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Cytotaxonomic investigations on some taxa of the genus *Vicia* L. from north-eastern Anatolia

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Abstract.- In this study, some natural *Vicia* L. species growing in north-eastern Anatolia were investigated cytotaxonomically. Chromosome numbers and morphologies of the 15 taxa belonging to the *Vicia* genus were studied by using karyological and numeric taxonomical techniques. Data obtained on chromosome measurements were analysed by using cluster analysis. The chromosome numbers of these taxa have been found as 2n = 10, 12, 14 and 24. The results were considered in conjuction with the literature and karyological analysis results.

Key-words : *Vicia* - cytotaxonomy - chromosome - karyotype - cluster analysis.

Résumé.- Dans cette étude, des espèces spontanées de *Vicia* L. de la région nord-orientale de l' Anatolie furent examinées au plan cytotaxonomique. Les nombres de chromosomes et leur morphologie furent étudiés chez quinze taxons appartenant au genre *Vicia* par les techniques de taxonomie numérique et caryologiques. Les dénombrements chromosomiques de ces taxons ont donné 2n = 10, 12, 14 et 24. Ces résultats sont discutés à la lumière des données antérieures.

Mots-clés : *Vicia* L. - cytotaxonomie - chromosome - caryotype - analyse numérique.

I. INTRODUCTION

The genus *Vicia* L. (Fabaceae) comprises about 166 species, chiefly located in Europe, Asia and North America, extending to the temperate regions of South America and tropical Africa (Maxted, 1993). The genus was grouped in four major species clusters "*Cracca*", "*Vicia*", "*Ervum*" and "*Faba*" by Kupicha (1976). According to Maxted *et al.* (1991), it is divided into two subgenus: *Vicilla* and *Vicia*. Subgenus *Vicilla* is divided into 17 sections, on the other hand subgenus *Vicia* is divided into 9 sections. Most of these species are annuals, but a few of them belonging to the section *Cracca* are perennials (Yamamoto,

1973). In Turkey, 59 species, 22 subspecies and 18 varieties of this genus have been recorded (Davis, 1970).

The genus *Vicia* is of considerable economic importance: two species, *V. faba* L. and *V. ervilia* (L.) Willd., belong to the earliest domesticated plants of the world and are characteristic components of the late Neolithic Near Eastern food plant complex; the faba bean is still one of the most widespread grain legumes in the temperate regions of the world. The genus includes some further minor food crops and more than a dozen forage plants, among them the most important common vetch, *V. sativa* L., cultivated in many countries in the Old and New World (Hanelt & Mettin, 1989).

The problems that the genus *Vicia* has in terms of taxonomy can not be ignored. This genus is poorly delimited from *Lathyrus* L. and *Lens* Miller. The species in sect. *Faba* have the facies of *Lathyrus*. *V. crocea* (Desf.) B. Fedtsch. is readily mistaken for *Lathyrus aureus* (Stev.) Brandza. *V. cappadocica* Boiss & Bal. also constitues a problem among the genus *Vicia* and *Lathyrus*. Many of the species are highly variable both geneticaly and in response to enviromental differences (Davis, 1970).

V. koeiana Rech. f. in terms of morphological characteristic is very similar to the taxa of the sect. *Cracca* and it is also similar to the some species of the genus *Lathyrus* and *Lens* as regard to style characteristic (Davis, 1970). Kupicha (1976) raised this species to the level of monotypic genus and then added it to the sect. *Anatropostylia* of the genus *Vicia*. *V. noeana* Reuter ex Boiss. var. *megalondonta* Rech. is similar to *V. hyrcanica* Fisch.& Mey. with some features of calix and leaflet. Sometimes they are confused with each other.

In recent years, karyological analyses had important role in solving taxonomic problems. Previously, the karyotype of some *Vicia* species were reported by Sveschnikova (1940), Mettin & Hanelt (1964), Hanelt & Mettin (1970), Cincura (1962), Zertova (1969), Plitmann (1967), Yamamoto (1973).

Therefore, as a result of studies mentioned above, problems related with the genus *Vicia* showing variation in Turkey have not been solved. We aimed in our research to indicate the chromosome numbers and chromosome morphologies of studied *Vicia* taxa, in order to do a cytotaxonomic comparison between the studied taxa. As a consequence, this study will contribute to the knowledge about phylogeny of them.

II. MATERIAL AND METHODS

A. Plant material

The *Vicia* species used in the study were collected from the mountains of N-E Anatolia, Turkey, in July and August 1997-1999 (Table I). Voucher specimens are deposited in KTÜB.

B. Karyotype analysis

Root tip meristems were obtained from germinating seeds in Petri dishes. Root tip meristems were pre-treated with 0,05% colchicine during 3-4 h and then fixed in an ethanol-acetic acid (3:1) solution for at least 24 h at 4 °C (Inceer *et al.*, 1999). The root tips were hydrolyzed in 1 N HCl at 60 °C during 13-15 min and then rinsed with tap water for a minimum of 5-6 min. After staining in Feulgen for 1 h, the root tips were squashed in 45% acetic acid and the preparations were mounted in Entellan.

8-9 specimens per population and per species were collected and more than 15 permanent slides were prepared from them. Ten out of the well-spread metaphase plates were

Table I.- Localities of *Vicia* L. species studied.
Tableau I.- Origine des espèces de *Vicia* L. étudiées.

