PLOIDY MEDIATED CHANGES IN STRUCTURAL AND SKELETAL COMPONENTS OF CELL GEOMETRY AT TWO PLOIDY LEVELS IN *Chrysopogon zizanioides*

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General perception

- **Polyploidy is known to bring-about increase in cell size but reduction in cell number enabling enhancement in organ / tissue size by a factor of 1.5**

Knowledge Gap

- **Detailed information on Cell geometry and Histo-morphological organization is lacking**

Objective

- **To address the above exhaustive analysis is performed on two diverse genotypes at the diploid vs tetraploid level on characterization phenotypic and developmental components.**

Material used

Diploids and their corresponding auto-tetraploids of the two diverse

Genotypes

- **Genotype Dharani: tall plant type sporting profuse seed set, larger stomata and thick roots,**

- **Genotype CIM-Vridhi: medium height, very low seed set, smaller stomata and medium root with high oil yield were targeted.**

Observations

Expectedly:-

There was increase in over cell size and its associated implications on histo-morphological characters and increase in essential oil concentration in the polyploids.

However:-

There was differential genotypic response for certain features with ploidy elevation

- **Variety Dharani : there was increase in tiller number, plant height, inflorescence length, pistil length, area of vascular bundle in the culm and culm thickness, average area of bulliform cell in the leaf, stomatal guard cell, area of stomatal complex, phytolyth size, oil concentration in fresh root, but reduction in average number of nodes in the culm, number of vascular bundles in the culm, stomatal frequency, root vascular bundle and number of primary roots per tiller,**

- **Variety CIM-Vriddhi : Contrary to above there was reduction in tiller number, plant height, inflorescence length, area of culm vascular bundle, more pronounced reduction in stomatal frequency.**

Findings suggest that :

- **there is genotype and organ specific response to ploidy change.**

- **The information provided has value predicting the impact of ploidy change on productivity.**

Exomorphology, histo-morphology, micro-morphology and growth-related patterns affected in source diploid and the corresponding autotetraploid of *Chrysopogon zizanioides* (**variety Dharani): 92 characters**

Characters	Diploid	Tetraploid	% Change
Number of tillers (1 year)	38 ± 0.86	47 ± 1.15	23.68
Number of leaves per tiller	8-10	9-11	
Plant height (cm) (taken as leaf length)	170 ± 0.94	190 ± 0.73	11.76
Culm length (inflorescence and culm combined) (cm)	230.22 ± 0.75	241.1 ± 0.54	4.78
Inflorescence length (cm)	60.03 ± 0.61	51 ± 0.29	14.02
Ovary length / breadth (mm^2)	0.2442	0.2736	12.03
Pistil length (mm)	1.98	2.18	10.10

Characters	Diploid	Tetraploid	% Change
Average number of nodes in culm	11.5 ± 0.73	10.2 ± 0.34	-11.30
Length of internode in the middle region of culm (cm)	25.5 ± 0.80	23.9 ± 0.69	-6.27
Average Diameter (cm) of culm between 2nd and 3rd node	0.51±0.017/0.447±0.005	0.57±0.002/0.44±0.00	12.89 -0.44
Average number of vascular bundles in the culm	149	136	-8.72
Area of the culm cross section occupied by the vascular bundles (mm^2)	3.65	5.98	63.83

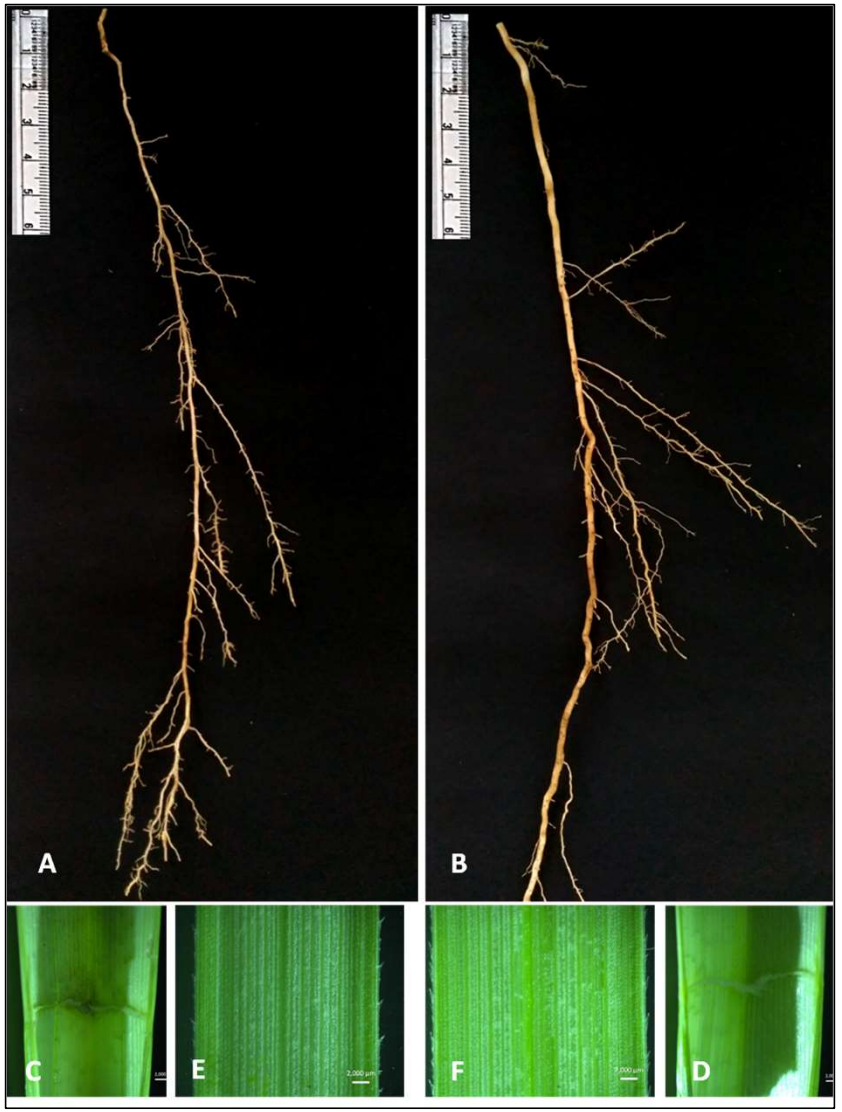
Characters	Diploid	Tetraploid	% Change
Number of leaf major vein	14	15	7.14
Average distance between major veins (mm)	1.1	1.3	18.18
Average leaf Area (cm²)	107.25	113.75	6.06
Leaf vascular thickness (µm)	236.6 ± 1.60	244.5 ± 3.20	3.33
Leaf sclerenchyma thickness (µm)	87.69 ± 3.66	96.94 ± 2.85	10.54
Average thickness of leaf cuticle adaxial/abaxial surface (µm)	3.37 ± 0.11/ 3.72 ± 0.15	3.97 ±0.15/ 4.23 ±0.12	17.80 13.70
Number of air chambers in leaf vertical section	15	17	13.33

