THE LIMA ORCHID

BY

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ABSTRACT

The habitat and identity of the "Lima-orchid" *Chloraea sp*., have been amply debated. Recent work carried out at Lomas de Asia, [close to Lima], where a single specimen of *Chloraea* was identified as *C. undulata*, re-sparked the debate. Here new research on this orchid, its identification and its alleged new habitat are presented, together with a recompilation of the studies carried out on species of *Chloraea* from coastal Peru. The Lima orchid is identified as *Chloraea pavonii*, and *C. undulata* is relegated under its synonymy.

In 2015, an article was published in Lima about the rediscovered “Lima Orchid”, found on the hills at Lomas de Asia (Llellish Juscamayta 2015), which re-sparked debates on the possible new habitat and identity of *Chloraea,* the famous “Lima Orchid”.

Let us start with the article by Llellish Juscamayta (2015), which has driven us to conduct this research. According to the author, the hills of Asia

were claimed by Raimondi, Weberbauer and Maish (Perú 2010. "Flora Perpetua" Arte y Ciencia botánica de Antonio Raimondi:Tomo III. Antonio Raimondi: Botánico Ilustre: 135-155. Lima) as the type location for *C. undulata* Raimondi. As a consequence of urban expansion, the author noted that the populations of the “Lima Orchid” have declined and, in certain cases, have been recorded as very rare or extinct (see Roque and León 2006). He cited Colunga (1878), who referred to *C. undulata* as “maybe the only indigenous species of *Chloraea* in Peru” and added that it “is found in the vicinity of the hills of Lima: it has a height of one meter, more or less: with elliptic-oblong leaves: the flowers are arranged in clusters: with a golden yellow perianth with greenish veins: the labellum is unguiculate and

trilobe". Llellish Juscamayta (2015) considered that the specimen he found in the Asia hills has the main diagnostic characteristics used to circumscribe *C. undulata*: terminal cluster with over 20 yellow flowers with green veins, terminal cluster with over 20 yellow flowers with green veins, sepals over 2.5 cm long, sub-simple or discretely trilobate labellum, middle lobe obtuse with undulate margins; and the disc of the labellum with a few thickened, falcate papillae following the direction of the veins but without forming a dense group (as in the case of *C. densipapillosa*, see Schweinfurth 1970). Finally, Llellish Juscamayta also considered that this description matches the details depicted in the watercolor painting by H. del Garnier (Raimondi *et al.* 2010), one of the illustrators who collaborated with Raimondi (Llellish Juscamayta 2015).

Doubts exist, however, that the famous and declared extinct "Orquídea de Lima" corresponds to *C. pavonii* Lindl. and not to *C. undulata*.

Chloraea pavonii is endemic to Peru. It was described by Lindley in 1840 and dedicated to José Pavón. It was recognized as a species which was characteristic of the hills of Lima until mid-20th century. From then on, it has been considered extinct from the coastal hills and especially from the type locality, Cerro Amancaes, a hill which today forms part of the urban area of the capital city.

In “The Plant List” we find the Lima Orchid, *Chloraea pavonii* (Lindl), as a synonym for *Chloraea chrysantha* Poepp. On the webpage of the Royal Botanic Gardens, Kew, we find the following information:

Chloraea pavonii. Homotypic Synonyms: *Asarca speciosa* Lindl., Quart. J. Roy. Inst. Gr. Brit., n.s., 1: 52 (1827). Heterotypic Synonyms: *Chloraea undulata* Raimondi in M.F.Colunga, Lecc. Bot. 2: 187 (1878). *Chloraea peruviana* Kraenzl., Bot. Jahrb. Syst. 37: 528 (1906) (the holotype specimen of *Chloraea peruviana* Kraenzl. was collected by A. Weberbauer at Cerro Amancaes: HBG501465).

