Qualitative study of phytocompounds antiradical potential from selective extracts of three plants, used in neurodegenerative diseases traditherapy in Côte d'Ivoire.

Abstract
The Ivorian flora is rich in plants of interest, some of which are used to treat neurodegenerative diseases. Among them, *Nauclea latifolia* (NL), *Bombax costatum* (BC) and *Vernonia cinerea* (VC) were studied for their potential. This qualitative research focuses on the phytochemical screening and the evaluation of the antioxidant power of selective extracts hexane, chloroform, ethyl acetate and n-butanol of these plants. These extracts were obtained by a series of successive extractions with solvents varying according to polarity, revealing the presence of sterols, terpenes, phenols and alkaloids. The antioxidant capacities observed are said to be due to the synergistic action of these phytochemical families, explaining their neuroprotective effects.
Keywords: plant, selective extract, antioxidant activity, neurodegeneration.

1. INTRODUCTION

Since the 1990s, the combination of molecular and structural biology, as well as chemistry, has led to the discovery of numerous drugs **[1].** However, this approach has not achieved the expected success, particularly for neurodegenerative diseases such as Alzheimer's disease (AD). Although this method is becoming less favored by the pharmaceutical industry, a recent study has shown that it remains more effective than targeted approaches for identifying first-class therapeutic small molecules **[2].** The African flora especially that of Côte d'Ivoire, constitutes an important reservoir of phytomedicines used in traditional therapy against many pathologies **[3].** However, neurodegenerative diseases, such as Alzheimer's disease **[4, 5],** often remain neglected, even though some plants used by traditional healers might offer potential solutions. Indeed, plants are recognized for their biological properties, particularly their antioxidant activity, which plays a crucial role in the treatment and prevention of diseases related to oxidative stress **[6-8].** This study aims to qualitatively highlight [9] the chemical composition and antioxidant activity of three plants from the Ivorian pharmacopoeia used in the traditional treatment of neurodegenerative diseases **[10]:** *Nauclea latifolia* (Smith) (Rubiaceae), *Bombax costatum* (Pellegr. & Vuill) (Bombacaceae), and *Vernonia cinerea* (Less.) (Asteraceae). These plants were identified through an ethnobotanical survey **[11-17].** Analyses were carried out on selective extracts **[18-23],** due to the complexity of the phytochemical analysis of crude plant extracts.

2. Materials and Methods

2.1. Materials

2.1.1. Chemicals and Consumables

The chemicals used are of analytical grade. The solvents and reagents employed were purchased from Alfa Aesar and Sigma-Aldrich (France). For phytochemical screening using thin-layer

chromatography (TLC), silica gel 60 F_{254} chromatoplates, aluminum support 20 × 20 cm (Merck, Germany) were used.

2.1.2. Plant Material

The plant material studied includes the organs of three plants of interest from Côte d'Ivoire: *Nauclea latifolia*, *Bombax costatum*, and Vernonia cinerea. Various organs of these plants were collected from different regions of the country. Their authentication was carried out at the National Center for Floristics (CNF) of Félix Houphouët-Boigny University (Abidjan-Cocody) using available herbarium specimens and confirmed by Prof. MALAN D. F., an ethnobotanist at Nangui ABROGOUA University (Abidjan). For each of these plants, the studied organs and collection sites are specified in **Table 1.**

Table 1: Informative Record on the Three (3) Plants Studied

Studied plant	Botanical family	Studied organ	Collection site
Nauclea latifolia (NL)	RUBIACEAE	Roots	Bouaflé
Bombax costatum (BC)	BOMBACACEAE	Leaves	Toumodi
Vernonia cinerea (VC)	FABACEAE	PL*	Abidjan (UNA)**