Characters	Diploid	Tetraploid	% Change
Average size of leaf midrib vascular bundle (µm²)	11362.5 ± 393.22	14805 ± 738.28	30.29
Leaf metaxylem size L X B (µm)	1703.04± 41.56	1807.08± 67.39	6.10
Total vascular bundle in leaf vertical section	136.2 ± 1.86	106.7 ± 1.11	-21.65
Average number of small vascular bundle in leaf vertical section	105 ± 1.27	79 ± 1.12	-24.76
Area of leaf small vascular bundle in leaf vertical section (µm²)	3971.25 ± 124.5	5141.25 ± 186.92	29.46
Average area of bulliform cell (µm²) in leaf vertical section	538.01 ± 21.61	772.11 ± 42.21	43.51

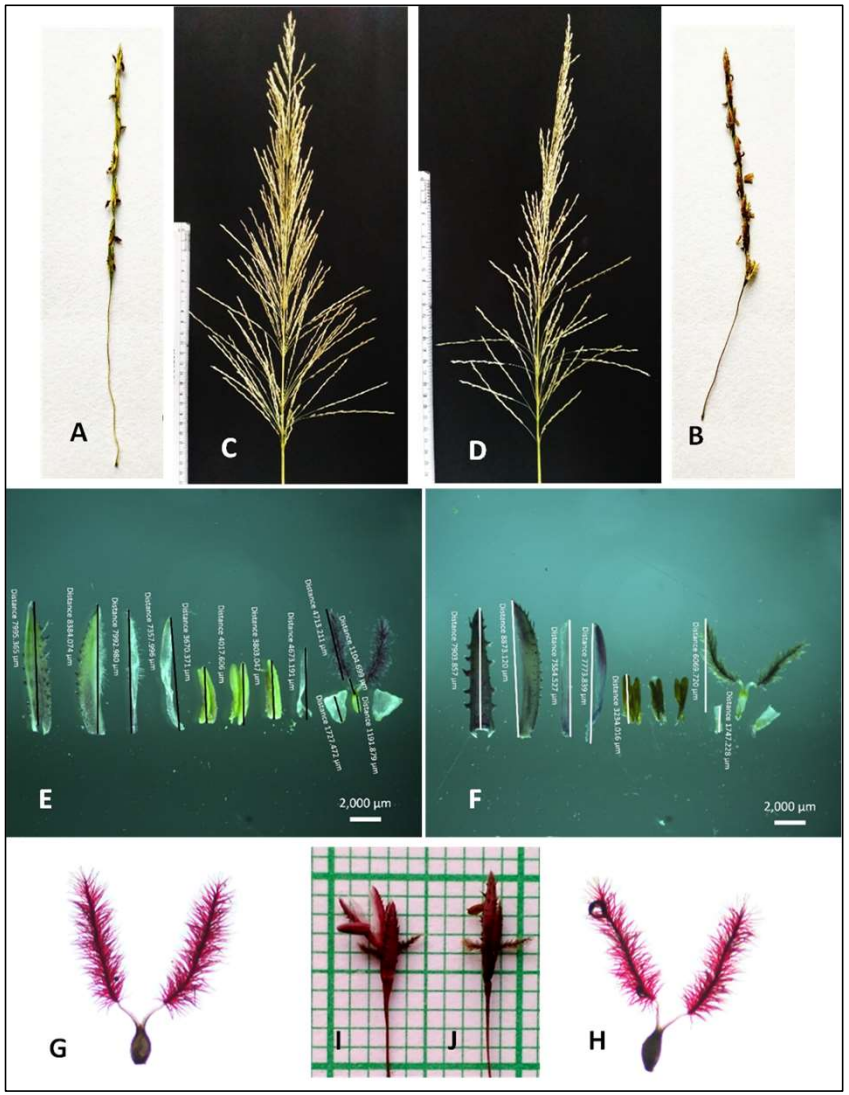
Characters	Diploid	Tetraploid	% Change
Average area of bulliform cell (µm²) in leaf vertical section	538.01 ± 21.61	772.11 ± 42.21	43.51
Area occupied by bulliform cell/cm² of leaf vertical section	0.365	0.405	10.95
Area of stomatal complex (µm²)	517.48 ± 27.46	625.63 ± 26.55	20.89
Area of stomata (µm²)	199.8±3.919	232.6±8.96	16.41
Stomatal Guard cell area (µm²)	101.30 ± 2.23	117.73 ± 2.23	16.21
Size of long epidermal cell (µm²) on abaxial leaf surface	2579.19 ± 293.88	3066.56 ± 283.52	18.89