Records of the San Marcos University Herbarium in Lima

A review of the records at the Herbarium of San Marcos University shows the following as habitats for *Chloraea pavonii*:

Lima-Prov. Canta: Lachaqui to Arahuay 2,750-2,900 m, *Vilcapoma 2420.* Between Arahuay and Lachaqui-2,650-2,700 m, *Vilcapoma 2212.* Collo, on the way to Achupata, 2,400-2,500 m, *Vilcapoma 7623.* Arahuay District, 2,550-2,650 m, *Gonzales 97.* Arahuay District, 2,635 m, *Bennett 6583.* **Lima-Prov. Chancay**: Lomas de Chancay 350 m, 1952, *Ferreyra 8748.* **Lima-Prov. Cañete**: Lomas de Asia, Quebrada Gonzalillo, 400 m, 2014, *Llellish s.n.* **Lima-Prov. Huarochiri**. Bosque de Zarate, San Bartolomé, km. 56 Carretera Central, 3,100 m, 1999, *Morón s.n.* San Bartolomé, Monte de Zarate, 1,400-3,550 m, *Gonzales 481*. Between Shaute and Santiago de Tuna, 2,550 m, 1994, *Bennett 1512.* Langa –venous type– 2,900 m, *Cano 2123.*

We also consulted the following specimens:

Lima-Prov. Huarochiri. Lomas de Amancaes-Rimac District 500 m (and Cerro El Agustino), *Weberbauer s.n*. (type of *C. undulata*: B, destroyed; photo, AMES). Langa District, 1850, *Maclean s.n.*(type of *C. venosa* Rchb.f., K). Mountains between San Cristobal de Amancaes and San Bartolomé, *Raimondi 471* (type of *C. undulata*: W).

There are 9 records of herbarium specimens by different collectors, compiled throughout the years, as this species grows – or used to grow – in the provinces of Lima, Huarochirí and Canta, in the department of Lima. As can be seen, all the records made in recent years have been of plants found at a higher altitude, on rocky slopes between 2600 and 2900 meters high, all in locations across the department of Lima. These sites are located at a higher altitude than the coastal hills, which are ecosystems with a maximum height of around 1200 meters, on the lower strata of the Andean flanks.

Trujillo (2013) mentioned that the last record of the species found on the coastal hills was

made by Ramón Ferreyra in 1952 on the hills of Iguanil, in the province of Huaral (approximately 72 km north of Lima). It has since not been spotted again in these communities, despite the efforts made to learn about its current state of conservation (Trinidad et al. 2012, Lleellish Juscamayta et al. 2015).

This discovery sparked this research, and we have found several descriptions. However, the research which has proved most enlightening is the study by Pupulin (2012). The author presented the following taxonomy:

Chloraea pavonii Lindl., Gen. Sp. Orchid. Pl. 404. 1840.

Basionym: *Asarca speciosa* Lindl., Quart. J. Sci. Lit. Arts 23: 52. 1827. Type: *"Hábitat en Chile, Pavón (olim v. s. sp.)"; "Serapias Gavilú. Pavón in herb. Lambert", Pavón s.n.* (holotype, G).

Synonyms: *Chloraea undulata* Raimondi ex Colunga, Lecciones de Botánica 2: 187. 1878. Type: Peru. Mountains between San Cristóbal de Amancaes and San Bartolomé, *A. Raimondi 471 (holotype, W).*

Chloraea peruviana Kraenzl., Bot. Jahrb. Syst. 37: 528. 1906. Type: Peru. Amancaes near Lima, *A. Weberbauer s.n.* (holotype: B†; photograph of the type, Ames).

Icones: AJB, Div. IV, 1318, tempera on paper by J. Brunete, upper part of the stem with inflorescence and flowers. «Jph. Brunete [firma] / 4 Serapias latifolia od. Gavilú Tessell.»

Serapias latifolia Jph.Brunete

The author goes on mentioning the references to the species made by Ruiz in his diary (Ruiz XXXX), and the use of the local name, “Gavilú” (recorded by Pavón and written by Brunete on his drawing), also for materials collected and described from Chile. Some *Peruvian and Chilean exsiccata* from the Expedition were sold by Pavón to Lambert, and one of them eventually served as the holotype for Lindley’s description as *Asarca speciosa.* With the dispersal of the Lambert Herbarium, Chloraea pavonii was acquired by the Delessert Herbarium, currently in Geneva (Pupulin 2012).

