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Investigation on flowering phenology of Brassicaceae in the Shanjan region Shabestar district, NW Iran (usage for honeybees)

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ABSTRACT

Identification of plants distribution honey plants in an area are very important and necessary for the Apiculture and Nectar production plays an important role in the pollination of flowering plants. The aim of this research was determine flowering duration and delay for seven plants of Brassicaceae family Shanjan Rangeland [*Aethionema arabicum*, *Alyssum bracteatum*, *Alyssum linifolium*, *Alyssum longistylum*, *Alyssum marginatum*, *Conringia perfoliata*, *Erysimum crassipes*]. This research was conducted in Shanjan Rangeland with elevation between 1600 m to 2050 m with SW aspect in Shabestar district, East Azerbaijan, Iran in spring and summer 2011. For sampling, we used an accidental sampling methodology (1*1 m quadrate) in this research and selected 10 samples in each 8 stations separately. Difference elevation was 55 m between each station. There are about 9 days delay for each 110 m elevation deference for flowering start of *Aethionema arabicum*, *Alyssum bracteatum*, *Alyssum linifolium*, *Alyssum longistylum*, *Alyssum marginatum*, *Conringia perfoliata*, *Erysimum crassipes*, respectively.

Keywords: Brassicaceae, *Aethionema arabicum*, *Alyssum bracteatum*, *Alyssum linifolium*, *Alyssum longistylum*, *Alyssum marginatum*, *Conringia perfoliata*, *Erysimum crassipes*.

INTRODUCTION

Identification of plants distribution honey plants in an area are very important and necessary for the Apiculture and Nectar production plays an important role in the pollination of flowering plants [18].

Because of diversity of plants and number of flowers in an area has an important effects on utilization by honey bees, Therefore, the identification of these plants for nectar or pollen feeding is very important in a region. Because of benefits of bees and trees or plants depend on phenology and biogeography. Most of these factors are specific to location, and depend heavily on seasonal weather patterns [11]. In addition, beekeepers can inform for potential pasture for foraging nectar and pollen production, and foraging management for theirs bees in the region, this will be important when the nectar and pollen production have been reduce in an area. If a beekeeper has good information about this crisis dates during foraging period in a pasture, he can manage his beehives movement on time before he spend so much cost for artificial nectar and sugar.

A colony of honey bees requires average 30 kg of pollen and 40 kg nectar per year [8, 14]. Razaghikamroudi et. al. studied on Nour River Watershed (north Iran) and found the famous pollen producer plants in this area is from Leguminosae, Rosaceae, Compositae, and Labiatae [16, 17]. Manafi found in honey from Northwest Iran (Azerbaijan area) the most pollen in Khoy, Oskou and kalibar districts are from Asteraceae (specially from *Helianthus* or Sunflower), Labiatae and Leguminosae plants, respectively [12]. Memarian found the most pollens in honey produced in Khorasan Province are from Compositae plants [13], he studied 43 Tribes from 28 plant families. Nazarian et al. found the most pollens in honey produced in Tehran Province are from Compositae, Leguminosae, Labiatae, Rosaceae, Brassicaceae, Umbelliferae, Liliaceae, Papaveraceae, Boraginaceae and Malvaceae [15].

Barbara suggested the best way for identifying and classification of plants is pollen identifying [3]. Crompton and Wojtas studied on pollen grains of Canadian honey plants and published a book with this name [7]. In addition period of flowering affect on amount of nectar and pollen producing, Collison (1973) sampled *Cucumis sativa* blossoms and found that nectar was only secreted on the first day of anthesis with none on the days thereafter [6, 18].

Much work has been done on nectar production and pollinator interaction, especially in tropical, southern and southwestern American species, and north European species [18]. Unfortunately, like this research have not studied yet. Flowering period of *Veronica beccabunga* has been studied in this area and started from 22 April [19].

