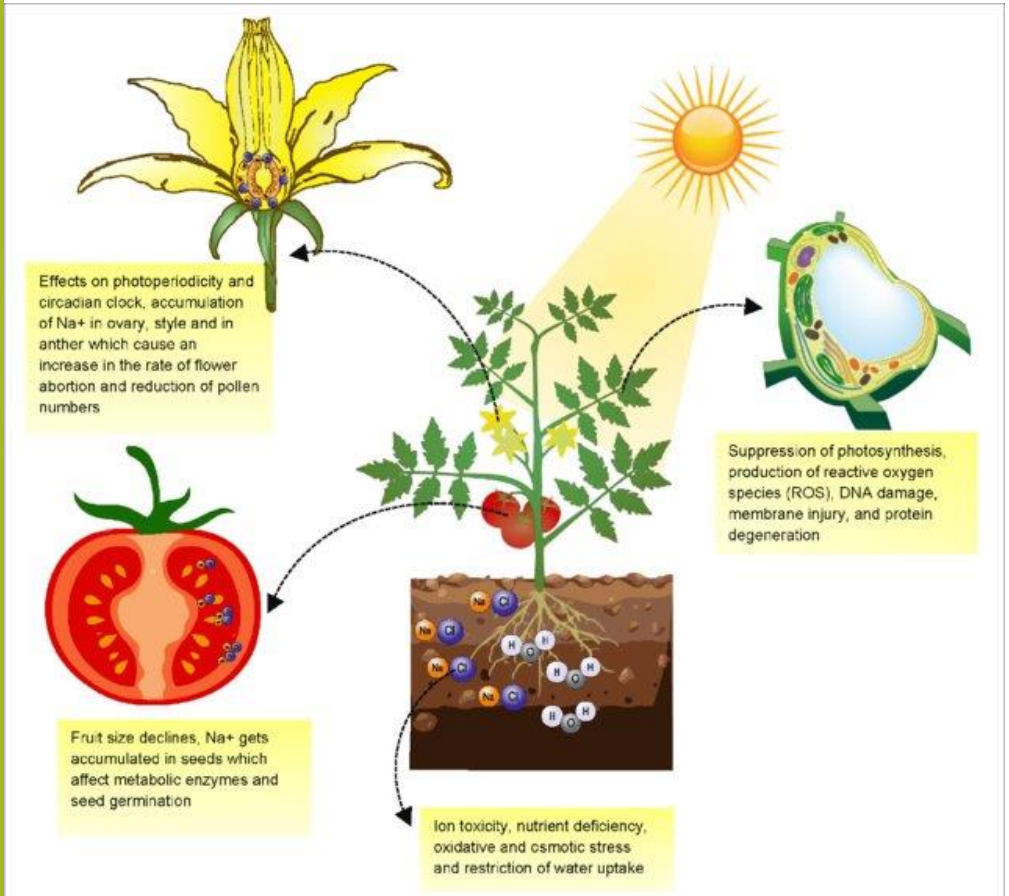
IECAG 2021
The 1st International Electronic Conference on Agronomy
03–17 MAY 2021 | ONLINE

USE OF MICROBIAL BIOSTIMULANTS TO ENHANCE THE SALINITY TOLERANCE OF TOMATO TRANSPLANTS

Università degli Studi di Palermo

Alessandro Miceli *, Alessandra Moncada and Filippo Vetrano

Dipartimento Scienze Agrarie, Alimentari e Forestali, Università di Palermo



Effect of salinity stress on plant development (Egamberdieva et al., 2019)

