paired only occasionally with one of the normal bivalents which led to the formation of a multivalent at pachytene and diakinesis in about 20% of the cells examined. The second plant (No. 20–1–1) also showed the same meiotic behaviour except for the absence of multivalent formation. In both the plants a slight reduction in pollen fertility and seed set was recorded (Table 1). However, in the progenies only 0·41% of the plants showed 13 bivalents and the rest carried apparently the normal complement. Evidently the recovery is much lower relative to the frequency of multivalent formation observed in one of the plants studied.

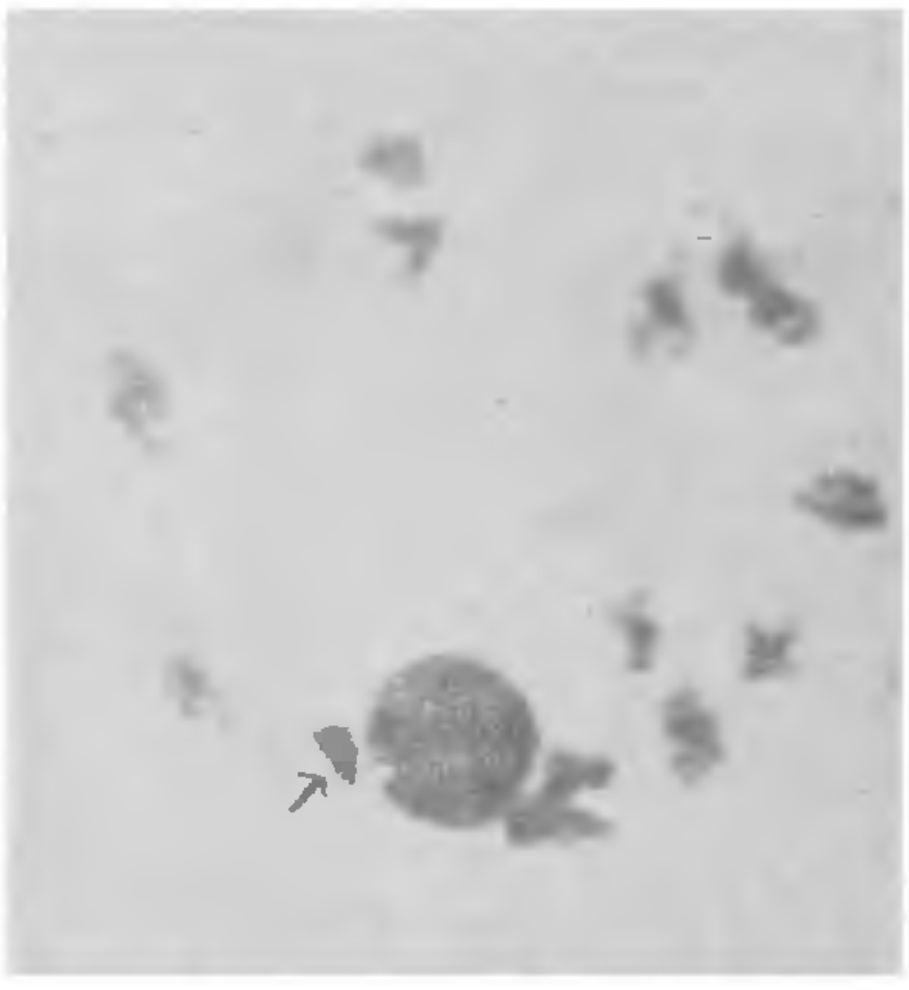

FIG. 1. IR8 diakinesis showing 13 bivalents showing the extra bivalent in 17–2 (arrowed) (× 1,500).

TABLE I

Plant No.	Pollen Sterility (%)	Seed Sterility (%)	Average No. of chiasmata per cell	't' value
IR8 Control	2·9	10·1	24·07 ± 1·304	
7–12	10·5	24·7	23·00 ± 1·140	1·6129
20–1–1	9·8	15·4	23·30 ± 4·219	0·5813

± indicates standard deviation value.

