

Revision of the genus *Sphenostylis* (Fabaceae: Phaseoleae) in South Africa and Swaziland

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Keywords: Fabaceae, Leguminosae, *Nesphostylis* Verdc., Phaseoleae, Phaseolinae, southern Africa, *Sphenostylis* E.Mey., *Vigna* Savi

ABSTRACT

A taxonomic revision of the genus *Sphenostylis* E.Mey. (tribe Phaseoleae) in southern Africa is presented. The genus is distinguishable by its characteristic wedge-shaped, dorsiventrally flattened style tip. Of the seven known species in the genus, only two, *S. angustifolia* and *S. marginata*, occur in South Africa and Swaziland; and the former is endemic to these countries. The two species differ in the size, shape, and venation of the leaflets; as well as the length of the petiole, peduncle, and pod. A key to the two species is provided and the correct nomenclature, typification, and known geographical distributions are given.

INTRODUCTION

Sphenostylis E.Mey. belongs to the subtribe Phaseolinae of tribe Phaseoleae (Fabaceae). It is named for the wedge-shaped, dorsiventrally flattened style (from the Greek word *spheno* = wedge). It is a small genus comprising seven species, all occurring in the tropics and southern parts of the African continent (Gillett *et al.* 1971; Potter 1992; Potter & Doyle 1994; Schrire 2005). The Indian species *S. bracteata* (Baker) Gillett, transferred from *Dolichos* L. to *Sphenostylis* by Gillett (1966), was moved to *Nesphostylis* Verdc. by Potter & Doyle (1994) based on a cladistic analysis of morphological data. Three species of *Sphenostylis* are used as food sources in Africa. *Sphenostylis stenocarpa* (Hochst. ex A.Rich.) Harms is known as African yam bean or *girigiri* (Burkhill 1995), and cultivars of this tropical African species are grown for their seeds and tubers in tropical and West Africa. The leaves, flowers, pods, and seeds of *S. schweinfurthii* Harms and *S. erecta* Hutch. ex Baker f. are wild-harvested. The roots of *S. erecta* are also used as fish poison (Potter 1992).

Sphenostylis appears to have a close relationship with *Nesphostylis* (Potter & Doyle 1994) with which it shares the dorsiventrally flattened style tip; but it differs by features of the calyx (Lackey 1981), the standard petals, and the stamens (Potter 1992). In *Nesphostylis*, the inner surface of the calyx is pubescent, standard appendages are present, the base of the vexillary stamen is hooked, and the stamen apices are dilated. None of these characters are present in *Sphenostylis*. Based mainly on the narrow pods, several botanists including Harvey (1862), Bentham (1865) and Taubert (1894), relegated *Sphenostylis* into synonymy with the genus *Vigna* Savi (Gillett 1966). Harms (1899) reinstated the genus and expanded it to include related species previously placed in *Dolichos* and *Vigna*. *Sphenostylis* differs from these two genera by its distinctive style tip. Furthermore, *Vigna* generally has peltate stipules (stipules not peltate in *Sphenostylis*). In addition, a phylogeny based on molecular data shows that *Vigna* and *Sphenostylis* are not

as closely related as previously thought, and that *Sphenostylis* is rather closer to *Dolichos* and *Macrotyloma* (Wight & Arn.) Verdc. (Wojciechowski *et al.* 2004). *Sphenostylis* can be distinguished from *Dolichos*, *Macrotyloma*, and *Vigna* by the absence of appendages on the standard petals (appendages present on the standard petals in the latter three genera).

Sphenostylis is represented in South Africa and Swaziland by two species, namely *S. angustifolia* Sond. and *S. marginata* E.Mey.; the former being endemic to the two countries.

MATERIALS AND METHODS

Plant material was studied mainly from herbarium specimens housed in JRAU, NH, NU, and PRE (acronyms after Holmgren *et al.* 1990); and also in the field. Habit affinities are described according to Mucina & Rutherford (2006).

TAXONOMY

***Sphenostylis* E.Mey.**, *Commentarium de Plantis Africae Australioris*: 148 (1836); Baker f.: 670 (1929); Burt Davy: 418 (1932); E.Phillips: 427 (1951); Wilczek: 273 (1954); Verdc.: 389 (1970); J.B.Gillett *et al.*: 670 (1971); Compton: 286 (1975); R.A.Dyer: 275 (1975); Potter & Doyle: 389–406 (1994); Germish.: 296 (2000); Verdc. & Døygard: 68 (2001). Type species: *S. marginata* E.Mey.

