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***Pseudotrimezia* *speciosa* (Iridaceae, Trimezieae), NEW COMBINATION IN PSEUDOTRIMEZIA FROM THE ROCKY FIELDS OF MINAS GERAIS (BRAZIL)**

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Abstract: The Iridaceae family has 66 genera and about 2030 species, with cosmopolitan distribution and center of diversity in South Africa, followed by South America (Goldblatt et al. 2008a). The genus **Pseudotrimezia** belongs to the Neotropical tribe Trimezieae Ravenna and had its circumscription expanded by Lovo et. al. (2018), as it includes part of the species previously recognized as **Trimezia** sect. **Juncella** (Chukr & Giulietti, 2001; 2008). **Pseudotrimezia** is characterized by having spiraled cataphylls, elongated corms, cylindrical leaves, aphyllous scapes or bearing two bracts imbricated with each other, patent or strongly revolute tepals, yellow, orange, lilac or purple flowers. **Pseudotrimezia speciosa** (Ravenna) Chukr was first described as **Trimezia juncifolia** (Klatt) Benth. & Hook. subsp. **speciosa** by Ravenna (1988). In previous works Chukr (1992) and Chukr & Giulietti (2008) synonymized the subspecies under the basionym **Trimezia juncifolia**, (=**Pseudotrimezia juncifolia**) without considering subspecies. Copies of **Trimezia** (=**Pseudotrimezia**) with cylindrical leaves and red flowers were found in two locations in rocky fields of Minas Gerais (Brazil), at the municipalities of Passos and São José do Barreiro, in the foothills of *Serra do Canastra*, where it is locally endemic. As the character is of paramount importance, the hierarchical level of the taxon was changed, moving from subspecies to species and effecting the change of genus. This work presents the diagnosis of the taxon, its anatomical characteristics, comments and relationships with other taxa, geographic distribution as well as its phenology.

Keywords: Iridaceae, Trimezieae, *Pseudotrimezia*, *Trimezia*.

Basionym: *Trimezia juncifolia* (Klatt) Benth & Hooker subsp. *speciosa* Ravenna, Onira 1(1): 10-11. 1988.

TYPUS: Brasil, Minas Gerais, Santana do Riacho, Serra do Cipó, Ravenna 180 (*holotypus* Herb. Ravennae, n.v.; *isotypus* RB, n.v.). Lectotype (here designated):

MINAS GERAIS: Passos, 20° 38'S, 46° 15'W, MG 50, km 280, Cachoeira da estrada, ca 820 m. alt., 29/01/2010, N. S. Chukr 805, fl. (SPF, RB).

INTRODUCTION

Pseudotrimezia speciosa (Ravenna) Chukr was first described as **Trimezia juncifolia** (Klatt) Benth. & Hook. subsp. **speciosa** by Ravenna (1988). The subspecies was reported from Serra do Cipó (MG), growing in rupestrian fields and having the presence of red flowers as a differential characteristic. The material Ravenna 180 (RB) was searched, without, however, being successful.

In previous works Chukr (1992) and Chukr & Giulietti (2008) synonymized the subspecies under the basionym **Trimezia juncifolia**, without considering subspecies, because red flowers belonging to the genus **Trimezia** were not detected in Serra do Cipó after many years of collection. It was considered that, as it has yellow or orange flowers, the description provided by Ravenna (1988) would be incorrect.

Subsequently, in consultation with the computer network: (https://www.brazilplants.com/iridaceae/trimezia_juncifolia-f.html), **Trimezia** (=**Pseudotrimezia**) with red flowers were observed.

In contact with the author of the page (Mauro Peixoto, personal information) was obtained on the occurrence of specimens of Iridaceae with red flowers in two locations in the Campos rupestres of Minas Gerais, in the municipalities of Passos and São

José do Barreiro, in the foothills from Serra do Canastra. During visits to the sites, the occurrence of **Pseudotrimexia** specimens with the presence of red flowers was evidenced, which could not be considered a variant of the yellow color. As the character is much important, the hierarchical level of the taxon was changed, moving from subspecies to species. The species is recognized by Lovo (2022) as a valid species for the Flora of Brazil.

