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## Reasons of Upgrading *Veronica anagalloides* subsp. *heureka* to Species Level as *Veronica heureka*

Avni Öztürk<sup>a,\*</sup>, Ömer Kılıç<sup>b</sup>

<sup>a</sup> Yüzüncü Yıl University, Van, Turkey

<sup>b</sup> Bingöl University, Technical Vocational College, Bingöl, Turkey

### Abstract

With plant samples related to *Veronica anagalloides* Guss. which was previously identified as *Veronica michauxii* Lam. by Öztürk and mentioned its name in his doctoral theses and in a publication. Samples published by M.A. Fischer as *Veronica anagalloides* Guss. subsp. *heureka* M.A. Fischer, due to reasons stated in this article it needs to be raised to species level named *V. heureka* (M.A. Fischer ex) A.Öztürk & Ö.Kılıç. In an article cited samples were given abortive names as *V. heureka* by Öztürk & Fischer. Because of the impossibilities in 1977, Öztürk identified *Veronica anagalloides* as *Veronica michauxii* due to more morphological similarities. M.A. Fischer in his paper which published in 1981, because of the large number of transitional forms in terms of morphological characters and at the time of his impossibilities he had to classify at subspecies level named *Veronica anagalloides* subsp. *heureka*. In later years, karyological evidences were obtained and publications were made to support this classification. Their details are mentioned in this article text.

**Keywords:** Scrophulariaceae, Veronicaceae, *Veronica*, *V. anagalloides*, *V. heureka*, stat. n.

### 1. Introduction

*Veronica* L. is a large diverse genus of the Veronicaceae sensu Angiosperm Phylogeny Group with approximately 450 species in the world. Its taxa distributed mainly in the temperate regions of the northern hemisphere and Australia (Albach et al., 2004). 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). *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, 1977; Öztürk, 2001; Albach, Chase, 2001).

In the past years, identification and classification of *Veronica heureka* hardship by Fischer and Öztürk. Öztürk investigated this species by morphological and compared with literature samples which was collected from Allahuekber mountains in 1976, to determine it is a new species or not. In 1977 Öztürk was identified and specified this species as *Veronica michauxii* Lam. in his PhD theses, because of more morphological similarities. In 1978 Öztürk took these samples to Vienna and showed them to Fischer. When Fischer saw these samples in the Öztürk's PhD theses

\* Corresponding author

E-mail addresses: [avniöztürk49@gmail.com](mailto:avniöztürk49@gmail.com) (A. Öztürk)

(Öztürk, 1977), he declared that he studied to clear this statement for five years and now he has cleared this statement. Then he used 'heureka' latin word which means 'I found'. Then Fischer identified these samples as *V. anagalloides* subsp. *heureka* M.A. Fischer in 'Flora of Iranica'. This decision of Fischer was influenced by incomplete examinations and transitional forms at that time. In later years, as a result of karyosystematic and karyological examinations, this issue has become more enlightened (Öztürk, Fischer, 1982; Fischer, 1982; Öztürk, Öztürk, 2000). During these investigations, some important morphological and karyological differences were found and compared. Thus, it has been concluded that the specimens should be a separate species.

In the light of these studies, it has become necessary to raise the *V. anagalloides* Guss. subsp. *heureka* M.A. Fischer to new species level as *V. heureka* (M.A. Fisch.) ex A. Öztürk & Ö. Kılıç.

