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Full Length Research Paper

Investigation on flowering period of Asteraceae members in the Shanjan region Shabestar district, Northwest Iran (usage for honeybees)

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Identification of plants distribution honey plants in an area are very important and necessary for the Apiculture and Nectar production and it also plays an important role in the pollination of flowering plants. The aim of this research was determine flowering duration and delay for three plants of Asteraceae family Shanjan Rangeland [*Scorzonera phaeopappa* (Boiss.), *Senecio mollis* (Willd.) and *Siebera nana* (DC.)]. This research was conducted in Shanjan Rangeland with elevation between 1600 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 10.5, 7.25 and 5.5 days delay for each 110 m elevation deference for flowering start of *S. phaeopappa*, *S. mollis* and *S. nana*, respectively.

Key words: Asteraceae, *Scorzonera phaeopappa*, *Senecio mollis*, *Siebera nana.*

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 (Southwick and Southwick, 1983). Due to the fact that diversity of plants and number of flowers in an area has an important effect on utilization by honey bees, the identification of these plants for nectar or pollen feeding is very important in a region. Because of the benefits of bees, trees or plants depend on phenology and biogeography. Most of these factors are specific to location, and depend heavily on seasonal weather patterns (Hill and Webster, 1995). 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 reduced 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 (Diemer, 1988; Nair and Singh, 1974). Studies on Nour River Watershed (north Iran), found that the famous pollen producer plants in this area is from Leguminosae, Rosaceae, Compositae, and Labiatae (Razaghikamroudi, 2000, 2006). Manafi found in honey from Northwest Iran (Azerbayjan area) the most pollen in Khoy, Oskou and kalibar districts are from Asteraceae (especially from Helianthus or Sunflower), Labiatae and Leguminosae plants, respectively (Manafi, 1994: 180-183). Memarian found the most pollens in honey produced in Khorasan Province are from Compositae plants (Memarian, 2000), he studied 43 Tribes from 28 plant families. Nazarian et al. (1997) found the most pollens in honey produced in Tehran Province are from Compositae, Leguminosae, Labiatae, Rosaceae, Brassicaceae, Umbelliferae, Liliaceae, Papaveraceae, Boraginaceae and Malvaceae. Barbara (1991) suggested the best way for identifying and classification of plants is pollen identifying. Crompton and Wojtas (1993) studied on pollen grains of Canadian honey plants and published a book with this name (Crompton, 1993). In addition, the

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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 (Collison, 1973; Southwick and Southwick, 1983). Much work has been done on nectar production and pollinator interaction, especially in tropical, southern and southwestern American species, and north European species (Southwick and Southwick, 1983). Unfortunately, a similar research to that of this research has not been studied yet.

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 phonological changes of plant for planning hives relocation time.

MATERIALS AND METHODS

This research was conducted in Shanjan Rangeland with elevation between 1600 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 to 1850 m (Bibalani et al., 2011b). The terrain in this area is hilly (Bibalani et al., 2011a; Bibalani et al., 2011b) and we carried out the study on a site with a SW aspect (Figure 2).

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.

Asteraceae or Compositae, (the aster, daisy, or sunflower family), comprise the largest family of vascular plants (Panero and Crozier, 2011; Stevens, 2011). The family has more than 22,750 currently accepted species, spread across 1620 genera, and 12 subfamilies. One of largest genera is *Senecio* with 1,500. Most members of Asteraceae are herbaceous, but a significant number are also shrubs, vines and trees. The family is distributed throughout the world, and is most common in the arid and semi-arid regions of subtropical and lower temperate latitudes (Scott et al., 2006). Compositae were first described in 1792 by the German botanist Paul Dietrich Giseke (Scott et al., 2006). Traditionally, two subfamilies were recognised: *Asteroideae* (or *Tubuliflorae*) and *Cichorioideae* (or *Liguliflorae*). The latter has been shown to be extensively paraphyletic, and has now been divided into 11 subfamilies, but the former still stands (Panero and Funk, 2002). Daisy roots are usually taproots, and sometimes fibrous. Stems are generally erect, but sometimes prostrate to ascending. Some species have underground stems in the form of caudices or rhizomes; these can be fleshy or woody depending on the species. The leaves and the stems very often contain secretory canals with resin or latex (particularly common among the Cichorioideae). The leaves can be alternate, opposite, or whorled. They may be simple, but are often deeply lobed or otherwise incised, often conduplicate or revolute. The margins can be entire or dentate. The most evident characteristic of Asteraceae is perhaps their inflorescence: a specialized *capitulum*, technically called a *calathid* or *calathidium*, but generally referred to as flower head or, alternatively, simply *capitulum.* The *capitulum* is a contracted raceme composed of numerous individual sessile flowers, called the florets, all sharing the same receptacle (Panero and Funk, 2002; Solbrig, 1963).

The capitulum of Asteraceae has evolved many characteristics that make it look superficially like a single flower. This type of flower-like inflorescence is fairly widespread amongst angiosperms, and has been given the name of pseudanthia (McKenzie et al., 2005).

