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# Terresoxazine, A Novel Compound with Benzoxazine Skeleton from *Tribulus terrestris*

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**Abstract:** Terresoxazine, a novel benzoxazine derivative was isolated from the fruits of *Tribulus terrestris*. Its structure was determined as 7-hydroxy-3, 3a-dihydro-5*H*-pyrrolo-[1,2-*a*] [3,1] -benzoxazin-1(2*H*)-one, on the basis of the spectral techniques and X-ray crystallographic analysis.

**Keywords:** Terresoxazine, benzoxazine, *Tribulus terrestris*.

*Tribulus terrestris* Linn. (Zygophyllaceae) is known as "*Baijili*" in Chinese folk medicine and has long been used for treatment of eye trouble, edema, abdominal distention, and promoting blood circulation to remove blood stasis[1]. Pharmacological studies showed saponins of this plant had significant active on cardiac diseases[2]. Chemical investigation on *T. terrestris* led to terresoxazine (**1**, 24 mg from 10 kg of air-dried fruits), a novel compound with benzoxazine skeleton. Herein, we present the structure identification and NMR assignments of **1** by means of spectroscopic techniques and X-ray crystallographic analysis.

**Figure 1** Key HMBC correlations of **1** (H→C)

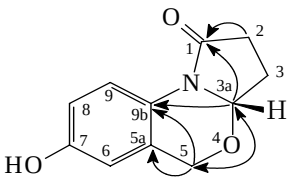
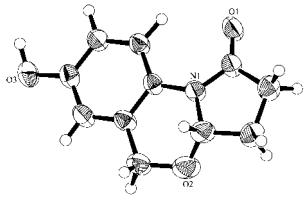



**Figure 2** The ORTEP view of **1**




Terresoxazine **1**, obtained as colorless prisms, m.p. 194-196 °C, $[\alpha]_D^{20}$ 0.75 (*c* 0.38, $Me_2CO$). The HR-EIMS showed the molecular ion peak at *m/z* 205.0731 in agreement with the molecular formula $C_{11}H_{11}NO_3$ (calcd. 205.0738) with seven degrees of unsaturation. The IR bands showed the presences of a hydroxyl group (3184 $cm^{-1}$), a five-membered ring lactam group (1653 $cm^{-1}$) and a benzene ring (1593, 1500 $cm^{-1}$).

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The $^{13}C$ NMR spectrum exhibited eleven carbons signals, which were resolved into three methylenes, three $sp^2$ and one $sp^3$ methines and four quaternary carbons through DEPT experiments.

In the $^{13}C$ NMR spectrum, the signal at δ 171.3 was attributed to the lactam group, six olefinic carbon signals (δ 155.2, 127.6, 126.3, 121.4, 111.9 and 115.2) were ascribed to a two-substituted phenol carbons, which was consistent with protons signals at δ 8.70 (d, 1H, *J*=8.8), 7.20 (dd, 1H, *J*=8.8, 2.7), and 6.95 (d, 1H, *J*=2.7) in the $^1H$ NMR spectrum. Moreover, detailed analysis of $^1H$ NMR and HMQC spectra (**Table 1**) showed the existence of an isolated spin system (-$CH_2$-$CH_2$-CH<, $\delta_C$ 30.3, 25.2 and 87.6). In the HMBC spectrum (**Figure 1**), significant long-range correlations were observed between H-3a (δ 5.19) and C-1 (δ 171.3), C-9b (δ 127.3), and C-5 (δ 68.2); and between $H_2$-5 (δ 5.04 and 4.95) and C-9b (δ 127.3), C-5a (δ 126.3), and C-3a (δ 87.6). A gross structure of terresoxazine was assigned as **1**, in which a five-membered lactam ring combined with a [2H] benzoxazine to form a novel tricyclic structure.

**Table 1** $^1H$ (400 MHz) and $^{13}C$ (100 MHz) NMR data of **1** (in $C_5D_5N$, TMS)

| Site | $^1H$ (*J* in Hz) | $^{13}C$ | Site | $^1H$ (*J* in Hz) | $^{13}C$ |
|---|---|---|---|---|---|
| 1 | — | 171.3 s | 5β | 5.04 d (15.2) | |
| 2α | 2.57 ddd (17.1, 10.3, 4.7) | 30.3 t | 5a | — | 126.3 s |
| 2β | 2.51 dt (17.1, 8.6) | | 6 | 6.95 d (2.7) | 111.9 d |
| 3α | 1.85 dddd (13.4, 10.3, 8.6, 4.9) | 25.2 t | 7 | — | 155.6 s |
| 3β | 2.31 dddd (13.4, 8.6, 6.8, 4.7) | | 8 | 7.20 dd (8.8, 2.7) | 115.2 d |
| 3a | 5.19 dd (6.8, 4.9) | 87.6 d | 9 | 8.70 d (8.8) | 121.4 d |
| 5α | 4.95 d (15.2) | 68.2 t | 9b | — | 127.3 s |

To establish unambiguously the structure and relative configuration of **1**, an X-ray crystallographic analysis[3] was conducted on terresoxazine. **Figure 2** shows an ORTEP drawing of **1**. Therefore, terresoxazine was proved to be 7-hydroxy-3, 3a-dihydro-5*H*-pyrrolo-[1,2-*a*] [3,1] benzoxazin-1(2*H*)-one. To our knowledge, this is a novel skeleton natural compound.

## References and Note

1. Jiangsu New Medical College, *The Dictionary of Traditional Chinese Medicine*, Shanghai Science and Technology Press, Shanghai, **1985**, p.1274.
2. S. D. Seth, G. Jagadeesh, *Indian J. Med. Res*., **1976**, *64*, 1821.
3. Crystallographic data (excluding structure factors) for the structure in this paper have been deposited with the Cambridge Crystallographic Data Centre as supplementary publication number CCDC-200945. Copies of the data can be obtained, free of charge, on application to CCDC, 12 Union Road, Cambridge CB2 1EZ, UK [fax: +44-(0)-1223-336033 or e-mail: deposit@ccdc.cam.ac.uk].

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