Mongolian Journal of Chemistry 12 (38), 2011, p 113-116

Mongolian Academy of Sciences

Mongolian Journal of Chemistry

Institute of Chemistry & Chemical Technology

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 regian, 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 rhematism treatments [7]. Many components such as alkaloids, flavonoids, stroides 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) stumlant [11] and hypotensive substances, antispasmolitic, antihistaminic, vasorelaxant, antibacterial, sedative effects, cytotoxic, antivirus activities and narcotic effect (vasicinone) [12-13]. Thus, the alkaliod 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] quinozolin-11-one, peganine, tetrahydroharmine, harmaline, harmine, harmalol, harmol[14-15], dipegine, dipeginol[16] and desoxypeganine[17] were

isolated and identified from seeds, aerial parts and roots of *P. harmala*.

Previous research on *P.harmala* were performed by using naturally grown plants. However, there is a risk on study of naturally grown plants because of natural climate changes and human activity. Therefore, cultivation of the naturally grown plants became popular around the world.

The goal of the present study was to characterise alkaloids from cultivated *P.harmala* and compare them with the alkaloids of naturally grown plants.

Experimental

***Plant material*:** The ground aerial parts and roots of *Peganum harmala L* were collected in july 2009 from greenhouse of the Institute of Botany, Mongolian Academy of Sciences**.**

Planted Peganum harmala L

Natural Peganum harmala L

Experimental:

The air dried under aerial parts and roots (33.5 and 8.6g) was extracted with 95% ethanol at room temperature. Following the evaporation of the solvent in vacuo the residue was suspended in 5% HCI at pH 1-2 and extracted with hexane(non-alkaloid). This purified acidic solution was made alkaline with 25% NH_4OH to pH- 9-10 and extracted with $CHCI_3$. The combined $CHCI_3$ extracts were dried (anh.Na_2SO_4) then concentrated to give crude alkaloids 1.1714g of aerial parts(3.4%) and 0.2136g roots(13.29 %/).

Gas chromatography-Mass spectrometry () (GC-MS), K equipped with fused silica capillary column 30mX0.25mmX0.25µm was used. Coated with HP-5 MS phase and coupled with Hewlett Packard 6890/MSD 5793A E was used. Carrying gas was :He, 0.8ml/min. Program of the GC-MS as follows: temperature 50-300^oC at 6^o /min, isotherm 0-10 min, solvent delay 2.0 min, mas range 50-750. The flame ionization detector was used at T_{inl} 260^oC, T_{aux} 280^oC.

TLC: silica gel 60 F_{254} (Merck).Mobile phase hexane/dichloroethan/EtOH (:1:0.4) over NH_4OH and $CHCE_3$ /MEOH (1:0.2) over NH_4OH. Spray reagent for TLC: Dragendroff's reagent.

Result and Discussion

By our investigation from total alkaloids(0.12603g of aerial parts and 0.12805g roots) of *P. harmala* identified seven alkaloids, harmine., 2.2.6.6-Tetramethyl-4-piperidone., Quinoline, 2.3.4-trimethyl-.,1H-cyclopenta(b) quinoline,2.3.5.6.7.8-hexahydro-9-amino-., Pyridine, 2-phenoxy-4-amino-., 4-(3-Propynyloxy)- quinazoline., 1H-Pyrrolo[2.1-b] quinazolin-9-one, 3-hydroxy-2.3-dihydro by GC-MS (Table 1, Figure 1-2).

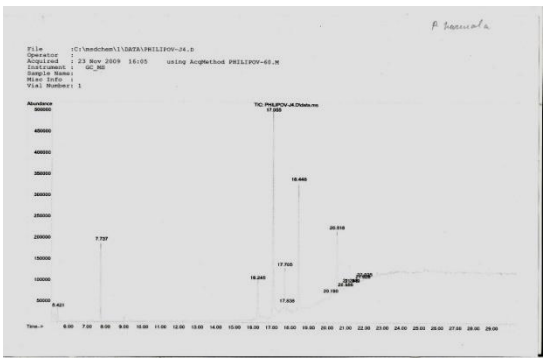


Figure 1.GC-MS data of *Peganum harmala* L

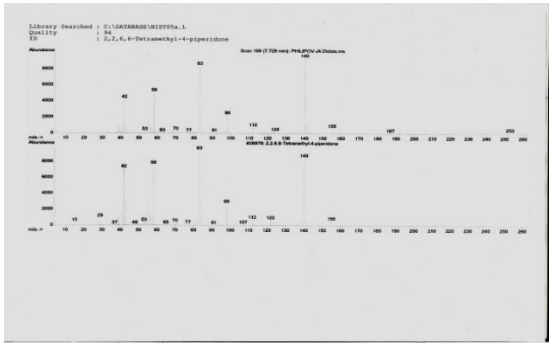
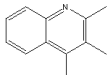
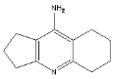
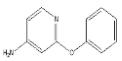
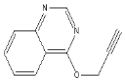
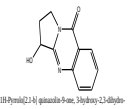
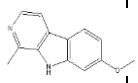


Figure 2 GC-MS data of 2.2.6.6-tetrabethyl-4-piperidone

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

№	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.

Conclution

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.

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