

The Extended Distributional Areas of *Solanum lasiocarpum* (Solanaceae) in Sumatra, Indonesia (Distribusi Tambahan *Solanum lasiocarpum* (Solanaceae) di Sumatra, Indonesia)

Muhammad Rifqi Hariri^{1*}, Arifin Surya Dwipa Irsyam^{2,3}, Rina Ratnasih Irwanto⁴, and Kusnadi¹

¹Research Center for Plant Conservation and Botanic Gardens, The National Research and Innovation Agency. Jl. Ir. H. Juanda No. 13 Bogor 16003, West Java, Indonesia. Phone +62251 8311362

²Herbarium Bandungense (FIPIA), School of Life Sciences and Technology (SITH), Bandung Technology Institute. Labtek VC Building, Jl. Let. Jen. Purn. Dr (HC) Mashudi No. 1 Jatinangor 45363, West Java, Indonesia. Phone +6222 86010020

³Yayasan Botani Tropika Indonesia (Botanika). Jl. Seruni No. 25, Bogor 16117, West Java, Indonesia. Phone +62251 8574654.

⁴School of Life Sciences and Technology (SITH), Bandung Technology Institute. Labtek XI Building, Jl. Ganesha No. 10 Bandung 40132, West Java, Indonesia. Phone +6222 2511575.

Info artikel:	ABSTRACT
Keywords: Extended distribution, hairy-fruited eggplant, padang bindu, solanaceae, Sumatra	<i>Solanum</i> is one of Solanaceae's largest genera, where some species are usually used as food and medicine. Until recently, 15 species of <i>Solanum</i> subg. <i>Leptostemonum</i> has been listed in Sumatra, Indonesia. <i>Solanum lasiocarpum</i> Dunal is a native <i>Leptostemonum</i> found in Indonesia. <i>S. lasiocarpum</i> was only recorded in Northern Sumatra by several botanists. In 2019, <i>S. lasiocarpum</i> was also reported from Bengkulu, but there were still doubts about these findings. During the expedition of invasive alien plant species in Padang Bindu, Sumatra Selatan, in May 2021, we discovered <i>S. lasiocarpum</i> with different noticeable characteristics from <i>S. lasiocarpum</i> , which was previously found in Bengkulu. Detailed examination of the morphological characters, our study revealed that that species was <i>S. lasiocarpum</i> . This finding suggested an extended distributional record for <i>S. lasiocarpum</i> in Sumatra.
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1. Introduction

Solanaceae consists of about 100 genera and 2600 species, distributed worldwide, with the diversity center in the western Neotropics (Utteridge, 2015; Christenhusz, Fay, & Chase, 2017). The family has a substantial economic value for food, ornamentals, and medicines (Samuels, 2015; Utteridge, 2015; Särkinen et al., 2018). About 15 genera have been utilized for food worldwide; one is *Solanum* L. (Samuels, 2015). In

addition, *Solanum* includes many cultivated crops, for example, aubergine (*S. melongena* L.), leunca (*S. nigrum* L.), potato (*S. tuberosum* L.), takokak (*S. torvum* Sw.), tamarillo (*S. betaceum* Cav.), and tomato (*S. lycopersicum* L.) (Vorontsova, Stern, Bohs, & Knapp, 2013; Samuels, 2015; Hidayat & Efendi, 2018; Särkinen et al., 2018; Maharijaya, Syukur, Salma, & Sanubary, 2021).

Solanum subg. *Leptostemonum* Bitter is the largest group within the genus

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Korespondensi penulis: Muhammad Rifqi Hariri* (E-mail: muhammadrifqiharirif@gmail.com)

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(Aubriot, Singh, & Knapp, 2016; McClelland, Nee, & Knapp, 2020). It has 570 species distributed in the warmer part of the world, especially in the Neotropics (Bean, 2004; Levin, Myers & Bohs, 2006; Vorontsova, Stern, Bohs, & Knapp, 2013; Aubriot et al., 2016; McClelland et al., 2020). In the Old World, *Solanum* subg. *Leptostemonum* comprises 240 species, with Australia as the diversity center (McClelland et al., 2020). Morphologically, the *Leptostemonum* clade is characterized by stellate trichomes, prickles, and attenuate anthers with tiny terminal pores (Bean, 2004; Levin et al., 2006; Vorontsova et al., 2013; Aubriot et al., 2016; El-Gazzar & Moustafa, 2021). Due to its epidermal prickles, the subgenus has been commonly known as the “spiny” solanums, distinguishing it from the other subgenus (Vorontsova et al., 2013; Aubriot et al., 2016; Knapp & Vorontsova, 2016).

