Some of South Sumatran Plants Containing Alkaloids

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Abstract

A phytochemical survey for alkaloid-containing plants has been conducted in South Sumatra including traditional medicinal plants. During the survey 180 satisfactory herbarium sample were obtained and all of them were tested for alkaloids. The results showed that 33 species gave a positive test for alkaloids, and high alkaloid contents were shown by: *Alstonia scholaris, Alstonia angustiloba, Ervatamia coronariaa, Voacanga foetida* Bl. K. Schum, *Litseaacceden toides* K & V, *Litsea angualata, Litsea tomentosa*, Fibraurea *chloroleuca* Miers (root), and *Uncaria cordata* (Lour.) Merr. The aboved survey was also continued to be an intensively phytochemical work focusing on alkaloid of Fibraurea *chloroleuca* Miers root. A quaternary isoquinoline alkaloid as a yellowish crystal, m.p. 214-215 °C; MS (FAB) *m/z* 352 has been successfully isolated and tested for antibacterial activity. This isolated alkaloid significantly inhibited *Bacilus substilis, Shigela dysentriae, Staphylococus aireus,* and *Pseudomonas sp* growth at 1 mg/mL. As a result, all of these alkaloid-containing plants are potential to explore their alkaloids and utilitarian for traditional medicines.

Keywords: Alkaloids, traditional, medicines, south sumatra, plants

Abstrak

Survei fitokimia terhadap tanaman yang mengandung alkaloid telah dilakukan di Sumatera Selatan termasuk tanaman obat tradisional. Selama survey ini, 180 sampel herbarium ditemukan, yang kemudian diuji kandungan alkoloidnya. Hasil pengujian ini menunjukkan bahwa 33 spesies memiliki kandungan alkoloid, dan kandungan alkoloid yang tinggi ditemukan pada Alstonia scholaris, Alstonia angustiloba, Ervatamia coronariaa, Voacanga foetida Bl. K. Schum, LitseaaccedentoidesK & V, Litsea angualata, Litsea tomentosa, Fibraurea chloroleuca Miers (root) and Uncaria cordata (Lour.) Merr. Survey diatas kemudian dilanjutkan menjadi penelitian fitokimia yang difokuskan kepada alkaloid akar Fibraurea chloroleuca Miers. Satu alkaloid isokuinolin kwarterner berbentuk kristal berwarna kuning, m.p. 214-215 °C; MS (FAB) m/z 352 berhasil didapatkan dan diuji kemampuannya terhadap penghambatan pertumbuhan bakteri. Alkaloid hasil isolasi ini secara signifikan dapat menghambat pertumbuhan Bacilus substilis, Shigela dysentriae, Staphylococus aireus, and Pseudomonas sp growth pada konsentrasi 1 mg/mL. Kesimpulannya seluruh tumbuhan yang mengandung alkaloid ini adalah potesial untuk dieksplorasi kandungan alkaloidnya dan dimanfaatkan untuk obat tradisional.

Kata Kunci: Alkaloida, obat, tradisional, sumatera selatan, tumbuhan

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INTRODUCTION

Phytochemical surveys for alkaloid-containing plants have been carried out in many countries, including Australia [1-4], Malaysia [5, 6], the Philippines [7], Thailand [8, 9] and Indonesia, especially in Central Sumatra [10-12]. These surveys have become the bases of more sophisticated studies and have had major influences on the indigenous development of organic chemistry and related sciences. A similar survey has been carried out in South Sumatra, Indonesia. The other survey has been also conducted in other country in Asia such as in Pakistan [13], and Iran [14].

On account of the monsoon, Sumatra is largely covered by dense tropical rain forests containing a wide variety of woody species as well as timbers, palm, orchids, and mosses. Although considerable interest and activity in the natural product chemistry in Indonesia, particularly in Sumatra, have been maintained and have even increased during the past ten

years, there are, however, no precise estimate having been made of the number of South Sumatran plant species. Sumatra that has very rich flora is comparable to those of Borneo and New Guinea. In addition, the Sumatran flora is far richer than the flora of Java and Sulawesi [15, 16] for instance, have identified 11 different primary vegetation types, including brackish water forest, mangrove forest, freshwater swamp, lower montane forest, upper montane forest, subalpine forest, heath forest, limestone forest, beach forest, and lowland rain forest. In recent years of these vegetation types are being cleared and the land is being converted to agriculture use, particularly for cultivation of rubber, coffee, rice, and cloves. Consequently, there is an urgency in studying the chemical constituents of the South Sumatran flora, especially alkaloids. Alkaloids are the compounds containing at least a basic nitrogen atom and most of those compounds have physiological activities. This article discusses the results from a survey of some Sumatran plants in exploring the chemical constituent of alkaloids.

