Revista de Ciências Agroveterinárias
Universidade do Estado de Santa Catarina (UDESC)

Research Article

Record of dead bees on *Spathodea campanulata* P. Beauv. flowers. Beauv. on the public promenade in São Luiz Gonzaga, State of Rio Grande do Sul

Registro de abelhas mortas em flores de Spathodea campanulata P. Beauv. no passeio público em São Luiz Gonzaga, Estado do Rio Grande do Sul

Rafael Narciso Meirelles *[1](ORCID 0000-0002-1079-8664), **Millene Matos Machado** [1](ORCID 0009-0008-1266-1064), **Paola Ramos Simões Pires** [2](ORCID 0000-0002-4521-8930)

[1]State University of Rio Grande do Sul, São Luiz Gonzaga, RS, Brazil. *Corresponding author: rafael-meirelles@uergs.edu.br
[2]Pontifical Catholic University of Rio Grande do Sul, São Luiz Gonzaga, RS, Brazil.

Submission: February 17, 2025 | Accepted: June 16, 2025

ABSTRACT

Bees are the main pollinators and are crucial for many agricultural crops, as well as contributing to the conservation of biodiversity. Many economically important plants depend on these insects, which contribute to increased fruit and seed production. However, high mortality rates have been recorded worldwide, as well as the disappearance of bees. Among the various causes of mortality, some plant species can be toxic and endanger the lives of these hymenoptera. Thus, this study aimed to record bee deaths on Spathodea flowers (*Spathodea campanulata* P. Beauv.), given that this plant is present on the public sidewalk in the municipality of São Luiz Gonzaga, RS. For this purpose, ten flowers were collected per sampling occasion between February and May 2024, on the ground, under the canopy of seven trees scattered throughout the urban area. The collected flowers were opened, and the insects inside were identified. Of 220 flowers, 14% had dead bees (32 individuals) distributed across four genera, with jataís (*Tetragonisca* sp.) being the most abundant with 12 records, followed by *Plebeia nigriceps* and *Scaptotrigona bipunctata* (with seven and six individuals, respectively). It is concluded that the spathodea flower contributes to the death of bees in the urban area of São Luiz Gonzaga.

KEYWORDS: Pollination. Food security. Meliponiculture.

RESUMO

As abelhas são os principais polinizadores e são cruciais para muitas culturas agrícolas, além de contribuir para a conservação da biodiversidade. Muitas plantas de importância econômica dependem desses insetos, que contribuem para aumento da produção de frutos e sementes. No entanto, altas taxas de mortalidade têm sido registradas no mundo, bem como o desaparecimento das abelhas. Dentre as diversas causas da mortandade, algumas espécies de plantas podem ser tóxicas e colocam em risco a vida destes himenópteros. Desta forma, este trabalho teve como objetivo registrar a morte de abelhas em flores de espatódea (*Spathodea campanulata* P. P. Beauv.), visto que esta planta está presente no passeio público do município de São Luiz Gonzaga, RS. Para isso, foram coletadas dez flores por ocasião amostral, entre fevereiro e maio de 2024, no chão, sob a copa de sete árvores espalhadas pela zona urbana. As flores coletadas foram abertas e os insetos identificados. De 220 flores, 14% apresentaram abelhas mortas (32 indivíduos), distribuídos em quatro gêneros, sendo que jataís (*Tetragonisca* sp.) foram as mais abundantes, com 12 registros, seguida por *Plebeia nigriceps* e *Scaptotrigona bipunctata*, (com sete e seis indivíduos, respectivamente). Conclui-se que a flor de espatódea contribui com a morte de abelhas na zona urbana de São Luiz Gonzaga.

PALAVRAS-CHAVE: Polinização. Segurança alimentar. Meliponicultura.

INTRODUCTION

Through pollination, bees trigger events that are important for the functioning of ecosystems, such as plant reproduction, the promotion of biodiversity, the resilience of natural environments, and the production of fruits and seeds (CAIRES & BARCELOS 2017, KHALIFA et al. 2021).

Despite their importance, bee populations have been declining in recent years. There is no single cause for this phenomenon, but among the main ones are deforestation of native areas, reduction of vegetated areas, urban expansion, agricultural expansion, pesticide use, global warming, fragmentation, and habitat loss. In each biome and location, these causes have varying levels of impact and significance (GOULSON et al. 2015, MEIRELLES et al. 2020).

