



First records of the genus *Pyrolirion* Herb. (Liliopsida, Asparagales, Amaryllidaceae) in Ecuador

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Abstract. We report for the first time in Ecuador the small plant genus *Pyrolirion* Herb. (Amaryllidaceae). We identify several Ecuadorian populations of *Pyrolirion tubiflorum* (L'Hér.) M. Roem. located in four provinces along the Ecuadorian Andes. This species has been previously recorded in Peru, Bolivia, and Chile. An updated description of *P. tubiflorum* is provided, along with detailed photographs of some of the Ecuadorian examples of the species.

Key words. Bulbous plant, dry valleys, citizen science, iNaturalist, conservation status

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INTRODUCTION

Pyrolirion Herb. (Amaryllidaceae, Asparagales) is a small genus of bulbous plants. Based on morphological characters, this genus was initially thought to be related to *Zephyranthes* Herb. (tribe Hippeastreae) because it has only one flower, fused spathe bracts, and a similar shape to the perigone (García et al. 2019). Even though it is morphologically different, recent molecular data indicate that *Pyrolirion* is related to *Hieronymiella* Pax, *Chlidanthus* Herb. and *Eustephia* Cav. (tribe Eustephieae) (Meerow 2010; Meerow et al. 2020). In *Pyrolirion*, the style is apically branched. There are 10 named *Pyrolirion* species recognized (Ulloa Ulloa et al. 2018); however, a current taxonomic revision of the genus is required because some might be synonyms. Herein, we formally report for the first time the genus *Pyrolirion* and *P. tubiflorum* (L'Hér.) M. Roem. from Ecuador. *Pyrolirion* was only known to occur in Peru, Bolivia, and northern Chile, where it occurred in the western slopes of the Andes, the inter-Andean valleys, the Prepuna and Puna vegetative formations, and the Peruvian coastal fog desert called “Lomas” (Huaylla et al. 2021). In 2020, a sample from Ecuador was included in the most recent phylogeny of Andean Amaryllidaceae species (Meerow et al. 2020). However, no further information about the specimen's exact location was provided. The purpose of our study is to provide the most up-to-date and comprehensive account of the geographic distribution of the genus *Pyrolirion* in Ecuador.

METHODS

We combined extensive fieldwork conducted from January 1998 to December 2024 in the dry inter-Andean valleys near Quito with revisions of herbarium specimens deposited at Quito Católica Herbarium (QCA; Quito, Ecuador), Herbario of Universidad Tecnológica Indoamérica (HUTI; Quito, Ecuador), Herbario Nacional del Ecuador (QCNE; Quito, Ecuador), Herbario de Azuay (HA; Cuenca, Ecuador), Missouri Botanical Garden (MO; Saint Louis, USA), Field Museum (F; Chicago, USA), Fairchild Botanical Garden (FTBG; Coral Gables, USA), New York Botanical Garden (NYBG; New York, USA), Herbario Nacional de Colombia (COL; Bogotá, Colombia),



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Herbario Universidad del Cauca (CAUP; Popayán Colombia), Herbarium Truxillense (HUT; Trujillo Peru), and Herbario San Marcos (MHN; Lima, Peru). Specialized literature was used to confirm the identity of the species (Cowley 1989). Geographic distribution and new records of *Pyrolirion tubiflorum* were obtained from specimen labels in herbaria, from online databases (Bioweb 2024; Tropicos 2024), and photographs deposited in iNaturalist (2024). Imprecise geographic locations were discarded.

The calculations to evaluate conservation status were performed using the GEOCAT program (Bachman et al., 2011), a geospatial conservation assessment tool designed to support Red List threat assessments.