Characters	Diploid	Tetraploid	% Change
Epidermal cell frequency/ mm² of leaf abaxial surface	699.52 ± 25.47	563.64 ± 9.53	-19.42
Stomatal frequency / (mm²) of leaf middle region	140.91 ± 5.24	101.90 ± 4.76	-27.68
Stomatal Index (leaf middle region)	16.79 ± 0.42	15.31 ± 0.69	-8.81
Leaf base stomatal index	2.18	0.88	-59.63
Phytolith size (µm²) on leaf abaxial surface	129.36 ± 6.81	142.68 ± 14.46	10.29
Phytolith frequency /mm² of leaf abaxial surface	344.73 ± 16.27	314.53 ± 9.93	-8.76
Area (µm²) occupied by phytolith / mm² of leaf abaxial surface	10571.6	7881.36	-25.44

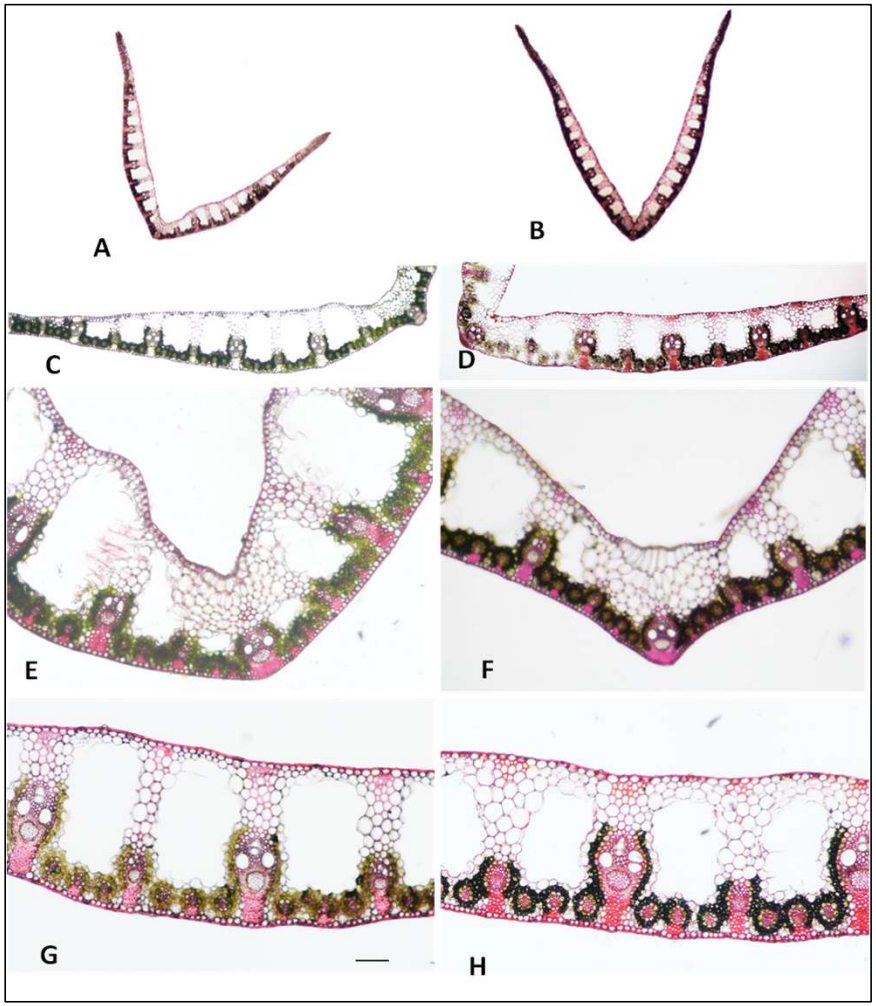
Relative comparison of plant **exo-morphological** of *Chrysopogon zizanioides* (Variety Dharani) in the source diploid (A, C, E) and the corresponding auto-tetraploid (B, D, F).



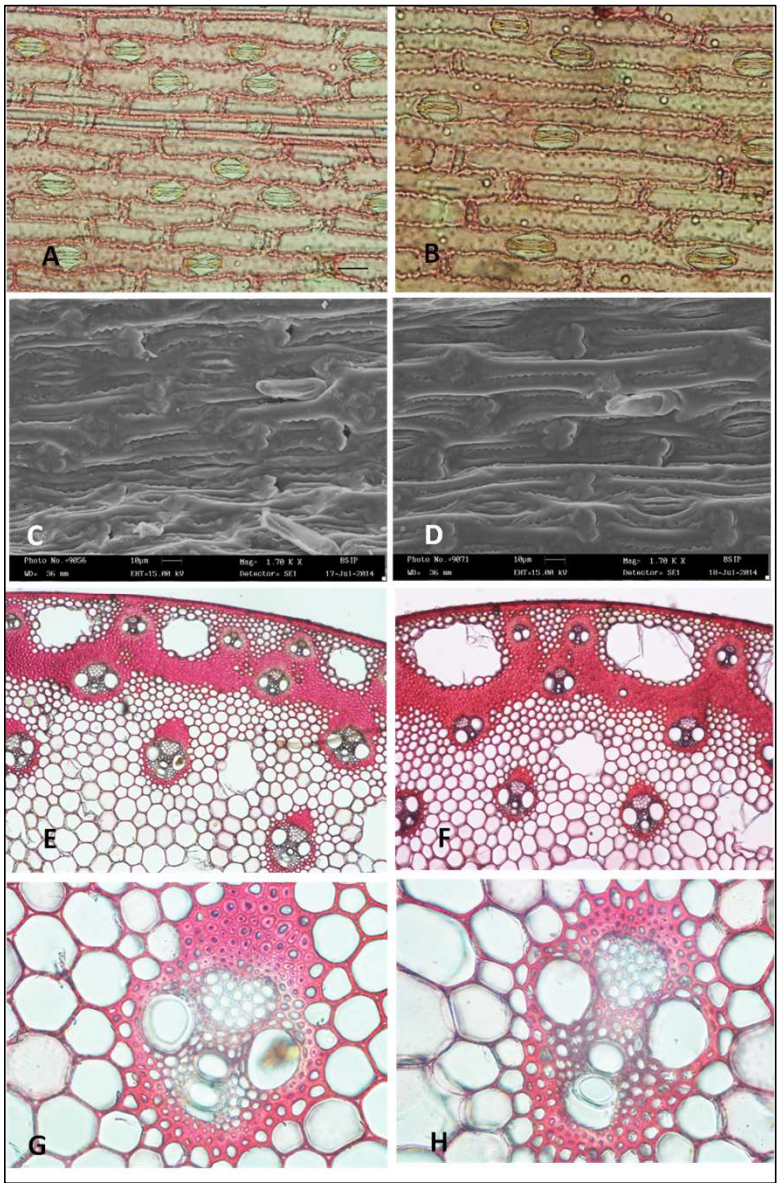
Relative comparison of **exo-morphological and reproductive features** of *Chrysopogon zizanioides* **(Variety Dharani)** in the source diploid (A, C, E, G, I) and the corresponding auto-tetraploid (B, D, F, H, J).



