

Genetic Resources Communication

Clearing confusion in *Stylosanthes* taxonomy. 2. *S. macrocephala* M.B. Ferreira & Sousa Costa vs. *S. capitata* Vogel and *S. bracteata* Vogel

Aclarando confusiones en la taxonomía de Stylosanthes. 2. S. macrocephala M.B. Ferreira & Sousa Costa vs. S. capitata Vogel y S. bracteata Vogel

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Abstract

Stylosanthes macrocephala was described as a new species in 1977 and has become an economically important pasture legume. It has recently been claimed to be conspecific with *S. capitata*, also an economically important species. This paper refutes this synonymization and summarizes morphological descriptions as well as genetic studies and cytological evidence indicating that diploid *S. macrocephala* should be considered a separate species, even being a likely progenitor of tetraploid *S. capitata*. Early confusion with *S. bracteata* is also discussed.

Keywords: Cytology, Fabaceae, molecular markers, morphology, phylogeny, synonymy.

Resumen

Stylosanthes macrocephala, una especie descrita en 1977 que se convirtió en una leguminosa forrajera económicamente importante, fue recientemente propuesta como sinónimo de *S. capitata*, también una especie económicamente importante. En el presente trabajo se refuta esta sinonimización y se resumen descripciones morfológicas, estudios genéticos y evidencia citológica que indican que *S. macrocephala*, una especie diploide, debe ser considerada como especie separada, siendo además el progenitor materno de *S. capitata*, una especie alotetraploide. También se discute una confusión con *S. bracteata* en tiempos anteriores.

Palabras clave: Citología, Fabaceae, filogenética, marcadores moleculares, morfología, sinonimia.

The species and germplasm diversity

In the 1970s, the potential of *Stylosanthes capitata* Vogel and *Stylosanthes macrocephala* M.B. Ferreira & Sousa Costa as pasture legumes for the acid, low-fertility soils in savanna regions of tropical America was recognized (Thomas and Grof 1986). Whereas *S. capitata* is native to Bolivia, Brazil and Venezuela, *S. macrocephala* is endemic to Brazil (Cook et al. 2020). In order to create a genetic resources pool for cultivar development by selecting within the naturally occurring diversity or for eventual breeding, both species were among the main subjects of germplasm collecting missions conducted since 1975 in Brazil (Costa and Brandão 1982; Coradin and Schultze-Kraft 1990) and,

for *S. capitata*, in Venezuela (Calles et al. 2017). Consequently, as at 28 May 2020 some 381 and 149 different accessions of *S. capitata* and *S. macrocephala*, respectively, are being held in the genebank of Empresa Brasileira de Pesquisa Agropecuária (Embrapa) (alelobag.cenargen.embrapa.br/AleloConsultas/Passaporte/especie.do?idg=33), and 345 and 139 accessions, respectively, in the genebank of International Center for Tropical Agriculture (CIAT) (genebank.ciat.cgiar.org/genebank/fsearchparam2.do). The vast majority of genotypes, including those from the EPAMIG (Empresa de Pesquisa Agropecuária de Minas Gerais) collection, which focussed on the State of Minas Gerais, Brazil, are common to both genebanks. *S. capitata* and *S. macrocephala*

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accessions that are in the Australian Pastures Genebank (apg.pir.sa.gov.au/gringlobal/search.aspx) and the genebank of the International Livestock Research Institute (ILRI) (ilri.org/research/facilities/ilri-genebank) are duplicates of material received as donations from CIAT, Embrapa or EPAMIG.

Both species belong to the subgeneric section, *Stylosanthes*, whose main distinguishing feature is the presence of a floral axis rudiment, in contrast with the species in the other section, *Astyposanthes*, which lack an axis rudiment [e.g. *S. guianensis* (Aubl.) Sw.] (Mohlenbrock 1957).

As a result of agronomic evaluation and animal production studies, several commercial cultivars were released (Cook et al. 2020), important selection criteria being productivity on infertile, acid soils and tolerance of anthracnose, a disease caused by the fungus, *Colletotrichum gloeosporioides*: for *S. capitata* cv. Capica and Alfalfa Criolla in Colombia (1983) and Venezuela (1998), respectively; and for *S. macrocephala* cv. Pioneiro in Brazil (1983). The most used cultivar currently is ‘Estilosantes Campo Grande’, released in 2000 in Brazil, a multi-line mixture comprising 80% *S. capitata* and 20% *S. macrocephala*.

In addition to the agronomic-diversity evaluations that led to the development of the above cultivars, several studies using molecular markers have been conducted, mainly to assess species relationships and genetic diversity within species, aiming at enhancement of germplasm management and future breeding programs of *Stylosanthes* species. Unless they are relevant to the topic of this paper and are cited in the text, the respective references are listed under “Further reading” (see below).

The confusion

Stylosanthes capitata was described by Vogel (1838), and *S. macrocephala* by Ferreira and Costa (1977). Because of their potential as forage legumes for poor soils, both species have been of interest to pasture scientists since the 1970s. Prior to the publication of its description, *S. macrocephala* was erroneously referred to as *S. bracteata* (presumably *S. bracteata* Vogel), e.g. by Grof et al. (1979). While there is a similarity in

inflorescence form between these 2 species, Liu et al. (1999) stated that, based on the high percentage of DNA fragments shared with a formally identified accession of *S. macrocephala*, it was unlikely that the ‘*S. bracteata*’ accession used in their work¹ and the *S. macrocephala* belonged to 2 different species. This is supported by the fact that *S. bracteata* is a fire climax savanna species (see Figure 1C), and as far as we are aware, it has not been possible to grow the plant outside its native habitat. The species is morphologically and genetically very closely related to *S. linearifolia* M.B. Ferreira & Sousa Costa (Vander Stappen et al. 2002).

In a recent revision of most of the South American species of the genus *Stylosanthes*, Vanni (2017) claimed that *Stylosanthes macrocephala* be considered a synonym of *S. capitata*. This synonymization has not been accepted by the 2 major taxonomic databases, the USDA Germplasm Resources Information Network, GRIN (npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx) and The Plant List, TPL (theplantlist.org/), nor by the Flora do Brasil (servicos.jbrj.gov.br/flora/search/Stylosanthes_macrocephala), presumably because Vanni (2017) did not provide any argument to support the action. While it has found entrance in the Plants of the World Online (POWO) database of the Royal Botanic Gardens, Kew (powo.science.kew.org), the curators of that database freely admit that “not all the taxonomic decisions contained derive from a peer reviewed, curated, authoritative source”.

