Asian Journal of Chemistry; Vol. 25, No. 4 (2013), 2321-2322

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2013.13176

NOTE

Chemical and Biologically Active Constituents of *Schisandra sphenanthera* Rehd. et.

JING-LING DU[1,2], XIAO-HUA ZOU[2], FEI ZHAO[1], YONG-SHENG JIN[1,*], XI-PING TUO[3] and HAI-SHENG CHEN[1,*]

[1]School of Pharmacy, Second Military Medical University, Shanghai 200433, P.R. China
[2]No. 117 Hospital, PLA, Hangzhou 310013, P.R. China
[3]Affiliated Changhai Hospital, Second Military Medical University, Shanghai 200433, P.R. China

*Corresponding authors: Fax: +86 21 81871250; Tel: +86 21 81871250; E-mail: chenhaishengsmmu@yahoo.com.cn; ysjin@smmu.edu.cn

(*Received*: 5 December 2011; *Accepted*: 26 October 2012) AJC-12341

Twenty-two known constituents were isolated from *Schisandra sphenanthera* Rehd.et. and their structures were elucidated on the basis of chemical reaction and spectral analysis. Six compounds of them were isolated from this plant for the first time. Among these isolated compounds, schisandrone (SCB-11) showed significant effects on alzheimer disease (AD).

Key Words: *Schisandra sphenanthera* Rehd.et., Lignanoid, Triterpenoid, Schisandrone, Constituents, AD, Antioxidative enzyme.

Schisandra sphenanthera Rehd.et. is a famous invigorator and has been used in clinics for more than 2000 years. China is the area in which *Schisandra sphenanthera* Rehd.et. is widely distributed except for Qinghai, Xinjiang and Hainan. The chemical constituents of *Schisandra sphenanthera* Rehd.et. are mainly lignanoid, triterpenic acid and lactone. It not only plays an important role in treating diseases related to oxygen radical damage and metabolic disorder, but also lactone contained is potential source of many synthetic drugs[1]. Resent studies indicated that triterpenoid as well has very strong physiological activity, such as HIV-1 reverse transcriptase inhibitory activity[2], tumor inhibition[3,4] and cholesterol biosynthesis inhibition[5-8], *etc*. In order to isolate new compounds and to search biologically active compounds from *Schisandra sphenanthera* Rehd.et., we have carried out a phytochemical investigation and obtained 22 known compounds (Fig. 1), which were schizandronic acid (SCB-1)[9], anwuweizic acid (SCB-2)[10], kadsuric acid (SCB-3)[11], nigranoic acid (SCB-4)[11], schisanhenol (SCB-5)[12], schizandrin (SCB-6)[13], schisantherin A (SCB-7)[14], schisantherin E (SCB-8)[14], deoxyschisandrin (SCB-9)[15], (+)-anwulignan (SCB-10)[16], schisandrone (SCB-11)[17], angeloylgomisin P (SCB-12)[18], daucosterol (SCB-13),

