The Genus Phragmipedium in Brazil; A journey to a Strange World

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ABSTRACT

For the Phragmipedium enthusiast, Brazil is a poorly understood place. Brazilian species are difficult to keep alive in cultivation and as a result rarely seen, and rarely used in commercial and hobby hybridization. When was the last time you saw a *Phrag. vitattum* or a *Phrag. klotzchianum* at an orchid show? When was the last time you saw a *Phrag. lindleyanum* in all its glory with 10 or more flowers open simultaneously? Where are all the *Phrag. vitattum* hybrids? The rarity of the Brazilian species outside of their natural habitats and the small sample size applied to prior attempts to classify the Brazilian species has led to taxonomic questions that persist. What do we need to learn to not only grow these species effectively, but to clarify their taxonomy and document their ecology? In an effort to answer these questions, the known populations of Brazilian *Phragmipedium* have been visited and studied over a period of twenty-five (25) years. What was learned was surprising, and reinforced that our popular conception of a one size fits all cultural approach to the genus needed to be reevaluated and that an expanded sample size coupled with direct observations could not support the old taxonomic treatment. There is no evidence of natural hybridization in Brazil or among the Brazilian species. Two (2) species that are alleged to come from Brazil do not, and never did, exist in Brazil.

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INTRODUCTION

As of today, there are three known and accepted Brazilian species of *Phragmipedium*, each known from a few isolated populations in different parts of the country separated by great distances. Although home to only three (3) species of *Phragmipedium*, Brazil represents over 50% of the total range of the genus. Brazilian *Phragmipedium* are all seasonal and partially xerophytic. Two (2) of the species, *klotzchianum* and *lindleyanum*, are seasonally dry for an extended part of the year. The third, *vitattum*, is seasonal, with a distinct growth and flowering season with a three (3) month dormant period. The unique ecology and biology of the Brazilian species set them apart from their Andean cousins. Brazilian *Phragmipedium*, consistent with the genus overall, are variable across multiple vegetative and floral characteristics, flowers continue to progress after anthesis, and specific ecology is tied to each species concept. All species of Brazilian *Phragmipedium* are ochlospecies. Despite twenty-five years of searching, two (2) species that are alleged to come from Brazil, *Phragmipedium chapadense* and *Phragmipedium brasiliense*, are invalid, have never been found in a natural population, and never existed in that country.

What makes Brazil so different and unique for the genus *Phragmipedium*? The annual weather cycle is unlike that of the Andes, a mountain range that runs generally north and south from Central America through South America along the continents Pacific edge where the majority of *Phragmipedium* Species can be found. The Andes do not pass through any part of Brazil, resulting in climate and weather patterns that are unique to the places we find Brazilian *Phrags*, the hills of the Atlantic seaboard, the Brazilian Central Plateau, and the Gran Sabana. Unlike the Andes, Brazilian *Phragmipedium* habitats cycle through distinct wet and dry seasons that impact all *Phragmipedium* habitats. In contrast, the Andes support *Phragmipedium* habitats that are more consistent throughout the year.

FIELD RESEARCH AND METHODOLOGY

All known habitats of *Phragmipedium* in Brazil, covering all species as recognized in the 2020 revision of the taxonomic revision of the genus (*Orchid Digest Vol. 84-4, Oct., Nov., Dec. 2020*) were visited and analyzed across a twenty-five (25) year period. The alleged habitats of both *Phragmipedium chapadense* and *Phragmipedium brasiliense* were explored extensively and not a single plant meeting the description of either was ever found. Many habitats, including the alleged habitats of both of the former alleged species, were visited multiple times at different times of the year by the author, together with small teams of Brazilian botanists, biologists, forestry engineers, and hobbyists with first-hand knowledge of the habitats and locations. Ecological factors and

taxonomic characters were examined as was species biology. Ecological factors included the annual weather cycle, temperature at different times of the day and at different points in the year, humidity, the amount of light plants were receiving, the amount of run-off available to the plants, the immediate conditions at the roots, Ph levels, the surrounding vegetation, and the ecological changes year over year. Notwithstanding twenty-five (25) years of searching and an aggregate of over one-hundred years of exploration among myself and the other team members only one secondary habitat was located in the alps north of Rio de Janeiro. Taxonomic variables were compared against the type descriptions and publications in support of the synonyms of the Brazilian species.