The proposed synonymization has the potential to create unnecessary confusion among the scientific community, because both species are of considerable economic importance. We consider that the confusion must be cleared and in the following sections we present peer-reviewed evidence to support the contention that *S. macrocephala* is a separate species and should not be considered a synonym of *S. capitata*.

Morphology

Comparative morphological descriptions of *Stylosanthes macrocephala* and *S. capitata* concur in relation to growth habit, leaf shape and size and inflorescence characters. Table 1 summarizes the most relevant differentiating

¹CPI 78478 (= NO 824 = CPAC 139) = CIAT 1281, the accession used by Grof et al. (1979) and released 1983 in Brazil as *S. macrocephala* cv. Pioneiro.

morphological characters and Figures 1–5 depict some of the differences. Furthermore, on live plants it can be observed that the vexillum (standard) of the *S. macrocephala* flower is striated with reddish nectar guides (Alzate-Marin et al. 2020), whereas in *S. capitata* there is no striation. The seeds of both species can be entirely yellow or entirely black but have mostly a yellow testa with mottles or blotches of species-specific coloration.

In Appendix I we provide: for *S. capitata* the original description by Vogel (1838) as well as the description in the revision of the genus by Mohlenbrock (1957) and the

one published by Vanni (2017); and for *S. macrocephala* the original description (in Portuguese) by Ferreira and Costa (1977). Recent publications that include descriptions of both species are those by Costa (2006), Costa et al. (2008) and Queiroz (2009); all are in Portuguese language. Whereas the descriptions by Costa (2006) are extraordinarily detailed and based on several hundreds of specimens, those of Costa et al. (2008) and Queiroz (2009) focus on specimens originating from the Brazilian State of Mato Grosso do Sul and the Caatinga biome, respectively.

Table 1. Summary of main differentiating morphological characters between *Stylosanthes macrocephala* and *S. capitata*.

Character	<i>Stylosanthes macrocephala</i>	<i>Stylosanthes capitata</i>
Growth habit	Generally prostrate to ascendant (up to 60 cm)	Generally decumbent, ascendant to erect (up to 120 cm) and rarely prostrate
Stems	Thinner multiple stems and branches	Coarser and fewer stems
Foliage	In adult plants, open (greater internode length)	In adult plants, dense (shorter internode length)
Leaflets	Narrow-elliptic-oblong, 5–8 mm broad, 6–8-nerved	Broad-elliptic, 8–13 mm broad, 8–12-nerved
Inflorescence shape	Globose ² , apiculate, 14–18 × 10–14 mm	Oblong, sometimes obovate, or ellipsoid, obtuse, 25–50 × 10–15 mm
Inflorescence bracts - color	Mostly with reddish, interveinal coloration	Rarely with reddish, interveinal coloration
Inflorescence bracts - shape	Bidentate with short leaflet mostly not extending beyond apices of bract teeth	Bidentate with ovate-lanceolate leaflet generally extending beyond apices of bract teeth
Inflorescence bracts - venation	8–13 pairs of veins	4–8 pairs of veins
Seed mottles/blotches	Reddish	Brown or black



Figure 1. Typical growth habit of (A) *Stylosanthes macrocephala*, (B) *S. capitata* and (C) *S. bracteata*. [Images A and B, Photographer: A. Ciprián, ©CIAT; image C, Photographer: R. Schultze-Kraft].

²The common name of *S. macrocephala* in the Brazilian Cerrado region, ‘maçazinha’ (= small apple), alludes to the globose shape of the inflorescence and its reddish coloration (Costa 2006).

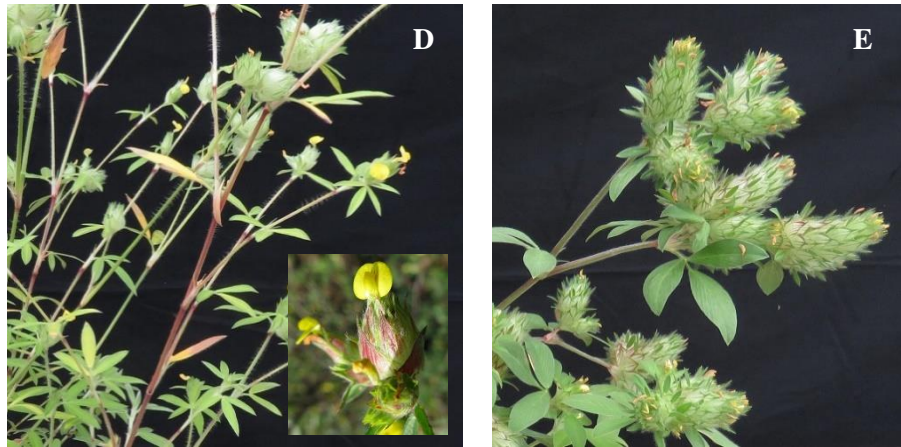


Figure 2. (D) Narrow leaflets and globose inflorescence of *Stylosanthes macrocephala* (inset: inflorescence with more typically rubescent bracts) and (E) broad leaflets and oblong/ellipsoid inflorescences of *S. capitata*. [Photographer: A. Ciprián, ©CIAT].



Figure 3. (F) Small bract leaflet, interveinal red coloration and red striations on vexillum of *Stylosanthes macrocephala* and (G) large bract leaflet and pure color of flower of *S. capitata*. [Photographer: A. Ciprián, ©CIAT].



Figure 4. (H) Inflorescences/seed heads of three different accessions of *Stylosanthes macrocephala* and (I) *S. capitata*. Accessions in columns, from left to right: (H) CIAT 2279, CIAT 2718 and CIAT 10325 and (I) CIAT 1728, CIAT 11129 and CIAT 11628. [Photographer: A. Ciprián].



Figure 5. (J) Inflorescence bracts of three different accessions of *Stylosanthes macrocephala* and (K) *S. capitata*. Accessions in columns, from left to right: (J) CIAT 2279, CIAT 2718 and CIAT 10325 and (K) CIAT 1728, CIAT 11129 and CIAT 11628. [Photographer: A. Ciprián].

