

INTRODUCTION OF ECONOMICALLY IMPORTANT BULBOUS PLANTS COLLECTED FROM WILD FLORA IN SEMI ARID CLIMATIC CONDITIONS OF SOUTHEASTERN ANATOLIAN REGION OF TURKEY

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Abstract

Turkey has rich biodiversity due to its topography comprising of plains, plateaus and mountainous regions that have contributed to enrichment of its flora including bulbous plants. Many among these have potential for use in pharmaceutical and ornamental plant industries. However, owing to lack of proper research many among these plants are yet to be evaluated for commercial propagation. Leaves, bulbs and flowers among many plant parts are being evaluated locally as salads, vegetables, products of pharmaceutical importance and flowers for use in cut flower and ornamental plant industries. The study aimed to find economically important plant geophytes that grow in the wild of the South Eastern Anatolian climatic zones. To meet the objective, a field survey of bulbous geophytes of South Eastern and Eastern Anatolia was carried out during April-July periods of 2011 and 2012 years.

The survey results indicated distribution of bulb geophytes at altitudes of 640 to 2651m. The geophytes belonging to the genus *Allium*, *Biarum*, *Bellevalia*, *Crocus*, *Eranthis*, *Fritillaria*, *Gladiolus*, *Hyacinthus*, *Iris*, *Ixillirion*, *Muscari*, *Narcissus*, *Ornithogalum*, *Sternbergia*, *Scilla*, *Tulipa*, *Ophrys* and *Orchis* were collected. After initial screening, it was decided to culture 40 species; the bulbs of these species were planted in the collection gardens of the Department of Field Crops, Dicle University, Diyarbakir for determination of several parameters including, flowering date, duration of flowering time and other agronomical characteristics important for bulbous species. The experimental results suggested that most of the geophytes collected had high domestication potential and could be evaluated for commercial production.

Keywords: Bulb plants, cultivation, introduction, flora, *Fritillaria* spp., *Iris* spp., *Allium* spp.

INTRODUCTION

Turkey has high diversity in its topography that consists of plains, plateaus and rocky locales that has contributed to advancement of its vegetation including geophytes especially bulb plants. Most of these can contribute importantly in industries related to pharmaceutical and ornamental plant. These could not be evaluated properly due to lack of systematically collected information about these plants. Locally, people use their leaves, bulbs and flowers as salads or vegetables and to obtain pharmaceutically important products. They are also popularly used in cut flower and ornamental plant industries.

Flowering bulbs can be used as indoor and outdoor plants. The researchers are focussing on usage of these plants for horticultural purposes as ornamental plants and for landscaping purposes in arid regions. These plants are highly resistant against number of abiotic and biotic stresses including diseases, insect pests and drought. Ornamental plants are produced over an area of 3.359 ha in Turkey. About 2.199 ha of this land are in the form of

open fields, 1.101 ha is in the form of plastic greenhouses and 58 ha are under glass houses during 2008-09. On average 59% of this production area is utilised for outdoor plant production. The share of cut flowers, indoor plants, and flower bulbs is 36%, 3% and 2% respectively. The import value of bulb plants was USD 5.56 million during the year 2010 (Anonymous, 2013).

Dominant geophytes species for export include *Galanthus*, *Eranthis*, *Anemone*, *Leucojum* and *Cyclamen*. The natural population of many of these plant species has dwindled due to a number of biotic and abiotic factors. The state has therefore regulated their use by banning digging up of these plants for their bulbs or roots and prohibited their export. Production areas for natural flower bulbs are concentrated in the Marmara, Mediterranean and Aegean regions (Zencirkiran and Gurbuz, 2009).

In natural populations of geophytes, seed propagation dominates over vegetative reproduction. Natural rates of annual vegetative multiplication vary with respect to species, so many bulb plants could be propagated under manageable conditions. Some genera occur in widespread areas while others are quite localized in their origin, as affected by environmental conditions like temperature, altitude, moisture and soil type variations (De Hertogh and Lee Nard, 1993).

