Antioxidant Activity of Some Selected East Borneo Plants

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ABSTRACT

The native plants of East Borneo the Costus speciosus (Koening) J.E. Smith stem, Lagerstroemaspesiosa Pers leaf, Cerberamangans L. leaf, Vitistrifolia L. fruit., Scurrulaatropurpurea (Blume) Danser root, Bruceajavanica (L.) Merr. leaf, Lygodiummicrophyllum, Bidens Chinensis Willd., Sonneratacaseolaris L. peel, Sonneratacaseolaris L. stem is almost under-explored for their potential benefits. They were extracted by the solvents of increasing polarity (n-hexane, ethyl acetate, and n-butanol) were tested for their free radical activity against DPPH (2,2-diphenyl-1-picrylhydrazyl). The ethyl acetate extract of Costusspesiosus (Koening) J. E. Smith antioxidant were screened concentration of 68 ppm, similarly ethyl acetate extract of Vitistrifolia L., showed antioxidant activity at 64.30 ppm. As the ethyl acetate extract of Scurrulaatropurpurea (Blume), Bruceajavanica (L.) Merr, Lygodiummicrophyllum and Sonneratacaseolaris L. stem, showed antioxidant activity at 273.52 ppm, 91.12 ppm, 17.39 ppm and 7.03 ppm. N-butanol extract of Lagerstroemaspesiosa Pers, Cerberamangans L., Bidenschinensis Willd, and Sonneratacaseolaris L. peel showed 8.37 ppm, 128.59 ppm, 18.17 ppm and 54.29 ppm antioxidant activity using DPPH model systems. Owing to the property, the studies can be further extended to exploit them for their possible application for preservation of food products as well as their use as health supplements.

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1. INTRODUCTION

Indonesia is a country that has the greatest biodiversity in the world with more than thirty thousand species of plants efficacious as a medicine. Only about 180 species have been used in traditional medicine by the traditional medicine industry in Indonesia.

This is due to the utilization of Indonesian medicinal plants for treating a disease typically only based on empirical experience passed on from generation to generation without any supporting data that meets the requirements. To be accepted in modern medicine, some of the requirements must be met mainly its active substances, so in addition to efficacy, safety rate can be predicted easily [1].

According to philosophies theory, potential of biological resources for human life depends on the amount and type of chemical compounds. Biological resources used as pharmaceuticals, agro-chemicals, and materials science generally contain alkaloids, these Terpenoids, flavanoid compounds, phenols, and others. Variations and composition of these compounds make the biological resources of economic valuable, but the economic value that also trigger the damage because it is exploited or utilized in excess.

Potential of natural compounds in East Borneo tropical forest region untapped to good use. utilization in a traditional manner for using traditional medicine has been done, meanwhile, wild plants
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who grow up in East Borneo region that is one sources of antioxidant compounds that has not been a lot of disclosed [1].

A free radical can be defined any molecular species capable of independent existence that contains an unpaired electron in an atomic orbital. The presence of an unpaired electron results in certain common properties that are shared by most radicals. Many radicals are unstable and highly reactive [2]. These free radicals have very short half-life, high reactivity, and damaging activity towards macromolecules like proteins DNA and lipids. Oxidative stress is among the major causative factor in the induction of many chronic and degenerative diseases including atherosclerosis, ischemic heart disease, ageing, diabetes mellitus, immunosuppressant, cancer and others. [3]

The purpose this research is conduct screening antioxidant activity in selected East Borneo wild plants with DPPH (2,2-diphenyl-1-picrylhydrazyl) method.

2. RESEARCH METHOD

2.1. Collecting Sample

Sample was collected and chosen based on folklore or traditional treatment from the society around east Kalimantan. It was determined in dendrology laboratorium of forestry faculty Mulawarmanuniversity. It was determined to ensure plant species. It was sorted to dry out and to be extracted.

2.2. Extraction

Each sample was extracted using maceration method with different polarity solvent (n-hexane, ethyl acetate and n-butanol). Sample was macerated using n-hexane for 24 hours approximately. Extraction was continued with ethyl acetate and n-butanol in order respectively. Maceration with each solvent was repeated three times.

2.3. Antioxidant activity Determination

As much as 1.0 mL DPPH 0.4 mM put to Volumetrik flask, added a certain number of test material is then added up volume of 5.0 mL ethanol, mixed for 1 minute, until mixture is homogenous and silenced for 30 minutes. This solution is then measured its absorbance at a wavelength of 517 nm maximum wavelength which is in preliminary trials. Do negative control absorbance readings anyway i.e. without addition of solution.

The scavenging ability of the plant extract was determined by the following equation : [4]

\[
\text{IC}_{50} = \left( \frac{(\text{Abs.Control} - \text{Abs.sample}) \times 100}{\text{Abs.Control}} \right)
\]

The DPPH radical absorbs at 517 nm and in a second substrate-free system, antioxidant activity can be determined by monitoring the decrease in this absorbance. Results were reported as the EC50, that is, the amount of antioxidant necessary to decrease by 50% the initial DPPH concentration [5].