Compatibility

In Brazil, *Stylosanthes macrocephala* and *S. capitata* are often sympatric (i.e. natural populations can be found growing at the same site) but, with one exception in Mato Grosso do Sul (J.F.M. Valls pers. comm. January 2020), the main *Stylosanthes* germplasm collectors [L. Coradin and G.P. da Silva (Embrapa), N.M.S. Costa (EPAMIG) and R. Schultze-Kraft (CIAT)] have not seen any hybrids between the two species in natural habitats. Furthermore, although intraspecific outcrossing has been reported to be relatively frequent in *S. capitata* (up to 31%; Miles 1983; Santos-García et al. 2011), with the exception of 2 isolated cases that resulted in sterile inflorescences (Costa 2006), no natural hybridization between *S. capitata* and *S. macrocephala* has been observed over many years of plant introduction and germplasm evaluation work with several hundred accessions (R. Schultze-Kraft and A. Ciprián unpublished), not even in the ‘Estilosantes Campo Grande’ mixture of both species, over many years and thousands of hectares in the Brazilian Cerrado (A. Pott pers. comm. January 2020). This suggests that *S. macrocephala* is a taxon that differs from *S. capitata*.

Molecular biology, ploidy and phylogeny

In a number of studies with varying marker systems, clear differences between the 2 species became evident: Barros et al. (2005) and Chiari et al. (2010) using random amplification of polymorphic DNA (RAPD); Santos (2014) using inter-simple sequence repeat; and Alzate-

Marin et al. (2020) using inter-simple sequence repeat/simple sequence repeat (ISSR/SSR).

Whereas *S. macrocephala* is a diploid ($2n = 20$) species (Battistin and Martins 1987), *S. capitata* is an allotetraploid ($2n = 40$) (Stace and Cameron 1984). The latter authors proposed a model for how tetraploid *Stylosanthes* species would have been formed. Gillies and Abbott (1996), using chloroplast DNA restriction fragment length variation, identified *S. macrocephala* as the maternal progenitor of *S. capitata*. This was corroborated by Vander Stappen et al. (1999) using chloroplast DNA sequence variation and by Vander Stappen et al. (2002) based on the internal transcribed spacer region (ITS) of nuclear ribosomal DNA analysis. In accordance with the evolutionary model put forward by Stace and Cameron (1984), Liu et al. (1999) proposed *S. macrocephala* and *S. pilosa* M.B. Ferreira & Sousa Costa as the putative diploid donor species of *S. capitata* from their work based on restriction fragment length polymorphisms (RFLP) and sequence-tagged-sites (STS) analyses.

Conclusion

In his revision of South American *Stylosanthes* species, Vanni (2017) did not provide any argument or evidence as to why *S. macrocephala* should be considered a synonym of *S. capitata*. He limits his synonymization proposal to merely indicating “syn. nov.” (p. 557). While we, as practitioners, by no means wish to question the authority of a botanical journal to publish revisions that have passed their respective peer review process, we

contend that formulating synonymization proposals without providing arguments is a questionable procedure which, because of the confusion they are likely to create, should be avoided.

In this paper we have advanced a summary of morphological, biochemical, cytological and phylogenetic evidence indicating that *S. macrocephala* is a valid species which should be maintained separately from *S. capitata*. Consequently, the synonymization imposed by Vanni (2017) must be refuted.

Acknowledgments

We are grateful to Lidio Coradin and Glocimar P. da Silva (formerly Embrapa Recursos Genéticos e Biotecnologia) for their comments on an earlier draft of this paper.

References

(Note of the editors: All hyperlinks were verified 30 June 2020.)