Among the forms of self-preservation, some bees end up migrating to urban areas, mainly trying to escape environments where pesticides are used, or where natural vegetation has been and is still being suppressed by various factors (OLIVEIRA 2024). Another reason for finding bees in cities is meliponiculture, which is the breeding of stingless bees. In addition to being a growing economic activity, it helps preserve the environment and encourages the population to understand the importance of these insects in food production (MEIRELLES et al. 2020). Studies indicate that meliponiculture is widely practiced in urban areas (RUARO et al. 2022).

However, these built-up and anthropized sites pose a number of risks to pollinators in general. Among them is the local flora itself, which may contain toxic species or species that provide resources poor in nutritional value, such as Indian neem (*Azadirachta indica*) and false barbatimão (*Dimorphandra mollis*) (CINTRA et al. 2005).

In this context, another species common in urban areas, the African tulip tree (*Spathodea campanulata*), is a tree of the *Bignoniaceae* family native to Central Africa (LORENZI et al. 2018). Under favorable conditions, the species is potentially invasive (LARRUE et al. 2016). Even so, it is often used as an ornamental plant in tropical areas and is highly appreciated for its orange-red, red, or, more rarely, yellow bell-shaped flowers (TRIGO & SANTOS 2000), although there are reports of its negative effect on the bee population in Brazil (MODRO et al. 2006).

The link between bee mortality and the mucilage of spurge plants is not new. NOGUEIRA-NETO (1997) described observations he made in Campinas (SP), reporting that he found a variable number of dead bees inside flowers, including the species mirim-droriana (*Plebeia droryana*), jataí (*Tetragonisca angustula*), mandaguari (*Scaptotrigona postic*a), irapuá (*Trigona spinipes*), and mirim-preguiça (*Friesella schrottky*). It was also noted that mandaçaias (*Melipona quadrifasciata*) and *Apis mellifera* were rarely observed, indicating that small and medium-sized meliponines are more severely affected.

The creators themselves have warned of cases of mortality and negative effects on beekeeping and meliponiculture, such as a study in which beekeepers in the Pantanal region of Mato Grosso cited spathodea as a harmful agent to bees (MODRO et al. 2006).

Therefore, with reports of dead bees on spathodea flowers, there is concern that it could be dangerous to the survival of bees and other small insects. Thus, studies are

needed to generate subsidies for damage mitigation measures and even for the development of legislation on the use of spathodea in urban afforestation. This study therefore aimed to record insect mortality, with a special focus on bees, in spathodea flowers located in the urban area of the municipality of São Luiz Gonzaga, in northwestern Rio Grande do Sul.

MATERIALS AND METHODS

The study was conducted in the urban area of the municipality of São Luiz Gonzaga-RS (28°24'25“S; 54°56'42”W), with flowers collected weekly between February and May 2024 from seven trees located on streets and squares in the central region of the municipality.

In total, 220 intact flowers that were on the ground were collected under the canopy of trees in the late afternoon. The structures were bagged and taken to the Beneficial Insect Research Laboratory (Laboratório de Pesquisas com Insetos Benéficos – LAPIB) at the State University of Rio Grande do Sul for screening. The flowers were opened with a scalpel, analyzed, and the dead insects found were collected (Figure 1).

Figure 1. Dead insect inside an spathodea flower (*Spathodea campanulata*) collected in the municipality of São Luiz Gonzaga, RS, Brazil.

The collected insects were stored in Falcon tubes (15 mL) with 70% alcohol to prevent deterioration until the end of the collection period, for subsequent identification, which was performed using an optical stereomicroscope, with the aid of dichotomous keys and images (SILVEIRA et al. 2002, WITTER et al. 2023). Some insects were so badly degraded that it was not possible to identify them beyond the taxonomic level of genus.

RESULTS AND DISCUSSION

Of the 220 flowers that were collected, 32 of them had dead insects (14.55%). A total of 45 insects were recorded, including 32 bees (Figure 2), all of which were native species.

