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Alkaloids from cultivated plant of *Peganum harmala* L

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Abstract: Alkaloids such as 1H-cyclopenta(b) quinoline, 2,3,5,6,7,8-hexahydro-9-amino-; Vasicinone(1H-Pyrrolo[2.1-b]quinazolin-9-one,3-hydroxy-2,3-dihydro) and harmine were isolated from cultivated plant of *P. harmala*. Four unknown alkaloids were isolated from *P. harmala* for the first time: 2,2,6,6-Tetramethyl-4-piperidone., Quinoline, 2,3,4-trimethyl-, Pyridine, 2-phenoxy-4-amino- and 4-(3-Propynyloxy)- quinazoline. Their structures were determined by GC-MS.

Keywords: GC-MS, alkaloids, harmine, *Peganum*, *Zygophyllaceae*

Introduction

The genus *Peganum* (Zygophyllaceae) comprises 6 species, that are widely distributed in Northern America, Mediterranean region, Russia and Mongolia. There were found 3 species- *Peganum nigellastrum* Bunge, *Peganum harmala* L and *Peganum multisectum* Maxim in Mongolia[1]. One of them- *Peganum harmala* (*P.harmala*) is commonly found in the Dzungarian Gobi, Transaltai Gobi, Depression of Great lakes, Valley of Lakes, Mongolian Altai and Gobi [2]. This plant has been used as a Chinese traditional medicine against a rheumatism, an abscess, an inflammation and so on[3]. In traditional Mongolian medicine it is used as antitussive and antidote and it also eliminates yellow liquorstasis[4]. At the same time, *P. harmala* is well-known traditional herbal medicine in China and Asian countries for the treatment of a variety of human ailments[5] and skin diseases[6]. Its seeds showed narcotic, anthelmintic and antispasmodic effects and

have been employed in the cases of asthma and rheumatism treatments [7]. Many components such as alkaloids, flavonoids, steroids and amino acids have been isolated from *P. harmala* [8-10]. The β -carboline type alkaloids-harmine and harmaline were discovered in *P.harmala* and are well known as a central nervous system(CNS) stimulant [11] and hypotensive substances, antispasmodic, antihistaminic, vasorelaxant, antibacterial, sedative effects, cytotoxic, antiviral activities and narcotic effect (vasicinone) [12-13]. Thus, the alkaloid fractions of three plants of the genus *Peganum* showed anti-tumor activity. Previously, alkaloids, (+)-vasicinone, 6-hydroxy-6,8,9,11-tetrahydro[2.1-b]quinazolin-11-one, (+)-vasicine, (+)-vasicinolone, deoxyvasicinone, 6,7,8,9-tetrahydro-pyrido[2.1-b]quinazolin-11-one, peganine, tetrahydroharmine, harmaline, harmine, harmalol, harmol[14-15], dipepine, dipeginol[16] and desoxypeganine[17] were

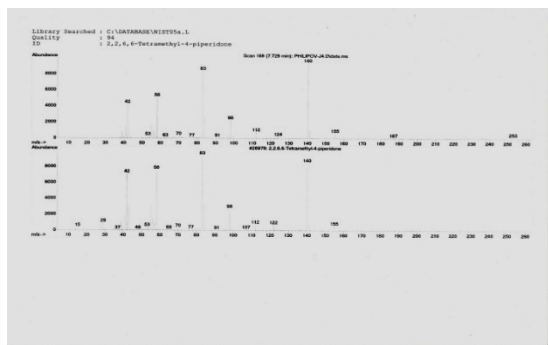


Figure 2 GC-MS data of 2,2,6,6-tetrabethyl-4-piperidone

Table 1. Alkaloids from cultivated plant of *P. harmala*

No	Alkaloids	Total alkaloids (%)	Retention time	M ⁺ , base reak.	Formula of alkaloids
1	2,2,6,6-Tetramethyl-4-piperidone	10.224	7.729	143,36	
2	Quinoline, 2,3,4-trimethyl-	5.303	16.229	171,156	
3	1H-cyclopenta(b)quinoline, 2,3,5,6,7,8-hexahydro-9-amino-	37.66	17.060	187,160	
4	Pyridine, 2-phenoxy-4-amino-	5.769	17.703	185, 66	
5	4-(3-Propynyloxy)-quinazoline	1.419	17.828	184, 130	
6	1H-Pyrrolo[2.1-b]quinazolin-9-one, 3-hydroxy-2,3-dihydro(Vasicinone)	17.969	18.445	202, 146	
7	Harmine	14.819	20.510	212, 169	

