

Supplementary data

Cold atmospheric plasma enhances morphological and biochemical attributes of tomato seedlings.

Sadoun M. E. Sultan^{1,#}, Ahmed Fathy Yousef^{1, #}, Waleed M. Ali^{1,#}, Amal A.A. Mohamed^{2,#}, Abdel- Raddy M. Ahmed³, Mohamed. E. Shalaby⁴, Islam I. Teiba⁵, A. M. Hassan⁶, Nabil A. Younes¹, and E. F. Kotb^{6,*}

¹ Department of Horticulture, College of Agriculture, University of Al-Azhar (Assiut Branch), Assiut 71524, Egypt.

² Botany Department, Faculty of Science, Aswan University, Aswan 81528, Egypt.

³ Department of Agronomy (biochemistry), Faculty of Agriculture, Al-Azar University (Assiut Branch), Assiut 71524, Egypt.

⁴ Department of Plant production, Collage of Agriculture (Saba Basha), Alexandria University, Alexandria 21531, Egypt.

⁵ Microbiology, Botany Department, Faculty of Agriculture, Tanta University, 31527, Tanta, Egypt

⁶ Department of Physics, College of Science, University of Al-Azhar (Assiut Branch), Assiut, 71542, Egypt.

Equal contribution

*Corresponding author: eizaldeen@yahoo.com

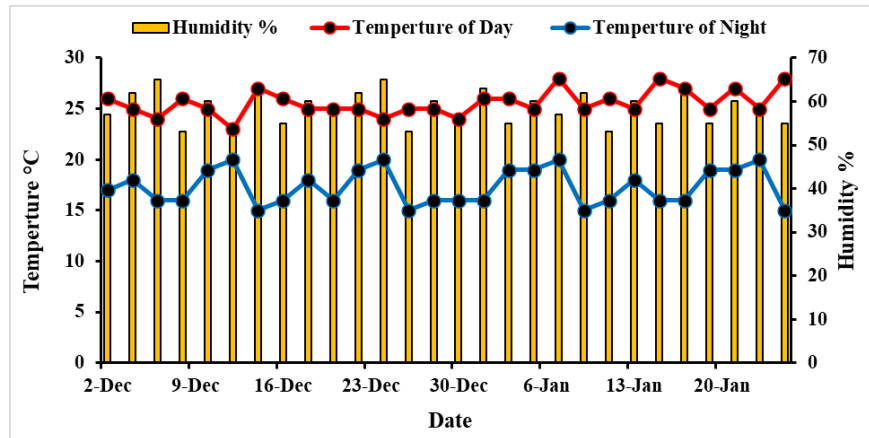


Figure S1: Environmental conditions (temperature and relative humidity) in the greenhouse during seedling growth (from December 1, 2022, to January 25, 2023).



Figure S2: Influence of cold atmospheric plasma (CAP) on morphology of tomato seedlings. The scale = 10 cm according to each picture individually.

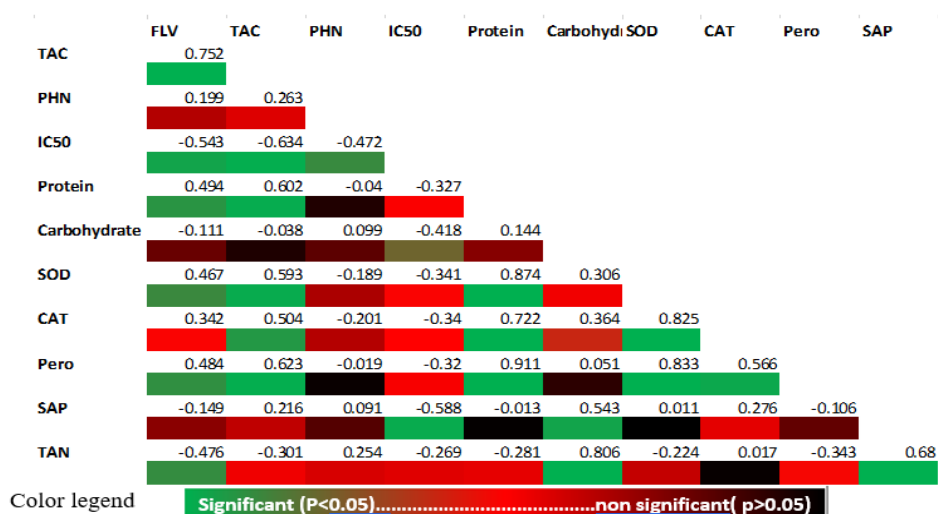


Figure S3: Correlation coefficients (r) between antioxidant activity, antioxidant enzymes and non-enzymatic antioxidants. CAT= catalase; FLV= total flavonoids; PHN= total phenolics; Pero= peroxidase; SAP= total saponins; SOD= superoxide dismutase; TAC= total antioxidant capacity, TAN= tannins.

Table S1. Analysis of variance of the effect of cold atmospheric plasma (CAP) on morphological variables, chlorophyll contents, antioxidant enzyme activity, and non-enzymatic antioxidants of tomato seedlings.

	Parameters	DF	SS	MS	F-ratio	<i>P-value</i>
Morphological variables	Shoot length	10	99.653	9.96529**	1.81	0.1234
	Root length	10	13.2947	1.32947*	2.00	0.0895
	Stem diameter	10	0.05082	0.00508*	1.44	0.2349
	Leaves number	10	4.2424	0.42424*	1.43	0.2381
	Leaf area	10	754.037	75.4037**	152.17	0.0000
Primary metabolites	Chlorophyll <i>a</i>	10	9.0309	0.90309*	10.19	0.0000
	Chlorophyll <i>b</i>	10	66.7234	6.67234**	205.06	0.0000
	Total chlorophyll	10	570.790	57.0790**	853	0.0000
	Carbohydrates	10	32.0129	3.20129**	50.94	0.0000
	Total protein	10	3139.51	313.951**	62.5	0.0000
Antioxidant enzyme activity	CAT	10	2.752E+07	2751927**	287	0.0000
	Peroxidase	10	2.009E+07	2008566**	34.1	0.0000
	SOD	10	268.825	26.8825**	1192	0.0000
	IC50	10	610.572	61.0572**	96.2	0.0000
	TAC	10	5628.35	562.835**	16636	0.0000
Non-enzymatic antioxidants	Flavonoids	10	56091.5	5609.15**	388	0.0000
	Phenolics	10	38825.6	3882.56**	193	0.0000
	Saponins	10	223388	22338.8**	3220	0.0000
	Tannins	10	113139	11313.9**	5307	0.0000

Where: DF= degree of freedom; SS = Sum of squares; MS = Mean squares; IC50 = the concentration of a substance required to scavenge 50% of free radicals present in a system; TAC = total antioxidant capacity.