3. RESULTS AND ANALYSIS

Dried sample from some different plants such as: Costus specious (Koening) J.E. Smith stem, Lagerstroemaspesiosa Pers leaf, Cerberamangans L. leaf, Vitistrifolia L fruit., Scurrulaatropurpurea (Blume) Danser root, Bruceajavanica (L.) Merr.leaf, Lygodiummicrophyllum, Bidens Chinensis Willd., Sonneratia caseolaris L peel, Sonneratia caseolaris L steem. Each sample was extracted using maceration method with different polarity solvent (n-hexane, ethyl acetate and n-butanol). Sample was macerated using n-hexane for 24 hours approximately. Extraction was continued with ethyl acetate and n-butanol in order respectively. Maceration with each solvent was repeated three times.

Antioxidant activity was defined as ability of each extract to inactivating DPPH radical. Parameter for antioxidant activity is called IC_{50}. Sample was mixed with DPPH solution. Absorbance of dphp and sample mixture measured using UV-Vis spectrofotometre at 510-520 nm wavelength. Measurement result showed that maximum wavelength is at 517 nm.

DPPH free radical used in antioxidant activity measurement generally. Purple colour of DPPH solution was resulted from nitrogen’s free electron. DPPH radical’s free electron reacted with electron from antioxidant compound in sample. Reaction resulted 2,2-diphenyl-1-picrylhydrazyn which changed solution’s colour from purple to pale yellow (Figure 1) [6].
Figure 1. Reaction of Free Radical and DPPH

Table 1. Antioxidant activity of plant extracts

| No. | Plants                        | Ekstrakt         | Equation         | r   | IC50 (ppm) |
|-----|-------------------------------|------------------|------------------|-----|------------|
| 1   | Costus specious (Koening) J.E. Smith stem | N-heksane        | y = 0.2569x + 13.028 | 0.960 | 143        |
|     |                               | Ethyl Asetate    | y = 0.3483x + 26.073 | 0.951 | 68         |
|     |                               | n-Butanol        | y = 0.0679x + 12.358 | 0.972 | 547        |
| 2   | LagerstroemaspesiosaPers leaf  | n-heksane        | y = 1.173x + 28.055 | 0.983 | 18.7       |
|     |                               | Ethyl Asetate    | y = 1.763x + 11.505 | 0.994 | 21.8       |
|     |                               | n-Butanol        | y = 2.761x + 26.877 | 0.981 | 8.37       |
| 3   | Cerberamangan L. leaf         | n-heksane        | y = 0.0724x + 14.078 | 0.996 | 496.16     |
|     |                               | Ethyl Asetate    | y = 0.1661x + 28.068 | 0.950 | 132.04     |
|     |                               | n-Butanol        | y = 0.2545x + 17.274 | 0.998 | 128.59     |
| 4   | Vitistrifolia L. fruit        | n-heksane        | y = 0.201x + 14.590 | 0.996 | 176.17     |
|     |                               | Ethyl Asetate    | y = 0.400x + 24.286 | 0.987 | 64.28      |
|     |                               | n-Butanol        | y = 0.116 x + 21.970 | 0.987 | 241.64     |
| 5   | Scurrulaatropurpurea(Blume) Danser root | n-heksane      | y = 0.138x + 7.173 | 0.951 | 310.34     |
|     |                               | Ethyl Asetate    | y = 0.149x + 9.246  | 0.897 | 273.53     |
|     |                               | n-Butanol        | y = 0.109x + 1.689  | 0.995 | 443.22     |
| 6   | Brucejavanicat(L.) Merr. leaf | n-heksane        | y = 0.1264x + 21.297 | 0.972 | 227        |
|     |                               | Ethyl Asetate    | y = 0.257x + 26.585 | 0.937 | 91.12      |
|     |                               | n-Butanol        | y = 0.1495x + 26.896 | 0.960 | 154.54     |
| 7   | Lygodiummicrophyllum          | n-heksane        | y = 0.2305x + 4.987 | 0.992 | 195.28     |
|     |                               | Ethyl Asetate    | y = 2.9982x - 2.137 | 0.996 | 17.39      |
|     |                               | n-Butanol        | y = 1.8474x + 4.36  | 0.974 | 24.70      |
| 8   | Bidens Chinesis Willd            | n-heksane        | y = 0.194x + 2.740  | 0.997 | 243.61     |
|     |                               | Ethyl Asetate    | y = 0.648x + 14.434 | 0.998 | 54.89      |
|     |                               | n-Butanol        | y = 2.596x + 2.826  | 0.999 | 18.17      |
| 9   | Sonneratiacaseolaris L. peel   | n-heksane        | y = 0.2737x + 31.3  | 0.989 | 67.48      |
|     |                               | Ethyl Asetate    | y = 0.470x + 1.346  | 0.992 | 109.24     |
|     |                               | n-Butanol        | y = 0.790x + 7.104  | 0.980 | 54.29      |
| 10  | Sonneratiacaseolaris L. steem  | n-heksane        | y = 1.601x + 1.370  | 0.973 | 30.37      |
|     |                               | Ethyl Asetate    | y = 5.995x + 7.882  | 0.991 | 7.03       |
|     |                               | n-Butanol        | y = 4.373x + 7.604  | 0.998 | 9.69       |