As noted by Pupulin (2012), even though Garay and Romero-González (1998) point toward a Peruvian origin of the type specimen of *C. pavonii*, the original label affixed to the type,

«Serapias Gavilu etc.», is the same that Ruiz used for the material originally collected in Chile under the intended name of *Serapias plicata.*

For different reasons, there might be plants which are given different names at a given time: species that have been studied under a different name until, later, other botanists notice that they are the same as other previously described taxa; in other cases, botanists in different areas used to study the same species and give it different names.

The true identity of *C. pavonii* eluded Kränzlin (1903: 107), Correa (1969), who revised the genus, and Schweinfurth (1958) in his "Orchids of Peru". According to Pupulin (2012), Lindley may have mistaken the type specimen to be from Chile because on the original herbarium sheet the polynomial "*Serapis Gavilu* etc." brought to mind similar designations by Feullée (1714). In the Delessert Herbarium, there is material collected by Pavón outside of Lima, in Amancaes, identified as *Serapias latifolia*, and this probably convinced Correa that *C. pavonii* was the same as *C. chrysantha* Poepp. (Pupulin 2012).

Delessert Herbarium in Geneva

Continuing with our research, we found the following information in the Delessert Herbarium, in Geneva (Table 1)

Chloraea pavonii Lindl. Original plate from Pavon. Herbario Delessert

141746/1.

SIB Identifier :

Barcode : G00105744

Name :

Validated determination : Chloraea pavonii Lindl.

Stored under (G): Chloraea pavonii Lindl.

Collector : Ruiz López, H. & J. A. Pavón y Jiménez

N° Collector : s.n.

Collection date : 1778-1788

Geography

Country : Peru

Locality : Pérou

Description :

Altitude : 0 m.

Longitude/Latitude : 74? 22' 32" W / 9??c 9' 50" S

Accuracy : Precision at the level of country

SIB Identifier: 141746/1

Research by Bennet and Christenson

Bennet and Christenson (1998) treat *C. pavonii* (as *C. pavoni*) as a valid species endemic to Peru, with *C. undulata, Asarca speciosa* and *C. peruviana* as synonyms, but also add to the synonymy *C. venosa* Rchb.f. (Linnaea 22: 864 1850). They provide the following description and comments about the species:

"Terrestrial plant, sprouting from a fascicle of fleshy roots and reaching up to 70 cm in height when in bloom. Erect, unbranched, leafy stem. Broadly ovate and basally obtuse leaves, gradually becoming smaller, elliptic-lanceolate and acute towards the apex, amplexicaule, 7-22 x 1-1.4 cm. Terminal inflorescence in a cluster, 25 cm long, with conspicuous, ovate, acuminate floral bract, almost the same as the ovaries.

6-12 bright yellow-green flowers with strongly contrasted dark-green reticular veins, the

column and base with a couple of orange lines at the base. Very similar sepals and petals, elliptic, rounded-obtuse, with extended sepals measuring 3.2 x 1.5 cm and curved petals, forming a chamber around the column, 2.8 x 1.5 cm. Elliptic, rounded-obtuse labellum, 2.7 x 1.5 cm, bilaterally compressed callus, keeled teeth dispersed along de primary labellum veins" (Bennett & Christenson, 1998).

The authors cite under the examined materials the following specimens: **Lima: Huarochirí**, between Chaute and Santiago de Tuna, 2550 masl. April 15, 1965, *D.&A Bennett 1512* (UC); **Lima: Canta**; Arahuay, 2635 masl, April 3, 1994, *M. Leon M. ex Bennet 6583* (Mol.USM).

The descriptions of *C. pavonii* made by Lindley (1840), by Bennet & Christenson (1998), and by Pupulin (2012) match Llellish Juscamayta's description, and for this reason we conclude that *C. undulata* is a heterotypic synonym of *C. pavonii*, an opinion confirmed by Govaerts' treatment of *C. pavonii* in the World Checklist of Selected Plant Families (http://wcsp.science.kew.org).

We can thus deduce that the plant found in Lomas de Asia, to the south of Lima, belongs to *C. pavonii*, which was thought to be lost to the ecosystem along the Peruvian coast.