Fifteen species of *Solanum* subg. *Leptostemonum* has been recorded in Sumatra, Indonesia (Kurniawan, 2019). One of the wild species of *Solanum* subg. *Leptostemonum* found in Sumatra Island is *Solanum lasiocarpum* Dunal (Whalen, 1981). It was only reported from the Northern areas of Sumatra, Aceh, and North Sumatra Provinces (Whalen, 1981). The first record of *S. lasiocarpum* in Northern Sumatra was presented by JA Lorzing in 1918 from Sibolangit, Sumatra Utara. A few years later, W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes collected the species from Ketambe (in 1972), Kluet (in 1985), and Sekundur (in 1991), Aceh Regency. However, Whalen (1981) only noted the presence of *S. lasiocarpum* in the Northern areas of Sumatra.

Kurniawan (2019) collected *S. lasiocarpum* from Bengkulu, covering the record of eggplant diversity in Indonesia. However, the description of morphological characters and representative photographs is doubtful. The species resemble *Solanum quitoense*

Lam, also recorded in his report. In 2021, we collected *S. lasiocarpum* from Padang Bindu, Sumatra Selatan, during the Mapping of Invasive Alien Flora and Fauna expedition in Conservation Areas and Essential Ecosystems by the former Indonesian Institute of Sciences. In this study, we also revealed the occurrences of *S. lasiocarpum* from other parts of Sumatra that have not been previously reported.

2. Methodology

The specimen was collected in May 2021 during the mapping of invasive alien flora and fauna expedition in conservation areas and essential ecosystems in Padang Bindu Karst, South Sumatra, Indonesia. Plant materials were collected following van Balgooy (1987), while the herbarium processing was done according to Djarwaningsih, Sunarti, & Kramadibrata (2002). The morphological observation was conducted in the Herbarium Kebun Raya Bogor (KRB) and the Herbarium Bandungense (FIPIA), School of Life Sciences and Technology (SITH), ITB. The specimens were further examined in the Herbarium Bogoriense (BO) and also supplemented by images from L, U, US (Bioportal, 2021), and the Global Biodiversity Information Facility (gbif.org) (GBIF, 2021). The specimens collected from Padang Bindu were identified using Backer & Bakhuizen van den Brink (1965), Whalen et al. (1981), Bean (2004), and Solanaceae Source (2021).

A species distribution map was generated based on the coordinates provided in each herbarium specimen. We used the GBIF (2021) coordinates or estimated the location using Google Maps to derive the coordinate based on the location information in the specimen's label for every specimen lacking a coordinate. The map was created with ArcGIS Software version 10.8 (<https://desktop.arcgis.com/en/>) using the GCS WGS 1984 coordinate model and an

ESRI Geodatabase through a base map from Badan Pusat Statistik (<https://sig.bps.go.id/>).

3. Result And Discussion

Solanum lasiocarpum Dunal, Hist. Nat. Solanum 222 (1813). Type: t. 35, Hortus Indicus malabaricus Vol. 2 (1680); lecto: the illustration, fide Whalen et al. (1981). *Solanum ferox* L., Sp. Pl., ed. 2. 1: 267 (1762); Backer & Bahk. van den Brink, Fl. Java 2: 437 (1965). *Solanum ferox* var. *lasiocarpum* (Dunal) Miq., Fl. Ind. Bataviae 2: 647 (1856). Shrub, erect, up to 1.5 m tall, with stipitate and stellate hairs. Lower stem aculeate, prickles curved, green, upper stem without prickles; branchlets green or purplish. Leaves simple, alternate; petiole slender, 2-10 cm long; lamina broadly ovate to ovate, 10-25 × 6.5-19.5 cm, base oblique to cordate, margin 4-7-lobed, apex acute, adaxial surface green, abaxial surface white, lateral vein 4-7 pairs, with or without prickles. Inflorescences supra-axillary, pseudo-raceme, 2-4-flowered; peduncle 1-2 mm, green; pedicels 2-4 mm long, green; calyx connate at base, 5-lobed, lobes deltate, 2-5 mm long, green, persistent; corolla actinomorphic, stellate, 5-lobed, connate at base, c. 1.5 cm long, white, caducous; stamens 5; filaments very short, adnate to corolla tube; anthers lanceolate, curved, c. 5 mm long, yellow, dehiscent by apical pores; ovary superior, globose; style c. 1 cm; stigma capitate. Fruits berry, globose, orange when ripe, with persistent stellate hairs. Seeds numerous, reniform, 2 mm long, brown.

