Turk J Bot
29 (2005) 263-267


Research Article

# Chromosome Counts of Some *Veronica* L. (*Scrophulariaceae*) Species from Iran

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Received: 02.09.2004
Accepted: 07.03.2005

**Abstract:** The chromosome numbers of 10 *Veronica* L. species belonging to sect. *Alsinebe* (Griseb.) Lehm. and sect. *Beccabunga* Griseb. from northern Iran are given. The chromosome numbers for 3 of the 10 studied taxa, i.e. *V. siaretensis* E. Lehm., *V. ceratocarpa* C.A.Mey. (2n = 14) and *V. hederifolia* L. (2n = 36) are presented for the first time. Our results are compared with previous records.

Key Words: *Veronica*, Chromosome number, Iran, mitosis.

## Introduction

Sect. *Beccabunga* subsect. *anagalloides* Keller includes *V. anagallis-aquatica* L. and *V. anagalloides* Guss., which presents a taxonomical problem. Sect. *Alsinebe* (Griseb.) Lehm. is also an extremely confusing group and includes 32 species and several subspecies. Hybridisation occurs frequently in this section with 3 ploidy levels, i.e. diploids, tetraploids and hexaploids are known (Öztürk & Fischer, 1982). Some taxa examined have nearly worldwide distribution, while *V. francispetae* M.A.Fischer, *V. siaretensis* E.Lehm. and *V. ceratocarpa* C.A.Mey. are endemic to the Elburz mountain range in Iran (Fischer, 1987).

There are several reports on the cytotaxonomy of various species of *Veronica* (Fischer, 1967, 1973; Podlech & Dieteric, 1969; Ferakova, 1976; Fernandes-Casas, 1977; Aryavand, 1987; Ghaffari 1987). The present study and the previous reports of chromosome numbers in *Veronica* confirm the variation in the basic number.

## Materials and Methods

The materials used for this study were collected from wild populations. Flower buds were fixed in Carnoy's mixture in the field; the ovaries were then excised and stained in 2% aceto-orcein solution for 5 min. They were immersed in 0.075 M KCl at room temperature for 20 min; then the ovaries were treated with enzyme solution containing 5% cellulase and 5% pectinase and adjusted to pH 4.0 for about 20 min at 35 °C in order to dissolve the cell wall (Kurata & Omura, 1978). The ovaries were squashed in 45% acetic acid and then permanently mounted in Entellan to facilitate investigations of somatic mitosis. Permanent preparations were made and studied using a BH-2 Zeiss photomicroscope. Voucher specimens are deposited in the Herbarium of Guilan University.

## Results

The chromosome numbers from 13 populations of the 10 species examined are given in Table 1.

*V. anagalloides* Guss subsp. *heureka* M.A.Fischer (Figure A)

This taxon occupies an area from Central Anatolia to Pakistan. It is distinguishable from *V. anagalloides* subsp. *anagalloides* by its wider and shorter leaves and its suborbicular (not elliptical) and larger capsule. Our counts of 2n = 36 agree with that given by Podlech & Dieteric

Table 1. Chromosome numbers of 10 *Veronica* species from Iran.

