

Quinolone Alkaloids Along with Other Constituents from *Zanthoxylum rhetsa* and their Chemotaxonomic Significance

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Abstract: A total of eight compounds were isolated from the petroleum ether and chloroform extracts of the root bark of *Zanthoxylum rhetsa* (Roxb.) (D.C). These are a coumarin xanthyletin (1), five quinolone alkaloids zanthodioline (2), arnottianamide (3), skimmianine (4), fagaridine (5), oxynitidine (7), a lignan pluviatilol (6), and a triterpene lupeol (8) were identified. Structures of the isolates were characterized by extensive 1D and 2D NMR analyses and by comparing their spectral data with the published values. The compounds, zanthodioline (2), oxynitidine (7), fagaridine (5), and pluviatilol (6) are the first record from this plant.

Keywords: *Zanthoxylum rhetsa*; quinolone alkaloids; lignan; triterpene; NMR spectroscopy. © 2018 ACG Publications. All rights reserved.

1. Plant Source

The root barks of *Zanthoxylum rhetsa* were collected from Narsingdi district, Bangladesh in the month of August, 2013. The plant part was identified by a taxonomist (Ms. Nasrin Aktar), Bangladesh National Herbarium where a voucher specimen was deposited for future reference (DACB Accession no. 42528).

2. Previous Studies

A series of isoquinoline and quinoline alkaloids, including canthine-6-one, 8-methoxy-N-methylfindersine, dihydrochelerythrine, chelerythrine, rhetine, rhetsine, rhetsinine, dihydroavicine, dictamnine, arborine and others have been isolated from the plant [1].

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3. Present Study

The air dried and powdered root barks of *Z. rhetsa* (3.5 kg) were extracted with methanol over the period of 15 days. The crude methanol extract (40 g) was then fractionated sequentially by petroleum ether (9 g), ethyl acetate (6 g), chloroform (12 g) and methanol (12 g) fractions with continuous stirring. Petroleum ether soluble fraction was subjected to silica gel column and was fractionated with a gradient of petroleum ether-dichloromethane- ethyl acetate-methanol which was given total of 551 fractions each with 20 ml. After TLC screening, similar fractions were mixed together and purified the compounds by recrystallization afforded xanthyletin (**1**, 100.6 mg), zanthodioline (**2**, 50.1 mg) and arnottianamide (**3**, 20 mg). Similarly the chloroform soluble fraction was loaded over silica gel column chromatography and fractionated with a solvent system of increasing polarity and yielding skimmianine (**4**, 200.4 mg). Similar fractions of silica column were mixed and further fractionated with sephadex LH-20 gel column eluted with petroleum ether-chloroform (20:80) to yield fagaridine (**5**, 2.5 mg), pluviatilol (**6**, 6 mg) and oxynitidine (**7**, 5.3 mg). In the current investigation, a total of eight compounds have been isolated from the root bark of *Zanthoxylum rhetsa* (Roxb.) (D.C). among these, zanthodioline (**2**), fagaridine (**5**), pluviatilol (**6**) and oxynitidine (**7**) are the first time report from this species.

Zanthodioline (2): white crystals; ¹H-NMR (500 MHz, CDCl₃): δ 7.64 (dd, *J*= 8.0, 1.2 Hz, H-5), 7.22 (1H, t, *J* = 8.0 Hz, H-6), 7.12 (1H, dd, *J*= 8.0, 1.2 Hz, H-7), 4.76 (1H, d, *J*= 8 Hz, H-4'), 3.97 (3H, s, N-Me), 3.93 (3H, s, OMe-8), 3.84 (1H, d, *J*= 8 Hz, H-3'), 1.64 (3H s, H-2' Me), 1.33 (3H, s, H-2' Me). ¹³C-NMR (125 MHz, CDCl₃): δ 164.6 (C-2), 154.8 (C-4), 148.8 (C-8), 130.8 (C-9), 122.8 (C-6), 118.2 (C-10), 116.2 (C-5), 114.4 (C-7), 106.0 (C-3), 80.9 (C-2'), 75.3 (C-3'), 67.7 (C-4'), 56.7 (OMe-8), 34.8 (N-Me), 26.1 (C-2' Me), 19.3 (C-2' Me).

Fagaridine (5): light yellow powder; ¹H-NMR (500 MHz, CDCl₃): δ 9.71 (1H, s, H-8), 8.67 (1H, d, *J*= 8.8 Hz, H-12), 8.31 (1H, s, H-1), 8.24 (1H, d, *J*= 9.2 Hz, H-5), 7.99 (1H, d, *J*= 9.2 Hz, H-11), 7.57 (1H, s, H-4), 7.54 (1H, d, *J*= 8.8 Hz, H-6), 6.23 (2H, s, OCH₂O), 5.50 (3H, s, N-Me), 4.28 (3H, s, OMe-9).