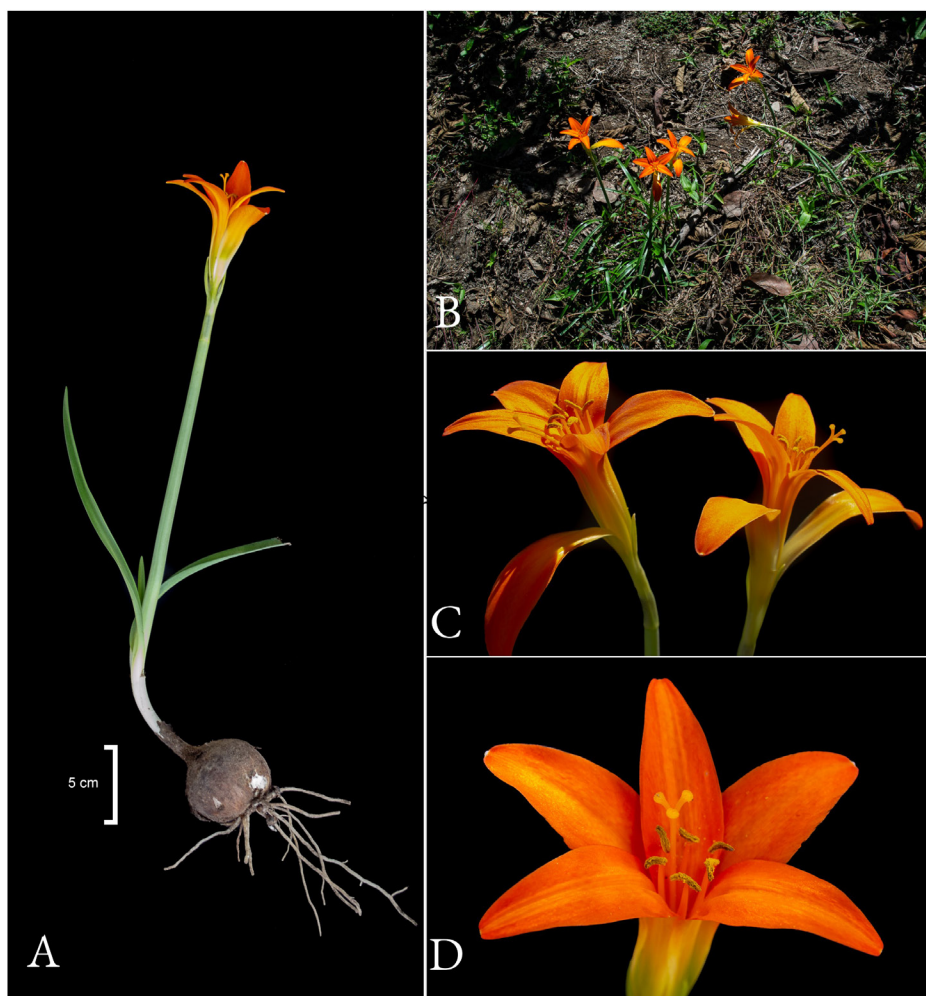
RESULTS

Pyrolirion tubiflorum (L'Hér.) M. Roem.

Figure 1

New records. ECUADOR – AZUAY • Susudel; 03°24'45"S, 079°10'52"W; 2230 m elev.; 30 Nov. 2021; K. Montesinos obs. <https://www.inaturalist.org/observations/102390825> – IMBABURA • Urcoquí, Hostería "In Yachay"; 00°24'05"N, 078°09'20"W; 2030 m elev.; 11 Oct. 2019; H. Romero-Saltos obs. <https://www.inaturalist.org/observations/209847563> – PICHINCHA • Carretera Guayllabamba a Puéllaro, ca. 1 km antes de Puéllaro; 00°01'S, 078°22'W; 2000 m elev.; 01 Dec. 1998; H. Balslev, E. Terneus 959 leg.; QCA5007 • Puéllaro, colección en la quebrada que desciende hacia el Río Guayllabamba; 00°01'25"N, 078°25'01"W; 2014 m elev.; 28 Sep. 2022; C. Quintana, R. Valencia, C. Guzmán Torres, R. Zambrano C. 4700 leg.; QCA251814 • Puéllaro, colección en la quebrada que desciende hacia el río Guayllabamba; 0°01'25"N 078°25'01"W; 2014 m elev.; 28 Sep. 2022; C. Quintana, R. Valencia, C. Guzmán Torres 4701 leg.; QCA251815 • Puéllaro, colecciones a lo largo del camino secundario que va de Puéllaro al Río Guayllabamba; 00°03'28"N, 078°24'47"W; 2263 m elev.; 23 Nov. 2022; R. Zambrano C., C. Quintana, A. Villarreal, C. Guzmán Torres 500 leg.; QCA251812 • Puéllaro, colecciones a lo largo del camino secundario que va de Puéllaro al Río Guayllabamba; 0°03'28"N, 078°24'47"W; 2263 m elev.; 23 Nov. 2022; R. Zambrano C., C. Quintana, A. Villarreal, C. Guzmán Torres 544 leg.; QCA251813 • Puéllaro, colecciones a lo largo del camino secundario que va de Puéllaro al Río Guayllabamba; 00°03'28"N,