Prostrate, climbing (twining), or erect shrubs or perennial herbs, arising from a thick, woody rootstock. *Leaves* pinnately 3-foliolate (Figure 1D); stipules persistent, ovate-lanceolate or ovate-acuminate; leaflets ovate, elliptic or linear, with four linear stipels, one at the base of each lateral leaflet and two at the base of the terminal one (Figure 1E), appressed-pubescent when young but becoming glabrescent with age. *Inflorescence*: flowers in congested heads on long peduncles, peduncles much longer than leaves; bracts linear or oblong-lanceolate, small, falling off at a very early stage or absent; bracteoles 2, ovate-lanceolate or oblong-ovate, caducous or persistent. *Calyx* tube campanulate, bilabiate, the two

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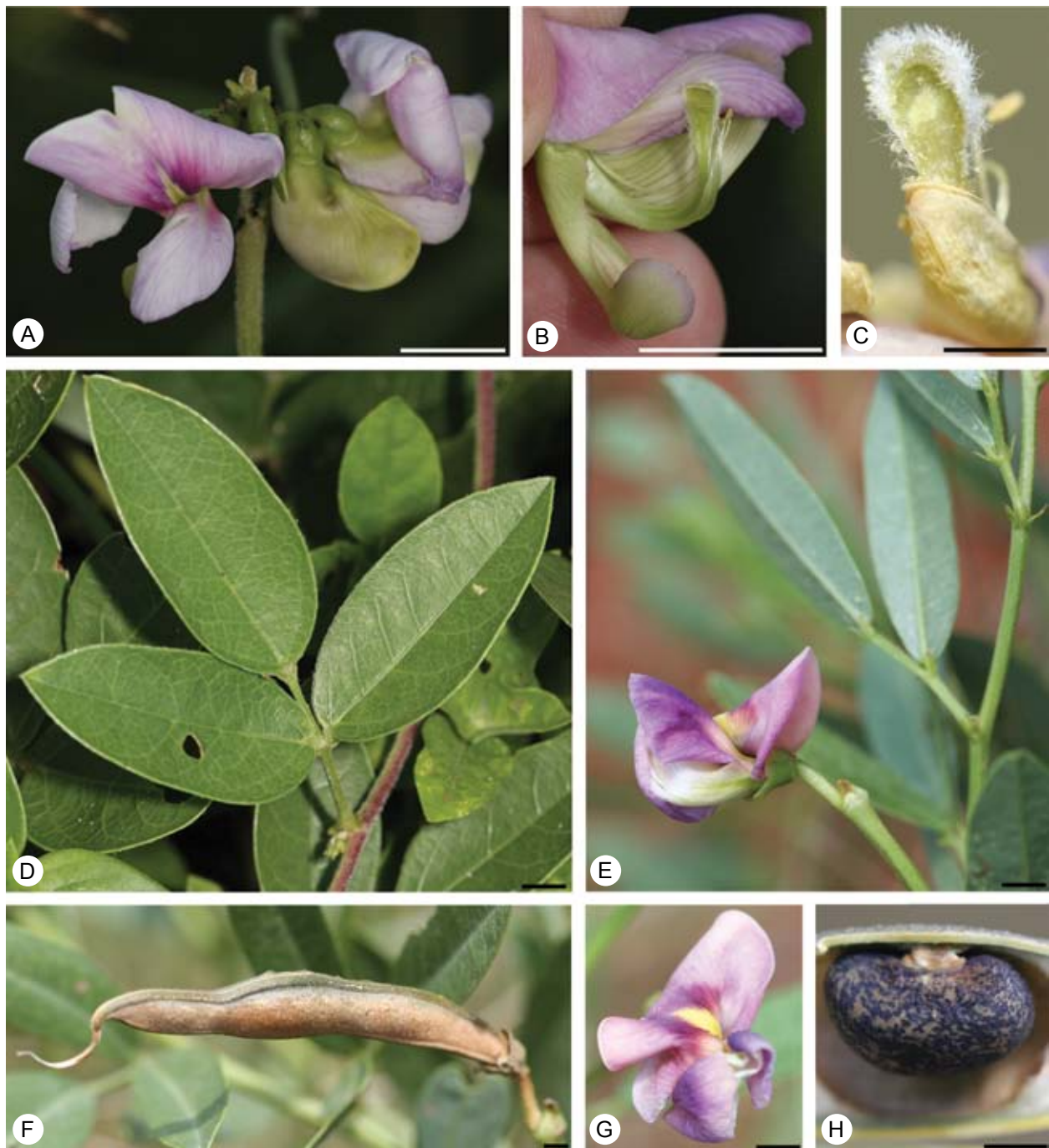


FIGURE 1.—*Sphenostylis marginata* (A, B, D) and *S. angustifolia* (C, E–H): A, flowers showing the twisted standard petals; B, flower showing the cuneate style tip; C, keel tip and cuneate style tip; D, leaf in adaxial view; E, flowering branch (note the stipules and stipels); F, pod; G, flower in front view (note the twisted petals); H, seed. Scale bars: A, 8 mm; B, 12 mm; C, E–G: 5 mm; D, H: 2 mm. Photographs: A, B, D by David Styles; C, E–H by Ben-Erik van Wyk.