As potential producing of pollen and nectar vary for different condition as climate, soil and topography in foraging duration of honey bees in rangelands, it is so important for knowing different phenological changes of plant for planning hives relocation time. Land degradation connote loss of biological productivity and confounds the widespread and increasing need for environmental conservation in the word [1].

MATERIALS AND METHODS

This research was conducted in Shanjan Rangeland with elevation between 1600 m to 2050 m with SW aspect in Shabestar district, East Azerbaijan, Iran (Figure 1) in spring and summer 2011. This region is component of Iran-Turan Flora with elevation between 1700-1850 m [5]. The terrain in this area is hilly [4, 5] and we carried out the study on a site with a SW aspect (Figure 2).



Figure 1: Location of Studding area on map of Iran.



Figure 2: Studding area at Shanjan rangeland in Shabestar district, East Azerbaijan province (photo was taken on May 28, 2011 by fist author).

For sampling, we used an accidental sampling methodology (1*1 m quadrate) in this research and selected 10 samples in each 8 stations separately (Figure 3). Difference elevation was 55 m between each station.



Figure 3: Sampling design in 1*1 m quadrate plot (photo was taken on May 5, 2011 by fist author).

We studied seven species of Brassicaceae family such as *Aethionema arabicum*, *Alyssum bracteatum*, *Alyssum linifolium*, *Alyssum longistylum*, *Alyssum marginatum*, *Conringia perfoliata*, *Erysimum crassipes*.

Aethionema

Aethionema is a genus of flowering plants, within the family Brassicaceae, subfamily Brassicoideae. The genus is collectively known as the stonecresses. *Aethionema* species are grown as herbaceous perennials [21, 25]. One of Species for this genus is *Aethionema arabicum* (figure 4, Table 1).

Table 1: Scientific name for *Aethionema arabicum* Classification Report [21].

Kingdom	<i>Plantae</i> – Plants
Subkingdom	<i>Tracheobionta</i> – Vascular plants
Superdivision	<i>Spermatophyta</i> – Seed plants
Division	<i>Magnoliophyta</i> – Flowering plants
Class	<i>Magnoliopsida</i> – Dicotyledons
Subclass	<i>Dilleniidae</i>
Order	<i>Capparales</i>
Family	<i>Brassicaceae</i> – Mustard family
Genus	<i>Aethionema</i>
	Species <i>Aethionema arabicum</i>

**Figure 4: *Aethionema arabicum******Alyssum***

Alyssum (Table 2) is a genus of about 100–170 species of flowering plants in the family Brassicaceae, native to Europe, Asia, and northern Africa, with the highest species diversity in the Mediterranean region. The genus comprises annual and perennial herbaceous plants or (rarely) small shrubs, with oblong-oval leaves and yellow or white flowers (pink to purple in a few species) [26]. We studied on four species of *Alyssum* family member in this research such as *Alyssum bracteatum* (Figure 5), *Alyssum linifolium* (Figure 6), *Alyssum longistylum* (Figure 7) and *Alyssum marginatum* (Figure 8).

Table 2: Scientific name for *Alyssum* Classification Report [20].

Kingdom	<i>Plantae</i> – Plants
Subkingdom	<i>Tracheobionta</i> – Vascular plants
Superdivision	<i>Spermatophyta</i> – Seed plants
Division	<i>Magnoliophyta</i> – Flowering plants
Class	<i>Magnoliopsida</i> – Dicotyledons
Subclass	<i>Dilleniidae</i>
Order	<i>Capparales</i>
Family	<i>Brassicaceae</i> – Mustard family
Genus	<i>Alyssum</i> L. – madwort

