UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
DEPARTAMENTO DE BOTÂNICA
PROGRAMA DE PÓS-GRADUAÇÃO EM BOTÂNICA

Gomesa R.Br. (ORCHIDACEAE: ONCIDIINAE) NO RIO GRANDE DO SUL, BRASIL: SINOPSE TAXONÔMICA E BIOLOGIA REPRODUTIVA DE ESPÉCIES REPRESENTATIVAS

JONAS BLANCO CASTRO

Orientador: Dr. Rodrigo Bustos Singer (UFRGS)

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Dissertação apresentada ao Programa de Pós-graduação em Botânica da Universidade Federal do Rio Grande do Sul, como requisito parcial para a obtenção do título de Mestre em Botânica.

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AGRADECIMENTOS

Ao meu orientador, Dr. Rodrigo Bustos Singer, pelo acolhimento, participação e correções realizadas durante esses dois anos de trabalho.

Aos amigos Dr. Sérgio Augusto de Loreto Bordignon, Dr. Cristiano Roberto Buzzato e Diober Borges Lucas, pela grande ajuda nos trabalhos de campo bem como nas demais etapas do trabalho.

Aos responsáveis, funcionários e pesquisadores da Fundação Zoobotânica do Rio Grande do Sul, em especial às Dras. Rosana Farias Singer e Andréia Maranhão Carneiro, pelos auxílios e por gentilmente disponibilizarem o orquidário para cultivo de plantas coletadas e a área da seção de coleções para estudos de polinização.

Aos curadores dos herbários pelo material disponibilizado para análises morfológicas.

À Dra. Rosa Mara Borges da Silveira e seus alunos, por disponibilizarem seu laboratório e equipamentos para visualização de elaióforos.

Aos colegas de laboratório, Me. Camila Carvalho de Gusmão Lôbo e Dimitri Souto Fagundes, pelo acompanhamento em saídas de campo e auxílios em relação aos estudos de polinização e biologia reprodutiva.

Aos demais colegas do PPGBot pelo companheirismo e por todas as sugestões para o melhoramento do trabalho.

Aos professores e demais funcionários do PPGBot, pelos conhecimentos agregados e por proporcionaram um ambiente favorável à realização das pesquisas.

Aos membros da comissão examinadora, por terem aceito o convite e pelas sugestões e correções que com certeza irão enriquecer este trabalho.

Aos meus amigos e familiares, principalmente meus pais, pela confiança e apoio incondicional.

À Capes pela bolsa concedida.

Às demais pessoas que, de uma forma ou de outra, colaboraram para a realização deste trabalho

RESUMO

Oncidiinae é uma das principais subtribos de Orchidaceae em número de representantes dentro da região Neotropical. As relações taxonômicas e filogenéticas entre as espécies da subtribo sempre foram controversas, sendo recentemente esclarecidas após o desenvolvimento de filogenias baseadas em caracteres moleculares. Como resultado, muitos gêneros foram atestados como não monofiléticos, entre eles *Oncidium* Sw., o gênero tipo da subtribo. As espécies brasileiras do gênero foram, então, transferidas para um conceito amplo de *Gomesa* R.Br., a fim de gerar grupos monofiléticos. Como atualmente aceita, *Gomesa* abrange 133 espécies do Brasil. Após observações de campo e revisão de literatura e herbários, foi detectada a necessidade de realização de tipificações e sinônimos sobre as espécies do sul do Brasil. Portanto, fornecemos uma lista de 20 holótipos, 3 isótipos, 8 síntipos, 16 lectótipos, 1 isolectótipo e 2 neótipos. Os novos sinônimos propostos são *Gomesa montana* (= *G. barbaceniae*); *G. ciliata* (= *G. barbata*); *Oncidium raniferum* var. *major* e *G. loefgrenii* (= *G. hookeri*); *G. gravesiana* (= *G. imperatoris-maximiliani*); *G. gardneri* (= *G. pectoralis*); *G. planifolia* (= *G. recurva*); e *G. longipes* (= *G. uniflora*). Após o conhecimento das identidades das espécies, realizamos uma sinopse de *Gomesa* no Estado do Rio Grande do Sul. Neste estudo, vinte espécies foram descritas, ilustradas e mapeadas. Pudemos observar que a riqueza específica é maior nas regiões leste e norte, enquanto diminui em direção ao oeste e sul. Em relação à lista de espécies previamente citadas para Estado, devem ser suprimidos 13 nomes e acrescentados três: *Gomesa barbaceniae*, *G. imperatoris-maximiliani* e *G. pectoralis*. Além disso, foram estudadas as estratégias de polinização e os sistemas reprodutivos de duas espécies representativas, *Gomesa flexuosa* e *G. cornigera*. Estas espécies oferecem óleos florais como recompensas a seus visitantes e são polinizadas por fêmeas de *Centris trigonoides* e *Trigonopedia ferruginea*, respectivamente. Ambas são polinizador-dependentes, mas fortemente auto-incompatíveis em relação aos seus sistemas de reprodução. Apesar de apresentarem altas porcentagens de frutificação por polinização cruzada em condições controladas (66,67% e 71,74%), suas eficiências de polinização são baixas, evidenciadas pelos índices de Nilsson de 0,27 e 0,35, que refletem em seus respectivos sucessos de frutificação. Esses fatores aliados aos comportamentos dos polinizadores, à provável ocorrência de auto-polinizações e a influência de características ecológicas resultam em baixas frutificações nas populações naturais, de no máximo 1,54% em *Gomesa flexuosa* e 6,10% em *G. cornigera*.

Palavras-chave – Oncidiinae, *Oncidium*, tipificações, sinônimos, chave de identificação, distribuição geográfica, estratégia de polinização, eficiência de polinização, sucesso de frutificação.

ABSTRACT

Oncidiinae is one of the main subtribes of Orchidaceae in number of representatives within the Neotropics. The taxonomic and phylogenetic relationships among species within the subtribe have always been controversial, being recently clarified after the development of molecular-based phylogenies. As a result, many genera were proven not to be monophyletics, between them *Oncidium* Sw., the type genus. The Brazilian species of the former genus were, then, transferred to an expanded concept of *Gomesa* R.Br., in order to generate monophyletic groups. As currently accepted, *Gomesa* englobes 133 species in Brazil. After field observations and revision of literature and *herbaria*, we detected the need for typifications and synonyms concerning the species from Southern Brazil. Then, we provided a list of 20 holotypes, 3 isotypes, 8 syntypes, 16 lectotypes, 1 isolectotype and 2 neotypes. The new synonyms proposed are *Gomesa montana* (= *G. barbaceniae*); *G. ciliata* (= *G. barbata*); *Oncidium raniferum* var. *major* and *G. loefgrenii* (= *G. hookeri*); *G. gravesiana* (= *G. imperatoris-maximiliani*); *G. gardneri* (= *G. pectoralis*); *G. planifolia* (= *G. recurva*); and *G. longipes* (= *G. uniflora*). After the knowledge about the species identities, we performed a synopsis of *Gomesa* in Rio Grande do Sul, the southernmost State of Brazil. In this study, twenty species were described, illustrated and mapped. We were able to observe that the specific richness is higher at the eastern and northern regions while decreases towards the west and south. In relation to the list of species previously cited to the State, 13 names should be suppressed and 3 names added: *Gomesa barbaceniae*, *G. imperatoris-maximiliani* and *G. pectoralis*. Moreover, the pollination strategies and breeding systems of two representative species, *Gomesa flexuosa* and *G. cornigera*, were studied. These species offer floral oils as rewards to visitors and are pollinated by *Centris trigonoides* and *Trigonopedia ferruginea*, respectively. Both are pollinator-dependents, but strongly self-incompatibles regarding their breeding systems. Despite presenting high percentages of fruiting by cross-polinations under controlled conditions (66.67% and 71.74%), their pollination efficiencies are low, evidenced by the Nilsson's indexes of 0.27 and 0.35, which reflect in their respective fruiting successes. These factors allied to the pollinators's behaviors, the probable occurrence of self-pollinations and the influence of ecological features result in low fruit sets in natural populations, maximum of 1.54% in *Gomesa flexuosa* and 6.10% in *G. cornigera*.

Keywords – Oncidiinae, *Oncidium*, typifications, synonyms, identification key, geographical distribution, pollination strategy, pollination efficiency, fruiting success.

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1. INTRODUCTION

Orchidaceae is pointed as the second largest family of Angiosperms, with approximately 24,500 species (Judd *et al*., 2009; Chase *et al.*, 2015), and has a broad geographical distribution, showing its diversity center within tropical regions. Their features are the presence of velamen at their roots; wide variety of stems, such as rhizomes, corms and pseudobulbs (thickened aerial structures of caulinar origin); presence of lip or labellum, their modified median petal; and androecium and gynoecium fused into a column (figure 1). In addition, most orchids present their pollen packaged in pollinia. Orchids generally have sympodial growth, with the pseudobulbs connected by a short or elongated rhizome, but monopodial growth is also observed in several unrelated lineages. The apex of mature roots in epiphytic orchids are often green due to the presence of chloroplasts in their cortex, although this color is masked by the velamen. Consequently, the roots may assume an essentially photosynthetic function in many species. In order for them to germinate and grow, the orchids need to associate their roots with fungi present in the soil, forming the so-called mycorrhizae, which will provide food for the plant in its first moments of life, at least until it is able to photosynthesize (Toscano-de-Brito & Cribb, 2005).

The subtribes Oncidiinae and Pleurothallidinae have the largest numbers of representatives within the Neotropics (Chase *et al*., 2008, 2015). Oncidiinae (Epidendroideae: Cymbidieae) comprises terrestrial or epiphytic herbs, bearing sympodial growth (few monopodials), uninodal pseudobulbs and usually two distichous and bifacial leaves (Chase, 2009). Until the end of the last decade, the taxonomic and phylogenetic relationships among Oncidiinae genera were not clear, due to the fact that several genera were described based upon few morphological features that were proven not to reflect the actual parental relations between the taxa (Faria, 2004). In Genera Orchidacearum (Chase, 2009) is presented a DNA matrix with robust sampling, clarifying some issues and proposing modifications in the genera level. Neubig *et al.* (2012) produced a phylogeny based on plastid and nuclear loci of 590 species of Oncidiinae, largely corroborating the results seen in Chase's work.

Oncidium Sw., the type genus, has always been on debate among experts due to its inconsistent traditional boundaries assumed over the years. In its broader delimitation, it covers more than 400 species popularly known as "dancing ladies" or "golden shower orchids", defined by the characteristic callosity observed in the lip, resembling tumors (from the greek word "onkos" = swelling). It was not a surprise when studies involving molecular

characters, such as Chase & Palmer (1992) through plastid DNA and Williams *et al.* (2001a, 2001b) using plastid and nuclear DNA sequences, proved that *Oncidium* is a polyphyletic grouping. With the advent of cladistic methods allied to analyses of molecular characters, *Oncidium sensu lato* was divided into several monophyletic genera, which were revalidated or described in later works. Chase *et al.* (2009) discussed the historical generic arrangements and necessary recircumscriptions in relation to the Brazilian species and grouped most of them within a broad concept of *Gomesa* R.Br., strongly supported by molecular analyzes. *Oncidium baueri* would remain as the only representative of the genus in Brazil. Faria (2004) generated a phylogeny of the almost Brazilian endemic "*Gomesa* clade" from morpho-anatomical, chemical and macromolecular data, providing a list of found apomorphies and plesiomorphies. As a result at the time, a new organization of monophyletic groupings was proposed, yet not formalized.

In its current delimitation (Chase *et al.*, 2009; Neubig *et al.*, 2012), *Gomesa* is constituted by seven strongly supported internal clades (figure 1) that can be easily identified and set apart. The genus is distinguished from the remaining Oncidiinae by a combination of features, as their fused lateral sepals, glaucous leaf surface, flexed pedicels and inflorescence bracteoles weakly attached to the pedicel and pointing externally (Chase *et al.*, 2009). *Gomesa* is very diversified in the Southern and Southeastern regions of Brazil, showing large diversity in the Cerrado and Atlantic Rainforest domains (Faria, 2004). Nothwithstanding, this circumscription is not a unanimity within the scientific community, due to the high heterogeneity seen both in vegetative and reproductive (figure 2) states of these species. Some authors defend its segregation in smaller genera, still morphologically diagnosable. Moreover, differences in the quantity, size and shape of certain flower structures suggest that there are distinct groups of active pollinators and pollination strategies driving each internal clade.

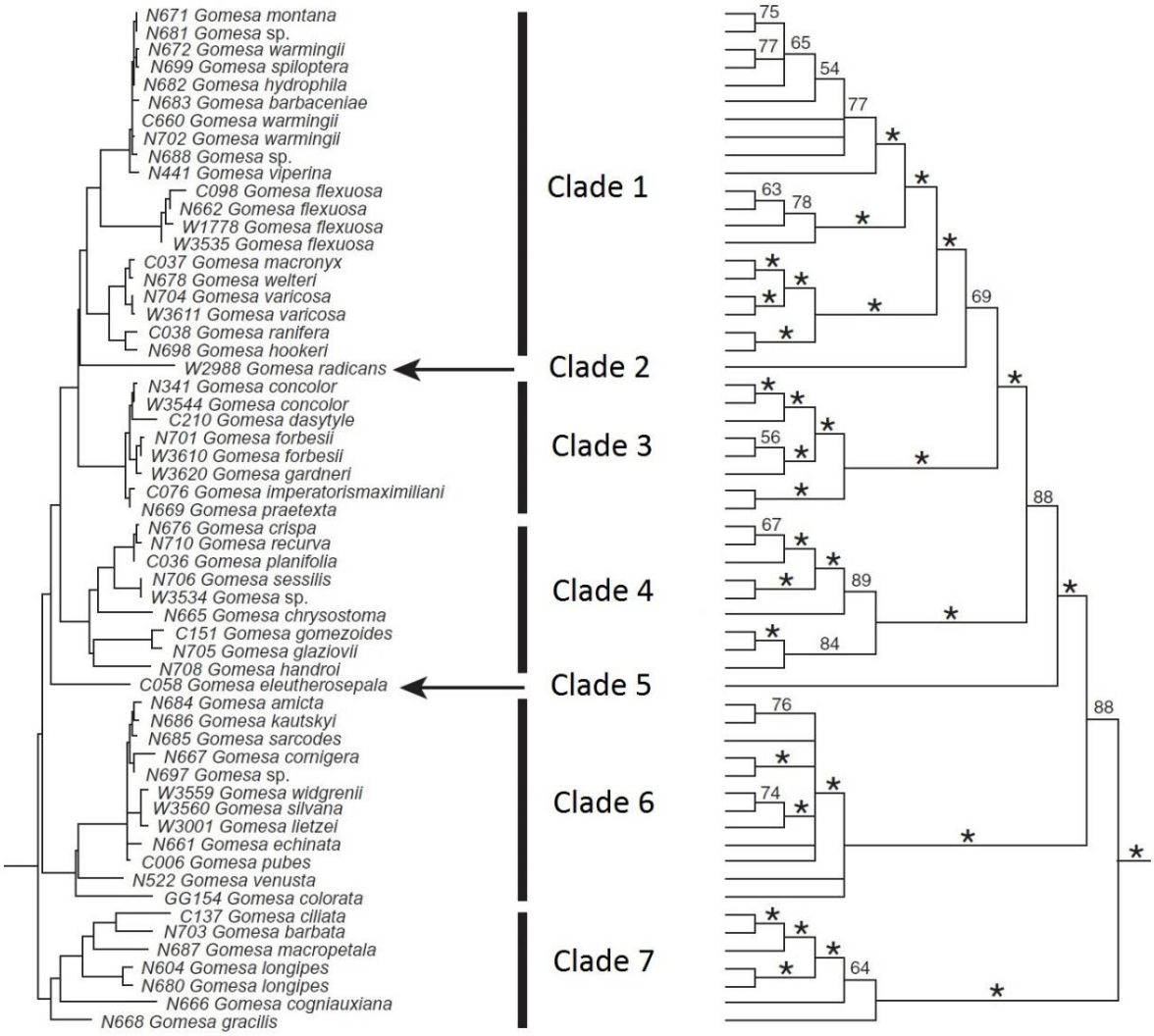

Figure 1 – Fragment of the single maximum likelihood tree of Oncidiinae published in Neubig *et al.* (2012), corresponding to *Gomesa s.l.* The asterisks indicate 95-100% bootstrap support. Source: Neubig *et al.* (2012), with modifications evidencing the internal clades.

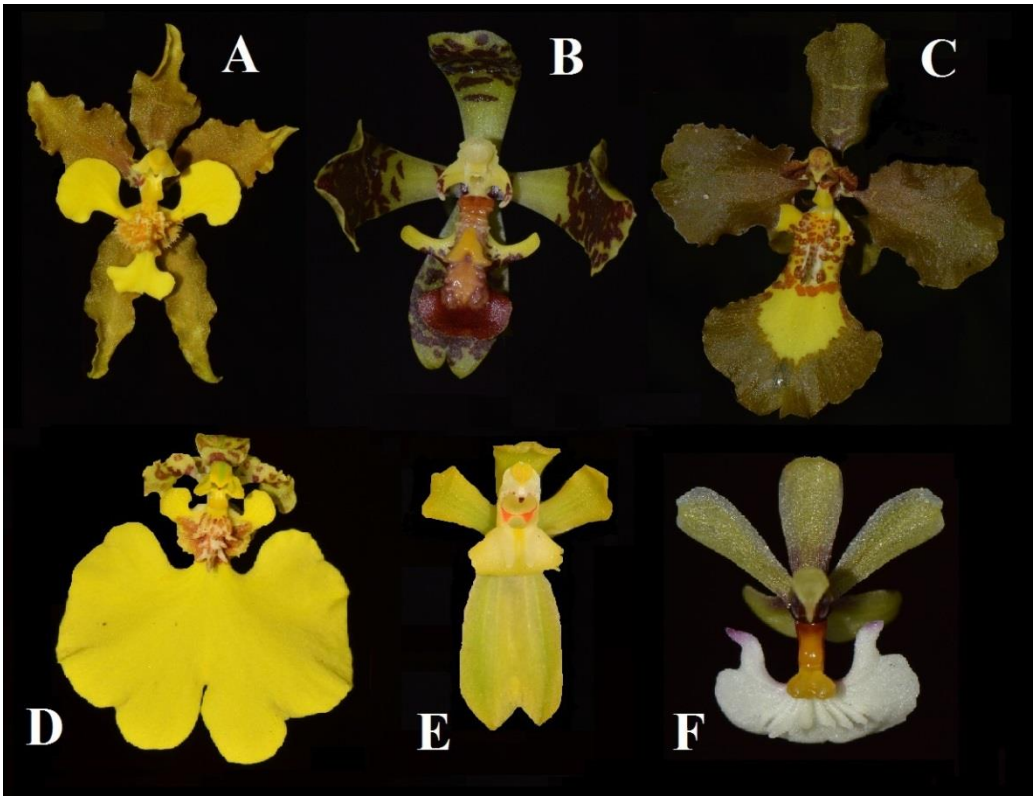

Figure 2 – Comparison of flowers of species included in *Gomesa s.l.*. See the high heterogeneity observed in their reproductive characters. A) *Gomesa barbata*; B) *Gomesa riograndensis*; C) *Gomesa imperatoris-maximiliani*; D) *Gomesa bifolia*; E) *Gomesa recurva*; F) *Gomesa radicans*.

In terms of reproductive features, the orchid flowers have long been studied in detail by researchers from all around the world, lured by their high potential as ornamental plants (van der Pijl & Dodson, 1966; van der Cingel, 2001). Their flowers exhibit two trimerous perianth whorls, being three sepals and three petals. The median petal, known as lip or labellum, is highly modified, often featuring ornamentations or secretions which serve as attraction to pollinators or floral visitors, being considered as a diagnostic feature of the family. The ovary is inferous, followed by a single structure formed by both androecium and gynoecium, the so-called column. Most species of orchids are pollinated and fertilized by animals as pollen-vectors while visiting flowers seeking for resources (nectar, pollen, oils or fragrances) or females to copulate, in cases of pollination by deceit, when pollinators are lured by rewardless flowers (Dressler, 1993). Currently, five subfamilies are accepted within Orchidaceae, named Apostasioideae, Vanilloideae, Cypripedioideae, Orchidoideae and Epidendroideae, distinguished by the number of fertile anthers and pattern of pollen aggregation (Chase *et al.*, 2003; Chase, 2005). Apostasioideae shows loose pollen and 2 or 3

fertile anthers, whilst Vanilloideae and Cypripedioideae present agglutinated pollen, 1 and 2 fertile anthers, respectively. The two subfamilies of most recent divergence, Orchidoideae and Epidendroideae, exhibit their pollinic content packaged inside pollinia, sac-like structures which are soft or divisible in the first and indivisible in the latter.

Epidendroideae presents the greatest diversification regarding reproductive structures (figure 3) among the subfamilies, characterized by the presence of 2 to 8 rigid pollinia. Ontogenetically, the gynoecium is composed by three stigmatic lobes, assuming a concave shape to wrap the rounded or elliptical pollinia deposited (Singer & Sazima, 1999, 2001a, 2001b). The median stigmatic lobe is non-receptive and called rostellum. The rostellum, in turn, may produce sticky secretions that either glue directly onto the pollinia or to appendages called caudiculae, assisting in their adhesion to the pollinator's body. In some cases, a part of the rostellum itself can become viscous and detachable, the viscidium, participating in the dispersion of the whole structure, then called pollinarium (figures 3 and 4). In practice, the pollinarium is responsible for the movement of all the pollinic content at once, which is removed and deposited together as a whole (Dressler 1993; Singer *et al.*, 2006; Judd *et al*., 2009), facilitating monitoring in pollination studies. In Oncidiinae, the column may or may not present a thickened lateral structure close to its base, called tabula infrastigmatica (figure 4).

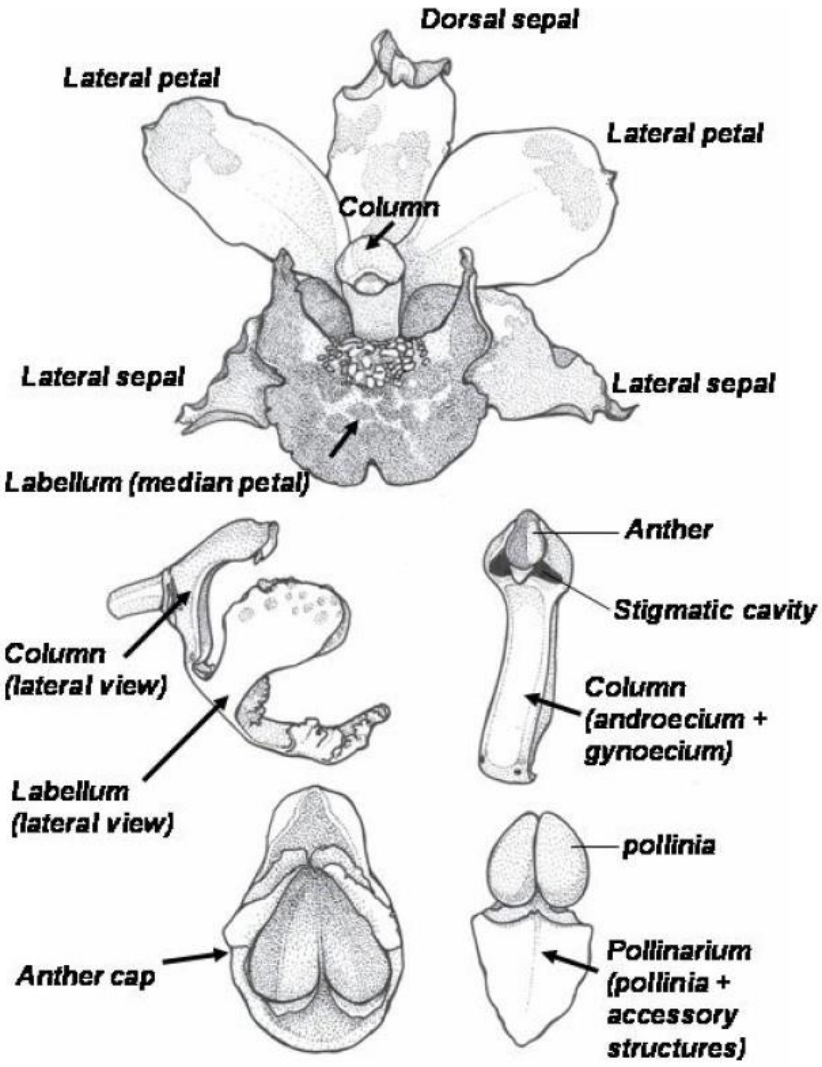

Figure 3 – Floral details of *Cyrtopodium triste* (Epidendroideae: Catasetinae) as an example of floral characters among Epidendroideae orchids. (Source: Singer *et al*., 2006).

Floral visitors (bees, hummingbirds, moths, flies or others), may dislodge the pollinarium and place it in the stigma of the same flower or a different flower from the same individual, promoting self-pollination, or carry the content to a stigmatic cavity in a different individual, promoting cross-pollination. Self-pollination causes the loss of genetic diversity in populations and for that reason several species developed mechanisms to avoid it (Dressler, 1993). There are species of plants that do not develop fruits resulting from their own pollen or abort them at some point of the process, therefore not disseminating viable seeds. In this point of view, we can coarsely classify the orchids into self-compatible or self-incompatible species. Many Maxilariinae, Pleurothalidiinae and also Oncidiinae fall inside the second

category, although intermediate cases may occur (Borba *et al.*, 2001; Singer & Koehler, 2003; Singer *et al.*, 2004; Singer *et al.*, 2006).

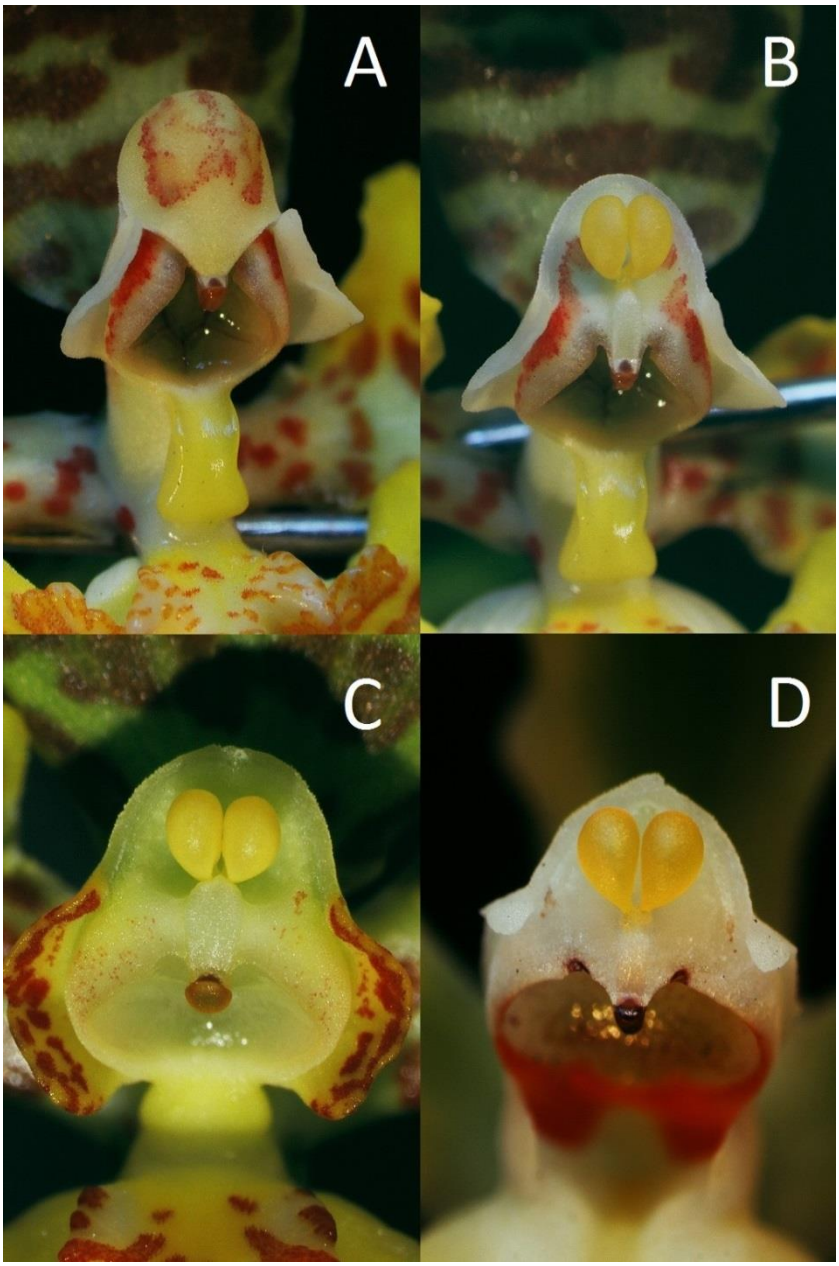

Figure 4 – Pollinarium of *Gomesa* spp. A and B) *Gomesa warmingii*, with and without the protection of the anther cap. We can see the tabula infrastigmatica, lateral expansions in the base of the column, in both figures; C) *Gomesa praetexta*; D) *Gomesa crispa*.

Oncidiinae orchids present a wide variety of pollination strategies, ranging from one to several species of pollinators. Frequently, they do not offer any kind of reward to their

pollinators, “fooling” them by food or sexual deception (Dressler, 1993). Some authors believe that the flowers of *Gomesa s.l.* mimic the oil-secreting flowers of several Malpighiaceae, exhibiting similar coloration, morphology and light absorption spectra (Chase *et al.*, 2009). Still, many species of *Gomesa* produce sufficient quantity of floral oils (mainly acyl-glycerols) to be offered as a reward to pollinators, just as has been demonstrated in anatomical (Stpiczynska *et al.*, 2007; Stpiczynska & Davies, 2008; Davies & Stpiczynska, 2009; Aliscioni *et al.*, 2009; Gomiz *et al*., 2017) and chemical studies (Reis *et al*., 2000). These studies verified the existence and morphological structure of the elaiophores and characterized their secretions, supporting the possibility that the pollination is performed by oil-collecting bees, as a result of a deliberate gathering behavior (Singer *et al.*, 2006; Toretta *et al.*, 2011). In respect to the pollination and reproductive success (fruiting), it is stated that the frequency of effective pollinations (with removal and deposition of pollen) is very low in Orchidaceae as a whole and particularly in Oncidiinae (Tremblay *et al*., 2005; Torretta *et al*., 2011). However, current studies have shown counterpoints to this teory, evidencing species that are often visited and pollinated, presenting a greater fruiting success than indicated in the literature (Pedron *et al.*, 2012; Sanguinetti *et al.*, 2012; Sanguinetti & Singer, 2014). Still, there are few studies on the reproductive biology of *Gomesa* species.

In the present study, we aim to answer the following questions: 1) What are the species of *Gomesa s.l.* occurring in Rio Grande do Sul and which is their geographical distribution in the State? 2) How can these species be identified in the field? 3) Are the characters used in preceding literature to set apart species reliable? 4) Is there a requirement for new synonymies?

As a step to know the biology of *Gomesa* spp., the breeding system and pollination of two species (*G. flexuosa* and *G. cornigera*) were studied through two flowering seasons. This part of the Dissertation specifically aims to address the following questions: 1) Are the species self-compatible or self-incompatible, in other words, able or unable to provide viable fruits and seeds when pollinated with its own pollen? 2) Are the species pollinator-dependent? 3) Who are the pollinators and what is their behavior on the flowers? 4) What is the fruiting success of the species?

The present Dissertation is structured in three chapters. In Chapter 1 we performed typifications and new synonyms required for species of *Gomesa* in Southern Brazil. Chaper 2 is a synopsis of the genus *Gomesa* in Rio Grande do Sul, updating the number of species and

providing descriptions, identification keys, illustrations and maps of their geographical distribution, as well as excluding some previously mentioned species. It is important to note that some species present in Chapter 2 are not treated in Chapter 1, due to the fact that we either did not find their typus (*Gomesa radicans*) or did not have comments or modifications to propose (*G. riograndensis*) regarding their type material or synonymization. Finally, in Chapter 3, we discuss the pollination strategies and breeding systems of two representative species, *Gomesa flexuosa* and *G. cornigera*, presenting informations about their floral features, pollination mechanisms, pollinators and pollinator behaviors, pollination efficiencies and fruiting success.

2. OBJECTIVES

As the general objective, we sought to inventory the species of *Gomesa* R.Br. in Rio Grande do Sul and to document the reproductive biology and pollination process in selected species. Our specific goals were:

- To perform a survey of *Gomesa* species native to Rio Grande do Sul, through the revision of literature, herbaria, as well as through specimens collected in the field;
- To describe, diagnose and illustrate all the species;
- To plot their geographical distribution on state maps;
- To offer identification keys;
- To describe the reproductive system of selected species, through controlled pollination experiments in cultured individuals;
- To identify active pollinators and floral visitors and their behavior during the visits, through photos and filming;
- To calculate the efficiency of pollen transference with the Nilsson index, as well as the fruiting success in natural populations.

3. CAPÍTULO 1

Artigo submetido ao periódico Taxon. Este capítulo está estruturado seguindo as normas de formatação referente ao respectivo periódico, exceto o alinhamento do texto e a edição das imagens.

Typifications, new synonyms and taxonomic notes in *Gomesa* R.Br. (Orchidaceae: Oncidiinae)

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Abstract We propose typifications and new synonyms for several species of the mostly Brazilian genus *Gomesa* R.Br. A total of 20 holotypes, 3 isotypes and 8 syntypes are identified. Moreover, 16 lectotypes, 1 isolectotype and 2 neotypes are assigned. Furthermore, 8 new synonyms are proposed. In our opinion, the number of species in *Gomesa* has been overestimated, since several species are based in floral features that are actually highly variable and show considerable phenotypic plasticity.

Keywords Brazil; Brazilian Atlantic Rainforest; nomenclature; *Oncidium*; protologues

INTRODUCTION

Oncidium Sw. (Orchidaceae: Oncidiinae) was traditionally constituted by a group of orchids bearing a characteristic callosity upon the basal region of the median petal or labellum. However, through phylogenetic analyses based on molecular characters, it has been proved that *Oncidium*, in its traditional delimitation, is not a monophyletic group (Chase &

Palmer, 1992; Williams & al., 2001a, 2001b; Chase & al., 2009; Neubig & al., 2012). As a consequence, Chase & al. (2009) transferred most of the Brazilian *Oncidium* species to an expanded concept of *Gomesa* R.Br (type species: *Gomesa recurva* R.Br.). In such delimitation, *Gomesa* is a clade with high statistical support (Chase & al., 2009; Neubig & al., 2012). Chase & al. (2009) defined as main diagnostic features of the genus their generally fused lateral sepals, glaucous leaf surface, lip pushed out through the sepals before they unfold, inflected pedicel and bracteoles externally pointed and loosely attached to the pedicel. For more explanations over the nomenclatural issues regarding the clade, see Chase & al. (2009).

As currently accepted, *Gomesa sensu* Chase & al. (2009) encompasses 133 species in Brazil (Flora do Brasil 2020), dwelling mainly within the Brazilian Atlantic Rainforest; some of them with an expanded distribution up to Northern Argentina and the Peruvian Amazon (Neubig & al., 2012). These plants are epiphytic or terrestrial herbs with sympodial growth. The uninodal pseudobulbs are oval, conical/oblong or fusiform, with smooth to sulcate surface and 1 to 3 terminal leaves. The leaves are elliptic, oblanceolate, oblong or linear, always glabrous, bifacial, conduplicate and articulate. The inflorescences are generally showy, in lateral racemes or panicles, 1—multi-flowered, lateral, erect/suberect or pendulous, subtended by a chartaceous or membranous bract, bearing bracteoles shorter than pedicels. The flowers are generally yellow, brown or white, often with a tubercular or keeled callus (sometimes inconspicuous and longitudinal). The column is erect and the anther is incumbent. The column normally presents two well-developed lateral wings and a hollow stigmatic cavity. The pollinarium presents two pollinia attached to the head of a stipe. The fruits are capsules. The genus as a whole is well known both by scientific and non-scientific communities, due to their common use as ornamental plants. Most of the species are popularly known as “dancing ladies” or “golden shower orchids”. Due to their commercial appeal, these orchids are target of many orchidophiles that have already described and illustrated several taxa, often based solely in floral details. However, we believe (see Methods) that the number of valid species is overestimated and that a thorough taxonomic revision is necessary.

This work is part of ongoing studies on this clade of Oncidiinae orchids. Here we went after necessary nomenclatural corrections and synonymizations in species mostly occurring in Brazil and, to a lesser extent, in adjacent parts of neighboring countries, as Argentina and Uruguay.

MATERIALS AND METHODS

Based on a thorough review of the literature, it is noteworthy that Barbosa Rodrigues, one of Brazil's greatest botanists and recognized for his work involving orchids and palms (Mori & Ferreira, 1987; Sprunger & al., 1996; Sá, 2001) described new *Oncidium* species based on exsiccates that are apparently lost (Barbosa Rodrigues, 1877, 1882). He illustrated the original specimens in order to publish the "Iconographie des Orchidées du Brésil" (Barbosa Rodrigues, 1877: 5, footnote) but the drawings and watercolors remained unpublished for a long time. However, they served as a base for the orchid treatment in Martius's "Flora Brasiliensis" (Cogniaux, 1883–1906) and many years later the original plates were reproduced in color, in Sprunger & al. (1996). Most volumes of the original illustrations (1–3 and 5–6) are housed at the Jardim Botânico do Rio de Janeiro, Brazil, except for Laellinae (vol. 4) which is found at the Orchid Herbarium of Oakes Ames, in Harvard University, United States. There is much debate over the existence of exsicatae related to Barbosa Rodrigues's work, but the fact is that after many revisions by researchers nothing involving *Oncidium* or other Oncidiinae orchids was found (see Buzatto & al., 2011, and Buzatto & al., 2013, for more explanations), with the exception of *Oncidium suscephalum* Barb.Rodr., collected by Freire-Allemão (see results). It is believed that most voucher specimens coming from Barbosa Rodrigues's works were destroyed during a tropical deluge (Cribb & Toscano de Brito, 1996; Buzatto & al., 2011). Therefore, when dealing with *Oncidium* species described by Barbosa Rodrigues we think it is appropriate to designate his original illustrations as lectotypes, since they reflect his concepts while describing these species and no extant herbarium specimens have been found. A similar approach was taken regarding species described by Robert Brown (*Gomesa recurva* R.Br.), Drapiez (*Oncidium venustum* Drapiez), Lindley (*Oncidium pectorale* Lindl.), Loddiges (*Oncidium flexuosum* Lodd.), Schlechter (*Oncidium ottonis* Schltr.) and Sims (*Oncidium bifolium* Sims), each one followed by an explanation under our taxonomic notes. In all those cases there are no extant exsicatae that could be considered the respective types and, consequently, the illustrations accompanying the protologues are proposed as lectotypes.

The protologues of all studied species were consulted. We revised a total of 431 exsiccates from the following herbaria: AMES, BM, BR, FUEL, G, HAS, HUCS, HUEFS, HURG, HVAT, ICN, K, La Salle, L, LE, L-K, MPUC, PACA, PEL, RSPF, S, UEC and W. Since *Gomesa sensu* Chase & al. (2009) presents a large generic synonymy, we searched for every name already employed within the clade (see Results), encompassing a total of 27

validly described genera. In this study, we treat 18 valid species of the genus. To each one of them, an updated list of synonyms is provided, corresponding to the informations in the World Checklist of Selected Plant Families (WCSP), except for the new synonyms proposed or cases in which we do not agree with the synonymization, followed by our justificatives and lists of examined materials. When syntypes or paratypes were identified, the exsicatae best preserved and bearing more diagnostic features was chosen as lectotype. The abbreviations of author names followed the International Plant Name Index (IPNI) and The Plant List websites. A total of 24 field trips were made and nearly 200 specimens were collected and cultivated at the Fundação Zoobotânica (FZB) do Rio Grande do Sul's orchidarium, enabling a more detailed analysis of the species when they bloomed.

RESULTS AND DISCUSSION

As summarized in Table 1, a total of 20 holotypes, 3 isotypes and 8 syntypes were identified. Furthermore, 16 lectotypes, 1 isolectotype and 2 neotypes are designated. All these type materials are distributed in the herbaria: AMES, BM, BR, G, K, LE, M, P, R, S and W (Table 1). Still, 8 new synonyms are proposed. *Gomesa montana* (Barb.Rodr.) M.W.Chase & N.H.Williams is considered a synonym of *Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams; *Gomesa ciliata* (Lindl.) M.W.Chase & N.H.Williams of *Gomesa barbata* (Lindl.) M.W.Chase & N.H.Williams; *Oncidium raniferum* var. *major* Hook. and *Gomesa loefgrenii* (Cogn.) M.W.Chase & N.H.Williams of *Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams; *Gomesa gravesiana* (Rolfe) M.W.Chase & N.H.Williams of *Gomesa imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams; *Gomesa gardneri* (Lindl.) M.W.Chase & N.H.Williams of *Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams; *Gomesa planifolia* (Lindl.) Klotzsch ex Rchb.f. of *Gomesa recurva* R.Br.; and *Gomesa longipes* (Lindl.) M.W.Chase & N.H.Williams of *Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams.

***Gomesa* R.Br.**, Bot. Mag. t. 1748. 1815. Type species: *Gomesa recurva* R.Br.

= *Coppensia* Dumort., Nouv. Mém. Acad. Roy. Sci. Bruxelles 9: 10. 1835. Type species: *Coppensia bifolia* (Sims) Dumort. (basionym: *Oncidium bifolium* Sims).

= *Maturna* Raf., Fl. Tellur. 2: 99. 1837. Type species: *Maturna suaveolens* (Lindl.) Raf. (basionym: *Rodriguezia suaveolens* Lindl.).

= *Baptistonia* Barb.Rodr., Gen. Sp. Orchid. 1: 95. 1877. Type species: *Baptistonia echinata* Barb.Rodr.

= *Theodorea* Barb.Rodr. (non Cass.), Gen. Sp. Orchid. 1: 144. 1877. Type species: *Theodorea gomezoides* Barb.Rodr.; this is a later homonym of *Theodorea* Cass., a genus of Asteraceae.

= *Ornithophora* Barb.Rodr., Gen. Sp. Orchid. 2: 225. 1882. Type species: *Ornithophora quadricolor* Barb.Rodr. (= *Ornithophora radicans* (Rchb.f.) Garay & Pabst).

= *Waluewa* Regel, Trudy Imp. S.-Peterburgsk. Bot. Sada 11: 309. 1890. Type species: *Waluewa pulchella* Regel.

= *Rodrigueziella* Kuntze, Rev. Gen. 649. 1891. Type species: *Rodrigueziella gomezoides* (Barb.Rodr.) Kuntze (basionym: *Theodorea gomezoides* Barb.Rodr.).

= *Binotia* Rolfe, Orchid Rev. 13: 296. 1905. Type species: *Binotia brasiliensis* Rolfe.

= *Rodrigueziopsis* Schltr., Repert. Spec. Nov. Regni Veg. 16: 427. 1920. Type species: *Rodrigueziopsis eleutherosepala* (Barb. Rodr.) Schltr. (basionym: *Rodriguezia eleutherosepala* Barb. Rodr.).

= *Hellerorchis* A.D.Hawkes, Orchid J. 3: 275. 1959. Type species: *Hellerorchis gomezoides* (Barb.Rodr.) A.D.Hawkes (basionym: *Rodrigueziella gomezoides* Barb.Rodr.).

= *Carria* V.P.Castro & K.G.Lacerda (non Gardn.), Orchids 74: 694. 2005. Type species: *Carria colorata* (Koniger & J.G.Weinm.bis) V.P.Castro & K.G.Lacerda (basionym: *Oncidium coloratum* Koniger & J.G.Weinm.bis). *Carria* V.P.Castro & K.G.Lacerda is a later homonym of *Carria* Gardn., a genus in Theaceae.

= *Alatiglossum* D.H.Baptista, Colet. Orq. Bras. 3: 87. 2006. Type species: *Alatiglossum barbatum* (Lindl.) D.H.Baptista (basionym: *Oncidium barbatum* Lindl.).

= *Ampliglossum* Campacci, Colet. Orq. Bras. 3: 83. 2006. Type species: *Ampliglossum varicosum* Campacci (basionym: *Oncidium varicosum* Lindl. & Paxton).

= *Anettea* Szlach. & Mytnik, Pol. J. Bot. 51: 49. 2006. Type species: *Anettea crispa* (Lodd.) Szlach. & Mytnik (basionym: *Oncidium crispum* Lodd.).

= *Brasilidium* Campacci, Colet. Orq. Bras. 3: 78. 2006. Type species: *Brasilidium crispum* Campacci (basionym: *Oncidium crispum* Lindl.).

= *Carenidium* D.H.Baptista, Colet. Orq. Bras. 3: 90. 2006. Type species: *Carenidium concolor* (Hook.) D.H.Baptista (basionym: *Oncidium concolor* Hook.).

= *Carriella* V.P.Castro & K.G.Lacerda, Icon. Orchid. Brasil. 2, t. 123. 2006. Type species: *Carriella colorata* (Koniger & J.G.Weinm.bis) V.P.Castro & K.G.Lacerda (basionym: *Oncidium coloratum* Koniger & J.G.Weinm.bis).

= *Castroa* Guiard, Richardiana 6: 162. 2006. Type species: *Castroa calimaniana* Guiard.

= *Concocidium* Romowicz & Szlach., Pol. Bot. J. 51: 44. 2006. Type species: *Concocidium concolor* (Hook.) Romowicz & Szlach. (basionym: *Oncidium concolor* Hook.).

= *Kleberiella* V.P.Castro & Catharino, Richardiana 6: 158. 2006. Type species: *Kleberiella uniflora* (Booth ex Lindl.) V.P.Castro & Catharino (basionym: *Oncidium uniflorum* Booth ex Lindl.).

= *Menezesiella* Chiron & V.P.Castro, Richardiana 6: 103. 2006. Type species: *Menezesiella ranifera* (Lindl.) Chiron & V.P.Castro (basionym: *Oncidium raniferum* Lindl.).

= *Neoruschia* Catharino & V.P.Castro, Richardiana 6: 58. 2006. Type species: *Neoruschia cogniauxiana* (Schltr.) Catharino & V.P.Castro (basionym: *Oncidium cogniauxianum* Schltr.).

= *Rhinocerotidium* Szlach., Pol. Bot. J. 51: 40. 2006. Type species: *Rhinocerotidium longicornu* (Mutel) Szlach. (basionym: *Oncidium longicornu* Mutel).

= *Rhinocidium* D.H.Baptista, Colet. Orq. Bras. 3: 93. 2006. Type species: *Rhinocidium longicornu* (Mutel) D.H.Baptista (basionym: *Oncidium longicornu* Mutel).

= *Nitidocidium* F.Barros & V.T.Rodrigues, Bol. CAOB 77-78: 27. 2010. Type species: *Nitidocidium gracile* (Lindl.) F.Barros & V.T.Rodrigues (basionym: *Oncidium gracile* Lindl.).

= *Campaccia* Baptista, P.A.Harding & V.P.Castro, Colet. Orq. Bras. 9: 316. 2011. Type species: *Campaccia venusta* (Drapiez) Baptista, P.A.Harding & V.P.Castro (basionym: *Oncidium venustum* Drapiez).

= *Hardingia* Docha Neto & Baptista, Colet. Orq. Bras. 9: 343. 2011. Type species: *Hardingia paranaensis* (Kaenzl.) Docha Neto & Baptista (basionym: *Oncidium paranaense* Kraenzl.)

1. *Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 395. 2009 ≡ *Oncidium barbaceniae* Lindl. in Fol. Orchid.: 32. 1855 ≡ *Ampliglossum barbaceniae* (Lindl.) Campacci in Colet. Orquídeas Brasil. 3: 83. 2006 ≡ *Coppensia barbaceniae* (Lindl.) Campacci in Bol. CAOB 62: 54. 2006 – Holotype: BRAZIL. Minas Gerais, Barbacenia, s.d., *ic. Weddell 32* (K no. 501738!).

= *Gomesa montana* (Barb.Rodr.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium montanum* Barb.Rodr. in Gen. Spec. Orchid. 1: 93. 1877. syn. nov. ≡ *Ampliglossum montanum* (Barb.Rodr.) Campacci in Colet. Orquídeas Brasil. 3: 85. 2006 ≡ *Coppensia montana* (Barb.Rodr.) Campacci in Bol. CAOB 62: 56. 2006 – Lectotype (here designated): Barbosa Rodrigues's original illustration in "Iconographie des Orchidées du Brésil" 6: t. 263, cited as tab. 427 (then unpublished) in Barbosa Rodrigues (1877: 93), reproduced in Sprunger & al. (1996: 391).

= *Oncidium uliginosum* Barb.Rodr. in Gen. Spec. Orchid. 1: 92. 1877 – Lectotype (here designated): Barbosa Rodrigues's original illustration in "Iconographie des Orchidées du Brésil" 6: t. 258, cited as tab. 420 (then unpublished) in Barbosa Rodrigues (1877: 92), reproduced in Sprunger & al. (1996: 386).

Notes – Both *Oncidium barbaceniae* and *O. montanum* lack any extant exsicatae that could be considered as potential types. In *O. barbaceniae* protologue, Lindley states that "… have only seen a sketch of this, which seems to be quite different from all the other known Brazilian species. Its lip is large and yellow. The sepals and petals are very small, and brownish green, spotted." The description and illustration of the protologue fit not only *O. barbaceniae* as well as *O. montanum*, except by the type of inflorescence, primarily racemes in *O. barbaceniae* and panicles in *O. montanum*. After the analysis of vegetative structures

and flowers of both variations, we did not find any other substantial difference. Notably, both names were attributed to specimens coming from the State of Minas Gerais.

Additional specimens examined – 13 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Cambará do Sul: estrada para São Francisco de Paula, Feb 1948, *B. Rambo s.n.* (PACA 36569). SANTA CATARINA. Bom Jardim da Serra: 9 Dec 2015, *J.B. Castro 12* (ICN). SÃO PAULO. Campos do Jordão: Jan 1944, *E. Friderichs s.n.* (PACA 27853/1).

2. *Gomesa barbata* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 395. 2009 ≡ *Oncidium barbatum* Lindl. in Coll. Bot.: t. 27. 1821 ≡ *Alatiglossum barbatum* (Lindl.) Baptista in Colet. Orquídeas Brasil. 3: 87. 2006 – Holotype: BRAZIL. s.d., *W. Swainson s.n.* (K no. 501739!).

= *Gomesa ciliata* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium ciliatum* Lindl. in Gen. Sp. Orchid. Pl.: 200. 1833. syn. nov. ≡ *Oncidium barbatum* var. *ciliatum* (Lindl.) Lindl. in Fol. Orchid. 6–7: 16. 1855 ≡ *Alatiglossum ciliatum* (Lindl.) Baptista in Colet. Orquídeas Brasil. 3: 88. 2006 – Holotype: BRAZIL. s.d., *s.coll. s.n.* (K no. 501740, A!).

= *Oncidium ciliolatum* Hoffmanns. in Bot. Zeitung (Berlin) 1: 834. 1843.

= *Oncidium fimbriatum* Hoffmanns. [Illegitimate] in Bot. Zeitung (Berlin) 1: 834. 1843.

= *Oncidium subciliatum* Hoffmanns. in Bot. Zeitung (Berlin) 1: 834. 1843.

= *Oncidium barbatum* Lindl. & Paxton [Illegitimate] in Paxton's Fl. Gard. 2: 30. 1851.

= *Gomesa trichodes* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium trichodes* Lindl. in Fol. Orchid. 6: 15. 1855 ≡ *Alatiglossum trichodes* (Lindl.) Baptista in Colet. Orquídeas Brasil. 3: 89. 2006.

= *Oncidium barbatum* subsp. *limbatum* (Lindl.) W.Zimm. in Biblioth. Bot. 109: 16. 1934 ≡ *Oncidium barbatum* var. *limbatum* Lindl. in Fol. Orchid. 6–7 : 16. 1855.

= *Oncidium barbatum* subsp. *microglossum* (Klotzsch) W.Zimm. in Biblioth. Bot. 109: 16. 1934 ≡ *Oncidium microglossum* Klotzsch in Allg. Gartenzeitung 23: 233. 1855.

= *Oncidium ciliatulum* Hoffmanns. ex Lindl. in Fol. Orchid. 6: 16. 1855.

= *Oncidium suscephalum* Barb.Rodr. in Gen. Spec. Orchid. 2: 188. 1882 – Holotype: BRAZIL. Ceará, "dans lês forêts de l' Aratanha", s.d., *F. Freire-Allemão 1480* (R no. 3276!).

= *Oncidium bahiense* (Cogn.) Schltr. in Repert. Spec. Nov. Regni Veg. 17: 17. 1921 ≡ *Oncidium micropogon* var. *bahiense* Cogn. in Fl. Bras. 3(6): 301. 1905.

= *Oncidium barbatum* var. *johnianum* (Schltr.) Kraenzl. in Pflanzenr. IV, 50(80): 194. 1922 ≡ *Oncidium johnianum* Schltr. in Orchis 1: 4. 1906.

= *Oncidium blossfeldianum* Schltr. in Orchis 9: 56. 1915.

= *Gomesa psyche* (Schltr.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium psyche* Schltr. in Repert. Spec. Nov. Regni Veg. 17: 16. 1921 ≡ *Alatiglossum psyche* (Schltr.) Baptista in Colet. Orquídeas Brasil. 3: 89. 2006.

= *Oncidium reisii* Hoehne & Schltr. in Arch. Bot. São Paulo 1: 290. 1926.

= *Oncidium barbatum* var. *labiosum* W.Zimm. in Biblioth. Bot. 109: 15. 1934.

Notes – After several field observations and an overview of the original descriptions as well as the revision of available type material of *Oncidium barbatum* and *O. ciliatum*, we conclude that these names refer to the variable and polymorphic species *Gomesa barbata*. *Oncidium ciliatum* was initially separated from *O. barbatum* "by all the divisions of the lip being equal and by its very dwarf habit. In colour its flowers vary, sometimes being yellow spotted with red, and sometimes a brownish orange…" (Lindley, 1835). However, not only their coloration is highly variable, as long as the lip lateral lobes/lip apical lobe proportion (Fig. 1), vegetative size and number of flowers in the inflorescence.