lobes of the upper lip partially or entirely connate, lobes very short and blunt. *Corolla* purple, purplish pink, violet, whitish pink, or yellow; standard suborbicular, symmetrical or twisted (Figure 1A & 1G) with 2 inflexed auricles, but without appendages, with well-developed, channelled claw; wings obliquely obovate, eared near base, with short linear claw; keel incurved, $\pm$ concave-convex beaked, with short linear claw. *Androecium* diadelphous (with 9 stamens fused into a tube, vexillary stamen free), 5 basifixed anthers alternating with 5 dorsifixed anthers. *Ovary* narrowly oblong, pubescent, 3–12-ovuled; style penicillate below the stigma; stigma dorsiventrally flattened, ciliate on the margins (Figures

1B & 1C). *Fruit* linear, compressed, twisting after dehiscence, glabrescent to densely silky, with persistent style at tip (Figure 1F), 2–several-seeded, dehiscent. *Seeds* oblong, uniformly black or brown to reddish brown speckled black, minutely papillose (Figure 1H).

Key to species of *Sphenostylis* in South Africa and Swaziland:

- 1a Leaflets 20–45 mm wide; petiole 50–70 mm long; peduncles 220–300 mm long; fruit 95–120 mm long *S. marginata*
- 1b Leaflets 10–19 mm wide; petiole 8–16 mm long; peduncles 75–115 mm long; fruit 55–85 mm long *S. angustifolia*

1. *Sphenostylis angustifolia* Sond. in Linnaea 23: 33 (1850); R.A.Dyer: t 1010 (1947); Burt Davy: 418 (1932); Compton: 287 (1975). *Vigna angustifolia* (Sond.) Benth. ex Harv.: 240 (1862). Type: South Africa, Gauteng, 2528 (Pretoria): Magaliesberg, (–DC), Zeyher 524 (S, specimen on the left, lecto!., here designated; BM!, K!, isoleccto.). Syntype: KwaZulu-Natal, 2931 (Stanger): Port Natal [now Durban], (–CC), Gueinzus 624 (S!).

Note: the Zeyher specimen in the Sonder Herbarium in S is chosen as lectotype because this is probably the specimen that Sonder used in his description. The twig on the left is chosen because it bears a flower and some immature fruits. Curiously Potter (in sched.) chose the Zeyher specimen in K as lectotype but this choice was apparently never published.

Erect suffrutex, rarely climbing and twining, much-branched, up to 0.5 m tall, spreading. *Leaflets* oblong or linear-lanceolate, 30–60 × (7–)10–19 mm; petiole 8–16 mm long; stipules ovate-acuminate, 3.5–5.0 × 2–3 mm. *Inflorescences* subumbellate axillary racemes; peduncles (55–)75–115 mm long, with 2–4 flowers; flowers pink or purple, with a whitish or yellowish centre, 12–25 mm long; bracts linear, ± 1.5 mm long, caducous; bracteoles ovate-lanceolate, 2.0–2.5 × ± 1.5 mm, persistent. *Calyx* sparsely pubescent, with ± equal lips, upper lip 6–8 mm long, lower lip 6–8 mm long; lobes rounded, those of the upper lip joined for almost their entire length. *Corolla* pinkish red; standard suborbicular, 15–25 × 15–26 mm,

glabrous; wings obovate, 14–24 × 4–7 mm, without surface sculpturing, apex rounded; keel falcate, 14–24 × 6–10 mm, apex rounded, pocket absent. *Ovary* 9–13 mm long, linear-oblong. *Fruit* linear, 55–85 × 5–6 mm, glabrescent, many-seeded. *Seeds* reniform, ± 7 × ± 4 mm, brown, reddish brown speckled black, or uniformly black (Figure 2). *Flowering time:* Sept.–Feb.

Diagnostic characters: Based on Potter & Doyle's cladistic analysis (1994), *Sphenostylis angustifolia* appears to have close affinities with *S. zimbabweensis* R.Mithen, which is restricted to the Highlands of Zimbabwe. The two species share the deciduous bracts and the persistent bracteoles. *Sphenostylis zimbabweensis* is, however, differentiated by the more prostrate growth form (as opposed to the erect growth form of *S. angustifolia*), and the broader, ovate to elliptic leaflets (leaflets narrower and oblong to linear-lanceolate in *S. angustifolia*). *Sphenostylis angustifolia* can be distinguished from *S. marginata* by the narrower leaflets and the much shorter petioles, peduncles, and pods (dimensions are given in the key).