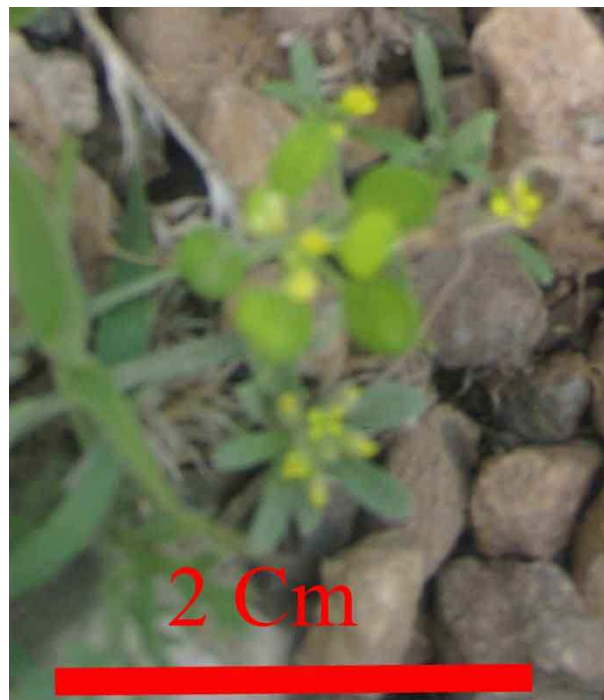
**Figure 5: *Alyssum bracteatum*****Figure 6: *Alyssum linifolium***



Figure 7: *Alyssum longistylum*



Figure 8: *Alyssum marginatum*

Conringia

Conringia (Table 3, Figure 9) is a genus of plants in the mustard family known commonly as **hare's ear mustards**. These herbs are native to Eurasia are known on many continents as a common weed [27]. we studied on *Conringia perfoliata* in this research.

Table 3: Scientific name for *Conringia* Classification Report [22].

Kingdom	<i>Plantae</i> – Plants
Subkingdom	<i>Tracheobionta</i> – Vascular plants
Superdivision	<i>Spermatophyta</i> – Seed plants
Division	<i>Magnoliophyta</i> – Flowering plants
Class	<i>Magnoliopsida</i> – Dicotyledons
Subclass	<i>Dilleniidae</i>
Order	<i>Capparales</i>
Family	<i>Brassicaceae</i> – Mustard family
Genus	<i>Conringia</i> – hare's ear mustard



Figure 9: *Conringia perfoliata*

Erysimum

Erysimum (wallflowers) is a genus that includes about 180 species, both popular garden plants and many wild forms. Wallflowers are small, annual, short-lived perennial herbs or sub-shrubs, reaching 10-130 cm tall (Table 4, Figure 10). Wallflowers are native to southwest Asia, the Mediterranean region, Europe, Macaronesia (Including Cabo Verde), and North America through Costa Rica. Most wallflowers are pollinator-generalists, their flowers being visited by many different species of bees, bee flies, hoverflies, butterflies, beetles, and ants [28].

Table 4: Scientific name for *Erysimum* Classification Report [23].

Kingdom	<i>Plantae</i> – Plants
Subkingdom	<i>Tracheobionta</i> – Vascular plants
Superdivision	<i>Spermatophyta</i> – Seed plants
Division	<i>Magnoliophyta</i> – Flowering plants
Class	<i>Magnoliopsida</i> – Dicotyledons
Subclass	<i>Dilleniidae</i>
Order	<i>Capparales</i>
Family	<i>Brassicaceae</i> – Mustard family
Genus	<i>Erysimum</i> L. – wallflower



Figure 10: *Erysimum crassipes*

RESULTS

We studied 8 stations with 55 m difference between each of them. The lowest elevation for first station was 1600 m and the last was 2040 m. Flowering date was very close relation with different elevation for these plants. Flowering date was on April, 29, 2011 in first station with elevation equal 1600 m and it was on Jun 3, 2011 on last station with 2040 m elevation for *Aethionema arabicum*, *Alyssum bracteatum*, *Alyssum marginatum*, *Conringia perfoliata* and *Erysimum crassipes*. It showed about 36 days delay for flowering of them with 440 m elevation difference. (Figure 7).