The presence of unpaired regions in several of the chromosomes at pachytene indicates that gross structural changes have occurred in both. The average chiasma frequency was less than the control value, although the diference was not significant. The origin of 26 chromosomed plants reported here was not immediately clear. The fact that such plants have been obtained in single and combination treatments, suggests that the cellular events that lead to their formation are reproducible. Occasional multivalent formation in one case and its complete absence in the other, indicates that structural changes of inversion type are probably responsible.

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FOLIAR VENATION OF *SONCHUS ARVENSIS*

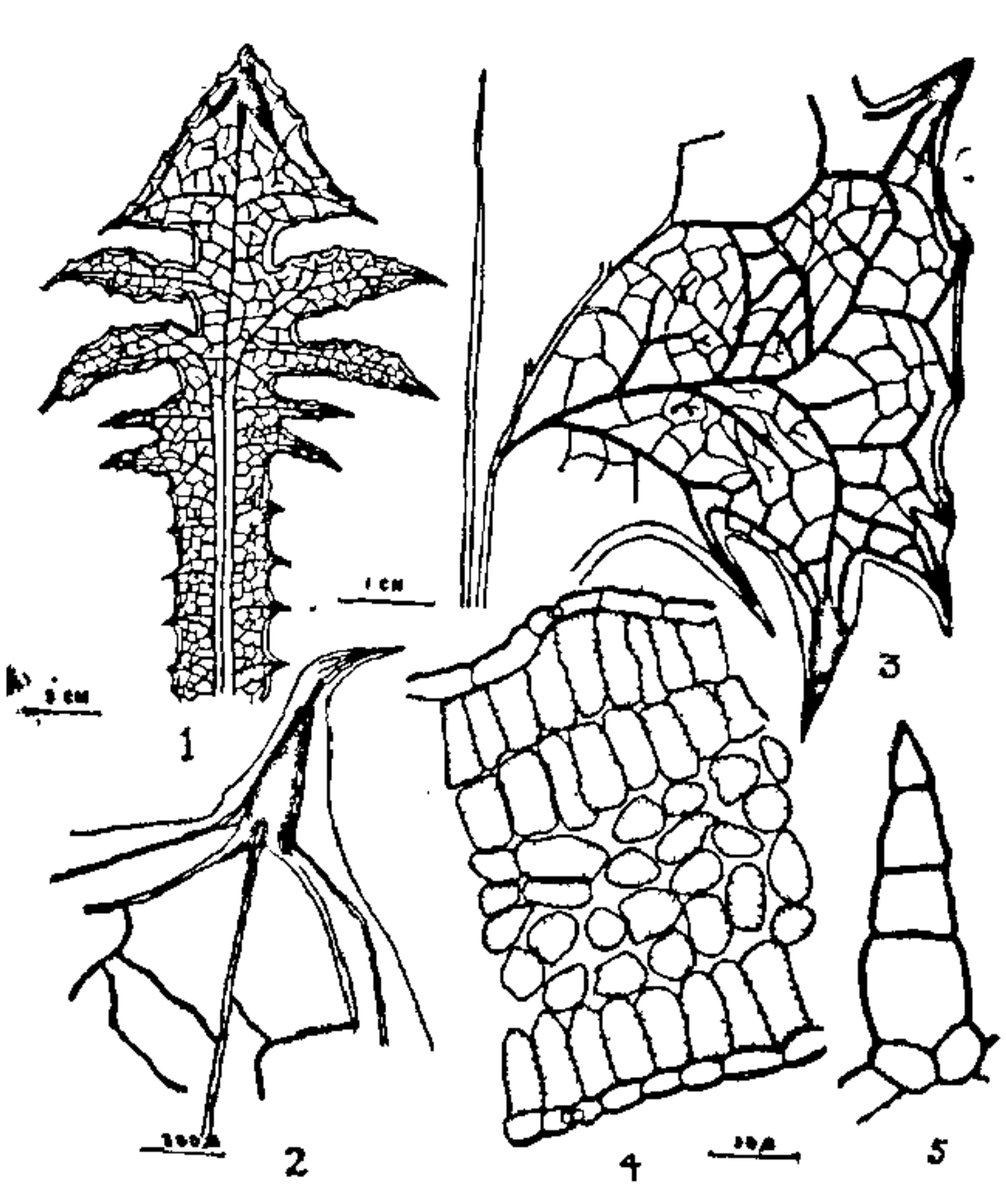
VENATION pattern of *Sonchus arvensis* is craspedodromous type. The secondary veins terminate at the large lobes and the smaller dentations bear the terminations of minor veins.

