

Two New Species of *Pandanus* Subg. *Rykia* Sect. *Rykia* (Pandanaceae) from Sarawak, Borneo

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ABSTRACT

Two new *Pandanus* species are herein described: *Pandanus mansio* Haziah, Raffi, Shabdin & Meekiong and *P. sakek* Haziah, Raffi, Shabdin & Meekiong. These species were discovered in Sematan, Lundu, Kuching, Sarawak. *Pandanus mansio* closely resembles *Pandanus leuconotus* but differs by its taller stature, longer and narrower leaves with an unarmed mid-section of the leaf margin, pinkish-orange to green leaf base and ovoid cephalium with long peduncle. Meanwhile, *P. sakek* is morphologically similar to *P. kamiae* but distinguishable by its shorter, narrower and subcoriaceous leaves and smaller cephalium bearing longer styles, including falcate styles at apical drupes. With these additions, Sarawak now harbours five species of *Pandanus* subg. *Rykia* sect. *Rykia*.

Keywords: Biodiversity, Malaysia, pandan, *Pandanus mansio*, *Pandanus sakek*

ARTICLE INFO

Article history:

Received: 09 September 2025

Accepted: 28 January 2026

Published: 24 February 2026

DOI: <https://doi.org/10.47836/pjtas.49.1.06>

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INTRODUCTION

Pandanaceae is a monocotyledon plant family widely distributed across the paleotropical region, comprising five main genera: *Pandanus*, *Freycinetia*, *Benstonea*, *Martellidendron* and *Sararanga* (Buerki et al., 2012). The family is distributed across Western Africa, Madagascar, Southeast Asia, the Pacific Islands and Australasia, with approximately 800 species recorded to date (Pandanaceae Project, 2020; POWO,

2025). Despite its diversity, the Pandanaceae of Borneo is currently represented by an outdated species inventory compiled by Stone (1970a, 1993), with no additional taxa recorded since then, except for the reclassification of several Bornean species from *Pandanus* to the newly described genus *Benstonea* (Buerki et al., 2016; Callmander et al., 2012) and the revisions of several others as synonyms (Callmander et al., 2020; Keim et al., 2011). Therefore, to improve understanding of this ecologically significant plant group, a series of field excursions have been conducted since 2022, focusing on documenting the species diversity of Pandanaceae in Western Sarawak. These efforts have led to the discovery of two morphologically distinctive taxa from previously recorded species in literature and herbarium collections. One of the species holotypes was collected from a domesticated specimen. It is well known that the ethnic communities in Sarawak have maintained a long-standing relationship with forests for their provisioning services. One of the practices involves the collection of various plant species for multiple purposes. In certain cases, such practices have led to the domestication of specific plant species (Jones et al., 2016). This is a case in point for the present study, whereby newly identified species were discovered from a domesticated species.

Both described species belong to *Pandanus* subg. *Rykia* sect. *Rykia* (De Vriese) Kurz (1867), based on its shared morphological characteristics such as leaves with unarmed apical ventral pleats and conspicuous tessellate reticulation, purplish-coppery leaf sheaths and spines, solitary or occasionally spicate cephalia with stout style which are generally forked stigmas (Nadaf & Zanan, 2012; Stone, 1983b, 1993). The *Pandanus* subg. *Rykia* section *Rykia* is known as one of the taxonomically complex groups within the genus *Pandanus*, due to its unresolved species boundaries and overlapping morphological traits among the species (Stone, 1970b; Stone, 1972). An earlier study has attempted to address these challenges through morphological, anatomical and phylogenetic analysis, aiming to clarify species relationships within the group (Rahayu et al., 2011). In addition, several species from this section have been revised and newly described (Callmander & Buerki, 2018; Nadaf et al., 2011; Zanan & Nadaf, 2012a, 2012b), yet no taxonomic updates from this section have been made for Sarawak within the Borneo region. To date, only three species from this section have been reported in Sarawak: *Pandanus albifrons* B. C. Stone (Teisher & Brazillian Flora Group, 2025), *Pandanus dictyotus* B. C. Stone (Stone, 1983c; Stone, 1993) and *Pandanus kamiae* B. C. Stone (Beentje & Callmander, 2023). The addition of these two newly described taxa increases the number of known species from subg. *Rykia* sect. *Rykia* to five, marking significant contributions to the diversity of Pandanaceae flora in Sarawak. In this study, the descriptions and taxonomic notes of these two new species are presented.