Lomas de Asia is politically located in the Cañete province of the Lima region, in the district of Asia, and belongs to the rural community Comunidad Campesina de Asia. The area is made up of a series of ravines and hills, the summits of which range between 200 and 1200 meters in height and, during the spring and winter months, are covered by seasonal herbaceous vegetation. These hills cover an area of 10,053.134 hectares to the

north and south of the Asia valley.

The coastal hills house fragile ecosystems with irregular characteristics and resources featuring low resilience and stability vis-à-vis human-related situations that impact them, causing profound changes in their fundamental structure and composition.

Climate at Lomas de Asia

The climate of Lomas de Asia results from the interaction of atmospheric systems at the Pacific basin level and of local coastal factors. The Andes mountain range causes the winds to move parallel to the coast, and the South Pacific anticyclone system pushes them towards the Equator. On the other hand, the aridity typical of the Peruvian coast in general is caused mainly by the Alisios winds and the thermal inversion phenomenon (Reyna, Lomas de Asia (1917).

The climate is characterized by being warm in summer (28°C) and temperate in winter (14°C to 20°C), with high humidity mists. In the exposed hills to the southwest, advective mists are formed, dampening the desert and producing “hill vegetation”. Two kinds of climate are known to exist in the coastal hills: Desert Climate (BW), practically without rain, and Steppe Climate (BS). Fed by the humidity of the mists coming from the Pacific Ocean, the hills have allowed some plant species to adapt to this environment and settle here, like the emblematic *Amancaes* [*Ismene amancaes* (Ker Gawl.) Herb.], and *Chloraea pavonii* Lindley, the “Lima Orchid”.

Properties of the soil at Lomas de Asia

Studies analyzing the organic composition and properties of the soil were conducted in the

lab of the Soil Department at the Agronomy Faculty of La Molina National Agrarian University. Samples were taken within a radius of 300 hectares, of which 10 samples were analyzed, taken from 10 different zones across the slopes, as it is here where most vegetation grows in winter.

The results were as follows: the soil in this area is low in salts, which is ideal for the germination of seeds of the species that regenerate each year. This area is low in organic matter, causing the acid pH. Microbial activity only occurs in the months when humidity is over 85% (May to November).

Chloraea in Peru and in the coastal hills

Consequences for the management and conservation of Lomas de Asia

Since *C. pavonii* was rediscovered at Lomas de Asia, the Peruvian Orchid Club has got in touch with the rural community of Asia and we have been pleasently surprised in various ways.

The rural community of Asia has revitalized this important ecosystem in their hills by establishing ecotourism circuits, controlling the frequency and number of visitors, organizing communal park rangers, modifying grazing routes, and preventing overexploitation of resources. Implementing these actions has led to the appearance of plant species that had not been seen for many years. In addition, they have spread thousands of seeds of the "*Amancaes*" flower with impressive results. In the month of June, the hills are covered in a layer of wonderful yellow flowers

Amancaes (Ismene amancaes)

They have also reforested the hills with trees native to Peru, such as tara (*Tara spinosa*) and molle (*Schinus molle*).

It is not common to find a rural community that is concerned about their ecosystem and has managed to self-finance, without any private or government help, a project contributing to the conservation of the environment.

When they found out there was such as special orchid growing on their hills, they started to look for it, but with no success. The coordinates given by Llellish led to the Pacific Ocean. Only in October, 2016, by mere chance, did they find 4 blooming plants, in a different location from the one described by Llellish but still on the hills of Lomas de Asia. They have been careful not to spread the news on social networks or to publish the find in any media.

They got in touch with the Peruvian Orchid Club and this is how we have been lucky

enough to be able to see the plants in bloom and take hundreds of photos. We were able to confirm that the plants and flowers are identical to those described by Pavón and by Lindley and that they looked the same as they are shown in Brunete's plate, and different from the watercolor painting of *Chloraea undulata* by H. del Garnier, Raimondi's drawer, which differs not only in the shape of the flower but also in its color.

