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Is the Origin of *Veronica* L. Genus Turkey?

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Abstract

In this study, distribution of *Veronica* taxa throughout the world that distributed from Turkey were explained. This subject has been considered in this article firstly as original and scientific. More than 80 species of *Veronica* genus are found in Turkey which is small region comparing to world land and the endemism rate of *Veronica* taxa is very high in Turkey. This suggest that *Veronica* taxa on the world may originate from Turkey. The richness and distribution of *Veronica* taxa may be affected by different factors; geomorphologic structure, climate changes in the region, specific sediments belong to geologic period, positioned in the moderate zone as a geographic situation and even paleomorphologic, paleogeographic and paleoclimatologic changes. Also, historical, ethnographical and some other natural factors have affected this distribution. In the earth, although Turkey is a small region but contains high number of *Veronica* taxa. Turkey is situated in the geometrical center of the distribution of *Veronica* in the earth. It can be concluded that Turkey is the original centre of *Veronica* genus and gene center according to scientific and theoretic data.

Keywords: *Veronica*, origin, gen center, Turkish flora.

1. Introduction

Veronica L. is a large diverse genus of the Veronicaceae sensu Angiosperm Phylogeny Group with approximately 450 species in the world. It's taxa distributed mainly in the temperate regions of the northern hemisphere and Australia (Albach et al., 2004). The genus *Veronica* comprises annual and perennial herbs, with alternate or opposite leaves, flowers solitary or in racemes and the habitats vary from wet places and damp grassland to cultivated ground and rocky slopes. Traditionally, *Veronica* was placed in the tribe Veroniceae by Bentham (Bentham, 1846); in addition *Veronica* also was placed Veroniceae family (Öztürk, Kılıç, 2016). In Flora of Turkey *Veronica* taxa are generally annual or perennial; leaves are facing one another; divided or undivided; flowers are in racemose or spica state; corolla is round, slightly zygomorphic, bluish, purple, reddish and in oviform; fruits are bilocular, locular or in septicidal capsule form; seed are in high and low numbers and in puffed or variolitic form (Fischer, 1978).

Due to its geographical location, geomorphologic structure, wide variety of soil types and climate diversity, our country has a interesting and rich flora and comes at the head of the world

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countries in terms of plant diversity and richness. While there are about 12.000 plant species in the whole European continent, there are more than 13.000 plant taxa in our country with current numbers, and this number is increasing every year as new plant species are discovered (Akman, 1993). The genus *Veronica* L. widely distributed throughout the Northern and Southern Hemisphere in the world, and is ecologically diverse with species growing in aquatic to dry steppe habitats from sea level to high alpine regions (Albach et al., 2005). *Veronica* has high species number and has more than 250 species around the world; 86 species and more than 107 taxa were found to be in Turkey (Öztürk, 2001; Öztürk, 1977; Albach, Chase, 2001).

Veronica has a remarkable ecological amplitude from aquatic to semidesert habitats, from high alpine meadows to urban lawns and gardens. *Veronica*'s center of diversity is the eastern Mediterranean region spreading from there over the whole Northern Hemisphere, East Africa, Australia and several species of this genus have become cosmopolitan. It has been determined that about 86 *Veronica* species have been grown in Turkey, this number is 59 for Europe (Öztürk, 2001). Therefore, the number of *Veronica* species of Turkey (Turkey's area is 15 times smaller than Europe area), are over 27 species than the European continent. This and other evidences which were explained in the results and discussion part of this article are the indicators that gene center of *Veronica* is Turkey.

Crucial information to understand the origin of *Veronica* genus; in this study we implemented a comparative analysis number and distribution of *Veronica* species in Turkey and World to address the following questions: Where is the origin or gen center of the *Veronica* genus? By answering this question, we aim to expand our understanding of the distribution of *Veronica* taxa in world and Turkey.

2. Relevance

Veronica taxa on the world may originate from Turkey. In Turkish Flora, the richness and wide distribution of *Veronica* taxa may be affected by different factors. In the earth, although Turkey is a small region but contains high number of *Veronica* taxa (more than 80 species). Turkey is situated in the geometrical center of the distribution of *Veronica* in the earth. It can be concluded that Turkey is the original centre of *Veronica* genus and gene center according to scientific, theoretic data like in this research.