Figure 1. *Pyrolirion tubiflorum*. **A.** Whole plant showing the bulbous herbaceous habit. **B.** An individual in its natural habitat in Ecuador (Puéllaro population, Pichincha). **C.** General view of the flowers, highlighting the bright orange hue of the tepals. **D.** Close-up of the flower, showing the distinctive trilobed stigma. Photos by Ricardo Zambrano C. and Cristian Guzmán Torres.



078°24'47"W; 2263 m elev.; 23 Nov. 2022; R. Zambrano C., C. Quintana, A. Villarreal, C. Guzmán Torres 545 leg.; QCA251809 • Puéllaro, colecciones a lo largo del camino secundario que va de Puéllaro al Río Guayllabamba; 00°01'25"N, 078°25'01"W; 2263 m elev.; 23 Nov. 2022; R. Zambrano C., C. Quintana, A. Villarreal, C. Guzmán Torres 546 leg.; QCA251811 • Puéllaro, colecciones a lo largo de la carretera que va de Puéllaro al Río Guayllabamba; 00°03'28"N, 078°24'47"W; 2263 m elev.; 23 Nov. 2022; R. Zambrano C., C. Quintana, A. Villarreal, C. Guzmán Torres 547 leg.; QCA251810 • Guayllabamba, Zoológico de Quito; 00°04'17"S, 078°21'32"W; 2170 m elev.; 10 Oct. 2024; E. Sánchez 40 leg.; HUT12056 • Puéllaro; 00°04'01"S, 078°24'0"W; 2003 m elev.; 13 Apr. 2021 C. Guzmán Torres obs. <https://www.inaturalist.org/observations/73888775> • Guayllabamba, Zoológico; 00°04'20"S, 078°21'36"W; 2174 m elev.; 18 Oct. 2021; Unknown obs. <https://www.inaturalist.org/observations/98624169> • Bosque de Jerusalem; 00°00'14"S, 078°21'29"W; 2276 m elev.; 12 Oct. 2007; R. Ripley obs. <https://www.inaturalist.org/observations/35901249> • Guayllabamba; 00°04'20"S, 078°21'37"W; 2176 m elev.; 27 Aug. 2020; J. Heredia obs. <https://www.inaturalist.org/observations/57748725> • Guayllabamba; 00°03'54"S, 078°21'06"W; 2130 m elev.; 2 May 2021; J. Solórzano obs. <https://www.inaturalist.org/observations/76755710> • Guayllabamba; 00°04'17"S, 078°21'37"W; 2171 m elev.; 26 Oct. 2021 J. Heredia obs. <https://www.inaturalist.org/observations/99494953> • Malchingui; 00°00'52"S, 078°21'17"W; 2259 m elev.; 22 Aug. 2013; M. Guerrón obs. <https://www.inaturalist.org/observations/105133958> • Guayllabamba; 00°04'14"S, 078°21'33"W; 2162 m elev.; 18 Oct. 2022; J. Heredia obs. <https://www.inaturalist.org/observations/139293116> – TUNGURAHUA • Salasaca; 01°19'10"S, 078°35'2"W; 2600 m elev.; 16. Jan. 1998; L. Jost 7045 leg.; QCA 5006.