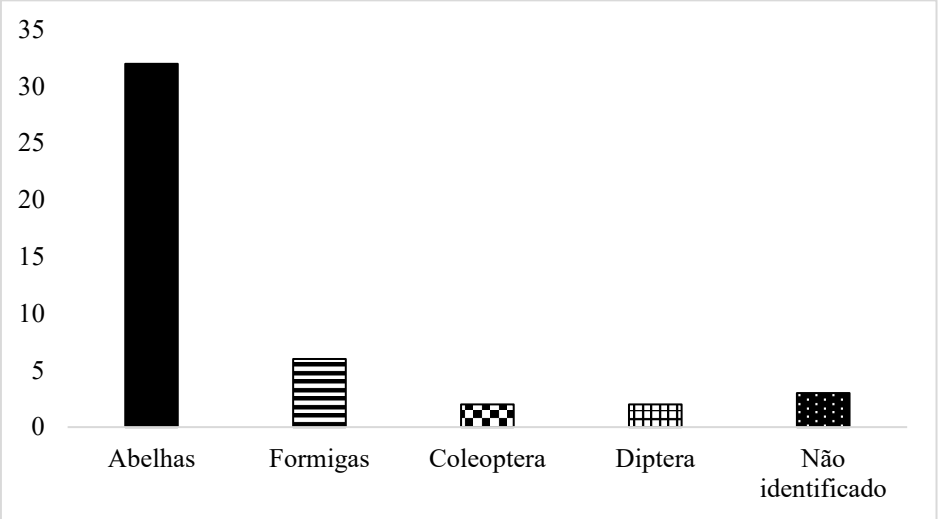

Figure 2. Total number of insects recorded on *Spathodea campanulata* flowers collected in the municipality of São Luiz Gonzaga, RS.

The rate of flowers with dead bees recorded in this study was similar to that reported by AYALA et al. (2024) in a study in Argentina, which collected 656 flowers from three spathodea trees over 12 days between June and August 2019. It is worth noting the similarity between the workplace environments in Ayala and São Luiz Gonzaga, separated by 400 km and with only four degrees of latitude south difference, indicating similar soil and climate conditions.

Another similarity between the research by AYALA et al. (2024) and this study was the collection of Diptera, Coleoptera, and Hymenoptera. However, despite records of visits by various species of arthropods in general (SOUZA et al. 2021), it appears that bees tend to account for the majority of organisms collected (TRIGO & SANTOS 2000, SOUZA et al. 2021, ARBOITTE et al. 2023, AYALA et al. 2024, CASTAGNINO et al. 2024).

SOUZA et al. (2021), when observing floral visitors, found that most visits were by arthropods that contribute to the pollination of the species, with bees predominating. The authors recorded the occurrence of a hummingbird (*Phaethornis* sp.) that was considered an effective pollinator of spathodea at the study site (Ivinhema, MS).

The collected bees were identified to the extent possible given their state of preservation and were distributed into nine taxa or groups (Table 1), namely: *Tetragonisca* sp., *Plebeia nigriceps*, *Plebeia witmanii*, *Plebeia* sp., *Scaptotrigona postica*, *Scaptotrigona bipunctata*, *Scaptotrigona* sp. and *Melitoma* sp.. In addition to a specimen collected belonging to the Halictidae family, which could not be identified beyond this level.

Table 1. Species, genera, or families of bees found on flowers of the African tulip tree (*Spathodea campanulata* P. Beauvi) collected in the municipality of São Luiz Gonzaga, RS.

Species	Number of individuals
Tetragonisca sp. (Jataí)	12
Plebeia nigriceps	7
Plebeia witmanii	1
Plebeia sp.	1
Scaptotrigona postica	1
Scaptotrigona bipunctata	6
Scaptotrigona sp.	1
Melitoma sp.	2
Halictidae (family)	1
TOTAL	32

Jataís (*Tetragonisca* sp.) accounted for the highest number of records (37.5%). In Rio Grande do Sul, there are two species of the same genus that receive this popular name, namely: *Tetragonisca angustula* and *Tetragona fiebrigi* (WITTER et al. 2023). However, it was not possible to define the species, as the structure responsible for differentiating between the two, the mesepisternum (black in *T. angustula* and yellow in *T. fiebrigi*), was not in good enough condition to be visualized in the specimens collected from the flowers.

Bees commonly known as mirins, of the genus *Plebeia*, accounted for 28.1% of the records, making them the second most collected group. They are small bees, rarely exceeding 3 mm in length, and, together with jataís, are very common in urban areas due to their generalist nesting habits, lodging in tree hollows, rock crevices, and spaces in masonry buildings in urban areas (SOUZA & ABREU 2023, REBOUÇAS et al. 2024).