THE SPECIES

Phragmipedium vittatum (Vellozo) Rolfe, *Orchid Rev.* 4: 332 (1896).
Syn:
*Cypripedium vitt*atum Vell., *Fl. Flumin*. 9: t. 62 (1831).
Selenipedium vittatum (Vell.) Rchb. f., *Ill. Hort*. 23: 57 (1876).
Cypripedium paulistanum Barb. Rodr., *Gen. Spec. Orchid.*1: 203 (1877).
Cypripedium vittatum var. *breve* Rchb. f., *Gard. Chron*., n.s., 15: 656 (1881).
Cypripedium binotii Anon., *Ill. Hort*. 34: 19 (1887).
Paphiopedilum vittatum (Vell.) Stein, *Orchid. Buch*: 491 (1892).
Selenipedium paulistanum (Barb. Rodr.) Rolfe, *Orchid Rev*. 1: 239 (1893).
Selenipedium vittatum var. *breve* Cogn., C. F. P. von Martius & auct. suc. (eds.), *Fl. Bras*. 3(4): 12 (1893).
Paphiopedilum paulistanum (Barb. Rodr.) Pfitzer, *Bot. Jahrb*. Syst. 19: 42 (1894).

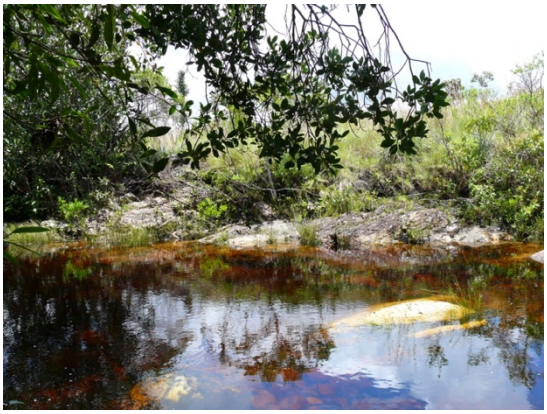

Fig. 1 A Streamside bog that is home to Phragmipedium vittatum.

Phragmipedium vittatum was first described by a Brazilian friar, Jose Mariano da Coneicao Vellozo in the 1780's, making it the first *Phragmipedium* ever described. The type location listed by Vellozo is the Alps north of Rio de Janeiro. Since that time *P. vittatum* has been found on the Brazilian central plateau growing in peat bogs, exposed to bright light, mixed grasses and low-lying shrubs. The habitats on the central plateau are surrounded by seasonally dry "cerrado", a vast tropical savannah.

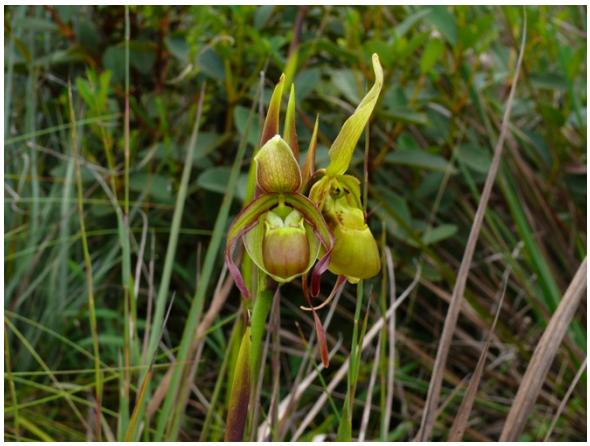

Fig. 2 Two flowers of Phrag. vittatum on the same plant showing the progressive nature of the flowers.

