A New Combination for the Indian Progenitor of Sesame, *Sesamum indicum* (Pedaliaceae)

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A New Combination for the Indian Progenitor of Sesame,
*Sesamum indicum* (Pedaliaceae)

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**ABSTRACT.** The new combination *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian (Pedaliaceae) is provided for the progenitor of sesame. Both lectotype and epitype for *S. malabaricum* Burm., the basionym of the new combination, are designated herein. A plate (van Rheede tot Draakestein, 1689: tab. 55) mentioned in the original protologue (Burman, 1769) is designated here as the lectotype for *S. indicum* L. subsp. *malabaricum* (Burm.) Bedigian. Previously published evidence about the relationship of *S. indicum* and *S. malabaricum* summarized here and shared morphological traits described here provide a foundation for the recognition of this taxon at the changed rank of subspecies.

*Key words:* Domestication, Lamiales, Pedaliaceae, sesame, *Sesamum*.

The new combination *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian (Pedaliaceae) is provided for the progenitor of sesame. Both lectotype and epitype for *S. malabaricum* Burm., the basionym of the new combination, are designated herein. A plate (van Rheede tot Draakestein, 1689: tab. 55) mentioned in the original protologue (Burman, 1769) is designated here as the lectotype for *S. indicum* L. subsp. *malabaricum* (Burm.) Bedigian. Previously published evidence about the relationship of *S. indicum* and *S. malabaricum* summarized here and shared morphological traits described here provide a foundation for the recognition of this taxon at the changed rank of subspecies.


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2003; Annapurna Kishore Kumar & Hiremath, 2008). The definitive criterion of domestication, defined by the fertile hybrid products of reciprocal crosses, has been reiteratively demonstrated between the two taxa (Bedigian, 1984, 1988, 1998, 2000, 2003a, 2003b, 2010, 2011; Bedigian et al., 1985) and indicates that both species belong in the same primary gene pool. Hybrids of reciprocal crosses between the crop plant and wild S. malabaricum have been confirmed as fully fertile. Independently, Hiremath and Patil (1999), Kawase (2000, 2003), Bisht et al. (2004), Annapurna Kishore Kumar (2003), and Annapurna Kishore Kumar and Hiremath (2008) repeated Bedigian’s crosses, and each team also found the offspring of these reciprocal crosses to be fertile. Some of these studies were prepared on material identified as S. malayanum. Separately, Bedigian (1984, 1988, 2003a, 2003b), Kawase (2000), and Annapurna Kishore Kumar (2003) each concluded from side-by-side morphological specimen comparisons that S. malabaricum and S. malayanum belong to a single species. Thus, Bedigian (2003a: 780) synonymized the name S. malayanum under S. malabaricum.

Bhat et al. (1999), Kawase (2000), and Nanthakumar et al. (2000), using RAPD genetic markers, supported the close relationship of Sesamum indicum to S. malabaricum. More recent results from molecular phylogeny analyses, using the two chloroplast DNA regions known to be broadly informative in the Lamiales (ndhF and trnLF, Olmstead et al., 2001) and from plants determined by this author, confirm that S. indicum and S. malabaricum are very closely related: “The results show that S. indicum and S. malabaricum are virtually identical in their chloroplast DNA sequences. This doesn’t mean that they are the same species, but it does mean that the specimens sampled share a very recent ancestry” (Olmstead, Aug. 2012, pers. comm.).