MATERIALS AND METHODS

Field sampling was conducted in Kuching Division, in which individuals bearing fruits (cephalia) were photographed and collected following the techniques outlined by Stone (1983a) and subsequently preserved as herbarium specimens based on the protocols listed by Bridson and Forman (1998). The specimens were deposited in the Herbarium Universiti Malaysia Sarawak. Species identifications were made by referring to *Pandanus* herbarium voucher specimens examined in the Sarawak Herbarium (SAR) and the Herbarium of Universiti of Malaya (KLU), as well as online databases such as Global Plants on JSTOR (<https://plants.jstor.org>), Global Biodiversity Information Facility GBIF (<https://www.gbif.org/>) and Tropicos Pandanaceae Project (<http://legacy.tropicos.org/Project/Pandanaceae>). Identification of the species was also aided by reference to manuscripts prepared by Beentje and Callmender (2023), Holttum and St. John (1962), and Stone (1983b; 1983c; 1993). Morphological comparisons were also conducted with closely resembling species, in which their accepted names were validated using Plants of the World Online databases (<https://powo.science.kew.org/>). Provisional conservation status of the new species were assessed by estimating the species extent of occurrence (EOO) and area of occupancy (AOO) using the Geospatial Conservation Assessment Tool, GeoCAT (<https://geocat.iucnredlist.org/>). The extinction risk was determined based on Criterion B and D by IUCN (2012) and guidelines provided by IUCN Standards and Petitions Committee (2024). Subsequently, taxonomic data including species distribution, habitats, ethnobotanical uses and taxonomic keys to *Pandanus* subg. *Rykia* sect. *Rykia* of Sarawak were presented.

RESULTS AND DISCUSSION

Taxonomic Treatment

Pandanus mansio Haziiah, Raffi, Shabdin & Meekiong *sp. nov.* (Figure 1)

Type : MALAYSIA: Sarawak, Kuching, Lundu, Sematan, 83 m alt., 10 July 2023, Haziiah Musa *et al.* PH050 (holotype SAR; isotype Herbarium Universiti Malaysia Sarawak).

Diagnosis : *Pandanus mansio* can be distinguished from *P. leuconotus* by having taller shrub with longer and narrower leaves (vs. smaller shrub with shorter and wider leaves in *P. leuconotus*), unarmed margins in the mid-part of the leaf (vs. dentate throughout the leaf), pinkish orange to green (vs. conspicuously white) leaf basal and ovoid cephalia with longer peduncle (vs. oblong cephalia with short peduncle in *P. leuconotus*) (Table 1).

Description : Decumbent shrub pandan up to 4 meters tall. **Stems** are erect or prostrate and ascending with persistent old leaves and small, blunt thorns, and bear few short aerial roots. **Leaves** linear-oblongate, *ca.* 312–368 cm × 6.0–6.8 cm, pinkish orange to purple when young and green at maturity, tessellate-reticulate venations (conspicuous when dry), subcoriaceous; apex slightly cucullate, attenuate with cauda *ca.* 8–14 cm long; marginal spines near base to middle part with antrorse spines 2–5 mm long, 13–65 mm apart, purplish bronze, higher up completely unarmed, near apex spines less than 1 mm long, 2–5 mm apart, brownish pink; midrib spines near base with generally retrorse, single spines (occasionally antrorse, biforked or clustered with two or three spines), 5–10 mm long, irregularly spaced, 5–40 mm apart, higher up spines sparsely arranged, near apex with single spines less than 1 mm long, 3–28 mm apart, randomly disposed and denser towards distal end; leaf sheath amplexicaul, green, 6.5–8 cm × 10.5–14 cm wide at base. **Infructescence** terminal, solitary, erect on a straight, trigonous peduncle, pink in early stages of fruiting and gradually turns to green at maturity, 16–22 cm × *ca.* 2 cm diameter; peduncle with more than four leafy bracts, brown, deciduous, chartaceous with slightly cucullate leaf apex with no flagellum. **Cephalia** bearing more drupes, *ca.* 240 drupes in immature fruits, lesser drupes *ca.* 100 drupes in mature fruit; oblong in early stages of fruiting, which gradually turns to ovoid at maturity; *ca.* 10–13 cm × 7.5–8 cm, shorter and wider in mature fruit, pale orange to sage green. **Drupes** cuneate-oblong, 21–30 mm × 7.8–11 mm, 6 angled (rarely 5 angled); pileus 8–13 mm × 10–14 mm, *ca.* 2–5 mm deep; apical drupes convex with deeper pileus, lateral drupes truncate with hexagon pyramidal, pale orange to sage green. Style bony, 4–6.7 mm long, generally simple, occasionally biforked (but more frequently occurred in immature cephalia), bright orange to green; stigma 1.6–3.3 mm long, reddish brown. **Endocarp** ellipsoid, 4–7 mm × 2–4.5 mm; mesocarp apical and basal fibrous. **Male inflorescence** unknown.