*PL : Whole plant ; **UNA : Nangui ABROGOUA university site

2.2. Methods

2.2.1. Preparation of Selective Extracts

The harvested organs were cleaned with running water and then placed on a laboratory bench under air conditioning (18°C) until a constant mass was obtained. The powders obtained after grinding with an artisanal electric grinder were stored in tightly closed glass jars for the preparation of the various selective extracts. 15 g of powder from each plant were macerated in 100 mL of methanol (MeOH, 80%), with magnetic stirring for 2 hours. This operation was repeated 3 times with the same residues. After filtration on Büchner, the obtained macerates were combined, and the aqueous extract was stored in the refrigerator (4-5°C) for 24 hours to precipitate lipophilic compounds. After decantation and vacuum concentration, the crude hydromethanolic concentrates (E1 for *N. latifolia*, E2 for *B. costatum*, and E3 for *V. cinerea*) were successively treated with 3×30 mL of hexane (n-C_6H_{14}), chloroform ($CHCl_3$), ethyl acetate (AcOEt), and n-butanol (n-BuOH). The solvents were then removed to give the respective selective extracts: hexane **(**E_1^I-E_3^I**),** chloroform **(**E_1^{II}-E_3^{II}**)**, ethyl acetate **(**E_1^{III}-E_3^{III}**)**, and n-butanol **(**E_1^{IV}-E_3^{IV}**)** [**9, 18, 24]**. These extracts were used as samples for phytochemical screening and antioxidant power detection by thin-layer chromatography (TLC).

2.2.2. Phytochemical Screening

To identify the content of phytochemical metabolites in the various extracts, TLC was used **[9, 21, 25-30]**. Using a capillary, 2 µL of each extract were deposited as spots 1 cm apart from each other on the chromatoplates, at 1.5 cm from the lower edge and 8 cm from the front line, located 0.5 cm from the upper edge. For each family of phytochemical compounds to be identified, appropriate developers and visualizers were employed.

2.2.3. Detection of Antiradical Potential

The technique for detecting the antiradical potential of selective extracts following Takao's methodology **[26]**, as adapted by Kabran **[25]**, was used. The stable radical DPPH (1,1-diphenyl-2-picrylhydrazyl) was used as the reference oxidant **[23, 31-33]**.

3. Results and Discussion

3.1. Yields of Selective Extracts

Successive extractions with hexane, chloroform, ethyl acetate, and n-butanol yielded respective percentages ranging from 0.80 to 9.33% for *N. latifolia*, from 0.27 to 11.10% for *B. costatum*, and from 0.27 to 10% for *V. cinerea* **(Table 2).**

Table 2 : Yields of Selective Extracts in Percentage (%)

Extract / Plant	Hexane	Chloroforme	Ethyl acetate	n-Butanol
NL	0.80	4.67	6.80	9.33
BC	0.27	0.53	8.00	11.10
VC	0.27	0.73	6.67	10.00

***NL**: *N. latifolia*, **BC**: *B. costatum*, **VC**: *V. Cinerea*

The results indicate that the yield is significantly influenced not only by the extraction power of the solvent but also by the extraction technique used. Furthermore, n-butanol, being the most polar solvent, presents the best extractability profile among the four solvents used for each plant. Similar results have been reported by other researchers **[34, 35].**

3.2. Phytochemical Profiles of Selective Extracts

Tables (3-6) below present the results of the qualitative phytochemical screening of hexane, chloroform, ethyl acetate, and n-butanol extracts of the organs of the studied plants. The phytochemicals predominantly identified are phenolic compounds, flavonoids, coumarins, tannins, alkaloids, sterols, and terpenes. Thus, the phytochemical diversity of the plants is highlighted. These results do not contradict those reported in the literature **[9, 25, 31, 32]**. Sterols and terpenes have a wide range of beneficial applications and are indispensable in various sectors (biology, health, industry). These biomolecules also have beneficial effects on human health. Like cholesterol, sterols are essential components of animal and plant cell membranes, contributing to membrane fluidity and stability **[36, 37].** Phytosterols, for example, help reduce blood cholesterol levels and thus decrease the risk of cardiovascular diseases. Additionally, they are used in the production of steroid medications and cosmetics for their emollient and moisturizing properties. Terpenes, on the other hand, play a role in plant defense against herbivores and pathogens, as well as in pollination by attracting pollinators. They have numerous properties, including anti-inflammatory, antimicrobial, antiviral, and anticancer activities. One such example is lupeol, a pharmacologically active triterpenoid **[38-40].** Terpenes are also widely used in aromatherapy and herbal medicines, in the manufacture of perfumes, cosmetics, and cleaning products due to their pleasant aromas. Alkaloids have broad biological activities, even in infinitesimal doses. In conventional medical practice, they are used as major analgesics (morphine), antimalarials (quinine), nervous system stimulants (strychnine, nicotine), psychotropics (cocaine, mescaline), cholinergics (pilocarpine), anticancer agents (vinblastine, vincristine), anthelmintics, paralytic substances (curare, caffeine), and to lower blood uric acid levels (colchicine) **[41].** These phytobiocides also have antimicrobial, anti-inflammatory, antiviral, antineoplastic properties, and are acetylcholinesterase inhibitors (effective in Alzheimer's disease) **[41].** Flavonoids are known for their multiple benefits on human health. They are excellent antioxidants and anti-inflammatory agents. Coumarins reduce edema and inflammation. These phytochemicals inhibit the multiplication of pathogenic bacteria, thus preventing the formation of gases and deleterious metabolites for the digestive system **[42].** Tannins bind to proline-rich proteins and interfere with protein synthesis **[43].** Therefore, the results obtained suggest that plant organs, including leaves, bark, and roots, are the sites of biosynthesis and accumulation of specialized plant metabolites involved in the biological effects of plants.