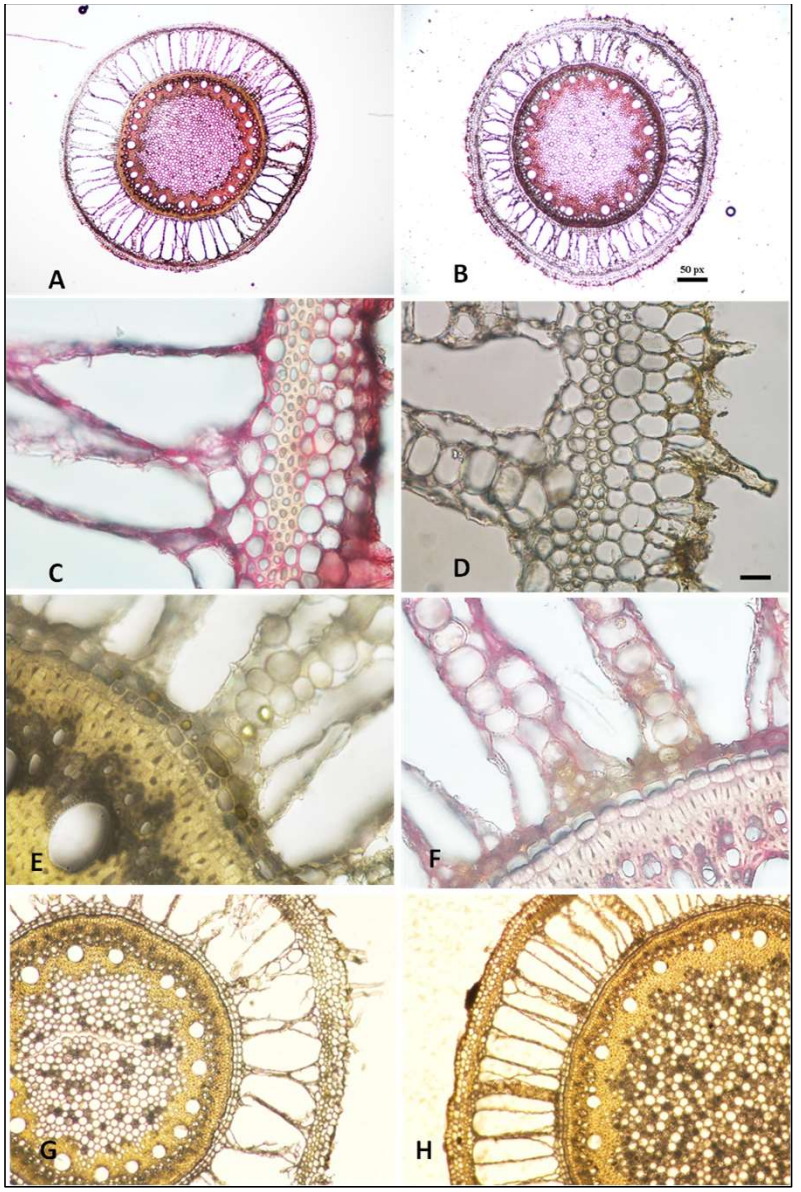
Relative comparison of histo-morphological features of **leaf** of *Chrysopogon zizanioides* (**Variety Dharani**) in the source diploid (A, C, E, G) and the corresponding auto-tetraploid (B, D, F, H).