Distribution and habitat : *Pandanus mansio* is only known from Sematan, Lundu, and Kuching, where it grows within the fragmented and degraded freshwater swamp forests in the lowlands.

- Provisional conservation assessment** : *Pandanus mansio* was only known from a single locality where its original habitat had been severely fragmented due to oil palm plantations. The species faces a continuing decline in habitat quality due to land conversion and habitat alteration, with fewer than 10 mature individuals recorded. Its extent of occurrence (EOO) was estimated to be less than 1 km² due to its small and restricted distribution, while its area of occupancy (AOO) was estimated at 4 km². Therefore, we provisionally assigned this species as Critically Endangered (CR) under IUCN criteria B1ab(iii,v)+B2ab(iii,v);D.
- Phenology** : Fruiting in July.
- Etymology** : The epithet '*mansio*' refers to the plant's local name, known by the Bidayuh Salako ethnic group as *sakek mansio*.
- Uses and vernacular name** : The leaves of *Pandanus mansio* were utilised for handicrafts purposes (Haziah et al., in prep) by the Bidayuh Salako people in Kampung Pueh and are known as *sakek mansio* by the locals.
- Notes** : The new species, *Pandanus mansio*, closely resembles *P. leuconotus*, an endemic species from Sabah, particularly during its juvenile stages. Juvenile individuals of *P. mansio* are morphologically nearly indistinguishable from mature plants of *P. leuconotus*, sharing several traits, including a purplish tinge near the leaf bases, cucullate and abruptly cuspidate leaf apices with either absent (Figure 1B) or short flagella measuring up to 5 cm. However, even at early development stages, *P. mansio* displayed two distinguishing features that remained consistent throughout its development stages, such as the absence of spines at the mid-section of the leaf margin, similar to *P. dictyotus* (Stone, 1983c) and the lack of conspicuous white leaf bases, which was a distinguishing feature present in *P. leuconotus* (reminiscent of *P. albifrons*). Although it could be argued that the leaf bases' colouration (absence or presence of white leaf bases in *Pandanus*) may vary due to environmental factors (Menzies et al., 2016), *ex situ* observations of *P. mansio* over a one-year period showed consistent pinkish colouration (Figure 2), despite being transplanted into different environmental conditions. Furthermore, herbarium specimens of *P. leuconotus* consistently exhibited striking white leaf bases, which further validated that these are two distinct taxa.

Pandanus mansio diverged more from *P. leuconotus* as it matured, forming a taller shrub reaching up to 4 meters in height, compared to the shorter *P. leuconotus*, which grew up to 2.5 meters tall. Leaf morphology also differed between the two taxa, with *P. mansio* bearing exceptionally longer and narrower leaves compared to *P. leuconotus*, as well as more prominent spines at the basal midrib, measuring up to 10 mm, nearly double the length observed in *P. leuconotus*. As for the cephalia, both *P. mansio* and *P. leuconotus* are morphologically similar, with nearly identical drupes dimension, style length and style shapes (having generally simple styles and rarely biforked styles). However, *P. mansio* can be readily distinguished by its longer peduncle, reaching up to 22 cm, in comparison to the approximately 9 cm long peduncle in *P. leuconotus*. Aside from that, *P. mansio* possessed ovoid cephalia, in contrast to the oblong cephalium of *P. leuconotus*.