Distribution. India, Indochina, Southern China, Malaysia, Indonesia, Philippines, Australia to New Guinea (Whalen et al., 1981; Bean, 2004).

Habitat. *Solanum lasiocarpum* occurs in open forests, monsoon forests, roadsides, humid places, ravines, and valleys at 0-1000 m asl (Lim, 2013). This species is reported to grow at an altitude of 50-400 m asl in disturbed (open) or

wasted places or near a riverbank based on specimens from Kluet (WJJO de Wilde & BEE de Wilde-Duyffjes 19835), Sekundur (WJJO de Wilde & BEE de Wilde-Duyffjes 21306), and Sibolangit (Lorzing JA 5494). In this study, *S. lasiocarpum* has been found around the exposed tracking area near Gua Candi, Padang Bindu, Sumatra Selatan Province, at 300 m asl. The additional unpublished records showed that the habitat of this species varied from disturbed places, uncultivated agricultural land, and exposed submontane areas. The preferred altitude of the species is 5-1500 m asl.

Examined Specimen. ACEH. Kluet Nature Reserve, S. Kloet, along the Krung(=River) Lembang/vicinity of Pucuk Lembang, July 9th, 1985, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffjes* 19835 (L!-image seen [L.2882226]); Atjeh, Sekundur Forest Reserve, August 8th, 1991, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffjes* 21306 (L!-image seen [L.2879726 & L.2809519]); Atjeh, Ketambe, June 7th, 1972, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffjes* 12693 (L!-image seen [L.2882231]); Sumatra. Lae Gurah, N. of Kutajane, March 22nd 1954, *Alston AHG* 14609 (L!-image seen [L.2882230]). **NORTH SUMATRA.** Sumatra Utara Province, Sibolangit, January 4th 1918, *Lorzing JA* 5494 (L!-image seen [L.2882180]; U!-image seen [U.1741146]); Sibolangit, February 21th 1918, *Lorzing JA* 5525 (L!-image seen [L.2882181]; (East Coast). Old jungle and second growth near Aek Sordang, Loendoet Concession, Koealoe, May 5th, 1927, *Bartlett HH* 7609 (US!-image seen [US.1552309-10]); Sumatra, East Coast, Sultanate of Asahan. Pargambiran, November 11th 1933, *Rahmat Si Boeea* 6286 (L!-image seen [L.2882229]); Sumatra, East Coast. Vicinity of Tomoean Dolok, Asahan, June 10th, 1936, *Rahmat Si Boeea* 9035 (L!-image seen [L.2882179]); Island North Sumatra. Labuhan Batu, Dolok Tombus, February 28th, 1983, *Widjaja EA* 187 (L!-image seen

[L.2882227]); N. Sumatra, Langket (Sukaranda estate and elsewhere) on the Wampu, January 18th, 1929, *Lorzing JA 15014* (L!-image seen [L.2882178]). **WEST SUMATRA.** Archipel.Ind. Sumatra W.H.G. Merapi, September 23rd, 1918, *Bünnemeijer HAB 4882* (L!-image seen [L.2882182]); Insula: Mentawai islands, Sikabulan, September 7th, 1953, *Borssum Waalkes J van 2695* (L!-image seen [L.2882232]). **RIAU ARCHIPELAGO.** Archipel. Ind. Lingga Arch. weg. Dabo, P. Singkep, August 4th 1919, *Bünnemeijer HAB 7261* (L!-image seen [L.2882228]). **SOUTH SUMATRA.** Sumatra Selatan Province, Ogan Komering Ulu Regency, Semidang Aji Subdistrict, Padang Bindu, Gua Candi, May 31st 2021, MR Hariri, *DQ461* (FIPIA!); Archipel.Ind. ! Mt Dempo! Sumatra, January 1st, 1881, *Forbes HO 2316* (L!-image seen [L.2882176]); Archipel.Ind. Sumatra Lematang Oeloe Res. Palembang, October 24th 1916, *Lambach PM 1268* (L!-image seen [L.2882177]). **LAMPUNG.** Sumatra, Gedong Tataan Lampong, March 3rd 1947, *Forbes HO 1270* (L!-image seen [L.2882183]).