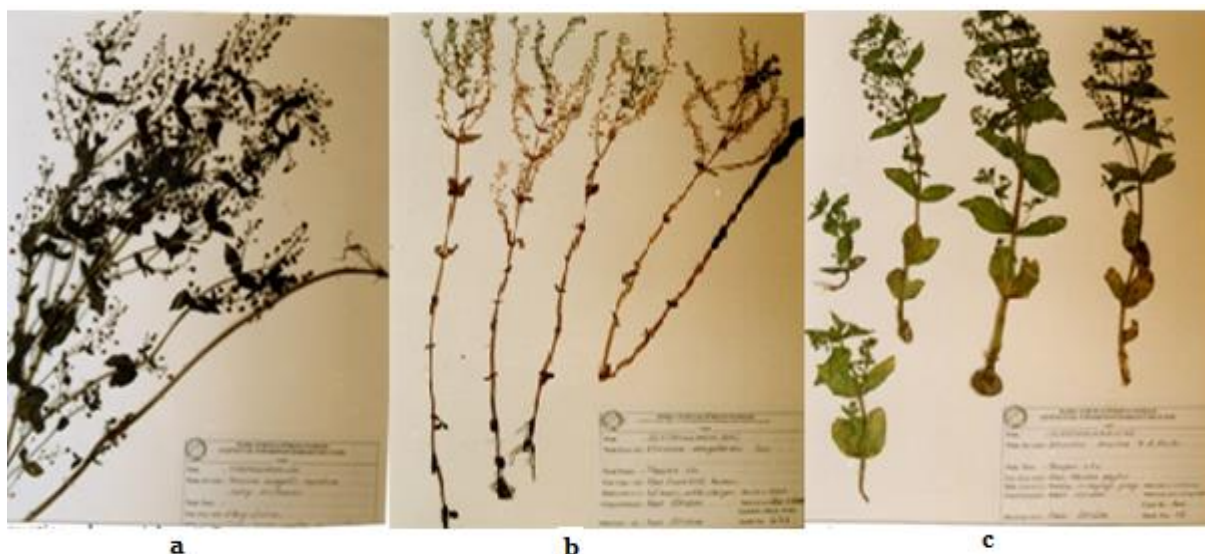
## 2. Relevance

In this research, we proved that *Veronica heureka* (M.A. Fisch.) ex A. Öztürk & Ö. Kılıç should be evaluated as a separate species, because of habitus, morphological, karyological and karyosystemic findings.

## 3. Material and methods

To reach the target of this article we used figures (Figures 1-5), datas and literature sources about *Veronica* taxa (Öztürk, 1978; Öztürk, 1983; Öztürk, 1982; Davis, 1978; Elçi, 1994; Darlington, 1976; Öztürk, 2006; Öztürk, 2008) and plant materials of *Veronica* taxa are deposited herbarium of Van Yüzüncü Yıl University (VANF).

General view of *Veronica* taxa is seen in Figure 1.



**Fig. 1.** General view of **a:** *V. anagallis-aquatica* subsp. *michauxi*, **b:** *V. anagalloides*, **c:** *V. heureka*

## 4. Results and Discussion

According to obtained results, the upgrade of *Veronica anagalloides* subsp. *heureka* to species level with the name *Veronica heureka* is due to the morphological and karyological differences between these taxa. In 1981 at Flora of Iranica *V. anagalloides* subsp. *heureka* published by Fischer and Öztürk; then Fischer mentioned these population samples as *V. heureka* in 1991 (Öztürk, Fischer, 1991). There are significant morphological and karyological differences when compared to the population samples of *V. anagalloides* subsp. *heureka* and *V. heureka*. Although the leaf blade is 5-30 x 15-60 mm in *V. heureka*, in *V. anagalloides* leaf blade is 2-10 x 25-40 mm. Details of these differences are shown in Table 1.

**Table 1.** Character Encounter Table

Characters	<i>Veronica anagalloides</i> subsp. <i>heureka</i>	<i>Veronica heureka</i>
Shape of leaf	Linear-lanceolat	Eliptic ovat-lanceolat
Leaf size	7-20 x 3-10 mm	(8-)15-40(-60) x 10-25 mm
Leaf base	Sessil, not sieged the stem	Sessil, sieged the stem
Pediceal connecting angle to stem	(10°-) 20°-30°	(60°-) 70°-80° (-90°)
Capsul shape	Eliptic triangular	Orbicular, obovat
Total genom	31.372 µm	40.198 µm
Avarage chromosom length	1.743 µm	2.223 µm
Status of petals length	Narrow and capsuls are equal length	Wide and exerted capsuls
Petal/pediceal	1/2	1/1
Corolla colour	Bright blue	Pink, rose red, white-blue
Satellite	There are 1-2 satellit	There aren't satellit
Chromozom size	(2n) = 18	(2n) = 18
Corolla fauces	Glandular, fragrant	Glandular, fragrant

Obtained karyosystematic studies, distinctive chromosome size and morphological differences require raised this subsp. to species level (Tables 1-4, Figures 1-5).