It is important to note that while immature cephalia of *P. mansio* exhibited an oblong shape similar to the mature cephalia of *P. leuconotus*, they differed in style behaviour. In *P. mansio*, biforked styles occurred more frequently in immature cephalia compared to mature ones, though simple styles have a relatively higher proportion overall. This pattern suggests that style behaviour may vary interspecifically, thus might pose a degree of difficulty in species identification, especially for the taxonomically challenging group, such as the subgenus (subg.) *Rykia* sect. *Rykia*. Aside from the difference in ratio of simple to biforked styles, the variation in cephalia dimensions and drupe number between different development stages was also important to take into account. The current study corroborates Stone (1970b), who noted that the dimensions of cephalia tend to decrease as it matures. However, while Stone assumed that the number of drupes remains constant across development stages, field observations from this study suggested that mature cephalia could bear fewer drupes, approximately 100 to 150 less than the immature cephalia, offering significant taxonomic insights in species delimitation, especially in the subg. *Rykia* sect. *Rykia*.

It is also noteworthy that *P. mansio* displayed unusual spine morphology and arrangement compared to other *Pandanus* species, characterised by the occasional presence of antrorse, biforked spines (Figure 1I) or clusters of two to three spines (Figure 1H) along the basal midrib of the leaves. These structures were consistently observed in both fertile individuals (with mature and immature cephalia) of *P. mansio*, and more prominently occurred on the nearest leaf to the infructescence. Although such traits may not be visible in sterile individuals, their presence may offer additional diagnostic value in distinguishing *P. mansio* from other members of *Pandanus* subg. *Rykia* sect. *Rykia*. A detailed comparison between *P. mansio* and *P. leuconotus* is provided in Table 1.

Additional : MALAYSIA: Sarawak, Kuching, Lundu, Sematan, 83 m alt., 10 July 2023,
specimens Haziah Musa et al. PH051 (Herbarium Universiti Malaysia Sarawak!);
examined PH052 (Herbarium Universiti Malaysia Sarawak!); ***P. leuconotus* (Type):**

MALAYSIA: Sabah state, Kota Kinabalu, Poring, base of Mt. Kinabalu, near the Hotsprings, 31 March 1977, *B. C. Stone 12906* (holotype KLU!; isotypes PH: barcodes PH00018284; BISH: barcodes BISH1011549, barcodes BISH1011548; L: barcodes L 0050564); *P. cf. leuconotus*: MALAYSIA: Sabah state, Sandakan-Telupid Rd, 83rd mile, Base of Bukit Tangkunan, swampy forest, 100 m alt., 31 March 1977, *B. C. Stone 12897* (KLU!).