Distribution and habitat: *Sphenostylis angustifolia* occurs in South Africa (Limpopo, North-West, Gauteng, Mpumalanga and KwaZulu-Natal Provinces) and Swaziland (Figure 3). It grows scattered in Zeerust Thornveld (SVcb 3), Central Sandy Bushveld (SVcb 12), Soutpansberg Mountain Bushveld (SVcb 21), Polokwane Plateau Bushveld (SVcb 23), Granite Lowveld (SVI 3), Tza-

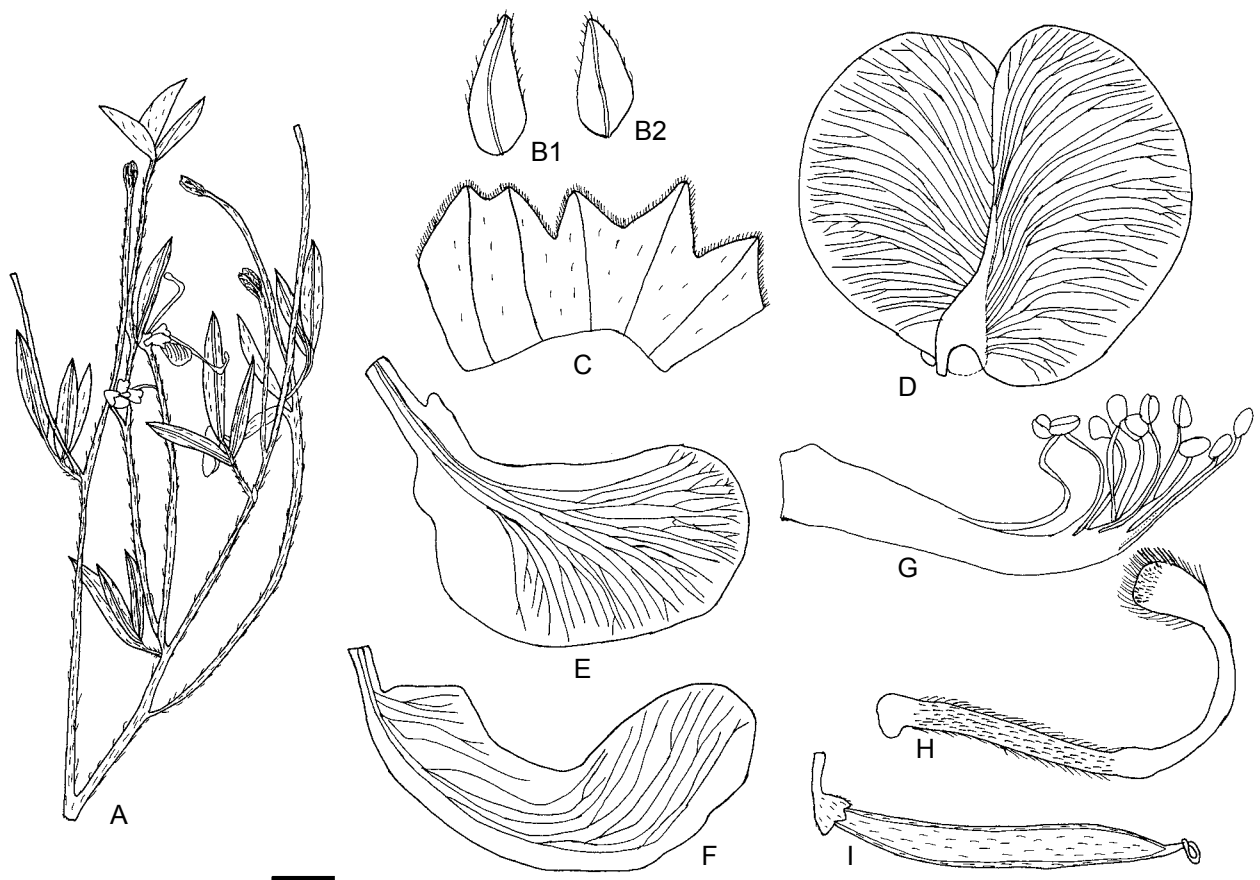


FIGURE 2.—Vegetative and reproductive morphology of *Sphenostylis angustifolia*: A, flowering branch; B1 & B2, abaxial view of bracteoles; C, calyx opened out with upper lobes to left; D, standard petal; E, wing petal; F, keel petal; G, stamens; H, pistil; I, lateral view of pod. Vouchers: A from A.O.D. Mogg 35461 (JRAU); B–I from B–E. van Wyk 1438 (JRAU). Scale bar: A, 30 mm; B, 1 mm; C–F, H, 3 mm; G, 2 mm; I, 10 mm.