The use of plants from the countryside for the purpose of cultivation is protected legally and encouraged for the fear that the population of favoured species may suffer, if multiplication of the plants is not encouraged. This is true, especially for plants of particular importance that are endangered, rare or endemic and it is difficult to collect and multiply their seeds or bulbs. The best practice is allowed for licensed suppliers to gather and take it up through cultivation on their own land. Collecting these plants from nature creates a big pressure on wild populations. Therefore except for licensed suppliers and producers, their collection from the wild is illegal under Turkish law.

The objective of this study was to provide a comprehensive knowledge of the economically important bulbous plants found in Southeast and Eastern Anatolian Regions of Turkey by determining their essential morphological characteristics under semi arid climatic controlled field trials.

MATERIALS AND METHODS

The study was carried out at the experimental station of Faculty of Agriculture at Dicle University, Diyarbakir province located at a 37°53' N latitude, 40°16' E longitude and 680 m above sea level, for two growing seasons (2011-12 and 2012-13). The field surveys were conducted between April and July 2011 and 2012.

The soil of the experimental area was sandy-loam which was deficient in organic matter (1.2%), available phosphorus (P) (1.62%), and potassium (K) (8.16%) with a pH of 7.6. The climate in Diyarbakir is dry and hot in summer and cold in winter. Precipitation regime is irregular during winter

For the survey, all plant related information was documented including family location, coordinates, altitude (m) and location characteristics that are given in Table 1 and Figure 1 to understand the current distribution pattern and abundance of the plants.

The total number of plant species in the collection garden was 40. The plants were planted at 70 x 20 cm row distance and 20 cm row spacing. In the field trial, plant height, bulb circumference at planting and some phenological characteristics like flowering, habitat were investigated.

RESULTS AND DISCUSSION

The surveyed areas were rich in target species belonging to *Araceae*, *Amaryllidaceae*, *Hyacinthaceae*, *Iridaceae*, *Liliaceae*, *Orchidaceae* and *Ranunculaceae* families; many of which have great potential as ornamental plants and could easily be introduced as future ornamentals, with little attention. The details about targeted plant species, their families and some morphological characteristics are described in Tables 1 and 2.

The bulbous geophytes collected from wild were screened for their adaptability potential and based on the results it was decided to plant 40 bulbous species in the field trial at the collection garden of the Department of Field Crops, Faculty of Agriculture, Dicle University, Diyarbakir, Turkey.

Most of the bulbs collected from flora that show their active growth and flowering in spring generally exhibit their rest period during summer. The genera included *Allium*, *Bellevalia*, *Eranthis*, *Fritillaria*, *Gladiolus*, *Hyacinthus*, *Iris*, *Ixillirion*, *Muscari*, *Narcissus*, *Ornithogalum*, *Sternbergia*, *Scilla*, *Tulipa*, *Ophrys* and *Orchis* (Table 1).

Amaryllidaceae

Narcissus tazetta, *Sternbergia fischeriana*, and *S. clusiana* were found in the area. *Narcissus* is one of major bulb plants in temperate regions. *Narcissus tazetta* was found in Diyarbakir-Silvan, Siirt-Baykan locations at altitude of 640 m on agricultural lands. *Narcissus tazetta* populations collected from Diyarbakir and Siirt floras flowered in last week of February and the flowering lasted until third week of March. *N. tazetta* plant height ranged between 25 and 35 cm. The plant is collected from agricultural land and used as a cut flower in the region. Flowering lasts 20-25 days (Table 2).

Sternbergia fischeriana was also found in Sirnak-Eruh locations at altitude of 860 m on agricultural lands. *S. fischeriana* plant height ranged between 15 to 25 cm, and flowering lasted more than one month. *S. clusiana* was found in Adiyaman-Gerger locations at altitude of 1680 m on agricultural lands and the plant flowered in autumn.

Araceae

Biarum is a genus of flowering plants in the *Araceae* family. The *Biarum* was found in Sanliurfa-Siverek locations at altitude of 1072 m on rocky mountainous slopes, crevices and gravelled soil (Table 1). The plant is small in height, and its flowering begins at late autumn.

Hyacinthaceae

Hyacinthus orientalis was found in Adiyaman-Gerger and Adiyaman-Nemrut Mountain locations at altitude of 1680 m on rocky mountainous slopes. The plant height of hyacinth varied between 15 and 23 cm, flowering occurred in March bearing strongly fragrant flowers under the semi arid field condition. *H. orientalis* flowered at the end of February, flowering continued until last week of March.