Bees of the genus *Scaptotrigona* accounted for 25% of the records. Among them, *Scaptotrigona postica* had one occurrence (3.1%), which seems to be of little relevance within the scope of the study. However, it is important to note that it is not on the list of native bees in Rio Grande do Sul (SEMA 2014), but was introduced by meliponiculture practitioners and has been bred illegally in the state (CONAMA 2020). The movement of bees outside their region of occurrence has become a legal problem and a threat to conservation, as they may compete for nesting sites and food, leading to a decrease in resources for native species (CARVALHO 2022).

The movement of bees outside their natural range has been facilitated by meliponiculture practitioners. In this context, there are two important findings recorded in the work of RUARO et al. (2022). First, they reported that most of the meliponiculture farmers interviewed (718) were urban. Second, 1.6% of respondents stated that they had purchased or intended to purchase bee colonies from outside their natural range. In other words, the record of *S. postica* exposes the problem that has been occurring with the transit of bees from outside Rio Grande do Sul into urban meliponaries.

As for bees of the genus *Melitoma* (6.25%) and the specimen of the Halictidae family (3.1%), unlike other species, they are solitary, meaning they do not form hives and there is no overlap between generations, and they are commonly observed in urbanized areas (MUÑOZ-URIAS et al. 2025). These bees, rarely seen and little known

by the general population, have been observed on spathodea flowers by CASTAGNINO et al. (2024), in a study conducted in Bahia, and by OLIVEIRA et al. (1991), in collections made in São Paulo.

Although the flowers are commonly visited by pollinating insects (SOUZA et al. 2021), in its region of natural occurrence, the spathodea is pollinated by birds, while in Central America it is pollinated by bats (FLACH 2005, SOUZA et al. 2021). The abundance of floral visitors recorded in the literature is partly due to its complex nectar composition and mucilaginous texture, which is attractive to many groups of insects, birds, and bats (TRIGO & SANTOS 2000, FLACH 2005, SOUZA et al. 2021).

There are differences of opinion among various authors regarding the mechanisms that lead to insect mortality in flowers. For some, both the pollen and nectar of the spurge contain substances that are toxic to bees. QUEIROZ et al. (2012) tested pollen and nectar from *S. campanulata* and found severe toxicity for *Melipona fasciculata* and *Melipona seminigra*. In a feeding test on *Apis mellifera* bees, MORAES-ALVES et al. (2003) observed significant mortality with flower extract and nectar.

On the other hand, FLACH (2005) isolated the components of nectar and none were considered toxic to insects. In fact, based on reports, the author suggested that floral visitors drown while trying to escape from the flower, as they are unable to grip the slippery inner walls, and that this would be a defense strategy against nectar “thieves,” since *S. campanulata* is not effectively pollinated by arthropods.

An important piece of information about the composition of the plant's nectar is that it contains additional chemicals besides sugars, such as a-amyrin, B-amyrin, cycloeucalenol, cholesterol, and stigmasterol (FLACH 2005). In addition, among the volatile compounds, there are two components that are insect pheromones, which are possibly involved in attracting them (FLACH 2005). In other words, in addition to the shape that makes it difficult for insects to escape and the mucilaginous substance that traps them, there is the possibility that the flower attracts insects due to its volatile compounds.

As for the plant's phenology, tulip-shaped flowers begin to appear in the fourth year after planting, in numerous buds that, with successive openings, ensure long flowering throughout most of the year, under the conditions of Rio Grande do Sul. In fact, a study conducted in Santa Catarina found that mortality increases in late fall and early winter (ARBOITTE et al. 2023), as this is a period of forage scarcity for bees in southern Brazil (WOLFF et al. 2008). This increases competition for food and forces bees to seek resources in the few existing flowers. This situation may lead to an increase in insect mortality in spathodea flowers.

As for measures to mitigate the potential damage caused by the plant, the state of Santa Catarina, through Law No. 17,694 of January 14, 2019 (SANTA CATARINA 2019), and Mato Grosso, through Law No. 11957 of December 9, 2022 (MATO GROSSO 2022), established legislative control measures by prohibiting the production of seedlings, transportation, and planting of spathodea throughout the entire territory of the states. There are also legal provisions at the municipal level in several municipalities across the country, in addition to state bills pending in at least seven states of the federation.

