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Three New Varieties of *Hoya ilagiorum* (Kloppenburg, Siar & Cajano)

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Three new varieties of *Hoya* were registered to the Germplasm and Technology Release and Registration Office of the Institute of Plant Breeding, College of Agriculture and Food Science, University of the Philippines Los Baños and the National Seed Industry Council, Bureau of Plant Industry, Department of Agriculture in 2020 and 2023, respectively. These are open-pollinated (OP) segregants of *Hoya ilagiorum* (Kloppenburg, Siar & Cajano) that were generated in 2010. Evaluation of OP seedlings started in 2012 and the selection of promising segregants yielded 3 varieties, namely 'Moonlight', 'Sunkissed', and 'Starburst'. 'Moonlight' has a dainty creamy yellow inflorescence consisting of 31 to 112 individual flowers forming a semi-globose to globose umbel akin to a full moon during anthesis, thus the name. 'Sunkissed', with its striking leaves, also has a semi-globose to globose umbel composed of 37 to 73 individual flowers, each with a shiny and highly reflexed corolla in varying shades of yellow with brownish-pink edges. 'Starburst' has 21 to 81 individual flowers forming a semi-globose umbel. The corolla has 2 color combinations that are visible even prior to flower opening — the principal color is creamy yellow with a thick, reddish outline along the edges of the lobes, forming a band-like pattern. These are the first varieties under the genus *Hoya* that are officially registered in the Philippines.

Keywords: hoya, *Hoya ilagiorum* 'Moonlight', 'Sunkissed', 'Starburst', NSIC-registered, variety

Introduction

The Philippines possesses one of the richest and most diverse ranges of *Hoya* species globally (Kloppenburg and Siar 2009). *Hoya*, which belongs to the Apocynaceae family, is characterized by shiny, waxy leaves, hence the common name 'wax plant'. Most *Hoya* species have climbing or vining habits; however, some species are short and bushy. The flowers have a star-like resemblance and some species emit scents upon anthesis or flower opening, which usually happens in the evening or early morning (Siar 2005; Aurigue 2013).

Hoyas can be found all over the Philippines at all altitudes, with about 198 species validly published (Pelser et al. c2011; Aurigue 2013). This group of plants is becoming increasingly popular in the country, as evidenced by its rising prominence as an ornamental plant in various social network groups and pages. Social media has become an effective platform for interactive discussions and exchanges of information among hoya enthusiasts and hobbyists. It also provided opportunities for small local plant traders/garden owners to advertise and sell their products. Hence, there is a growing awareness and utilization of hoyas in the local community, in addition to their existing prominence abroad.

As with any ornamental crop, new hoya variants are consistently being sought and pursued. The Institute of Plant Breeding (IPB), College of Agriculture and Food Science (CAFS), University of the Philippines Los Baños (UPLB) has a substantial hoya collection that includes native and introduced species. These different accessions are being utilized in the breeding activities under the IPB Ornamental Crops Varietal Improvement Program. From these different species, a few produced open-pollinated (OP) follicles/seeds with segregating progenies. These segregating populations were evaluated and outstanding segregants were selected as potential varieties. One that spontaneously produced follicles was *Hoya ilagiorum*, an endemic species with a reddish-orange corolla and a light pink corona (Fig. 1). This twining herb was discovered in Mt. Mabilog, Nagcarlan, Laguna, Philippines and was first published as a new species in 2011 (Kloppenburg et al. 2011; Royal Botanic Gardens, Kew c2017).

Materials and Methods

Hoya breeding at IPB started in 2010 under the core-funded project "Genetic diversity conservation, utilization and improvement in Philippine Ornamentals: *Mussaenda*, *Hoya*, *Medinilla*, Nepenthes, foliage and flowering trees". One of the objectives was to develop novel and/or improved varieties of the aforementioned crops.