- Alzate-Marin AL; Costa-Silva C; Rivas PMS; Bonifacio-Anacleto F; Santos LG; Moraes Filho RM de; Martinez CA. 2020. Diagnostic fingerprints ISSR/SSR for tropical leguminous species *Stylosanthes capitata* and *Stylosanthes macrocephala*. *Scientia Agricola* 77(3):e20180252. doi: [10.1590/1678-992x-2018-0252](https://doi.org/10.1590/1678-992x-2018-0252)
- Barros AM; Faleiro FG; Karia CT; Shiratsuchi LS; Andrade RP de; Lopes GKB. 2005. Genetic and ecological variability of *Stylosanthes macrocephala* determined by RAPD markers and GIS. *Pesquisa Agropecuária Brasileira* 40:899–909. (In Portuguese). doi: [10.1590/S0100-204X2005000900010](https://doi.org/10.1590/S0100-204X2005000900010)
- Battistin A; Martins PS. 1987. Chromosome number of seven species and three varieties of the genus *Stylosanthes* Sw. (Leguminosae – Papilionoideae). *Revista Brasileira de Genética* 10:599–602.
- Calles T; Schultze-Kraft R; Guenni O. 2017. Exploration and conservation of *Stylosanthes* (Leguminosae) genetic resources in Venezuela. *Genetic Resources and Crop Evolution* 64:345–366. doi: [10.1007/s10722-015-0359-7](https://doi.org/10.1007/s10722-015-0359-7)
- Chiari L; Jerba VF; Fernandes CD; Resende RMS. 2010. Variabilidade genética molecular entre acessos de *Stylosanthes capitata* e *Stylosanthes macrocephala*, resistentes e suscetíveis à antracnose. *Boletim de Pesquisa e Desenvolvimento* 27. Embrapa Gado de Corte, Campo Grande, MS, Brazil. [bit.ly/3eQcXYC](https://doi.org/10.1590/1678-992x-2010-0252)
- Cook BG; Pengelly BC; Schultze-Kraft R; Taylor M; Burkart S; Cardoso Arango JA; González Guzmán JJ; Cox K; Jones C; Peters M. 2020. Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.info
- Coradin L; Schultze-Kraft R. 1990. Germplasm collection of tropical pasture legumes in Brazil. *Tropical Agriculture (Trinidad)* 67:98–100. [bit.ly/3iivR0s](https://doi.org/10.1590/1678-992x-2010-0252)
- Costa LC da; Sartori ALB; Pott A. 2008. Estudo taxonômico de *Stylosanthes* (Leguminosae – Papilionoideae – Dalbergieae) em Mato Grosso do Sul, Brasil. *Rodriguésia* 59:547–572. doi: [10.1590/2175-7860200859310](https://doi.org/10.1590/2175-7860200859310)
- Costa NMS. 2006. Revisão do gênero *Stylosanthes* Sw. Ph.D. Thesis. Universidade Técnica de Lisboa, Instituto Superior de Agronomia, Lisbon, Portugal.
- Costa NMS; Ferreira MB. 1982. O gênero *Stylosanthes* no Estado de Minas Gerais. Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG), Belo Horizonte, MG, Brazil.
- Ferreira MB; Costa NMS. 1977. Novas espécies do gênero *Stylosanthes* para Minas Gerais. In: Anais, XXVIII Congresso Nacional da Sociedade Botânica do Brasil, Belo Horizonte, MG, Brazil, 23–30 January 1977. p. 77–100.
- Gillies ACM; Abbott RJ. 1996. Phylogenetic relationships in the genus *Stylosanthes* (Leguminosae) based upon chloroplast DNA variation. *Plant Systematics and Evolution* 200:193–211. doi: [10.1007/BF00984935](https://doi.org/10.1007/BF00984935)
- Grof B; Schultze-Kraft R; Müller F. 1979. *Stylosanthes capitata* Vog., some agronomic attributes and resistance to anthracnose (*Colletotrichum gloeosporioides* Penz.). *Tropical Grasslands* 13:28–37. [bit.ly/2NHm2af](https://doi.org/10.1590/1678-992x-2018-0252)
- Liu CJ; Musial JM; Thomas BD. 1999. Genetic relationships among *Stylosanthes* species revealed by RFLP and STS analyses. *Theoretical and Applied Genetics* 99:1179–1186. doi: [10.1007/s001220051322](https://doi.org/10.1007/s001220051322)
- Miles JW. 1983. Natural outcrossing in *Stylosanthes capitata*. *Tropical Grasslands* 17:114–117. [bit.ly/3dSZ62s](https://doi.org/10.1590/1678-992x-2018-0252)
- Mohlenbrock RH. 1957. A revision of the genus *Stylosanthes*. *Annals of the Missouri Botanical Garden* 44:299–355. doi: [10.2307/2394648](https://doi.org/10.2307/2394648)
- Queiroz LP de. 2009. Leguminosas da Caatinga. Universidade Estadual de Feira de Santana. Feira de Santana, BA, Brazil.
- Santos LG dos. 2014. Análise comparativa da pureza genética das leguminosas forrageiras *Stylosanthes capitata* Vog. e *Stylosanthes macrocephala* M.B. Ferr. et Sousa Costa utilizando marcadores moleculares. M.Sc. Thesis. Universidade de São Paulo, Ribeirão Preto, SP, Brazil. doi: [10.11606/D.59.2014.tde-29122014-214827](https://doi.org/10.11606/D.59.2014.tde-29122014-214827)
- Santos-Garcia MO; Resende RMS; Chiari L; Zucchi MI; Souza AP de. 2011. Mating systems in tropical forages: *Stylosanthes capitata* Vog. and *Stylosanthes guianensis* (Aubl.) Sw. *Euphytica* 178:185–193. doi: [10.1007/s10681-010-0293-x](https://doi.org/10.1007/s10681-010-0293-x)
- Stace HM; Cameron DF. 1984. Cytogenetics and the evolution of *Stylosanthes*. In: Stace HM; Edey LA, eds. *The biology and agronomy of Stylosanthes*. Academic Press Australia, North Ryde, NSW, Australia. p. 49–72. doi: [10.1016/B978-0-12-661680-4.50008-1](https://doi.org/10.1016/B978-0-12-661680-4.50008-1)
- Thomas D; Grof B. 1986. Some pasture species for the tropical savannas of South America. I. Species of *Stylosanthes*. *Herbage Abstracts* 56:445–454.
- Vander Stappen J; Weltjens I; Munaut F; Volckaert G. 1999. Interspecific and progeny relationships in the genus *Stylosanthes* inferred from chloroplast DNA sequence variation. *Comptes Rendus de l'Académie des Sciences - Series*