MATERIALS AND METHODS

Sample collection:

Plant specimens for surveying montane forest plants were collected from different area surrounding Kepahiyang forest: Bukit Jupi, Pondok P.U., Taba Penanjung and Ekor Curup. In the meantime, lowland rain forest species were collected on from Talang Betutu, Pangkalan Balai, Durian Daun, Betung, Sungai Lilin, and Gelumbang. During the survey, special attention was given to species which have become traditional medical plants. Sets of voucher specimens have been deposited in the Herbarium Bogoriense at Bogor, and in the Herbarium Bandungense of Biology Department at the Institute of Technology Bandung, and the other two sets are kept in the Department of Biology at the Faculty of Mathematics and Natural Science of Sriwijaya University.

Chemical testing:

The alkaloid screening was conducted according to procedures described by Culvenor and Fitzgerald [17] as follows. About 2-4 g of fresh plants materials were cut into small pieces and then grounded together with sand and 5 ml of ammoniacal chloroform. A further 10 mL of solvent was added and the mixture was stirred for 5 minutes. The solvent was then filtered into a 10 mL test tube. Dilute sulfuric acid (2N, 10 drops) was added and test tube was shaken gently. The phases were separated and the aqueous layer was tested with Meyer's reagent. The categories are divided into dense heavy precipitate (4+), a strong precipitate (3+), a moderate precipitate (2+), and a faint cloud (1+). The dense precipitate above was respectively equivalent to 0.10% brucine (4+); 0.05% brucine (3+); 0.025% brucine (2+); and 0.01% brucine (1+).

Figure 1. *Fagraea fragrans*

Figure 2. *Fibraureachloroleuca* (Cover of Bull. Soc.Nat. Prod. Chem (Indonesia), 2011, Vol. 11, 1-4)

RESULTS AND DISCUSSION

Despite the fact that 180 satisfactory herbarium samples were obtained from on the field and then fully tested for alkaloids, only 154 species representing 45 families have been taxonomically identified so far. These include 33 species representing 15 families, which have a positive test for alkaloids, and are listed in Table 1. The remaining 121 identified species giving a negative test for alkaloids are keeping in our Natural Products chemistry laboratory. In the tables, families and species are listed alphabetically.

Most of remaining 26 species unidentified specimens can be placed in known species but there is still some uncertainty concerning identification

because of the lack of adequate reference material. Even though all of these specimens gave a negative test for alkaloids, attempts to complete the identification of the remaining species are still continuing. Generally, this survey would give us chances for developing organic chemical investigation in Sumatra, especially the isolation and the characterization of chemical structure of alkaloids from some potential South Sumatran plants, including biological activity tests for herbal and non herbal medicinals.

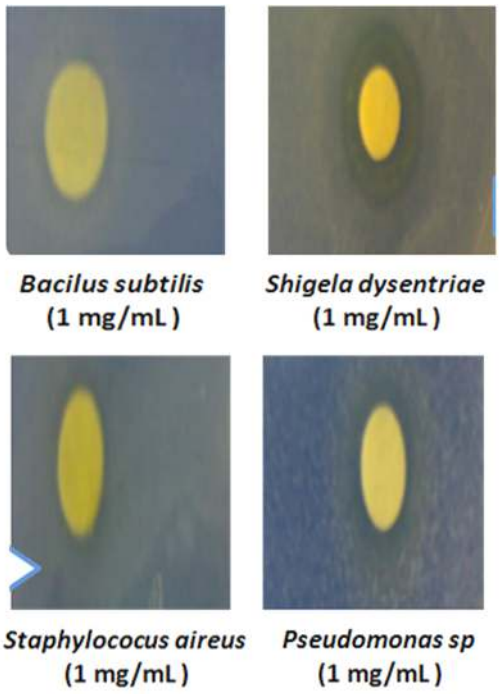

Figure 3. Alkaloids of *Fibraureachloroleuca* inhibited the bacterial growth

The major source for the biosynthesis of alkaloids was just a few amino acids, and one major reaction-a Mannish reaction-is the common pathway for building the many diverse skeletons of alkaloids. In addition, reported that most of the alkaloids were biosynthetically subject to amino acids, such as lysine, phenylalanine, tyrosine, and tryptophan [18].

