

Investigation on the Potential of Sabah Mosses as Antioxidant and Anti-cancer Phytopharmaceutical Products

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Monica Suleiman
Mohd Fadzelly Abu Bakar
Fifilyana Abdul Karim

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Institute for Tropical Biology and Conservation
Universiti Malaysia Sabah



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ABSTRACT

Bryophytes are small, non-vascular plants that include mosses, liverworts and hornworts. They have been reported to possess various types of biological activities. This study was carried out to evaluate and determine the phytochemical contents, antioxidant and antiproliferative properties of nine bryophytes species. Four liverworts species, namely, *Schistochila aligera*, *Schistochila acuminata*, *Lepidozia borneensis* and *Lepidozia ferdinandi-muelleri* and five mosses species, namely, *Sphagnum cuspidatum* subsp. *subrecurvum*, *Sphagnum cuspidatum*, *Sphagnum junghuhnianum*, *Pogonatum cirratum* subsp. *fuscatum* and *Pogonatum cirratum* subsp. *macrophyllum* were extracted using 80% methanol, aqueous and ethanol. Total phenolic and total flavonoid contents were determined using Folin-ciocalteau and aluminium chloride colorimetric methods. The antioxidant activities were evaluated by FRAP, ABTS and DPPH assays. Antiproliferative activity against hormone dependent breast cancer (MCF-7), non-hormone dependent breast cancer (MDA-MB-231), ovarian cancer (CaOV₃) and liver cancer (HepG2) cell lines were determined by using MTT assay and further evaluated for cell cycle analysis by using flow cytometry. The results showed that the 80% methanol extract of *S. acuminata* had the highest total phenolic and total flavonoid content with the values of 24.24 ± 0.92 and 22.09 ± 1.35 mg/g of dry sample, respectively. The 80% methanol extract of *S. aligera* had the highest free radical scavenging activity with IC₅₀ value of 193.33 ± 30.55 µg/ml. There was no scavenging activity displayed for aqueous and ethanol extracts of all samples. The reducing ability of ethanol extracts of all species was poor compared to 80% methanol and aqueous extracts. Aqueous extract of *L. borneensis* displayed the highest reducing ability with a value of 229.13 ± 0.97 mM for FRAP assay. For ABTS assay, aqueous extracts displayed higher scavenging activity than 80% methanol and ethanol extracts. The findings for antiproliferative activity showed that *S. aligera* induced cytotoxicity in all tested cells. Among all samples, the extract of *L. borneensis*, *P. cirratum* subsp. *fuscatum* and *S. cuspidatum* subsp. *subrecurvum* did not display cytotoxicity against normal cells. *L. borneensis* and *P. cirratum* subsp. *fuscatum* induced cell cycle and apoptosis against MCF-7 cells. Statistical analysis showed that there was a correlation between phenolic and flavonoid with antioxidant activities except for DPPH. *L. borneensis* and *P. cirratum* subsp. *fuscatum* have the potential as natural antioxidant and anticancer agents.

ABSTRAK

CIRI-CIRI FITOKIMIA, ANTIOKSIDA AND ANTIPROLIFERATIF SEMBILAN SPESIES BRIOFIT TERPILIH DARI GUNUNG ALAB DAN GUNUNG KINABALU, SABAH, MALAYSIA

Lumut merupakan tumbuhan yang kecil dan tidak bervaskular yang terdiri daripada lumut jati, lumut hati dan lumut tanduk. Lumut dilaporkan mempunyai pelbagai aktiviti biologi. Kajian ini dijalankan untuk menilai dan menentukan kandungan fitokimia, aktiviti antioksidan dan antiproliferatif sembilan spesies lumut. Empat spesies lumut hati iaitu *Schistochila aligera*, *Schistochila acuminata*, *Lepidozia borneensis* and *Lepidozia ferdinandi-muelleri* dan lima spesies lumut jati iaitu *Sphagnum cuspidatum* subsp. *subrecurvum*, *Sphagnum cuspidatum*, *Sphagnum junghuhnianum*, *Pogonatum cirratum* subsp. *fuscatum* dan *Pogonatum cirratum* subsp. *macrophyllum* diekstrak menggunakan 80% metanol, air suling dan etanol. Jumlah kandungan fenolik dan flavonoid ditentukan melalui kaedah Folin-ciocalteu dan kolorimetrik aluminium klorida. Aktiviti antioksidan diukur menggunakan kaedah FRAP, ABTS dan DPPH. Aktiviti antiproliferatif terhadap sel kanser payu dara yang bergantung kepada hormon (MCF-7), kanser payu dara yang tidak bergantung kepada hormon (MDA-MB-231), kanser ovari (CaOV₃) dan kanser hati (HepG2) ditentukan dengan menggunakan kaedah MTT dan dinilai dengan lanjut untuk analisis kitaran sel dengan menggunakan aliran sitometri. Hasil kajian menunjukkan ekstrak 80% metanol *S. acuminata* mempunyai kandungan fenolik dan flavonoid yang paling tinggi dengan nilai 24.24 ± 0.92 dan 22.09 ± 1.35 mg/g sampel kering. Ekstrak 80% metanol *S. aligera* mempunyai penghapusan radikal bebas yang paling tinggi dengan nilai IC_{50} iaitu 193.33 ± 30.55 μ g/ml. Tiada aktiviti penghapusan dipamerkan oleh ekstrak air suling dan etanol bagi kesemua sampel. Kebolehan pengurangan ekstrak etanol bagi kesemua spesies adalah lemah jika dibandingkan dengan ekstrak 80% metanol dan ekstrak air suling. Ekstrak air suling *L. borneensis* menunjukkan kebolehan pengurangan yang paling tinggi dengan nilai 229.13 ± 0.97 mM bagi ujian FRAP. Bagi ujian ABTS, ekstrak air suling mempamerkan aktiviti penghapusan yang paling tinggi berbanding ekstrak 80% metanol dan etanol. Hasil kajian bagi aktiviti antiproliferatif menunjukkan *S. aligera* mengaruh sitotoksik terhadap kesemua sel yang diuji. Antara kesemua sampel, ekstrak *L. borneensis*, *P. cirratum* subsp. *fuscatum* dan *S. cuspidatum* subsp. *subrecurvum* tidak mempamerkan sitotoksik terhadap sel normal. *L. borneensis* dan *P. cirratum* subsp. *fuscatum* mengaruh kitaran sel dan apoptosis sel MCF-7. Analisis statistik menunjukkan wujudnya korelasi diantara fenolik dan flavonoid dengan aktiviti antioksidan kecuali DPPH. *L. borneensis* dan *P. cirratum* subsp. *fuscatum* mempunyai potensi sebagai agen antioksidan dan sitotoksik yang semulajadi.