Vernacular names. *Terong bulu, terong asam* (Malay); *latteoeng* (Asahan).

Uses. The edible fruits are eaten as vegetables (Lim, 2013; Kurniawan, 2019).

Based on our observation through virtual specimens, the oldest record of *S. lasiocarpum* was taken from Gunung Dempo, Sumatra Selatan. The specimen was collected by HO Forbes in 1881. Other botanists such as Alston, Widjaja, Lorzing, Bünnemeijer, Borssum, and Lambach also provided the occurrences data of the species throughout West Sumatra, Riau Archipelago, and Lampung, which had not been previously recorded by Whalen (1981) (Table 1). Moreover, Sumatra is excluded from *S. lasiocarpum* distribution map (POWO, 2019). The updated distributional areas of

S. lasiocarpum in Sumatra are provided by incorporating the report from Whalen (1981), virtual specimens (L, U, and US), and our current study (Figure 1).

We considered that Sumatra's population in Padang Bindu and the other unreported locations is an extended distributional range. Therefore, in our study, *S. lasiocarpum* found in a small area near the Gua Candi, Padang Bindu, Sumatra Selatan, like the other *Solanum* species reported by Kunarso & Azwar (2015), grows in the secondary forest border. Previous studies showed that *S. lasiocarpum* grows in open forests, near roads, humid areas, valleys, and ravines (Whalen, 1981; Lim, 2013). Usually, *Solanum* grows associated with *Alpinia* sp. (Zingiberaceae), *Chromolaena odorata* (L.) R.M.King & H.Rob. (Asteraceae), *Begonia* spp. (Begoniaceae), *Colocasia* (Araceae), *Imperata cylindrica* (Poaceae), *Leucaena leucocephala* (Lam.) de Wit (Fabaceae), *Macaranga* sp. (Euphorbiaceae), and *Piper aduncum* L. (Piperaceae) (Undaharta, Sutomo, Ardaka, & Tirta, 2012).

Solanum lasiocarpum is quite prominent in the appearance of persistent hairs on mature fruit surfaces. The significant characteristics of *S. lasiocarpum* are shown in Figure 2. A previous report by Kurniawan (2019) showed that *S. lasiocarpum* from Bengkulu has caducous hairs on the mature fruit, which is the specific character of *S. quitoense*, a hairy eggplant native to tropical America. Morphologically, *S. lasiocarpum* is similar to the latter species, which differs in the characteristics of fruit and seeds (Table 2). However, *S. quitoense*, also collected from West Sumatra (Kurniawan, 2019), showed a close identity to *S. lasiocarpum*. Therefore, we suspect that the previously reported *S. lasiocarpum* and *S. quitoense* are confused.