All hoyas from the germplasm collection, including *H. ilagiorum*, were maintained inside IPB Screenhouse 2. The plants were established in 8 in-diameter hanging plastic pots and maintained under partial shade conditions. Necessary cultural management was employed, including spraying foliar fertilizer (15 + 15 + 30 + microelements) to boost flowering. Various insect species (i.e., ants) were observed to visit the hoya flowers especially during anthesis, which may have facilitated natural pollination.

Hoya 'Moonlight', 'Sunkissed', and 'Starburst' are outstanding selections from OP segregants of *H. ilagiorum*. These selections, together with their siblings, were initially evaluated during flowering in 2012 to 2013 (Fig. 1). Asexual propagation of promising selections to increase the number of plants for subsequent characterization was done during the 2019 to 2020 flowering seasons. A total of 32 horticultural characters were used in the morpho-evaluation of these varieties, 9 of which are quantitative traits: leaf length, leaf width, leaf thickness, number of flowers per umbel, umbel length, umbel width, pedicel length, corolla, and corona sizes. These traits were then measured using a ruler and/or digital caliper. Leaf and flower traits were collected from 10 random samples per plant, while the umbel trait was gathered from 5 umbels per plant, using 3 plants per variety. In addition, other flowering traits such as days from bud formation to anthesis, days to full anthesis, days to first and full flower senescence, and days to bud-to-bud cycle were noted. The Royal Horticultural Society (RHS) Colour Chart (RHS 2007) was used for qualitative traits such as leaf, sap, and flower colors. Further propagation was done to comply with the plant requirements necessary for variety registration. The outstanding selections were then applied to the Germplasm and Technology Release and Registration Office of IPB, CAFS, UPLB, and to the National Seed Industry Council (NSIC), Bureau of Plant Industry, Department of Agriculture and were approved as new varieties in 2020 and 2023, respectively.

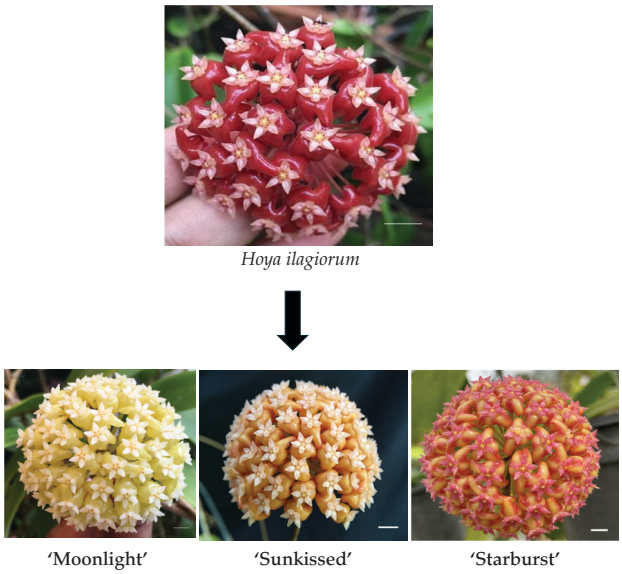

Fig. 1 Flower umbels of the parental *Hoya ilagiorum* and its 3 open-pollinated varieties (scale bar = 5 mm)

Results and Discussion

Hoya ilagiorum 'Moonlight'