Phragmipedium vittatum is very rare, if not the most rare, species of *Phragmipedium*. The peat bogs on the central plateau are feed by underground springs that feed nearby streams. A keen eye can discern small holes in the ground throughout the habitats that feed spring water to the bogs. Unlike other species of *Phragmipedium*, *vittatum* is not fed by runoff from the surrounding jungle or by excess rainfall. It is the constant, year-round flow of spring water from below the habitat that keeps the roots of *P. vittatum* constantly moist. The surrounding environment, immediately outside the area of the bogs, is seasonally dry. Companion orchids, if that is an appropriate term, are *Cattleya* that can found growing on nearby rocks, several species of *Cyrtopodium, Encyclia, Catasetum, Mormodes*, and *Epidendrums*, all which can be found close to, but outside the bogs and are subject to long periods without rain. This dichotomy, between the omnipresent flowing spring water at the roots and, at times, dry, arid air in which the vegetative parts live presents unique challenges to the grower. The uniqueness of the environment and ecology are part of what defines *P. vittatum* as a species. Perhaps due to its rarity, both in natural populations and in cultivation, *P. vittatum* has not

been described as numerous other species. The only synonym is *paulistanum*, which was described in 1893 by Rodrigues from the same habitat near Rio De Janeiro in Brazil as the Vellozo specimen. Differences were noted as a free labellum that is not fused, the synsepal as long as the labellum, and a lanceolate staminode. *Phragmipedium vittatum* are as variable as all other species in the genus, and flowers continue to evolve after anthesis. Most flowers that I have observed in natural populations have the fused labellum and generally rhombic staminode of *P. vittatum*. The ratio of the length of the synsepal to the length of the slipper varies as the flower ages. The claw face has a somewhat triangular patch of closely spaced brown spots with a more or less vertical line of green spots up and down each side of the claw that is distinctive. The depth of color of the brown and green spots varies from plant to plant and with the age of the flower.

Phrag. vittatum's most closely allied cousin in the genus is *longifolium*, with which *vittatum* shares commonalities in color, staminode, and general floral morphology. There are, however, three (3) unique characteristics that separate *Phrag. vittatum* from *longifolium*. One is the distinct yellow to white margin to the leaves. The margin is quite wide, measuring ~2mm on mature plants, and can be seen through the grasses from a distance. If you have to look closely or look twice to try to discern the margin to the leaves, your plant is probably not *P. vittatum*. This margin is equally obvious on the seedling plants I have seen in situ as small as 15cm. Second are the differences in the pattern of brown and green spots on the face of the claw. While both have the vertical line of green spots on opposite side of the center of the claw, the brown spots are spread out across the entirety of the claw in *longifolium* as opposed to the generally triangular arrangement of brown spots on the claw of *vittatum*. The other is the distinct ecology and geography. *Longifolium* can only be found north of the Equator in the Andes, growing on more or less vertical rock surfaces over hanging rivers and streams, along roadsides, and in open areas recently degraded by human activity with fairly uniform weather throughout the year, while *vittatum* inhabits bogs along the Brazilian central plateau south of the equator that are subject to long periods of seasonal dryness. The lateral petals of *Phrag. vittatum* tend to be shorter and less twisted than those of *Phrag. longifolium*, however, petal length and the number of twists in the petals of *Phrag. longifolium* varies, and there can be some overlap in length and appearance.

Phrag. vittatum has a distinct growth and flowering season, whereas *Phrag. longifolium* can

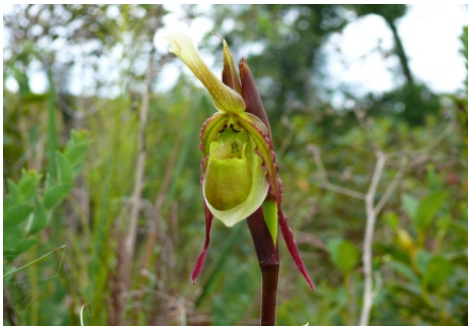

Fig. 3 Phrag. vittatum showing the unique pattern of spots on the claw face.

be found in flower all during the year. This biological difference should be noted, as it is significant. *Phrag. vittatum* subsists in a larger ecosystem that has a distinct dry season, which *vittatum* mirrors in its annual growth cycle. Generally, plants receive no rain from June through September. During the dry season, plants stop growing and plants in natural populations do not produce flowers. This is the period of heightened risk of rot when attempting to cultivate this species. Light levels are intense year-round. The only protection from tropical sun are nearby grasses, which do not provide much. Low light levels in the northern hemisphere, especially during the winter months when the angle of the sun decreases, also have a negative impact on *vittatum* in cultivation. Plants either don't flower or rot in lower light levels. The Ph has been recorded as 7.0, 7.2 and 7.4, with the latter being after a fire recently destroyed one of the habitats. Like several other species in the genus, it is strongly suspected that *Phrag. vittatum* self-pollinates. However, more field study is needed to confirm this.

