

CYTOTAXONOMIC STUDIES ON SOME *EUPHORBIA* L. (*EUPHORBIACEAE*) SPECIES IN TURKEY

SEMA HAYIRLIOĞLU-AYAZ, HÜSEYİN İNCEER AND OSMAN BEYAZOĞLU

*Karadeniz Technical University, Faculty of Sciences and Arts,
Department of Biology, 61080 Trabzon, Turkey*

Abstract

Some *Euphorbia* L. species growing in Northeast Anatolia have been investigated cytotaxonomically. Karyologic and morphologic analyses were carried out on *Euphorbia helioscopia* L., *E. stricta* L. and *E. oblongifolia* (C. Koch) C. Koch. Their chromosome numbers were as follows: *E. helioscopia* $2n=40-42$; *E. stricta* $2n=10$; *E. oblongifolia* $2n=16$.

Introduction

Leaf spurge, a native of Eurasia were introduced into North America sometime in the nineteenth century (Macoun, 1883; Rausseau, 1968). The weed is mainly found in untilled abandoned cropland, pastures, range lands, woodland, roadsides and waste areas. Leafy spurge is most invasive in semiarid habitats where interference from associated species is generally low (Watson, 1985a).

Leaf spurge has been targets of biological control. Recently, it has been suggested that the failure of these biocontrol initiatives may have been due to the fact that we are dealing with not one but a complex of several very similar species (Harris, 1984; Watson, 1985b).

The *Euphorbia* L. species of Turkey are classified by Radcliffe-Smith (1976) as 4 subgenus, 7 section and 7 subsection. The genus is composed of 91 species (Davis, 1982). Cytogenetical studies have been undertaken on the *Euphorbia* species (Schulz-Schaeffer & Gerhardt, 1989; Stahevitch *et al.*, 1987) which have been restricted at the level of chromosome counts of several species such as *E. amygdaloides* var. *robbiae*, *E. herniariifolia* var. *glaberrima* and *E. herniariifolia* var. *herniariifolia* in Turkey (Davis, 1988). The aim of the present study was to give the first cytotaxonomical results of *Euphorbia* species distributed in Northeast Anatolia.

Material and Methods

Euphorbia helioscopia L., *E. stricta* L. and *E. oblongifolia* L. were used in this study. The plants were collected from the mountains of Northeast Anatolia, Turkey, between June and July in 1994 and 1995.

Actively growing root tips were used for karyotype analyses and chromosome counts. Root tips pre-treated with 0,05% colchicine for 3-4 h were cut off and then fixed in an ethanol-acetic acid (3:1) solution for at least 24 h at 4°C (Hayirlioglu & Beyazoglu, 1997). The root tips were hydrolyzed in 1 N HCl at 60°C for 13-15 min and then rinsed with tap water for 5-6 min. Staining was carried out in Feulgen for 1 h. Karyotype analysis was performed according to Levan *et al.*, (1964). Permanent slides were taken from at least five well-spread metaphase plates using an Olympus BH-2 camera. Permanent slides were deposited at the Department of Biology, Karadeniz Technical University, Trabzon.

Result and Discussion

Cytotaxonomical features of *Euphorbia* species is given below:

E. stricta L.: Plant length 45-75 cm, stems simple or 2-branched from base, length of cauline leaves 1-5 cm, width of cauline leaves 0,5-1,5 cm. Raylet-leaves 5-12 X 8-13 cm. Fruit 2,5-3 mm diameter with reddish-brown 1,2-1,5 mm seed. It is an Euro-Sib. element. It grows in *Abies*, *Picea*, *Fagus* and *Quercus* forests, amongst rocks on limestone and sandstone, grassy slopes, streamsides, fallow fields and roadsides at 1-2100 m.

The chromosome number is $2n=10$. The 1st and 2nd chromosome are submedian-centromeric. The 3rd, 4th and 5th chromosome are median-centromeric. The satellite is present on the short arms of the 4th chromosome (Table 1, Fig. 1a & 2a).