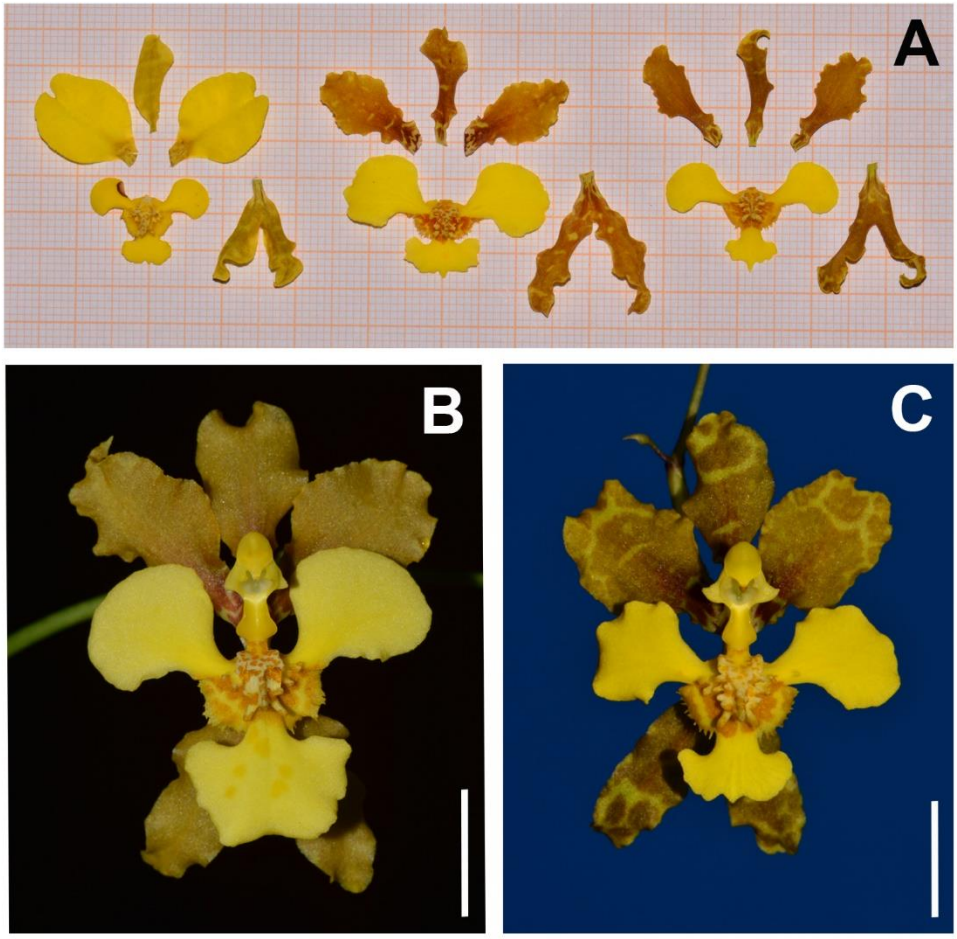

Fig. 1. Variability observed in *Gomesa barbata* flowers. See the lip apical lobe's variability. All of them are cultivated at the Porto Alegre Botanical Garden and flowered between November and January. **A,** variations within the same population. **B,** sepals and petals with intermediate coloration and size, lip bearing 3 lobes equally sized. **C,** spotted sepals, apical lobe smaller than lateral ones. – Scale bars = 1cm.

Additional specimens examined – 49 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Arambaré: 05 Oct 1995, *M. Neves 1905* (HAS). Arroio do Sal: Rondinha, Parque Tupancy, 7 Jan 2011, *M.S. Marchioretto, J.L. Schmitt. D. Becker & S. Cunha s.n.* (PACA 109233). Capão do Leão: Horto Botânico Ir. Teodoro Luiz, 23 Nov 1986, *J.A. Jarenkow 525* (PACA). Palmares do Sul: Fazenda Marcelina, 30°22'22.7"S, 50°20'68.2"W, 23 Sep 2014, *M.L. Paz, V. Graeff, M.F. Parode, V.R.S.P. Silva 20* (PACA). Porto Alegre: Belém Novo, Nov 1929, *J. Dutra 1115* (ICN). Rio Grande: E.E. Taim, 5 Dec 1978, *J.L. Waechter 1073* (ICN). Taquara: 12 Sep 1926, *J. Dutra 958* (ICN). Taquari: 10 Dec 1957, *O. Camargo 3042* (PACA). SANTA CATARINA. Passo de Torres: 21 Jan 1976, *K. Hagelund 879* (HAS).

3. *Gomesa bifolia* (Sims) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium bifolium* Sims in Bot. Mag. 36: t. 1491. 1812 ≡ *Coppensia bifolia* (Sims) Dumort. in Nouv. Mém. Acad. Roy. Sci. Bruxelles 9: 10. 1835 ≡ *Ampliglossum bifolium* (Sims) Campacci in Colet. Orquídeas Brasil. 3: 83. 2006 – Lectotype (here designated): Sims's illustration in Bot. Mag. 36: t. 1491. 1812.

= *Oncidium maculosum* Lindl. in Edwards's Bot. Reg. 23: sub t. 1920. 1837 – Holotype: BRAZIL. Minas Gerais, s.d., *C. F. P. von Martius 1842* (M no. 232037!). Isotype: M no. 232036!.

= *Oncidium celsianum* A.Rich. in Hort. Universel 6: 113. 1844 – Holotype: s.loc., 23 Mar 1846, *M. Cels s.n.* (P no. 437169!). Isotype: P no. 437170!.

= *Gomesa chrysothyrsus* (Rchb.f. ex R.Warner) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium chrysothyrsus* Rchb.f. ex R.Warner in Select Orchid. Pl. 2: t. 5. 1865.

= *Oncidium batemanianum* Griseb [Illegitimate] in Symb. Fl. Argent: 337. 1879.

= *Oncidium bifolium* var. *majus* B.S.Williams in Orch.-Grow. Man. ed. 7: 383. 1894.

= *Oncidium beyrodtianum* Schltr. in Repert. Spec. Nov. Regni Veg. 8: 572. 1910.

Notes – *Oncidium bifolium* lacks any extant exsicatae that could be considered as a potential type. So, it seems appropriate to designate the protologue's original illustration as lectotype for the species.

Additional specimens examined – 44 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Barra do Ribeiro: Ponta da Formiga, 23 Feb 1986, *K. Potter 229* (PACA). Brochier: estrada para Catupi, 29°34'52.95"S, 51°40'34.7"W, 19 Jan 2016, *J.B. Castro 37* (ICN), *J.B. Castro 41* (ICN). Camaquã: Pacheca, 18 Dec 1990, *J.L. Waechter 2466* (ICN). Jaquirana: Faxinal dos Pelúcios, RS-110, 20 Dec 2001, *A. Knob & S. Bordignon 6999* (UniLaSalle). Mato Castelhano: Floresta Nacional de Passo Fundo, 29 Dec 2005, *C.R. Buzatto s.n.* (RSPF 10503); Muitos Capões: [Esmeralda] Estação Ecológica de Aracuri, Jan 1982, *K. Kleebank 5* (ICN), 11 Oct 1982, *J.L. Waechter 1943* (ICN). Santa Vitória do Palmar: Pontal Santiago, 7 Dec 1996, *J.A. Jarenkow 3313* (PEL). Torres: Lageadinho, 19 Dec 1980, *J.L. Waechter 1815* (ICN).

4. *Gomesa concolor* (Hook.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium concolor* Hook. in Bot. Mag. 66: t. 3752. 1839 ≡ *Concocidium concolor* (Hook.) Romowicz & Szlach. in Polish Bot. J. 51: 45. 2006 ≡ *Carenidium concolor* (Hook.) Baptista in Colet. Orquídeas Brasil. 3: 91. 2006 ≡ *Brasilidium concolor* (Hook.) F.Barros & V.T.Rodrigues in Bol. CAOB 77–78: 9. 2010 – Holotype: BRAZIL. Organ Mountains, 1837, *Gardner s.n.* (K no. 586532!), on sheet with K no. 586527–31.

= *Oncidium normanii* Hort. ex Pritz. in Glenny Journ. Hort. 2: 149. 1839.

= *Cyrtochilum citrinum* Hook. in Bot. Mag. 75: t. 4454. 1849.

= *Oncidium unguiculatum* Klotzsch [Illegitimate] in Allg. Gartenzeitung 17: 9. 1849.

= *Brasilidium ottonis* (Schltr.) Docha Neto & Varella in Bol. CAOB 81/82: 27. 2011 ≡ *Oncidium ottonis* Schltr. in Orchis 8: 61. 1914 ≡ *Oncidium concolor* var. *ottonis* (Schltr.) Pabst in Orquídea (Rio de Janeiro) 19: 124. 1957 ≡ *Concocidium ottonis* (Schltr.) Romowicz & Szlach. in Polish Bot. J. 51: 45. 2006 ≡ *Carenidium ottonis* (Schltr.) Docha Neto & Varella in Orchidstud. 2: 42. 2007 – Lectotype (here designated): Schlechter's illustration in Orchis 8: 59. t. 11. 1914.

Notes – According to Butzin (1978), no *Oncidium* specimen is left in what remains of Schlechter's type collection, in Berlin-Dahlem Herbarium. In agreement with this, no Schlechter's specimens were found during a visit at B. These materials were probably destroyed during World War II. Thereby we consider appropriate to assign the original illustration in *O. ottonis*'s protologue as lectotype for the species. Furthermore, we did not find substantial differences either in vegetative or reproductive features between *Oncidium concolor* and *O. ottonis*, except for the position of the lateral petals, closely held to the column in *O. ottonis*, and the crispy appearance of the flowers in the latter one. For that reason, we treated *O. ottonis* as a variation form of *O. concolor*, just as stated by Govaerts (2003).

Additional specimens examined – 50 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Canguçu: estrada para Piratini, 11 Oct 1972, *J.C. Lindeman, B.E. Irgang & J.F.M. Valls s.n.* (ICN 20706). Caraá: nascente do rio dos Sinos, 29°42'25"S, 50°17'27.8"W, 15 Dec 2012, *L.D. Rocha, D.F.P. Becker & F. Junges 246* (PACA). Caxias do Sul: Campus da UCS, 29 Oct 1987, *M. Rossato & al. s.n.* (HUCS 3401). Passo Fundo:

Bosque Lucas Araújo, Sep 1994, *M. Antonio s.n.* (RSPF 5156). São Francisco de Paula: Parque Municipal da Ronda, 29°27'03"S, 50°35'41"W, 29 Sep 2007, *J. Brustulin 32* (PACA). Sério: 21 Sep 2000, *E.M. Freitas s.n.* (HVAT 390). SANTA CATARINA. Campo Belo do Sul: Fazenda Gateados, 19 Oct 2007, *C.R. Buzatto 348* (ICN).

5. *Gomesa cornigera* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium cornigerum* Lindl. in Edwards's Bot. Reg. 18: t. 1542. 1832 ≡ *Baptistonia cornigera* (Lindl.) Chiron & V.P.Castro in Richardiana 4: 117. 2004 – Syntypes: BRAZIL. s.d., *s.coll. s.n.* (K no. 883239!), on sheet with K no. 883238; s.d., *Watts 55* (K no. 883238!), on sheet with K no. 883239; s.d., *s.coll. s.n.* (BM no. 534452!). Lectotype (here designated): K no. 883239!.

= *Baptistonia fimbriata* (Lindl.) Chiron & V.P.Castro in Richardiana 4: 117. 2004 ≡ *Oncidium fimbriatum* Lindl. in Gen. Sp. Orchid. Pl.: 199. 1833.

= *Oncidium pyxidophorum* Rchb.f. in Gard. Chron. n.s., 12: 136. 1879.

= *Gomesa chrysorhapis* (Rchb.f.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium chrysorhapis* Rchb.f. in Gard. Chron. III, 3: 72. 1888.

= *Oncidium godseffianum* Kraenzl. in Gard. Chron.: 754. 1896.

= *Oncidium hecatanthum* Kraenzl. in Kongl. Svenska Vetensk. Acad. Handl. n.s., 46(10): 81. 1911 – Syntypes: BRAZIL. Rio Grande do Sul, Serra dos Tapes, Cascata de Hermenegilda, 28 Dec 1908, *C. A. M. Lindman 793a* (S no. R-3796!; S no. 07-7908!). Lectotype (here designated): S no. R-3796!.

Additional specimens examined – 36 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Caraá: Alto Vila Nova, 29°43'42.1"S, 50°22'00.8"W, 5 Mar 2011, *S. Cunha 24* (PACA). Farroupilha: Parque dos Pinheiros, 29°14'30"S, 51°26'20"W, 26 Mar 2007, *J. Brustulin 9* (PACA). Lajeado: Bairro Carneiros, 11 Dec 1999, *E.M. Freitas s.n.* (HVAT 211). Porto Alegre: Morro Santana, 10 Dec 2015, *J.B. Castro 11* (ICN). Pinhal da Serra: balsa para Anita Garibaldi, 30 Aug 2000, *J. Spanholi s.n.* (HAS 39246). São Pedro do Sul: 11 Jan 1988, *J.C. Corrêa 47* (HAS). Três Cachoeiras: [Torres] Morro Azul, 19 Dec 1977, *J.L. Waechter 674* (ICN).

6. *Gomesa crispa* (Lindl.) Klotzsch ex Rchb.f. in Bot. Zeitung (Berlin) 10: 772. 1852 ≡ *Rodriguezia crispa* Lindl. in Edwards's Bot. Reg. 25: Misc. 86. 1839 – Holotype: BRAZIL. s.d., *s.coll. s.n.* (K no. 501741!).

= *Gomesa undulata* Hoffmanns. in Verz. Orchid.: 52. 1843.

= *Odontoglossum crispatulum* Rchb.f. in Ann. Bot. Syst. 6: 853. 1864.

Notes – In the Flora do Brasil 2020, *Gomesa crispa* is considered as synonym of *G. recurva*. There is no doubt that these species are closely related. However, after our observations over their morphology and phenology, we conclude that they are supported as two distinct species. *Gomesa crispa* presents crispy perianth parts and free lateral sepals, flowering period between April to June. On the other hand, *G. recurva* presents flat perianth parts with lateral sepals connate for almost all their extension and flowering period from December to January. In addition, the flowers of *G. crispa* are more fragrant.

Additional specimens examined – 25 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Barracão: 21 Dec 2000, *J. Spanholi s.n.* (HAS 39440). Caraá: nascente do rio dos Sinos, 29°42'25"S, 50°17'27.8"W, 16 Dec 2012, *L.D. Rocha, D.F.P. Becker & F. Junges 274* (PACA). Cotiporã: [Veranópolis] Cascata do Marins, 17 May 1980, *I. Matte & V. Haas s.n.* (PACA 66991), *L. Klauss & J.H. Pereira s.n.* (PACA 66992/1). Dois Irmãos: estrada para São Leopoldo, 25 Jun 1949, *B. Rambo s.n.* (PACA 42198). Rio Pardo: Fazenda Soledade, Jun 1921, *J. Dutra 29* (ICN). São Francisco de Paula: Parque das 8 Cachoeiras, 18 Aug 2015, *J.B. Castro 21* (ICN), 23 Aug 2015, *J.B. Castro 22* (ICN), Jun 2016, *J.B. Castro 2* (ICN). Derrubadas: [Tenente Portela] Parque Estadual do Turvo, 11 Jan 1977, *J. Mattos 16396* (HAS), 11 Jan 1977, *J. Mattos 16397* (HAS). Torres: Faxinal, 14 May 1977, *J.L. Waechter & al. 533* (ICN). SANTA CATARINA. Campo Belo do Sul: Gasperim, Arroio Tijolo, 20 Feb 2003, *C. Rohrig & N. Silveira s.n.* (RSPF 10044).

7. *Gomesa flexuosa* (Lodd.) M.W.Chase & N.H.Williams in Phytotaxa 1: 58. 2009 ≡ *Oncidium flexuosum* Lodd. in Bot. Cab. 5: t. 424. 1820 ≡ *Ampliglossum flexuosum* (Lodd.) Campacci in Colet. Orquídeas Brasil. 3: 84. 2006 ≡ *Coppensia flexuosa* (Lodd.) Campacci in Bol. CAOB 62: 55. 2006 – Lectotype (here designated): Loddiges's illustration in Bot. Cab. 5: t. 424. 1820.

= *Epidendrum lineatum* Vell. in Fl. Flumin. 9: t. 36. 1831.

= *Oncidium haematochrysum* Rchb.f. in Linnaea 22: 844. 1849.

= *Oncidium haematoxanthum* Rchb.f. ex Lindl. in Fol. Orchid. 6: 25. 1855.

= *Oncidium flexuosum* var. *radiatum* Rchb.f. in Gard. Chron.: 358. 1872.

= *Gomesa megaloptera* (Kraenzl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium megalopterum* Kraenzl. in Pflanzenr. IV, 50(80): 156. 1922.

Notes – *Oncidium flexuosum* lacks any extant exsicatae that could be considered as potential type. So, it seems appropriate to designate the protologue's original illustration as lectotype for the species.

Additional specimens examined – 41 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Cambará do Sul: [São Francisco de Paula] Serra do Faxinal, 23 Feb 1951, *A. Sehnem s.n.* (PACA 84975). Caraá: Alto Vila Nova, 29°43'42.1"S, 50°22'00.8"W, 30 Jul 2010, *M.B. Dorneles s.n.* (PACA 114629). Casca Evangelista: margem do arroio Barra Funda, 27 Nov 2010, *M.C. Marchezi s.n.* (RSPF 12321). Encruzilhada do Sul: Estação Experimental, 17 Nov 1978, *J. Mattos 19725* (HAS). Estrela Velha: UHE Itaúba, 17 May 2002, *C. Mansan & V.L. Caetano 515* (HAS). Garibaldi: Marcorama, Vila Santana, 7 Nov 1987, *M. Rossato & al. s.n.* (HUCS 3466). Pelotas: Instituto Agronômico do Sul, Horto Botânico, 20 Dec 1960, *E.C. dos Santos 181* (FUEL, ICN, PACA). Viamão: Parque Estadual de Itapuã, 25 Oct 1975, *J.L. Waechter 198* (ICN). SANTA CATARINA. São João do Sul: estrada para Praia Grande, 13 Jan 1978, *K. Hagelund 12040* (ICN).

8. *Gomesa gomezoides* (Barb.Rodr.) Pabst in Orquídea (Niteroi) 29: 165. 1967 ≡ *Theodorea gomezoides* Barb.Rodr. in Gen. Spec. Orchid. 1: 145. 1877 ≡ *Hellerorchis gomezoides* (Barb.Rodr.) A.D.Hawkes in Orchid J. 3: 275. 1959 ≡ *Rodrigueziella gomezoides* (Barb.Rodr.) Berman in Orchid Rev. 81: 56. 1973 – Lectotype (here designated): Barbosa Rodrigues's original illustration in "Iconographie des Orchidées du Brésil" 6: t. 318, cited as tab. 480 (then unpublished) in Barbosa Rodrigues (1877: 145), reproduced in Sprunger & al. (1996: 447).

= *Gomesa theodorea* Cogn. [Illegitimate] in Fl. Bras. 3(6): 250. 1905.

= *Hellerorchis paniculata* (Brade) A.D.Hawkes in Orchid J. 3: 275. 1959 ≡ *Theodorea paniculata* Brade in Arch. Jard. Bot. Rio de Janeiro 9: 13. 1949.

Additional specimens examined – 17 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. São Francisco de Paula: Banhado Amarelo, 24 Oct 1976, *C.R. Dillenburg 212* (ICN). São José dos Ausentes: [Bom Jesus] Serra da Rocinha, 14 Jan 1942, *B. Rambo s.n.* (PACA 8753). SANTA CATARINA. Urubici: Serra do Corvo Branco, 28°3'19.9"S, 49°21'58.1"W, 18 Nov 2008, *J.R.V. Iganci, P.M.A. Ferreira, G.H. Silveira & C.R. Buzatto 520* (ICN).

9. *Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium hookeri* Rolfe in Gard. Chron. III, 2: 520. 1887 ≡ *Carenidium hookeri* (Rolfe) Baptista in Colet. Orquídeas Brasil. 3: 91. 2006 ≡ *Menezesiella hookeri* (Rolfe) V.P.Castro & Chiron in Richardiana 6(2): 105 2006 ≡ *Coppensia hookeri* (Rolfe) F.Barros & L.R.S.Guim. in Neodiversity 5(1): 31. 2010 – Syntypes: BRAZIL. Rio de Janeiro, "Environs de Rio Janeiro et d'Ourou Preto", 1883, *A. Glaziou 15644* (K no. 586523!), on sheet with K no. 586524–25; Rio de Janeiro, s.d., *W. Longman s.n.* (K no. 586522!), on sheet with K no. 586521. Lectotype (here designated): K no. 586523!.

= *Oncidium raniferum* var. *major* Hook. in Bot. Mag. 66: t. 3712. 1839. syn. nov. – Holotype: BRAZIL. Organ Mountains, 1837, *Gardner 637* (K no. 886894!).

= *Gomesa loefgrenii* (Cogn.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium loefgrenii* Cogn. in Fl. Bras. 3(6): 381. 1905. syn. nov. ≡ *Carenidium loefgrenii* (Cogn.) Baptista in Colet. Orquídeas Brasil. 3: 91. 2006 ≡ *Menezesiella loefgrenii* (Cogn.) V.P.Castro & Chiron in Richardiana 6(2): 105. 2006 ≡ *Coppensia loefgrenii* (Cogn.) F.Barros & V.T.Rodrigues in Bol. CAOB 77–78: 12. 2010 – Holotype: BRAZIL. São Paulo, Serra do Mar, 1896, *E. Gustavo 3264* (BR no. 6272111!).

= *Oncidium mellifluum* Kraenzl. in Pflanzenr. IV, 50(80): 156. 1922.

= *Coppensia hookeri* f. *albescens* (Pabst) F.Barros & L.R.S.Guim. in Neodiversity 5(1): 31. 2010 ≡ *Oncidium hookeri* var. *albescens* Pabst in Bradea 2: 64. 1976 ≡ *Oncidium*

hookeri f. *albescens* (Pabst) F.Barros & J.A.N.Bat. in Orquidologia Sul-Amer.: 103. 2004.

Notes – *Oncidium raniferum* var. *major* was treated as synonym of *Gomesa ranifera* by Govaerts (2011), yet we do not agree, due to the following considerations. In the protologue of *Oncidium hookeri*, it is mentioned that "[*Oncidium raniferum*] was found in Brazil, being n. 637 of Gardner's Organ Mountain plants… This plant [*O. raniferum*] has the lateral sepals quite free… In 1840 Sir William Hooker figured a plant (*Bot. Mag.*, t. 3712) which he called variety major, remarking that it had much longer leaves than the plant figured in the *Bot. Reg.*, a scape 1 and a half foot high, and larger and more numerous flowers. This is identical with the present plant, but nothwithstanding its great similarity to Lindley's plant [*O. raniferum*], it has the lateral sepals connate for half their length… The plant is so well represented in the figure above cited that a full description is unnecessary, though I may say the flowers are half an inch long, the sepals and petals sharply reflexed, and each bearing a few dull red spots, and that the bright yellow lip, with its large chestnut-coloured callus, give the plant a very singular appearance". Along with the type material of *Oncidium raniferum* var. *major*, Rolfe states that "This is not *Oncidium raniferum*, Lindl. though it is *O. raniferum* var. *major*, Hook. and = *O. hookeri*, Rolfe. I have discovered this sheet subsequent to the publication of *O. hookeri*. It must be the one to which sir W. Hooker alludes (Bot. Mag. t. 3712), for the same number in Herb. Lindley is *O. raniferum*, Lindl. as stated in Gard. Chron. 1887. 2. 520. (R.A.Rolfe)". In turn, the type specimen of *O. hookeri* collected by Glaziou is accompanied by notes that state "O. raniferum, 'Lindl.' var. major, Hook. Bot. Mag. t. 3712", "lateral sepals certainly connate for half their length". All these considerations led us to consider *O. raniferum* var. *major* as a synonym of *Gomesa hookeri* and this species apart from *G. ranifera*.

In fact, according to the descriptions and based on our observations in the field and over exsicatae, *G. ranifera* has a smaller habit, more lax inflorescenes with more spaced flowers, lateral sepals connate only at the base (vs. connate for half their length in *G. hookeri*) and coloration from white to a palid yellow (vs. vivid yellow) (Fig. 2). Also, their flowering periods are divergent, from October to December in *G. ranifera* and December to March in *G. hookeri*. All these factors combined bring a totally divergent aspect to each species, besides we were not able to find intermediate individuals, corroborating the idea of two different species. *G. loefgrenii*, on the other hand, resembles in all aspects *G. hookeri*, as supported by the comparative analysis of their respective type materials.

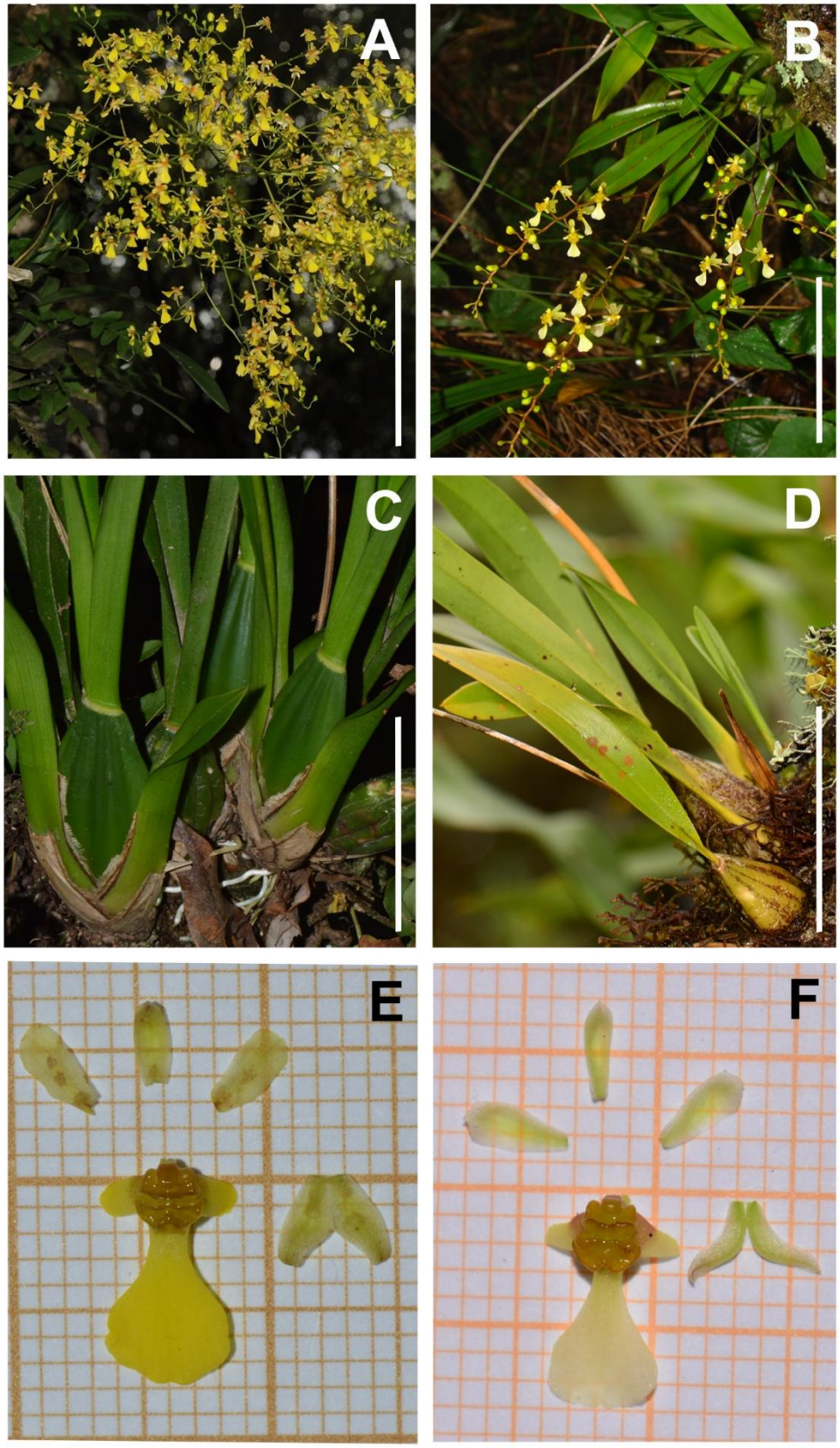

Fig. 2. Comparison of *Gomesa hookeri* and *G. ranifera*. **A, C, E,** *Gomesa hookeri*. **A,** inflorescence; **C,** pseudobulbs; **E,** expanded perianth. **B, D, F,** *Gomesa ranifera*. **B,** inflorescence; **D,** pseudobulbs; **F,** expanded perianth. – Scale bars = 5cm.

Additional specimens examined – 22 exsicatae. Representative material: BRAZIL. PARANÁ. Curitiba: Lago Azul, 30 Jan 1984, *G. Hatschbach 47619* (HUCS). RIO GRANDE DO SUL. Bom Jesus: Fazenda do Cilho, 8 Jan 2005, *R. Wasum s.n.* (HVAT 2270). Caxias do Sul: Barragem Faxinal, 5 Dec 1991, *A. Jasper s.n.* (PACA 71168). Riozinho, estrada para Barra do Ouro, 29°37'10.47"S, 50°20'46.71"W, 24 Mar 2016, *J.B. Castro 19* (ICN). São Francisco de Paula: Cânion Itaimbezinho, 30 Jan 1950, *B. Rambo s.n.* (PACA 45558). Torres: Jan and Feb 1927, *J. Dutra 927* (ICN). SANTA CATARINA. Mafra: 26 Jan 1953, *s.coll. s.n.* (PACA 55120).

10. *Gomesa hydrophila* (Barb.Rodr.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium hydrophilum* Barb.Rodr. in Gen. Spec. Orchid. 1: 92. 1877 ≡ *Ampliglossum hydrophilum* (Barb.Rodr.) Campacci in Colet. Orquídeas Brasil. 3: 84. 2006 ≡ *Coppensia hydrophila* (Barb.Rodr.) Campacci in Bol. CAOB 62: 55. 2006 – Lectotype (here designated): Barbosa Rodrigues's original illustration in "Iconographie des Orchidées du Brésil" 6: t. 257, cited as tab. 421 (then unpublished) in Barbosa Rodrigues (1877: 92), reproduced in Sprunger & al. (1996: 385).

= *Oncidium hydrophilum* f. *immaculatum* (L.C.Menezes) Christenson in Lindleyana 11: 20. 1996 ≡ *Oncidium hydrophilum* var. *immaculatum* L.C.Menezes in Schlechteriana 2(2): 49. 1991.

Additional specimens examined – 4 exsicatae. Representative material: BRAZIL. GOIÁS. Alto Paraíso: GO-118, 13 Feb 1990, *G. Hatschbach, M. Hatschbach & V. Nicolack 53934* (HUCS). RIO GRANDE DO SUL. Lombas: 2 Jul 2015, *J.B. Castro 18* (ICN). São Leopoldo: 28 Nov 1935, *J. Dutra 1193* (ICN).

11. *Gomesa imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium imperatoris-maximiliani* Rchb.f. in Bot. Ergebn.: 154. 1866 ≡ *Anettea imperatoris-maximiliani* (Rchb.f.) Szlach. & Mytnik in Polish Bot. J. 51: 50. 2006 – Holotype: BRAZIL. Rio de Janeiro, Petrópolis, 1859, *Wawra & Maly 417* (W no. 595!).

= *Brasilidium crispum* (Lodd. ex Lindl.) Campacci in Colet. Orquídeas Brasil. 3: 78. 2006 ≡ *Oncidium crispum* Lodd. ex Lindl. in Gen. Sp. Orchid. Pl.: 197. 1833 ≡ *Anettea crispa* (Lodd. ex Lindl.) Szlach. & Mytnik in Polish Bot. J. 51: 50. 2006.

= *Oncidium crispum* var. *grandiflorum* B.S.Williams in Orch.-Grow. Man. 2: 127. 1862.

= *Oncidium crispum* var. *sublaeve* Rchb.f. in Gard. Chron.: 1290. 1872.

= *Oncidium crispum* var. *olivaceum* Rchb.f. in Gard. Chron.: 40. 1877.

= *Oncidium crispum* var. *ochraceum* Rchb.f. in Gard. Chron.: 756. 1888.

= *Gomesa gravesiana* (Rolfe) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104: 397. 2009 ≡ *Oncidium gravesianum* Rolfe in Gard. Chron. III, 11: 650. 1892. syn. nov. ≡ *Anettea gravesiana* (Rolfe) Szlach. & Mytnik in Polish Bot. J. 51: 50. 2006 ≡ *Brasilidium gravesianum* (Rolfe) Campacci in Colet. Orquídeas Brasil. 3: 79. 2006 – Holotype: BRAZIL. Pernambuco, Apr 1892, *F. Sander; Co. s.n.* (K no. 294032!).

= *Oncidium crispum* var. *flabellulatum* Stein in Orchid.-Buch: 410. 1892.

= *Oncidium crispum* var. *aureum* auct. in Garden (London) 1: 107. 1898.

= *Oncidium crispum* var. *limbatum* Cogn. in Chron. Orchid. 20: 155. 1898.

= *Oncidium crispum* var. *lionetianum* Cogn. in Dict. Icon. Orchid. Oncidium: t. 6A. 1899.

= *Oncidium crispum* var. *rodriguesii* Cogn. in Fl. Bras. 3(6): 350. 1905.

Notes – The main feature used by Rolfe to distinguish between *Oncidium gravesianum* and *O. crispum* was “its much narrower petals, averaging only half an inch in breadth…”. Inasmuch as the size of petals is highly variable in *O. crispum,* which led to the description of several varieties (as *O. crispum* var. *grandiflorum*), we decided to synonymize *Gomesa gravesiana* under *G. imperatoris-maximiliani* (the current valid name for *O. crispum*).

Additional specimens examined – 7 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Osório: Morro da Borrússia, próximo à igreja Santa Rita, 28 Feb 2016, *J.B. Castro 43* (ICN). Torres: 28 Jan 1992, *J.L. Waechter 2512* (ICN). SANTA CATARINA. Florianópolis: Morro Costa da Lagoa, 17 Jan 1967, *R.M. Klein 7094* (PACA).

12. *Gomesa longicornu* (Mutel) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium longicornu* Mutel in Mém. Scarpe Oct.: 13. 1838, Mém. Soc. Hist. Nat. Strasbourg 3(1): 28. 1840 ≡ *Rhinocerotidium longicornu* (Mutel) Szlach. in Polish Bot. J. 51: 40. 2006 ≡ *Rhinocidium longicornu* (Mutel) Baptista in Colet. Orquídeas Brasil. 3: 93. 2006 ≡ *Coppensia longicornu* (Mutel) F.Barros & V.T.Rodrigues in Bol. CAOB 77–78: 12. 2010 – Neotype (here designated): BRAZIL. Organ Mountains, Mar 1837, *Gardner 639* (K no. 586519!), on sheet with K no. 586517–20.

= *Oncidium unicornutum* Knowles & Westc. in Fl. Cab. 2: 143. 1838.

= *Oncidium unicorne* Lindl. in Edwards's Bot. Reg. 25: Misc. 55. 1839.

= *Oncidium monoceras* Hook. in Bot. Mag. 68: t. 3890. 1841.

= *Gomesa rhinoceros* (Rchb.f.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium rhinoceros* Rchb.f. in Bot. Zeitung 14: 514. 1856 ≡ *Rhinocerotidium rhinoceros* (Rchb.f.) Szlach. in Polish Bot. J. 51: 40. 2006.

= *Oncidium longicornu* var. *gautieri* (Regel) Cogn. in Fl. Bras. 3(6): 315. 1905 ≡ *Oncidium gautieri* Regel in Index Seminum (St. Petersburg.): 80. 1868.

= *Oncidium longicornu* var. *grossmannii* Dammer in Orchis 1: 87. 1907.

Notes – Despite being cited in the protologue, the figure 54 of *Oncidium longicornu* was never published. There is a sheet in Kew herbarium (K) with two important records. The first one, K000586518, is labeled as "*Oncidium monoceras* Hook., Woburn, type". The second one, in turn, is K000586519 (Gardner #639), which has a label mentioning the "Bot. Mag. tab. 3890", in other words it is refering to *O. monoceras*'s protologue. In Mémoires de la Société d'Histoire Naturelle de Strasbourg 3 (1842), on page 21, Mutel wrote about *O. longicornu* in the footnote, that "he saw the same plant blooming in a greenhouse in Paris in 1841 under the name *Oncidium monoceras* Richard; and that the same plant is described in (Curtis's) Botanical Magazine, August 1841, under the name *Oncidium monoceras* Hook., … the plant is very well illustrated, on table 3890". After being aware of these informations, it seems appropriate to choose Gardner's plant as a neotype to *O. longicornu*.

Additional specimens examined – 17 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Itaara: [Santa Maria] Reserva Biológica do Ibicuí-Mirim, 9 Nov 1990,

N. Silveira 7995 (HAS). Montenegro: L. Campestre, 15 Nov 1946, *A. Sehnem s.n.* (PACA 84957). Ronda Alta: estrada para Passo Fundo, 14 Nov 1976, *J.L. Waechter 387* (ICN). São Francisco de Paula: 19 Dec 1950, *A. Sehnem s.n.* (PACA 50985/1), Jan 1954, *Ir. Edésio s.n.* (ICN 19443); Cânion Itaimbezinho, 18 Dec 1950, *B. Rambo* (PACA 49444). São José dos Ausentes: [Vacaria] Fazenda da Ronda, 5 Jan 1947, *B. Rambo s.n.* (PACA 34836). Vacaria: Passo do Socorro, 28 Jan 1951, *A. Sehnem s.n.* (PACA 82080). Vale do Sol: [Santa Cruz do Sul] Trombudo, 22 Sep 1975, *J.L. Waechter 212* (ICN);

13. *Gomesa paranensoides* M.W.Chase & N.H.Williams in Phytotaxa 1: 58. 2009 ≡ *Oncidium paranaense* Kraenzl. in Kongl. Svenska Vetensk. Acad. Handl. n.s., 46(10): 84. 1911 ≡ *Carenidium paranaense* (Kraenzl.) Baptista in Colet. Orquídeas Brasil. 3: 91. 2006 ≡ *Rhinocidium paranaense* (Kraenzl.) Docha Neto in Orchidstud. 2: 42. 2007 ≡ *Gomesa paranaensis* (Kraenzl.) M.W.Chase & N.H.Williams [Illegitimate] in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Coppensia paranaensis* (Kraenzl.) F.Barros & V.T.Rodrigues in Bol. CAOB 77–78: 13. 2010 ≡ *Hardingia paranaensis* (Kraenzl.) Docha Neto & Baptista in Colet. Orquídeas Brasil. 9: 343. 2011 – Syntypes: BRAZIL. Paraná, Itaperussú, 23 Dec 1908, *P. K. H. Dusén 7452* (S no. 04-233!); 31 Dec 1908, *P. K. H. Dusén 7431* (S no. R-3799!); 30 Nov 1909, *P. K. H. Dusén 9042* (S no. 07-7916!); Paraná, Vila Velha, 12 Dec 1908, *P. K. H. Dusén 7399* (S no. R-3797!); Rio Grande do Sul, Piratiny, 18 Dec 1892, *C. A. M. Lindman 789* (S no. 07-7917!; S no. R-3798!). Isosyntype: *P. K. H. Dusén 7452* (AMES no. 102524!). Lectotype (here designated): S no. 04-233!. Isolectotype (here designated): AMES no. 102524!.

= *Oncidium hatschbachii* Schltr. in Repert. Spec. Nov. Regni Veg. 23: 64. 1926.

= *Oncidium schadei* L.O.Williams in Lilloa 5: 10. 1939 – Holotype: PARAGUAY. Paso Yobay, Cordillera de Cuaguazu, 100km east of Villarrica, Dec 1938, *F. Schade s.n.* (AMES no. 102544!).

Notes – In Chase & al. (2009), *Oncidium paranense* was transferred to *Gomesa* as *G. paranaensis*. However, this name was already employed for another species within the genus. Being aware of the situation, Chase (2009) considered the name as illegitimate and proposed a new epithet for the species, *Gomesa paranensoides*.

Additional specimens examined – 23 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Barracão: 6 Jan 2011, *W. Heberle s.n.* (HVAT 4267). Cambará do Sul: 23 Dec 2016, *J.B. Castro 59* (ICN), 29 Dec 2016, *J.B. Castro 57* (ICN). Canela: Caracol, 2 Jan 1973, *J. Jung & al. s.n.* (ICN 21898). Encruzilhada do Sul: Assentamento Farroupilha, 16 Dec 2007, *M. Grings 459* (ICN). Ivorá: Piruva, Cascata Queda Livre, 9 Jan 2016, *J.B. Castro 33* (ICN). Passo Fundo: Barragem Fazenda, 20 Dec 2002, *R.V. Kilca s.n.* (RSPF 9569); Bom Recreio, Haras da Luz, 8 May 2006, *C.R. Buzatto s.n.* (ICN 143774). Rio Pardo: Fazenda Soledade, Jan 1921, *J. Dutra 4* (ICN). São José do Herval: PCH Salto do Forqueta, 16 Nov 2001, *C. Gonçalves s.n.* (HVAT 859). São Leopoldo: Quinta S. Manoel, Dec 1927, *J. Dutra 1008* (ICN).

14. *Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium pectorale* Lindl. in Sert. Orchid.: t. 39. 1840 ≡ *Anettea pectoralis* (Lindl.) Szlach. & Mytnik in Polish Bot. J. 51: 50. 2006 ≡ *Brasilidium pectorale* (Lindl.) Campacci in Colet. Orquídeas Brasil. 3: 79. 2006 – Lectotype (here designated): Lindley's illustration in Sert. Orchid.: t. 39. 1840.

= *Gomesa gardneri* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium gardneri* Lindl. in London J. Bot. 2: 662. 1843. syn. nov. ≡ *Anettea gardneri* (Lindl.) Szlach. & Mytnik in Polish Bot. J. 51: 50. 2006 ≡ *Brasilidium gardneri* (Lindl.) Campacci in Colet. Orquídeas Brasil. 3: 79. 2006 – Holotype: BRAZIL. Organ Mountains, 1837, *s.coll. 642* (BM no. 534462!).

= *Gomesa curta* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium curtum* Lindl. in Edwards's Bot. Reg. 33: t. 68. 1847 ≡ *Anettea curta* (Lindl.) Szlach. & Mytnik in Polish Bot. J. 51: 50. 2006 ≡ *Brasilidium curtum* (Lindl.) Campacci in Colet. Orquídeas Brasil. 3: 78. 2006.

= *Oncidium flabelliferum* Pinel in Paxton's Mag. Bot. 16: 65. 1849.

= *Oncidium gardneri* var. *elegantissimum* (Rchb.f.) Cogn. in Fl. Bras. 3(6): 357. 1905 ≡ *Oncidium elegantissimum* Rchb.f. in Gard. Chron. 1: 13. 1877.

= *Oncidium gardneri* var. *praestans* (Rchb.f.) Cogn. in Fl. Bras. 3(6): 357. 1905 ≡ *Oncidium praestans* Rchb.f. in Gard. Chron. n.s., 14: 296. 1880.

= *Oncidium gardnerianum* auct. [Spelling variant] in Gard. Chron. n.s., 13: 759. 1880.

= *Gomesa brunnipetala* (Barb.Rodr.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium brunnipetalum* Barb.Rodr. in Gen. Spec. Orchid. 2: 190. 1882 ≡ *Ampliglossum brunnipetalum* (Barb.Rodr.) Campacci in Colet. Orquídeas Brasil. 3: 83. 2006 ≡ *Coppensia brunnipetala* (Barb.Rodr.) Campacci in Bol. CAOB 62: 55. 2006.

= *Oncidium gardneri* subsp. *caloglossum* (Rchb.f.) Fowlie in Orchid Digest 40: 48. 1976 ≡ *Oncidium caloglossum* Rchb.f. in Gard. Chron. n.s., 24: 166. 1885 ≡ *Oncidium pectorale* var. *caloglossum* (Rchb.f.) Cogn. in Fl. Bras. 3(6): 355. 1905.

= *Oncidium gardneri* var. *pollettianum* (Rchb.f.) Cogn. in Fl. Bras. 3(6): 357. 1905 ≡ *Oncidium pollettianum* Rchb.f. in Gard. Chron. n.s., 26: 326. 1886.

= *Oncidium pectorale* var. *mantinii* (God.-Leb.) Cogn. in Fl. Bras. 3(6): 355. 1905 ≡ *Oncidium mantinii* God.-Leb. In Orchidophile (Argenteuil) 8: 47. 1888.

= *Oncidium pectorale* var. *larkinianum* (Gower) Cogn. in Fl. Bras. 3(6): 355. 1905 ≡ *Oncidium larkinianum* Gower in Garden (London) 37: 325. 1890 – Holotype: BRAZIL. s.d., *Larkin s.n.* (K no. 586545!), on sheet with K no. 586543–46.

= *Gomesa wheatleyana* (Gower) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 395. 2009 ≡ *Oncidium wheatleyanum* Gower in Garden (London) 44: 227. 1893 – Holotype: s.loc., 15 Nov 1894, *F. Wheatley s.n.* (K no. 586548!).

Notes – *Oncidium pectorale* lacks any extant exsicatae that could be considered as a potential type. So, it seems appropriate to designate the protologue's original illustration as lectotype for the species. Also, under *Gomesa pectoralis* we synonymized *G. gardneri*. In *Oncidium garneri*'s protologue, Lindley distinguishes his new species from *O. crispum* and *O. forbesii* "by the peculiar form and tuberculation of the lip, and by the very small wings of the column.", but does not distinguish it from *O. pectorale*, previously described by him. In fact, the patterns of the tubercles in the lip are the same.

Additional specimens examined – 2 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. São Francisco de Paula: CPCN Pró-Mata, 7 Nov 2009, *P.J.S. Silva Filho 524* (MPUC).

15. *Gomesa ranifera* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium raniferum* Lindl. in Edwards's Bot. Reg. 24: t. 48. 1838 ≡ *Carenidium raniferum* (Lindl.) Baptista in Colet. Orquídeas Brasil. 3: 91. 2006 ≡ *Menezesiella ranifera* (Lindl.) Chiron & V.P.Castro in Richardiana 6(2): 105. 2006 ≡ *Rhinocidium raniferum* (Lindl.) Baptista in Orchidstud. 2: 42. 2007 ≡ *Coppensia ranifera* (Lindl.) F.Barros & V.T.Rodrigues in Bol. CAOB 77–78: 13. 2010 – Holotype: BRAZIL. Organ Mountains, 1837, *Gardner 637* (BM no. 534488!).

Notes – For differentiation between *G. ranifera* and *G. hookeri*, see explanations under the latter species's notes (and Fig. 2).

Additional specimens examined – 30 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Cambará do Sul: estrada para o Cânion Fortaleza, 18 Mar 1983, *N. Silveira 419* (HAS). Muitos Capões: [Esmeralda] Estação Ecológica de Aracuri, 14 Jan 1982, *K. Kleebank 6* (ICN). Garibaldi: Marcorama, Jan 1988, *M. Rossato s.n.* (HUCS 3968). Riozinho: 16 Mar 1997, *N. Bittencourt & al. s.n.* (PACA 93592). Vacaria: Passo do Socorro, 29 Dec 2016, *J.B. Castro 56* (ICN).

16. *Gomesa recurva* R.Br. in Bot. Mag. 42: t. 1748. 1815 ≡ *Rodriguezia recurva* (R.Br.) Lindl. in Trans. Hort. Soc. London 7: 67. 1827. ≡ *Odontoglossum recurvum* (R.Br.) Rchb.f. in Ann. Bot. Syst. 6: 853. 1864 – Lectotype (here designated): Brown's illustration in Bot. Mag. 42: t. 1748. 1815.

= *Gomesa recurva* Lodd. [Illegitimate] in Bot. Cab. 7: t. 660. 1822.

= *Gomesa planifolia* (Lindl.) Klotzsch ex Rchb.f. in Bot. Zeitung (Berlin) 10: 772. 1852 ≡ *Rodriguezia planifolia* Lindl. in Trans. Hort. Soc. London 7: 67. 1830. syn. nov. ≡ *Odontoglossum planifolium* (Lindl.) Rchb.f. in Ann. Bot. Syst. 6: 853. 1864 – Lectoype (here designated): Loddiges's illustration in Bot. Cab. 7: t. 660. 1822.

= *Epidendrum inflexum* Vell. in Fl. Flumin. 9: t. 30. 1831.

= *Gomesa densiflora* Hoffmanns. in Verz. Orchid.: 50. 1843.

= *Gomesa reclinata* Hoffmanns. in Verz. Orchid.: 52. 1843.

= *Gomesa planifolia* var. *densa* Regel in Ann. Sci. Nat., Bot. IV, 6: 377. 1856.

= *Gomesa planifolia* var. *laxa* Regel in Ann. Sci. Nat., Bot. IV, 6: 377. 1856.

= *Gomesa planifolia* var. *crocea* Regel in Gartenflora 30: 259. 1881.

Notes – *Gomesa recurva* lacks any extant exsicatae that could be considered as potential type. So, it seems appropriate to designate the protologue's original illustration as lectotype for the species. Concerning *Gomesa planifolia*, Lindley writes that "These have in every respect so much the structure of *Gomeza recurva*, figured in the Botanical Magazine, tab. 1748, that there can be no doubt of their near relation to that plant; but I cannot bring myself to believe that they are absolutely the same, although it appears from the 660th figure of the Botanical Cabinet, which is a good representation of this species [*Rodriguezia planifolia*], that Messrs. Loddiges do not distinguish the two plants". Therefore, it seems appropriate to designate the mentioned illustration (from Botanical Cabinet) as a lectotype for *G. planifolia*, since it was mentioned in the protologue. Lindley distinguished the two species by the pseudobulbs being ovate and the leaves lanceolate, widening gradually towards the upper extremity, strongly plaited and many times longer than the bulbs in *G. recurva*; and the pseudobulbs being very long and almost linear, bearing linear-lanceolate leaves, by no means widening to either extremity, with no trace of plicatures and scarcely more than twice the length of the bulbs in *G. planifolia*. Though, in the field we can observe a variation in the shape of pseudobulbs and leaves even in the same individual, which indicates that both names refer to the same species. Furthermore, for differentiation between *Gomesa recurva* and *G. crispa*, see comments under the latter species's notes.

Additional specimens examined – 11 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Garibaldi: Marcorama, Jan 1988, *M. Rossato & al. s.n.* (HUCS 3967). Marcelino Ramos: Feb 1927, *J. Dutra 1045* (ICN). Pouso Novo: Canhada Funda, -29.181364, -52.227357, 17 Jan 2016, *J.B. Castro 35* (ICN). Quevedos: 27 Jan 2016, *J.B. Castro 79* (ICN). São Leopoldo: 22 Sep 1933, *C. Orth s.n.* (PACA 598). SANTA CATARINA. Anita Garibaldi: Jaboticaba do Neri, UHE Campos Novos, 14 Jan 2003, *F. Teixeira & N. Silveira s.n.* (RSPF 8491).

17. *Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium uniflorum* Booth ex Lindl. in Edwards's Bot. Reg. 29: t. 43. 1843 ≡ *Alatiglossum uniflorum* (Booth ex Lindl.) Baptista in Colet. Orquídeas

Brasil. 3: 89. 2006 ≡ *Kleberiella uniflora* (Booth ex Lindl.) V.P.Castro & Cath. in Richardiana 6: 158. 2006 – Holotype: BRAZIL. Organ Mountains, 1841, *Gardner 5873* (BM no. 1122690!), on sheet with BM no. 534457.

= *Gomesa longipes* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009 ≡ *Oncidium longipes* Lindl. in Paxton's Fl. Gard. 1: 46. 1850. syn. nov. ≡ *Alatiglossum longipes* (Lindl.) Baptista in Colet. Orquídeas Brasil. 3: 88. 2006 ≡ *Kleberiella longipes* (Lindl.) V.P.Castro & Cath. in Richardiana 6: 159. 2006 – Neotype (here designated): BRAZIL. São Paulo and Rio de Janeiro, 1861, *J. Weir 381* (K no. 886838!).

= *Oncidium janeirense* Rchb.f. in Bonplandia (Hannover) 2: 90. 1854.

= *Oncidium oxyacanthosmum* Rchb.f. ex Linden in Ill. Hort.: t. 54. 1855.

= *Oncidium uniflorum* var. *robustum* Regel in Ann. Sci. Nat., Bot. IV, 6: 377. 1856.

= *Oncidium monophyllum* (Regel) Herter in Estud. Bot. Reg. Uruguay 24: 255. 1956 ≡ *Oncidium longipes* var. *monophyllum* Regel in Index Seminum (St. Petersburg): 30. 1863.

= *Oncidium biflorum* Barb.Rodr. in Gen. Spec. Orchid. 2: 187. 1882 – Lectotype (here designated): Barbosa Rodrigues's original illustration in "Iconographie des Orchidées du Brésil" 6: t. 253, cited as tab. 516 (then unpublished) in Barbosa Rodrigues (1882: 187), reproduced in Sprunger & al. (1996: 381).

= *Gomesa eurycline* (Rchb.f.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009 ≡ *Oncidium eurycline* Rchb.f. in Gard. Chron. n.s., 20: 812. 1883.

= *Gomesa unicolor* (Rolfe) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium unicolor* Rolfe in Orchid Rev. 1: 266. 1893 ≡ *Alatiglossum unicolor* (Rolfe) Baptista in Colet. Orquídeas Brasil. 3: 89. 2006 ≡ *Kleberiella unicolor* (Rolfe) V.P.Castro & Cath. in Richardiana 6: 159. 2006.

= *Oncidium hasslerii* Cogn. in Fl. Bras. 3(6): 445. 1906 – Holotype: PARAGUAY. Caaguazú, Mar 1905, *E. Hassler 9284* (G no. 9361!). Isotypes: BR no. 6585198!; BM no. 526853!; K no. 79331!.

Notes – *Oncidium longipes*'s type, if extant, was missing. In this context, we assigned as neotype a collection from Weir that was mentioned in "Flora Brasiliensis" (Cogniaux, 1906), an important literature concerning Brazilian orchids. In addition to its historical value, the exsiccate fits well in the original description. In *O. longipes*'s protologue is stated that its "habit is plainly that of *O. uniflorum*, but the sepals and petals are deeply stained with dull brown". Another traditional differentiation between them is based on the number of flowers per inflorescence and the number of leaves per pseudobulb, 2–5 flowers and 2 leaves in *O. longipes* against 1 flower and 1 leaf in *O. uniflorum*. However, we could find individuals bearing both features in our observations and by analyzing the literature, which led to the description of several variations such *Oncidium longipes* var. *monophyllum*. Therefore, *Gomesa longipes* must be treated as a synonym of *G. uniflora*.

Additional specimens examined – 36 exsicatae. Representative material: BRAZIL. PARANÁ. Ponta Grossa: rio Tibagi, 14 Jan 1988, *R. Kummrow 3003* (HUCS). RIO GRANDE DO SUL. Caçapava do Sul: Gruta da Varzinha, 31 Oct 1999, *R Wasum 222* (HUCS). Guaíba: Fazenda São Maximiano, BR 116, km 308, 12 Nov 2006, *C.R. Buzatto 189* (ICN). Machadinho: Linha Monjolinho, 4 Aug 2000, *A. Wilt s.n.* (HAS 39006). Passo Fundo: Bosque Lucas Araújo, 1 Sep 1987, *V. Menegazzo, A. Peacheco & N. Menegazzo s.n.* (RSPF 3596). Rio Grande: Centro, 3 Sep 1986, *T. Vinagre s.n.* (HURG 2075). Santana da Boa Vista: Serra do Apertado, 3 Nov 1995, *J.A. Jarenkow & M. Sobral 2853* (PEL). São Francisco de Paula: CPCN Pró-Mata PUCRS, 23 Nov 2016, *J.B. Castro 66* (ICN). Três Cachoeiras: [Torres] Morro Azul, 25 Mar 1977, *J.L. Waechter 478* (ICN). SANTA CATARINA. Lauro Muller: Rio do Meio, 20 Mar 1959, *Reitz & Klein 8689* (HBR, PACA).

18. *Gomesa venusta* (Drapiez) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009 ≡ *Oncidium venustum* Drapiez in Hort. Belge 3: 28, t. 49. 1836 ≡ *Carenidium venustum* (Drapiez) Baptista in Colet. Orquídeas Brasil. 3: 91. 2006 ≡ *Baptistonia venusta* (Drapiez) Docha Neto in Orchidstud. 2: 41. 2007 ≡ *Baptistonia venusta* (Drapiez) Chiron in Richardiana 8: 121. 2008 ≡ *Campaccia venusta* (Drapiez) Baptista, P.A.Harding & V.P.Castro in Colet. Orquídeas Brasil. 9: 317. 2011 – Lectotype (here designated): Drapiez's illustration in Hort. Belge 3: t. 49. 1836.

= *Oncidium galeatum* Scheidw. in Allg. Gartenzeitung 7: 406. 1839.