Species	Localities	Voucher
V. cassubica	A7 Trabzon; on the road of Zigana Dagi Trabzon, 1700 m	H. Inceer 17, KTUB
V. cracca subsp. *cracca*	A7 Trabzon; on the road of Sürmene Trabzon, 30 m	H. Inceer 15, KTUB
V. tetrasperma	A7 Trabzon; KTU Kanuni Kampüsü Trabzon, 30 m	H. Inceer 13, KTUB
V. hirsuta	A7 Trabzon; on the road of Zigana Dagi Trabzon, 1700 m	H. Inceer 22, KTUB
V. sepium	A8 Rize; Sivrikaya Köyü, Ikizdere, 1850 m	H. Inceer 25, KTUB
V. hyrcanica	A8/B8 Erzurum; Kop Dagi pass, 2440 m	H. Inceer 74, KTUB
V. noeana var. *noeana*	A7 Gümüshane; on the road of Siran Gümüshane, 1500 m	H. Inceer 65, KTUB
V. melanops	A8 Gümüshane; Vavuk Dagi Gümüshane, 1800 m	H. Inceer 41, KTUB
V. peregrina	A7 Trabzon; Kalanema Dere, 500 m	H. Inceer 45, KTUB
V. pannonica	A9 Artvin; on the road of Savsat to Ardahan Artvin, 1500 m	H. Inceer 90a, KTUB
V. hybrida	A7 Trabzon; KTU Kanuni Kampüsü Trabzon, 30 m	H. Inceer 10, KTUB
V. grandiflora var. *gr.*	A9 Artvin: on the road of Savsat to Ardahan Artvin, 2000 m	H. Inceer 90b, KTUB
V. sativa subsp. *nigra*	A7 Trabzon; on the road of Zigana Dagi Trabzon, 1700 m	H. Inceer 7a , KTUB
V. sativa subsp. *nigra* var. *n.*	A7 Trabzon; on the road of Zigana Dagi Trabzon, 1750 m	H. Inceer 7b, KTUB
V. bithynica	A7 Trabzon; KTU Kanuni Kampüsü Trabzon, 30 m	H. Inceer 11, KTUB

photographed with an Olympus BH-2 camera and drawn from permanent slides deposited at the department of Biology, Karadeniz Technical University, Trabzon.

Karyotype analysis was performed according to Levan *et al.* (1964).

C. Cluster analysis

The quantitative values were obtained from chromosome character measurements. They are chromosome number, total length (C), long arm length (L), short arm length (S), arm ratio (r = L/S), centromeric index (I = 100.S/C), relative length (RL = C/total haploid length.100).

Totally seven characters were analysed by using cluster analysis, one of the numeric taxonomic methods: euclidean distance methods in the SPSS computer program.

III. RESULTS

A. Chromosomal characteristics

1. Section *Cracca* S.F. Gray

V. cassubica L. (2n = 24)

It is an Euro-Sibirian element that grows on forests, banks, fields at 1-2,150 m.

The chromosome set of this taxon contains twelve pairs of homologous chromosomes. The following chromosome types could be distinguished: five pairs of submetacentric chromosomes, four pairs of acrocentric chromosomes and three pairs of subacrocentric chromosomes (Table II; Fig. 1a, 4a).

V. cracca L. subsp. *cracca* (2n = 14)

It is an Euro-Sibirian element that grows on deciduous scrub, hedgerows and moist meadows at 100-2,270 m.

In the karyotype of this species seven pairs of homologous chromosomes could be distinguished. The following types of chromosomes were identified: one pair metacentric chromosomes with satellite connected to the short arm and six pairs of submetacentric chromosomes (Table II; Fig. 1b, 4b).

2. Section *Ervum* (L.) S.F. Gray

V. tetrasperma (L.) Schreb. Spic (2n = 14)

It grows on thickets, fields, river terraces and moist soils at 20-1,950 m.

The karyotype of *V. tetrasperma* shows a high degree of symetry. Four chromosomes are metacentric and ten chromosomes are submetacentric (Table II; Fig. 1c, 4c).

V. hirsuta (L.) S.F. Gray (2n = 14)

It grows in *Quercus* forest and sandy soils at 10-800 m.

In the karyotype of *V. hirsuta* seven pairs of homologous chromosomes have been distinguished. The following types of chromosomes were identified: one pair of metacentric chromosome, two pairs of subacrocentric chromosomes and three pairs of submetacentric chromosomes. One pair of submetacentric chromosomes has a satellite connected to the short arm (Table II; Fig. 1d, 4d).

Table II.- The chromosome lengths of *Vicia* species.
Tableau II.- Longueurs des chromosomes des espèces de *Vicia*.

Species[x]	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total length (μm)
V. cassubica	7.00 t	4.00 t	3.50 sm	3.00 sm	2.75 sm	2.50 st	2.25 t	2.13 st	2.00 t	1.75 sm	1.50 sm	1.25 st	33.63
V. cracca subsp. *cracca*	2.28 sm	2.14 sm	2.09 sm	2.02 m*	1.84 sm	1.63 sm	1.51 sm						13.51
V. tetrasperma	4.75 sm	3.50 sm	3.25 sm	3.00 sm	2.90 m	2.85 sm	2.50 m						22.75
V. hirsuta	5.50 sm	4.00 m	3.50 sm*	3.25 st	3.13 sm	3.00 sm	2.75 st						25.13
V. sepium	5.25 sm	5.00 st	4.97 sm	4.75 st	4.50 sm	4.00 m	3.85 st						32.32
V. hyrcanica	5.50 st	5.25 st	5.10 t	5.00 st	4.60 st	4.25 st							29.70
V. noeana var. *noeana*	5.75 st	5.60 sm	5.25 sm	5.00 st	4.60 st	4.00 st							30.20
V. melanops	14.00 m*	11.00 t	7.25 st	7.00 st	6.80 t*								46.05
V. peregrina	7.50 sm	6.25 st	5.00 t	4.80 t	4.50 t	3.90 t	3.00 st*						34.95
V. pannonica	5.00 st	4.50 st	4.25 st	4.10 st	4.00 st	3.25 st							25.10
V. hybrida	6.50 m	6.00 st*	5.75 st	5.38 st	4.88 st	4.50 st							33.01
V. grandiflora	4.45 st	4.00 st*	3.85 st	3.75 st	3.70 st	3.60 st	3.10 sm						26.45
V. sativa subsp. *nigra*	2.00 st	1.77 sm	1.66 sm*	1.54 st	1.45 sm	1.33 sm							9.75
V. sativa subsp. *nigra* var. *nigra*	1.90 st	1.50 st	1.36 sm	1.25 st	1.20 sm*	1.15 sm							8.36
V. bithynica	7.75 st	6.25 sm	5.51 st	5.00 t	4.75 t	4.13 t*	4.00 st						37.39

m: metacentric, sm: submetacentric, st: subacrocentric, t: acrocentric, *: satellite.
[x]: species were arranged in order of evolutionary sequence (Davis, 1970).