In the present work, classical taxonomic studies were carried out with anatomical sections of leaves and scapes, seeking to better define the taxon in relation to closely related species.

MATERIAL AND METHODS

The collected material was divided, being part pressed in the field due to the fragility of its flowers and then subjected to drying in an oven with registration of collector number, date of collection, phenological state, closest geographic point and geographic and altitude coordinates. Another part, consisting of leaves and scapes, was fixed in FAA (formaldehyde, acetic acid, ethyl alcohol 5:5:90 in 50% ethanol (Johansen, 1940). Sections of leaves and scapes was performed by hand, with the aid of a razor blade, and the transverse leaf sections obtained were submitted to double staining with safranin and astra blue in 1% aqueous solution and toluidine blue in the transverse sections to the scape (Bukatsch 1972, *apud* Kraus & Arduin, 1997). The anatomical studies was carry on in the Institute of Botany of the Secretary of Environment of the São Paulo State, Nucleus of Research in Anatomy.

SPECIES DESCRIPTION

Erect herbs. Corm 0.7-1.2 X 0.5-1.0 cm. covered by spiral, crass, brown cataphylls. Leaves cylindrical 45-97 X 0.2-0.3 cm., erect,

glabrous, longitudinal striations visible to the naked eye. Aphyllous scapes, 10-15 cm long, cylindrical, bearing at the apex rhipidium, 7.0-7.5 cm long, composed of faired bracts arranged in 3 series, the external ones leathery, sterile, the internal membranous, fertile. Pedicels 3.0-3.5 cm long. Red flowers. Oboval-elliptic external tepals, 4.0-6.5 X 1.7-2.5 cm, lower portion therefore capitate trichomes, with pink or vinaceous arabesques, upper portion glabrous, internal oboval-oblong tepals, with pink arabesques at the base or vinaceous; red internal tepals, 3.5-4.8 X 1.0-1.4 cm, revolute upper portions, densely hairy articulation zones, sharp apices, vinaceous arabesques throughout. Anthers attached to style columns, blackish-green, oblong, 1.0-1.2 cm long, very thin filaments, 0.8-1.2 cm long. Hypanthum oblong, slightly trine, 1-1.2X0.3-0.4 cm, greenish, grooved; style triangles 2.5-3.2 cm in total length, rosy, bases widened, upper portions free, 0.5-0.8 cm long, bifid, lacinia erect, 0.4-0.5 cm long. Oboval-oblong capsules, 1.0-2.0 cm long, 0.6-1.5 cm in diameter, locules opening to half their length. Seeds 9-25 per locule, 2.6-4.0 mm long, 2.0-3.0 mm. width.

MATERIAL EXAMINED

MINAS GERAIS: Passos, 20° 38'S, 46°

15'W, MG 50, km 280, Cachoeira da estrada, ca 820 m. alt., 29/01/2010, N. S. Chukr 805, fl. (SPF, RB); *idem*, 12/01/2011, N.S. Chukr 825 & P.U. Ávila, fl. (SP); São José do Barreiro, Serra da Babilônia, 20°22'S, 46° 28'W, 30/01/2010, N. S. Chukr 806, young fruit (RB).

RESULTS AND DISCUSSION

Iridaceae Juss. it is formed by perennial or annual herbs with an underground system in the form of a rhizome or vertical underground stem corm-like (ex. **Trimexia** and **Pseudotrimexia**). The leaves blades in the family have a variety of shapes, being

generally linear or ensiform, equitabile, bi- or monofacial and with parallel venation (Dahlgren & Clifford 1982). Most species have flat leaves, but cylindrical leaves are found with some frequency in the genera (Chukr & Giulietti, 2008). The leaves are characterized by presenting a basal, laminar and subterranean part, corresponding to fibrous cataphylls, and an aerial part, cylindrical or linear, with a green color and an acute apex. The leaves are inserted into the stem nodes with a spiral arrangement and juxtaposed with each other, due to the proximity of the stem nodes. The cataphylls partially surround the stem system, forming an oval structure. The outermost cataphylls correspond to the sheaths of deciduous leaves, they are fibrous, more or less thickened, brownish in color or blackened due to the presence of resiniferous substances.