We provide here a description of the plants found in the Lomas de Asia population. Height of the plant: 79 cm including the floral scape. Foliaceous stem covered by leaf sheaths. Leaves: 8, ovate-lanceolate. Total number of flowers: 23. Color of the flower: yellow with evident reticulated green veins. Although no data on the root were observed or taken, it is important to mention the notes made by Ramón Ferreyra on the light, "almost transparent" coloring of the tubers of a specimen found in the hills of Chancay (record card 8748 USM, 1952). Fruit 3.2 cm to 4.2 cm in length and 1.0 cm to 1.2 cm in width. Blooming was observed between September and the first week in October.

We managed to pollinate the plants and later harvested the capsules, which unfortunately were already open. We reproduced them in vitro and the seedlings are already sprouting. We are considering the possibility of reintroducing them in their habitat. We are very grateful to the rural community members who have been smart enough to keep the exact location of the plants a secret. On the other hand, they were so overprotective of this orchid that they did not allow us to collect even one flower to produce the botanical drawing, let alone take organic samples to perform DNA tests and to deposit in the Herbarium of San Marcos University in Lima, in 2016.

During the summer (January, February, March), we observed Lomas de Asia to spot the first trace of green on the hills. It is worth mentioning that the hills dry out completely in

summer, when the Lima Orchid also disappears seasonally.

We were thrilled to find the 4 plants sprouting on June 3, 2017. Since that day, we have visited them at least once a month, observing their growth and also the weather. During July they grew very little; July and August are the coldest months on the Peruvian coast. Moreover, the community members have told us that there is relatively little humidity and that the hills are drying out before time. We hoped that they will bloom in October, when it is normal for them to bloom on the coast. The blooming period for this same species growing at a higher altitude is at the end of the rainy season, in April-May.

We have observed that the Lima Orchid we found to the south of Lima grows in conditions that are very similar to those at Cerro San Cristóbal in Rímac, where it was found for the first time. Cerro San Cristóbal is a hill that gets covered in mist during winter, with very high environmental humidity, just like in Lomas de Asia. And in summer, the climate is temperate. The distance to the sea from Cerro San Cristóbal is similar to the distance there is from Lomas de Asia to the sea of Sarapampa.

On the 8th of September 2017 I was informed that they had found another plant in bloom in Asia. We found the plant with a height of 75 cm protruding from the other seasonal vegetation. On the other hand, the outbreaks had not grown and, on the contrary; they were failing.

These results give us a new puzzle to solve! The plant that is in flower this year, definitely did not bloom last year! By contrast, those who bloomed last year, and who have emerged so promisingly in June, would definitely not flourish this year. Are they blooming only every two years? Or is it an abnormal year? It is a year that was hard hit by the coastal Niño

in Peru and definitely the weather was different from other years. However: why does a plant bloom now, which did not bloom last year?

However, the culminating visit was the 16th of September 17. In a parallel ravine we found a population of 9 plants in full bloom. It is striking that they always grow next to a stone, in open slopes in herbaceous areas. That day we also find the natural pollinator of *C. pavonii*, a small black bee (*Halictidae*).

It was fascinating to observe how the bee entered the perfumed flower and left it again in his legs full of pollinia, to get into another flower.

Work in progress:

- Planting of new harvested capsules.
- Botanical drawing of the species found in Asia.
- Deposit and register harvested plant in the Herbarium of the UNSM.

Pending work:

- Exact base of botanical drawing and eventually by DNA identification.
- Develop a map of the location of the entire population of *Chloraea* with order and follow up year after year.
- Investigate the flowering cycle of the plant.
- Compare the flowering cycle of coastal *Chloraea* with the *Chloraea* recorded at higher altitudes.

Acknowledgments. We thank the rural community “Lomas de Asia for ther commitment to the environment and for trusting us.

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CAPTIONS TO THE ILLUSTRATIONS

Figure 1. Hills of Asia. Photo by S. Spittler.

Figure 2. *Chloraea pavonii*. Photo by Giancarlo Bonicelli.

Figure 3. Illustration of "Serapias latifolia od. Gavilú Tessell." By José Brunete. From Pupulin 2010.

Figure 4. *Chloraea pavonii*. Original sheet from Pavón. Herbario Delessert.

Figure 5. Amancaes (*Ismene amancaes*). Photo by S. Spittler.

Table 1. Catalogue from the Delessert Herbarium, Geneva.