- III - Sciences de la Vie 322:481–490. doi: [10.1016/S0764-4469\(99\)80098-5](https://doi.org/10.1016/S0764-4469(99)80098-5)
- Vander Stappen J; De Laet J; Gama-López S; Van Campenhout S; Volckaert G. 2002. Phylogenetic analysis of *Stylosanthes* (Fabaceae) based on the internal transcribed spacer region (ITS) of nuclear ribosomal DNA. *Plant Systematics and Evolution* 234:27–51. doi: [10.1007/s00606-002-0193-1](https://doi.org/10.1007/s00606-002-0193-1)
- Vanni RO. 2017. The genus *Stylosanthes* (Fabaceae, Papilionoideae, Dalbergieae) in South America. *Boletín de la Sociedad Argentina de Botánica* 52:549–585. doi: [10.31055/1851.2372.v52.n3.18033](https://doi.org/10.31055/1851.2372.v52.n3.18033)
- Vogel JRT. 1838. De Hedysareis Brasiliae. *Linnaea* 12:51–70. biodiversitylibrary.org/page/35385336
- Further reading**
- This section comprises selected literature not cited in the text, which however is relevant for the better understanding of the taxonomy, biogeography, genetic resources and genetic and agronomic diversity in the *S. macrocephala* and *S. capitata* germplasm collections.
- Costa AM. 2004. Uso de marcadores RAPD e do sistema de informação geográfica no estudo da variabilidade genética e ecológica de *Stylosanthes macrocephala* M.B. Ferr. et S. Costa. M.Sc. Thesis. Universidade Católica de Brasília, Brasília, DF, Brazil. bdtd.ucb.br:8443/jspui/handle/123456789/143
- Costa NMS; Ferreira MB. 1984. Some Brazilian species of *Stylosanthes*. In: Stace HM; Edye LA, eds. *The biology and agronomy of Stylosanthes*. Academic Press Australia, North Ryde, NSW, Australia. p. 23–48. doi: [10.1016/B978-0-12-661680-4.50007-X](https://doi.org/10.1016/B978-0-12-661680-4.50007-X)
- Costa NMS; Schultze-Kraft R. 1993. Biogeografia de *Stylosanthes capitata* Vog. y de *S. guianensis* Sw. var. *pauciflora*. *Pasturas Tropicales* 15(1):10–15. bit.ly/3ieDXCZ
- Costa NMS; Coradin L. 2016. *Stylosanthes capitata* (Estilosantes). In: Vieira RF; Camillo J; Coradin L, eds. *Espécies nativas da flora brasileira de valor econômico atual ou potencial: Plantas para o futuro – Região Centro-Oeste*. Secretaria de Biodiversidade, Ministério do Meio Ambiente, Brasília, DF, Brazil. p. 553–560. bit.ly/2UMZUzo
- Costa NMS; Coradin L. 2016. *Stylosanthes macrocephala* (Estilosantes). In: Vieira RF; Camillo J; Coradin L, eds. *Espécies nativas da flora brasileira de valor econômico atual ou potencial: Plantas para o futuro – Região Centro-Oeste*. Secretaria de Biodiversidade, Ministério do Meio Ambiente, Brasília, DF, Brazil. p. 572–578. bit.ly/2UMZUzo
- Date RA; Eagles DA. 2010. *Bradyrhizobium* strain effectiveness for *Stylosanthes macrocephala*. *Tropical Grasslands* 44:158–164. bit.ly/2JsMguG
- Ferreira MB; Costa NMS. 1979. O gênero *Stylosanthes* no Brasil. Empresa de Pesquisa Agropecuária de Minas Gerais (EPAMIG), Belo Horizonte, MG, Brazil.
- Franco AL; Figueredo A; Pereira LM; Sousa SM de; Souza G; Carvalho MA; Simon MF; Viccini LF. 2020. Low cytomolecular diversification in the genus *Stylosanthes* Sw. (Papilionoideae, Leguminosae). *Genetics and Molecular Biology* 43(1):e20180250. doi: [10.1590/1678-4685-gmb-2018-0250](https://doi.org/10.1590/1678-4685-gmb-2018-0250)
- Gillies ACM; Abbott RJ. 1998. Evaluation of random amplified polymorphic DNA for species identification and phylogenetic analysis in *Stylosanthes* (Fabaceae). *Plant Systematics and Evolution* 211:201–216. doi: [10.1007/BF00985359](https://doi.org/10.1007/BF00985359)
- Huang C; Liu G; Bai C. 2017. Polymorphism analysis in identification of genetic variation and relationships among *Stylosanthes* species. *3 Biotech* 7(1):39. doi: [10.1007/s13205-017-0705-x](https://doi.org/10.1007/s13205-017-0705-x)
- Lira ICSA. 2015. Caracterização citogenética e morfo-agronômica de acessos de *Stylosanthes* spp. (Fabaceae – Papilionoideae) coletados no Nordeste brasileiro. M.Sc. Thesis. Universidade Estadual de Feira de Santana, Feira de Santana, BA, Brazil. tede2.uefs.br:8080/handle/tede/152
- Maass BL; Sawkins M. 2004. History, relationships and diversity among *Stylosanthes* species of commercial significance. In: Chakraborty S, ed. *High-yielding anthracnose-resistant Stylosanthes for agricultural systems*. CSIRO, Canberra, Australia. p. 9–26. aciar.gov.au/node/8471
- Mannetje L't. 1984. Considerations on the taxonomy of the genus *Stylosanthes*. In: Stace HM; Edye LA, eds. *The biology and agronomy of Stylosanthes*. Academic Press Australia, North Ryde, NSW, Australia. p. 1–21. doi: [10.1016/B978-0-12-661680-4.50006-8](https://doi.org/10.1016/B978-0-12-661680-4.50006-8)
- Martuscello JA; Braz TMS; Silveira JM; Simeão RM; Jank L; Ferreira MR; Cunha DNFV da. 2015. Diversidade genética em acessos de *Stylosanthes capitata*. *Boletim de Indústria Animal* 72:284–289. doi: [10.17523/bia.v72n4p284](https://doi.org/10.17523/bia.v72n4p284)
- Santos MO; Sasaki RP; Ferreira THS; Resende RMS; Chiari L; Karia CT; Faleiro FG; Jungmann L; Zucchi MI; Souza AP de. 2009. Polymorphic microsatellite loci for *Stylosanthes macrocephala* Ferr. et Costa, a tropical forage legume. *Conservation Genetics Resources* 1:481–485. doi: [10.1007/s12686-009-9112-x](https://doi.org/10.1007/s12686-009-9112-x)
- Santos MO; Sasaki RP; Chiari L; Resende RMS; Souza AP de. 2009. Isolation and characterization of microsatellite loci in tropical forage *Stylosanthes capitata* Vogel. *Molecular Ecology Resources* 9:192–194. doi: [10.1111/j.1755-0998.2008.02308.x](https://doi.org/10.1111/j.1755-0998.2008.02308.x)
- Santos-Garcia MO; Resende RMS; Chiari L; Zucchi MI; Souza AP de. 2010. Mating systems in tropical forages: *Stylosanthes capitata* Vog. and *Stylosanthes guianensis* (Aubl.) Sw. *Euphytica* 178:185–193. doi: [10.1007/s10681-010-0293-x](https://doi.org/10.1007/s10681-010-0293-x)
- Santos-Garcia MO; Toledo-Silva G de; Sasaki RP; Ferreira TH; Resende RMS; Chiari L; Karia CT; Carvalho MA; Faleiro FG; Zucchi MI; Souza AP de. 2012. Using genetic diversity information to establish core collections of *Stylosanthes capitata* and *Stylosanthes macrocephala*. *Genetics and Molecular Biology* 35:847–861. doi: [10.1590/S1415-47572012005000076](https://doi.org/10.1590/S1415-47572012005000076)
- Schultze-Kraft R; Costa NMS; Flores A. 1984. *Stylosanthes macrocephala* M.B. Ferr. et S. Costa – collection and preliminary agronomic evaluation of a new tropical pasture

- legume. *Tropical Agriculture* (Trinidad) 61:230–240. [bit.ly/2Vz2KYJ](https://doi.org/10.1007/s001220051167)
- Toledo-Silva G de; Santos-Garcia MO; Resende RMS; Chiari L; Karia CT; Carvalho MA; Faleiro FG; Zucchi MI; Souza AP de. 2011. Molecular genetic evaluation of the *Stylosanthes capitata* Vog. and *Stylosanthes macrocephala* Ferr. et Costa germoplasms. Proceedings of the III International Symposium on Forage Breeding, Bonito, MS, Brazil, 7–11 November 2011. p. 104–107. [bit.ly/31xEtGy](https://doi.org/10.1508/cytologia.58.305)
- Vander Stappen J; Weltjens I; Van Campenhout S; Volckaert G. 1999. Genetic relationships among *Stylosanthes* species as revealed by sequence-tagged site markers. *Theoretical and Applied Genetics* 98:1054–1062. doi: [10.1007/s001220051167](https://doi.org/10.1007/s001220051167)
- Vieira MLC; Aguiar-Perecin MLR de; Martins PS. 1992. A cytotaxonomic study in twelve Brazilian taxa of *Stylosanthes* Sw., Leguminosae. *Cytologia* 58:305–311. doi: [10.1508/cytologia.58.305](https://doi.org/10.1508/cytologia.58.305)

Appendix I

Descriptions of *Stylosanthes capitata* and *S. macrocephala*

- *S. capitata* ([Vogel 1838](#); p. 70)

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tum. Alae brevi-stipitatae, subsemi-obovatae, basi intus dentatae. Carina bipes petalis angustis falcato-curvatis dorso connatis apice obtusis. Leg. plerumque biarticulatum; articuli antice recti, dorso convexi, inferior pilis densis hirsuto-sericeus bracteolas aequans, superior multo minus pilosus nervis primariis prominentibus reticulatus, rudimentum stipitifforme superans.