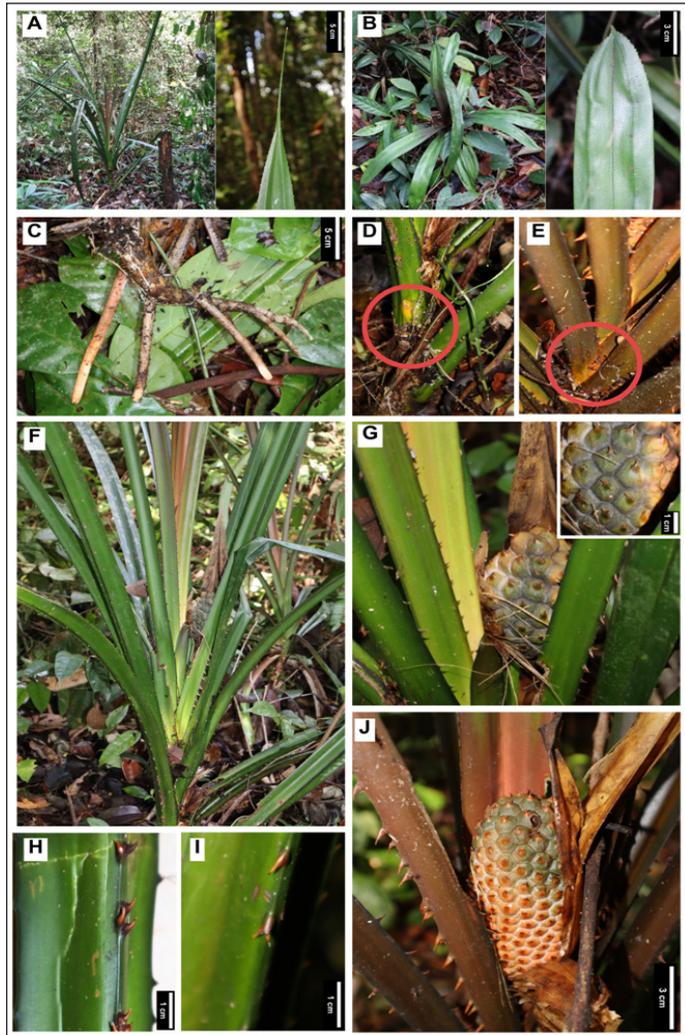


Figure 1. Pandanus mansio Haziah, Raffi, Shabdin & Meekiong, *sp. nov.* **A.** Growth form of the mature plant with a close-up at the leaf apex. **B.** Habit of a young sterile plant with a close-up leaf apex. **C.** Slender stem bearing a few short prop roots. **D.** Green leaf sheath of a mature plant (as shown in the circle). **E.** Pinkish orange leaf sheath of the plant at early reproductive stages (as shown in the circle). **F.** Inflorescence of mature plant. **G.** Cephalium of a mature plant showing ovoid-shaped cephalia with close-up style and stigma (inset). **H.** Abaxial midrib basal spines clustered in groups of two to three. **I.** Biforked spine at the midrib basal of mature leaves. **J.** Cephalium at the early stages of fruiting, showing oblong cephalia



Figure 2. *Ex situ* conservation of *Pandanus mansio* (PH052b) showing consistent colouration of the leaf bases, matching those from its original locality, one year after transplantation at the UNIMAS Arboretum

Table 1

Comparison between *Pandanus mansio* Haziah, Raffi, Shabdin & Meekiong, sp. nov. and *Pandanus leuconotus* B. C. Stone. Note: *Pandanus leuconotus*' descriptions were based on Stone (1983b; 1983c; 1993) and specimens examined as listed

Characteristics	<i>P. mansio</i>	<i>P. leuconotus</i>
Leaves		
Shape	Linear–oblanceolate, leaf erect or upright	Broadly loriform, leaf arcuate or curved
Dimension	312–368 cm × 6–6.8 cm	120 cm × 9.5 cm
Length of cauda	8–14 cm	Approximately 7.5 cm
Marginal spines	Present at apical and basal, with the middle part completely unarmed	The entire margin dentate throughout
Midrib basal spines	Generally retrorse and single spines, occasionally antrorse, biforked or clustered of two to three spines, which is prominent in mature fertile plant, 5–10 mm long.	Retrorse, single spines throughout, 4–5.8 mm long.
Colour of leaf sheath	Pinkish orange (juvenile) to green (mature)	Conspicuously glaucous white
Infructescence		
Peduncle length	16 to 22 cm	Approximately 9 cm
Cephalia		
Shape	Ovoid	Oblong
Dimension	10–13 cm × 7.5–8 cm	10–12.5 cm × 6–7 cm
Styles		
Styles shape	Generally simple, occasionally biforked (but more frequently occurred in immature cephalia)	Generally simple, rarely biforked

Pandanus sakek Haziah, Raffi, Shabdin & Meekiong *sp. nov.* (Figure 3)

Type : Malaysia, Sarawak, Kuching, Lundu, Sematan, domesticated, 41.15 m alt., 24 October 2022, *Haziah Musa et al. PH014* (holotype SAR; isotype Herbarium Universiti Malaysia Sarawak).

Diagnosis : *Pandanus sakek* is morphologically similar to *P. kamiae* but can be distinguished by its shorter and narrower leaves (vs. longer and wider leaves in *P. kamiae*), subcoriaceous leaf (vs. coriaceous and stiff leaf), smaller cephalia with longer styles (vs. longer cephalia with shorter styles), which bear predominantly biforked styles (vs. mostly simple styles) and falcate style at apical drupes, which curved away from the axis (vs. deflected towards the distal of cephalia) (Table 2).

