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# CYTOLOGICAL STUDIES ON THE TRIBE *HELIANTHOIDEAE* (ASTERACEAE)

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ABSTRACT

Cytological investigations on 7 taxa of the tribe *Helianthoideae* (Asteraceae) reveal certain interesting features. Meiotic counts reported here are all normal, forming regular bivalents. Karyotypes show homogeneity with graded types of chromosome complement. The occurrence of tetraploid species of *Tridax procumbens* L. (n = 18) is of interest. The reports of *Eclipta alba* (L.) Hassk. (n = 11, 2n = 22), *Tithonia tagetiflora* Desf. ex Juss. (n=17), *Xanthium strumarium* L. (n = 18) are confirmatory in nature. Aneuploid variations are also noted in some cases.

## INTRODUCTION

Hooker (1882) divided the family Compositae into 11 tribes, the tribe *V Helianthoideae* comprising 7 subtribes. Five representative genera of the subtribe as shown below, as also two other genera, *Parthenium* L. and *Tithonia* Desf. ex Juss. not listed by Hooker, were taken for cytological investigation.

| | | | |
|---|---|---|---|
| Subtribe 4. | *Ambrosieae* | ... | *Xanthium* L. |
| 5. | *Verbesineae* | ... | *Eclipta* L. |
| | | | *Wedelia* Jacq. |
| 6. | *Coreosideae* | ... | *Synedrella* Gaertn. |
| 7. | *Gallinsogeae* | ... | *Tridax* L. |

The genera *Tithonia* and *Parthenium* introduced and/or naturalized in India after Hooker f. (1882) were not assigned by him to any of these subtribes. But Bentham and Hooker f. (1873) considered the two genera as belonging to the tribe *Helianthoideae.*

## MATERIALS AND METHODS

Seven species cytologiclly analysed in the present investigations were collected from different localities of West Bengal except for Sl. No. 6 for which material emanated from Ranchi (Bihar).

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| *Name of the taxon* | *Voucher No.* | *Locality* |
|---|---|---|
| 1. *Tridax procumbens* L. | 13953 | Indian Botanic Garden |
| 2. *Wedelia chinensis* (Osbeck) Merr. | 14115 | Indian Botanic Garden |
| 3. *Synedrella nodiflora* (L.) Gaertn. | 13887 | Eden Garden |
| | 14123 | Indian Botanic Garden |
| 4. *Parthenium hysterophorus* L. | 14064 | Santragachi Rly. Station (Howrah) |
| 5. *Eclipta alba* (L.) Hassk. | 14106 | Indian Botanic Garden |
| | 14147 | Dankuni |
| 6. *Tithonia tagetiflora* Desf. ex Juss. | 13824 | Ranchi (Bihar) |
| 7. *Xanthium strumarium* L. | 14701 | Ramrajatala (Howrah) |

For somatic study, pre-treatment chemicals like aesculine, paradichlorobenzene, oxyquinoline, colchicine etc. in different concentrations for different time periods have been tried. However, best result was obtained in a pre-treatment with soln. of aesculine for 3 hours at 9-12°C. Root tips were then fixed in acetic acid-ethyl alcohol 1 : 1 for 45 minutes, warmed in 2% acetic-orcein : (N) HCl (9: 1) over a flame for a few seconds and squashed in 1% aceto-orcein after 3-4 hours.

For meiotic study Belling's aceto-carmine schedule (1928) was followed. From a number of cytological preparations chromosome analysis was made. Meiotic counts reported here

are all from diakinesis stages, none showing any meiotic irregularity but forming regular bivalents.

OBSERVATIONS

1. *Xanthium strumarium* L. (n=18)
2. *Eclipta alba* (L.) Hassk. (n=11, 2n=22)

Somatic complement with 2n=22 has one pair of chromosomes with secondary constriction. Chromosomes are medium-sized (1.5-2.5 $\mu$ ).

3. *Wedelia chinensis* (Osbeck) Merrill (n=25, 2n=50).

Somatic complement with 2n=50 shows comparatively medium to short chromosomes (1.1-2.2 $\mu$ ).

