

## Phytochemical Investigation of *Gagea Reticulate* (Kuwait Medicinal Plants)

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### Abstract

**Background:** *Gagea reticulata* is one of the medicinal plants, yet there is no enough information about its phytochemical profile. In this endeavour.

**Aim of Study:** This study was aimed to carry out a detailed phytochemical screening of the active constituents in the bulbs, stems, leaves and flowers of *Gagea reticulata* growing wildly in Kuwait.

**Material and Methods:** Phytochemical screening were done for plant after collection of flowering plants from Kabd area of Kuwait during the spring of 2005.

**Results:** The present study results reported the presence of high amounts of cardiac glycosides, Carbohydrates, flavonoids and steroids and triterperes in the bulbs while flavonoids is more abundant in the yellow flowers and the scarce presence of alkalonids.

**Conclusion:** *Gagea reticulata* plant contains significant amounts of cardiac glycosides, flavonoids and some sterols in the different parts of the plant especially the bulbs. The literature revealed similar findings in different species of the family. The results of the current paper could serve as a starting point for further future investigation of the contents of the *Gagea reticulata* plant.

**Key Words:** *Gagea* – Star – Glycosides – Flavanoids.

### Introduction

**GAGEA** *reticulata* (Pall.) Schult. et Schult. f. (Liliaceae) is a yellow-flowered dwarf lily which is usually found on rocky terrain. It was listed as a plant (presumably the bulb) which can be consumed raw but, many consultants reported that it can not be eaten as the bulb is bitter. Although its common presense, the economic botanist Carter revealed that this species collected in the Kuwait hinterland is not used by men and also animals do not graze on it [1].

The *Gagea reticulata* (Pall.) Schult. and Schult. f. species complex belongs to *Gagea* section *Platyspermum* and reported at least twelve named taxa with the names of, *G. alexeenkoana* Misch., *G. anonyma* Rech.f., *G. bergii* Litv., *G. calcicola-Zarrei* and Wilkin, *G. caroli-kochii* Grossh., *G. commutate* K. Koch, *G. graminifolia* Vved., *G. reticulata*, *G. robusta* Zarrei & Wilkin, *G. tenuifolia* (Boiss.) Fomin, *G. setifolia* Baker, and *G. vegeta* Vved [2-5].

The main center for *Gagea* section *Platyspermum* diversity is reported in Iran, However most species are also growing in the neighboring countries. Many of them distribute widely till reaching as far as North Africa. *G. reticulata* is the most common widespread species in dry areas [4,5].

With its bright yellow star shaped flower (Fig. 1) growing in higher grounds in Kuwait desert, and sometimes in the soft sandy sea shores, blooming very early in the spring, *Gagea reticulata* is considered to be one of the most beautiful rare flowers of Kuwait [6].

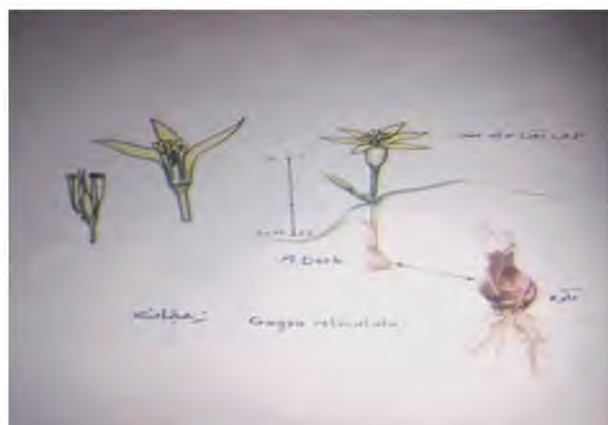


Fig. (1): *Gagea Reticulata*.

In this investigation, preliminary phytochemical screening of the bulbs, stems, leaves and flowers of *Gagea reticulata* is carried out with a detailed background literature survey for the hope of establishing a base for future more elaborate investigation.

#### Experimental:

##### Plant material preparation:

The whole plant of *Gagea reticulata* was collected during the month of March which represents the end of spring season where the plants are in full blossoms just before the hot summer burned the delicate flower petals.