Hbt. In Brasil. merid.; Sellow leg. in Serra da Moeda; Luschnath ad Bahia.

14. *S. capitata* n. caule ascendente (?) villosopubescente, stipulis subhispidis, foliolis oblongis mucronatis pilosopubescentibus hispido-ciliatis, floribus capitato-glomeratis, bracteis tenui-membranaceis subhispidis pilosociliatis.

Vidi specimen unum incompletum; ab omnibus speciebus excepta sequente differt bracteis tenui-membranaceis quam stipulae latioribus magis oblongis lamina foliosa brevissima instructis. Capitula plura appropinquata; plerumque folium e quarum axilla capitulum sessile oritur bractea apparet a foliis caulinis non diversum nisi lamina unica foliosa instructum. Bracteae reliquae plerumque rubicundo fucatae, tantum inferiores adhuc lamina foliosa angustissima instructae. Bracteolae 2 scarioso-membranaceae, longe ciliatae, $1\frac{1}{2}$ '' lg., rudimento stipitifformi patenti-piloso multo minores. Pili inflorescentiae molles sunt elongati subfusi.

Hbt. In Brasil.; Sellow leg. inter Victoria et Bahia.

15. *S. bracteata* n. villosopubescentis, caulibus erectis, foliolis angustissimo-ellipticis longe acutis, petiolo brevissimo, capitalis pedunculatis, bracteis amplis late ovatis tenuimembranaceis, legumine cristato-uncinato molli-sericeo.

Habitu a ceteris parum dehiscit. Radix crassa, multi-ceps; caules multi, vix spithamei, suffrutescentes, tenues, plerumque simplices, erecti, pilis villosis mollibus tecti. Sti-

- *S. capitata* ([Mohlenbrock 1957](#); p. 308–309)

Section I. STYLOSANTHES

Section *STYPOSANTHES* Vog. in *Linnaea* 12:68. 1838. (T: *S. hamata* (L.) Taub.)

Each flower, or at least the lower, subtended by an axis rudiment; inner bracteoles 2.

Stylosanthes hamata (L.) Taub., as type of the genus, automatically becomes the type of § *STYLOSANTHES*.

1. *STYLOSANTHES CAPITATA* Vog. in *Linnaea* 12:70. 1838, ex char.

Stems erect, branched, to 1 m. tall, subglabrous near the base, decumbent or ascending, densely and shortly white-hairy and also with some scattered bristles, the pubescence generally more dense below each node. Leaflets oblong to elliptic, to 30 mm. long and 15 mm. broad, usually about 15 mm. long and 5 mm. broad, acute and mucronulate at the apex, densely villous on both surfaces, with 7–9 pairs of conspicuous veins; petioles 3–6 mm. long, densely villous, the rachis 1.0–3.5 mm. long; sheath of the stipules 7–9 mm. long, densely villous, longer than the subulate teeth, several-nerved. Spikes thick, capituliform, about two-thirds as broad as high, to 35 mm. long, many-flowered, on peduncles usually 5–7

cm. long, occasionally 2–3 cm. long; bracts with a single very reduced leaflet; sheath often purplish, 8–12 mm. broad, conspicuously 11- to 17-nerved, copiously soft-pubescent; outer bracteole 1, to 3 mm. long, ciliate; axis rudiment 5–7 mm. long in fruit, very long-ciliate; inner bracteoles 2, 2.0–2.5 mm. long and much narrower than the outer, densely ciliate at the apex. Calyx tube 4–6 mm. long, the mostly acute and sparsely ciliate lobes about 2.5 mm. long. Standard obovate, 5–7 mm. long; wings obovate, 4–5 mm. long, auriculate at the base; keel petals 3–4 mm. long, falcate and auriculate. Loment to 2.5 mm. broad, reticulate-nerved; both articulations usually fertile (either sometimes abortive), the upper about 3.5 mm. long and glabrous, the lower somewhat shorter and glabrous or sparsely pubescent; beak uncinata, about 1 mm. long, glabrous or with very few short stiff hairs on the inner face.

Taubert in his diagnosis of *S. capitata* states that the legume is uni-articulate, the lower joint being abortive. However, specimens of this species may bear two fertile articulations. The original description of *S. capitata* which contains no mention of the fruit apparently is based on an incomplete specimen, for Vogel comments: “*Vidi specimen unum incompletum*”.

All species of *Stylosanthes* except *S. capitata*, *S. bracteata*, and *S. angustifolia* possess 1–3 leaflets between the teeth of the bracteal sheaths. In these three, a small laminal extension of the midvein of the sheath usually is all that is present.

Specimens from Venezuela and the Piauí state of Brazil are more coarse and have the general vegetative appearance of *S. scabra*. The nature of the inflorescence and loment clearly distinguishes *S. capitata* from *S. scabra*.

Grows in fields, forests, or waste ground and is known only from Brazil and Venezuela. It grows at altitudes of about 1000 meters. Vogel does not specifically cite any specimens but merely states that *S. capitata* has been collected in Brazil by Sellow between Victoria and Bahia (fig. 3).

- *S. capitata* ([Vanni 2017](#); p. 557–558)

3. *Stylosanthes capitata* Vogel, *Linnaea* 12: 70. 1838. TYPE: Brazil. Hab. in Brazil; inter Victoria et Bahia *Sellow leg.* (holotype, B, destroyed). Bahiensis, caxoeira et Feira da Conceicao, February 1819, *Martius 2209* (neotype designated here, M!).