= *Oncidium trulliferum* Lindl. in Edwards's Bot. Reg. 25: t. 57. 1839.

= *Oncidium dimorphum* Regel in Index Seminum (St. Petersburg): 22. 1869 – Holotype: s.loc., s.d., *s.coll. s.n.* (LE no. 11226!).

= *Oncidium ornithocephaloides* Kraenzl. in Pflanzenr. IV, 50(80): 127. 1922.

= *Oncidium rhynchophorum* Schltr. ex Hoehne in Bol. Mus. Nac. Rio de Janeiro 12(2): 33. 1936.

Notes – *Oncidium venustum* lacks any extant exsicatae that could be considered as potential type. So, it seems appropriate to designate the protologue's original illustration as lectotype for the species.

Additional specimens examined – 4 exsicatae. Representative material: BRAZIL. RIO GRANDE DO SUL. Maquiné: estrada para a cascata do Garapiá, 29°31'22.2"S, 50°14'52.2"W, 2 Mar 2016, *J.B. Castro 80* (ICN). Torres: Faxinal, 22 Feb 1979, *J.L. Waechter 1192* (ICN).

We can infer that the number of species in *Gomesa s.l.* has been overestimated. The taxa we herein studied, at least, show a high phenotypic plasticity, exhibiting several variations and intermediates, turning almost impossible to inequivocally distinguish several validly described species. Here comes the importance of taxonomic studies, gathering information and favoring prospective studies. Additional studies involving *Gomesa* species are necessary in order to clarify the real number of species in the genus. Hopefully, these forthcoming studies will be multidisciplinary, embracing not only the mandatory nomenclatural aspects, but also the study of living specimens and their variation in the wild and under cultivation. Thus, a more reliable panorama of the real number of species in the genus could be elucidated and stablished.

Table 1. Binomials typificated of *Gomesa* spp from Brazil. Names in bold are the currently accepted names. HT, Holotype; IT, Isotype; ST, Syntype; LT, Lectotype; ILT, Isolectotype; NT, Neotype; *, Here designated.

Binomial	Reference to typification
1. *Oncidium barbaceniae* Lindl. ≡ ***Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams**	HT: *ic. Weddell 32* (K no. 501738!)
= *Oncidium montanum* Barb.Rodr. ≡ ***Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams**	LT*: "Iconographie des Orchidées du Brésil" 6: t. 263
= *Oncidium uliginosum* Barb.Rodr. ≡ ***Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams**	LT*: "Iconographie des Orchidées du Brésil" 6: t. 258
2. *Oncidium barbatum* Lindl. ≡ ***Gomesa barbata* (Lindl.) M.W.Chase & N.H.Williams**	HT: *W. Swainson s.n.* (K no. 501739!)
= *Oncidium ciliatum* Lindl. ≡ ***Gomesa barbata* (Lindl.) M.W.Chase & N.H.Williams**	HT: *s.coll. s.n.* (K no. 501740, A!).
= *Oncidium suscephalum* Barb.Rodr. ≡ ***Gomesa barbata* (Lindl.) M.W.Chase & N.H.Williams**	HT: *F. Freire-Allemão 1480* (R no. 3276!)
3. *Oncidium bifolium* Sims ≡ ***Gomesa bifolia* (Sims) M.W.Chase & N.H.Williams**	LT*: Bot. Mag. 36: t. 1491
= *Oncidium maculosum* Lindl. ≡ ***Gomesa bifolia* (Sims) M.W.Chase & N.H.Williams**	HT: *C. F. P. von Martius 1842* (M no. 232037!) IT: M no. 232036!
= *Oncidium celsianum* A.Rich. ≡ ***Gomesa bifolia* (Sims) M.W.Chase & N.H.Williams**	HT: *M. Cels s.n.* (P no. 437169!) IT: P no. 437170!
4. *Oncidium concolor* Hook. ≡ ***Gomesa concolor* (Hook.) M.W.Chase & N.H.Williams**	HT: *Gardner s.n.* (K no. 586532!)
= *Oncidium ottonis* Schltr. ≡ ***Gomesa concolor* (Hook.) M.W.Chase & N.H.Williams**	LT*: Orchis 8: 59. t. 11
5. *Oncidium cornigerum* Lindl. ≡ ***Gomesa cornigera* (Lindl.) M.W.Chase & N.H.Williams**	LT*: *s.coll. s.n.* (K no. 883239!) ST: *Watts 55* (K no. 883238!)
= *Oncidium hecatanthum* Kraenzl. ≡ ***Gomesa cornigera* (Lindl.) M.W.Chase & N.H.Williams**	LT*: *C. A. M. Lindman 793a* (S no. R-3796!) ST: S no. 07-7908!
6. *Rodriguezia crispa* Lindl. ≡ ***Gomesa crispa* (Lindl.) Klotzsch ex Rchb.f.**	HT: *s.coll. s.n.* (K no. 501741!)
7. *Oncidium flexuosum* Lodd. ≡ ***Gomesa flexuosa* (Lodd.) M.W.Chase & N.H.Williams**	LT*: Bot. Cab. 5: t. 424
8. *Theodorea gomezoides* Barb.Rodr. ≡ ***Gomesa gomezoides* (Barb.Rodr.) Pabst**	LT*: "Iconographie des Orchidées du Brésil" 6: t. 318

Table 1. Continued.

Binomial	Reference to typification
9. *Oncidium hookeri* Rolfe ≡ ***Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams**	LT*: *A. Glaziou 15644* (K no. 586523!) ST: *W. Longman s.n.* (K no. 586522!)
= *Oncidium raniferum* var. *major* Hook. ≡ ***Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams**	HT: *Gardner 637* (K no. 886894!)
= *Oncidium loefgrenii* Cogn. ≡ ***Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams**	HT: *E. Gustavo 3264* (BR no. 6272111!)
10. *Oncidium hydrophilum* Barb.Rodr. ≡ ***Gomesa hydrophila* (Barb.Rodr.) M.W.Chase & N.H.Williams**	LT*: "Iconographie des Orchidées du Brésil" 6: t. 257
11. *Oncidium imperatoris-maximiliani* Rchb.f. ≡ ***Gomesa imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams**	HT: *Wawra & Maly 417* (W no. 595!)
= *Oncidium gravesianum* Rolfe ≡ ***Gomesa imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams**	HT: *F. Sander; Co. s.n.* (K no. 294032!)
12. *Oncidium longicornu* Mutel ≡ ***Gomesa longicornu* (Mutel) M.W.Chase & N.H.Williams**	NT*: *Gardner 639* (K no. 586519!)
13. *Oncidium paranaense* Kraenzl. ≡ ***Gomesa paranensoides* M.W.Chase & N.H.Williams**	LT*: *P. K. H. Dusén 7452* (S no. 04-233!) ILT*: *P. K. H. Dusén 7452* (AMES no. 102524!) ST: *P. K. H. Dusén 7431* (S no. R-3799!); *P. K. H. Dusén 9042* (S no. 07-7916!); *P. K. H. Dusén 7399* (S no. R-3797!); *C. A. M. Lindman 789* (S no. 07-7917!; S no. R-3798!)
= *Oncidium schadei* L.O.Williams ≡ ***Gomesa paranensoides* M.W.Chase & N.H.Williams**	HT: *F. Schade s.n.* (AMES no. 102544!)
14. *Oncidium pectorale* Lindl. ≡ ***Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams**	LT*: Sert. Orchid.: t. 39
= *Oncidium gardneri* Lindl. ≡ ***Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams**	HT: *s.coll. 642* (BM no. 534462!)
= *Oncidium larkinianum* Gower ≡ ***Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams**	HT: *Larkin s.n.* (K no. 586545!)
= *Oncidium wheatleyanum* Gower ≡ ***Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams**	HT: *F. Wheatley s.n.* (K no. 586548!)
15. *Oncidium raniferum* Lindl. ≡ ***Gomesa ranifera* (Lindl.) M.W.Chase & N.H.Williams**	HT: *Gardner 637* (BM no. 534488!)

Table 1. Continued.

Binomial	Reference to typification
16. ***Gomesa recurva* R.Br.**	LT*: Bot. Mag. 42: t. 1748
= *Rodriguezia planifolia* Lindl. ≡ ***Gomesa recurva* R.Br.**	LT*: Bot. Cab. 7: t. 660
17. *Oncidium uniflorum* Booth ex Lindl. ≡ ***Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams**	HT: *Gardner 5873* (BM no. 1122690!)
= *Oncidium longipes* Lindl. ≡ ***Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams**	NT*: *J. Weir 381* (K no. 886838!)
= *Oncidium biflorum* Barb.Rodr. ≡ ***Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams**	LT*: "Iconographie des Orchidées du Brésil" 6: t. 253
= *Oncidium hasslerii* Cogn. ≡ ***Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams**	HT: *E. Hassler 9284* (G no. 9361!) IT: BR no. 6585198!; BM no. 526853!; K no. 79331!
18. *Oncidium venustum* Drapiez ≡ ***Gomesa venusta* (Drapiez) M.W.Chase & N.H.Williams**	LT*: Hort. Belge 3: t. 49
= *Oncidium dimorphum* Regel ≡ ***Gomesa venusta* (Drapiez) M.W.Chase & N.H.Williams**	HT: *s.coll. s.n.* (LE no. 11226!)

AKNOWLEDGEMENTS

This contribution is part of the first author's M. Sc. Dissertation (in Botany) at the Programa de Pós-graduação em Botânica – UFRGS. J.B. Castro gratefully acknowledges his CAPES grant. We thank ICMBio for the collecting permit (process 40448-4). We also thank P.G. Windisch for careful reading and useful suggestions to the improvement of the manuscript.

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4. CAPÍTULO 2

Artigo a ser submetido ao periódico Systematic Botany. Este capítulo está estruturado seguindo as normas de formatação referente ao respectivo periódico, exceto o alinhamento e a fonte do texto e a edição das imagens.

A taxonomic study of *Gomesa* R.Br. (Orchidaceae: Oncidiinae) in Rio Grande do Sul, Brazil

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Abstract – Through many years, *Oncidium* Sw. consisted of a polyphyletic group. After molecular-based phylogenies, the genus underwent several fragmentations and many genera were recircumscribed to hold the former species of *Oncidium*. The Brazilian species were included under *Gomesa* R.Br. The present study concerns the inventory of species occurring in Rio Grande do Sul, south Brazil, offering general descriptions, identification keys, illustrations and maps of their geographical distributions. The State presents a specific richness of twenty species, distributed preferentially at the eastern and northern regions while decreasing in number of species towards the west and south. *Gomesa flexuosa* and *G. bifolia* are the most widely distributed species over the State's territory. After our observations, the use of 13 names previously cited to the State's flora should be suppressed, since vouchers or specimens were not found, and 3 names not mentioned before should be added: *Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams, *G. imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams and *G. pectoralis* (Lindl.) M.W.Chase & N.H.Williams.

Keywords – *Oncidium* Sw., *Ornithophora* Barb.Rodr., key to species, Brazilian Atlantic Rainforest.

INTRODUCTION

The subtribe Oncidiinae has passed through several different delimitations across the years, from broader to narrower circumscriptions. One of the classifications with highest acceptance within the scientific community is the one proposed by Dressler (1993), although two of his subtribes, Ornithocephalinae and Telipogoninae, have been proven to be nested within Oncidiinae (Whitten *et al*., 2000). On the other hand, Szlatchetko (1995) proposed a classification with many subtribes, based primarily on column and pollinarium structures. Recently, the systematics of the subtribe was the target of several studies, which corrected and proposed new delimitations in order to keep only monophyletic groups as valid (Chase & Palmer, 1992; Whitten *et al.*, 2000; Williams *et al.*, 2001a, 2001b; Chase, 2009; Chase *et al.*, 2009; Neubig *et al*., 2012). Szlatchetko's (1995) classification was proved polyphyletic. As defined by Whitten *et al.* (2000) and Chase (2009), Oncidiinae is sister to the remainder of Cymbidieae, except for *Eriopsis*, which assumes a position of sister to both clades. The subtribe encompasses species with two or four pollinia, refuting the idea that species of Cymbidieae present two pollinia while Maxillarieae, four (Dressler, 1981). Oncidiinae species are terrestrial or epiphytic, their general appearance consist of uninodal pseudobulbs with one to three apical leaves and generally presenting sympodial growth (Chase, 2009).

Not only the subtribes needed recircumscriptions but also some large genera of Oncidiinae underwent modifications. Among them, *Oncidium* Sw., the type genus, underwent fragmentations, with subsequent description of new genera and deposition of species in already valid clades (Chase *et al*., 2008; Chase *et al.*, 2009; Neubig *et al.*, 2012). *Oncidium*, in its wider concept, englobes more than 400 species through their characteristic callus, protuberances over the lip that resemble little tumors (from the greek word "onkos" = swelling). However, this feature is convergent in several lineages far apart from each other, as seen in Chase's (2009) phylogeny. Chase *et al*. (2009), then, attested the proximity of the Brazilian species of *Oncidium s.l.* to the clade *Gomesa* R.Br.,, composed by species bearing undivided and two-ridged lips and generally pendulous racemes. So, the latter genus had its concept expanded, grouping, in addition to *Oncidium s.l.*, species of *Ornithophora*, *Rodrigueziella* and *Rodrigueziopsis*. *Gomesa* is closely related to *Tolumnia* and the "twig

epiphytes". According to Chase *et al.* (2009), the genus is distinguished from the remaining Oncidiinae by displaying connate lateral sepals, glaucous leaf surface, lip pushed through the tepals in the buds, inflected pedicel and bracts loosely attached to the pedicel and externally pointed (Chase *et al.*, 2009).

Many Brazilian authors defend the use of smaller genera when it comes to species of *Gomesa s.l.* (Chiron & Castro Neto, 2004, 2006; Castro Neto & Lacerda, 2005, 2006; Baptista, 2006a, 2006b, 2006c; Campacci, 2006a, 2006b; Guiard, 2006; Romowicz & Szlachetko, 2006; Szlachetko, 2006; Szlachetko & Mytnik-Ejsmont, 2006; Barros & Rodrigues, 2010; Baptista *et al.*, 2011; Docha Neto & Baptista, 2011). Still, the lack of studies focused both on morphological and molecular features is notable, as well as those presenting a reasonable number of species and characters to allow the distinction of clades in field. In the search for monophyletic groups, to counterweigh molecular-based phylogenies and morphological studies is crucial. Chase (2009) argued that the high levels of evolutionary convergence seen in floral traits within Oncidiinae, mainly caused by pollination syndromes, lead to a confounding effect when it comes to grouping related species and genera. Therefore, reproductive characters are not suggested to be employed alone for these means. Instead, the use of related vegetative features and chromosome numbers or combinations of them all is encouraged (Chase *et al.*, 2009). In addition to these recent studies, earlier and important publications regarding Oncidiinae and *Oncidium* in particular that can be cited are the "Flora Brasiliensis" (von Martius, 1904-1906), "Iconografia de Orchidaceas do Brasil" (Hoehne, 1949) and "Iconographie des orchidées du Brésil (Sprunger *et al.*, 1996). The latter includes original illustrations of Barbosa Rodrigues's plants that constitute, in many cases, the types of described species, since the corresponding herbarium material has been lost or never existed (Cribb & Toscano de Brito, 1996; Buzatto *et al.*, 2011).

Several orchids have potential for being cultured as ornamental plants, including the subset of Oncidiinae popularly known as "dancing ladies" or "golden shower orchids" – the "oncidioid" orchids" – due to their multi-flowered panicles bearing vivid yellow flowers, sometimes with brown, white or purple markings. For this reason, they suffer a high pressure of collection, as well as lose their natural habitats due to the transformation of natural areas into plantations, pastures or housings. In this context, the knowledge of each species, their area of distribution and their status of conservation are of extreme importance for the preservation of the natural environment. Most species of *Gomesa sensu* Chase *et al.*, 2009 have their center of distribution in the Brazilian Atlantic Rainforest and the Cerrado, although

their overall distribution extends until Northern Argentina and the Peruvian Amazon (Neubig *et al.*, 2012). Estimates of species richness reach a value of 133 natives to the country's territory (Flora do Brasil 2020; IPNI, 2012; The Plant List, 2013). Also, in the literature 30 species (table 1) were referred to Rio Grande do Sul, the southernmost state of Brazil. Yet, by our previous observations, the number of species is overestimated because of several unrecognized synonymies. The present study aims to inventory the species belonging to *Gomesa* R.Br. in Rio Grande do Sul, Brazil, providing general descriptions of each taxon and plotting their geographical distribution. So far, this orchid genus hasn't been monographed in Rio Grande do Sul. Some species may be potentially threatened because they dwell in the Atlantic Rainforest, a Brazilian *hotspot* which has already lost much of its natural vegetation cover due to human occupation.

MATERIALS AND METHODS

The project was carried out in Rio Grande do Sul, Southern Brazil. The State has a privileged territory because it presents a diversified and peculiar flora, marked by the meeting of two important biomes, Pampa and Atlantic Rainforest. It is characterized by a mesothermic climate (temperate) and covers part of the watersheds of the Southeast and Uruguay. Studying the flora of Rio Grande do Sul, Rambo (1950) pointed out that most of the species of hygrophilous forests would have moved through the "Torres Gate", having its origin in the Dense Ombrophilous Forest (belonging to the Atlantic Rainforest *lato sensu*) while the species dwelling drier environments would be associated with the Crystalline Shield. Fortes (1959) divided the State into 11 physiographic regions (figure 1), a classification widely followed in studies on the flora of the State. Rio Grande do Sul is fairly representative in number of species, 20 out of the 133 estimated to the country. In order to verify the populational distribution of the species, 24 field expeditions were performed (regions and cities shown in table 2) and nearly 200 specimens were collected for further cultivation in the Fundação Zoobotânica do Rio Grande do Sul's orchidarium, enabling a more detailed study on their morphological features. Morphological terminology followed Radford *et al.* (1974) and for the abbreviations of author names the International Plant Name Index (IPNI) and The Plant List websites were applied. The identification of species was based on their original descriptions and by reviewing their typus (either by manual observations or analysis of digital images), but field recognition of the species was also conclusive. The list of synonyms

followed Baptista, Docha Neto & Campacci (2005-2013), Chiron (2010), Govaerts (1999, 2003, 2011), Königer (2004, 2005) and Manilal & Kumar (2004). The distribution maps were produced through the Diva-GIS software.

As previously mentioned, most of the Brazilian species traditionally known as *Oncidium* were incorporated into *Gomesa*. It is important to note that after the publication of molecular-based phylogenies, some of these species were included in separate genera, unrelated to either *Gomesa* or *Oncidium*, such as *Grandiphyllum* Docha Neto and *Trichocentrum* Poepp. & Endl., which were not contemplated in our work. A literature review was performed over all the names once used for the species inside the clade, namely: *Alatiglossum* D.H.Baptista, *Ampliglossum* Campacci, *Anettea* Szlach. & Mytnik, *Baptistonia* Barb.Rodr., *Binotia* Rolfe, *Brasilidium* Campacci, *Campaccia* Baptista, P.A.Harding & V.P.Castro, *Carenidium* D.H.Baptista, *Carria* V.P.Castro & K.G.Lacerda, *Carriella* V.P.Castro & K.G.Lacerda, *Castroa* Guiard, *Concocidium* Romowicz & Szlach., *Coppensia* Dumort., *Gomesa* R.Br, *Hardingia* Docha Neto & Baptista, *Hellerorchis* A.D.Hawkes, *Kleberiella* V.P.Castro & Catharino, *Maturna* Raf., *Menezesiella* Chiron & V.P.Castro, *Neoruschia* Catharino & V.P.Castro, *Nitidocidium* F.Barros & V.T.Rodrigues, *Ornithophora* Barb.Rodr., *Rhinocidium* D.H.Baptista, *Rhinocerotidium* Szlach., *Rodrigueziella* Kuntze, *Rodrigueziopsis* Schltr., *Theodorea* Barb. Rodr. and *Waluewa* Regel. The following herbaria were examined: AMES, BM, BR, FUEL, G, HAS, HUCS, HUEFS, HURG, HVAT, ICN, K, La Salle, L, LE, L-K, MBM, MPUC, PACA, PEL, R, RB, RSPF, S, SP, UEC and W. Most of the measures followed the pattern length x width, excepting the pseudobulbs' measures, which represent height x width, and inflorescences' measures, which inform their length.

RESULTS AND DISCUSSION

Gomesa is particularly rich in number of species in Rio Grande do Sul, mainly in moist environments on the Serra Geral, but quite representative in quantity in the Litoral and Depressão Central. Its specific richness decreases towards the west of the State. According to Rambo (1950) and Waechter (1998), the great majority would have entered through the "Torres gate", migrating southward along the Planície Costeira or the Planalto region, or through both. This fact would explain the greater presence of *Gomesa* species in the Campos de Cima da Serra, Encosta Superior do Nordeste, Encosta Inferior do Nordeste, Depressão Central and Litoral in relation to the other physiographic regions (figure 1). The genus as a

whole is well represented in several protected environments, such as reserves and conservation units.

As seen in figure 1, the most representative regions in number of species are the Encosta Inferior do Nordeste (14 species), Campos de Cima da Serra (12), Depressão Central (10), Litoral (10), Encosta Superior do Nordeste (8) and Planalto Médio (7). On the other hand, Missões and Campanha are poor in number of species, with only 1 being present in the Missões (*Gomesa riograndensis*) and none in the Campanha. The rest of the physiographic regions present a specific richness equivalent to 4, they are the Encosta do Sudeste, Serra do Sudeste and Alto Uruguai. In relation to the species, *Gomesa flexuosa* and *G. bifolia* are the most widely distributed, in 7 physiographic regions each. *G. paranensoides*, *G. uniflora* and *G. crispa* have register for 6 different regions. In Rio Grande do Sul, 5 species are restricted to only one region, named *G. imperatoris-maximiliani* and *G. venusta* for Litoral and *G. barbaceniae*, *G. gomezoides* and *G. pectoralis* for the Campos de Cima da Serra. In turn, *G. pectoralis* is only recorded for the CPCN Pró-Mata, in São Francisco de Paula. The remaining species were found between 2 to 5 different regions, named *G. concolor* (5), *G. barbata* (4), *G. longicornu* (4), *G. radicans* (4), *G. ranifera* (4), *G. recurva* (4), *G. riograndensis* (4), *G. cornigera* (3), *G. hookeri* (3) and *G. hydrophila* (2).

***Gomesa* R.Br.**, Bot. Mag. t. 1748. 1815. Type species: *Gomesa recurva* R.Br.

Synonyms – *Alatiglossum* D.H.Baptista; *Ampliglossum* Campacci; *Anettea* Szlach. & Mytnik; *Baptistonia* Barb.Rodr.; *Binotia* Rolfe; *Brasilidium* Campacci; *Campaccia* Baptista, P.A.Harding & V.P.Castro; *Carenidium* D.H.Baptista; *Carria* V.P.Castro & K.G.Lacerda; *Carriella* V.P.Castro & K.G.Lacerda; *Castroa* Guiard; *Concocidium* Romowicz & Szlach.; *Coppensia* Dumort.; *Gomesa* R.Br; *Hardingia* Docha Neto & Baptista; *Hellerorchis* A.D.Hawkes; *Kleberiella* V.P.Castro & Catharino; *Maturna* Raf.; *Menezesiella* Chiron & V.P.Castro; *Neoruschia* Catharino & V.P.Castro; *Nitidocidium* F.Barros & V.T.Rodrigues; *Ornithophora* Barb.Rodr.; *Rhinocidium* D.H.Baptista; *Rhinocerotidium* Szlach.; *Rodrigueziella* Kuntze; *Rodrigueziopsis* Schltr.; *Theodorea* Barb. Rodr.; *Waluewa* Regel.

Etymology – Named after Bernardino Antônio Gomes, physician and author of "Botanico-Medical Observations on the Plants of Brazil".

Description – Epiphytic, terrestrial or rupicolous herbs; sympodial; generally caespitose, with pseudobulbs showing a short to elongated rhizome (in other words, clustered or spaced pseudobulbs). Pseudobulbs oval to terete; ancipitous (2-edged), tetragonal (4-edged) or weakly compressed; smooth to sulcate surface; 1-3 terminal leaves; single internode. Leaves elliptic to linear; chartaceous to nearly coriaceous; glabrous; bifacial; conduplicate; articulate; deciduous; sessile; entire margin. Inflorescences racemes or panicles; 1-multi-flowered; congest or lax; one or two inflorescences per pseudobulb, produced laterally from the base of the pseudobulb; suberect or erect, flaccid or rigid; exceeding or not the length of leaves; subtended by a chartaceous to membranous sheath; bracteoles shorter than pedicels. Flowers pedicellate; resupinate or not. Dorsal sepal free, lateral sepals free or connate, all sepals with plane to undulated margin; yellow, brown or white (often with brown, red, orange or purple markings). Petals free; similar or not in size and shape to dorsal sepal; plane to undulated margin; yellow, brown or white (often with brown, red, orange or purple markings). Lip 3-lobed or undivided; lateral lobes (when present) showing diversified shapes; apical lobe generally expanded; unicolor or bicolor; yellow, brown and/or white. Callus tubercular, horned, keeled, lobed or longitudinal (sometimes inconspicuous); entire to fimbriate isthmus; yellow/white and brown/orange (purple in few cases). Column anther terminal operculate with acute to truncate rostellum; stigmatic cavity rounded and concave; presence or absence of lateral wings; presence or absence of tabula infrastigmatica; pollinarium with two pollinia attached to the head of a stipe. Fruit septicidal capsules.

Distribution and notes – *Gomesa* is represented by twenty species in Rio Grande do Sul. Its distribution is especially over the Atlantic Rainforest, of which only 7.48% of the original territory remains in the State (Fundação SOS Mata Atlântica e Instituto Nacional de Pesquisas Espaciais, 2011). The callosity over the lip proved to be of great value for taxonomic purposes, enabling the separation of even closely related species. The identification key was based primarily over vegetative structures. When not possible, floral features (mainly the callus) were employed.

KEY TO SPECIES

1 – Terrestrial or rupicolous plants; buried pseudobulbs 2

1’ – Epiphytic plants (rare rupicolous); if rupicolous, pseudobulbs never buried 3

2 – Plants from wetlands or swampy grasslands; lowlands dwellers; callus with several tubercles ..... (10) *G. hydrophila*

2’ – Plants in drier plains among grasses or partially exposed on rocky outcrops; high altitude dwellers; callus 5-keeled ..... (1) *G. barbaceniae*

3 – Tetragonal pseudobulbs; reniform lip lateral lobes, generally bigger than the apical lobe, sometimes equally sized ..... (2) *G. barbata*

3’ – Pseudobulbs assuming several shapes, but never tetragonal; lip lateral lobes absent or smaller than apical lobe, if equally sized, never reniform-shaped 4

4 – Oval pseudobulbs with acuminate apex and linear (“graminoid”) leaves; lip callus formed by one proximal and two distal lobes; basal and frontal portion of the column vivid purple ..... (15) *G. radicans*

4’ – Pseudobulbs assuming several shapes, never with acuminate apex, bearing elliptic, oblong or oblanceolate leaves; lip callus tubercular, keeled, smooth or longitudinal; basal portion of the column stained by different colors, ranging from white/yellow to orange/brown 5

5 – Fusiform to terete (“cigar-like”) pseudobulbs, generally not compressed and with smooth surface 6

5’ – Oval to conical/oblong pseudobulbs, compressed, ancipitous (2-edged), generally striate to sulcate surface (rare smooth) 8

6 – Broad callus region followed by a constriction and subsequent expansion of the apical lobe; callus tubercular, tubercles forming a V-shaped structure; rostellum acute (beak-like) ..... (20) *G. venusta*

6’ – Narrow callus region with parallel edges; callus tubercular, tubercles forming horn-like projections or inverted “V” shapes; truncate rostellum 7

7 – Rigid inflorescences; callus with tubercles at the central region forming an inverted “V” shape; straight lip lateral lobes ..... (18) *G. riograndensis*

7’ – Flaccid inflorescences; callus with tubercles assuming the shape of horns; lip lateral lobes curved and pointing upwards ..... (5) *G. cornigera*

8 – Single horned callus ..... (12) *G. longicornu*

8’ – Tubercular, smooth or longitudinal callus 9

9 – Undivided (1-lobed) lip; callus longitudinal and 2-keeled (sometimes the keels are inconspicuous) 10

9’ – 3-lobed lip; tubercular (sometimes also keeled) or smooth callus 13

10 – Lip much longer than sepals and petals; presence of well-developed column wings and tabula infrastigmatica ..... (4) *G. concolor*

10’ – Lip of lesser or equal length in relation to sepals and petals; absence of column wings and tabula infrastigmatica 11

11 – Rigid racemes; not resupinate flowers; lip assuming different coloration of sepals and petals; stigmatic cavity not surrounded by a reddish marking ..... (8) *G. gomezoides*

11’ – Flaccid racemes; resupinate flowers; lip, sepals and petals with same coloration patterns; stigmatic cavity surrounded by a reddish marking 12

12 – Crispy flowers; free lateral sepals ..... (6) *G. crispa*

12’ – Plain flowers; lateral sepals connate for at least half their extension ..... (17) *G. recurva*

13 – Oblong leaves; lateral sepals longer or equally sized in relation to the lip’s length; fimbriate to denticulate lip isthmus ..... (19) *G. uniflora*

13’ – Elliptic to oblanceolate leaves; lateral sepals’s length shorter than lip’s length; entire lip isthmus 14

14 – Not resupinate flowers; smooth callus region; lip apical lobe folded downwards ..... (13) *G. paranensoides*

14’ – Resupinate flowers; tubercular callus, sometimes with keels; lip apical lobe straight 15

15 – Tubercles assuming a particular shape, resembling a “crouching frog” 16

15’ – Tubercles with varied arrangements, but never resembling a “crouching frog” 17

16 – Congest inflorescences; lateral sepals connate for at least half of their extension ..... (9) *G. hookeri*

16’ – Lax inflorescences; lateral sepals connate only close to their base ..... (16) *G. ranifera*

17 – Perianth parts mainly stained by yellow shades or equal proportions of yellow and brown; generally multi-flowered panicles (more than 20 flowers) 18

17’ – Perianth parts mainly stained by brown shades (sometimes excepting the lip); generally few-flowered racemes or panicles (less than 20 flowers) 20

18 – Pseudobulbs markedly sulcate, often showing black dots ..... (3) *G. bifolia*

18’ – Pseudobulbs with smooth to little striate surface, never showing black dots 19

19 – Oval pseudobulbs; elongated rhizome (spaced pseudobulbs); lip apical lobe more than three times the size of the sepals and petals ..... (7) *G. flexuosa*

19’ – Oblong pseudobulbs (may be oval when young); short rhizome (clustered pseudobulbs); lip apical lobe no more than twice the size of sepals and petals ..... (20) *G. venusta*

20 – Lip callus with one central keel surrounded by tubercles; lateral sepals connate for not more than half of their lengths ..... (11) *G. imperatoris-maximiliani*

20’ – Lip callus with one central (smaller) and two lateral keels surrounded by tubercles; lateral sepals connate for almost all their extension ..... (14) *G. pectoralis*

1. *Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 395. 2009.

Type – Holotype: BRAZIL. Minas Gerais, Barbacenia, s.d., *ic. Weddell 32* (K no. 501738!).

Synonyms – *Ampliglossum barbaceniae* (Lindl.) Campacci; *Ampliglossum montanum* (Barb.Rodr.) Campacci; *Coppensia barbaceniae* (Lindl.) Campacci; *Coppensia montana* (Barb.Rodr.) Campacci; *Gomesa montana* (Barb.Rodr.) M.W.Chase & N.H.Williams; *Oncidium barbaceniae* Lindl.; *Oncidium montanum* Barb.Rodr.; *Oncidium uliginosum* Barb.Rodr..

Etymology – From the place of origin of the typus, the city of Barbacena, Minas Gerais, Brazil.

Description – Figure 2. Terrestrial herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 1.8-3.8cm x 1.2-2.5cm, oval, weakly compressed, smooth to striate surface, without black dots, 2-3 terminal leaves. Leaves 7.4-20.3cm x 0.5-1.6cm, oblong to linear, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 24-103cm, racemes or panicles, 3-multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 5-8mm x 5-6mm, free, elliptic, lateral sepals 9-11mm x 4-5mm, fused only at the base, elliptic and arched laterally, all sepals with cuneate base, acute to obtuse apex, plane to undulated margin, yellow and brown markings. Petals 7-9mm x 5-7mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, acute to obtuse apex, undulated margin, yellow and brown markings. Lip 16-19mm x 14-16mm, 3-lobed, lateral lobes asymmetric (distal portion longer than proximal portion), apical lobe expanded, truncate base, emarginate apex, unicolor, yellow. Callus 5-keeled, being the central one smaller than the two nearest ones and the two lateral ones connected to the median portion of the callus, unicolor, yellow, entire isthmus. Column 5-8mm x 4-6mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 4. In Rio Grande do Sul, restricted to the Campos de Cima da Serra, in the municipalities of São Francisco de Paula, Cambará do Sul and São José dos Ausentes.

Habitat – Cool environments at high altitudes, in drier plains among grasses or exposed on rocky outcrops. Pseudobulbs totally or partially buried.

Flowering period – From November to December.

Notes – Species of difficult perception when in its vegetative state due to the similarity of its leaves to grasses. Also, the pseudobulbs are buried for most of their extension. Easily identified between *Gomesa* species in the State by its terrestrial habit (except for *Gomesa hydrophila*, which occurs in wetlands at lower altitudes).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Cambará do Sul:** Cânion Fortaleza, 5 Dec 2015, *J. B. Castro 13* (ICN); estrada para São Francisco de Paula, Feb 1948, *B. Rambo s.n.* (PACA 36569). **São Francisco de Paula:** 1 Nov 1965, *A. Sehnem s.n.* (PACA

84969); Parque Municipal da Ronda, 29°27’03”S, 50°35’41”W, 10 Nov 2007, *J. Brustulin 66* (PACA). **São José dos Ausentes:** Dec 2001, *M. Sobral et al. 9419* (ICN).

Additional specimens examined – BRAZIL. SANTA CATARINA. **Bom Jardim da Serra:** 9 Dec 2015, *J. B. Castro 12* (ICN). **Campo Alegre:** Serra do Quiriri, 28 Dec 1999, *J. Cordeiro, J. M. Silva, E. Barbosa & O. S. Ribas 1702* (HUCS). **Lages:** 10 Jan 1951, *A. Sehnem s.n.* (PACA 82081); 4 Dec 2015, *J. B. Castro 9* (ICN); Morro Pinheiro Seco, 27°49’9.8”S, 50°17’1”W, 14 Dec 2015, *J. B. Castro 24* (ICN). **Painel:** 27°53’15”S, 50°9’40.8”W, 15 Dec 2015, *J. B. Castro 25* (ICN). SÃO PAULO. **Campos do Jordão:** Jan 1944, *E. Friderichs s.n.* (PACA 27853/1). **Itararé:** Campos de São Pedro, Fazenda Ventania (Horto Florestal), 20 Oct 1966, *J. Mattos 14062-a* (HAS).

2. *Gomesa barbata* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 395. 2009.

Type – Holotype: BRAZIL. s.d., *W. Swainson s.n.* (K no. 501739!).

Synonyms – *Alatiglossum barbatum* (Lindl.) Baptista; *Alatiglossum ciliatum* (Lindl.) Baptista; *Alatiglossum psyche* (Schltr.) Baptista; *Alatiglossum trichodes* (Lindl.) Baptista; *Gomesa ciliata* (Lindl.) M.W.Chase & N.H.Williams; *Gomesa psyche* (Schltr.) M.W.Chase & N.H.Williams; *Gomesa trichodes* (Lindl.) M.W.Chase & N.H.Williams; *Oncidium bahiense* (Cogn.) Schltr.; *Oncidium barbatum* Lindl.; *Oncidium barbatum* Lindl. & Paxton [Illegitimate]; *Oncidium barbatum* subsp. *limbatum* (Lindl.) W.Zimm.; *Oncidium barbatum* subsp. *microglossum* (Klotzsch) W.Zimm.; *Oncidium barbatum* var. *ciliatum* (Lindl.) Lindl.; *Oncidium barbatum* var. *johnianum* (Schltr.) Kraenzl.; *Oncidium barbatum* var. *labiosum* W.Zimm.; *Oncidium barbatum* var. *limbatum* Lindl.; *Oncidium blossfeldianum* Schltr.; *Oncidium ciliatulum* Hoffmanns.; *Oncidium ciliatum* Lindl.; *Oncidium ciliolatum* Hoffmanns.; *Oncidium fimbriatum* Hoffmanns. [Illegitimate]; *Oncidium johnianum* Schltr.; *Oncidium microglossum* Klotzsch; *Oncidium micropogon* var. *bahiense* Cogn.; *Oncidium psyche* Schltr.; *Oncidium reisii* Hoehne & Schltr.; *Oncidium subciliatum* Hoffmanns.; *Oncidium suscephalum* Barb.Rodr.; *Oncidium trichodes* Lindl..

Etymology – In allusion to the fimbriate, “beard-like” isthmus of the lip.

Description – Figure 3. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 1.9-7.6cm x 1.5-3.7mm, oval, tetragonal (4-edged), smooth surface, without black dots, 1-2 terminal leaves. Leaves 5.4-15.1cm x 1.3-3.6cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, obtuse apex, entire margin. Inflorescences 7-138cm, racemes or panicles, 3-multi-flowered (usually few flowers), one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 13-19mm x 4-8mm, free, obovate to spatulate, lateral sepals 14-24mm x 4-6mm, fused for 1/3 of their extension, spatulate, all sepals with cuneate base, acute to obtuse apex, flat to undulated margin, yellow and brown markings. Petals 15-19mm x 5-14mm, free, obovate to spatulate, similar in size and shape to dorsal sepal or markedly broader, cuneate to attenuate base, acute/obtuse to emarginate apex, flat to undulated margin, yellow and brown markings or all-yellow with few purple markings. Lip 12-17mm x 16-29mm, 3-lobed, lateral lobes reniform, apical lobe expanded (sometimes reduced and smaller than lateral lobes), truncate to attenuate base, obcordate/emarginate to cuspidate apex, unicolor (except for callus region), yellow. Callus tubercular, basal portion flat and forming a perpendicular plate in relation to the column, tubercles aggregated at the central region, yellow/white and orange/brown background (there is an all-yellow variation), fimbriate to denticulate isthmus. Column 4-8mm x 3-5mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 5. Common in the Litoral, Encosta Inferior do Nordeste, Encosta do Sudeste and Depressão Central.

Habitat – Plants adapted both to cool and moist and to warm and dry environments, but that need bright light and air circulation. Dwell from open areas in montane forests to swamps both in coastal or inland regions.

Flowering period – From December to February.

Notes – Easily recognizable even in vegetative state, due to their tetragonal pseudobulbs. Their flowers, along with *Gomesa uniflora*, are the only to present lip with fimbriate to denticulate isthmus. The species present highly variable flowers, mainly when it comes to the petals and lip, assuming both broader and narrower shapes. There is a variation in which the petals and sepals assume unequal sizes, the petals being much broader than sepals. The perianth pieces also demonstrate variation in their coloration, ranging from brown with yellow markings to predominantly vivid yellow (figure 3, E).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Alvorada:** 28 Dec 2015, *J. B. Castro 3* (ICN), *J.B. Castro 14* (ICN); 27 Nov 2015, *J. B. Castro 15* (ICN); 30 Nov 2016, *J. B. Castro 62* (ICN). **Arambaré:** 05 Oct 1995, *M. Neves 1905* (HAS). **Arroio do Sal:** Rondinha, Parque Tupancy, 7 Jan 2011, *M. S. Marchioretto, J. L. Schmitt. D. Becker & S. Cunha s.n.* (PACA 109233), *M. S. Marchioretto, J. L. Schmitt. D. Becker & S. Cunha s.n.* (PACA 109234); Rondinha Velha, 17 Mar 1990, *M. G. Rossoni s.n.* (ICN 98834). **Camaquã:** Ilha de Santo Antônio, 25 Dec 1999, *G. De Marchi s.n.* (PACA 93587). **Capão da Canoa:** 1 Feb 1927, *J. Dutra 928* (ICN), *J. Dutra 929* (ICN). **Capão do Leão:** Horto Botânico Ir. Teodoro Luiz, 23 Nov 1986, *J. A. Jarenkow 525* (PACA). **Dom Pedro de Alcântara:** Morrinho de Porto Fagundes, 17 Jan 2009, *P. J. S. Silva Filho et al. 52* (MPUC). **Eldorado do Sul:** Estação Experimental Agronômica da UFRGS, 18 Dec 2001, *J. L. Waechter & C. Giongo 216* (ICN). **Gravataí:** Barro Vermelho, Dec 1929, *J. Dutra 1123* (ICN); Fazenda Estância de São Pedro, 12 Jan 2017, *J. B. Castro 49* (ICN). **Guaíba:** Passo do Petim, Fazenda São Maximiano, Cerro do Poeta, 23 Nov 1994, *V. F. Nunes 1424* (ICN). **Lombas:** 16 May 2015, *J. B. Castro 5* (ICN). **Osório:** Emboaba, 25 Nov 1983, *J. L. Waechter 1995* (ICN); Fazenda do Arroio, 23 Jan 1958, *B. Rambo s.n.* (PACA 63568); Morro Grande, 10 Feb 1952, *B. Rambo s.n.* (PACA 51792). **Palmares do Sul:** Fazenda Marcelina, 30°22'22.7"S, 50°20'68.2"W, 23 Sep 2014, *M. L. Paz, V. Graeff, M. F. Parode, V. R. S. P. Silva 20* (PACA). **Porto Alegre:** Belém Novo, Nov 1929, *J. Dutra 1115* (ICN); Glória, 20 Jan 1932, *C. Orth s.n.* (PACA 563), 12 Dec 1945, *B. Rambo s.n.* (PACA 32800); Ilha da Casa da Pólvora, 30 Apr 1977, *Longhi, Bins & Born s.n.* (ICN 82023). **Rio Grande:** E. E. Taim, 5 Dec 1978, *J. L. Waechter 1073* (ICN). **São Leopoldo:** 25 Jan 1929, *C. Orth s.n.* (PACA 625). **São Lourenço do Sul:** Fazenda Crisanto Soares, 11 Dec 1965, *A. Sehnem s.n.* (PACA 84971). **Sapucaia do Sul:** estrada para São Leopoldo, 24 Nov 1948, *B. Rambo s.n.* (PACA 38363). **Taquara:** 12 Sep 1926, *J. Dutra 958* (ICN). **Taquari:** 10 Dec 1957, *O. Camargo 3042* (PACA). **Torres:** Dec 1928, *J. Dutra 1100* (ICN); Jan 1951, *Ir. Bento s.n.* (ICN 19440); Faxinal, 3 Dec 1976, *J. L. Waechter 398* (ICN), *J. L. Waechter 399* (ICN); 21 Dec 1977, *J. L. Waechter 689* (ICN), *J. L. Waechter 690* (ICN); Itapeva, 29°22'40.4"S, 49°49'39.6"W, 26 Jan 2010, *P. P. A. Ferreira & G. A. Dettke 347* (ICN); Próximo à Lagoa do Jacaré, 25 Jan 1985, *N. Silveira 4064* (HAS), 08 Jan 1990, *N. Silveira 9080* (HAS). **Tramandaí:** Lagoa da Fortaleza, 8 Dec 1981, *P. Brack & M. Sobral 801* (ICN), *P. Brack & M. Sobral s.n.* (ICN 51186). **Viamão:** Fazenda Santa Fé, APA do Banhado Grande, 19 Nov 1997, *T. B. Breier 122* (ICN), 16 Dec 1998, *T. B. Breier 154* (ICN); Itapuã, Feb 1954, *Ir. Bento s.n.* (ICN 19444), Dec 2015, *J. B. Castro 73* (ICN), *J. B. Castro 74* (ICN).

***Additional specimens examined* –** BRAZIL. SANTA CATARINA. **Passo de Torres:** 21 Jan 1976, *K. Hagelund 879* (HAS).

3. *Gomesa bifolia* (Sims) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009.

***Type* –** Lectotype: Sims's illustration in Bot. Mag. 36: t. 1491. 1812.

Synonyms – *Ampliglossum bifolium* (Sims) Campacci; *Coppensia bifolia* (Sims) Dumort.; *Gomesa chrysothyrsus* (Rchb.f. ex R.Warner) M.W.Chase & N.H.Williams; *Oncidium batemanianum* Griseb [Illegitimate]; *Oncidium beyrodtianum* Schltr.; *Oncidium bifolium* Sims; *Oncidium bifolium* var. *majus* B.S.Williams; *Oncidium celsianum* A.Rich.; *Oncidium chrysothyrsus* Rchb.f. ex R.Warner; *Oncidium maculosum* Lindl..

Etymology – Reference to the two leaves present in the pseudobulbs.

Description – Figure 6. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.6-9cm x 1.8-2.4cm, oval to conical/oblong, ancipitous (2-edged), striate to sulcate surface, sometimes bearing black dots, 2-3 terminal leaves. Leaves 11.8-27.4cm x 1.9-3.3cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 36-91cm, racemes or panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 6.8-10.2mm x 4.3-5.3mm, free, elliptic, lateral sepals 7.8-11.3mm x 3-4.7mm, fused until half their extension, elliptic, all sepals with cuneate base, obtuse to rounded apex, flat to undulated margin, yellow and brown markings. Petals free, elliptic, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat to undulated margin, yellow and brown markings. Lip 22-26mm x 21-30mm, 3-lobed, lateral lobes rounded, apical lobe expanded, emarginate base, emarginate apex, unicolor, yellow. Callus tubercular, tubercles aggregated at the central region, yellow/white and orange/brown background, entire isthmus. Column 5-8mm x 5-6mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 8. Common in the Depressão Central, Encosta Inferior do Nordeste and Encosta Superior do Nordeste. Eventual in the Litoral, Planalto Médio, Encosta do Sudeste and Campos de Cima da Serra (where is rare).

Habitat – Hot lowlands to cooler montane forests, dwelling mainly in forest and stream borders, generally high up in the threes, close to the canopy.

Flowering period – From November to February.

Notes – In the vegetative state resembles *Gomesa longicornu*, bearing, however, leaves with a more tender consistency. Besides, *G. longicornu* dwells mainly near shady streams. Also, this species resembles *G. flexuosa* when it comes to floral features in a first moment, but their pseudobulbs are easily distinguishable, being more oval and with a smooth to little striate surface in *G. flexuosa* and close to conical/oblong, markedly sulcate and sometimes bearing black dots in *G. bifolia*. The apical lobe of the lip in *G. bifolia* assumes a great prominence over the other perianth pieces, the greater proportion among the species of *Gomesa* in Rio Grande do Sul.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Alvorada:** 28 Dec 2015, *J. B. Castro 6* (ICN). **Barra do Ribeiro:** Ponta da Formiga, 23 Feb 1986, *K. Potter 229* (PACA). **Bom Jesus:** Fazenda Caraúna, Nov 1927, *J. Dutra 1006* (ICN). **Brochier:** estrada para Catupi, 29°34’52.95”S, 51°40’34.7”W, 19 Jan 2016, *J. B. Castro 37* (ICN), *J. B. Castro 41* (ICN). **Camaquã:** Pacheca, 18 Dec 1990, *J. L. Waechter 2466* (ICN). **Casca Evangelista:** margem do arroio Barra Funda, 14 Dec 2010, *M. C. Marchezi s.n.* (RSPF 12326), *M. C. Marchezi s.n.* (RSPF 12343). **Farroupilha:** Parque dos Pinheiros, 29°14’30”S, 51°26’20”W, 24 Jan 2007, *J. Brustulin 5* (PACA). **Gravataí:** Fazenda Estância de São Pedro, 12 Jan 2017, *J. B. Castro 50* (ICN). **Guaíba:** Fazenda São Maximiano, 2 Apr 1977, *J. L. Waechter 497* (ICN), 26 Jan 2007, *E. M. Freitas 202* (ICN), 28 Mar 1999, *N. I. Matzenbacher s.n.* (MPUC 10203), 13 Jan 1994, *V. F. Nunes 1387* (ICN). **Itati:** 29°29’38.05”S, 50°6’5.75”W, 27 Feb 2016, *J. B. Castro 45* (ICN). **Jaquirana:** Faxinal dos Pelúcios, RS-110, 20 Dec 2001, *A. Knob & S. Bordignon 6999* (UniLaSalle). **Mato Castelhano:** Floresta Nacional de Passo Fundo, 29 Dec 2005, *C. R. Buzatto s.n.* (RSPF 10503); **Muitos Capões:** [Esmeralda] Estação Ecológica de Aracuri, Jan 1982, *K. Kleebank 5* (ICN), 11 Oct 1982, *J. L. Waechter 1943* (ICN). **Nova Petrópolis:** Linha Imperial, 29°21’31.29”S, 51°3’7.26”W, 18 Dec 2015, *J. B. Castro 26* (ICN). **Passo Fundo:** 28°15’S, 52°24’W, 22 Nov 2002, *R. V. Kilca s.n.* (ICN 127142); Barragem Fazenda, *R. V. Kilca s.n.* (RSPF 9570), 20 Dec 2002, *R. V. Kilca s.n.* (RSPF 9571), 14 Apr 2005, *R. V. Kilca s.n.* (RSPF 9568); Bosque Lucas Araújo, 10 Jan 1995, *M. Antonio s.n.* (RSPF 5484). **Paverama:** 04 Jan 1989, *M. Rossato et al. s.n.* (HUCS 5103). **Porto Alegre:** Glória, 15 Jan 1932, *C. Orth s.n.* (PACA 590), 3 Feb 1950, *A. Sehn s.n.*

(PACA 84974); Morro Santana, 19 Mar 1977, *J. L. Waechter 465* (ICN). **Santa Maria do Herval:** estrada para Gramado, 29°27'44.01"S, 50°57'18,15"W, 18 Dec 2015, *J. B. Castro 27* (ICN). **Santa Rita:** estrada para Farroupilha, 18 May 1957, *Camargo 1494* (PACA). **Santa Vitória do Palmar:** Pontal Santiago, 7 Dec 1996, *J. A. Jarenkow 3313* (PEL). **São Francisco de Paula:** Lajeado Grande, 15 Dec 2008, *C. R. Buzatto 458* (ICN). **São José dos Ausentes:** [Vacaria] Fazenda da Ronda, 5 Jan 1947, *B. Rambo s.n.* (PACA 34837). **São Leopoldo:** Morro das Pedras, 1 Jan 1926, *J. Dutra 956* (ICN). **Taquara:** 29°45'52.8"S, 50°54'14.18"W, 12 Jan 2017, *J. B. Castro 46* (ICN), 29°44'48.97"S, 50°50'59.08"W, 12 Jan 2017, *J. B. Castro 47* (ICN), 29°45'25.21"S, 50°51'59.72"W, 12 Jan 2017, *J. B. Castro 48* (ICN), 29°45'41.3"S, 50°51'58.94"W, 12 Jan 2017, *J. B. Castro 51* (ICN); Distrito Santa Cruz, 5 Jan 2016, *J. B. Castro 29* (ICN). **Taquari:** Morro Pelado, 19 Jan 2016, *J. B. Castro 36* (ICN). **Torres:** Lageadinho, 19 Dec 1980, *J. L. Waechter 1815* (ICN). **Viamão:** Bairro Tarumã, próximo ao Lago Tarumã, 30°4'8.37"S, 51°1'16.97"W, 2011, *P. J. S. Silva Filho 1113* (ICN); Fazenda Santa Fé, APA do Banhado Grande, 4 Feb 1999, *T. B. Breier 168* (ICN).

4. *Gomesa concolor* (Hook.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009.

***Type* –** Holotype: BRAZIL. Organ Mountains, 1837, *Gardner s.n.* (K no. 586532!), on sheet with K no. 586527-31.

Synonyms – *Brasilidium concolor* (Hook.) F.Barros & V.T.Rodrigues; *Brasilidium ottonis* (Schltr.) Docha Neto & Varella; *Carenidium concolor* (Hook.) Baptista; *Carenidium ottonis* (Schltr.) Docha Neto & Varella; *Concocidium concolor* (Hook.) Romowicz & Szlach.; *Concocidium ottonis* (Schltr.) Romowicz & Szlach.; *Cyrtochilum citrinum* Hook.; *Oncidium concolor* Hook.; *Oncidium concolor* var. *ottonis* (Schltr.) Pabst; *Oncidium normanii* Hort. ex Pritz.; *Oncidium ottonis* Schltr.; *Oncidium unguiculatum* Klotzsch [Illegitimate].

Etymology – Reference to the flowers mostly in only one color.

Description – Figure 7. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 2.9-4.4cm x 1.5-3.3cm, oval, ancipitous (2-edged), smooth to striate surface, without black dots, 2-3 terminal leaves. Leaves 9.3-17.5cm x 1.4-3cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 18-43cm, racemes or panicles, 2-multi-flowered (usually few flowers), one

inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 21-26mm x 8-12mm, free, elliptic, lateral sepals 24-30mm x 7-10mm, fused until half their extension, elliptic, all sepals with cuneate base, obtuse to rounded apex, flat to undulated margin, unicolor, yellow (in some cases with brown markings). Petals 19-25mm x 7-11mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat to undulated margin, unicolor, yellow (in some cases with brown markings). Lip 27-42mm x 30-39mm, 1-lobed, cuneate base, emarginate apex, unicolor, yellow. Callus longitudinal, 2-keeled, unicolor, yellow, entire isthmus. Column 8-13mm x 5-7mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 9. Common in the Campos de Cima da Serra, Encosta Superior do Nordeste, Encosta Inferior do Nordeste and Planalto Médio. Rare in the Serra do Sudeste.

Habitat – Areas submitted to short frosts, dwelling in montane forests, preferentially open canopy, with moderately bright light and air movement.

Flowering period – From October to December.