Initially designated as Selection Hy 2010-007, this is an NSIC-registered OP variety (NSIC 2023 Or 109) named 'Moonlight' due to its inflorescence resembling a full moon. It has a vigorous woody climbing vine and shiny light green (144A) leaves. The lanceolate to ovate-lanceolate leaves are 9.20 to 19.00 cm long, 3.10 to 5.10 cm wide, and 0.69 to 2.69 mm thick; with a prominent midrib vein above and below; mostly with entire margins but others with slight undulations (Fig. 2). It has a dainty creamy yellow inflorescence which consists of 31 to 112 individual flowers forming a semi-globose to globose umbel measuring 35.00 to 54.21 mm × 20.00 to 50.78 mm (Fig. 3). The pedicel is 13.00 to 22.00 mm long and is very light green (145D) speckled with anthocyanin pigmentation. The corolla is glabrous, 5.70 to 10.90 mm in diameter, in different tints of yellow (3C, 6C, 7D, 12A), and highly reflexed during full anthesis, with each outer lobe curled under. It gradually flattens before dehiscence with a diameter of 8.66 to 14.06 mm. At the center of the corolla is a glossy white (155A) star-shaped corona. It is 4.79 to 7.70 mm in diameter and highly raised, with each of the 5 lobes pointing upward (Fig. 4). It has a strong ginger-like scent during anthesis (Tables 1 and 2). Anthesis started at 9 to 15 d from initial bud formation; the reference point was when the floral bud was 5 mm high from the base (spur tip) to the tip. In some floral spurs, individual flowers opened simultaneously on the first day (hence, full anthesis occurred in 1 d), while other umbels took 2 d to completely bloom. Flower dehiscence was observed as early as 3 d from the first flower opening. Thus, bloom longevity lasted for 3 to 6 d. However, 1 complete flowering cycle from initial bud formation to another bud formation on the same spur was noted at 21 to 35 d (Table 3).

Fig. 2 Growth habit of *Hoya ilagiorum* 'Moonlight'

Fig. 3 *Hoya ilagiorum* 'Moonlight' with reflexed (left) and flattened (right) corolla (scale bar = 5 mm)

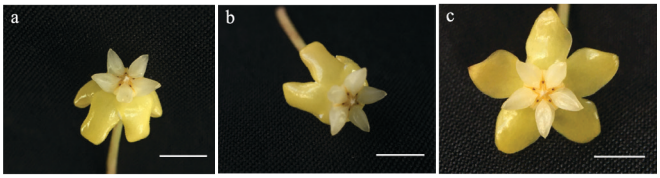

Fig. 4 Individual flowers of *Hoya ilagiorum* 'Moonlight' showing the a) and b) reflexed and c) flattened corolla and corona (scale bar = 5 mm)

Hoya ilagiorum 'Sunkissed'

Hy 2010-013 (NSIC Or 110) has a climbing habit and is one of the selections with the most striking leaves among segregants from *H. ilagiorum*. The leaves are ovate-lanceolate to ovate-elliptical in shape; 10.60 to 18.20 cm long, 3.80 to 6.10 cm wide, and 1.12 to 2.50 mm thick; and light green (144A) with very prominent anthocyanin pigmentation on the center of the adaxial surface. Some leaves have red-colored midribs and veins, making the plants look appealing even in the absence of flowers (Fig. 5). The inflorescence is a semi-globose to globose umbel composed of 37 to 73 individual flowers, with an umbel size of 46.00 to 55.00 mm × 39.00 to 50.00 mm (Fig. 6 and Table 1). It has a shiny and highly reflexed corolla that curls under during anthesis and is 6.62 to 12.52 mm in diameter, extending up to 11.23 to 14.03 mm when flattened. The corolla is in varying shades of yellow orange (15C, 18A, 20A, 20B) with brownish-pink (N172B/C) edges. The corona is translucent white (69B/C, N155C, 155C) with a slight tinge of pink along the edge of the inner lobe, 5.28 to 9.53 mm in diameter, and slightly raised (Fig. 7, Table 1). Flower opening from initial bud formation was noted as early as 11 d and as late as 14 d, with all the flowers in an umbel open all together. Dehiscence started 2 to 4 d from anthesis, with floral blooms lasting only for 3 to 5 d. In addition, 1 complete flowering cycle from bud development to succeeding bud formation on the same spur was noted at 17 to 33 d (Table 3).