Identification. *Pyrolirion tubiflorum* is a perennial, bulbous herb that can be easily recognized by its unifloral escape, with a flower with bright orange tepals and a trifid stigma. Its bulbs are globose to ovoid, measuring 2.5–4.5 cm in length and covered with a dark brown papery tunic. Leaves can be absent or up to three, linear, green, shiny, and to 36 cm long and 4–7 mm wide. The erect scape ranges from 12 to 30 cm in height and is light green. The inflorescence consists of a single actinomorphic flower, with a spathe valve measuring 3–6 cm long. The perianth is funnel-shaped, fused at the base forming a tube measuring 1.5–2.5 cm long and up to 9 cm wide at the top. The six oval tepals are equal in size, 5–7 cm long, and 1.6–2.0 cm wide, with acute tips. The six stamens are erect or suberect, with filaments attached just above the junction of the perianth tube, measuring 5.0–5.5 cm long. The versatile anthers are 6–14 mm long. The style is orange, suberect of up to 6 cm, terminating in a 3-lobed orange stigma. The ovary is sessile, oblong, and 3-locular, measuring 1.1–2.0 cm long and 5–9 mm wide. This species flowers from August to January and occasionally in May. Its fruit is a green, tri-locular, dehiscent capsule measuring 1.6 cm long and 1 cm wide. Unfortunately, all herbarium specimens were in flower and not in fruit. While we managed to collect flowering plants that produced capsules, we were not successful in obtaining seeds, and therefore we are unable to report on them.

Geographic distribution. The species was previously found only in Bolivia, Peru, and Chile. The Ecuadorian populations are found in dry inter-Andean valleys in the provinces of Azuay, Imbabura, Pichincha, and Tungurahua (Figure 2), growing naturally in disturbed areas and exposed soils along roadsides and in uncultivated fields, across both flat and steep terrain at 2000–2300 m. This species prefers sunlight and can tolerate 4–9 months of dryness without issue.

Conservation status. The species' extent of occurrence (EOO) is estimated at 4,700 km², which could classify it as Endangered under IUCN criteria. However, the area of occupancy (AOO) is significantly larger, at 36,000 km², placing it well above the threshold for this threat category. This discrepancy suggests that there is insufficient evidence to assign a definitive threat category based solely on EOO and AOO. Additional, more specific data regarding threats to the species are required to refine its conservation status. Given this uncertainty, it may be appropriate to classify the species as Data Deficient until further information is available.

DISCUSSION

The discovery of *Pyrolirion tubiflorum* in Ecuador adds a new genus to the flora of that country, extending the range of the genus north by at least 1,000 km from its nearest previously known location in Huancayo, Peru.

The species had gone previously unnoticed because vegetatively it is a very inconspicuous herb which can be easily missed, and it rarely flowers. In some populations, the species is deciduous and hysteroanthous, and thus completely not visible for part of the year. Several populations have been found over the years when the individuals are in flower. Sterile collections deposited in herbaria could possibly be misidentified and missed by us; fertile specimens are very important in herbaria to facilitate accurate identification. In Ecuador, the species is distributed in the dry inter-Andean valleys that are part of the Tropical Andean hotspot, forming a component of the ruderal vegetation that coexists with cultivated areas (Quintana et al. 2019).

The sparse, discontinuous occurrences suggest the possibility that these showy plants may originally have been spread by Inca or pre-Inca peoples. In wooden Peruvian Inca ceremonial vessels, known as keros, drawings of *P. tubiflorum* have been observed, presumably representing a homage to important people (Vargas 1981). The drawings are on the lower part of the vases and painted in brilliant red. Vargas (1981: 315–318) made the following description of the flower: "... This plant produces a scape of 250 mm length from a large bulb and the perianth is fiery red; the flowers are protandrous. It grows in mesothermic interandine valleys between 2600