Notes – Impossible to differentiate from *Gomesa pectoralis* in vegetative state, but shows a much larger area of occurrence and totally distinct flowers. Distinguishable by their larger and mostly one-colored flowers, yellow (that sometimes may show few brown markings). In comparison with other "oncidioid species", the diagnostic features are the callus formed solely by two longitudinal keels and the undivided (1-lobed) lip. The flowers present some variations, one of them with plain perianth parts and petals somewhat distant from the column, while the other shows crispy perianth and petals closely attached to the column. Some flowers may also display purple column wings.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Arvorezinha:** 4 Oct 2003, *E. M. Freitas s.n.* (HVAT 1213). **Cambará do Sul:** Cânion Fortaleza, 8 Nov 1986, *R. Wasum et al. s.n.* (HUCS 2285); acima da Praia Grande, 23 Oct 1986, *K. Hagelund 16030* (HAS, ICN); próximo ao Parque Nacional de Aparados da Serra, 17 Nov 1986, *M. L. Abruzzi 1152* (HAS). **Canela:** 7 Oct 1980, *J. L. Waechter 1769* (ICN). **Canguçu:** estrada para Piratini, 11 Oct 1972, *J. C. Lindeman, B. E. Irgang & J. F. M. Valls s.n.* (ICN 20706). **Caraá:** nascente do rio dos Sinos, 29°42'25"S, 50°17'27.8"W, 15 Dec 2012, *L. D. Rocha, D. F. P.*

Becker & F. Junges 246 (PACA), 14 Jun 2013, *L. D. Rocha, D. F. P. Becker & F. Junges s.n.* (PACA 115539). **Caxias do Sul:** Campus da UCS, 29 Oct 1987, *M. Rossato et al. s.n.* (HUCS 3401), 18 Sep 1991, *A. Jasper s.n.* (HUCS 9587); Jardim Botânico, próximo à Barragem São Paulo, 15 May 2008, *S. Maboni 57* (HUCS), 9 May 2009, *S. Maboni 70* (HUCS), *S. Maboni 71* (HUCS), 5 Oct 2009, *S. Maboni 75* (HUCS), 11 Oct 2009, *S. Maboni 80* (HUCS); Mato Sanvitto, 10 Oct 2009, *S. Magrini 39* (HUCS), 11 Oct 2009, *T. M. Ferreira 57* (HUCS), 14 Oct 2009, *S. Magrini 53* (HUCS); Mulada, 13 Oct 2016, *J. B. Castro 69* (ICN), 24 Oct 2016, *J. B. Castro 64* (ICN); Santa Lúcia do Piaí, 29 Oct 1989, *R. Wasum et al. s.n.* (HUCS 8023), 08 Sep 2006, *F. Daneluz 15* (HUCS). **Cerro Grande do Sul:** Morro da Antena, 5 Oct 1996, *J. A. Jarenkow 3199* (PEL). **Farroupilha:** Parque dos Pinheiros, 29°14'30"S, 51°26'20"W, 16 Jul 2007, *J. Brustulin 33* (PACA); São José, 21 Oct 1984, *R. Wasum et al. s.n.* (HUCS 492). **Flores da Cunha:** Otávio Rocha, 5 Oct 1986, *R. Wasum s.n.* (HUCS 2071). **Ilópolis:** 2 Oct 1999, *A. Jasper s.n.* (HVAT 286). **Mato Castelhano:** Floresta Nacional de Passo Fundo, 29 Dec 2005, *C. R. Buzatto 36* (RSPF). **Matos de Caxias:** Oct 1928, *Ir. Augusto s.n.* (ICN 20347). **Montenegro:** Kappesberg, 25 Sep 1945, *A. Bruxel s.n.* (PACA 29706); L. Campestre, 30 Sep 1946, *A. Sehnem s.n.* (PACA 84967); S. Salvador, 21 Oct 1949, *A. Sehnem s.n.* (PACA 84968). **Passo Fundo:** Bosque Lucas Araújo, Sep 1994, *M. Antonio s.n.* (RSPF 5156); **Riozinho:** Fazenda Forjasul, 12 Oct 2016, *J. B. Castro 70* (ICN). **São Francisco de Paula:** 13 Oct 1976, *J. L. Waechter 337* (ICN), 21 Oct 2001, *R. Wasum s.n.* (HVAT 2445); RS 235, 21 Oct 2001, *R. Wasum 1187* (HUCS); Banhado Amarelo, 24 Oct 1976, *C. R. Dillenburg 210* (ICN); Barragem Blang, 26 Sep 1958, *O. R. Camargo 110* (PACA); CPCN Pró-Mata, 19 Oct 1993, *C. Schlindwein 2143* (MPUC), 6 Nov 2016, *J. B. Castro 63* (ICN); Parque Municipal da Ronda, 29°27'03"S, 50°35'41"W, 29 Sep 2007, *J. Brustulin 32* (PACA); Querência da Amizade, 28 Oct 1998, *A. Knob & S. Bordignon 5707* (UniLaSalle). **São Leopoldo:** Morro das Pedras, Nov 1926, *J. Dutra 971* (ICN). **Sério:** 21 Sep 2000, *E. M. Freitas s.n.* (HVAT 390), 21 Oct 2000, *E. M. Freitas s.n.* (HVAT 442), 30 Sep 2002, *E. M. Freitas s.n.* (HVAT 1002).

***Additional specimens examined* –** BRAZIL. SANTA CATARINA. **Campo Belo do Sul:** Fazenda Gateados, 19 Oct 2007, *C. R. Buzatto 348* (ICN). **Timbé do Sul:** na subida da Serra da Rocinha, 12 Nov 1987, *G. Meyer 176* (HAS).

5. *Gomesa cornigera* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 396. 2009.

Type – Lectotype: BRAZIL. s.d., *s.coll. s.n.* (K no. 883239!), on sheet with K no. 883238. Syntype: BRAZIL. s.d., *Watts 55* (K no. 883238!), on sheet with K no. 883239; s.d., *s.coll. s.n.* (BM no. 534452!).

Synonyms – *Baptistonia cornigera* (Lindl.) Chiron & V.P.Castro; *Baptistonia fimbriata* (Lindl.) Chiron & V.P.Castro; *Gomesa chrysorhapis* (Rchb.f.) M.W.Chase & N.H.Williams; *Oncidium chrysorhapis* Rchb.f.; *Oncidium cornigerum* Lindl.; *Oncidium fimbriatum* Lindl.; *Oncidium godseffianum* Kraenzl.; *Oncidium hecatanthum* Kraenzl.; *Oncidium pyxidophorum* Rchb.f..

Etymology – In allusion to the "horns" found in the callus region.

Description – Figure 10. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.2-9.3cm x 1.1-2.2cm, fusiform to terete ("cigar-like"), weakly compressed, smooth surface, without black dots, 1-2 terminal leaves. Leaves 5.6-18.3cm x 2.1-4.4cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 15-53cm, racemes or panicles, multi-flowered, one inflorescence per pseudobulb, flaccid, exceeding the length of leaves, subtended by a membranous sheath. Flowers pedicellate, resupinate. Dorsal sepal 9-15mm x 7-9mm, free, obovate, lateral sepals 9-12mm x 4-7mm, fused for almost all their extension, obovate, all sepals with cuneate base, obtuse to rounded apex, flat margin, yellow and brown markings. Petals 8-15mm x 6-8mm, free, obovate, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat margin, yellow and brown markings. Lip 7-13mm x 6-9mm, 3-lobed, lateral lobes arm-like and pointing upwards, apical lobe expanded, truncate base, rounded apex, unicolor, yellow (there is a white variation). Callus tubercular, smooth surface, two median cuspidate tubercles connected at the base, two distal elliptic tubercles also connected at the base, yellow/white and brown background (variation with yellow/white and purple background), entire isthmus. Column 5-7mm x 5-6mm, anther with truncate rostellum, presence of lateral wings with hook-like or arm-like shape, presence of tabula infrastigmatica (reduced).

Distribution in Rio Grande do Sul – Figure 12. Common in the Depressão Central and Encosta Inferior do Nordeste. Rare in the Campos de Cima da Serra.

Habitat – Cool montane forests to warmer lowlands, dwelling at shady places, generally with close canopy.

Flowering period – From December to February.

Notes – *Gomesa cornigera* and *G. riograndensis* are easily identified by their fusiform to terete and generally not compressed pseudobulbs, with the appearance of a "cigar". However, these species may only be separated at vegetative state if remains of inflorescences are present, which are flaccid in *G. cornigera* and rigid in *G. riograndensis*. When flowered, they may be separated by the callus with prominent horns at the basal region and the lip's lateral lobes curved and pointing upwards in *G. cornigera* opposed to the callus with a central structure resembling an inverted "V" and the straight lateral lobes of the lip in *G. riograndensis*. The flowers of *G. cornigera* present a variation bearing white lips (figure 10, C).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Arroio do Meio:** 19 Jan 2003, *R. Krahl s.n.* (HVAT 1951); Morro Gaúcho, 02 Jan 2001, *J. Bruxel & E. Muskopf s.n.* (HVAT 553), 3 Dec 2003, *C. Gonçalves s.n.* (HVAT 1650). **Caraá:** Alto Vila Nova, 29°43'42.1"S, 50°22'00.8"W, 5 Mar 2011, *S. Cunha 24* (PACA). **Colinas:** nas margens do rio Taquari, 29°23'37"S, 51°52'39"W, 28 Nov 2012, *E. M. Freitas 951* (HVAT). **Estrela:** 4 Jan 1989, *M. Rossato et al.* (HUCS 5093). **Farroupilha:** Parque dos Pinheiros, 29°14'30"S, 51°26'20"W, 26 Mar 2007, *J. Brustulin 9* (PACA). **Forquetinha:** Morro Eckardt, 22 Dec 2000, *E. M. Freitas s.n.* (HVAT 545). **Guaíba:** Passo do Petim, Fazenda São Maximiano, Cerro do Poeta, 22 Dec 1993, *V. F. Nunes 1382* (ICN). **Itaara:** Centro Tabor, 8 Jan 2016, *J. B. Castro 30* (ICN), *J. B. Castro 31* (ICN), *J. B. Castro 32* (ICN). **Lajeado:** Bairro Carneiros, 11 Dec 1999, *E. M. Freitas s.n.* (HVAT 211); Bairro São Bento, 22 Dec 2001, *E. M. Freitas s.n.* (HVAT 858). **Maquiné:** 29°41'14.64"S, 50°14'6.76"W, 28 Feb 2016, *J. B. Castro 42* (ICN); Estação Experimental Fitotécnica, 29 Dec 1987, *N. Silveira 5575* (HAS). **Porto Alegre:** 5 Mar 1947, *K. Emrich s.n.* (PACA 36004); Glória, 15 Sep 1931, *C. Orth s.n.* (PACA 363), 12 Dec 1945, *B. Rambo s.n.* (PACA 32807); Morro Santana, 10 Dec 2015, *J. B. Castro 11* (ICN); Partenon, 15 Dec 1965, *L. Korner s.n.* (ICN 4319). **Pinhal da Serra:** balsa para Anita Garibaldi, 30 Aug 2000, *J. Spanholi s.n.* (HAS 39246). **Santa Maria:** 1956, *O. Camargo s.n.* (PACA 60497). **São Jerônimo:** Pólo Carboquímico, nas margens do rio Jacuí, 15 Dec 1982, *M. L. Abruzzi 752* (HAS, UEC). **São Leopoldo:** Quinta S. Manoel, Dec 1929, *J. Dutra 1145* (ICN). **São Pedro do Sul:** 11 Jan 1988, *J. C. Corrêa 47* (HAS). **Sapiranga:** [São

Leopoldo] Ferrabraz, 29 Dec 1930, *J. Dutra 1121* (ICN); Recanto da Cascata, Picada Verão, 20 Jan 1991, *V. F. Nunes et al. 1233* (PACA). **Sério:** 13 Dec 2001, *E. M. Freitas s.n.* (HVAT 870). **Taquara:** [Gravataí] Fazenda Fialho, 1 Jan 1926, *J. Dutra 955* (ICN); nas margens do rio dos Sinos, 29°40'46.8"S, 50°45'57"W, 23 Nov 2013, *L. D. Rocha, D. F. P Becker & F. Junges 159* (PACA). **Três Cachoeiras:** [Torres] Morro Azul, 19 Dec 1977, *J. L. Waechter 674* (ICN). **Vale do Sol:** [Santa Cruz do Sul] Trombudo, 13 Mar 1977, *J. L. Waechter 458* (ICN), 2 Jan 1980, *J. L. Waechter 1517* (ICN). **Viamão:** Itapuã, entre a Praia de Fora e a Praia do Tigre, 21 Dec 2004, *E. Musskopf 343* (ICN).

6. *Gomesa crispa* (Lindl.) Klotzsch ex Rchb.f. in Bot. Zeitung (Berlin) 10: 772. 1852.

Type – Holotype: BRAZIL. s.d., *s.coll. s.n.* (K no. 501741!).

Synonyms – *Gomesa undulata* Hoffmanns.; *Odontoglossum crispatulum* Rchb.f.; *Rodriguezia crispa* Lindl..

Etymology – Reference to their crispy flowers.

Description – Figure 11. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 4.1-9.6cm x 1.2-2.8cm, oval to conical/oblong, ancipitous (2-edged), smooth to striate surface, without black dots, 1-2 terminal leaves. Leaves 8.9-29.2cm x 1.2-3.4cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 14-30cm, racemes, multi-flowered, two inflorescences per pseudobulb (rarely only one), flaccid, not exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate, aromatic. Dorsal sepal 10-12mm x 2-4mm, free, obovate to spatulate, lateral sepals 10-12mm x 2-4mm, free, obovate to spatulate, all sepals with cuneate base, obtuse to rounded apex, undulated margin, pale green. Petals 9-12mm x 2-4mm, free, obovate to spatulate, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, undulated margin, pale green. Lip 8-10mm x 4-6mm, 1-lobed, cuneate base, rounded apex, unicolor, pale green. Callus longitudinal, two parallel smooth elevations, pale green with a yellowish marking at the center, entire isthmus. Column 5-7mm x 2-3mm, anther with acute rostellum, stigmatic cavity surrounded by a reddish marking with two triangular projections in its base, absence of lateral wings, absence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 13. Common in the Alto Uruguai, Encosta Inferior do Nordeste and Encosta Superior do Nordeste. Eventual in the Depressão Central, Campos de Cima da Serra and Litoral (where is rare).

Habitat – Areas submitted to short frosts, in montane forests, dwelling humid places generally close to streams and rivers.

Flowering period – From April to June.

Notes – Similar to *Gomesa recurva* in vegetative state. They may be differentiated by the crispy appearance of the flowers and the free lateral sepals in *G, crispa* against the plain flowers and lateral sepals connate for at least half of their extension in *G. recurva*. Also, their phenologies do not overlap in Rio Grande do Sul's territory. Both species can be distinguished from the others (except *G. gomezoides*) by their pendulous racemes and flowers with undivided lip, folded downwards, the longitudinal callus, almost inconspicuous, and the absence of tabula infrastigmatica. From *G. gomezoides*, they may be segregated by the larger pseudobulbs size and resupinate flowers, which are not resupinate in the latter species. Also, *G. gomezoides* dwells exclusively on nebular forests, with more humidity.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Barracão:** 21 Dec 2000, *J. Spanholi s.n.* (HAS 39440). **Caraá:** nascente do rio dos Sinos, 29°42'25"S, 50°17'27.8"W, 16 Dec 2012, *L. D. Rocha, D. F. P. Becker & F. Junges 274* (PACA). **Caxias do Sul:** 20 Jun 1987, *M. Rossato et al. s.n.* (HUCS 3044); Conceição, 28 Jun 1986, *R. Wasum et al. s.n.* (HUCS 1844a). **Cotiporã:** [Veranópolis] Cascata do Marins, 17 May 1980, *I. Matte & V. Haas s.n.* (PACA 66991), *L. Klauss & J. H. Pereira s.n.* (PACA 66992/1). **Dois Irmãos:** estrada para São Leopoldo, 25 Jun 1949, *B. Rambo s.n.* (PACA 42198). **Osório:** próximo à lagoa dos Barros, Jan 1950, *Ir. Bento s.n.* (ICN 19434). **Rio Pardo:** Fazenda Soledade, Jun 1921, *J. Dutra 29* (ICN). **São Francisco de Paula:** Parque das 8 Cachoeiras, 18 Aug 2015, *J. B. Castro 21* (ICN), 23 Aug 2015, *J. B. Castro 22* (ICN), Jun 2016, *J. B. Castro 2* (ICN). **Sapiranga:** [São Leopoldo] Ferrabraz, Jun 1926, *J. Dutra 881a* (ICN); Recanto da Cascata, Picada Verão, 12 May 1991, *V. F. Nunes et al. 1270* (PACA). **Taquara:** [Gravataí] Fazenda Fialho, Feb 1927, *J. Dutra 881b* (ICN). **Derrubadas:** [Tenente Portela] Parque Estadual do Turvo, 11 Jan 1977, *J. Mattos 16396* (HAS), 11 Jan 1977, *J. Mattos 16397* (HAS). **Torres:** 12 Mar 1978, *S. Winkler s.n.* (ICN 41256a); Faxinal, 14 May 1977, *J. L. Waechter et al. 533* (ICN); nas margens do rio Terra, 13 Jul 1988, *N. Silveira 6815* (HAS). **Vale do Sol:** [Santa Cruz do Sul] Trombudo, 16 Jul 1975, *J. L. Waechter 112* (ICN), 17 Jul 1979, *J. L. Waechter*

1273 (ICN). **Veranópolis:** Dec 1982, *N. Silveira 639* (HAS), 22 May 1987, *N. Silveira 4577* (HAS).

***Additional specimens examined* –** BRAZIL. SANTA CATARINA. **Campo Belo do Sul:** Gasperim, Arroio Tijolo, 20 Feb 2003, *C. Rohrig & N. Silveira s.n.* (RSPF 10044).

7. *Gomesa flexuosa* (Lodd.) M.W.Chase & N.H.Williams in Phytotaxa 1: 58. 2009.

***Type* –** Lectotype: Loddiges's illustration in Bot. Cab. 5: t. 424. 1820.

Synonyms – *Ampliglossum flexuosum* (Lodd.) Campacci; *Coppensia flexuosa* (Lodd.) Campacci; *Epidendrum lineatum* Vell.; *Gomesa megaloptera* (Kraenzl.) M.W.Chase & N.H.Williams; *Oncidium flexuosum* Lodd.; *Oncidium flexuosum* var. *radiatum* Rchb.f.; *Oncidium haematochrysum* Rchb.f.; *Oncidium haematoxanthum* Rchb.f.; *Oncidium megalopterum* Kraenzl..

Etymology – Due to their flexible inflorescences, that may coil themselves in any support.

Description – Figure 14. Epiphytic or rupicolous herbs with pseudobulbs distributed on an elongated rhizome. Pseudobulbs 3-7.8cm x 2.4-4.1cm, oval, ancipitous (2-edged), smooth to striate surface, without black dots, 1-3 terminal leaves. Leaves 11.4-27.2cm x 1.9-3.8cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 41-106cm, racemes or panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 4-6mm x 2-3mm, free, elliptic, lateral sepals 5-7mm x 1-2mm, fused until half their extension, elliptic, all sepals with cuneate base, obtuse to rounded apex, flat to undulated margin, yellow and brown markings. Petals 4-7mm x 2-4mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat to undulated margin, yellow and brown markings. Lip 13-17mm x 14-18mm, 3-lobed, lateral lobes elliptic, apical lobe expanded, truncate base, emarginate apex, unicolor, yellow. Callus tubercular, basal portion flat and forming a perpendicular plate to the column, some yellow tubercles aggregated at the central region, surrounded by isolated yellow tubercles, brown and yellow background, entire isthmus. Column 3-5mm x 2-4mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 16. Common in the Depressão Central, Encosta Inferior do Nordeste, Litoral and Encosta do Sudeste. Eventual in the Serra do Sudeste, Planalto Médio and Campos de Cima da Serra (where is rare).

Habitat – Both cool to warm and moist areas, from lowlands to low montane forests, also along inland creeks and marshes, generally in open areas or forest borders, receiving direct light. May be rupicolous, pseudobulbs exposed on rocky granite outcrops.

Flowering period – From October to February.

Notes – It may be confused with *Gomesa recurva* or *G. crispa* in vegetative state, however *G. flexuosa* bears an elongated rhizome, in other words the pseudobulbs are spaced, while they are clustered in the two previous species. On the other hand, these species are extremely different in terms of floral features. *Gomesa flexuosa* generally presents panicles with "oncidioid flowers", vivid yellow with brown markings and tubercular callus, while the other two present pendulous racemes with pale flowers, almost unicolor, and longitudinal callus. Still, due to their elongated rhizome associated to the pseudobulbs's shape, *G. flexuosa* may be easily distinguishable from the remaining of *Gomesa* species in the State.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Alvorada:** 27 Nov 2015, *J. B. Castro 16* (ICN). **Arroio dos Ratos:** Fazenda Faxinal, 1 Jan 1981, *K. Hagelund 13409* (ICN). **Camaquã:** Barbosa Lessa, 1 Dec 2000, *C. F. Jurinitz 91* (ICN); Ilha de Santo Antônio, 29 Dec 1999, *G. De Marchi s.n.* (PACA 93588). **Cambará do Sul:** [São Francisco de Paula] Serra do Faxinal, 23 Feb 1951, *A. Sehnem s.n.* (PACA 84975). **Campo Bom:** nas margens do rio dos Sinos, 29°40'54"S, 51°3'35"W, 23 Nov 2013, *L. D. Rocha, D. F. P. Becker & F. Junges 119* (PACA). **Caraá:** Alto Vila Nova, 29°43'42.1"S, 50°22'00.8"W, 30 Jul 2010, *M. B. Dorneles s.n.* (PACA 114629). **Casca Evangelista:** margem do arroio Barra Funda, 27 Nov 2010, *M. C. Marchezi s.n.* (RSPF 12321). **Encruzilhada do Sul:** Estação Experimental, 17 Nov 1978, *J. Mattos 19725* (HAS). **Estrela Velha:** UHE Itaúba, 17 May 2002, *C. Mansan & V. L. Caetano 515* (HAS). **Garibaldi:** Marcorama, Vila Santana, 7 Nov 1987, *M. Rossato et al. s.n.* (HUCS 3466). **Glorinha:** [Gravataí] 27 Mar 1950, *G. Pabst 660* (PACA). **Guaíba:** Centro, 18 Oct 1981, *M. B. L. Sbardellotto s.n.* (MPUC 15308); Passo do Petim, Fazenda São Maximiano, Cerro do Poeta, 3 Dec 1993, *V. F. Nunes 1375* (ICN), 3 Dec 2005, *L. F. Lima 168* (ICN). **Montenegro:** Fortaleza, 15 Dec 1952, *B. Rambo s.n.* (PACA 52895), *B. Rambo s.n.* (PACA 52900). **Morro Reuter:** 30 Nov 2016, *J. B. Castro 60* (ICN). **Nova Petrópolis:** limite com Caxias do Sul, próximo ao rio Caí, 4 Jan 2016, *J. B. Castro 8*

(ICN). **Novo Hamburgo:** Parque Municipal Henrique Luiz Roessler, 29°40’54”S, 51°06’56”W, 22 Nov 2007, *J. Brustulin 34* (PACA). **Osório:** Emboaba, 21 Dec 1984, *J. L. Waechter 2063* (ICN). **Pelotas:** Instituto Agronômico do Sul, Horto Botânico, 20 Dec 1960, *E. C. dos Santos 181* (FUEL, ICN, PACA). **Porto Alegre:** Feb 1954, *Ir. Bento s.n.* (ICN 19442); Morro da Polícia, 20 Nov 1931, *C. Orth s.n.* (PACA 378); 4 Nov 1939, *Ir. Augusto s.n.* (ICN 20346); 14 Nov 1995, *V. F. Nunes s.n.* (ICN 110389). **Rio Grande:** Estação Ecológica do Taim, 14 Nov 1986, *J. L. Waechter 2251* (ICN); Mato Costa Verde, 26 Nov 1986, *B. Irgang s.n.* (HURG 3354). **São Leopoldo:** 1944, *J. Blessmann s.n.* (PACA 27304); Quinta S. Manoel, 27 Nov 1927, *J. Dutra 952* (ICN). **São Lourenço do Sul:** Fazenda do Pontal, 14 NOV 1998, *R. Wasum et al. s.n.* (HUCS 13703). **Sapiranga:** Recanto da Cascata, Picada Verão, 9 Dec 1990, *V. F. Nunes 1221* (PACA). **Taquara:** margens do rio dos Sinos, 29°40’46.8”S, 50°45’57”W, 6 Nov 2013, *L. D. Rocha, D. F. P. Becker & F. Junges 138* (PACA). **Taquari:** Morro Pelado, 11 Dec 2015, *J. B. Castro 10* (ICN). **Vale do Sol:** [Santa Cruz do Sul] Trombudo, 16 Nov 1980, *J. L. Waechter 1770* (HAS). **Viamão:** Parque Estadual de Itapuã, 25 Oct 1975, *J. L. Waechter 198* (ICN), 4 Nov 1987, *J. L. Waechter 2262* (HAS); Parque Saint’Hilaire, 10 Nov 1976, *J. L. Waechter 368* (ICN).

Additional specimens examined **–** BRAZIL. SANTA CATARINA. **São João do Sul:** estrada para Praia Grande, 13 Jan 1978, *K. Hagelund 12040* (ICN).

8. *Gomesa gomezoides* (Barb.Rodr.) Pabst in Orquídea (Niteroi) 29: 165. 1967.

Type **–** Lectotype: Barbosa Rodrigues’s original illustration at Biblioteca Barbosa Rodrigues, “Iconographie des Orchidées du Brésil” 6: t. 318, cited as tab. 480 (then unpublished) in Barbosa Rodrigues (1877: 145), reproduced in Sprunger *et al.* (1996: 447).

Synonyms – *Gomesa theodorea* Cogn. [Illegitimate]; *Hellerorchis gomezoides* (Barb.Rodr.) A.D.Hawkes; *Hellerorchis paniculata* (Brade) A.D.Hawkes; *Rodrigueziella gomezoides* (Barb.Rodr.) Berman; *Theodorea gomezoides* Barb.Rodr.; *Theodorea paniculata* Brade.

Etymology – Seen that this species was described under *Theodorea*, it refers to the similitude to the genus *Gomesa*.

Description – Figure 15. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 1.2-3.7cm x 0.4-1.2cm, oval to conical/oblong, ancipitous (2-edged) or weakly compressed, smooth to striate surface, without black dots, 1-2 terminal leaves. Leaves 4.8-13.1cm x 0.5-1.3cm, elliptic, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 7-16cm, racemes, 3-multi-flowered (usually few flowers), one inflorescence per pseudobulb, rigid, not exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, not resupinate. Dorsal sepal 8-10mm x 2-3mm, free, ovate to lanceolate, lateral sepals 8-10mm x 2-3mm, free, ovate to lanceolate, all sepals with truncate base, acute apex, flat margin, pale yellow/green (sometimes with brown markings). Petals 8-10mm x 2-3mm, free, ovate to lanceolate, similar in size and shape to dorsal sepal, truncate base, acute apex, flat margin, pale yellow/green (sometimes with brown markings). Lip 6-9mm x 3-4mm, 1-lobed, truncate base, apiculate apex, unicolor, white. Callus longitudinal, two parallel smooth elevations, white with a yellow/orange marking at the center, entire isthmus. Column 3-4mm x 2-3mm, anther with acute rostellum, absence of lateral wings, absence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 17. In Rio Grande do Sul, restricted to the Campos de Cima da Serra, in the municipalities of São Francisco de Paula, Cambará do Sul, São José dos Ausentes and Bom Jesus.

Habitat – Nebular forests, dwelling humid places, over mossy trees.

Flowering period – From October to November.

Notes – Distinguishable by their few-flowered racemes bearing not resupinate flowers, with longitudinal callus and absence of tabula infrastigmatica, just as its close relatives, *Gomesa recurva* and *G. crispa*. However, the latter two species present a larger size, multi-flowered inflorescences and resupinate flowers.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Bom Jesus:** 15 Jan 1941, *A. Sehnem s.n.* (PACA 33958). **Cambará do Sul:** Cânion Fortaleza, 15 Sep 1976, *J. L. Waechter 343* (ICN); estrada para Cânion Fortaleza, 22 Nov 1998, *R. Wasum et al. s.n.* (HUCS 12857), 29°3’42.98”S, 50°3’18.09”W, 30 Nov 2015, *J. B. Castro 17* (ICN); Cânion Itaimbezinho, 18 Dec 1950, *B. Rambo s.n.* (PACA 49426), 3 Dec 1971, *J. C & F. M. L., M. L. P. & A. M. G. s.n.* (ICN 9341); Fortaleza dos Aparados, 1 Dec 1974, *A. A. Lise s.n.* (PACA 67258), 15 Apr 1979, *J. L. Waechter 1218* (ICN); [São Francisco de Paula] Serra do Faxinal,

19 Dec 1950, *A. Sehnem s.n.* (PACA 50986), Dec 1983, *M. Sobral & J. R. Stehmann 2804* (ICN). **São Francisco de Paula:** Banhado Amarelo, 24 Oct 1976, *C. R. Dillenburg 212* (ICN). **São José dos Ausentes:** 3 Jul 2006, *E. M. Freitas s.n.* (HVAT 2109); [Bom Jesus] Serra da Rocinha, 14 Jan 1942, *B. Rambo s.n.* (PACA 8753), 18 Jan 1950, *A. Sehnem s.n.* (PACA 84985), 29 Oct 1983, *S. Eisinger 69* (ICN); Pico Montenegro, 23 Nov 2016, *J. B. Castro 65* (ICN).

Additional specimens examined – BRAZIL. SANTA CATARINA. **Urubici:** Serra do Corvo Branco, 28°3'19.9"S, 49°21'58.1"W, 18 Nov 2008, *J. R. V. Iganci, P. M. A. Ferreira, G. H. Silveira & C. R. Buzatto 520* (ICN).

9. *Gomesa hookeri* (Rolfe) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009.

Type – Lectotype: BRAZIL. Rio de Janeiro, "Environs de Rio Janeiro et d'Ourou Preto", 1883, *A. Glaziou 15644* (K no. 586523!), on sheet with K no. 586524-25. Syntype: BRAZIL. Rio de Janeiro, s.d., *W. Longman s.n.* (K no. 586522!), on sheet with K no. 586521.

Synonyms – *Carenidium hookeri* (Rolfe) Baptista; *Carenidium loefgrenii* (Cogn.) Baptista; *Coppensia hookeri* (Rolfe) F.Barros & L.R.S.Guim.; *Coppensia hookeri* f. *albescens* (Pabst) F.Barros & L.R.S.Guim.; *Coppensia loefgrenii* (Cogn.) F.Barros & V.T.Rodrigues; *Gomesa loefgrenii* (Cogn.) M.W.Chase & N.H.Williams; *Menezesiella hookeri* (Rolfe) V.P.Castro & Chiron; *Menezesiella loefgrenii* (Cogn.) V.P.Castro & Chiron; *Oncidium hookeri* Rolfe; *Oncidium hookeri* f. *albescens* (Pabst) F.Barros & J.A.N.Bat.; *Oncidium hookeri* var. *albescens* Pabst; *Oncidium loefgrenii* Cogn.; *Oncidium mellifluum* Kraenzl.; *Oncidium raniferum* var. *major* Hook..

Etymology – Named after William Hooker, who described *Oncidium raniferum* var. *major*.

Description – Figure 18. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.1-6.2cm x 0.8-1.9cm, oval, ancipitous (2-edged), striate to sulcate surface, sometimes bearing black dots, 1-2 terminal leaves. Leaves 12.8-23cm x 1.2-1.8cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 15-43cm, panicles, multi-flowered, one inflorescence per pseudobulb,

rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 3-4mm x 1-2mm, free, elliptic, lateral sepals 3-4mm x 1-2mm, fused until half their extension, elliptic, all sepals with cuneate base, rounded to truncate apex, flat margin, yellow (with few brown markings). Petals 3-4mm x 1-2mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, rounded to truncate apex, flat margin, yellow (with few brown markings). Lip 7-9mm x 5-6mm, 3-lobed, lateral lobes rounded to squared, apical lobe expanded, attenuate base, rounded to emarginated apex, unicolor, yellow. Callus tubercular, "looked from above it resembles the figure of a frog couchant, the double lower tubercle representing the creatures haunches and the anterior emarginated one his head" (Lindley, 1838), unicolor, orange/brownish, entire isthmus. Column 2-3mm x 1-2mm, anther with acute rostellum, absence of lateral wings, presence of tabula infrastigmatica (inserted in the callus).

Distribution in Rio Grande do Sul – Figure 20. Common in the Campos de Cima da Serra and Encosta Superior do Nordeste. Rare in the Litoral.

Habitat – Areas submitted to short frosts, in montane forests, dwelling preferentially at shady areas, sometimes close to forest borders.

Flowering period – From December to March.

Notes – Similar to *Gomesa paranensoides* when it comes to vegetative features, though separated by the appearance of their flowers and by *G. hookeri* presenting resupinate flowers (vs. not resupinate in *G. paranensoides*). The present species and *Gomesa ranifera* are distinguishable by their small flowers with callus resembling a "crouching frog". For differentiation between them, *G. hookeri* is more robust, with inflorescences more congest and with more flowers, vivid yellow (vs. white to pale yellow) and lateral sepals connate for half their length (vs. connate only at the base).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Bom Jesus:** Fazenda do Cilho, 8 Jan 2005, *R. Wasum s.n.* (HVAT 2270). **Cambará do Sul:** estrada para São Francisco de Paula, Feb 1948, *B. Rambo s.n.* (PACA 36585). **Caxias do Sul:** Barragem Faxinal, 5 Dec 1991, *A. Jasper s.n.* (PACA 71168); Vila Oliva, 3 Jan 1946, *B. Rambo s.n.* (PACA 30982). **Farroupiha:** Parque dos Pinheiros, 29°14'30"S, 51°26'20"W, *J. Brustulin 11* (PACA). **Jaquirana:** Roça Redonda, 27 Dec 2007, *R. Wasum s.n.* (HVAT 2449). **Riozinho,** estrada para Barra do Ouro, 29°37'10.47"S, 50°20'46.71"W, 24 Mar 2016, *J. B.*

Castro 19 (ICN). **São Francisco de Paula:** RS 235, 29°21'36"S, 50°39'34"W, 11 Dec 1999, *R. Wasum 345* (HUCS); Cânion Itaimbezinho, 30 Jan 1950, *B. Rambo s.n.* (PACA 45558), 19 Dec 1950, *B. Rambo s.n.* (PACA 49427); CPCN Pró-Mata PUCRS, 20 Feb 2017, *J. B. Castro 72* (ICN); Fazenda Englert, 2 Jan 1955, *B. Rambo s.n.* (PACA 56406); Tainhas, Potreiro Novo, 22 Feb 1978, *A. Sehnem s.n.* (PACA 84976). **Torres:** Jan and Feb 1927, *J. Dutra 927* (ICN).

***Additional specimens examined* –** BRAZIL. PARANÁ. **Bocaiúva do Sul:** Serra S'Ana, 23 Mar 1983, *G. Hatschbach 46854* (HAS). **Curitiba:** Lago Azul, 30 Jan 1984, *G. Hatschbach 47619* (HUCS); Parque Iguaçu, 14 Jan 1986, *J. Cordeiro 211* (PACA). **Piraquara:** Florestal, 5 Jan 1947, *G. Hatschbach 576* (PACA). **São José dos Pinhais:** rio Castelhanos, 6 Apr 1983, *G. Hatschbach 46261* (HUCS, PACA). **Tunas:** [Bocaiúva do Sul] Colônia João XXIII, 12 Feb 2004, *J. M. Silva 4002* (HUCS). SANTA CATARINA. **Mafra:** 26 Jan 1953, *s.coll. s.n.* (PACA 55120).

10. *Gomesa hydrophila* (Barb.Rodr.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009.

***Type* –** Lectotype: Barbosa Rodrigues's original illustration at Biblioteca Barbosa Rodrigues, "Iconographie des Orchidées du Brésil" 6: t. 257, cited as tab. 421 (then unpublished) in Barbosa Rodrigues (1877: 92), reproduced in Sprunger *et al.* (1996: 385).

Synonyms – *Ampliglossum hydrophilum* (Barb.Rodr.) Campacci; *Coppensia hydrophila* (Barb.Rodr.) Campacci; *Oncidium hydrophilum* Barb.Rodr.; *Oncidium hydrophilum* f. *immaculatum* (L.C.Menezes) Christenson; *Oncidium hydrophilum* var. *immaculatum* L.C.Menezes.

Etymology – Reference to its habit, living in wetlands, always in presence of abundant water.

Description – Figure 19. Terrestrial herbs with pseudobulbs clustered on a short rhizome, living in wetlands. Pseudobulbs 1.8-3.4cm x 1.4-2.3cm, oval, weakly compressed, smooth to striate surface, without black dots, 2-3 terminal leaves. Leaves 15.5-23.2cm x 0.7-1.5cm, oblong to linear, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 56-95cm, racemes or panicles, multi-flowered, one inflorescence per

pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 5-7mm x 3-4mm, free, elliptic, lateral sepals 8-10mm x 2-3mm, fused for 1/3 of their extension, spatulate and arched laterally, all sepals with cuneate base, acute to obtuse apex, flat to undulated margin, yellow and brown markings. Petals 7-9mm x 4-5mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, acute to obtuse apex, undulated margin, yellow and brown markings. Lip 13-18mm x 12-15mm, 3-lobed, lateral lobes elliptic, apical lobe expanded, truncate base, emarginate apex, unicolor, yellow. Callus tubercular, tubercles distributed all over the callus region, yellow/white and orange background, entire isthmus. Column 6-8mm x 4-6mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 21. Eventual in the Depressão Central and Encosta Inferior do Nordeste.

Habitat – Swamps and swampy grasslands.

Flowering period – From June to August.

Notes – Species of difficult perception when in its vegetative state due to its buried pseudobulbs and presence between high grasses. Easily distinguishable by its habit, being the only terrestrial *Gomesa* species occurring in wetlands.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Lombas:** 2 Jul 2015, *J. B. Castro 18* (ICN), *J. B. Castro 23* (ICN). **São Leopoldo:** 28 Nov 1935, *J. Dutra 1193* (ICN).

***Additional specimens examined* –** BRAZIL. GOIÁS. **Alto Paraíso:** GO-118, 13 Feb 1990, *G. Hatschbach, M. Hatschbach & V. Nicolack 53934* (HUCS).

11. *Gomesa imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009.

***Type* –** Holotype: BRAZIL. Rio de Janeiro, Petrópolis, 1859, *Wawra & Maly 417* (W no. 595!).

Synonyms – *Anettea crispa* (Lodd. ex Lindl.) Szlach. & Mytnik; *Anettea gravesiana* (Rolfe) Szlach. & Mytnik; *Anettea imperatoris-maximiliani* (Rchb.f.) Szlach. & Mytnik; *Brasilidium crispum* (Lodd. ex Lindl.) Campacci; *Brasilidium gravesianum* (Rolfe)

Campacci; *Gomesa gravesiana* (Rolfe) M.W.Chase & N.H.Williams; *Oncidium crispum* Lodd. ex Lindl.; *Oncidium crispum* var. *aureum* auct.; *Oncidium crispum* var. *flabellulatum* Stein; *Oncidium crispum* var. *grandiflorum* B.S.Williams; *Oncidium crispum* var. *limbatum* Cogn.; *Oncidium crispum* var. *lionetianum* Cogn.; *Oncidium crispum* var. *ochraceum* Rchb.f.; *Oncidium crispum* var. *olivaceum* Rchb.f.; *Oncidium crispum* var. *rodriguesii* Cogn.; *Oncidium crispum* var. *sublaeve* Rchb.f.; *Oncidium gravesianum* Rolfe; *Oncidium imperatoris-maximiliani* Rchb.f..

Etymology – Named after the Mexico's emperor at the time, Maximilian I.

Description – Figure 22. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.6-8.3cm x 2.1-3.4cm, oval, ancipitous (2-edged), smooth to striate surface, without black dots, 2-3 terminal leaves. Leaves 13.1-18.7cm x 2.8-5.1cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 28-59cm, racemes or panicles, 3-multi-flowered (usually few flowers), one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 20-23mm x 11-13mm, free, elliptic, lateral sepals 20-23mm x 7-9mm, fused for 1/3 of their extension, spatulate, all sepals with attenuate base, obtuse to rounded apex, undulated margin, brown (with few yellow markings). Petals 21-24mm x 13-16mm, free, elliptic, similar in size and shape to dorsal sepal, attenuate base, emarginate to rounded apex, undulated margin, brown (with few yellow markings). Lip 25-28mm x 21-24mm, 3-lobed, lateral lobes rounded, apical lobe expanded, truncate base, emarginate apex, bicolor, yellow with a broad brown border. Callus tubercular, formed by one central keel resembling a "Y" due to its disjunction at the base, bearing brown tubercles and also surrounded by isolated brown tubercles reaching the lateral edge of the lip, yellow and white background, entire isthmus. Column 8-12mm x 5-7mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 24. In Rio Grande do Sul, restricted to the Litoral, in the municipalities of Osório, Três Cachoeiras and Torres.

Habitat – Areas submitted to short frosts, in the coastal mountains, dwelling places with open canopy or in border areas.

Flowering period – From January to February.

Notes – Species distinguishable by their large pseudobulbs and flowers, the latter being predominantly brown. The floral features are close to the ones of *Gomesa pectoralis*, from which they may be separated, in addition to the larger size of vegetative structures, by the callus with one central keel surrounded by tubercles (vs. one central and two lateral keels also surrounded by tubercles) and the lateral sepals connate not more than half of their lengths (vs. connate for almost all their extension).The flowers may present great variations on the width of petals and sepals.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Osório:** 4 Feb 1933, *C. Orth s.n.* (PACA 1716); [Conceição do Arroio] próximo à lagoa dos Quadros, 1 Apr 1931, *J. Dutra 1126* (ICN); Morro da Borrússia, próximo à igreja Santa Rita, 28 Feb 2016, *J. B. Castro 43* (ICN). **Três Cachoeiras:** 1977, *J. L. Waechter 714* (ICN); Morro Azul, 28 Jan 2017, *J. B. Castro 71* (ICN). **Torres:** 28 Jan 1992, *J. L. Waechter 2512* (ICN).

Additional specimens examined – BRAZIL. SANTA CATARINA. **Florianópolis:** Morro Costa da Lagoa, 17 Jan 1967, *R. M. Klein 7094* (PACA).

12. *Gomesa longicornu* (Mutel) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009.

Type – Neotype: BRAZIL. Organ Mountains, Mar 1837, *Gardner 639* (K no. 586519!), on sheet with K no. 586517-20.

Synonyms – *Coppensia longicornu* (Mutel) F.Barros & V.T.Rodrigues; *Gomesa rhinoceros* (Rchb.f.) M.W.Chase & N.H.Williams; *Oncidium gautieri* Regel; *Oncidium longicornu* Mutel; *Oncidium longicornu* var. *gautieri* (Regel) Cogn.; *Oncidium longicornu* var. *grossmannii* Dammer; *Oncidium monoceras* Hook.; *Oncidium rhinoceros* Rchb.f.; *Oncidium unicorne* Lindl.; *Oncidium unicornutum* Knowles & Westc.; *Rhinocerotidium longicornu* (Mutel) Szlach.; *Rhinocidium longicornu* (Mutel) Baptista; *Rhinocerotidium rhinoceros* (Rchb.f.) Szlach..

Etymology – In allusion to the horned callus.

Description – Figure 23. Epiphytic herbs with pseudobulbs clustered on a short rhizome or distributed on a somewhat elongated rhizome. Pseudobulbs 2.9-6.4cm x 1-2.7cm, conical/oblong, ancipitous (2-edged), striate to sulcate surface, sometimes bearing black dots,

1-2 terminal leaves. Leaves 9.5-24.4cm x 1.1-2.5cm, elliptic to oblong, chartaceous to nearly coriaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 33-55cm, panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a membranous sheath. Flowers pedicellate, resupinate. Dorsal sepal 4-8mm x 3-5mm, free, elliptic, lateral sepals 5-7mm x 2-4mm, fused until half their extension, elliptic, all sepals with cuneate base, obtuse to rounded apex, flat margin, brown with yellow markings. Petals 4-8mm x 3-6mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, rounded to truncate apex, flat margin, brown with yellow markings. Lip 11-16mm x 8-13mm, 3-lobed, lateral lobes rounded, apical lobe expanded, cuneate base, emarginated to rounded apex, unicolor, yellow. Callus horned, with two auricular projections above the horn, unicolor, yellow (but different shades), entire isthmus. Column 5-7mm x 2-3mm, anther with acute rostellum, absence of lateral wings, presence of tabula infrastigmatica (reduced).

Distribution in Rio Grande do Sul – Figure 25. Common in the Campos de Cima da Serra, Encosta Inferior do Nordeste, Encosta Superior do Nordeste and Planalto Médio.

Habitat – Areas submitted to short frosts, in montane forests, dwelling humid places preferentially along shady streams.

Flowering period – From November to December.

Notes – Vegetative structures resemble *Gomesa bifolia*. However, this species present leaves with harder consistency. Easily distinguishable when flowered, because of the unique callus bearing a single long horn.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Bom Jesus:** Fazenda Caraúna, Mar 1927, *J. Dutra 1099* (ICN). **Cambará do Sul:** [São Francisco de Paula] Serra do Faxinal, 19 Dec 1950, *A. Sehnem s.n.* (PACA 50985). **Criúva:** [Caxias do Sul] estrada para Mulada, 10 Dec 2005, *M. Machado 734* (HUEFS), 30 Nov 2016, *J. B. Castro 61* (ICN). **Itaara:** [Santa Maria] Reserva Biológica do Ibicuí-Mirim, 9 Nov 1990, *N. Silveira 7995* (HAS). **Mato Castelhano:** Floresta Nacional de Passo Fundo, 29 Dec 2005, *C. R. Buzatto 35* (RSPF), *C. R. Buzatto s.n.* (RSPF 10927), 9 May 2006, *C. R. Buzatto s.n.* (ICN 143766). **Montenegro:** L. Campestre, 15 Nov 1946, *A. Sehnem s.n.* (PACA 84957). **Ronda Alta:** estrada para Passo Fundo, 14 Nov 1976, *J. L. Waechter 387* (ICN). **São Francisco de Paula:** 19 Dec 1950, *A. Sehnem s.n.* (PACA 50985/1), Jan 1954, *Ir. Edésio s.n.* (ICN 19443); Cânion

Itaimbezinho, 18 Dec 1950, *B. Rambo* (PACA 49444). **São José dos Ausentes:** [Vacaria] Fazenda da Ronda, 5 Jan 1947, *B. Rambo s.n.* (PACA 34836). **São Leopoldo:** Quinta S. Manoel, 8 Nov 1925, *J. Dutra 953* (ICN). **Vacaria:** Passo do Socorro, 28 Jan 1951, *A. Sehnem s.n.* (PACA 82080). **Vale do Sol:** [Santa Cruz do Sul] Trombudo, 22 Sep 1975, *J. L. Waechter 212* (ICN).

13. *Gomesa paranensoides* M.W.Chase & N.H.Williams in Phytotaxa 1: 58. 2009.

Type – Lectotype: BRAZIL. Paraná, Itaperussú, 23 Dec 1908, *P. K. H. Dusén 7452* (S no. 04-233!). Isolectotype: BRAZIL. Paraná, Itaperussú, 23 Dec 1908, *P. K. H. Dusén 7452* (AMES no. 102524!). Syntypes: BRAZIL. Paraná, Itaperussú, 31 Dec 1908, *P. K. H. Dusén 7431* (S no. R-3799!); Paraná, Itaperussú, 30 Nov 1909, *P. K. H. Dusén 9042* (S no. 07-7916!); Paraná, Vila Velha, 12 Dec 1908, *P. K. H. Dusén 7399* (S no. R-3797!); Rio Grande do Sul, Piratiny, 18 Dec 1892, *C. A. M. Lindman 789* (S no. 07-7917!, S no. R-3798!).

Synonyms – *Carenidium paranaense* (Kraenzl.) Baptista; *Coppensia paranaensis* (Kraenzl.) F.Barros & V.T.Rodrigues; *Gomesa paranaensis* (Kraenzl.) M.W.Chase & N.H.Williams [Illegitimate]; *Hardingia paranaensis* (Kraenzl.) Docha Neto & Baptista; *Oncidium hatschbachii* Schltr.; *Oncidium paranaense* Kraenzl.; *Oncidium schadei* L.O.Williams; *Rhinocidium paranaense* (Kraenzl.) Docha Neto.

Etymology – From the place of origin of the typus, the State of Paraná, Brazil.

Description – Figure 26. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 1.2-4.5cm x 0.7-1.7cm, oval, ancipitous (2-edged), striate to sulcate surface, sometimes bearing black dots, 1-2 terminal leaves. Leaves 6.6-18.9cm x 0.6-1.9cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 10-33cm, panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, not resupinate. Dorsal sepal 2-4mm x 2-3mm, free, elliptic, lateral sepals 2-4mm x 2-3mm, fused only at the base and laterally pointing, elliptic, all sepals with cuneate base, acute to obtuse apex, flat to undulated margin, yellow and brown markings. Petals 2-4mm x 2-3mm, free, elliptic, similar in size and shape to dorsal sepal, cuneate base, acute to obtuse apex, flat to undulated margin, yellow and brown markings. Lip 6-9mm x 5-7mm, 3-lobed, lateral lobes oblong, apical lobe assuming the same size of lateral lobes and folded downwards, truncate

base, acute apex, bicolor, yellow with brown lines (lines only present over the lateral lobes). Callus smooth, yellow and brown markings, entire isthmus. Column 2-3mm x 2-3mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica (reduced).

Distribution in Rio Grande do Sul – Figure 28. Common in the Campos de Cima da Serra, Encosta Superior do Nordeste, Encosta Inferior do Nordeste and Planalto Médio. Eventual in the Depressão Central and the Serra do Sudeste (where is rare).

Habitat – Areas submitted to short frosts, mainly in montane forests with presence of *Araucaria angustifolia*, dwelling preferentially at shady areas, sometimes close to forest borders.

Flowering period – From December to January.

Notes – Resembles *Gomesa hookeri* in vegetative structures. Nevertheless, what distinguishes this species from the one mentioned (and from the remaining species as well) is its highly apomorphic flowers, which actually look like *Trichocentrum pumilum*. The flowers are small and not resupinate, the lip is 3-lobed (despite the apical lobe usually being folded downwards) and the lateral lobes present brown lines that are not present in the median one.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Barracão:** 6 Jan 2011, *W. Heberle s.n.* (HVAT 4267). **Cambará do Sul:** 23 Dec 2016, *J. B. Castro 59* (ICN), 29 Dec 2016, *J. B. Castro 57* (ICN). **Canela:** Caracol, 2 Jan 1973, *J. Jung et al. s.n.* (ICN 21898); Passo do Inferno, 29 Dec 2016, *J. B. Castro 55* (ICN). **Casca Evangelista:** nas margens do arroio Barra Funda, 14 Dec 2010, *M. C. Marchezi s.n.* (RSPF 12338). **Caxias do Sul:** Barragem Faxinal, 05 Dec 1991, *A. Jasper s.n.* (PACA 71167). **Encruzilhada do Sul:** Assentamento Farroupilha, 16 Dec 2007, *M. Grings 459* (ICN). **Esmeralda:** estrada para Estrela, 29 Dec 2016, *J. B. Castro 58* (ICN). **Guaporé:** 27 Nov 2002, *E. M. Freitas s.n.* (HVAT 2467). **Ilópolis:** 13 Dec 2007, *E. M. Freitas s.n.* (HVAT 2163). **Itaara:** [Santa Maria] Reserva Biológica do Ibicuí-Mirim, 9 Nov 1990, *N. Silveira 7990* (HAS). **Ivorá:** Piruva, Cascata Queda Livre, 9 Jan 2016, *J. B. Castro 33* (ICN). **Jaquirana:** 19 Dec 2001, *A. Knob & S. Bordignon 6984* (UniLaSalle). **Passo Fundo:** Barragem Fazenda, 20 Dec 2002, *R. V. Kilca s.n.* (RSPF 9569); Bom Recreio, Haras da Luz, 8 May 2006, *C. R. Buzatto s.n.* (ICN 143774). **Rio Pardo:** Fazenda Soledade, Jan 1921, *J. Dutra 4* (ICN). **São Francisco de Paula:** Parque Municipal da Ronda, 29°27’03”S, 50°35’41”W, 15 Dec 2007, *J. Brustulin 35* (PACA); PCH Cazuza Ferreira, 10 Jul 2007, *J. Spellemeier s.n.* (HVAT 2255). **São José do Herval:** PCH

Salto do Forqueta, 16 Nov 2001, *C. Gonçalves s.n.* (HVAT 859). **São Leopoldo:** Quinta S. Manoel, Dec 1927, *J. Dutra 1008* (ICN). **Vacaria:** Passo do Socorro, 26 Dec 1951, *s.coll. s..n.* (PACA 71545). **Veranópolis:** próximo ao aeroclube, 30 Dec 1981, *N. Silveira 172* (HAS).

14. *Gomesa pectoralis* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 397. 2009

Type – Lectotype: Lindley's illustration in Sert. Orchid.: t. 39. 1840.

Synonyms – *Ampliglossum brunnipetalum* (Barb.Rodr.) Campacci; *Anettea curta* (Lindl.) Szlach. & Mytnik; *Anettea gardneri* (Lindl.) Szlach. & Mytnik; *Anettea pectoralis* (Lindl.) Szlach. & Mytnik; *Brasilidium curtum* (Lindl.) Campacci; *Brasilidium gardneri* (Lindl.) Campacci; *Brasilidium pectorale* (Lindl.) Campacci; *Coppensia brunnipetala* (Barb.Rodr.) Campacci; *Gomesa brunnipetala* (Barb.Rodr.) M.W.Chase & N.H.Williams; *Gomesa curta* (Lindl.) M.W.Chase & N.H.Williams; *Gomesa gardneri* (Lindl.) M.W.Chase & N.H.Williams; *Gomesa wheatleyana* (Gower) M.W.Chase & N.H.Williams; *Oncidium brunnipetalum* Barb.Rodr.; *Oncidium caloglossum* Rchb.f.; *Oncidium curtum* Lindl.; *Oncidium elegantissimum* Rchb.f.; *Oncidium flabelliferum* Pinel; *Oncidium gardneri* Lindl.; *Oncidium gardneri* var. *elegantissimum* (Rchb.f.) Cogn.; *Oncidium gardneri* var. *pollettianum* (Rchb.f.) Cogn.; *Oncidium gardneri* var. *praestans* (Rchb.f.) Cogn.; *Oncidium gardneri* subsp. *caloglossum* (Rchb.f.) Fowlie; *Oncidium gardnerianum* auct. [Spelling variant]; *Oncidium larkinianum* Gower; *Oncidium mantinii* God.-Leb.; *Oncidium pectorale* Lindl.; *Oncidium pectorale* var. *caloglossum* (Rchb.f.) Cogn.; *Oncidium pectorale* var. *larkinianum* (Gower) Cogn.; *Oncidium pectorale* var. *mantinii* (God.-Leb.) Cogn.; *Oncidium pollettianum* Rchb.f.; *Oncidium praestans* Rchb.f.; *Oncidium wheatleyanum* Gower.

Etymology – Reference to the callus that resembles a breastbone.

Description – Figure 27. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.1-4.3cm x 1.4-3.2m, oval, ancipitous (2-edged), smooth to striate surface, without black dots, 2 terminal leaves. Leaves 9.5-17cm x 1.5-3.1cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 19-36cm, racemes or panicles, 3-multi-flowered (usually few flowers), one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a

chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 10-12mm x 7-10mm, free, elliptic, lateral sepals 12-14mm x 4-5mm, fused for almost all their extension, elliptic, all sepals with attenuate base, obtuse to rounded apex, flat to undulated margin, brown with yellow markings. Petals 12-14mm x 8-10mm, free, elliptic to obovate, similar in size and shape to dorsal sepal, attenuate base, emarginate to truncate apex, flat to undulated margin, brown (with few yellow markings). Lip 20-23cm x 20-24cm, 3-lobed, lateral lobes rounded to squared, apical lobe expanded, truncate base, emarginate apex, unicolor or bicolor, yellow (with a brown border when bicolor). Callus tubercular, formed by one central and two lateral keels (the central one smaller), bearing brown tubercles and also surrounded by isolated brown tubercles and two lateral lines of tubercles resembling "wings" that reach the basal edge of the lip (close to the insertion of the lateral lobes), yellow/white and brown background, entire isthmus. Column 5-8mm x 5-6mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 29. In Rio Grande do Sul, restricted to the Campos de Cima da Serra. Only seen in São Francisco de Paula, at the Centro de Pesquisas e Conservação da Natureza (CPCN) Pró-Mata.

Habitat – Areas submitted to short frosts, in montane forests, dwelling preferentially places with open canopy and moderately bright light and air movement.

Flowering period – From October to December.

Notes – This species is equal to *Gomesa concolor* when it comes to vegetative features, but their flowers are different, *G. pectoralis* showing flowers with sepals and petals highly stained by brown while *G. concolor* is all yellow. In terms of floral features, it is closely related to *G. imperatoris-maximiliani*, from which may be distinguished mainly by the callus, with one central and two lateral keels surrounded by tubercles (vs. only one central keel surrounded by tubercles), and the degree of fusion of the lateral sepals, which are connate for almost all their extension (vs. connate not more than half of their extension). The flowers may present variation in the lip's coloration, ranging from all yellow to yellow with a broad brown border.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **São Francisco de Paula:** CPCN Pró-Mata, 7 Nov 2009, *P. J. S. Silva Filho 524* (MPUC), Oct 2015, *J. B. Castro 77* (ICN).