**Table 2.** Chromosome measurements *V. anagallis-aquatica* subsp. *michauxi*

Chromosome No	Average chromosom length (µm)	Proportional length
1	4.755 <sup>+</sup> - 0.223	15.782
2	4.044 <sup>+</sup> - 0.236	13.422
3	3.666 <sup>+</sup> - 0.217	12.167
4	3.600 <sup>+</sup> - 0.240	11.948
5	3.333 <sup>+</sup> - 0.186	11.062
6	3.200 <sup>+</sup> - 0.151	10.621
7	2.733 <sup>+</sup> - 0.143	9.071
8	2.577 <sup>+</sup> - 0.117	8.523
9	2.222 <sup>+</sup> - 0.111	7.375

**Total chromosome length:** 60.260 (µm), **Average chromosome length:** 3.347 (µm)

**Table 3.** Chromosome measurements *V. anagalloides* subsp. *heureka*

Chromosome No	Average chromosom length (µm)	Proportional length
1	2.911 <sup>+</sup> - 0.312	18.558
2	2.533 <sup>+</sup> - 0.315 -SAT	16.148
3	2.033 <sup>+</sup> - 0.293	12.961
4	1.833 <sup>+</sup> - 0.286	11.686
5	1.577 <sup>+</sup> - 0.245	10.054

6	1.411 <sup>+</sup> <sub>-</sub> 0.217	8.995
7	1.333 <sup>+</sup> <sub>-</sub> 0.236	8.498
8	1.133 <sup>+</sup> <sub>-</sub> 0.180	7.223
9	0.922 <sup>+</sup> <sub>-</sub> 0.167	5.878

**Total chromosome length:** 31.372 (µm), **Average chromosome length:** 1.743 (µm)

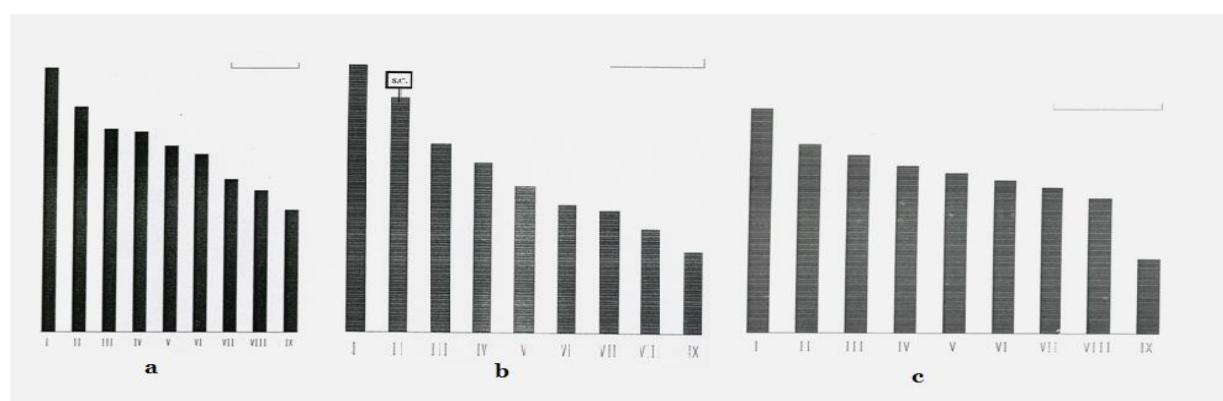
**Table 4.** Chromosome measurements *V. heureka*