Table 3 : Phytocompounds identified in hexane extracts

Extract	Rf, Color, Developer, Possible compound in hexane extracts
E_1^I	0.89(vi^{d}) : ***te*** ; 0.83(vi^{d}) : ***te*** **;** 0.71(j^{a}) : ***ni*** ; 0.65(vi^{e}-jp^{k}) : ***ant^{e,k}*** ; 0.60(br^{b}) : ***st*** ; 0.58(j^{c}- v^{d}) : ***st^{c}/trte^{d}*** ; 0.52(b^{a}-jo^{b}-j^{c}) : ***trl^{b}/st^{c}*** ; 0.45(br^{b}-vf^{c}-vi^{d}) : ***st^{b,c}/te^{d}*** ; 0.40(b^{a}–r^{b}-v^{c}) : ***st*** ; 0.32(b^{a} –j^{b}-v^{c}-r^{e}-jp^{k}) : ***st^{b,c,k}/cou^{e,k}*** ; 0.29(v^{d}) : ***ni*** ; 0.25(j^{b}-v^{c}) : ***st*** ; 0.21(v^{a}-r^{e}) : ***cou*** ; 0.13(vi^{b}-v^{c}-j^{e1}-r^{e}-jp^{k}) : ***tro^{b,c,k}/cou^{e1,e,k}*** **;** 0.06(j^{a}-j^{b}-v^{c}) : ***st*** ; 0.02(v^{a}-br^{b}-jp^{k}) : ***st^{b,k}.***
E_2^I	0.93(j^{b}–j^{c}) : ***st*** ; 0.67(jv^{d}) : ***ni*** **;** 0.62(v^{d}) : ***ni*** ; 0.58(r^{b}-j^{c}) : ***te*** ; 0.56(rg^{a} –j^{b}-v^{c}) : ***st*** ; 0.45(b^{a}- j^{b}–j^{c}) : ***st*** ; 0.42(vi^{e}) : ***ant*** ; 0.37(vi^{d}) : ***te*** ; 0.36(j^{b}–j^{c}) : ***st*** ; 0.30(vf^{a} –j^{b}-jv^{c}) : ***st*** ; 0.21(b^{a}- r^{b} –v^{c}) : ***st*** ; 0.14(r^{b}-v^{c}) : ***st*** ; 0.10(b^{a}- j^{b} –jo^{c}-vi^{d}-vi^{e}) : ***te^{b,c,d,k}/ant^{e}*** ; 0.07(j^{b}-j^{c}-v^{e}) : ***st^{b,c}/ant^{e}.***
E_3^I	0.64(v^{d}) : ***ni*** ; 0.56(b^{a}-j^{b,c}) : ***st*** **;** 0.45(vi^{e}) : ***ant*** ; 0.33(b^{e}) : ***cou*** ; 0.24(b^{a} –j^{b}-vi^{c,d}-jp^{k}) : ***st^{b,c,k}/te^{d,k}*** ; 0.14(r^{b}- vi^{b}-j^{e1}-vi^{e}) : ***tro^{b}/ant^{e}*** ; 0.10(j^{b}-vi^{b}-g^{d}) : ***tro^{b}/ni^{d}*** ; 0.05(vi^{d}) : ***te***.

Rf : frontal ratio; *j/yellow; jv/yellow-green; jp/pale-yellow; v/green; vf/fluorescent green; vi/purple; o/orange; b/blue; bf/fluorescent blue; m/brown; br/brown ; gr/grey; rg/red; r/pink; a/without developer/366 nm; a1/without developer/visible; b/Libermann-Bürchard/visible; c/Libermann-Bürchard/UV366 nm; d/Godin/visible ; e/KOH/UV366 nm; e1/KOH/visible; f/Neu/visible; j/Neu/UV366; h/$AlCl_3$; i/$FeCl_3$; k/DPPH; l/Dragendorff; m/NH_3; st/sterol; te/terpene ; tro/triterpene of the oleanane or ursane type; trl /triterpene of the lupane type; cou/coumarin; ant/anthracene; ni/unidentified; E_1^I , E_2^I, E_3^I : hexane extracts of *N. latifolia*, *B. costatum* and *V. cinerea*, respectively.