15. *Gomesa radicans* (Rchb.f.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104: 398. 2009.

Type – Not identified.

Synonyms – *Ornithophora quadricolor* Barb.Rodr.; *Ornithophora radicans* (Rchb.f.) Garay & Pabst; *Sigmatostalix radicans* Rchb.f.

Etymology – Reference to the ground rooting habit.

Description – Figure 30. Epiphytic herbs with pseudobulbs distributed on an elongated rhizome, but also presenting a ground rooting habit. Pseudobulbs 2.4-3.2mm x 1.1-1.7mm, oval, ancipitous (2-edged) or weakly compressed, smooth to little striate surface, without black dots, 1-2 terminal leaves. Leaves 7.3-22.1cm x 0.3-0.5cm, linear, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 9-23cm, racemes, multi-flowered, one inflorescence per pseudobulb, rigid, not exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 3-4mm x 2-3mm, free, elliptic, lateral sepals 3-4mm x 2-3mm, free, elliptic, all sepals with cuneate base, rounded to apiculate apex, flat margin, pale yellow (with few purple markings). Petals 3-4mm x 2-3mm, free, obovate, similar in size and shape to dorsal sepal, cuneate base, truncate to apiculate apex, flat margin, pale yellow. Lip 4-5mm x 5-6mm, 3-lobed, lateral lobes wing-like and inserted in both sides of the basal portion of the apical lobe (instead of insertion in the lateral edge of the callus), apical lobe expanded, truncate base, rounded to emarginated apex, unicolor, white. Callus 3-lobed, showing one proximal lobe and two distal lobes, unicolor, yellow, entire isthmus. Column 2-3mm x 1mm, basal portion vivid purple, apical portion yellow, anther with acute rostellum, absence of lateral wings, presence of tabula infrastigmatica (reduced).

Distribution in Rio Grande do Sul – Figure 32. Common in the Encosta do Sudeste, Depressão Central and Encosta Inferior do Nordeste. Rare in the Litoral.

Habitat – Montane forests, areas with moderate shade and moisture.

Flowering period – From January to February.

Notes – One of the most autapomorphic species of *Gomesa*. Easily distinguishable both over vegetative and reproductive features. They show an elongated rhizome and their pseudobulbs are oval, just as many others, yet present an acuminate apex and bear linear

leaves, a rare character between epiphytic plants. Regarding the flowers, the 3-lobed callus and the purple column that resembles a bird in side view are unique.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Arroio dos Ratos:** Fazenda Faxinal, 4 Feb 1978, *K. Hagelund 12258* (ICN). **Camaquã:** 4 Feb 1999, *A. Knob & S. Bordignon 5898* (UniLaSalle); Barbosa Lessa, 19 Jan 2001, *C. F. Jurinitz 134* (ICN), 19 Feb 2016, *J. B. Castro 40* (ICN), *J. B. Castro 44* (ICN). **Capão da Canoa:** 27 Mar 1955, *Ir. Ligório s.n.* (ICN 19445). **Estrela:** Novo Paraíso, 2 Apr 2000, *E. M. Freitas s.n.* (HVAT 309), 22 Feb 2005, *E. M. Freitas s.n.* (HVAT 1705). **Lajeado:** Bairro Carneiros, 18 Mar 2000, *E. M. Freitas s.n.* (HVAT 245). **Nova Petrópolis:** May 1949, *R. Reibt s.n.* (ICN 19429). **Portão:** estrada para São Leopoldo, 25 Feb 1973, *A. Sehnem s.n.* (PACA 84956). **Porto Alegre:** Glória, 17 Feb 1933, *B. Rambo s.n.* (PACA 566). **São Leopoldo:** Quinta S. Manoel, Mar 1925, *J. Dutra 859* (ICN). **Sapiranga:** Recanto da Cascata, Picada Verão, 10 Mar 1991, *V. F. Nunes et al. 1242* (PACA). **Torres:** Lageadinho, 16 Jan 1980, *J. L. Waechter 1528* (ICN). **Viamão:** Parque Saint'Hilaire, 12 Mar 1978, *J. L. Waechter s.n.* (ICN 41256b).

***Additional specimens examined* –** BRAZIL. PARANÁ. **Curitiba:** Bairro Uberaba, Praça Paulínia José Schmitt, 24 Jan 2012, *J. M. Silva & L. H. O. Viana 3174* (HUCS).

16. *Gomesa ranifera* (Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009.

***Type* –** Holotype: BRAZIL. Organ Mountains, 1837, *Gardner 637* (BM no. 534488!).

***Synonyms* –** *Carenidium raniferum* (Lindl.) Baptista; *Coppensia ranifera* (Lindl.) F.Barros & V.T.Rodrigues; *Menezesiella ranifera* (Lindl.) Chiron & V.P.Castro; *Oncidium raniferum* Lindl.; *Rhinocidium raniferum* (Lindl.) Baptista.

Etymology – In allusion to the lip callus, resembling a "crouching frog".

Description – Figure 31. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 1.9-3cm x 0.8-2.2cm, oval, ancipitous (2-edged), striate to sulcate surface, sometimes bearing black dots, 1-2 terminal leaves. Leaves 8.4-21.1cm x 1.1-2cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 7-28cm, panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate,

resupinate. Dorsal sepal 3-5mm x 1-2mm, free, obovate, lateral sepals 3-5mm x 1-2mm, free or fused only at the base, elliptic and arched laterally, all sepals with cuneate base, acute to obtuse apex, flat margin, white (there is a yellowish variation). Petals 3-5mm x 1-3mm, free, obovate, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat margin, white (there is a yellow variation with few brown markings). Lip 7-9mm x 5-6mm, 3-lobed, lateral lobes triangular, apical lobe expanded, attenuate base, rounded to emarginated apex, unicolor, white (there is a yellow variation). Callus tubercular, "looked from above it resembles the figure of a frog couchant, the double lower tubercle representing the creatures haunches and the anterior emarginated one his head" (Lindley, 1838), unicolor, orange/brownish, entire isthmus. Column 2-3mm x 1-2mm, anther with acute rostellum, absence of lateral wings, presence of tabula infrastigmatica (inserted in the callus).

Distribution in Rio Grande do Sul – Figure 33. Common in the Campos de Cima da Serra, Encosta Superior do Nordeste and Encosta Inferior do Nordeste. Eventual in the Depressão Central.

Habitat – Areas submitted to short frosts, in montane forests, dwelling preferentially at shady areas, sometimes close to forest borders.

Flowering period – From October to December.

Notes – Besides displaying common features regarding vegetative structures, such as markedly sulcate pseudobulbs, this species present a dwarf habit that facilitates its recognition in the field. Its size even helps in its distinction from *Gomesa hookeri*, a close relative. The flowers of both species are small and diagnosed by the callus that is similar to a "crouching frog". Notwithstanding, the present species shows smaller and more lax inflorescences (vs. larger and more congest), connate only at the base (vs. connate for half their length), triangular lip lateral lobes (vs. rounded to squared) and coloration from white to a palid yellow (vs. vivid yellow with some brown markings).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Bom Jesus:** Fazenda do Cilho, 06 Jan 2005, *R. Wasum 2294* (HUCS), 08 Jan 2005, *R. Wasum 2370* (HUCS), *R. Wasum 2358* (HUCS). **Cambará do Sul:** 20 Dec 1969, *B. Irgang & A. Ferreira s.n.* (ICN 7367); Cânion Fortaleza, 12 Jan 1994, *R. Ramos 379* (HAS); estrada para o Cânion Fortaleza, 18 Mar 1983, *N. Silveira 419* (HAS), *N. Silveira 585* (HAS); Cânion Itaimbezinho, 12 Dec 1978, *J. Mattos 20126* (HAS), 27 Dec 1980, *J. L. Waechter 1799* (ICN), 28 May 1983, *A.*

Oliveira s.n. (MPUC 15886), 27 Dec 1988, *J. A. Jarenkow & R. M. Bueno 1190* (PEL); Fazenda Velha, Celulose Cambará, 16 Dec 1993, *M. Neves 1799* (HAS), *N. Silveira 10128* (HAS), 11 Jan 1994, *N. Silveira 10190* (HAS), *T. Strehl 1155* (HAS), *T. Strehl 1156* (HAS). **Canela:** Caracol, 1941, *K. Emrich s.n.* (PACA 2779). **Muitos Capões:** [Esmeralda] Estação Ecológica de Aracuri, 14 Jan 1982, *K. Kleebank 6* (ICN). **Garibaldi:** Marcorama, Jan 1988, *M. Rossato s.n.* (HUCS 3968). **Jaquirana:** 29 Dec 2016, *J. B. Castro 54* (ICN). **Porto Alegre:** Glória, 5 Mar 1944, *C. Orth s.n.* (PACA 1703a). **Riozinho:** 16 Mar 1997, *N. Bittencourt et al. s.n.* (PACA 93592). **São Francisco de Paula:** Mar 1926, *J. Dutra 960* (ICN), 10 Nov 1971, *L. Korner s.n.* (ICN 9282), 30 Nov 2004, *E. M. Freitas s.n.* (HVAT 1653); Fazenda Englert, 1 Jan 1954, *B. Rambo s.n.* (PACA 54750); Lajeado Grande, 15 Dec 2008, *C. R. Buzatto 457* (ICN); Parque Municipal da Ronda, 29°27'03"S, 50°35'41"W, 18 Mar 2006, *J. Brustulin 31* (PACA); Parque Paraíso da Serra, 19 Dec 1999, *R. Wasum 379* (HUCS). **Vacaria:** Passo do Socorro, 29 Dec 2016, *J. B. Castro 56* (ICN).

17. *Gomesa recurva* R.Br. in Bot. Mag. 42: t. 1748. 1815.

***Type* –** Lectotype: Brown's illustration in Bot. Mag. 42: t. 1748. 1815.

Synonyms – *Epidendrum inflexum* Vell.; *Gomesa densiflora* Hoffmanns.; *Gomesa reclinata* Hoffmanns.; *Gomesa recurva* Lodd. [Illegitimate]; *Gomesa planifolia* (Lindl.) Klotzsch ex Rchb.f.; *Gomesa planifolia* var. *crocea* Regel; *Gomesa planifolia* var. *densa* Regel; *Gomesa planifolia* var. *laxa* Regel; *Odontoglossum planifolium* (Lindl.) Rchb.f.; *Odontoglossum recurvum* (R.Br.) Rchb.f.; *Rodriguezia planifolia* Lindl.; *Rodriguezia recurva* (R.Br.) Lindl..

Etymology – Reference to the recurved lip.

Description – Figure 34. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.1-8.1cm x 1.7-3.2cm, oval to conical/oblong, ancipitous (2-edged), smooth to striate surface, without black dots, 1-2 terminal leaves. Leaves 15.2-27.7cm x 1.5-3.9cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 12-32cm, racemes, multi-flowered, two inflorescences per pseudobulb (rarely only one), flaccid, generally not exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 7-10mm x 3-4mm, free, obovate, lateral sepals 8-11mm x 2-4mm, fused from half to almost all their extension,

obovate, all sepals with cuneate base, obtuse to rounded apex, flat margin, pale yellow. Petals 7-10mm x 3-4mm, free, obovate, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat margin, pale yellow. Lip 7-9mm x 4-5mm, 1-lobed, cuneate base, rounded apex, unicolor, pale yellow. Callus longitudinal, two parallel smooth elevations, pale yellow with a vivid yellow marking at the center, entire isthmus. Column 5-7mm x 2-3mm, anther with acute rostellum, stigmatic cavity surrounded by a reddish marking with two triangular projections in its base, absence of lateral wings, absence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 36. Common in the Encosta Inferior do Nordeste. Eventual in the Encosta Superior do Nordeste, Planalto Médio and Alto Uruguai.

Habitat – Areas submitted to short frosts, in montane forests, dwelling humid places preferentially close to streams and rivers.

Flowering period – From December to February.

Notes – Similar to *Gomesa crispa* in vegetative state. They are separated by the plain flowers and lateral sepals connate for at least half of their extension in *G. recurva*, in opposition to the crispy flowers and free lateral sepals in *G. crispa*. Still, these species do not overlap on their flowering periods in the State. Both can be distinguished from the remaining species (except *G.* gomezoides) by their pendulous racemes and flowers with undivided lip, folded downwards, the longitudinal callus, almost inconspicuous, and the absence of tabula infrastigmatica. They possess larger pseudobulbs size in relation to *G. gomezoides* and resupinate flowers (vs. not resupinate in the latter). Also, *G. gomezoides* dwells only nebular forests, with more humidity.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Garibaldi:** Marcorama, Jan 1988, *M. Rossato et al. s.n.* (HUCS 3967). **Marcelino Ramos:** Feb 1927, *J. Dutra 1045* (ICN). **Morro Reuter:** Dec 2015, *J. B. Castro 4* (ICN). **Pouso Novo:** Canhada Funda, -29.181364, -52.227357, 17 Jan 2016, *J. B. Castro 35* (ICN). **Quevedos:** 27 Jan 2016, *J. B. Castro 79* (ICN), 13 Jan 2017, *J. B. Castro 53* (ICN). **São Leopoldo:** *J. Dutra 9* (ICN), 22 Sep 1933, *C. Orth s.n.* (PACA 598); Quinta S. Manoel, 5 Feb 1927, *J. Dutra 982* (ICN).

***Additional specimens examined* –** BRAZIL. SANTA CATARINA. **Anita Garibaldi:** 9 Jan 2003, *C. Rohrig, N. Silveira s.n.* (RSPF 9775); Jaboticaba do Neri, UHE Campos Novos, 14 Jan 2003, *F. Teixeira & N. Silveira s.n.* (RSPF 8491).

18. *Gomesa riograndensis* (Cogn.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009.

Type – Holotype: BRAZIL. Rio Grande do Sul, s.d., *A. Kunert s.n.* (BR no. 21455261!).

Synonyms – *Baptistonia* x *cassolana* (V.P.Castro & Campacci) Chiron & V.P.Castro; *Baptistonia riograndensis* (Cogn.) Chiron & V.P.Castro; *Oncidium* x *cassolanum* V.P.Castro & Campacci; *Oncidium riograndense* Cogn..

Etymology – From the place of origin of the typus, the State of Rio Grande do Sul, Brazil.

Description – Figure 35. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.1-12.4cm x 0.9-2cm, fusiform to terete ("cigar-like"), weakly compressed, smooth surface, without black dots, 1-2 terminal leaves. Leaves 6.4-21.5cm x 1.8-4.5cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 12-56cm, racemes or panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a membranous sheath. Flowers pedicellate, resupinate. Dorsal sepal 11-15mm x 5-8mm, free, obovate, lateral sepals 10-14mm x 4-7mm, fused from half to almost all their extension, obovate, all sepals with cuneate base, obtuse to rounded apex, flat margin, brown and yellow markings. Petals 10-16mm x 5-10mm, free, obovate, similar in size and shape to dorsal sepal, cuneate base, obtuse to rounded apex, flat margin, brown and yellow markings. Lip 8-12mm x 8-10mm, 3-lobed, lateral lobes rectangular, apical lobe expanded, truncate base, rounded apex, bicolor, yellow lateral lobes and brown/purple apical lobe. Callus tubercular, rough surface, two median tubercles connected for at least half their extension and resembling and "inverted V", brown background, entire isthmus. Column 5-7mm x 4-6mm, anther with truncate rostellum, presence of lateral wings with hook-like or arm-like shape, presence of tabula infrastigmatica (reduced).

Distribution in Rio Grande do Sul – Figure 37. Common in the Encosta Inferior do Nordeste and Alto Uruguai. Eventual in the Missões and Litoral.

Habitat – Cool montane forests to warmer lowlands, dwelling at shady places.

Flowering period – From January to April.

Notes – This species, as well as *G. cornigera*, is easily identified by their fusiform to terete and generally not compressed pseudobulbs, with the appearance of a "cigar". *G. riograndensis* and *G. cornigera* may only be separated at vegetative state if remains of inflorescences are present, which are totally pendulous in *G. cornigera* and erect to suberect in *G. riograndensis*. When flowered, they may be separated by the callus with a central structure resembling an inverted "V" and the straight lateral lobes of the lip in *G. riograndensis* against the callus with prominent horns at the basal region and the lip's lateral lobes curved and pointing upwards in *G. cornigera*.

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Boa Vista do Incra:** Fazenda Santa Maria, 21 Apr 2007, *C. R. Buzatto 287* (RSPF), 22 Apr 2006, *C. R. Buzatto s.n.* (ICN 143768). **Derrubadas:** [Tenente Portela] Parque Estadual do Turvo, 22 Mar 1988, *N. Silveira 8793* (HAS). **Osório:** [Conceição do Arroio] próximo à lagoa dos Quadros, Feb 1927, *J. Dutra 925* (ICN). **Feliz:** Morro do Carvão, 28 Mar 1975, *R. Wasum s.n.* (PACA 91971). **Giruá:** Granja Sodal, Apr 1965, *K. Hagelund 3725* (HAS). **Itaara:** 12 Mar 2016, *J. B. Castro 1* (ICN). **Jóia:** Apr 2016, *J. B. Castro 81* (ICN). **Marcelino Ramos:** Mar 1927, *J. Dutra 1101* (ICN). **Montenegro:** S. Salvador, 25 Mar 1950, *A. Sehnem s.n.* (PACA 50678). **Nova Petrópolis:** Linha Imperial, 29°21'31.29"S, 51°3'7.26"W, 18 Dec 2015, *J. B. Castro 28* (ICN). **São Francisco de Assis:** Fazenda Santa Terezinha, 1 Feb 2007, *C. R. Buzatto 282* (ICN). **São Sebastião do Caí:** Feb 1928, *J. Dutra 1102* (ICN). **Torres:** Oct 1927, *J. Dutra 1103* (ICN), 8 Jan 1975, *K. Hagelund 9044* (HAS). **Veranópolis:** Parque da Fumaça, 20 Dec 1985, *N. Silveira 3045* (HAS).

19. *Gomesa uniflora* (Booth ex Lindl.) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009.

Type – Holotype: BRAZIL. Organ Mountains, 1841, *Gardner 5873* (BM no. 1122690!), on sheet with BM no. 534457.

Synonyms – *Alatiglossum longipes* (Lindl.) Baptista; *Alatiglossum unicolor* (Rolfe) Baptista; *Alatiglossum uniflorum* (Booth ex Lindl.) Baptista; *Gomesa eurycline* (Rchb.f.) M.W.Chase & N.H.Williams; *Gomesa longipes* (Lindl.) M.W.Chase & N.H.Williams; *Gomesa unicolor* (Rolfe) M.W.Chase & N.H.Williams; *Kleberiella longipes* (Lindl.) V.P.Castro & Cath.; *Kleberiella unicolor* (Rolfe) V.P.Castro & Cath.; *Kleberiella uniflora*

(Booth ex Lindl.) V.P.Castro & Cath.; *Oncidium biflorum* Barb.Rodr.; *Oncidium eurycline* Rchb.f.; *Oncidium hasslerii* Cogn.; *Oncidium janeirense* Rchb.f.; *Oncidium longipes* Lindl.; *Oncidium longipes* var. *monophyllum* Regel; *Oncidium monophyllum* (Regel) Herter; *Oncidium oxyacanthosmum* Rchb.f. ex Linden; *Oncidium unicolor* Rolfe; *Oncidium uniflorum* Booth ex Lindl.; *Oncidium uniflorum* var. *robustum* Regel.

Etymology – Reference to the reduced inflorescences, displaying only one flower per floral scape.

Description – Figure 38. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 2.2-5.6cm x 0.4-1.6cm, conical/oblong, ancipitous (2-edged), striate to sulcate surface, without black dots, 1-2 terminal leaves. Leaves 8.3-25.2cm x 1-2.1cm, oblong, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 8.9-16.3cm, racemes, 1-10-flowered, one inflorescence per pseudobulb, rigid, not exceeding the length of leaves, subtended by a chartaceous sheath. Flowers pedicellate, resupinate. Dorsal sepal 10-19mm x 7-13mm, free, elliptic to spatulate, lateral sepals 17-22mm x 4-12mm, fused until half their extension, obovate to spatulate, all sepals with cuneate to attenuate base, acute to rounded apex, flat to undulated margin, yellow and brown markings (there is an all-brown variation). Petals 10-18mm x 6-10mm, free, obovate to spatulate, similar in size and shape to dorsal sepal, cuneate to attenuate base, acute to rounded apex, flat to undulated margin, yellow and brown markings (there is an all-brown variation). Lip 14-24mm x 15-21mm, 3-lobed, lateral lobes elliptic to obovate, apical lobe expanded, truncate base, emarginate to rounded apex, unicolor, yellow. Callus tubercular, tubercles aggregated at the central region, yellow/white and orange/brown background, fimbriate to denticulate isthmus. Column 5-8mm x 4-6mm, anther with acute rostellum, presence of lateral wings, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 40. Common in the Depressão Central, Encosta Inferior do Nordeste and Litoral. Eventual in the Alto Uruguai, Planalto Médio and Serra do Sudeste.

Habitat – Cool montane forests to warmer lowlands, at shady places, sometimes close to forest borders.

Flowering period – Between April-May and October-November.

Notes – Identified in field by their clumps with many narrow pseudobulbs and oblong leaves, and small floral scapes with no more than 5 flowers, generally. Along with *Gomesa barbata*, is the only species to display fimbriate isthmus, but easily distinguished from this species by the shape of their pseudobulbs, ancipitous (2-edged) in *G. uniflora* and tetragonal (4-edged) in *G. barbata*. The inflorescences may be reduced to only one flower or present from 2-5 flowers (rarely more than 5).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Arroio dos Ratos:** Fazenda Faxinal, 2 Oct 1979, *K. Hagelund 13131* (HAS), 2 Nov 1979, *K. Hagelund 13155* (HAS), 16 Oct 1980, *K. Hagelund 13475* (ICN). **Caçapava do Sul:** Gruta da Varzinha, 31 Oct 1999, *R Wasum 222* (HUCS). **Campo Bonito:** BR 101, km 6, 10 Feb 1983, *A. Krapovickas & C. L. Cristóbal 38534* (HAS). **Canoas:** Itabuí, 6 Oct 1973, *K. Hagelund 6964* (ICN). **Esteio:** estrada para São Leopoldo, 24 Nov 1948, *B. Rambo s.n.* (PACA 38362). **Guaíba:** Fazenda São Maximiano, BR 116, km 308, 12 Nov 2006, *C. R. Buzatto 189* (ICN); Passo do Petim, Fazenda São Maximiano, Cerro do Poeta, 11 Oct 1993, *V. F. Nunes 1349* (ICN). **Machadinho:** Linha Monjolinho, 4 Aug 2000, *A. Wilt s.n.* (HAS 39006). **Passo Fundo:** Bosque Lucas Araújo, 1 Sep 1987, *V. Menegazzo, A. Peacheco & N. Menegazzo s.n.* (RSPF 3596), 30 Sep 1994, *M. Antonio s.n.* (RSPF 5052). **Porto Alegre:** Belém Novo, Nov 1929, *J. Dutra 1116* (ICN); Campus do Vale UFRGS, 20 Apr 2016, *J. B. Castro 20* (ICN); Glória, 20 Sep 1931, *C. Orth s.n.* (PACA 212), Oct 1944, *B. Rambo s.n.* (PACA 26944), 12 Dec 1945, *B. Rambo s.n.* (PACA 33143), 1946, *B. Rambo s.n.* (PACA 34458); Ipanema, 25 Oct 1945, *K. Emrich s.n.* (PACA 30169); Morro Santana, 4 Nov 1939, *Ir. Augusto s.n.* (ICN 19415). **Rio Grande:** Centro, 3 Sep 1986, *T. Vinagre s.n.* (HURG 2075), *T. Vinagre s.n.* (HURG 2092). **Santana da Boa Vista:** Serra do Apertado, 3 Nov 1995, *J. A. Jarenkow & M. Sobral 2853* (PEL). **São Francisco de Paula:** CPCN Pró-Mata PUCRS, 23 Nov 2016, *J. B. Castro 66* (ICN). **São Jerônimo:** Pólo Carboquímico, nas margens do rio Jacuí, 15 Dec 1982, *M. L. Abruzzi 751* (HAS). **São Leopoldo:** Morro das Pedras, *J. Dutra 959* (ICN). **Torres:** Perdida, 30 Oct 1992, *J. A. Jarenkow 2175* (PEL); Vila São João, 19 Nov 1977, *J. L. Waechter 671* (ICN). **Três Cachoeiras:** [Torres] Morro Azul, 25 Mar 1977, *J. L. Waechter 478* (ICN). **Triunfo:** estrada para Taquari, 24 Sep 1987, *N. Silveira 9354* (HAS). **Viamão:** Bairro Tarumã, próximo ao Lago Tarumã, -30.069048, -51.017042, 5 Oct 2008, *P. J. S. Silva Filho 434* (ICN); Ilha dos Juncos, *A. D. Nilson 26* (HAS); Morro do Coco, 30 May 1983, *K. Potter s.n.* (HAS 18907); Parque Estadual de Itapuã, 25 Oct 1975, *J. L. Waechter 197* (ICN),

21 Oct 1990, *N. Hausen s.n.* (PACA 93589); Parque Saint'Hilaire, 24 Oct 1976, *J. L. Waechter 352* (ICN).

***Additional specimens examined* –** BRAZIL. PARANÁ. **Bocaiúva do Sul:** Serra da Bocaina, 11 Nov 1998, *J. M. Silva & L. M. Abe 2606* (HUCS). **Ponta Grossa:** rio Tibagi, 14 Jan 1988, *R. Kummrow 3003* (HUCS). SANTA CATARINA. **Lauro Muller:** Rio do Meio, 20 Mar 1959, *Reitz & Klein 8689* (HBR, PACA). **Palhoça:** Morro do Cambirela, 5 Apr 1972, *A. Brasolin 541* (ICN).

20. *Gomesa venusta* (Drapiez) M.W.Chase & N.H.Williams in Ann. Bot. (Oxford) 104(3): 398. 2009.

***Type* –** Lectotype: Drapiez's illustration in Hort. Belge 3: t. 49. 1836.

Synonyms – *Baptistonia venusta* (Drapiez) Docha Neto; *Baptistonia venusta* (Drapiez) Chiron; *Campaccia venusta* (Drapiez) Baptista, P.A.Harding & V.P.Castro; *Carenidium venustum* (Drapiez) Baptista; *Oncidium dimorphum* Regel; *Oncidium galeatum* Scheidw.; *Oncidium ornithocephaloides* Kraenzl.; *Oncidium rhynchophorum* Schltr. ex Hoehne; *Oncidium trulliferum* Lindl.; *Oncidium venustum* Drapiez.

Etymology – From the Latin, lovely, charming.

Description – Figure 39. Epiphytic herbs with pseudobulbs clustered on a short rhizome. Pseudobulbs 3.6-20.6cm x 1.5-3.4cm, fusiform to oblong (sometimes oval when young), ancipitous (2-edged) or weakly compressed, smooth surface, without black dots, 2-3 terminal leaves. Leaves 7.9-26.4cm x 2.4-5.5cm, elliptic to oblanceolate, chartaceous, permanently folded in the base, acute apex, entire margin. Inflorescences 30-61cm, panicles, multi-flowered, one inflorescence per pseudobulb, rigid, exceeding the length of leaves, subtended by a membranous sheath. Flowers pedicellate, resupinate. Dorsal sepal 4-7mm x 4-6mm, free, elliptic, arched over the column, lateral sepals 5-8mm x 4-6mm, fused only at the base, elliptic, all sepals with cuneate base, obtuse to rounded apex, flat to undulated margin, yellow (with few brown markings). Petals 5-8mm x 5-7mm, free, elliptic, similar in size and shape to dorsal sepal (but not arched over the column), cuneate base, obtuse to rounded apex, flat to undulated margin, yellow and brown markings. Lip 10-13mm x 9-11mm, 3-lobed, lateral lobes elliptic, apical lobe expanded, truncate base, rounded apex, bicolor, yellow with

brown markings. Callus tubercular, smooth surface, tubercles aggregated at the central region, forming a V-shaped structure, yellow and brown background, entire isthmus. Column 5-7mm x 3-4mm, anther with acute rostellum ("beak-like"), presence of lateral wings assuming the shape of elevated arms, presence of tabula infrastigmatica.

Distribution in Rio Grande do Sul – Figure 41. In Rio Grande do Sul, restricted to the Litoral, in the municipalities of Osório, Maquiné and Torres.

Habitat – Cool montane forests in the coastal region, at median altitudes.

Flowering period – From February to March.

Notes – Belongs to the "cigar-like" pseudobulbs group, despite being more robust and somewhat compressed. From *Gomesa cornigera* and *G. riograndensis* it may be differentiated by the expanded callus region (vs. narrow callus region) and by the acute rostellum (vs. truncate rostellum).

Specimens examined – BRAZIL. RIO GRANDE DO SUL. **Osório:** [Conceição do Arroio] próximo à lagoa dos Quadros, Feb 1927, *J. Dutra 1104* (ICN). **Maquiné:** estrada para a cascata do Garapiá, 29°31'22.2"S, 50°14'52.2"W, 2 Mar 2016, *J. B. Castro 80* (ICN). **Torres:** Feb 1927, *J. Dutra 918* (ICN); Faxinal, 22 Feb 1979, *J. L. Waechter 1192* (ICN).

EXCLUDED SPECIES

Gomesa albinoi **(Schltr.) M.W.Chase & N.H.Williams -** It is a valid species. Some authors consider this species as a hybrid between *G. cornigera* and *G. riograndensis* and others as a variation of *G. riograndensis*. Indeed, it resembles the latter species both in vegetative and floral features. However, we did not find any register either in herbaria or in field of such variation in Rio Grande do Sul.

Gomesa brieniana **(Rchb.f.) M.W.Chase & N.H.Williams** – It is a valid species. However, the herbarium register of that species in the State was a specimen of *G. riograndensis* (HAS 82510).

Gomesa cruciata **(Rchb.f.) M.W.Chase & N.H.Williams** – It is a valid species. However, the herbarium registers of that species in the State were specimens of *G. riograndensis* (J. Dutra #1101 – ICN; ICN 143768; RSPF 11485) and *G. cornigera* (PACA 36004).

***Gomesa cuneata* (Scheidw.) M.W.Chase & N.H.Williams** – It is a valid species. Though, we did not find any register either in herbaria or in field of the plant's presence in Rio Grande do Sul. Maybe it was misidentified, due to the occurrence of a white variety in flowers of *G. cornigera*, seen that both species are similar in terms of vegetative structures.

***Gomesa divaricata* Hoffmanns. ex Schltr.** – It is a valid species. Still, easy to be confused with *G. recurva*, so that some authors consider both as a single species. However, its register to Rio Grande do Sul was probably a *G. crispa* specimen (J. Dutra #29 – ICN). All these species are similar both in vegetative and reproductive states. We did not find any register either in herbaria or in the field.

***Gomesa duseniana* Kraenzl. –** It is a valid species. However, we did not find any register either in herbaria or in the field of the plant's presence in Rio Grande do Sul. Some authors treat *G. duseniana* and *G. crispa* as a singles species, so it was probably a misidentification.

***Gomesa fuscans* (Rchb.f.) M.W.Chase & N.H.Williams –** Probably a synonym of *G. barbaceniae*, although we were not able to see the type material.

***Gomesa leinigii* (Pabst) M.W.Chase & N.H.Williams –** It is a valid species. However, we did not find any register either in herbaria or in field of the plant's presence in Rio Grande do Sul. In vegetative state resembles both *G. cornigera* and *G. riograndesis.*

***Gomesa macronyx* (Rchb.f.) M.W.Chase & N.H.Williams** – Probably a synonym of *G. longicornu*, although we were not able to see the type material.

***Gomesa micropogon* (Rchb.f.) M.W.Chase & N.H.Williams –** Probably a synonym of *G. barbata*, although we were not able to see the type material.

***Gomesa praetexta* (Rchb.f.) M.W.Chase & N.H.Williams –** Probably a synonym of *G. pectoralis*, although we were not able to see the type material.

***Gomesa varicosa* (Lindl.) M.W.Chase & N.H.Williams** – It is a valid species. However, the herbarium register of that species in the State was a specimen of *G. bifolia* (PACA 84974). In fact, both species are similar, *G. varicosa* is more huge and with broader lateral lobes. This species is usually cultured, being sold in supermarkets as an ornamental plant.

***Gomesa widgrenii* (Lindl.) M.W.Chase & N.H.Williams** – It is a valid species. Resembles *G. riograndensis* both in vegetative and reproductive structures. In fact, the specimen cited to Rio Grande do Sul was actually a *G. riograndensis* individual (J. Dutra #1102 – ICN).

CONCLUSION

From the results of this study, the use of 13 names previously cited to the State's flora should be supressed (already justified in the "excluded species" session) and 3 names not mentioned before should be added, *Gomesa barbaceniae* (Lindl.) M.W.Chase & N.H.Williams, *G. imperatoris-maximiliani* (Rchb.f.) M.W.Chase & N.H.Williams and *G. pectoralis* (Lindl.) M.W.Chase & N.H.Williams. Throughout the work, 79 exsiccates were deposited in the ICN herbarium, seeking to cover a wide variety of sites and information and avoiding repetitions. The distributions of most of the species were expanded. Studies that describe species and their morphological and ecological features show fundamental importance for the knowledge of the local flora, especially when it comes to botanical families of great economic interest, as is the case of Orchidaceae, due to its ornamental potential. In this way, their appreciation is favored and subsidies are offered for the sustainable exploitation of all this richness, which is often ignored or unknown for most people.

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TABLE 1. List of species mentioned to occur in Rio Grande do Sul, Brazil, according to exsiccates in the herbaria (Species Link), Flora do Brasil and Flora Digital do Rio Grande do Sul e de Santa Catarina websites. Herb. = Herbaria; FB = Flora do Brasil (Reflora); FD = Flora Digital/RS (UFRGS); * = Confirmed occurrence.

SPECIES	HB	FB	FD
Gomesa albinoi (Schltr.) M.W.Chase & N.H.Williams		X	
Gomesa barbata (Lindl.) M.W.Chase & N.H.Williams *	X		X
Gomesa bifolia (Sims) M.W.Chase & N.H.Williams *	X	X	X
Gomesa brieniana (Rchb.f.) M.W.Chase & N.H.Williams		X	X
Gomesa ciliata (Lindl.) M.W.Chase & N.H.Williams	X	X	X
Gomesa concolor (Hook.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa cornigera (Lindl.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa crispa (Lindl.) Klotzsch ex Rchb.f. *	X	X	X
Gomesa cruciata (Rchb.f.) M.W.Chase & N.H.Williams	X	X	
Gomesa cuneata (Sheidw.) M.W.Chase & N.H.Williams		X	
Gomesa divaricata Hoffmans. ex Schltr.		X	X
Gomesa duseniana Kraenzl.		X	X
Gomesa flexuosa (Lodd.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa fuscans (Rchb.f.) M.W.Chase & N.H.Williams	X		
Gomesa gardneri (Lindl.) M.W.Chase & N.H.Williams	X		
Gomesa gomezoides (Barb.Rodr.) Pabst *	X	X	
Gomesa gravesiana (Rolfe) M.W.Chase & N.H.Williams	X	X	X
Gomesa handroi (Hoehne) Pabst	X		
Gomesa hookeri (Rolfe) M.W.Chase & N.H.Williams *	X	X	X
Gomesa hydrophila (Barb.Rodr.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa leinigii (Pabst) M.W.Chase & N.H.Williams	X		
Gomesa loefgrenii (Cogn.) M.W.Chase & N.H.Williams		X	X
Gomesa longicornu (Mutel) M.W.Chase & N.H.Williams *	X	X	
Gomesa longipes (Lindl.) M.W.Chase & N.H.Williams	X	X	X
Gomesa macronyx (Rchb.f.) M.W.Chase & N.H.Williams	X	X	X
Gomesa micropogon (Rchb.f.) M.W.Chase & N.H.Williams	X	X	X
Gomesa montana (Barb.Rodr.) M.W.Chase & N.H.Williams	X	X	X

TABLE 1 (continued). List of species mentioned to occur in Rio Grande do Sul, Brazil, according to exsiccates in the herbaria (Species Link), Flora do Brasil and Flora Digital do Rio Grande do Sul e de Santa Catarina websites. Herb. = Herbaria; FB = Flora do Brasil (Reflora); FD = Flora Digital/RS (UFRGS); * = Confirmed occurrence.

SPECIES	*HB*	FB	FD
Gomesa paranensoides M.W.Chase & N.H.Williams *	X	X	X
Gomesa planifolia (Lindl.) Klotzsch ex Rchb.f.	X	X	X
Gomesa praetexta (Rchb.f.) M.W.Chase & N.H.Williams			X
Gomesa radicans (Rchb.f.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa ranifera (Lindl.) M.W.Chase & N.H.Williams *	X	X	
Gomesa recurva R.Br. *		X	
Gomesa riograndensis (Cogn.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa uniflora (Booth ex Lindl.) M.W.Chase & N.H.Williams *	X	X	X
Gomesa varicosa (Lindl.) M.W.Chase & N.H.Williams	X		
Gomesa venusta (Drapiez) M.W.Chase & N.H.Williams *	X	X	X
Gomesa widgrenii (Lindl.) M.W.Chase & N.H.Williams	X		

TABLE 2. Physiographic regions and localities visited in field expeditions.

REGION	CITIES	NUMBER OF *Gomesa* spp.
Litoral	Arroio do Sal, Dom Pedro de Alcântara, Itati, Maquiné, Osório, Torres, Três Cachoeiras	10
Campos de Cima da Serra	Bom Jesus, Cambará do Sul, Esmeralda, Jaquirana, Pinhal da Serra, São Francisco de Paula, São José dos Ausentes, Vacaria	12
Encosta Superior do Nordeste	Caxias do Sul, Criúva, Flores da Cunha	8
Encosta Inferior do Nordeste	Morro Reuter, Nova Petrópolis, Riozinho, Santa Maria do Herval, São Leopoldo, Taquara, Três Coroas	14
Depressão Central	Alvorada, Guaíba, Lombas, Porto Alegre, Santa Maria, Taquari, Viamão	10
Serra do Sudeste	Barrocada, Caçapava do Sul	4
Encosta do Sudeste	Arambaré, Camaquã, Tapes	4
Planalto Médio	Cruz Alta, Itaara, Ivorá	7
Alto Uruguai	Derrubadas	4
Missões	Santana do Livramento, São Francisco de Assis	1
Campanha	Aceguá, Alegrete, Bagé, Caverá	0

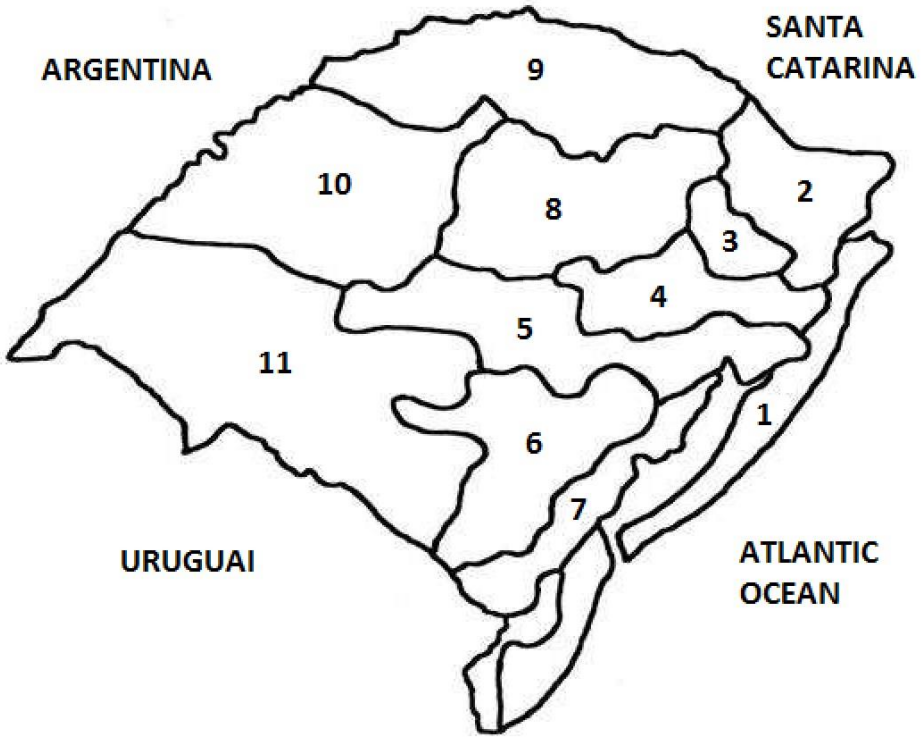

FIG. 1. Physiographic regions of Rio Grande do Sul. 1 = Litoral. 2 = Campos de Cima da Serra. 3 = Encosta Superior do Nordeste. 4 = Encosta Inferior do Nordeste. 5 = Depressão Central. 6 = Serra do Sudeste. 7 = Encosta do Sudeste. 8 = Planalto Médio. 9 = Alto Uruguai. 10 = Missões. 11 = Campanha. (Source: Modified from Fortes, 1959).

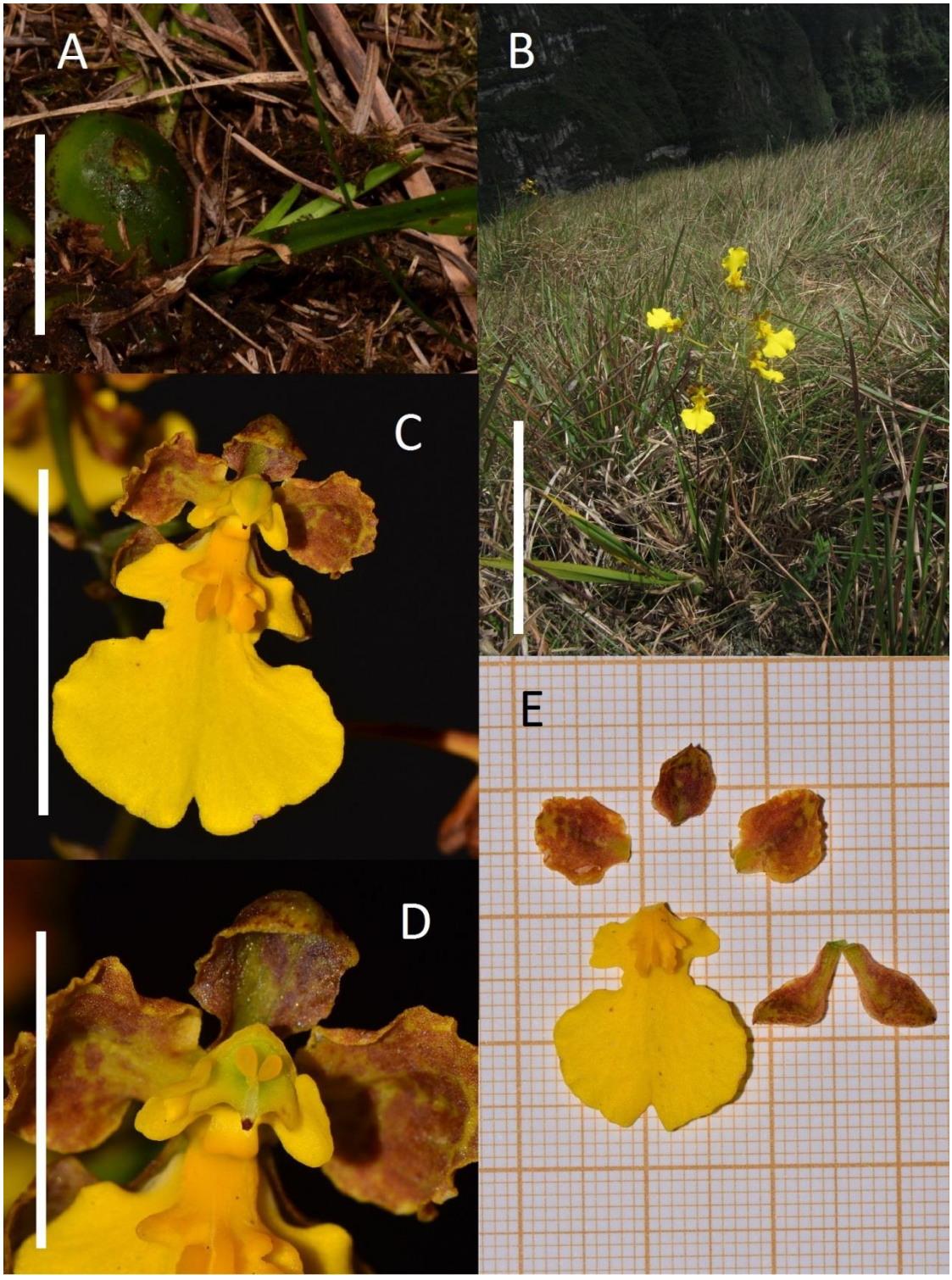

FIG. 2. *Gomesa barbaceniae*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A and C) = 2cm; (B) = 20cm; (D) = 1cm.

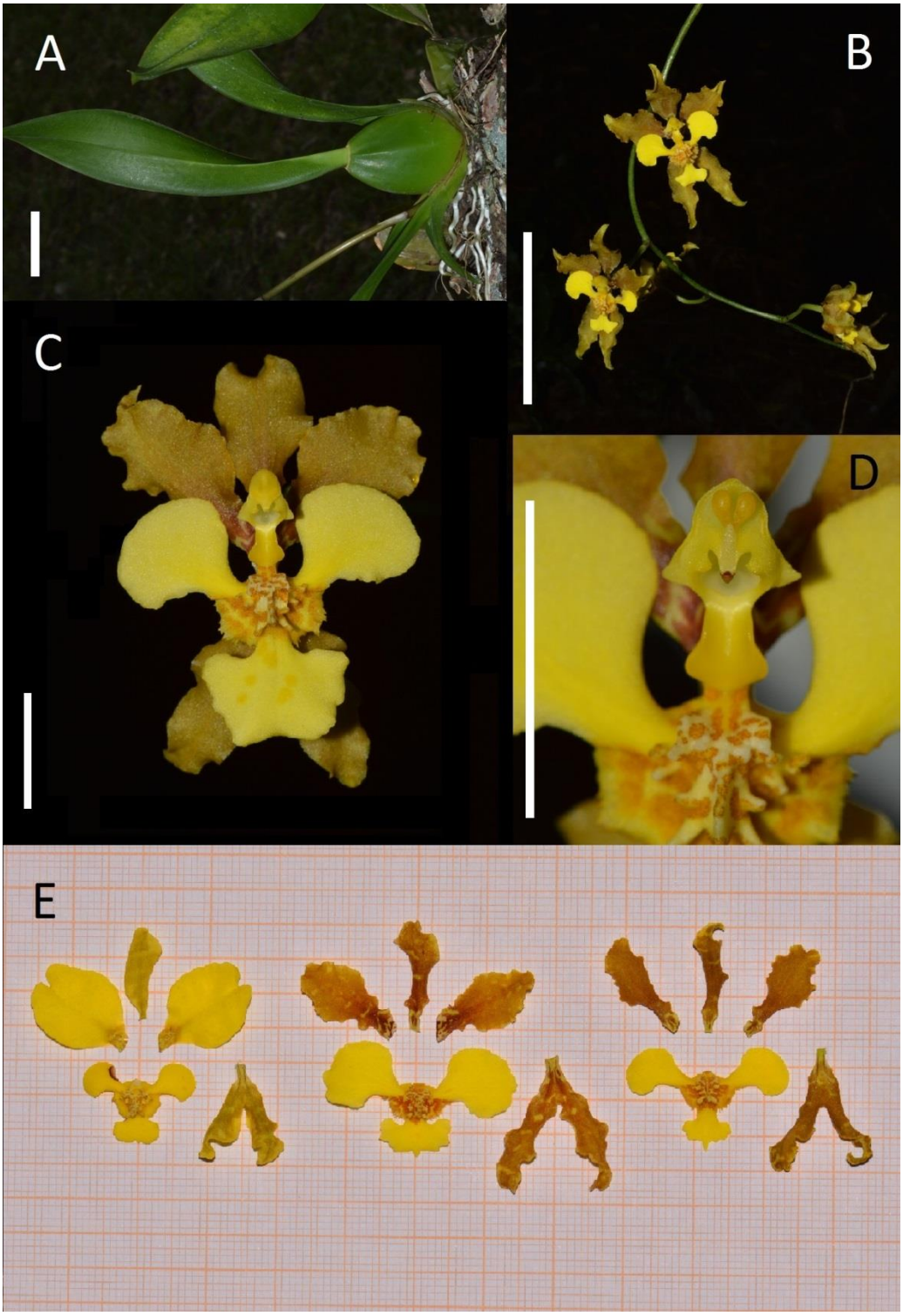

FIG. 3. *Gomesa barbata*. A. Habit and vegetative structures. B. Inflorescence. C) Frontal view of a variation of flower. D. Detail of callus, column and pollinarium. E. Distended perianth of three variations in the flowers's format and coloration. Scale bars (A) = 2cm; (B) = 5cm; (C-D) = 1cm.

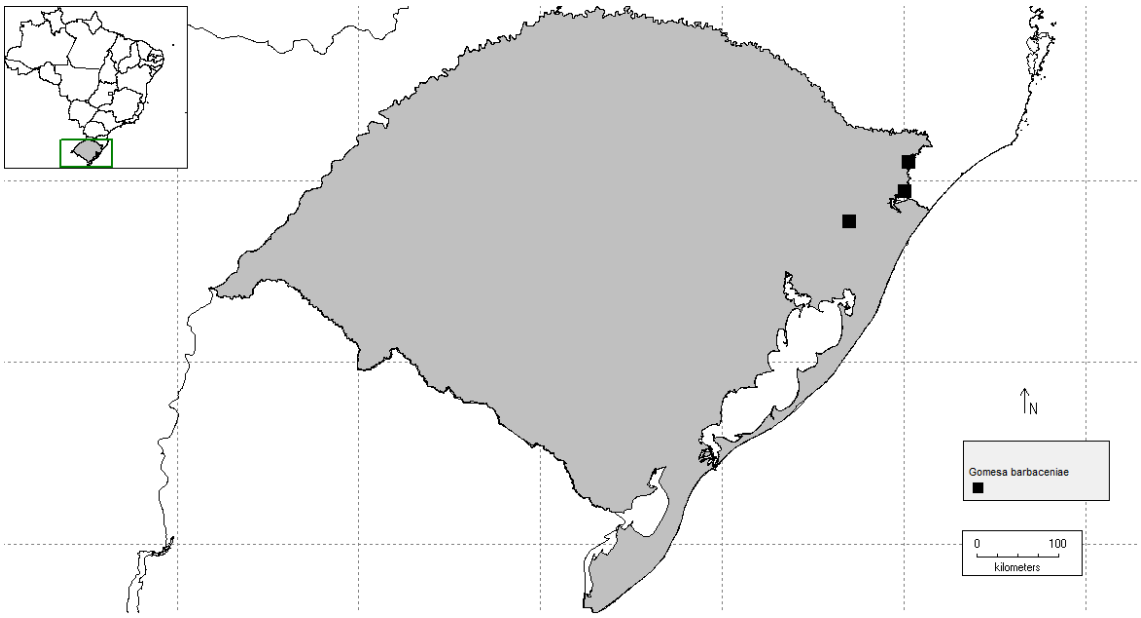

FIG. 4. Distribution of *Gomesa barbaceniae* in Rio Grande do Sul.

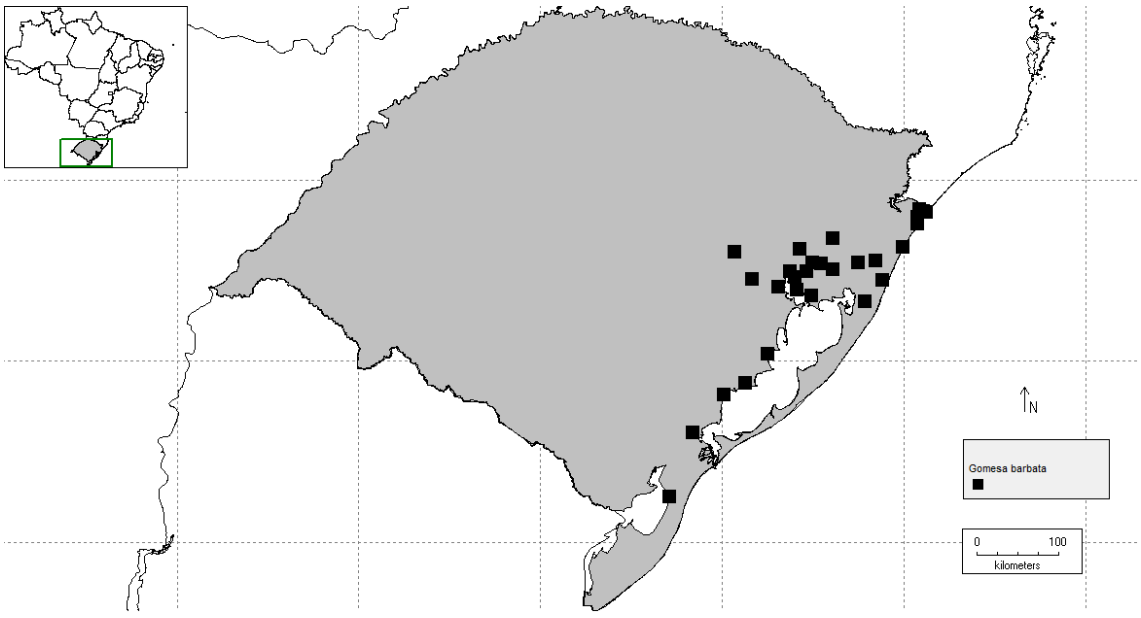

FIG. 5. Distribution of *Gomesa barbata* in Rio Grande do Sul.

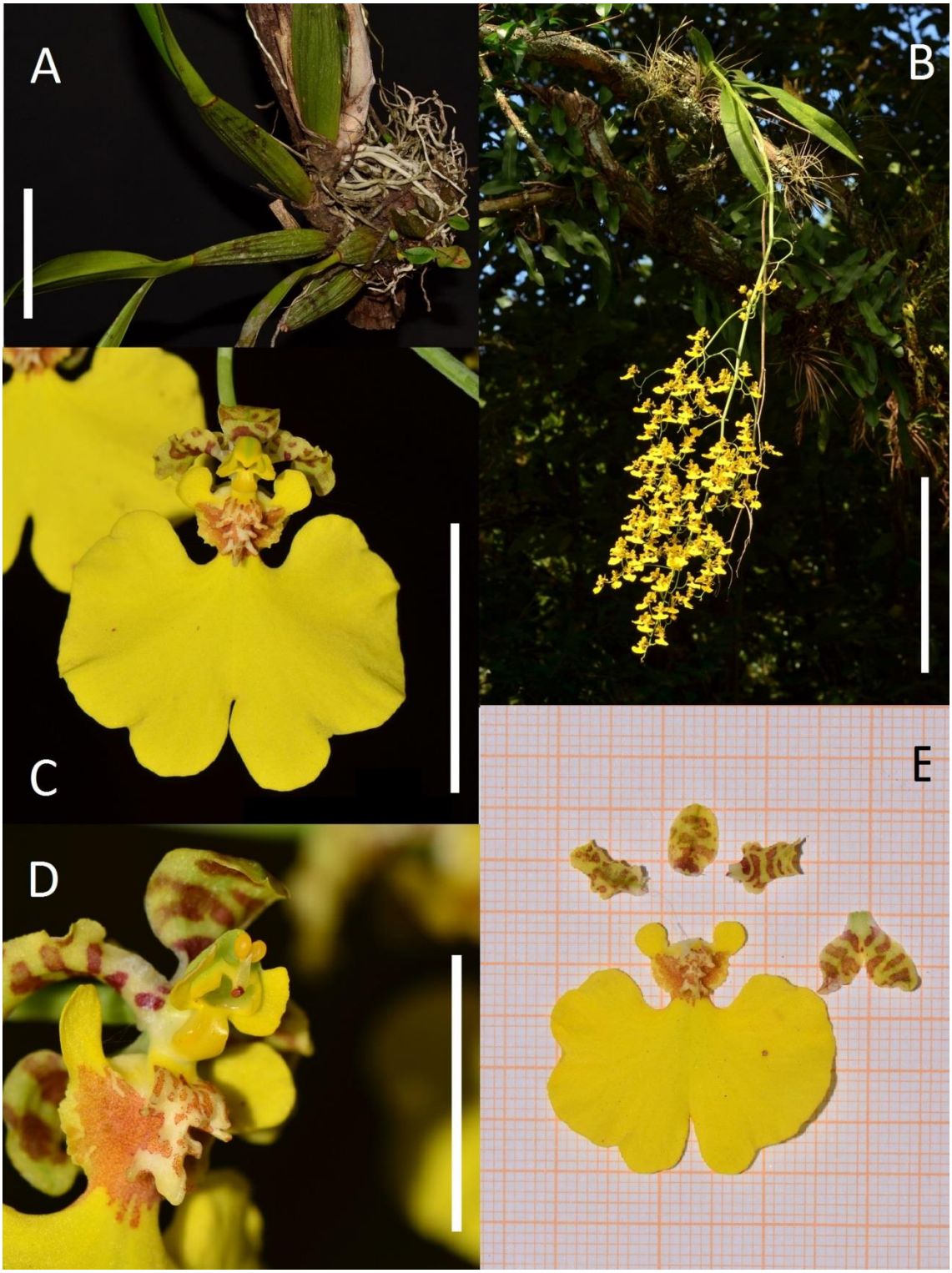

FIG. 6. *Gomesa bifolia*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 30cm; (C) = 2cm; (D) = 1cm.