Chukr & Giulietti (2008) had separated the genus **Trimezia** into two sections, sect. **Juncella** with the cylindrical and sect. **Trimezia** with flat, bifacial leaves, as proposed by Ruddall (1993). Lovo et al. (2018) transferred the cylindrical, monofacial species of **Trimezia** to the **Pseudotrimexia** and maintained the flat-leaved, linear species in **Trimezia** based on morphological and molecular studies. In **Pseudotrimexia**, there is a separation of a group with ebracteate or with two imbricated, morphologically similar bracts at the first proximal node of the scape (Lovo et al. 2018; Chukr & Giulietti, 2008; Chukr & Giulietti, 2003). In group of ebracteate scape are: **Pseudotrimexia juncifolia** (Klatt) Lovo & A.Gil, **Pseudotrimexia truncata** (Ravenna) Lovo & A.Gil, **Pseudotrimexia fistulosa** (Foster) Lovo & A. Gil, **Pseudotrimexia gracilis** Chukr, **Pseudotrimexia synandra** Ravenna and now **Pseudotrimexia speciosa** (Ravenna) Chukr.

The cylindrical leaves of **Pseudotrimexia**

speciosa present, in cross-section, a unistratified glabrous epidermis with a relatively thick cuticle, subepidermal sclerenchyma, interconnecting the collateral bundles (Fig. 1C, 1D, 1E). They have about ten furrows in the leaf median region, visible to the naked eye, whose epidermis has globular cells with a thin cuticle and several stomata, but they do not have papillae, as in **P. truncata** and **P. juncifolia** (Fig. 1A, 1B, 1C, 1D). Chueiri (1977), Chueiri-Chiaretto (1984) and Rudall (1993) pointed out that the presence of trichomes and stomata in depressions are xeromorphic characteristics of the species, conditioned by water stress, giving **P. speciosa** an adaptive character to such environmental conditions.

In **Pseudotrimexia speciosa**, the leaves have different types of vascular bundles, with a large bundle in the median region of each arm formed by the sulci, surrounded by two smaller bundles, both collateral and associated with the subepidermal sclerenchyma (Fig. 1A, 1B, 1C, 1D, 1E). In addition to these, there are small collateral bundles in the medullary region (Fig. 1C, 1D). The phloem of the large bundles is submerged in the subepidermal sclerenchyma, presenting a sheath made up of enlarged parenchyma cells whose content gives them different shades of red coloring (Fig. 1C, 1D, 1E). The presence of sclerenchyma just below the epidermis was considered by Rudall & Goldblatt (1993) and Rudall (1994) as a plesiomorphic character, widely disseminated in the subfamilies of Iridaceae and present in some very primitive species, such as **Isophysis tasmanica** (Rudall 1986). In all the materials examined, the presence of subepidermal sclerenchyma associated with the large vascular bundles can be noted (Table 1).

By analyzing the histological sections of the leaf blades, the following characteristics can be observed:

The cross section is circular with the presence of a uniseriate epidermis and the presence of sporadic papillae (Fig. 1C, 1D, 1E). Stomata occur randomly, especially associated with the sulci.

The grooves have an opening of 100 to 200 μm and a length of 180 to 220 μm (Table 1; Fig. 1E), without associated trichomes. Such grooves do not extend beyond the xylem line (Fig. 1C, 1D, 1E).

Below the epidermis there is a continuous sclerenchymatic band of 5 to 6 cell layers (Fig. 1E).

The vascular bundles are collateral, arranged neatly below the sclerenchymatic band and disorderly in the medullary region (Fig. 1A, 1B); in these, a sclerenchyma hood may occur over the phloem pole in larger bundles (Fig. 1A, 1B)

In relation to the vascular bundles, there may be two smaller bundles associated

with the larger bundles immersed in the sclerenchymatic band, arranged laterally and in the same line as the phloem (Fig. 1D, 1E). Within the Trimezieae tribe, several synapomorphies can be evidenced in the leaf blade, such as the presence of subepidermal sclerenchyma linking the collateral bundles together, phloem surrounded by sclerenchyma and the presence of small lateral bundles to the larger bundles (Rudall, 1993, Chukr & Giulietti, 2003; 2008, Lovo, 2007, Lovo et al. 2018). The presence of small lateral bundles was considered by Rudall (1993) as a unique character of the tribe Trimezieae within the subfamily Iridoideae, with correspondence only between some representatives of the subfamily Ixioideae.