| Taxon | Pop. No. | Locality | 2n |
|---|---|---|---|
| *V. anagalloides* Guss subsp. *heureka* M.A.Fischer | 1 | Guilan; Asalam, 50 km to Khalkhal, 1700 m, Saeidi 24077 | 36 |
| *V. anagallis-aquatica* L. subsp *michauxii* (Lam.) A.Jelen. | 2 | Mazandaran; SW Ramsar, Javaher-Deh, 1800 m, Saeidi 1505 | 36 |
| *V. siaretensis* E.Lehm. | 3 | Gorgan; Ziarat village, 1000-1100 m, Saeidi & Kaviani 1248 | 14 |
| *V. francispetae* M.A.Fischer | 4 | Guilan; near Langroud, Talesh-Mahleh, 30 m, Saeidi 24025 | 14 |
| *V. capillipes* Neveski | 5 | Tehran; from Karaj to Chalus, near Gachsar, 1400 m, Saeidi 1301 | 28 |
| *V. campylopoda* Boiss. | 6 | Gorgan; Bastam, Tash-Olia, Shavar, Saeidi & Kaviani 1311 | 42 |
| *V. polita* Fr. | 7 | Guilan; 7 km from Asalam to Talesh, 500-600 m Saeidi 1315 | 14 |
| | 8 | Mazandaran; near Abas-Abad, 1080 m, Saeidi & Asaadi 1452 | 14 |
| *V. persica* Poir. | 9 | Guilan; Daylaman, Shah-Shahidan, 1500-2000 m, Jamzad & Asri 71766 | 28 |
| | 10 | Mazandaran; Nowshahr, Kheyrud-Kenar forest, 200 m, Saeidi 1307 | 28 |
| *V. hederifolia* L. | 11 | Tehran; from Karaj to Chalus, near Gachsar, 1400 m, Saeidi 1310 | 36 |
| *V. ceratocarpa* C.A.Mey. | 12 | Mazandaran; Klardasht, 1300-1400 m, Saeidi 24021 | 14 |
| | 13 | Guilan; Masuleh, 700-800 m, Saeidi 1197 | 14 |

(1969), who studied material from Afghanistan. Öztürk & Fischer (1982) have reported 2n = 18 for this subspecies based on only one collection of Turkish material of *V. anagallis-aquatica* subsp. *lysimachioides*.

*V. anagallis-aquatica* L. subsp. *michauxii* (Lam.) A.Jelen. (Figure B)

Some taxa of the *V. anagallis-aquatica* group have an almost worldwide distribution, but its centre of diversity is south-west Asia (Turkey to Pakistan), where there are at least 9 subspecies or species. The tetraploid chromosome number of 2n = 36 studied here confirms that reported by previous authors (Öztürk & Fischer, 1982) as well as by Aryavand (1987), who examined material from central Iran.

According to Öztürk & Fischer (1982), this species is possibly a hybrid between subsp. *michuaxii* and subsp. *anagallis-aquatica*, although capsules with fertile seeds develop.

*V. siaretensis* E.Lehm. (Figure C)

This species is endemic to Iran, where we found it only in one locality, Gorgan. The chromosome number of 2n = 14 is the first record for this species.

*V. ceratocarpa* C.A.Mey. (Figure D)

This taxon is distributed in Turkey, Iran and middle Asia with a wide distribution in the deciduous forests of Elburz mountain in northern Iran. There are no previous counts for this taxon, and so the chromosome number of 2n = 14 is reported here for the first time.

*V. francispetae* M.A.Fischer (Figure E)