4. *Synedrella nodiflora* (L.) Gaertn. (n=20, 2n=40).

Somatic complement with 2n=40 shows comparatively medium to short chromosomes, four chromosomes bearing secondary constrictions (0.9-2.0 $\mu$ ).

5. *Tridax procumbens* L. (n=18)
6. *Parthenium hysterophorus* L. (n=17)
7. *Tithonia tagetiflora* Desf. ex Juss. (n=17)

Cytological studies of the members of the tribe *Helianthoideae* reveal some interesting features. All the species have been checked for nomenclatures and their citations are stated against each.

**Tridax procumbens** L., Sp. Pl. 900. 1753; Gamble, Fl. Madras: 711 (500). 1921.

Although this is a highly variable taxon widely distributed in the tropical and subtropical regions of the world, yet it shows the same chromosome complement (n=18) both in India and abroad (Turner, Ellison & King, 1961; Powell, 1965; Mehra *et al.*, 1965; Harvey, 1966; Tandon and Bhalla, 1968; Powell and King, 1969; Gupta, 1969; Rogers, 1969; Bhattacharya & Sharma, 1970; Hsu, 1970; Torres and Liogier, 1970; Powell & Sikes, 1970; Solbrig, Kyhos, Powell and Raven, 1972; Singh, 1972; Mehra and Remanandan, 1974).

However, Turner *et al.* (1961) reported n=9 in a diploid unnamed taxon having affinity with *Tridax procumbens*. That *T. procumbens* complex has evolved to tetraploid level with n=18 (Darlington & Wylie, 1955), is, therefore, of interest. It is easy to infer that tetraploidy confers on this species a great ecological plasticity to inhabit diverse niches and habitats—to account for its weedy nature within its range.

**Wedelia chinensis** (Osbeck) Merrill. in Philip. J. Sci. Bot. 12: 111. 1971.

*Solidago chinensis* Osbeck, Dagbok Ostined Resa. 241. 1757.

*Wedelia calendulaceae* Less. Syn. Compos. 222. 1832; Hook. f. FBI. 3: 306; Prain B. P. 611. 1903.