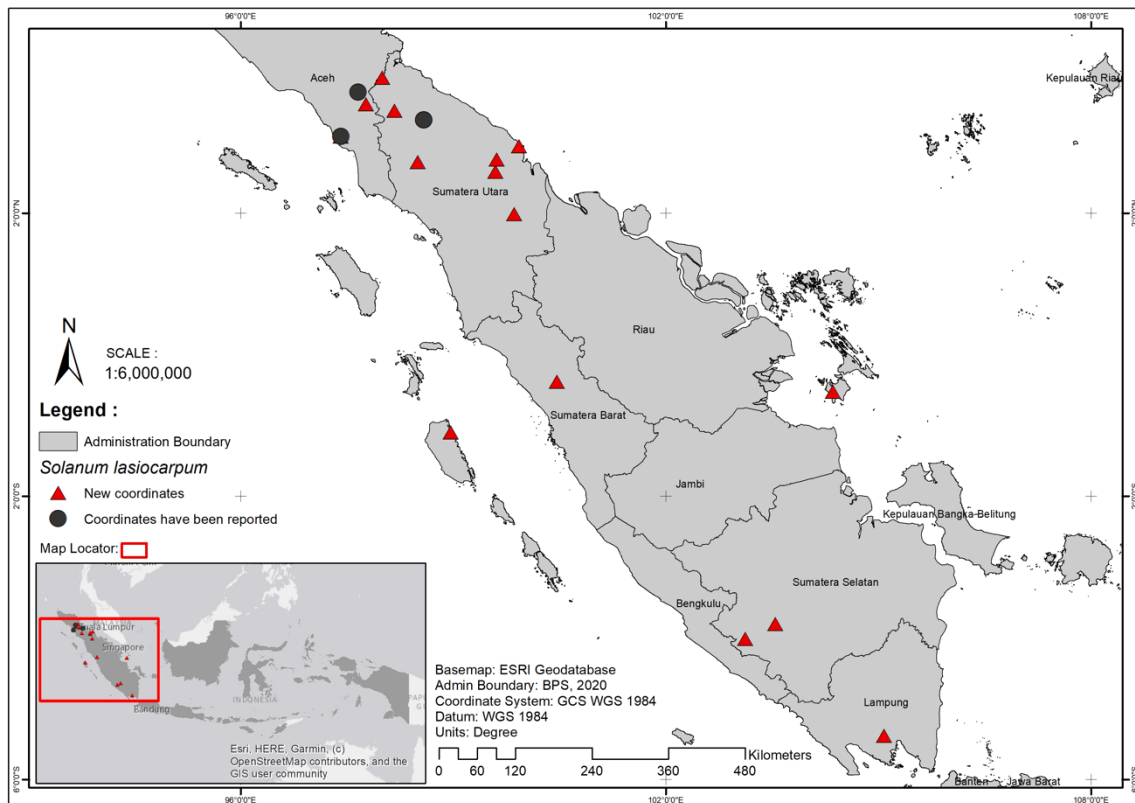


Figure 1. The distribution coordinates of *S. lasiocarpum* in Sumatra

Table 1. The extended distributional areas of *S. lasiocarpum* in Sumatra

No	Province	Location	Specimen	Year
1	Aceh	Lae Gurah, N. of Kutajane, Aceh	<i>Alston AHG 14609</i> (L.2882230)	March 22 nd , 1954
2	North Sumatra	Island North Sumatra, Labuhan Batu, Dolok Tombus	<i>Widjaja EA 187</i> (L.2882227)	February 28 th , 1983
3	North Sumatra	Langket (Sukaranda estate and elsewhere) om the Wampu	<i>Lorzing JA 15014</i> (2882178)	January 18 th , 1929
4	West Sumatra	Archipel.Ind. Sumatra W.H.G. Merapi	<i>Bünnemeijer HAB 4882</i> (L.2882182)	September 23 rd , 1918
5	West Sumatra	Mentawai islands, Sikabalan	<i>Borssum Waalkes J van 2695</i> (L.2882232)	September 7 th , 1953
6	Riau Archipelago	Lingga Arch. weg. Dabo, P. Singkep	<i>Bünnemeijer HAB 7261</i> (L.2882228)	August 4 th , 1919
7	South Sumatra	Ogan Komering Ulu Regency, Semidang Aji Subdistrict, Padang Bindu, Gua Candi	<i>MR Hariri DQ 461</i> (FIPIA)	May 31 st 2021
8	South Sumatra	Mt Dempo	<i>Forbes HO 2316</i> (L.2882176)	January 1 st 1881
9	South Sumatra	Lematang Oeloe Res. Palembang	<i>Lambach PM 1268</i> (L.2882177)	October 24 th 1916
10	Lampung	Gedong Tataan Lampong	<i>Forbes HO 1270</i> (L.2882183)	March 3 rd 1947

Table2. Comparison of fruit characters of *S. lasiocarpum* and *S. quitoense*

Characters	<i>S. lasiocarpum</i>	<i>S. quitoense</i>
Flesh of ripe fruit	pale orange	green
Fruit trichomes	persistent	caducous
Seed shape	reniform-ovate	broadly ovate
Seed color	brown	yellow or light tan

Based on the updated distributional areas and brief morphological description of *S. lasiocarpum* in Sumatra, we strongly suggested that the project of Flora Sumatrana should be carried out as soon as possible. Unfortunately, some

specimens from the exploration in Sumatra ended only as herbarium specimens without accurate scientific reports. Therefore, all collected specimens can be reported as a whole, either the species or its distribution.