Many bracts form an involucre under the basis of the capitulum; these are called "phyllaries", or "involucral bracts". They may simulate the sepals of the pseudanthium. These are mostly herbaceous but can also be brightly colored (e.g. Helichrysum) or have a scarious texture. The bracts can be free or fused, and arranged in one to many rows, overlapping like the tiles of a roof (imbricate) or not (this variation is important in identification of tribes and genera) (McKenzie et al., 2005).

Each floret may itself be subtended by a bract, called a "palea" or "receptacular bract". These bracts as a group are often called "chaff". The presence or absence of these bracts, their distribution on the receptacle, and their size and shape are all important diagnostic characteristics for genera and tribes (McKenzie et al., 2005; Panero and Funk, 2002).

The florets have five petals fused at the base to form a corolla tube and they may be either actinomorphic or zygomorphic (McKenzie et al., 2005). Disc florets are usually actinomorphic, with five petal lips on the rim of the corolla tube. The petal lips may be either very short, or long, in which case they form deeply lobed petals. The latter is the only kind of floret in the Carduoideae, while the first kind is more widespread. Ray florets are always highly zygomorphic and are characterized by the presence of a ligule, a strap-shaped structure on the edge of the corolla tube consisting of fused petals. In the Asteroideae and other minor subfamilies these are usually borne only on florets at the circumference of the capitulum and have a 3+2 scheme above the fused corolla tube, three very long fused petals form the ligule, with the other two petals being inconspicuously small. The Cichorioidea has only ray florets, with a 5+0 scheme all five petals form the ligule. A 4+1 scheme is found in the Barnadesioideae. The tip of the ligule is often divided into teeth, each one representing a petal. Some marginal florets may have no petals at all (filiform floret) (Solbrig, 1963).

The calyx of the florets may be absent, but when present, it is always modified into a pappus of two or more teeth, scales or bristles and this is often involved in the dispersion of the seeds. As with the bracts, the nature of the pappus is an important diagnostic feature (Panero and Funk, 2002).

There are usually five stamens. The filaments are fused to the corolla, while the anthers are generally connate (syngenesious anthers), thus forming a sort of tube around the style (theca). They commonly have basal and/or apical appendages. Pollen is released inside the tube and is collected around the growing style, expelled with a sort of pump mechanism (nüdelspritze) or a brush (Panero and Funk, 2002).

The pistil is made of two connate carpels. The style has two lobes; stigmatic tissue may be located in the interior surface or form two lateral lines (McKenzie et al., 2005). The ovary is inferior and has only one ovule, with basal placentation (Solbrig, 1963).

The fruit of the Asteraceae is achene-like, and is called a cypsela (plural cypselae). Although there are two fused carpels, there is only one locule, and only one seed per fruit is formed (McKenzie et al., 2005). It may sometimes be winged or spiny because the pappus, which is derived from calyx tissue often, remains on the fruit (for example in dandelion). In some species, however, the pappus falls off (for example in Helianthus). Cypsela morphology is often used to help determine plant relationships at the genus and species level.http://en.wikipedia.org/wiki/Asteraceae. The mature seeds usually have little endosperm or none. Asteraceae are especially common in open and dry environments. Many members of the Asteraceae are pollinated by insects, which explain their value in attracting beneficial insects, but anemophyly is also present. There are many apomictic species in the family (Panero and Funk, 2002; Solbrig, 1963; Stevens, 2011).

We studied three species of Asteraceae family such as *Scorzonera phaeopappa* (Boiss.) (Figure 4), *Senecio mollis* (Willd.) (Figure 5) and *Siebera nana* (DC.) (Figure 6).

Figure 1. Location of studing area on map of Iran.

RESULTS

We studied 8 stations with 55 m deference 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 deferent elevation for this plants. Flowering date was on April, 15, 2011 in first station with elevation equal 1600 m and it was on May 27, 2011 on last station with 2040 m elevation for *S. phaeopappa* (Boiss). It showed about 42 days delay for flowering of *S. phaeopappa* (Boiss) with 440 m elevation deference. Flowering date was on May, 06, 2011 in first station with

Figure 2. Studding area at Shanjan rangeland in Shabestar district, East Azerbaijan province, Iran with two kinds of Beehives (photo was taken on Jun 11, 2011 by fist author).

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

Figure 4. *Scorzonera phaeopappa* (Boiss.) species.

elevation equal 1600 m and June 03, 2011 on last station with 2040 m elevation for *S. mollis*. It showed about 29 days delay for flowering of *S. mollis* with 440 m elevation deference. Flowering date was on May, 13, 2011 in first station with elevation equal 1600 m and June 03, 2011 on last station with 2040 m elevation for *S. nana*. It showed about 22 days delay for flowering of *S. nana* with 440 m elevation deference. On the other hand, there are 10.5, 7.25 and 5.5 days delay for each 110 m elevation deference for flowering start of *S. phaeopappa*, *S. mollis* and *S. nana*, respectively (Figure 7).