Phragmipedium klotzschianum (Rchb. f.) Rolfe, *Orchid*
Rev. 4: 332 (1896).
Syn:
Cypripedium klotzschianum Rchb. f., *Linnaea 22: 811*
(1850).
Selenipedium klotzschianum (Rchb. f.) Rchb. f., *Xenia*
Orchid. 1: 3 (1854)
Cypripedium schomburgkianum Klotz sch ex M. R. Schomb., *Bot. Remin. Br. Guiana:* 59 (1876).
Selenipedium schomburgkianum (Klotz sch ex M. R.
Schomb.) Desbois, *Monogr.* Cypriped.: 141 (1888).
Paphiopedilum klotzschianum (Rchb. f.) Stein., *Orchid. -Buch:* 473 (1892)

Phragmipedium klotzschianum is a small species similar to *Phrag. pearcei, hirtzii, cabrejosii*, and *caricinum* vegetatively as well as ecologically. When out of bloom, it is not easy to differentiate the species in this subsection. Each of these species inhabits a similar ecological niche, on the rocks and boulders inside the confines of rivers large and small below the high-water line. *Phragmipedium klotzchianum* is, however, the only species from this group that cannot be found in the Andes.

Fig. 4 A typical Phrag. klotzschianum habitat showing the light levels

Phrag. klotzschianum has long, stoloniferous rhizomes that can be up to 10 cm (4 inches) in length. Flower spikes can range from 20 to 40 cm (8 to 16 inches). Spikes can carry up to four flowers blooming sequentially. The claw face is white with brown and green spots on the labellum. In this species the brown and green spots, which are quite common in the genus, are on the rim of the slipper, or labellum, and not in the middle of the white claw face.

Fig. 5 Phrag. klotzschianum showing the unique pattern of spots on the claw face

The labellum is obovate in shape, meaning that it is generally egg shaped with the broadest part just below the middle of the slipper. The shape of the slipper is quite unique and does not overlap with other species in the same subsection. Other differentiating characteristics are the dense, hairy ovary and the staminode. The staminode is very close to the staminode that we see in the caudatum group in general shape. When in flower this species is easy to recognize. *Phragmipedium klotzchianum* is limited to a small range for the genus. There are several large populations along the edges of rivers throughout the Gran Sabana in Venezuela, Guyana, and northern Brazil. The range overlaps with the range of *P. lindleyanum*. However, the two species have not been observed nor reported to cohabitate, nor are there any natural hybrids. The Gran Sabana is another area that experiences a prolonged dry season. *Phrag. klotzschianum* subsists on the tops of rocks, within the confines of the river, in an area that, similar to the other Brazilian *Phragmipedium*, is seasonally dry, consists mainly of grassland, and stands as a stark contrast to the ecology of the Andes. The roots, densely packed, with occasional mosses and transitory river sand, sustained by the humidity of the passing water. The immediate environment that can go long periods without rain. Being on rocks, in full sun, and in accumulated river sand during an extended dry season would not appear to be an ideal location for any species of *Phragmipedium*.

Fig. 6 Phrag. klotzschianum growing atop rocks below the high water line

The surrounding area is a vast grassland, subject to long periods without rain. There are no large trees overhanging the rivers in the Gran Sabana like we see in the Andes. *Phrag. klotzschianum* needs bright light. Plants have limited, if any, protection from the sun. The length of the day is more consistent than in northern latitudes, as is the angle of the sun in the sky above.

Phrag. klotzschianum is very difficult to maintain in cultivation. The vast majority of hobbyists see their plants quickly decline in conditions too wet for this species with light levels far below those needed. Near equatorial light levels are vastly different from the substantial variations in light levels seen in northern latitudes. Add in shade clothe and a saucer of water and the result are plants that quickly decline. It is strongly suspected that *Phrag. klotzschianum* self-pollinates. However, more field study is needed to confirm this.