All these features were visualized in **Pseudotriimezia speciosa**, including the taxon perfectly into the tribe. Due to the external morphological characteristics, the

	CHARACTER / TAXON	<i>P. speciosa</i>	<i>P. truncata</i> *	<i>P. juncifolia</i> **
LEAF	Presence of trichomes in the leaf furrows	_____	_____	XXXX
	Furrows to the xylem line	XXXXX	(crosses the xylem line)	XXXX
	Length of furrows (μm)	180-(200)-220	250- 300	85-100-(175)-200-240
	Furrows opening (μm)	100-120-200	125-250	50-97,5-100
	Lateral bundles at phloem height in leaf cuts	XXXXX	ABOVE	ABOVE
SCAPE	Alternation of smaller and larger sized beams on the scape	XXXXX	_____	_____
	Beam sheath extending to sclerenchymatic band on stem	XXXXX	XXXXX	_____
	Numerous papillae on the scape	XXXXX	_____	_____

Table 1. Leaf and scape data of **Pseudotriimezia speciosa**, **Trimezia truncata** (= *P. truncata*) and **Trimezia juncifolia** (= *P. juncifolia*) according to Chueiri, 1977(*) (**), Rudall, 1993(**), Lovo, 2007 (**). _____ absence. XXXX - presence.

species is indistinguishable from the other two species of the genus, **Pseudotriremezia truncata** and **Pseudotriremezia juncifolia**, both because of the scape structure, the main characteristic of the genus, and the cylindrical leaves. The most evident visual feature that separates the three species is the color of the flowers, although other external morphological features help us in the specific separation, namely yellow flowers in **P. juncifolia**, purple or violet flowers in **Triremezia truncata** (= **P. truncata** (Ravenna) Lovo & A. Gil) and red flowers in **P. speciosa** (fig 2A, 2B, 2C, 2D, 2E, 2F, 2G). The presence of smaller anthers separated by a large connective is marked in **P. truncata** (Chukr & Giulietti, 2008) and little evident in **P. juncifolia** (Chukr & Giulietti, 2008) and **P. speciosa** (Fig. 2B, 2D). The apical portion of the styles is also a selective character for **Pseudotriremezia truncata**, because in this species they are bifid and patent (Chukr & Giulietti, 2008), while in **P. speciosa** they are bifid and erect (fig. 2B, 2D) and in **P. juncifolia** they are polymorphic, being bifid, patent or erect and yet trifid and erect (Chukr & Giulietti, 2008). The coloring of arabesques is also distinctive: in **P. truncata** there are vinaceous (Chukr & Giulietti, 2008) in **P. juncifolia** (Chukr & Giulietti, 2008) they are ocracea or vinaceous and in **P. speciosa** they are vinaceous to pink, as well as the styles. (fig. 2A, 2B, 2C, 2D, 2E, 2F, 2G). The stamens in **P. speciosa** are blackened and the connective narrow (fig. 2B, 2D) as in **P. juncifolia**, while in **P. truncata**, they are also blackish but are separated by a large connective (Chukr & Giulietti, 2008), which distinguishes them from other species.

Analyzing Tab. 1, we can notice some common features to **P. truncata**, such as:

- Absence of papillae associated with leaf furrows;
- Presence of opening of larger furrows;

c) Beam sheath that extends to the continuous sclerenchymatic band of the scape.

The absence of trichomes in the furrows is a character of strong taxonomic importance, as it involves gene regulation. The presence of wide-opening furrows is evident (Table 1). Regarding the length of the furrows: **P. speciosa** stands in an intermediate position to **P. truncata** e **P. juncifolia** (Tab. 1), however getting closer to **P. truncata**. In this sense, we can see that the proposition of Ravenna (1988), positioning the taxon as a subspecies of **P. juncifolia** does not find support in anatomical analysis, because the absence of trichomes in the furrows is a strong factor, which speaks in favor of bringing the species closer to **P. truncata**, but not **P. juncifolia**. Also the size of the furrows opening is much closer to **P. truncata** than **P. juncifolia**, the latter having furrows with smaller openings (Table 1).