3. Section *Vicia* L.

V. sepium L. (2n = 14)

It is an Euro-Sibirian element that grows on edge of *Picea* forest, *Rhododendron luteum* scrub and river banks at 1,450-2,100 m.

The chromosome set of this taxon contains seven pairs of homologous chromosomes. The following chromosome types could be distinguished: one pair of metacentric chromosome, three pairs of submetacentric chromosomes and three pairs of subacrocentric chromosomes (Table II; Fig. 1e, 4e).

V. hyrcanica Fish.& Mey. (2n = 12)

It is an Iran-Turanian element that grows on fallow fields and irrigated land at 1,100-2,440 m.

In the karyotype of this species, five pairs chromosomes are subacrocentric and one pair is acrocentric (Table II; Fig. 1f, 4f).

V. noeana Reuter ex Boiss. var. *noeana* (2n = 12)

It is an Iran-Turanian element that grows on cultivated and fallow fields at 500-1,700 m.

The karyotype of *V. noeana* var. *noeana* comprises six pairs of chromosomes. Two pairs are submetacentric and four pairs are subacrocentric (Table II; Fig. 2a, 4g).

V. melanops Sibth. & Sm. (2n = 10)

It grows on fields and hillsides at 1,500-1,800 m.

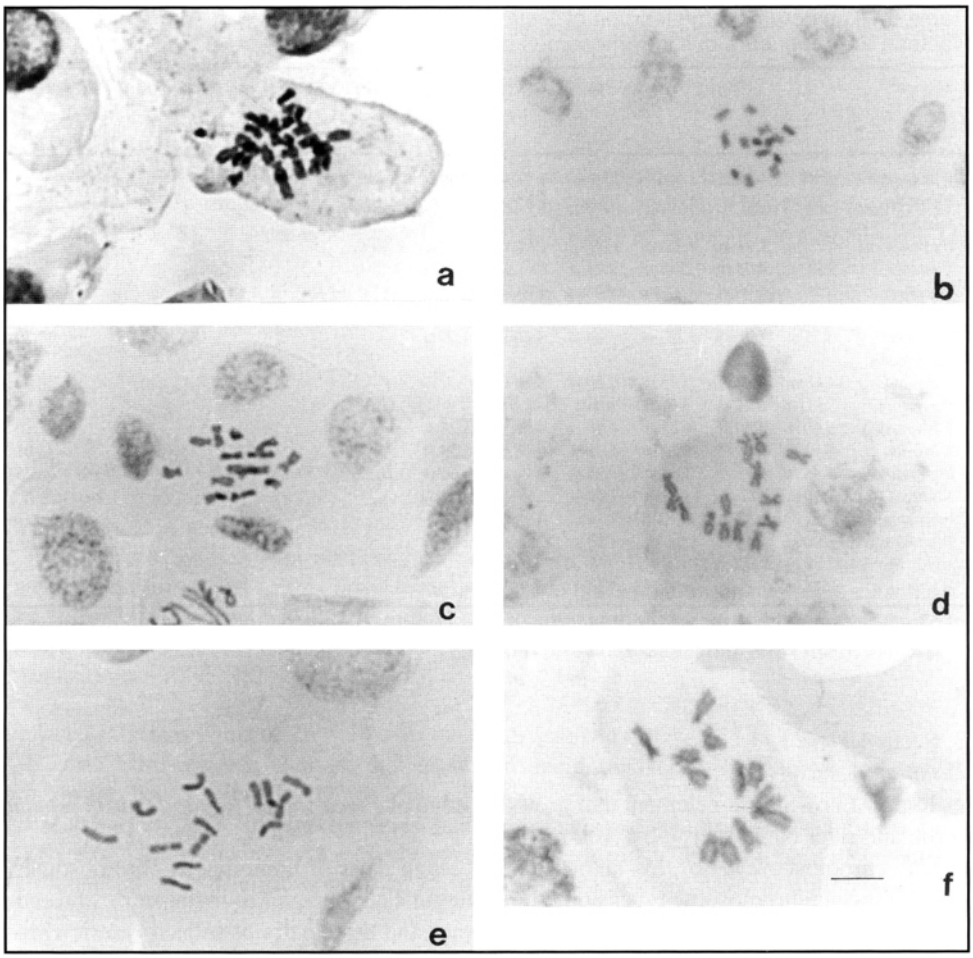


Fig. 1.- Somatic metaphases; scale = 10 µm.
Fig. 1.- Figures de métaphases somatiques ; échelle = 10 µm.
a: *V. cassubica*. b: *V. cracca* subsp. *cracca*. c: *V. tetrasperma*. d: *V. hirsuta*. e: *V. sepium*. f: *V. hyrcanica*.

In the karyotype of *V. melanops* five pairs of homologous chromosomes could be distinguished. The following types of chromosomes were identified: one pair metacentric with satellite connected to the short arm, two pairs acrocentric and two pairs subacrocentric. One pair of these acrocentric chromosomes has a satellite connected to the long arm (Table II; Fig. 2b, 4h).

V. peregrina L. (2n = 14)

It grows on *Quercus* scrub, phrygena, rocky limestone slopes, corn and fallow fields at 1-1,400 m.