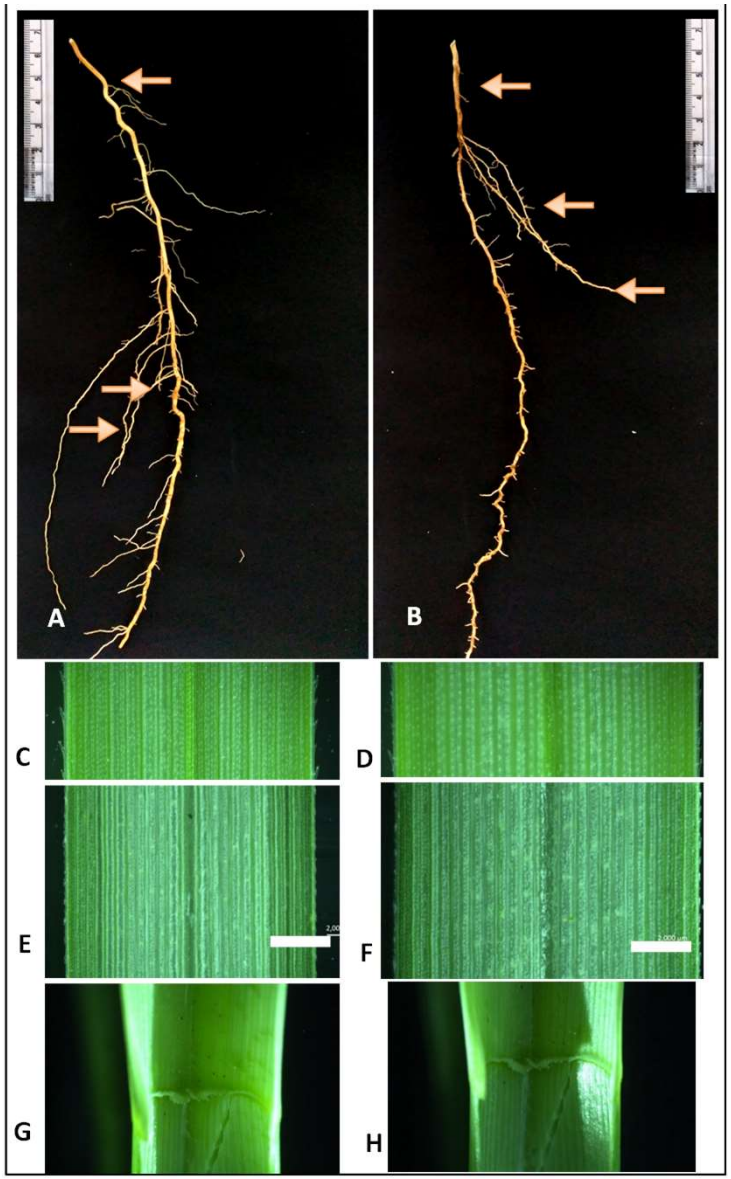
Relative comparison of micro-morphological features **(Epidermis and Stem)** of *Chrysopogon zizanioides* (Variety Dharani) in the source diploid (A, C, E, G) and the corresponding auto-tetraploid (B, D, F, H).

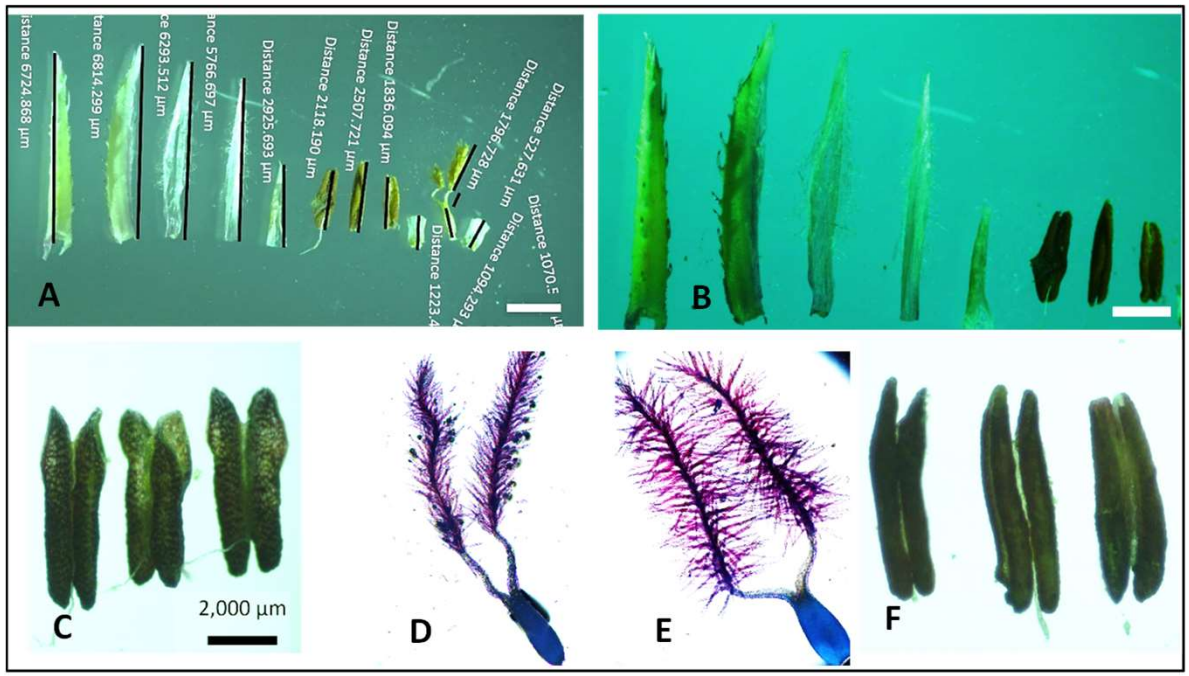


Relative comparison of **root histo-morphological** and micromorphological features of *Chrysopogon zizanioides* (**Variety Dharani)** in the source diploid (A, C, E, G) and the corresponding auto-tetraploid (B, D, F, H).