Scilla hyacinthoides was also found in Diyarbakir-Lice locations at altitude of 1337 m on wet and rocky mountainous slopes. *S. hyacinthoides* bulb circumference varied between 14 and 25 cm at planting time. The plant sprouted in January and flowered at the end of April with total of 24 flowering days recorded and the plant height varied between 60 and 85 cm (Table 2).

Iridaceae

Both Southeast and Eastern Anatolia regions are rich in *Iris* species and most of them are endemic. *Iris* species grows erect and spread out early on the soil. All species flowered during late spring, except *I. aucheri* (March-April). *Iris aucheri* was found in Diyarbakir at Siverek locations at altitude of 1072 m on wet and rocky mountainous slopes. The plant had a

likeable smell, bloomed in March, and flowering lasted about 25 days during March-April. The plant height varied between 25 and 30cm. The plant had white, purple and light blue flowers. The plants did not flower during the first year, but flowered regularly during the second year.

Iris germanica was found in Sirnak-Eruh locations at altitude of 860 m. *Iris iberica* subsp. *lycatis*, *Iris spuria* subsp. *musulmanica* and *Iris paradoxa* (end.) were found in Van-Guzeldere locations at altitude of 2651 m (Table 1). *Iris* species such as *I. sari*, *I. paradoxa*, *I. spuria* subsp. *musulmanica*, *I. iberica* subsp. *lycatis* and *I. germanica* sprouted early (October) but flowering lasted by the end of May (18 days). *I. persica* also flowered on the first week of March.

Gladiolus italicus was found in Dicle University, Campus at altitude of 680-700 m. *Crocus pallasi* Goldb. subsp. *turcicus* Mathew was found in Malatya-Surgun, *Crocus cancellatus* Herbert subsp. *damascenus* was found in Malatya, *Crocus kotschyanus* Koch subsp. *kotschyanus* was also found in Malatya.

Liliaceae

It is estimated that there are 800 species in the genus of *Allium* (Fritsch et al. 2010). The genus *Allium* is economically important because it includes several important vegetable crops such as onion and garlic, as well as many ornamental species (Stavelikova, 2008). The Turkish flora is also rich in terms of *Allium* species and it is represented by 187 species (Kocuyigit and Ozhatay, 2010). *Allium* species were found naturally at altitude between 1200 and 2000 m. *A. akaka* was found in Van-Baskale at altitude of 1908 m, *A. shatakiense* (end.) was found in Hakkari-Yuksekovva at altitude of 1865 m, *A. kharputense* was found in Diyarbakir-Karacadag at altitude of 1010 m, *A. vinale* was found in Hakkari-Yuksekovva at altitude of 1865 m, *A. nemrutdaghense* (end.) was found in Adiyaman-Gerger, at altitude of 1610, *A. noeanum* was found in Diyarbakir-Karacadag. *A. tuncelianum* (end.) was found in Tunceli-Ovacik at altitude of 1050 m on mountain, forest and rocky areas and *A. giganteum* was found in Sirnak-Uludere at altitude of 1299-2000 m. Among *Allium* species *A. vinale*, *A. shatakiense* and *A. tuncelianum* are used as vegetable by indigenous people. *A. noeanum*, *A. tuncelianum*, *A. giganteum* and *A. kharputense* have showy flowers and are grown as outdoor commercial cut flowers.

A. scorodoprasum was sprouted November 2012, *A. Akaka*, *A. kharputense*, *A. noeanum* and *A. nemrutdaghense* species sprouted at the beginning of March, *A. giganteum* species also sprouted in February 2013 (Table 1). *A. tuncelianum* is an important *Allium* species used in place of garlic locally and is an important, ornamental and medicinal plant.

Fritillaria is represented worldwide by 7 subgenera, 2 sections, and 165 taxa (Rix, 2001). Turkish flora has a total of 41 taxa, 21 of which are endemic (Teksen and Aytac, 2011). *Fritillaria* species flower during spring and mainly used as garden plants, in borders, rock gardens, beds, under trees and shrubs, or with ground covers. *Fritillaria imperialis* was found in Hakkari-Yuksekovva, Diyarbakir-Hani at altitude of 1511m. *F. persica* was found in Sirnak-Uludere at altitude of 1299 m. *F. imperialis* and *F. persica* species are well known bulbous plants and their cultivation is performed in the region over an area of about 5 ha.