Description : Acaulescent shrub pandan up to 4 meters tall. **Stems** are erect, short and unbranched. **Leaves** lanceolate, 254–270 cm × 8 cm, green, slightly waxy, tessellate–reticulate venations (conspicuously when dry), subcoriaceous, green; apex attenuate with cauda *ca.* 9–14 cm long; marginal spines near base to middle part with antrorse spines 4–5 mm long, 13–20 mm apart, green with orangish tip, higher up with retrorse spines, 1 mm long, 4 mm apart, white; midrib spines near base with retrorse spines, 3–5 mm long, 10–45 mm apart, orangish brown, higher up with antrorse spines, less than 1 mm long, 5 mm apart, white; leaf sheath amplexicaul, orangish brown, 7 cm × 19 cm wide at base. **Infructescence** terminal, solitary, erect on a straight, trigonous peduncle, green, *ca.* 35 cm long × 2 cm diameter; peduncle with more than six leafy bracts enclosing the cephalia, lanceolate to ovoid; inner bracts brown and caducous; outer bracts yellow to green, persistent. **Cephalia** bearing *ca.* 600 drupes, oblong, 19 × 8.8 cm, green. **Drupes** cuneate–oblong, 28–31 mm × 8.8 mm–10 mm, apical drupes longer and wider than lateral, 6–angled (rarely 5–angled); pileus *ca.* 9 × 12 mm, 3.3–8.6 mm deep; apical drupes convex with deeper pileus, lateral drupes truncate with hexagon pyramidal to slightly hemispherical pyramidal, green. **Style** *ca.* 5.5–7.0 mm long, bony, shining, biforked, horn–like style, rarely a simple style except for one–third from the distal part of the cephalia covered with simple, falcate style curving outwards from the axis, green; stigma *ca.* 3–4 mm long, brown. **Endocarp** ellipsoid, 8 × 4.8 mm; mesocarp apical fibrous and fleshy; basal mesocarp highly fibrous. **Male inflorescence** unknown.

- Distribution and habitat*** : This species is a domesticated species and can be commonly found within the settlement area of the Bidayuh Salako community in Kampung Pueh.
- Provisional conservation assessment*** : The populations of the domesticated *Pandanus sakek* were found within the settlement area in Sematan. Although its wild population have not yet been determined, the local informants reported that the species is believed to have originated from the vicinity area of Sematan (R. Panchar, personal communication, June 16, 2025). Therefore, until a clearer understanding of the species' wild population is obtained, it is appropriate to provisionally assign *P. sakek* under the Data Deficient (DD) category.
- Phenology*** : The fruiting occurs in October.
- Etymology*** : The epithet *sakek* is derived from its vernacular name, which generally refers to pandan species in the Bidayuh Salako language.
- Uses and vernacular name*** : *Pandanus sakek*, commonly known by the names *sakek*, *sakek benang* and *sakek tanam*, has been utilised for different purposes such as handicrafts and medicinal uses by the Bidayuh Salako ethnic in Kampung Pueh (Haziah et al., in prep).
- Notes*** : *Pandanus sakek* is morphologically similar to *Pandanus kamiae*, sharing an acaulescent shrub habit, similar leaf sheath colour and solitary oblong cephalia. However, it can be distinguished by several traits such as its shorter, narrower lanceolate leaves (vs. longer, wider linear leaves in *P. kamiae*) and subcoriaceous leaf (vs. coriaceous and stiff leaf in *P. kamiae*). Its cephalia are relatively smaller but bear longer styles and lack the flattened, depressed base characteristics present in *P. kamiae*. The style shapes further differentiate the two species, in which *P. sakek* styles are predominantly biforked, whereas *P. kamiae* styles are mostly simple (or subulate) as described in Stone (1970b). A distinctive feature of *P. sakek* is the presence of falcate simple styles at the apical drupes, which curve away from the axis, in contrast to deflecting simple styles oriented distally in *P. kamiae* or most of *Pandanus* subg. *Rykia* sect. *Rykia*. This trait remained consistent and was observed in immature cephalia (not collected) of *P. sakek* (Figure 3G), highlighting its diagnostic characteristics.

Additional specimens examined : MALAYSIA: Sarawak, Kuching, Lundu, Sematan, Kampung Pueh, 18 m alt., 2 March 2022, *Haziah Musa et al. PH004* (Herbarium Universiti Malaysia Sarawak!); *P. kamiae*: MALAYSIA: Sarawak, Samarahan, Simunjan, Sabal Forest Reserve, 60 m alt., 23 February 2022, *Haziah et al. PH002* (SAR!); Kuching, Lundu, Sematan, 39.2 m alt., 29 February 2024, *Haziah et al. PH070* (Herbarium of Universiti Malaysia Sarawak); Sarawak, Bako National Park, Jalan Telok Paku, less than 15 m alt., 18 January 1977, *B. C. Stone 13485* (KLU!); Johore, Johore-Timor-Jemaluang Forest Reserve, Cpr. 17, in logged forests, under ca. 61 m alt., 8 July 1968, *Y. K. KAM KLU-9521* (holotype PH: barcodes PH00018277, PH00018276; isotype BISH: barcodes BISH1011516, BISH1011517); Johore, Mersing to Kluang Road Mile 29, 50 m alt., August 1982, *B. C. Stone 15306* (KLU!); Kuala Lumpur, University of Malaya, Rimba Ilmu, 30 March 1982, *B. C. Stone 15131* (KLU!).