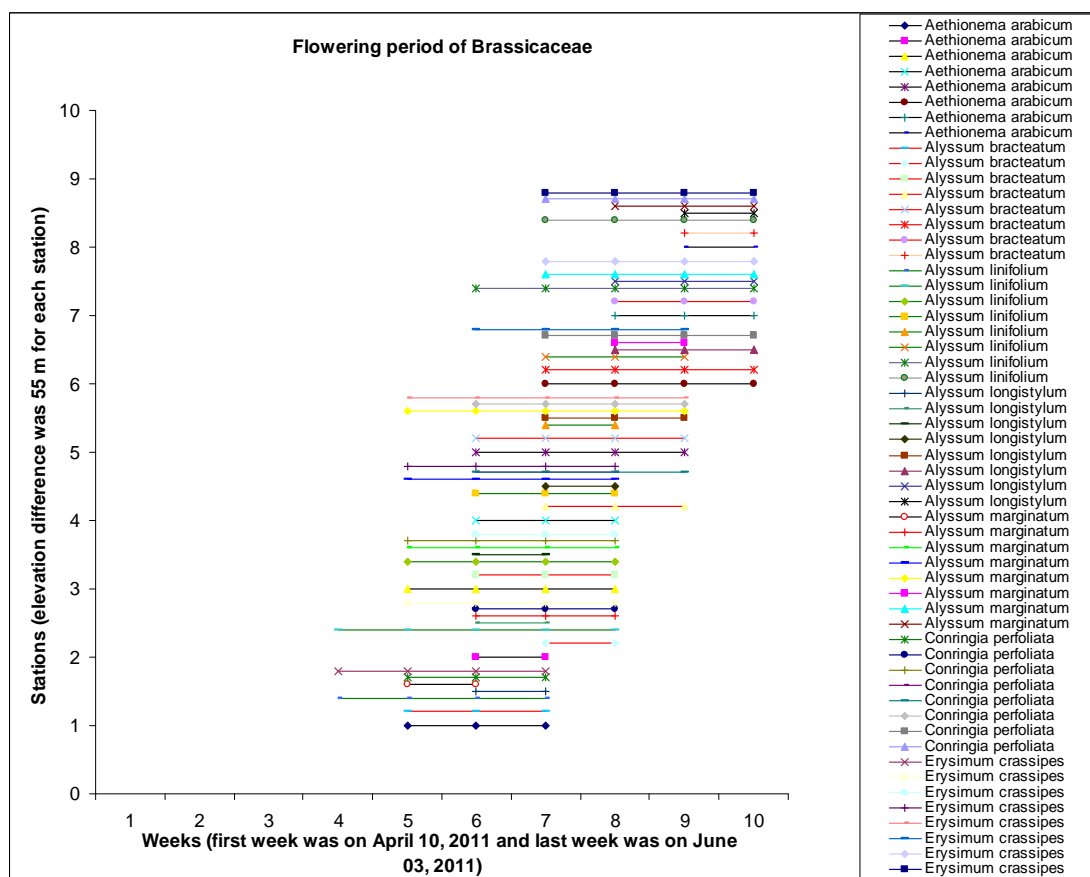


Figure 7: Flowering period (start and end of flowering) of *Aethionema arabicum*, *Alyssum bracteatum*, *Alyssum linifolium*, *Alyssum longistylum*, *Alyssum marginatum*, *Conringia perfoliata*, *Erysimum crassipes* in research area.

CONCLUSION

We studied flowering period as an important factor for pollination, nectar and pollen usage with honey bees. Much of the previous work on flower nectar has not taken into account the age of the blossoms as a factor in nectar production; yet several studies indicate that age is important [18]. Ewert [10] reported that aged flowers in several lime species yielded twice the weight of nectar of young flowers (both protected from insect pollination) [10, 18] and The elevation can be affected on quality and quantity of grasses too [9]. Suitable conditions for seed germination and seedling growth are the most important factors that affect the natural regeneration of plants [2, 24] and start of flowering period in an area. But Besides age of flowers, it is so important to know period of flowering duration for each plant in an area. As results of this research (figure 7), *Alyssum linifolium* had *Alyssum longistylum* shortest flowering period about 29 days and had longest flowering period about 42 days.

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