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Phytochemicals isolated from the root bark of *Sarcocephalus latifolius* (Sm.) E.A.Bruce

Abdulfatai T. Ajiboye[a,b,c], Olayinka T. Asekun[b], Oluwole B. Familoni[b], Zulfiqar Ali[c,*], Yan-Hong Wang[c], Mustafa Ghanadian[c,d], Fazila Zulfiqar[c], Christopher Larbie[c,e], Odewo A. Samuel[f], Ikhlas A. Khan[c]

[a] Department of Chemical, Geological, and Physical Sciences, Kwara State University, Malete, Nigeria
[b] Department of Chemistry, Faculty of Science, University of Lagos, Lagos, Nigeria
[c] National Center for Natural Products Research, School of Pharmacy, University of Mississippi, University, MS, 38677, United States
[d] Isfahan Pharmaceutical Sciences Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
[e] Department of Biochemistry and Biotechnology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
[f] Department of Forest Conversation and Protection, Forestry Research Institute of Nigeria, Jericho, Ibadan, Nigeria

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ABSTRACT

Phytochemical investigation of the root bark of *Sarcocephalus latifolius* resulted in isolation and identification of eight compounds, including triterpenoid glycosides (**1-4**), ethyl glucoside (**5**), monoterpene indole alkaloids (**6-7**), and sterol (**8**). The structure elucidation of isolated compounds was achieved on the basis of NMR and mass spectral data. Compounds **2-5** were isolated for the first time from this genus and their chemotaxonomic significance was discussed.

1. Subject and source

The genus Sarcocephalus (syn. *Nauclea)* are tropical evergreen trees or shrubs in the Rubiaceae family. They are native to Africa and Asia (Gidado et al., 2005) and widely distributed in the forests and tropical forests of West Africa (Benin, Burkina Faso, Cameroon, Democratic Republic of Congo, Ghana, and Nigeria) (Lamidi et al., 1995). *Sarcocephalus latifolius* (Sm.) E.A.Bruce (syn. *Nauclea latifolia* Smith*)* is a multi-stemmed small tree with glossy, rounded-ovate leaves with interesting flower and large red ball fruit (Haudecoeur et al., 2018). It is commonly known as Pin cushion tree (in English), African peach, and Scille maritime (in French) (Arise et al., 2012). In Nigeria, this plant is known as “Egbesi”, “Tafashiya,” or “Ubulu inu” by Yoruba, Hausa and Igbo tribes respectively and locally used to treat diabetes, diarrhea, malaria, leprosy, debility, hypertension, prolonged menstrual flow, gastrointestinal disorders, stomach ache, fever, jaundice and dysentery (Gidado et al., 2005; Kerharo, 1974; Abreu and Pereira, 1998; Okwori et al., 2008; Maitera et al., 2011; Elujoba, 1995). In the present study, the root bark of *S. latifolius* was collected in April 2017 from Kwara State University environ, Malete, Nigeria (8° 42′ 35.9215″ N, 4° 27′ 59.5904″ E). The plant was taxonomically identified and authenticated by Mr Odewo A. Samuel (Department of Forest Conversation and Protection, Forestry Research Institute of Nigeria (FRIN)), Ibadan Oyo State, Nigeria, where its voucher specimen (FHI 112260) was deposited. A voucher specimen (#20831) was also deposited at the National Centre for Natural Products Research, University of Mississippi, USA.

2. Previous work

Previous phytochemical reports on *S. latifolius* showed the presence of indole alkaloids, triterpenoids, steroids, and saponins (Ngnokam et al., 2003; Shigemori et al., 2003; Abreu and Pereira, 2001). The literature survey revealed that monoterpene indole alkaloids are higher in numbers among the isolated phytochemicals from this genus.

3. Present study

The air-dried pulverized root bark of *S. latifolius* (500 g) was extracted with 95% ethanol (3 × 4 L × 72 h) at ambient temperature. The extracts were filtered, combined and evaporated under reduced pressure at 40 °C to afford 20 g of the crude extract. An aliquot of the

* Corresponding author.
E-mail address: zulfiqar@olemiss.edu (Z. Ali).