The plants are dried in shade and after performing macro-and micro-morphology they were powdered mechanically and sieved through a number 40 sieve and saved in labeled containers for further investigations.

Photochemical screening investigation were carried out using procedure described by my previous instructors Brain and Turner [7].

Tests for after the different extractions specific reagents like Dragendorff's, Mayer's, Baljet, Keller Killiani, Froth tests and others were performed on aliquots of the different extracts of leaves stems bulbs and flowers of the plant.

##### Plant material:

Flowering plants were collected from Kabd area of Kuwait during the spring of 2005. A voucher specimen was deposited at Kuwait University herbarium after authentication by Dr. K.T. Mathew, Keeper of the herbarium.

##### Phytochemical screening:

Carried out according to standard procedures used by my former instructors Brian & Turner [7].

## Results

##### Macro-morphology:

Small bulb with many roots inclosed in articulate fibrous coat with solitary leaves long and recurved exceeding the inflorescence; Scape short, bearing  $\pm$  umbelliform leapy cymes or corgombs of flowers; perianth-segments pubescent, long-acute about 8mm long, 2-3mm wide, outer ones longer than the inner, many-nerved, yellow with greenish-brown backs. Pedicels unequal, about 2cm long, capsule oblong, about 1cm long. With flat, angular seeds.



Fig. (2): *Gagea Reticulata* Flower.

Table (1): Phytochemical screening of *gagea reticulata*.

Test For	Bulb & Stem	Leaf Flower
<i>Sterols &amp; triterpenes:</i>		
Libermanns Test	++ ve	+ ve + ve
Slkwiski Test		
<i>Alkaloids or nitrogenous bases:</i>		
Dragendorffs reagent	+ ve	- ve - ve
Wagner's reagent	+ ve	- ve - ve
Mayer's reagent	+ ve	- ve - ve
<i>Cardiac glycosides:</i>		
Keller Killiani Test	+++ ve	+ ve + ve
Baljet reaction	+++ ve	+ve +ve
<i>Flavonoids:</i>		
NaOH Test	++ ve	+ ve +++ ve
NH <sub>4</sub> OH Test	++ ve	+++ ve
AlCl <sub>3</sub> /UV	++ ve	+++ ve
<i>Anthraquinones:</i>		
Borntragers test	+ ve	- ve - ve
<i>Tannins:</i>		
FeCl <sub>3</sub> test	- ve	- ve - ve
<i>Saponins:</i>		
Forth test	++ ve	+ ve + ve
<i>Carbohydrates:</i>		
Molish test	+++ ve	+ ve - ve

++ ve Slight, +++ ve Moderate, +++ ve High & - ve Negative.

## Discussion

*Gagea reticulata* belongs to the liliaceae family that is formed of at least 280 genera and 4000 species, mainly perennial herbs of starchy rhizomes or corms. Most common names in this group of herbs are: *Colchicum* (65 spp.); *Aloe* (330 spp.); *Gagea* (70 spp.); *Allium* (450 spp.); *Lilium* (20 spp.); *Tulipa* (100 spp.); *Scilla* (80 spp.); *Dipcadi*, *Asparagus*, *convallaria*, *agavaceae* and *smilax*. Many members of the family are cultivated for their flowers, vegetables including asparagus, onion, garlic, shallot, leek and chives. Drugs including squill, Sarsaparilla, veratrum, colchicum and aloes [8].

Zarrei et al. (2009) examined species delimitation within *Gagea* and did not have enough character polymorphisms to uncover relationships between the five major groups [9].

Moreover, no resolution was observed between species in *G.* section *Platyspermum* Boiss., including the *G. reticulata* complex of species examined at that study. Although, its normally high level of evolutionary divergence, unequivocal evidence of relationships between major groups was not provided [10].

A designed study of morphological, karyological, and molecular evidence, it was reported that polyploidization and hybridization are responsible of *Gagea* evolution and speciation [11,12].

Zarrei et al. (2009) reported monophyly of the *G. reticulata* species complex and that there was no evidence of multiple copies of the Nuclear ribosomal internal transcribed spacer region with complete homogenization in the *G. reticulata* species complex [9].

Without providing resolution between the different complex species, Zarrei et al., 2012 explains that kind of pattern as most of the named taxa are closely related due to evolution/hybridization of reticulate in other groups [10].