Chromosome No	Average chromosom length (µm)	Proportional length
1	3.144 <sup>+</sup> <sub>-</sub> 0.464	15.643
2	2.667 <sup>+</sup> <sub>-</sub> 0.373	13.269
3	2.522 <sup>+</sup> <sub>-</sub> 0.254	12.548
4	2.333 <sup>+</sup> <sub>-</sub> 0.217	11.608
5	2.244 <sup>+</sup> <sub>-</sub> 0.206	11.165
6	2.167 <sup>+</sup> <sub>-</sub> 0.218	10.782
7	2.033 <sup>+</sup> <sub>-</sub> 0.163	10.115
8	1.922 <sup>+</sup> <sub>-</sub> 0.168	9.563
9	1.067 <sup>+</sup> <sub>-</sub> 0.142	5.309

**Total chromosome length:** 40.198 (µm), **Average chromosome length:** 2.233 (µm)

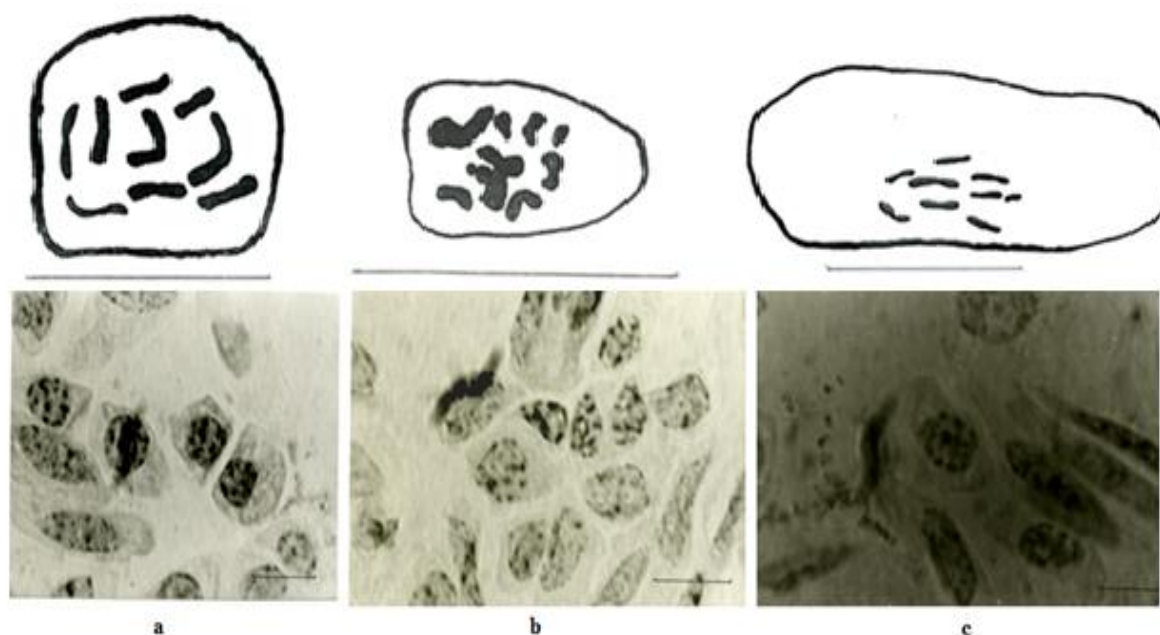
In a research about chromosom and caryotype analyzes of *V. anagalloides* populations, two pairs of satellite have been detected on two chromosomes (Öztürk, Fischer, 1982).

In another study, 1 satellite was detected in 2 chromosomes (Öztürk, Öztürk, 2000). Despite the presence of satellites in the chromosomes of the populations of *V. anagalloides*, no satellite could be detected in the chromosomes of the populations of *V. heureka*.