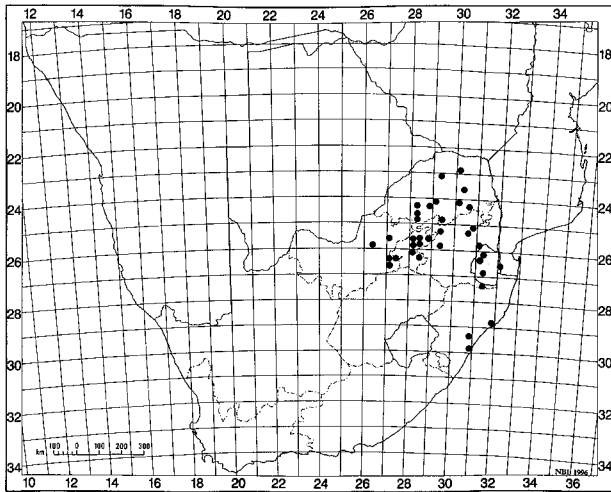


FIGURE 3.—Distribution of *Sphenostylis angustifolia*.

neen Sour Bushveld (SVI 8), Legogote Sour Bushveld (SVI 9), Swaziland Sour Bushveld (SVI 14), Southern Lebombo Bushveld (SVI 16), Carletonville Dolomite Grassland (Gh 15), Soweto Highveld Grassland (Gm 8), Rand Highveld Grassland (Gm 11), KaNgwane Montane Grassland (Gm 16), Maputaland Coastal Belt (CB 1), KwaZulu-Natal Coastal Belt (CB 3).

Additional specimens examined

LIMPOPO.—2230 (Messina): Soutpansberg, Entabeni Forestry Station at Muchindudi Fall, (–CC), 27 Jan. 1954, *L.E. Codd* 8392 (PRE). 2329 (Polokwane): Polokwane, Farm Eersteling, on slope of mtn, (–AB), 1 Jan. 1992, *G.J. du Toit* 2238 (NH). 2330 (Tzaneen): Modjadji Reserve near Duiwelskloof, (–CB), 24 May 1938, *J.D. Krige* 164 (PRE). 2428 (Nylstroom): Waterberg, (–AD), 6 Nov. 1978, *G. Germishuizen* 909 (PRE); Naboomfontein, (–BD), 13 Dec. 1934, *E.E. Galpin* 133130 (PRE); between Warmbaths and Pietersburg [Polokwane], (–CB), 4 Nov. 1985, *B.J. Pienaar* 636 (PRE); 18 km from Nylstroom on road to Warmbaths near Groot Nyl turn-off, (–CD), 4 Nov. 1985, *G. Germishuizen* 3347 (PRE). 2429 (Zebediela): near Daggakraal 50 m NE of Potgietersrus, (–AA), 3 Jan. 1954, *B. Maguire* 2569 (PRE); Arabie, Camp 1, (–CD), 7 Jan. 2007, *W. Ellery* 357 (PRE). 2430 (Pilgrim's Rest): Lekgalameetse Nature Reserve, The Downs, SE of Makwens, (–AA), 16 Oct. 1985, *M. Stalmans* 718 (PRE).

NORTH-WEST.—2526 (Zeerust): Marico Distr., ± 10 km NE of Wondergat, (–CD), 6 Feb. 1983, *C. Reid* 676 (PRE). 2527 (Rustenburg): Rustenburg Nature Reserve, (–CA), 27 Feb. 1970, *N. Jacobsen* 845 (PRE). 2627 (Potchefstroom): on road from Frederikstad to Rysmierbult, (–AC), 31 Oct. 1978, *B. Ubbink* 733 (PRE); Ventersdorp, Goedgedacht, (–CA), 29 Dec. 1930, *J.D. Sutton* 511 (PRE).

GAUTENG.—2528 (Pretoria): La Montagne Rand, N of Chamber W/S, (–CA), 30 Sept. 1978, *A.E. van Wyk* 2405 (PRE); 28 miles [45 km] from the National Herbarium on road to Boekenshoutsloof, (–CB), 15 Apr. 1971, *L.A. Coetzer* 73 (PRE); Fountains Valley, (–CC), 3 Oct. 1948, *J.M. Watt* 4565 (PRE); Doornkloof, Smutskoppie, (–CD); 24 Nov. 1985, *B-E. van Wyk* 1438 (JRAU); Renosterkop, NE of Bronkhorstspuit, (–DB); 6 Dec. 1987, *B-E. van Wyk* 2730 (JRAU). 2628 (Johannesburg): Melville Koppies Nature Reserve, (–AA), 4 Feb. 1987, *B-E. van Wyk* 2600–2604 (JRAU); Heidelberg, (–AD), Nov. 1927, *A. Thode* A1311 (PRE).