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ethanol extract (8.0 g) was subjected to column chromatography (CC) over a normal silica gel (230–400 mesh) and eluted with a combination of solvents chloroform/ethyl acetate/methanol/water (8:15:2:0.5). The progress of the column was monitored by TLC of the resulting fractions and spots were visualized by employing a UV light (254 and 360 nm) as well as by heating after vanillin-H_2SO_4 reagent spray. Column fractions were combined based on the TLC pattern to afford six fractions (A-F). Fraction B (300.3 mg) was washed with methanol (20 mL) to afford white crystalline compound **8** (25.1 mg). Fraction C (262.2 mg) was loaded onto a silica gel column (60 cm × 2.5 cm), eluted with chloroform/ethyl acetate/methanol/water (8:15:2:0.5) to afford 10 fractions which were further pooled to afford two sub-fractions (C1 and C2) based on their TLC profile. Fraction C1 (20.2 mg) was further purified over a Sephadex LH-20 column with methanol to give compound **1** (6.7 mg). Fraction D (250.4 mg) was chromatographed over a silica gel column (56 cm × 2.5 cm) with chloroform/ethyl acetate/methanol/water (8:15:2:0.5) to give eight fractions which were pooled based on their TLC profiles to three sub-fractions (D1-D3). Fractions D1 (15.5 mg) and D2 (38.2 mg) were further purified by Sephadex LH-20 (20 cm × 0.5 cm) CC with methanol as eluting solvent to afford compound **2** (2.6 mg) and compound **3** (6.0 mg), respectively. Fraction D3 (120.3 mg) afforded compound **6** (64.4 mg) after being chromatographed over a silica gel column (56 cm × 2.5 cm) with chloroform/ethyl acetate/methanol/water (4:6:4:1), followed by purification over Sephadex LH-20 (40 × 2.5 cm) CC with methanol. Compounds **4** (7.1 mg) and **5** (13.6 mg) were purified from Fr. E (150.4 mg) by repeated CC [silica gel (56 cm × 2.5), chloroform/ethyl acetate/methanol/water (4:6:4:1)] and [Sephadex LH-20 (20 cm × 0.5 cm), methanol]. Compound **7** (15.9 mg) was purified from fraction F by CC over a Sephadex LH-20 (56 × 2.5 cm) with methanol.

Structures of the purified compounds were elucidated by analyzing their mass, 1D and 2D NMR spectral data as well as by comparison of the corresponding spectral data with those of literature. The compounds were identified as quinovic acid 3-*O*-β-D-fucopyranoside (**1**) (Lamidi et al., 1995; Abreu and Pereira, 2001), quinovic acid 3-*O*-α-L-rhamnopyranosyl-28-β-D-glucopyranosyl ester (**2**) (Lamidi et al., 1995), quinovic acid 3-*O*-β-D-glucopyranoside (**3**) (Aquino et al., 1989; Lamidi et al., 1995), quinovic acid 3-*O*-β-D-fucopyranosyl-28-β-D-glucopyranosyl ester (**4**) (Lamidi et al., 1995), ethylglucopyranoside (**5**), strictosamide (**6**) (Brown et al., 1977), strictosidine (**7**) (Xu et al., 2012), and β-sitosterol (Abreu and Pereira, 2001).

