A New Diarylheptanoid from *Garuga pinnata* Roxb.

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ABSTRACT: A new macrocyclic diarylheptanoid, 1-desmethylgaruganin III (**1**) was isolated from a dichloromethane extract of the stem bark of *Garuga pinnata*. The structure of the compound was elucidated by high field NMR studies as well as comparison with spectral data of related compounds.

Key words: *Garuga pinnata*; Burseraceae; Diarylheptanoid.

INTRODUCTION

Garuga pinnata Roxb. (Bengali name- Silbhadi, Nibhadi, Paharijya, Dabudabi; Family- Burseraceae), a deciduous tree reaching 50 feet in height, with bark peeling off in flakes is inhabited in hilly areas and semi evergreen forests of Bangladesh, India, Malaysia and the Philippines.[1] It is used as traditional medicine to treat various diseases, including asthma, opacity of cornea and pulmonary infections.[2] Several triterpenoids,[3] ubiquitous β-sitosterol[4] and 21-hydroxydammar-5,24-diene-3-one,[5] biphenyl ether and biphenyl types macrocyclic diarylheptanoids[6] have been reported from *G. pinnata*. Recently, we reported three macrocyclic diarylheptanoids from *G. pinnata*.[7] In continuation to the previous work7, we now report the isolation of a new diarylheptanoid from this plant.

MATERIALS AND METHODS

Experimental. NMR spectrum was acquired using the Ultra shield Bruker DPX 400 NMR instrument in $CDCl_3$ and the chemical shifts are reported in ppm with respect to residual non deuterated solvent signal.

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Plant material. Stem bark of *Garuga pinnata* was collected from National Botanical Garden, Dhaka, in April, 2002. It was identified by Dr. Mahbuba Khanam, Principal Scientific Officer, Bangladesh National Herbarium, Dhaka, where a voucher specimen has been deposited (DACB no. 30,734) representing this collection. The bark was first sun dried and then ground to a coarse powder using a grinding machine.

Extraction and isolation. The powdered bark (500 g) of *G. pinnata* was successively extracted with petroleum ether (2.25 L), dichloromethane (1.75 L) and methanol (1.75 L) in a Soxhlet apparatus. An aliquot of the dichloromethane extract (2 gm) was chromatographed over silica gel (Kiesel gel 60H) and the vacuum liquid chromatography (VLC) column was eluted with petroleum ether, ethyl acetate and methanol mixtures of increasing polarities to give a total of 14 fractions, each 100 ml. VLC fraction 9 was subjected to preparative thin layer chromatography (PTLC) using toluene-ethyl acetate (7:1) with few drops of acetic acid, as solvent system. The plates were developed thrice to facilitate resolution. From the developed plates a band was scrapped off and eluted with ethyl acetate to yield compound **1** (1-desmethylgaruganin III, Figure 1) (1.4 mg).

1-desmethylgaruganin III (1), Gummy yellowish mass; for NMR data see Table 1.

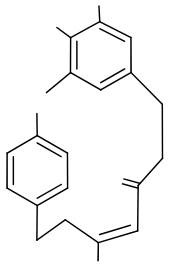


Figure 1. Structure of the isolated compound 1 (1-desmethyl-garuganin III)

Table 1. ^{1}H NMR spectral data of 1, 2 (garuganin- III)[8] and 3 (1,9'-didesmethyl-garuganin III).[7]

Proton	δ_H in ppm, mult (*J* in Hz)		
	1	**2**	**3**
H-3	6.32 d (1.5)	6.28 d (1.5)	6.36 d (1.2)
H-5	4.80 d (1.5)	4.90 d (1.5)	5.15 d (1.2)
H_2-7	2.76 m	2.84 m	2.87 m
H_2-8	2.76 m	2.84 m	2.34 m
H-10	5.18 s	5.20 s	4.93 s
H-2', H-6'	6.93 d (8.2)	6.95 d (8.0)	6.98 d (8.2)
H-3', H-5'	7.27 d (8.2)	7.27 d (8.0)	7.18 d (8.2)
H_2-7'	3.07* t (6.6)	2.74 m	3.04 t (6.6)
H_2-8'	2.33* t (6.6)	3.10 t (7.2)	2.46 t (6.6)
OMe -1*		3.94 s	
OMe – 2*	4.05 s	3.84 s	4.05 s
OMe – 9'	3.44 s	3.44 s	

*Values within the column with identical asterisks are interchangeable.