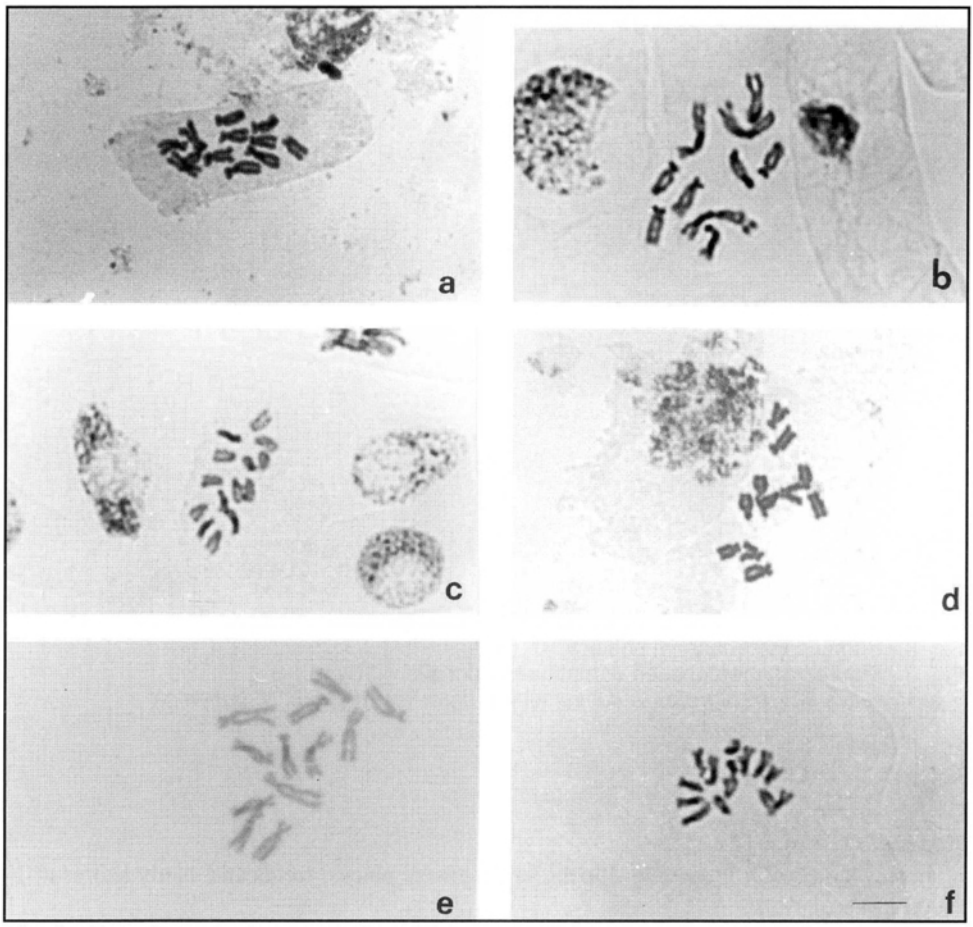


Fig. 2.- Somatic metaphases; scale = 10 µm.
Fig. 2.- Figures de métaphases somatiques ; échelle = 10 µm.
a: *V. noeana* var. *noeana*. b: *V. melanops*. c: *V. peregrina*. d: *V. pannonica*. e: *V. hybrida*. f: *V. grandiflora*.

The chromosome set of taxon contains seven pairs of homologous chromosomes. The following chromosome types could be distinguished: one pair of submetacentric chromosomes, four pairs acrocentric and two pairs subacrocentric with the satellite connected to the short arm (Table II; Fig. 2c, 5a).

V. pannonica Crantz. (2n = 12)

It may be a Caucasian element that grows on road sides and fallow fields at 1-1,300 m.

The karyotype of *V. pannonica* is highly symetrical. Six pairs of chromosomes are subacrocentric. In the investigated material, the satellites were not observed (Table II; Fig. 2d, 5b).

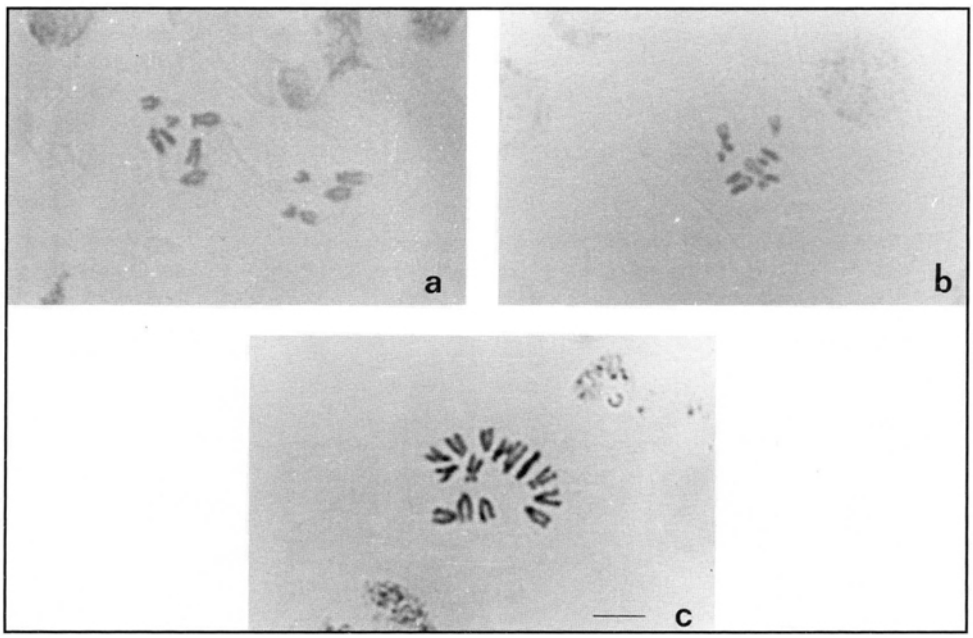


Fig. 3.- Somatic metaphases; scale = 10 µm.
Fig. 3.- Figures de métaphases somatiques ; échelle = 10 µm.
a: *V. sativa* subsp. *nigra* b: *V. sativa* subsp. *nigra* var. *nigra*. c: *V. bithynica*.

V. hybrida L. (2n = 12)

It grows on rocky limestone slopes, scrub, grassy places, fields and sandy shores at 1-1,000 m.

The karyotype of *V. hybrida* comprises six pairs of chromosomes. One pair is metacentric with the satellite connected to the short arm. The remaining five pairs of chromosomes are subacrocentric (Table II; Fig. 2e, 5c).

V. grandiflora Scop. (2n = 14)

This is an Euro-Sibirian element that grows on forest, scrub, fields and roadsides at 1-1,200 m.

In the karyotype of *V. grandiflora* seven pairs of chromosomes were observed. One pair of the shortest chromosomes is submetacentric. The remaining six pairs of chromosomes are subacrocentric. One of which having the satellite connected to the short arm (Table II; Fig. 2f, 5d).

V. sativa L. subsp. *nigra* (L.) Ehrh. (2n = 12)

It grows on rocky calcareous slopes, screes, wild and cultivated fields at 1-1,900 m.