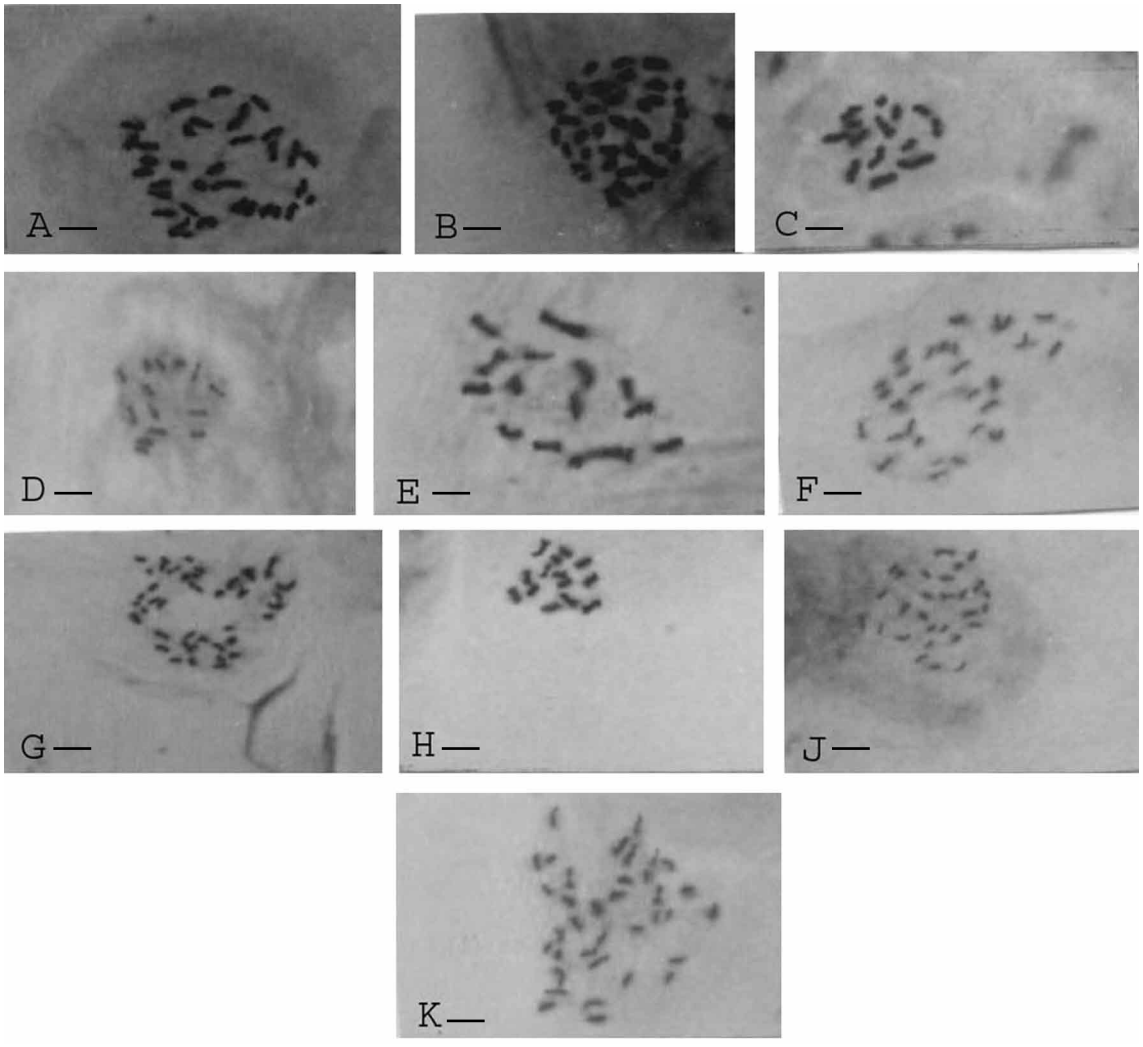
This species is endemic to northern Iran and grows beneath trees and shrubs. The diploid chromosome number of 2n = 14 confirms the count reported by Fischer (1981).

*V. capillipes* Nevski (Figure F)

This species has a disjunct distribution in north-east and central Iran, Pakistan and middle Asia. Meiosis studies of this species by Aryavand (1987) resulted in a count of n = 14, which he reported in the abstract, although in the main text this is incorrectly given as 2n = 14. Our count of 2n = 28 for this species agrees with the n = 14 reported by Aryavand (1978), who studied plant material from Isfahan province in Iran.

*V. campylopoda* Boiss. (Figure G)

This species is an Irano-Turanian element with a wide distribution in Iran, Turkey and middle Asia. A meiotic count of n = 21 was reported for this species by Aryavand (1987) and Ghaffari (1987). We found 2n = 42 for this species, which agrees with the previously published counts.




Figures. A-K: Somatic cells of *Veronica* species. A. *V. anagalloides* subsp. *heureka* B. *V. anagallis-aquatica* L. subsp. *michauxii* C. *V. siaretensis* D. *V. ceratocarpa* E. *V. francispetae* F. *V. capillipes* G. *V. campylopoda* H. *V. polita* J. *V. persica* K. *V. hederifolia*. (Scale bar = 10 µm).