Thus, several lines of evidence indicate that Sesamum malabaricum is the wild progenitor of cultivated sesame, which necessitates a revised circumscription of Sesamum sect. Sesamum. Sesamum latifolium was previously included with S. indicum in Sesamum sect. Sesamum by Ihlenfeldt and Grabow-Seidensticker (1979: 58) and Ihlenfeldt (2004), while they treated S. malayanum as a “form” of S. indicum, representing an early stage in the process of domestication, but failed to recognize S. malayanum at the rank of “forma” within any formal nomenclature. Given the numerous differences between S. latifolium and S. indicum indicated above, S. latifolium should no longer be assigned to Sesamum sect. Sesamum (Bedigian, in prep.). The sesame crop’s progenitor has a recognizably different morphology, some ecological differences, and a substantially separate ecological trajectory. Consequently, a new combination at the infraspecific level in Sesamum is needed to unite the crop plants and their wild progenitor in the same species, as predicated by the various lines of evidence noted above. A full description is presented here for this new subspecies; a corresponding description of cultivated sesame, interpreted as the autonymic subspecies of S. indicum below, was presented by Stapf (1906), Bruce (1953), and Mkamilo and Bedigian (2007: 153–158).


Sesamum L. sect. Sesamum.

Included species (2). Sesamum indicum L., Sesamum malabaricum Burm.

Ihlenfeldt and Grabow-Seidensticker (1979: 58) described the corollas of the species of Sesamum sect. Sesamum as having the “lower lip of flower not prominent.” Quite the opposite, the lower lip of these species usually extends ca. 1 cm beyond the rest of the campanulate corolla, and the lower lip’s pigmentation in the crop’s progenitor is an intense purple. A photograph of that striking flower appeared on the cover of Descriptors for Sesame (Sesamum spp.) (International Plant Genetic Resources Institute, 2004). Additional photographs of S. indicum can be found at <http://www.tropicos.org/>.

According to the International Code of Nomenclature (McNeill et al., 2012), Article 39.1, the name Sesamum orientale var. malabaricum G. V. Narayana (John et al., 1950) was not validly published, lacking a Latin description.

   TYPE: India. “Habitat in India” (lectotype, designated by Abed in Nasir & Ali [1973: 4], LINN-802.3).

1a. Sesamum indicum L. subsp. indicum.


Erect annual herb, 0.5–3 m high, with unpleasant, rank odor, often divergently branched; stems and branches in their upper part quadrangular with furrowed sides, pubescent to glabrescent, rarely pilose, glandular. Leaves heteromorphic, opposite below, alternate above, lower surfaces densely glandular, thinly pubescent on the prominent nerves; lower leaves 2–17 × 0.7–5.5 cm, usually palmately 3-foliolate, 3-lobed or tripartite, in less-developed ones the blade undivided, ovate from a rounded or obtuse base, apex acute, obtuse or rounded, margin coarsely dentate to serrate; upper leaves 0.75–2.5 cm, with gradually shorter petioles, the blades obovate to oblong to lanceolate to linear from an acute base, entire, apex acute. Flowers solitary in the axils of upper leaves; pedicel erect, 2–5 mm, with 2 sessile yellow glands each in the axil of a bract. Calyx persistent, to 1 cm at anthesis, drying and shrinking to 4–7.5 mm in fruit, thickened and obconical, calyx segments oblong to lanceolate, acute or obtuse, pubescent; corolla 2.25–5.5 cm, pink or white, pubescent, usually with intensely deep purple pigmentation on the lower lip (Fig. 3), with 2 yellow extraloral nectary glands 2–3 mm long at the base, with nectar guide and foveola in throat; filaments glabrous, arising at base of corolla, with a cushion of eglandular trichomes, 6–9 mm; anthers 3–3.5 mm, glabrous, with a thin black longitudinal stripe, connective prolonged and terminating in a globose gland; staminode minute or wanting; ovary slightly compressed, 4 mm, rounded at apex, pilose; style glabrous, white, 8–12 mm; stigmatic lamellae lanceolate, acute. Capsule erect, oblong, quadrangular, 4-grooved, rounded at base, acuminate into a beak at apex, capsule body excluding beak length 2–2.5 × 0.6 cm, woody, pubescent, pilose or bristly.
Figure 2. Epitype specimen for *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian, C. A. Ninan 5 (K). Photograph provided by ©The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew. The author met the collector, C. A. Ninan, Head, Department of Botany, Kerala University, Kariyavattom, Trivandrum, India, in September 1979; the following day the author visited C. M. John at his plantation in Changancherry to document the location where Ninan's specimen had been collected.
incompletely dehiscent, finally splitting to base; capsule beak 3–5 mm; seeds dark brown or black, broadly ovoid, 2–2.5 × 1.5 × 1 mm, faces conspicuously reticulately rugose (Fig. 3).