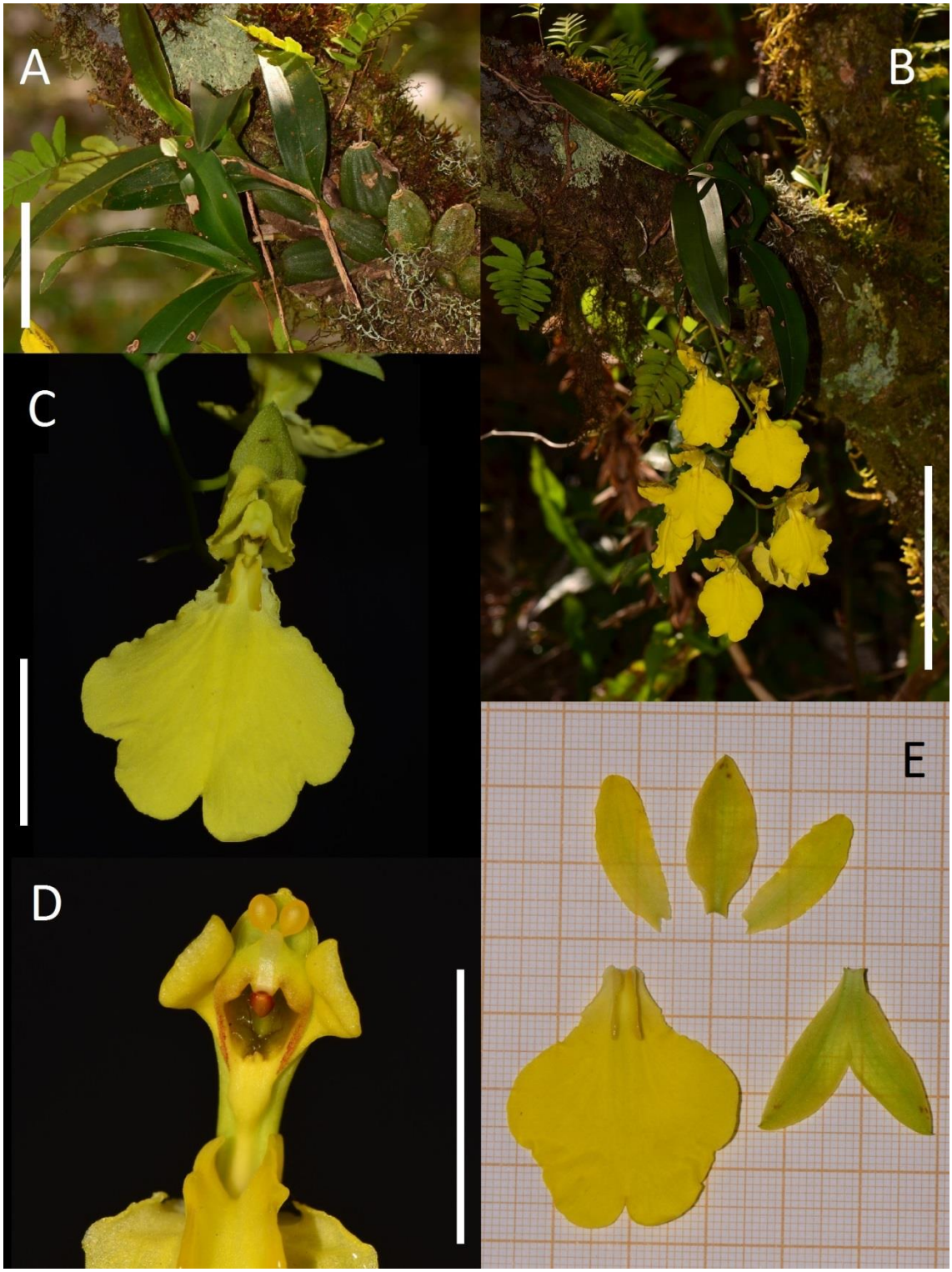

FIG. 7. *Gomesa concolor*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 10cm; (C) = 2cm; (D) = 1cm.

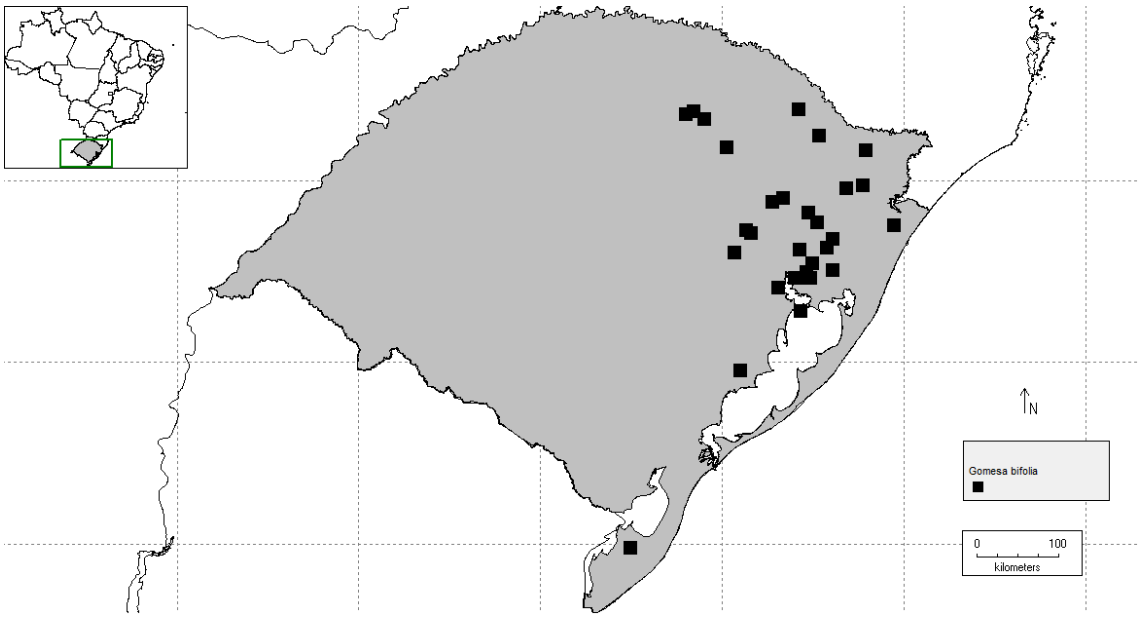

FIG. 8. Distribution of *Gomesa bifolia* in Rio Grande do Sul.

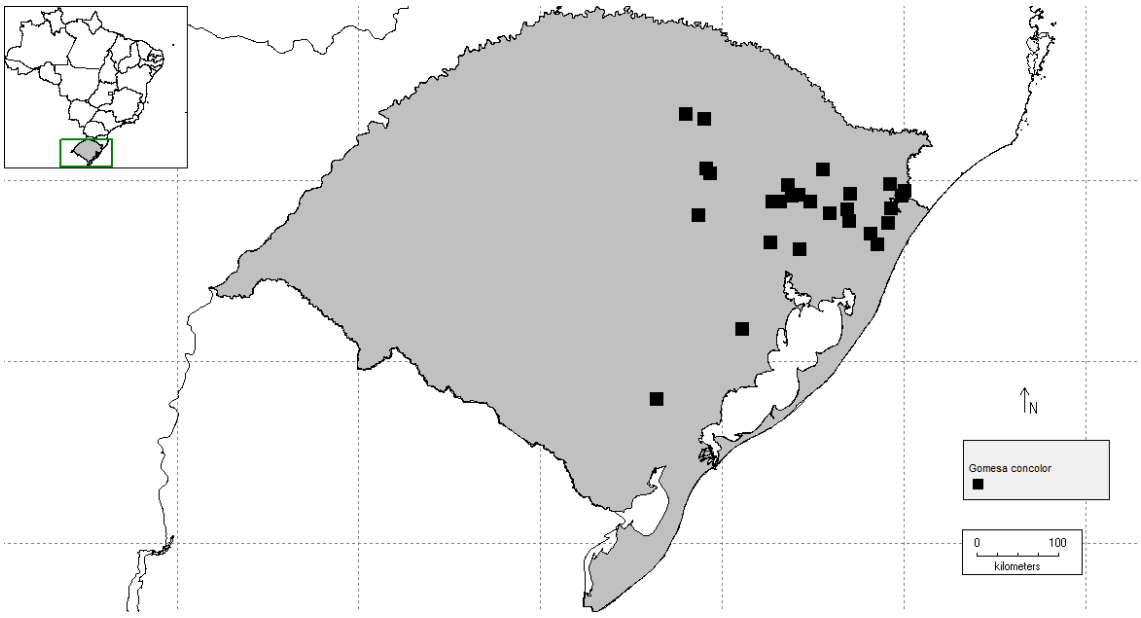

FIG. 9. Distribution of *Gomesa concolor* in Rio Grande do Sul.

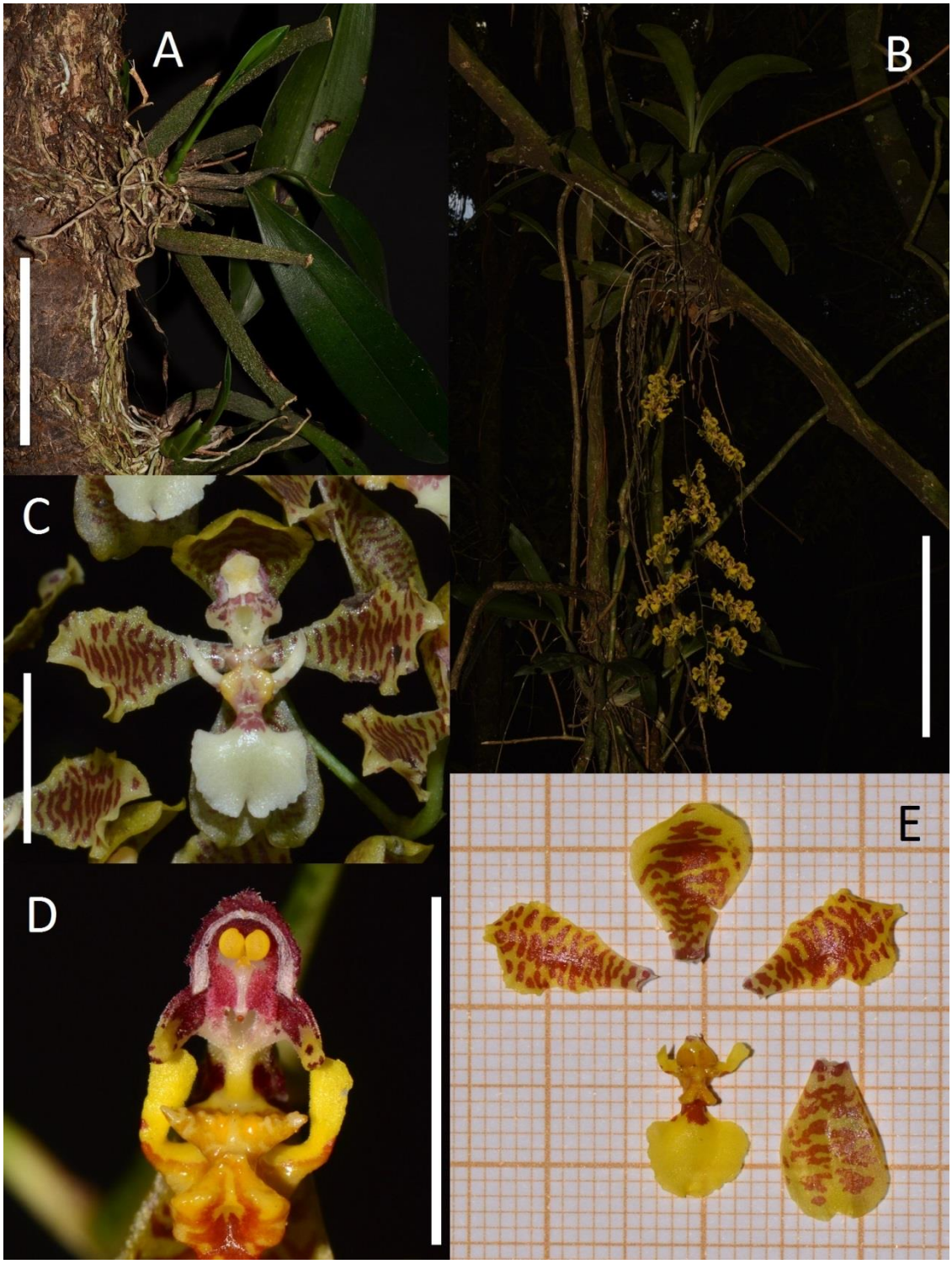

FIG. 10. *Gomesa cornigera*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of a variation of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 10cm; (C-D) = 1cm.

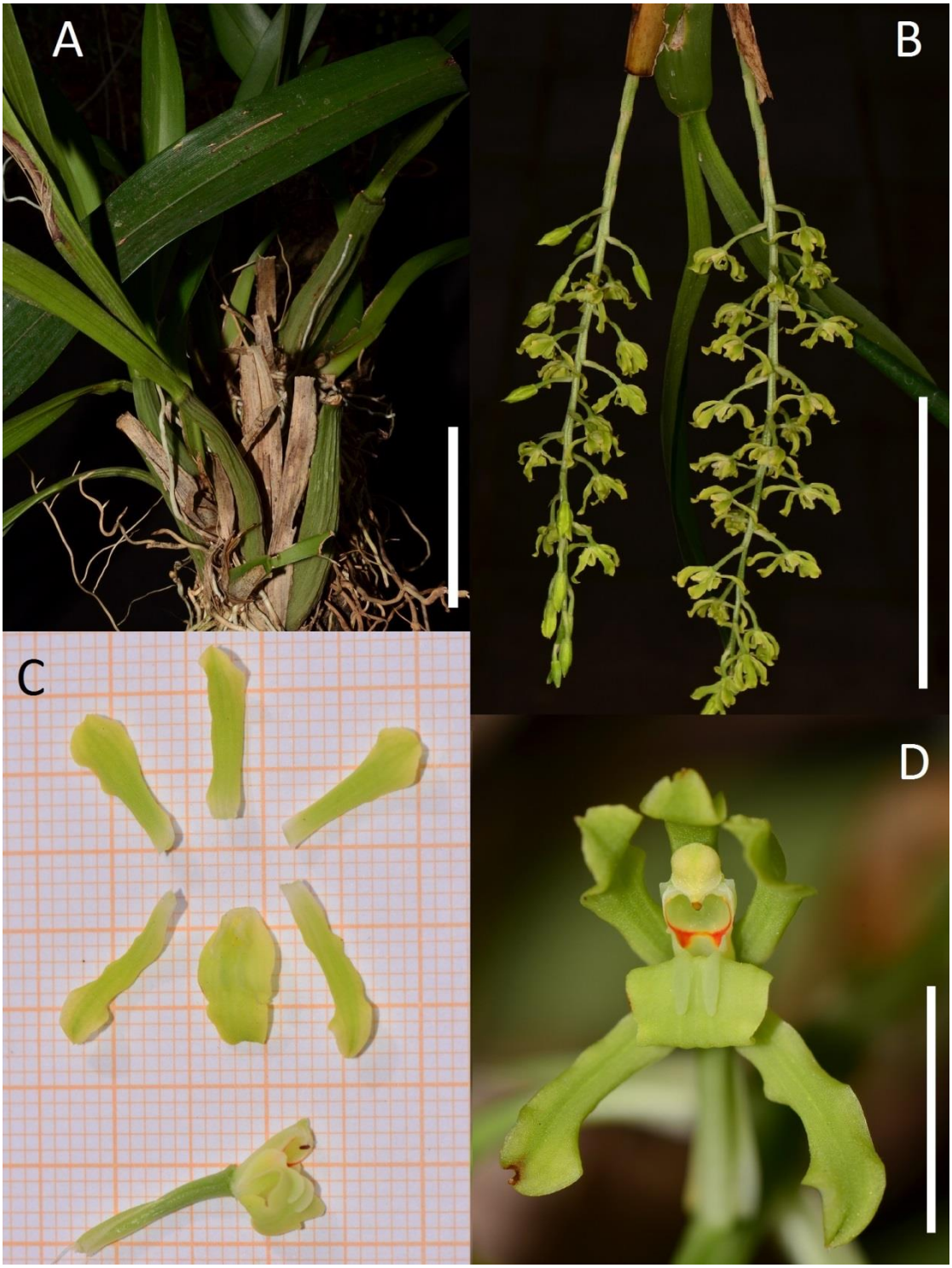

FIG. 11. *Gomesa crispa*. A. Vegetative structures. B. Inflorescences, note the presence of one at each side of the pseudobulb. C. Distended perianth. D. Frontal view of flower. Scale bars (A) = 5cm; (B) = 10cm; (D) = 1cm.

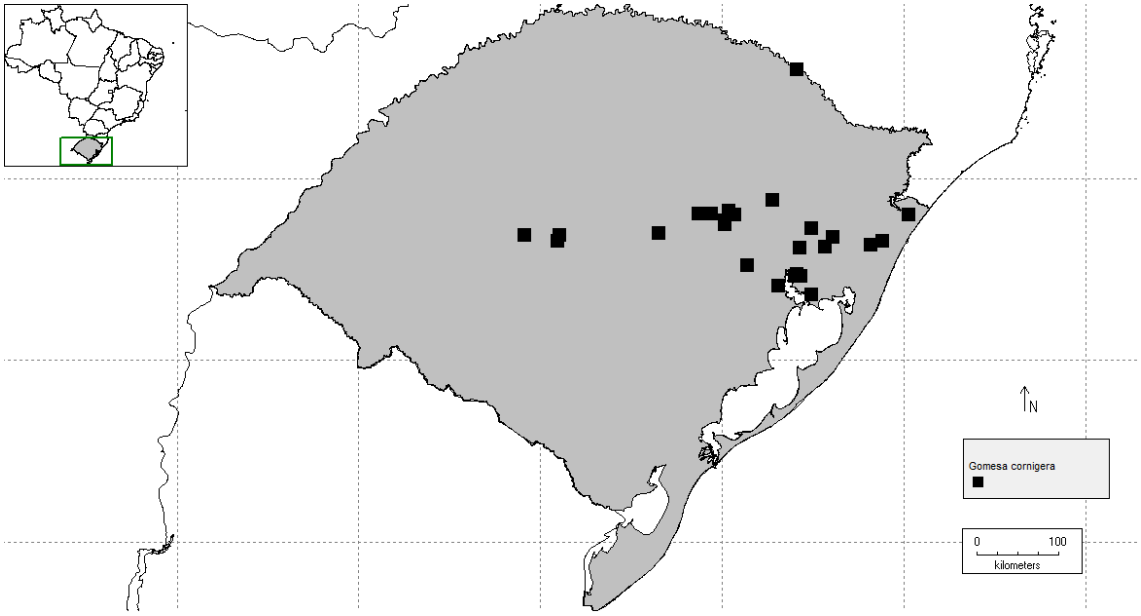

FIG. 12. Distribution of *Gomesa cornigera* in Rio Grande do Sul.

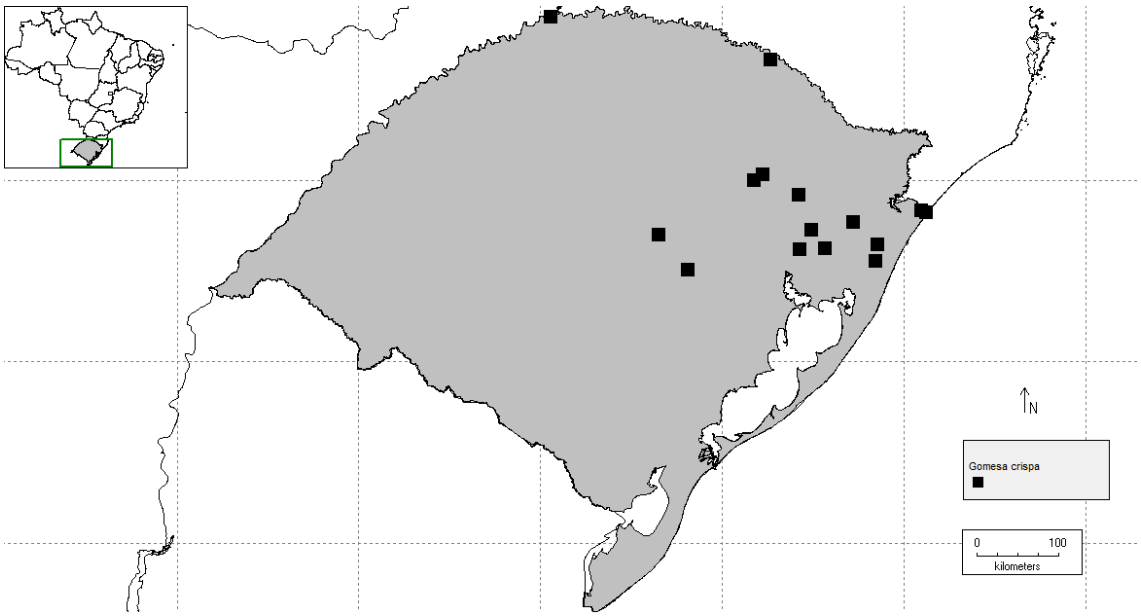

FIG. 13. Distribution of *Gomesa crispa* in Rio Grande do Sul.

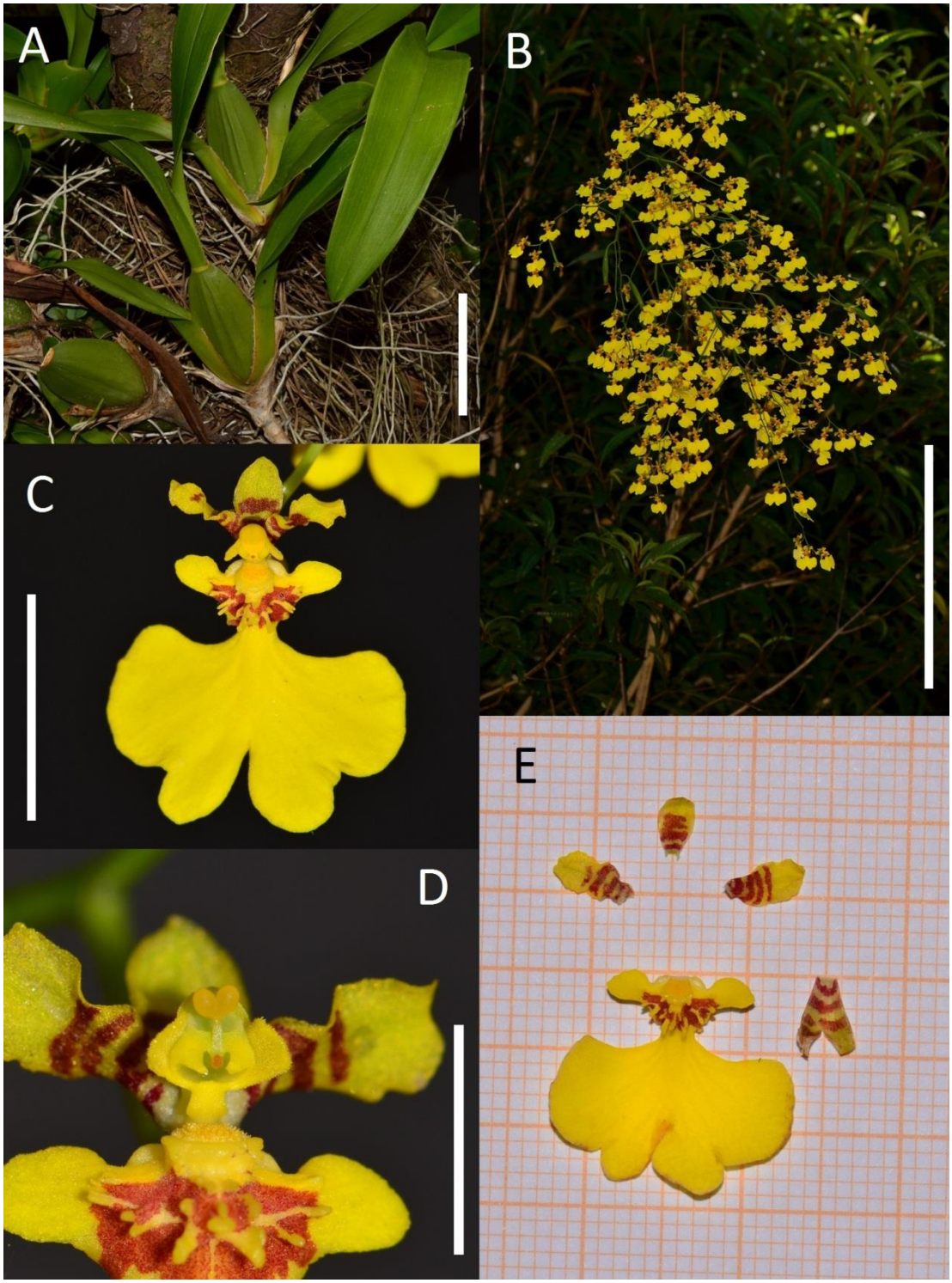

FIG. 14. *Gomesa flexuosa*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 20cm; (C) = 1cm; (D) = 5mm.

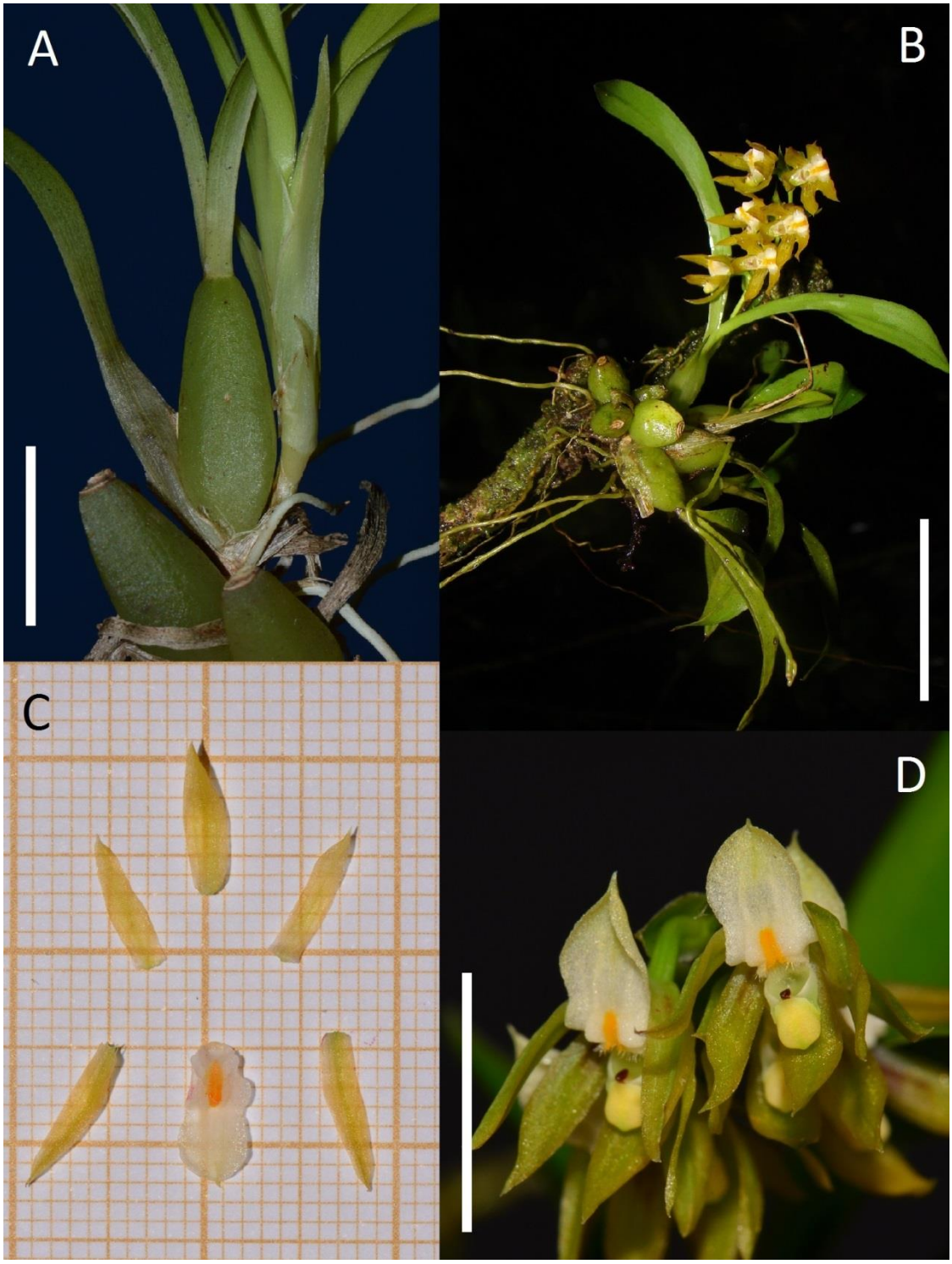

FIG. 15. *Gomesa gomezoides*. A. Vegetative structures. B. Habit and inflorescence. C. Distended perianth. D. Frontal view of flower. Scale bars (A) = 2cm; (B) = 5cm; (D) = 1cm.

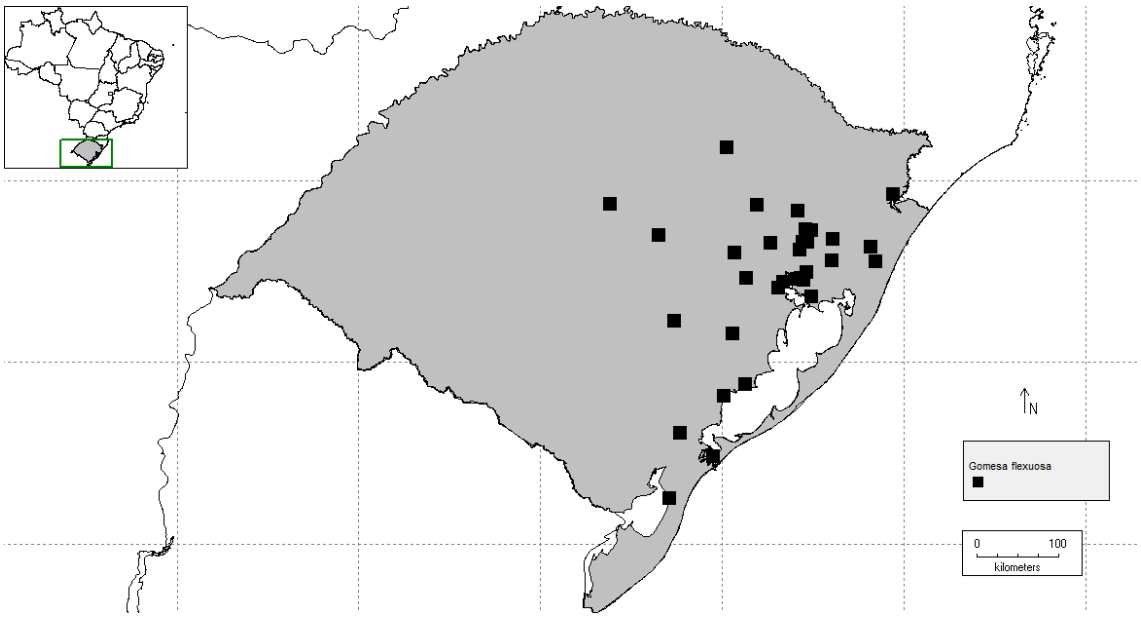

FIG. 16. Distribution of *Gomesa flexuosa* in Rio Grande do Sul.

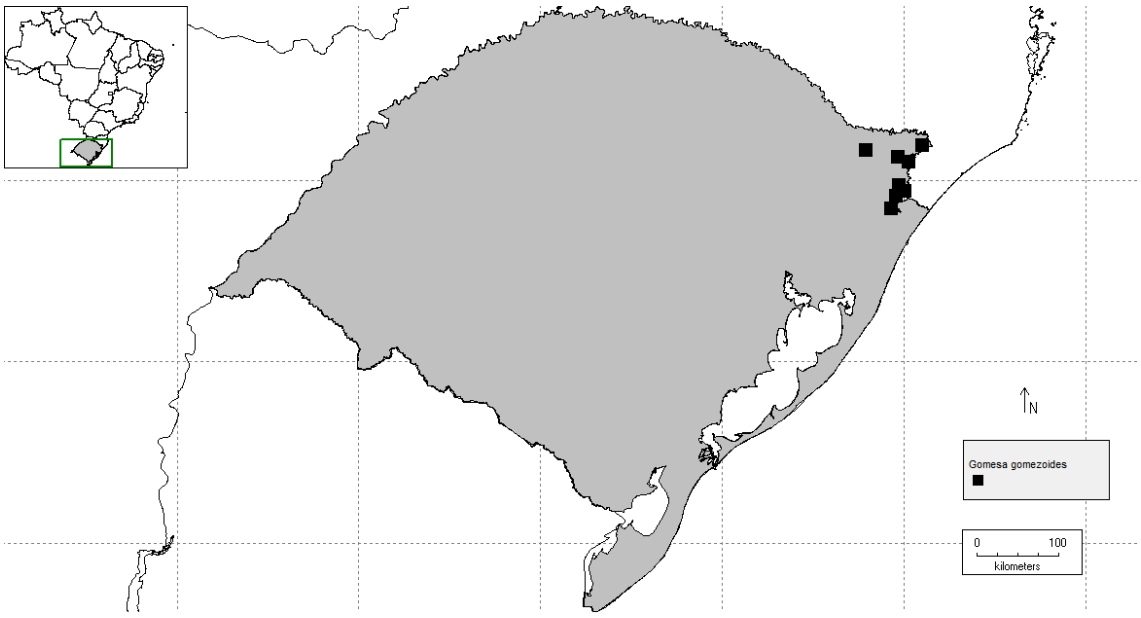

FIG. 17. Distribution of *Gomesa gomezoides* in Rio Grande do Sul.

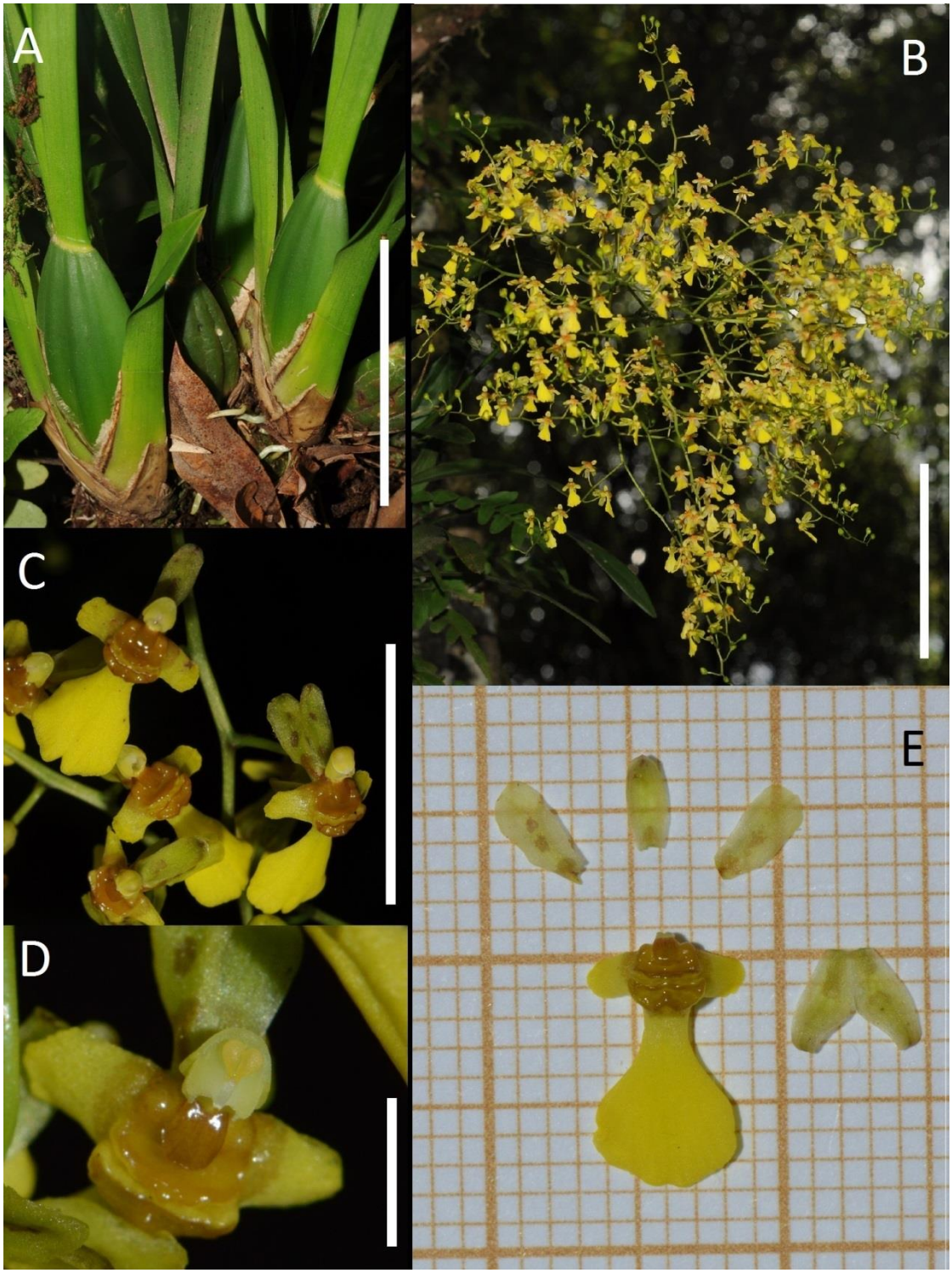

FIG. 18. *Gomesa hookeri*. A. Vegetative structures. B. Inflorescence. C. Frontal and lateral view of flowers. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A-B) = 5cm; (C) = 1cm; (D) = 2mm.

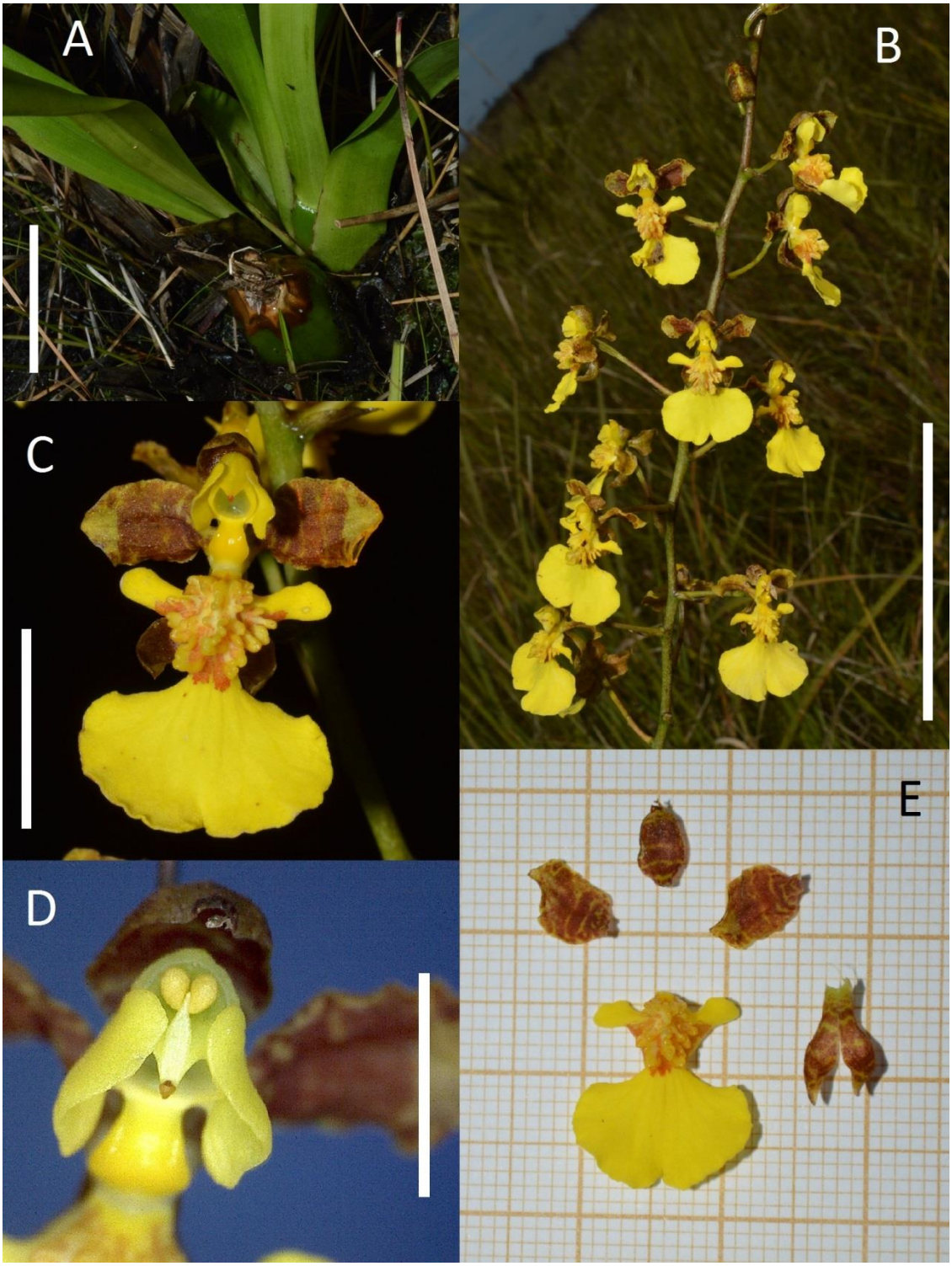

FIG. 19. *Gomesa hydrophila*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Detail of column and pollinarium. E. Distended perianth. Scale bars (A) = 2cm; (B) = 5cm; (C) = 1cm; (D) = 5mm.

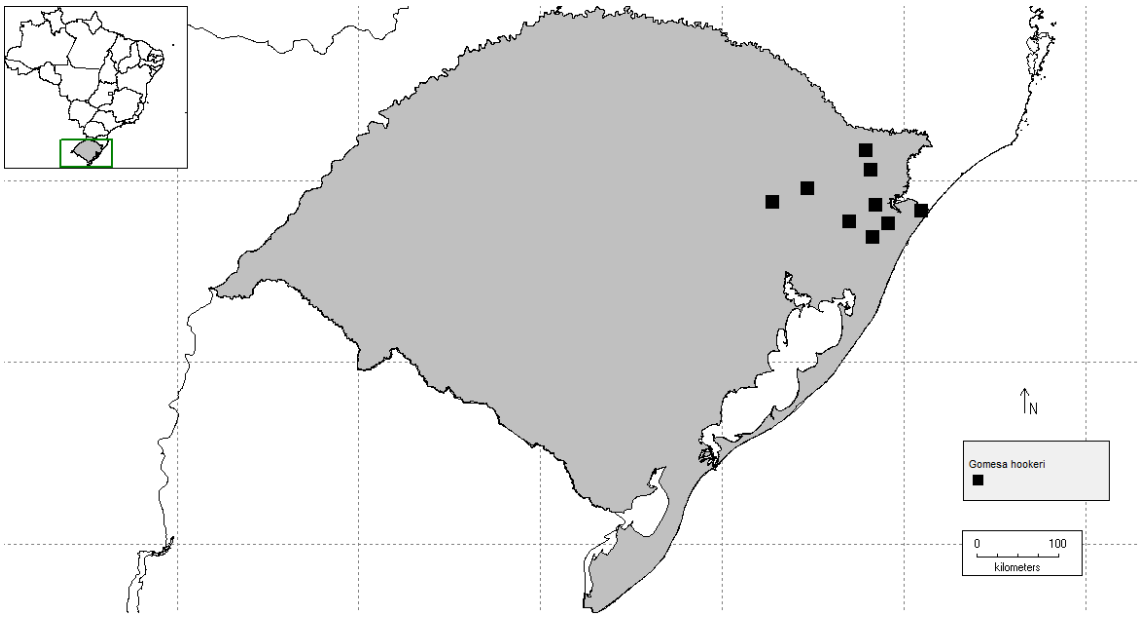

FIG. 20. Distribution of *Gomesa hookeri* in Rio Grande do Sul.

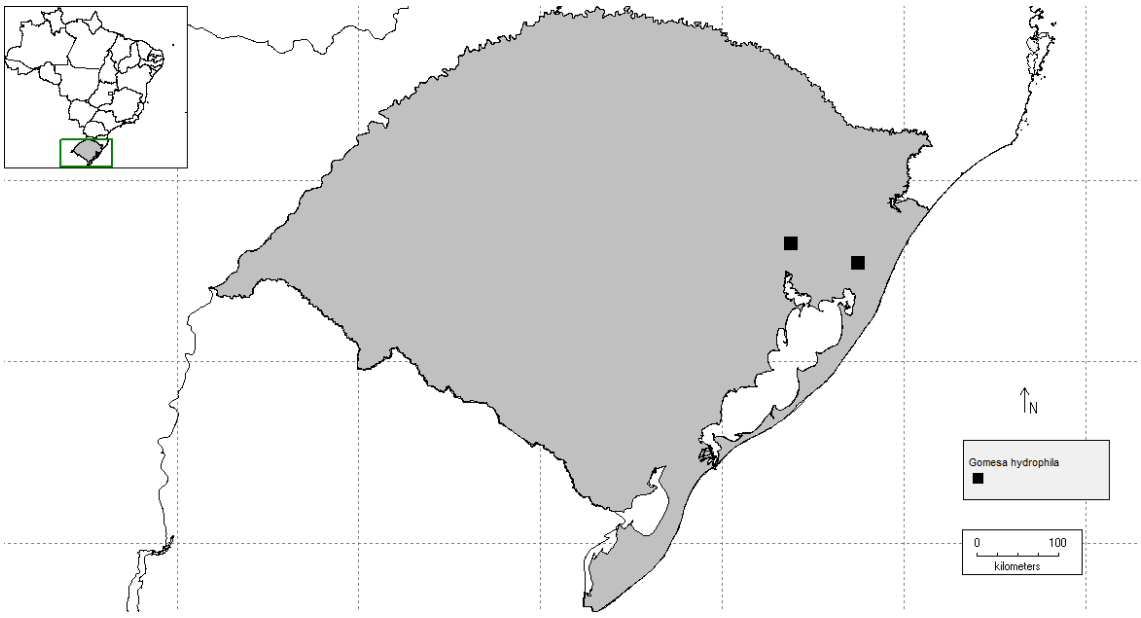

FIG. 21. Distribution of *Gomesa hydrophila* in Rio Grande do Sul.

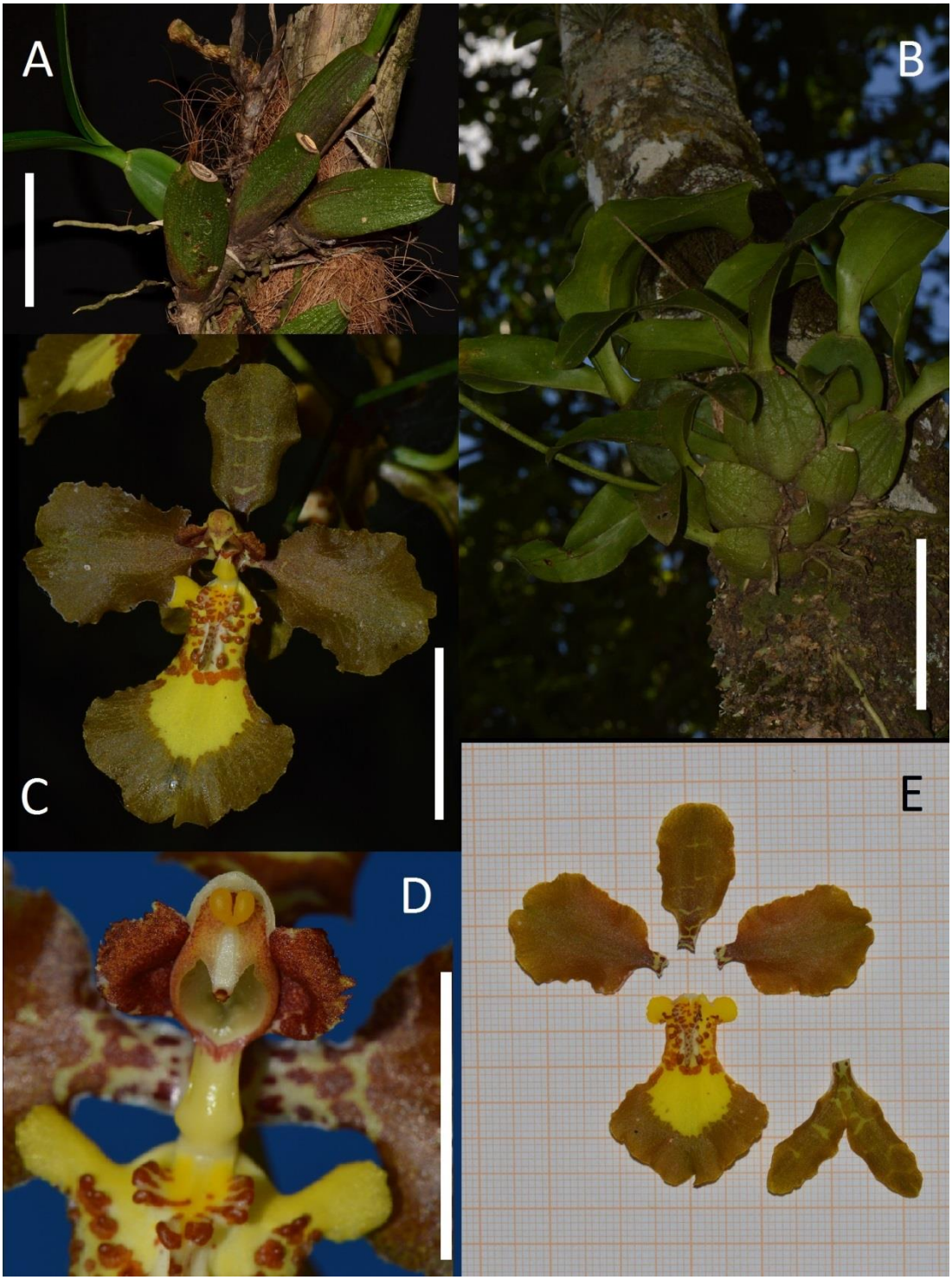

FIG 22. *Gomesa imperatoris-maximiliani*. A. Vegetative structures. B. Habit and different shape of pseudobulbs. C. Frontal view of flower. D. Detail of column and pollinarium. E. Distended perianth. Scale bars (A-B) = 5cm; (C) = 2cm; (D) = 1cm.

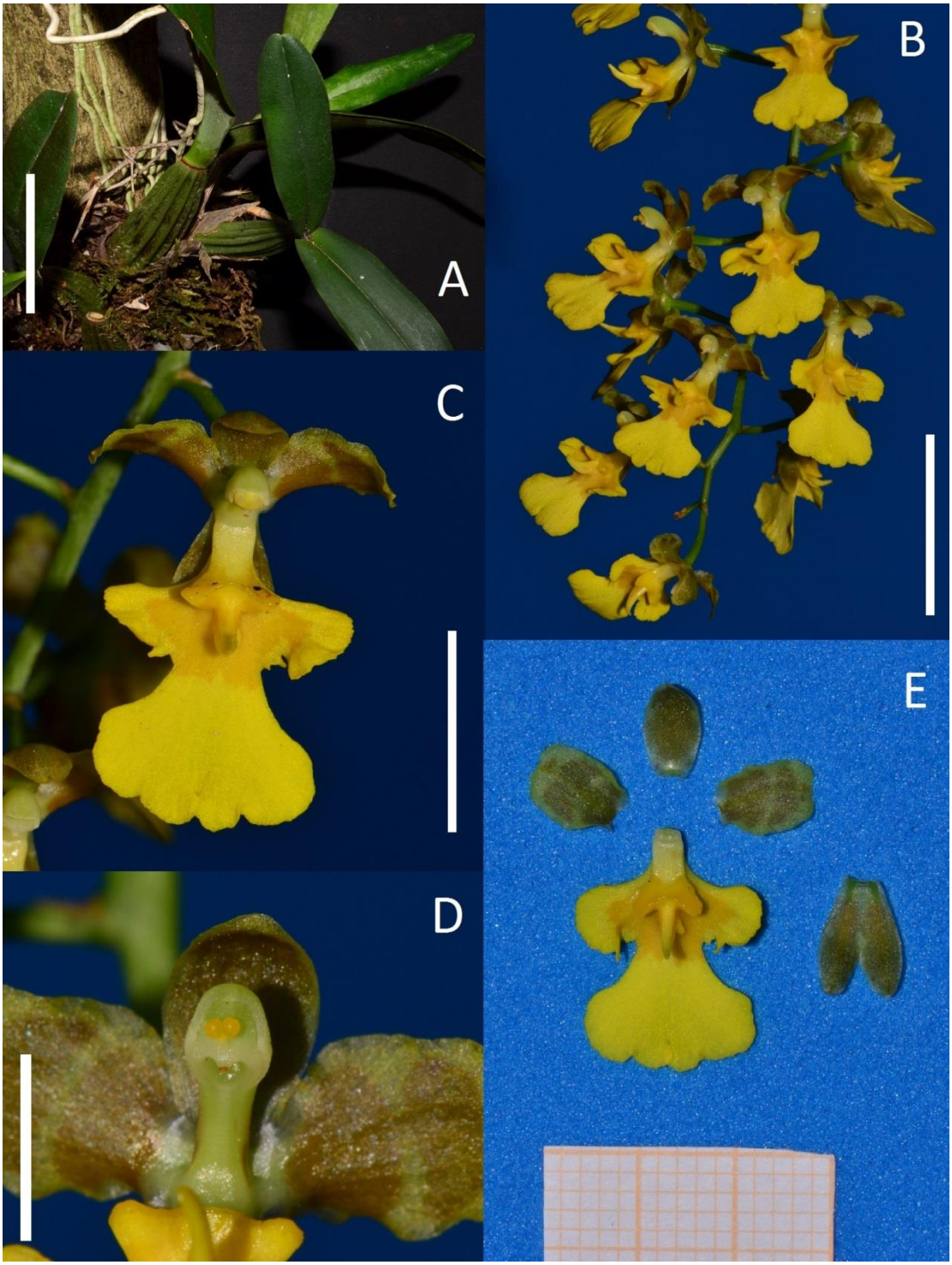

FIG. 23. *Gomesa longicornu*. A. Vegetative structures. B. Inflorescence. C. Frontal view of flower. D. Detail of column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 2cm; (C) = 1cm; (D) = 5mm.