*V. polita* Fr. (Figure H)

This species is widespread in Asia and Europe and extends into Africa and is also distributed in the USA (Fischer, 1981). The diploid chromosome number of 2n = 14 coincides with the results of previous authors (Fernandes et al., 1977; Aryavand, 1987; Ghaffari, 1987).

*V. persica* Poir. (Figure J)

This species is widespread in Iran and throughout the world. Our count of 2n = 28 agrees with those reported by Ferakova (1976) and Fernandes et al. (1977).

*V. hederifolia* L. (Figure K)

This species has a relatively wide distribution in Iran, south-west Asia, middle Asia, Turkey and Europe (Fischer, 1981) and can be found at elevations of up to 1000 m. The count of 2n = 36 is the first record for this species from Iran, although an earlier chromosome count of 2n = 54 was reported from central Iran by Aryavand (1987), which agrees with previous counts by Fernandes et al. (1977) and Fischer (1981). Based on Danish and Dutch material, Gadella & Kliphuis (1975, 1976) reported 2n = 36 for this species.

**Discussion**

The reports so far suggest that each taxon representing a biological entity (subspecies or species) is characterised by one ploidy level, either diploid, tetraploid or hexaploid.

A meiotic count of n = 14 was reported for *V. capillipes* by Aryavand (1987). Ghaffari, in unpublished data (personal communication), repeated a mistake in the text of the paper, which gives 2n = 14, and which was published in Persian by Aryavand (1987). Aryavand (1987) has indicated that the species is diploid, but our studies confirm that *V. capillipes* is a tetraploid species.

Two different cytotypes were known for *V. hederifolia*, with 2n = 54 the more common. This cytotype is also recorded for *V. hederifolia* in Iran by Aryavand (1987). The other cytotype (2n = 36), corresponding to subsp. *lucorum* (Klett & Richter) Hartl. was not previously known in Iran, but according to the present study the cytotype of 2n = 36 suggests that this subspecies may be present in Iran.

Fischer (1967) concluded that the 2 cytotypes are so different that they can be regarded as separate species, *Veronica sublobata* Fisch. (tetraploid) and *Veronica hederifolia* L. (hexaploid), rather than as just a subspecies. Neither Nordenstam & Nilsson (1969), nor De Jongh & Kern (1971) accepted this conclusion. They agreed with Fischer that the 2 taxa could be recognised, but they disagreed with him about the species level for these taxa. The *Veronica hederifolia* complex represented by material from the Netherlands by 2 different habitat cytotypes differ morphologically and probably do not exchange genes (Gadella & Kliphuis, 1976). They suggested that the morphological characters can to a certain extent vary, but in all cases tetraploid and hexaploid plants can be identified by means of a combination of at least 3 or 4 such characters. Gadella & Kliphuis (1975, 1976) support Fischer's view that these taxa should be regarded as separate biological species. They agree that the 2 groups are distinguishable based on the colour of the anthers and the corolla, and the form and structure of the seeds. However, we did not find any comparable morphological differences between them in Iran except for the habit of the 2 cytotypes. We found that the tetraploid plants were usually more slender and smaller than the hexaploid plants.

Hybrids between tetraploid and hexaploid plants of *Veronica hederifolia* are unknown and, considering the subspecific rank to which the variants belong, it seems that this subject needs to be studied in more detail before the correct taxa can be assigned. If the view is held that the (apparently rare) intermediate transitional forms are so important that they blur the distinction between the 2 forms, then the tetraploid should be assigned to *Veronica hederifolia* L. subsp. *lucorum* (Klett & Richter) Hartl. and the hexaploid to *Veronica hederifolia* L. subsp. *hederifolia*.

Since these transitional specimens are perfectly fertile and may occur in large proportions in Asian and European populations, this is the main reason why we have decided to assign the subspecific level to these 2 taxa.

These deviating chromosome numbers demonstrate the need for further studies on the *Veronica hederifolia* complex.

**Acknowledgements**

We are grateful to Dr. Sh. Zarre, Tehran University, for his useful comments. The first author was supported by project number 65 of the University of Guilan Research Council.

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