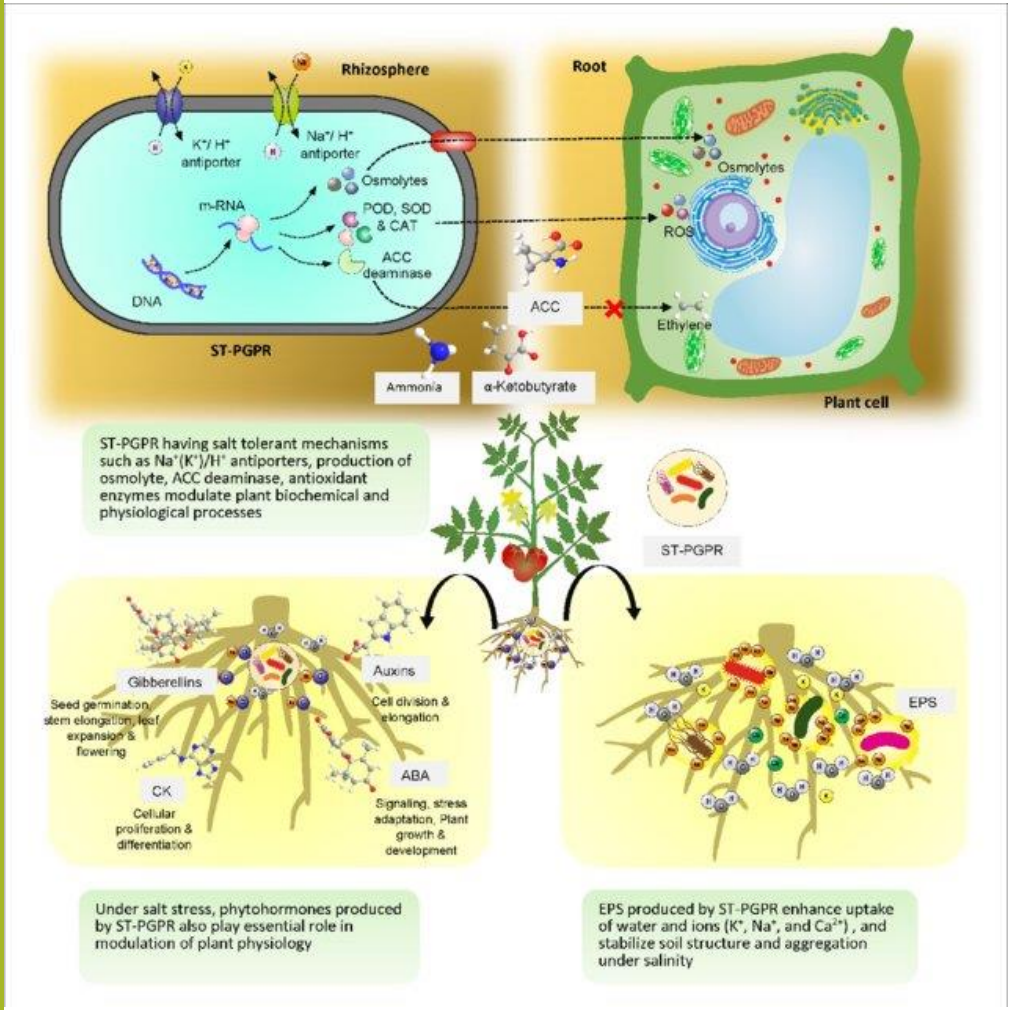
Introduction

- Salt stress reduces plant growth due to increasing soil osmotic pressure, specific-ion toxicities, and nutritional imbalances or a combination of these factors. These effects can determine severe growth and productivity reductions in most vegetable crops.

Introduction

https://commons.wikimedia.org/w/index.php?title=File:TomateJungpflanzepikiertErdpresstopf.jpg&oldid=46063924

- Vegetable plants are more sensitive to salt stress during the early growth stages
- Hence, the availability of poor-quality brackish water can be a big issue for the nursery vegetable industry.



Salt-tolerant plant growth promoting rhizobacteria mediated mitigation of salt stress in plants (Egamberdieva et al., 2019).

Introduction

- Microbial biostimulants may promote growth and vigor and counterbalance salt stress in mature plants.
- They have been applied to many vegetable crops to improve plant growth and stress tolerance, but they have not been yet applied to vegetable transplant production.

THIS STUDY AIMED TO EVALUATE THE USE OF MICROBIAL BIOSTIMULANTS TO INCREASE SALT TOLERANCE OF TOMATO SEEDLINGS DURING NURSERY GROWTH

Materials and Methods

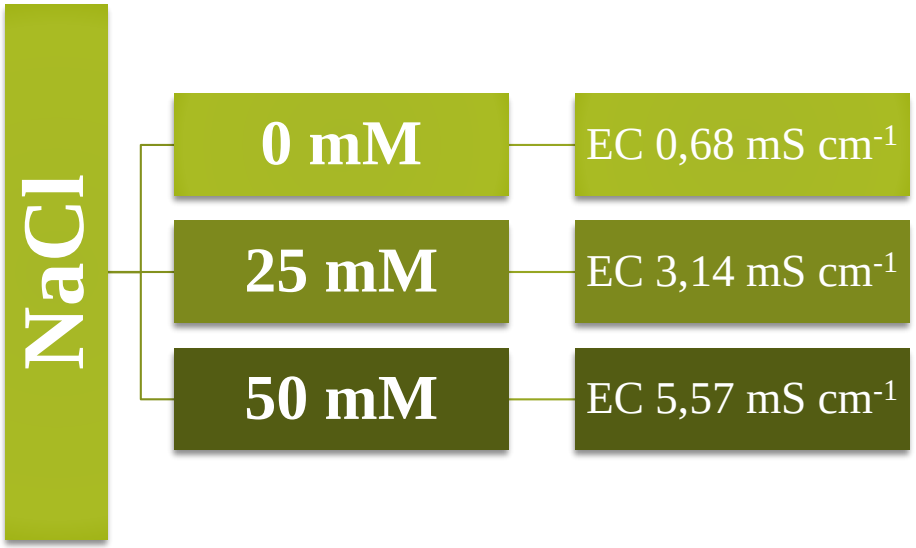
The experimental design consisted a factorial combination of microbial biostimulant and NaCl level