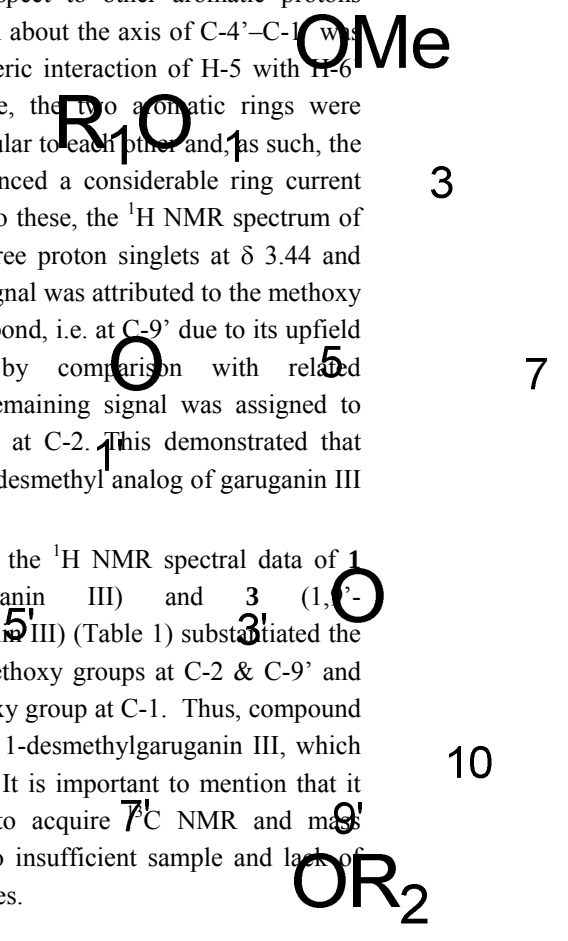
RESULTS AND DISCUSSION

Compound **1** was isolated as a yellowish mass from dichloromethane extract of the stem bark of *G. pinnata* by repeated chromatographic separation over silica gel. It appeared as a dark quenching and violet fluorescencing spot on TLC plate under UV light at 254 nm and 366 nm, respectively. Spraying the developed plate with vanillin-sulfuric acid followed by heating at 110 ^oC for 5-10 minutes afforded a purple color.

The ^{1}H NMR spectral data (400 MHz, $CDCl_3$) of **1** was almost identical to that of garuganin III (**2**) (Table 1) suggesting a close structural similarity between these two compounds. However, the ^{1}H NMR spectrum of **1** showed the presence of two methoxy signals at δ 3.44 and 4.05 instead of three methoxy group resonances observed in garuganin III (2), which suggested that compound **1** was a desmethyl analog of garuganin III (**2**).

Like other diarylheptanoid[6] mentioned previously the ^{1}H NMR spectrum of **1** showed a complex second order splitting in the region of δ 2.30 - 3.10 (8H) for four methylene groups. A singlet at δ 5.18 (1H) corresponded to the proton attached to the α-carbon (C-10) of the α,β-unsaturated carbonyl group. The doublets of two protons intensity centered at δ 6.93 and 7.27 were ascribed to the protons (H-2' & H-6' and H-3' & H-5') of a *para*-substituted benzene ring. The doublets (*J* = 1.5 Hz) centered at δ 4.80 and 6.32 were assigned to the tetra substituted benzene ring protons, H-5 and H-3, respectively. Furthermore, the C-5 proton exhibited a large high-field shift with respect to other aromatic protons because the rotation about the axis of C-4'–C-1 was restricted by the steric interaction of H-5 with H-6 and H-2'; therefore, the two aromatic rings were arranged perpendicular to each other and, as such, the C-5 proton experienced a considerable ring current effect. In addition to these, the ^{1}H NMR spectrum of **1** displayed two three proton singlets at δ 3.44 and 4.05. The former signal was attributed to the methoxy group on a double bond, i.e. at C-9' due to its upfield shift and also by comparison with related compounds. The remaining signal was assigned to the methoxy group at C-2. This demonstrated that compound **1** was a desmethyl analog of garuganin III (**2**).

Comparison of the ^{1}H NMR spectral data of **1** with **2** (garuganin III) and **3** (1,9'-didesmethylgaruganin III) (Table 1) substantiated the presence of two methoxy groups at C-2 & C-9' and absence of a methoxy group at C-1. Thus, compound **1** was identified as 1-desmethylgaruganin III, which appears to be new. It is important to mention that it was not possible to acquire ^{13}C NMR and mass spectral data due to insufficient sample and lack of instrumental facilities.



$R_1 = H, R_2 = CH_3$: **1** (1- Desm

$R_1 = R_2 = CH_3$: **2** (Garugar

$R_1 = R_2 = H$: **3** (1,9'- Did

CONCLUSION

Phytochemical investigation of the dichloromethane extract of the stem bark of *Garuga pinnata* led to the isolation of a new macrocyclic diarylheptanoid, 1-desmethylgaruganin III (**1**). Further biological studies are required to determine for its specific therapeutic utilities.

ACKNOWLEDGEMENTS

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