Conclusions

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

Figure 5. *Senecio mollis* (Willd.) species.

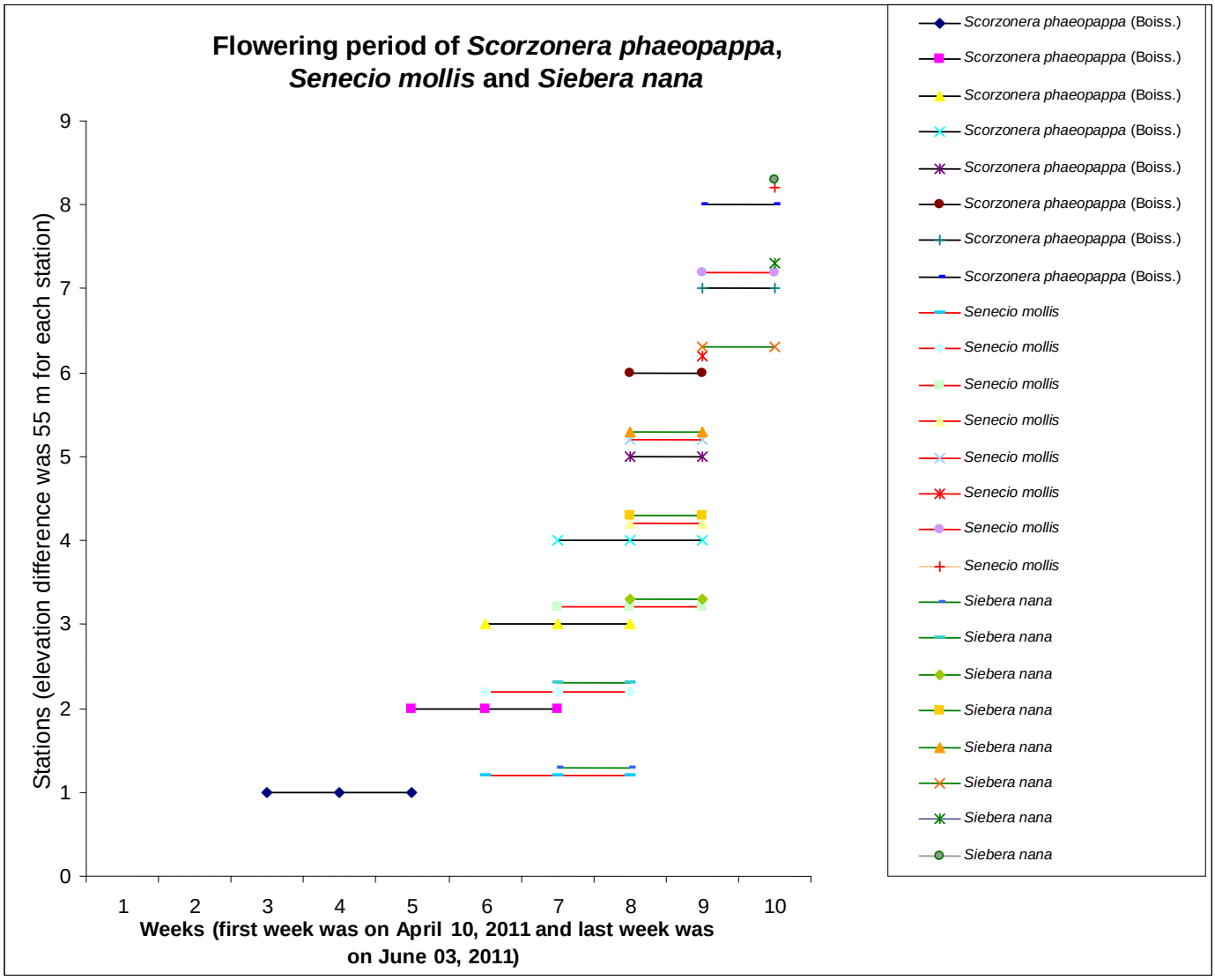

Figure 7. Flowering period (start and end of flowering) of *Scorzonera phaeopappa*, *Senecio mollis* and *Siebera nana* in research area.

into account the age of the blossoms as a factor in nectar production; yet several studies indicate that age is important (Southwick and Southwick, 1983). Ewert (1936) reported that aged flowers in several lime species yielded twice the weight of nectar of young flowers (both protected from insect pollination) (Ewert, 1936; Southwick and Southwick, 1983), but besides the age of flowers, it is so important to know period of flowering duration for each plant in an area.

As a results of this research (Figure 7), *S. phaeopappa* had the longest flowering period about 50 days. More nectar and pollen have been collected with honey bees form this member of Asteraceae in this period. Most of the researches on bee and plants phenology relationship have been done for tropical regions (Hernandez and Abud, 1987; Hill et al., 1995; Loneragan, 1979; Park, 1987: 1-8.), but we studied this research in a part of developing country for improving honey beekeepers with providing additional income. There is need to know the density of these flowers per hectare for calculating the amount of nectar and pollen that have been utilized with bees.

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