However, genetic data for *G.* section *Platyspermum* and particularly the *G. reticulata* species complex are very scarce. Probably some taxa only merit recognition as subspecies or morphological variants. Zarrei et al. (2007, 2010b,c) have designed many studies for establishing species limits and published morphological details of *Gagea* species in Iran, giving a spot on the *G. reticulata* complex, but unfortunately that group suffers from a lack of detailed phylogenetic studies. Also, scarce karyological data about species of *G. reticulata* complex are available [4,5,13].

Several genera of this family are reputed for their folkloric use and active constituents [14]. Alkaloids as in colchicine [15], anthraquinones as in *Aloe*, *Bulbina* and other species [16,17], steroidal substances such as sterols, cardenolides, bufadienolides and steroidal saponins. The amino acid azetidin-2-carboxylic acid in *aganacea*, other constituents such as anothocyanins and flavonoids,  $\gamma$ -pyronechelidonic acid; cyanogenic substances [8].

More than 20 cardioactive glycosides including convallatoxin, one of the strongest cardiotonics of vegetable world and convallotoxinol and convallotoxin were reported in "Lily of the valley" *Convallaria-majalis* [18].

Zargary [19] mentioned that in fusions of *C. majalis* in small doses could be used for strengthening heart muscles and as a diuretic.

A review by komiasarenko and stupakova [20] revealed cardiotonics, flavonoids and steroids isolated and synthesized from the genus *Convallaria*. In a different study by Evdokimove et al., [21], it was proven that cardenolides were more stable in extracts than in fusions in hot climates. Tittel [22] used improved HPLC techniques for the detection of biological values of cardiac glycosides in *convallaria herb*. *Strophanthidan* is a product of the hydrolysis of convallatoxin, a number of flavonoid glycosides along with a saponinconvallamarozide were reported by Shank [23] *Convallaria Keiski* (Japanese lily of the valley) contains glycosides of convallagenin. The dried roots of *Adonis vernalis* contains cumarim and strophanthus like glycosides. Squill which consist of the dried sliced bulbs of *Drimiamaritina* (Liliaceae) is the source of scillaren A, B Glycosides [8].

From what was mentioned above in Table (1) one can notice the presence of high amounts of cardiac glycosides, Carbohydrates, flavonoids and steroids and triterpenes in the bulbs while flavonoids is more abundant in the yellow flowers and the scarce presence of alkaloids.

#### Conclusion:

From the literature survey and the phytochemical screening tests, one could conclude that this plant contains significant amounts of cardiac glycosides, flavonoids and some sterols in the different parts of the plant especially the bulbs. The literature revealed similar findings in different species of the family. This report could very well serve as a starting point for further sophisticated analysis using GC/MS for the identification of the cardiotonics and flavonoids.

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## فحص نباتي كيميائي لنبات *Gagea Reticulate* (نباتات الكويت الطبية)

نبات *Gagea reticulata* هو واحد من النباتات الطبية ومع ذلك لا توجد معلومات كافية حول ملفه الكيميائي.

الهدف من الدراسة وخطة البحث: تم تصميم هذه الدراسة لإجراء فحص كيميائي مفصل للمكونات الفعالة في الأوراق والزهور لنبات *Gagea reticulata* بعد جمع النباتات المزهرة من منطقة كابد بالكويت خلال ربيع عام ٢٠٠٥.

نتائج البحث: أشارت نتائج الدراسة الحالية إلى وجود كميات كبيرة من الجليكوسيدات والفلافونويدات والفلافونويدات أكثر وفرة في الزهور الصفراء وحضور نادر من alkaloids.

الخلاصة: توجد كميات كبيرة من الجليكوسيدات والفلافونويدات وبعض الستيروول في الأجزاء المختلفة لنبات *Gagea reticulata* وكشفت الأبحاث السابقة عن نتائج مماثلة في أنواع مختلفة للنبات من العائلة وأخيراً يمكن أن تكون نتائج هذه الدراسة بمثابة نقطة بداية لانطلاق المزيد من الفحص الكيميائي في المستقبل في محتويات نبات *Gagea reticulata*.