

THE DIVERSITY OF EPIPHYTIC FERN ON THE OIL PALM TREE (*Elaeis guineensis* Jacq.) IN PEKANBARU, RIAU

KEANEKARAGAMAN JENIS PAKU EPIFIT YANG TUMBUH PADA BATANG KELAPA SAWIT (*Elaeis guineensis* Jacq.) DI PEKANBARU, RIAU

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INTISARI

Kelapa sawit (*Elaeis guineensis*) merupakan salah satu komoditas utama di Provinsi Riau. Secara morfologi, batang kelapa sawit mempunyai lingkungan yang sesuai bagi pertumbuhan paku-pakuan epifit, karena bagian pangkal tangkai daun yang melebar sehingga dapat menampung serasah organik dan materi anorganik lainnya. Tujuan dari kajian ini adalah untuk mengetahui keanekaragaman jenis paku epifit yang tumbuh pada batang kelapa sawit. Sebanyak 125 individu kelapa sawit dari tujuh area kajian di Pekanbaru, Riau telah diteliti. Jumlah jenis paku epifit yang diidentifikasi pada penelitian ini adalah 16 jenis yang tergolong enam famili.

Kata kunci : paku epifit, kelapa sawit, Pekanbaru

ABSTRACT

Oil palm (*Elaeis guineensis*) is one main commodity in Riau Province. Morphologically, the trunk of oil palm has suitable environment to the growth of epiphytic fern, due to its broaden base of petiole that may accumulate organic and inorganic debris. The objective of this study was to investigate the diversity of epiphytic fern on the oil palm tree. A total of 125 oil palm trees from seven study sites in Pekanbaru, Riau were observed. The number of epiphytic ferns identified in this study was 16 species belongs to six families.

Keyword: epiphytic fern, oil palm tree, Pekanbaru

INTRODUCTION

The palm oil (*Elaeis guineensis*) is one of the main commodity in Riau Province. The fruit of palm oil can be processed to produce palm oil. This species is a monoecious tall palm with leaf-bases adhere, the tree height may reach up to 20m. The petiole is 1.3-2.3 m long, 12.5-20 cm wide, broadened at base. Therefore, the base of petiole may accumulate leaves debris or other litters and makes this part is moist and has suitable micro environment for the growth of epiphytic flora, especially fern. Epiphytic flora are plant which rely on other plants non-parasitically for support. It grows on trunks and branches rather than rooting themselves to the ground, or sometimes upon some other object. The epiphytic species may occur on three types of tree growth, i.e. vertical trunk, horizontal branch and horizontal crothch (Wooley and Lacher, 2008) depends on the root type of each species. Generally, the root of epiphytic plants has ability to derive support and assimilate water and nutrient from surface.

Fern is a botanical group known as Pteridophyta. This group has very distinct generation alternation from independent inconspicuous and sort-lived gametophyte (sexual) to conspicuous and dominant sporophyte (asexual) stages. Unlike mosses, fern have vascular bundle consisted of xylem and floem, therefore it is grouped into vascular plant but have neither seeds nor

flowers. The reproduction of fern uses spore. According to Schuettpelz (2007), almost 10% of leptosporangiate fern are epiphytic fern. These plant group need unique microhabitat on host bark or trunk (Roberts *et al.* 2005)

The aims of this study was to investigate the diversity off the epiphytic fern on the oil palm tree from Pekanbaru, Riau. The oil palm plantations in this region are commonly located in both side of village road or folk garden, with various number of tree ranged from about 50 to 500 trees depends on the area. The age of oil palm trees in this study were ranged from 5 to 7 year.

MATERIAL AND METHOD

Study sites and data collection

Floristic data were collected from seven sites in Pekanbaru, Riau Province and a total of 125 oil palm trees were examined (Table 1). A survey was carried out to know which oil palm tree that had high epiphytic fern coverage and diversity. The selection of trees was conducted using purposive sampling based on the high diversity of epiphytic fern, and not based on the tree age.