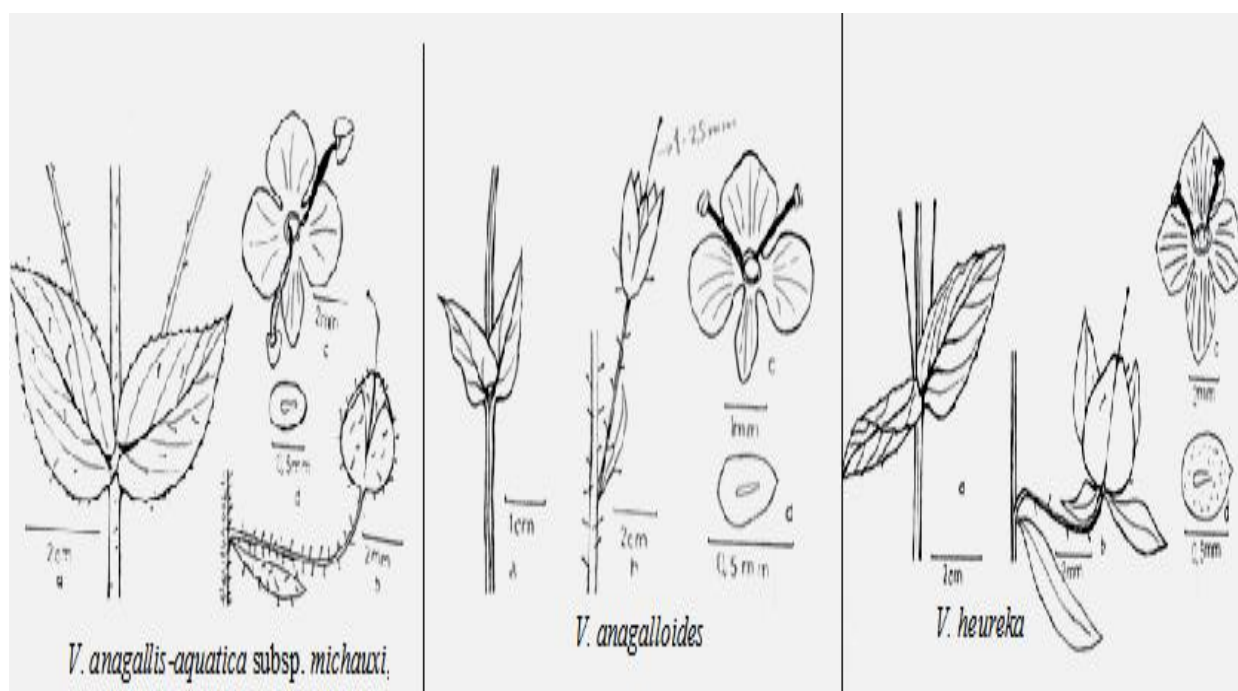
**Fig. 2.** Idiograms (Bar 1µm) of **a:** *V. anagallis-aquatica* subsp. *michauxi*, **b:** *V. anagalloides*, **c:** *V. heureka*