Table 4 : Phytocompounds identified in chloroform extracts

Extract	Rf, Color, Developer, Possible compound in chloroform extracts
E_1^{II}	0.96(j^{a1}-j^{a}) : ***ni*** ; 0.83(j^{a1}-b^{a}-b^{j}-jp^{k}) : ***fl^{k}*** **;** 0.71(b^{a}-vf^{h}-bf^{e}) : ***fl^{h}/cou^{e}*** ; 0.63(b^{a}-vi^{d}-jo^{i}-jp^{k}) : ***te^{k,d}/ph^{i,k}*** **;** 0.54(b^{a}) : ***ni*** ; 0.45(j^{a}-b^{h}-v^{e}) : ***fl^{h}/cou^{e}*** ; 0.39(b^{j}) : ***fl*** ; 0.30(j^{a}-vi^{d}-j^{h}) : ***te^{d}/fl^{h,k}*** ; 0.27(b^{h}) : ***fl*** ; 0.26(j^{a} –j^{l}-v^{h}-vi^{e}) : ***fl^{j,h}/cou^{e,k}*** ; 0.21 (b^{l}-v^{d}) : ***fl^{jk}/st^{d}*** ; 0.19(j^{a}-b^{d}) : ***st*** ; 0.14(j^{j}) : ***fl*** ; 0.02(o^{l}) : ***alc^{lk}.***
E_2^{II}	0.96(j^{a1}-v^{d}) : ***st*** ; 0.87(v^{j}) : ***fl^{k}*** **;** 0.67(J^{a1}-v^{d}) : ***te*** ; 0.63(vi^{a}-j^{j}) : ***fl*** ; 0.60(vf^{h} –j^{e1}-v^{e}) : ***fl^{h,k}/cou^{e}*** ; 0.56(m^{a}) : ***ni*** ; 0.54(jv^{i}) : ***ph^{k}*** ; 0.50(j^{f}-jf ^{j}) : ***fl^{k}*** ; 0.48(br^{d}) : ***st*** ; 0.40(j^{e1} –vi^{e}) : ***ant*** ; 0.38 (vi^{a1}) : ***ni*** ; 0.33(j^{f}-jf ^{j}-jp^{k}) : ***fl*** ; 0.31(ve^{h}) : ***fl*** ; 0.22(j^{f}- v^{j}) : ***fl ^{f,j}*** ; 0.20(vi^{d}-b^{e}) : ***te^{d}/cou^{e,k}*** ; 0.18(o^{l}) : ***alc^{lk}*** ; 0.09(o^{l}) : ***alc^{l}.***
E_3^{II}	0.93(b^{j}) : ***fl*** ; 0.75(m^{a}-o^{j}) : ***fl*** **;** 0.69(J^{f,j}-j^{e1}) : ***fl^{f,j}/cou^{e1}*** ; 0.45(vi^{a,h}-j^{e1}- vi^{e}-jp^{k}) : ***fl^{h,k}/cou^{e1,k}/ant^{e}*** ; 0.39(v^{j}) : ***ph*** ; 0.36(j^{f,j}-vi^{e} – jp^{k}) : ***fl^{f,k}/cou^{e,k}*** ; 0.32(g^{d}) : ***ni*** ; 0.23(o^{e}) : ***cou*** ; 0.12(j^{a,j}-jp^{k}) : ***fl.***

Rf : Frontal ratio; *j/yellow; jv/yellow-green; jp/pale-yellow; v/green; vf/fluorescent green; vi/purple; o/orange; b/blue; bf/fluorescent blue; m/brown; br/brown; gr/grey; rg/red; r/pink; a/without developer/366 nm; a1/without developer/visible; b/Libermann-Bürchard/visible ; c/Libermann-Bürchard/UV366 nm; d/Godin/visible; e/KOH/UV 366 nm; e1/KOH/visible; f/Neu/visible; j/Neu/UV366; h/$AlCl_3$; i/$FeCl_3$; k/DPPH; l/Dragendorff ; m/NH_3; st/sterol; te/terpene; cou/coumarin; ant/anthracene; fl/flavonoid; ta/tanin; alk/alkaloid; ph/phenolic compound; ni/unidentified. E_1^{II}, E_2^{II}, E_3^{II} : chloroform extracts of *N. latifolia*, *B. costatum* and *V. cinerea*, respectively.