MPUMALANGA.—2430 (Pilgrim's Rest): Drie Rondavels lookout, (–BC), 2 Feb. 1982, *A.E. van Wyk*, *R. Dahlgren* & *P.D.F. Kok* 5487 (PRE). 2529 (Witbank): Loskopdam Game Reserve, (–AD), 13 Dec. 1966, *G.K. Theron* 728 (JRAU, PRE); between Witbank and Middelburg along N4 highway, (–CD), 20 Feb. 1991, *P. Herman* 1338 (PRE). 2530 (Lydenburg): 7 km S of Sabie, (–BB), 29 Sept. 2005, *J.J. Meyer* 4530 (PRE); Wonderkloof Nature Reserve, (–BC), 17 Nov. 1978, *J.P. Kluge* 1408 (PRE). 2531 (Komatipoort): KaNgwane, Songimvelo Game Reserve, (–CC), 8 Dec. 1992, *N.L. Meyer* 29 (PRE).

SWAZILAND.—2631 (Mbabane): Hhohho Dist., Nyokane, 15 km from Piggs Peak-Mbabane turnoff on road to Maphalaleni, (–AB), 23 Oct. 1963, *R.H. Compton* 31707 (PRE); Dabriach, (–AC), 18 Oct. 1958, *R.H. Compton* 28097 (PRE); Hlatikulu, (–CD), Oct. 1910, *M. Steward* 10081 (PRE). 2632 (Bela Vista): Lebombo Mountains, near fence separating Swaziland and Mozambique, (–CA), 22 Nov. 2002, *M.K. Maserumule* 74 (PRE).

KWAZULU-NATAL.—2930 (Pietermaritzburg): Beacon Hill, off Panorama Terrace, Wyebank, (–DD), 10 Jan. 2005, *D. Styles* 2180 (NH).

2. *Sphenostylis marginata* E.Mey., *Commentarium de Plantis Africae Australioris*: 148 (Feb. 1836); Baker f.: 148 (1929); Wilczek 6: 274 (1954); Verdoorn: t. 1521 (1968); J.B. Gillett et al.: 671 (1971); Compton: 287 (1975); Lock: 438 (1989); Potter & Doyle: 403 (1994); Verdc. & Døygard.: 71 (2001). *Vigna marginata* (E.Mey.) Benth. ex Harv.: 240 (1862); De Wild.: 98 (1921). Type: KwaZulu-Natal, 3030 (Port Shepstone): 'in graminosis ad ostia fluvii Omsamculo' [mouth of Umzimkulu River], (–CB), *Drège s.n.* (K!, lecto., designated by Potter & Doyle (1994) [as 'holo.'], G!, MO!, P!, isolecto.)

Note: although the P specimen which bears an original *Drège* label with locality details corresponding exactly to those given in the prognosis as well as Meyer's handwriting ('*mihi*') would have been more appropriately selected as lectotype, Potter & Doyle's (1994) designation of the K specimen as the holotype constitutes effective lectotypification (Art. 9.8).

Prostrate suffrutex with twining stems up to 1.5 m long, arising from a woody rootstock. *Leaflets* ovate, elliptic or oblong, 45–110(–125) × 20–40(–45) mm; petiole (15–)50–70 mm long; stipules oblong-lanceolate or ovate, 3–7 × 2–4 mm. *Inflorescence* pseudo-umbellate, axillary raceme, long-stalked; peduncles 220–300 mm long, few-flowered; flowers mauve, 14–16 mm long; bracts oblong-lanceolate, ± 1.5 mm long, caducous, bracteoles ovate-lanceolate, 2–3 × 1.5–2.0 mm, persistent. *Calyx* pubescent, lobes rounded, with equal lips, upper and lower lips 5–6 mm long, lobes of upper lip joined for almost their entire length. *Corolla* pinkish red; standard broadly obovate, 13–17 × 14–23 mm, glabrous; wings obovate, deep purplish pink 10–17 × 4–6 mm, without surface sculpturing, apex rounded; keel ± equal to wings, 12–18 × 4–6 mm, paler or white, apex rounded, pocket absent. *Ovary* 10–15 mm long, linear-oblong. *Fruit* linear, 95–120 × 4–8 mm, glabrescent, 5–8-seeded. *Seeds* reniform, ± 5.0 × ± 3.5 mm, brown or reddish brown speckled black (Figure 4). *Flowering time:* Nov.–Feb.

Diagnostic characters: *Sphenostylis marginata* differs from *S. angustifolia* in having broader leaflets and longer petioles, peduncles, and pods (see key for dimensions).