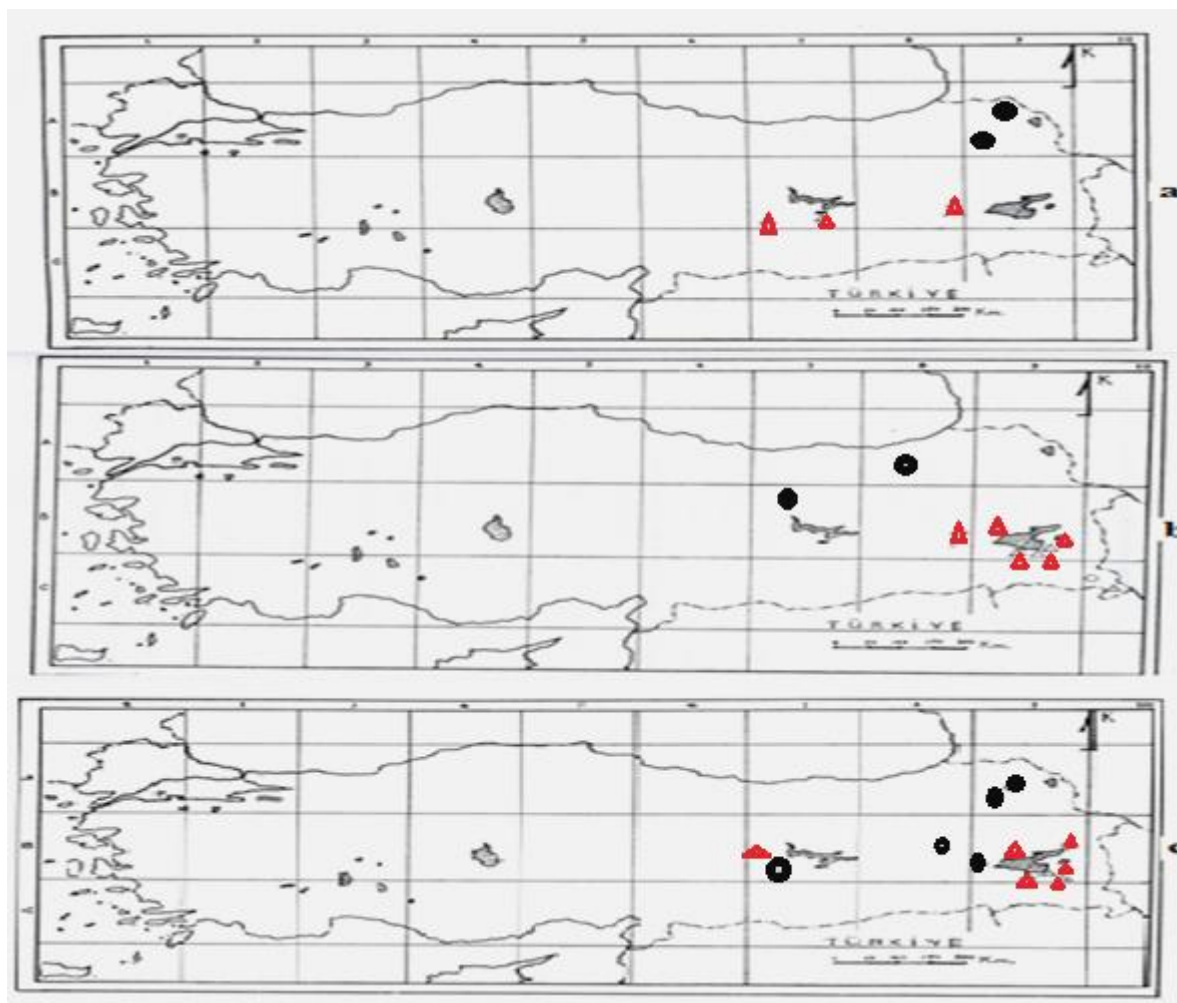


**Fig. 3.** Meiotic metaphase chromosomes in pollen mother cell (Bar 10  $\mu$ m) of **a:** *V. anagallis-aquatica* subsp. *michauxi*, **b:** *V. anagalloides*, **c:** *V. heureka*

In *V. anagalloides*, pedicel are stand out from raceme axes narrow angle (20-30°) but in *V. heureka* pedicel are stand out from raceme axes vertical angle (80-90°). Nevertheless in *V. anagalloides* the capsule is in a narrow elliptical structure, in *V. heureka* base of capsule is wide and orbicular-rounded shape (Figure 4).



**Fig. 4.** **a:** stem and leaves; **b:** fruiting pedicel, peduncul, capsul and stilüs; **c:** corolla and stamens; **d:** seed



**Fig. 5.** ▲ new localities, ● previous localities of **a:** *V. anagallis-aquatica* subsp. *michauxi*, **b:** *V. anagalloides*, **c:** *V. heureka*

When other distinctive morphological differences (Table 1) added, it is a scientific necessity to increase the previously mentioned subsp. to the species level.

### 5. Conclusion

According to the evaluations made in light of the new scientific findings and determinations mentioned in this article, it is appropriate to classify the problematic taxon as a separate taxon from *V. anagalloides* and to raise it to species level as *V. heureka* (M.A. Fischer ex) A. Öztürk & Ö. Kılıç, stat. nova.

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