Microbial inoculation

- Polystyrene trays filled with a commercial substrate (Control)
- Substrate inoculated with 1.5 g L^{-1} of TNC Bactorr^{S13} (The Nutrient Company, Rochdale, UK) (B)
- (M) Substrate inoculated with 0.75 g L^{-1} of Flortis Micorrize (Orvital, Settimo Milanese, Italy).

Materials and Methods

Salt treatments were applied with an ebb and flow sub-irrigation system when tomato seedlings had the first true leaf.



Seedlings were sub-irrigated according to their need until they were ready for transplanting (twice a week on average)

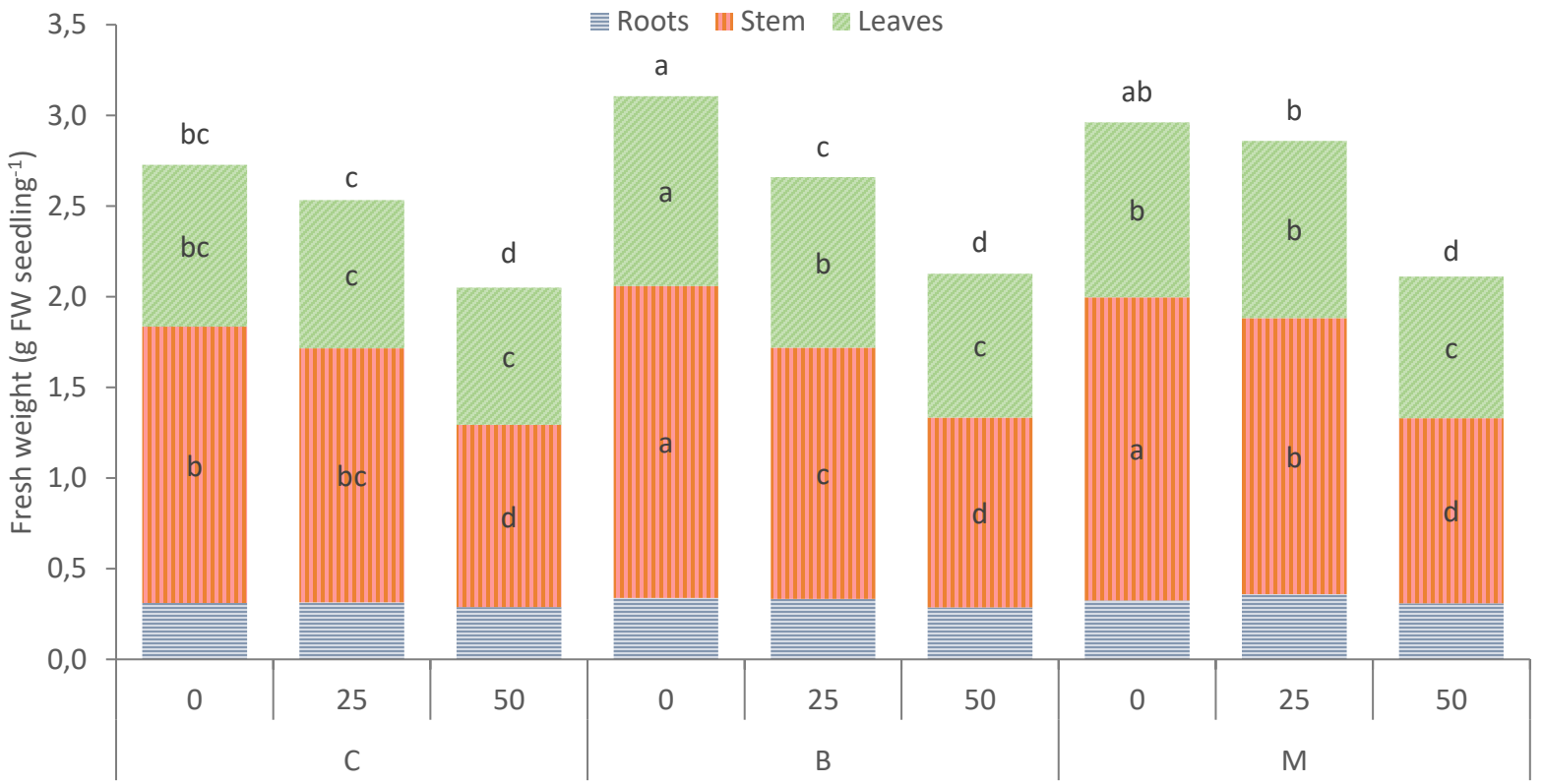
Materials and Methods

The seedlings were considered ready for transplanting when they had 4-5 true leaves (28 days from sowing).