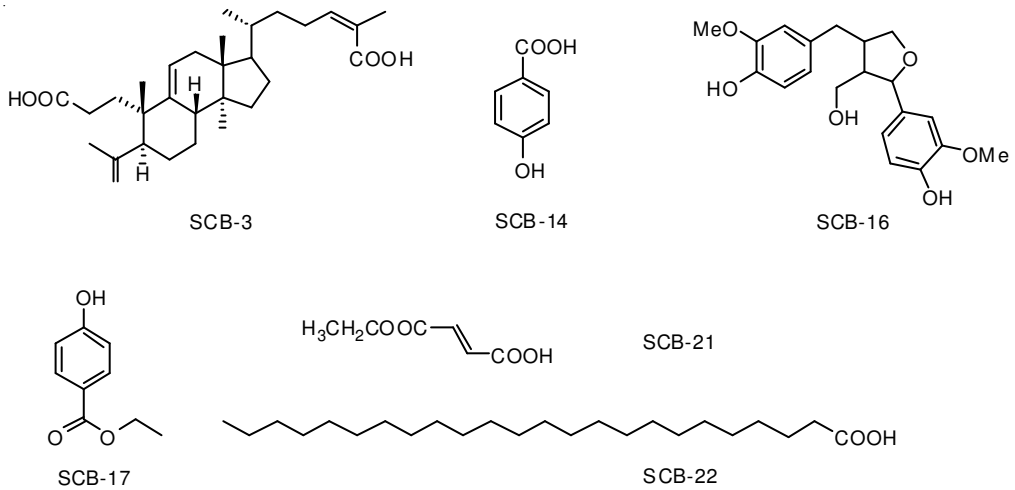

Fig. 1. Structures of compounds SCB 3, 14, 16, 17, 21 and 22

p-hydroxybenzonic acid (SCB-14), oleanolic acid (SCB-15), lariciresinol (SCB-16)[19], ethyl 4-hydroxybenzoate (SCB-17), β-sitosterol (SCB-18), stigmasterol (SCB-19), ferulic acid (SCB-20)[20], mono-ethyl fumarate (SCB-21), tetracosanoic acid (SCB-22)[21]. Among these, compounds SCB-3, SCB-14, SCB-16, SCB-17, SCB-21 and SCB-22 were isolated from this plant for the first time. The biologically activity results showed that schisandrone (SCB-11) has protective effects on the learning and memory impairment and can increase the activity of anti-oxidative enzyme in the brain in the AD model of rats.

ESI-MS were performed on a Waters Q-Tof micro mass spectrometer. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker AVANCE II-300 spectrometer. All solvents used were of analytical grade (Shanghai Chemical Co. Ltd.). Silica gel (100-200 and 200-300 mesh, Qingdao Haiyang Chemical Co. Ltd.), sephadex LH-20 (Pharmacia Co. Ltd.) were used for column chromatography. Ab_{25-35} (Sigma), CAT, GSH-Px and SOD kit (Nanjing Jiancheng Bioengineering Institute, Nanjing, China) were used for inhibition of AD assay.

Plant material: The fruit of *Schisandra sphenanthera* Rehd.et. were collected in Yunnan province, People's Republic of China, in September, 2001 and were authenticated as *Schisandra sphenanthera* Rehd.et Wils by Prof. Hanmin Zhang, Department of Pharmacognosy, School of Pharmacy, Second Military Medical University.

Extraction and isolation: The air-dried and powdered ripened fruits of *Schisandra sphenanthera* Rehd.et (2.5 kg) were extracted with 80 % EtOH (25 L × 3). The extraction was evaporated under vacuum to obtain *ca.* 200 g of a residue, which was well-distributed in 5 L distilled water and then extracted with petroleum ether (5 L × 3), EtOAc (5 L × 3) and water-saturated *n*-BuOH (5 L × 3) successively to give petroleum ether partition (extract A 20 g), EtOAc partition (extract B 30 g) and *n*-BuOH partition (extract C 20 g). Extract B was subjected to silica gel CC (petroleum ether-EtOAc and $CHCl_3$-MeOH), Sephadex LH-20 gel CC ($CHCl_3$-MeOH, MeOH, MeOH-H_2O) and RP18 (MeOH-H_2O) repeatedly to yield the compounds. Their structures were identified on the basis of chemical reaction, spectral analysis and comparison of their spectroscopic data with those previously described in the literature.

Inhibition of AD assay: Morris water maze was applied to study the effect of schisandrone (SCB-11) on the latency to find the hidden platform in the AD model of rats and the activity of SOD, GSH-Px and CAT.

The results of inhibition of AD of schisandrone (SCB-11) are presented in Table-1 and Fig. 2. The results indicated that schisandrone (SCB-11) can improve the learning-memory in $Aβ_{25-35}$ induced AD model of rats as well as elevate the activity of CAT, GSH-Px and SOD therefore exert a protective effect on brain tissue.

ACKNOWLEDGEMENTS

This study was supported by the National Natural Science Foundation of China (20502034) and the Shanghai Leading Academic Discipline Project (No. B906).

