ABSTRACT

Borneo Island has a large number of wild banana species. As a part of Borneo Island, West Kalimantan has limited information about the diversity of wild bananas. This research aims to update the record distribution of wild bananas from Bonti District of Sanggau Regency and to determine their morphological characteristics. Exploration method and resident information were used in this study. Two species of wild bananas have been identified and considered as new distribution records in West Kalimantan Province, namely Musa borneensis var. sarawakensis with morphological character pseudostem red-purple colour, sparse black-purple blotches at petiole base, leaf base shape rounded on both sides, male bud red-purple colour and Musa campestris var. sarawakensis with morphological character pseudostem yellow-green colour, inflorescence erect, leaf base one side rounded and one-pointed, the dorsally pink-purple and ventrally pink-purple colour of bract.

Keywords: Bonti District, Musa borneensis var. sarawakensis, Musa campestris var. sarawakensis, Pisang Kera, wild banana
Island has been carried out intensively in Sabah, Sarawak, and Brunei Darussalam. Häkkinen (2004a) also reported 20 species of endemic wild bananas were found in Borneo, but only 15 species have been previously described. Borneo Island is divided into three-state territories, namely Indonesia, Malaysia, and Brunei Darussalam. In Indonesia, the island of Borneo is known by the name Kalimantan which is divided into five provinces. However, the forest fire and resultant haze have potential impacts on Kalimantan’s biodiversity such as habitat loss, forest fragmentation, and low sunlight on forest trees (Horrison et al., 2016). The exploration, inventory, and conservation of wild bananas in West Kalimantan need to be done before the wild banana species are lost due to forest fire.

Studies on wild bananas in West Kalimantan are still limited. Sulistyaningsih and Irawanto (2011) reported Musa campestris var. sarawakensis Häkkinen or Pisang Kera in Nek Rokon Hill of Raya Pasi Natural Resources area, Singkawang-West Kalimantan. Previously, the distribution of Musa campestris was only considered in Sabah, Sarawak, and Brunei Darussalam (Häkkinen, 2004b). Moreover, Sunandar (2017) reported Musa balbisiana Colla or Pisang Klotok in Teluk Nibung Village, Kubu Raya District -West Kalimantan. Previously, Musa balbisiana Colla was known to be distributed in Java (Cheesman, 1948) and Sulawesi Island (Sulistyaningsih et al., 2014).

The information on the diversity and distribution of wild bananas in West Kalimantan are needed to improve the quality of cultivated banana using genetic manipulation in the future and for conservation management of wild bananas in West Kalimantan. This study aimed to update the record distribution of wild bananas from Bonti District of Sanggau Regency and to determine their morphological characteristics.

The study on wild bananas species were conducted in Bonti Village, Bonti District, Sanggau Regency, West Kalimantan, Indonesia (Figure 1). The study area was surrounded by Noyan and Kembayan Districts in the northern part, Parindu and Kapuas Districts in the southern part, and Tayan Hulu District in the western part. The average rainfall is 235 mm (BPS Sanggau, 2017). The topographic area in Bonti Sub-district is plains.

The exploration was carried out in March 2017. Morphological characters were documented with a digital camera. Morphological characterization was done under Descriptors for Banana (Musa spp.) from the International Plant Genetic Resources Institute (IPGRI, 1996). Morphological character records included the plant’s general habit as well as characteristics of pseudostem, petiole, leaf, peduncle, male bud, male flower, fruit, and seed (shape and colour). Morphological characteristics obtained from the field were then crosschecked with references (Nasution & Yamada, 2001; Häkkinen, 2004b; Sulistyaningsih et al., 2014).
Häkkinen & Meekiong, 2005; Sulistyaningsih, 2017).

Based on the differences in 12 morphological characters, two species of wild banana were identified in Bonti District, West Kalimantan, i.e. *Musa borneensis* var. *sarawakensis* and *Musa campestris* var. *sarawakensis* (Table 1, Figure 2-3). Some morphological features of both species can be seen in Figures 2 and 3. In daily life, the villagers of Bonti District only utilized *M. borneensis* var. *sarawakensis* as food.

*Musa borneensis* var. *sarawakensis* has vernacular name Pisang Boha’ (Bonti, Indonesia). However, local people in Sarawak called it Pisang hutan (Malay) or Baliek guun (Melanau) (Häkkinen & Meekiong, 2005). Geographically, *M. borneensis* var. *sarawakensis* located between 110°32'56.781” E and 0°24'47.893” N.