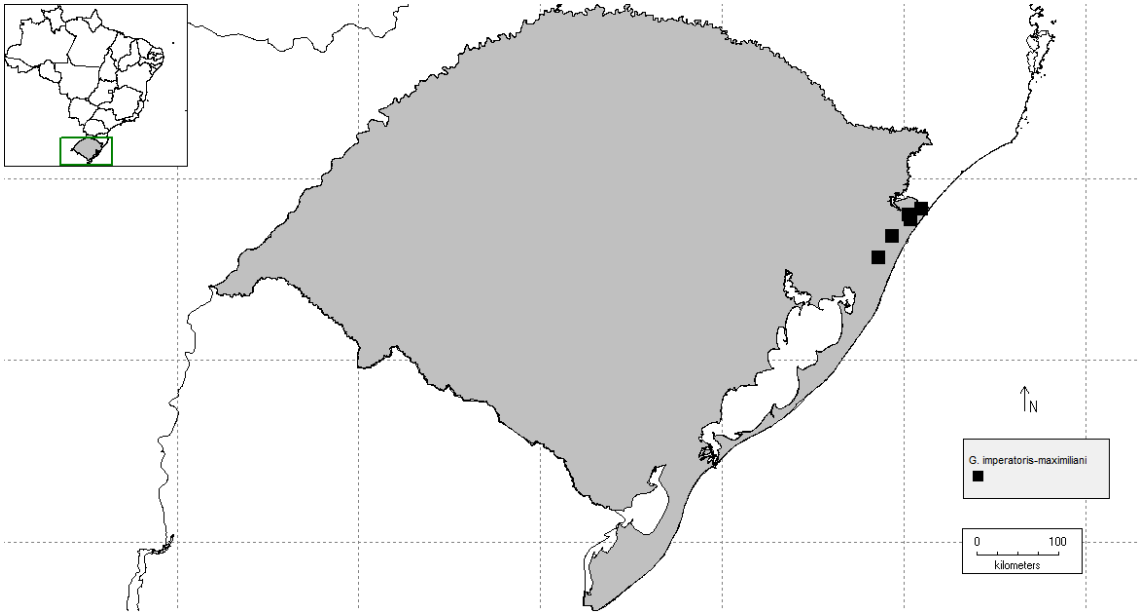

FIG. 24. Distribution of *Gomesa imperatoris-maximiliani* in Rio Grande do Sul.

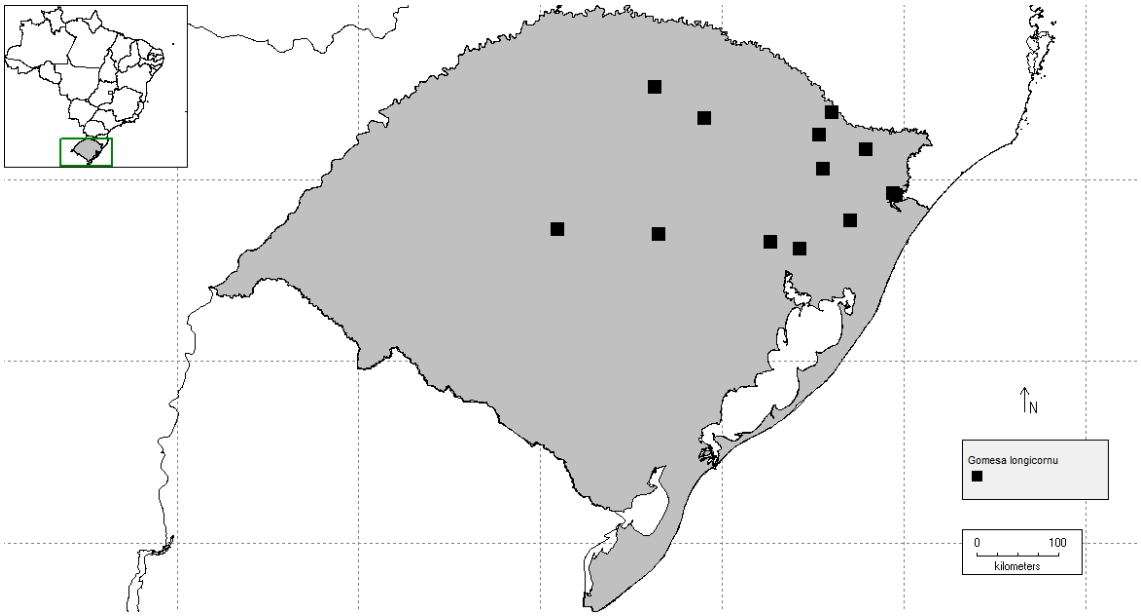

FIG. 25. Distribution of *Gomesa longicornu* in Rio Grande do Sul.

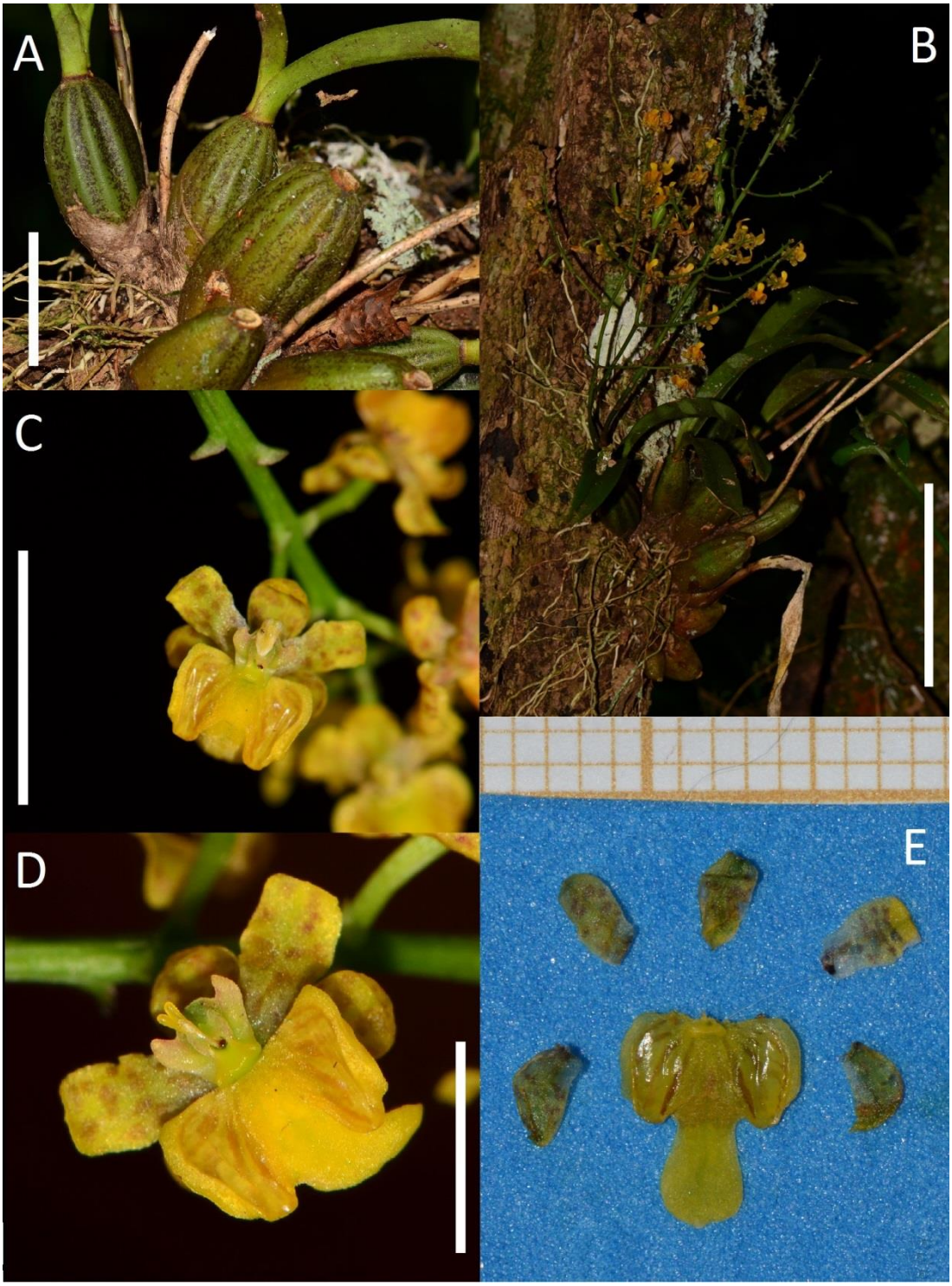

FIG. 26. *Gomesa paranensoides*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Flower without the anther cap, showing the pollinarium. E. Distended perianth. Scale bars (A) 3cm; (B) = 10cm; (C) = 1cm; (D) = 5mm.

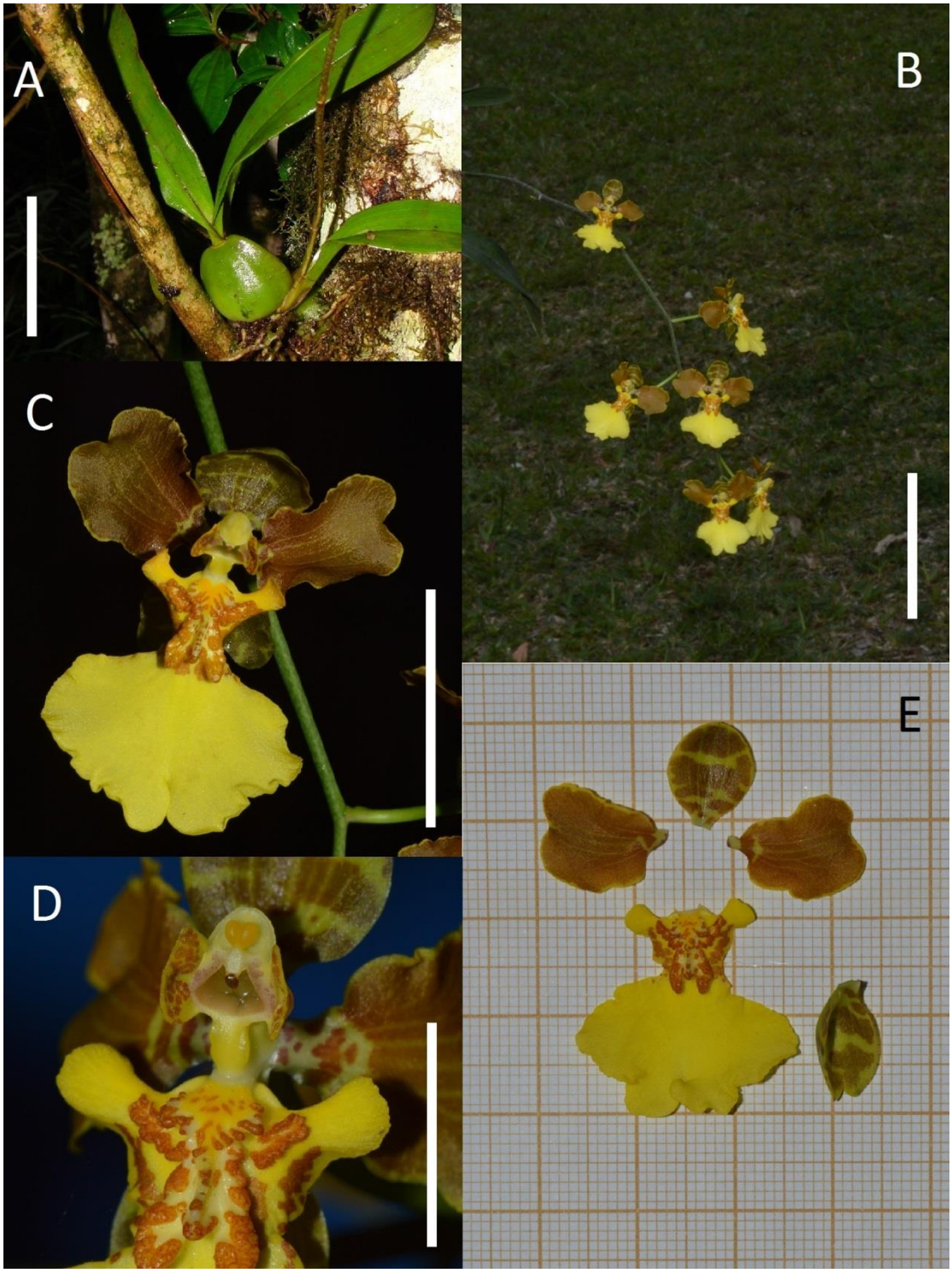

FIG. 27. *Gomesa pectoralis*. A. Habit and vegetative structures. B. Inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A-B) = 5cm; (C) = 2cm; (D) = 1cm.

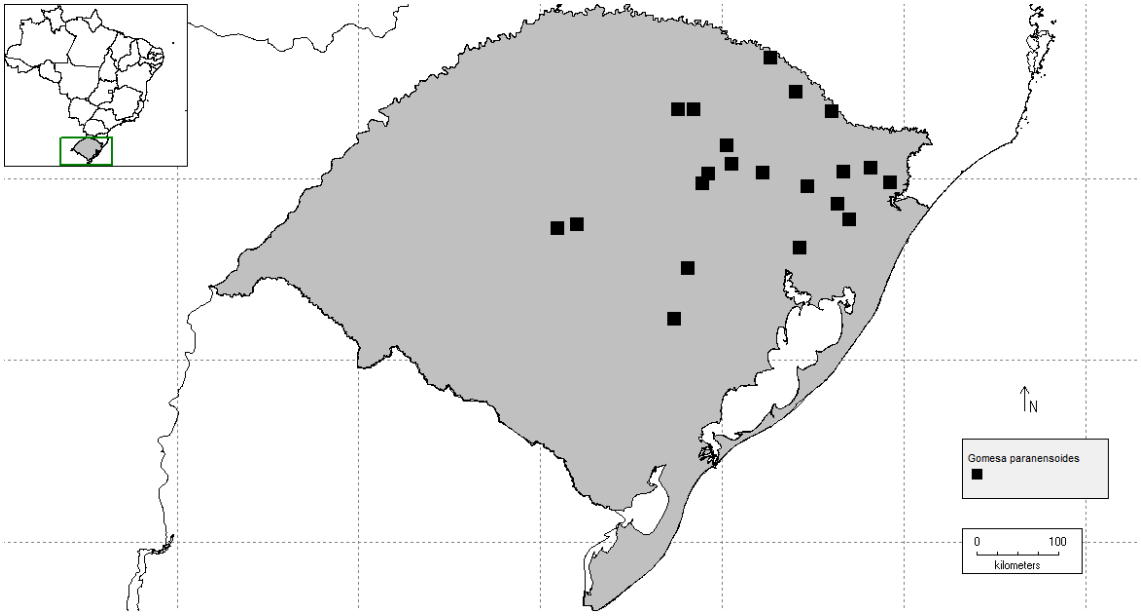

FIG. 28. Distribution of *Gomesa paranensoides* in Rio Grande do Sul.

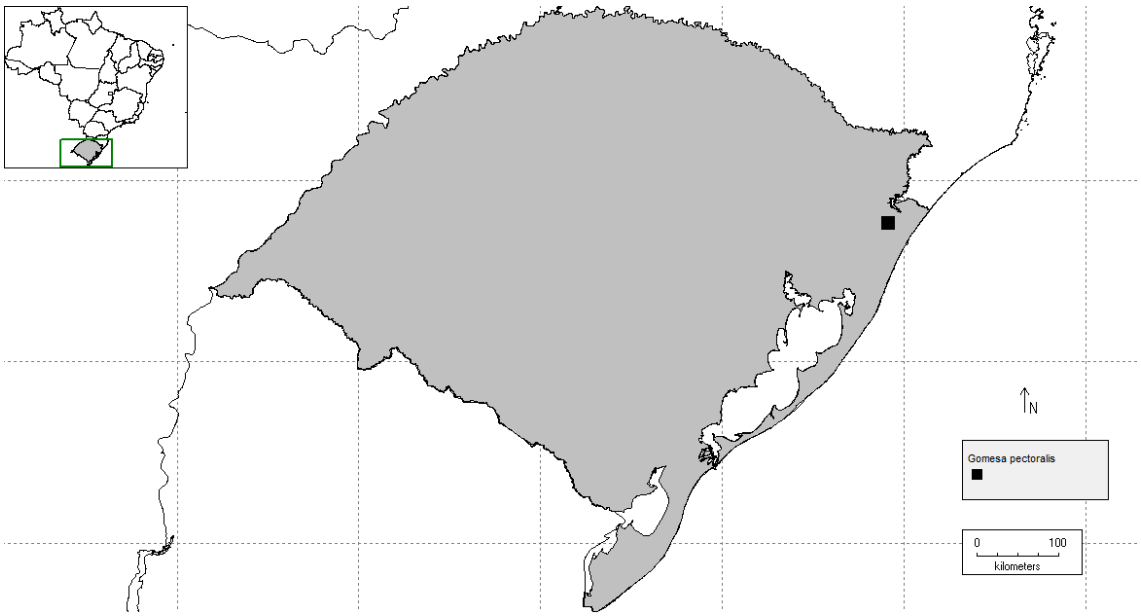

FIG. 29. Distribution of *Gomesa pectoralis* in Rio Grande do Sul.

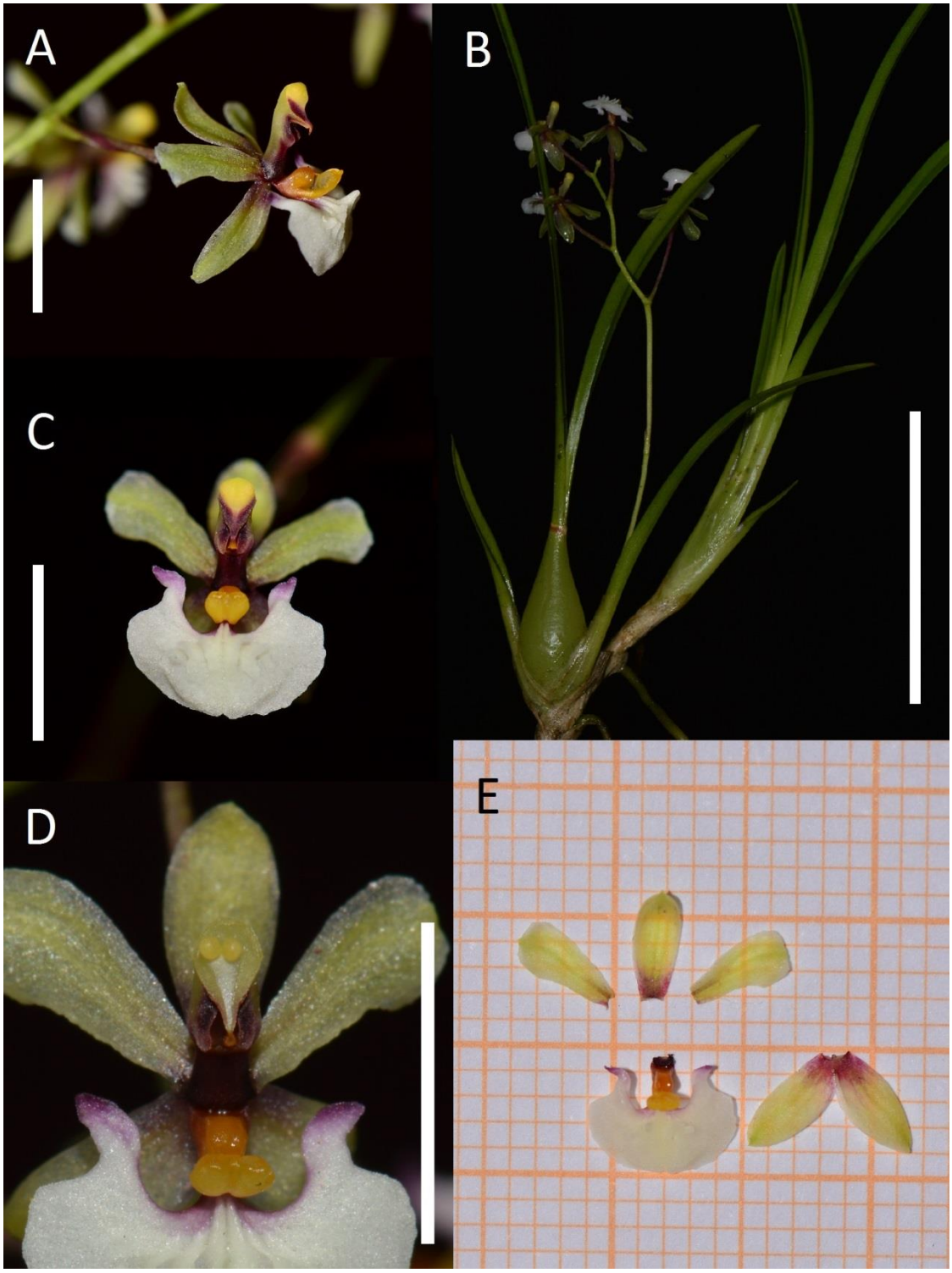

FIG. 30. *Gomesa radicans*. A. Side view of flower, note the column resembling a bird's beak. B. Vegetative structures and inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 3mm; (B) = 5cm; (C-D) = 5mm.

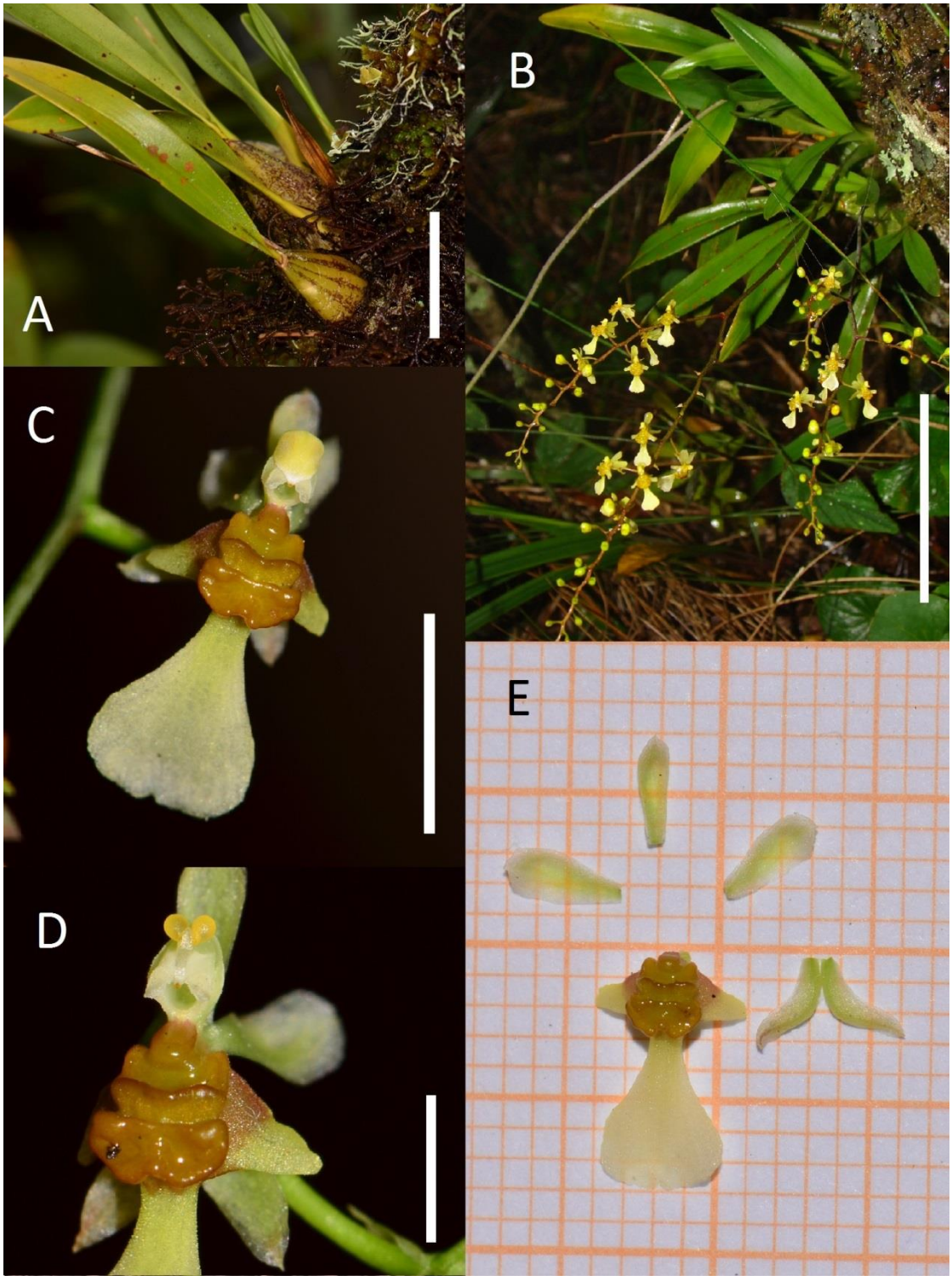

FIG. 31. *Gomesa ranifera*. A. Vegetative structures. B. Habit and inflorescence. C. Frontal view of flower. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 2cm; (B) = 5cm; (C) = 5mm; (D) = 3mm.

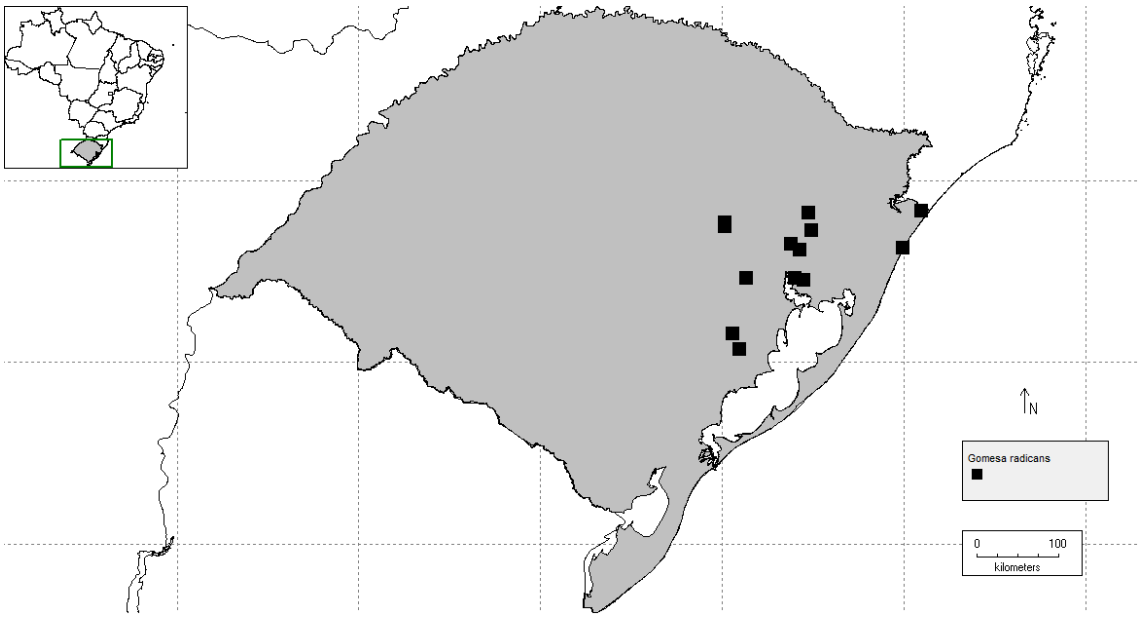

FIG. 32. Distribution of *Gomesa radicans* in Rio Grande do Sul.

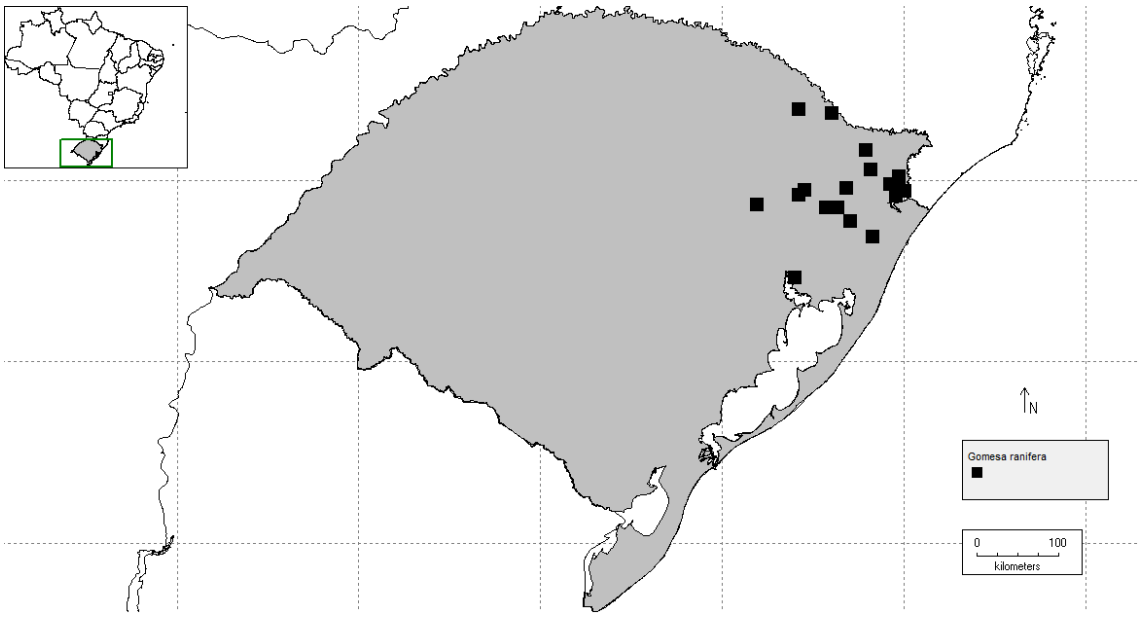

FIG. 33. Distribution of *Gomesa ranifera* in Rio Grande do Sul.

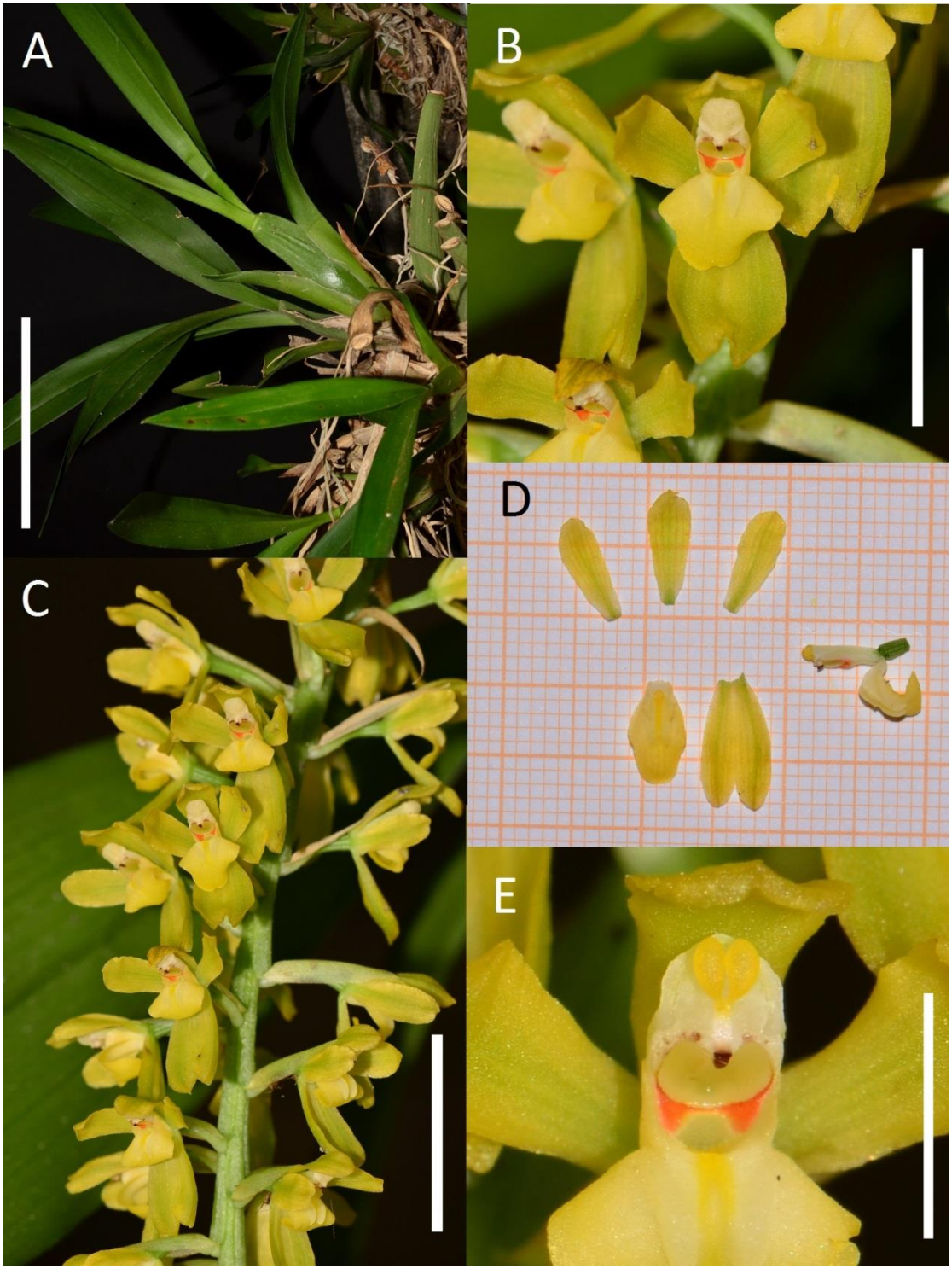

FIG. 34. *Gomesa recurva*. A. Vegetative structures. B. Frontal view of flower. C. Inflorescence. D. Detail of callus, column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 1cm; (C) = 2cm; (E) = 5mm.

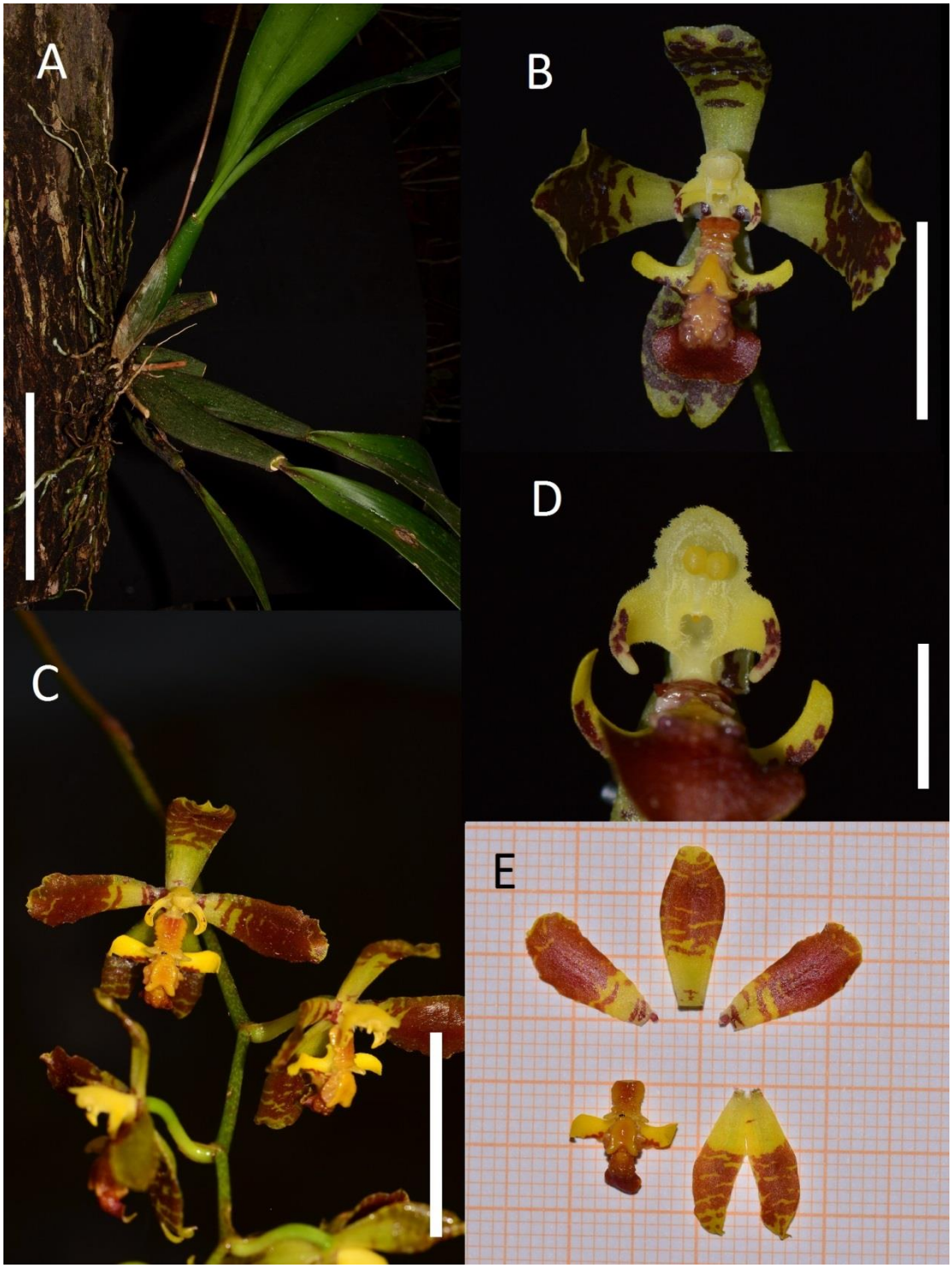

FIG. 35. *Gomesa riograndensis*. A. Vegetative structures. B. Frontal view of flower. C. Part of inflorescence. D. Detail of column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 1cm; (C) = 2cm; (D) = 5mm.

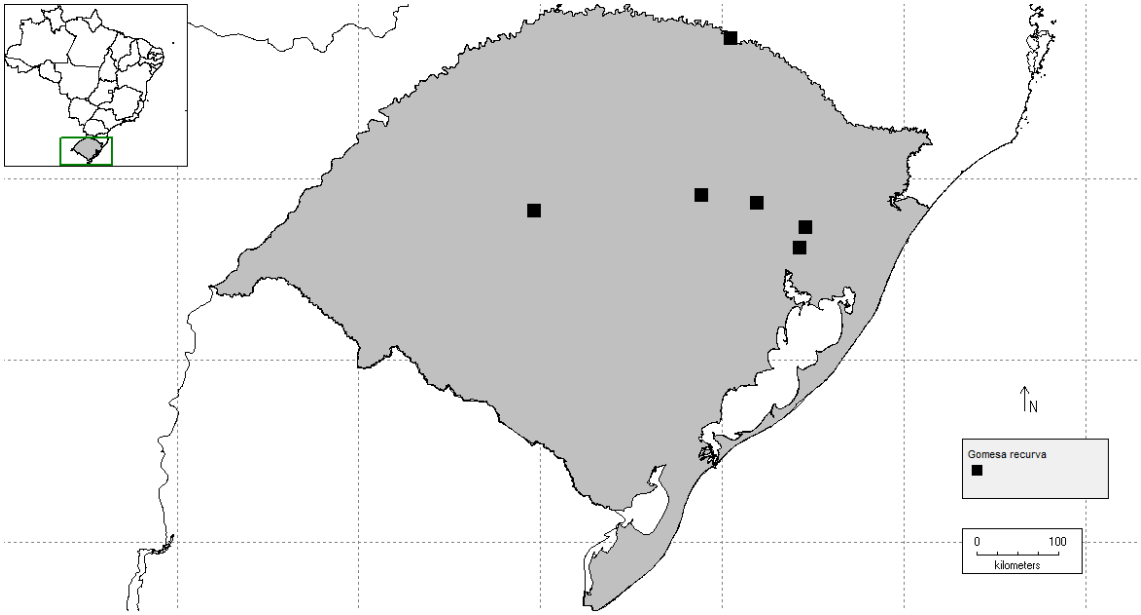

FIG. 36. Distribution of *Gomesa recurva* in Rio Grande do Sul.

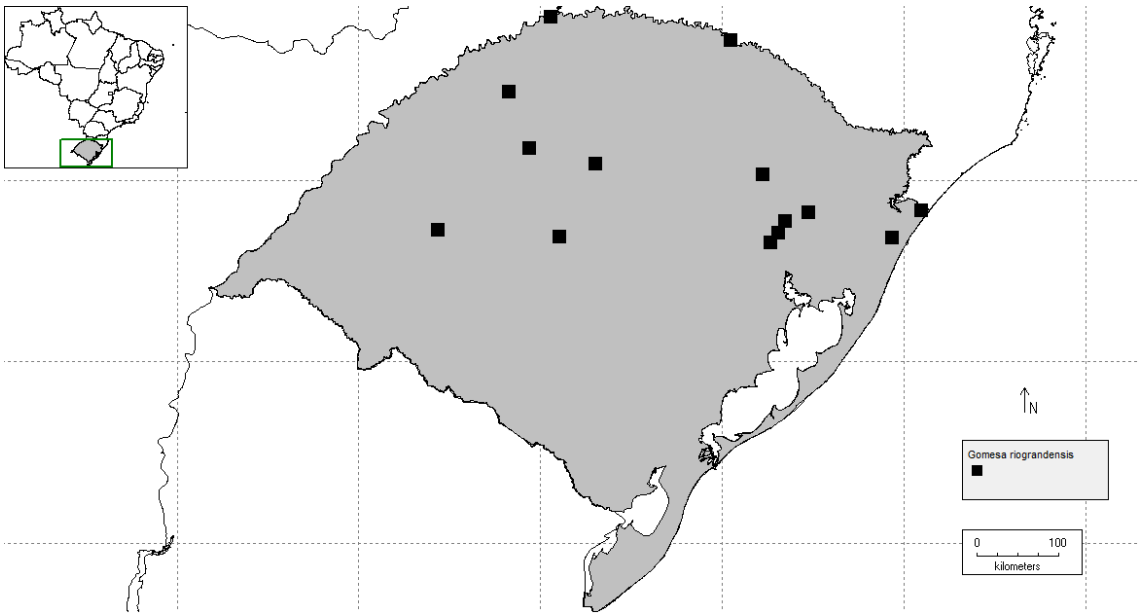

FIG. 37. Distribution of *Gomesa riograndensis* in Rio Grande do Sul.

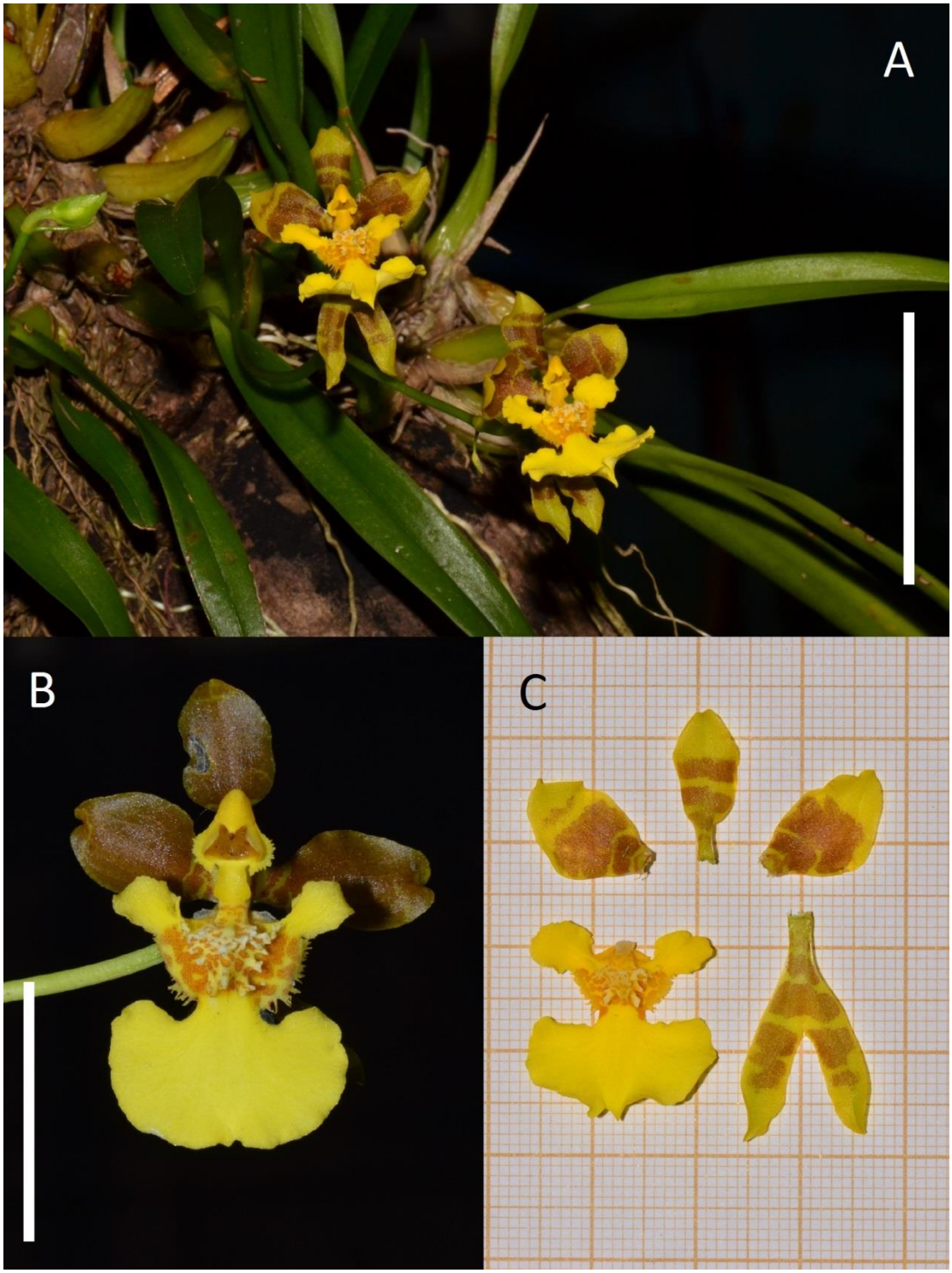

FIG. 38. *Gomesa uniflora*. A. Habit, vegetative structures and inflorescence. B. Frontal view of flower. C. Distended perianth. Scale bars (A) = 5cm; (B) = 2cm.

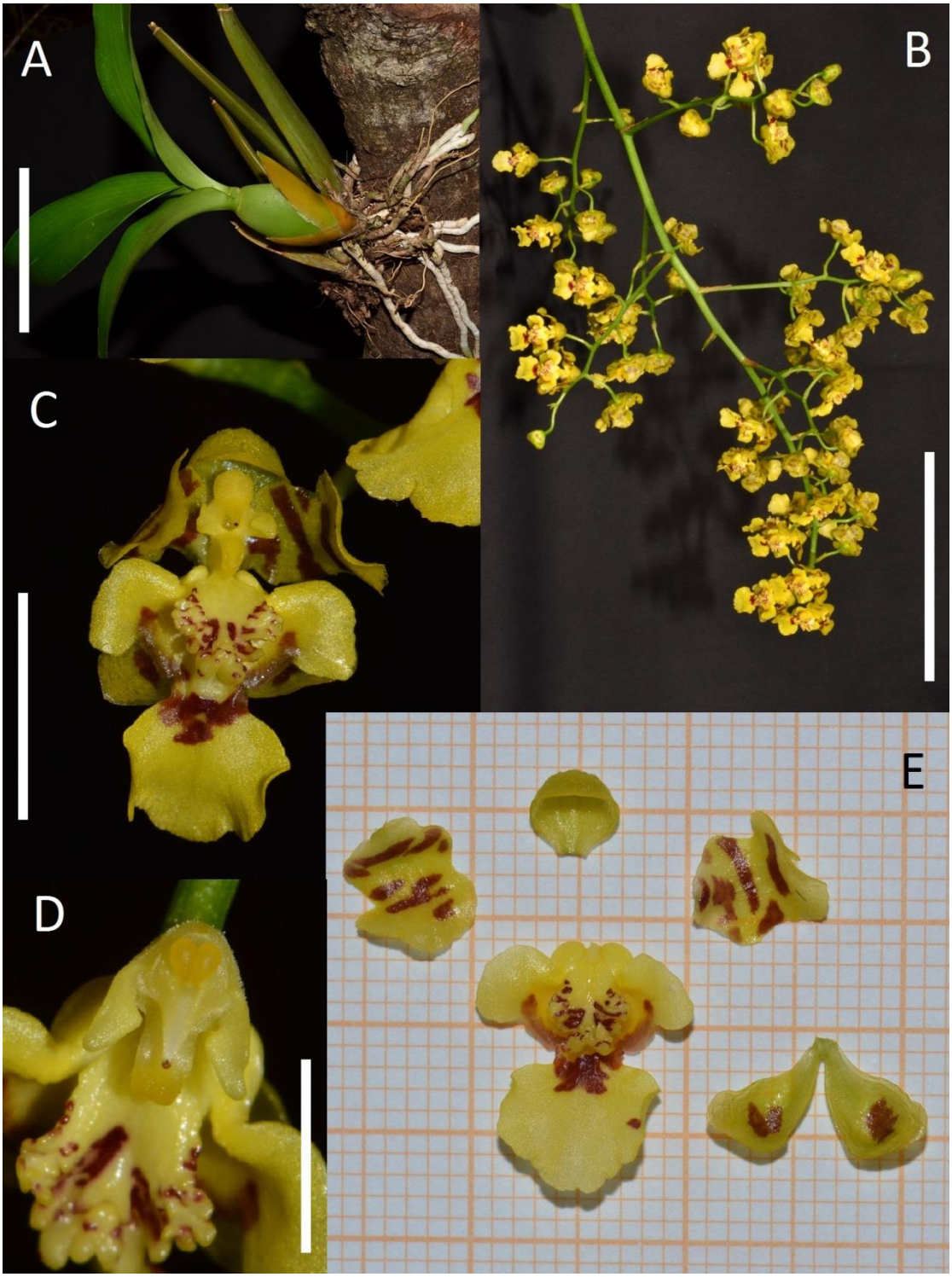

FIG. 39. *Gomesa venusta*. A. Vegetative structures. B. Inflorescence. C. Frontal view of flower. D. Detail of column and pollinarium. E. Distended perianth. Scale bars (A) = 5cm; (B) = 10cm; (C) = 1cm; (D) = 5mm.

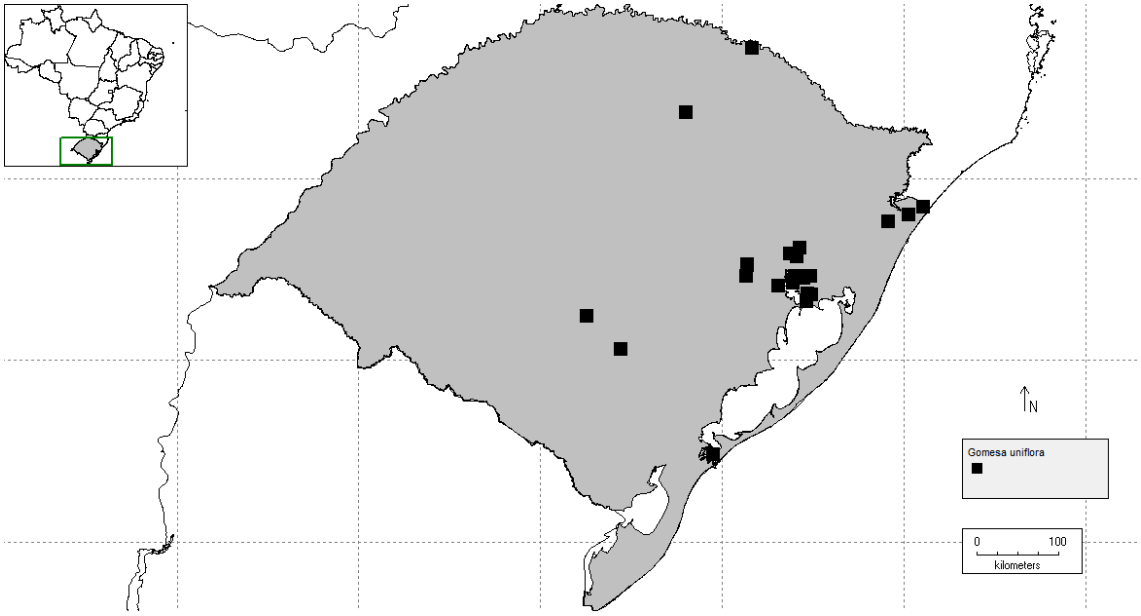

FIG. 40. Distribution of *Gomesa uniflora* in Rio Grande do Sul.

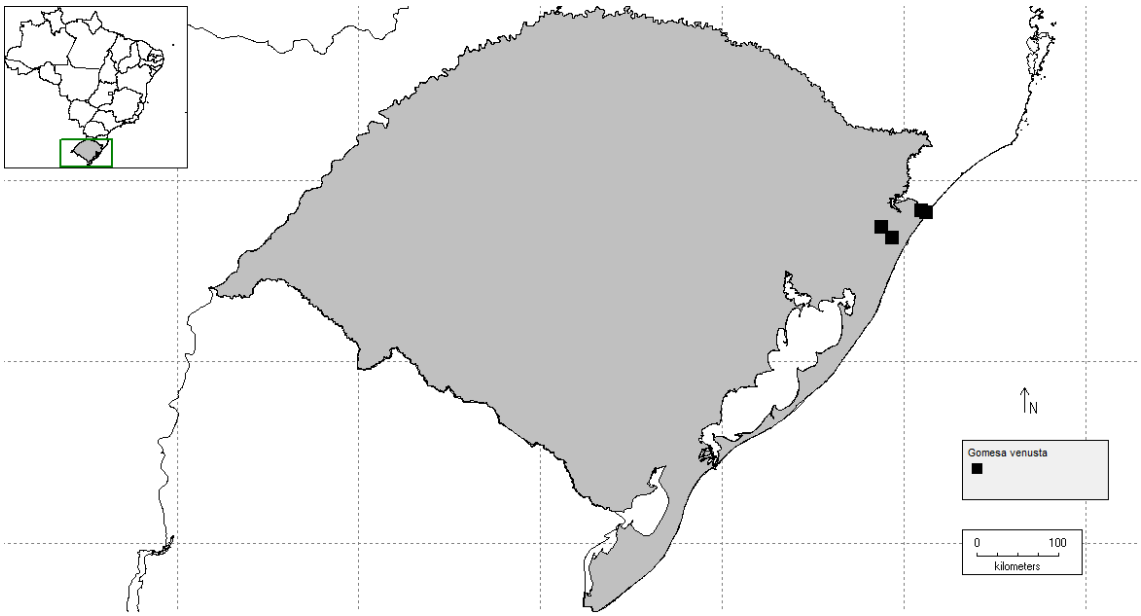

FIG. 41. Distribution of *Gomesa venusta* in Rio Grande do Sul.