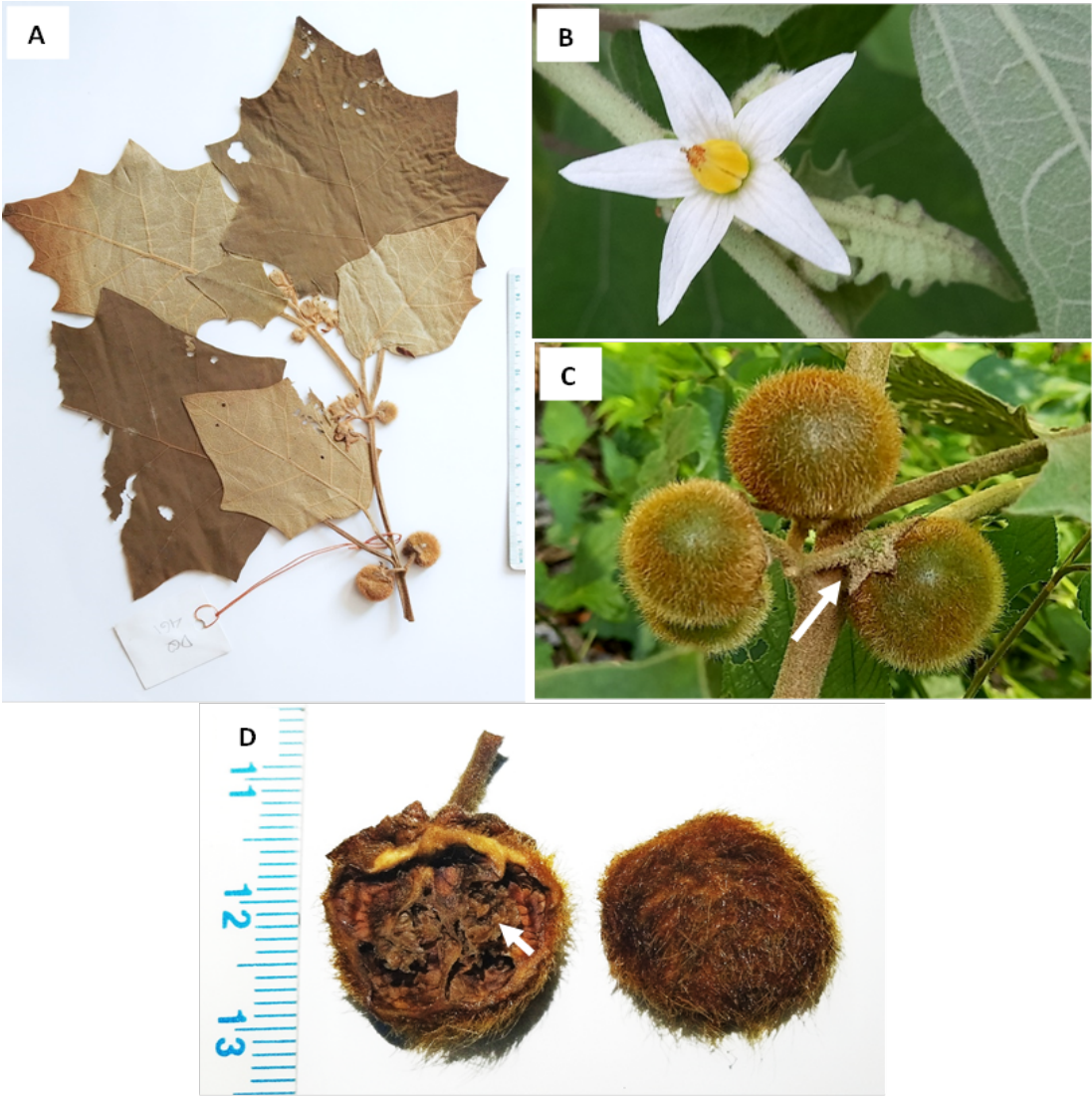


Figure 2. The morphological characters of *S. lasiocarpum*. A. Habit; B. Flower with exposed whitish abaxial leaf surface; C. Hairy fruits with persistent calyx (white arrow); D. Transversal section of the fruit exposing the immature seeds (white arrow)

4. Conclusion

Solanum lasiocarpum is not only distributed in the Northern part of Sumatra, but the species almost spread throughout the whole of Sumatra. The current study revealed that the occurrences of *S. lasiocarpum* cover West Sumatra, Riau Archipelago, South Sumatra, and Lampung. In addition, the species has significant character, *i.e.*, the persistent hairs on the ripe fruit.

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