In the karyotype of *V. sativa* subsp. *nigra* six pairs of chromosomes were observed. Two pairs of the chromosomes are subacrocentric. The remaining four pairs of chromosomes

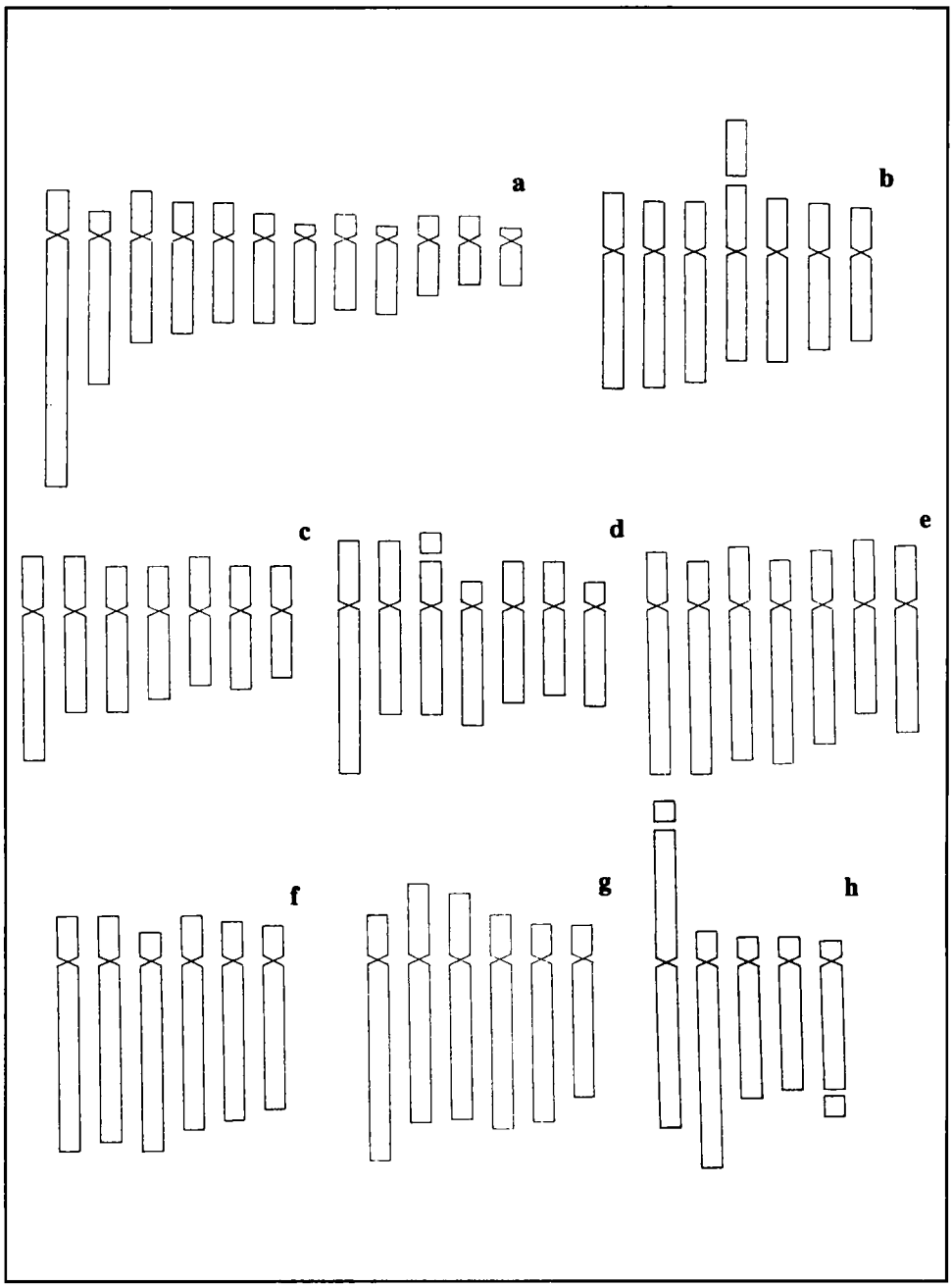


Fig. 4.- Haploid idiograms.
Fig. 4.- Idiogrammes haploïdes.
a: *V. cassubica*. b: *V. cracca* subsp. *cracca*. c: *V. tetrasperma*. d: *V. hirsuta*. e: *V. sepium*. f: *V. hyrcanica*. g: *V. noeana* var. *noeana*. h: *V. melanops*.