3. Material and Methods

To reach the target of this article we used figure, datas and literature sources about *Veronica* genus and *Veronica* taxa and plant materials of *Veronica* taxa are deposited herbarium of Van Yüzüncü Yıl University (VANF).

4. Discussion

While the number of *Veronica* species naturally grown in the whole world is 250 (Albach, Chase, 2001), the number of *Veronica* species in Turkey is 86 (Öztürk, 2001). However, the area of the world land is about 100 times more than the area of Turkey. Such: Turkey area / World area = 4/1.000. *Veronica* species in Turkey/*Veronica* species in World = 86/250 = 1/3. So the number of *Veronica* species in Turkey is about three (86/250 = 0.3) in ten species in the world. In the literature it can not be found *Veronica* number in any other country as much as Turkey. So it can be say that, Turkey is gen center or origin area of *Veronica* genus because of high density of *Veronica* species. In addition, the *Veronica* species distribution world map published by Elenevakij (Elenevakij, 1978) shows that the gen center of the *Veronica* is Turkey (Figure 1). Geometric centre, origin centre and density centre are come over eachother in Turkey. This is a rare situtation for *Veronica* genus, so we can say that this is a new genus and is not belong to old geologie time and distribution of genus countionoutly going on. Turkey is one of the rare examples of includes three types of area centers (geometric, origin and density centre). *Veronica*'s distribution area type is in a continuous (closed) areal view, so this is a new areal. In addition, many *Veronica* taxa have rich endemism in Turkey and the population density of *Veronica* taxa is high in Turkey. An interesting exception is that some islands in northern and mid-northern Australia and northern Australia are lacking spreading of *Veronica* taxa (Figure 1) and the cause of this situation needs to be explored and explained. An assumption; *Veronica* in the North Australian territory has spread even earlier, but may have disappeared due to the current negative eco-geographic conditions. Partial

propagation can also be considered in this case. However, finalization of this can be done by exploring the *Veronica* fossils in that area. There is no *Veronica* species distribution in southern South America, southern Africa, and Madagascar Island; *Veronica* as a new genus of fourth geological time and did not spread around these areas because of adverse climate, soil or ecogeographic conditions. Perhaps after a long time (1000-10.000 years) when ecogeographic conditions are available, it will be possible to spread the appropriate species of *Veronica* in the cited empty areas (Öztürk, 2010).