Verdcourt (1970) divided what he called the *Sphenostylis marginata* complex, which included the two central and East African species *S. erecta* (Baker f.) Baker f. and *S. obtusifolia* Harms, into three subspecies, namely subsp. *marginata* (occurring only in South Africa and Swaziland), subsp. *obtusifolia* (Harms) Verdc., and subsp. *erecta* (Baker f.) Verdc. However, based on morphological and DNA data, Potter & Doyle (1994) pro-

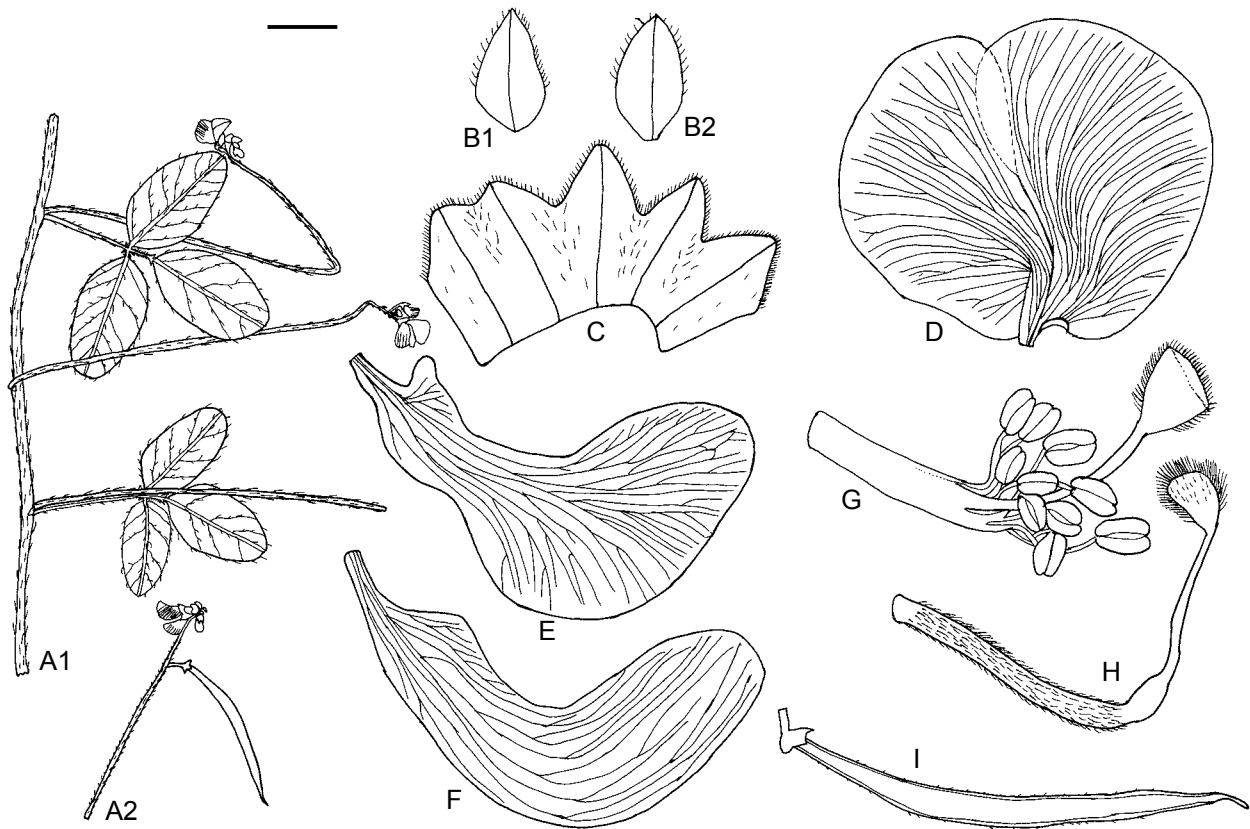


FIGURE 4.—Vegetative and reproductive morphology of *Sphenostylis marginata*: A1, flowering branch; A2, inflorescence; B1 & B2, abaxial view of bracteoles; C, calyx opened out with upper lobes to left; D, standard petal; E, wing petal; F, keel petal; G, stamens; H, pistil; I, lateral view of pod. Vouchers: A from *N. Grobbelaar* 1648 (PRE); B–F from *Commis* 855 (PRE); H from *Acocks* 20928 (PRE); I from *N. Grobbelaar* 1648 (PRE). Scale bar: A1, A2, 30 mm; B, 1 mm; C, 2 mm; D–F, H, 3 mm; G, 4 mm; I, 15 mm.

posed a narrow view of *S. marginata* by limiting the species concept to subsp. *marginata* (the other two subspecies were excluded). *Sphenostylis marginata* subsp. *erecta* was restored to species level and subspecies *obtusifolia* was transferred to *S. erecta* (as subspecies).

Distribution and habitat: *Sphenostylis marginata* occurs in South Africa (Limpopo, Mpumalanga, KwaZulu-Natal and Eastern Cape Provinces), and Swaziland (Figure 5). It grows in Central Sandy Bushveld (SVcb 12), Ohrigstad Mountain Bushveld (SVcb 26), Gran-

ite Lowveld (SVI 3), Legogote Sour Bushveld (SVI 9), Zululand Lowveld (SVI 23), Paulpietersburg Moist Grassland (Gm 15), KaNgwane Montane Grassland (Gm 16), Income Sandy Grassland (Gs 7), Ngongoni Veld (SVs 4), Eastern Valley Bushveld (SVs 6), Maputaland Coasal Belt (CB 1), and KwaZulu-Natal Coastal Belt (CB 3).