Parameter analyzed:

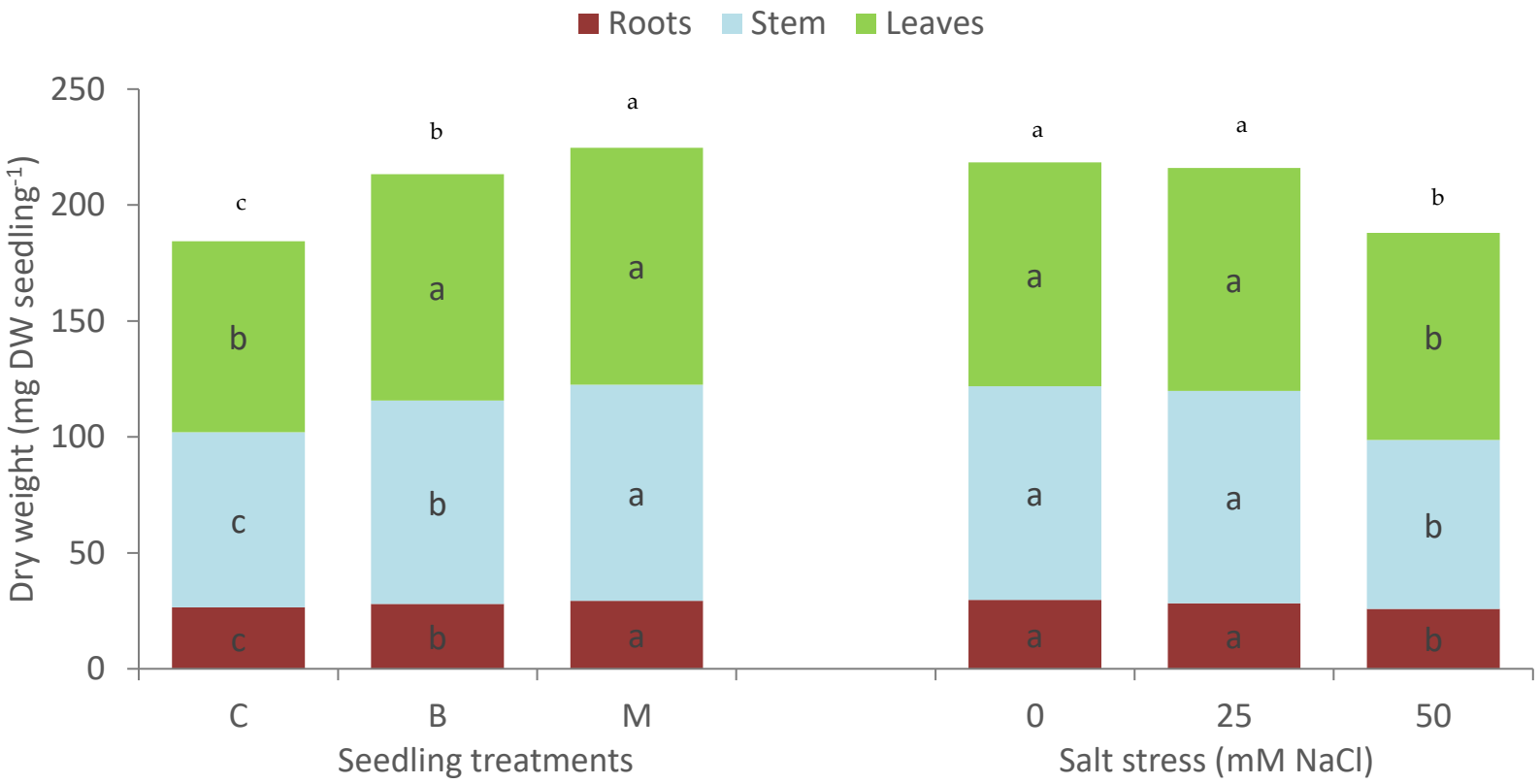
Seedling height	Leaf number
Total fresh weight	Plant area
Root fresh weight	SLA
Stem fresh weight	Stomatal conductance
Leaf fresh weight	RWC
Total dry weight	WUE
Root dry weight	L*
Stem dry weight	Chroma
Leaf dry weight	Hue°
Dry matter %	