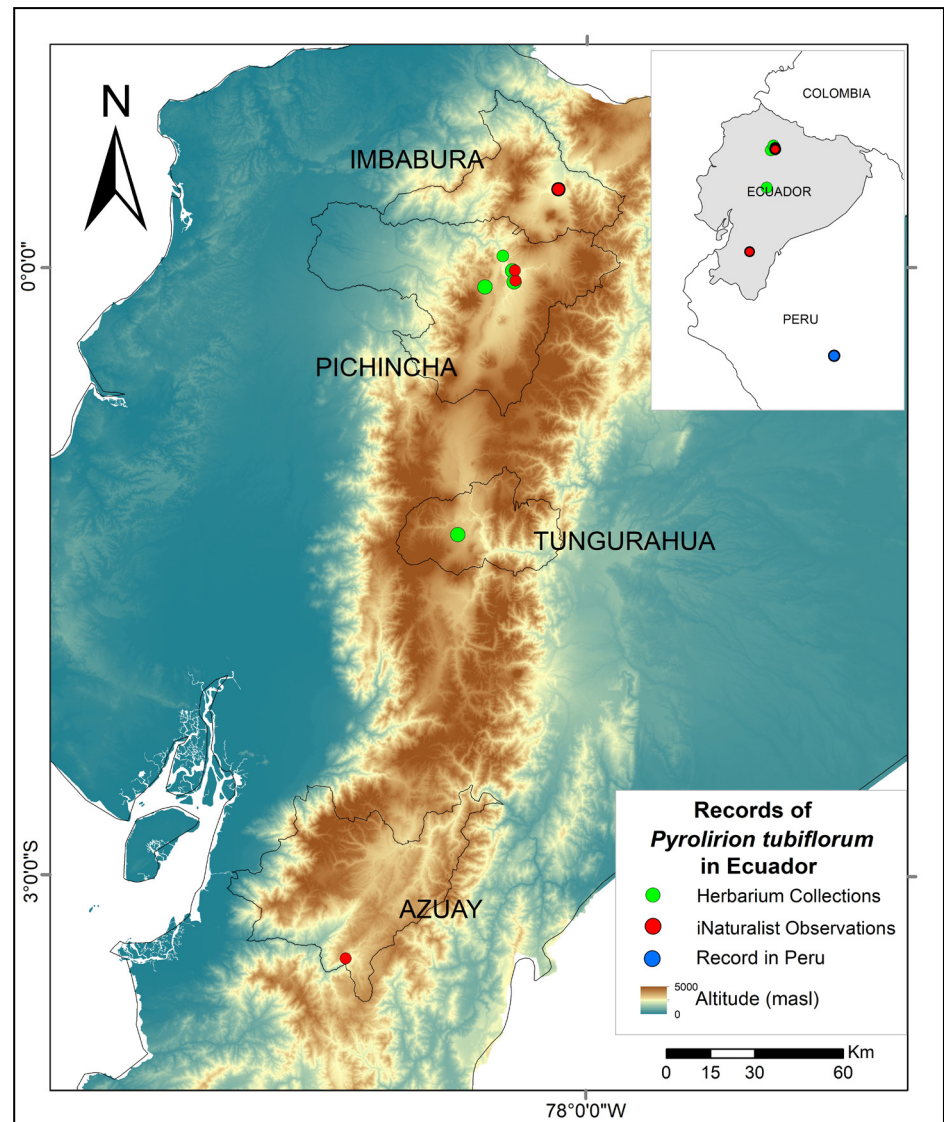


Figure 2. Distribution map of the known populations of *Pyrolirion tubiflorum* in Ecuador.

and 3200 m above sea level and flowers in the spring (September to December). The plant was evidently of considerable ritual significance to the Incas ...". Given the apparent cultural importance of *P. tubiflorum* to the Inca, it is possible that the Inca brought this plant when they invaded what's now Ecuadorian territory. Genetic analysis are needed to support this hypothesis.

The plant attracts local attention even today. Several populations of *P. tubiflorum* were recorded in Puéllaro, an inter-Andean village located north of Quito. The local people refer to this species as "cebolleta", "cebolla de lobo", and "flor del difunto"—or "spring onion and flower of the dead"—due to the bulb's resemblance to an onion and because the plant blooms in November, when the Day of the Dead is celebrated. People from Puéllaro take great pride in having this beautiful plant in their ruderal flora. With this publication, they will empower themselves and embrace a "local flower" that symbolizes their conservation efforts to preserve the remnants of the inter-Andean flora.