Hoya ilagiorum 'Starburst'

Hy 2010-022, registered as *Hoya ilagiorum* 'Starburst' (NSIC Or 110), is a vigorous climbing vine with woody stems. The leaves are 8.50 to 19.60 cm long, 3.20 to 6.30 wide, and 0.93 to

Table 1 Comparative morphology of the parental *Hoya ilagiorum* and its 3 open-pollinated varieties 'Moonlight', 'Sunkissed', and 'Starburst'

Characters	*Hoya ilagiorum*	'Moonlight'	'Sunkissed'	'Starburst'
Plant growth habit	Twining	Twining	Twining	Twining
Leaf color	Yellow-green (146D)	Light green (144A)	Green with heavy anthocyanin pigmentation	Light green (144A)
Leaf shape	Lanceolate	Lanceolate to ovate-lanceolate	Ovate-lanceolate to ovate-elliptic	Ovate-lanceolate
Leaf length (cm)	11.80 – 12.60	9.20 – 19.00	10.60 – 18.20	8.50 – 19.60
Leaf width (cm)	3.90 – 4.70	3.10 – 5.10	3.80 – 6.10	3.20 – 6.30
Leaf thickness (mm)	1.4 – 2.24	0.69 – 2.69	1.12 – 2.50	0.93 – 2.71
Leaf sap color	Milky white	Milky white	Milky white	Milky white, translucent white
Leaf, other notable traits	Leathery, variable in size, prominent veins, acuminate apex, margins rolled or folded back	Leathery, leaf margin entire but some are undulating; slightly visible midrib; apex acuminate	Thick leaves with very prominent veins, apex acute to acuminate, margins entire	Visible midrib and secondary veins above; apex acuminate; margin entire
Umbel shape	Semi-globose	Semi-globose to globose	Semi-globose to globose	Semi-globose
Umbel diameter (mm); widest part	38.80 – 53.40	35.00 – 54.21	46.00 – 55.00	46.00 – 56.00
Umbel, number of flowers	17 – 38	31 – 112	37 – 73	21 – 81
Pedicel color and other notable traits	Terete, granulate, slightly curved	Very light green (145D) with anthocyanin pigmentation	Very light green (145C) with slight tinge of anthocyanin	Yellow green (N144D, 145B)
Pedicel length (mm)	17.00 – 19.50	13.00 – 22.00	18.00 – 23.00	17.00 – 26.00

Table 2 Comparative corolla and corona traits of the parental *Hoya ilagiorum* and its 3 open-pollinated varieties 'Moonlight', 'Sunkissed', and 'Starburst'.

Characters	*Hoya ilagiorum*	'Moonlight'	'Sunkissed'	'Starburst'
Corolla main color	Reddish orange	Chartreuse yellow (3C), sulfur yellow (6C), yellow (7D), aureolin (12A)	Chrome yellow (15C), amber yellow (18A), chinese yellow (20A, 20B)	Chartreuse yellow (3C), dresden yellow (5D), sulphur yellow (6C/D), 149D
Corolla secondary color	None	None	Brownish pink (N172B/C) along the edge of the corolla lobe	Rhodonite red (51B/C), Ruby red (59D)
Corolla size at full anthesis (mm)	7.90 – 11.90	5.70 – 10.90	6.62 – 12.52	7.35 – 11.96
Corolla size flattened (mm)	12.20 – 13.70	8.66 – 14.06	11.23 – 14.03	9.44 – 15.83
Corolla, other notable traits	Reflexed with outer corolla lobe curled under during full anthesis and flattened towards senescence	Reflexed with outer corolla lobe curled under during full anthesis and flattened towards senescence	Reflexed with outer corolla lobe curled under during full anthesis and flattened towards senescence; glossy	Reflexed during full anthesis and flattened towards senescence; secondary color diffused along the edge of each lobe in a band-like pattern
Corona main color	Light pink	Glossy white (155A)	Translucent white (69B/C, N155C, 155C)	Mallow purple (72C/D)
Corona secondary color	None	None	With slight tinge of pink along the edge of inner	None
Corona size (mm)	5.50 – 6.50	4.79 – 7.70	5.28 – 9.53	5.34 – 6.97
Corona, other notable traits	Slightly raised	Highly raised compared to parent	Slightly raised	Slightly flattened