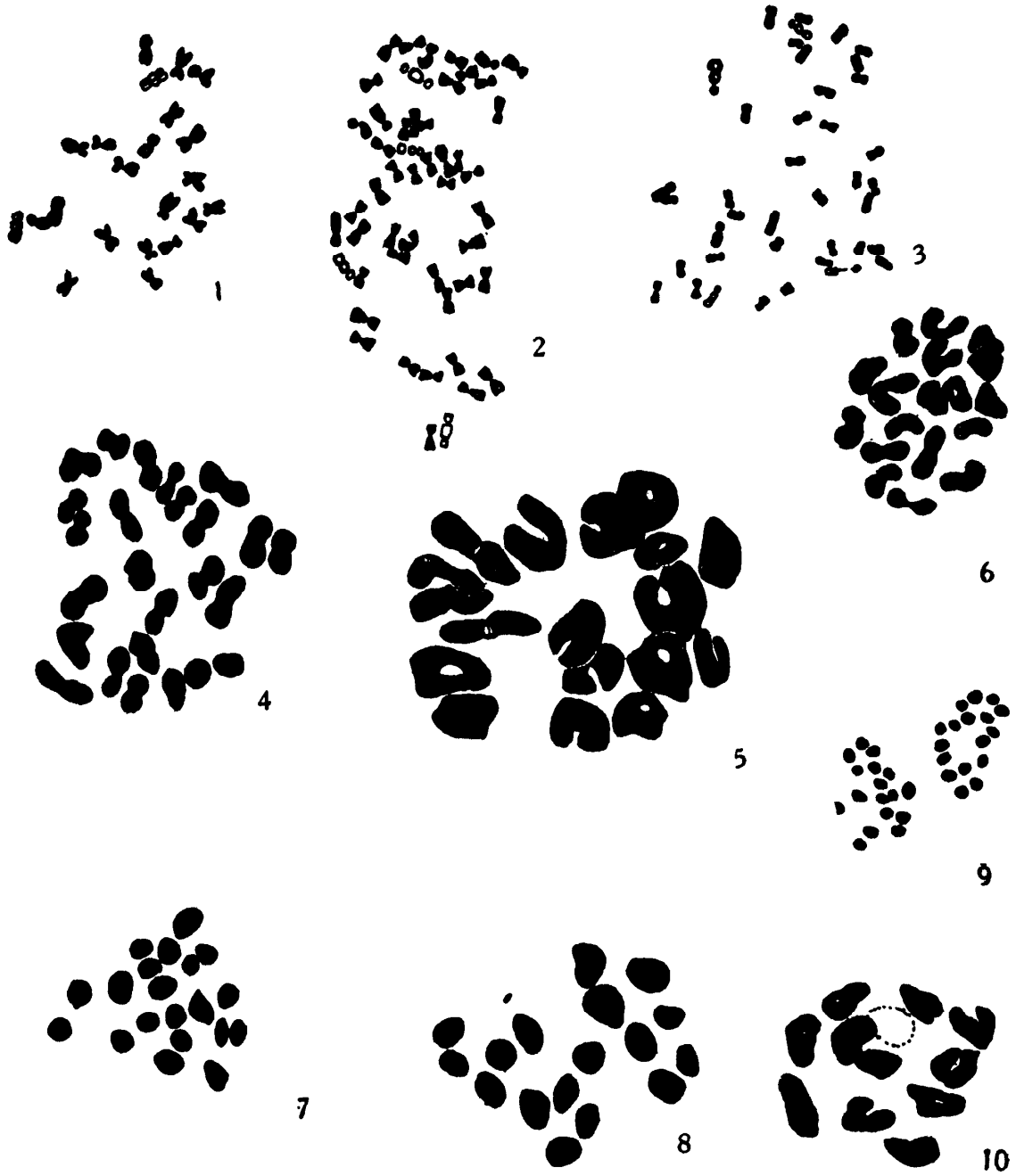
The present report of n=25 and 2n=50 confirms that of Ghosh (1962) and Koul (1964). However, another report of 2n=52 by Bhattacharya & Sharma (1970) may be an instance of a cytotype with 26 chromosomes, assuming the duplication of a chromosome. The karyotype analysed here is more homogeneous than other genera of the *Helianthoideae*.

It is distributed in the wet places of West Bengal, Assam, Sylhet, the eastern and western Peninsula of India.

**Synedrella nodiflora** (L.) Gaertn. Fruct. 2: 456. t. 171 f. 7. 1791; Hooker f. FBI. 3: 308; Prain B. P. 615. 1903 & Rec. Bot. Surv. India 3(1): 229. 1905.

*Verbesina nodiflora* L. in Juslenius. Cent. 1. Pl. 20. 1753.

In this species n=20 and 2n=40 have been determined. It is distributed in the cultivated places of Assam, West Bengal, Andaman Islands and Tropical America. The above report confirms that of Mehra and Remanandan (1974) from Punjab. However, some discrepant reports are n=16, 17 and 19 (Hsu, 1970; Bhattacharya and Sharma, 1970). Such a wide variation of chromosome reports of a highly evolved species with effective sexual reproduction is rare. Possibly aneuploid variation is pre-




Figs. 1-10: 1&10. *Eclipta alba* (L.) Hassk. showing somatic plate with 2n=22 chromosomes & 11 bivalents in diakinesis. 2 & 4. *Wedelia chinensis* (Osbeck) Merr. showing somatic plate with 2n=40 chromosomes and 25 bivalents in Metaphase I. 3 & 7. *Synedrella nodiflora* (L.) Gaertn. showing somatic plate with 2n=40 chromosomes and 20 chromosomes in Metaphase I. 5. *Tridax procumbens* L. showing 18 bivalents in Metaphase I. 6. *Xanthium strumarium* L. showing 18 bivalents in Metaphase I. 8. *Tithonia tagetiflora* Desf. ex Juss. showing 17 chromosomes in Metaphase I. 9. *Parthenium hysterophorus* L. showing 17 chromosomes in Anaphase I.
(All the figures are drawn at a table magnification of approximately × 2500 using a Carl Zeiss eye piece of ×12.5. In the figures chromosomes with secondary constrictions are drawn by out line only and reduced to approximately one-third of the-original.)

valent in this genus. However, karyotype analysis shows a general homogeneity in the presence of graded types of chromosomes.