SCAPE

In the family Iridaceae, the scapes are usually erect, rigid, flat or cylindrical, ebracteate or with two imbricated, morphologically similar bracts in their extension. The genus **Pseudotriremezia** has condensed inflorescences where the bracts are juxtaposed due to the proximity of the internal ones, being considered a type of rhipidium (Chukr & Giulietti, 2003; 2008, Lovo, 2007, Lovo et al.2018).

In relation to the scape, we can observe in **P. speciosa** the presence of an aphyllous scape (fig. 2C), bearing striations visible to the naked eye. Such striations are related to the presence of sclerenchymatic cords that reach the epidermis and that connect to a continuous sclerenchymatic band arranged more internally, regularly associated with bundles located in its cortical region and others sparsely distributed in the medullary

region (Fig. 1F, 1G, 1H, 1I). All bundles are collateral, sometimes with a sclerenchymatic hood positioned over the phloem pole (Fig. 1G, 1H, 1I). On the epidermis there are numerous sclerified papillae arranged around the entire circumference of the scape (Fig. 1G, 1H). In the central portion, other vascular bundles are randomly distributed, with the xylem facing inwards and the phloem facing outwards (Fig. 1H, 1I).

On the scape there is a marked difference in relation to the two species, as there is an alternation of larger and smaller vascular bundles over the sclerenchymatic band (Figs 1F, 1G). This feature is not found in *P. truncata* nor in *P. juncifolia* (Chueiri 1977, Tab. 1). A similar character was evidenced in *P. fistulosa* Foster (Chukr & Giulietti, 2008). This alternation is not total to the circumference of the stem, but it is quite evident (fig. 1F). Similarly to *P. truncata* and differing from *P. juncifolia* is observed that the bundles placed above the sclerenchyma have a bundle sheath that extends until to the sclerenchyma (fig. 1F, 1G, 1H, tab. 1), an important feature that once again separates the species from *P. juncifolia* (Chueiri, 1977). In phenology, *Pseudotrimexia speciosa* blooms from January to April on sunny days. Flower anthesis begins in the first hours (~6 hours), fully opening between 8:00 and 9:00 hours with intense secretion of glandular trichomes (probably elaiophores) present in the outer tepals and more pronounced in the inner tepals (fig. 2A, 2B, 2C, 2D, 2F, 2G). Between 10:00 and 12:00 hours the secretion of elaiophores becomes more pronounced. Between 15:00 and 16:00 hours the closing of the flowers begins. All these alterations were taken from material in cultivation of the species, Chukr 825 (SP), taken in the municipality of Passos (MG). It is interesting to say that this species showed good tolerance to growing conditions in an environment