Table 1. Species Giving a Positive Test for Alkaloids

Family/Species	Herbarium	Alkaloids
Apocynaceae		
AlstoniaangustilobaMig	DA 091	4+
Alstoniascholaris	DA 173	4+
Ervatamiacoronaria	DA 166	4+
Kopsiaarborea BI	DA 169	3+
Voacangafoetida (BI.) K.Schum	DA 180	4+
Euphorbiaceae		
Margaritariaindica (Dalz.)		1+
G.L. Webster	DA 149	2+
Gnetaceae		
Gnetumlatifolium BI	DA 095	2+
Gnetumlatifolium	DA 172	2+
Gnetummicrocarpium BI	DA 148	2+
Lauraceae		
*Litseaaccedentoides*K&V	DA 100	4+
LitseaAngulata	DA 174	4+
LitseaTomentosa	DA 178	4+
Lecythidaceae		
Barringtoniainsingis (BL.) Mig	DA 075	2+
Loganiaceae		
Fagreablumai	DA 179	2+
Fagrea sp.	DA 180	2+
*Fagraeafragrans*Roxb (bark)	DA 181	3+
Meliaceae		
Aglia sp. 1	DA 122	1+
Aglia sp. 2	DA 139	1+
Menispermaceae		
FibraureachloroleucaMiers	DA 132	4+
Fenucampylusgalucus	DA 175	2+
Mimosaceae		
Acacia pennata (L.) Willd	DA 088	1+
Moraceae		
*Ficusglandulifera*Wall	DA 012	3+
Ficuslepicarpa BI.	DA 006	1+
Ficussaxophila BI.	DA 082	2+
*Ficusstricta*Mig.	DA 096	2+
Piperaceae		
Piper sarmentosum	DA 176	2+
Piper betle	DA 177	1+
Rubiaceae		
Uncaria sp. 1	DA 063	1+
Uncaria sp. 2	DA 064	2+
Uncariacordata (Lour.) Merr	DA 067	4+
Sapindaceae		

*Hebecoccusferrugineae*Radlk	DA 116	2+
Pometiapinnata J.R. & G. Forst.	DA 097	3+
Urticaceae		
Urlicabullata BI.	DA 038	2+
Vitaceae		
*Cissusadnata*roxb	DA 010	1+

They had the striking richness of structural diversity, but were only classified into three main principal skeletons: quinolone, isoquinolone, and indole alkaloids. There are over 600 known indole alkaloids all derived from tryptophan and the other 9 to 10 carbons of these actually are obtained from a monoterpene precursor.

Our continuous work on *Fibraurea chloroleuca* has successfully isolated an alkaloid, a quaternary isoquinoline alkaloid as a yellowish crystal, m.p. 214-215 ^{o}C; MS (FAB) *m/z* 352, compound-1 such as palmatine from the *n*-butanol extract of *Fibraurea chloroleuca* roots [22]. This alkaloid significantly inhibited *Bacilus substilis, Shigela dysentriae, Staphylococus aireus,* and *Pseudomonas sp* growth. Sumatran people used the *Fibraurea chloroleuca* decoction as traditional medicine for scabies [19]. Now we are focusing on exploration of alkaloids from Fagraea fragrans, see Figure 4.

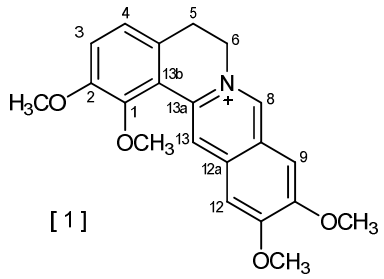

Figure 4. Quaternary isoquinoline alkaloid of *Fibraurea chloroleuca* root.

CONCLUSION

The results showed that a number of plants in this survey are potential for further chemical investigation, especially to the 33 species representing 15 families of containing alkaloids. The test indicated that the very strong positive alkaloid constituents were shown by *Alstonia angustiloba Mig.* (Apocynaceae), *Alstonia scholaris* (Apocynaceae), *Ervatamia coronaria* (Apocynaceae), *Voacanga foetida* (Bl.) K. Schum (Apocynaceae) *Litsea accedentoides* (Lauraceae), *Litsea angulata* (Lauraceae), *Litsea tomentosa* (Lauraceae), *Fibraurea chloroleuca M*iers (Menispermaceae) and *Uncaria cordata* (Lour.) Merr. (Rubiaceae).

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