Table 1. Chromosomes types, chromosome length and arm ratio of *Euphorbia stricta*.

Chromosome pairs	C (µm)	L (µm)	S (µm)	SAT (µm)	L/S	I (µm)	R %	Centromere position
1	2,50	1,67	0,83	-	2,01	33,20	23,69	Submedian region
2	2,23	1,67	0,56	-	2,98	25,11	21,13	Submedian region
3	2,08	1,11	0,97	-	1,14	46,63	19,71	Median region
4	1,94	1,11	0,83	1,25	1,33	42,78	18,38	Median region
5	1,80	1,11	0,69	-	1,60	38,33	17,06	Median region

C: Total chromosome length, L: Long arm length, S: Short arm length, L/S: Arm ratio, SAT: Satellite, I: Centromere index, R: Relative length.

E. helioscopia L.: Plant length 30-40 cm, stems simple or 2-branched from base, length of cauline leaves 1-4 cm, width of cauline leaves 0,5-2,5 cm. Raylet-leaves 0,5-3 X 0,4-2 cm. Fruit 3,5 mm diameter with dark brown 2-mm seed. It grows on limestone cliff and slopes, phrygana, streamsides, ruins, fallow fields, waste ground at 1-1400 m.

The chromosome number of this species is $2n=40-42$ (Fig. 1b).

E. oblongifolia (C. Koch) C. Koch: Plant length 35-65 cm, length of cauline leaves 4-10 cm, width of cauline leaves 1-5 cm. Fruit 5 mm diameter with dark grey 2,5 mm seed. It is Fuxine element. It grows in *Fagus* and *Picea* forests, rocky igneous and limestone slopes and screes and alpine meadows at 1200-2800 m.

The chromosome number is $2n=16$. The 1st chromosome is subterminal-centromeric. The 2nd, 3rd, 4th, 5th and 7th chromosomes are submedian-centromeric. No satellite is present on the karyotype of this species (Table 2, Fig. 1c & 2b).

Table 2. Chromosomes types, chromosome length and arm ratio of *Euphorbia oblongifolia*.

Chromosome pairs	C (µm)	L (µm)	S (µm)	SAT (µm)	L/S	I (µm)	R %	Centromere position
1	3,59	2,81	0,78	-	3,60	21,72	15,72	Subterminal region
2	3,44	2,19	1,25	-	1,75	36,33	15,06	Submedian region
3	3,22	2,11	1,17	-	1,80	35,67	14,36	Submedian region
4	2,97	2,19	0,78	-	2,80	26,26	13,00	Submedian region
5	2,82	1,88	0,94	-	2,00	33,33	12,35	Submedian region
6	2,51	1,88	0,63	-	2,98	25,09	10,99	Submedian region
7	2,19	1,56	0,63	-	2,47	28,76	9,59	Submedian region
8	2,03	1,48	0,55	-	2,69	27,09	8,89	Submedian region