Out of the 7 alkaloids four unknown alkaloids were isolated from *P. harmala* for the first time: 2,2,6,6-Tetramethyl-4-piperidone., Quinoline, 2,3,4-trimethyl-, Pyridine, 2-phenoxy-4-amino- and 4-(3-Propynyloxy)-quinazoline. The other three alkaloids: 1H-cyclopenta(b) quinoline, 2,3,5,6,7,8-hexahydro-9-amino-., 1H-Pyrrolo[2.1-b]quinazolin-9-one, 3-hydroxy-2,3-dihydro and harmine were found earlier in the same species.

We determined that cultivated *P. harmala* content of the alkaloids as follows: 1H-cyclopenta(b) quinoline, 2,3,5,6,7,8-hexahydro-9-amino-(37%), (1H-Pyrrolo[2.1-b] quinazolin-9-one, 3-hydroxy-2,3-dihydro)(17.969%), harmine(14.819%). As it shown the contents of vasicinone and harmine in cultivated *P. harmala* were high and it gives us a wide opportunity to use in clinical practice.

Conclusion

We have obtained total alkaloid from aerial parts (33.5g) -0.12603 (0.376%) and 0.12941 g roots(1.5 %). High content of vasicinone and harmine from cultivated *P. harmala* indicates that the cultivation is an alternative way to obtain useful alkaloids from this plant.

References

1. Amartuvshin N Taxonomy of the genus *Peganum* L Peganaceae Van Tieghem in Mongolia Mongolian Journal of Biological Sciences vol.4(2), p-9-13, (2006)
2. Grubov V.I. Opredelitel sosudistikh rastenii Mongolii, Nauka, Leningrad. (1982)
3. Xiao, P-G. A Pictorial Encyclopedia of Chinese Medical Herbs (Japanese edition), Chuokoron-sha, Inc. Tokyo, Japan, vol. III, p 125, (1993)
4. U. Jigaa Medicinal Plants of Mongolia used in Mongolian Traditional Medicine. Korea, Seoul, pp 343-344, 1996
5. S. Siddiqui., O.Y Khan .,B. S. Siddiqui and S. Faizi Phytochemistry vol 26, pp1548 (1987)
6. Al-Shamma A., S. Drake J. Nat.Prod.vol 44, pp 745, (1994)
7. S. Siddiqui., O.Y Khan., B. S. Siddiqui and S. Faizi Heterocycles vol 27, pp 1401 (1988)
8. Jiangshu Yixueyuan, Zhongyao Dacidian shanghai Keji chubanshe, China, vol II, pp 1757, (1977)
9. A.A Ahmed., N.A Saleh J. Nat.prod.vol 50, pp 256, (1987)
10. M. Sharaf., A.M El-Ansari Phytochemistry vol 44, pp 533 (1997)

11. Xiao, X.-H., Qiu, G. -L., Wang, H.-L., Liu, L.-S., Zheng, Y.-L., Jia, Z.-J., Deng, Z.-B Chinese journal of Pharmacology and Toxicology **2**, 232, (1988)
12. Liu, Y-X. Zhongguo Shamo Zhiwuzhi, Kexue chubanshe, China, vol. 2, p-306, (1987)
13. D. Prashanth., S. John Antibacterial activity of Peganum harmala L Fitoterapia vol 70, pp 438,(1999)
14. X.H Khashimov Chem.. Prir. Soedin. 382(1971)
15. X.H Khashimov Chem.. Prir. Soedin. 456(1969)
16. X.H Khashimov Chem.. Prir. Soedin. 453(1970)
17. T. Mikdad Phytochemistry vol 30, pp 1046 (1991)