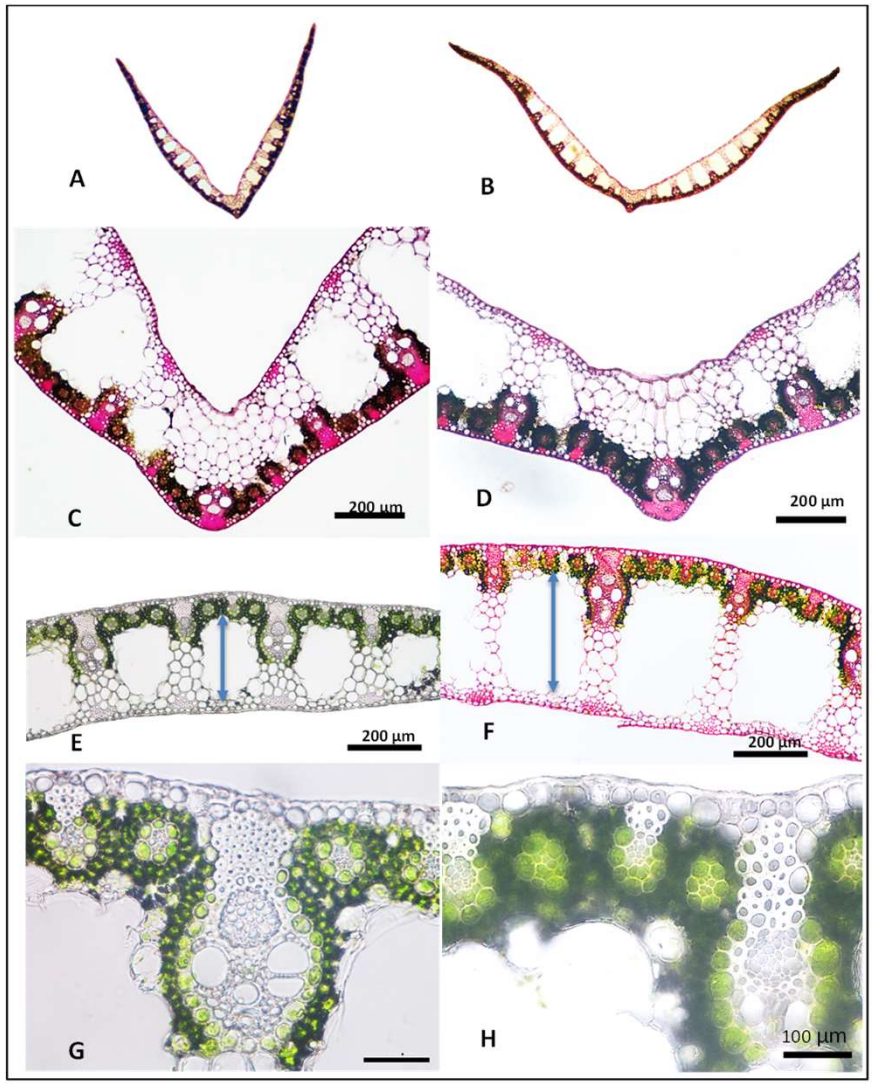
Relative comparison of *Chrysopogon zizanioides* (CIM-Vriddhi) in source diploid (A, C, E, G) and auto-tetraploid (B, D, F, H). **Fresh root** (A, B), **middle region of mature leaf abaxial and adaxial surface** (C, D, E, F), leaf base with hairy ligule (G, H).



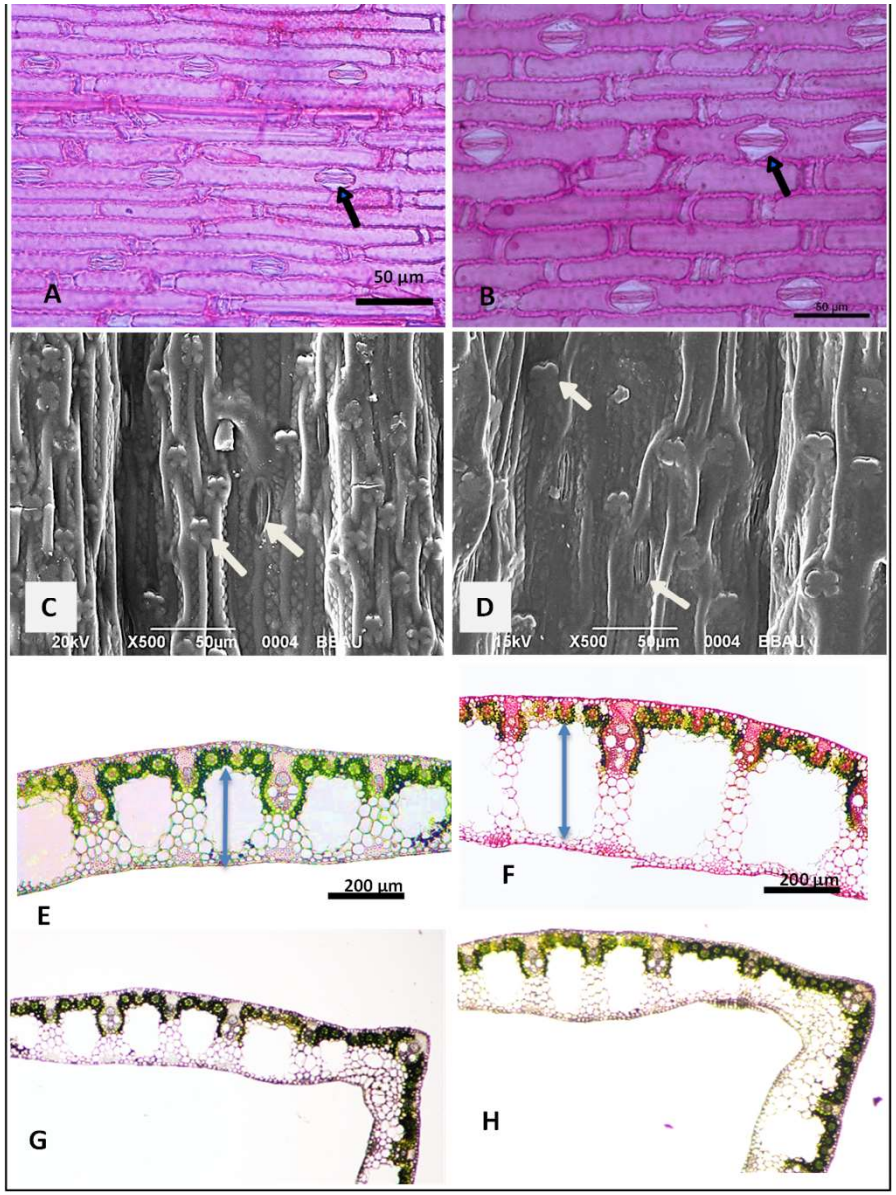


Relative comparison of **floral parts** of *Chrysopogon zizanioides* (CIM-Vriddhi) in source diploid (A, C, D) and auto-tetraploid (B, E, F). Morphological and micromorphological **features of single floret and its parts.** Dissected **sessile floret (A, B**). Sessile floret **anther** (C, F), Sessile **floret pistil** (D, E)