Results



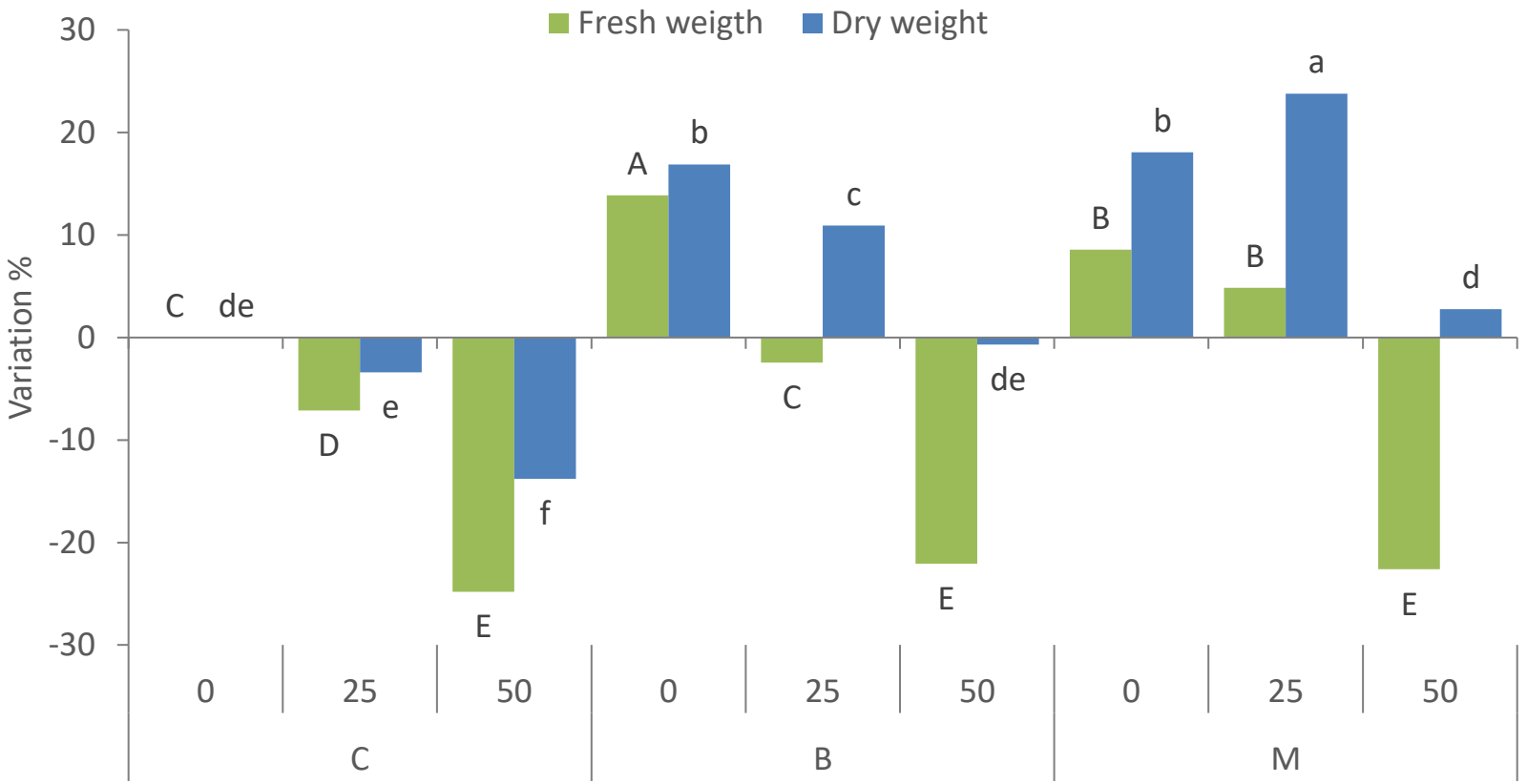
Effect of microbial biostimulant treatments (C, untreated control; B, BactorS13; M, Flortis Micorrize) and salt stress (0, 25, and 50 mM NaCl in the irrigation water) on the total, root, stem, and leaf fresh weight of tomato seedlings (Bars of the same color with different letters are significantly different at $p < 0.05$ according to the LSD test).