Although Burman (1769) provided no descriptions of his new species, he made direct reference to published descriptions and plates of van Rheede tot Draakestein (1689). Article 38.1 of the International Code of Nomenclature (McNeill et al., 2012) specifies that a name may be validated by reference to a previously and effectively published description or diagnosis, as was done by Burman. Thus this name is validly published here by J. Burman, the father, and not N. L. Burman, as sometimes cited. The van Rheede tot Draakestein figure (1689: 107, tab. 55) is associated with Burman’s protologue and

Figure 3. Fertile plant of *Sesamum indicum* L. subsp. *malabaricum* (Burm.) Bedigian, photographed by the author September 18, 1979, at Sinhagad, a hill fortress 30 km southwest of Pune, India. The hill is ca. 800 m, with the Sinhagad fortress ca. 1350 m above sea level. The corolla has a long, dark purple lip and yellow extrafloral nectary glands. Inset: Reticulations on the seed surface of *S. indicum* subsp. *malabaricum* photographed by the author using a Nikon (Tokyo) SMZ1000 microscope and a Nikon Coolpix 8800VR camera.
is selected here as the lectotype. The plate is closely correspondent to the plant collected by myself in 1979 (Fig. 3). Nicolson et al. (1988: 180) refer to Car-elu, citing van Rheede tot Draakestein (1689: 107, tab. 55): “probably a shortened form of karuthella sometimes used instead of ellu; karatha means black (a reference to seed color).” Bedigian and Harlan (1986) discussed the widespread adoption of the word ellu, and its derivation from the Dravidian eL.
Distribution. *Sesamum indicum* subsp. *malabaricum* is documented from the Indian subcontinent, extending from northernmost Himachal Pradesh southward to Kerala (Fig. 4).

Habitat and ecology. *Sesamum indicum* subsp. *malabaricum* has been collected from plains and hilly forests at elevations to 1600 m. The subspecies has been observed in cultivated fields and forests. Populations can be weedy on roadsides. The taxon has been noted from mountain foothills and along railroad tracks. Van Rheede tot Draakestein (1689: 107) noted it as “loving sandy soil.”

**KEY TO THE SUBSPECIES OF SESAMUM INDICUM L.**

1a. Seed color variable, white, ivory, beige, tan, mustard yellow, brick red, various shades of brown, gray, or black; seed surfaces smooth, granular, seldom transversely or reticulately rugose, not dormant; corolla 15–33 mm long; lower lip occasionally equal to, or more usually 2–10 mm longer than, other lobes; corolla color variable, from white, light pink, pale lavender to light purple, or with pale lavender coloration variable, from white, light pink, pale lavender to light purple, or with pale lavender colorations, ranging in intensity from 1 to 8 on a scale of 1 to 10, coloration varies with cultivar, some with linear markings, some tinted only at lower margin of lower lip, with variable intensity and variable amount of surface area covered; capsule 2–2.5 cm long, bicarpellate, texture variable, cultivar-dependent, from single-stemmed to profusely branching; plant often reaching 200 cm high, typically woody; living plant color dark green, often with purplish hue; extrafloral nectary glands 1–1.2 mm; plant generally 30–110 cm high, branching variable, cultivar-dependent, from single-stemmed to profusely branching; lower leaves varying by cultivar, ranging from occasionally divided, tripartite, with toothed margins, some with leafy outgrowths at base of leaves above petiole; many cultivars with lanceolate or simple ovate leaves ........................ S. indicum subsp. indicum