Additional specimens examined

LIMPOPO.—2428 (Nylstroom): 13 km NE of Warmbaths [Bela-Bela] on road to Nylstroom, (–CD), 18 Nov. 1981, *C. Reid* 439 (PRE).

MPUMALANGA.—2430 (Pilgrim's Rest): foothills SE of Magalieskop, Mariepskop Dist., (–DB), 6 Dec. 1990, *H.P. van der Schijf* 5878 (PRE). 2531 (Komatipoort): 25 km from White River to Hazyview, near White Waters Forest Station, (–AA), 3 Jan. 1984, *M. Jordaan* 298 (PRE); Kruger National Park, Lower Sabie dam, (–BB), 26 Nov. 1990, *V.R. Bredenkamp* 468 (PRE); Eerste Geluk no. 16, Uitkyk, (–CA), 26 Mar. 1975, *C.H. Stirton* 1729 (PRE).

SWAZILAND.—2631 (Mbabane): Hhohho Dist., Masilela area, on Maphalaleni Rd., (–AB), 27 Jan. 1994, *G. Germishuizen* 7152 (PRE); Little Usutu River, (–AC), 27 Oct. 1956, *R.H. Compton* 26163 (NH, PRE); Stegi, (–BD), 22 Dec. 1960, *R.H. Compton* 30388 (NH, PRE); S of Mankai-ana, (–AA), 6 Nov. 1949, *J.L. Sidey* 1933 (PRE). 2731 (Louwsburg): at camp on hilltop before reaching Hluti, (–BA), 8 1931, *I.B. Pole-Evans* 3364 (PRE).

KWAZULU-NATAL.—2730 (Vryheid): 0.9 km towards Vryheid from Natal Spa, Freddie Coetzee's farm, (–BD), 2 Dec. 1988, *P.D.F. Kok & B.J. Pienaar* 1282 (PRE). 2731 (Louwsburg): Nongoma, (–DC), 20 Nov. 1960, *M.J. Wells* 2060 (PRE). 2830 (Dundee): hill near Glencoe, (–AA), 22 Feb. 1993, *J. Medley-Wood* 4823 (PRE); Dundee Dist., on banks of Buffalo River, 1 km S of P.O. Vantsdrift, (–AB), 22 Dec. 1946, *L.E. Codd* 2377 (PRE); Elandslaagte, Blanerne Farm,

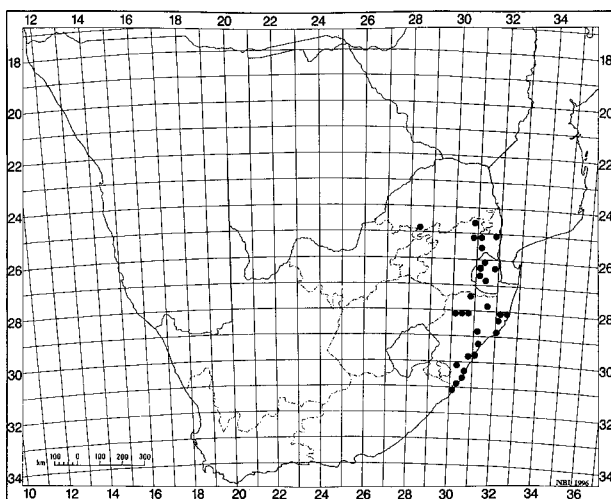


FIGURE 5.—Distribution of *Sphenostylis marginata*.

32 km from Ladysmith on road to Newcastle, (–BA), 15 Nov. 1994, A.M. Ngwenya 1295 (PRE). 2831 (Nkandla): Babanango Dist., valley N of Izulu Hill, (–CC), 16 Jan. 1946, J.P.H. Acocks 12317 (PRE). 2832 (Mtubatuba): Masundwini, Hluhluwe Game Reserve, (–AA), 7 Nov. 1971, P.M. Hitchins 635 (NU, PRE); Palm Ridge Farm, (–AC), 3 Oct. 1967, E.R. Harrison 128 (PRE). 2931 (Stanger): Twinstreams Farm, Mtunzini, (–DC), 12 Oct. 1984, I. Garland s.n., & G. Nichols 805 (PRE). 3030 (Port Shepstone): St Michaels-on-Sea, (–AB), 1 Feb. 1985, B.J. Pienaar 587 (PRE); Port Shepstone (–CD), 24 Mar. 1967, R.G. Strey 7420 (PRE); Hibberdene, (–DA), 09 Mar. 1970, R.G. Strey 9701 (NU).

ACKNOWLEDGEMENTS

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