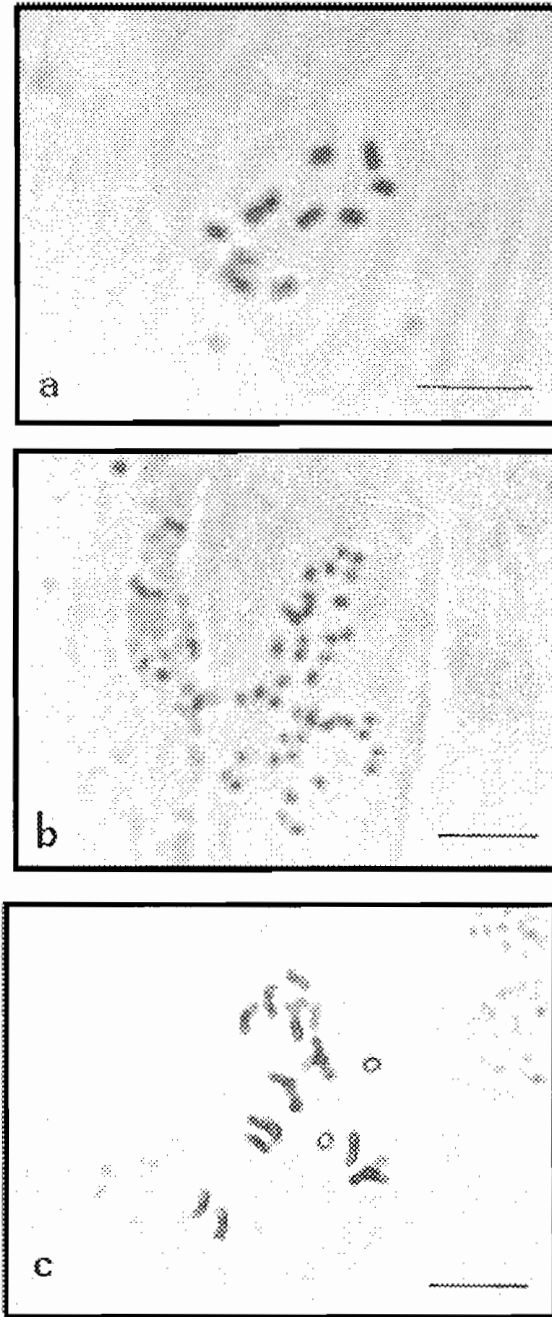


Fig. 1. Mitotic metaphase chromosomes in *Euphorbia* L. a: *E. stricta* L., b: *E. heliscopia* L., c: *E. oblongifolia* (C.Koch) C. Koch. Bar: 10 μ m.

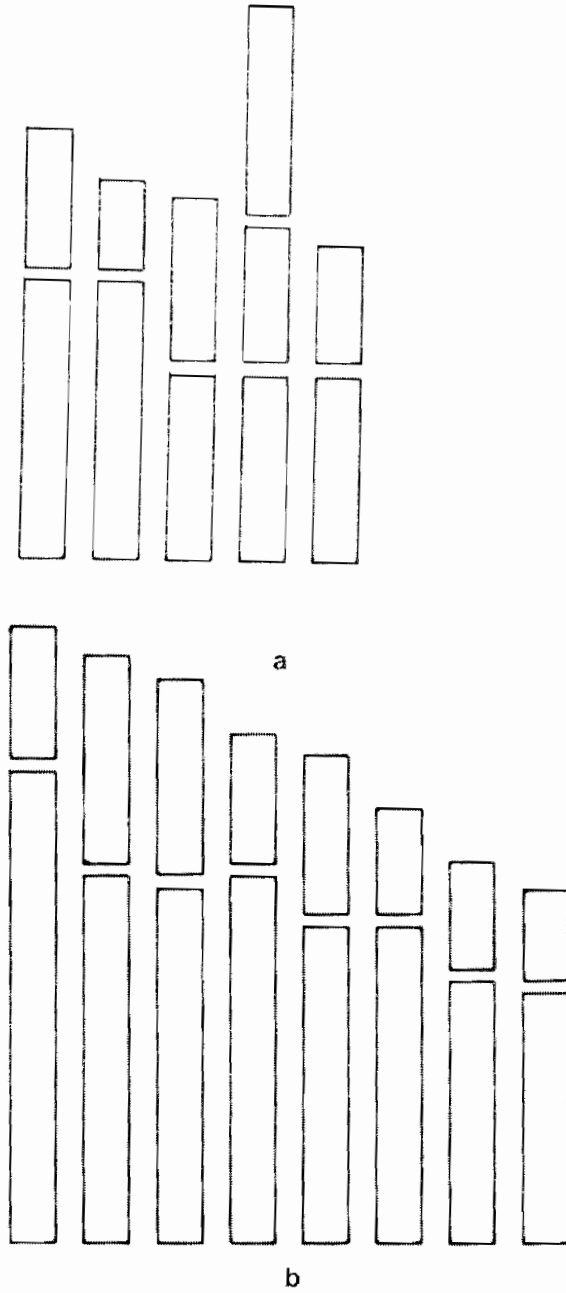


Fig. 2. Idiograms of two *Euphorbia* L. species. *a*: *E. stricta* L., *b*: *E. oblongifolia* (C. Koch) C. Koch.