Table 2

Comparison between Pandanus sakek Haziah, Raffi, Shabdin & Meekiong, sp. nov. and Pandanus kamiae B. C. Stone. Note: Pandanus kamiae's descriptions were based on Stone (1970b; 1983b), Beentje and Callmander (2023) and specimens examined as listed

Characteristics	<i>P. sakek</i>	<i>P. kamiae</i>
Leaves		
Shape	Lanceolate	Linear
Dimension	254–270 cm × 8 cm	400–800 cm × 6–10 cm
Leaf texture	Subcoriaceous, not stiff	Coriaceous, stiff
Cephalia		
Dimension	19 cm × 8.8 cm	23–27 cm × 9–13 cm
Style		
Length	ca. 5.5–7.0 mm long	2–6 mm
Shape (lateral drupe)	Flattened depressed base absent, simple or biforked styles, mostly biforked	Flattened depressed base present, simple or biforked styles, mostly subulate
Shape (apical drupe)	Simple style, falcate curving away from the axis	Simple style, deflected towards the distal

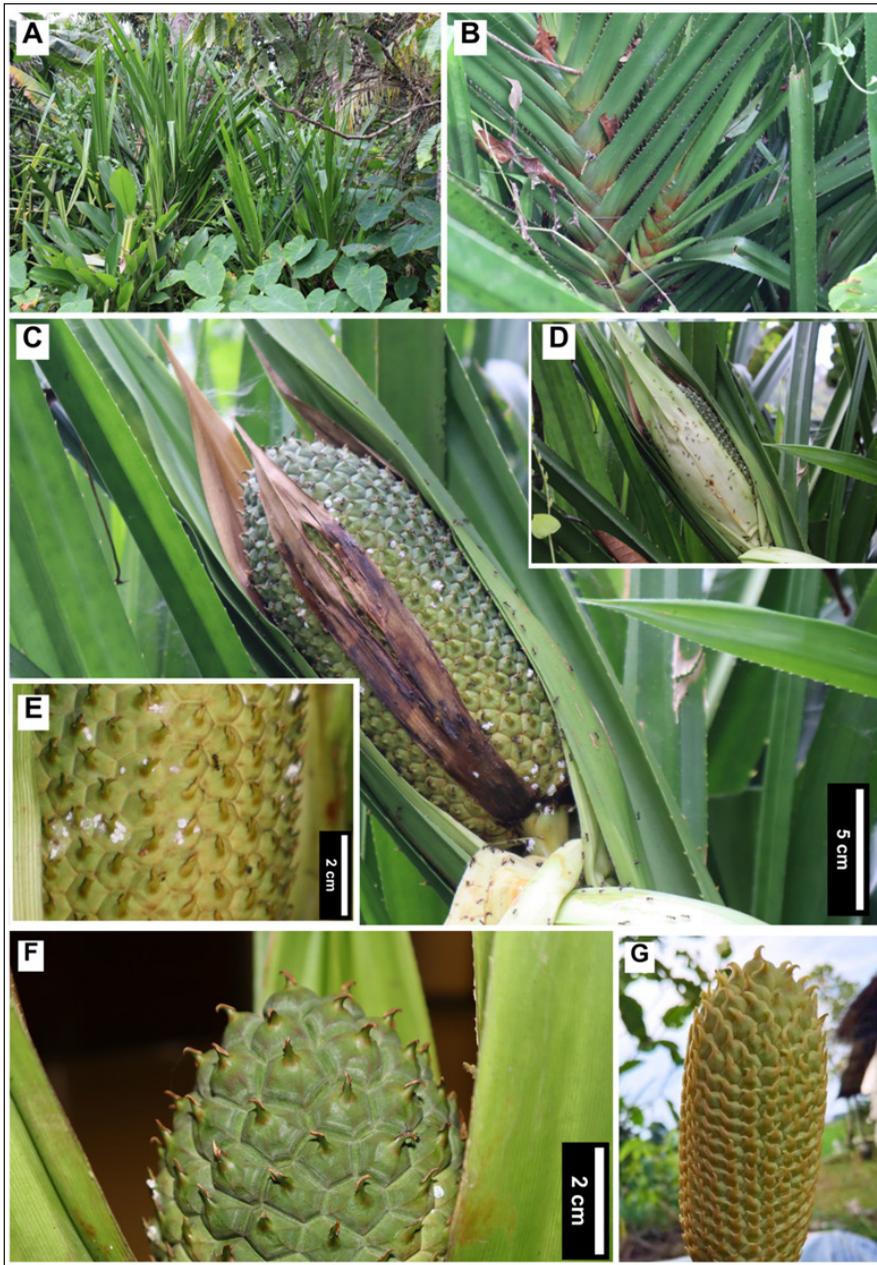


Figure 3. *Pandanus sakek* Haziah, Raffi, Shabdin & Meekiong, *sp. nov.* A. Habit. B. Orangish brown leaf sheath. C. Ellipsoid oblong cephalia. D. Cephalia covered with leafy bracts. E. Close-up of lateral drupes showing style and stigma of *P. sakek*. F. Close-up of apical drupes showing falcate style pointing away from the axis. G. Falcate style at the apical drupes of immature cephalium. Note: Image 3G is credited to Rita Panchar

Key to *Pandanus* (Subg. *Rykia* Sect. *Rykia*) from Sarawak, Borneo

- 1a. Acaulescent shrub with the absence of prop roots..... 2
- 1b. Stemmed shrub with the presence of a few short prop roots..... 3
- 2a. Subcoriaceous and less stiff leaves measuring up to 270 cm long, cephalia with falcate apical drupes deflected away from the axis..... *Pandanus sakek*
- 2b. Coriaceous and stiff leaves measuring up to 800 cm long, cephalia with apical drupes deflected towards distal.....*P. kamiae*
- 3a. Leaves with conspicuously white leaf sheath and marginal spines dentate throughout the leaf.....*P. albifrons*
- 3b. Leaves with no white leaf sheath and marginal spines only present at the apical and basal parts of the leaf, the middle part unarmed.....4
- 4a. Ovoid cephalia, 10–13 cm long, 7.5–8 cm wide, with 21–30 mm long, 7.5–8 cm wide drupes.....*P. mansio*