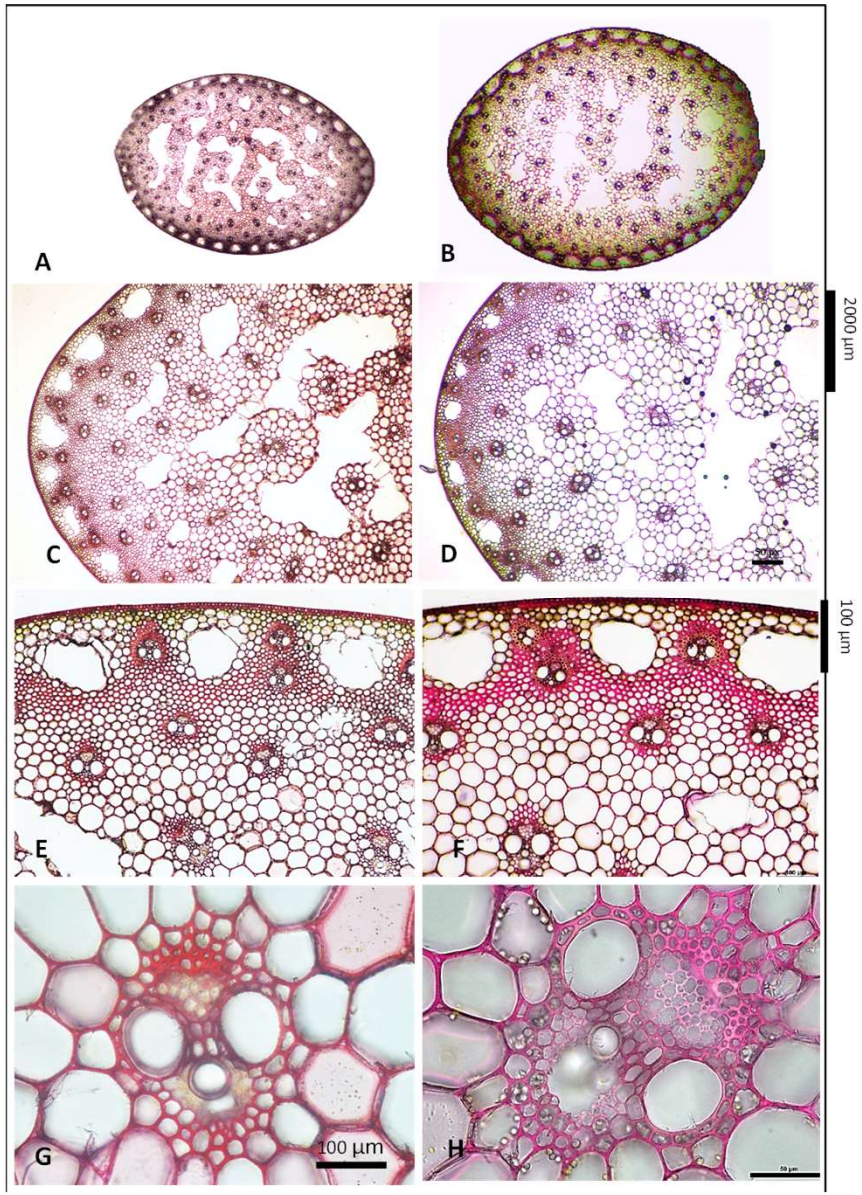
Relative comparison of micro-morphological features **in leaf V.S.** of *Chrysopogon zizanioides* (CIM-Vriddhi):in source diploid (A, C, E, G) and auto-tetraploid (B, D, F, H).