In the present study, the chromosome numbers and morphological characters of three *Euphorbia* species were determined. The morphological characters were consistent with Davis (1982). The following chromosome numbers have been detected $2n=40-42$ for *E. helioscopia*, $2n=10$ for *E. stricta* and $2n=16$ for *E. oblongifolia*. Moreover, the karyotype analysis of one species have not be given because of the small size of its chromosomes. Karyotypes of the remaning two species consisted of median, submedian and subterminal chromosomes. Our results are in accordance with the reports of chromosome counts and karyotype analyses in other species of *Euphorbia* L., (Radcliffe-Smith, 1976; Schulz-Schaeffer & Gerhardt, 1989; Stahevitch *et al.*, 1987; Strid, 1987). There is need for further karyological studies of *Euphorbia* species distributed in Turkey and the nearest geographical regions.

References

- Davis, P.H. 1982. *Flora of Turkey and The East Aegean Islands*. Edinburgh Univ. Press, Edinburgh, Vol VII, pp. 571-630.
- Davis, P.H. 1988. *Flora of Turkey and The East Aegean Islands*. Edinburgh Univ. Press, Edinburgh, Vol X, pp. 352.
- Harris, P. 1984. *Euphorbia esula* - *virgata* complex, leafy spurge and *E. cyparissias* L., cypress spurge (*Euphorbiaceae*). In Biological control programs against insects and weeds in Canada.
- Hayırhoğlu, S. and O. Beyazoğlu. 1997. Chromosome numbers in species of *Alchemilla* L. belong to the series *Sericeae* Bus., and *Pubescentes* Bus. (section *Alchemilla* Rothm) in Turkey. *Caryologia*, 50: 77-84.
- Levan, A., K. Fredga and A.A. Sandberg. 1964. Nomenclature for centromeric position on chromosomes. *Hereditas*, 52: 201-220.
- Macoun, J. 1883. *Catalogue of Canadian plants*. Dawson Bros., Montreal.
- Radcliffe-Smith, A. 1976. The mystery of *Euphorbia robbiae* (*Euphorbiaceae*). *Kew Bull.*, 30: 697-698.
- Rousscu, C. 1968. Histoire, habitat et distribution de 220 plantes introduites au Quebec. *Nat. Can.*, (Que) 95: 49-149.
- Schulz-Schaeffer, B.J. and S. Gerhardt. 1989. Cytotaxonomic analysis of the *Euphorbia* spp., ("Leafy Spurge") complex. II. Comparative study of the chromosome morphology. *Biol. Zent. Bl.*, 108: 69-76.
- Stahevitch, A.E., C.W. Crompton and W.A. Wojtas. 1987. Cytogenetic studies of leafy spurge, *euphorbia esula*, and its allies (*Euphorbiaceae*). *Can. J. Bot.*, 66: 2247-2257.
- Strid, A. 1987. Chromosome numbers of Turkish mountain plants. An annotated list of 34 taxa. *Notes R. B. G. Edinburgh*, 44: 351-356.
- Watson, A.K. 1985a. The leafy spurge problem. In: *Leafy spurge Monogr.* Ser. No. 3. (Ed.): A. K. Watson. Weed Sci. Soc. Amer. Champaign, Illinois. 1-6.
- Watson, A. K. 1985b. Leafy spurge. Weed Science Society of America, Champaign, IL.

(Received for publication 3 April 2001)