Field observation included position of fern on trunk, the abundance of the species and the color of rhizome, petiole, leaf and sori. The abundance of epiphytic species that determine based on the percentage of each species occurrence on tree selected was explained as follow, very

rare (<20%), rare (21-40%), abundant (41-70%) and very abundant (>70%). All collected specimens were labelled and dried to make herbarium. Herbarium specimens were prepared in Laboratory of Botany, Department of Biology, Faculty of Math and Natural Science, University of Riau. The morphological characters of each fern was carefully examined for species identification. All photographs were taken using two Canon and Nikon D70.

Table 1. Details of data collection sites

| No | Location | Number of oil palm tree examined |
|----|---------------------|----------------------------------|
| 1 | Kartama, Bukit Raya | 30 |
| 2 | Panam | 20 |
| 3 | Tampan | 11 |
| 4 | Rumbai | 23 |
| 5 | Senapelan | 13 |
| 6 | Marpoan Damai | 20 |
| 7 | Sukajadi | 8 |
| | Total | 125 |

Species identification

All fern specimens were identified to species level based on Piggeot (1996). The morphological characters used for identification including vegetative characters (rhizom and leaf) and generative characters (sori and spora) The accepted name of each species were checked using The Plant List site (www.theplantlist.com). Voucher specimens of all identified species were deposited in Herbarium Riauensis, University of Riau.

RESULTS

In this study a total of 16 epiphytic ferns were identified on the oil palm trees from Peanbaru, Riau (presented in Table 1). These species belongs to seven familia i.e. Polypodiaceae (five species), Aspleniaceae, Davalliaceae, and Vittariaceae (three species each), and Blechnaceae and Gleicheniaceae (one species each). Generally, the specimens of a fern species that collected from different study sites showed the similar morphological characters.

Table 1. List of epiphytic ferns on the oil palm tree

| Family | Species | Abundance |
|----------------|---|-----------------------------|
| Aspleniaceae | 1. Asplenium nidus L. | + |
| | 2. Asplenium crinicaule Hance | + |
| | 3. Asplenium monanthes L. | ++ |
| Blechnaceae | 4. Stenochlaena palustris (Burm. f.) Bedd. | ++ |
| Davalliaceae | 5. Nephrolepis biserrata (Sw.) Schott | ++++ |
| | 6. Nephrolepis hirsutula (G. Forst.) C. Presl | ++++ |
| | 7. Davallia denticulata (Burm. F.) Mett. Ex. Kuhn. | +++ |
| Gleicheniaceae | 8. Dicranopteris linearis (Burm. f.) Underw. | + |
| Polypodiaceae | 9. Microsorium pustulatum (G.Forst.) Copel | + |
| | 10. Microsorium punctatum (L.) Copel | + |
| | 11. Phymatosorus scolopendria (Burm. f.) Pic. Serm | ++ |
| | 12. Pyrrosia piloselloides (L.) M.G. Price | + |
| | 13. Goniophlebium percussum (Cav.) Wagner & Grether | ++ |
| | Vittariaceae | 14. Vittaria ensiformis Sw. |
| | 15. Vittaria graminifolia Kaulf | + |
| | 16. Vittaria scolopendrina (Bory) Schkuhr ex Thwaites | + |

Note : + very rare, ++ rare, +++ abundant, ++++ very abundant

DISCUSSION

The polypod ferns are grouped in Polypodiaceae family. Polypod group has long creeping and branched rhizome (Smith *et al.* 2006), simple or pinnate fronds (Negi *et al.* 2009). Species identified in this study i.e. *Microsorium punctatum*, *Microsorium pustulatum*, *Phymatosorus scolopendria*, *Pyrrosia piloselloides* and *Goniophlebium percussum*. Among these five polypod fern, only *Pyrrosia piloselloides* was an dimorphic fern, with diferent shape of fertile and sterile frond. *Microsorium punctatum* was characterized by its simple frond and small sori that irregularly arranged on both sides of costa. Morphologically, *Microsorium pustulatum* and *Phymatosorus scolopendria* had similar pinnatifid pinnae with larger sori. The abundance of all of these three Polypodiaceae species were less abundant than Davalliaceae member. They were commonly found in the midle to the top of oil plam trunk, as these part are easier to be attached by uncovered sori carried by the wind.