Results



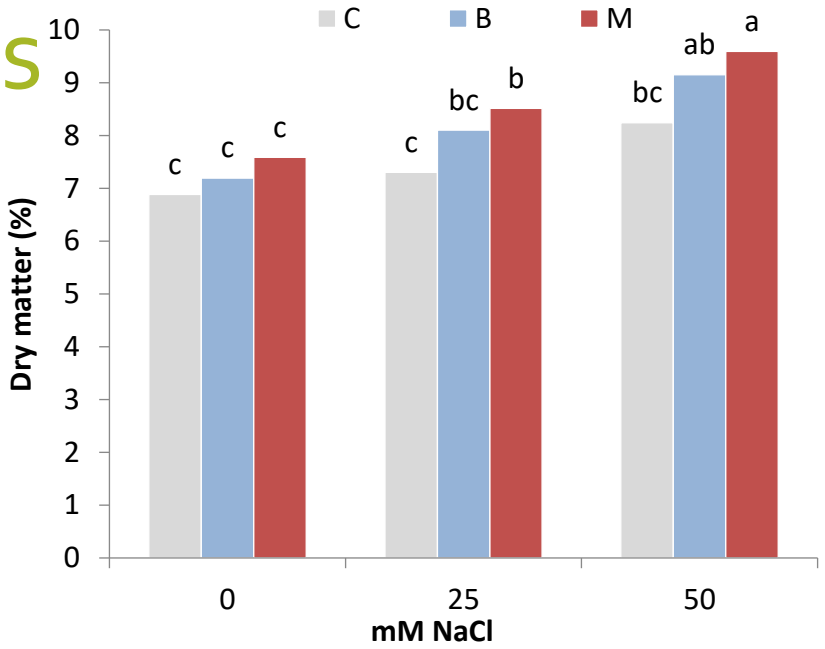
Effect of microbial biostimulant treatments (C, untreated control; B, BactorS13; M, Flortis Micorrize) and salt stress (0, 25, and 50 mM NaCl in the irrigation water) on the total, root, stem, and leaf dry weight of tomato seedlings (within each experimental factor, bars of the same color with different letters are significantly different at $p < 0.05$ according to the LSD test).