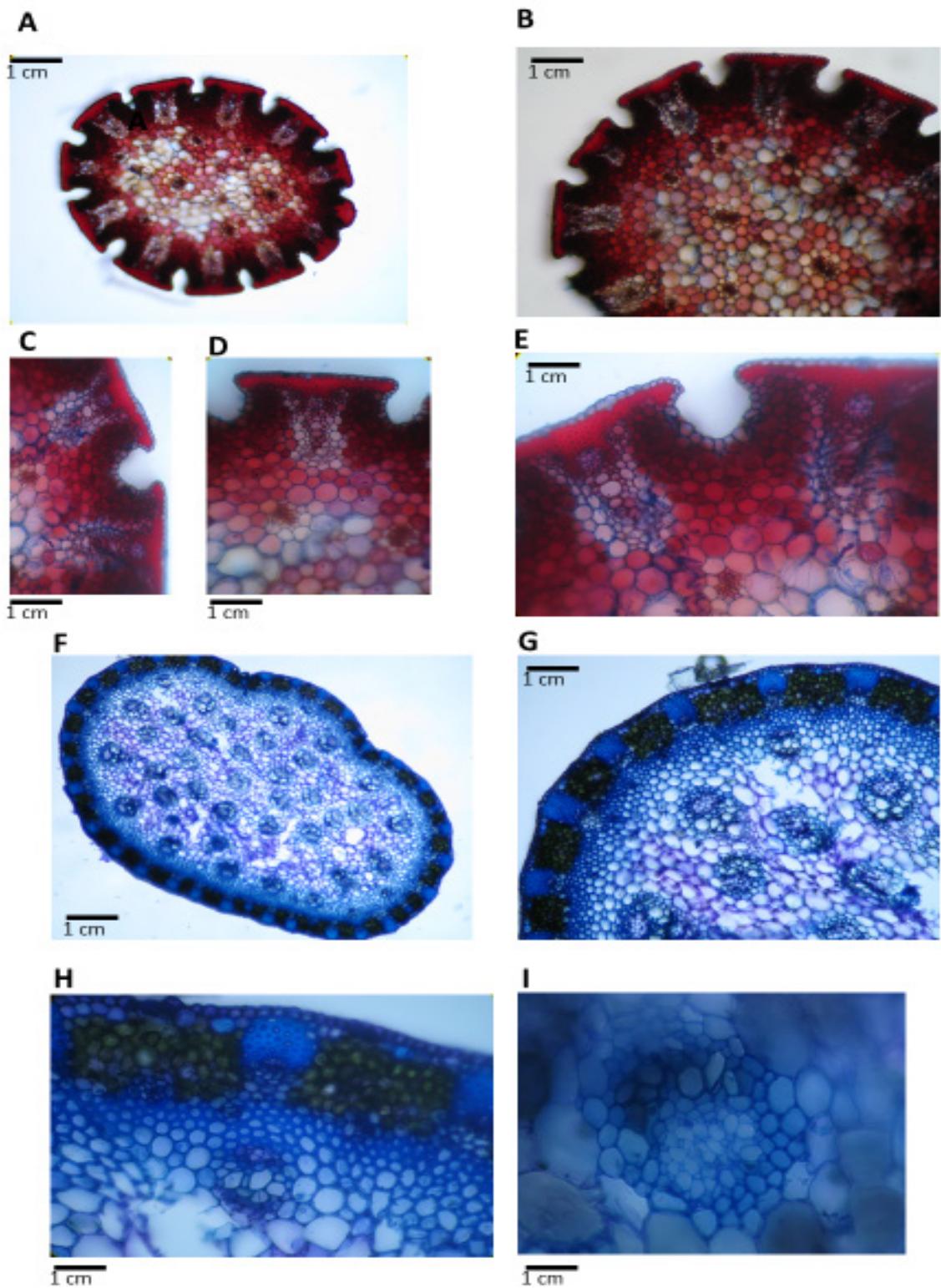
different from the Cerrado climate, as the material was grown in Cotia (SP/Brazil), under subtropical environmental conditions. No other species of the genus accepted "ex situ" cultivation, and even among the specimens, because the materials taken from São José do Barreiro (MG) were not successful, processed in the same way and in the same place. Despite flowering for 2 or 3 years, the material of Passos went into senescence and died.