2.71 mm thick; shiny and light green (144A) in color; ovate-lanceolate; with a visible midrib and secondary veins above, entire margins, and the presence of anthocyanin along the midrib and edges (Fig. 8). It has the most outstanding color of inflorescence among the selections; it consists of 21 to 81 individual flowers forming a semi-globose umbel measuring 46.00 to 56.00 mm × 30.00 to 51.60 mm (Fig. 9). The pedicel is very long at 17.00 to 26.00 mm and yellow green (N144D, 145B) in color (Table 1). The corolla is glabrous, reflexed during full anthesis with each outer lobe curled under, 7.35 to 11.96 mm in diameter, and flattens towards dehiscence with a diameter of 9.44 to 15.83 mm. The corolla has 2 color combinations that are visible even prior to flower opening, making it unique among segregants. The principal color is creamy yellow (3C, 5D, 6C/D, 149D) with a thick, reddish (51B/C, 59D) outline along the edges of the lobes, forming a band-like pattern. At the center is a glossy, mallow purple (72C/D) corona that is 5.34 to 6.97 mm in diameter and slightly flattened (Fig. 10; Table 2). Days to first flower opening took 10 to 16 d from initial bud formation. All flowers opened simultaneously on the first day of anthesis and started to dehisce as early as 2 d from the first flower opening and took 5 d for complete dehiscence. Thus, bloom longevity lasted only for 2 to 6 d. Furthermore, 1 complete flowering cycle from initial bud formation to another bud formation on the same spur was recorded at 23 to 28 d (Table 3).

The floral characters of these 3 new varieties are significantly different from the female parent. Notable differences observed are the color of the corolla and the presence of secondary colors in varieties 'Sunkissed' and 'Starburst', which are the major traits that set these new varieties apart from their female parent *H. ilagiorum*.

Fig. 5 Growth habit (left) of *Hoya ilagiorum* 'Sunkissed' and leaves with prominent venation and anthocyanin pigmentation (right)

Fig. 6 *Hoya ilagiorum* 'Sunkissed' with reflexed (left) and flattened (right) corolla (scale bar = 5 mm)

Fig. 7 Individual flowers of *Hoya ilagiorum* 'Sunkissed' showing the a) and b) reflexed and c) flattened corolla and corona (scale bar = 5 mm)

Table 3 Horticultural and other notable characters of the 3 open-pollinated varieties 'Moonlight', 'Sunkissed', and 'Starburst'.

Characters	'Moonlight'	'Sunkissed'	'Starburst'
Days to first anthesis from initial bud formation	9 – 15	11 – 14	10 – 16
Percent flowers opened at first anthesis	35 – 100	100	100
Days to 100% full anthesis from bud formation	11 – 17	11 – 14	10 – 16
Days to start of senescence from first anthesis	1 – 4	2 – 4	2 – 5
Percent of flowers that dehisced at start of flower senescence	6 – 84	6 – 95	12 – 100
Days to 100% flower senescence from 1st anthesis	3 – 6	3 – 5	2 – 6
Days to bud-to-bud development	21 – 35	17 – 33	23 – 28
Scent	Strong (ginger-like scent)	Strong (lemony scent)	Very faint

Fig. 8 Growth habit (left) of *Hoya ilagiorum* 'Starburst' and its leaves with slight anthocyanin pigmentation (right)

Fig. 9 *Hoya ilagiorum* 'Starburst' with reflexed (left) and flattened (right) corolla (scale bar = 5 mm)

Fig. 10 Individual flowers of *Hoya ilagiorum* 'Starburst' showing the a) and b) reflexed and c) flattened corolla and corona (scale bar = 5 mm)

Dichotomous Key to Three *Hoya* Varieties and Female Parent

A dichotomous key was developed based on vegetative and reproductive traits (Table 4). Qualitative morphological characters that are both easily observable and taxonomically informative were used to differentiate the 3 varieties and the female parent. Four leaf traits (shape, venation, anthocyanin pigmentation, and margin) and 5 floral traits (corona and corolla main colors, presence/absence of corona and corolla secondary colors, and corolla secondary color) are the delineating key characters that separate the 4 genotypes from one another.