1b. Seed color dark brown or black; seed surface conspicuously reticulate and rugose, markedly dormant; seeds 2–2.5 mm long, with distinct sharp edges, sides broad, transversely or reticulately rugose; corolla 22.5–55 mm long; lower lip 10–15 mm longer than other lobes, dark purple, with intensity of color ranking 10 on a scale of 1 to 10, pigmentation occupying entire lower lip; capsule 2–2.5 cm long, bicarpellate, texture woody; living plant color dark green, often with purplish hue; extrafloral nectary glands 2–3 mm; plant often reaching 200 cm high, typically branching profusely; lower leaves divided, undivided, and serrate in less-developed leaves, without leafy outgrowths at base of leaves above petiole .............................. S. indicum subsp. malabaricum

Selected specimens examined. INDIA. Andhra Pradesh: Jct. near Mananur [Pratap Rudra Kot], L. J. G. van der Maesen 3234 (K); Karimnagar Dist., Aklapur loc., G. V. Subbarao 25601 (MH); Hyderabad, Jubilee Hills, L. J. G. van der Maesen 4957 (K, WAG); Kurnool Dist., Chelama, Nallamalais, J. Ellis 22027 (MH); Nandyal-Kurnoor Dist., Nallamalal-Nandyal, Nallamalai loc., 26 Sep. 1951, N. Krishnaswamy s.n. (MH-94223); Polavarum (W. Godavaram), S. K. Wagh 6921 (BLAT); Warangal, 29 Sep 1974, s. coll. (K). Assam: Lakhimpur, C. L. Malhotra 23566 (BSD). Delhi: Delhi Ridge, D. Bedigian 105 (MO); Delhi Ridge, ref. to Univ. of Delhi, R. J. Rodin 8025 (K). Diu: Gogale, R. S. Rao 102770 (BSI, CAL), G. Bayanar, R. P. Singh 125068 (BSI); Caranzal, N. P. Singh 124952 (BSI); Valpaj, G. H. Khiri 124098 (BSI). Gujarat: Broach, N railway track, G. L. Shah 6244 (BLAT); Dwarka along railway line, H. Santapau 14676 (BLAT); Gir Forest, K. T. B. Dodd 37 (K); Subir, Dang Forest, R. Asrava 3192 (BLAT). Haryana: Gurgaon, 25 Oct. 1962 (BSI-25261). Himachal Pradesh: Bilaspur, Mondi Rd., Pritam Lal 63204 (BSD); Dhamilla, B. P. Uniyal 61125 (BSD); Kangoo to Dehar, S. K. Murti & R. Prasad 62215 (BSD); Mahasu Dist., Rohru, N. C. Nair 36185 (BSD). Karnataka: Siddapur, S. Singh 44597 (BSD); Sullia, S. Kanara, C. A. Baker 2147 (MH), K. Mahalanobis Dist., [Kannur], Kumbla loc., R. Ansari 64917 (CAL); Changanacherry, C. A. Ninan 5 (K); Palakkad [Malabar] Dist., Walayar loc., S. R. Raju & Rama Prasad 18635 (MH); Trichur Dist., near Vadakkancherry, K. Ramamurty 48451 (MH). Madhya Pradesh: Hoshangabad Dist., Churna–Dharin Rd., J. Joseph 11220 (MH); Tikamgarh, Singhpura loc., D. M. Verma 30666 (CAL). Maharashtra: Aarey Milk Colony, Goregaon, near central dairy, S. C. Tavakari 39 (BLAT); Bassein, Thana Dist., H. Santapau 22625 (BLAT); Borivali Nat. Park, P. S. Herbert 1760 (BLAT); Dhaura Forest, Malki, near Vangani Badlapur range, K. V. Millore 115333 (BSI, CAL); Madh Island, C. T. Saldanha 1348, 1355, 1357 (BLAT); Nasik Dist., Sawarna, on way to Gujarat border, J. Cherian 111476 (BSI); Pune Dist., below Malega, on way to