Our results are based on the information of specimens deposited in the QCA and HUTI herbaria and photographic records in iNaturalist. This exemplifies the importance of both types of resources to better understand species distribution. Foremost, herbarium specimens are physical, permanent records that can be used for many applications, including phylogenetic studies, learning basic plant biology and ecology, developing habitat suitability models, and assessing changes in flower phenology due to climate change, among others (Molano-Flores et al. 2023). But citizen science also plays an important role in democratizing research and expanding the scope of discovery, and by engaging ordinary citizens in scientific pursuits through the power of collective observation and data collection, we accelerate our understanding of the natural world. Platforms like iNaturalist demonstrate this collaborative approach, empowering individuals to document biodiversity and contribute valuable data to scientific databases (Aristeidou et al. 2021).

Our study underscores the crucial role of comprehensive datasets in expanding our understanding of botanical distributions. It also reveals the need for more extensive fieldwork in dry habitats, which have tended

to be overlooked in favor of the more biodiverse humid Ecuadorian habitats (Quintana et al. 2017). There are many poorly known local endemics in such habitats, including several other Amaryllidaceae such as *Phaedranassa schizantha* Baker, *P. viridiflora* Baker, *P. glauciflora* Meerow, *P. brevifolia* Meerow (Oleas 2011; Oleas et al. 2013, 2014, 2016), and the recently described *Phaedranassa cuencana* Minga, C. Ulloa & Oleas (Minga et al. 2015). These overlooked desert and seasonally dry habitats deserve more attention from botanists and the conservation community. This new genus and species record for the Ecuadorian flora also reinforces the importance of protecting and preserving native vegetation in agricultural landscapes.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: NHO, CQ. Data curation: NHO, AWM. Funding acquisition: NHO, CQ. Investigation: NHO, CQ, LJ, RZC, CGT, MPM, MB, JH. Methodology: NHO, CQ. Resources: CQ, NHO. Supervision: NHO, CQ. Validation: AWM. Writing – original draft: NHO, CQ, LJ, HRS, AWM, CGT, MPM, MB, JH. Writing – review and editing: NHO, CQ, LJ, RZC, HRS, AWM, CGT, MPM, MB, JH.

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Data availability

All data that support the findings of this study are available in the main text.

REFERENCES

- Aristeidou M, Herodotou C, Ballard HL, Higgins L, Johnson RF, Miller AE, Young AN, Robinson LD** (2021) How do young community and citizen science volunteers support scientific research on biodiversity? The case of iNaturalist. *Diversity* 13: 318. <https://doi.org/10.3390/d13070318>
- Bachman S, Moat J, Hill AW, de la Torre J, Scott B** (2011) "upporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. In: Smith V, Penev L (Eds.) e-Infrastructures for data publishing in biodiversity science. *ZooKeys* 150 (Special Issue): 117–126. <https://doi.org/10.3897/zookeys.150.2109>
- Bioweb** (2024) Pontificia Universidad Católica del Ecuador. Base de datos del Herbario QCA. Versión 2024.1. <https://bioweb.bio/portal/>. Accessed on: 2024-10-14.
- Cowley J** (1989) *Pyrolirion tubiflorum* Amaryllidaceae. *Curtis's Botanical Magazine* 6: 95–101. <https://doi.org/10.1111/j.1467-8748.1989.tb00327.x>
- García N, Meerow AW, Arroyo-Leuenberger S, Oliveira RS., Dutilh JH, Soltis PS, Judd WS** (2019) Generic classification of Amaryllidaceae tribe Hippeastreae. *Taxon* 68: 481–498.
- Huaylla H, Llalla O, Torras-Clavería L, Bastida J** (2021) Alkaloid profile in *Pyrolirion albicans* Herb. (Amaryllidaceae), a Peruvian endemic species. *South African Journal of Botany* 136: 76–80.
- iNaturalist** (2024) <https://www.inaturalist.org/>. Accessed on: 2024-04-16.

