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THE MITOTIQUE CHROMOSOMES OF *HELIANTHUS ANNUUS* L

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Key words: *Helianthus annuus*, metaphases, chromosomes, satellites, karyotype.

Abstract: It was identified metaphases with 34, 32 and 17 chromosomes. The chromosomes of two pairs have satellites.The chromosomes belong to m, sm and st types.

INTRODUCTION

The establishing of karyotype traits have a big importance for a species characterization. This type of studies are very necessary, interesting and of great value because the chromosomal formula is useful to establish the taxonomic position of every species and to trace the best way for its selection and melioration. On the other hand is possible to use the karyotype to trace the ways of speciation inside a genus or family. For *Helianthus* genus, the origin of its species is enough controversial. Some hypothesis start from the premise that the species inside the genus have different origins and for this is possible to explain the discontinuity of surface occupied by a species and the great amplitude of species variability. Inside the genus, *Helianthus annuus* L. species is characterized by the biggest variability amplitude, both inside the cultivated forms and inside the spontaneous ones.

THE AIM OF INVESTIGATIONS

We aimed to characterize *Helianthus annuus* L species from cytogenetically point of view as a first step to establish a correct systematic position. This species has a big economic importance and, for this, is necessary to be very carefully investigated, to establish the chromosomal formula, ploidy level and the karyotype evolution..

MATERIAL AND METHODS

The seeds were gain in Botanical Garden of University "Al.I. Cuza"-Iaşi, in 1999. 1999.

The germination was assured in laboratory, in Petri dishes, on filter paper moistened with distilled water, in darkness, at 25^0C. When the roots had 0.5-1 cm, the germinated seeds were placed for 2 hours on filter paper moistened with 0.2% colchicines solution and, after that, for other 2 hours back on paper filters moistened with distilled water.

The fixation was assured with 95% ethanol/acetic acid 3/1 solution, for 24 hours. Hydrolyse was made with 50% HCl, for 10-12 minutes, at room temperature. The coloration was assured with Carr solution. The metaphases were examined by MC5A microscope.

REZULTS AND DISCUSSIONS

In tables 1-3 we can see that the selected metaphases contain chromosomes with small length variability. As result the haploid sets lengths have registered values very similar. More variability is for the numbers ofchromosomes and their types.

We consider as very interesting the fact that some metaphases contain aneuploid number of chromosomes (2n=32). Many of them lack the 16^{th} pair (see table 3) of chromosomes. But the biggest surprise, for us, was the fact that we have found a metaphase with 17 chromosomes (a number corresponding to **n**, not to **2n**).

Relative to average length of chromosomes, in analyzed metaphases, we can pointed out that it is comprised between 2.85 µm (the last pair) asnd 4.82 µm (first pair). The difference of 1.95 µm, between first and last pairs of homologous is distributed very unequal on the 17 pairs of chromosomes, being of 0 µm for IV, V and VI pairs and of 0.65 µm for I and II pairs.

Not the same may we say about differences between chromosomes arms. The biggest difference between long arm and short arm (2.39 µm) was registered at chromosomes of 10^{th} pair, the smallest one (0.21 µm) being registered at chromosomes of 8^{th} pair

The total length ofan haploid complement is between 61.04 µm and 63.21 µm.

As types, established on the basis of arms ratio, centromere index and differences between arms, the chromosomes belong to **m** (pairs II, III, VI. VIII, XI, XII, XIII), **sm** (pairs I, IV, V, XV, XVII) and **st** (pairs IX, X, XIV, XVI). So we may consider that the karyotype is enough asymmetrical (an evolved karyotype). More, at two of chromosomes pairs (III and XV) it was constated the presence of satellites of 0.4 µm. This situation increases the karyotype asymmetry.

CONCLUSIONS

The diploid number of chromosomes**,** in *Helianthus annuus* L. individuals investigated by us was 34 (2n=34). But, with an enough high frequency, we have identified metaphases with aneuploid number (2n=32) and, very interesting, metaphase with 17 chromosomes.

The chromosomes were small (between 2.82 µm, the shortest and 4.82 µm, the longest).

The karyotype is asymmetrical and two pairs of chromosomes have satellites.

The pair of chromosomes	The chromosome type	Long arm (L) µm	Short arm (s) µm	The arms sum (L+s) µm	The arms difference (L-s) µm	The total length (T.l) µm	Relative length (R.l)	Arms ratio (r)	Centromere index (I)	Satelites length
I	sm	3.04	1.74	4.78	1.3	4.82	76.25	1.74	36.40	
II	m	2.39	1.74	4.13	0.65	4.17	65.97	1.34	42.13	
III	m	2.17	1.95	4.12	0.22	4.16	65.81	1.11	47.33	0.04
IV	sm	2.61	1.3	3.91	1.31	3.95	62.49	2.01	33.24	
V	sm	2.61	1.3	3.91	1.31	3.95	62.49	2.01	33.24	
VI	m	2.17	1.74	3.91	0.43	3.95	62.49	1.25	44.50	
VII	m	2.06	1.84	3.90	0.22	3.94	62.33	1.12	47.17	
VIII	m	1.95	1.74	3.69	0.21	3.73	59.01	1.12	47.15	
IX	st	2.82	0.87	3.69	1.95	3.73	59.01	3.24	23.57	
X	st	3.04	0.65	3.69	2.39	3.73	59.01	4.67	17.61	
XI	m	2.17	1.3	3.47	0.87	3.51	55.53	1.67	37.46	
XII	m	1.84	1.63	3.47	0.21	3.51	55.53	1.12	46.97	
XIII	m	2.17	1.3	3.47	0.87	3.51	55.53	1.67	37.46	
XIV	st	2.61	0.65	3.26	1.96	3.30	52.20	4.02	19.93	
XV	sm	2.39	0.87	3.26	1.52	3.30	52.20	2.47	26.68	0.04
XVI	st	2.39	0.65	3.04	1.74	3.08	48.72	3.67	21.38	
XVII	sm	1.96	0.87	2.83	1.09	2.87	45.40	2.24	30.74	