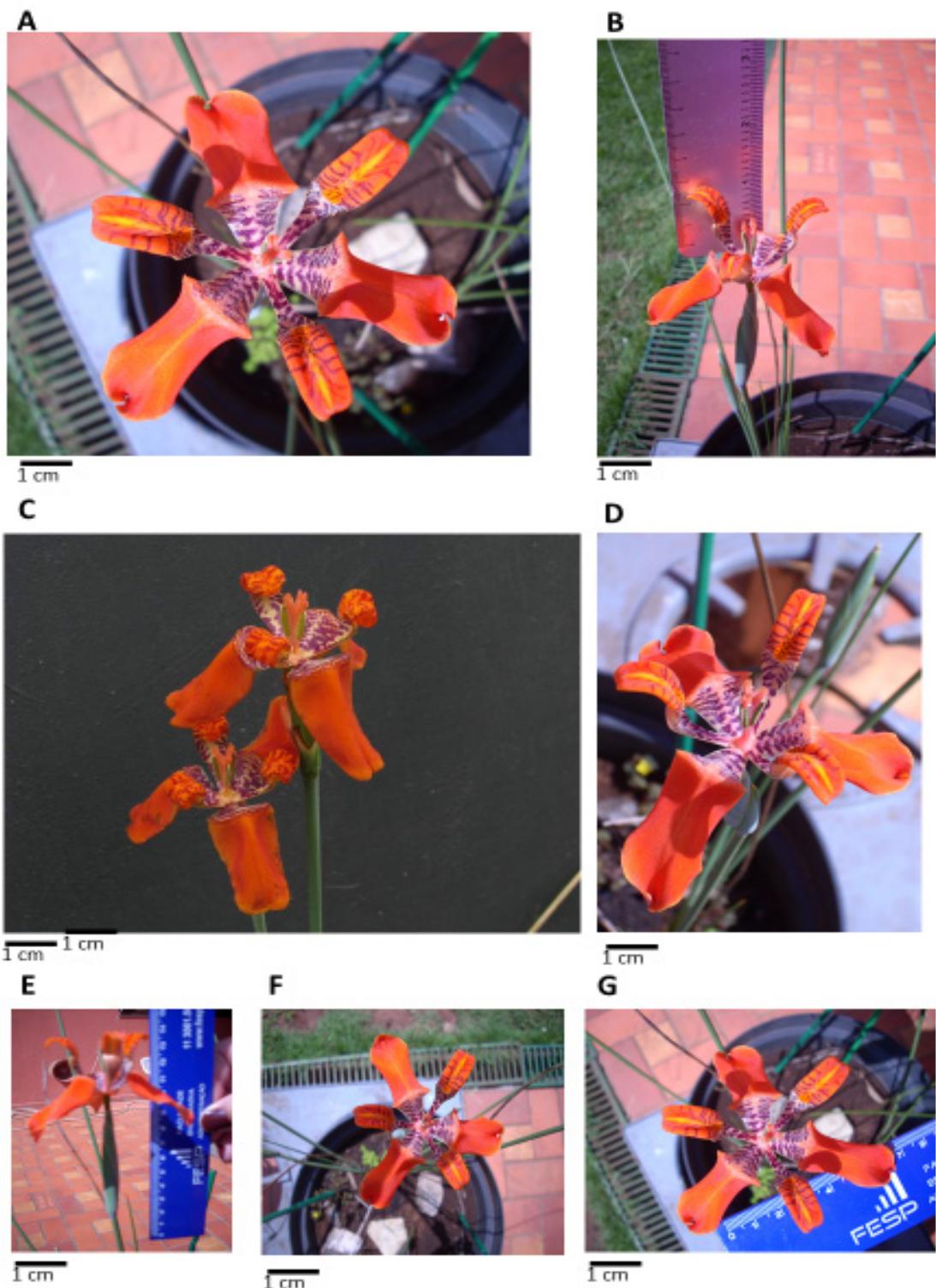
Pseudotrimexia speciosa was only found in the municipalities of Passos and São José do Barreiro (MG) in a rocky field. There was no fruit formation in the cultivated material, which was probably due to the absence of a specific pollinator.

The data therefore confirm the species **Pseudotrimexia speciosa**, especially due to the absence of trichomes in the leaf furrows associated with estomata and the alternation of larger and smaller bundles on the stem, an uncommon feature in **Pseudotrimexia**, observed only in **Pseudotrimexia. fistulosa**.

PLANKS

1- Anatomy of **Pseudotrimexia speciosa** (A-E- cross sections of the leaves) A-B: overview. C: Detail of the furrows. D: Detail of a large collateral bundle associated with two small lateral bundles and a bundle sheath that extends to the sclerenchyma. E: Detail of uniseriate epidermis and furrows. F-I: cross-sections to the scape. F: general view showing alternation of larger and smaller sized bundles above the continuous sclerenchymatic band. G: Detail of the lateral bundles associated with the sclerenchyma and medullary region with collateral bundles. H: Detail of cortical bundle with sclerenchyma hood and sclerified papillae. I: Detail of medullary collateral bundle. A, B, F: scale:1 cm = 400 μ m; C,D,G: 1cm=200 μ m; E-H: 1cm=100 μ m; I: 1cm=50 μ m.





2- Details of the flowers of ***Pseudotrimezia speciosa***, especially the crimson-red color of the tepals (A- G).
 Photos: A, B, D, E, F, G: N. S. Chukr. Photo C: Mauro Peixoto.

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