**Parthenium hysterophorus** L. Sp. Pl. 988. 1953; Adams. Fl. Pl. Jamaica 751. 1972.

This species, a native of North America, was recorded for India (HBC) as far back

as 1810 (Roxburgh, 1814) and subsequently by Rao (1956) from Pune and is considered now as a dangerous weed commonly known as 'Congress grass' (Bennet *et al.*, 1978). Our count of n=17 is in conformity with De Jang and Longpre (1963), Coleman (1968) and Powell and King (1969). However, a basic number x=9 for the genus has been recorded by Darlington & Wylie (l.c.). It may be assumed that on migration, either from Australia or North America, the weed has adapted itself to Indian soil with its present aneuploid number. The report by Thombre (1959) with n=18 from Western India needs further examination and scrutiny.

**Eclipta alba** (L.) Hassk. Pl. Jav. Rar. 528. 1848; Hooker f. FBI. 3: 304; Prain B. P. 610. 1903.

*Verbesinia alba* L. Sp. Pl. 902. 1753.

*V. prostrata* L. Sp. Pl. 902. 1753.

*Eclipta prostrata* (L.) Linn. Mant. 2: 286. 1771, Santapau in Bull. Bot. Surv. India 3: 16. 1961.

It shows n=11 and 2n=22. Another population collected from Dankuni (Hooghly) has the same chromosome number. This species is distributed throughout India, and found even at certain altitudes of the Himalayas and other mountains. The above report has been given earlier by many authors from India and abroad (Miege, 1960; Mangenot & Mangenot, 1962; Mehra, Gill, Mehta and Sidhu, 1965; Turner & Flyer, 1966; Coleman, 1968; Gupta, 1969; Thakur and Singh, 1969; Strother, 1972; Singh, 1972; Turner, Powell & Watson, 1973).

From the chromosome number, it is assumed that this species is highly stable showing uniform chromosome reports in all the populations distributed throughout the world. The karyotype studied also show homogeneity with other members of *Helianthoideae* having graded types of chromosomes.

**Tithonia tagetiflora** Desf. ex Juss. in Ann. Mus. Par. 1:46 t. 4. 1802.

It shows n=17, earlier recorded by Mehra and Remanandan (1974) from the Western Himalayas. In view of the chromosome reports being the same both from western and eastern India, it may be assumed that the species is stable in India. This is a Mexican species immigrant.

**Xanthium strumarium** L. Sp. Pl. 987. 1953; Gamble Fl. Madras 702 (494). 1912.

*Xanthium indicum* Koening ex Roxb., Fl. India 3: 601. 1832; Wight, Ic. t. 1104. 1846.

It is a cosmopolitan species worked out to show n=18, confirming an earlier count by a number of authors from India and abroad (Raghavan, 1957; Love & Dansereau, 1959; Arano, 1964; Mehra *et al.*, 1965; Hsu, 1970; Majovsky *et al.*, 1970; Bhattacharya & Sharma, 1970; Fernandes & Queiros, 1971; Queiros, 1973).

The identical chromosome counts so far indicate that this species is highly stable.

## CONCLUSION

The cytological analysis of the different members of *Helianthoideae* made from meiotic studies and in some cases from karyotypes show the following characteristic features within this group:

(1) Chromosome numbers are generally high and their morphological structure is mainly symmetrical in the genera studied here.

(2) Genera with aneuploid numbers are prevalent.

(3) Karyotypes studied in different members show homogeneity.

(4) It is difficult to ascertain the correctness of position of the subtribes of Helianthoideae as made by Hooker f. (*l.c.*) from cytological stand point.

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