Characteristics: Mature pseudostem up to 4 m high, sheaths red-purple colour. Sucker Closed to parent and vertical growth. Petiole up to 42-93 cm long, petiole canal wide with erect margins, petiole bases corrugated auricles with sparse black-purple blotching. Leaf habit erects up to 400-470 cm long, 78-82 cm wide, colour of upper surface is green, lower surface is green-yellow, and leaf bases asymmetric and rounded on both sides, midrib dorsally yellow, midrib ventrally light green. Inflorescence first horizontal then pendulous, peduncle 37-48 cm long, 8 cm in diameter, hairless, and red-green. Male bud rounded, normal male bud, apex obtuse and split with green tips, dorsally red-purple, ventrally yellow of bract, revolute bract behaviour, lifting two bracts at a time, and rachis position horizontal. Male flower compound tepal cream with cream lobes, free tepal translucent white, oval, with triangular apex, style straight, ovary straight. Fruit 6 fruits per hand, individual fruit 14 cm long, straight in shape, without any floral relics, and apical part bottle-necked shaped. Seed obpyriform and brown (Figure 2). Variations morphology were found between *M. borneensis* var. *sarawakensis* in Bonti, West Kalimantan, and *M. borneensis* var. *sarawakensis* in Serian-Sri Aman, Sarawak. *Musa borneensis* var. *sarawakensis* in Bonti, West Kalimantan had red-purple pseudostem. Sucker closed to parent. Dorsally red-purple and ventrally yellow of bract (Table 1). However, *M. borneensis* var. *sarawakensis* in Serian-Sri Aman, Sarawak had purple-brown pseudostem. Sucker far from the parent plant. Dorsally pink-purple and ventrally yellow of bract (Table 1) (Häkkinen & Meekiong, 2005).

*M. borneensis* var. *sarawakensis* can be found on forest border in Bonti village, Sanggau District, West Kalimantan and considered as a new distribution record (Figure 2). Previously, *M. borneensis* was reported in Sarawak, Malaysia (Häkkinen & Meekiong, 2005) and Donggala-Central Sulawesi (Sulistyaningsih, 2017). In Serian-Sri Aman, Sarawak, *M. borneensis* var. *sarawakensis* was found on the roadside (Häkkinen & Meekiong, 2005).

Local people in Bonti village consume the young pseudostem of *M. borneensis* var. *sarawakensis*. The young pseudostem of *M. borneensis* var. *sarawakensis* boiled in water then cooked with coconut milk. Punan tribe consume the young pseudostem of *M. borneensis* var. *flavida* and as a land certificate (Sulistyaningsih & Wawo, 2011).

The key character of *M. borneensis* var. *sarawakensis* in Bonti, West Kalimantan is pseudostem red-purple colour, sparse black-purple blotches at petiole base, leaf base shape rounded on both sides, male bud red-purple colour.

![Figure 2](image)

*Figure 2. Musa borneensis* var. *sarawakensis* in West Kalimantan. a. Habitus; b. Auricle; c. Leaf and petiole canal leaf; d. Bunch; e. Male bud; f. Male flower; g. A hand of fruits; h. Longitudinally section of fruit.

Another species of wild bananas have been identified namely-*Musa campestris* var. *sarawakensis*. *Musa campestris* var. *sarawakensis* has a vernacular name: Pisang Kera in Bonti District, Sanggau Regency. Local people in Nek Rokon Hill, Raya Pasi Natural Resource area, Singkawang, West Kalimantan also called it Pisang Kera.
Table 1. Morphological characters of *Musa borneensis* var. *sarawakensis* and *Musa campestris* var. *sarawakensis*.

| No | Character                        | *M. borneensis* var. *sarawakensis* in this study | *M. borneensis* var. *sarawakensis* (Häkkinen & Meekiong 2005) | *M. campestris* var. *sarawakensis* in this study | *M. campestris* var. *sarawakensis* (Häkkinen 2004) |
|----|----------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| 1  | Mature pseudostem color          | Red-purple                                    | Purple brown                                    | Yellow-green                                    | Yellow red-purple                                 |
| 2  | Petiole canal leaf               | Wide with erect margin                       | Wide with erect margin                         | Straight with erect margins                     | Straight with erect margins                      |
| 3  | Leaf habit                       | Erect, Lamina up to 400-470 x 78-82 cm        | Erect, Lamina up to 350 x 80 cm                 | Erect, Lamina up to 210-285 x 30-42 cm          | Erect, Lamina up to 240 cm x 50 cm               |
| 4  | Colour of upper surface leaf     | Green                                         | Green and shiny                                 | Dark green                                       | Green                                             |
| 5  | Colour of lower surface leaf     | Green-yellow                                  | Medium green                                    | Asymmetric; one side rounded and one-pointed of leaf bases | Asymmetric; both side rounded                     |
| 6  | Leaf bases                       | Asymmetric; rounded on both sides             | Asymmetric; both side rounded                  | Asymmetric; one side rounded and one-pointed of leaf bases | Asymmetric; both side rounded                     |
| 7  | Midrib                           | Dorsally yellow; ventrally light green        | Dorsally light green to yellow; ventrally yellow | Dorsally yellow; ventrally green                 | Dorsally light-green; ventrally medium green      |
| 8  | Inflorescence                    | First horizontal then pendulous              | First horizontal then pendulous                 | Erect                                           | Erect                                            |
| 9  | Peduncle                         | Hairless, red-green                          | Hairless, light green yellow                   | Very hairy, red-purple                         | Very hairy, reddish-purple                      |
| 10 | Male bud                         | Rounded; Dorsally red-purple, ventrally yellow; revolute before falling | Rounded or cordate; dorsally pink-purple, ventrally yellow; revolute before falling | Ovoid; dorsally pink-purple, ventrally pink-purple; not revolute | Ovoid; dorsally purple, ventrally pale-purple; deflexed but not rolled back |
| 11 | Male flower                      | Compound tepal cream; free tepal translucent white, oval | Compound tepal cream; free tepal translucent white, oval | Compound tepal cream; free tepal translucent white, rectangular | Compound tepal watery green; free tepal translucent white, oblong |
| 12 | Fruits                           | Straight                                      | Straight                                        | Straight                                        | Straight                                         |