CONCLUSION

The *Spathodea campanulata* flowers collected in São Luiz Gonzaga, in the northwest of Rio Grande do Sul, contained dead insects, with bees predominating among the specimens examined.

Bees of the genus *Tetragonisca* were the most commonly recorded, followed by dwarf bees (*Plebeia* spp.) and *Scaptotrigona* spp. Among those collected, the species *Scaptotrigona postica* stands out, as it is not listed as native by the Rio Grande do Sul State Department of the Environment, indicating illegal activity involving the transport of bees outside their area of occurrence.

It is therefore recommended to avoid planting this species throughout the region, especially in areas where stingless bees are bred.

NOTES

AUTHORS' CONTRIBUTIONS

Conceptualization, methodology, and formal analysis, Rafael Narciso Meirelles, Millene Matos Machado, and Paola Ramos Simões Pires; software and validation, Rafael Narciso Meirelles; investigation, Millene Matos Machado and Paola Ramos Simões Pires; resources and data curation, Rafael Narciso Meirelles and Millene Matos Machado; writing - preparation of the original draft, Rafael Narciso Meirelles, Millene Matos Machado, and Paola Ramos Simões Pires; writing - revision and editing, Rafael Narciso Meirelles and Paola Ramos Simões Pires; visualization, Millene Matos Machado and Paola Ramos Simões Pires; supervision, Rafael Narciso Meirelles; project management, Rafael Narciso Meirelles; funding acquisition, Rafael Narciso Meirelles. All authors have read and agreed to the published version of the manuscript.

FINANCING

This paper was not supported by any funding agency.

STATEMENT BY THE INSTITUTIONAL REVIEW BOARD

Not applicable to studies that do not involve humans or animals.

INFORMED CONSENT STATEMENT

Not applicable because this study did not involve humans.

DATA AVAILABILITY STATEMENT

Data can be made available upon request.

REFERENCES

ARBOITTE MZ et al. 2023. Ocorrência de *Spathodea Campanulata* no município de Santa Rosa do Sul-SC. ScientiaTec 10: 39-51.

AYALA FE et al. 2024. El tulipanero africano *Spathodea campanulata* (Bignoniaceae) en la Argentina: Impacto de una planta exótica sobre la mortalidad de entomofauna nativa. Ecología Austral 34: 322-329.

CAIRES SC & BARCELOS D. 2017. Colapso das abelhas: Possíveis causas e consequências do seu desaparecimento na natureza. Acta Apicola Brasilica 5: 11-15.

CARVALHO AF. 2022. Ilegalidades no comércio online de abelhas sem ferrão no Brasil Illegalities in the online trade of stingless bees in Brazil. Acta Biológica Paranaense 51: e86333.

CASTAGNINO GLB et al. 2024. Mortality of stingless bees on *Spathodea campanulata* Beauv. (Bignoniaceae) flowers. Revista Brasileira de Saúde e Produção Animal 25: e20230031.

CINTRA P et al. 2005. Plantas tóxicas para abelhas. Arquivos do Instituto Biológico 72: 547-551.

CONAMA. 2020. Resolução Nº 496, de 19 de agosto de 2020. Disciplina o uso e o manejo sustentáveis das abelhas-nativas-sem-ferrão em meliponicultura.

FLACH A. 2005. Ecologia química de Maxillariinae, *Spathodea campanulata* e Meliponiinae. Tese (Doutorado em Química). Campinas: Unicamp. 202p.

GOULSON D et al. 2015. Bee declines driven by combined stress from parasites, pesticides, and lack of flowers. Science 347: 1255957.

KHALIFA SAM et al. 2021. Overview of Bee Pollination and Its Economic Value for Crop Production. Insects 12: 688.

LARRUE S et al. 2016. Elevational distribution and photosynthetic characteristics of the invasive tree *Spathodea campanulata* on the island of Tahiti (South Pacific Ocean). NeoBiota 30: 127-149.

LORENZI H et al. 2018. Árvores e arvoretas exóticas no Brasil: medeiras, ornamentais e aromáticas. Nova Odessa: Instituto Plantarum de Estudos da Flora.