Pluviatilol (6): white crystals; ¹H-NMR (500 MHz, CDCl₃): δ 6.97 (1H,d, *J*= 1.2 Hz, H-2), 6.92 (1H, d, *J*= 8.0 Hz, H-5), 6.89 (1H, d, *J*= 1.2 Hz, H-2'), 6.85 (1H, dd, *J*= 8.0, 1.2 Hz, H-6'), 6.81 (1H, dd, *J*=8.0, 2.0 Hz, H-6), 6.80 (1H, d, *J*= 8.0 Hz, H-5'), 5.98 (2H, s, OCH₂O), 4.87 (1H, d, *J*= 5.2 Hz, H-7), 4.44 (1H, d, *J*= 6.8 Hz, H-7'), 4.13 (1H, d, *J*= 9.6 Hz, H-9'α), 3.93 (3H, s, OMe-3), 3.87 (1H, dd, *J*= 9.6, 6.0 Hz, H-9α), 3.86 (1H, m, H-9'β), 3.34 (1H, m, H-8), 3.34 (1H, m, H-9β), 2.89 (1H, dd, *J*= 7.2, 6.4 Hz, H-8'). ¹³C-NMR (125 MHz, CDCl₃): δ 148.0* (C-4'), 147.2* (C-3'), 145.9* (C-3), 144.7* (C-4), 130.3 (C-1), 119.5 (C-6'), 118.4 (C-6), 114.2 (C-5), 108.4 (C-2), 108.2 (C-5'), 106.5 (C-2'), 101.0 (OCH₂O), 87.7 (C-7'), 82.1 (C-7), 71.0 (C-9'), 69.8 (C-9), 56.0 (OMe-3), 54.6 (C-8'), 50.2 (C-8).

Oxynitidine (7): white amorphous; ¹H-NMR (500 MHz, CDCl₃): δ 8.02 (1H, d, *J*= 8.8 Hz, H-6), 7.96 (1H, s, H-9), 7.68 (1H, s, H-12), 7.63 (1H, s, H-1), 7.60 (1H, d, *J*= 8.8 Hz, H-5), 7.22 (1H, s, H-4), 6.13 (2H, s, OCH₂O), 4.14 (3H, s, OMe-11), 4.08 (3H, s, OMe-11), 4.02 (3H, s, N-Me).

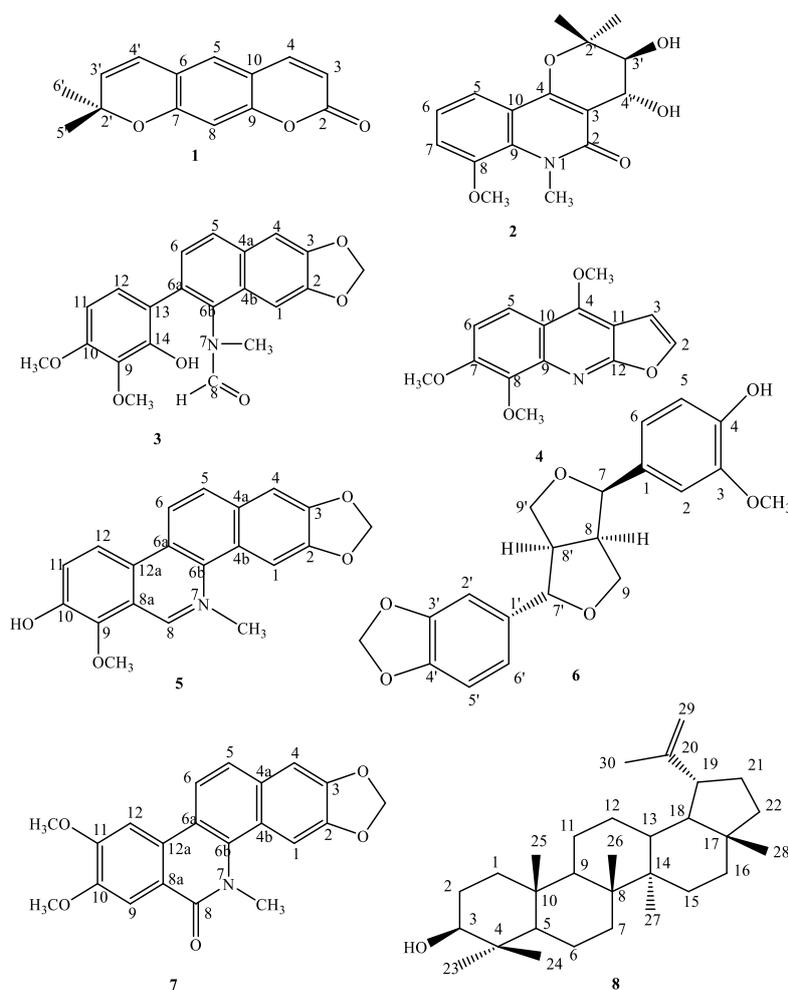


Figure 1. Compounds **1-8** isolated from *Z. rhetsa*

3. Chemotaxonomic Significance

In our present investigation out of eight compounds, four namely zanthodioline (**2**), fagaridine (**5**), pluviatilol (**6**) and oxynitidine (**7**) are the first report from this species. The pyranoquinoline alkaloid Zanthodioline (**2**) was previously isolated from *Zanthoxylum simulans* [2]. The benzophenanthridine alkaloids fagaridine (**5**) and oxynitidine (**7**) have been reported respectively from *Zanthoxylum rhoifolium* [3] and *Zanthoxylum nitidum* [4]. The benzophenanthridine alkaloids are the most commonly found in the genus [5]. The isolation of the lignan pluviatilol (**6**) earlier reported from *Zanthoxylum acanthopodium* [6] and *Zanthoxylum pluviatile* [7] also support a close relationship among these three rutaceous species.

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Supporting Information

Supporting Information accompanies this paper on <http://www.acgpubs.org/RNP>

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