Stylosanthes macrocephala M. B. Ferreira & Sousa Costa, *Anais Soc. Bot. Brasil* 28: 87. 1977 [1978]. TYPE: Minas Gerais: Brasilia de Minas, 2 km apos a cidades en direção a Saõ Francisco, 900 m.s.m., 3 May 1975, *M. L. Gavilanes 229* (holotype, RB!). *syn. nov.*

Stylosanthes bahiensis ‘t Mannetje & G. P. Lewis. *Kew Bull.* 37 (1): 125-127. 1982. TYPE:

Brazil. Bahia: Serra Du Acuruá, 5-6 km S de São Ignacio on the rd. to Gentio do Ouro. Disturbed caatinga, 27 Feb.1977, *R. M. Harley, S. J-Mayo. R. M. Storr; T. S. Santos & R. S. Pinehiro 19134* (holotype CEPLAC, isotype, K!). *syn. nov.*

Perennial, branches 70 cm, with indument of whitish, incurved hairs and bristles variable in density. Leaves trifoliate, pinnate-trifoliate. Stipules 10-14 mm, adnate welded to petiole, free at opposite margin, point tippedapically, with long, lax, and hyaline hairs, and bristles. Leaflets 14-20 × 3-8 mm, elliptic, inferior side with white, marked veins, protruding, hairs hyaline, lax and dense, bristles on veins. Superior side with similar hairs to inferior side, bristles absent. Inflorescences in dense spikes, axillary or terminal, over 20-flowered. Bracts 9 × 7 mm, very wide, formed by 2 ovoid, acute and papiraceous parts, short lamina between, with dense, yellow-golden hairs, 1 mm. Flowers 6 mm, hypanthium 7 mm; calyx 2 mm, with appressed hairs, 5 teeth, inferior larger. Corolla 6 mm. Petals unguiculate, standard rounded, wings oblong, keel incurved. Fruit 8 mm, 2-articulated, inferior segment 3 mm, with dense, yellow-golden hairs, superior segment 5 mm, glabrous. Beak slightly curved.

Distribution and habitat. It inhabits in French Guyana, Venezuela, Bolivia, Paraguay, and Brazil in savanna-like habitats and forest openings at 300-1100 m a. s. l.

- *S. macrocephala* (Ferreira and Costa 1977; p. 87–88)

NOVAS ESPÉCIES DO GÊNERO *STYLOSANTHES* PARA MINAS GERAIS

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neiro, tendo sido vista, mas não colhida em Paracatu. Ocorre em campo-cerrado muito pobre sobre Cambissolo com concreções, em relevo plano a suave ondulado. Apresenta pouca massa verde; nodulação sem muita significação, mostrando nódulos sobre o xilopódio. Suas raízes são espessadas atingindo 3 cm de diâmetro. As gemas localizam-se 2-3 cm a baixo da superfície do solo, o que confere à espécie, resistência ao fogo. Aparece quase sempre ao lado de *Stylosanthes bracteata* e *S. guianensis*. Mostra-se pastejada pelo gado.

CARACTERES DIFERENCIAIS

A espécie situa-se na secção *Stylosanthes* Vog pela presença de um eixo rudimentar na base das flores. O nome da espécie foi dado em função do aspecto de seus folíolos. Aproxima-se de *S. capitata*, *S. bracteata* e *S. macrocephala* (Sp. n.). Distingue-se de *S. capitata* e *S. macrocephala* por possuir xilopódio. Separa-se de *S. bracteata* que também possui xilopódio por apresentar folíolos lineares com 30-40 mm de comp. por 3-4 mm de larg., glabros e glabrescentes, de base aguda e ápice acuminado e 12-14 pares de nervura, muito pronunciadas, aflorando na bordada lâmina, enquanto *S. bracteata* os possui lanceolados ou elípticos, agudos, obtusos ou mucronados no ápice, com 25-40 mm de comp., com 5-7 pares de nervuras.

S. linearifolia apresenta estípulas obovadas com bainha de 7-8 mm de comp. e dentes de 10-12 mm de comp. com cerdas muito longas; com 11-13 nervuras; *S. bracteata* tem estípulas com dentes bem menores e cerdas raras com 15-17 nervuras; embora ambos tenham 1 só articulo fértil, *S. linearifolia* apresenta frutos com retículo mais pronunciado.

Stylosanthes macrocephala M.B. Ferr. et Sousa Costa Sp.n.

Suffrutex suberectus, ramosissimus 20-40 cm altus, vilosus et setis hispidis intermixtis vestitus, stipulae ad medium adnatae, base vaginantes, membranaceae, obovatae, vel villosae, parte livre erecta patente, 9-10 mm longae 5-6 mm latae, Petiolus supra stipulas 1-3 mm longus; foliola maxima oblongo-lanceolata, acuta, pubescentia, 30-40 mm longa 5.0-8,0 mm lata, venosa, nervi utrinque 8-9 pseudo nervo marginali conspicuo. Spicae ovoideae congesta, multiflorae, terminales 20-25 mm longae 18-20 mm late. Bractea imbricatae latae ovatae, apice bifidae ad medium adnatae, parte libera erecta vel patente rigida, 13-15 mm longae 9-10 mm latae, 21-23 nervatae; bracteolae 3 hyalinae vel subpaleaceae, apice ciliate.

Stipes plumosus 6-7 mm longo. Corolla flava, calycis tubus filiformis bracteis equilongus, limbus campanulatus, membranaceus, 9-10 mm longus, lobi 4; vexillum obovatum 3,0-3,3 mm longum, alae et carenae oblongae 4,0-4,2 mm longae. Legumen articulo supero glabro et infero pilis longis vestito 4,5-5,0 mm longum et 2,2-2,5 mm latum infero quam supero minor; styli base persistenti aristato-acuminatum, arista apice uncinato recurva. Semen bruneum, oblongum 3,0-3,2 mm longum, 1,4-1,6 mm latum.

Subarbusto, ramoso com 20-40 cm de altura; caule piloso, com cerdas esparsas e pelos claros; estípula obovada, pilosa; bainha da estípula com 9 - 10 mm de comp. por 5-6 mm de larg., 11-13 nervadas; dentes com 5-6 mm de comp., estreitos. Pecíolo com 1-2 mm de comp., piloso; folíolos pubescentes a glabros com 20-55 mm de comp. por 10-19 mm de larg., 7-9 pares de nervuras tênues na inserção com nervura média e proeminentes nas extremidades. Espigas ovóides, com poucas flores em capítulos densos; 22-24 mm de comp. com 23-26 mm de largura; bracteas imbricatas largas, elípticas, de ápice bifido, as externas unifolioladas, pubescentes cerdosas com 12-14 mm de comp. por 8-9 mm de larg.; 11-13 nervadas. Eixo plumoso nulo, bracteolas 2, hialinas a subpaleáceas, oblongas, de ápice ciliado. Flores amarelas; cálice tubuloso exserto, com 5-7 mm de comp. 4 lobado, ciliado; vexilo obovóide ou oblongo com 4-5 mm de comp., ala e carena oblongas com 5 mm de comp. Legume suborbiculado, reticulado, glabro, às vezes com glandulas sêsses no ápice com 3-4 mm de comp. e 2,5-3,0 de larg.; estilete curtíssimo recurvo mucronado; semente negra, raramente amarela, com 2,5-3,0 mm de comp., 2,2-5,0 mm de larg.