Aspleniaceae is the family with the largest number of species within the Pteridophyta (Ekrt and Stech, 2008). This family is remarkable with its large morphological diversity (Sleep, 1983). The species of Aspleniaceae identified in this study were belong to genus *Asplenium*, i.e. *A. nidus* *A. crinicaule* and *A. monanthes*. Among these three species, *A. monanthes* was more abundant than *A. nidus* and *A. crinicaule*. Morphologically, *A. monanthes* and *A. crinicaule* are more similar to each other, they had pinnate leaflet and long stipes, while *A. nidus* had simple, long frond and short stipes. In spite of their diverse frond shapes, *Asplenium* species have similar sorus position and shape. Sori are linear, aranged regulary on both side of costa.

The most abundant epiphytic ferns found in oil palm trunk belong to Davalliaceae family, with three species identified, i.e.. *Nephrolepis biserrata*, *Nephrolepis hirsutula* and *Davallia denticulata*. The occurrence of the two *Nephrolepis* species was very abundant in all study sites and sometime covered from basal to upper part of the oil palm trunk. According to Gauchan *et al.* (2008), that in nature, this fern grow in a wide variety of situation, such as in the soil, among rocks or as an epiphyte. All of the *Nephrolepis* species are fertile all year, and spread by spores, rhizome, stolon and tuber. But tuber production apparently limeted to plants growing in humus (Nauman, 1981). If *Nephrolepis* species occured tought out the stem, *Davallia denticulata* was densely found in the basal of oil palm stem and rarely found in the top of stem. This species is dimorphic fern, with different fertile and sterile frond. The fertile frond is usually narrower than steril one. Both fronds have triangular shape.

Blechnaceae and Gleicheniaceae with one species each, *Stenochlaena palustris* and *Dicranopteris linearis* were commonly found in the basal of the trunk. *Stenochlaena palustris* was dimorphic, creeping or climbing fern. The sterile pinnae is wider than fertile frond. *Dicranopteris linearis* is isomorphic and climbing fern. Figure 1. presents the morphology of all of the 16 epiphytic fern identified from oil palm tree.

Morphological characters

The morphological characters were observed directly in the field and also in the Botany Laboratory. The characters of each species are presented below based on the observation in this study, and compared with the description by Piggeot (1996).

1. *Asplenium nidus* L.

Epiphytic or lithophytic. Rhizome short, erect or ascending, dark brown. Roots scaly. Stipes stramineous to dark, 2-5cm long, scaly at the base. Fronds rossete, simple, up to 150 or more, 12-20cm broad, broadest in the middle, gradually narrowing toward both apex and base, light green, paler below; midrib raised on upper surface, flat below. Sori elongate along veins. Indusia present.

2. *Asplenium crinicaule* Hance

Epiphytic. Rhizome short, erect, densely scaly. Stipes usually up to 10cm long, dark brownish-purple to nearly black. Frond narrowly lanceolate, gradually narrowing towards both apex and base, 40cm long or more, 13cm wide or more. Lateral pinnae about 25 pairs, sessile, narrowing subtriangular to elliptic, apex acute, indistinctly lobed. Lobe with a few teeth. Sori long, crescent-shaped along posterior veinlet. Indusia entire.

3. *Asplenium monanthes* L.

Rarely epiphytic. Stems erect or nearly erect, scaly. Leaves monomorphic. Pinnae extremely diverse, simple to 4-pinnate. Veins free to anastomosing. Sori elongate along vein, ± lunate to linear. Indusia usually present.

4. *Stenochlaena palustris* (Burm. f.) Bedd.

Rhizome long, dark brown, creeping, climbing on tree trunk. Stipes up to 17cm long. Frond 40-75cm long or more, bearing pinnae up to 15 pairs, opposite. Sterile pinnae stalked, articulate, 18cm long or more, about 4cm wide, apex acuminate. Veins simple or forked. Fertile pinnae about 20cm long, 3mm wide, sporangia on the whole lower surface.