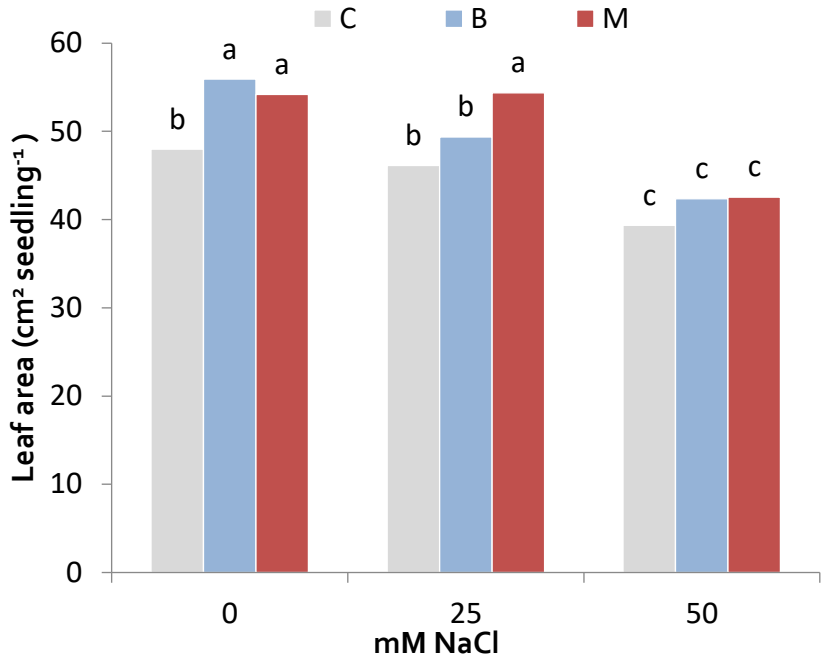
Results

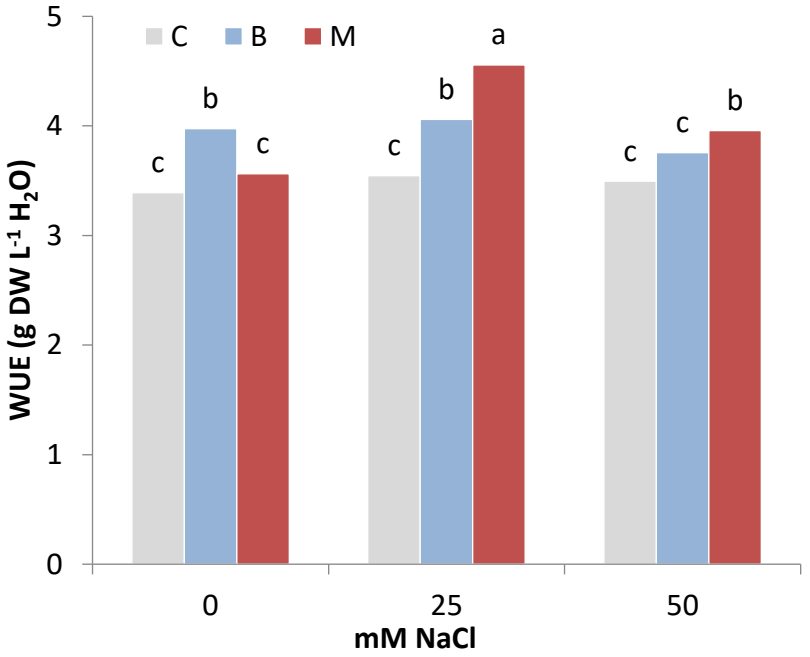


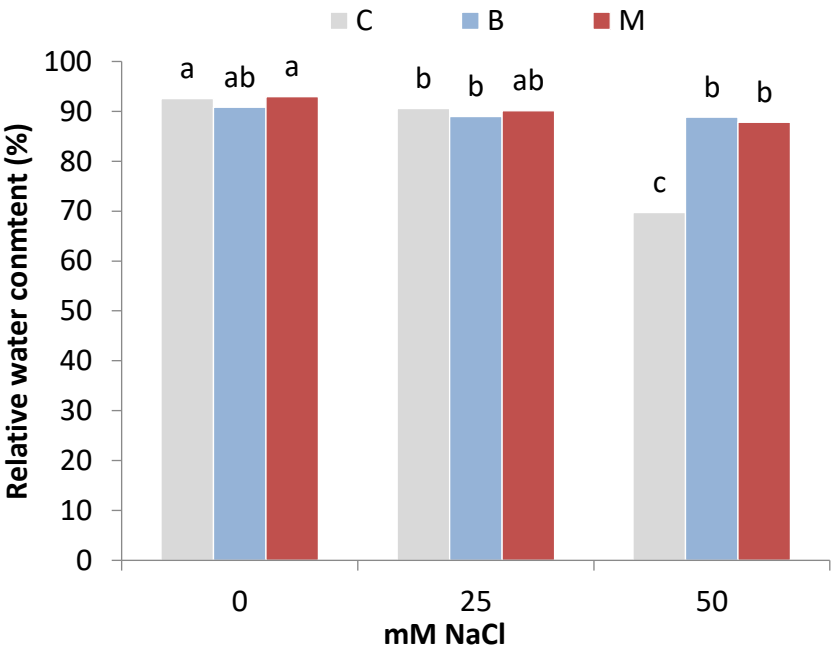
Percentage variation of total fresh and dry weight of each experimental treatment compared to the unstressed control seedlings (bars of the same color with different letters are significantly different at $p < 0.05$ according to the LSD test).