- Meerow AW** (2010) Convergence or reticulation? Mosaic evolution in the canalized American Amaryllidaceae. In: Seberg O (Ed.) Diversity, phylogeny and evolution in the monocotyledons. Aarhus University Press, Aarhus, Denmark, 145–168.
- Meerow AW, Gardner EM, Nakamura K** (2020) Phylogenomics of the Andean tetraploid clade of the American Amaryllidaceae (subfamily Amaryllidoideae): unlocking a polyploid generic radiation abetted by continental geodynamics. *Frontiers in Plant Science* 11:582422. <https://doi.org/10.3389/fpls.2020.582422>
- Minga D, Ulloa Ulloa C, Oleas N, Verdugo A.** (2015) A new species of *Phaedranassa* (Amaryllidaceae) from Ecuador. *Phytotaxa* 192: 50–53. <https://doi.org/10.11646/phytotaxa.192.1.6>
- Molano-Flores B, Johnson SA, Marcum PB, Feist MA** (2023) Utilizing herbarium specimens to assist with the listing of rare plants. *Frontiers in Conservation Science* 4: 1144593. <https://doi.org/10.3389/fcsc.2023.1144593>
- Oleas N** (2011) Landscape Genetics of *Phaedranassa* Herb (Amaryllidaceae) in Ecuador. PhD thesis, Florida International University, Miami, USA, 115 pp.
- Oleas NH, Meerow AW, Francisco-Ortega J** (2013) Molecular markers and conservation of plant species in the Latin-America: the case of *Phaedranassa viridiflora* (Amaryllidaceae). *The Botanical Review* 79: 507–527. <https://doi.org/10.1007/s12229-013-9125-8>
- Oleas NH, Meerow AW, Feeley KJ, Gebelein J, Francisco-Ortega, J** (2014) Using species distribution models as a tool to discover new populations of *Phaedranassa brevifolia* Meerow, 1987 (Liliopsida: Amaryllidaceae) in northern Ecuador. *Check List* 10: 689–691. <https://doi.org/10.15560/10.3.689>
- Oleas NH, Meerow AW, Francisco-Ortega J** (2016) Genetic structure of the threatened *Phaedranassa schizantha* (Amaryllidaceae). *Botanical Journal of the Linnean Society* 182: 169–179. <https://doi.org/10.1111/boj.12444>
- Quintana C, Girardello M, Balslev H** (2019) Balancing plant conservation and agricultural production in the Ecuadorian Dry Inter-Andean Valleys. *PeerJ* 7: e6207 <https://doi.org/10.7717/peerj.6207>
- Quintana C, Girardello M, Barfod A S, Balslev H.** (2017) Diversity patterns, environmental drivers and changes in vegetation composition in dry inter-Andean valleys. *Journal of Plant Ecology* 10 (3): 461–475. <https://doi.org/10.1093/jpe/rtw036>
- Tropicos** (2024) Tropicos v. 3.4.2. <http://www.tropicos.org/>. Accessed on: 2024-04-16.
- Ulloa Ulloa C, Acevedo-Rodríguez P, Beck S, Belgrano MJ, Bernal R, Berry PE, Brako L, Celis M, Davidse G, Forzza RC, Gradstein SR, Hokche O, León B, León-Yáñez S, Magill RE, Neill DA, Nee M, Raven PH, Stimmel H, Strong MT, Villaseñor JL, Zarucchi JL, Zuloaga FO, Jørgensen PM** (2018) Vascular plants of the Americas (VPA) website. Tropicos, Botanical Information System at the Missouri Botanical Garden, St. Louis, Missouri, USA. <http://www.tropicos.org/Project/VPA>. Accessed on: 2024-04-16.
- Vargas FC,** (1981) Plant motifs on Inca ceremonial vases from Peru. *Botanical Journal of the Linnean Society* 82: 313–325. <https://doi.org/10.1111/j.1095-8339.1981.tb00963.x>