- 4b. Sub-ellipsoid cephalia, 7 cm long, 4.5 wide, with 16–21 mm long, 5–10 cm wide drupes..... *P. dictyotus*

CONCLUSION

This study formally describes two new species from *Pandanus* subg. *Rykia* sect. *Rykia*, *Pandanus mansio* and *Pandanus sakek* further enrich the documented diversity of Pandanaceae in Sarawak. These findings acknowledged the taxonomic complexity within subg. *Rykia* sect. *Rykia*, particularly the slight morphological variations in leaves, cephalia and styles shapes across different developmental stages, offers new insights into species delimitation of this poorly understood group. Beyond taxonomy, the discoveries also carry important conservation implications in which both species were found outside protected areas, highlighting the urgency of further field surveys to clarify their distribution, ecological preferences and conservation status. With the addition of *P. mansio* and *P. sakek*, the total number of *Pandanus* species recorded in Sarawak has now increased to 15 species in total, reflecting the region’s rich species diversity and reinforcing the need for continued botanical exploration, particularly in unexplored regions of Borneo Island.

ACKNOWLEDGEMENT

The authors acknowledged the financial support from the Ministry of Higher Education Malaysia through the Fundamental Research Grant Scheme (FRGS) FRGS/1/2021/WAB11/UNIMAS/03/2. Gratitude is extended to the Kampung Pueh community, especially to

Madam Rita anak Panchar, for their significant contributions to our understanding of Pandanaceae species and traditional knowledge. Special thanks to Almunah bin Abd. Mutalib and Awang Ahmad Zahid bin Awang Baim for assisting in the collection of specimens. The authors also thank the Forest Department of Sarawak and Dr. Yong Kien Thai (Universiti Malaya) for permitting us to examine the specimens from SAR and KLU, respectively. Appreciation goes to Sarawak Forest Corporation (SFC) for providing a permit to conduct the study (research permit IDs: SFC.810-4/6/1-075, SFC.810-4/6/1 (2024)-193, Park permit: WL 25/2022). Lastly, sincere gratitude to the Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, for providing research facilities.

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