Stylosanthes macrocephala - M.B. Ferreira et N.M. Sousa Costa

Holotypus - Leg. M.L. Gavilanes, 229; (3/5/75) Minas Gerais, Brasília de Minas 2 km após a cidade de São Francisco, alt. 900 m, lat. 16°11'S, long. 44°29'W. Subar-

XXIII Cong. Nac., Belo Horizonte, 23 a 30 - Janeiro, 1977

busto prostrado, coletado em cerrado sobre Latossolo vermelho amarelo, relevo suave ondulado. RB. Isotypi. EPAMIG! NY! F.!

MATERIAL EXAMINADO

MG- Montes Claros, 20 km direção Brasília de Minas, 10/5/77, M. L. Gaviannes, 351, EPAMIG (Isótipo); Diamantina, Miradouro da Cruz, (11/1/77), M.N. Sousa Costa, 802 EPAMIG, idem 789, (17/1/77, Betim, BR-381, km 16, (27/VI/76) N.M. Sousa Costa, 390, EPAMIG, Janaúba, 10 km antes de Janaúria, (20/IV/77), M.B. Ferreira, 5802, EPAMIG. Janaúria, km 1. Janaúria para Pandeiros, (19/IV/77). M.B. Ferreira 5808, EPAMIG, idem km 19, (19/IV/77), idem 5809, EPAMIG; idem km 25 (19/IV/77), idem 5810; idem km 50, idem (19/4/77), idem 5810; idem km 50, idem; (19/4/77); idem 5812, EPAMIG: Pandeiros - km 8- Pandeiros - S. Joaquim (19/IV/77), M.B. Ferreira 5813, EPAMIG. S. Joaquim - 1 km apos S. Joaquim - Serra das Araras, (19/IV/77), M.B. Ferreira, 5814, EPAMIG. Lagoa Santa, 5 km de Lagoa Santa, vindo de Belo Horizonte, (23/V/78), M.B. Ferreira et N.M. Sousa Costa, 836 EPAMIG. Lagoa Santa, próximo do local anterior, (23/V/78), M.B. Ferreira et N.M. Sousa Costa 887, EPAMIG. Diamantina, alto da Serra, próximo à Cruz, (26/V/78), M. B. Ferreira et N.M. Sousa Costa, 856, EPAMIG. Diamantina, próximo ao local anterior (26/V/78) M.B. Ferreira et N.M. Sousa Costa, 858, EPAMIG. Couto de Magalhães, cerca de 500 m de pois de Couto Magalhães à beira da mata, (26/V/78), M.B. Ferreira, N.M. Sousa Costa 869 EPAMIG. Modestino Gonçalves, 25 km depois de Modestino Gonçalves-Itamarandiba (26/V/78), M.B. Ferreira et N.M. Sousa Costa 871, EPAMIG. Felisberto Caldeira, 2 km antes do cruzamento para Felisberto Caldas vindo de Senador Mourão, (27/V/78), M.B. Ferreira et N.M. Sousa Costa, 880, EPAMIG.

DISTRIBUIÇÃO GEOGRÁFICA

Esta espécie foi encontrada nas proximidades de Belo Horizonte (Betim), em Lagoa Santa, na Serra do Cipó e entre Datas e Diamantina. Entre esta última cidade e Mendaña, ocorre em povoamentos densos. No noroeste do Estado, apresenta-se com frequência. Aparece também na Bahia, Distrito Federal e Goiás.

OBS.- A espécie ocorre no cerrado, campo-cerrado e campo limpo sobre Latossolo amarelo distrófico, Cambissolos e areias quartzosas, respectivamente, em relevo variado. Mostra hábito prostrado na maioria das coletas; geralmente nodula bem, apresentando nódulos pequenos, com 1-2 mm de diâmetro. Aparece geralmente associado ao *S. capitata* e muitas vezes ao *S. guianensis* var. *vulgaris* e espécies dos gêneros; *Cassia*, *Mimosa*, *Aeschynomene*, *Aristida*, *Echinolaena*, etc.

CARACTERES DIFERENCIAIS

A espécie situa-se na seção *Styposanthes* Vog pela presença de um eixo rudimentar na base das flores. O nome *S. macrocephala* foi dado em função do tamanho de sua inflorescência. Situa-se entre as espécies *S. capitata*, *S. bracteata* e *S. linearifolia*. Distingue-se de *S. capitata* por apresentar porte mais baixo (20-40 cm); inflorescência mais curta e ovoide com 20-25 mm de comp. por 18-20 mm larg.; brácteas com 13-15 mm de comp. e 9-10 larg.; com 21 a 23 nervuras; estípula com bainha de 9 - 10 mm de comp. por 5-6 mm de larg. dentes com 5-6 mm de comp., estreitos com 11-13 nervuras; semente amarela, enquanto que *S. capitata* tem porte mais baixo (50-80 cm) mostra inflorescência mais longa (20-45 mm de comp., 10-20 mm de larg.) brácteas com 12-14 mm de comp. por 7-9 mm de larg. com 13-15 nervuras; estípula com bainha 10-12 mm de comp. 0,8-1,0 mm de larg., 9-11 nervuras, dentes com 0,6-0,8 mm de base alargada; semente mosqueada.

Distingue-se de *S. bracteata* por apresentar tomento com 2 artículos férteis; o superior glabro e o inferior piloso, eixo ultrapassando o artículo superior, enquanto que, *S. bracteata* tem 1 só artículo fértil extremamente piloso; eixo mais curto e menos denso, não ultrapassando o artículo.

S. macrocephala é piloso não apresentando cerdas nem nas estípulas, nem nas brácteas; ao passo que, *S. bracteata* apresenta estípulas piloso-credosas e apresenta xilopódio o que não ocorre na primeira espécie.

Separa-se facilmente de *S. linearifolia* pelo formato e nº de nervuras dos seus folíolos e pela ausência do xilopódio.

Anais da Sociedade de Botânica do Brasil, 1977

(Received for publication 8 July 2020; accepted 23 August 2020; published 30 September 2020)

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