Literature on foliar venation has been reviewed by Banerjee and Deshpande[1]. *Sonchus arvensis* grows during winter near water resources. It bears yellow heads. Leaves were collected from flower beds of Botanical garden (B.I.T.S.) and were fixed in F.A.A. Methodology was followed as described by Banerjee aod Deshpande[1].

Observation

Venation pattern is craspedodromous type. Three primary veins run from the leaf base to the leaf lamina. Of these, the two laterals give out three to six secondaries and diverge towards the margin at two-thirds of the leaf length (Fig. 1). The central vein has a median course which gives out secondary veins after the divergence of the laterals and ultimately terminates at the leaf tip with branched veins. The secondary veins from the laterals, as well as from the median, branch off into tertiary veins during their course towards the margin, ultimately terminate at the tip of the lobes. Minute dentations receive terminating veins from the tertiaries or their branches. Secondary veins do not form any distinct loop at the marginal region. There is not much difference in laminal tertiary veins and marginal tertiary veins. This shows an extreme open type of venation pattern. In the large leaves, the teeth are long and veins proceed

right upto the tip of the teeth where opening is lined by elongated cells (Fig. 2). The large teeth receive the branches of major veins (Fig. 3). Some minor veins run to the margin and terminate at the small teeth and sometimes even without any reference to marginal teeth (Fig. 3). The termination shows a strong central vein which is the extension of secondary veins accompanied by two weak veins on either side (Fig. 2). Sometimes in large lobes three to four veins accompany the central vein (Fig. 3). In larger lobes the veins anastomose and then terminate. The minor veins at the margin are discontinuous (Fig. 1) showing a remote sign of camptodromy. At the terminations, the epidermal cells are elongated into a long extension which opens to the surface. These openings are of different types, depending upon the length of the dentation and size of the leaf. In small leaves the teeth are blunt and small veins terminate in an opening which is surrounded by rounded cells. Quaternaries and its branches constitute the minor veins, forming the areoles which mostly enclose one free vein. Areoles are comparatively larger.



FIGS. 1–5. *Sonchus arvensis*. Fig. 1. Entire leaf. Fig. 2. Marginal termination. Fig. 3. Enlarged lobes with marginal dentations. Fig. 4. T.S. of leaf. Fig. 5. Trichome.

Size of the areoles varies from 136,800 microns to 228,000 microns. Large areoles enclose 1 to 3 free vein ends, while, small areoles enclose 1 free vein end. Free vein ends are simple, rod-shaped or sometimes forked. Tracheids are not associated with the free vein ends. Intra-marginal tracheids occur at the terminations. Palisade ratio is 3.

Leaf Histology

Upper epidermal cells are more elongated and slightly larger than the lower epidermal cells. Stomata occur on both the surfaces at the same level as that of the epidermal cells. Upper epidermis is followed by two layers of palisade and lower epidermis is followed by one layer palisade. In between occurs loosely arranged parenchyma (Fig. 4). Midrib is traversed by three vascular strands, one median and two laterals, the median being larger than laterals. Trichomes are simple uniseriate, three to five cells in height. Pedestal cells are small, two in number, and the body cells taper towards the apex (Fig. 5).

Discussion

Sonchus along with *Launea* Banerjee and Deshpande[1] may be considered as representatives of extremely open type venation pattern in Compositae. All the major as well as minor veins at the margin are craspedodromous in nature. These two plants form a group which is different from other members of Compositae. A definite line can be traced from *Launea* and *Sonchus* to other members which show different grades in close type of venation pattern.

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DWARF SUNFLOWERS FOR FITTING IN ROTATIONS REQUIRING A SHORT DURATION CROP

SUNFLOWER (*Helianthus annuus* L.) has gained importance as an oil seed crop because of the spectacular advance in yield and oil percentage attained in it by the Russian workers[1]. In India, although Russian and Western varieties have been tried, this crop has not yet proved a success due to a number of problems which come up during cultivation[2-4]. The major problem at present is poor seed set and filling which besides genetics is influenced by physiological and