Fritillaria aurea (end.) was found in Malatya-Surgun at an altitude of 1841. This species is endemic and have very beautiful and attractive flowers; flowering occurs during first week of April. The plant has attractive and golden spotty yellow flowers. *F. caucasica* was found in Van-Baskale at altitude of 1908 m. *F. crassifolia* was found in Van-Baskale at altitude of 1908 m. *F. pinardii* was found in Adiyaman-Ulubaba Mountains. *Fritillaria minima* flowered towards end of March and duration of flowering is recorded as 16 days, *F. pinardii* flowered last week of March.

Tulip varieties are forced for use as cut flowers, potted plants and growing plants in outdoor plantings. There is a great diversity in their colour, size and form of the flowers. The project area included many tulip species. *Tulipa allepensis* was found in Diyarbakir-Cungus at altitude of 840 m. *T. armena* was found in Malatya-Surgun at altitude of 1841 m. *T. humilis* was found in Van-Baskale at altitude of 1908 m. *T. sintenisii* was found in Mus at altitude of 1265 m on grassy lands. *T. slyvestris* was found in Van-Baskale at altitude of 1908 m. *T. slyvestris* and *T. humilis* species did not sprout under field conditions. This situation may be due to the type of plant habitats under natural conditions where they are planted naturally at depth of 35-45 cm but during cultivation these were planted at depth of 4-5 cm in the soil. It is assumed that the deepness acts as storage for the bulbs and protects them from negative environment factors especially in the semi arid climatic conditions. Moreover, the larger the bulb size also supports production of bigger/larger flowers; as the energy stored in the bulbs help to produce larger flowers.

Bellavalia rixi species flowered during March 2013, the plant height reached 8-12 cm with attractive blue flowers. *Colchicum falcifolium* species also flowered in autumn and sprouted at the beginning of early spring (February).

Ornithogalum species were found in Adiyaman-Gerger location at altitude of 1680 m. *O. narbonensis* bulbs are bigger than *O. oligophyllum*. Plants sprout in February and March. Flowering occurred in the beginning of April and lasted 14-18 days. Both species are used as vegetable in the region.

Ranunculaceae

Eranthis species are used as border plants in rock gardens, under trees, close to shrubs, and as potted plants. Turkey is major importer of *Eranthis* tubers to the amount of 10 million bulbs per year. *Eranthis hyemalis* is found growing under natural conditions at altitude of 1865 m in Hakkari-Yukseko. The plant flowered on the beginning of March 2012, and the flowering finished on the end of March 2012 (Table 2).

Orchidaceae

Orchid species are raw materials of the Turkish ice cream. Their cultivation is not practised and collection from wild is not permitted legally.

CONCLUSIONS

Prolonged flowering duration is very important and desired depending on their use. Depending on the type, flowering bulbs are used for different purposes including, marriages, landscape beautification, cut flowers, pot plants, in park, rocky gardens and as cemetery plants etc.

Generally potted floral plants are imported and; these include *Narcissus* and *Hyacinthus* which are indigenous to Turkey. The plants could be propagated and cultivated for this purpose easily as was observed in this experiment.

Development of protocols for propagation of important ornamental plants will consequently help and ensure in conservation of genetic resources of South East and Eastern Anatolia regions. It will also help in their production, which is a labour-intensive activity, where number of jobs could be created with a little investment. This in turn will help in the prosperity of locals and they will also be able to earn considerable foreign exchange through export. Further a production enterprise will also contribute to the local economy due to use of fertilizer and agricultural chemicals produced and sold locally. Moreover, plants and flower supply to the market will lead to development of transport and packaging material industry

locally accompanied by the need to develop cold chain facility to handle export geophyte plants or their flowers. Application of all these will create huge employment opportunities.

In conclusion, nature has produced a tremendous number of flower bulb genera and species and they provide material for a wide range of potential aesthetic uses. It is expected that this research will have significant impact on the development of flower bulb industry in South East Anatolia and Turkey, which will influence the development of local floriculture and pharmaceutical industry, healthy environment and the well-being of the public at large. Cultivation of bulbous geophytes plants by farmers must be encouraged, to ensure their production on larger scale.