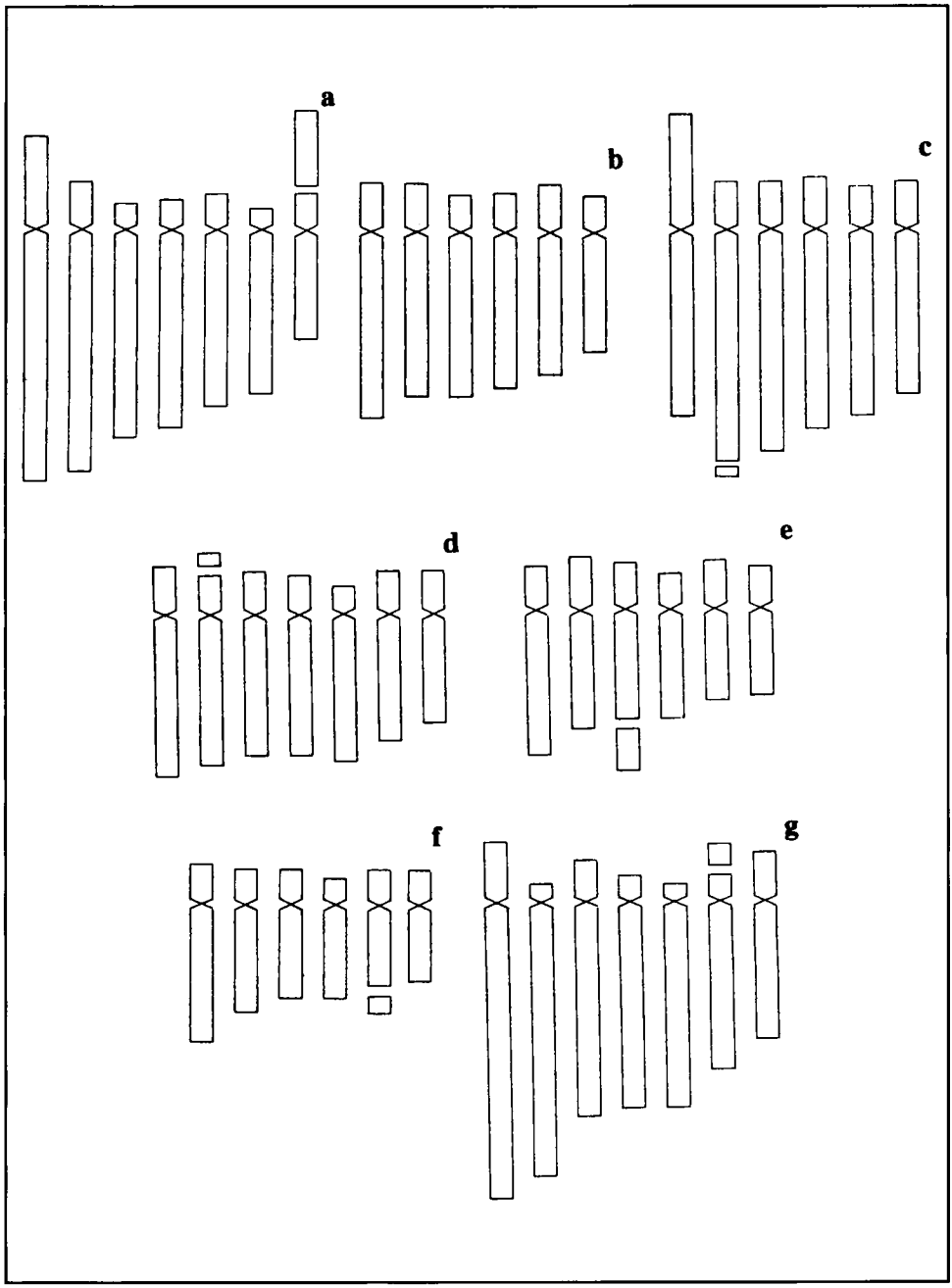


Fig. 5.- Haploid idiograms.
Fig. 5.- Idiogrammes haploïdes.
a: *V. peregrina*. b: *V. pannonica*. c: *V. hybrida*. d: *V. grandiflora*. e: *V. sativa* subsp. *nigra*. f: *V. sativa* subsp. *nigra* var. *nigra*. g: *V. bithynica*..

are submetacentric. One pair of submetacentric chromosomes has the satellite connected to the short arm (Table II; Fig. 3a, 5e).

V. sativa L. subsp. *nigra* (L.) Ehrh. var. *nigra* (2n = 12)

It grows on rocky calcareous slopes, screes, wild and cultivated fields at 1-1,900 m.

In the karyotype of this taxon six pairs of chromosomes were observed. Three pairs of the chromosomes are subacrocentric. The remaining three pairs of chromosomes are submetacentric. One pair of submetacentric chromosomes has the satellite connected to the short arm (Table II; Fig. 3b, 5f).

4. Section *Faba* Aschers & Grasbn.

V. bithynica L. (2n = 14)

It grows on scrub, fallow and cultivated fields at 1-1,900 m.

In the karyotype of *V. bithynica* seven pairs of homologous chromosomes could be distinguished. The following types of chromosomes were identified: one pair of metacentric chromosomes, two pairs of subacrocentric chromosomes, two pairs of acrocentric chromosomes and one pair of acrocentric chromosomes with the satellite connected to the short arm (Table II; Fig. 3c, 5g).

B. Dendrogram

In the dendrogram (Fig. 6), studied *Vicia* species connect with each other at several levels, according to their chromosomal characteristics. The cluster analysis shows that *V. hyrcanica* and *V. noeana* var *noeana* are closely similar. *V. peregrina* is linked to *V. hyrcanica* and *V. noeana* var *noeana* in the same cluster, those this species is found very similar to both *Vicia* species in that karyology. *V. pannonica* and *V. hybrida* are found closely related species as foreseen in the dendrogram. *V. grandiflora* is connected with them in the same cluster. Likewise, the dendogram shows that *V. sativa* subsp. *nigra* and *V. sativa* subsp. *nigra* var. *nigra* are affine to each other. It was determined that *V. hirsuta* and *V. sepium* are closely related species, despite belonging to different section. Similarly, *V. cracca* subsp. *cracca* is connected with *V. tetrasperma* in the same cluster. But, it is known that morphological features of these species are not similar each other. Owing to the similarity of chromosomal characters, these taxa were connected with each other in a same cluster.

IV. DISCUSSION

Fifteen taxa of the genus *Vicia* from N-E Anatolia were studied cytologically. The chromosome number of the taxa studied varies among 2n = 2x = 10, 12, 14 and 4x = 24. The karyotypes of the taxa consist of metacentric, submetacentric, subacrocentric and acrocentric chromosomes. The basic chromosome numbers in this genus are x = 5, 6 and 7 (Darlington & Wylie, 1955). Many of them are diploid species but some representatives of the section *Cracca* are polyploid (Yamamoto, 1973). Only a small proportion of 4x and 6x cytotypes has been observed so far. The tetraploids and hexaploids are quite often indistinguishable from the conspecific diploids, and mostly the diploid ancestors of polyploid species are unknown (Hanelt & Mettin, 1989).