Table 5 : Phytocompounds identified in ethyl acetate extracts

Extract	Rf, Color, Developer, Possible compound in ethyl acetate extracts
E_1^{III}	0.96(j^{a1}-rg^{a}-rg^{h}-r^{j}) : ***fl^{h,j,k}*** ; 0.71(j^{a1}-rg^{a}-br^{h}-b^{j}) : ***fl^{h,j}*** ; 0.60(o^{j}-b^{e}-jp^{k}) : ***fl^{j,k}/cou^{e,k}*** ; 0.55(rg^{a}-bf^{h,j}) ; ***fl^{h,j,k}*** ; 0.44(b^{h,j}) : ***fl^{h,j}*** ; 0.14(b^{h}-vi^{e}) : ***fl^{h}/ant^{e}*** ; 0.06(b^{j}) : ***fj^{j}*** ; 0.04(j^{h}) : ***fl^{h}*** ; 0.02(g^{i}) : ***ta*** **.**
E_2^{III}	0.95(j^{a1}-rg^{a}-br^{h}-r^{j}) : ***fl*** ; 0.73(j^{a1}-rg^{a}-rg^{j}-jp^{k}) : ***fl*** ; 0.64(vi^{a}-v^{h}) : ***fl*** ; 0.60(rg^{j}) ; ***fl*** ; 0.54(rg^{a} –bf^{h}-b^{j} – jp^{k}) : ***fl^{k}*** ; 0.43(v^{h}) : ***fl*** ; 0.11(b^{h}) : ***fl*** ; 0.06(vi^{e}) : ***ant*** ; 0.02(gr^{i}-jp^{k}) : ***ta*** **.**
E_3^{III}	0.98(r^{a1}) : ***ni*** ; 0.74(rg^{a,j}) : ***fl*** **;** 0.68(rg^{a,h}-vi^{j}) : ***fl^{k}*** ; 0.65(br^{i}-vi^{e}) ; ***ta^{i}/ant^{e}*** ; 0.60(o^{j}) : ***fl*** ; 0.52(rg^{a}-j^{j}-g^{i}) : ***fl^{j}/ta^{i}*** ; 0.17(g^{i}) : ***ta*** ; 0.08(vi^{e}) : ***ant***; 0.04(v^{h}-b^{j}): ***fl***

Rf : frontal ratio; *j/yellow; jv/yellow-green; jp/pale-yellow; v/green; vf/fluorescent green; vi/puple; o/orange; b/blue; bf/fluorescent blue; m/brown; br/brown; gr/grey; rg/red; r/pink; a/without developer/366 nm; a1/without developer/visible ; b/Libermann-Bürchard/visible; c/Libermann-Bürchard/UV366 nm; d/Godin/visible; e/KOH/UV 366 nm; e1/KOH/visible; f/Neu/visible; j/Neu/UV366; h/$AlCl_3$; i/$FeCl_3$; k/DPPH; l/Dragendorff; m/NH_3; st/sterol; te/terpene; tr. ou/triterpene of the oleanane and ursane type; cou/coumarin; ant/anthracene; fl/flavonoid; ta/tanin; alc/alkaloid; ph/phenolic compound; ni/unidentified. E_1^{III}, E_2^{III}, E_3^{III} : ethyl acetate extracts of *N. latifolia*, *B. costatum* and *V. cinerea*, respectively.

Table 6 : Phytocompounds identified in n-butanol extracts

Extract	Rf, Color, Developer, Possible compound in n-butnol extracts
E_1^{IV}	0.99(b^{h}-v^{j}-g^{i}) : ***fl^{h,j}/ta^{i}*** ; 0.93(v^{j}) : ***fl^{k}*** ; 0.87(o^{j}) : ***fl*** ; 0.52(vi^{h}-o^{j}) : ***fl^{h,j}*** **;** 0.40(vi^{m}- jp^{k}) : ***anth***^{m,k}.
E_2^{IV}	0.96(j^{i}) : ***ph*** ; 0.66(g^{i}- jp^{k}) : ***ta^{i,k}*** ; 0.64(vf^{h}- jv^{j}- jp^{k}) : ***fl ^{h,j}*** ; 0.52(j^{h}-o^{j}- o^{m} – jp^{k}) : ***fl^{h,j,k}*** ; 0.48(b^{m}- jp^{k}) : ***cou*** ; 01.0(vi^{m}) : ***anth***.
E_3^{IV}	0.99(b^{h}-bf^{i}) : ***fl*** ; 0.83(j^{h}- jf^{i}-jp^{k}) : ***fl^{h,j,k}*** ; 0.80(b^{j}) : ***fl*** ; 0.62(v^{j}) : ***fl*** ; 0.52(b^{h}-o^{j}-jp^{k}) : ***fl^{h,j,k}/cou^{e,k}*** ; 0.43(vi^{j}-b^{m}) : ***fl^{j}/cou^{m}.***

