apex truncate, above green, with wooly hairs, beneath deep red with pink wooly hairs, venation palmate with 7-8 primary veins, veins bright yellow. Margin serrulate; **Inflorescence:** axillary, 6-8, many-flowered with 16-27 flowers, bisexual, cymose, peduncle 16-24 cm long, bracteoles 1.1x0.4 cm, soon falling. **Male flowers:** tepals 4, white, outer pair covered with short pink hairs, ovate, 1.2x1.3 cm, inner pair

REFERENCES

- Holley F (1999) Setting and saving seed for species conservation. A Seminar for SWR-American Begonia Society-USA, May 1999.
- Hoover SW, Hunter JM, Wiriadinata H, Girmansyah D (2006) *Begonias* at Bali Botanic Gardens, Indonesia. *Begonian*. November-December 2006: 224-225.
- Siregar HM, Ardaka IM, Siregar M (2007) Masa berbunga 22 jenis *Begonia* alam di Kebun Raya "Eka Karya" Bali. *Biodiversitas* 8: 188-192
- Siregar HM (2008a) Mengenal dan merawat *Begonia*. PT Agromedia Pustaka, Jakarta.
- Siregar HM (2008b) *Begonia* "Tuti Siregar", the new hybrid from Bali Botanic Garden-Indonesia. *Begonian*. September/October 2008: 214-217.
- Kiew R (2005) *Begonias* of Peninsular Malaysia. Natural History Publications (Borneo) Sdn. Bhd, Kota Kinabalu, Sabah, Malaysia.
- Salisbury G (2008) New cultivar *Begonia* "Tuti Siregar" (*Begonia listada* Smith & Wasshausen x *Begonia acetosa* Vellozo). Official International Registration number 1001. *Begonian*. September/October 2008: 212-213.
- Tebbutt MC (2005) *Begonias*: cultivation, identification, and natural history. Brooklyn Botanic Garden, New York.
- Thompson B (2007a) *Begonia* registration handbook. www.begonias.org/registered/registeredAF.htm. [19 December 2007].
- Thompson B (2007b) Hybridizing page, hints on hybridizing. www.begonias.org/registered/registeredAF.htm. [19 December 2007].
- Sanusie I, Qodriyah L (2008) Teknik penyerbukan silang dan pembibitan *Anthurium*. www.kebonkembang.com/mod.php?mod=publisher&op=viewarticle&artid=164. [1 January 2008].