From this study, selection criteria for cultivation of a new flower bulb should aim at producing a wide range of high quality bulbs that readily adapt to multiple climatic zones. They must be profitable to produce and easy to market. The bulbs must have the ability to withstand extended periods of drought conditions. Those bulb species that provide wide range of flower colours, flower sizes, and types should be preferred initially. Many of the geophytes found under natural conditions of Eastern and South Eastern Anatolian conditions could be exploited commercially and could become a source of income for a large number of people.

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Figure 1. Bulbous plants collected South East and East Anatolia Regions of Turkey

Table 1. The bulbous geophytes collected from South East and East Anatolia Regions of Turkey

Family	Locations	Coordinates	Altitude (m)	Location properties
ARACEAE				
<i>Biarum carduchorum</i>	Sanliurfa-Siverek	37° 50' N; 39° 41' E	1072	Rocky areas
AMARYLLIDACEAE				
<i>Ixiolirion tataricum</i>	Diyarbakir-Hani	38° 26' N; 40° 16' E	1511	Mountainous
<i>Narcissus tazetta</i>	Diyarbakir-Silvan; Siirt-Baykan	38° 08' N; 41° 76' E	640	Agricultural land
<i>Sternbergia fischeriana</i>	Sirnak-Eruh	37° 46' N; 42° 05' E	860	Cemetery
<i>S. clusiana</i>	Adiyaman-Gerger	38° 03' N; 38° 56' E	1680	Mountainous
HYACINTHACEAE				
<i>Hyacinthus orientalis</i>	Adiyaman-Ulubaba	38° 03' N; 38° 56' E	1680	Rocky mountain hillside
<i>Scilla hyacinthoides</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Rocky mountain hillside
IRIDACEAE				
<i>Iris aucheri</i>	Diyarbakir to Siverek	37° 50' N; 39° 41' E	1072	Land wet and rocky
<i>I. gatesii</i>	Mardin-Yesilli	37° 21' N; 40° 51' E	1080	Hillside
<i>I. germanica</i>	Sirnak-Eruh	37° 46' N; 42° 05' E	860	Cemetery
<i>I. iberica</i> subsp. <i>lycatis</i>	Van-Guzeldere	38° 11' N; 43° 54' E	2651	Hillside
<i>I. masia</i>	D.U. Kampus	37° 53' N; 40° 16' E	700	Land
<i>I. paradoxa</i> (end.)	Van-Guzeldere	38° 11' N; 43° 54' E	2651	River border
<i>I. persica</i>	Hakkari-Yuksekovva	37° 34' N; 44° 15' E	1900	Rocky areas
<i>I. sari</i> (end.)	Adiyaman-Gerger	38° 42' N; 38° 44' E	1610	Rocky areas
<i>I. spuria</i> L. subsp. <i>musulmanica</i>	Van-Guzeldere	38° 11' N; 43° 54' E	2651	Hillside
<i>Gladiolus italicus</i>	D.U. Kampus	37° 53' N; 40° 16' E	680	Land
<i>G. atroviolaceus</i>	Diyarbakir-Karacadag	37° 50' N; 39° 41' E	1010	Rocky areas
<i>Crocus biflorus</i>				
<i>C. pallasi</i> Goldb. subsp. <i>turcicus</i>	Malatya-Surgun	37° 54' N; 37° 58' E	1841	Mountainous
<i>Mathew</i>				
<i>C. cancellatus</i> Herbert subsp. <i>damascenus</i>	Malatya-Surgun	37° 54' N; 37° 58' E	1841	Mountainous
<i>C. kotschyanus</i> Koch subsp. <i>kotschyanus</i>	Malatya-Surgun	37° 54' N; 37° 58' E	1841	Mountainous
LILIACEAE				
<i>Allium akaka</i>	Van-Baskale	37° 50' N; 44° 06' E	1908	Mountainous