Phragmipedium lindleyanum (R. H. Schomb. ex Lindl.) Rolfe, *Orchid Review* 4: 332. 1896.
Syn:
Cypripedium lindleyanum R. H. Schomb. ex Lindl., *Gen. Sp. Orchid. Pl.*: 53 (1830).
Selenipedium lindleyanum (R. H. Schomb. ex Lindl.) Rchb. f., *Xenia Orchid.* 1: 3 (1854).
Paphiopedilum lindleyanum (R. H. Schomb. ex Lindl.) Pfitz er, *Bot. Jahrb. Syst.* 19: 41 (1894).
Phragmipedium sargentianum (Rolfe) Rolfe., *Orchid Review* 4: 332 (1896).
*Phragmipedium kaieteurum (*N. E. Brown) Garay. *Orchid Digest* 43: 136. 1979.

Phragmipedium lindleyanum has a wide distribution range, with most populations scattered throughout Venezuela, Guyana, Suriname, and French Guiana. There is a single area in Pernambuco State, Brazil along the Atlantic seaboard, south of the equator, where several populations are found. Like all species of *Phragmipedium*, *Phrag. lindleyanum* is an ochlospecies that is variable across multiple vegetative and floral characteristics, including the inflorescence and how hairy the parts of the flower are. There is a yellow margin to the leaves that varies from subtle to obvious. The leaves can be brittle, shiny, and stiff, indicative of the partially xerophytic nature of the species. *Phragmipedium lindleyanum* is a distinct species and is not easily confused with other species in the genus. Not unlike the other species of *Phragmipedium*, *Phrag. lindleyanum* is not without its confused taxonomic past, and like other species in the genus, natural populations do not support the contentions made in support of breaking *Phrag. lindleyanum* out into multiple species.
In 1979, Garay stated that *kaieteurum* could be differentiated from *Phrag. lindleyanum* based on the "the shape and color of the leaves, the color of the flowers, and the shape of the staminode." Additionally, *Phrag. kaieteurum* was proposed to have more glabrous (less hairy) sheaths and floral bracts, different colored flowers, and leaves that lack a yellow margin. However, the leaves of the type material have the same cells on the leaf margins as plants throughout the range, the difference being that they are difficult to see on the small plants used for Garay's description. The lack of a yellow leaf margin has also been used in support of *Phrag. sargentianum*. Plants from the type population demonstrate varying degrees of pubescence with those with shorter hairs being more prevalent. However, the amount and length of the hairs on the flowers are variable throughout all known populations from Venezuela to Pernambuco Brazil and cannot be used as a distinguishing taxonomic characteristic.
Phragmipedium sargentianum was originally differentiated from *Phrag. lindleyanum* based on "the presence of a pair of small white tubercles [a small rounded projection] on the inner margin of the side lobes of the lip." It is not clear if the herbarium specimens of the two previously described species, *Phrag. lindleyanum* and *Phrag. kaieteurum* were examined as both have the small, white tubercles used to justify *Phrag. sargentianum*. Other authors have attempted to differentiate *Phrag. sargentianum* as having leaves that lack the yellow margin seen on plants from the northern part of the continent, making them consistent with the language used in support of *Phrag. kaieteurum,* the shape of the staminode as being triangular rather than square, the considerable distance between the populations in Pernambuco, Brazil, and those in Venezuela, Guyana, Suriname, and French Guiana, a dull, yellow flower versus a greener flower, larger floral bracts, and a taller inflorescence.

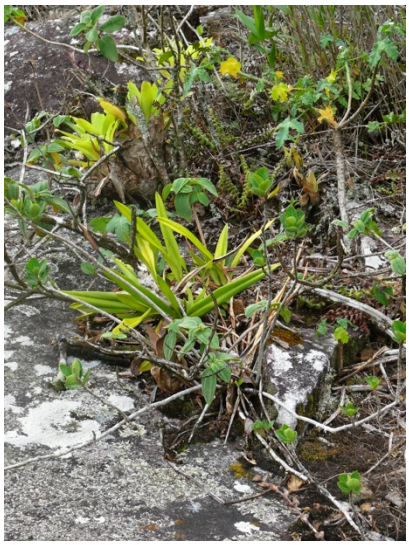

Fig. 7 Phrag. lindleyanum growing in full sun during the dry season

There is no mention of the color red, although that color is present in varying degrees in all flowers.