The chromosome number of *V. cassubica* was previously reported by Hanelt and Mettin (1989) as 2n = 12. In the investigated material the diploid chromosome number was not

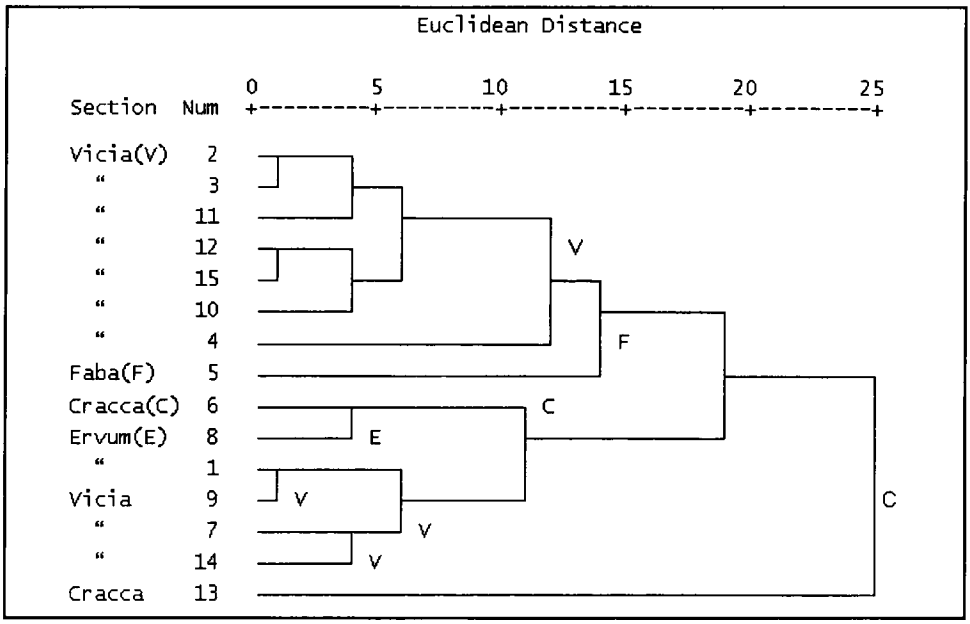


Fig. 6. Cluster analysis dendrogram of the *Vicia* L. species.
Fig. 6.- Dendrograme de l'analyse en "cluster" des espèces de *Vicia*.
1 - *V. hirsuta*; 2 - *V. pannonica*; 3 - *V. hybrida*; 4 - *V. melanops*; 5 - *V. bithynica*; 6 - *V. cracca* subsp. *cracca*; 7 - *V. sativa* subsp. *nigra*; 8 - *V. tetrasperma*; 9 - *V. sepium*; 10 - *V. peregrina*; 11 - *V. grandiflora*; 12 - *V. hyrcanica*; 13 - *V. cassubica*; 14 - *V. sativa* subsp. *nigra* var. *nigra*; 15 - *V. noeana* var. *noeana*.

observed. Polyploidy chromosome number of this species has been determined in this study.

The karyotype in *V. cracca* subsp. *cracca* was reported by Sahin & Babaç (1990) and Beyazoglu & Hayirlioglu (1991). Sahin and Babaç (1990) observed six pairs of subacrocentric chromosomes and one pair of submetacentric chromosomes. The presence of subacrocentric chromosomes and absence of metacentric chromosomes differ from our observations. However, Beyazoglu and Hayirlioglu's (1991) results are similar to ours.

Yamamoto (1973) and Kuta (1980) have previously reported data on the karyotype of *V. tetrasperma*. In Yamamoto's data, the satellite chromosome was observed. The absence of the satellite chromosome in our observations differs from the above reports. However, our observations are in agreement with the karyotype of this species reported by Kuta (1980).

The presence of the satellite chromosome has been also noted in the karyotype of *V. hirsuta* by Yamamoto (1973) and Kuta (1980). But their occurence was not observed by some previous authors who studied this taxa (Sveschnikova, 1927; Cincura, 1962; Huziwara & Kondo, 1963).

V. sepium was studied cytologically by several authors in various parts of its distribution area. Most of them were reported 2n =14 for its somatic chromosome number. However, Baksay (1954) and Kumar (1960) determined the chromosome number 2n = 12, whereas Tischler (1950) counted in the meiotic division n = 8-9. The karyotype of this species was similar to that described by Sveschnikova (1927), Cincura (1962) and Kuta (1980).

Similar findings were previously reported for *V. melanops* (Yamamoto, 1973; Kolev & Terzijski, 1964), *V. peregrina* (Yamamoto, 1973; Sahin & Babaç, 1990), *V. hybrida* (Yamamoto, 1973; Beyazoglu & Hayirlioglu, 1991) and *V. grandiflora* (Yamamoto, 1973; Kuta, 1980).

The karyotype of *V. hyrcanica* reported by Yamamoto (1973) displays chromosomes with satellite. These results differ from the present data because we observed no satellited chromosome in this species.

The description of *V. noeana* var. *noeana* differed from Sahin & Babaç's (1990) data regarding the presence of the submetacentric chromosomes and the absence of the satellited chromosomes. Similarly, in the investigated material of *V. pannonica*, the satellited chromosomes were not observed. The presence of this type of chromosomes was reported by Yamamoto (1973).

The karyotype of *V. sativa* subsp. *nigra* was similar to that described by Sahin & Babaç (1990). In addition, the karyotype of *V. sativa* subsp. *nigra* var. *nigra* was similar to that of *V. sativa* subsp. *nigra*. This observation is in close agreement with the data by Sahin & Babaç (1990). The results obtained for *V. bithynica* slighly differ from those reported by Yamamoto (1973).

As far as their karyotypes are concerned, rather significant differences could be noticed in comparison with the data obtained by some previous authors (Sveschnikova, 1927; Cincura, 1962; Yamamoto, 1973; Kuta, 1980; Sahin & Babaç, 1990). These differences may result to some extent from various methods used by various authors; it is also possible that plants of various origin differ in their karyotype structure.

It was reported that the divergence and evolution of *Vicia* species were accompained not only by the addition or deletion of DNA but, in some cases, also by chromosomal rearrangement brought about by structural changes (Akpynar & Bilaloglu, 1997). It is generally accepted that the primitive *Vicia* complement is 2x = 14 and that lower basic numbers were derived as a result of Robertsonian fusion (Raina & Rees, 1983; Sinha & Das, 1985; Raina & Bisht, 1988). At present, data support the view that Robertsonian fusion caused the chromosome numbers to decrease in *V. hybrida* (2x = 12) and *V. melanops* (2x = 10), which have a pair of metacentric chromosomes. It is probable that pericentric inversions and unequal translocations also contributed to the variation in centromere position within chromosomes of the *Vicia* species.

The confusion shown by the cluster analysis needs more detailed investigation in our opinion. In the dendrogram, *V. melanops, V. bithynica* and *V. cassubica,* belonging to different section, were connected with other *Vicia* species at top level, especially *V. cassubica*, a polyploid species. This analysis shows that these three *Vicia* species are similar at low level as regard to studying chromosome characters. According to the results obtained, there is a good correlation between our dendrogram and the Davis (1970)'s classification, despite of some exceptions.