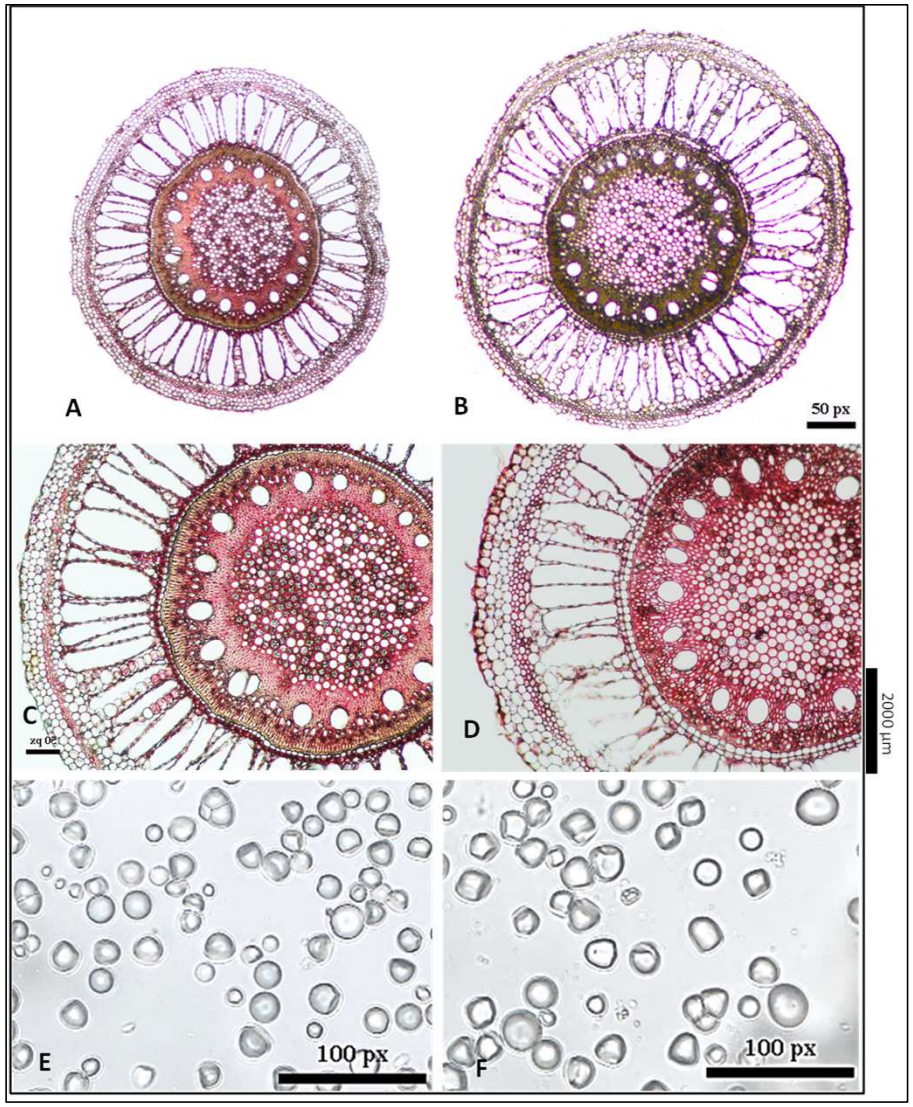
Relative comparison of **leaf abaxial surface and leaf micro-morphology** of *Chrysopogon zizanioides* (CIM-Vriddhi):in source diploid (A, C, E, G) and auto-tetraploid (B, D, F, H). Scanning Electron microgtraphs (C, D) showing **phytolith, stomata, papillae and epidermal cells.**

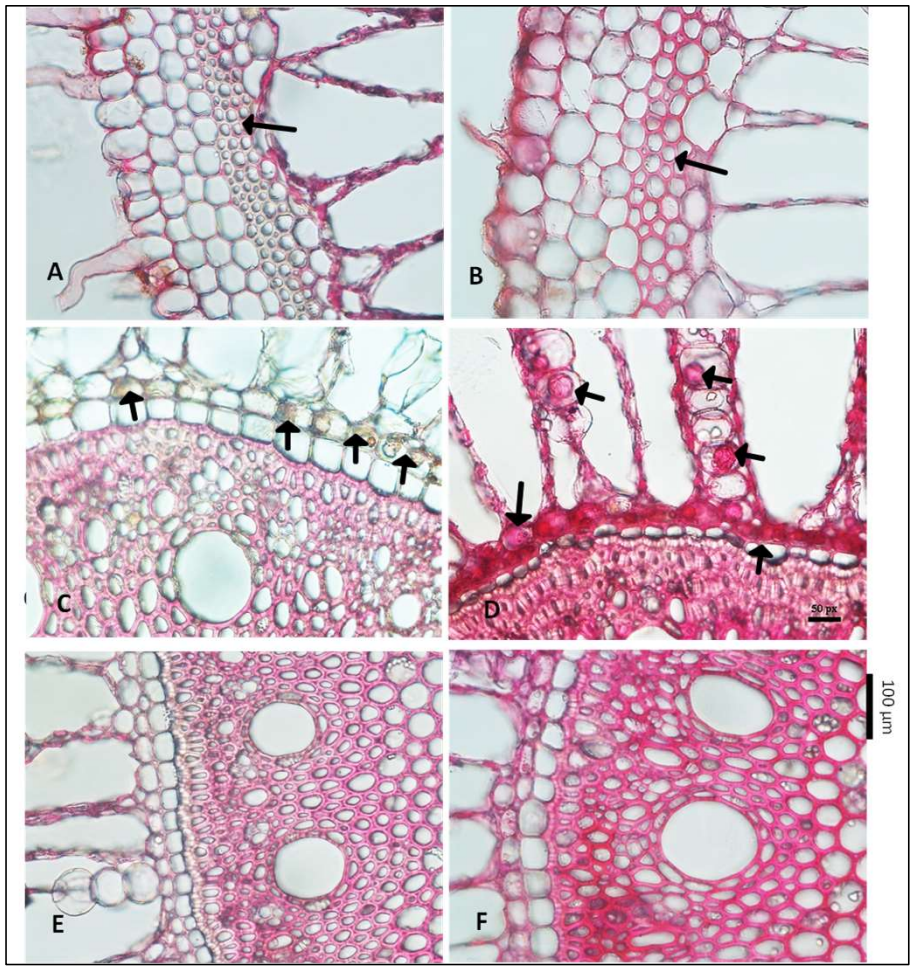


Relative comparison of **stem micro-morphology** of *Chrysopogon zizanioides* **(CIM-Vriddhi):**
in source diploid (A, C, E, G) and auto-tetraploid (B, D, F, H).



Relative comparison of **root micro-morphology** and histo-morphology of *Chrysopogon zizanioides* (CIM-Vriddhi) in source diploid (A, C, E) and auto-tetraploid (B, D, F).





Diploid Auto-tetraploid

Relative comparison of **root micro-morphology** and histo-morphology of *Chrysopogon zizanioides* (CIM-Vriddhi) in source diploid (A, C, E) and auto-tetraploid (B, D, F).

THANK YOU