<i>Allium shatakiense</i> (end.)	Hakkari-Yuksekovva	37° 34' N; 44° 15' E	1865	Mountainous
<i>Allium kharputense</i>	Diyarbakir-Karacadag	37° 50' N; 39° 41' E	1072	Mountainous
<i>Allium vineale</i>	Hakkari-Yuksekovva	37° 34' N; 44° 15' E	1865	Mountainous
<i>Allium nemrutdaghense</i> (end.)	Adiyaman-Gerger	38° 03' N; 38° 56' E	1680	Mountainous
<i>Allium noeanum</i>	Diyarbakir-Karacadag	37° 50' N; 39° 41' E	1072	Mountainous
<i>Allium tuncelianum</i> (end.)	Tunceli-Ovacik	39° 16' N; 39° 26' E	1050	Mountain, forest and rocky areas
<i>Allium giganteum</i>	Sirnak-Uludere	37° 21' N; 43° 15' E	1299	Mountainous
<i>A. wendelboanum</i> (end.)	Mardin	37° 23' N; 40° 38' E	1052	Hillside
<i>Bellevia rixi</i> (end.)	Van-Baskale	37° 50' N; 44° 06' E	1908	Land wet
<i>Colchicum falcifolium</i>	Diyarbakir-Cungus	37° 52' N; 39° 17' E	1040	Mountainous
<i>Fritillaria aurea</i> (end.)	Malatya-Surgun	37° 54' N; 37° 58' E	1841	Mountainous
<i>F. crassifolia</i>	Van-Baskale	37° 50' N; 44° 06' E	1908	Mountainous
<i>F. imperialis</i>	Hakkari-Yuksekovva	37° 34' N; 44° 15' E	1865	Mountainous
	Diyarbakir-Hani			
<i>F. minima</i>	Van-Baskale	37° 50' N; 44° 06' E	1908	Mountainous
<i>F. persica</i>	Sirnak-Uludere	37° 21' N; 43° 15' E	1299	Mountainous
<i>F. pinardii</i>	Adiyaman-Ulubaba Mountain	38° 03' N; 38° 56' E	1680	Mountainous
<i>Muscari tenuiflorum</i>	Hakkari-Uludere	37° 32' N; 44° 13' E	1299	Hillside of stream
<i>Ornithogalum narbonense</i>	Adiyaman-Gerger	38° 03' N; 38° 56' E	1680	Mountainous
<i>O. oligophyllum</i>	Adiyaman-Gerger	38° 03' N; 38° 56' E	1680	Mountainous
<i>Tulipa alepensis</i>	Diyarbakir-Cungus	37° 52' N; 39° 17' E	840	Farming land
<i>T. armena</i>	Malatya-Surgun	37° 54' N; 37° 58' E	1841	Mountainous, hillside
<i>T. humilis</i>	Van-Baskale	37° 50' N; 44° 06' E	1908	Mountainous
<i>T. sintenisii</i>	Mus	38° 47' N; 41° 31' E	1265	Grassy land
<i>T. slyvestris</i>	Van-Baskale	37° 50' N; 44° 06' E	1908	Mountainous
ORCHIDACEAE				
<i>Ophrys cilicica</i> (end.)	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>O. schulzei</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>O. spp</i> (hybrid)	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>Orchis anatolica</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>O. simia</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>O. collina</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>O. tridentata</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>Comperia comperiana</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
<i>Himantoglossum affine</i>	Diyarbakir-Lice	38° 29' N; 40° 41' E	1337	Forest and wet lands
RANUNCULACEAE				
<i>Anemone blanda</i>	Malatya-Erkenek	37° 54' N; 37° 58' E	1841	Mountainous hillside
<i>Eranthis hyemalis</i>	Hakkari-Yuksekovva	37° 34' N; 44° 15' E	1865	Mountainous hillside, rocky places

Table 2. Some morphological and agronomical characteristics of screened bulbous geophytes in the field of semi arid climatic conditions