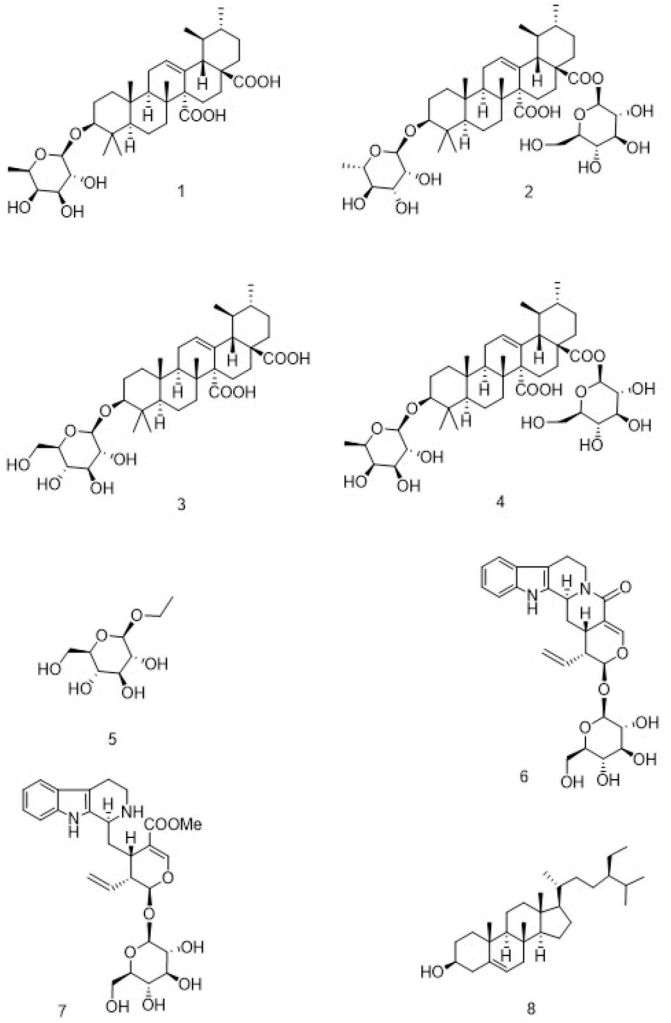

Fig. 1. Structures of isolated compounds.

4. Chemotaxonomic significance

The present study reported the isolation and identification of eight compounds (Fig. 1) from the root bark of *S. latifolius*. Compounds **1** and **3** are monodesmoside triterpene glycosides while **2** and **4** are bidesmoside triterpenoid saponins. Compounds **6** and **7** belong to monoterpene indole alkaloids. The metabolites **2-5** were isolated for the first time from this species.

Compound **1** had been previously reported in *N. diderrichii* (De Wild.) Merr. (Lamidi et al., 1995), *N. latifolia* (Abreu and Pereira, 2001), *N. pobeguinii* (Pobég. ex Pellegr.) Merr. ex E.M.A. Petit (Mesia et al., 2010), and *Uncaria guianensis* (Aubl.) J.F.Gmel. (Yépez et al., 1991). Compounds **2-4** were first isolated and identified from the bark of *N. diderrichii* (Lamidi et al., 1995). Besides that, the presence of compound **3** had been reported in *Guettarda platypoda* DC (Aquino et al., 1989). and *Guettarda grazielae* M.R.Barbosa (Lima et al., 2009) and compound **4** had been reported in *Uncaria tomentosa* (Willd. ex Schult.) DC. (Aquino et al., 1997). The presence of these compounds in *S. latifolius* is being reported for the first time in the present study. This observation supports a close chemosystematic relationship between *S. latifolius* and other species in the genus of family Rubiaceae (Matins and Nunez, 2015). The occurrence of strictosamide (**6**) in the bark of *N. pobeguinii* (Zeches et al., 1985; Xu et al., 2012), *N. officinalis* (Pierre ex Pit.) Merr. & Chun (Liew et al., 2012), leaves (Erdelmeier et al., 1991) and bark (Zhang et al., 2001) of *N. orientalis* (L.) L., root of *Mitragyna inermis* (Willd.) Kuntze (Donfack et al., 2012), leaves of *Psychotria nuda* (Cham. & Schltdl.) Wawra (Farias et al., 2008), leaves of *Psychotria prunifolia* (Kunth) Steyerm (Faria et al., 2010), and leaves of *Psychotria suterella* Müll.Arg (Van De Santos et al., 2001) is significant in the *Nauclea* genus and other species within the Rubiaceae family. Strictosidine (**7**) has been previously identified in *N. pobeguinii* (Xu et al., 2012), and serves as the intermediate for the synthesis of monoterpene indole alkaloids (O'Connor and Maresh, 2006). Further, this chemotaxonomic association based on secondary metabolite content has been supported by DNA marker assays with other members of Cinchonoideae subfamily within Rubiaceae (Manns and Bremer, 2010) including *U. tomentosa*, *N. diderrichi*, *N. orientalis*, *Mitragyna inermis*, and others of genus Guettarda.

In conclusion, the occurrence and distribution of monoterpene indole alkaloids (**6** and **7**) and triterpenoid saponins (**1-4**) point out a close chemotaxonomic correlation among *Sarcocephalus* (syn. *Nauclea*) and other genera within Rubiaceae family. The results of the present findings have, to a certain extent, provided the chemotaxonomic information of the genus *Sarcocephalus* (syn. *Nauclea*).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bse.2019.05.017.

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