TABLE-1
ACTIVITY OF CAT, GSH-Px AND SOD IN BRAIN OF RATS IN EACH GROUP

Group	N	CAT (U/mgprot)	SOD (U/mgprot)	GSH-Px (U/mgprot)
Control group	10	0.468±0.115	41.446±4.752	81.784±7.540
Model group	10	0.351±0.053*	33.661±3.356**	69.882±13.582*
Trail group	10	0.424±0.098[a]	42.412±1.829[b]	91.124±13.791[b]

Compared with the control: $*p < 0.05$, $**p < 0.01$; compared with model: $^{a}p < 0.05$, $^{b}p < 0.001$.

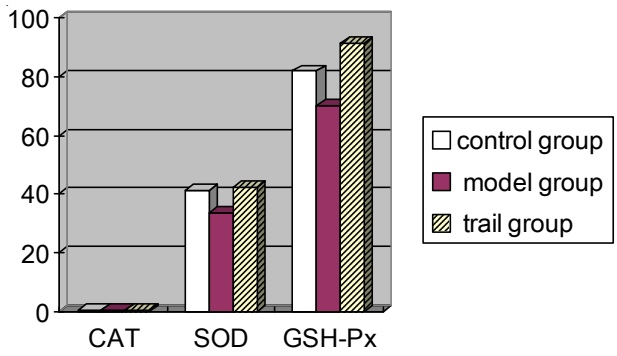

Fig. 2. Activity of CAT, GSH-Px and SOD in brain of rats in each group

REFERENCES

1. H.D. Sun, S.X. Qiu, L.Z. Lin, Z.Y.W. Wang, T. Pengsuarp, J.M. Pezzuto and H. Fong, *J. Nat. Prod.*, **59**, 525 (1996).
2. J.S. Liu and Y.P. Pan, *Acta Chim. Sin*, **49**, 308 (1991).
3. J.S. Liu, Y.T. Ma and M.F. Huang, *Acta. Chim. Sin.*, **46**, 345 (1988).
4. L.N. Li and H. Xue, *Planta Med.*, **52**, 492 (1986).
5. L.N. Li, H. Xue, K. Kangouri, A. Ikeda and S. Omura, *Planta Med.*, **55**, 294 (1989).
6. K. Kangouri, T. Miyoshi, A. Kawashima, A. Ikeda, T. Mizutani, S. Omura, L.N. Li and H. Xue, *Planta Med.*, **55**, 297 (1989).
7. L.N. Li, H. Xue, D.L. Ge, K. Kangouri, T. Miyoshi and S. Omura, *Planta Med.*, **55**, 300 (1989).
8. Y.P. Chen, Z.W. Lin, H.J. Zhang and H.D. Sun, *Phytochemistry*, **29**, 3358 (1990).
9. L.N. Li and H. Xue, *Planta Med.*, **52**, 492 (1986).
10. J.S. Liu and M.F. Huang, *Acta Chim. Sin.*, **42**, 264 (1984).
11. H.J. Wang and Y.Y. Chen, *Acta Pharm. Sin.*, **20**, 832 (1985).
12. J.S. Liu, M.F. Huang and Y.L. Gao, *Acta Chim. Sin.*, **38**, 361 (1980).
13. J.S. Liu and M.F. Huang, *Phytochemistry*, **31**, 957 (1992).
14. Y. Ikeya, E. Miki, M. Okada, Q. Benzoylgomisin and P. Benzoylgomisin, *Chem. Pharm. Bull.*, **38**, 1408 (1990).
15. Y. Ikeya, *Phytochemistry*, **27**, 569 (1988).
16. J.S. Liu and M.F. Huang, *Acta Chem. Sin.*, **42**, 264 (1984).
17. S.J. Jiang, Y.H. Wang and D.F. Chen, *Chin. J. Nat. Med.*, **3**, 75 (2005).
18. Y. Ikeya, H. Taguchi, I. Yosioka, Y. Litaka and H. Kobayashi, *Chem. Pharm. Bull.*, **28**, 3357 (1980).
19. L.G. Zhuang, O. Seligmann, K. Jurcic and H. Wagner, *Planta Med.*, **45**, 172 (1982).
20. Z.Z. Zhang, K. Kazuo and D.A. Guo, *Chin. Trad. Herb. Drugs*, **30**, 167 (1999).
21. Z.P. Li, S. Gao, C.S. Hao and G.M. Fan, *Chin. J. Chin. Mater. Med.*, **25**, 39 (2000).