A review of the plants and flowers in natural populations indicates that a dull, yellow color does not predominate in the Brazilian populations and that the Brazilian populations do have plants with a yellow margin to the leaves. The author has personally seen large plants of *lindleyanum* put into private gardens near the habitats in Pernambuco that flower in subsequent years with smaller floral bracts and shorter inflorescence than the same plants did in their natural habitats (phenotypic plasticity). Plants in Pernambuco, Brazil do have a quadratic staminode alongside plants with triangular staminodes. Flower color is highly variable and can change with cultural conditions. The height of the inflorescence varies depending on the size and age of the plant. Also, the claw face is heavily spotted with small brown spots across the entire surface with two green spots at the center of the claw. The commonalities, often overlooked by authors who have focused solely on minute differences in small samples sizes, are considerable, as are the ecological consistencies.

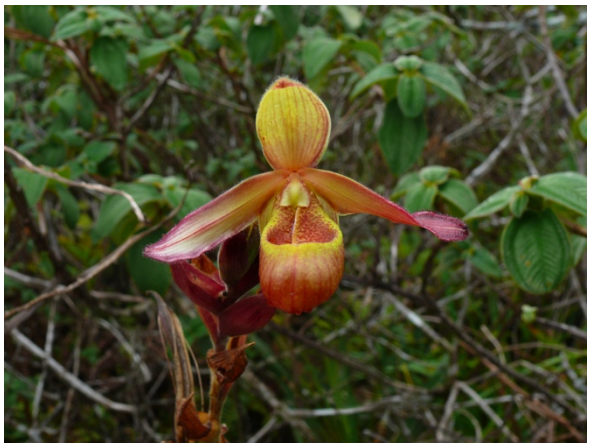

Fig. 8 A red color form of Phrag. Lindleyanum showing the unique pattern of spots on the claw face.

Phragmipedium lindleyanum, like its Brazilian cousins, inhabits ecosystems that cycle through an annual wet and dry season. *Phrag. lindleyanum* has a distinct dry season. During the dry season, generally December through March, plants receive no rain. *Phragmipedium lindleyanum* is a partially xerophytic species. Humidity remains between 50 and 60 percent as the habitats are all close to the Atlantic seaboard. Companion genera include *Catasetum*, *Encyclia*, *Cyrtopodium*, *Epidendrum* and *Brassavola*, each requiring, in its right, a distinct dry season. In some locations, plants of *Phrag. lindleyanum* can be found sharing their root mass with *Catasetum* bulbs, a natural reality that would not be possible if the one size fits all cultural approach to this genus was credible. During the wet season, surrounding shrubs and trees are green, lush, and provide some shade to *lindleyanum* plants, which can be found along the margins of small groups of trees atop large, granite hills, as well as in more exposed locations at the edges of groups of low-lying shrubs. During the rainy season, it rains every day, habitats receive copious amounts of water, necessitating a mechanism for removing that water as quickly as it arrives in order to keep everything in the ecosystem from rotting. That mechanism is the granite hill itself, being round, smooth, and with exposed rock. Light levels are reduced due to ever present rain clouds and an overcast sky. During the dry season the rain stops, the clouds disappear, and *lindleyanum* waits, under almost full sun, for the dry season to end. Surrounding vegetation drops its leaves.

Phragmipedium longifolium (Reichenbach fil. & Warszewicz) Rolfe, Orchid Rev, 4: 332. 1896.
Syn:
Phragmipedium chapadense (Campacci & Takase) *Journal of the Hokkaido Orchid Society*, 28 (supplement no. 1): 1. 2000.

Phragmipedium chapadense was described in 2000 based on a plant in a private collection in Sao Paulo Brazil that was alleged to have come from Chapada dos Veadeiros in central Brazil. The alleged location is a few hundred meters from a population of *P. vittatum*. I know this area very well. Not one plant meeting the description of *Phragmipedium chapadense* has ever been encountered in the area the proposed species is alleged to come from. No natural plant meeting this description of *P. longifolium* has ever been located in Chapada dos Veadeiros.

Phragmipedium × *brasiliense* Quené & O.Gruss *Orchid Digest* 67: 242 (2003).

Phragmipedium × *brasiliense* is a man-made hybrid. The two (2) type plants are neither naturally occurring nor are they a species. The type material was previously misidentified as *P. vittatum* by Marie Selby Botanical Garden based on erroneous hand me down plant history, and as man-made hybrids by the source of the type material, which is the accurate history of the holotype.

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