Haploid set length (HSL)=63.21 µm

Table 1. The traits of mitotic chromosomes of *Helianthus annuus* L(2n=34)

The pair of chromosomes	The chromosome type	Long arm (L) µm	Short arm (s) µm	The arms sum (L+s) µm	The arms difference (L-s) µm	The total length (T.l) µm	Relative length (R.l)	Arms ratio (r)	Centromere index (I)	Satelites length
I	sm	2.61	1.3	3.91	1.31	3.95	64.71	2.01	33.25	
II	m	2.17	1.74	3.91	0.43	3.95	64.71	1.24	44.50	
III	m	2.17	1.74	3.91	0.43	3.95	64.71	1.24	44.50	0.04
IV	sm	2.61	1.3	3.91	1.31	3.95	64.71	2.01	33.25	
V	sm	2.61	1.3	3.91	1.31	3.95	64.71	2.01	33.25	
VI	m	1.95	1.74	3.69	0.21	3.73	61.10	1.12	47.15	
VII	m	1.95	1.74	3.69	0.21	3.73	61.10	1.12	47.15	
VIII	m	1.74	1.52	3.26	0.22	3.30	54.06	1.14	46.62	
IX	st	2.61	0.86	3.47	1.75	3.51	57.50	3.03	24.78	
X	st	3.04	0.65	3.69	2.39	3.73	61.10	4.67	17.61	
XI	m	2.17	1.3	3.47	0.87	3.51	57.50	1.67	37.46	
XII	m	1.95	1.52	3.47	0.43	3.51	57.50	1.28	43.80	
XIII	m	2.17	1.3	3.47	0.87	3.51	57.50	1.67	37.46	
XIV	st	2.61	0.65	3.26	1.96	3.30	54.06	4.01	19.94	
XV	sm	2.60	0.87	3.47	1.73	3.51	57.50	2.89	25.07	0.04
XVI	st	2.39	0.65	3.04	1.74	3.08	50.45	3.67	21.38	
XVII	sm	1.96	0.87	2.83	1.09	2.87	47.01	2.25	30.74	

HSL=61.04 µm

Table 2. The traits of mitotic chromosomes of *Helianthus annuus* L(2n = 17 ?)

The pair of chromosomes	The chromosome type	Long arm (L) µm	Short arm (s) µm	The arms sum (L+s) µm	The arms difference (L-s) µm	The total length (T.l) µm	Relative length (R.l)	Arms ratio (r)	Centromere index (I)	Satelites length
I	m-sm	2.96	1.74	4.70	1.22	4.74	76.89	1.70	37.02	
II	m	1.95	1.52	3.47	0.43	3.51	56.94	1.28	43.80	
II	m	1.95	1.52	3.47	0.43	3.51	56.94	1.28	43.80	0.04
IV	sm	2.71	1.30	4.01	1.41	4.05	65.70	2.08	32.42	
V	sm	2.61	1.30	3.91	1.31	3.95	64.08	2.01	33.25	
VI	m	2.17	1.74	3.91	0.43	3.95	64.08	1.24	44.50	
VII	m	2.06	1.84	3.90	0.22	3.94	63.92	1.12	47.18	
VIII	m	1.95	1.74	3.69	0.21	3.73	60.51	1.12	47.15	
IX	st	2.93	0.86	3.79	2.07	3.83	62.13	3.40	22.69	
X	st	3.04	0.65	3.69	2.39	3.73	60.51	4.67	17.61	
XI	m	2.61	1.74	4.35	0.87	4.39	71.22	1.50	40.00	
XII	m	2.17	1.95	4.42	0.22	4.16	67.48	1.11	47.33	
XIII	m	2.50	1.74	4.24	0.76	4.28	69.43	1.43	41.04	
XIV	st	2.61	0.86	3.47	1.75	3.51	56.94	3.03	24.78	
XV	sm	2.60	0.87	3.47	1.73	3.51	56.94	2.89	25.07	0.04
XVI	Pereche de cromosomi lipsă									
XVII	sm	1.95	0.86	2.81	1.09	2.85	46.23	2.26	30.60	

LSH= 61.54 µm

Table 3. The traits of mitotic chromosomes of *Helianthus annuus* L.(2n=32)