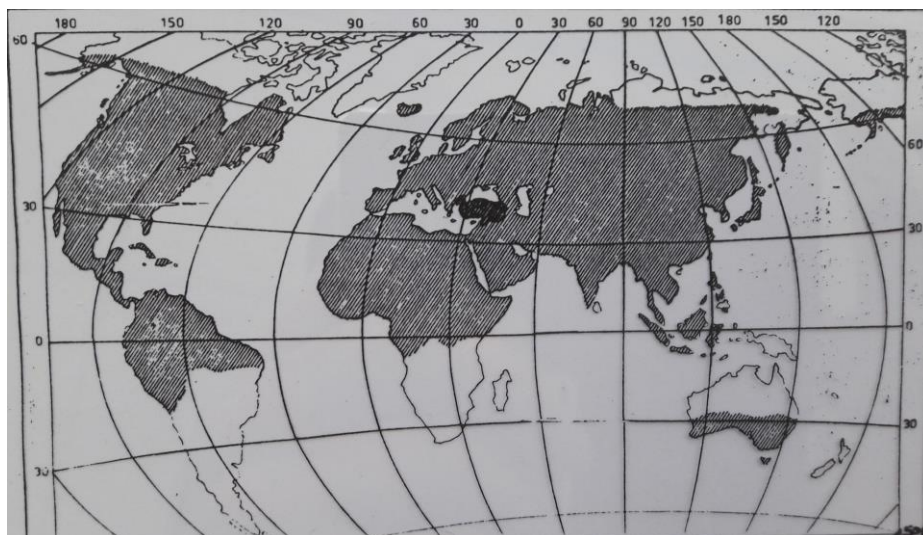


Fig. 1. Areal of *Veronica* genus and Turkey

Another interesting points are continuous distribution of *Veronica* genus in Northern Hemisphere and discontinuous or partial distribution in Southern hemisphere Lands. Also unrepresented of *Veronica* genus in south part of South America and in North of Australia is interesting (Elenevakij, 1978) (Figure 1). The reasons for this could be climatologic, geographic, tectonic, paleoclimatologic or paleogeographic condition of geologic time or now. These factors may evidence that gene center or creation centre of *Veronica* genus should be northern hemisphere, particularly Turkey. Both richness of *Veronica* taxa and endemic richness and population richness in Turkey may be evidences and support the gene centre observed, it can be seen that *Veronica* species has not yet distributed on South America, southern part of Africa and North part of Australia. Probably creation geometric centre of *Veronica* genus may northern hemisphere; for instance Turkey which is geometric centre of northern hemisphere (Figure 1) since there is no any fossil record of them. Also it supports the idea of new genus created in fourth geologic time and it is not belong to old geologic time. When we compared number species of *Veronica* in Turkey with the other countries the following situation is evident; percentage of *Veronica* species compared to Turkey with all other countries; Turkey's *Veronica* species number is more than other countries. For example, the area of Iran is more than twice the area of Turkey, but the number of *Veronica* species is 62 in Iran (Fischer, 1982), however Turkey includes 86 *Veronica* species; so the number of *Veronica* species of Turkey much higher than Iran's *Veronica* species according to surface areas (Öztürk, 2001). Although the area of Turkey is very small (1/15th) according to the total area of European countries (Ekim, 2000), the number of *Veronica* species in Europe is 59 (Öztürk, 1977). Armenia is a very narrow country and it has 35 *Veronica* species, because it is a country close to Turkey in the Caucasus region, Caucasus region and for the Aegean Islands and peninsulas includes 59 *Veronica* species (Gabrielyan, 1962; Grossgeym, 1967; Rechinger, 1973). The Russian territory is a very large geography and has 150 *Veronica* species (Komarov, Borisova, 1955). Twenty four *Veronica* species are given for Lebanon and Syria flora (Fischer, 1980). When compared the distribution of *Veronica* species on world the surface and the spread of the species on the Turkey; Turkey has 40 % of *Veronica* species growing in the world. However, the area of Turkey is very small (0.004 %) according to earth's surface. This indicates that the *Veronica* taxa in Turkey are at a very high density. That kind of density is showed that Turkey is the the first creation of *Veronica*

genus (Öztürk, 1986; Öztürk, 1982). Gen center (origin center) is known as the data of the science of plant geography (Erinç, 1977). Moreover, Turkey territory is located in the center of *Veronica* areal (geographical area) (Figure 1). Figure 1 clearly shows that density center of the genus *Veronica* and the geometric center of the distribution area in the world coincide in Turkey. This article has been partially published in the oral presentation and in the summary book in the congress summary book (Öztürk, 2000; Öztürk, 2005)

Until today, there have been many studies on *Veronica* genus. Many new species have also been discovered in the post-Linne period. In the last 40-50 years many studies were done about *Veronica* and many new taxa have been discovered especially from Turkey and the addition of new species are continues (Öztürk, Öztürk, 2000; Colak, Sorger, 2004; Vural, 2009; Öztürk, 2006; Öztürk, 2008; Öztürk, 2004; Öztürk, 2004; Öztürk, 1978; Öztürk, 1978; Öztürk, Fischer, 1982; Öztürk, Fischer, 1989; Öztürk, 1983; Öztürk, Öztürk, 2000).

5. Conclusion

In conclusion, the world area is 100 times more than Turkey, but *Veronica* species are not as dense in any part of the world as in Turkey. When we compared to the number of *Veronica* (rich in endemism) contained in the area of Turkey to the number of species contained in the areas of the world, it is seen that Turkey contains 120 times more *Veronica* species. As it can be seen from the literature, no region of the world is as dense as *Veronica* species as in Turkey. These evidences mentioned in the article are strong evidences that the gen center of the genus *Veronica* is Turkey. Therefore, we can say that the origin area of *Veronica* is Turkey.

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