(Sulistyaningsih & Irawanto, 2011). However, local people in Kuching, Sarawak, Malaysia called it Pisang Lengki (Häkkinen, 2004b). Geographically, *M. campestris* var. *sarawakensis* located between 110°31′59.593″ E and 0°24′31.938″ N.

Characteristics: Pseudostem sheaths yellow-green colour. Sucker closed to parent and vertical growth. Petiole up to 42-93 cm long, petiole canal straight with erect margins. Leaf habit erect up to 210-285 cm long, 30-42 cm wide, colour of upper surface dark green, lower surface green, and leaf bases one side rounded and one-pointed, midrib dorsally yellow, midrib ventrally green. Inflorescence erect. Peduncle red-purple in colour. Male bud ovoid, normal male bud, apex slightly pointed, dorsally pink-purple, ventrally pink-purple colour of bract, not revolute bract behaviour, lifting one at a time, and rachis position erect. Male flower compound tepal cream with yellow lobes, free tepal translucent white, rectangular, with obtuse apex, style straight, ovary straight. Fruit 5 fruits per hand, individual fruit 18 cm long, straight in shape, without any floral relics, and apical part blunt-tipped. The Seed is obpyriform and brown color (Figure 3). Variations morphology were found between *M. campestris* var. *sarawakensis* in Bonti, West Kalimantan and *M. campestris* var. *sarawakensis* in Kg. Jambu, Sarawak. *M. campestris* var. *sarawakensis* in Bonti, West Kalimantan had yellow-green pseudostem colour. Leaf bases one side rounded and one-pointed. The Dorsally pink-purple and ventrally pink-purple colour of bract (Table 1). However, *M. campestris* var. *sarawakensis* in Kg. Jambu, Sarawak had yellow-red purple pseudostem colour. Leaf bases both sides rounded. The dorsally purple and ventrally pale-purple colour of bract (Table 1) (Häkkinen, 2004).
M. campestris var. sarawakensis can be found on forest border in Bonti village, Sanggau District, West Kalimantan and also considered as a new distribution record (Figure 3). Previously, M. campestris var. sarawakensis was reported in Sarawak, Malaysia (Häkkinen, 2004b) and on foothill in Nek Rokon hill, Raya Pasi Natural Resource area, Singkawang, West Kalimantan (Sulistyaningsih & Irawanto, 2011).

Local people in Bonti village have not utilized M. campestris var. sarawakensis. However, local people in Keritan Ulu, Mongool, Senagang Ulu villages, Sabah, consume the heart of inner shoot and flower inflorescence as a salad with chilli sauce or sambal biris (Noweg et al., 2003).

The Key character of M. campestris var. sarawakensis from Bonti West Kalimantan is pseudostem yellow-green colour, inflorescence erect, leaf base one side rounded, and one-pointed, the dorsally pink-purple and ventrally pink-purple colour of bract. The two wild bananas species were successfully identified from Bonti district, Sanggau Regency, West Kalimantan i.e. M. borneensis var. sarawakensis and M. campestris var. sarawakensis and it is considered as new distribution records. The Conservation of M. borneensis var. sarawakensis, M. campestris var. sarawakensis, and other wild bananas in Indonesia is important to be prioritized both in-situ and/or ex-situ before it goes to extinction caused of deforestation and forests fragmentations. Conservation of wild bananas will provide long term and sustainable conservation of genetic diversity, that’s important resources to improve the quality of cultivated banana using genetic manipulation in the future.

ACKNOWLEDGMENTS
The authors would like to thank LPPM Universitas Muhammadiyah Pontianak who has funded this study.

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