5. CAPÍTULO 3

Pollination strategies and breeding systems in *Gomesa flexuosa* and *Gomesa cornigera* (Orchidaceae: Oncidiinae) from Southern Brazil

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Abstract

Gomesa is a large genus of epiphytic or terrestrial orchids, particularly rich in the South and Southeast of Brazil. Recent anatomical and chemical studies have shown that the flowers of several species of the clade bear elaiophores, consequently, should be pollinated by oil-collecting bees. During two flowering seasons we observed populations of *Gomesa flexuosa* and *G. cornigera* in Rio Grande do Sul, regarding their pollination strategies and breeding systems. Both species offer floral oils as rewards to their visitors as evidenced by tests with Sudan IV. *Gomesa flexuosa* and *G. cornigera* are pollinated by *Centris trigonoides* and *Trigonopedia ferruginea*, respectively, which transfer pollinaria while foraging and gathering oil using the forelegs and middle legs. In *G.* flexuosa, pollinators hold the column and/or the tabula infrastigmatica with the mandibles to stabilize themselves. This bee behavior was not observed in *G. cornigera*. According to our filmic record, pollinators of *G. flexuosa* may visit 1-15 flowers in sequence, spending up to two minutes per visit to the inflorescence.

Pollinators of *G. cornigera* visit 1-14 flowers in sequence, spending up to three minutes and forty seconds per visit to the inflorescence. Both species demonstrated strong self-incompatibility (inability to set fruits after pollination with pollen of the same individual) and pollinator dependency (inability to set fruits without pollination by an animal pollen-vector). In both flowering seasons, *Gomesa flexuosa* and *G. cornigera* displayed low total fruiting successes (≤ 6.10%) and low fruit set per inflorescence (≤ 27.91%). Nilsson's male efficiency factors reached 0.27 and 0.35, respectively, meaning that less than one flower was pollinated per pollinarium removed. These orchid species present high percentages of fruits formed by cross-pollination under controlled conditions, but low fruit sets in natural populations. We infer that this result may be due to a significant rate of insect-mediated self-pollinations.

Keywords: *Centris trigonoides*, *Trigonopedia ferruginea*, Fruiting success, Nilsson's male efficiency factor

Introduction

Oncidiinae is one of the most diverse subtribes within the Neotropics. Regarding the clade, van der Pijl & Dodson (1966) suggested that many Oncidiinae mimic oil-secreting Malpighiaceae blossoms, working as "food-frauds" to their pollinators by not offering any kind of reward. Nevertheless, more recent studies have shown that several species of Oncidiinae from South America do not invest in alimentary or sexual deceit strategies. Concerning the subtribe, researchers have proved that their flowers often bear oil-secretor glands, or elaiophores, making their secretions available as rewards to pollinators (Singer & Cocucci, 1999b; Alcántara *et al*., 2006; Singer *et al.*, 2006; Stpiczynska *et al.*, 2007; Stpiczynska & Davies, 2008; Davies & Stpiczynska, 2009; Aliscioni *et al.*, 2009; Gomiz *et al.*, 2013; Gomiz *et al*., 2017). These floral oils consist mainly of acyl-glycerols (Reis *et al*., 2000, 2003). Flowers bearing oils are pollinated by bees belonging to Melittidae, Ctenoplectridae and Apidae, though only the latter has representatives in the Neotropics, distributed in the tribes Centridini (*Centris* and *Epicharis*), Tapinotaspidini (*Caenonomada*, *Chalepogenus*, *Lanthanomelissa*, *Monoeca*, *Paratetrapedia s.l.*, *Tapinotaspis*, *Trigonopedia*) and Tetrapediini (*Tetrapedia*). These bees mix the collected oil with pollen in order to nurture their larvae or apply them in the construction of their nests, to seal and waterproof cells (Singer *et al.*, 2006).

Elaiophores in Oncidiinae species are thought to have arisen at least 7 times (Renner & Schaefer, 2010), being considered as a convergence found in different groups of the subtribe. Floral oils were already reported to *Gomesa amicta*, *G. cornigera*, *G. cuneata*, *G. echinata*, *G. kautskyi*, *G. longicornu*, *G. pubes*, *G. welteri* (Singer *et al.*, 2006), *G. bifolia* (Aliscioni *et al.*, 2009), *G. flexuosa*, *G. riograndensis*, *G. varicosa* (Gomiz *et al.*, 2013), *G. hookeri* (Alcántara *et al*., 2006), *G. loefgrenii*, *G. recurva* (Stpiczynska *et al*., 2007), *G. paranensoides* (Singer & Cocucci, 1999b), *G. radicans*, *G. venusta* (Stpiczynska & Davies, 2008) and *G. herzogii* (Gomiz *et al.*, 2017). Yet, it is important to highlight that not all Oncidiinae species secrete oils, many also secrete nectar or are rewardless (Dressler, 1993).

In several species of Oncidiinae the floral oils are most present in the callus and some parts of the lateral lobes, as seen in *G. radicans*, *G. venusta*, *G. loefgrenii* and *G. recurva* (Stpiczynska *et al.*, 2007; Stpiczynska & Davies, 2008). On the other hand, in *G. paranensoides* and *Trichocentrum cavendishianum* the elaiophores occur solely on the lateral lobes (Singer & Cocucci, 1999b; Stpiczynska *et al.*, 2007; Stpiczynska & Davies, 2008). *Oncidium s.l.* species generally present epidermal elaiophores and secrete the oil directly onto an epidermis. In these species, it is possible their gathering by bees through scratching movements over the lip, during which the oils adhere to their legs by capillarity, just as demonstrated to *Gomesa loefgrenii* in Stpiczynska *et al*. (2007), *G. venusta* in Stpiczynska & Davies (2008) and *G. bifolia* in Torretta *et al.* (2011). Conversely, sometimes the oil may accumulate under a thick layer of cuticle, forcing the visitor to "squeeze" the structure in order to get the floral oil (Singer & Cocucci, 1999a). In these cases, as shown to *Trichocentrum cavendishianum* (in Stpiczynska *et al*., 2007), *Gomesa paranensoides* and *G. radicans* (in Singer & Cocucci, 1999b), the floral visitors need to break the cuticle in order to obtain the rewards. Still, there are different structures assisting the oil secretion. In *Trichocentrum cavendishianum* and *Gomesa loefgrenii*, for example, the secretion can be related to the presence of saddle-like, labellar elaiophores and the labellar callus, respectively, whereas, in *Gomesa recurva*, no obvious structure appears to be involved in its secretion although oil is present (Stpiczynska *et al.*, 2007). So, some species may retain oils in their flowers but no apparent structure is involved in its secretion, therefore functioning as a rewardless flower, as seen in *Gomesa recurva* (Stpiczynska *et al.*, 2007).

Just as Oncidiinae orchids, many American malpighiaceous plants bear floral oils (Singer & Cocucci, 1999b). The resemblance between flowers of some Oncidiinae and Malpighiaceae species is thought to be due to convergence (Singer & Cocucci, 1999b; van der

Cingel, 2001; Singer *et al*., 2006; Stpiczynska *et al*., 2007; Davies & Stpiczynska, 2008). There are some points that may strengthen the theory of evolutionary convergence. For example, in *Trichocentrum cavendishianum* and *Gomesa loefgrenii* the secretory tissue consists of palisade-like cells, just like malpighiaceous elaiophores (Stpiczynska *et al.*, 2007). Stpiczynska & Davies (2008) also indicate structural features shared between the elaiophores of Oncidiinae species investigated thus far and those of Malpighiaceae. The similarities extend to the chemical level, demonstrated in the comparison of the oncidinol and byrsonic acid produced by these two unrelated taxa (Reis *et al.*, 2007). In addition, Powell (2008) established that many Oncidiinae with yellow flowers closely match yellow Malpighiaceae species also in terms of spectral reflectance. Then, anatomical and chemical features may be responsible for the successful sharing of pollinators between Oncidiinae and Malpighiaceae, even though these bees have evolved to pollinate the latter at a first moment (Stpiczynska & Davies, 2008). In spite of many Oncidiinae having been suggested to mimic members of the Malpighiaceae (Chase *et al*., 2009), the deceit/pollination syndrome may be more restricted in Oncidiinae than traditionally inferred, based on the growing number of species with demonstrated elaiophores in their flowers (Reis *et al*., 2006; Torretta *et al*., 2011). Beyond offering oils, *Gomesa* inflorescences are also more conspicuous and abundant than those of Malpighiaceae in some regions, contradicting what is postulated as a rule for mimicry (Vereecken & McNeil, 2010).

Many Oncidiinae present a thickened structure on the base of the column, the tabula infrastigmatica. This structure is suggested to assist in the stabilization of floral visitors, which grab the tabula while foraging for floral rewards (Dressler, 1981, 1993). Its presence in an orchid flower is an indication that oil-collecting bees may be acting on the flowers. Dressler (1981) suggested that bees hold the tabula infrastigmatica using their mandibles to stabilize themselves in the flowers, making possible the extraction of floral oils. Such a behavior is similar to that performed by *Centris* bees while pollinating some Malpighiaceae species, which grasp the constrictions at the base of the petals while using their forelimbs for the gathering (Vogel, 1974, 1990). In fact, several oil-collecting bees were already reported pollinating species of Oncidiinae, as summarized in Gomiz *et al.* (2017). In these cases, the bees move the entire pollinarium attached to different parts of their body, and while visiting another flower (or returning to the same flower) they may leave this content at the stigmatic cavity and promote pollination (Dressler, 1981, 1993). Many Oncidiinae are self-incompatible, this is, unable to set fruit after pollination with pollen of the same individual

(Tremblay *et al.*, 2005, Singer *et al.*, 2006). Tremblay *et al.* provided a list of self-incompatible species of orchids and the references to each study, in which are included *Oncidium crispum* (= *Gomesa imperatoris-maximiliani*), *Oncidium divaricatum* (*Grandiphyllum divaricatum*) and *Oncidium unicorne* (= *Gomesa longicornu*), Brazilian species of the above mentioned subtribe.

As long suggested, several Oncidiinae display a remarkably low fruit set (Tremblay *et al.*, 2005; Chase, 2009). Most species present a low fruit-to-flower ratio presumably due to pollen limitation (Tremblay *et al.*, 2005), which, in turn, may be explained by a combination of factors. First, the pollinator abundance may be low, and many flowers are never visited by individuals with potential to carry their pollinic contents to other flowers. Even when the frequencies of pollinators visiting the flowers are higher, the pollen transference efficiency may be low, in other words, not much amount of pollen actually reaches a stigmatic cavity (Tremblay *et al*., 2005). Also, in actual deceptive flowers, the visitors tend to stay for shorter durations and visit few flowers before departing from the plant (Dafni, 1987), in comparison to those visitors of flowers bearing rewards. The source (or quality) of pollen is also important and plays a role on the development of fruits with viable seeds (Charlesworth & Charlesworth, 1987), since many flowers may abort fruits in self-incompatible species when supplied with pollen coming from the same individual.

Tremblay *et al.* (2005) indicated some ecological effects that may act on the reproductive success, as well. The phenology counts for the degree of synchronization between the reproductive state of the plants and the foraging period of the visitors, affecting by consequence the visitation rates. The microhabitat occupied may influence as a potential source of variation in attractiveness to pollinators, since plants that attract their pollinators by means of visual cues, in order to do so, need to avoid growing among other plants or in shady places. Likewise, the inflorescence sizes affect their perception by visitors, seen that larger flowers and inflorescences are more visited, in the other hand the probability of geitonogamy also increases, since the pollinators spend more time in flowers of a single inflorescence. Besides, population size and density, along with habitat fragmentation, may affect the visitation rates by inducing different pollinator responses to the larger/smaller floral display (Fritz & Nilsson, 1994; Donaldson *et al.*, 2002; Tremblay *et al.*, 2005).

Orchidaceae was preferentially studied in the Northern Hemisphere, and there are few studies covering the Southern Hemisphere species. In Neotropical orchids, most pollination

reports involved Euglossini bees (Singer *et al*., 2006). In southern Brazil, studies covering orchid pollination are rare. They include efforts mainly around terrestrial orchids, from the genera *Habenaria* (Moreira *et al*., 1996; Pedron *et al*., 2012) and *Chloraea* (Sanguinetti *et al*., 2012). Our work focuses on species currently included in *Gomesa* R.Br. (Cymbidieae: Oncidiinae), but traditionally treated inside *Oncidium* Sw., a genus that has been proven polyphyletic in its broader concept (Williams *et al*., 2001a, 2001b, Chase, 2009; Neubig *et al*., 2012). This transfer between genera was performed and justified in Chase *et al.* (2009). Pollination studies are particularly rare to *Gomesa* as a whole. *Gomesa bifolia* (in Torretta *et al.*, 2011) and *G. paranensoides* (in Singer & Cocucci, 1999b) had part of their pollination process detailed. Both studies documented pollinations mediated by oil-collecting bees (from the genera *Centris* and *Tetrapedia*, respectively). However, Torretta *et al.* (2011) carried out their experiments with plants grown outside their natural occurrence and Singer & Cocucci (1999b) did not include studies of the breeding systems. The aim of the present contribution is thus to provide a detailed study on thepollination biology and breeding systems in two sympatric *Gomesa* spp. from Southern Brazil. The questions behind this contribution are: 1) are the study plants pollinator-dependent? 2) Which is their breeding system (self-compatibility; self-incompatibility)? 3) Who are their pollinators? 4) How does pollinator behavior affect fruit set?

Methods

Studied species and sites – The work was carried out in Porto Alegre (30°01’59” S, 51°13’48” W), capital of Rio Grande do Sul, southern Brazil. The city has a warm and moist climate and is located in a region influenced by three geomorphological units, the Escudo Rio-Grandense, Depressão Central and Planície Costeira (Vieira, 1984). It represents a transition region between the Pampa and Mata Atlântica *lato sensu* biomes, forming an important and biologically diverse ecotone (Rambo, 1950; Vieira, 1984). In order to perform the present study, we chose two sympatric species, both occurring naturally in Porto Alegre and close to the Universidade Federal do Rio Grande do Sul (UFRGS) *campus*. The selected species and localities were *Gomesa flexuosa* (Lodd.) M.W.Chase & N.H.Williams, at the Jardim Botânico de Porto Alegre (65m of altitude); and *Gomesa cornigera* (Lindl.) M.W.Chase & N.H.Williams, at the Morro Santana (130m of altitude). It is important to note that, after previous works related to *Gomesa* spp. in the State, we collected and cultivated

individuals in the Fundação Zoobotânica (FZB) do Rio Grande do Sul's orchidarium, mainly representatives of the two selected species, in quantity of specimens. This collection enabled the monitoring of their breeding system under controlled conditions. Plant vouchers are deposited at the herbarium of the Federal University of Rio Grande do Sul (UFRGS).

Pollination – The studied species have already been shown to offer floral oils to pollinators (Singer *et al.*, 2006; Aliscioni *et al.*, 2009; Gomiz *et al.*, 2013) secreted by elaiophores over the callus region, sometimes also seen in the base of the lip's lateral lobes. Anyhow, to verify the presence of elaiophores in the very individuals we studied, we soaked five flowers of each species in a saturated alcoholic solution of Sudan IV (following Dafni, 1992), enabling the observation of the presence and location of the oils. The pollination process in *Gomesa flexuosa* was monitored during October and December/2015 and from the end of November/2016 to January/2017, totaling 140 hours x person of observations (table 1). *Gomesa cornigera*, in turn, was studied between December and January in both seasons (2015-2016 and 2016-2017), totaling 110 hours x person of observations (table 1). The observations were taken from 8:00-12:00 and 13:00-16:00, the pollinator activity was notably lower, almost inexistent, after 16:00 for both species. Our work was documented through a Nikon D5100 digital camera and a Panasonic video camera attached to a tripod. The films obtained were edited using the Windows Movie Maker software. This video recording allowed an accurate report of the pollinator activities over the flowers, aiming the identification of the animal species, their general behavior, the time spent in flowers and inflorescences, the frequency of visits, among other factors. Through the filming we evaluated the possibility of self-pollinations occurrence. Passive pollinators or animals that visit many flowers in a single inflorescence may promote self-pollinations which, in the case of self-incompatible plants, result in fruit abortion (Singer & Koehler, 2003; Singer *et al.*, 2006). Pollinator individuals were collected for further identification. Insect vouchers are deposited at the entomological collection of the Federal University of Paraná (UFPR).

Breeding system – The breeding systems of both species were studied during the flowering season of 2016-2017. For floral longevity estimates, ten intact flowers of *G. flexuosa* and *G. cornigera* were selected and bagged from the opening of the flower until they started to wilt. The flowers were monitored every two days for an accurate estimate. The breeding system was studied through controlled pollinations, consisting of self-pollination, cross-pollination, emasculation and control – intact flowers – applied to the flowers, five replicates of each treatment in every chosen individual, except for control (the remaining

number of flowers in the inflorescence). All the flowers were previously isolated from pollinators to avoid the influence of external factors, according to the methodology used by Pedron *et al*. (2012), Sanguinetti *et al*. (2012) and Sanguinetti & Singer (2014). The treatments were applied to 8 individuals of *Gomesa flexuosa* and 12 of *G. cornigera*.

Pollination efficiency and fruiting success – To evaluate the success of the pollination process in natural populations, we calculated the Nilsson's index (Nilsson *et al*., 1992), in the flowering season of 2016-2017. It is equivalent to the quotient between the percentage of pollinated flowers and the percentage of flowers acting as pollen donors. During two seasons, the fruiting success in natural pollinations (not excluded from pollinators) was recorded, between December-February in *Gomesa flexuosa* and January-March in *G. cornigera*. It consists of the percentage of mature fruits produced by each individual, at the end of their respective observation periods. The total fructification was measured, as well as the mean fruit set per inflorescence, for both species.

Results

Floral features – The two studied *Gomesa* species present inflorescences consisting of lateral panicles (rarely racemes), rigid in *Gomesa flexuosa* and flaccid in *G. cornigera*, coming from the base of the pseudobulb and bearing multiple "oncidioid flowers", characterized by their callosity over the lip and yellow to brown coloration. Both species display bracteoles, which are shorter than the pedicels, and resupinate flowers. *Gomesa flexuosa*'s inflorescences bear between 40-418 flowers (mean = 195.1 ± 86.2), while those of *G. cornigera* bear 18-125 flowers (49.2 ± 21.9). *Gomesa flexuosa*'s flowers (figure 1) have 3-lobed lips that assume prominence over sepals and petals. The lateral lobes are smaller and auriculate, the apical or median lobe being much larger. The callus is tubercular, with finger-like projections arranged in the central region. The column has two rounded lateral wings and a tabula infrastigmatica close to its base. The stigmatic cavity is rounded and concave. The anther is terminal operculate and the rostellum is acute. The pollinia are attached to the head of a stipe and protected by the anther cap. On the other hand, *Gomesa cornigera* possess flowers (figure 1) bearing lip, sepals and petals similarly sized. The lip is also 3-lobed, the lateral lobes are arm-like and pointing upwards, the apical or median lobe is larger but does not assume the same proportion as in the previous species. The callus has two median cuspidate tubercles connected at the base and two distal elliptic tubercles also connected at the

base and resembling and “inverted V”. The column has two arm-like or hook-like lateral wings and the tabula infrastigmatica is present, but reduced. The structures of anther, pollinarium and stigmatic cavity are similar to those of *Gomesa flexuosa*, with the exception that the rostellum is truncate. In both species, the callus region was strongly stained when soaked in the saturated alcoholic solution of Sudan IV, showing, therefore, more concentration of floral oils than the remaining of the lip (figure 2).

Pollination mechanism – Pollinarium withdrawal takes place when floral visitors press the surface of the viscidium with a smooth part of their heads, which may vary depending on the species. Thus, the pollinic content is dislodged and attaches to the insect, being carried to other flowers. In this process, the anther cap may fall or not. Pollination occurs when a pollinarium-laden insect visits a flower and assumes a position that allows the entry and subsequent deposition of at least one pollinium on the stigmatic cavity. This structure is rounded and concave, therefore adapted to easily accommodate and retain the pollinium, which, in turn, remains entire at a first moment since is rigid and indivisible. After pollinated, the flowers start to seal their stigmatic cavity either by the closing of the column wings and by the thickening of the column walls, which occur soon after the capture of the pollinic content, taking no more than one day to be totally closed.

Pollinators and pollinator behavior – Both species are pollinated by oil-collecting bees, from the tribes Centridini (in *Gomesa flexuosa*) and Tapinotaspidini (in *G. cornigera*). These bees visit the flowers primarily during the daylight, with a reduced frequency of visits before 9:00 and after 15:00. In both species filmed, the frequency of visits is higher between 10:30 and 13:30 and highly dependent on the availability of bright light. Rainy or cloudy days negatively affect the visits. Between all days of observations, the frequency of visits ranged between 2 and 19 times in a same individual of *Gomesa flexuosa* and 3 and 13 times in a single individual of *G. cornigera*.

For *Gomesa flexuosa* the pollinators detected were females of *Centris trigonoides* (figure 3; supplementary material Video S1). These insects visit the inflorescences for 25s-2min (mean = 54s), spending 2-25s per flower (mean = 6.9s) (table 1). The individuals fly quickly and approach the flowers without hovering much. The pollinators of *G. flexuosa* are much faster and more distrustful than the pollinators of *G. cornigera*. After landing on the lip, the bees use their mandibles to grab the tabula infrastigmatica or the column, freeing their legs for gathering oil. In order to do so, the bees scratch the callus with their forelegs and

median legs. During this activity, their heads touch the viscidium, causing the attachment of the pollinarium to the insect's clypeus (figure 3). After the pollinarium removal, the anther cap easily falls. More than one pollinarium can adhere to the same bee (sometimes up to 5 at the same time), which sometimes induce them to move their forelegs trying to get rid of the structures, therefore it can provoke some sort of disturb in the individuals. In flight, the bees transfer the oil collected to the scopae on their posterior legs. Then, the pollinators, while visiting other flowers, may leave the pollinia when contacting the stigmatic cavity. The roundish pollinia are easily arrested at the convex stigmatic cavity. The accessory structures (stipe and viscidium) may persist on the insect for more time. In addition, some male *Centris trigonoides* bees demonstrated a territorial behavior, pushing away other individuals who land on nearby flowers through "flat flights" (supplementary material Video S3). Halictidae bees were also seen visiting flowers of *Gomesa flexuosa*, but they do not have the appropriate size to effectively remove the pollinic content and promote pollination.

In relation to *Gomesa cornigera*, the pollinators detected were females of *Trigonopedia ferruginea* (figure 4; supplementary material Video S2). These insects visit the inflorescences for 35s-3min40s (mean = 1min37s), spending 2-40s per flower (mean = 10.8s) (table 1). The individuals fly more quietly compared to the pollinators of *G. flexuosa* and approach the flowers, hovering in front of the flowers sometimes. After landing on the lip, they do not assume a frontal position and sometimes may access the flower laterally, without touching the column, since the tabula infrastigmatica is reduced in this species. As the pollinators of *Gomesa flexuosa*, these bees also scratch the callus with their anterior and median legs. If they touch the viscidium, the same adheres to the frons region of the insect, between the antennae and just below the ocelli (figure 4). After the pollinarium removal, the anther cap generally does not fall as in *Gomesa flexuosa*. The pollinarium sometimes disturb the bees, forcing them to try to remove it with their forelegs. In flight, the bees transfer the oil collected to the scopae on their posterior legs. Whether the pollinia touch a stigmatic cavity, one pollinium may be retained, but is not easy to deposit both pollinia in the same stigma, as in the previous species, because the stigmatic cavity's aperture is relatively tight. The accessory structures may persist on the insect for more time. Male individuals of *Paratetrapedia fervida* were also seen (both in *Gomesa cornigera* and *G. flexuosa*), but solely as floral visitors, never carrying a pollinarium. Maybe this is due their behavior on the flowers, they never assume a parallel position in front of the column, instead, they "walk" around all the lip's surface.

Breeding system – The anthesis takes approximately one day, generally starting at the beginning of the morning. The inflorescences lasted nearly one month and a half in *Gomesa flexuosa* and one month in *G. cornigera*, while the floral longevities were between 24-32 days (mean = 27.8 ± 2.40) and 15-21 days (mean = 17.6 ± 1.52), respectively (table 1). The percentages of fructification by cross-pollination were high, 66.67% to *G. flexuosa* (n = 8 individuals) and 71.74% to *G. cornigera* (n = 12 individuals). None of the remaining treatments developed fruits (table 2). So, both studied species are pollinator-dependent and self-incompatible.

Pollination efficiency and fruiting success – For the calculation of the Nilsson's index, we monitored 176 flowers of *Gomesa flexuosa* and 106 flowers of *G. cornigera*. In *G. flexuosa*, the percentage of pollinated flowers was 14.77% and of pollen-donors was 54.55%, generating a Nilsson's index of 0.27. As for *G. cornigera*, the percentages of pollinated and pollen-donor flowers were, respectively, 20.75% and 59.43%, resulting in a Nilsson's index of 0.35 (table 2). In practical terms, it means that, for each 10 *pollinaria* removed, less than 3 flowers were pollinated in *G. flexuosa* and less than 4 in *G. cornigera*. A total of 43 inflorescences of *Gomesa flexuosa* (totaling 8390 flowers) and 16 inflorescences of *G. cornigera* (totaling 787 flowers) were available for estimates of fruiting in natural populations. The total fruiting successes displayed by *G. flexuosa* in the first and second seasons were, respectively, 1.54% and 1.43%. In relation to *G. cornigera*, the fruiting successes were 6.10% (in 2015) and 5.33% (in 2016). The values for maximum, minimum and mean fructification in both seasons are indicated in table 2.

Discussion

The flowers of the studied species are in accordance with the specialized literature, as shown by Dressler (1981, 1993), bearing similar structures and shapes to those of the group recognized as "oncidioid flowers". These plants possess huge inflorescences with dozens of resupinate flowers, conformation that enables the approximation and subsequent landing of visitors over the lip. It is important to highlight that, in the clade as a whole, the anther is terminal and substantially exposed, which facilitates their access by potential pollinators. The stigmatic cavity, in turn, is rounded and concave, adapted to arrest the roundish polllinia (Dressler, 1981, 1993). Both anther and stigmatic cavity of *Gomesa flexuosa* and *G. cornigera* follow these conformations. Although there are similarities in the general structure

of the column, there are also some differences between the species that must be mentioned. Column wings are present in both species, but they are roundish in *Gomesa flexuosa* and arm-like or hook-like in *G. cornigera*. This may affect the positioning necessary for the insects to touch the viscidium and the way that stigmatic cavity is sealed after pollination, despite we did not focus on these issues. Still, tabula infrastigmatica is present in both orchids, but is substantially reduced in *G. cornigera*. We were able to note that the pollinators of *G. flexuosa* assume a frontal position in relation to the column precisely by grabbing the tabula and this is not true to pollinators of *G. cornigera*. So, our study supports Dressler's hypothesis that the tabula infrastigmatica plays a role on the stabilization of visitors over the flowers. Moreover, the lip plays several functions (just as summarized in van der Pijl & Dodson, 1966), serving as a landing platform and housing the floral rewards. The anatomical and chemical data already mentioned for these species (Singer *et al.*, 2006; Gomiz *et al.*, 2013) and the results of our tests involving saturated alcoholic solution of Sudan IV (figure 2) confirm that *Gomesa flexuosa* and *G. cornigera* offer floral oils as a reward to pollinators. In both species, the elaiophores are present in the lip, mostly in the callus and some parts of the lateral lobes, similar to what is seen in *G. radicans*, *G. venusta*, *G. loefgrenii* and *G. recurva* (Stpiczynska *et al.*, 2007; Stpiczynska & Davies, 2008).

The pollination mechanisms follow what appears to be a rule for the clade. Some floral visitors land on the flowers looking for rewards. Whenever they are able to assume a position that favors the removal of the pollinarium, the same is dislodged and attaches to the body of the pollinator, which transports it during the flights, just as observed by Singer & Cocucci (1999b). After this contact between the plant's column and the insect, we were able to document that the anther cap falls in individuals of *Gomesa flexuosa* but remains intact in *G. cornigera*, fact that impairs the perception of pollinator's effectiveness in removing pollinic contents of the latter species. For now, we do not know if this issue affects the pollinator activity in any way. Whereas all the pollen is packaged inside the pollinia, a single visit is potentially sufficient to produce a full seed complement.

Tremblay (1992) stated that 67% of the orchids are pollinated by only one species, and that coincide with our observations. We only identified one species of *Centris* as pollinator of *Gomesa flexuosa*, as long as one species of *Trigonopedia* in *G. cornigera*. Also, their general behaviors are somewhat similar. The behavior of *Centris trigonoides* in *G. flexuosa also* resembles the description to individuals of this species over flowers of *G. bifolia* (Torretta *et al.*, 2011). In spite of reporting female bees of *Centris trigonoides* as pollinators of *G. bifolia*,

the authors inferred that other species would play this role in different localities. In fact, during a field trip to Taquari, where *G. bifolia* is abundant, we were able to note a bigger species of *Centris* (maybe a *Melacentris*) visiting their flowers, though we could not capture any individual for identification or film their behavior, in order to confirm if they dislodged *pollinaria* or not. Another *Centris*, *C. fuscata*, was cited as pollinator of *Gomesa longipes*, by personal observations in Gomiz *et al.* (2017). Bees of *Tetrapedia diversipes* were seen carrying *pollinaria* of *Gomesa paranensoides* (Singer and Cocucci, 1999b). It is noteworthy that the individual was a male, by that time the authors did not infer how the oil would be used by this insect. *Tetrapedia* sp. females have also been reported to pollinate *Gomesa pubes* (Singer, 2003). Individuals of *Paratetrapedia fervida* landed several times in flowers of *Gomesa flexuosa* and *G. cornigera* during our observations, but they were mere floral visitors, not effectively promoting pollination, since we did not see any individual transporting pollinic contents. In addition, the presence of tabula infrastigmatica in some species of *Gomesa* but absence in others further support the idea that different insect species are involved in the clade's pollination. *Centris* spp., for example, seem to need their presence in order to stabilize over the flowers. Also, it is important to highlight that the same species that pollinates *Gomesa flexuosa* was also observed over flowers of *Janussia guaranitica* (Malpighiaceae) during our observations. Furthermore, male individuals of *Centris trigonoides* have shown a territorial behavior near masses of flowers, already suggested by Dressler (1993) but only documented in the present study (supplementary material video S3).

According to Singer and Koehler (2003), pollinators maximize their collecting efforts in the presence of floral rewards and this behavior induces at least some degree of self-pollination. The more time a pollinator spends at the flowers of a single plant, the greater the chances of self-pollination (Singer *et al.*, 2006). In our records, up to 15 flowers of a single inflorescence were visited in sequence, to both species, and sometimes the bees returned to visit the same inflorescence soon after their departure, such behavior probably induces some degree of geitonogamy. This fact, in turn, may provoke the abortion of several fruits in self-incompatible species. Dressler (1993) stated that species of *Oncidium s.l.* and *Dendrobium* are strongly self-incompatible. Our results agreed with Tremblay *et al.* (2005) and Singer *et al.* (2006) by showing strongly self-incompatible *Gomesa* species. No apomixis or autogamy occurs in *Gomesa flexuosa* and *G. cornigera*, attested by the lack of fruit set in flowers treated as control or emasculated. Indeed, these species rely on insect-vectors to be capable of setting fruits. Other proved self-incompatibles Oncidiinae species cited in the literature are

Rodriguezia bahiensis (Carvalho & Machado, 2006), *Gomesa hookeri* (Alcántara *et al.*, 2006), *Trichocentrum ascendens* (Parra-Tabla *et al.*, 2000) and *Trichocentrum pumilum* (Pansarin & Pansarin, 2011). Torretta *et al.* (2011) also judged *Gomesa bifolia* as primarily self-incompatible, but mentioned that a low percentage of self-pollinated flowers developed fruits, despite not performing seed viability studies. The self-incompatibility of the studied species negatively affects their development and distribution in nature. However, *Gomesa s.l.* species are capable of growing clonally trough vegetative structures and maintain clones for many generations, which may attenuate the effects. Very low (<5%) fruit set levels have been reported to self-incompatible species (Neiland & Wilcock, 1998).

It is stated that Orchidaceae as a whole and Oncidiinae in particular do not present efficiency in pollen transferences and subsequent pollinations (Tremblay *et al*., 2005; Torretta *et al*., 2011). Neiland & Wilcock (1998) inferred that frequency of visits is low in rewarless orchids. However, in some days we were able to see insects visiting the inflorescences almost 20 times in *Gomesa flexuosa* and almost 15 times in *G. cornigera*, despite pollinators of *G. cornigera* were not carrying *pollinaria* in most of the time. In both species, nearly half of the flowers acted as pollen-donors and no more than 20% as pollen-receptors, very low numbers including when compared to other Oncidiinae species, as mentioned by Tremblay *et al.* (2005). Following their observations, the Nilsson's index in the subtribe varies from 0.4 to 0.6. Herein, *Gomesa flexuosa* and *G. cornigera* presented indexes of 0.27 and 0.35, respectively. Yet, species of Oncidiinae usually bear multi-flowered inflorescences, which mean that a large number of flowers may not be pollinated. So, not necessarily the pollinators are not effective in transferring the pollen, maybe their numbers are not sufficient to cover all the available flowers. Even so, many more flowers are pollinated than fruits are matured (see table 2), just as indicated a long time ago by the works of Stephenson (1981) and Lee (1988).

The fruits in Orchidaceae consist of abundant dust-like seeds, as indicated by Neiland & Wilcock (1998). These authors promoted a wide literature revision and stated that capsule production in rewardless species is low (usually <50%). Their study was conducted comparing nectar-offering and nectarless orchids, evidencing substantially higher fruiting success in the former group. On the other hand, the most successful nectarless orchids (>50% capsule set) offered pollen or floral fragrances as alternative rewards, presented success in mimicry or provided sleeping places. The combination of all the nectarless orchids studied until that date provided an average fruit set of 22.2%, but this result included species from both temperate and tropical climates. Orchids from the tropics usually display a lower fruiting

success when compared to groups in temperate areas, nearly one-third as successful (Neiland & Wilcock, 1998). In respect to the orchids from South Brazil, recent studies have shown higher frequency of effective pollinations (with removal and deposition of pollinic contents) and greater fruiting percentages than traditionally seen in specialized literature (Pedron *et al.*, 2012; Sanguinetti *et al.*, 2012; Sanguinetti & Singer, 2014). However, all of them dealt with terrestrial Orchidoideae species. On the other hand, there are studies pointing lower numbers regarding both aspects. Tremblay *et al.* (2005) demonstrated species that form a substantial higher number of fruits under cross-pollinations done manually in comparison to the natural and "intact" populations. Our study shows similar results, although the work of Tremblay *et al.* applied all the flowers of a single inflorescence for cross-pollination treatments and was carried out in populations in their natural environments. The fruiting in natural populations of *Gomesa flexuosa* and *G. cornigera* were very low in comparison to the cross-pollinations performed under controlled conditions, assuming percentages of 1.54% and 6.10%, respectively, as the maximum values of total fructification, taking into account the results of two seasons of observations (see table 2). These results reflect what is observed to other Oncidiinae species. Ackerman (1995) reported a percentage of capsule set of 2% to *Oncidium altissimum* in Puerto Rico, while Parra-Tabla *et al.* (2000) calculated a fruit set of 1.8% to *O. stipitatum* and two values related to *O. ascencdens*, 6.8% in forest and 3.1% in pastoral field. The mentioned species were classified as deceptive (rewardless). As a consequence, many flowers present what is called fruiting failure. Nevertheless, flowers that fail to become fruits are not always wasted, they can assume a substantial importance by donating their pollen (Willson & Rathcke, 1974).

Conclusion

Our study brought informations to increase our knowledge about pollination processes and breeding systems in Oncidiinae from Southern Brazil. The studied species are pollinated by bees that visit their inflorescences searching for floral oils and, during this activity, promote the transference of pollinic contents between anthers and stigmatic cavities. The presence of the rewards allied to the huge size of the inflorescences, more than attracting these visitors, cause them to remain foraging on flowers of a single inflorescence or even leave and return soon after the departure. Therefore, we assume that substantial degrees of autogamy and geitonogamy are taking place. Whereas both species are self-incompatible, this

fact induces abortion of many fruits, reflecting in the low percentages of fruiting successes observed in natural populations. This conclusion may be also based upon the high percentages of fruits formed in cross-pollinations under controlled conditions. Even though both *Gomesa flexuosa* and *G. cornigera* showed a high fruiting percentage in controlled cross-pollinations, our results suggest that in natural populations their pollinic content do not reach stigmatic cavities from different individuals that easily, then causing the low fruit set seen. So, the variation seen between fruiting success in nature and under controlled conditions is mainly dependent on the levels of pollinator activity and subsequent efficiency in transference of pollen. The frequency of visits is actually not so low, instead the pollen transference efficiency by the pollinators show low values, as inferred by the Nilsson's indexes calculated. For each 10 pollinarium removed, less than 3 flowers are pollinated in *Gomesa flexuosa* and less than 4 flowers in *G. cornigera*. Therefore, as indicated in our results, they present substantially more flowers acting as pollen-donors than as pollen-receptors or as fruit-forming, also serving as evidence that many abortions may be occurring.

Acknowledgements

This contribution is part of the first author's M. Sc. Dissertation (in Botany) at the Programa de Pós-graduação em Botânica – UFRGS. J.B.C. gratefully acknowledge his CAPES grant. We thank ICMBio for the collecting permit (process 40448-4) and the researchers of the Fundação Zoobotânica (FZB) do Rio Grande do Sul for allowing access to the cultivated orchid populations at the orchidarium and to a natural population of *Gomesa flexuosa*, for observation purposes of the pollination process.

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Table 1 – Observation hours and features of the pollination processes observed in *Gomesa flexuosa* and *G. cornigera*.

Species	Pollinator	Site of pollinarium attachment	Time of observation (hours x person)*	Time spent in flowers**	Time spent in inflorescences**	Floral longevity (days)**
Gomesa flexuosa	*Centris trigonoides*	Clypeus	140 (60 + 80)	2s - 25s (6.9s ± 3.5s)	25s - 2min (54s ± 1.96s)	24 - 32 (27.8 ± 2.4)
Gomesa cornigera	*Trigonopedia ferruginea*	Frons	110 (50 + 60)	2s - 40s (10.8s ± 6.2s)	35s - 3min40s (1min37s ± 43.7s)	15 - 21 (17.6 ± 1.52)

*Numbers in parentheses represent the time of observation to the first and second seasons, respectively, in hours x person.
**Numbers in parentheses represent the mean ± standard deviation.

Table 2 – Breeding system treatments, fruiting successes in natural populations and pollen transference efficiencies in *Gomesa flexuosa* and *G. cornigera.*

Species	Treatment				Fruiting success 1st season (%)**	Fruiting success 2nd season (%)**	Nilsson's index
	Control (%)*	Emasculation (%)*	Self-pollination (%)*	Cross-pollination (%)*			
Gomesa flexuosa	0 (0/739)	0 (0/39)	0 (0/39)	66.67 (26/39)	1.54 (14.94; 0; 2.45 ± 2.56)	1.43 (6.00; 0; 1.06 ± 1.24)	0.27 (N: 176; 14.77/54.55)
Gomesa cornigera	0 (0/201)	0 (0/46)	0 (0/46)	71.74 (33/46)	6.10 (27.91; 0; 7.04 ± 6.53)	5.33 (11.43; 0; 4.65 ± 4.45)	0.35 (N: 106; 20.75/59.43)

*Numbers in parentheses represent the number of fruit obtained over the number of flowers used in each treatment.

**Numbers in parentheses represent: maximum, minimum, mean ± standard deviation, in percentages.

***Numbers in parentheses represent: N = total number of flowers used in the calculation; percentage of pollinated flowers/percentage of flowers acting as pollen donors.

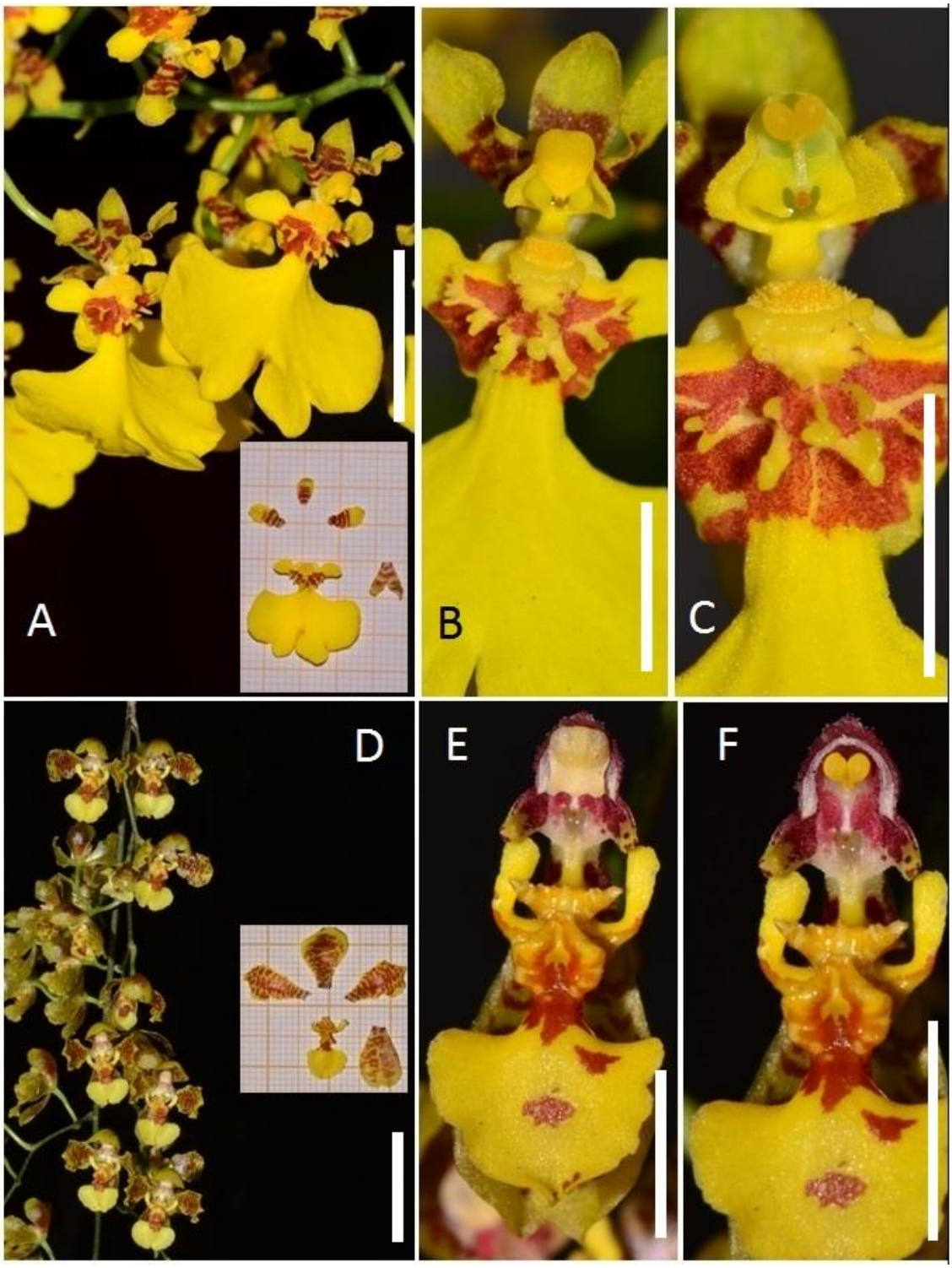

Figure 1 – Flowers of *Gomesa flexuosa* and *G. cornigera*. A-C) *Gomesa flexuosa*; A, flowers and distended perianth; B, detail of callus and column, anther cap present; C, detail of callus and column, pollinarium apparent; D-F) *Gomesa cornigera*; D, flowers and distended perianth; E, detail of callus and column, anther cap present; F, detail of callus and column, pollinarium apparent. Scale bars (A) = 1cm; (B-C and E-F) = 5mm; (D) = 2cm.

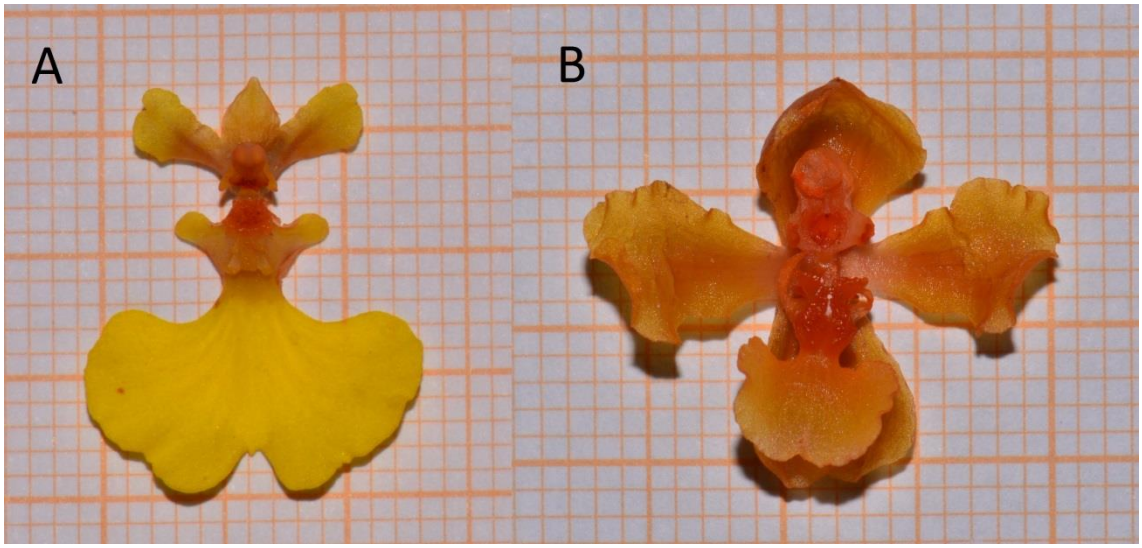

Figure 2 – Flowers of *Gomesa flexuosa* and *G. cornigera* stained with Sudan IV. A) *Gomesa flexuosa*; B) *Gomesa cornigera.* PS: Note the greater concentration of oils in the callus region, where the reagent provided a reddish coloration.

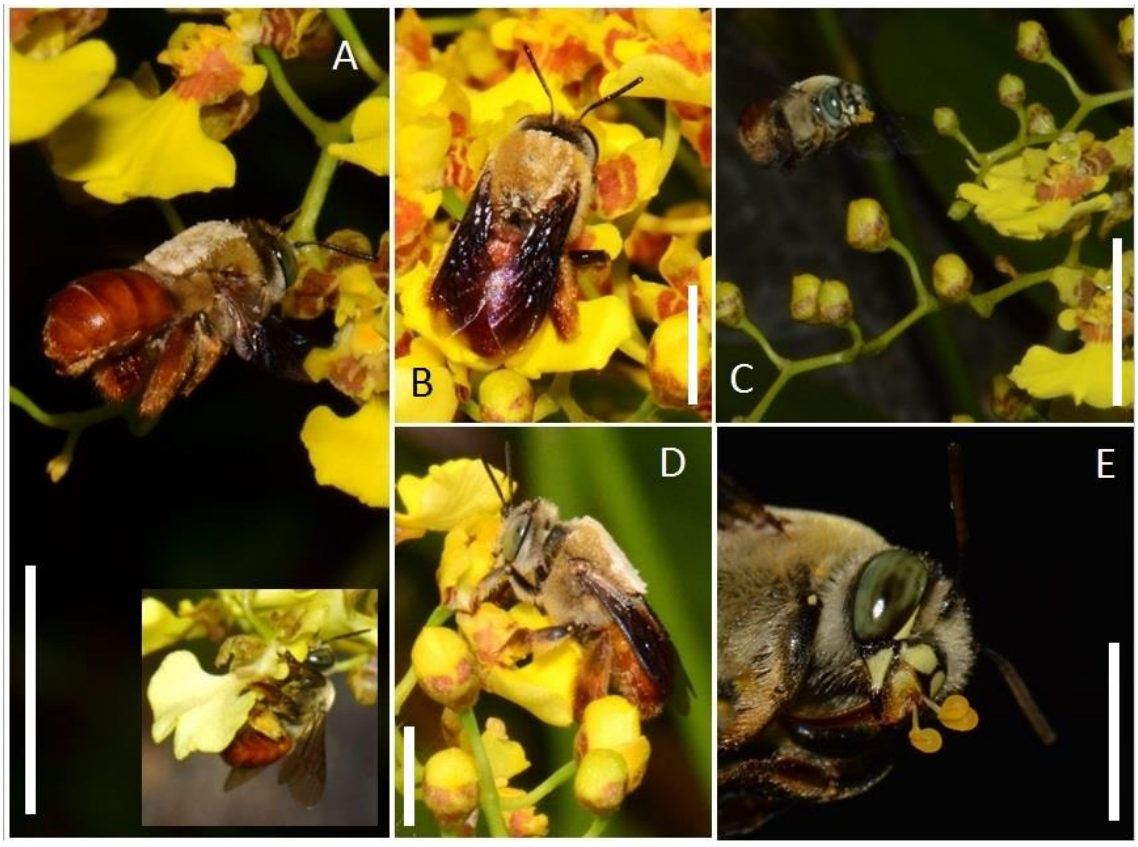

Figure 3 – *Centris trigonoides* pollinating *Gomesa flexuosa*. A) Insect approximation; B) Dorsal view; C) Insect carrying pollinaria during flight; D) Lateral view; E) Details of site of pollinarium attachment (clypeus). Scale bars (A and C) = 2cm; (B and D) = 1cm; (E) = 5mm.

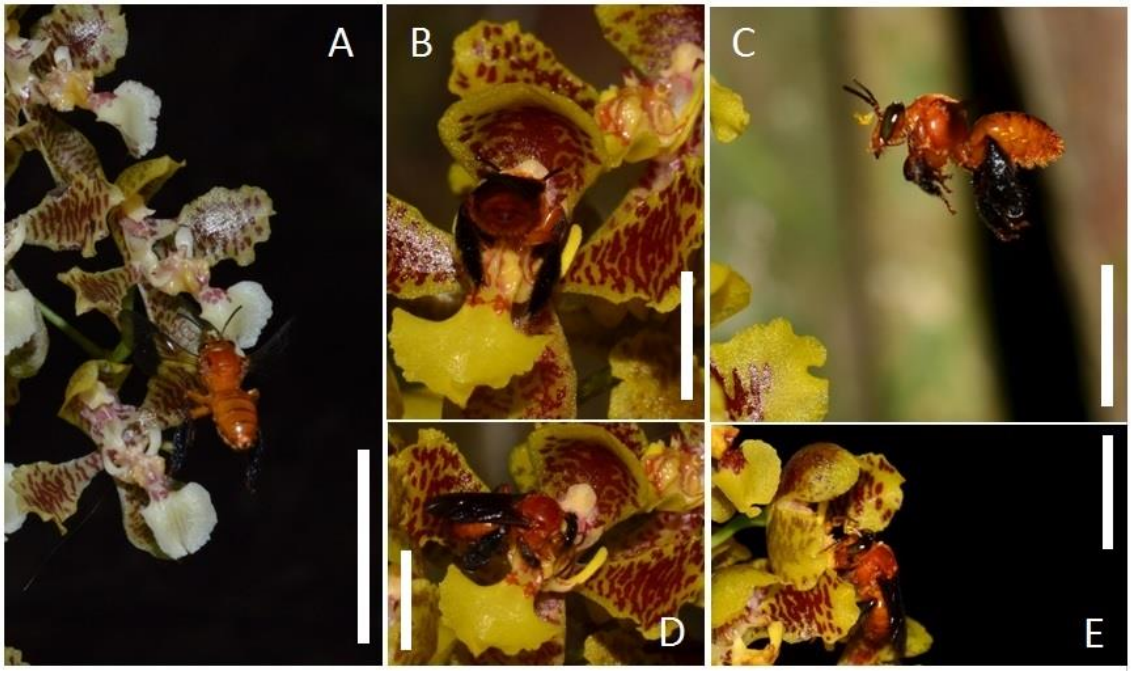

Figure 4 – *Trigonopedia ferruginea* pollinating *Gomesa cornigera*. A) Insect approximation; B) Dorsal view; C) Insect carrying pollinaria during flight; D) Lateral view; E) Site of pollinarium attachment (frons). Scale bars (A) = 2cm; (B-E) = 1cm.

Supplementary material Video S1. *Centris trigonoides* pollinating flowers of *Gomesa flexuosa.*

Supplementary material Video S2. Territorial behavior of male *Centris trigonoides* individuals.

Supplementary material Video S3. *Trigonopedia ferruginea* pollinating flowers of *Gomesa cornigera*.

Supplementary material Video S4. Male *Paratetrapedia fervida* visiting flowers of *Gomesa flexuosa* and *G. cornigera*.

6. CONCLUSION

Our observations over the genus *Gomesa* in Southern Brazil demonstrate that these orchids display high degrees of phenotypic variations and, therefore, the number of species is actually overestimated. Regarding only the State of Rio Grande do Sul, 8 new synonyms were required: *Gomesa montana* (= *G. barbaceniae*); *G. ciliata* (= *G. barbata*); *Oncidium raniferum* var. *major* and *G. loefgrenii* (= *G. hookeri*); *G. gravesiana* (= *G. imperatoris-maximiliani*); *G. gardneri* (= *G. pectoralis*); *G. planifolia* (= *G. recurva*); and *G. longipes* (= *G. uniflora*). When dealing with species described by Barbosa Rodrigues, it is suggested to designate his original illustrations, found at the Biblioteca Barbosa Rodrigues in the Jardim Botânico do Rio de Janeiro, as lectotypes, since potential types are rare to find or either were destroyed or never existed. Moreover, the majority of types of Brazilian *Gomesa* species are housed at the AMES, BM, BR, G, K, LE, M, P, R, S and W herbaria.

Gomesa is particularly rich in number of species in Rio Grande do Sul. Twenty species occur in the State: *Gomesa barbaceniae*; *G. barbata*; *G. bifolia*; *G. concolor*; *G. cornigera*; *G. crispa*; *G. flexuosa*; *G. gomezoides*; *G. hookeri*; *G. hydrophila*; *G. imperatoris-maximiliani*; *G. longicornu*; *G. paranensoides*; *G. pectoralis*; *G. radicans*; *G. ranifera*; *G. recurva*; *G. riograndensis*; *G. uniflora* and *G. venusta*. Most of these plants have an epiphytic habit, only two are strictly terrestrial. *Gomesa flexuosa* and *G. bifolia* are the most widely distributed, being present in 7 of the 11 physiographic regions. In the other hand, the Encosta Inferior do Nordeste and the Campos de Cima da Serra are the regions with the highest species richness, being inhabited by 14 and 12 species, respectively. The number of species is higher at northern and eastern regions, gradually decreasing towards southern and western places. This result support the idea that many species may have entered the State though the "Torres gate", then dispersing over the territory from this point. Most of the species present a high potential for ornamental plants, since they bear multi-flowered inflorescences mostly stained by vivid shades of yellow and brown. For that reason, they may be targeted by economic interests, therefore their preservation must be encouraged and subsidies must be offered in order to promote their sustainable exploitation.

At last, we studied the pollination strategies and breeding systems of *Gomesa flexuosa* and *G. cornigera*. The former is pollinated by females of *Centris* sp., while the responsibles for this process in the latter species are females of *Trigonopedia* sp.. Individuals of *Tetrapedia* sp. were also seen landing on flowers of both species but are mere visitors, insofar as they

were never observed carrying pollinaria. Seen that both orchids display floral oils, mainly dispersed over the callus region of the lip, these oil-collecting bees carry pollinic contents from anthers to stigmatic cavities while foraging over the inflorescences in the search for the rewards, then promoting pollination. *Gomesa flexuosa* and *G. cornigera* are strongly self-incompatible. So, we infer that some degree of self-pollination takes place, because the fruiting successes in natural populations are very low to both species, despite they present relatively high fruit sets when cross-pollinations are performed under controlled conditions. In addition, other factor that may lead to this result is their low pollen transference efficiency, evidenced by the substantial differences between the number of flowers acting as pollen donors and being pollinated, the former group presenting much higher percentages.

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