Hanelt and Mettin reported that the polyploid series in the section *Cracca* and *Cassubicae* originated from different basic numbers. Therefore, *V. cassubica* may be an allotetraploid species (2n = 4x = 24) because it is connected with other diploid *Vicia* taxa having different basic numbers in the dendrogram. But, further studies, especially phylogenetic and meiotic analyses, will be necessary before any definite conclusions can be made about the origin of this tetraploid species.

This cluster analysis shows that the variation in chromosome size and morphology plays an important role in taxonomical considerations. It was found that the chromosome morphology within and between karyotypes was another important diagnostic with evolutio-

nary significance in the genus *Vicia*. There was evidence for prevailing symmetrical or near-symmetrical chromosomes.

It is reported that, especially in the interspecific hybridization, studies in the genus *Vicia* are essential for clarifying the genetic relationships among species of this important genus (Yamamoto, 1986; Ladizinsky & Van Oss, 1984). Phylogenetic relationships among the *Vicia* species will be widely determined in the future by revision and monograph studies.

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REFERENCES

Akpynar N. & B. Bilaloglu, 1997.- Cytological investigations of certain species of *Vicia* L. *Tr. J. of Biology*, **21**, 197-207.

Baksay L., 1954.- Chromosomen Studien an den ungarischen *Vicia*-Arten. *Hist. Not. Mus. Natl. Hung. S. N.*, **5**, 139-148.

Beyazoglu O. & S. Hayirlioglu, 1991.- Karyotype analysis of some *Vicia* species in Turkey. *La Kromosomo II*, **63** (64), 1143-1148.

Cincura F., 1962.- Bemerkungen zur Zytologie der *Vicia* L. Arten aus den slovakischen Fundarten. *Acta F. R. N. Uniniv. Comen*, **7** (6-7), 349-388.

Darlington C.D. & A.P. Wylie, 1955.- Chromosome atlas of flowering plants. George Allen & Unvin, London, 154-155.

Davis P.H., 1970.- Flora of Turkey and East Aegean Island, 3. Edinburgh Univ. Press, 274-325.

Hanelt P. & D. Mettin, 1970.- Zur systematishen Stellung von *Vicia oroboides* Wulf. *Kulterpflanze*, **18**, 179-188.

Hanelt P. & D. Mettin, 1989.- Biosystematics of the genus *Vicia* L. (Leguminosae). *Annual Review of Ecology and Systematics*, **20**, 199-223.

Huziwara Y. & S. Kondo, 1963.- Studies on the karyotype of *Vicia*. *Bot. Mag.*, **67**, 324-331.

Inceer H., O. Beyazoglu & S. Hayirlioglu-Ayaz, 1999.- Karyotype analysis of some *Lilium* L. (Liliaceae) species from Turkey. *Pak. J. Botany*, **31** (2), 315-321.

Kolev I. & D. Terzijski, 1964.- Karyologische unt embriologische Characteristik von *Vicia melanops*. *Plant Growing*, **1** (7), 43-49.

Kumar S., 1960.- Chromosome numbers in some species of *Vicia*. *Curr. Sci.*, **6**, 226-229.

Kupicha F.K., 1976.- The infrageneric structure of *Vicia* L. *Notes Roy. Bot. Gard.*, **34**, 287-326.

Kuta E., 1980.- Karyological studies on the genus *Vicia* L. *Acta. Biol. Cracov.*, ser. Bot., **22**, 81-89.

Ladizinsky G. & H. Van Oss, 1984.- Genetic relationships between wild and cultivated *Vicia ervilia* (L.) Willd. *Bot. Jour. Linn. Soc.*, **89**, 97-100.

Levan A., K. Fredga & A.A. Sandberg, 1964.- Nomenclature for centromeric position chromosomes. *Hereditas*, **52**, 201-220.

Maxted N., 1993.- A phenetic investigation of *Vicia* (Leguminosae, Vicieae). *Bot. Journ. Lin. Soc.*, **111**, 155-182.

Maxted N., M.A. Callimassia & M.D. Bennett, 1991.- Cytotaxonomic studies of eastern Mediterranean *Vicia* species (Leguminosae). *Pl. Syst. Evol.*, **177**, 221-234.

Mettin D. & P. Hanelt, 1964.- Cytosystematische untersuchungen in der Arten-Gruppe um *Vicia sativa* L. *Kulterpflanze*, **12**, 163-225.

Plitmann U., 1967.- Biosystematical study of *Vicia* of the Middle- East. Private publication, 1-128.

Raina S.N. & M.S. Bisht, 1988.- DNA amounts and chromatin compactness in *Vicia*. *Genetica*, **77**, 65-77.

Raina S.N. & H. Rees, 1983.- DNA variation between and within chromosomes complements of *Vicia* species. *Heredity*, **51**, 335-346.

Sahin A. & M.T. Babaç, 1990.- Cytotaxonomic investigations on some *Vicia* L. species in east and south east I. Doga *Tr. J. of Botany*, **14**, 24-38.

Sinha S.S.N. & I.N. Das, 1985.- Karyotypic analysis in some European species of *Vicia*. *Genetica Iberica*, **37** (3/4), 229-246.

Sveschnikova I.N., 1927.- Karyological studies on *Vicia*. *Bull. Appl. Gen. Plant-Breed.*, **17** (3), 63-72.

Sveschnikova I.N, 1940.- Cytological of heterosis in hybrids of *Vicia*. *J. Hered.*, **31**, 349-360.

Tischler G., 1950.- Die Chromosomenzahlen der ge fass pflanzen Mitteleuropas. Gravenhage.

Yamamoto K., 1973.- Karyotaxonomical studies on *Vicia* L. on the karyotype and character at some annul species of *Vicia*. *Japan J. Genetics*, **48**, 315-327.

Yamamoto K., 1986.- Interspesific hybridization among *Vicia narbonensis* and its related species. *Biol. Zentralbl.*, **105**, 181-197.

Zertova A.C., 1969.- Bemerkungen zur Taxonomie von *Vicia sepium* L. *Folia Geobiol. Phytotax.*, **4**, 303-311.