The first delineating trait presented is the leaf shape; the female parent (*H. ilagiorum*) and 'Moonlight' have a lanceolate shape, while the other 2 varieties have an ovate-lanceolate to ovate-elliptic shape. Obscure leaf venation with a slightly visible midrib is exhibited by 'Moonlight' in contrast to the

Table 4 Key to the parental *H. ilagiorum* and OP varieties 'Moonlight', 'Sunkissed', and 'Starburst' based on qualitative morphological characters.

Key to the *Hoya ilagiorum* varieties based on vegetative characters
1a. Leaf shape lanceolate 2
1b. Leaf shape ovate-lanceolate or ovate-elliptic 3
2a. Leaf venation prominent, visible midrib 4
2b. Leaf venation obscure, slightly visible midrib ..... *H.* 'Moonlight'
3a. Leaf with heavy and prominent anthocyanin pigmentation .... *H.* 'Sunkissed'
3b. Leaf without to slightly anthocyanin pigmentation ..... *H.* 'Starburst'
4a. Leaf margin rolled or folded back ..... *H. ilagiorum*
4b. Leaf margin entire with some undulation ..... *H.* 'Moonlight'[a]

[a] If leaf shape is lanceolate

Key to the *Hoya ilagiorum* varieties based on reproductive characters
1a. Corona main color, white 2
1b. Corona main color, pink to purple 3
2a. Corona secondary color, present ..... *H.* 'Sunkissed'
2b. Corona secondary color, absent ..... *H.* 'Moonlight'
3a. Corolla main color, red-orange ..... *H. ilagiorum*
3b. Corolla main color, yellow 4
4a. Corolla secondary color, present 5
4b. Corolla secondary color, absent ..... *H.* 'Moonlight'[b]
5a. Corolla secondary color, brownish pink ..... *H.* 'Sunkissed'
5b. Corolla secondary color, red..... *H.* 'Starburst'

[b] If corona main color is white

other 3 which have prominent leaf venation and a visible midrib. 'Sunkissed' exhibits heavy and prominent anthocyanin pigmentation on the leaves, while the other 2 varieties and the parent have only slight leaf pigmentation. Both 'Sunkissed' and' Starburst' have entire leaf margins, while *H. ilagiorum* has a rolled or folded back, and 'Moonlight' has some degree of undulation.

In terms of floral traits, 'Moonlight' and 'Sunkissed' possess a white corona primary color whereas the female parent and 'Starburst' have a pink to purple color. Secondary color is present in 'Sunkissed' and the parent but is absent in 'Moonlight' and 'Starburst'. In terms of corolla color, all 3 varieties fall under the yellow color group based on the RHS Colour Chart (RHS 2007) in contrast to the parent with red-orange color. Moreover, *H. ilagiorum* and 'Moonlight' do not have a secondary corolla color, while 'Sunkissed' and 'Starburst' have brownish-pink and red colors, respectively.

Conclusion

The 3 new varieties of *Hoya ilagiorum* are the first hoya varieties officially registered in the Philippines. These are outputs of the Institute of Plant Breeding (IPB), College of Agriculture and Food Science (CAFS), University of the Philippines Los Baños (UPLB) and the Department of Science and Technology - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) core-funded projects entitled "Genetic Diversity Conservation, Utilization and Improvement in Philippine Ornamentals: *Mussaenda, Medinilla, Hoya,* Foliage and Ornamental Trees" and "Varietal Development in Philippine Native Hoyas", respectively. Propagation is ongoing for commercialization through the National Seed Foundation, IPB, CAFS, UPLB.

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