Mangavan–Avangavi–Mushli taluk, B. V. Reddi 101113 (BSI); Orissa: Sambalpur Dist., Chamunda, H. F. Mooney 2309 (K). Punjab: Gagret, Hoshiarpur, O. P. Misra 44637 (BSD); Gurdaspur, Batala, U. C. Bhattacharyya 37599 (BSD); Gurdaspur, Dhar, U. C. Bhattacharyya 39448 (BSD); Hoshiarpur, P. Daniel 67549 (BSD); Jalandhar, Div Rd., R. S. Rao 102490 (BSI, CAL). Rajasthan: Badnor, Bhilwara, BSD Jodhpur, A. N. Singh 6481 (CAL); Jodhpur Dist., Seriganga compound I, Jodhpur, B. V. Shetty 149 (CAL); Lohargal, N. C. Nair 1033 (BSD); Massoria, Jodhpur Dist., P. J. Parmar 4857 (BSI); Mt. Abu, Abu Rd., 4th mile, R. S. Rao 66694 (BSI); Udaipur Dist., Parshad, Sisa forest, 27 Sep. 1962 (BSI, 82194). Tamil Nadu: Boluvampatti-Ichipatti Forest Res., on way from Valayar from Komalalai, C. P. Sreemadhavan 745 (MH); Coimbatore Dist., Ichipatti Forest Res., V. Narayanaswamy 78109 (MH); Dinidigul Dist., Udumelpet, Palni Hills, Amaravathi Dun, K. M. Matthew 47199 (K); Trancavo Dist., Kotiyam loc., C. M. John & G. V. Narayana s.n. (MH-94220). Uttar Pradesh: Akharpur, Y. K. Sarin 8844 (BSD); Batia Chaur, Bijrani, Corbett Nat. Park, B. C. Point 72251 (BSD); Lakhhoiti, N. P. Singh 25422 (BSD); Palaipur, N. P. Singh 31933 (BSD). Uttarakhand: Dak Pathar, next to rest house, J. P. Sharma 77006 (BSD); Dehra Dun on way to Gorja, Gori Valley, C. L. Malhotra & B. P. N. Bolodi 77724 (BSD); Dehra Dun, Ajalpur, N. C. Nair 25373 (BSD); Dehra Dun, Bindal, C. R. Babu 33460, 33460a (BSD); Dehra Dun, Bindal Rao loc., T. A. Rao 974 (BSD); Dehra Dun, Nara, FRH loc., J. N. Vohra & P. Daniel 54575 (BSD); Dehra Dun, Niranjanpur, N. P. Singh 27475.
Bassuner (MO) helped draw the distribution map for seed photography; Bedigian, State University, Dayton, Ohio, offered use of his Agricultural University regional station Vridhachalam, India, for access to their specimens. Initial fieldwork and herbarium study in India (BLAT, BSI, DUH, MH, TBGT), Sudan (KHU, WM), and Europe (BM, BR, FI, HBG, K, P, W) in 1979–1980 were sponsored by the Crop Evolution Laboratory, Department of Agronomy, University of Illinois Urbana-Champaign. National Geographic Society (NGS) #6218-98 and NGS #7732-04 supported fieldwork and herbarium study in Africa (DSM, EA, KHU, MHU, WIND, WM), and herbarium study in Europe (B, BR, COI, K, LISC, LISU, M, WAG) and India (BSD, CAL). The author financed herbarium studies in the U.S.A. (F, GH, MO, NY, PH, UC, US). S. Thangavelu, Tamil Nadu Agricultural University regional station Vridhachalam, provided a seed sample; J. O. Stireman, Wright State University, Dayton, Ohio, offered use of his microscope and camera for seed photography; B. Bassuner (MO) helped draw the distribution map using ArcViewGIS software; R. E. Gereau (MO), H.-D. Ihlenfeldt (HBG), L. J. G. van der Maesen (WAG), C. M. Taylor (MO), and J. F. Veldkamp (L) provided constructive critiques.

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