MATO GROSSO. 2022. Lei Nº 11957 DE 09/12/2022. Proíbe a produção de mudas e o plantio da *Spathodea Campanulata*, também conhecida como Espatódea, Bisnagueira, Tulipeira-do-Gabão, Xixi-de-Macaco ou Chama-da-Floresta e incentiva a substituição das existentes.

MEIRELLES RN et al. 2020. O furto como um fator limitante na criação de abelhas. Pesquisa Agropecuária Gaúcha 26: 82-91.

MODRO AFH et al. 2006. Agentes nocivos para abelhas (*Apis mellifera* L.), segundo a percepção dos apicultores de Cáceres, Pantanal Norte, Brasil. SITIENTIBUS série Ciências Biológicas 6: 93-97.

MORAES-ALVES MMB et al. 2003. Fitotoxicidade em *Apis mellifera* africanizada (Hym.: Apidae). I. Secreção do botão floral e néctar de *Spathodea campanulata* Beauvois (Bignoniaceae). Biotemas 16: 89-103.

MUÑOZ-URIAS A et al. 2025. Effects of urbanization and floral diversity on the bee community (Hymenoptera, Apoidea) in an oak forest in a Protected Natural Area of Mexico. Journal of Hymenoptera Research 98: 47-68.

NOGUEIRA-NETO P. 1997. Vida e criação de abelhas indígenas sem-ferrão. São Paulo: Editora Nogueirapis**.**

OLIVEIRA AC 2024. Qualidade do ambiente urbano para abelhas: índice de qualidade ambiental e avaliação da contaminação dos recursos alimentares por metais. Tese (Doutorado em Ecologia, Conservação e Biodiversidade). Uberlândia: UFB. 78p.

OLIVEIRA RM et al. 1991. Visitantes florais de *Spathodea Campanulata* Beauv. (Bignoniaceae). Bioikos 5: 7-30.

QUEIROZ ACM et al. 2012. Effect of toxicity of nectar and pollen of african tulip tree (Spathodea campanulata) on *Melipona fasciculata* and *M. seminigra* (Apidae, Meliponini). In: X Encontro sobre Abelhas. Anais... Ribeirão Preto: FUNPEC Editora. p.135.

REBOUÇAS JS et al. 2024. Reuso de embalagem cartonada como ninhos artificiais para nidificação de abelhas sociais (Meliponini) em áreas antropizadas: uma pesquisa exploratória de campo. Revista Delos 17: e2187-e2187.

RUARO EL et al. 2022. Urbano e conectado: um perfil do meliponicultor do século XXI. Revista de Ciências Agroveterinárias 21: 468-480.

SANTA CATARINA. 2019. LEI Nº 17.694, DE 14 DE JANEIRO DE 2019. Proíbe a produção de mudas e o plantio da *Spathodea Campanulata*, também conhecida como Espatódea, Bisnagueira, Tulipeira-do-Gabão, Xixi-de-Macaco ou Chama-da-Floresta e incentiva a substituição das existentes.

SEMA-RS. 2014. Instrução Normativa SEMA Nº 3 DE 29/09/2014. Institui e normatiza a criação e conservação de meliponíneos nativos (abelhas-sem-ferrão), no Estado do Rio Grande do Sul.

SILVEIRA FA et al. 2002. Abelhas brasileiras: sistemática e identificação. Belo Horizonte: Fernando A. Silveira.

SOUZA PO & ABREU PF. 2023. Abelhas nativas sem ferrão em ambiente urbano: publicações nos últimos 10 anos. Biológica-Caderno do Curso de Ciências Biológicas 6: 33-49.

SOUZA ES et al. 2021. Comportamento de forrageio de recursos florais em *Spathodea campanulata* (Bignoniaceae): uma espécie vegetal exótica. Brazilian Journal of Development 7: 99157-99168.

TRIGO JR & SANTOS W. 2000. Insect mortality in *Spathodea campanulata* Beauv. (Bignoniaceae) flowers. Revista Brasileira de Biologia 60: 537-538.

WITTER S et al. 2023. Guia de Reconhecimento de abelhas-sem-ferrão do Rio Grande do Sul. Porto Alegre: SEAPI/DDPA.

WOLFF LF et al. 2008. Flora apícola arbórea nativa na região serrana de Pelotas para a apicultura sustentável na Metade Sul do Rio Grande do Sul, Documentos n. 242. Pelotas: Embrapa Clima Temperado.