<i>Bulbous plants</i>	Bulb circumference at planting (cm)	Sprout date	Flowering date	Duration of flowering (day)	Flower colour	Plant height (cm)
<i>Allium akaka</i>	3-5	28.02.2013	03.04.2013	12	Pink, white	4-7
<i>A. chatakiense</i>	2-4	24.02.2012	20.04.2012	14	Purple	30-35
<i>A. giganteum</i>	20-28	04.01.2012	18.04.2012	22	White, purple	90-110
<i>A. kharputense</i>	7-10	14.02.2012	16.04.2012	14	White	35-45
<i>A. nemrutdaghense</i>	2-4	28.02.2012	12.04.2012	18	White, dirty yellow	12-16
<i>A. noeanum</i>	8-10	17.02.2012	12.04.2012	19	Purple	40-50
<i>A. scodoprasum</i>	3-5	24.10.2012	24.05.2012	20	Purple	40-55
<i>A. wendelboanum</i>	1-2	05.11.2012	28.06.2013	15	Purple	10-15
<i>A. tuncelianum</i>	10-16	07.03.2012	27.05.2012	19	White, purple	90-120
<i>Bellevalia rixi</i>	2-3	14.02.2012	01.04.2012	12	Purple	10-15
<i>Biarum carduchorum</i>	12-15	13.10.2012	15.10.2012	20	Dark purple	15-20
<i>Colchicum falcifolium</i>	3-6	03.12.2012	22.02.2012	8	Purple	12-15
<i>Crocus biflorus</i>	2-4	14.02.2012	19.03.2012	8	Light blue	8-12
<i>Eranthis hyemalis</i>	1.5-2	29.02.2012	01.03.2012	15	Yellow	5-8
<i>Fritillaria aurea</i>	4-12	28.03.2012	04.04.2012	12	Yellow	15-30
<i>F. crassifolia</i>	2-3	28.03.2012	09.04.2012	7	Purple-Yellow	10-12
<i>F. imperialis</i>	22-30	03.03.2012	15.03.2012	22	Orange	45-72
<i>F. minima</i>	3-6	17.03.2012	22.03.2012	16	Yellow	8-13
<i>F. persica</i>	20-30	27.02.2013	24.03.2013	21	Purple	45-80
<i>F. pinardii</i>	2-3	17.03.2012	20.03.2012	7-10	Purple-Yellow	8-10
<i>Gladiolus atroviolaceus</i>	-*	02.02.2012	05.05.2012	14	Dark purple	30-40
<i>Hyacinthus orientalis</i>	4-9	03.12.2012	24.02.2013	22	Blue	15-23
<i>Iris aucheri</i>	4-8	15.11.2011	03.03.2012	25	White, purple	25-30
<i>I. gatesii</i>	8-12	28.10.2012	08.05.2013	15	White, yellow	35-45
<i>I. germanica</i>	-	24.10.2012	02.05.2013	18	Purple	65-80
<i>I. paradoksa subsp. hosap</i>	-	14.11.2011	14.04.2012	10	Dark blue with white	20-25
<i>I. sari</i>	4-8	24.10.2012	08.04.2013	19	Dark blue with yellow	20-25
<i>I. iberica subsp. lycatis</i>	-	14.11.2012	13.04.2013	11	Dark blue with white	12-15
<i>Ixillirion tataricum</i>	3-6	24.02.2012	21.04.2012	15	White with blue and purple	50-55
<i>Muscari teunifolium</i>	20-30	04.01.2012	14.04.2012	25	White-purple	45-55
<i>Narcissus tazetta</i>	6-10	29.11.2012	26.02.2013	20	White-yellow	25-35
<i>Ornithogalum narbonensis</i>	3-6	01.03.2013	03.04.2013	14	White	35-45
<i>O. oligophyllum</i>	2.5-5	14.02.2012	01.04.2012	18	White	40-45
<i>S. clusiana</i>	8-20	12.10.2012	12.10.2012	23	Yellow	15-20
<i>S. fischeriana</i>	4-10	24.02.2013	26.02.2013	34	Yellow	15-25
<i>Scilla hyacinthoides</i>	14-25	18.01.2012	29.04.2013	24	Purple	60-85
<i>Tulpia armena</i>	2.5-6	21.02.2012	09.04.2012	20	Red	10-15
<i>T. humilis</i>	1.5-4	24.03.2012	01.04.2012	8	Purple	8-10
<i>T. sinteisii</i>	3-7	24.02.2012	09.04.2012	22	Light red	20-30
<i>T. slyvestris</i>	1.5-4	24.03.2012	01.04.2012	9	Yellow	8-10

* Reproduced by rhizome