5. *Nephrolepis biserrata* (Sw.) Schott

Rhizome ascending, brown, bearing a few fronds drooping at apex, numerous roots and stolon. Stipes up to 70cm or more, densely scaly with narrower scales. Laminae large, usually more than 140cm long, 20cm wide, lanceolate, narrowing toward both apex and base, pinnate. Lateral pinnae 50 pairs or more, linear-lanceolate, apex acuminate to caudate, base cuneate, sessile, serrate at the margin of posterior part. Sori round, in row at 1/3-1/2 way from margin to costa. Indusia reniform.

6. *Nephrolepis hirsutula* (G. Forst.) C. Presl

Rhizome ascending, brown, bearing a few fronds drooping at apex, numerous roots and stolon. Scales dense, bicoloured with dark brown in the middle and paler in the margin. Stipes up to 60cm or more, scaly throughout. Laminae large, usually more than 60cm long, 20cm wide, lanceolate, narrowing toward both apex and base, pinnate. Lateral pinnae 50 pairs or more, linear-lanceolate, apex acuminate to caudate, base cuneate. Sori round, submarginal. Indusia reniform.

7. *Davallia denticulata* (Burm. F.) Mett. Ex. Kuhn

Rhizome long, light to dark brown, creeping, densely

scale throughout, brown to dark brown. Laminae subtriangular, gradually narrowing toward apex, quadripinnatifid, 50cm long or more, 25cm wide or more. Pinnules oblong, lobed at the margin. Sori small, at every margin of lobes. Indusia cup-shaped.

8. *Dicranopteris linearis* (Burm. f.) Underw

Rhizome long, brownish green, creeping or climbing on other plant. Stem grows from rhizome, green to brown. Main rachis dichotomous, divided into rachis branches. The branches fork 3-4 times, up to 7m or more. The two leafy branch has equal length 20cm long or more, 18cm broad or more, deeply pinnatifid lobe, comb-shaped, light green. Sori at the underside of the lobes. Indusia absent.

9. *Microsorium pustulatum* (G. Forst.) Copel

Epiphyte. Rhizome climbing. Stipes short, scaly, swollen at the base. Fronds simple, shiny, light green, well-spaced along the rhizome, erect or weeping, 40cm long or more, 10cm wide or more, variable in shape (oblong to linear-lance shaped, unevenly three-pronged, and irregularly divided / pinnatifid). Sori globe-shaped, 2-4 mm in diameter. Indusia absent.

10. *Microsorium punctatum* (L.) Copel

Rhizome creeping, dark or glaucous on the upper surface, scaly. Stipes not distinct from laminae, light green or stramineous. Laminae narrowly oblong to lanceolate, gradually narrowing toward both apex and base, up to 100cm long or more, 15cm broad or more. Midrib raised on bot surface. Sori small, round, irregularly arranged on the under surface of laminae.

11. *Phymatosorus scolopendria* (Burm. f.) Pic. Serm

Rhizome long, creeping, brown, bearing fronds more than 1cm apart, scaly. Stipes up to 50cm long, stramineous. Laminae oblong-ovate to subdeltoid, pinnatifid with broadly winged rachis, up to 40 long or more, 30cm broad or more. Lateral lobes up to 6 pairs, margin entire. Sori round or elongated, spread out on each mid rib side.

12. *Pyrrhosia piloselloides* (L.) M.G. Price

Rhizome long, creeping, brown, bearing fronds, 1-4cm apart, densely scaly. Fronds simple, distinctly dimorphic. Sterile frond nearly circular, oblong, apex round, 4cm long or more, 1.5cm broad or more, fleshy, green. Fertile frond linear-lanceolate, apex round, gradually narrowing towards base, up to 15cm long or more, 1.5cm broad or more. Sori line-shape on the margin.