Concentration of sample that could scavenge 50 % free radical (IC50) was used to determine antioxidant capacity of sample compared to standard. Sample that had IC50 < 50 ppm, it was very strong antioxidant, 50-100 ppm strong antioxidant, 101-150 ppm medium antioxidant, while weak antioxidant with IC50 > 150 ppm[7].

Research results in Table 1 indicate that the extract has a very strong antioxidant activity among others Lagerstroemaspesiosa Pressleaves with IC50 values of each extract n-butanol 8.37 ppm, 18.17 ppm n-hexane and ethylacetate extract of 21.8 ppm. Lygodiummicrophyllum 17.39 ppm ethyl acetate extract and 24.70 ppm of n-butanol in IC50. Bidens Chinesis Willd n-butanol extract with IC50 value of 18.17 ppm. And Sonneratiacaseolaris L. steem with IC50 values in 7.03 ppm the ethyl acetate and 9.69 ppm n-butanol, and n-hexane of 30.37 ppm extract.

The extract of ethyl acetate Costusspecious (Koening) J.E Smithstem and Vitistrifolia L. fruit, Bidens Chinesis Willd with respective IC50 of 68 ppm, 64.28 ppm and 54.89 ppm has powerful antioxidant. While extracts which have antioksidan activity being that n-hexane extract of Costusspecious(Koening) J.E Smithstem with IC50 of 143 ppm, Cerberamangan L leaves with IC50 values in the ethyl acetate extract of 132.04 ppm.
and 128.59 ppm n-butanol and ethylacetate extracts Sonneratia caseolaris L. peel with IC$_{50}$ of 109.24 ppm. And extracts which have a weak antioxidant activity of n-hexane extracts Vitistrifolia L. fruit and Lygodium microphyllum with IC$_{50}$ values of each 176.17 ppm and 195.28 ppm, and n-butanol extract Bruceajavanica (L.) Merr. Leaves with IC$_{50}$ of 154.54 ppm. While the extract with IC$_{50}$ values above 200 ppm excluding categories that have antioxidant activity.

The antioxidant activity exhibited by plant extracts obtained from the activity is suspected of secondary metabolites present in the plant above [8].

Secondary metabolites are produced or synthesized compounds on cells and certain taxonomic groups in the rate of growth or a particular stress. Secondary metabolites are used as modern medicine among other alkaloids from plants Rouwolvia serpentine, atropine from Hyoscyamus niger plant, Caffeine from Coffea Arabica plant, Caffeine from Erythorxyln coca plant, and Vinblastine from Catharanthus roseus [9].

Some secondary metabolits such as phenolic and flavonoid group has recorded a reduction of free radicals activity [9],[10].

In general it can be seen that the best antioxidant activity of each plant in Table 2.

Table 2. The best activity of each plant

| No | Plants                                | Ekstrat   | IC$_{50}$ (ppm) |
|----|---------------------------------------|-----------|-----------------|
| 1  | Costus specious (Koening) J.E. Smith stem | EtilAsetat | 68              |
| 2  | LagerstroemaspesisiaPers leaf         | n-heksan   | 18.7            |
| 3  | CerberamangansL leaf                  | n-butanol  | 128.59          |
| 4  | Vitistrifoliak. fruit                 | EtilAsetat | 64.28           |
| 5  | Sceculustroppurpurea(Blume) root      | EtilAsetat | 273.53          |
| 6  | Bruceajavanica (L.) Merr. leaf        | EtilAsetat | 91.12           |
| 7  | Lygodiummicrophyllum                 | EtilAsetat | 17.39           |
| 8  | BidensChinensisWilld                 | n-butanol  | 18.17           |
| 9  | Sonneratia caseolarisL. peel         | n-butanol  | 54.29           |
| 10 | Sonneratia caseolarisL. steem         | EtilAsetat | 7.03            |

Based on the results of the determination of antioxidant activity (IC50) of some herbsare extracted using solvents with different polarity level (n-hexane, ethylacetate, and n-butanol). Showed that the plants that grow naturally in East Kalimantan region has a very promising potential as a source of natural antioxidants that can be developed into a good health product in dosage form drugs and health sulplemen.

4. CONCLUSION

Based on the research that has been done, it can be concluded that results of screening antioxidant activity of various extracts from each plant is known that most of the material has potential as a natural antioxidant from the category of the most powerful to the weak category.

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