Rf : Frontal ratio; *j/yellow; jv/yellow-green; jp/pale-yellow; v/green; vf/fluorescent green; vi/ purple; o/orange; b/blue; bf/fluorescent blue; m/brown; br/brown; gr/gray; rg/red; r/pink; a/without developer/366 nm; a1/without developer/visible; b/Libermann-Bürchard/visible; c/Libermann-Bürchard/UV366 nm; d/Godin/visible; e/KOH/UV 366 nm; e1/KOH/visible; f/Neu/visible; j/Neu/UV366; h/$AlCl_3$; i/$FeCl_3$; k/DPPH; l/Dragendorff; m/NH_3; st/sterol; te/terpene; tr. or/triterpene of the oleanane and ursane type; cou/coumarin; ant/anthracene; fl/flavonoid; ta/tanin; alk/alkaloid; ph/phenolic compound; anth./anthocyane; ni/unidentified. E_1^{IV}, E_2^{IV}, E_3^{IV} : n-butanol extracts of *N. latifolia*, *B. costatum* and *V. cinerea*, respectively.

3.3. Qualitative Evaluation on the Layer of the Antiradical Potential of Selective Extracts

Tables (3-6) highlight the presence of pale-yellow spots on a purple background, represented by the letter k, corresponding to the application of the DPPH solution. This suggests that certain selective extracts contain phytocompounds capable of scavenging free radicals. By comparing the chromatographic profiles of the phytochemical screening of the selective extracts with those of the detection of antiradical potential, the correspondence between the active zones and the phytocompounds responsible for this activity has been established. The chromatographic profiles of the selective extracts show molecular fingerprints (pale yellow on purple visible in the chromatograms) that would correspond to the manifestation of the antiradical power detected in the mostly identified phytocompounds **(Table 7).** This antiradical aptitude of the extracts seems to primarily justify the use of the plants of interest in traditional medicinal practices against neurodegenerative diseases in particular.

Table 7: Results of the thin-layer detection of the antioxidant potential of phytocompounds identified in the selective extracts.

		Phytochemical family										
Extract	**Plant**	**Sterols**	**terpenes**	**Triterpenes**	**Coumarines**	**anthracenes**	**Anthocyanes**	**Flavonoids**	**Tanins**	**alkaloids**	**c. phénoliques**	**Antioxidant activity**
Hexane	*N. latifolia*	++	-	+	++	+	-	-	-	-	-	B
	B. costatum	-	+	-	-	+	-	-	-	-	-	M
	V. cinerea	+	+	-	-	-	-	-	-	-	-	M
Chloroform	*N. latifolia*	-	+	-	+	-	-	+++	-	+	+	B
	B. costatum	-	-	-	+	-	-	++	-	+	+	B
	V. cinerea	-	-	-	++	-	-	++	-	-	+	B
Ethyl acetate	*N. latifolia*	-	-	-	+	-	-	+++	-	-	-	B*
	B. costatum	-	-	-	-	-	-	+	+	-	-	M
	V. cinerea	-	-	-	-	-	-	+	-	-	-	M
n-Butanol	*N. latifolia*	-	-	-	-	-	+	+	-	-	-	M
	B. costatum	-	-	-	+	-	-	+	+	-	-	B*
	V. cinerea	-	-	-	+	-	-	++	-	-	-	B*

+ : presence ; ++ : medium presence ; +++ : abundant presence ; - : absence ; M : minor ; B : good ; B*: average

4. Conclusion

The enhancement of species such as *Nauclea latifolia*, *Bombax costatum*, and *Vernonia cinerea* could open new perspectives in the traditional treatment of neurodegenerative diseases. Scientific research on the phytochemical and antiradical properties of these plants is essential to understand their therapeutic potential. The copresence of various phytochemical families in the studied extracts, as well as their ability to neutralize DPPH free radicals, are promising discoveries.

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