Results

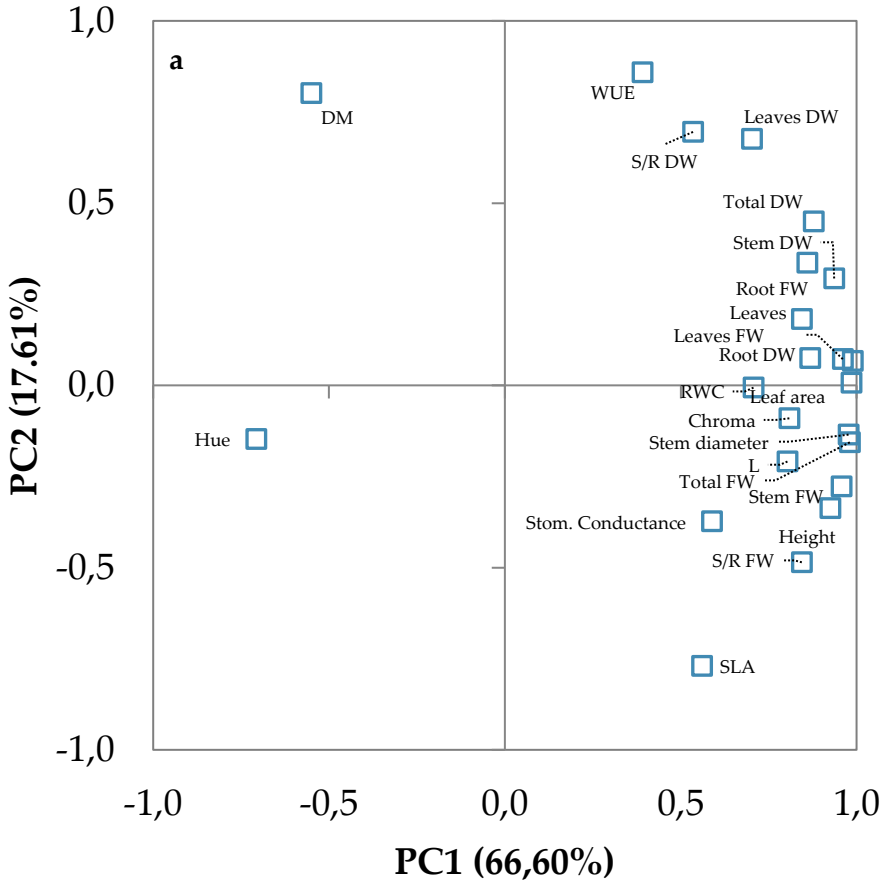

C
B
M
Dry matter (%)
0
1
2
3
4
5
6
7
8
9
10
c
c
c
c
bc
b
bc
ab
a
0
25
50
mM NaCl

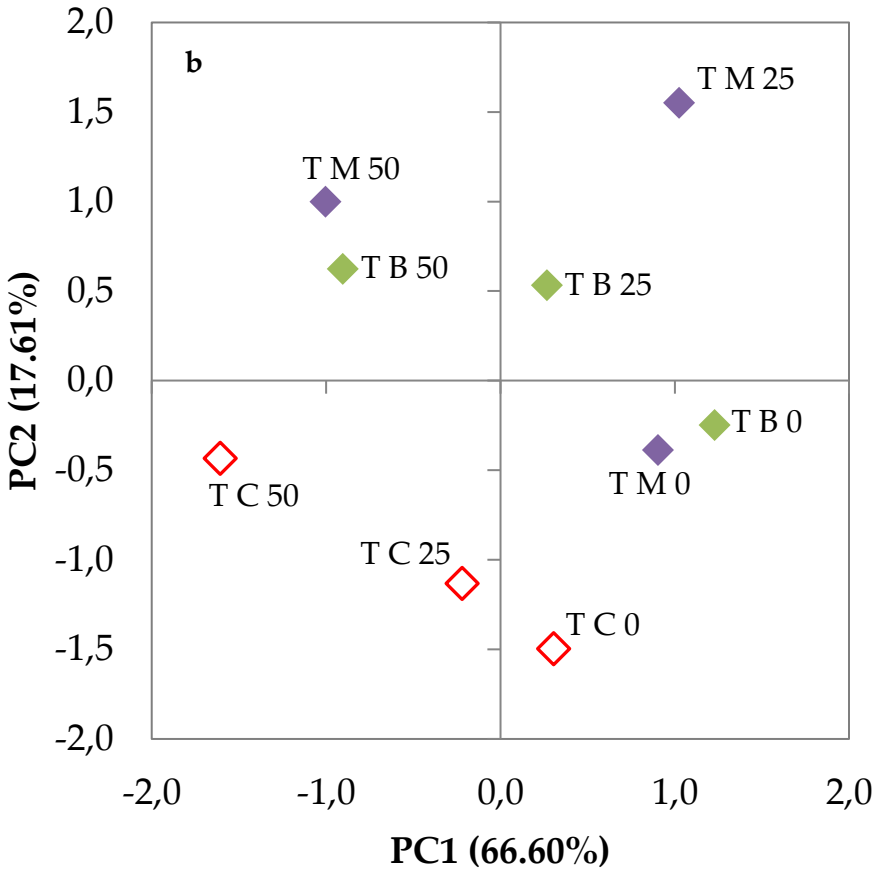

C
B
M
Leaf area (cm² seedling⁻¹)
0
10
20
30
40
50
60
b
a
a
b
b
a
c
c
c
0
25
50
mM NaCl


C
B
M
WUE (g DW L-1 H2O)
0
1
2
3
4
5
c
b
c
c
b
a
c
c
b
0
25
50
mM NaCl


C
B
M
Relative water conmtent (%)
0
10
20
30
40
50
60
70
80
90
100
a
ab
a
b
b
ab
c
b
b
0
25
50
mM NaCl

Results





Plots of (a) loadings (morphophysiological characteristics of tomato seedlings) and (b) scores (trials) formed by the two principal components from the Principal Component Analysis (PCA). T C: untreated tomato seedlings; T B: tomato seedlings inoculated with BactorS13; T M: tomato seedlings inoculated with Flortis Micorrize; 0, 25, and 50: concentration of NaCl (mM) in the irrigation water.

Conclusions

- Nursery transplant production of tomato seedlings was affected by the salinity of irrigation water that negatively influenced biomass accumulation, leaf number, leaf area, and seedling quality.
- Tomato seedlings suffered a significant growth reduction only with the highest salt stress (50 mM NaCl).
- The inoculation of the substrate with microbial biostimulants exerted a growth-promoting effect on the unstressed tomato seedlings and was also effective in modifying the tolerance of seedlings to salt stress but with some differences for Bactor^{S13} (B) and Flortis Micorrize (M)
- The treatment with B and M delayed the beginning of salt stress symptoms and limited growth reduction of tomato seedlings at the intermediate salinity level (25 mM NaCl) especially in salt-stressed tomato seedlings inoculated with M

Conclusions

The initial inoculation of the substrate with microbial biostimulants was successful in enhancing plant growth and allowed to increase the salinity tolerance, especially when using the biostimulant that was characterized by the highest biodiversity.