13. *Goniophlebium percussum* (Cav.) Wagner & Grether

Rhizome long, brown to almost black, creeping, scaly. Stipe long, up to 150cm long or more. Fronds pinnate. Laminae dark green, 150cm long or more, widest at the base, margin entire to crenate, apex acuminate. Sori uniserial, costal, deeply sunken.

14. *Vittaria ensiformis* Sw.

Rhizome short, creeping, dark brown, scaly. Fronds simple, lamina extending to the rhizome, stipes absent. Laminae linear, 20cm long or more, 1 cm broad or more, narrowing toward both apex and base, light green, margin. Sori in two continuous lines inside the lamina margin.

15. *Vittaria graminifolia* Kaulf

Rhizome short, creeping, dark brown, densely scaly. Frond simple, young frond bright red, paler toward base. Laminae pendent, linear, dark green at the middle toward base, redish at the apex, glossy, up to 20 cm long or more, 0.5cm wide or more, margin entire, apex acute. Sori in single submarginal groove on each side of midrib, dark brown, 0,5mm wide.

16. *Vittaria scolopendrina* (Bory) Schkuhr ex Thwaites

Rhizome short, dark brown, creeping, bearing close fronds, scaly. Lamina sessile, up to 40cm long or more, 3cm broad or more, gradually narrowing toward both apex and base. Sori in the groove inside the margin.

CONCLUSION

Oil palm (*Elaeis guineensis*) has suitable micro environment of epiphytic fern. A total of 16 epiphytic fern species from six families were identified in this study. The member of Davalliaceae, especially *Nephrolepis bisserata* and *Nephrolepis hirsutula* were the most abundance species, while Vittariaceae species was very rare species occur in oil palm tree.

Specimens examined :

Asplenium nidus : AN1-2, Kartama, Simpang Tiga; AN3 UNRI, Panam. *Asplenium crinicaule*: AC1, Rumbai. *Asplenium monanthes*: AM1-4, Kartama, AM5, UNRI Gobah. *Stenochlaena palustris*: SP1-5 Kartama; SP6, Rumbai. *Nephrolepis biserrata*: NB 1- 10 Kartama, NB 11-14 Simpang Tiga; NB 14-23 Panam; NB 24-29 Gobah. *Davallia denticulata*: DD1-6 Kartama, DD6-11 Simpang Tiga; DD 12-18 Rumbai. *Nephrolepis hirsutula*: NH 1- 12 Kartama, NH 13-14 Simpang Tiga; NH 15-23 Panam; NH 24-29 Gobah. *Davallia denticulata*: DD1-6 Kartama, DD6-11 Simpang Tiga; DD 12-18 Rumbai. *Dicranopteris linearis*: DL1-2 Panam. *Microsorium pustulatum*: MP1-4, Panam. *Microsorium punctatum*: MPC1-2 Panam. *Phymatosorus scolopendria*, PSC1-4 Kartama; PSC3-7 Panam. *Pyrrosia piloselloides*: PPI1-3 Panam. *Goniophlebium percussum*: GP1-3 Kartama, GP4 UNRI Panam; GP5 Simpang Tiga. *Vittaria ensiformis*: VE1-2 Kartama; VE3 Gobah, Pekanbaru. *Vittaria graminifolia*: VG1-2 Kartama. *Vittaria scolopendrina*: VS1 Kartama. Collector Nery Sofiyanti.

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Figure 1. Morphology of epiphytic ferns on the oil palm tree. a. Young frond of *Asplenium nidus*, b. *Asplenium crinicaule*, c-d. *Asplenium monanthe*, e. *Stenochlaena palustris*, f. *Nephrolepis biserrata*, g. *Nephrolepis hirsutula*, h-i. Fertile frond of *Davallia denticulata*, j. *Dicranopteris linearis*, k. *Microsorium pustulatum*, l-m. *Phymatosorus scolopendria*, n. Steril and fertile frond of *Pyrrosia piloselloides*, o. *Goniophlebium percussum*, p. *Vittaria ensiformis*, q. *Vittaria graminifolia*, r. *Vittaria scolopendrina* (photographed by Nery)